The Political Economy of Budget Trade-offs*

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Abstract. Because the American states operate under balanced budget requirements, increases in spending in one area typically entail equal and opposite budget cuts in other programs. The literature analyzing the correlates of government spending by policy area has mostly ignored these tradeoffs inherent to policy-making, failing to address one of the most politically interesting and important dimensions of fiscal policy. Borrowing from the statistical literature on compositional data, we present more appropriate and efficient methods that explicitly incorporate the budget constraint into models of spending by budget category. We apply these methods to eight categories of spending from the American states over the years 1984–2009 to reveal winners and losers in the scramble for government spending. Our findings show that partisan governments finance their distinct priorities by raiding spending items that the opposition prefers, while different political institutions, economic conditions, and state demographics impose different tradeoffs across the budget.

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Politics is who gets what, when, where, and how.

HAROLD LASSWELL

1 Introduction

The American states fund myriad policies that impact the lives of their citizens (Gray, Hanson, and Kousser, 2012; Boehmke and Skinner, 2012; Morehouse and Jewell, 2004). Because they operate under strict rules against deficit spending, states are forced to make tough choices across different public policy priorities. If spending on hospitals or highways could be raised without recourse to new taxes or budget cuts elsewhere – if actual spending on public goods were as cheap as talk supporting such spending – there might be little controversy in budget making. But even in political systems where policymakers are able to finance expenditure with new debts, every spending decision bears an opportunity cost and thus invites controversy into the budget process. In short, every year legislators and heads of government in the American states and elsewhere must face tradeoffs across budget priorities – tradeoffs that we believe form the heart of budget politics.

The aim of this paper is twofold. First, we develop intuitions on how ideologically distinct governments set particular spending priorities. These priorities lead governments to increase spending on some items and finance them with relative cuts to spending the opposition prefers. Second, we illustrate the statistical and substantive advantages of treating budgets as the composition of multiple categories. With the exceptions of Philips, Rutherford, and Whitten (2016) and Lipsmeyer, Philips, Rutherford, and Whitten (2017), whose focus is primarily methodological, we are unaware of any study in the large literature on budgets which uses appropriate methods to examine how increases in one budget area are offset by cuts in others.[1] Instead, most analysts treat budget categories in isolation, potentially missing the tradeoffs which impact every category of public spending. Accordingly, we propose a simple statistical model for

1 Much of the literature (e.g. Hendrick and Garand, 1991; Nicholson-Crotty, Theobald, and Wood, 2006) at best follow some of the recommendations for studying federal budget trade-offs provided by Berry and Lowery (1990). However, even classic works in public finance (Borcherding and Deacon, 1972; Bergstrom and Goodman, 1973) highlight the importance of trade-offs. Philips, Rutherford, and Whitten (2016) and Lipsmeyer et al. (2017) propose the use of error correction models to deal with potentially nonstationary time series; here we demonstrate the utility of even simpler time series cross-sectional models, familiar to scholars of comparative politics and public policy, but adapted for compositional data.

time series cross-sectional compositional budget data and use that model to uncover the influence of political and economic variables on spending within, and tradeoffs across, all the components of a budget.

The American states present a near-ideal opportunity to examine trade-offs. Compared to national governments, these states operate under hard budget constraints, offer straightforward measures of partisanship, and are data rich. Specifically, we apply our model to annual data from American states over the years 1984 to 2009, parcelling each annual budget into spending on eight categories: Medicaid and welfare, K-12 education, higher education, highways, public health and hospitals, police and prisons, natural resources, and all other spending. Our results show budget categories Democratic and Republican governments favor with extra spending and which parts of the budget they raid to pay for their policy priorities. Democratic priorities include K-12 education and Medicaid and welfare, while Republicans favor highways, police and prisons, and higher education. Additionally, we uncover how different budgetary rules advantage or disadvantage certain spending items, which policy areas suffer hardest during recessions and which are protected, how states reorder their budget priorities as they grow richer, and how the remaining differences in spending priorities vary across regions of the country once our political and economic variables are taken into account. These findings suggest that trade-offs are an inherent feature of politics that is not exclusive to budgeting in the American states.

An important starting point for our theoretical framework is the assumption that policymakers tasked with creating a budget face a series of pressures and constraints that influence funding priorities. Plainly, policymakers must, at some level, make decisions regarding increases and decreases in public funding. Trade-offs in public budgeting occur when politics and problems disrupt existing modes of expenditure. Policy and public administration scholars have well established that budgetary decisions (like other forms of policymaking) respond to multiple demands from diverse stake holders (Ryu, 2015). Some of these demands have priority over others for structural reasons (such as programmatic inertia) or political reasons (such as widely held valence issues, as in Anderson and Harbridge, 2010). We assume that demands on the budget are not only a function of partisan preferences, but also of problems that affect both demands on the budget and its capacity to meet them. While policymaking institutions are built to control the overall size of the budget, individual policymakers often focus on individual programs to provide for constituent demands (Weingast, Shepsle, and Johnsen, 1981). Thus, an accurate accounting of public budgeting from a policymaking perspective is one that conceives of the budget as composed of bundles of demands rather than

as a single aggregate. Competition between particular demands and capacity create trade-offs with notable consequences. Our investigation captures the trade-offs across large categories of policy demands which respond to political demands and financial constraints.

The paper unfolds in six parts. Section 2 reviews the literature on the political economy of public spending, suggesting a set of covariates likely to shape the trade-offs across budget priorities. We focus in particular on the literature on partisan effects of government spending and derive our expectation that the ideological disposition of government leads to particular spending bundles. In this section, we introduce the idea that partisan governments not only spend on their constituency's demands but simultaneously deny funds to the opposition's priorities. Section 3 motivates our focus on the American states and describes the budget data and covariates. Section 4 presents our method for compositional data analysis and Section 5 presents the results of our analysis. We find that governments led by different parties shift the budget towards preferred areas and away from rival priorities, while institutional, demographic, and especially economic factors have strong budget effects. Section 6 concludes that trade-off manifest themselves in budgets, but we explore other areas of political science where compositional models might lead to important insights.

2 Theoretical explanations of budget priorities

The literature on state budget decisions is both vast and deep. One major avenue of inquiry, about which we will say little, focuses on the specific motivations of budgeting officials and the "nuts and bolts" of the budget process (Rubin, 1997; Thurmaier and Willoughby, 2001). Another stream of literature, to which this study contributes, looks instead to the broader political, institutional, and economic forces shaping budgets (Alt and Lowry, 1994; Barrilleaux and Berkman, 2003; Gilligan and Matsusaka, 2001; Primo, 2006; Krause and Melusky, 2012; Lewis, Schneider, and Jacoby, 2015; Ryu, 2011). The best known of these studies examine variations only in the total amount of state spending; however, some works study variation in select spending categories.

We rely heavily on the existing literature for theoretical insights into which political and economic variables are likely to influence the allocation of state spending. Existing literatures rarely or only implicitly discusses trade-offs. Our contribution is to make these statements explicit and to advance a new method for analyzing budget compositions. In particular, we identify from this literature three sets of variables – partisanship,

budget institutions, and economic conditions – which we expect to have systematic effects on the composition of the budget. But even in borrowing from this literature we face two challenges. First, because our data cover each component of the budget, we must consider many more relationships than a study of a single policy area. Second, because we consider each budget category as part of the whole, rather than as an independent sum of money, some variables commonly employed in studies of spending may have unexpected effects, such as spillovers.

