The Multiplier Effect of Education Expenditures*

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Abstract

This paper examines the short-run effects of education expenditures on local income and employment. We estimate fiscal multipliers using city-level variation in exposure to national changes in the $30-billion Federal Pell Grant Program, which is the largest U.S. program to help low-income students attend college. An increase in Pell grants by 1 percent of a city's income raises local income by 2.8% and local employment by 1.9% over the next two years, both exceeding estimates for military spending (1.5% on average). The higher multiplier is partly driven by Pell grants enabling students to take up student loans, which further relaxes their budget constraint. Multipliers are higher when grants are awarded to students at non-profit colleges. Multipliers are also higher during recessions than in expansions, suggesting that Pell grants can be an effective tool for countercyclical policy that adds to long-term benefits, such as increasing the affordability of college and fostering long-run growth.

Keywords: Fiscal Expenditure, Pell Grants, Education Policy, Fiscal Multipliers.

JEL classification: H52, E62, H30, I28

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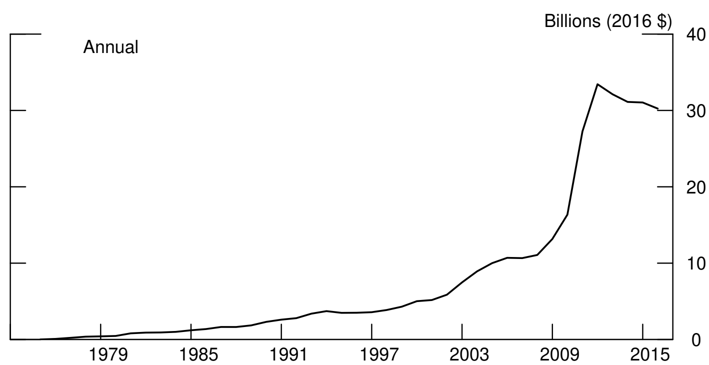
1. Introduction

Investments in education make up a significant part of government spending in advanced economies. In the United States, educational spending measured 5.4 percent of national income in 2020, which exceeds defense spending and spending on welfare programs. These investments are usually motivated by the well-documented effects that education has on well-being and economic growth in the long run (see, e.g., Barro, 1991, Benhabib and Spiegel, 1994, Bils and Klenow, 2000, and Manuelli and Seshadri, 2014). Like any other form of government spending, however, educational investments also have the potential to stimulate economic activity in the short run. Programs that reduce the cost of tuition or that involve direct transfers to students could, for example, increase purchasing power and therefore raise consumption and employment. They also unlock complementary sources of income that arise when students go to college, such as student loans. Such programs could be used to stimulate economic activity during recessions and serve as a tool for macroeconomic stabilization. However, empirical evidence on the short-run effects of educational investments on economic activity is needed to assess whether this is the case.

We quantify the effect of educational investments on economic growth in the short run. Specifically, we measure the impact of the Federal Pell Grant Program at the city (Metropolitan Statistical Area–MSA) level. Pell grants are need-based grants to low-income undergraduate and select post-baccalaureate students, designed to enable them to access post-secondary education. The Federal Pell Grant Program is the largest program to help low-income students attend college in the United States, with total awards exceeding 30 billion U.S. Dollars in 2015 (Figure 1). To express the effect of this program on an MSA's economic growth, we estimate the program's "fiscal multiplier," the increase in income and economic activity for a given increase in the program's spending. Our estimate of the fiscal multiplier quantifies the effect of a *relative* increase in Pell grant disbursements on the *relative* increase of a city's aggregate income and employment. If the income from Pell grants acts as a substitute for other income, such as income from work, the multiplier of Pell grants will be between 0 and 1 for income and negative for employment. In contrast, if the multiplier of Pell grant enhances local economic activity, the multiplier will be above 1 for income and positive for employment.

Figure 1. The Pell Grant Program: Expenditures and Recipients



Notes: The figure plots the total value of Pell grants in 2016 USD. Data is obtained from the Title IV Program Volume Reports by the Department of Education.

We obtain a causal estimate of the multiplier of the Pell Grant Program using a shift-share instrumental variable approach. Rather than directly relating increases in local Pell grants to local growth, we instrument local Pell grants by the interaction of national changes to Pell grant disbursements with the fraction of a city's population that received Pell grants *prior to* the change. We then assess the validity of the "shares" approach that we employ using a series of validity tests proposed by Goldsmith-Pinkham et al. (2020), and show that our shift-share instrument passes these tests.

We find that Pell grants have a significantly positive effect on economic activity. Our main result is that the multiplier of Pell grants—the percentage increase in a city's relative income or employment from a relative increase in Pell grants by one percent of initial income—is 2.8 for our full sample on local income and 1.9 for employment. This means that a dollar spent on Pell grants creates (more than) twice as much relative economic activity. This estimate is robust to the inclusion of city and time fixed effects, city-size weighting, controls for spending by state governments, other main fiscal transfers to low-income households, and various other controls for the economic performance of a city. We find that schools increase expenditures when the Pell grant program becomes more generous, but that the main source of short-run economic gains is likely a rise in consumer spending. We find that, in part, the Pell grant fiscal multiplier operates through enabling students to attend college and acquiring students loans. An expansion in Pell grants increases student loan disbursements, which further relax students' budget constraints and enable these low-income students to spend more. This plausibly explains why the effect of Pell grants is larger than multipliers of other fiscal programs that do not directly unlock other sources of income.

Our estimate of the multiplier comes with uncertainty: our preferred estimate has a standard error of 1.5. This error is in line with multiplier estimates for other sources of spending, and our results for employment confirm that there is a significantly positive effect on economic activity when Pell grants increase. We do find that there is a high degree of variability in the magnitude of the multipliers, driven by the timing of the award and the types of schools that Pell grant awardees attend. When comparing the effect of Pell grants that are received by students at for-profit institutions to grants for students at non-profit institutions, we find that multipliers are lower at for-profit colleges. This appears to be because for-profit schools raise tuition fees in response to an increase in Pell grant generosity. It therefore appears that Pell grants are implicitly acting as subsidies for the for-profit university sector.[1] While we find that both for-profit and non-profit colleges raise some expenditures when Pell grants rise, we find no evidence that the majority of the positive effect of Pell grants operates through this channel. We also find that four-year institutions have significantly larger multipliers than two-year institutions. Finally, we assess whether the multiplier of Pell grants is higher during recessions, as has previously been found for military expenditure.[2] We find that Pell grants' effect on economic activity is larger in recessions than in expansions. While multipliers are only statistically significantly higher in recessions than expansions in the post 1999 sample, the point estimate is large and suggests that Pell grants can serve as a macroeconomic stabilizer during recessions.

[1] Note that since 2010 the "Gainful Employment" regulation has limited the Pell grants at certain for-profit colleges (see Cellini et al., 2016). In general, Turner (2017) estimates that 11-20 percent of Pell grants passes through to schools.

[2] See, e.g., Nakamura and Steinsson (2014), Auerbach and Gorodnichenko (2012), and Berge et al. (2021).

Our estimates of the multiplier of Pell grants add to a vast literature that uses geographic cross-sectional variation in fiscal spending to estimate its short-run economic effects. The use of geographic variation became increasingly popular in the aftermath of the Great Recession. The advantage of using geographical cross-sectional data is that there is much greater variation in spending at the sub-national level, and more of this variation is plausibly exogenous. Like other sub-national estimations of multipliers, our results do have a particular interpretation: they measure the effect of Pell grants in one city on that city's relative economic performance, rather than the effect of Pell grants on economic performance at the national level. Local multipliers are estimated under different conditions than national multipliers. First, a city-level increase in Pell grants typically does not involve an increase in city-level fiscal deficits (and subsequent taxation), such that Pell grants do not crowd out private spending.[3] Second, a city-level increase in spending is typically sufficiently small such that it does not induce a monetary policy response. Third, local estimates may be affected by positive spillovers across local areas. Auerbach et al. (2020) note that local fiscal spending can have large spillovers to geographically close metropolitan areas, and find that these spillovers are typically positive.[4] Chodorow-Reich (2019) argues, on theoretical grounds, that the kind of geographical cross-sectional multiplier we estimate remains informative. It measures the national-level multiplier of fiscal spending when it is deficit financed and when monetary policy does not respond to the fiscal expansion, for example because interest rates are constrained by the effective lower bound. As these conditions often apply during recessions, our results give insight into the effectiveness of Pell grants as a tool to stimulate demand during downturns at the national level.

Our analysis of the multiplier for Pell grants takes into account changes in other local spending, such as unemployment insurance, housing benefits, food stamps, or state appropriations. Our main multiplier estimates thus evaluate the economic impact of an increase in Pell grants while keeping other fiscal spending constant. This approach allows us to factor out the possibility that other types of spending may automatically increase or decrease in response to changes in Pell grants, which could cloud our understanding of the direct effect of Pell grants. Our results indicate that these automatic responses are minimal; we observe similar multipliers even without controlling for other types of spending targeted to support low-income households. This evidence suggests that the positive effects of Pell grants on economic activity are neither diluted nor intensified by shifts in other fiscal spending.

The multiplier of 2.8 for Pell grants is higher than most estimates based on cross-sectional geographical variation of other forms of government spending. Early examples include Nakamura and Steinsson (2014), who estimate the state-level response of output to defense spending and find an average multiplier of 1.5. Acconcia et al. (2014) estimate multipliers from reductions in spending due the expulsion of mafia-infiltrated city council members in Italy and find a multiplier of 1.9. Cross-sectional estimates of the multiplier were also frequently used to assess the effect of the American Recovery and Reinvestment Act (ARRA) (see, e.g., Chodorow-Reich et al. 2012, Chhabra et al. 2019, Conley and Dupor 2013, Dupor and Mehkari 2016, Feyrer and Sacerdote 2011) and the fiscal stimuli during the COVID-19 recession (see, e.g., Auerbach et al. 2022). Dupor and McCrory (2018), Suárez Serrato and Wingender (2016), and Hasna

[3] Note that in a standard Neoclassical model, local multipliers are higher when they *are* locally financed, as the resultant tax increase would incentivize an increase in labor supply.

[4] The lack of local crowding-out is consistent with the idea that there is often excess capacity in production (Murphy 2017).

(2021) also study fiscal multipliers at a local level. Chodorow-Reich (2019) summarizes the literature on cross-sectional multipliers and finds that the mean estimated multiplier is 2.1 and the median estimated multiplier is 1.9. This evidence suggests that the multiplier for Pell grants is high compared to the multiplier of other forms of government spending and is, therefore, an effective tool to stimulate short-run economic activity. Furthermore, we also contribute to the literature on state dependence of fiscal multipliers by examining the differential effects across expansions and recessions (see, e.g., Auerbach and Gorodnichenko 2012, Berge et al. 2021, Barnichon et al. 2021, and Ghassibe and Zanetti 2022).

Why is the effect of Pell grants on local income so large? There are three likely drivers. First, Pell grants are a direct cash transfer and thus a part of personal income. This means that transfers themselves cause a one-for-one increase in personal income to begin with. Only if Pell grants "crowd out" other sources of private income, for example through a reduction in students' labor supply, would the multiplier ever be below one. Other forms of government spending, such as infrastructure investments or defence spending, only raise local income indirectly. As we find large effects of Pell grants on employment as well, however, this is unlikely to explain the full magnitude of Pell grants' multiplier. Second, Pell Grants are awarded to students from lower-income families. These students have limited borrowing capacity and are likely to have high marginal propensities to consume.[5] Fiscal stimuli that target households with high marginal propensities to consume generate higher multipliers (see, e.g., Johnson et al., 2006, Parker et al., 2013, and Jappelli and Pistaferri, 2014). Third, Pell grants enable many students to attend college (Dynarski, 2003), but are not enough to fully finance the cost of attending the college. These low-income students often rely on complementary financing sources, such as student loans. We find that large estimated multipliers can be reconciled, at least in part, with our finding that Pell grants increase cause an increase in student loans as well. These three factors may explain why Pell grants cause local income growth that significantly exceeds the initial cash transfer and produce fiscal multipliers that are higher than those estimated for other types of government spending.

In addition to providing evidence on the magnitude of the fiscal multiplier, this paper contributes to the literature on the Pell Grant Program. Previous work has documented several other positive effects, in particular in relation to education outcomes. Bettinger (2004) shows that receiving a Pell grant reduces college drop-out behavior. Pell grants also increase educational attainment, the probability of attending college, credit accumulation and has positive effects on students persistence and degree completion (Dynarski, 2003, Castleman and Long, 2016, and Fack and Grenet, 2015). Denning et al. (2019) show that eligibility for an additional Pell grant significantly increases the likelihood of degree receipt and raises earnings four years after the receipt of the degree. As higher earnings increase tax payments, they estimate that the government expenditures are fully repaid within 10 years.[6]

Dinerstein et al. (2014) use a shift-share instrument to look at the short-term economic benefits of Pell grants as part of various federal transfers to post-secondary education during the Global Financial Crisis. They find that counties which benefited from increases in the generosity of the Pell Grant Program did not have a significant increase in local income. They argue that one reason for this may be that students do

[5] For a literature review on the heterogeneity of marginal propensity to consume see, e.g., Jappelli and Pistaferri (2010).

[6] In addition, Black et al. (2020) show that increased access to student loans increases college attainment and implies that these students do not have to rely on other sources of funding and do not have to work as much while in college.

not spend their grants in the immediate vicinity of their university. Our analysis differs from Dinerstein et al.'s because we estimate the Pell grant's multiplier by exploiting the variation in the share of Pell grant recipients across cities such that our estimate of the multiplier is causal if these local exposure shares are exogenous. This new shift-share strategy also enables us to control for state and time-fixed effects. We furthermore consider a sample from 1990 to 2015 rather than 2006–2009, and conduct our analysis at the city (MSA) rather than the county level, which may be more appropriate given that consumers regularly travel outside their home county to consume.[7]

The remainder of this paper proceeds as follows. We begin by providing an overview of the Pell Grant Program in Section 2, in which we also explain our empirical approach. In Section 3 we discuss our main results, while in Section 4 we discuss how multipliers vary over the business cycle and compare multipliers at different types of colleges. Section 5 concludes.

2. Empirical Approach

This section outlines the empirical strategy to estimate the short-term economic effects of Pell grants. We start with a brief summary of the Pell grant program and how grants are allocated to students in Section 2.1. Section 2.2 outlines the identification strategy while Section 2.3 summarizes the dataset.

2.1. Pell Grants: Background

The Federal Pell Grant Program was initiated in 1974 as the Basic Educational Opportunity Grant to provide a need-based grant to enable low-income students to attend college. It was renamed the Pell Grant Program after Senator Claiborne Pell in 1980. The evolution of the program is plotted in Figure 2(a). It started off as a program for 280 thousand students in 1974 with a total appropriation of $122 million, which increased to over 9 million recipients and a $30 billion appropriation by 2015. The program's size depends on the size of the cohort receiving Pell grants and on the maximum grant amount determined by the law. The program expanded particularly rapidly from the early 2000s to 2010. Since 2000, the U.S. has witnessed a substantial increase in enrollment at post-secondary institutions and a marked increase in college tuition, both reflected in the non-profit and the for-profit education sectors. Federal support for higher education was expanded in order to compensate for the increasing costs, which led to an increase in both the average and the maximum awards for Pell grants, as shown in Figure 2(b). These were part, for example, of the College Cost Reduction and Access Act of 2007 and of the American Recovery and Reinvestment Act of 2009.[8]

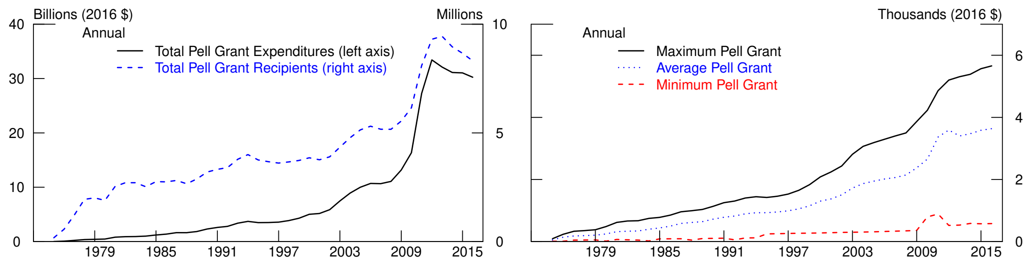
The size of individual grants primarily depends on a student's family earnings. The largest share of Pell grant disbursements is typically received by students from families with an adjusted gross income of less than $60,000.[9] The grant amounts are conditional on the student's expected family contribution

[7] Using credit card data, Dunn and Gholizadeh (2023) show that consumers regularly consume outside their home county and that this consumption link across counties has important implications for economic measurement.

[8] A full summary of legislative changes is found in the Appendix.

[9] For example, 96.6 percent of Pell grant recipients in 2011-12 had an income of $65,995 or less (see Delisle, 2017).

Figure 2. Evolution of the Federal Pell Grant Program



(a) Aggregate Awards (b) Individual Awards

Notes: Left figure plots the evolution of the dollar-value of Pell grant awards (left axis, solid) and the number of Pell grant recipients (right-axis, dashed). Right figure plots the minimum (dashed), average (dotted) and maximum (solid) value of an individual Pell grant. Data is obtained from the Title IV Program Volume Reports by the Department of Education.

(EFC), the institutional cost of attendance, the student's enrollment status, and whether or not they attend a full academic year or less.[10] A full-time student is eligible for the following Pell grant award if the maximum Pell grant ($Pell^{MAX}$) is higher than the EFC:

$$Pell_{i,t} = max\left\{(Pell_t^{MAX} - EFC_{i,t}), Pell_t^{MIN}\right\}, \tag{1}$$

where $Pell^{MIN}$ is the minimum Pell grant.[11] Once the grant amount is determined, the institution at which the student is enrolled either credits the grant funds to the student's account, pays the student directly by check, or combines these methods. Grant recipients can enroll at various types of institutions, ranging from four-year colleges to those specialized in occupational training. Currently, about 5,000 post-secondary institutions participate in the program and more than 40 percent of all undergraduates are relying on this type of aid. A significant share of grant recipients are enrolled at public two-year schools and at for-profit institutions. Pell grants do not typically cover the entire cost of attendance and, as result most recipients supplement this type of aid with funds from other sources, such as federal and/or private student loans, personal savings, and 529 plan savings.

