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Stone, Joe A.

U. Oregon

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Joe A. Stone

Economics

University of Oregon

Eugene OR 97402

(jstone@uoregon.edu)

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Abstract

This study links federal Pell grants to college students in the United States to the decades-long decline in state-local funding for public colleges. The effect is at least as significant as other explanations based on taxes, Medicaid, or K-12 funding. Estimates are obtained from multiple identification strategies, including a crossover, repeated-measures (RM) design—a powerful design particularly well suited to the Pell program. The results offer a compelling example of how federal funding can induce an unintended cascade of effects even when it is given to individuals, not as traditional inter-governmental grants.

1. Introduction

Goldin and Katz (1998) point to a sustained increase in state and local funding for public colleges across the United States from the late 19th century to the middle of the 20th century as a central factor in building a strong, broadly accessible system of higher education. However, by the latter third of the 20th century, state and local governments were engaged in a great retreat from funding public colleges. The extent of the retreat is evident in an array of measures. Kane, Orszag, and Gunter (2002) (KOG) report that appropriations in constant dollars per thousand dollars of personal income and as a share of overall state budgets declined by more than 20 percent after the mid 1970s. Archibald and Feldman (2006) (AF) note a similar decline. KOG also report that despite a corresponding increase of 39 percent in revenue from student tuition and fees as public colleges sought to replace lost public funding, spending per student at public relative to private colleges declined by 20 percent from 1977 to 1996 as a barometer for effects of the great retreat on the quality of public colleges. Ehrenberg (2006) also considers effects of the great retreat for the quality of public colleges. This paper tests the provocative argument that Pell Grants, intended to make college more affordable for students in the United States are instead a major factor in the great retreat.

Pell Grants were established in 1972 when the U.S. Congress established the Basic Educational Opportunity Grant (BEOG) as an amendment to the Higher Education Act (HEA) of 1965. The BEOG was intended to serve as the floor for federal support for low-income students, with other forms of federal aid (direct student loans and the Supplemental Educational Opportunity Grant) intended as supplements. Incomes eligible for the BEOG were expanded in 1978, and the BEOG was renamed the Pell Grant by Congress in 1980 in honor of Senator Claiborne Pell, the primary sponsor of the 1972 legislation. The 1965 HEA also established guaranteed student loans, precursors to the Stafford, Perkins, and PLUS student loans.

After rising from zero prior to the Pell program to a peak of more than half of the average cost of college attendance in 1977–78, the maximum authorized award has declined to less than half the cost of attendance, and participation in the program has expanded well beyond low-income students to more than 8 million students. The annual cost of Pell Grants now exceeds 30 billion dollars. Until recently, the maximum authorized Pell Grant (MAP) was established each year by Congress in advance of each fiscal year, and Congress subsequently set a maximum appropriated amount as part of each year's federal budget.[1] Congress now treats the appropriated maximum as an entitlement in the budget by automatically indexing it to the Consumer Price Index (CPI). Awards for individual students are based on a complex formula for contributions expected from the student's family, tuition, and other costs of college attendance; awards vary between a minimum award and the MAP. The appropriated maximum has typically been lower than the MAP but has chased the MAP. As a result, the MAP has been a leading indicator of the following year's appropriated maximum, to the extent that the MAP is a better predictor of the following year's appropriated maximum than the appropriated maximum itself. From 1972 to 2016-2017, the MAP rose from $1400 to $5815 in current dollars but declined from $7529 to $5815 in constant 2014 dollars, which nevertheless, represents a real increase of $5815 from zero prior to Pell Grants.

A link between Pell Grants and the great retreat is now widely suspected and is reflected for example, in a recent proposal by the American Association of Public Colleges and

[1] Mercer (2005) explains factors involved in setting maximum award levels

Universities to index Pell Grant award amounts to funding for public colleges in each state.[2] Direct grants have a stronger effect on student enrollment behavior than guaranteed student loans (Singell and Stone, 2002), so suspicion falls on Pell Grants rather than on student loans and other forms of student aid.