2.1 Partisan trade-offs and budget consequences

More than any other political variable, government partisanship features prominently in the discussion of "who gets what" at the state level (Alt and Lowry, 1994; Dye, 1984; Gilligan and Matsusaka, 2001; Brown, 1995). Alt and Lowry (1994, 2000) show that unified partisan governments – those in which the same party holds the governorship and a majority of House and Senate – are dramatically quicker and better able to adjust state budget outcomes to match their preferences. Dye (1984) and Barrilleaux (2000) similarly find that Democratically controlled legislatures produce polices that are more liberal and more consistent with constituent interests. In particular, Husted and Kenny (1997) find that Democratic governments generally spend more on welfare programs, consistent with their constituents' higher demand for redistribution and social insurance.

The literature devotes less attention to the role of parties in other budget areas. The largest portion of state spending goes to education, which is broadly supported by the electorate. This might suggest negligible net partisan effects on education spending as a budget component, but it pays to consider trade-offs within this large category. Following Ansell (2010), who notes that education spending provides parties with an opportunity for targeted redistribution, we argue Democratic governments should place relative emphasis on state support for K-12 schools – spending which is disproportionally targeted towards schools in poorer districts – while Republicans should emphasize higher education spending, which lowers tuition costs for students of state colleges, who are more likely to be middle class (Busemeyer, 2014; Garritzmann, 2017). Considering other areas of the budget, spending on highways and natural resources benefit suburban and rural voters more than urban constituents, suggesting Republican support may be higher for these areas. Public health and hospitals, on the other hand, seem more likely to be pure public goods and thus less subject to partisan dispute. Finally, over the period studied, Republicans have more often pursued a "law and or-

der" platform, including wider use of mandatory prison sentences, suggesting a higher priority for spending on police and especially prisons, which are typically located in – and provide economic support for – Republican-leaning rural communities (Jacobs and Jackson, 2010; Thorpe, 2015).

If Democrats shift state resources towards redistributive programs, and if Republicans shift resources to local public goods targeted at their constituents, those resources will not be available for other state priorities. Focusing on budget compositions brings into sharp relief the notion that parties affect not just levels of particular budgets, but trade-offs among them. Even if a party promises to support all areas of public policy – and, for good measure, to keep taxes low – any effort to raise spending in one area must be complemented with sacrifices elsewhere.[2] Existing theories of partisan spending largely have neglected this aspect of spending decisions. At best, partisan models of fiscal policy literature only contend that right governments want a smaller government and left-leaning ones increase the budget.

How parties target those cuts says just as much about their agenda as which budgets they increase. Our expectation is that Republicans and Democrats will raid the preferred policies of their opponents for funds to support their own agendas, while preserving universal public goods from cutbacks. Our argument about raiding opponent's budget preferences is in stark contrast to theories of partisan competition that focus on issue emphasis (Green-Pedersen and Mortensen, 2015; Sigelman and Buell Jr., 2004; Meguid, 2005). This literature suggests that political parties avoid and de-emphasize policy domains where they cannot gain new voters. We go a step further to argue that political parties in power are more confrontational: they intentionally and inevitably deny resources to constituents of the opposition party.

Much of the literature on partisanship in state spending focuses on the question of measurement. Here we follow Alt and Lowry (1994, 2000) and contrast three types of governments: those in which Democrats have control of the statehouse and majorities in both legislatures, those in which the Republicans have unified control, and all other governments, which we term divided. This classification highlights the central importance of the legislative median voters and governor in setting budget policy; moreover, if unified partisan governments fail to differ in policy priorities, it seems

2 Under conditions of unusually high tax revenue growth, any sacrifices made by politically disadvantaged budget categories might take the form of forgone opportunities for additional spending; nevertheless, competition to win gains and competition to avoid cuts are both reflected by shifts in budget shares. In typical conditions in the American states, we expect budget constraints to more politically salient that budget windfalls.

unlikely that partisan effects are strong. However, there are other measures of partisan control worth considering. These measures include those which take into account the effects of partisan supermajorities and electoral competitiveness on the parties's ability to pursue an agenda that benefits their own constituents, rather than one which primarily satisfies the state's median voter (Barrilleaux, Holbrook, and Langer, 2002). We leave investigation of such measures to ensuing work.

2.2 Institutional influences

Among the many political institutions influencing the budget process, we focus on two which are highlighted by the public budgeting literature: gubernatorial powers and budgetary rules (Poterba, 1996; Ryu, 2015).

Gubernatorial Powers. Governors draw much of their influence over the budget process from their constitutionally defined authority to set the budget agenda and veto budgets passed by the legislature (Barrilleaux and Berkman, 2003; Beyle, 1996; Kousser and Phillips, 2012). At one extreme, governors exercise hegemony over the budget agenda, constructing budgets by themselves or with committees appointed at the governor's discretion. At the other, governors draw up budgets in collaboration with agency officials and legislators not of his or her choosing. Governors' powers to veto a passed budget also vary, from a simple blanket veto that can be overridden by simple majorities of the legislature, to an item veto, or, in most states, a line-item veto which can be overridden only by a two-thirds legislative majority.

We expect governors to use these powers to advance their budget priorities at the expense of spending in budget categories they either oppose outright or favor less strongly. While we expect individual legislators to prefer spending on local public goods and to participate in log-rolls with other legislators to fund such pork barrel spending, we expect governors, who answer to a statewide constituency, to be less supportive of such funding, and more interested in providing statewide public goods (Weingast, Shepsle, and Johnsen, 1981). Thus under strong governors, we expect spending on highways and natural resources – prototypical local public goods – to shrink. Cutting local public goods provision also gives governors a chance to raise spending on statewide public goods like public health and hospitals; hence this category should gain under strong governors.

Budget Rules. In contrast to the federal government, almost all states are required to maintain a balanced budget in one form or another (Poterba, 1996; Rose, 2008; Fatás

and Mihov, 2006).[3] As a result, in times of budgetary shortfall politicians should make spending cuts to keep in line with the budgetary restrictions placed on them. Cuts made to satisfy the balanced budget rule need not fall equally across budget categories. We expect entitlement programs, which predominate in the welfare and education categories, to be especially resistent to the budget axe; indeed, automatic increases in entitlement programs may be the key source of budget pressures. Instead, we expect discretionary programs – such as spending on highways, police and prisons, natural resources, and the myriad smaller programs lumped in Other Spending – to bear the brunt of fiscal adjustment.[4]

While most states have strict balanced budget amendments, some states enjoy a limited ability to deficit spend or carry over past debts. These states should be able to weather budgetary crises with fewer budget cuts and so should reallocate fewer resources from discretionary to entitlement programs. On average, states with strict balanced budget rules should devote a higher proportion of their budgets to entitlements than states with more flexible rules.