2.2. Strategy

Identification Problem We estimate the effect of Pell grants on short-run economic activity by exploiting variation in Pell grant disbursements across cities. By relying on regional variation, we enable causal identification of Pell grants' multiplier. At the national level, changes in Pell grants are highly endogenous to economic fluctuations. Enrollment in higher education is counter-cyclical, tending to increase when economic performance is poor, for example, causing an endogenously negative relationship between growth and the size of the Pell Grant Program. In fact, the 2009 increase in the level of individual Pell

[10] Financial need is determined by the Department of Education using a standard formula established by Congress to evaluate the to determine the EFC. The formula relies on the student's income (and assets for independent students), the parents' income and assets (for dependent students), the family's household size, and the number of family members (excluding parents) attending post-secondary education.

[11] Awards are rounded to the nearest $100. Part-time student awards are scaled by a factor of 0.5; scale factor is used for all determinants in eq. (1). Part-year students receive a prorated Pell grant.

grants as part of the American Recovery and Reinvestment Act was expressly in response to poor economic performance during the Global Financial Crisis. This places a downward bias on national-level multiplier estimates.

We overcome this national-level limitation by analyzing the effect of an increase in generosity of the Pell Grant Program at the city (Metropolitan Statistical Area–MSA) level. While the generosity and conditionality of Pell grants are determined federally, there is significant variation in the extent to which sub-national areas benefit from an increase in national-level Pell grant awards. This variation is driven by the fact that areas differ in the number of eligible students in post-secondary education. A city with a large number of universities benefits more from an increase than a city without universities, while a city where a small fraction of its student population is eligible (e.g., because of average income) benefits less than a city where a greater fraction is eligible, even if both cities have a similar number of students overall. Metropolitan areas are the appropriate level of analysis because a vast majority of U.S. college students resides locally where their school is located.[12] College students also tend to spend most of their income for basic household goods, such as groceries, housing, transportation, and health care. Usually, most spending for these categories occurs within the MSA the school is located in.

Shift-Share Instrument Approach We estimate the effect of an increase in Pell grants along:

$$\frac{\Delta y_{m,t;t-2}}{y_{m,t-2}} = \beta \cdot \frac{\Delta e_{m,t;t-2}}{y_{m,t-2}} + \phi_m + \psi_t + \gamma' x_{m,t-2} + \mu_{m,t}, \tag{2}$$

where β is the multiplier, $y_{m,t}$ is per-capita personal income in metropolitan area m in year t, while $\Delta y_{m,t;t-2}$ is its bi-annual change. $\Delta e_{m,t;t-2}$ is the bi-annual change in the per-capita transfer of Pell grants to students enrolled at schools in m. It follows that our estimates of the multiplier of the Federal Pell Grant Program, coefficient β in eq. (2), measures the *relative* increase in metropolitan area m's income when it achieves a relative increase in Pell grants of 1 percent of local income. $x_{m,t-2}$ is a vector of local control variables, while ϕ_m and ψ_t denote fixed effects for metropolitan areas and years, respectively. We measure economic activity through personal income, which is a measure that correlates highly with GDP.[13] We use biannual changes to mitigate the noise coming from the mismatch between calendar years and academic years, and to account for the fact that shocks to spending tend to precipitate in the second year. As for specifications using labor change, we replace the dependent variable by $\frac{\Delta L_{m,t;t-2}}{L_{m,t-2}}$ where $L_{m,t}$ is local employment.

To obtain a causal estimate of Pell grants' multiplier β, we must still address the possibility of endogeneity in changes to local Pell-grant awards. Increases in Pell-grant awards at the level of a metropolitan

[12]According to the 2015 Digest of Education Statistics Table 309.10 covering student residence and migration, 82 percent of first-time degree-seeking undergraduate students attend college within their state of residence. Dunn and Gholizadeh (2023) show that consumers regularly consume outside their home county, so areas like MSAs or commuting zone may be more appropriate for the analysis of fiscal multipliers than counties. Additionally, there is more variation in spending across metropolitan areas than at other levels commonly used in the estimation of multipliers, like at the state level. Over the complete sample, the ratio of Pell grant spending to GDP is 0.16 percent across MSAs with a standard deviation of 0.17 percent, while that ratio is 0.12 percent at the state level with a standard deviation of just 0.08 percent.

[13]MSA GDP is only available from 2001. The correlation between GDP and personal income is 0.997 in overlapping years.

area may respond, for example, to an increase in local college enrollment that is driven by a deterioration of local economic conditions. This again puts a downward bias on the estimates of the multiplier.

We address this identification problem using shift-share instrumental variables (SSIV). We rely on the "shares-approach" identification strategy, as proposed by Goldsmith-Pinkham et al. (2020). In particular, we construct shift-share instrument $b_{m,t}$ that equals the interaction of the national growth in Pell grant disbursements and the fraction of a metropolitan area's population that received a grant two years prior:

$$b_{m,t} = \left(\frac{\Delta e_{t;t-2}}{y_{t-2}}\right) \cdot s_{m,t-2} \tag{3}$$

where $\Delta e_{t;t-2}$ is the bi-annual change in national Pell grants while y_{t-2} denotes twice-lagged national mean of personal income, and where $s_{m,t-2}$ denotes the share of a city's population that received a Pell grant two years prior. Our SSIV therefore leverages variation in the density of Pell grant recipients across cities prior to an increase in the program's national generosity to identify the effect of the grants on short-term economic growth.

Goldsmith-Pinkham et al. (2020) show that an SSIV along the one described in eq. (3) enables a causal identification of β as long as (i) the instrument $b_{m,t}$ is relevant and that (ii) the "shares" in the SSIV are orthogonal to the structural error term.[14] The first condition is straightforward to verify by regressing the instrument on changes in a city's Pell grant receipts. The second condition, which in our case requires that the shares $s_{m,t-2}$ are orthogonal to $\mu_{m,t}$ in eq. (2), cannot be verified directly. Instead, we conduct a series of falsification tests recommended by recent papers on the use of SSIVs (Goldsmith-Pinkham et al. 2020, Borusyak et al. 2022) to validate the empirical strategy, and show that our SSIV passes these tests consistently.

2.3. Data

To estimate the short-run economic effects of the Pell Grant Program we analyze a sample of 367 metropolitan areas with data from 1990 to 2015.[15] Summary statistics are provided in Table 1. We obtain data on personal income from the Bureau of Economic Analysis (BEA) and our data on employment from Bureau of Labor Statistics (BLS). Our data on the Pell Grant Program comes from two sources: the Delta Cost Project—an independent, nonprofit organization, that provides estimates based on data from the Integrated Postsecondary Education Data Systems—and the Title IV Program Volume reports published by the Department of Education. These datasets provide information about Pell grant disbursements at the level of higher education institutions. We aggregate the data to the metropolitan area level, which we are able to do for around 87 percent of Pell grants.[16] We use Delta Cost as our primary source for Pell grant data because it covers the entire sample period, while data from the Department of Education is

[14] While we also expect the "shifts," i.e., the annual changes to the national amount spent with Pell grants, to be exogenous in this framework we do not adopt the "shifts-approach" in Borusyak et al. (2022) because we do not have enough time periods for a large-enough shock sample size.

[15] Our data starts from the universe of MSAs, from which we exclude areas that never receive Pell grants and MSA-years with bi-annual income changes of less than -5 percent. This assures that we do not include local "natural" disasters in the sample. If we were to include these natural disasters, the estimates of the multipliers would remain roughly the same, if anything they would increase a touch.

[16] The remainder of Pell grants is awarded to institutions in rural areas.

available only from 2000.[17] The latter also has data on the number of Pell grant recipients, which we use to construct the shift-share instrumental variable.[18]

Our control variables come from a variety of sources. From the Delta Cost and Department of Education datasets we obtain various characteristics of an MSA's higher education institutions. These include the number of undergraduate students enrolled and the average tuition fee they pay, information on the fraction of institutions that is for-profit, and whether institutions primarily offer two- or four-year degrees. We additionally obtain financial control variables from Equifax credit bureau data through the Federal Reserve Bank of New York's Consumer Credit Panel. We use this dataset to control for student and overall debt, median Equifax Risk Score, mortgage delinquency, and credit card utilization. Data is available for the post-1999 period at quarterly frequency, which we annualize by taking averages. Finally, we retrieve demographic control variables for race and average education levels from the Census Bureau.

We use Delta Cost to obtain data on state appropriations for higher education. As we aim to measure the fiscal multiplier effects of Pell grants, in some specifications we control for state appropriations as they may be substitutes or complements for Pell grants. This means that without controlling for appropriations, our estimated multipliers would not measure the effect holding other fiscal spending on higher education constant. For readers interested in understanding how Pell grants' multiplier may be amplified or dampened by changes in other spending, we also present results without this control.

We also use data on the main U.S. fiscal transfer programs for supporting low-income households to control for possible confounding shocks. Data on the Supplemental Nutrition Assistance Program (SNAP) comes from the USDA and is available at the county level for most states for a single month in the year (July). We then multiply SNAP disbursements by 12 to get yearly amounts. Housing assistance data to low-income households comes from the U.S. Department of Housing and Urban Development (HUD) which is available at the MSA level after 2004. HUD data provide average government spending per unit per month which we multiply by the total number of units and by 12 to get yearly spending. Finally, unemployment insurance (UI) spending data comes from the Department of Labor. This data is only available at the state level. To get MSA-level estimates, we assume MSA disbursements are proportional to the MSA's share of unemployed calculated at the state level. For MSAs that cross state lines, we further assume that their population is split between states proportionally to their population levels.[19]

[17] A small fraction of observations in Delta Cost is adjusted or imputed. To validate the Delta Cost data, we compare the MSA-level Delta Cost data with the available DoEd data aggregated at the same level. This comparison reveals 16 areas where Pell grants from Delta Cost differ erratically from the DoEd data, which we address in two ways on a case-by-case basis. First, for the cases when one year of data were missing or one MSA-year observation was considered suspicious, we used linear interpolation based on the Delta Cost data. Second, for the cases when multiple MSA-year observations were either missing or were questionable, we applied the growth rate observed in the DoEd data to Delta Cost data. From our sample of 367 MSAs we correct the path of Pell grants for 9 using interpolation and 10 using the DoEd growth rate.

[18] Given that Pell grant recipient data is not available between 1990 and 1999, we impute the Pell grant recipient share ($s_{m,t}$) for these years. To do so, we approximate the number of Pell grant recipients in an MSA by dividing an MSA's Pell grant disbursement by the maximum per-capita Pell grant that year, as most students receive the maximum amount. We then calculate $s_{m,t}$ as before. The correlation between the actual Pell grant recipient shares and the imputed shares is 0.925. To assure that our results are robust to not using the imputation, we always include specifications that only rely on data from 2000 to 2015.

[19] As a final adjustment, for each of these fiscal transfer programs we replace missing data with the respective yearly sample average.

Table 1: Summary Statistics

	Mean	St. Dev.	Obs	Min	Max	Source
Dependent Variable						
Δ Personal Income (Biannual)	0.036	0.038	8,436	-0.050	0.624	BEA
Δ Employment (Biannual)	0.007	0.028	8,436	-0.130	0.251	BLS
Pell Grants and SSIV						
Growth in Expenditure - MSA	0.016	0.067	8,436	-0.757	1.084	Delta Cost
Growth in Expenditure - National	0.012	0.031	8,436	-0.029	0.116	Delta Cost
Pell Recipients Share (% of Pop.)	1.743	1.691	8,436	0.000	22.681	DoE
Appropriations Share (% of Income)	1.005	1.701	8,436	0.000	15.210	Delta Cost
Loan Disbursements						
Growth in Loan Disbursements	0.062	0.221	4,447	-2.544	3.237	Delta Cost
Control Variables						
Growth in Appropriations	-0.012	0.237	8,436	-5.237	6.664	Delta Cost
Students (Log Change)	0.028	0.152	8,436	-4.222	4.352	Delta Cost
Tuition fee (Log)	8.606	0.835	8,436	4.745	10.768	Delta Cost
For Profit (%)	18.873	20.148	8,436	0.000	81.818	Delta Cost
Black (% of Population)	10.414	10.668	8,436	0.094	52.672	Census
Hispanic (% of Population)	9.661	14.142	8,436	0.284	95.745	Census
Bachelors Degree (% of Pop.)	9.342	2.646	8,436	3.200	21.018	Census
Credit Card Utilization Rate	26.744	6.033	4,447	8.004	65.020	CCP (post 1999)
Age(Median)	47.549	4.385	4,447	27.500	63.000	CCP (post 1999)
Risk Score (Median)	701.264	34.814	4,447	583.875	787.188	CCP (post 1999)
Mortgage Delinq. (%)	5.713	4.803	4,447	-7.601	64.438	CCP (post 1999)
Total Debt (% of Income)	4.002	3.331	4,447	0.043	42.245	CCP (post 1999)
Student Debt (% of Income)	0.278	0.329	4,447	0.001	4.812	CCP (post 1999)
SNAP Share (% of Income)	0.459	0.288	4,447	0.000	3.346	USDA
UI Share (% of Income)	0.406	0.383	4,447	0.030	7.444	DoL
HUD Share (% of Income)	0.200	0.104	4,447	0.001	0.799	HUD
Growth in Fiscal Transfers	0.000	0.004	4,447	-0.052	0.049	USDA, DoL, HUD, Delta Cost

Notes: Summary statistics for the merged sample. Data from 1990 to 2015 covering 376 metropolitan areas. CCP stands for Federal Reserve Bank of New York/Equifax Consumer Credit Panel. BEA stands for Bureau of Economic Analysis. USDA stands for US Department of Agriculture. DoL stands for US Department of Labor. HUD stands for US Department of Housing and Urban Development.

3. Results

We now proceed with the main exercise. Section 3.1 presents the multiplier estimates for Pell grants along equation (2) and shows that our instrument is relevant. Section 3.2 performs a series of validity tests for the shift-share instrument as prescribed by Goldsmith-Pinkham et al. (2020) and also provides robustness results using alternative estimators. Finally, Section 3.3 assesses the effect Pell grants on student loans.

3.1. Multiplier Estimates

Results for the main estimation of the multiplier of Pell grants are presented in Table 2. Panel A of this table shows the effect of Pell grants on local income per capita and panel B shows the effect on em-

Table 2: Effect of Pell Grants on Local Income Per Capita and Employment

	Full Sample				Post 1999						Full Sample
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS	(8) 2SLS	(9) 2SLS	(10) 2SLS	(11) OLS
Panel A: Income Growth											
Multiplier	2.735*	2.656*	2.910**	2.796*	3.640**	3.615**	3.058*	2.982*	2.967*	3.126*	-1.672*
	(1.441)	(1.486)	(1.442)	(1.486)	(1.691)	(1.725)	(1.672)	(1.650)	(1.679)	(1.638)	(0.925)
Panel B: Employment Growth											
Multiplier	1.620	1.835	1.764	1.930*	3.120**	3.243**	2.855**	2.634**	2.771**	2.660**	-1.559**
	(1.123)	(1.132)	(1.125)	(1.143)	(1.312)	(1.322)	(1.277)	(1.258)	(1.264)	(1.256)	(0.772)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes	Yes	Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test	107.9	100.0	107.9	100.0	78.0	74.2	73.7	77.2	73.5	80.9	-
Joint F-test	-	67.3	-	67.7	-	37.8	37.5	-	37.4	45.7	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population (see eq. 3). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

ployment. The estimated coefficient β from equation (2) represents the multiplier.[20] All estimations control for MSA-level and time fixed effects. In some regressions we additionally control for changes in state appropriations for higher education. State appropriations are included because they interact with Pell grants. During the 2009 recession, for example, state appropriations fell by 29 cents for every dollar increase in federal research funds (Dinerstein et al. 2014). Some states even reduce appropriations proportionally to increases in Pell grants. This has a negative effect on economic activity and not controlling for appropriations would therefore lead to an underestimation of the ceteris paribus effect of Pell grants on short-term growth.[21] As state appropriations might also suffer from endogeneity with respect to economy growth, we instrument it with a SSIV that is analogous to the one we use for Pell grants, i.e., we calculate the shift-share instrument using national changes in appropriations spending and the twice lagged appropriations share of local income. Finally, we cluster standard errors by MSA.

[20] Table A1 in the Appendix uses our baseline methodology to calculate the one-year multiplier of Pell grants to local income.

[21] Reductions in state appropriations tend to have negative effects on students. Webber (2017) shows that for every $1,000 per student state budget cut, the average student pays $257 more in tuition and fees. Webber (2017) also shows that this trend has increased over time. State appropriations for higher education are also shown to have an impact on enrollment and borrowing. Goodman and Volz (2019) find that changes in appropriations induce students to substitute between public and for-profit colleges and have corresponding effects on student borrowing.

Our results show that the Pell Grant Program has an economically and statistically significant multiplier effect. For the full data from 1990 to 2015, in panel A we find a multiplier of 2.7 with our standard controls. This means that when an MSA receives an increase in Pell grants of 1 percent of income, local income increases by 2.7 percent compared to other MSAs. We then progress in steps to add additional controls: controlling for MSA controls, which include change in undergraduate students, average tuition and the percentage of schools that is for profit, demographic controls consisting of the percentage of the population that is black, Hispanic, and the fraction that at least has a Bachelor's degrees, the estimated multiplier rises to 2.8. This barely affects the estimated multiplier effect. We can also see that the effect of state appropriations is small, suggesting that our multiplier effects are only marginally offset by the nature of state funding for higher education.