The implementation and expansion of Pell Grants coincides with the great retreat, but no study has identified a direct link between the great retreat and any specific parameter for Pell Grants, as is done here. Both Rizzo (2004) and Stone (2012) find a significant role for Pell Grants, but neither links the decline to a specific parameter in the program. Rizzo (2004) identifies an indirect effect for Pell Grants (and a possible mechanism for the direct link found here) by linking the number of Pell-eligible students in a state to increased funding for direct student aid then by linking increased funding for direct student aid to reduced funding for public colleges. Stone (2012) uses data similar to those in this study but only identifies an indirect effect using a pre/post Pell event design. This study differs from both Rizzo (2004) and Stone (2012) in two fundamental ways: (1) it tests for a direct link between the Pell-Grant parameter (MAP) authorized at the federal level and funding for public colleges at the state and local level; and (2) it uses a repeated-measures (RM) empirical design particularly well suited to identifying the direct effect of Pell Grants. Figure (1) presents visually suggestive evidence and provides a heuristic view of the RM design. The two variables plotted over the period 1967-2012 are (deltahied), the change in state and local funding for operating expenses of public colleges, expressed as percentage points of state personal income and (deltamapk), the change in MAP in thousands of dollars, adjusted for inflation. Some explanation is necessary before turning to details in Figure (1). Five-year data intervals and first differencing are used in the figure and in

[2] (Hurley and others, 2014)

later statistical analysis for several reasons: state and local budget data are not available on an annual basis until 1977, well after the establishment of Pell Grants; a five-year interval encompasses the two- to four-year cycle in state and local budgets identified by Tucker (1982); and according to Hahn and others (2005), five-year differencing aids in smoothing out extraneous cyclical factors in identifying low-frequency, long-run effects in time-series data. Moreover, five-year differencing has been used successfully in a number of prior studies of state and local budgets, including Mofidi and Stone (1990), Bania et al. (2007), and Reed (2008). MAP is announced in advance of each fiscal and academic year, and is a strong predictor of the next year's maximum appropriated award, so it is aligned to the five-year intervals by assigning it to the year in which it is announced. Analysis focuses on MAP because it is a central program parameter predetermined at the federal level and has been a leading indicator of the maximum appropriated award. The authorized and appropriated measures are very highly correlated in five-year data (0.98), and yield equivalent results here.

Turning now to Figure (1), note several salient features. Even without the great recession period of (2007-2012), there are eight nonzero values (treatments) for deltamapk, four increases and four decreases, and in all but two of the eight cases, deltamapk and deltahied go in opposite directions as hypothesized (They also go in opposite directions in the great recession period). Given the divergent scales for the two variables, the magnitude of the inverse relation is small, but its prevalence is strongly suggestive. For example, in the 1967-1972 period, the figure shows a sharp increase in deltamapk and a corresponding decrease in deltahied, followed in the 1972-1977 period by a sharp decrease in deltamapk and a corresponding increase in deltahied. Similarly, in the 1982-1987 period, the figure shows a sharp increase in deltamapk and a corresponding decrease in deltahied, followed in the 1987-1992 period by a sharp decrease in deltamapk and a corresponding increase in deltahied. The two exceptional periods where deltamapk and deltahied go in the same direction are 1992-1997 and 2002-2007.

Figure (1) also highlights key differences between a repeated measures (RM) design, a standard difference in differences (DID), and an event study (ES). For a given number of subjects, RM yields a more precise estimate because it relies on multiple treatments (dosages) for each subject, not just one, as in DID and ES.[3] Unlike DID, RM also has no need for randomized assignment of subjects to the treatment and control groups because each subject serves as its own control, so that the treatment and control groups are necessarily identical. Although not always explicitly stated, ES DID, and RM each requires a key (untestable) assumption in order to identify the treatment effect. ES requires that there be no important but omitted differences between the pre- and post-event periods. DID requires that there be no important but omitted differences between the treatment and control groups (often reduced to an assumption that the two groups share a common trend). RM requires that there be no important but omitted period-specific factors. Because these assumptions cannot be tested, the standard protocol is to probe the pertinent assumption in multiple ways using relevant data.

In ES for example, one probes the robustness to possibly important differences in other factors before and after the event. In DID, one considers possible differences between the treatment and control groups. In RM, one considers those period-specific factors most likely to be important. In Figure (1) for example, to what extent are the inverse movements of deltahied and deltamapk due to other factors idiosyncratic to each period? The formal statistical analysis addresses this

[3] Quinn and Keough (2001) discuss RM and other experimental designs.

question directly by examining sensitivity to a variety of period-specific factors, including those already identified as important by prior studies. Stone (2012) relies on a similar strategy and data to gauge robustness.