2.3 Economic factors

The literature on the federal budget suggests economic conditions should have a strong impact on the outcomes of the budget process (e.g. Su, Kamlet, and Mowery, 1993). Here, we focus on three commonly examined economic variables: the state unemployment rate, state per capita income, and state population density.

Unemployment. The unemployment rate provides the clearest available signal of a state's macroeconomic well-being. Fluctuations in unemployment over the business cycle also trigger automatic spending, especially on welfare programs, and so should strongly impact the proportion of the budget devoted to this area. But state governments must also decide what spending to curtail during a recession, and which budget priorities to protect, even as more resources flow into entitlements.

Real Per Capita Income. If unemployment proxies short-run economic conditions, real per capita income contrasts states at different levels of long-run economic development. Because we are focused not on the size of government but on how relative demand for

3 Primo (2006) and others doubt that the institutional rules alone have much bite. The empirical evidence is mixed for fiscal policy.

4 Kousser (2002) suggests that discretionary portions of the Medicaid budget are more subject to change than entitlement portions.

different types of policy depends on income, it helps to borrow the language of microeconomics, which identifies three ways demand for a good can respond to changes in income. Demand for some goods rises in proportion to income. If everyone, rich or poor, spends roughly the same proportion of their income on a good such as housing, then housing is said to be a normal good. Goods on which the rich spend a greater share of their income than the poor, like international travel, are luxury goods. Finally, inferior goods (or necessities) are those goods, like food, which take up a greater share of the budgets of the poor than the rich.

A long standing claim (known as Wagner's Law) holds that economic development is the primary determinant of the size of government. According to the welfare state literature, as an economy grows, government spending will account not only for a growing absolute amount of real dollars, but a growing share of the gross domestic product (Wilensky, 1975; Cameron, 1978). Because Wagner's Law focuses on redistributive policy as the main element of the expanding state, we draw from it the hypothesis that welfare spending in particular is a luxury good and should grow as a percentage of the state budget as per capita income rises.

The existence of a luxury good in the state budget – and in a large category of spending – would logically require that some other portions of the budget shrink as income rises. The most likely candidates for inferior goods in the budget are programs favored by states seeking to develop lagging economies. This could include programs with heavy public investment components, such as highways, natural resources, hospitals, and prisons. By the same token, we expect economically developed states to have already made extensive public investments in these areas and better afford to shrink continuing spending in these categories.

2.4 Demographic factors

Early work on the growth of the state stressed that slow-moving but long-term demographic changes lead to increasing government commitments. As societies changes, demands toward the state and subsequently its reach increases. Wilensky (1975) was among the first to consider structural determinants of government involvement among different spending categories. We follow his lead and consider how two covariates – population density and age composition – result in distinct spending trade–offs.

Population Density. How closely people live together within a given boundary affects how governments allocate their funding (Bergstrom and Goodman, 1973; Borcherding and Deacon, 1972). Increasing population density might put two forces in motion. A

denser population might increase demand for some services to deal with congestion or environmental consequences of density; most notably, these would include mass transit spending, which is grouped in Other Spending in our rubric, and environmental spending, which falls under Natural Resources. Other services might see cost savings from physical concentration, particularly for services that can be delivered centrally, such as higher education and hospitals, leading to relative reductions in these spending areas. For most other spending items the net effect of population density is ambiguous. We therefore expect a null finding on most of them. For example, low density might result more spending on roads as people are spread out over a territory; alternatively, high density results in higher costs for traffic control.[5]

Age Composition. Different age groups demand distinct types of government support. This demand might be based on two mechanisms. First, the young might simply hold different spending preferences from the old, whereas elderly may possess more political resources to have their preferences heard. In particular, the welfare state literature shows that preferences for spending across age cohorts different and the political power of the elderly matters (Pierson, 1995; Busemeyer, Goerres, and Weschle, 2009). Second, spending needs among states might differ depending on the age composition among their inhabitants: this most obviously affects demand for education spending, but also should lead to less demand for prisons where a higher percentage of the population is too young to serve prison sentences. Both mechanisms point in the same direction. We expect that states with a increasing share of young people to spend more on early education and less on prisons, while those with many elderly residents should use their funds for Medicaid and Welfare and cut back on both K-12 and higher education. For several other spending categories is it more challenging to make a coherent argument. For example, we believe that age composition is unlikely to affect spending on highways or natural resources.

5 We do not control for population growth in our baseline model for two reasons. First, because we normalize the total state budget to unity, we do not expect to see any service demand effects. Rather, any effect of population shifts on relative budget shares are likely to be the result of temporarily increased investment to recalibrate infrastructure to meet the needs of a larger state. Second, when we do include population growth in the model, its effects on budget shares are few and small and can be omitted without noteworthy changes to other results.

3 Data

The data we examine comprise yearly state expenditures in eight programmatic categories over 47 states and the years 1984–2009, and are constructed using publicly available data from State Government Finances. We delineate the construction of the eight categories in the appendix.[6]. Our guiding principle is to stay close to actual budget categories but also identify politically relevant groupings. Figure 1 plots the division of the budget across these categories over time for the median state, the middle 50 percent of states, and the middle 90 percent. The top three categories of spending – Medicaid and welfare, K-12 education, and higher education[7] – account for the majority of state budgets: the median state spent 61% of its budget on these categories in 1984, rising to 70% by 2009. Over time, Medicaid and Welfare is clearly the fastest growing category of spending across all states, while other spending, highways, public health and hospitals, and natural resources all declined significantly as a proportion of their initial budget shares. Spending on education, especially at the K-12 level, lost ground, while the budget share of police and prisons held steady. Although states differ in the shares they devote to each category, the relatively tight 50 and 90 percent ranges suggest that most state budgets are variations on a common theme. As a result, our task is to illustrate the factors associated with quantitative trade-offs among the categories, rather than to delineate qualitatively different spending regimes.

We gather covariates from a variety of sources (see Appendix for summary statistics). Most of these data are measured over states and years, though some variables, particularly those measuring institutions, tend to be static in many states. Using data from Hoover and Pecorino (2005), updated using the Book of States, we identify observations with *Unified Democratic Control* of the legislature and executive (25 percent of cases), and those under *Unified Republican Control* (18 percent). We measure the stringency of balanced budget requirements across states and years using the American Council on Intergovernmental Relations' (ACIR) time-invariant 0 to 10 scale.[8] *Budget Stringency* is strongly skewed: most states score the maximum ten points on this scale, indicating the strongest budget rules. Next, we construct an index of *Governor*

6 We exclude Alaska and Hawaii because of their unusual arrangements of Federal support and Nebraska because its unicameral legislature is officially non-partisan. The end date of 2009 is selected due to data limitations but also restricts attention to pre-Great-Recession decision making, allowing future work to consider how extreme fiscal crisis, new infusions of federal aid, and the Affordable Care Act may have changed the budget tradeoff calculus.