Columns (5) to (10) of Table 2 are for the shorter post-1999 sample for which we have financial controls from the Federal Reserve Bank of New York/Equifax Consumer Credit Panel. In columns (5) to (7) we reproduce the specifications from columns (1), (2), and (4), respectively, for the shorter sample. The estimated multipliers are about 0.9 point higher in columns (5) and (6) compared to columns (1) and (2) and 0.3 point higher in column (7) compared to column (4). It follows that there remains a strong positive effect of Pell grant receipts on local economic growth in the shorter sample. Columns (8) to (10) add the Equifax controls, consisting of credit card utilization rates, average age, Equifax Risk Score, mortgage delinquency, and both total and student debt as a percentage of income. Adding these controls yields a multipliers between 2.9 and 3.1. Note that controlling for appropriations has very little, if any, effect in the shorter sample, as can be seen by comparing results in columns (8) and (9). In column (10) we reproduce the specification of column (9) using the broader definition of changes in fiscal spending instead of just appropriations. These transfers include the state appropriations as well as SNAP, HUD, and UI, and thus capture all the major fiscal transfers in the U.S. to low-income households. This yields a 0.15 point increase in the multiplier, which is well within a standard error. Importantly, our estimate of the Pell grant multiplier does not fall when including these fiscal spending controls. Thus, our high estimates of the economic effects of Pell grants are not driven by a positive correlation between Pell grants and other fiscal spending.

Our results suggest that multipliers of Pell grants are large. Our estimates exceed the median (1.9) and the average (2.1) of multipliers found in previous studies relying on geographic cross-sectional variation in other forms of fiscal spending, as surveyed by Chodorow-Reich (2019). Our estimates also exceed the 1.3 to 2.5 range for military spending in Nakamura and Steinsson (2014). Importantly, all of our estimates exceed unity. As Pell grants are transfers, they cause one-for-one increases in the BEA's measured personal income—hence our multiplier estimates show that local activity increases with disbursements.

In panel B of Table 2 we display estimates the effect of Pell grant disbursements on local employment. This is useful as it enables a comparison with a part of the literature that—among others for reasons of data availability—uses this dependant variable. Estimates of the fiscal multiplier on employment suggest that the employment fiscal multipliers are between 1.8 and 3.2, with the preferred estimate around 1.9 for the full sample. We can observe that—similarly as for the evidence in Panel A—multipliers increase somewhat when we move to the shorter sample. In column (7) where we reproduce the estimates from column (4) for a post-1999 sample, the fiscal multiplier on employment increases by about 0.9 points. When including the financial controls in columns (8)–(10) the effect of Pell grant disbursements on local employment ranges between 2.6 and 2.8. It is important to note that the fiscal multipliers do not change materially when we include controls for the appropriations and other fiscal transfers as is the case for the fiscal multipliers on local income. However, we can note that fiscal multipliers on employment are more precisely estimated than fiscal multipliers on local income as can be seen by substantially lower standard errors in panel B compared to panel A. Thus, the employment growth multipliers are highly significant in the post-1999 sample and suggest that Pell grant disbursements have large and significant effects on local employment.

To compare our employment growth multipliers with other similar multipliers estimated in the literature, the same specification for military expenditure at the state level in Nakamura and Steinsson (2014) gives an employment rate multiplier of 1.3. In addition, due to spillover effects (McCrory, 2020) the employment multipliers are generally increasing in the economic geography. Thus, one would expect smaller multipliers for MSAs than for state-level data. Our estimate implies that the cost of creating a job through Pell grants is around $30,500.[22] For a comparison, Auerbach et al. (2022) studies the effect of fiscal stimuli during the COVID-19 recession and find that at a core-based statistical area the cost of creating a job was about $50,000. At the commuting-zone level, Dupor and McCrory (2018) find that it takes between $67,000 and $100,000 to create a job-year, while at the county level, Suárez Serrato and Wingender (2016) estimate that about $30,000 in federal spending creates a new job-year. Our multipliers are very similar to those estimated in Suárez Serrato and Wingender (2016).[23] In addition to the effects on local income, our results show that transfers to education can also have significant effects on employment.[24]

The bottom row of Table 2 presents Kleibergen-Paap F-statistics for all instrument relevance jointly, while the row above presents robust F-statistics of the first-stage regression for Pell grants. We calculate critical values for the F-statistic using the Olea and Pflueger (2013) test and find critical values of 23.1 for a 10 percent worst case bias, which is the usual threshold. This critical value is comfortably exceeded in all columns.

As a robustness check, Table A2 in the Appendix presents results where we check whether city size matters for the estimated multiplier (Shoag, 2013). Our weighting relies on the two-year lagged logarithm of MSA population. We find that the estimated multipliers are very similar to those in Table 2.

3.2. Shift-Share Validity Tests

We next show that our shift-share instrumental variable passes a series of validity tests. Our strategy uses the "shares approach" (Goldsmith-Pinkham et al., 2020), which means we assume that the share of Pell recipients in the MSA's population is exogenous to the error term in the second stage of the regression

[22]This number is found from equation (2) using the change in employment rates as the dependent variable. The effect of Pell grants on employment count is given by $\partial L_t / \partial E_t = \widehat{\beta} \cdot L_{t-2} / Y_{t-2}$. Inserting the inverse of average personal income per employee in the sample and $\widehat{\beta} = 1.93$ gives 0.328 jobs per $10,000.

[23]Chodorow-Reich (2019) surveys other estimates of local fiscal multipliers.

[24]Previously, Feyrer and Sacerdote (2011) argued that transfers for education have modest effects on employment.

analysis. That is, we assume that MSAs with a large share of Pell recipients would have seen a similar level of economic growth as MSAs with low shares absent changes in aggregate Pell grant disbursements.

As with all instruments, this exclusion restriction cannot be tested directly. Instead, we follow the recommendation in Goldsmith-Pinkham et al. (2020) to conduct a series of validation tests. In Section 3.2.1 we perform a balance test, which involves regressing both the Pell grant recipient population share and the second stage's dependent variable on the covariates. In Section 3.2.2 we assess whether the endogenous dynamic bias identified in Jaeger et al. (2018) poses a threat to our results. In Section 3.2.3 we analyze which years in our sample are most important for our shift-share estimate of the fiscal multiplier. In Section 3.2.4 we use the Pell grant population shares directly as instruments. Finally, in Section 3.2.5 we assess whether our estimates are robust to using alternative IV estimators. We show that our instrument passes each of these checks. As our sample starts several years after Pell grant program was introduced, testing for pre-trends is not possible without additional assumptions.

3.2.1. Balance Tests

The first validity test for our shift-share instrument is a balance test. The test consists of two regressions, one with either growth in personal income or employment growth as the dependent variable, and one with the instrument shares—Pell grant recipients as a percentage of the population—as the dependent variable. In each regression, all of the control variables of the main analysis are the regressors. The idea behind this exercise is to assess whether we observe any simultaneous correlation between *observables*, the recipient shares, and income growth. If so, we might worry about omitted variable bias from *unobservables*.[25] The robustness of our point estimates in Table 2 to the inclusion of various alternative control variables suggests that such simultaneous correlation is unlikely; in this section we present a formal test that confirms that such simultaneous correlation is absent.

We report the results of the balance test in Table 3. As we use two time samples, we present results for the balance test separately for 1990–2015, columns (1) and (3), and for post 1999, columns (5) and (7). We include the largest possible set of observables (control variables) for the time sample as we do in the preferred specifications (4) and (9) in Table 2. To make coefficients easier to interpret, all variables are demeaned and normalized to have unit variance. The balance test falsifies the instrumental variable if one of the outcome variables—growth in personal income or employment growth—and the shares variable—Pell grant recipients as a percentage of the population—significantly correlate with an observable. If there are no simultaneous significant correlations for shares and either dependent variables, the balance test passes.[26] We mark these cases with a "✓" in columns (4) and (8). As shown in Table 3, all of our observable control variables pass the balance test. This makes it less likely that an unobserved confounder would correlate with both the income growth (or employment growth) and the share of the population

[25] A similar argument is put forward in Oster (2019).

[26] Naturally, the test passes if we have significant correlations for both dependent variables so long as it is not significant for shares.

Table 3: Balance Test

	Full Sample				Post 1999			
	(1) Shares	(2) Income Growth	(3) Empl. Growth	(4) Pass	(5) Shares	(6) Income Growth	(7) Empl. Growth	(8) Pass
Approp. Growth	0.003	0.032***	0.051***	✓	0.001	0.033***	0.047***	✓
	(0.014)	(0.010)	(0.014)		(0.008)	(0.011)	(0.013)	
Log(Tuition)	-0.006	-0.070	-0.023	✓	-0.022	-0.240***	-0.124*	✓
	(0.048)	(0.051)	(0.050)		(0.049)	(0.062)	(0.064)	
D.Log(Students)	0.017*	0.001	-0.006	✓	0.021*	0.001	-0.009	✓
	(0.010)	(0.009)	(0.009)		(0.011)	(0.011)	(0.007)	
For Profit	0.052	-0.003	0.025	✓	0.006	0.031	0.100**	✓
	(0.035)	(0.040)	(0.028)		(0.028)	(0.057)	(0.047)	
Share Black	0.157	-0.028	0.241	✓	0.594	0.044	0.423	✓
	(0.233)	(0.159)	(0.157)		(0.388)	(0.521)	(0.357)	
Share Hisp.	-0.172	0.548***	0.763***	✓	-0.287	0.358	0.799***	✓
	(0.141)	(0.144)	(0.117)		(0.223)	(0.362)	(0.279)	
Share Bach.	-0.116	0.074	0.273***	✓	0.028	0.664***	0.792***	✓
	(0.133)	(0.100)	(0.080)		(0.135)	(0.163)	(0.145)	
Risk Score					-0.041	-0.024	-0.094**	✓
					(0.029)	(0.042)	(0.048)	
Age					0.002	-0.013	0.006	✓
					(0.037)	(0.041)	(0.038)	
Debt to Income					-0.052	0.238	-0.082*	✓
					(0.032)	(0.191)	(0.045)	
Card Util.					0.026*	-0.039	-0.017	✓
					(0.016)	(0.030)	(0.024)	
Mort. Delinq.					0.013	-0.009	-0.022	✓
					(0.015)	(0.019)	(0.019)	
Observations	8,436	8,436	8,436		4,447	4,447	4,447	
R-square	0.7	0.3	0.5		0.8	0.4	0.6	
Time FE	Yes	Yes	Yes		Yes	Yes	Yes	
MSA FE	Yes	Yes	Yes		Yes	Yes	Yes	

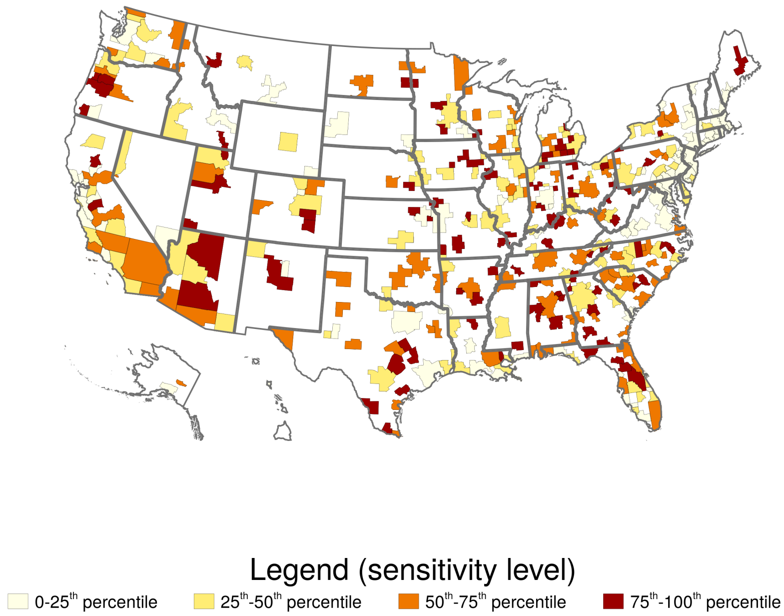
Notes: Independent variables are twice lagged in columns (2), (3), (6), and (7) except for appropriation growth. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

that ex-ante receives Pell grants. We show in Table A3 in the Appendix that our SSIV also passes a balance test for the specification in column (10) of Table 2.[27]

We further assess the validity of the appropriations and fiscal transfer SSIVs by running their respective balance tests. These are reported in Tables A4 and A5 in the Appendix, respectively. The balance test for appropriations is a pass for all but three control variables, the local share of Hispanics and people with at least a bachelor degree, and the share of for-profit colleges. While this is potentially worrying, results in Table 2 for the specifications without state appropriations (columns (3) and (8)) show that our results are not significantly affected by removing appropriations altogether. As for the combined fiscal transfers variable, the balance test fails for the local share of Hispanics and people with bachelor degrees, and for the debt to income ratio. This result, however, seems to be affected by the missing data imputation procedure that we describe in Section 2.3. Indeed, we do not observe a simultaneous significant correlation for these control variables and income growth when we restrict the sample to observations with

[27]We also run a balance test adding real college spending per capita as an additional observable and verify that our identification strategy still passes the test. Results are available upon request.

Figure 3. Geographical Distribution of the Ratio of Pell Grant Recipients over Population



Notes: The figure plots $s_{m,2010}$ from equation (3). Blank areas fall outside metropolitan areas or, in rare cases, are areas that never receive Pell grants.

complete data availability (see Table A5 in the Appendix). As for the specification with employment, the failure of the balance test for the debt to income ratio is small in magnitude: a standard deviation change in the observable only affects shares by 4.1% of their standard deviation. Moreover, the estimate for the specification in column (10) in Table 2 does not deviate from the other estimates significantly, which is evidence that any potential underlying bias is not qualitatively affecting results.

We next assess the balance of the geographical distribution of the population share of Pell grant recipients. It is well established that local income growth and employment growth varies strongly across U.S. regions, with poorer areas growing faster than richer areas (see, e.g., Barro et al., 1991). If Pell grant recipient shares are persistently higher in areas with low or high income growth (employment growth), that would be an example of an observable variable that correlates with both our shares and dependent variable, violating the SSIV balance test proposed by Goldsmith-Pinkham et al. (2020). As in informal investigation, Figure 3 plots the share of Pell grant recipients in an MSA's population for 2010.[28] Dark areas have a larger population share of Pell recipients and are more sensitive to national changes in the amount disbursed, while light areas have a lower share. The figure shows that the distribution of Pell recipients does not exhibit geographical clustering. Most states contain both MSAs with above- and below-average Pell grant recipient shares, in support of the requirement that there is a balanced distribution of our instrument across regions. Insofar as geographical clustering would make a correlation between our instrument shares and dependent variables more likely, Figure 3 thus provides an additional successful balance test.

[28] Results for other years, available on request, are similar to those for 2010.

3.2.2. Bias from Persistent Effects of Pell Grants

Next we study the potential identification issues arising from endogenous dynamic responses to SSIVs. Jaeger et al. (2018) shows that our estimates in Table 2 may be biased if two conditions are met. First, the SSIV is serially correlated. Second, the multiplier effects induced by the Pell disbursements affect future local GDP, as the economy takes some time to adjust to changes in the Pell grants. The latter can happen if, for example, Pell grants boost local demand which prompts firms to invest in capital, an effect that might take longer than a year to show up. If these conditions are met, our estimates capture not only the short-term multiplier effect of Pell grants but also their long-term, persistent effects, confounding the identification approach in the paper. The solution proposed in Jaeger et al. (2018) entails controlling for one-year lagged Pell grants and instrument them with one-year lagged SSIV. Table 4 reports results for both income and employment growth. As the coefficient on this lagged regressor is not significant for any of our specifications and the coefficient on current Pell grants is statistically indistinguishable from those in Table 2, we find no evidence of a significant dynamic bias in our coefficients.

3.2.3. Rotemberg Weights

In a third validation exercise of our shift-share instrument, we analyze whether particular years drive the identification of our multiplier estimates. To do so, we calculate the Rotemberg weights, which tell us how sensitive the overall estimate of the fiscal multiplier is to endogeneity (misspecification) in the instrument. Goldsmith-Pinkham et al. (2020) show that the shift-share IV estimates can be written as a weighted sum of a GMM estimates using the recipient shares interacted with time fixed-effects as separate instruments. Weights in this decomposition are called "Rotemberg weights" and they sum up to 1. These weights depend on the covariance between the specific instrument's fitted value of the endogenous variable and the endogenous variable itself.[29] In our case, the SSIV estimate can be interpreted as a weighted sum of just-identified estimates calculated using the MSA-level Pell recipients population share for each year ($s_{m,t-2}$) separately.

Rotemberg weights indicate which years are most important for both our estimate and the identification strategy. If the instrument is misspecified (endogenous) in a specific year and that year has a high Rotemberg weight, our estimate of the multiplier could be significantly biased. Ideally, years with a high Rotemberg weight and a high first stage F-statistics should be close to the overall estimate of the fiscal multiplier. We plot the Rotemberg weights in Figure 4, which shows the just-identified yearly estimates of the multiplier $\hat{\beta}_t$ with respect to the first-stage F-statistics calculated using the specification in column (4) of Table 2. The size of each point is proportional to the magnitude of each weight and the horizontal dashed line represents the baseline estimate in column (4) of Table 2 for both income and employment growth. As we can see in both panels of Figure 4, the high-weight years (2011 and 2010) are close to the baseline estimate and have a high F-statistic. This suggests that our estimate of the fiscal multiplier is not noticeably biased due to endogeneity of the instruments in a particular year: Even if there is some misspecification in a particular year this does not significantly affect the overall estimate. Additionally, while

[29] In the simplest example where the individual, yearly instruments are all orthogonal, the weights are simply the ratio between the just-identified first-stage R^2 and the full SSIV first-stage R^2.