Section 2 begins with a summary of the major explanations previously proposed for the great retreat. Section 3 explains the data and empirical specification of the RM design. Section 4 presents the estimation strategy and empirical results. The central result is that a one thousand dollar increase in the maximum Pell Grant is linked to a decrease in funding for public colleges of between 0.4 and 0.7 percentage points of state personal income Section 5 presents results for an extensive set of robustness checks, including GMM instrumental-variable estimates and placebo tests. A final section (Section 6) explores the dynamic interdependence of federal and

State-local decisions and discusses a reform to the Pell program to counter incentives for state and local governments to reduce funding for public colleges.

1. Explanations

2.1Prior explanations

Explanations for the Great Retreat previously offered include: KOG, who single out the rising burden of Medicaid costs and the cyclicality of public budgets in crowding out funding for public colleges;[4] Rizzo (2004),

who emphasizes the costs of K12 schools and the role of Pell Grants; and AF, who focus on restrictions on tax revenues imposed by tax-limitation measures enacted in a number of states. All these explanations are plausible, and all but the last rely on forces affecting state and

[4] Humphries (2000) and Bettinger and Williams (2013) also emphasize the cyclicality of public budgets.

local budgets nationwide.

2.2 Pell Grants

Rizzo (2004) links increases in direct student aid to reduced funding for public colleges. There are many potential reasons for this pattern, but the most straightforward one is that legislators can find it to their advantage to provide aid directly to voting constituents, leaving colleges to deal with the consequences, including public ire, and that Pell Grants made this strategy more feasible. For example, Singell and others (2006) find that Pell Grants interact with state-level direct student aid to increase enrollments of Pell-eligible students, and Rizzo (2004) concludes that 'As more households in a state become eligible to receive federal Pell Grants, states move aid away from institutions and toward students' to 'capture increased student eligibility for federal grant aid.' A Mississippi newspaper, *Picayune Item (**2011**)*, suggests the states' perspective: 'Cutting Pell Grants will undermine the portion of Mississippi's higher education freight being paid by federal taxpayers.'

3. Data and Specifications

3.1Data

Estimation relies on five-year interval data for 49 states and their local governments in the U. S. over the half century from 1957 to 2007, just prior to the great recession. Consistent with other recent studies of state budgets, such as Bania and others (2007) and KOG, Alaska is not included. (The dominance of the Alaska pipeline generates outlying variances in Alaska's fiscal variables relative to other states). In addition to advantages already discussed, long-interval data provide key strengths in an alternative set of instrumental-variable generalized method of moments (GMM) estimates (Hahn and others, 2005).

Data for the state and local government fiscal variables are from the Census of Governments.

Related economic, demographic, and other data for corresponding years are from the Bureau of Labor Statistics and the Department of Commerce. Data for Pell Grants are from the Department of Education. All data are available from public sources. Summary statistics and definitions for the fiscal and Pell variables used in regressions are presented in Table (1). (Statistics for other control variables are omitted for brevity).

Table (1) here

3.2 Empirical specification

Estimation begins with equation (1) as a simple baseline to gauge sensitivity first, to additional controls for those time-varying factors identified as important by prior studies and second, to alternative instrumental-variables estimation. Equation (1) is a skeletal version of a fully balanced, crossover RM design in which each subject (in this case each state) serves as its own control in an identical series of treatments of varying intensity (different MAP awards).

Because the federal Pell Grant applies in all states, a standard DID design, using an untreated group of states as a control group is not feasible, but the repeated-measures (RM) design expressed by Eq. (1) is a research design with key advantages for examining effects of Pell Grants.

(1) $\Delta H_{it} = a_i + b_1 \Delta MAP_{it} + b_2 TREND + b_3 TRENDBREAK + e_{1it}$

The dependent variable (ΔH_{it}) in equation (1) represents the change in state and local government funding for public two- and four-year colleges in state *(i)* in period *(t)* in percentage points of personal income. (a_i) accounts for a trend in the dependent variable specific to each state. (ΔMAP_{it}) with coefficient (b_1), represents the change in the maximum authorized Pell award in thousands of dollars adjusted for inflation. (Using nominal MAP, while controlling for each state's CPI yields equivalent results). TREND is a linear trend in the dependent variable, and TRENDBREAK represents a break in trend in the mid 1070s (1977), near the beginning of the great retreat, as identified by KOG and AF. The time-related variables are included only as an initial set of simple control variables in the baseline equation. The treatment effect for Pell Grants is identified in eq. (1) by (b_1) the coefficient for (ΔMAP_{it}).