7 We thank an anonymous reviewer for suggesting we model the split in education spending.

8 Smith and Hou (2013) have an alternative measure, but have not made the data publicly available.

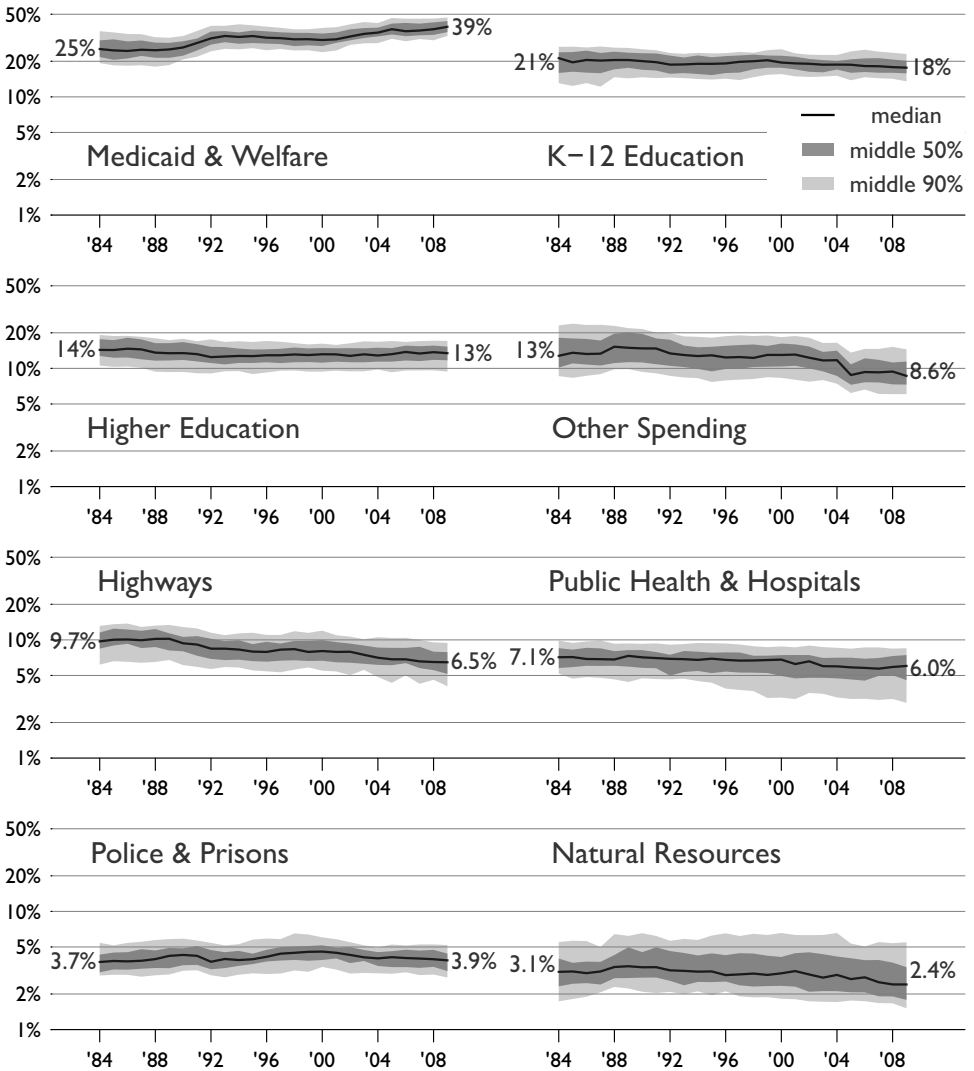

Figure 1. Temporal and cross-sectional variation in state spending by budget category, 1984–2009. Data from 47 states (excluding AK, HI, and NE); Source: U.S. Census, State Government Finances.

Power by summing Beyle's (1996, 2003) time-varying 5-point scales of governor's veto and budget agenda powers.[9] High scores indicate exclusive gubernatorial control over the proposed budget and restrictions on the legislature's power to amend the governor's budget. Finally, we obtain state unemployment rates from the Bureau of Labor Statistics, population density and age composition from the U.S. Census, and per capita state income (in tens of thousands of constant dollars) from the Bureau of Economic Analysis.

4 Methods

For any government, spending in different policy areas must sum to a constraint, which is simply the overall budget. For the American states – almost all of which are constitutionally compelled to produce a balanced budget – this constraint is binding indeed. Any revision of the budget to expand spending in one area entails an equal and opposite combination of budget cuts and tax increases elsewhere. This linkage across budget areas implies that the political economy of state spending is largely one of trade-offs. However, quantitative analyses of state budgets in political economy generally study budget categories in isolation, or when studying multiple categories at once, implicitly assume independence by estimating separate regressions for each category. These inappropriate models not only make implausible assumptions about the data but also edit out the trade-offs that form the essence of the political process.

4.1 Budgets as compositional data

We treat state budgets as compositional data. Denote as w_{kit} the spending in budget category k by state i in year t, where there are K budget categories, I states, and T years in total. We normalize all budgets to sum to 1. Our unit of analysis is the collection of budget shares denoted w_{kit}, which for each state and year together fulfill the budget constraint:

$$w_{1it} + \cdots + w_{kit} + \cdots + w_{Kit} = 1, \qquad 0 \leq w_{kit} \leq 1 \tag{1}$$

9 Beyle reports veto and budget agenda scores for 1980, 1988, 1994, 1998, 2000, 2001, 2004, and 2005; we interpolate the missing years and extrapolate to 2009 as needed. Departing from Beyle, we code North Carolina as a zero on the veto scale prior to 1996, as the governor had no veto whatsoever. In the appendix, we show the results for an alternative measure (Krupnikov and Shipan, 2012).

Data that obey such constraints are said to be compositional (Aitchison, 1986). With few exceptions, existing work on state budgets ignores the methodological implications of the compositional constraint, and in so doing estimates inefficient models with potentially misleading conclusions. It is easiest to see this by considering two commonly employed approaches that fail to take the constraints on w_{kit} into account.

Dangers posed by ignoring the budget constraint in single equation models. Simple linear regression is the most commonly used method for analyzing state budget categories, but this model fails because it makes several assumptions about the compositional nature of budget data implicitly. Consider a linear regression model for a single category $k = j$, so that our response variable is w_{jit}. Linear regression assumes that w_{jit} can potentially take any value from negative to positive infinity. However, for budget data, w_{jit} is bounded by $[0, 1]$ – a state cannot spend negative dollars on a policy, nor can it spend more than its entire budget on any one budget category. Though linear regression will produce unbiased results when applied to bounded continuous data, it will often produce impossible fitted values, suggesting a basic mismatch between data and model.

There is a deeper problem with analyzing a budget category outside the context of the complete budget composition. For concreteness, imagine that states can only spend money on welfare, highways, and education, so that the budget for any state and year has three components – $\{\text{Welfare}_{it}, \text{Highways}_{it}, \text{Education}_{it}\}$ – which, because of the budget constraint, sum to 1. Suppose that as data analysts we ignore the second and third budget components and fit the following linear regression:

$$\text{Welfare}_{it} = \alpha_0 + \alpha_1 \text{Unified Democratic Control}_{i,t-1} + \varepsilon_{it} \quad (2)$$

If we estimate $\hat{\alpha}_1 > 0$, we might be tempted to conclude that Democratic governments simply support increased welfare spending. However, substituting from the budget accounting identity, $\text{Welfare}_{it} = 1 - (\text{Highways}_{it} + \text{Education}_{it})$, reveals an alternative interpretation of the estimated model:

$$\text{Highways}_{it} + \text{Education}_{it} = (1 - \alpha_0) - \alpha_1 \text{Unified Democratic Control}_{i,t-1} - \varepsilon_{it} \quad (3)$$

Rewritten, the model reveals an alternative interpretation of $\hat{\alpha}_1 > 0$: Democrats oppose spending on (the sum of) Education and Highways. These interpretations appear at first to have very different meanings. Both reflect, though neither fully expresses, the finding that Democrats trade-off Welfare spending against Highways and Educa-

tion. Unfortunately, because we have modelled only a single budget component, we do not know where specifically the budget cuts fall – they could come entirely from Education, entirely from Highways, or from a combination of the two.