Table 4: Effect of Pell Grants on Local Income Per Capita Controlling for Lagged Pell Grants

	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
Multiplier_t	4.125**	4.149**	3.824**	3.851**	4.813**	4.849**	4.194**	4.198**	4.233**	4.059**	-1.922**
	(1.913)	(1.910)	(1.886)	(1.883)	(2.195)	(2.190)	(2.078)	(2.066)	(2.059)	(2.057)	(0.920)
Multiplier_{t-1}	-1.789	-1.967	-1.180	-1.393	-1.514	-1.637	-1.504	-1.572	-1.680	-1.215	0.460
	(1.819)	(1.847)	(1.763)	(1.788)	(1.992)	(2.046)	(1.968)	(1.953)	(2.009)	(1.992)	(0.859)
Panel B: Employment Growth											
Multiplier_t	2.448*	2.407**	2.086*	2.055*	3.201**	3.124**	2.500*	2.544*	2.444*	2.516*	-2.586***
	(1.262)	(1.207)	(1.226)	(1.181)	(1.496)	(1.429)	(1.331)	(1.358)	(1.283)	(1.334)	(0.912)
Multiplier_{t-1}	-1.065	-0.753	-0.415	-0.166	-0.105	0.158	0.471	0.117	0.434	0.188	1.883***
	(1.166)	(1.115)	(1.119)	(1.085)	(1.256)	(1.268)	(1.222)	(1.210)	(1.235)	(1.219)	(0.618)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test	74.8	76.3	74.7	76.2	52.5	54.7	53.6	51.6	54.1	53.2	-
Joint F-test	35.3	35.8	35.3	35.9	24.5	21.2	20.9	-	20.8	32.5	-

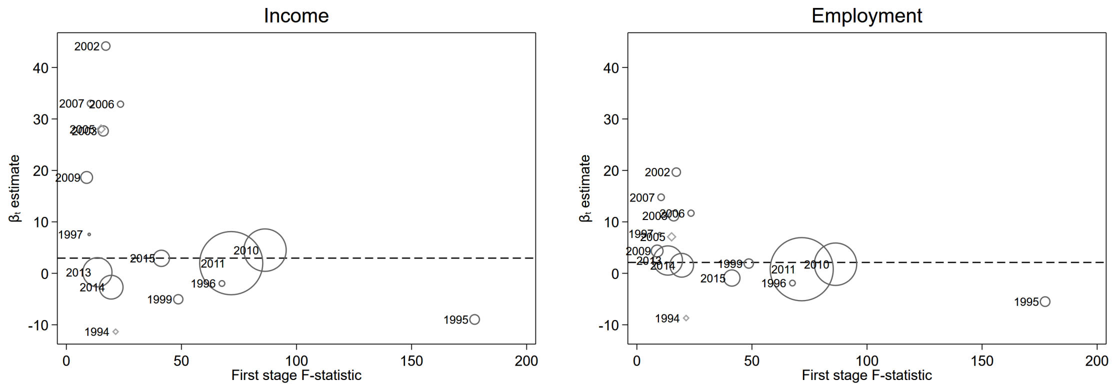
Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population (see eq. 3). SSIV strategy for the one-year lagged Pell grants regressor uses the three-times-lagged share of recipients in MSA population (see eq. 3). SSIV strategy for appropriations uses the two-year lagged appropriation share of income. Controls are one-year lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

we do observe some dispersion between the $\hat{\beta}_t$ most of the outliers carry a low weight and a relatively low F-statistic. The large weights in 2011 and 2010 are expected given the large increases in Pell disbursements in those years as shown in Figure 2. Moreover, while there are points with negative weights, these account for little in the overall weight.

3.2.4. Analysis using Shares Directly

In a fourth validity check, we replace the instrument in eq. (3) with the interaction of our shares variable—the lagged share of Pell-grant receivers as a fraction of the population—and time fixed effects. The idea behind this validity check, as proposed by Goldsmith-Pinkham et al. (2020), is to assure that our estimates of the multiplier of Pell grants are driven by variation in the shares variable, and not primarily by the shocks to the national Pell grants program. Estimates of the multiplier with the alternative instrument should therefore be similar to the main estimates. This check is important, as changes in the program are

Figure 4. Multiplier Estimates from Single-Year Instruments and Rotemberg Weights



Notes: The figure plots each $\hat{\beta}_t$ as a function of their first-stage F-statistics for the full sample. The $\hat{\beta}_t$ are calculated using the specification of column (4) in Table 2 using both income and employment growth rates. The size of the circles and diamonds is scaled by the magnitude of the respective Rotemberg weight. Circles denote positive weights while diamonds denote negative weights. The horizontal dashed line shows the overall $\hat{\beta}_{SSIV}$ of column (4) in Table 2. The figure excludes instruments with first-stage F-statistics below 5.

partially endogenous to economic growth. Indeed, the main expansions of the program that we discussed in previous sections were explicitly in response to the Great Recession.

To implement the "shares-directly" instrumental variable specification, we run:

$$\frac{\Delta e_{m,t;t-2}}{y_{m,t-2}} = \sum_{t\in T} \alpha_t \cdot s_{m,t-2} + \phi_m + \psi_t + \gamma' x_{m,t-2} + \mu_{m,t}, \tag{4}$$

where T denotes the total number of years in our sample. The second stage of the regression is unchanged. By interacting $s_{m,t-2}$ with time fixed effects rather than changes in the size of the Pell grant program at the national level, we reweigh the importance of years. With the new instrumental variables, the analysis now derives the estimated multipliers from an unweighted average of the points in Figure 4.

The multiplier estimates from the shares-directly approach are presented in Table 5. Results for the full sample are in columns (1)–(4), while columns (5)–(10) report the results for the post-1999 sample. The result in column (1) is a touch smaller than the companion in Table 2, though not significantly different from zero. The multipliers in columns (3) and (4) increase slightly to about 2.1, but still remain below their counterparts in Table 2, potentially because the proxy variable for the Pell recipients that we use in the first part of the full sample is constructed using MSA-year variation. As such, the fixed effects absorb some of variation in the proxy. When we consider the post-1999 sample, where we do not have to rely on a proxy for the Pell recipients, the estimates in columns (5) to (10) are slightly higher in panel A and slightly lower in panel B, but overall close to the corresponding estimates in Table 2.

In the final row of Table 5, we report the p-value of an over-identification J test. The shares-directly regression enables such a test because the regression now relies on T instruments rather than a single instrument. The J-test rejects that all of our instruments give rise to similar estimates of the multiplier—as was already evident from Figure 4. In some settings this may be worrisome, because it means that subsamples of the data imply heterogeneous multipliers. In our case, however, heterogeneity in multipliers

Table 5: Effect of Pell Grants on Local Income Per Capita (using shares directly)

	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
Multiplier	1.762	1.890	2.144*	2.103	4.418**	4.351**	3.811**	3.854**	3.769**	3.880**	-1.672*
	(1.308)	(1.348)	(1.286)	(1.338)	(1.726)	(1.759)	(1.699)	(1.670)	(1.698)	(1.664)	(0.925)
Panel B: Employment Growth											
Multiplier	0.325	1.022	0.628	1.144	2.707**	2.888**	2.465**	2.207*	2.354**	2.227*	-1.559**
	(0.978)	(0.986)	(0.960)	(0.988)	(1.236)	(1.260)	(1.220)	(1.182)	(1.194)	(1.187)	(0.772)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes	Yes	Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test	107.6	72.3	107.0	71.3	12.8	13.6	13.3	12.8	13.1	14.0	-
Joint F-test	-	17.8	-	17.9	-	8.3	8.4	-	8.5	11.9	-
AR Test p-value, Income	0.00	0.00	0.00	0.00	0.02	0.02	0.04	0.02	0.03	0.01	-
J-test, p-value, Income	0.00	0.00	0.00	0.00	0.02	0.02	0.03	0.01	0.01	0.01	-
AR Test p-value, Employment	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.05	0.05	0.06	-
J-test, p-value, Employment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population directly as instruments. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. AR Test p-value shows the p-value for the Anderson-Rubin weak-IV test. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

across different years is expected. There is a wide literature, for example, that suggests that multipliers are different across various stages of the business cycle (see, e.g., Berge et al., 2021). We study this heterogeneity in Section 4.1 and confirm that also Pell grants multipliers differ substantially across different business cycle stages. Therefore, it is not a surprise that we reject the null hypothesis of the overidentification test.

3.2.5. Alternative Instrumental Variable Estimators

In a fifth and final validity check, we replace the standard two-stage least squares (2SLS) estimator with two alternatives: the Limited Information Maximum Likelihood (LIML) and the heteroskedasticity-robust Fuller (1977) (HFUL) estimator proposed by Hausman et al. (2012). As Goldsmith-Pinkham et al. (2020) note, estimates from the LIML and HFUL estimator may differ from the 2SLS estimator because they rely on different identification assumptions. The LIML estimator reduces the small-sample bias from weak

Table 6: Effect of Pell Grants on Local Income Per Capita Using Different Estimators

Post 1999	Income Growth			Over ID test	Employment Growth			Over ID test
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2SLS (SSIV)	3.615**	3.058*	2.967*	.	3.243**	2.855**	2.771**	.
	(1.725)	(1.672)	(1.679)	.	(1.322)	(1.277)	(1.264)	.
2SLS	4.351**	3.924**	3.769**	26.758	2.888**	2.312**	2.354*	29.588
	(1.759)	(1.671)	(1.698)	[0.013]	(1.260)	(1.203)	(1.194)	[0.005]
LIML	4.454**	4.024**	3.856**	26.777	3.121**	2.481**	2.510**	29.543
	(1.813)	(1.716)	(1.746)	[0.013]	(1.350)	(1.261)	(1.255)	[0.005]
HFUL	4.778***	4.237***	4.107***	156.115	3.316***	2.438***	2.620**	237.354
	(1.494)	(1.476)	(1.499)	[0.000]	(1.031)	(0.965)	(0.980)	[0.000]
Observations	4,447	4,447	4,447	4,447	4,447	4,447	4,447	4,447
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA Controls		Yes	Yes	Yes		Yes	Yes	Yes
Financial Controls			Yes	Yes			Yes	Yes

Notes: 2SLS uses each yearly share as a separate IV. LIML uses the limited information maximum likelihood estimation with the same set of instruments. Finally, HFUL uses the estimator from Hausman et al. (2012) also with the same set of instruments. Controls are contemporaneous to the respective timing of shares. Overidentification tests in column (5) refer to the specification in column (4). We use the Sargan test (Sargan, 1958) for the 2SLS and LIML estimators, and the overidentification test from Chao et al. (2014) for the HFUL estimator. P-values for the overidentification tests are in brackets. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

instruments though it is inconsistent under heteroskedasticity. The HFUL estimator, on the other hand, is consistent under heteroskedasticity and many instruments though it can be slightly more biased than LIML under homoskedasticity. Given these different properties, if point-estimates are similar under these approaches it is less likely that our strategy is misspecified.

Table 6 presents the results. The alternative estimators all use the separate instruments for every year in the data, which means they are most comparable to our shares-directly estimates. As these shares are only available for the post-1999 sample, we focus on those specifications. The first two rows in the table reproduce the baseline SSIV estimator (from Table 2). The third and fourth row present the fiscal multiplier estimates using the Limited Information Maximum Likelihood (LIML) estimator and the HFUL estimator from Hausman et al. (2012). Columns progressively add controls as in the previous tables.[30] Comparing the estimates, it is clear that the alternative estimators imply similar multipliers of the Pell Grant Program. All show similarly large positive economic effects of the program, and the difference between specifications within columns is not statistically significant.

3.3. Understanding the Pell Grant Multiplier

The preceding three sections show that the multiplier of the Pell Grant Program is large and causally estimated. In the remainder of this section, we posit a hypothesis for the driver of the multiplier: Pell grants enable students to raise consumption, as they both increase students' income directly and give

[30] Table A6 in the Appendix reports the specifications without controlling for appropriations.

Table 7: Pell Grants and Student Loans

Post 1999 Sample	Student Loan Growth			Income Growth			Employment Growth		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Δ Pell Grants	1.990***	1.978***	1.977***						
	(0.456)	(0.457)	(0.453)						
Δ (Pell Grants + Loans)				1.209**	1.027*	0.997*	1.085***	0.959**	0.931**
				(0.549)	(0.541)	(0.549)	(0.393)	(0.393)	(0.390)
Observations	4,447	4,447	4,447	4,447	4,447	4,447	4,447	4,447	4,447
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA Controls		Yes	Yes		Yes	Yes		Yes	Yes
Financial Controls			Yes			Yes			Yes
Fiscal Transfers									
Δ Pell Grants F-test	74.2	73.7	73.5	71.0	70.6	71.0	71.0	70.6	71.0
Joint F-test	37.8	37.5	37.4	30.8	30.4	30.5	30.8	30.4	30.5

Notes: SSIV strategy for the Pell grants regressor and the sum of Pell grants and loan disbursements uses the twice-lagged share of recipients in MSA population (see eq. 3). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

them access to student loans.[31] According to the National Postsecondary Student Aid study, in 2015-16 school year 56% of Pell grants recipients supplemented Pell grants with student loans. If Pell grants enable students to attend college, they therefore also enable recipients to acquire student loans, further easing their budget constraint.

We test this assertion with two additional analyses. We first look at the effect of an expansion of Pell grants on the disbursement of student loans. Data on student loans is available through Delta Cost at the school level for the post-1999 sample. We aggregate the school-level data to the city level to estimate a regression akin to eq. (2) using the ratio of changes in student loan disbursement over lagged personal income as the dependent variable. Results are presented in the first three columns of Table 7. The point estimates average around 2.0, which means that an increase in Pell grants causes an increase in student loan disbursements that is around twice the size of the initial Pell grants rise. This means that, besides directly raising income, Pell grants indeed enable students to increase their borrowing.

In the second analysis, we assess whether the combined increase in Pell grants and student loans is sufficiently large to explain the overall increase in local activity after exogenous increases in Pell grants. To do so, we re-estimate the original regression in eq. (2) using the change in the sum of Pell grants and

[31] Student loan disbursements and number of students receiving student loans are for first-time degree/certificate-seeking undergraduate students who received student loans. Loans to students are defined as any monies that must be repaid to the lending institution for which the student is the designated borrower. They include all Title IV loans and all institutionally- and privately-sponsored loans but do not include PLUS and other loans made directly to parents.

student loans as the independent variable, leaving the SSIV unchanged. If the increase in local economic activity is proportional to the increase in the sum of Pell grants and student loans, we expect an estimated β of exactly 1 in this regression. The final six columns in Table 7 present the estimates for both local income growth and employment growth, which are indeed all around 1.[32] In the absence of individual consumption data of Pell grant recipients, this is the closest test of consumption hypothesis we are able to provide. Note that the lower estimates for β in Table 7 compared to Table 2 above do not mean that we overestimate the fiscal multiplier of Pell grants, as student loans are not a fiscal transfer. The fiscal multiplier is the ratio of the change in personal income and the change in the Pell grants, and is thus given by the estimates in Table 2.

It may come as a surprise that Pell grants and student loans are complementary, as evidenced by the results in the first three columns of Table 7. In practice, all students who may be eligible for any type of student aid apply through a single application known as the Free Application for Federal Student Aid or the FAFSA form. Then colleges, considering the student aid disbursement criteria discussed in section 2.1, send out financial aid offers that include the financing aid package to cover the difference between the cost of attendance and the expected family contribution (EFC). Lower-income students often rely both on Pell grants and different types of student loans, as they are often constrained in their ability to raise EFC. Thus, it is not surprising that Marx and Turner (2018) find that Pell grants reduce potential borrowing (student loans), suggesting that Pell grants and student loans act as *substitutes* for students who have to meet the cost of attendance threshold. This can be reconciled with our results, however, by the fact that we measure the relationship between Pell grants and student loans at the city level. As long as Pell grants enable students to attend college when they otherwise would not have, a positive correlation between changes in Pell grants and student loans should arise.

4. When Are Pell Grants Most Effective?

We next assess under what conditions the effect of an increase in Pell grant disbursements on local economic activity is the largest. To do so, we look at how the multiplier effect of Pell grants varies across recessions and expansions, and whether the effect of grants depends on the type of institution that students attend.

4.1. Multipliers in Recessions and Expansions

We first compare the multiplier of Pell grants during episodes when the economy is in expansion to when it is in recession. Recent evidence suggests that fiscal spending generally has a greater effect on output

[32] Table A7 in the Appendix reports the specifications without controlling for appropriations.

when the economy is in recession.[33] If this holds for Pell grants, they could form a particularly effective tool to stabilize macroeconomic activity. We estimate the following equation to test this:

$$\begin{aligned}\frac{\Delta y_{m,t;t-2}}{y_{m,t-2}} &= F(z_{m,t-2})\left[\alpha_E + \beta_E \frac{\Delta e_{m,t;t-2}}{y_{m,t-2}}\right] + [1 - F(z_{m,t-2})]\left[\alpha_R + \beta_R \frac{\Delta e_{m,t;t-2}}{y_{m,t-2}}\right] \\ &\quad + \phi_m + \psi_t + \gamma' x_{m,t-2} + \mu_{m,t},\end{aligned} \tag{5}$$

where β_R and β_E respectively capture the multiplier in recessions and expansions, while $F(z_{m,t-2})$ is a continuous function that strictly increases with a moving average of lagged biannual growth, or employment for the specification on employment growth, $z_{m,t-2}$.[34]

This equation is also known as a smooth transition model, which we borrow from the literature on the state-dependent effect of fiscal and monetary policy on economic activity.[35] The specification assigns weights to observations based on whether the economy is in recession or expansion. If two-year lagged growth was relatively high, the observation weights towards β_E while it weights more towards β_R if lagged growth was low. Following Tenreyro and Thwaites (2016), $F(z_{m,t})$ is a logistic function:

$$F(z_{m,t}) = \frac{\exp\left(\theta \frac{[z_{m,t} - \mu_m]}{\sigma_m}\right)}{1 + \exp\left(\theta \frac{[z_{m,t} - \mu_m]}{\sigma_m}\right)}, \tag{6}$$

where μ_m determines the fraction of the sample in which the metropolitan area is in recession, σ_m gives the standard deviation of biannual growth and θ determines how stark the demarcation between recessions and expansions are (e.g., for a lower θ, the weight of observations is more equally split between β_E and β_R). μ_m is calibrated such that each area is in recession 20 percent of the sample, which matches the percent of quarters that the economy is in recession at the national level according to the NBER. We calibrate θ to 3 in line with Tenreyro and Thwaites (2016). We estimate equation (5) using two-stage least squares, where Pell grant disbursements at the MSA level are instrumented using the same instruments as in our main regressions, but multiplied by $F(z_{m,t-2})$ for the expansion term and $1 - F(z_{m,t-2})$ for the recession term.

