TEACHERS OR ROADS:

HOW FLUCTUATIONS IN PUBLIC FINANCES ERODE PUBLIC INFRASTRUCTURE[1]

TROUP HOWARD
University of Utah, David Eccles School of Business

ADAIR MORSE
University of California, Berkeley & U.S. Department of the Treasury

May 2021

Abstract

In observed public choice over 83,000 state/local governments, some public goods act as luxuries and some as necessities in a Deaton-Muellbauer (1980) classic model of consumer choice applied novelly to public expenditures. We find that when fiscally stressed, governments forego infrastructure to instead spend on necessities – education, safety and financial obligations. We model the total impact of a severe financial shock by applying public goods elasticity estimates to COVID19 revenue projections across the United States. We find more than $50 billion of rebalancing from infrastructure (capital expenditures on transportation, schools, and utilities) predominantly towards current education services and public safety. In a fiscal expansion, infrastructure still acts as a luxury, but with a whole magnitude lower effect, gaining only $5 billion in rebalancing allocation in a perfectly symmetric shock. Volatility in public budgets due to fiscal conditions generate a long-term pattern of disinvestment in public infrastructure, crumbling roads to pay for schools. Additional evidence points to heterogeneities in regional preferences mattering.

[1] The ideas and views expressed in this paper are solely those of the authors and do not represent any policy or program of the U.S. Department of the Treasury.

I. Introduction

The decline in U.S. infrastructure is well documented and not new (e.g., the tragic example of water infrastructure in Flint, Michigan as described by Baskaran (2021)). It is also a result of public choices by government. The vastness of public choice literature attests to the difficulties of making budget allocations, in light of both the goods at stake and the frictions in tough choices. At stake from a welfare perspective are current goods such as education, public safety, healthcare, and income support for pensioners and those disadvantaged. Competing against these current expenditures are the choices to spend on capital allocations for critical infrastructure supporting future economic growth (e.g., Barro 1991; Fisher, 1997; McNichols and Johnson, 2010; Gordon, 2018; Saxer, 2020).[2] Yet, neither optimizing current welfare models nor growth models through infrastructure building observationally explains the patterns of year-to-year budget allocations. Observed budget share spending by governments can respond to the preferences of residents – via median or average voter preferences, the Tiebout mechanism, or others frictions such as commitments and political pressures.[3] Furthermore, as we document herein, budget share allocations can vary over the business cycle, complicating understanding of these decisions. Our contribution is not in the political mechanism of the choice. Rather, we offer a new understanding of public choice consequences by delving into elasticities of public expenditures, trading off among themselves for budget allocations, in times of fiscal expansion and a period of fiscal stress.

In particular, we take the novel approach of using a classic household model to think about expenditures by a government. Using the Great Recession (fiscal stress) and post 9/11 boom (fiscal expansion) income shocks, we apply the Deaton demand system (Deaton and Muellbauer, 1980) to characterize goods as luxuries and necessities. We then use these elasticities to simulate government curtailments in spending across public goods following a negative macroeconomic

[2] The benefits of public infrastructure may not accrue back to the government doing the investment; Gupta, Nieuwerburgh, and Kontokosta (2020) demonstrate this friction in studying how New York City investment expanding a subway line created more value than its costs, but only 30% of that value transmitted back to the city, with the residual being internalized by a small set of individuals.

[3] See, e.g., for Median Voter: Hotelling, 1929; Bowen, 1943; Black, 1948; Downs, 1957; Average Voter: Turnbull and Djoundourian, 1994; Tiebout: Tiebout, 1956; Gramlich, and Rubinfeld, 1982; political pressures: Poterba, 1994; Desai, 2018. The evidence as to whether governments allocate budget shares according to the median voter model across public goods is mixed (e.g., Inman, 1978; Holcome, 1980; Gramlich, and Rubinfeld, 1982; Turnbull and Djoundourian, 1994).

shock. We calibrate this shock by drawing upon early projections of the fiscal impact of COVID19. These embody a realistic scenario: unforeseen budget shortfalls arising from an aggregate downturn induced by a broad exogenous shock. Both our estimated elasticities and our calibrated shocks vary across states as well as by level of government. We aggregate the predictions from the simulation to understand the dollar magnitude of the loss of particular public goods as a result of a fiscal downturn.

We gather Census of Governments (COG) spending data covering the population of public entities in the United States (amassing to nearly $4 trillion in 2017). For the full survey years of 2002, 2007, 2012 and 2017, we construct public goods provision datasets separately for states, counties, cities, school districts, and other special districts. For each government, we group expenditures into several broad service-areas categories, and then further distinguish between the current (flow) components of spending and the capital outlays. We then estimate a Deaton demand system by taking first-differences of jurisdictional expenditures over the five-year period. This estimation yields a set of elasticities for public good expenditures, which classify each good as a luxury or a necessity. Jointly, these elasticities characterize relative allocation choices made in response to any given shock to total public funding. We produce estimates for each government type – reflecting that state priorities may differ from city priorities, for instance – and in our preferred specification, also allow for regional heterogeneity in funding choices for all sub-state governments.

We use this framework to make four contributions. We first estimate government expenditure tradeoffs pursuant to a large negative fiscal shock. We calibrate the Deaton model with data during the Great Recession, comparing allocations between 2007 and 2012. During this time when public budgets were under signification strain, our estimated elasticities suggest that governments strongly prioritize spending on education (both K12 and higher ed) and on public safety. Civil administration is valued differently across levels of government: a strong necessity at the most local level, and a luxury good at the state level. The preservation of funding to necessary goods is "paid for" by steering dollars away from the luxury areas of transportation spending and long-term capital expenditures.

Second, we use our estimated spending responses to model how a severe financial shock would impact the aggregate bundle of public goods and services. To calibrate this financial shock, we extract early estimates of public revenue shortfalls in the wake of COVID19 using scenarios

generated by Whittaker (2020), and apply these to current levels of spending (the most recent 2017 data extrapolated to 2021).[4] In conjunction with our elasticities, this enables us to project expenditure shifts, dollar-by-dollar, for each individual government and then aggregate to the total social provision of public goods. Although smaller budgets mechanically imply reduced spending, our framework allows us to focus on the *additional* funding shifts that arise from rebalancing between budget areas. These rebalancing flows are large: $72 billion in our calibrated exercise, representing 20% of the total reduction in public budgets. We project an aggregate shifting of nearly $45 billion away from transportation spending (both on current services and on capital improvements). A further $10 billion is shifted away from capital infrastructure spending in other areas, chiefly within K12 schooling. These flows are used to preserve spending on current education services and public safety, and also expenditures on financial commitments: debt service and retirement systems.

Our third contribution is to explore whether allocation priorities are different in good times versus bad times. The first decade of the 21st century offers a natural laboratory for making this distinction. During the five-year period preceding the Great Recession (2002-2007), public budgets expanded steadily and substantially. We recalibrate our Deaton demand system using changes in expenditures during this period. The resulting elasticities suggest that the necessity or luxury classification of public goods is largely static with respect to economic climate: largely goods that are necessities during bad times are also necessities during good times, and vice-versa. However, there is a stark difference in magnitudes. During budget expansions, budget shares move nearly in lockstep: rebalancing between areas is very limited. We project total shifts in response to an unwinding of our negative shock: a budget increase of equal magnitude. Whereas a fiscal contraction leads to a *relative* reduction in transportation spending of $45 billion, an equally sized expansion leads only to relative inflows of $3.5 billion; the same disparity holds broadly across all capital expenditures. This suggests that there is no catch-up period: infrastructure spending is compressed when budgets shrink, but then is barely restored (in relative terms) when budgets

[4] Emerging evidence suggest that the realized impact of COVID-19 on public budgets may be smaller than the estimates of mid-2020 suggested; higher than anticipated income and capital gains revenues (at the state level) and property tax receipts (at the local level) appear to be the major drivers. We use these early projections as a realistic, detailed, and flexible way to calibrate a significant budget shortfall arising from some national economic downturn.

expand. As public budgets fluctuate in response either to the business cycle or from idiosyncratic drivers, this will lead to long-term pattern of disinvestment in public infrastructure.

Our fourth contribution considers the cross-state implications to preferences. We exploit two sources of regional variation: (i) state-specific elasticity estimates for counties, cities, school districts, and special districts, and (ii) regional heterogeneity in baseline allocation choices. We again calibrate our shocks using estimates based on the impact of COVID19. State-by-state, for each expenditure area, we plot the relative magnitude of the rebalancing component: the extent of deviation from one-for-one cuts. We find relatively intuitive regional patterns. K12 education appears equally necessary countywide. Transportation spending, much of which flows to highways, appears to be more of necessity in northern states with larger climate variation. Allocations to parks and recreation is a necessary good in states with large land preserves, but a luxury good in more urban regions. Unemployment spending is a necessity in states historically more exposed to the economic cycle.

Our paper is closest related to the practical-oriented literature on the incidence of government spending reactions to recessions or other negative shocks (Reid, 1988;[5] Hoene and Pagano, 2009;[6] Desai, 2018[7]). We also contribute to the literature on understanding deviations of governments actions from a median voter model in the cross-section of public goods (e.g., Inman, 1978; Holcome, 1980; Gramlich, and Rubinfeld, 1982; Turnbull and Djoundourian, 1994).

Our paper also is related to the vast literature on local government expenditures in relation to the optimality of the federal-local system and intergovernmental transfers (Bradford and Oates, 1971). In particular, the role of shocks to local public expenditures has been extensively studied in the context of grants-in-aid from national or state government coffers to local governments. However, the crisis shift we study is the opposite direction from positive grant-in-aid shocks to

[5] Reid (1988) studies the 18 percent loss of revenues experienced by California cities over the interim 1977-1978 to 1982-1983 following the passage of Proposition 13, limiting property tax assessments. He finds that, as a part of the response, cities shifted budget shares toward safety and health and away from civil administration, public works, parks, and libraries.

[6] In this research brief from the National League of Cities, Hoene and Pagano (2009) find that two thirds of cities responded to the Great Recession by layoffs/hiring freezes and halting of capital projects. Yet, only 14% and 33%, respectively, reduced safety and other services.

[7] In a survey-based study of Great Recession cutbacks by New Mexico local governments, Desai (2018) finds that the governments overwhelmingly (86%) tried to avoid curtailment of services, consistent with the Hoene and Pagano (2009) results of ex post expenditures but delving into motivations expressed in the survey. Desai (2018) further provides an important survey of case studies and industry articles as to how public officials make cutback decisions across recessions and jurisdictions.

government budgets, which cause the well-known flypaper effect whereby lump-sum grants to governments induce more government spending than similar increases in government budgets that would be due to local income increases (Courant, Gramlich, and Rubinfeld, 1979; Clay, 1843; Hines and Thaler, 1995 Bailey and Connolly, 1998). Deller and Maher (2005), for example, studies how public goods budget shares are reallocated using a grant-in-aid setting in Wisconsin. But, generally this literature focuses on why the increased government coffers from grants cause more public good spending than a similar local population income shock would do, and thus does not directly inform the crisis decisions surrounding budget shortfalls. Yet, we build off Deller and Maher (2005), who overlay the luxury-versus-necessity properties of public good categories as an aspect of the flypaper effect.

The remainder of the paper proceeds as follows. Section II lays out our empirical methodology. Section III introduces our Census of Governments data. Section IV reports our estimations and discusses robustness. Section V uses the estimates to simulate the public good provision consequences to the Covid-19 crisis across public goods and locations. Section VI concludes.