Dangers posed by ignoring the budget constraint in multi-equation models. An obvious (but flawed) solution is to run a separate regression for each category. For our three component example, we would estimate three linear regressions:

$$\begin{aligned}
\text{Welfare}_{it} &= \alpha_0 + \alpha_1 \text{Unified Democratic Control}_{i,t-1} + \varepsilon_{it} \\
\text{Education}_{it} &= \theta_0 + \theta_1 \text{Unified Democratic Control}_{i,t-1} + \nu_{it} \\
\text{Highways}_{it} &= \lambda_0 + \lambda_1 \text{Unified Democratic Control}_{i,t-1} + \eta_{it}
\end{aligned}$$

Note that this equation-by-equation approach assumes that the components are independent: $\text{corr}(\varepsilon_{it}, \nu_{it}) = \text{corr}(\nu_{it}, \eta_{it}) = \text{corr}(\varepsilon_{it}, \eta_{it}) = 0$. In contrast, the budget constraint requires that if one component goes up, some combination of the others must go down. In general, the components of a budget tend to be negatively correlated, violating the assumption of independence. By ignoring the negative correlations across budget categories, the equation-by-equation approach fails to exploit all of the information in the data and is inefficient (Aitchison, 1986). A model incorporating the information provided by the budget constraint would produce more precise estimates of the quantities of interest and thus a clearer picture of both the factors that influence each budget category and the trade-offs across categories.

The equation-by-equation approach also regularly makes impossible predictions for individual categories and the composition as a whole. Because nothing in the equation-by-equation model constrains the sum of the components to equal the overall budget, the expected budget for any hypothetical values of the covariates will rarely if ever satisfy that constraint. Instead of capturing the actual trade-offs across the budget categories, then, the model often predicts a "budget constraint" which impossibly expands or shrinks to accommodate changes in spending by category. These are not merely methodological quibbles: the inefficiency and impossible predictions of standard models of budgets point to a deep mismatch between the political process that generates budgets and the assumptions of the simple linear regressions commonly used to model them. Trade-offs are the essence of budgetary politics and ignoring them makes neither political nor statistical sense. A covariate can no more affect only a single budget category than a state government can raise spending in one area without taking that money from some other priority.

4.2 Estimation and specification

A good model of state budgets jointly estimates the budget categories and respects the unit constraint across them. Fortunately, appropriate models for compositional data are easy to estimate and are widely employed throughout statistics, geology, and other fields. Surprisingly, despite the ubiquity of compositional data in politics – examples include party vote shares in multiparty elections, the proportion of space devoted to particular issues in political speech, the time budgets of bureaucrats – models of compositional data have received only sporadic attention from political scientists. Recent political science applications of compositional data models include Lantz, Alexander, Adolph, and Montgomery (2014), Adolph (2013), and Breunig and Busemeyer (2012); Philips, Rutherford, and Whitten (2016) and Lipsmeyer et al. (2017) add compositional data models and further examples focused on challenges presented by time series data which are nonstationarity and spatial correlated, respectively. Here we focus on a compositional method for stationary time series cross-section data that is easy to implement and surprisingly easy to interpret – even for many simultaneous components and covariates.

The common methods for compositional data analysis are due to Aitchison (1986), whose central insight is that while compositional data are jointly dependent and bounded by zero and one, the logarithms of their ratios are independent and unbounded and thus can be jointly modeled using standard multivariate methods for continuous data. Formally, let $\mathbf{w}_{it}$ be a K-vector containing the budget shares for a single observation. Then stack all observed compositions into a single $IT \times K$ matrix $\mathbf{W}$, which contains one row for each observation and one column for each component. Select one of the columns of $\mathbf{W}$ to serve as the reference component. The results do not depend on which column we choose, so for convenience let the last component, K, be the reference. Then apply Aitchison's additive logratio transformation to the budget components, which turns the $IT \times K$ matrix $\mathbf{W}$ into an $IT \times K - 1$ matrix $\mathbf{Y}$ such that

$$y_{kit} = \log(w_{kit}/w_{Kit}) \tag{4}$$

The columns of $\mathbf{Y}$ are independently distributed, yet the new matrix retains all the ratio information in $\mathbf{W}$. This means that the original composition $\mathbf{W}$ can be exactly reconstructed from $\mathbf{Y}$, up to the budget constraint. If we estimate a regression model on the logratio scale, we can easily recover conditional expectations of the original K components for any counterfactual we care to consider (Aitchison, 1986).

Our data have not only compositional but also time series cross-sectional properties. While regression models of compositional time series have received some attention in statistics (Grunwald, Raftery, and Guttorp, 1993; Ravishanker, Dey, and Iyengar, 2004; Larrosa, 2005) and political methodology (Brandt, Monroe, and Williams, 1999), most proposed models are for a single time series and do not easily lend themselves to panel applications (Lipsmeyer et al., 2017, is an exception). However, Smith and Brundson (1989) show that simple time series models provide consistent estimates of compositions that are invariant to the choice of reference category. If we accept that common dynamic parameters across our units can be pooled, this model easily extends to time series cross-section data.

After transforming the state budget data, we pool the logratios across time and states and estimate the following $K-1$ equation time series cross-section compositional data model by seemingly unrelated regressions:

$$y_{kit} = \sum_{p=1}^{P} \phi_{pk} y_{k,i,t-p} + \mathbf{x}_{i,t-1}\beta_k + \psi_i + t\tau + \varepsilon_{kit} \tag{5}$$

For each logratio y_{kit}, we specify an equation regressing y_{kit} on one or more of its lagged values, as well as a vector of lagged covariates $\mathbf{x}_{i,t-1}$, a set of regional dummies ψ_i, and a linear time trend parameterized by τ. We estimate the system of $K-1$ equations jointly by seemingly unrelated regressions, which allow non-zero correlations across the error terms for a given state and period (Zellner, 1962).