Results are presented in Table 8. Recession multipliers represent β_R in eq. (5) while expansion multipliers represent β_E. The recession (expansion) should be interpreted as the two-year effect of a relative increase in Pell grants on relative income growth if growth is initially at its *lowest* (highest) level in the dataset. Thus, the multipliers in the table are for these extreme observations. The actual multiplier of an increase in Pell grant disbursements depends on how close growth is to either of these levels. As before, panel A reports state-dependant fiscal multipliers for personal income growth and panel B for employment growth. Column (1) contains the specification that controls for metropolitan and year fixed effects.

[33] Examples include Auerbach and Gorodnichenko (2012), Corsetti et al. (2012), Ilzetzki et al. (2013), Blanchard and Leigh (2013), Jordà and Taylor (2016), and Berge et al. (2021). Ghassibe and Zanetti (2022) further stress that the source of fluctuations matter as well. Ramey and Zubairy (2018) do not find state-dependence in a historical sample with news shocks about defense spending.

[34] Specifically, $z_{m,t-2}$ is defined as the moving average of two-year lagged local income growth. We adopt a moving average with weights of 0.5 for $t-3$, 1 for $t-2$, and 0.5 for $t-1$.

[35] Similar specifications are used by Auerbach and Gorodnichenko (2012), Ramey and Zubairy (2018), Tenreyro and Thwaites (2016), and De Ridder and Pfajfar (2017).

Table 8: State-Dependence of Education Spending Multiplier

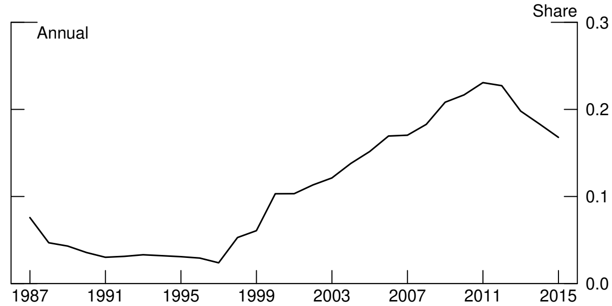
	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
Recession Multiplier	3.494*	3.440*	3.272*	3.173	6.514**	6.506**	6.727***	6.238**	6.234**	6.265***	-0.470
	(1.867)	(1.918)	(1.912)	(1.969)	(2.521)	(2.538)	(2.471)	(2.425)	(2.441)	(2.397)	(1.395)
Expansion Multiplier	1.990	1.952	2.494	2.429	1.969	1.955	1.065	1.137	1.131	1.361	-1.533
	(1.795)	(1.815)	(1.802)	(1.817)	(1.997)	(2.034)	(2.009)	(1.940)	(1.973)	(1.931)	(1.056)
Panel B: Employment Growth											
Recession Multiplier	2.057	2.263	2.227	2.394*	5.382***	5.432***	5.140***	5.016***	5.073***	5.045***	0.639
	(1.403)	(1.395)	(1.408)	(1.406)	(1.794)	(1.800)	(1.742)	(1.731)	(1.736)	(1.739)	(0.845)
Expansion Multiplier	1.472	1.803	1.431	1.705	0.183	0.403	-0.162	-0.422	-0.188	-0.400	-2.492*
	(1.840)	(1.848)	(1.811)	(1.835)	(1.815)	(1.835)	(1.887)	(1.845)	(1.860)	(1.842)	(1.287)
Difference, Income	-1.504	-1.488	-0.778	-0.744	-4.545	-4.550	-5.661**	-5.101*	-5.103*	-4.905*	-1.063
Std. Error, Income	(2.331)	(2.336)	(2.428)	(2.434)	(2.924)	(2.927)	(2.866)	(2.752)	(2.755)	(2.728)	(1.674)
Difference, Employment	-0.585	-0.460	-0.796	-0.688	-5.199**	-5.029**	-5.301**	-5.438**	-5.261**	-5.446**	-3.131*
Std. Error, Employment	(2.239)	(2.221)	(2.215)	(2.206)	(2.493)	(2.493)	(2.565)	(2.541)	(2.538)	(2.549)	(1.604)
Observations	8,435	8,435	8,435	8,435	4,446	4,446	4,446	4,446	4,446	4,446	8,435
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, Recession	216.2	214.0	217.0	214.8	253.7	254.7	259.0	260.9	263.6	267.7	-
Δ Pell Grants F-test, Expansion	141.4	142.7	140.9	142.6	92.7	83.4	81.2	91.2	82.3	90.4	-
Joint F-test	50.9	49.3	50.9	49.8	33.4	24.7	24.2	32.8	24.3	23.4	-

Notes: Multipliers follow from Smooth Transition estimates. SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population (see eq. 3). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, Recession is the robust F-statistic of the first-stage regression of Pell grants multiplied with $(1 - F(z_{m,t-2}))$. Δ Pell Grants F-test, Expansion is the robust F-statistic of the first-stage regression of Pell grants multiplied with $F(z_{m,t-2})$. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Column (2) adds appropriations, while column (3) adds the area-specific controls, but does not control for appropriations. Column (4) controls for both appropriations and the area-specific controls. Columns (5)-(7) repeat the regressions in columns (1), (2), and (5) on the post-1999 sample, while columns (8)-(10) add the financial control variables and explore the relevance of appropriations and other major fiscal transfers to low-income households.

All columns show considerably larger multipliers in recessions than in expansions, where the differences between the two multipliers are most of the time statistically significant for the post-1999 sample. This result holds for both income growth and employment growth. In our preferred estimate on the full

Figure 5. Percentage of Pell Grants Awarded to For-Profit Schools



Notes: Figure plots the fraction of national-level Pell grants that is awarded to students who are enrolled at for-profit institutions. Data is obtained from Delta Cost.

sample with all controls, column (4), the multiplier for income growth is 2.4 in expansions and 3.2 in recessions. While the differences between the two multipliers are between 0.7 and 1.5 points in the full sample, the estimated multipliers in expansions are never statistically significant. Similarly, employment growth multipliers 1.7 in expansion and 2.4 in recession, where the difference between the two multipliers across specifications for the full sample range between 0.5 and 0.8 points.

The results for the post-1999 sample, columns (5)-(10), predict much larger gaps in the multipliers between recessions and expansions (about 5 points) with the difference being significant at conventional confidence levels. This result holds for both income and employment growth multipliers. While the standard errors of our estimates suggest that the effect is noisy, the large estimates of the recession multiplier suggest that Pell grants are particularly effective when the local economy is in a recession. These results further the case that Pell grants offer a tool to stimulate economic activity when needed, which means that they can potentially be used as part of countercyclical fiscal policy.

4.2. Institutions: For-Profit versus Non-Profit Colleges

We next assess whether multipliers depend on the type of institution attended by the beneficiary student. The previous sections have shown that Pell grants have substantial multipliers, especially during recessions. One objection to using Pell grants for countercyclical policy may be, however, that 15–20 percent of grants is spent at for-profit colleges (Figure 5).[36] If for-profit colleges have market power, they may be able to charge higher tuition fees in response to higher generosity of Pell grants. Pell grants can therefore operate as an implicit subsidy. As public companies own a large fraction of for-profit colleges, not all of these subsidies will be spent within the college's metropolitan area, reducing local economic effects.[37]

Given these concerns, we explore whether there is indeed a relationship between the multiplier of Pell grants and the for-profit status of institutions at which students study. Because for-profit Pell grants and non-profit Pell grants may be correlated at the MSA level, we estimate both multipliers jointly:

[36] The reduction after 2013 is the result of "Gainful Employment" regulation. This regulation restricts federal student aid at several for-profit institutions (see, for example, Cellini et al., 2016).

[37] Examples of publicly listed companies that own for-profit colleges are Grand Canyon University (LOPE), Adtalem (ATGE, previously DeVry), American Public University System (APEI), and Bridgepoint Education Inc. (BPI).

$$\frac{\Delta y_{m,t;t-2}}{y_{m,t-2}} = \beta^{FP}\frac{\Delta e^{FP}_{m,t;t-2}}{y_{m,t-2}} + \beta^{NP}\frac{\Delta e^{NP}_{m,t;t-2}}{y_{m,t-2}} + \phi_m + \psi_t + \gamma' x_{m,t-2} + \mu_{m,t}, \tag{7}$$

where $e^{FP}_{m,t}$ denotes the total amount of Pell grants awarded to for-profit schools in metropolitan area m in year t, while $e^{NP}_{m,t}$ denotes the amount awarded to non-profit schools. As instruments we thus use:

$$b^z_{m,t} = \left(\frac{\Delta e^z_{t;t-2}}{y_{t-2}}\right) \cdot s^z_{m,t-2}; \quad z \in \{FP, NP\} \tag{8}$$

where $e^z_{t;t-2}$ is the per-capita national change in the Pell grants awarded to each group (for-profit, non-profit) and $s^z_{m,t-2}$ is the share of Pell grant recipients within each group (for-profit, non-profit) in an MSA.[38]

Results are presented in Table 9. Control variables follow the same sequence as in Table 2. The for-profit multiplier of Pell grants estimates the multiplier effects of grants awarded to private for-profit schools, while the non-profit multiplier estimates the effects of Pell grants at other schools. By including both estimates in the same specification we control for the correlation between awards at both types of schools. As we can see in Table 9, both income growth and employment multipliers are considerably higher when Pell grants are awarded at non-profit schools than at for-profit schools where the difference between the multipliers is between 1.3 and 3.1 points for income growth multipliers and between 0.8 and 2.1 for employment growth multipliers, although it is not statistically significant at conventional levels due to high standard errors. The income multipliers for non-profit schools ranges from 4.5 to 6, while for for-profit schools from 2.1 to 3.6. The employment multipliers range between 2.2 and 4.4 at non-profit schools and 1.4 and 2.5 at for-profit schools. Multipliers initiated from grants to for-profit schools are only significant in columns (7)-(10) in both our panels. These estimates imply that there are notable differences in the policy transmission of the education spending depending on profit orientation of recipient schools. Multipliers in the for-profit education sector are considerably smaller in all specifications.

We next assess the drivers of the smaller multipliers of Pell grant receipts at for-profit schools. Using school-level micro data on enrollment, expenditures, and revenue sources from Delta Cost, we first explore the effect of Pell grant receipts on a school's tuition fees. We define a school's tuition fee as the amount of tuition received directly from students, net of any grants or (institutional) student aid, divided by the number of full-time students. The estimation equation reads:

$$\frac{\Delta \tau_{i,t;t-2}}{\tau_{i,t-2}} = \Gamma\left(\frac{\Delta e_{i,t;t-2}}{e_{i,t-2}}\right) + \phi_i + \psi_t + \mu_{i,t}, \tag{9}$$

where τ_{it} is the average tuition rate at school i during academic year t, while $e_{i,t}$ denotes the amount of Pell grants received per full-time equivalent student. We look at biannual changes to match the horizon over which we estimate the multiplier and estimate Γ separately for for-profit and non-profit schools.

[38] In some cases the recipient data is missing in our databases for a specific MSA-year. For these MSA-years—about 29 percent of all of the MSA-years—, we use MSA-level recipient proxy based on the share of for-profit institutions among all institutions in a specific MSA and the share of undergraduate population in the total population in that MSA. In addition, pre-1999 instruments were computed using the proxy described in Section 2.3.

Table 9: Effect of Pell Grants on Local Income Per Capita: For-Profit versus Non-Profit

	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
Non-Profit Multiplier	4.577**	4.485**	4.935***	4.788**	5.914***	5.956***	5.125**	4.694**	4.728**	5.059**	-1.482
	(1.773)	(1.877)	(1.760)	(1.867)	(2.015)	(2.105)	(2.057)	(2.043)	(2.121)	(2.036)	(0.967)
For-Profit Multiplier	2.047	2.058	2.053	2.071	2.837	2.833	2.908*	3.427*	3.425*	3.462*	-2.459
	(1.596)	(1.593)	(1.633)	(1.628)	(1.783)	(1.783)	(1.730)	(1.806)	(1.806)	(1.789)	(2.657)
Panel B: Employment Growth											
Non-Profit Multiplier	2.240	2.667*	2.550*	2.891*	4.140**	4.429***	3.840**	3.383**	3.674**	3.465**	-1.544*
	(1.472)	(1.487)	(1.467)	(1.500)	(1.608)	(1.616)	(1.604)	(1.586)	(1.594)	(1.586)	(0.865)
For-Profit Multiplier	1.449	1.398	1.507	1.467	2.397	2.370	2.505*	2.585*	2.563*	2.593*	-1.640
	(1.264)	(1.265)	(1.238)	(1.240)	(1.478)	(1.476)	(1.454)	(1.448)	(1.445)	(1.446)	(1.610)
Difference, Income	2.530	2.427	2.882	2.717	3.077	3.123	2.217	1.267	1.303	1.596	0.977
Std. Error, Income	(2.188)	(2.273)	(2.221)	(2.305)	(2.385)	(2.464)	(2.379)	(2.445)	(2.514)	(2.435)	(2.762)
Difference, Employment	0.791	1.269	1.044	1.423	1.743	2.059	1.335	0.798	1.112	0.872	0.097
Std. Error, Employment	(1.859)	(1.882)	(1.837)	(1.873)	(2.026)	(2.041)	(2.008)	(1.982)	(1.996)	(1.984)	(1.799)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.2	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	34.9	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for-profit and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization and 30-day mortgage delinquency. Robust F-statistic is for the Pell grants SSIV. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

The estimation of eq. (9) is subject to endogeneity because an increase in demand for schooling may increase both tuition fees and the number of Pell grants a school receives. To address this, we again resort to shift-share instrumental variables. We instrument school-level Pell grants by the interaction of the share of an institution's student body that receives Pell grants—analogous to our city-level shift-share instrument—and interact this with national changes in the Pell grant program along eq. (3).

Results are presented in Table 10. When Pell grants increase as a percentage of the total tuition revenue, both non-profit and for-profit schools increase their average tuition fees by about 1.7 percent when Pell grants share in the total tuition increase by 1 percentage point. However, only the estimate for the for-profit schools is significant. The standard error for non-profit schools is large and the estimate is not

Table 10: Effect of Pell Grants on Tuition Fees

Tuition Growth	For-Profit	Non-Profit
	(1)	(2)
Δ Pell Grants (% Tuition)	1.749**	1.715
	(0.822)	(1.678)
Observations	14,697	65,386
Time FE	Y	Y
School FE	Y	Y
Instrument F-test	13.1	13.1

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for-profit and non-profit institutions. Dependent and independent variables are winsorized at the 1^{th} and 99^{th} percentiles. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

statistically significant, which may suggest greater heterogeneity in non-profit schools' reaction to Pell grant increase. The estimate at for-profit schools suggests that for-profit schools raise tuition fees more than proportionally when the grants increase.

From the results above, it seems that it is likely that both for-profit and non-profit schools raise tuition fees when Pell grant generosity increases. As tuition hikes prevent students from gaining purchasing power when Pell grants disbursements increase, these grants may have a smaller effect on economic activity when tuition fees increase. This may, at least partly, explain why we find lower multipliers at for-profit schools.

While the increase in tuition fees is slightly larger (and significant) at for-profit schools, both types of institutions may to some degree raise their tuition fees in response to Pell grant increases. This is in line with the "Bennett Hypothesis," first proposed by former Secretary of Education William Bennett. The hypothesis roughly yields that colleges expropriate rises in student aid. At for-profit colleges, this may raise their profits. At non-profit colleges, schools may use additional tuition to subsidize and expand their broader activities, such as research. Previous studies supporting the hypothesis are anchored by Cellini and Goldin (2014) which links higher tuition charged by for-profit institutions with their eligibility for federal aid and Lucca et al. (2019) which documents a 60 cents on the dollar pass-through effect on tuition of changes in subsidized loan maximums and about 20 cents on the dollar for unsubsidized federal loans. Among the studies challenging the hypothesis is Rizzo and Ehrenberg (2004), which found no evidence of tuition increases in response to increases in federal or state financial aid, Kelchen (2019) which showed that law schools did not raise tuition prices once federal aid was increased, and Kelchen (2020), which found a similar result for medical and business schools.

As the difference in tuition hikes is relatively small, we examine further what may explain the smaller effect of for-profit Pell grant disbursements on growth. One potential mechanism is that for-profit and non-profit schools differ in how they *use* their additional tuition revenue. While tuition fee hikes moderate the effect of Pell grants on students' consumer spending, grants can also positively affect growth when schools spend their tuition revenue productively. To explore this, we estimate the effect of overall expenditures at for-profit and non-profit schools when Pell grants rise.

Table 11: Effect of Education Spending on College Expenditures: For-Profit versus Non-Profit

Expenditure Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Non-Profit Δ Pell Grants	0.763	1.125*	0.777	1.136*	1.115	1.218*	1.226*	1.158	1.261*	1.185	0.976***
	(0.628)	(0.619)	(0.627)	(0.617)	(0.744)	(0.705)	(0.706)	(0.736)	(0.698)	(0.721)	(0.240)
For-Profit Δ Pell Grants	1.507***	1.464***	1.498***	1.457***	1.451***	1.441***	1.430***	1.401***	1.393***	1.403***	1.378***
	(0.199)	(0.194)	(0.201)	(0.196)	(0.222)	(0.219)	(0.221)	(0.227)	(0.224)	(0.228)	(0.190)
Difference	-0.745	-0.339	-0.722	-0.322	-0.336	-0.223	-0.204	-0.243	-0.132	-0.218	-0.402
Std. Error	(0.552)	(0.564)	(0.552)	(0.562)	(0.640)	(0.612)	(0.612)	(0.640)	(0.612)	(0.628)	(0.305)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

To see how total expenditures by colleges respond to a change in Pell grants, Table 11 estimates the "college spending multiplier" of the grants.[39] The dependent variable is the biannual change in total expenditure as a percentage of aggregate personal income in the MSA, analogous to equation (2). Pell grants are instrumented with our shift-share instrument as before.