II. Methodology

Deaton-Muellbauer Framework

Our empirical framework adheres to the Almost Ideal Demand System first outlined in Deaton and Muellbauer (1980). The setting is one of a household facing choices in how it spends income across the set of expenditure categories in light of an income shock. In such setting, a flexible expenditure functional form leads to an expression for the budget share of any particular good at a particular point in time (with time subscripts suppressed) which can be aggregated across households with minimal additional assumptions:

$$\overline{w_i} = \alpha_i + \sum_j \gamma_{ij} \log(p_j) + \beta_i \log\left(\frac{\bar{x}}{P}\right). \quad (1)$$

The dependent variable, $\overline{w_i}$, is average budget share for good *i,* and $\bar{x}$ is average household total expenditure (which is equal to income in a full allocation of income model). The p_j terms in the

summation are prices of the J goods available; each good i has an exposure to all prices. P is a price level index. The variable of interest, β_i, measures the sensitivity of good i's budget share with respect to changes in total income. Deaton and Muellbauer show that this demand function inherits properties of the PIGLOG class of consumer preferences, and is therefore a first-order approximation to any demand functions which are microfounded in utility maximization.

Our innovation in the methodology is only in that we apply the notion of a household choosing among goods and services to a government choosing among public goods and services provisions to which to allocate budget shares. Without loss of generality as to political mechanism (and any associated frictions), we argue that public expenditures represent a realized-aggregation of voter preferences for public goods and services within a given government's purview.[8] Accordingly, we translate the Deaton specification into a public sector setting. Our main estimating equation is the time 1st difference specification of equation (1), equation 17 from Deaton & Muellbauer (1980):

$$\Delta w_{ig} = \sum_j \gamma_{ij} \Delta \log(p_{jg}) + \beta_i \Delta \log\left(\frac{X_g}{P}\right) \quad (2)$$

The index g denotes a government. As before, both i and j index the public goods. p_{jg} is the price for good j faced by government g. X_g is total expenditure by government g. P is a price index. In first differences, the coefficients of interest, β_i, is the elasticity of budget share with respect to a change in real expenditures.[9] Since the largest component of most public budgets is driven by wages and salaries, we use local wage measures by goods-category to measure the price, p_j.

This demand system, by design, has the feature that the sum of all goods elasticities, β_i, equals zero, as total budget shares always equal one. If the government just balances its budget, we can speak of expenditures and government income or revenues equivalent.[10] Any shock to revenues will induce dollar changes in allocations across goods. The null, $\beta_i = 0$, is that these dollar changes will be perfectly proportional: an overall revenue reduction translates into equal cuts (in percentage) across all goods categories. $\beta_i < 0$ means that a reduction in government

[8] As noted, there are a range of theoretical explorations of exactly how to model this aggregation. The median-voter theory and Tiebout sorting are particularly prominent within the field of public economics.

[9] Formally, β_i is a quasi-elasticity; the percentage-point shift with respect to changes in total budget. The distinction is rarely important in our discussion.

[10] Most state and local governments are subject to some form of balanced budget requirement: https://www.urban.org/research/publication/balanced-budget-requirements

revenues translates into an *increase* in expenditure share. This denotes less than one-for-one cuts in good *i.* Such a good, in this framework, is deemed a "necessary" good: spending on this good is preserved more than it would be relative to proportional cuts. In order for budgets to balance, shielding necessary goods from proportional cutbacks requires an offsetting pullback on some other expenditure. In this framework, those are "luxury" goods, which have $\beta_i > 0$. This means that an overall income reduction will lead to a *decrease* in expenditure share: more than proportional cuts for good *i*.

Our Application of the Methodology

We decompose total public expenditures into several broad categories: civil administration, public safety, transportation, social welfare, elementary education, higher education, public health, parks and recreation, and utilities. For each of these, we are further able to decompose spending into expenditure on current operations versus capital project, assigning transfers for a service to the originating source of government, not the one implementing the spend. We also track three committed costs expenditures: unemployment assistance, flows to retirement systems, and debt service.

Our central empirical exercise uses data on public financial shocks to estimate spending elasticities. We estimate elasticities separately for times of fiscal stress and times of fiscal slack, and find sharply different responses. Our period of budgetary contraction is the Great Recession. For a near-universe of governments in the U.S., we obtain changes in expenditures between 2007 and 2012, and use equation (2) to estimate elasticities for each category of public goods. We estimate these elasticities separately by five levels of government: states, counties, cities, independent school districts, and special entities (*e.g*. municipal utility districts). This is done to reflect that both sources of revenue and the span of responsibility for goods provision can differ substantially depending on government level. For all classes of sub-state governments – counties, cities, towns, schools and special districts – we estimate elasticities within state, allowing for regional heterogeneity in public goods preferences.

We then use these elasticities to simulate implied total changes in public goods during fiscal contraction. We calibrate the magnitude of reductions by using estimates that reflect a sharp, unanticipated fiscal contraction: projections of COVID-19's impact on public budgets from mid-2020. Our preferred specification adopts state-varying shocks produced by Whitaker (2020). These

shocks vary according to a given state or local government's revenue mix, along with heterogeneity in how the pandemic is expected to affecting funding streams. While a future negative shock might have somewhat different distributional consequences (the COVID projections disproportionally affect regions that rely on tourism, for instance), at a high level, the heterogeneity in our calibrated shocks is a proxy for regional exposure to macroeconomic conditions. For any posited shock, our framework allows us to think about two shifts: first, the direct shift that would be occasioned by assuming across-the-board cuts on a pro-rata basis; and second, the additional (or attenuated) reduction that relates to whether a good is viewed as a luxury or a necessity. In times when budgets are being compressed, we show that these "rebalancing effects" can be quite substantial with respect to proportional changes.

Then we explore whether these patterns are symmetrical with respect to budgetary expansions. We re-estimate elasticities using data from the 2002-2007, just before the Great Recession. Public budgets during this time were broadly increasing in real terms. We calibrate our fiscal expansion by assuming a positive shock equal in magnitude and distribution to our negative shock. If spending adjustments are symmetrical, then budgets shares after two equal and opposite shocks will return to baseline. We find a starkly different pattern however. Elasticities estimated from periods of expansion are an order of magnitude lower than those estimated during periods of contraction. This suggests that cyclicality has long-term implications for allocation levels. In response to fiscal stress, luxury goods are reduced more than one-for-one in order to preserve spending on necessities. Expansions, however, appear proportional. There is no rebound spending on luxury goods. Infrastructure spending is the strongest luxury. Our results therefore suggest that low-frequency economic cycles will lead to an ongoing, long-term compression of infrastructure spending.

III. Data

Data on public expenditures comes from the US Census of Government's Government Finance Statistics. This is the most comprehensive compiled data on public finances and spans the near-universe of public entities. The data is self-reported by local units to the Census Bureau, which surveys every government in the country every five years (…2002, 2007, 2012, 2017…).

Therefore, the estimated elasticities are based on the change in total expenditures from either 2002-2007 or 2007-2012. Note that these year breaks line up naturally, just by luck, with expansionary (the 2002-2007 half-decade) and contractionary (2007-2012) periods in the business cycle.

We decompose total expenditures into public goods categories using the Census of Governments aggregation guidelines. We validate our assignment of line-items to categories by ensuring that the total of our constructed buckets matched the reported value of total expenditures. We have complete data and are able to exactly match aggregate totals for more than 90% of governments in the data. This represents 83,650 governments which include all 50 states plus 3,030 counties, 35,535 cities and towns, 13,432 independent school districts and 31,603 special government districts.

At the end of our analysis, we project fiscal adjustments coming out of the pandemic. We base these projections to 2021 based on the Census 2017 survey, combined with an extrapolation of the growth of total public budgets between 2017 and 2021, noting that we have annual total expenditures, just not expenditures at a category level.

Our demand system analysis requires prices for each expenditure item. We obtain county-level wages by NAICS code for 2002, 2007 and 2012 from the Bureau of Labor Statistic's Quarterly Census of Employment and Wages (QECW). We construct a many-to-one match between NAICS codes and the broad areas of public goods that we establish, and take the average across industries as a county-level measure of the cost of providing public goods for all sub-state governments. For state governments, we construct an identical measure using state-level aggregates from QECW. We use another BLS measure of state-level purchasing-power-parity by year for the price index, ΔP_g. The BLS state-level series begins in 2008, so for the 2002 data, we use Census Region CPIs also from BLS.

We also construct a cost-of-funding measure, which is the price for the cost of money. This is relevant for goods categories which represent transfers of money: debt service, unemployment assistance, and retirement system funding. We obtain this measure by associating each government ID in the Census of Governments with, first, an Obligor ID (obtained from Atlas Muni Data) and, second, all CUSIPs associated with that Obligor ID in the Municipal Securities Rulemaking Board transactions data. This allows us to associate government entities with the yield from observed security prices. For each government, we average yields from all long-dated municipal securities that trade anytime during 2007 or 2012, and use the log difference as the change in cost of money.

This construction relies on observing a traded debt security, and therefore we cannot create it for smaller governments which do not access public capital markets (or do so in such small quantity that we don't observe their debt trade in the relevant years). For these governments, we assign a regional average measure, using the same government type within the same state if feasible, and within the same census region otherwise. We are unable to obtain trading data from MSRB prior to 2005, and therefore we exclude the cost of money as a control when estimating elasticities over the 2002-2007 period. The inclusion of this control has a negligible effect on our estimates for the 2007-2012 period, and therefore we assume its lack also has little impact during the 2002-2007 period.

Statistics

We classify all expenditures into one of twelve areas. Nine are direct services: elementary education, higher education, civil administration, public safety (police and fire), transportation, health, utilities, parks and recreation, and utilities. The remaining three represent financial payments: debt service, retirement, and unemployment. We exclude expenditures that are reported as intergovernmental transfers in order to ensure that we are not double-counting expenditures. (An intergovernmental transfer from a state to a city, for example, may then show up as a transportation expenditure; thus we capture the money spent at the city level in the appropriate expenditure category, even if the ultimate source of the funds originated at a higher level.)

Table 1 shows the aggregate totals across all levels of government for the full Census of Governments survey years of 2002, 2007 and 2012. The largest expenditure area is consistently elementary education, at 21% - 23% of allocations. A set of other expenditure categories – including higher education, civil administration, public safety, transportation, health, utilities, welfare, and retirement all bundle, each with 7% - 11% of the budget. Looking across the columns shows that growth is relatively consistent across categories with budget shares staying mostly stable, but with some distinct heterogeneities (for example, whereas K-12 education declines, higher education increases in its proportion) that account for large changes in the dollar values. The patterns are not readily interpretable, partially because this analysis combines operational expenditures and capital investments and may involve differences in price level effects.

Yet the total expenditures nationally across all expenditure categories does tell a story of incredible growth in expenditures, with the national aggregate starting at $1.8 trillion in 2002 and reaching $2.7 trillion by 2012, a 50% growth over a decade.

To delve into this pattern more deeply, Figure 1 shows the evolutions of public budgets between 2000 and 2012 for the four major types of governments.[11] (Although the full Census of Governments is administered every five years, larger governments – representing 94% of total dollars – are surveyed every year. These governments underlie Figure 1.) Public budgets are increasing in real terms until 2008/2009. Across all governments, budgets grew by approximately 4% annually between 2000-2009. From the Great Recession onwards, average budgets decline by several percentage points. States see a peak-to-trough decline of 5 percentage points. For counties, cities, and independent school districts, the contraction is between 10 and 12 percentage points. The growth of public budgets over time suggests that even a flattening represents significant fiscal strain. It has been widely documented that state and local governments faced severe funding pressures during the Great Recession well through 2012 (Oliff, et al, 2012).

IV. Results

Budget Allocation Changes: The Case of Fiscal Stress

We first use the Great Recession period to estimate how budget allocations change when governments are forced to reevaluate expenditure choices due to fiscal stress. In particular, we estimate the first differences version of Deaton & Muellbauer (1980)'s demand system, using government-level data on expenditures in 2007 and in 2012, along with the full system of prices for all goods as described in equation (2). In keeping with Deaton & Muellbauer (1980), we estimate these elasticities with separate OLS regressions for each expenditure area. We also do the process separately for each level of government, and, for the levels of government beneath the state, we estimate by state to capture local preferences.