Our preferred specification[10] regresses seven logratios, formed from the full eight-part budget composition, on four political variables – *Unified Democratic Control*, *Unified Republican Control*, *Budget Stringency*, and *Governor Power*, each lagged one year – and three economic variables – *Unemployment Rate*, *Income per capita*, and *Population Density*, also lagged one year. We also control for the state's region – *Northeast*, *Midwest*, *South*, or *West* – and a linear time trend to allow for secular changes like the steady rise in the price of medical care over the study period and avoids confounding such trends with the shift towards greater Republican control. We experimented with different lag structures for the response variable and found little substantive or statistical difference

10 We consider several alternative specifications – either controlling for changes in the size of the total state budget in per capita dollars, or dropping controls – and find substantively very similar results, which is striking given the large number of quantities estimated in the model. Scholars have examined tax and expenditure limitations (TELs) in explaining fiscal policy and economic growth. Including a measure for TELs does not change the regression results (see appendix).

among models with one, two, or three lags. We thus settled on a model with a single lag to minimize loss of data to lagging. Panel unit root tests (Im, Pesaran, and Shin, 2003) easily rejected the presence of a unit root, confirming our budget logratios are stationary time series, which allows us to use simpler methods compared to those of Philips, Rutherford, and Whitten (2016) and Lipsmeyer et al. (2017). As is typical for time series models of budget data, the model fits the data well, and R^2 for the system of equations was 0.922. There are no missing data.

However, there are several potential sources of bias to bear in mind as we report our results. First, because some of our variables are time invariant (budget stringency, and in some states, partisan control), we could not estimate a model with state fixed effects. Thus there is a danger that our results reflect or are biased by omitted features of states, whether institutional, demographic, geographic, or cultural. Including regional effects mitigates but does not eliminate this threat.

Second, budgets not only react to political economic variables, but influence them as well. Voters may choose parties in response to existing budget allocations. Governments may change institutions with the aim of reshaping existing budget priorities. And the spending priorities of the government may influence either long or short run economic growth. Endogeneity is thus another potential source of bias, but here there are mitigating factors as well. Economic measures such as state unemployment reflect both state-level and national economic conditions, and the latter are not under the state's influence. By lagging our partisan variables one year to reflect the budget process, we also reduce the risk of conflating political effects on the budget with voters' reactions to the budget. On the other hand, institutional variables pose perhaps the greatest risk of reverse causation or spurious correlation, as both they and the budget are slow to change and are under the influence of the same political actors.

4.3 Interpretation and presentation

Our model and presentation of results focuses on the reallocation among all budget categories expected when one of the covariates changes. To show these tradeoffs clearly, we must translate estimates from the scale of estimation back to the scale of the budget shares and account for the dynamic process by which changes in our covariates influence sticky budgets over a period of years. We must also face the challenge of collating and comparing results across time and across potentially large number of budget categories, which is only possible through carefully designed counterfactuals and visual displays. For each counterfactual, we hold the remaining covariates at their means.

Translating estimates back to budget shares. Because they relate directly to the logratios of components, and only indirectly to the underlying budget categories, the parameters of an additive logratio model do not allow easy interpretation in the manner of most regression coefficients. However, the estimated parameters $\hat{\phi}_k$, $\hat{\beta}_k$, $\hat{\psi}_k$, and $\hat{\tau}_k$ allow us to calculate the expected logratios $\hat{\gamma}_{kit}$ for any observed or hypothetical values of the covariates. We can easily translate these fitted logratios back to the composition space by inverting the logratio, which lets us present the expected budget allocation under the model for any particular scenario of interest.[11]

Accounting for time. The effects of our covariates on the composition of the budget accumulate slowly over time due to a lagged dependent variable and incremental changes in budgets. Using the impulse-response function enables us to explore the response of the composition over time to a change in individual covariates. However, given the large number of components and covariates in our model, plotting and describing here each complete impulse response function is impractical. Instead, we summarize the results by calculating the response in each budget category for the fourth year after a permanent change in each covariate (the choice of period is necessarily arbitrary; we choose four years to focus on the duration of a single gubernatorial term). We also present 95 percent confidence intervals for these quantities, obtained by stochastic simulation of the iterated response variable (Adolph, 2013). To clarify the effect of a given covariate h on a budget category k, we simulate the expected share of the budget category after four years if the value of covariate h changes from an initial value, h_0 (usually its mean) to a new value h'; this yields $\mathbb{E}(k|h')$. We also simulate the expected share of the budget category assuming the covariate stays unchanged at h_0, which yields $\mathbb{E}(k|h_0)$. We then express the ratio of these two expectations as a percentage change, which reveals how much budget category k would increase or decrease given a change in covariate h, relative to the initial expectation of spending in that category. This allows us to describe a budget area that shifts from 20 percent of all state spending to 22 percent as having increased by 10 percent of its initial level, rather than 2 percent of the overall

11 We undo the additive logratio transformation using its inverse,

$$\begin{aligned} \hat{w}_{kit} &= \frac{\exp \hat{\gamma}_{kit}}{1 + \sum_{\ell=1}^{K-1} \exp \hat{\gamma}_{\ell it}} \qquad \text{for } k = 1, \ldots, K-1 \\ \hat{w}_{Kit} &= \frac{1}{1 + \sum_{\ell=1}^{K-1} \exp \hat{\gamma}_{\ell it}} \qquad \text{for } k = K. \end{aligned}$$

budget. Presenting changes in this format helps avoid conflating the size of political and economic effects with the widely different average shares states tend to devote to different budget categories.[12]

5 Results

Table A3 in the Appendix collects the estimated parameters from our preferred specification for the full compositional data model, which jointly estimates the effects of all our covariates on each budget category using additive logratio transformations to account for the budget constraint. Because direct interpretation on the logratio scale is difficult, we focus our discussion of results on simulation showing the shift over time in each budget category as a response to changes in each covariate. Although all results are jointly estimated, we discuss our findings for each category of explanation – partisan control, institutions, economic shocks, and demographic change – one at a time. The appendix also collects discussion of estimated regional differences in our baseline model and full details on alternative specifications, including models dropping budget stringency as a control or adding the growth in the total size of the budget in constant dollars per capita; both alternative models yield substantively and statistically similar results.

5.1 Partisan effects

Democrats and Republicans appear to set distinct budget priorities when they hold majorities in both legislative chambers and control the statehouse (Figure 2), including at least five statistically significant effects. Four years after a shift from unified Republican to unified Democratic control, spending on K-12 education increases 7.8 percent (95% CI: 1.3% to 14.5%) and Medicaid and Welfare increases by 5.0 percent (95% CI: 0.5% to 9.7%). A shift in the other direction, to unified Republican control, leads to a 10.6 percent increase Other Spending (95% CI: 2.4% to 19.2%), an 8.2 percent increase in Police & Prisons budgets (95% CI: 2.1% to 14.5%), and 6.1 percent more state money for Higher Education (95% CI: 1.7% to 10.6%). Highways spending also rises 6.9 percent, though this result is only significant at the 0.1 level (95% CI: -1.2% to +15.5%).

12 The use of percentage changes in a budget category relative to that category's own past values as a summary of the politically salient degree of budgetary change has a long history, including early work on correlations (and competition) across budget categories by Natchez and Bupp (1973).