In addition to accounting for state-specific trends in the dependent variable, eq. (1) also accounts for the nonstationarity of funding for public colleges, which is nonstationary in levels but trend stationary in first differences.[5] Unfortunately, prior studies have failed to account for this nonstationarity, which raises concerns regarding spurious regression results. First differencing raises an issue of autocorrelation, and that is addressed using the Wooldridge (2002) test for autocorrelation in first-differenced data (which indicates no significant autocorrelation), along with robust standard errors for each set of estimates.

MAP is predetermined at the federal level in advance of each fiscal year. (e_{1it}) is the residual error. Of course, MAP is not randomly assigned across periods, so to it is necessary to be confident that the effect of MAP is identified independently of the error term. Three key assumptions are required: first, that MAP set at the federal level at a point in time be predetermined, unaffected by funding decisions for public colleges made at the state-local level; second, that there be no important but omitted factors correlated with both the dependent variable and MAP; and third, that there be no significant autocorrelation. The issues raised by the first assumption are addressed by the naturally recursive structure that places the announcement of federal decisions ahead of state and local decisions. Results for tests of robustness for the recursive structure are reported in the

[5] Tests fail to reject a unit root in levels, but reject in first differences.

robustness section using an explicit one-period lag. The issues raised by the second assumption are addressed by gauging sensitivity to the addition of an extensive set of state-specific time-varying controls in an expanded specification expressed by equation (2) below. These controls include the factors already proposed by others as primary explanations for the great retreat, as well as demographic, cyclical, and other period-specific variables. The number of potentially important period-specific controls is inexhaustible, but adding an extensive set of factors already identified as important by prior studies helps to gauge whether estimates are sensitive to period-specific controls.

Autocorrelation is tested using Wooldridge (2002), and Instrumental-variable estimates based on the GMM estimator are used as an additional robustness check.

(2) $\Delta H_{it} = a_i + b_1 \Delta MAP_{it} + b_2 TREND + b_3 TRENDBREAK + b_4 \Delta X_{it} + e_{2it}$

(X) in equation (2) represents a vector of other control variables that includes other elements of state and local budgets expressed as percentage points of state personal income. These explicitly include those previously proposed by prior studies as important factors in the great retreat, such as limited tax revenues (TAXES), rising costs of Medicaid and other health-care programs (HEALTH), and funding for K-12 school systems (K12). For completeness, the budget categories for other expenditures not elsewhere included (OTHER) and the budget surplus or deficit (SURPLUS) are also included. SURPLUS is negative for deficits. A residual category is comprised of non-tax revenues and expenditures for physical and public services infrastructure. The linear dependence among elements of a state budget constraint that arises from state balanced-budget rules limits the interpretation of the effect of any one element to its change relative to another element, so our focus in estimates of equation (2) is on the sensitivity of the estimated effect of MAP, not on effects of individual budget elements. [6] (b_3) is a vector of the coefficients corresponding to (X). Other variables included in X include cyclical economic factors, such as the unemployment rate (UR) and the log of state per-capita personal income (LINCOME), along with a set of variables for age composition of the state population. (e_{2it}) is the residual error. Issues of possible endogeneity for the budget variables are addressed below in Section 5 using GMM instrumental-variable estimation.

4. Estimation Strategy and Results

4.1 *Estimation strategy*

The estimation strategy begins with panel least-squares estimates in Table (2) for baseline eq. (1), and then moves to panel least-squares estimates of the expanded specification in equation (2).

The strategy concludes in Section 5 with an extensive set of robustness results, including GMM instrumental-variable estimates of equation (2), which do not rely on either the recursiveness of MAP or the exogeneity of the controls for identification.

4.1 Baseline results

Table (2) here

The coefficient for MAP in Table(2) for the baseline equation is significantly negative (-0.04) at the .05 level, based on robust (period SUR) standard errors, which are clustered on states, since the number of states is much larger than the number of periods, but cross-section SUR, which clusters on periods yields equivalent results[7]

[6] Mofidi and Stone (1990) and Bania and others (2007) discuss empirical specification of state-local budget constraints.

[7] Explanations of these standard errors are found in Eviews (2009, pp.611-12).