Figure 2 shows the results by level of government. Each bar is the β_i coefficient for a given expenditure area: the quasi-elasticity of expenditure share with respect to the overall budget changes, where a quasi-elasticity captures a percentage-point shift in budget share of a particular

[11] Special district entities show a very similar expansion and contraction pattern over this period.

expenditure item, with respect to a percent change in total budget. When a bar is positive, the item is a luxury in that the category's share increases with increases in income (i.e., the total public budget expenditure). Note that Figure 2 has five panels, one for each level of government. Hence, it is a bit cumbersome to interpret all at once, and we defer drawing our main economic magnitude takeaways until we aggregate these elasticity effects into an inference about overall budget dollar allocations. Nevertheless, we can draw out a number of observations.

First, we find that capital spending is a luxury good in most cases across public good and across government types. In particular, for states, municipalities, and counties, capital investments in transportation are either the strongest, or 2nd-strongest luxury good, measured in how strongly the budget share reacts. This is perhaps most transparent in school districts, where current spending on education is a necessity and capital investment in education is a luxury. Yet, special districts also evince a clear necessity-luxury divide between current and capital spending. The strongest luxuries for these entities are utilities, public safety, and parks & recreation – again, a direct reflection of the distribution of single-issue special districts. More than half of the 31,600 special districts in the data are dedicated to one of these three areas.[12]

Second, among current services a pattern exists in tensions among the necessities of education (predominantly higher education) and financial commitments to both retirement systems and debt service; and non-necessities (e.g., transportation current services at the state level). As we discuss shortly, this is highly consequential, as state spending on current transportation services is quite high in levels.

Third, there may be level-of-government offsetting of luxuries and necessities. Civil administration is a luxury at the state level. It is a necessity good for counties, and even more of a necessity for municipalities. The more local the government, the more public administration seems to be a necessity good. This is consistent with the idea that policy makers tend to make cuts as far away from the voter as possible. Public bureaucrats in state capitols seem to be a luxury good, whereas city-level local officials appear to be treated as a necessary good. Apart from civil administration, the strongest luxury good for both counties and municipalities is public safety. The

[12] Utility districts are identified by the presence of any of the following words in the entity's name: utility, water, waste, gas, electric, sewer, soil, irrigation, drainage, sanitary. The keywords for public safety districts are: police, fire or safety. Parks and recreation districts are identified by those two eponymous keywords.

strongest necessity for special districts is debt service. This is another unsurprising finding, as special entity districts are often substantially funded by issuance of revenue bonds.

Total Funding Shifts following to a Negative Fiscal Shock

Overall changes in allocations depend not only on expenditure share elasticities but also on baseline level of spending. State spending is approximately equal to spending across all other government types, and is approximately four times total spending at the county level.[13] Accordingly, state elasticities represent substantially larger allocative choices than county elasticities do. To understand the total adjustment of public goods and services during times of fiscal stress, we apply the estimates to budgetary projections arising from COVID-19 and the subsequent "sudden-stop" in economic activity of Q2 2020. While state and local budgets currently appear to have been less impacted by COVID-19 than anticipated, our exercise uses these COVID projections to provide realistic magnitudes of public budget shortfalls arising from a negative macroeconomic shock. This allows us to speak to the consequences of the choices of government in dollar terms, i.e., impact on residents pursuant to significant fiscal stress.

The starting point of this analysis is our set of elasticity estimations. We pair these estimated elasticities with the estimate of total state (all level of government) budget reductions driven by COVID19 from Whitaker (2020), who incorporates detailed geographic analysis of sectors of production and relative sources of tax revenue to understand the pandemic's implication for the total budget. He uses a state-level shock, along with a different state-specific shock for local governments. These estimates reflect two primary features of the landscape: (i) the impacts of COVID19 will vary regionally depending the mix of existing funding streams, and (ii) state governments will be impacted differently from local governments (due to, for instance, higher diversification of funding streams). Whitaker produces several scenarios as of June 2020. We extrapolate a midpoint between the "slow" and "second-wave" scenarios, intended to reflect the reality of a 2nd wave during Winter 2020-2021 that came with limited economic shutdowns (the mid-2020 projection of a second wave included "complete shutdowns" during 2020:Q4).

The final piece of data we need for our projection is a baseline for 2021. We model forward the most recent (2017) Census of Governments data using aggregate growth rates of public budgets to project a 2021 baseline budget for each of 86,608 government entities.

[13] Author's calculation using Census of Governments data for 2007.

Our main result is depicted in Figure 3, the projected spending response in each category, done at the micro governmental level but aggregated to the expenditure category. The figure decomposes total spending adjustments across all levels of government into two components: the proportional reduction implied by the total fiscal shock (blue bars, at bottom), and a rebalancing effect which is governed by estimated elasticities (red bars, at top).

Since the scenario is a negative fiscal shock, the proportional adjustment is mechanically downward (negative). The blue bars in the bottom panel convey relative magnitude of this proportional response. Because the fiscal shocks vary by and are aggregated across states and government types, this is not quite a direct reflection of expenditure weights for public budgets in aggregate – however, the cross-sectional (across locations) variance in projected shocks is low relative to cross-sectional variance in allocations. Therefore, the blue bars are approximately a rank-ordered snapshot of total allocations. In response to a negative shock, therefore, a proportional adjustment would lead to welfare spending declining by the largest dollar amount, followed by elementary education, higher education, and health spending. The main point of these blue bars is to put the relative magnitude of the rebalancing in effect.

The red bars in this figure show the dollar magnitude change in expenditures, not due to the income shock effect, but due instead to across-expenditure reallocations that comes from some public services being more of a luxury or necessity than others. For necessities, the bar will project upwards into positive dollar measure: as a negative fiscal shock hits, the representative aggregate state (including all the sub-state level entities) offsets the proportional allocation decline in dollars by rebalancing positively toward this category's budget share. For luxuries, the rebalancing effect will be negative: allocations are reduced even more than one-for-one. This additional reduction is instead steered towards the necessity goods to maintain as much spending as possible.

The total reallocation represented in Figure 3 is just over $72 billion dollars – that is, a total of $72 billion dollars is rerouted from luxuries to necessities in this projected scenario. By construction, all across-expenditure reallocations sum to zero. But reallocations are significant with respect to the total magnitude: the total projected budget impact is $365 billion, meaning that about 20% of the shifts in expenditure areas are due to reallocations.

Figure 3 provides four main results about public expenditures in the United States. First, the largest rebalancing reductions are for transportation, both in capital spending and current expenditures. Both current and capital transportation spending are treated as luxuries in aggregate

across districts, and the magnitudes are large. In total, our projections suggest that more than $40 billion dollars will be moved away from transportation during the COVID19 crisis, in order to maintain spending elsewhere. Because transportation spending, in both forms, represents maintaining and building infrastructure, this result suggests that, per our title, recessionary times imply a crumbling to infrastructure.

Second, our elementary education results also reflect a crumbling of infrastructure, but a strong role for the necessity of current spending. Any consideration of the total spending in education may have missed this offsetting result: education current spending acts as a necessity, education capital spending acts as a luxury, potentially causing some crumbling of education infrastructure to support current education in fiscal distress times.

Yet, the result is even stronger than that, leading to our third result. The sum of the necessity demand for spending in current spending in K-12 and higher education, plus public safety (nearly $40 billion), are so large as to need cutbacks in necessities across other aspects of public infrastructure: roads, bridges, public transportation, and new school buildings. This represents another $10 billion in flows away from infrastructure, bringing the total to $55 billion. Infrastructure accounts for more than three-quarters of the total rebalancing flows.

Our final result from Figure 3 concerns allocations to financial commitments: funding retirement systems and debt service. These financial commitments act like necessities; across the two categories, $25 billion is allocated from luxury goods to offset proportional cuts. This implies that when cash is most precious, governments are nonetheless stuck in committed costs in a direct parallel to the role of growing committed costs in households. We infer that these commitments reflect a combination of legislative constraints (flows to retirement systems are often legally proscribed) and capital markets discipline (the cost of losing access to debt markets is assumed to be quite high).

To summarize our main allocation results, we find evidence that in times of fiscal distress, governments step up to preserve education at large and public safety, increasing their budget share. Yet this comes at a cost of eroding infrastructure. These results beg the question of whether government unwind this crumbling of infrastructure. In the next section, we explore whether the patterns documented above are symmetric with respect to budget increases.

Budget Allocations Changes: The Case of Fiscal Expansion

In good financial times, do dollars flow back into infrastructure and the public service categories continue to act in the same cross-sectional way as luxuries and necessities? Cuts to luxury goods are made to preserve spending on necessities during fiscal contraction. If budgets subsequently expand (as one would expect with either transitory shocks or with macroeconomic business cycles), then perhaps dollars flow back to luxuries in the medium- or long-run. In this case, the reallocations are chiefly a *timing* effect: spending is deferred during "rainy days" and backfilled during times of prosperity.

To test this, we re-estimate elasticities using data from 2002-2007. As Figure 1 shows, this 5-year period before the Great Recession was characterized by expanding public budgets across all levels of government. We again use the changes in expenditures over this period in estimating equation (2).

Figure 4 shows the resulting elasticities by level of government. In general – though not without exception – directionality is consistent. That is, luxury goods during times of fiscal stress are also treated as luxury goods during times of expansion. Some expenditure areas appear to switch: civil administration for municipalities is a necessity during contractions, but appears to be a luxury during contractions. This pattern of changing elasticity-sign implies that spending is preserved while budgets are shrinking, and then during expansions spending on municipal administration expands even more than would be suggested by simple return-to-baseline dynamics.

The central empirical implication, however, comes not from the direction of the shifts, but from the magnitude. In particular, the elasticities estimated from a time of fiscal expansion are an order of magnitude smaller than those estimated during times of fiscal stress. This suggests that when public budgets are growing, relative budget shares change little. Expenditures increase nearly one-for-one regardless of the funding use. This has large, immediately implications for the path of public budgets subject to cyclical fluctuations.

Figure 5 shows the total adjustments implied by the expansion-elasticities. As in the preceding discussion, to project aggregate changes in allocation, we need to hypothesize a shock to public budgets. Here, we hypothesize a positive shock exactly equal to the projected COVID shock of the previous section. This represents a full round-trip recovery for public budgets: if some region is projected to undergo an 8% reduction in public budget in the negative scenario, the

expansion scenario will an 8% increase in the positive scenario.[14] The two panels in Figure 5 have the same interpretation as in Figure 3: blue bars show the proportional adjustment, and red bars the rebalancing effect. The proportional responses to a positive shock (at bottom) are increases that are mechanically equal and opposite to the reductions in Figure 3.

The impact of the smaller elasticities can be seen clearly by comparing the top panel of Figure 5 to the top panel of Figure 3. In both, the largest rebalancing adjustments come in education spending and infrastructure spending. Note, however, that the scaling of the dollar magnitudes on the y-axis is an order of magnitude lower (one less digit). Also note that because the sign of the aggregate shock changes, luxury goods are now those which have a *positive* rebalancing effect, and necessary goods have a *negative* rebalancing effect.

We look to particular categories to compare our results from Figure 3. First, recall that rebalancing to education and public safety necessity services implied that governments needed to sacrifice $70 billion in luxury goods (of which, $45 billion came from transportation spending and $55 billion related to infrastructure more broadly). In Figure 5, however, in an exact opposite fiscal expansion, K12, higher education, and safety only give up an aggregate of $6.3 billion to luxury public services in reallocations from budge share tradeoffs. Thus, education and safety are sharp necessities in contractionary times, but keep relatively stable dollar expenditures in fiscal expansion. This no doubt results from sticky expenditures, but has large consequences for infrastructure.