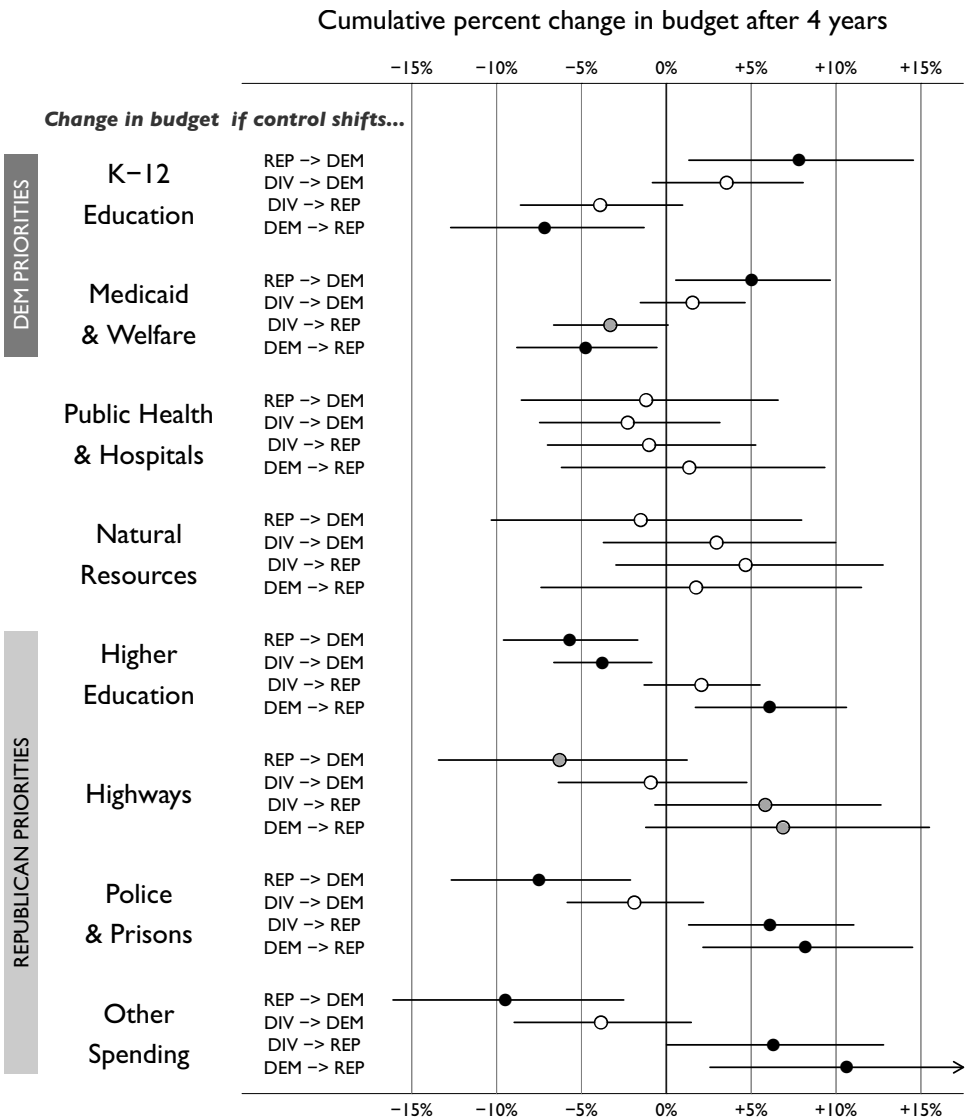

Figure 2. Estimated change in each budget component four years after a shift in partisan control. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated. Filled black circles indicate changes that are significant at the 0.05 level, filled gray circles indicate significance at the 0.1 level, and open circles are non-significant results. Horizontal lines are 95% confidence intervals. All results simulated from the model presented in Table A3; all other covariates are held constant at their means.

Intermediate shifts, such as from divided government to unified control, produce intermediate effects that are often statistically significant.[13]

Both parties find ways to funnel a greater share of state resources to their constituents, with Democrats spending more on social welfare programs and state aid to schools to benefit lower income citizens, and the Republicans shifting those resources into investment in prisons, higher education, and (possibly) highways – transfers to the rural, suburban, and middle-class base of the GOP. By focusing on the composition of the whole budget, rather than on isolated categories, we see not only what the parties devote resources to, but also the trade-offs they are willing to make, and those they are unwilling to consider. Relative to Republicans, Democrats' preference for redistributive spending like Medicaid and welfare and state aid for K-12 education leads them to cut resources that would otherwise flow to some areas Democrats support but do not prioritize, like higher education – yet neither party seems willing to pillage more broadly beneficial public goods like public health and hospitals to finance their priorities. The substantive importance of these effects is underlined both by the frequency of shifts in partisan control in the U.S. states – over the period studied, 96% of states had some change in the category of party control and 31% managed to shift from unified control by one party to unified control by the other – and by the fact that regular elections enable contestation over different partisan budget priorities in every election, whether or not voters ultimately opt for change.

5.2 Institutional effects

We turn now to the relationship between political institutions and budget priorities (Figure 3). States that raise their governors' budget and veto powers by one standard deviation at the start of a governor's term can expect, all else equal, to see spending on natural resources to rise 4.8 percent (95% CI: 1.7% to 8.0%) and higher education spending to fall 1.2 percent (95% CI: +0.2% to -2.5%) by the end of her four-year term, though the latter effect is only significant at the 0.1 level. In terms of our theoretical expectations, these results are mixed: there is a hint that institutionally powerful governors increase spending on broadly beneficial public goods like public health and hospitals, but this result is not statistically significant. Meanwhile, powerful gover-

13 Note that because the effects of Republican and Democratic control are estimated via separate dummy variables, this is a finding rather than a modeling artifact: it is entirely possible for divided governments to have had more extreme effects on some budget categories, but this is not the case.

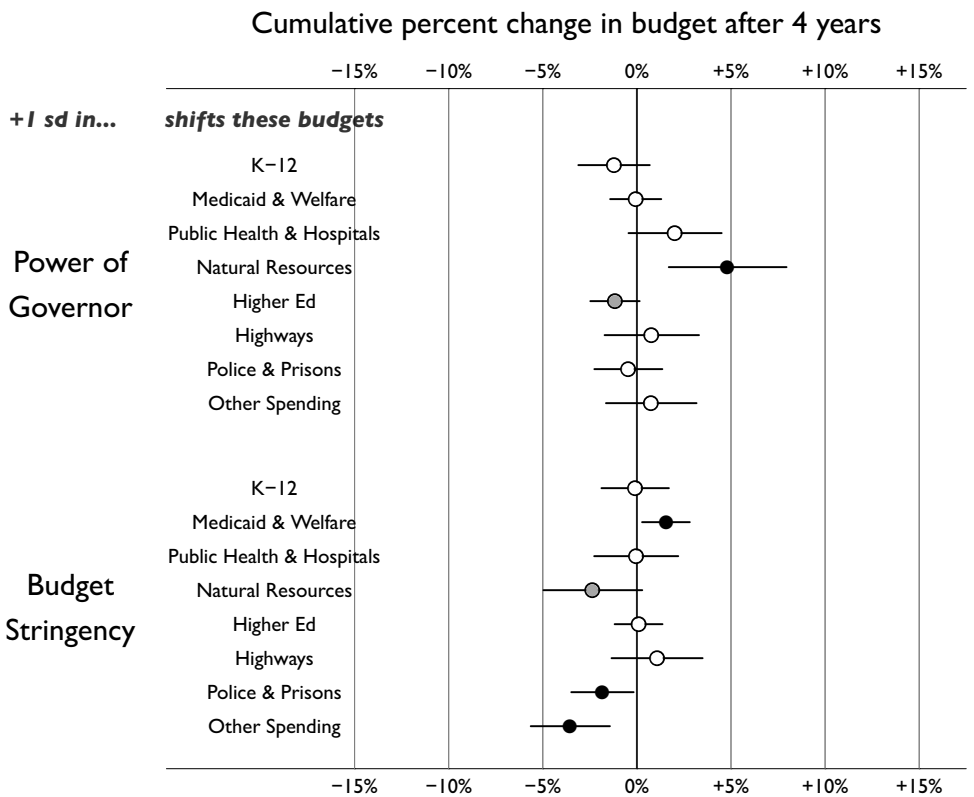

Figure 3. Estimated change in each budget component four years after institutional change. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states. See Figure 2 for further details.