4.2 Expanded results

Turn now to estimates of equation (2), which is the same as equation (1), but expanded to incorporate a large set of period-specific controls to gauge robustness. Given that state-specific trends, a common trend and a break in trend are already included in equation (1), there may be little role left for additional period-specific variables, but to find out whether that is the case, panel role least-squares estimates of equation (2) are presented in Table (3).

Table (3) here

With the addition of the various controls in equation (2), the MAP coefficient in Table (3) increases in absolute value from the baseline estimate of (-0.04) in Table (2) to (-0.07) and remains significantly negative. Hence, the significance of the negative coefficient for MAP is not sensitive to inclusion of period-specific budget and cyclical economic factors identified as important in prior studies. The focus in these estimates is only on the sensitivity to the inclusion of other period-specific factors, not on the individual effects.[8] Hence, estimates for the other factors are discussed only briefly. With the exception of TAXES, budget factors associated with other explanations proposed for the great retreat (i.e., HEALTH and K12) are insignificant. Importantly, the Wooldridge test for autocorrelation in first-differenced data yields a coefficient of (-0.4) for the lagged residual, insignificantly different (p 0.28) from the critical value relevant for first-differenced data (-0.5).

5. Robustness

5.1 GMM results.

[8] State-level unemployment rates and consumer price indices are included as controls but results for these are omitted for brevity.

GMM offers an alternative identification strategy to address possible issues of endogeneity, as it uses generalized moments of appropriately lagged values of the dependent and independent variables as instruments for MAP and the control variables in equation (2). The fiscal variables are likely endogenous, as they are contemporaneous substitutes in the budget constraint, but GMM estimates do not rely on either the recursiveness of MAP or the exogeneity of the fiscal variables. The instruments are appropriately lagged values of the dependent and independent variables. For first-differenced variables, appropriate instruments are two-period lagged levels and more generally, one period prior to the earliest period in the first differences). Hahn and others (2005) demonstrate that long-difference data intervals, along with appropriately lagged levels of the dependent and independent variables substantially mitigate the weak-instrument problem for GMM estimates for highly persistent dynamic panel data.

The GMM estimates presented in Table (4) support to the validity of results for MAP in Tables (2) and (3).

Table (4) here

The coefficient for MAP in Table (4) (-0.07) is significantly negative, and equivalent to the estimate in Table (3). Aside from the inclusion of the lagged dependent variable included to account for possible autocorrelation in the dynamic model, the only major difference from Table (3) in the GMM results is that the coefficient for HEALTH is now also significantly negative, consistent with the Kane and Orszag (2003) evidence that Medicaid is important. The GMM estimates use mean-differenced fixed effects and robust, White-period standard errors and weighting matrix, but equivalent estimates for MAP are obtained using first-difference fixed effects and period-SUR standard errors and weighting matrix. As for the validity of the GMM instruments, Hansen's J-statistic (32.23) fails to reject the exogeneity of the instrument set at the .05 level.[9] Results of a series of additional robustness checks are summarized below, but not presented in detail.[10]

5.2 Lags. Results for MAP are equivalent whether or not an explicit one-period (five year) lag for MAP is also included, and the coefficient for lagged MAP is insignificant, suggesting that the five-year data interval is sufficient.

5.3 Changes vs. levels for MAP. Equivalent results are obtained for MAP in levels or changes.

5.4 Authorized vs. appropriated MAP. Using the maximum authorized or the maximum appropriated Pell grant yields equivalent results.

5.5 Variation across states. There are too few observations to estimate separate treatment effects of Pell Grants for individual states, but there are two other ways to look at the extent to which the estimates vary geographically. One is to examine if the estimates are a particularly poor fit for any individual states. This check is done by testing whether individual state residuals differ significantly from zero; none of the state-specific residuals differs significantly. A second, more thorough approach examines whether the estimated MAP coefficient varies geographically by interacting the MAP variable with a dummy variable for each of the nine Census regions (in turn) to test whether the treatment effect in any one region differs significantly from the overall estimate for all regions. In this case as well, none of the interactions by region differs significantly.

5.6 Placebo tests. To assess whether there are unobserved factors generating spuriously significant correlations between the maximum Pell Grant (MAP) and state fiscal variables, two

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9 (Chi-square, 41.37).