Thus our second fiscal expansion result concerns the resurrection of infrastructure spending in good times. In Figure 3 we showed that the rebalancing effect routs approximately $45 billion *away* from transportation during fiscal contractions. In Figure 5 we show that the additional dollars allocated *towards* transportation when budgets expand is approximately $3.5 billion. The implied net loss for transportation spending alone is in excess of $40 billion. A similar pattern holds for most capital areas, especially K12 education.

This implies that when infrastructure is cut during bad times, there is no concomitant catch-up funding during good times. As public budgets go through cycles – driven either by idiosyncratic shocks like COVID19, or by macroeconomic cycles that directly impact public budgets – the result

[14] Mathematically, of course, this is not an exact return to baseline as (1-X)*(1+X) is slightly less than 1. We use equal and opposite shocks relative to the same baseline, to facilitate direct comparison of magnitudes in Figures 3 and 5.

is repeated erosion of budget share for the luxury goods of critical public infrastructure. In such a setting, the crumbling of U.S. infrastructure seems obvious and inevitable because of the public choice frameworks operating in budget share allocation decisions.

Heterogeneity by Region

We are also able to use our regionally-varying elasticities along with the spatial variation in projected budget shocks to understand how changes in funding allocation may vary by state. Figures 6-9 show results from this analysis.

As before, we use the within-state estimates for sub-state governments and pooled state analysis for the state-level estimations, but this time, we plot variations across states with the aggregate spending across jurisdictions in a heat map. Our metric is in percentage change. A value of positive 20%, therefore, would suggest that for every $10 cut, $2 are reallocated from another area to preserve spending – this would be a necessary good.

For some areas, there is little spatial variation. Figure 6 shows that elementary education is a strong necessity everywhere. We note that two states which are at the lower end of the necessity scale – Florida and Arizona – are states with a large retiree population; this may reflect the reduced important of K12 systems in these states.

Figure 7 shows the analysis for current spending on transportation. There is a clear regional pattern here: in northern states, especially highly urban north eastern states, transportation spending is less of a luxury than in southern states. This result is consistent with the intuition f regional amenities: cold weather states have a limited ability to cut spending on snowplows and salt or road repair, whereas warm weather states do not face the same constraints.

Figure 8 shows large heterogeneity in parks and recreation. In places with large federal and state land preservations – chiefly the Pacific and Mountain West – parks and recreation spending is a necessary good. In other parts of the county, parks and recreation appears to be a luxury good. Again, these results are consistent with local preference and amenities.

Finally, Figure 9 shows that unemployment is a necessary good everywhere, but that there are large differences in regional intensity. In the southeast, which is often strongly impacted by economic downturns, unemployment is a substantially stronger necessity than in many other parts

of the county. The implication here that some states' workforces are better able to weather national economic downturns has large implications.

V. Conclusion

We adopt a standard model of individual consumption, the Deaton and Muellbauer Almost Ideal Demand System, to a public choice setting. We classify public spending into one of twelve expenditure areas, for each of 80,000+ governments in the Census of Governments. We identify two different periods from the past two decades: a period of fiscal expansion prior to the Great Recession (2002-2007), and a period of fiscal stress during and immediately after the Great Recession (2007-2012). We use the Deaton demand system to estimate how budget shares are reallocated pursuant to an overall fiscal shock. This allows us to classify public goods as either luxuries or necessities. A necessity is an expenditure area that receives offset funding during times of budget reductions in order to maintain a level of spending. Luxury goods are those that are reduced in order to reallocate funds to the necessity goods. We show that these rebalancing effects between public goods are large in times of fiscal stress. We project a total magnitude of dollar shifts facing state and local governments in response to budget reductions occasioned by a several fiscal shock. These estimates rely on our estimated elasticities, baseline allocations, and projections of revenue shortfalls arising from a sudden fiscal downturn.

The results show that education and public safety are the key "necessity" public goods. In order to maintain spending within these areas, state and local governments are projected to shift more than $70 billion from "luxury" public goods. More than $55 billion of these reallocated dollars come from infrastructure spending: transportation spending (current and capital), K12 funding for new school construction and renovation of existing buildings (capital), and a broad range of capital spending on other goods and services including utilities and public safety.

We then re-estimate elasticities using data from the 2002-2007 period of expanding public budgets, and show that rebalancing effects during good times are not symmetric to those during bad times. Budget expansions result in nearly proportional shifts for each underlying expenditure area. This means that cuts to luxury goods during times of fiscal strain are not matched with a

restoration of those budgets during expansions. This implies that fluctuations in public budgets leads to a long-term erosion of budget share for those areas which are most compressed whenever budgets shrink. As we show, these are primarily expenditures related to physical infrastructure. This pattern can help explain the long-run secular decline in infrastructure investment experienced in America during the past several decades.

References

Bailey, Stephen J., and Stephen Connolly (1998). “The flypaper effect: Identifying areas for further research.” Public Choice 95: 335–361, 1998.

Barro RJ. Government Spending in a Simple Model of Endogeneous Growth. Journal of political economy. 1990 Oct 1;98(5, Part 2):S103-25.

Baskaram, Priya, 2021. “Thirsty Places.” Utah Law Review, forthcoming

Black, Duncan. "On the rationale of group decision-making." Journal of political economy 56, no. 1 (1948): 23-34.

Bowen, Howard R. (1943). "The Interpretation of Voting in the Allocation of Resources". Quarterly Journal of Economics. 58 (1): 27–48.

Bradford, David F. and Oates, William E. (1971). The Analysis of Revenue Sharing in a New Approach to Collective Fiscal Decisions.” Quarterly Journal of Economics 85 (3): 416–439

Clay, Henry (1843). The Life and Speeches of Henry Clay. Vol. 2. New York: Greeley & McElrath.

Courant, Paul N., Edward M. Gramlich, and Daniel Rubinfeld (1979), "The Stimulative Effects of Intergovernmental Grants.” In P. Mieskowski and W.H. Oakland, Fiscal federalism and grants-in-aid. Washington, DC: The Urban Institute

Deaton, A., & Muellbauer, J. (1980). An Almost Ideal Demand System. The American Economic Review, 70(3), 312-326.

Deller, Steven C. and Craig S. Maher (2005). “Categorical Municipal Expenditures with a Focus on the Flypaper Effect.” Public Budgeting and Finance, Volume 25 (3): pg: 73-90.

Desai, Uday (2018). “Responses to Recession Era Fiscal Stress: Local Government Strategies in New Mexico.” Public Finance and Management, 18 (1).

Downs, Anthony (1957). "An Economic Theory of Political Action in a Democracy". Journal of Political Economy. 65 (2): 135–150.

Fisher, Ronald (1997). “The Effects of State and Local Public Services on Economic Development,” New England Economic Review, March/April: 53-67.

Gordon, Robert J., 2018. Why has Economic Growth Slowed when Innovation Appears to be Accelerating?” NBER Working Paper.

Gramlich, Edward M. and Daniel Rubinfeld (1982). “Micro Estimates of Public Spending Demand Functions and Tests of the Tiebout and Median-Voter Hypotheses,” Journal of Political Economy 90: 536-560.

Gupta, Arpit, Stijn Van Nieuwerburgh, and Constantine Kontokosta. “Take the Q Train: Value Capture of Public Infrastructure Projects.” No. w26789. National Bureau of Economic Research, 2020.

Hines, James R. and Richard H. Thaler (1995), "Anomalies: The Flypaper Effect", The Journal of Economic Perspectives, 9 (4): 217–226.

Hoene, Christopher W. and Michael Pagano (2009). “City Fiscal Conditions in 2009.” Washington: The National League of Cities. Report.

Holcombe, Randall G. (1980). "An Empirical Test of the Median Voter Model". Economic Inquiry 18 (2): 260–275.

Hotelling, Harold (1929). "Stability in Competition". The Economic Journal. 39 (153): 41–57.

Inman, Robert P. (1978). "Testing Political Economy's 'As If' Proposition: Is the Median Income Voter Really Decisive?" Public Choice 33 (4): 45-65.

Oliff, Phil, Mai, Chris and Palacios, Vincent (2012). “States Continue to Feel Recession’s Impact”. Washington, DC: Center on Budget and Policy Priorities.

McNicol, Elizabeth, and Nicholas Johnson, 2010. “Recession Continues to Battle State Budgets; State Response Could Slow Recovery.” Center on Budget and Policy Priorities Report

Poterba, James M. (1994) "State responses to fiscal crisis: The effects of budgetary institutions and politics", Journal of Political Economy, 102(4):799-821.

Reid, Gary J. (1988). ‘‘How Cities in California Have Responded to Fiscal Pressure since Proposition 13,’’ Public Budgeting & Finance 8 (1): 20–37.

Romer, T. and Rosenthal, H. (1980). An institutional theory of the effect of intergovernmental grants. National Tax Journal 33: 451–458.

Saxer, Shelley Ross, 2020. “Paying for Disasters.” Pepperdine Law Working Paper.

Scott, A.D. (1952). The evaluation of Federal Grants. Economica 19 (76): 377–394.

Skertich, Robert L. S, David E.A. Johnson, and Louise K. Comfort, 2012. “A Bad Time for Disaster: Economic Stress and Disaster Resilience.” Administration 7 Society, Volume: 45 issue: 2, page(s): 145-166.

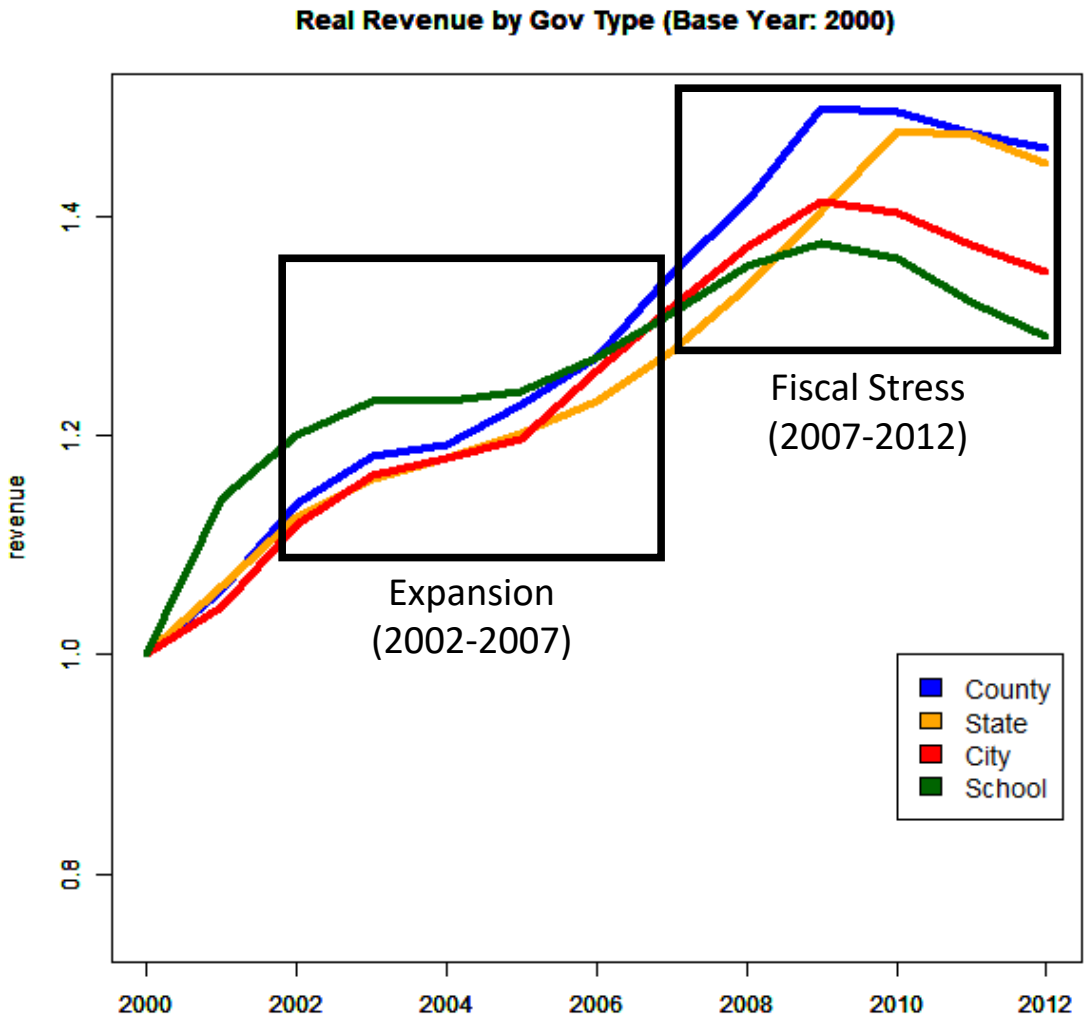
Tiebout, Charles M (1956). "A Pure Theory of Local Expenditures." Journal of Political Economy 64 (5): 416-24.