The results in Table 11 show evidence that both non-profit and for-profit colleges raise spending when the Pell grant program increases in generosity. The point estimate is a touch lower than the one in Table 10, suggesting that colleges increase their expenditures at a rate slightly below the one for tuition increases when the Pell Grant Program expands. The point estimate for spending at for-profit schools is about 1.4, while the estimate at non-profit colleges is about 1.1. The results in Table 11 are in line with the finding in Dinerstein et al. (2014) that public universities (a subset of our non-profit universities) increased their educational expenditures during the Great Recession as a result of the increase in the maximum Pell grants that occurred during 2009/2010.

[39]We focus on the expenditures directly related to the primary function of universities: education expenditures (instruction, student services) and non-education expenditures (research, public service). Education and non-education expenditures constitute total expenditures in our definition. From our measure of total expenditures we are thus excluding expenses incurred from institutional support (day-to-day operational support, like HR, legal service, etc.), main operating expenses (utilities, insurance, etc.), and grants and scholarships.

As these results do not explain why the effect of Pell grants on economic activity is smaller when grants are disbursed to for-profit schools, we consider two further potential explanations. The first potential explanation is that for-profit and non-profit colleges increase different *types* of college expenditures in response to the increase in generosity of the Pell grant program. The second possibility is that the consumer spending response to Pell grants is different for students at for-profit and non-profit schools. While we attempt to evaluate the first explanation, the evidence in favor of the second explanation is largely by exclusion, as the data to directly address it are not available. Tables A8–A13 in the Appendix conduct the estimation separately for education expenditures and non-education expenditures and then further split the education expenditures into instruction and student services, and non-education expenditures into research and public service. Results suggest that for-profit schools only increase education expenditures—where the estimated multiplier is larger for student services than for instruction—while non-profit schools mostly increase non-education expenditures, where only the effect on the research subcomponent is statistically significant. There is also some evidence that these schools increase student services. Ideally, the next step would be to assess whether these different expenditures changes in response to Pell grants' increase in generosity lead to a positive effect of college expenditures on local income. However, this analysis turns out to be challenging due to weak instrument problem when we use our standard instruments.[40] Thus, it is difficult to judge exactly what portion of the Pell grants multiplier on local income may go through the college expenditure, if any, as we cannot reliably estimate the effect of college expenditures on local income. The fact that the "college spending multiplier" is smaller than the overall Pell grant multiplier also suggests that the large effect of Pell grants on growth is unlikely to work primarily through expenditures by the college. Rather, it seems that student loan increases as a result of Pell grants increases and the associated relaxation of students' budget constraint may be the main driver of the grants' economic effects.

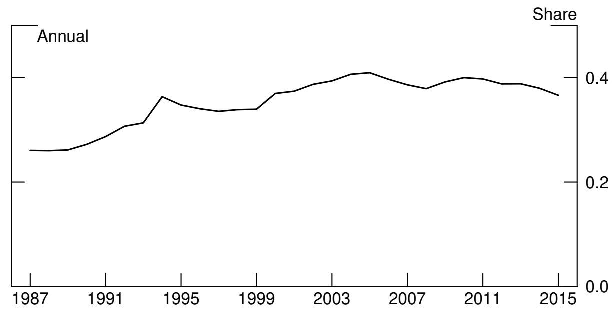
4.3. Institutions: Two-Year versus Four-Year Colleges

Finally, we assess whether there are differences in the multiplier of Pell grants between four-year and two-year colleges. Two-year colleges are typically community colleges that offer post-secondary education to local students. Four-year colleges are often more broadly engaged in academic activities, including research. The share of Pell grants received by students at two-year colleges has gradually increased over time: while only 25 percent of all Pell grants were disbursed to two-year institutions in 1987, this share has increased in the 80's and 90's and has fluctuated between 35 and 40 percent (see Figure 6).

To test whether multipliers between these types of institutions are different, we estimate eq. (7) with Pell grant disbursements to two- and four-year institutions rather than for-profit and non-profit institutions. Table 12 presents the results. We find that multipliers are larger at four-year institutions compared to two-year institutions. Income multipliers at four-year institutions range from 2.7 to 3.9 and employment multipliers range between 1.4 and 3.5, while income multipliers at two-year institutions range from

[40] We have tried alternative instruments that rely on national college expenditure growth and the lagged share of student population in a city. We report these results in Table A14. The estimates of the college expenditure multiplier are positive but insignificant: These estimates suffer from the weak instrument problem.

Figure 6. Percentage of Pell grants Awarded at Two-year Institutions



Notes: Figure plots the fraction of national-level Pell grants that is awarded to students who are enrolled at two-year institutions. Data is obtained from Delta Cost.

-0.7 to 2.2 and employment multipliers range between -0.6 and 0.4. Only multipliers at the four-year institution are significantly different from zero. In our preferred specification that uses all available controls for the full sample (column (4)), the income multiplier of four-year schools is 1.1 points higher and employment multiplier is 2.0 points higher. The differences in multipliers between two- and four-year schools are even larger in the post-1999 sample.

We next assess whether the difference in multipliers between two- and four-year colleges is due to differences in the response of spending by these types of institutions. Table 13 presents the results, which is analogous to Table 11 for for-profit versus non-profit schools. The table shows that at four-year colleges, an increase in Pell grants by 1 percent of local personal income leads to an increase in total college expenditures by 1.4 percent of local personal income. In contrast, two-year institutions do not significantly increase their total expenditures in response to the increase of Pell grants. The difference in response of two- and four-year colleges—that is often statistically significant—may be behind the large standard errors in Table 11 for non-profit schools, as roughly one third of students at non-profit schools are enrolled at public two-year institutions (community colleges) that do not raise spending in response to the increase of Pell grants. Thus, the non-profit sector exhibits a significant degree of heterogeneity.

We proceed with a similar analysis to the one we performed for the for-profit and non-profit schools and evaluate the effect of Pell grants on various types of college expenditures. These results are reported in Appendix Tables A15–A20. These tables show that the main source of the overall increase in expenditures in Table 13 is the increase of education expenditures at four-year institutions—in particular student services—, although in the overall sample non-education expenditures—in particular research expenditures—also display significant effects. Two-year institutions do not increase their expenditures in response to the increase in generosity of the Pell Grant Program. College spending effects are smaller also for two- and four-year colleges than the overall Pell grant multiplier, similarly as in the case for for-profit and non-profit colleges, suggesting that student spending is the main driver of the Pell grant's multiplier on local income.

Our findings offer a broader perspective on the "Bennett Hypothesis". While we confirm that four-year colleges raise expenditures in response to an increase in Pell grants, we also find that the multiplier of Pell grants is largest at these schools. While some part of higher Pell grants gets transferred to schools,

Table 12: Effect of Pell Grants on Local Income Per Capita: Two-Year versus Four-Year Schools

	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
4-year Multiplier	2.814*	2.706*	3.229**	3.079*	4.133**	4.134**	3.709**	3.638**	3.661**	3.923**	-1.443
	(1.481)	(1.545)	(1.539)	(1.600)	(1.760)	(1.813)	(1.759)	(1.700)	(1.751)	(1.723)	(1.163)
2-year Multiplier	2.163	2.223	1.914	1.998	1.099	1.098	0.172	-0.150	-0.164	-0.740	-2.101
	(3.545)	(3.549)	(3.544)	(3.548)	(3.830)	(3.836)	(3.745)	(3.797)	(3.806)	(3.856)	(1.788)
Panel B: Employment Growth											
4-year Multiplier	1.419	1.726	1.759	2.001	3.343**	3.529**	3.261**	2.964**	3.173**	3.030**	-0.919
	(1.362)	(1.383)	(1.370)	(1.406)	(1.510)	(1.535)	(1.508)	(1.461)	(1.483)	(1.463)	(0.822)
2-year Multiplier	0.366	0.194	0.145	0.011	0.279	0.176	-0.523	-0.424	-0.549	-0.561	-2.852*
	(1.936)	(1.925)	(1.954)	(1.948)	(2.110)	(2.104)	(2.042)	(2.019)	(2.016)	(2.027)	(1.607)
Difference, Income	0.651	0.482	1.315	1.081	3.034	3.036	3.536	3.789	3.825	4.663	0.658
Std. Error, Income	(3.657)	(3.711)	(3.708)	(3.763)	(3.713)	(3.770)	(3.668)	(3.668)	(3.727)	(3.767)	(2.241)
Difference, Employment	1.053	1.532	1.613	1.990	3.064	3.353	3.784	3.388	3.721	3.591	1.934
Std. Error, Employment	(2.397)	(2.416)	(2.420)	(2.450)	(2.424)	(2.441)	(2.400)	(2.347)	(2.365)	(2.374)	(1.726)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes	Yes	Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	94.9	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.3	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

this transfer does not seem to impede the beneficial local economic effects of expansions of the Pell Grant Program—the additional spending by colleges may even enhance them.

5. Conclusion

This paper estimates the effect of the Federal Pell Grant Program on short-run economic activity. Specifically, we assess how a relative increase in Pell grant disbursements at the metropolitan area raises the area's relative income and relative employment. To do so, we employ a shift-share approach where our identification relies on the variation in Pell grant receipts across metropolitan areas. We deploy a series of

Table 13: Effect of Pell Grants on College Expenditures: Two-Year versus Four-Year Schools

Expenditure Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS	est11
4-year Δ Pell Grants	1.107**	1.392***	1.120**	1.401***	1.362**	1.446**	1.442**	1.366**	1.448**	1.393**	1.152***
	(0.551)	(0.526)	(0.549)	(0.524)	(0.608)	(0.570)	(0.571)	(0.606)	(0.569)	(0.592)	(0.234)
2-year Δ Pell Grants	0.534	0.374	0.523	0.367	0.369	0.322	0.326	0.399	0.350	0.343	0.852*
	(0.335)	(0.323)	(0.336)	(0.323)	(0.344)	(0.337)	(0.338)	(0.345)	(0.337)	(0.343)	(0.438)
Difference	0.573	1.017*	0.598	1.035*	0.993	1.124*	1.117*	0.966	1.097*	1.050*	0.300
Std. Error	(0.547)	(0.556)	(0.547)	(0.554)	(0.607)	(0.577)	(0.579)	(0.606)	(0.576)	(0.594)	(0.501)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes	Yes	Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

validity tests for the shift-share instrument to ensure that the empirical strategy delivers a causal estimate of the effect of the Pell Grant Program on local economic growth.

We find an average income multiplier of 2.8 and an employment multiplier of 1.9 in the main specification. This implies that a 1 percent increase in Pell grants as a fraction of local income raises local income by 2.8 percent and local employment by 1.9 percent. These multipliers are higher than the average estimates of the multipliers from geographical cross-sectional data of other forms of fiscal spending found in the literature, e.g., the multipliers of military spending. Pell grants are fiscal transfers that raise personal income one-by-one and are awarded to students from lower-income households that tend to have higher propensity to consume than wealthier households. Our results suggest that, in part, the Pell grant fiscal multiplier operates through enabling students to attend college and acquire students loans. An increase in generosity of Pell grants increases student loans disbursements. This increase in disbursements further eases students' budget constraint and allows them to spend more. We also find that multipliers are higher when the economy is in recession. Our results imply that besides having beneficial effects in the long run, educational investments can also be used for countercyclical fiscal policy.

Our findings also have implications for education policy. We find that the multiplier of the Pell Grant Program is higher at non-profit colleges. For-profit colleges raise education spending when Pell grants become more generous, but there appears to be no effect of these expenditures on local economic growth or local employment. This result offers some validation for recent restrictions imposed on the eligibility of students at for-profit institutions for Pell grants. Finally, we show that four-year institutions have larger multipliers than two-year institutions. Pell grants are therefore particularly effective as a tool for countercyclical policy if granted to students attending four-year non-profit colleges.

References

Acconcia, A., Corsetti, G., and Simonelli, S. (2014). Mafia and public spending: Evidence on the fiscal multiplier from a quasi-experiment. *American Economic Review*, 104(7):2185–2209.

Auerbach, A., Gorodnichenko, Y., McCrory, P. B., and Murphy, D. (2022). Fiscal multipliers in the covid19 recession. *Journal of International Money and Finance*, 126:102669.

Auerbach, A., Gorodnichenko, Y., and Murphy, D. (2020). Local fiscal multipliers and fiscal spillovers in the usa. *IMF Economic Review*, 68:195–229.

Auerbach, A. J. and Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, 4(2):1–27.

Barnichon, R., Debortoli, D., and Matthes, C. (2021). Understanding the Size of the Government Spending Multiplier: It's in the Sign. *The Review of Economic Studies*, 89(1):87–117.

Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *The Quarterly Journal of Economics*, 106(2):407–443.

Barro, R. J., Sala-i Martin, X., Blanchard, O. J., and Hall, R. E. (1991). Convergence across states and regions. *Brookings papers on economic activity*, pages 107–182.

Benhabib, J. and Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34(2):143 – 173.

Berge, T., De Ridder, M., and Pfajfar, D. (2021). When is the fiscal multiplier high? a comparison of four business cycle phases. *European Economic Review*, 138:103852.

Bettinger, E. (2004). How financial aid affects persistence. In *College choices: The economics of where to go, when to go, and how to pay for it*, pages 207–238. University of Chicago Press.

Bils, M. and Klenow, P. J. (2000). Does schooling cause growth? *American Economic Review*, 90(5):1160–1183.

Black, S. E., Denning, J. T., Dettling, L. J., Goodman, S., and Turner, L. J. (2020). Taking it to the limit: Effects of increased student loan availability on attainment, earnings, and financial well-being. Working Paper 27658, National Bureau of Economic Research.

Blanchard, O. J. and Leigh, D. (2013). Growth forecast errors and fiscal multipliers. *The American Economic Review*, 103(3):117–120.

Borusyak, K., Hull, P., and Jaravel, X. (2022). Quasi-experimental shift-share research designs. *The Review of Economic Studies*, 89(1):181–213.

Castleman, B. L. and Long, B. T. (2016). Looking beyond enrollment: The causal effect of need-based grants on college access, persistence, and graduation. *Journal of Labor Economics*, 34(4):1023–1073.

Cellini, S. R., Darolia, R., and Turner, L. J. (2016). Where Do Students Go when For-Profit Colleges Lose Federal Aid? NBER Working Papers 22967, National Bureau of Economic Research, Inc.

Cellini, S. R. and Goldin, C. (2014). Does federal student aid raise tuition? new evidence on for-profit colleges. *American Economic Journal: Economic Policy*, 6(4):174–206.

Chao, J. C., Hausman, J. A., Newey, W. K., Swanson, N. R., and Woutersen, T. (2014). Testing overidentifying restrictions with many instruments and heteroskedasticity. *Journal of Econometrics*, 178:15–21. Annals Issue: Misspecification Test Methods in Econometrics.

Chhabra, Y., Levenstein, M. C., and Owen-Smith, J. (2019). The local economic impact of science spending: Evidence from the american recovery and reinvestment act. Working Paper 1383, Ross School of Business.

Chodorow-Reich, G. (2019). Geographic cross-sectional fiscal spending multipliers: What have we learned? *American Economic Journal: Economic Policy*, 11(2):1–34.

Chodorow-Reich, G., Feiveson, L., Liscow, Z., and Woolston, W. G. (2012). Does state fiscal relief during recessions increase employment? evidence from the american recovery and reinvestment act. *American Economic Journal: Economic Policy*, 4(3):118–45.

Conley, T. G. and Dupor, B. (2013). The american recovery and reinvestment act: Solely a government jobs program? *Journal of Monetary Economics*, 60(5):535 – 549. Aggregate Implications of Local Public Finance.

Corsetti, G., Meier, A., and Müller, G. J. (2012). What determines government spending multipliers? *Economic Policy*, 27(72):521–565.

De Ridder, M. and Pfajfar, D. (2017). Policy shocks and wage rigidities: Empirical evidence from regional effects of national shocks. *Working Paper*.

Delisle, J. (2017). The pell grant proxy: A ubiquitous but flawed measure of low-income student enrollment. *Evidence Speaks Reports*, 2(26):1–12.

Denning, J. T., Marx, B. M., and Turner, L. J. (2019). Propelled: The effects of grants on graduation, earnings, and welfare. *American Economic Journal: Applied Economics*, 11(3):193–224.

Dinerstein, M. F., Hoxby, C. M., Meer, J., and Villanueva, P. (2014). *Did the Fiscal Stimulus Work for Universities?*, pages 263–320. University of Chicago Press.

Dunn, A. C. and Gholizadeh, M. (2023). The Geography of Consumption and Local Economic Shocks: The Case of the Great Recession. BEA Working Papers 0205, Bureau of Economic Analysis.

Dupor, B. and McCrory, P. B. (2018). A Cup Runneth Over: Fiscal Policy Spillovers from the 2009 Recovery Act. *Economic Journal*, 128(611):1476–1508.

Dupor, B. and Mehkari, M. S. (2016). The 2009 recovery act: Stimulus at the extensive and intensive labor margins. *European Economic Review*, 85:208 – 228.

Dynarski, S. M. (2003). Does aid matter? measuring the effect of student aid on college attendance and completion. *American Economic Review*, (93):179–88.

Fack, G. and Grenet, J. (2015). Improving college access and success for low-income students: Evidence from a large need-based grant program. *American Economic Journal: Applied Economics*, 7(2):1–34.

Feyrer, J. and Sacerdote, B. (2011). Did the stimulus stimulate? real time estimates of the effects of the american recovery and reinvestment act. Working Paper 16759, National Bureau of Economic Research.