10 Detailed results are available on request.

placebo tests are performed. The first uses health expenditures as the dependent variable in both the baseline and expanded regressions. Health expenditures are attractive as a placebo test because even though there is no obvious direct link from MAP to health expenditures, KOG demonstrate a significant link from health expenditures to higher education funding. Even so, the placebo regressions for health expenditures reveal no significant coefficients for MAP. The second approach uses K-12 funding as the dependent variable. K-12 funding poses a stronger placebo test because many factors affect both K-12 and higher education. The placebo regressions for k-12 funding also yield no significant coefficients for MAP. Hence, neither placebo test raises concern over omitted factors that induce spurious correlations between the maximum Pell Grant and elements of state-local budgets.

5.7 Student loans. The federal guaranteed student loan (GSL) program also authorized by the HEA in 1965 may also play a role in the reduced funding for public colleges. Beyond the establishment of GSL in 1965, the most significant expansion of GSL was in 1978 when income restrictions on eligibility were removed.[11] To explore whether the estimates for MAP are sensitive to the GSL program, event dummy variables for the establishment of GSL in 1965 and the lifting of income restrictions for eligibility in 1978 are included (separately and together) in the baseline equation. Equivalent estimates are found for MAP, and there is no evidence of a link between either event dummy and reduced funding. GSL may play a significant role in reduced funding, but there is no evidence that it influences the results for MAP in these estimates.

5.8 Range of estimates. Across the various specifications including the GMM results, the point

[11] More recently, GLS 'PLUS loans' were authorized in 1978 for parents of students and loan consolidations.

estimates for the effect of MAP fall into a narrow range of (-0.04) in Table (2) to (-0.07) in Tables (3) and (4), indicating that a thousand dollar increase in MAP is related to a decrease in funding of (0.04) to (0.07) percentage points of personal income.

6. Federal-State Interactions

Casual observation and press reports of federal-state interactions suggest the following speculation: federal increases in Pell awards lead state-local governments to reduce funding for public colleges; reduced funding for public colleges leads to tuition hikes and ultimately, further increases in the MAP at the federal level.

The results of Granger-causality tests in Table (5) offer at least suggestive evidence of this dynamic between the federal and state-local levels for MAP and higher education funding.

Table (5) here

The results in Table (5) indicate that changes in MAP 'Granger cause' changes in state-local funding for public colleges, and changes in funding for public colleges 'Granger cause' changes in MAP. Neither link is rejected at (.05).

Given the interdependent dynamics evident in Table (5), the federal government may find it worthwhile to consider maintenance-of-effort (MOE requirements for state and local governments to increase the 'flypaper' effect of federal funding. The flypaper effect, a term coined by Fisher (1982) refers to the extent to which federal funding 'sticks' to its intended purpose or alternatively, displaces state-local funding. Mehiriz and Marceau (2014) provide a recent study of flypaper effects in Canadian municipalities. Cascio and others (2013) find evidence that federal Title 1 funds tend to crowd out state and local funding. Many federal programs already incorporate MOE rules for state and local governments to blunt perverse incentives that cause federal funding to crowd out state-local funding, and a similar rule may be overdue for the Pell program. Indeed, an MOE for state fiscal stimulus funding was included in the 2009 American Recovery and Reinvestment Act in 2009, and the American Association of State Colleges and Universities recently offered a more far-reaching proposal (Hurley and others, 2007) to index the MAP available to students in each state to the state's level of operational funding for public colleges to induce greater funding from state-local governments. The politics of a stronger MOE are difficult, perhaps impossible. In any event, no MOE requirement is unlikely to fully unwind the effects of the great retreat. Perhaps the most to be expected is a slowing of what appears to be a vicious cycle of interactions between the federal and state-local governments.

The full cascade of effects of Pell Grants was clearly not anticipated when Pell Grants were first established, and the experience offers a compelling example of how federal funding can induce a complex set of unanticipated effects in a federal system even when it is given to individuals.

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Table 1. Summary Statistics

(49 states 1957-2007)

	HIGHERED	MAP	HEALTH	K12	TAXES
Mean	1.641185	2.095.400	1.320581	4.313326	9.904849
Median	1.629214	1.650.000	1.210206	4.285281	9.872397
Maximum	3.663851	5.100.000	3.771012	8.438629	17.74776
Minimum	0.137900	0.000000	0.423005	2.470914	5.233230
Std. Dev.	0.651707	1.785.794	0.577894	0.726956	1.407045
Observations	490	490	490	490	490

Table Notes:
See text for sources of data.

Observations in regressions may differ due to lags.

All state-local fiscal variables in percentage points of state personal income.