Turnbull, Geoffrey K. and Salpie S. Djoundourian (1994). “The median voter hypothesis: Evidence from general purpose local governments.” Public Choice, 81: 223–240.

Whitaker, Stephan (2020). “How Much Help Do State and Local Governments Need? Updated Estimates of Revenue Losses from Pandemic Mitigation”. District Data Brief, Federal Reserve Bank of Cleveland.

Wilde, James (1968). “The Expenditure Effects of Grants-in-Aid Programs.” National Tax Journal 21: 340–348.

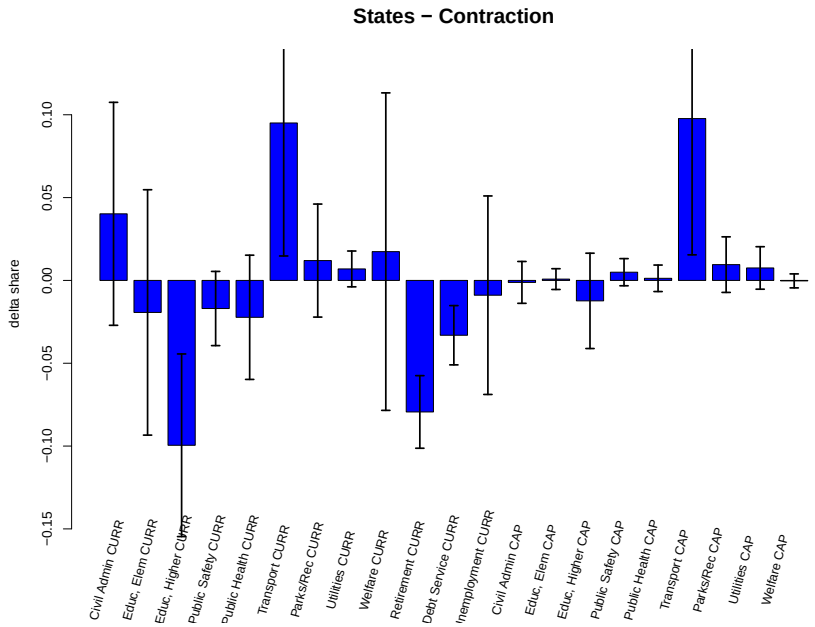
Figure 1: Path of Government Budgets



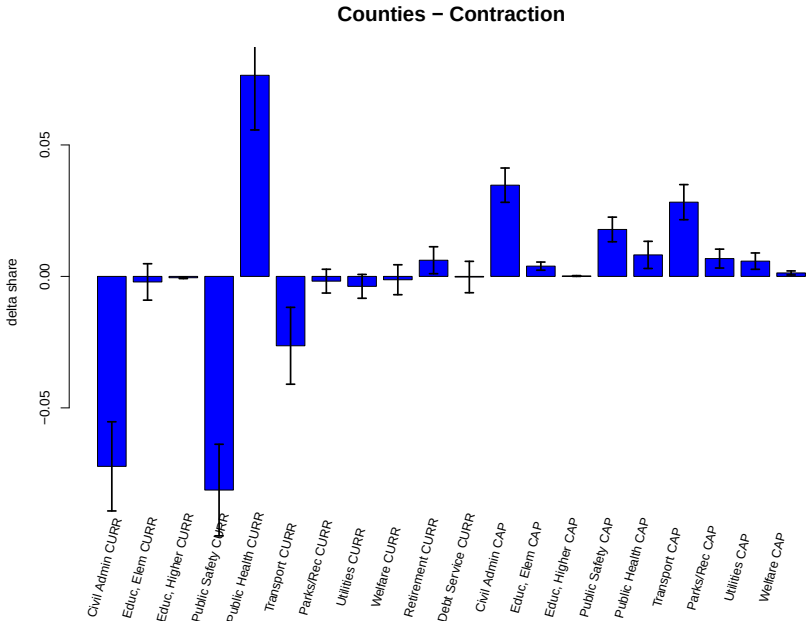
Note: This figure plots average budget growth by level of government between 2000 - 2012. Budgets are normalized to 1 in 2000, the base year. The period of increasing budget growth between 2002–2007 is used for estimating elasticities of expenditure share during expansions. The period between 2007–2012m, which includes the Great Recession, is used for estimating elasticities with respect to a budgetary contraction.

Figure 2: Luxury or Necessity During Contractions

Panel A



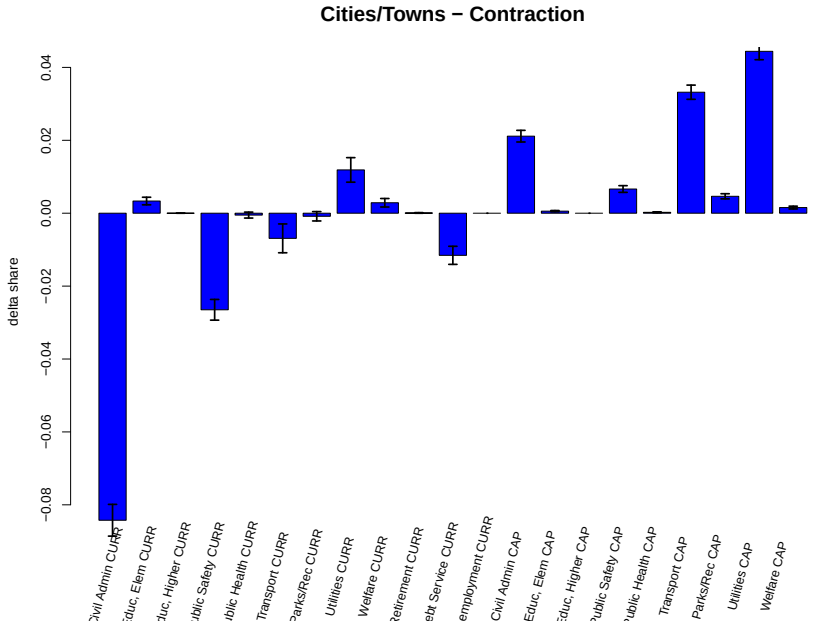
Panel B



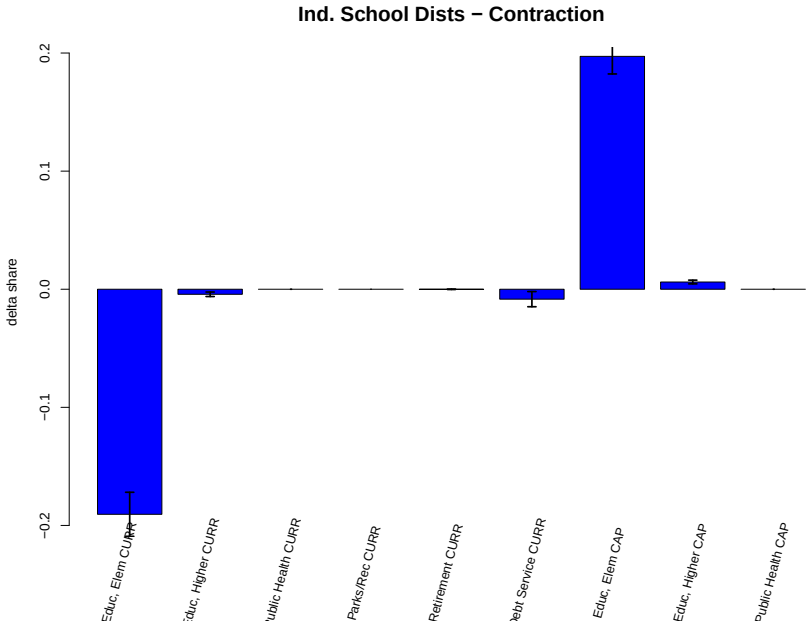
Note: See note after Panel E.

Figure 2: Luxury or Necessity During Contractions

Panel C



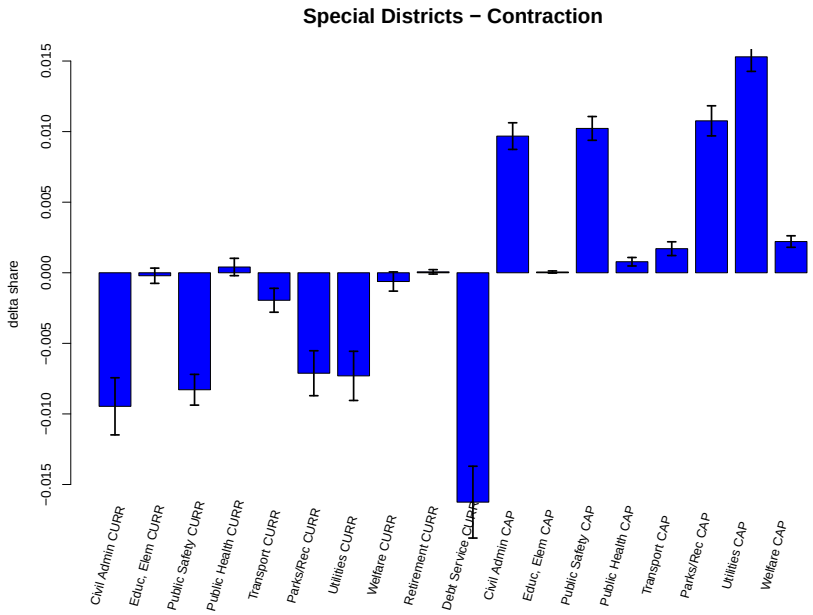
Panel D



Note: See note after Panel E.