Fuller, W. A. (1977). Some properties of a modification of the limited information estimator. *Econometrica: Journal of the Econometric Society*, pages 939–953.

Ghassibe, M. and Zanetti, F. (2022). State dependence of fiscal multipliers: the source of fluctuations matters. *Journal of Monetary Economics*.

Goldsmith-Pinkham, P., Sorkin, I., and Swift, H. (2020). Bartik instruments: What, when, why, and how. *American Economic Review*, 110(8):2586–2624.

Goodman, S. and Volz, A. H. (2019). Attendance spillovers between public and for-profit colleges: Evidence from statewide variation in appropriations for higher education. *Education Finance and Policy*, 0(ja):1–67.

Hasna, Z. (2021). The grass is actually greener on the other side: Evidence on green multipliers from the united states.

Hausman, J. A., Newey, W. K., Woutersen, T., Chao, J. C., and Swanson, N. R. (2012). Instrumental variable estimation with heteroskedasticity and many instruments. *Quantitative Economics*, 3(2):211–255.

Ilzetzki, E., Mendoza, E. G., and Végh, C. A. (2013). How big (small?) are fiscal multipliers? *Journal of monetary economics*, 60(2):239–254.

Jaeger, D. A., Ruist, J., and Stuhler, J. (2018). Shift-share instruments and the impact of immigration. Working Paper 24285, National Bureau of Economic Research.

Jappelli, T. and Pistaferri, L. (2010). The consumption response to income changes. *Annual Review of Economics*, 2(1):479–506.

Jappelli, T. and Pistaferri, L. (2014). Fiscal policy and mpc heterogeneity. *American Economic Journal: Macroeconomics*, 6(4):107–36.

Johnson, D. S., Parker, J. A., and Souleles, N. S. (2006). Household expenditure and the income tax rebates of 2001. *American Economic Review*, 96(5):1589–1610.

Jordà, Ò. and Taylor, A. M. (2016). The time for austerity: estimating the average treatment effect of fiscal policy. *The Economic Journal*, 126(590):219–255.

Kelchen, R. (2019). An empirical examination of the bennett hypothesis in law school prices. *Economics of Education Review*, 73:101915.

Kelchen, R. (2020). Does the Bennett Hypothesis Hold in Professional Education? An Empirical Analysis. *Research in Higher Education*, 61(3):357–382.

Lucca, D., Nadauld, T., and Shen, K. (2019). Credit supply and the rise in college tuition: Evidence from the expansion in federal student aid programs. *Review of Financial Studies*, 32(2):423–466.

Manuelli, R. E. and Seshadri, A. (2014). Human capital and the wealth of nations. *American Economic Review*, 104(9):2736–62.

Marx, B. M. and Turner, L. J. (2018). Borrowing trouble? human capital investment with opt-in costs and implications for the effectiveness of grant aid. *American Economic Journal: Applied Economics*, 10(2):163–201.

McCrory, P. B. (2020). Tradable Spillovers of Fiscal Policy: Evidence from the 2009 Recovery Act. Institute for Research on Labor and Employment, Working Paper Series qt04n482qf, Institute of Industrial Relations, UC Berkeley.

Murphy, D. (2017). Excess capacity in a fixed-cost economy. *European Economic Review*, 91:245–260.

Nakamura, E. and Steinsson, J. (2014). Fiscal Stimulus in a Monetary Union: Evidence from US Regions. *American Economic Review*, 104(3):753–92.

Olea, J. L. M. and Pflueger, C. (2013). A robust test for weak instruments. *Journal of Business & Economic Statistics*, 31(3):358–369.

Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business & Economic Statistics*, 37(2):187–204.

Parker, J. A., Souleles, N. S., Johnson, D. S., and McClelland, R. (2013). Consumer spending and the economic stimulus payments of 2008. *American Economic Review*, 103(6):2530–53.

Ramey, V. A. and Zubairy, S. (2018). Government Spending Multipliers in Good Times and in Bad: Evidence from U.S. Historical Data. *Journal of Political Economy*, 126(2).

Rizzo, M. and Ehrenberg, R. G. (2004). Resident and Nonresident Tuition and Enrollment at Flagship State Universities. In *College Choices: The Economics of Where to Go, When to Go, and How to Pay For It*, NBER Chapters, pages 303–354. National Bureau of Economic Research, Inc.

Sargan, J. D. (1958). The estimation of economic relationships using instrumental variables. *Econometrica*, 26(3):393–415.

Shoag, D. (2013). Using state pension shocks to estimate fiscal multipliers since the great recession. *American Economic Review*, 103(3):121–24.

Suárez Serrato, J. C. and Wingender, P. (2016). Estimating local fiscal multipliers. Working Paper 22425, National Bureau of Economic Research.

Tenreyro, S. and Thwaites, G. (2016). Pushing on a string: Us monetary policy is less powerful in recessions. *American Economic Journal: Macroeconomics*, 8(4):43–74.

Turner, L. J. (2017). The Economic Incidence of Federal Student Grant Aid. mimeo, University of Maryland.

Webber, D. A. (2017). State divestment and tuition at public institutions. *Economics of Education Review*.

Appendix

Main Legislative Changes to the Pell Grant Program

First, in 1978, the Middle Income Student Assistance Act (MISAA) expanded student eligibility by limiting the rate at which parental discretionary income was assessed under the EFC formula. This act was repealed two years later, in 1980. In 1990, the Omnibus Budget Reconciliation Act eliminated student aid eligibility at high default schools. In 1992, the Higher Education Act was reauthorized and changed the definition of an independent student. In 1994, the Violent Crime Control and Law Enforcement Act eliminated Pell grants for prisoners. In 2007 Congress passed the College Cost Reduction and Access Act (CCRAA), which supplemented the grant funding and changed Pell eligibility by increasing the amount and types of income excluded from the EFC formula. A renewed set of legislative measures paired with the countercyclicality of the enrollment effect caused a significant increase in Pell grant disbursements. These legislative measures include: the Higher Education Opportunity Act (HEOA) of 2008, which authorized year-round Pell grants and limited eligibility to 18 full-time semesters or the equivalent; the American Recovery and Reinvestment Act (ARRA) of 2009, which provided additional funding to the Pell Grant Program (ARRA raised the maximum Pell grant by more than $400); the Health Care and Education Reconciliation Act of 2010, which increased the maximum Pell grant by over $600 and expanded eligibility by increasing the income threshold (from $20,000 to $30,000) for an automatic EFC of zero. Pell grant disbursements started to decline in 2011, once the economy gained momentum and undergraduate enrollment returned to pre-crisis levels.[41] Congress eliminated the year-round Pell grant eligibility established in 2008, when it provided supplemental funding to the program and lowered the income threshold for an automatic EFC of zero to $23,000. In 2012, the Consolidated Appropriations Act provided additional funding to the Pell Grant Program and reduced Pell lifetime eligibility to 12 semesters.

[41] During economic recovery, fewer individuals qualify to receive Pell grants. Enrollment is counter-cyclical as people opt for employment instead of education.

Additional Tables

Table A1: Effect of Pell Grants on Local Income Per Capita for 1-Year Horizon

	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
Multiplier	2.232*	2.221*	2.371*	2.358*	2.930*	3.011**	2.874*	2.775*	2.858*	2.836*	-0.785
	(1.233)	(1.254)	(1.234)	(1.254)	(1.499)	(1.524)	(1.528)	(1.519)	(1.539)	(1.505)	(0.728)
Panel B: Employment Growth											
Multiplier	0.888	0.984	1.022	1.107	1.996*	2.151**	2.135**	1.793	1.939*	1.809	-0.992
	(0.977)	(0.956)	(0.973)	(0.957)	(1.108)	(1.065)	(1.077)	(1.118)	(1.073)	(1.099)	(0.617)
Observations	8,793	8,793	8,793	8,793	4,781	4,781	4,781	4,781	4,781	4,781	8,793
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test	96.4	94.1	96.4	94.2	65.3	64.2	63.6	64.2	63.3	68.2	-
Joint F-test	-	54.0	-	53.9	-	36.4	36.3	-	36.0	35.3	-

Notes: SSIV strategy for the Pell grants regressor uses the one-year lagged population share of recipients. SSIV strategy for appropriations uses the one-year lagged appropriation share of income. Controls are one-year lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A2: Effect of Pell Grants on Local Income Per Capita Weighting by Two-Year Lagged MSA Population Logarithm

	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Panel A: Income Growth											
Multiplier	2.898**	2.816*	3.056**	2.940**	3.723**	3.708**	3.175*	3.085*	3.080*	3.219**	-1.662*
	(1.434)	(1.471)	(1.443)	(1.479)	(1.690)	(1.719)	(1.667)	(1.637)	(1.662)	(1.627)	(0.923)
Panel B: Employment Growth											
Multiplier	1.711	1.895*	1.842*	1.978*	3.191**	3.302**	2.935**	2.727**	2.850**	2.749**	-1.577**
	(1.091)	(1.103)	(1.095)	(1.115)	(1.292)	(1.304)	(1.256)	(1.233)	(1.239)	(1.231)	(0.761)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test	103.4	95.8	103.4	95.9	74.8	71.3	70.8	74.0	70.7	77.3	-
Joint F-test	-	70.1	-	70.4	-	38.7	38.4	-	38.3	45.1	-

Notes: SSIV strategy for the Pell grants regressor uses the two-year lagged population share of recipients. SSIV strategy for appropriations uses the two-year lagged appropriation share of income. Controls are one-year lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A3: Balance Test for the Specification with Fiscal Transfers

	Full Sample				Post 1999			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Shares	Income Growth	Empl. Growth	Pass	Shares	Income Growth	Empl. Growth	Pass
Spending Growth	0.006	-0.013	-0.038**	✓	-0.005	-0.022	-0.048**	✓
	(0.014)	(0.023)	(0.017)		(0.008)	(0.033)	(0.019)	
Log(Tuition)	-0.006	-0.068	-0.019	✓	-0.022	-0.237***	-0.118*	✓
	(0.048)	(0.051)	(0.050)		(0.049)	(0.063)	(0.064)	
D.Log(Students)	0.017	0.001	-0.007	✓	0.021*	0.001	-0.009	✓
	(0.010)	(0.009)	(0.009)		(0.011)	(0.011)	(0.007)	
For Profit	0.052	-0.002	0.026	✓	0.006	0.027	0.092*	✓
	(0.035)	(0.040)	(0.028)		(0.028)	(0.057)	(0.047)	
Share Black	0.157	-0.026	0.246	✓	0.593	0.046	0.427	✓
	(0.233)	(0.159)	(0.158)		(0.388)	(0.524)	(0.360)	
Share Hisp.	-0.172	0.558***	0.780***	✓	-0.287	0.353	0.794***	✓
	(0.142)	(0.144)	(0.117)		(0.223)	(0.363)	(0.278)	
Share Bach.	-0.115	0.074	0.271***	✓	0.026	0.654***	0.771***	✓
	(0.133)	(0.102)	(0.081)		(0.134)	(0.166)	(0.147)	
Risk Score					-0.041	-0.022	-0.090*	✓
					(0.029)	(0.042)	(0.048)	
Age					0.002	-0.016	0.001	✓
					(0.037)	(0.041)	(0.038)	
Debt to Income					-0.052	0.238	-0.082*	✓
					(0.032)	(0.191)	(0.044)	
Card Util.					0.026*	-0.037	-0.014	✓
					(0.016)	(0.030)	(0.024)	
Mort. Delinq.					0.013	-0.009	-0.022	✓
					(0.015)	(0.019)	(0.019)	
Observations	8,436	8,436	8,436		4,447	4,447	4,447	
R-square	0.7	0.3	0.5		0.8	0.4	0.6	
Time FE	Yes	Yes	Yes		Yes	Yes	Yes	
MSA FE	Yes	Yes	Yes		Yes	Yes	Yes	

Notes: Independent variables are twice lagged in columns (2), (3), (6), and (7) except for spending growth. Spending Growth refers to the change in the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A4: Balance Test for Appropriations

	Full Sample				Post 1999			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Shares	Income Growth	Empl. Growth	Pass	Shares	Income Growth	Empl. Growth	Pass
Log(Tuition)	-0.015	-0.069	-0.021	✓	-0.037	-0.239***	-0.123*	✓
	(0.028)	(0.051)	(0.050)		(0.034)	(0.063)	(0.064)	
D.Log(Students)	-0.000	0.001	-0.006	✓	-0.003	0.001	-0.009	✓
	(0.003)	(0.009)	(0.009)		(0.006)	(0.011)	(0.007)	
For Profit	0.026	-0.002	0.026	✓	0.030**	0.029	0.097**	×
	(0.018)	(0.040)	(0.028)		(0.014)	(0.057)	(0.048)	
Share Black	0.183	-0.027	0.244	✓	-0.147	0.044	0.423	✓
	(0.125)	(0.159)	(0.158)		(0.156)	(0.523)	(0.359)	
Share Hisp.	0.347***	0.557***	0.777***	×	0.470***	0.349	0.787***	×
	(0.076)	(0.143)	(0.117)		(0.148)	(0.362)	(0.279)	
Share Bach.	0.271***	0.075	0.274***	×	0.342***	0.662***	0.788***	×
	(0.067)	(0.101)	(0.081)		(0.082)	(0.164)	(0.146)	
Risk Score					0.007	-0.024	-0.093*	✓
					(0.017)	(0.043)	(0.048)	
Age					0.015	-0.014	0.005	✓
					(0.020)	(0.041)	(0.038)	
Debt to Income					0.005	0.237	-0.084*	✓
					(0.017)	(0.191)	(0.045)	
Card Util.					-0.014	-0.038	-0.015	✓
					(0.010)	(0.030)	(0.024)	
Mort. Delinq.					0.003	-0.009	-0.022	✓
					(0.005)	(0.019)	(0.019)	
Observations	8,436	8,436	8,436		4,447	4,447	4,447	
R-square	1.0	0.3	0.5		1.0	0.4	0.6	
Time FE	Yes	Yes	Yes		Yes	Yes	Yes	
MSA FE	Yes	Yes	Yes		Yes	Yes	Yes	

Notes: Independent variables are twice lagged in columns (2), (3), (6), and (7). MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A5: Balance Test for Fiscal Transfers

	Post 1999				Full Cases Only			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Shares	Income Growth	Empl. Growth	Pass	Shares	Income Growth	Empl. Growth	Pass
Log(Tuition)	-0.019	-0.239***	-0.123*	✓	-0.003	-0.121	-0.066	✓
	(0.035)	(0.063)	(0.064)		(0.041)	(0.125)	(0.109)	
D.Log(Students)	0.000	0.001	-0.009	✓	0.009	-0.009	-0.022	✓
	(0.006)	(0.011)	(0.007)		(0.013)	(0.028)	(0.014)	
For Profit	0.038**	0.029	0.097**	×	-0.000	0.030	0.119*	✓
	(0.015)	(0.057)	(0.048)		(0.020)	(0.079)	(0.067)	
Share Black	-0.020	0.044	0.423	✓	-0.209	0.971	1.050	✓
	(0.182)	(0.523)	(0.359)		(0.256)	(1.384)	(1.004)	
Share Hisp.	0.541***	0.349	0.787***	×	0.739***	0.245	0.834	✓
	(0.166)	(0.362)	(0.279)		(0.259)	(0.714)	(0.643)	
Share Bach.	0.407***	0.662***	0.788***	×	0.349***	0.578	0.698**	×
	(0.083)	(0.164)	(0.146)		(0.112)	(0.389)	(0.281)	
Risk Score	0.013	-0.024	-0.093*	✓	0.014	-0.115**	-0.107*	✓
	(0.019)	(0.043)	(0.048)		(0.022)	(0.053)	(0.061)	
Age	0.041*	-0.014	0.005	✓	0.054*	-0.040	0.050	✓
	(0.022)	(0.041)	(0.038)		(0.028)	(0.051)	(0.046)	
Debt to Income	0.017	0.237	-0.084*	✓	0.041**	0.527	-0.143*	×
	(0.016)	(0.191)	(0.045)		(0.018)	(0.338)	(0.083)	
Card Util.	-0.012	-0.038	-0.015	✓	-0.009	-0.067	0.019	✓
	(0.011)	(0.030)	(0.024)		(0.009)	(0.041)	(0.028)	
Mort. Delinq.	0.019***	-0.009	-0.022	✓	0.022***	0.024	-0.000	✓
	(0.006)	(0.019)	(0.019)		(0.007)	(0.028)	(0.027)	
Observations	4,447	4,447	4,447		2,523	2,523	2,523	
R-square	1.0	0.4	0.6		1.0	0.5	0.7	
Time FE	Yes	Yes	Yes		Yes	Yes	Yes	
MSA FE	Yes	Yes	Yes		Yes	Yes	Yes	

Notes: Independent variables are twice lagged in columns (2), (3), (6), and (7). Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A6: Effect of Pell Grants on Local Income Per Capita Using Different Estimators (Additional Specifications)

Post 1999	Income Growth			Employment Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
2SLS (SSIV)	3.640**	3.077*	3.125**	3.120**	2.722**	2.657**
	(1.691)	(1.641)	(1.638)	(1.312)	(1.268)	(1.257)
2SLS	4.418**	3.811**	3.896**	2.707**	2.465**	2.223*
	(1.726)	(1.699)	(1.664)	(1.236)	(1.220)	(1.184)
LIML	4.540**	3.892**	4.022**	2.941**	2.631**	2.393*
	(1.777)	(1.744)	(1.714)	(1.315)	(1.286)	(1.238)
HFUL	4.882***	4.146***	4.328***	3.089***	2.758***	2.469**
	(1.467)	(1.480)	(1.483)	(1.007)	(0.994)	(0.970)
Observations	4,447	4,447	4,447	4,447	4,447	4,447
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes
Approp.						
MSA Controls		Yes	Yes		Yes	Yes
Financial Controls			Yes			Yes
Fiscal Transfers			Yes			Yes