HIGHERED—expenditures on operating expenses of public colleges.
MAP— maximum authorized Pell Grant in thousands (adjusted for inflation in regressions).

HEALTH— expenditures on public health, including Medicaid,

TAXES— revenues from taxes and fees.

K12—expenditures on K-12 public schools.

Table 2. Baseline equation (1) (1957-2007)

(change in higher-ed funding in % pts state personal income)

(Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.201371	3.306312	2.782972	0.0056
ΔMAP**	-0.041952	0.020734	-2.023391	0.0437
TREND**	-0.004525	0.001679	-2.695232	0.0073
TRENDBREAK**	-5.90E-05	2.19E-05	-2.700963	0.0072
Cross-section fixed (dummy variables)				

R-squared 0.152551

Observations: 441 (*sig .10, **sig .05)

Δ— first difference.

MAP— maximum authorized Pell Grant in thousands, adjusted for inflation.

TREND—linear trend in the dependent variable.

TRENDBREAK— break in TREND as of 1977.

Table 3. Expanded Equation (2) (1957-2007)
(change in higher-ed funding in % pts state personal income)
(Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.39411	4.794581	4.879282	0.0000
ΔMAP**	-0.066982	0.022699	-2.950855	0.0034
TREND**	-0.011598	0.002426	-4.780445	0.0000
TRENDBREAK	3.67E-05	3.21E-05	1.143146	0.2537
ΔHEALTH	0.023130	0.069935	0.330742	0.7410
ΔTAXES**	0.087093	0.024754	3.518406	0.0005
ΔK12	0.036904	0.050694	0.727979	0.4671
ΔSURPLUS**	-0.097800	0.018538	-5.275557	0.0000
ΔOTHER**	-0.073182	0.033648	-2.174929	0.0303
ΔUR	-0.008499	0.006279	-1.353701	0.1766
ΔLINCOME**	-0.942884	0.192163	-4.906681	0.0000
ΔPCT1864**	0.089423	0.017999	4.968244	0.0000
ΔPCT0517**	0.065210	0.018765	3.475122	0.0006

Cross-section fixed (dummy variables)

R-squared 0.476553

Observations: 441 (*sig .10, **sig .05)
Δ— first difference.

State-local fiscal variables are in percentage points of state personal income.

MAP— maximum authorized Pell Grant in thousands, adjusted for inflation.

TREND—linear trend in the dependent variable.

TRENDBREAK— break in TREND as of 1977.

HEALTH— expenditures on public health, including Medicaid,

TAXES— revenues from taxes and fees.

K12—expenditures on K-12 public schools.

SURPLUS— budget surplus (or deficit, if negative).

OTHER— other expenditures not elsewhere included.

UR—state—state unemployment rate.

LINCOME—log of state personal income per capita, adjusted for inflation.

PCT1864 (PCT0517)—percent of state population 18 to 64 (5 to 17), respectively.

Table 4. Expanded Equation (2) GMM Estimates (1957-2007)

(change in higher-ed funding in % pts state personal income)
(White-period standard errors and weighting matrix)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔHIGHERED-1**	-0.101975	0.038716	-2.633947	0.0088
ΔMAP**	-0.070783	0.019981	-3.542494	0.0005
TREND**	-0.018257	0.003011	-6.064290	0.0000
TRENDBREAK*	5.78E-05	3.45E-05	1.677755	0.0943
ΔHEALTH**	-0.504761	0.139355	-3.622120	0.0003
ΔTAXES**	0.117537	0.036143	3.251977	0.0013
ΔK12	-0.053675	0.095263	-0.563432	0.5735
ΔSURPLUS**	-0.194054	0.023713	-8.183315	0.0000
ΔOTHER**	-0.227463	0.036268	-6.271728	0.0000
ΔUR**	0.027879	0.007604	3.666161	0.0003
ΔLINCOME**	-0.926999	0.462744	-2.003267	0.0460
ΔPCT1864**	0.141000	0.028082	5.021092	0.0000
ΔPCT0517**	0.160846	0.024609	6.536053	0.0000

Cross-section fixed (orthogonal deviations) instruments (2+ period lag levels of RHS variables)

R-squared	0.265270		
S.E. of regression	0.318466	Instrument rank	41
J-statistic	32.23369		

Observations: 343 (*sig .10, **sig .05)

Δ— first difference. State-local fiscal variables in percentage points of personal income.

MAP— maximum authorized Pell Grant in thousands, adjusted for inflation.