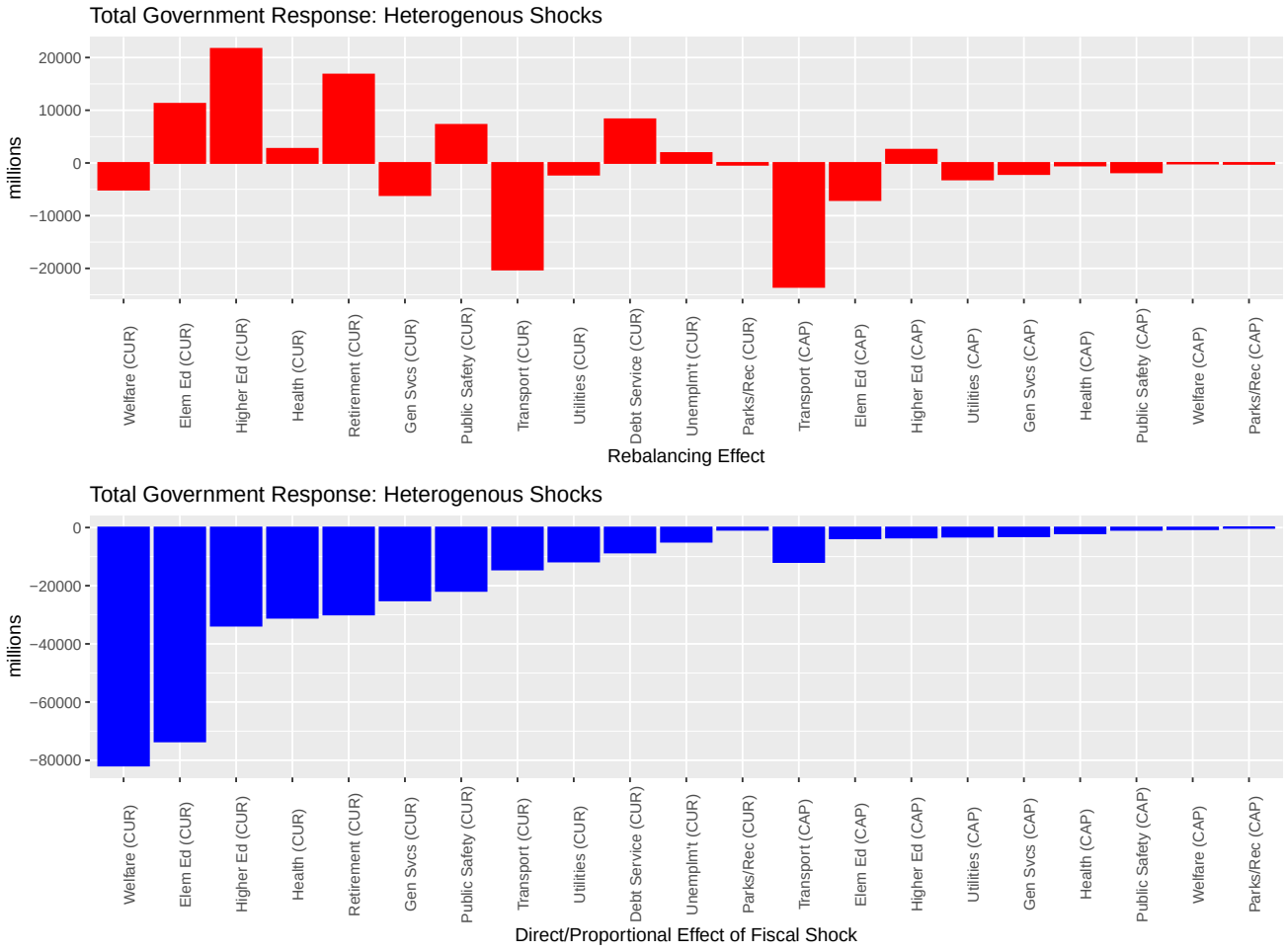
Figure 2: Luxury or Necessity During Contractions

Panel E



Note: Each figure plots the estimated coefficients from Deaton's Almost Ideal Demand System for each expenditure area. All estimates are based the 2007-2012 period, and therefore reflect responses during a period of fiscal stress. Each panel shows estimates for a distinct level of government (state, county, municipality, school district, or special district). Each bar is the estimated quasi-elasticity for a given expenditure area. An estimate of zero denotes an expenditure area which moves proportionally with changes in total expenditures. A positive estimate denotes a "luxury" good – an expenditure area that receives more than one-for-one cuts with respect to a budget reduction. A negative estimate denotes a "necessity" good – an expenditure area that receives less than one-for-one cuts with respect to a budget reduction.

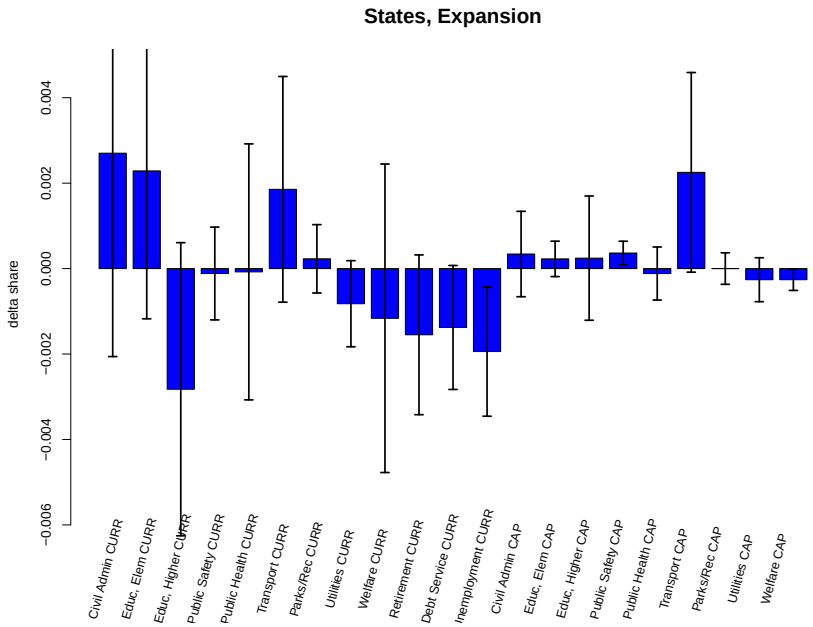
Figure 3: Contraction: Rebalancing and Direct Effect



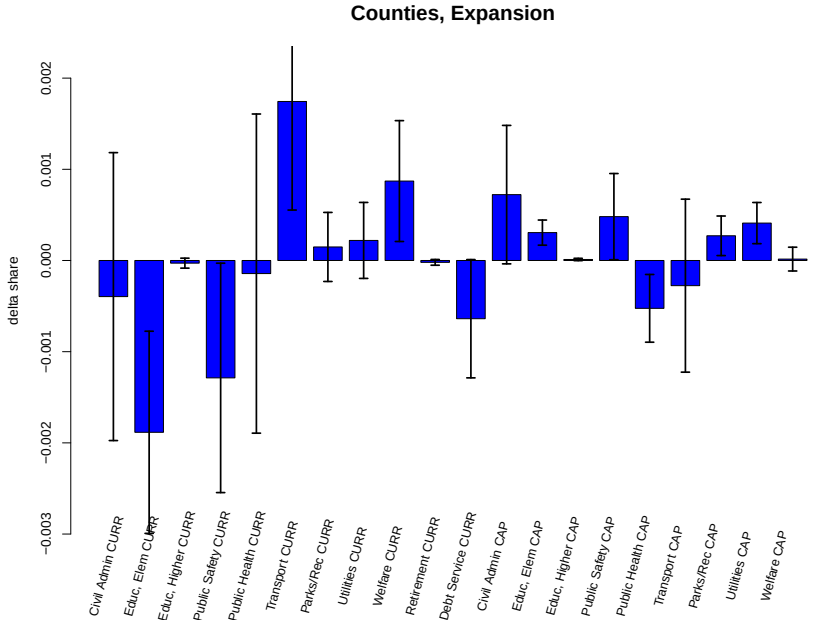
Note: This figure decomposes the total projected shifts in public goods provision pursuant to a negative fiscal shock into two components: the proportional reduction implied by the total fiscal shock (blue bars, at bottom), and a rebalancing effect capturing relative adjustment between goods (red bars, at top). In each expenditure area, the projection is based on a local shock measure taken from Whittaker (2020) and government-level elasticities of expenditure share. Elasticities are estimated from Great Recession spending adjustments (2007-2012). State-level elasticities are estimated nationally, and local government elasticities are estimated within state by government type. A positive rebalancing effect (red bar above zero) reflects a necessary good: relative to proportional cuts, dollars are reallocated towards these areas. Negative rebalancing effects represent additional cuts on top of proportional reductions; that additional increment is used to maintain spending on necessities.

Figure 4: Luxury or Necessity During Expansions

Panel A



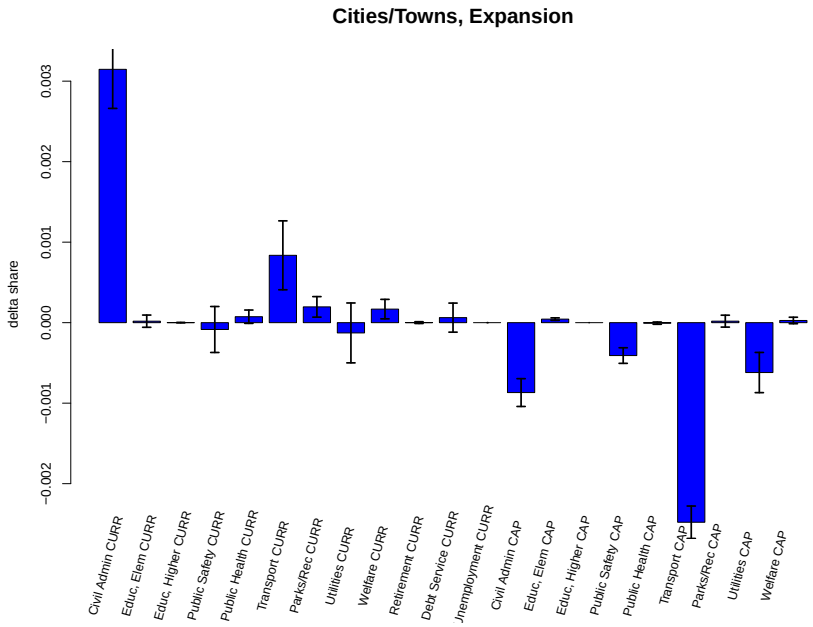
Panel B



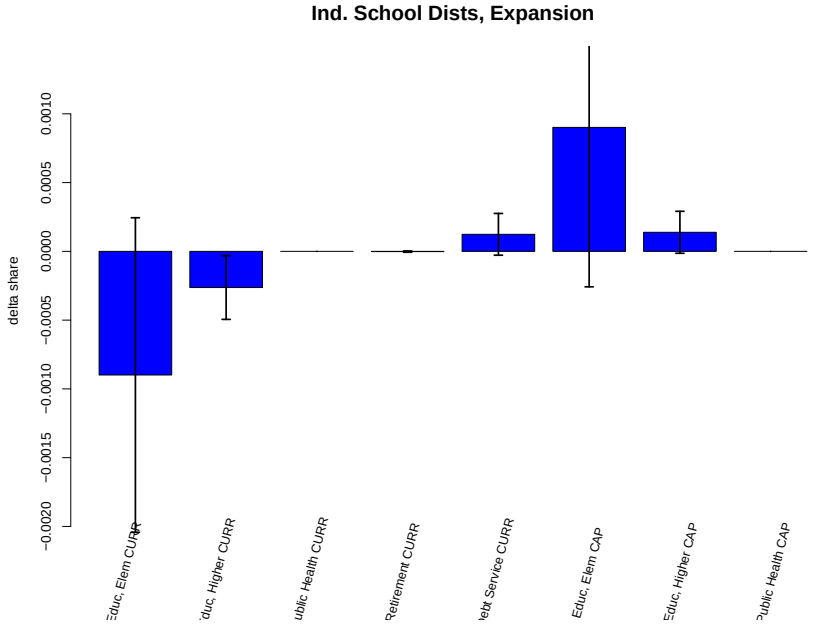
Note: See note after Panel E.