Notes: 2SLS uses each yearly share as a separate IV. LIML uses the limited information maximum likelihood estimation with the same set of instruments. Finally, HFUL uses the estimator from Hausman et al. (2012) also with the same set of instruments. Controls are contemporaneous to the respective timing of shares. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A7: Pell Grants and Student Loans (Additional Specifications)

Post 1999 Sample	Student Loan Growth			Income Growth			Employment Growth		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Multiplier	2.019***	2.006***	1.995***						
	(0.450)	(0.447)	(0.448)						
Δ (Pell Grants + Loans)				1.206**	0.992*	1.044**	1.033***	0.876**	0.888**
				(0.531)	(0.533)	(0.530)	(0.392)	(0.389)	(0.388)
Observations	4,447	4,447	4,447	4,447	4,447	4,447	4,447	4,447	4,447
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.									
MSA Controls		Yes	Yes		Yes	Yes		Yes	Yes
Financial Controls		Yes	Yes		Yes	Yes		Yes	Yes
Fiscal Transfers			Yes			Yes			Yes
Δ Pell Grants F-test	78.0	77.2	80.9	80.3	80.1	79.5	80.3	80.1	79.5
Joint F-test	-	-	45.7		-	36.3		-	36.3

Notes: SSIV strategy for the Pell grants regressor and the sum of Pell grants and loan disbursements uses the twice-lagged share of recipients in MSA population (see eq. 3). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A8: Effect of Pell Grants on Education Expenditures by For-Profit and Non-Profit Colleges

Education Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Non-Profit Δ Pell Grants	0.466	0.729	0.473	0.733	0.608	0.824	0.845	0.648	0.862	0.728	0.855***
	(0.589)	(0.570)	(0.588)	(0.568)	(0.665)	(0.574)	(0.576)	(0.662)	(0.570)	(0.622)	(0.226)
For-Profit Δ Pell Grants	1.500***	1.469***	1.490***	1.460***	1.457***	1.436***	1.432***	1.434***	1.417***	1.442***	1.397***
	(0.160)	(0.158)	(0.161)	(0.159)	(0.187)	(0.180)	(0.180)	(0.189)	(0.182)	(0.193)	(0.190)
Difference	-1.034*	-0.740	-1.017*	-0.727	-0.849	-0.613	-0.588	-0.786	-0.556	-0.714	-0.542*
Std. Error	(0.530)	(0.529)	(0.530)	(0.527)	(0.576)	(0.510)	(0.510)	(0.575)	(0.507)	(0.546)	(0.285)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A9: Effect of Pell Grants on Non-Education Expenditures by For-Profit and Non-Profit Colleges

Non-Education Exp. Growth	Full Sample				Post 1999						Full Sample
	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS	(8) 2SLS	(9) 2SLS	(10) 2SLS	(11) OLS
Non-Profit Δ Pell Grants	0.296*	0.396**	0.304*	0.402**	0.507**	0.395*	0.382*	0.510***	0.399*	0.458**	0.121
	(0.160)	(0.195)	(0.161)	(0.195)	(0.197)	(0.228)	(0.228)	(0.195)	(0.223)	(0.197)	(0.108)
For-Profit Δ Pell Grants	0.007	-0.005	0.008	-0.003	-0.006	0.005	-0.002	-0.033	-0.025	-0.038	-0.019
	(0.086)	(0.085)	(0.086)	(0.085)	(0.086)	(0.088)	(0.088)	(0.083)	(0.083)	(0.085)	(0.051)
Difference	0.289*	0.401**	0.296*	0.405**	0.513***	0.390*	0.383*	0.543***	0.424*	0.496***	0.140
Std. Error	(0.166)	(0.203)	(0.167)	(0.204)	(0.189)	(0.222)	(0.222)	(0.190)	(0.216)	(0.190)	(0.125)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A10: Effect of Pell Grants on Research Expenditures by For-Profit and Non-Profit Colleges

Research Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Non-Profit Δ Pell Grants	0.167	0.231*	0.173	0.236*	0.340**	0.257*	0.249	0.338**	0.255*	0.300**	0.047
	(0.115)	(0.125)	(0.117)	(0.126)	(0.155)	(0.151)	(0.154)	(0.157)	(0.152)	(0.149)	(0.062)
For-Profit Δ Pell Grants	0.016	0.008	0.017	0.010	0.004	0.012	0.006	-0.006	0.000	-0.010	-0.036
	(0.071)	(0.070)	(0.071)	(0.070)	(0.071)	(0.071)	(0.070)	(0.071)	(0.069)	(0.071)	(0.029)
Difference	0.151	0.222	0.156	0.226	0.336**	0.244	0.243	0.344**	0.255	0.310**	0.083
Std. Error	(0.138)	(0.143)	(0.139)	(0.144)	(0.161)	(0.156)	(0.158)	(0.164)	(0.158)	(0.156)	(0.075)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A11: Effect of Pell Grants on Instruction Expenditures by For-Profit and Non-Profit Colleges

Instruction Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Non-Profit Δ Pell Grants	0.392	0.635	0.397	0.639	0.480	0.680	0.699	0.511	0.710	0.585	0.764***
	(0.538)	(0.520)	(0.537)	(0.518)	(0.611)	(0.526)	(0.528)	(0.608)	(0.522)	(0.571)	(0.217)
For-Profit Δ Pell Grants	0.493***	0.464***	0.485***	0.457***	0.452**	0.433***	0.430***	0.433**	0.418***	0.440***	0.477***
	(0.188)	(0.167)	(0.186)	(0.167)	(0.177)	(0.161)	(0.162)	(0.173)	(0.157)	(0.162)	(0.097)
Difference	-0.102	0.171	-0.088	0.182	0.027	0.247	0.269	0.077	0.292	0.144	0.287
Std. Error	(0.497)	(0.490)	(0.496)	(0.488)	(0.531)	(0.466)	(0.467)	(0.529)	(0.462)	(0.497)	(0.230)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A12: Effect of Pell Grants on Public Service Expenditures by For-Profit and Non-Profit Colleges

Public Service Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Non-Profit Δ Pell Grants	0.130	0.165	0.131	0.166	0.167	0.138	0.133	0.172	0.144	0.158	0.074
	(0.131)	(0.157)	(0.131)	(0.157)	(0.131)	(0.158)	(0.158)	(0.130)	(0.153)	(0.134)	(0.084)
For-Profit Δ Pell Grants	-0.009	-0.013	-0.009	-0.013	-0.010	-0.008	-0.008	-0.027	-0.025	-0.028	0.017
	(0.031)	(0.030)	(0.031)	(0.030)	(0.033)	(0.035)	(0.036)	(0.031)	(0.031)	(0.033)	(0.035)
Difference	0.139	0.178	0.140	0.179	0.177	0.146	0.141	0.199*	0.169	0.186	0.057
Std. Error	(0.120)	(0.151)	(0.120)	(0.150)	(0.114)	(0.146)	(0.146)	(0.118)	(0.138)	(0.118)	(0.092)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A13: Effect of Pell Grants on Student Service Expenditures by For-Profit and Non-Profit Colleges

Student Serv. Exp. Grw.	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Non-Profit Δ Pell Grants	0.075	0.094	0.075	0.095	0.128*	0.143**	0.146**	0.137*	0.152**	0.143**	0.091***
	(0.067)	(0.064)	(0.067)	(0.064)	(0.071)	(0.065)	(0.066)	(0.072)	(0.067)	(0.069)	(0.033)
For-Profit Δ Pell Grants	1.007***	1.005***	1.005***	1.003***	1.004***	1.003***	1.002***	1.001***	0.999***	1.001***	0.920***
	(0.250)	(0.251)	(0.250)	(0.251)	(0.252)	(0.252)	(0.250)	(0.251)	(0.252)	(0.252)	(0.258)
Difference	-0.932***	-0.911***	-0.930***	-0.908***	-0.876***	-0.860***	-0.856***	-0.864***	-0.847***	-0.858***	-0.829***
Std. Error	(0.248)	(0.248)	(0.248)	(0.248)	(0.247)	(0.247)	(0.244)	(0.246)	(0.245)	(0.246)	(0.256)
Observations	8,432	8,432	8,432	8,432	4,443	4,443	4,443	4,443	4,443	4,443	8,432
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, NP	107.3	97.1	107.1	97.1	85.0	79.9	80.2	85.5	80.3	92.3	-
Δ Pell Grants F-test, FP	28.8	29.8	29.0	29.8	33.4	33.3	33.6	33.0	33.0	35.0	-
Joint F-test	53.7	39.9	53.7	40.3	42.4	20.6	20.6	42.7	20.5	27.3	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at for- and non-profit institutions (see eq. 8). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, NP is the robust F-statistic of the first-stage regression of Pell grants at non-profit colleges. Δ Pell Grants F-test, FP is the robust F-statistic of the first-stage regression of Pell grants at for-profit colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A14: Effect of College Spending on Local Income Per Capita

Income Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
Δ Expenditure	0.473	0.695	0.301	0.531	0.904	0.940	0.619	0.658	0.686	0.686	0.422*
	(0.646)	(0.721)	(0.621)	(0.688)	(0.931)	(0.932)	(0.885)	(0.892)	(0.894)	(0.911)	(0.217)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes		Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test	10.7	8.2	11.2	8.5	6.1	7.6	9.1	7.0	9.1	10.3	-
Joint F-test	10.7	4.3	-	4.5	6.1	3.2	3.7	-	3.8	3.8	-

Notes: SSIV strategy for the college spending regressor uses the twice-lagged share of students in MSA population as shares and yearly changes to total national spending as shocks (see eq. 3). SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Robust F-test statistic is for the college spending SSIV. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test is the robust F-statistic of the first-stage regression of Pell grants. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A15: Effect of Pell Grants on Education Expenditures by Four-Year and Two-Year Colleges

Education Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
4-year Δ Pell Grants	0.850	1.061**	0.854	1.062**	0.945*	1.104**	1.113**	0.960*	1.118**	1.026**	0.914***
	(0.528)	(0.491)	(0.526)	(0.489)	(0.552)	(0.464)	(0.465)	(0.550)	(0.462)	(0.515)	(0.195)
2-year Δ Pell Grants	0.447	0.329	0.444	0.328	0.423	0.334	0.353	0.458	0.364	0.322	1.075**
	(0.301)	(0.281)	(0.301)	(0.281)	(0.333)	(0.306)	(0.307)	(0.334)	(0.307)	(0.331)	(0.420)
Difference	0.403	0.731	0.410	0.734	0.522	0.770*	0.760*	0.502	0.754*	0.703	-0.161
Std. Error	(0.519)	(0.514)	(0.518)	(0.512)	(0.500)	(0.435)	(0.437)	(0.501)	(0.437)	(0.479)	(0.453)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes	Yes	Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A16: Effect of Pell Grants on Non-Education Expenditures by Four-Year and Two-Year Colleges

Non-Education Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
4-year Δ Pell Grants	0.257*	0.331*	0.267*	0.340*	0.418**	0.342	0.329	0.406**	0.330	0.368*	0.239*
	(0.145)	(0.177)	(0.147)	(0.178)	(0.200)	(0.208)	(0.206)	(0.199)	(0.207)	(0.201)	(0.123)
2-year Δ Pell Grants	0.086	0.045	0.079	0.039	-0.054	-0.012	-0.027	-0.059	-0.014	0.020	-0.223*
	(0.195)	(0.201)	(0.195)	(0.201)	(0.203)	(0.195)	(0.197)	(0.208)	(0.199)	(0.214)	(0.128)
Difference	0.171	0.286	0.187	0.301	0.472**	0.353	0.356	0.465**	0.344	0.347	0.461**
Std. Error	(0.191)	(0.220)	(0.190)	(0.219)	(0.212)	(0.242)	(0.243)	(0.213)	(0.244)	(0.236)	(0.181)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes	Yes	Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A17: Effect of Pell Grants on Research Expenditures by Four-Year and Two-Year Colleges

Research Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
4-year Δ Pell Grants	0.173*	0.222*	0.181*	0.229*	0.299**	0.244*	0.235*	0.291**	0.236*	0.264*	0.143*
	(0.104)	(0.117)	(0.106)	(0.119)	(0.145)	(0.135)	(0.136)	(0.144)	(0.135)	(0.140)	(0.079)
2-year Δ Pell Grants	0.003	-0.025	-0.001	-0.028	-0.096	-0.065	-0.074	-0.103	-0.070	-0.046	-0.206***
	(0.169)	(0.175)	(0.168)	(0.175)	(0.183)	(0.169)	(0.174)	(0.188)	(0.174)	(0.184)	(0.074)
Difference	0.170	0.246	0.182	0.256	0.395**	0.308*	0.309*	0.394**	0.305*	0.310*	0.349***
Std. Error	(0.159)	(0.168)	(0.159)	(0.168)	(0.168)	(0.166)	(0.167)	(0.170)	(0.168)	(0.170)	(0.125)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes	Yes	Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A18: Effect of Pell Grants on Instruction Expenditures by Four-Year and Two-Year Colleges

Instruction Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
4-year Δ Pell Grants	0.461	0.647	0.465	0.648	0.521	0.660	0.667	0.530	0.668	0.588	0.622^{***}
	(0.492)	(0.484)	(0.491)	(0.484)	(0.526)	(0.470)	(0.473)	(0.526)	(0.471)	(0.500)	(0.155)
2-year Δ Pell Grants	0.270	0.166	0.268	0.166	0.158	0.081	0.096	0.185	0.103	0.065	0.931^{**}
	(0.252)	(0.243)	(0.253)	(0.244)	(0.285)	(0.277)	(0.279)	(0.288)	(0.279)	(0.289)	(0.416)
Difference	0.191	0.481	0.197	0.482	0.363	0.579	0.571	0.346	0.565	0.523	-0.309
Std. Error	(0.495)	(0.500)	(0.494)	(0.498)	(0.472)	(0.425)	(0.426)	(0.474)	(0.426)	(0.456)	(0.431)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes	Yes	Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A19: Effect of Pell Grants on Public Service Expenditures by Four-Year and Two-Year Colleges

Public Service Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
4-year Δ Pell Grants	0.084	0.109	0.086	0.111	0.118	0.098	0.094	0.115	0.094	0.104	0.096
	(0.107)	(0.126)	(0.107)	(0.125)	(0.113)	(0.130)	(0.129)	(0.113)	(0.129)	(0.117)	(0.079)
2-year Δ Pell Grants	0.084	0.070	0.080	0.066	0.042	0.053	0.046	0.044	0.056	0.067	-0.017
	(0.123)	(0.118)	(0.123)	(0.117)	(0.120)	(0.123)	(0.123)	(0.122)	(0.126)	(0.132)	(0.103)
Difference	0.000	0.040	0.006	0.045	0.077	0.045	0.047	0.071	0.038	0.037	0.113
Std. Error	(0.149)	(0.162)	(0.149)	(0.159)	(0.148)	(0.171)	(0.171)	(0.150)	(0.173)	(0.168)	(0.114)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes	Yes	Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A20: Effect of Pell Grants on Student Service Expenditures by Four-Year and Two-Year Colleges

Student Services Exp. Growth	Full Sample				Post 1999						Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	OLS
4-year Δ Pell Grants	0.389*	0.414*	0.389*	0.414*	0.424*	0.444*	0.447*	0.430*	0.450*	0.438*	0.291*
	(0.231)	(0.229)	(0.230)	(0.229)	(0.235)	(0.234)	(0.233)	(0.232)	(0.232)	(0.233)	(0.164)
2-year Δ Pell Grants	0.177	0.163	0.176	0.162	0.265	0.253	0.257	0.274	0.262	0.257	0.144***
	(0.135)	(0.128)	(0.134)	(0.128)	(0.170)	(0.162)	(0.161)	(0.169)	(0.161)	(0.164)	(0.035)
Difference	0.211	0.251*	0.213	0.252*	0.159	0.192	0.190	0.156	0.188	0.181	0.148
Std. Error	(0.139)	(0.141)	(0.139)	(0.141)	(0.120)	(0.122)	(0.121)	(0.118)	(0.120)	(0.120)	(0.148)
Observations	8,436	8,436	8,436	8,436	4,447	4,447	4,447	4,447	4,447	4,447	8,436
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Approp.		Yes	Yes	Yes		Yes	Yes		Yes		Yes
MSA Controls			Yes	Yes			Yes	Yes	Yes	Yes	Yes
Financial Controls								Yes	Yes	Yes	
Fiscal Transfers										Yes	
Δ Pell Grants F-test, 4-Year	133.8	119.0	133.9	119.3	95.3	86.0	84.7	93.8	84.5	95.0	-
Δ Pell Grants F-test, 2-Year	65.2	65.0	65.2	65.2	54.0	54.1	54.8	54.9	55.2	57.2	-
Joint F-test	32.5	43.1	32.6	43.4	29.5	26.0	25.6	29.9	25.6	20.1	-

Notes: SSIV strategy for the Pell grants regressor uses the twice-lagged share of recipients in MSA population at four-year and two-year institutions. We estimate the four-year share based on the MSA four-year penetration and the MSA-level number of recipients where missing. SSIV strategy for appropriations uses the twice-lagged appropriation share of income. Controls are twice-lagged. MSA controls: change in undergraduate students (log) in the last 2 years, average tuition fee (log), for-profit penetration, percentage of population black, percentage Hispanic, percentage with at least a bachelor's degree. Data on financial controls is from Federal Reserve Bank of New York/Equifax Consumer Credit Panel and is available from 1999 to 2015. It includes median Equifax Risk Score, age, debt-to-income ratio, credit card utilization, and 30-day mortgage delinquency rate. Fiscal Transfers refers to the total amount of fiscal transfers due to state appropriations, SNAP, UI, and HUD programs. We instrument the fiscal transfers variable with an SSIV analogous to the appropriations SSIV. Δ Pell Grants F-test, 4-Year is the robust F-statistic of the first-stage regression of Pell grants at 4-year colleges. Δ Pell Grants F-test, 2-Year is the robust F-statistic of the first-stage regression of Pell grants at 2-year colleges. Joint F-test is the robust F-statistic of the joint IV set. MSA-clustered standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.