TREND—linear trend in the dependent variable, and TRENDBREAK— as of 1977

HEALTH— expenditures on public health, including Medicaid,

TAXES— revenues from taxes and fees.

K12—expenditures on K-12 public schools.

SURPLUS— budget surplus (or deficit, if negative).

OTHER— other expenditures not elsewhere included.

UR—state unemployment rate.

LINCOME—log of state personal income, adjusted for inflation.

PCT1864 (PCT0517)—percent of state population 18 to 64 (5 to 17), respectively.

Table 5. Pair wise Granger-causality tests

(Two lags 1957-2007)

Null Hypothesis:	Obs	F-Statistic	Probability
ΔMAP does not Granger Cause ΔHIGHERED**	343	26.2375	0.0000
ΔHIGHERED does not Granger Cause ΔMAP**	343	80.3636	0.0000

*sig .10, **sig .05

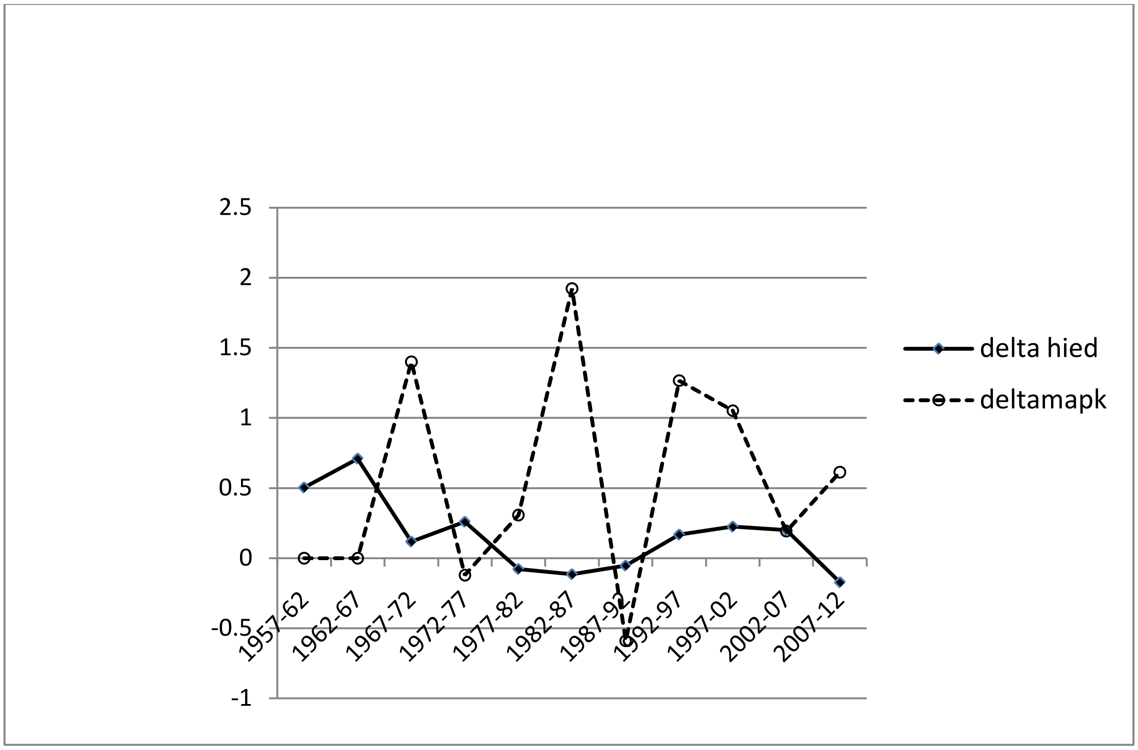
Notes

Δ—first difference.

MAP— maximum authorized Pell Grant in thousands, adjusted for inflation.

HIGHERED—state-local expenditures on operating expenses of public colleges in percentage points of state personal income.

Figure 1. Change in State-Local Funding for Public Colleges and the Maximum Pell Grant (five-year intervals, 1957-2012).



Notes

Delta hied is the percentage point *change* in the ratio of state-local funding for higher education operating expenses to personal income.

Delta mapk is the *change* in the maximum authorized Pell Grant in thousands of dollars, adjusted for inflation.

Sources: U.S. Bureau of Census, *Census of Governments* for state-local data and U.S. Department of Education, *Federal Pell Grant Program End-of-Year Reports*.