Figure 4: Luxury or Necessity During Expansions

Panel C



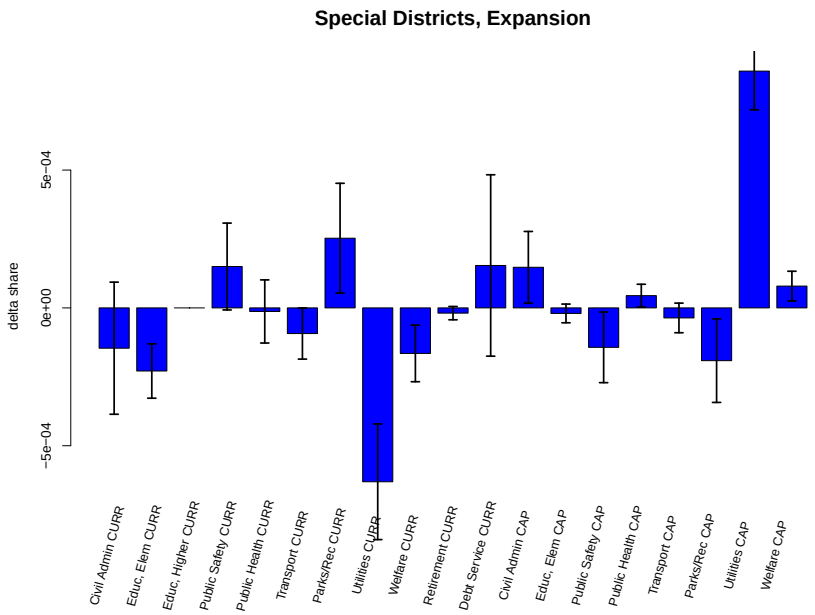
Panel D



Note: See note after Panel E.

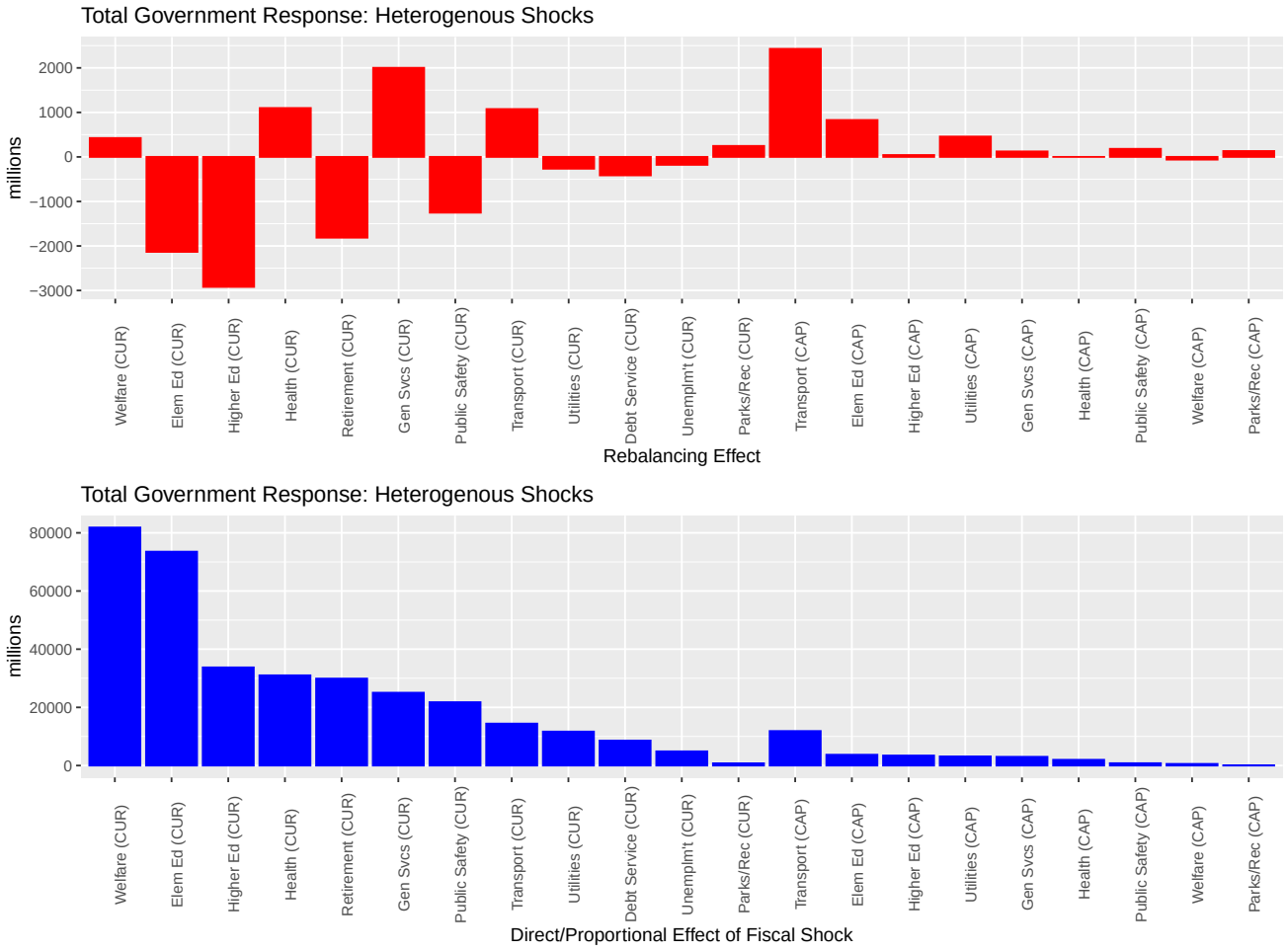
Figure 4: Luxury or Necessity During Expansions

Panel E



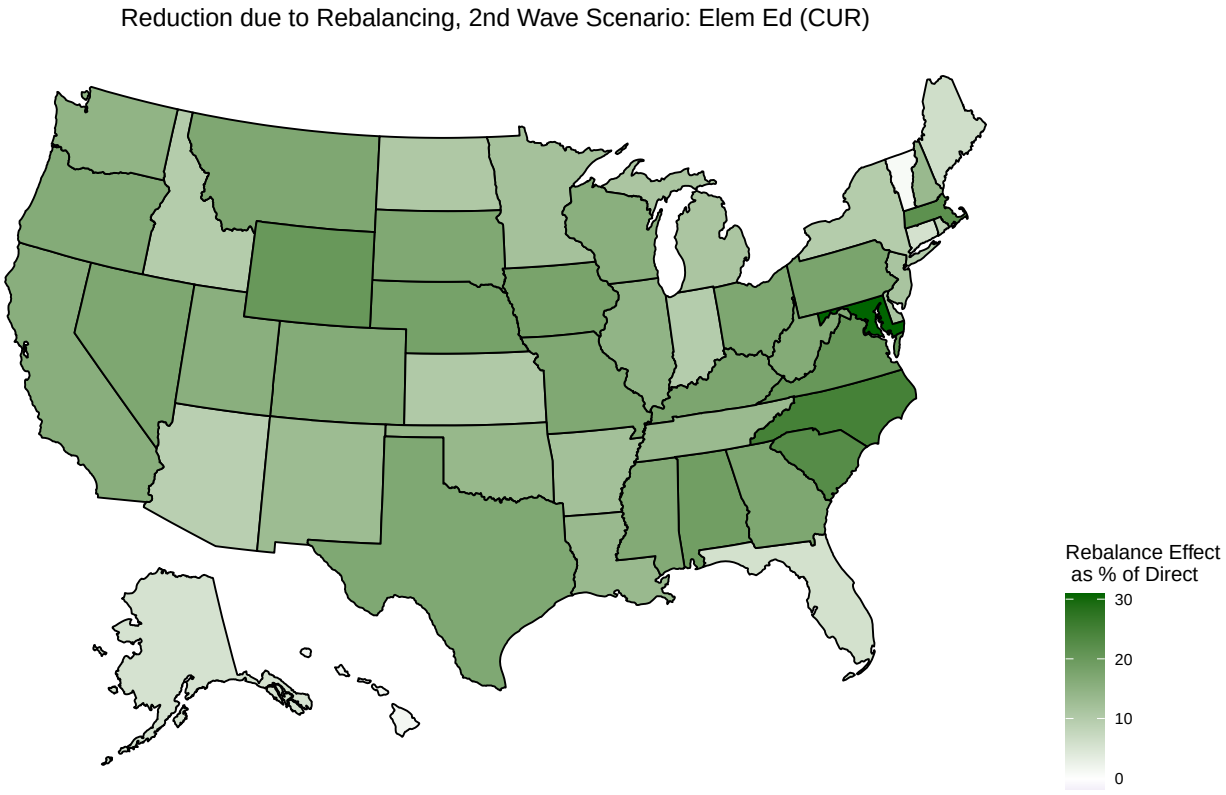
Note: Each figure plots the estimated coefficients from Deaton's Almost Ideal Demand System for each expenditure area. All estimates are based the 2002-2007 period, and therefore reflect responses during a period of expanding public budgets. Each panel shows estimates for a distinct level of government (state, county, municipality, school district, or special district). Each bar is the estimated quasi-elasticity for a given expenditure area. An estimate of zero denotes an expenditure area which moves proportionally with changes in total expenditures. A positive estimate denotes a "luxury" good – an expenditure area that receives more than one-for-one increases with respect to a budget expansion. A negative estimate denotes a "necessity" good – an expenditure area that receives less than one-for-one increases with respect to a budget expansion.

Figure 5: Expansion: Rebalancing and Direct Effect



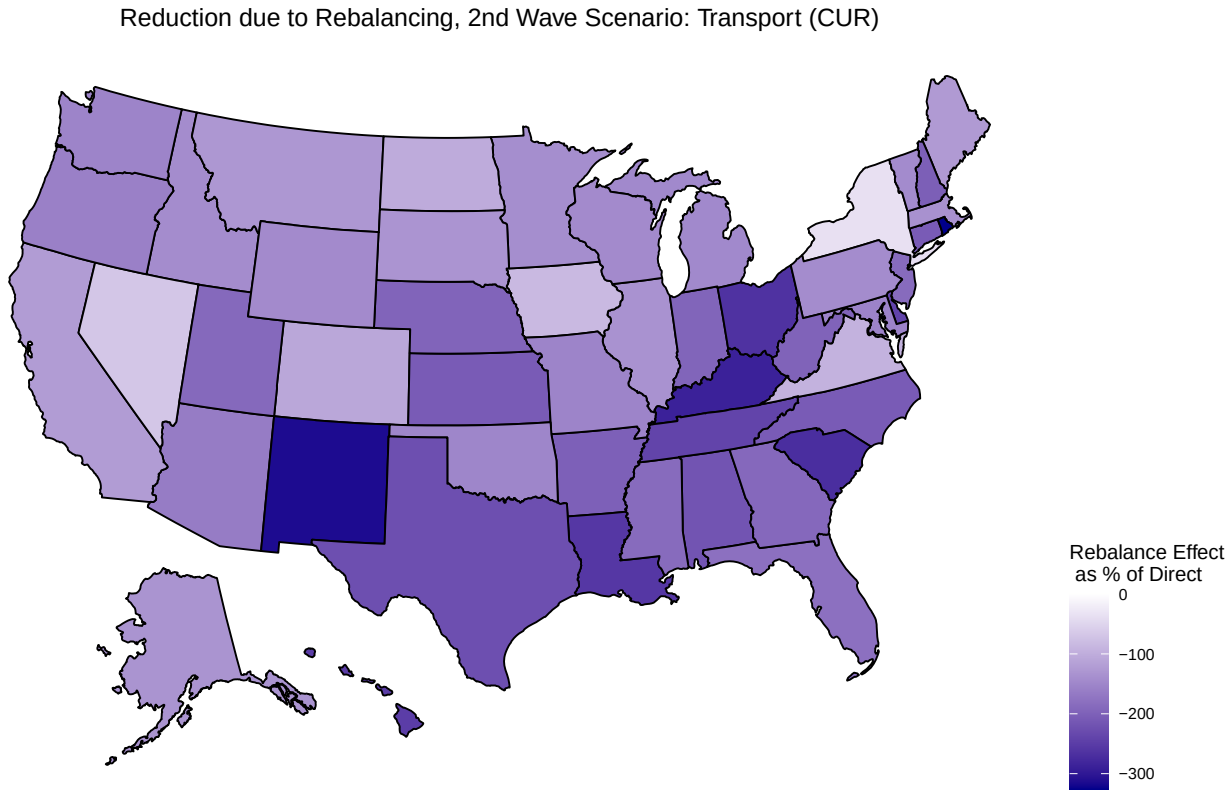
Note: This figure decomposes the total projected shifts in public goods provision pursuant to a positive fiscal shock into two components: the proportional reduction implied by the total fiscal shock (blue bars, at bottom), and a rebalancing effect capturing relative adjustment between goods (red bars, at top). In each expenditure area, the projection is based on a local positive shock equal in magnitude to the projected negative shocks used in Figure 3, and government-level elasticities of expenditure share. Elasticities are estimated from the expansionary period of 2002-2007. State-level elasticities are estimated nationally, and local government elasticities are estimated within state by government type. In contrast to Figure 3, a positive rebalancing effect (red bar above zero) in this figure reflects a luxury good: that area receives dollars above and beyond the aggregate proportional increase. Necessary goods have a negative rebalancing effect pursuant to a positive shock: increases are less than one-for-one, with the difference being routed towards luxury goods.

Figure 6: Regional Heterogeneity: Elementary Education



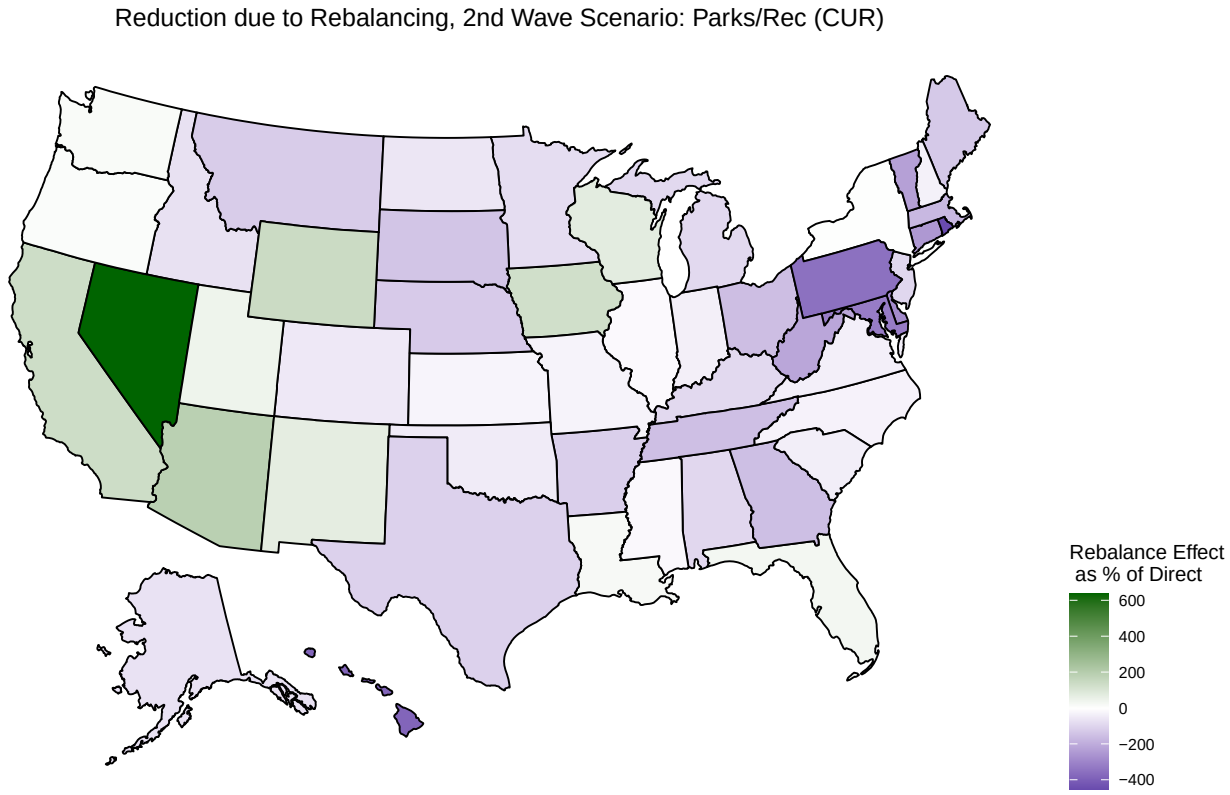
Note: This figure shows the total rebalancing effect by state for the expenditure area of elementary education pursuant to a negative overall fiscal shock. For each state, the total rebalancing adjustment is plotted as a share of the direct (proportional) adjustment in that expenditure area. Elementary education is a necessity good, and thus the rebalancing adjustment is positive, representing a reallocation of dollars from other to preserve funding. Areas of darker green represent a larger response as a percent of the total allocation to K12 education. Variation in this figure is driven by, (i) regional differences in elasticities, (ii) regional projected shock intensity, and (iii) regional differences in base allocations.

Figure 7: Regional Heterogeneity: Transportation Services



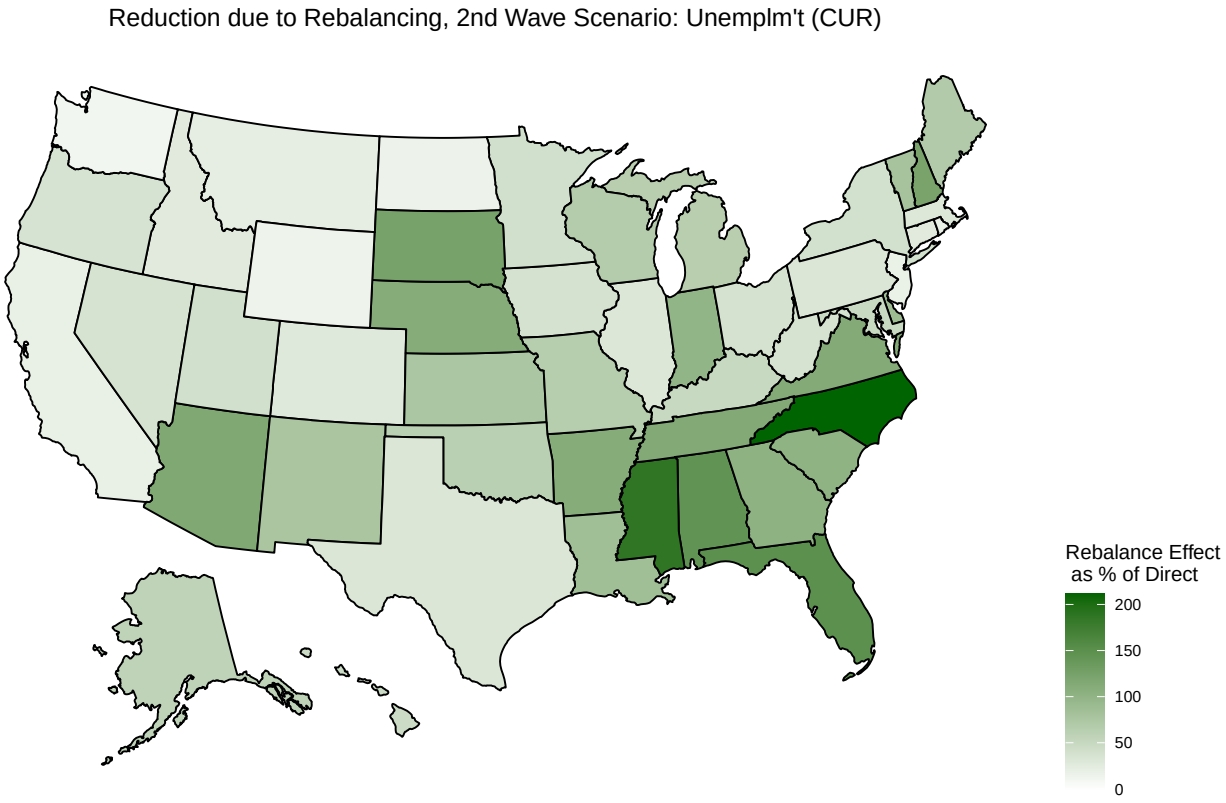
Note: This figure shows the total rebalancing effect by state for the expenditure area of current transportation services pursuant to a negative overall fiscal shock. For each state, the total rebalancing adjustment is plotted as a share of the direct (proportional) adjustment in that expenditure area. Transportation is a luxury good, and thus the rebalancing adjustment is negative, representing a reduction of dollars to preserve funding in other areas. Areas of darker purple represent a larger response as a percent of the total allocation to transportation spending. Variation in this figure is driven by, (i) regional differences in elasticities, (ii) regional projected shock intensity, and (iii) regional differences in base allocations.

Figure 8: Regional Heterogeneity: Parks and Recreation



Note: This figure shows the total rebalancing effect by state for the expenditure area of current spending on parks and recreation pursuant to a negative overall fiscal shock. For each state, the total rebalancing adjustment is plotted as a share of the direct (proportional) adjustment in that expenditure area. In some regions, parks and recreation is a luxury good (purple) and in other regions it is a necessary good (green). Darker areas represent a larger response as a percent of the total allocation to transportation spending. Variation in this figure is driven by, (i) regional differences in elasticities, (ii) regional projected shock intensity, and (iii) regional differences in base allocations. The color scheme of this scale is somewhat dominated by outlier responses of two states: Nevada and Hawaii.

Figure 9: Regional Heterogeneity: Unemployment



Note: This figure shows the total rebalancing effect by state for the expenditure area of unemployment funding pursuant to a negative overall fiscal shock. For each state, the total rebalancing adjustment is plotted as a share of the direct (proportional) adjustment in that expenditure area. Unemployment is a necessity good, and thus the rebalancing adjustment is positive, representing a reallocation of dollars from other to preserve funding. Areas of darker green represent a larger response as a percent of the total allocation to unemployment. Variation in this figure is driven by, (i) regional differences in elasticities, (ii) regional projected shock intensity, and (iii) regional differences in base allocations.

Table 1: Expenditure Totals: 2002, 2007 and 2012

Expenditure Area	2002	2002 - %	2007	2007 - %	2012	2012 - %
Education, K12	411.216	22.425	534.932	22.710	562.267	20.917
Civil Administration	199.019	10.853	252.092	10.702	263.282	9.794
Education, Higher	183.478	10.006	239.238	10.156	303.792	11.301
Public Safety	176.281	9.613	227.416	9.655	254.751	9.477
Transportation	153.389	8.365	193.184	8.201	220.374	8.198
Health	147.065	8.020	193.885	8.231	238.901	8.887
Utilities	141.445	7.713	190.793	8.100	203.624	7.575
Welfare	117.432	6.404	144.790	6.147	150.696	5.606
Retirement	114.931	6.268	167.189	7.098	193.000	7.180
Debt Service	86.933	4.741	106.141	4.506	124.537	4.633
Parks/Rec	60.361	3.292	76.946	3.267	77.326	2.877
Unemployment	42.196	2.301	28.934	1.228	95.554	3.555
Total	1833.746	100.001	2355.539	100.001	2688.104	100.000

Dollar amounts are in Billions (nominal)

Note: This figure shows the reported spending across all levels of government from the 2002, 2007 and 2012 vintages of the Census of Government Government Finance Statistics, aggregated to each of the 12 expenditure categories we define in the paper. This table reports the total of current and capital spending for each expenditure area. For three areas – retirement, debt service, and unemployment – the underlying data does not distinguish between current and capital spending. To avoid double counting, this table excludes all inter-governmental transfers at every government level for all expenditure areas.