nors expand spending on natural resources and have no effect on highways spending, local public goods we expected them to curtail. The possibility of lower spending on higher education under strong governors is intriguing, as state universities do tend to represent concentrated local public goods for college towns.

Next we consider budget stringency, which we expected to protect entitlement spending at the expense of discretionary programs. The results here are clearer: four years after increasing budget stringency by 1 standard deviation from its already-high mean, Medicaid & Welfare spending is 1.5 percent higher (95% CI: 0.3 to 2.8) while Other Spending – a catch-all of mostly discretionary programs – falls 3.6 percent (95% CI: -1.4% to -5.6%), Police and Prisons' share drops 1.8 percent (95% CI: -0.2 to -3.5),

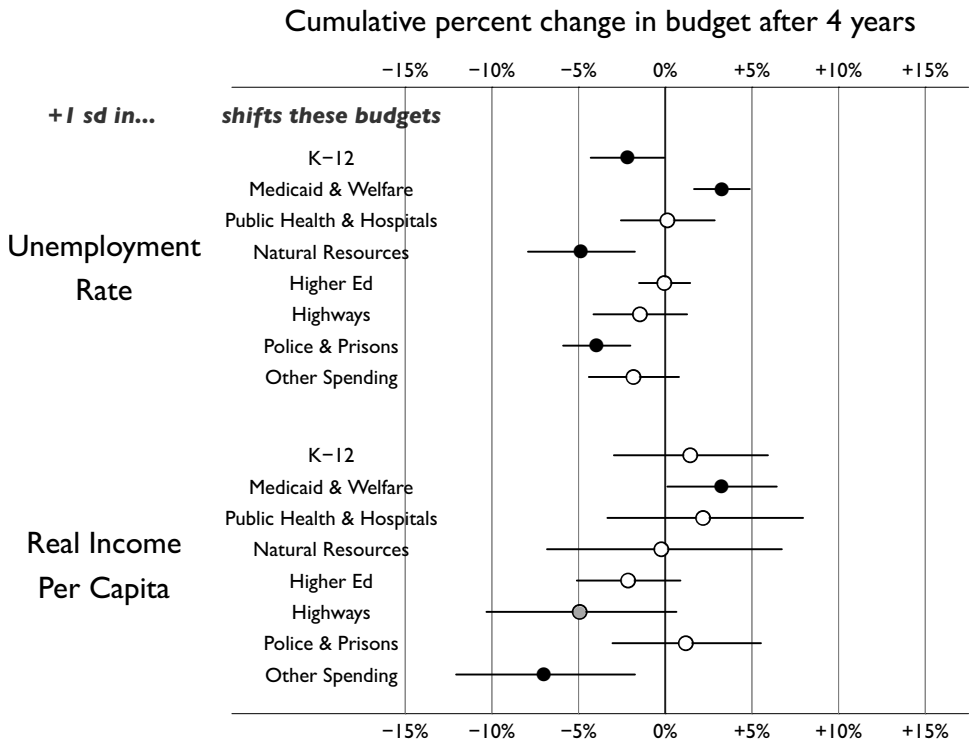

Figure 4. Estimated change in each budget component four years after a permanent economic shock. Plotted points show the cumulative percent change in each budget share four years after either unemployment or real income per capita increases by one standard deviation from the mean level across states. See Figure 2 for further details.

and Natural Resources declines by 2.4 percent (significant only at the 0.1 level). Discretionary but arguably more essential programs in the category of Public health and Hospitals remain unchanged. Interestingly, we did not obtain significant results for the classic discretionary category of highways spending.

5.3 Economic effects

Economic conditions strongly shape budget priorities as well (Figure 4). When unemployment rises by one standard deviation (approximately two points), state budget priorities shift dramatically. Medicaid and Welfare's already large budget share rises by 3.3 percent (95% CI: 1.7% to 4.9%), two-thirds the size of the shift associated with partisan control. But unlike parties, who appear to offset increases in spending in favored

areas with targeted cuts in less favored categories, rising unemployment is accompanied by largely indiscriminant discretionary budget belt-tightening, with significant cuts to natural resources (-4.9 percent; 95% CI: -1.8% to -7.9%), police and prisons (-4.0 percent; 95% CI: -2.0% to -5.9%), and K-12 education (-2.2 percent; 95% CI: -0.1% to -4.3%).

If unemployment lets us examine states' responses to short-run economic crises, real personal income per capita offers a window into how state budget priorities react to long-term economic development. Following Wagner's Law, we expect states to increase spending on welfare state programs as they grow richer, while states lagging in economic development would should seek to stimulate economic growth through higher spending on public infrastructure and investment. Our results bear out this intuition. According to the model, if we raise personal income by one standard deviation, after five years, Medicaid and Welfare spending rises 3.2 percent (95% CI: 0.2% to 6.4%), marking welfare spending as a "luxury good." At the same time, rich states seem to cut back on investment in highways (-4.9 percent, significant at the 0.1 level), suggesting this category is an inferior good or necessity. The catch-all category of Other Spending also falls significantly as income rises (-7.0 percent; 95% CI: -1.7% to -12.0%).

5.4 Demographic effects

Our final pair of counterfactuals consider how state budget priorities shift with changes in the population (Figure 5). The model suggests several systematic relationships between population density and budget priorities which generally accord with the different demands of cities: a one standard deviation increase in population density is associated with a 6.2 percent increase (95% CI: 2.3% to 10.1%) in Other Spending, which notably includes mass transit subsidies; conversely, spending on Highways is 3.7 percent lower (significant only at the 0.1 level). Spending on Police and Prisons is also higher in denser states (3.3 percent; 95% CI: 0.4% to 6.3%), while spending on Medicaid and Welfare may be slightly lower (-1.9 percent; significant at the 0.1 level). Less intuitively, states with denser populations seem to spend 5.7% more on Natural Resources (95% CI: 1.0% to 10.6%).

The age composition of the population has few systematic effects, but those present are intuitive: a one standard deviation increase in the share of the population under 19 years of age is associated with spending 2.9 percent more on K-12 education (95% CI: 0.1% to 5.8%) and 2.3 percent less on police and prisons (significant at the 0.1 level); these shifts reflect changes in the share of the population eligible for enrollment or im-

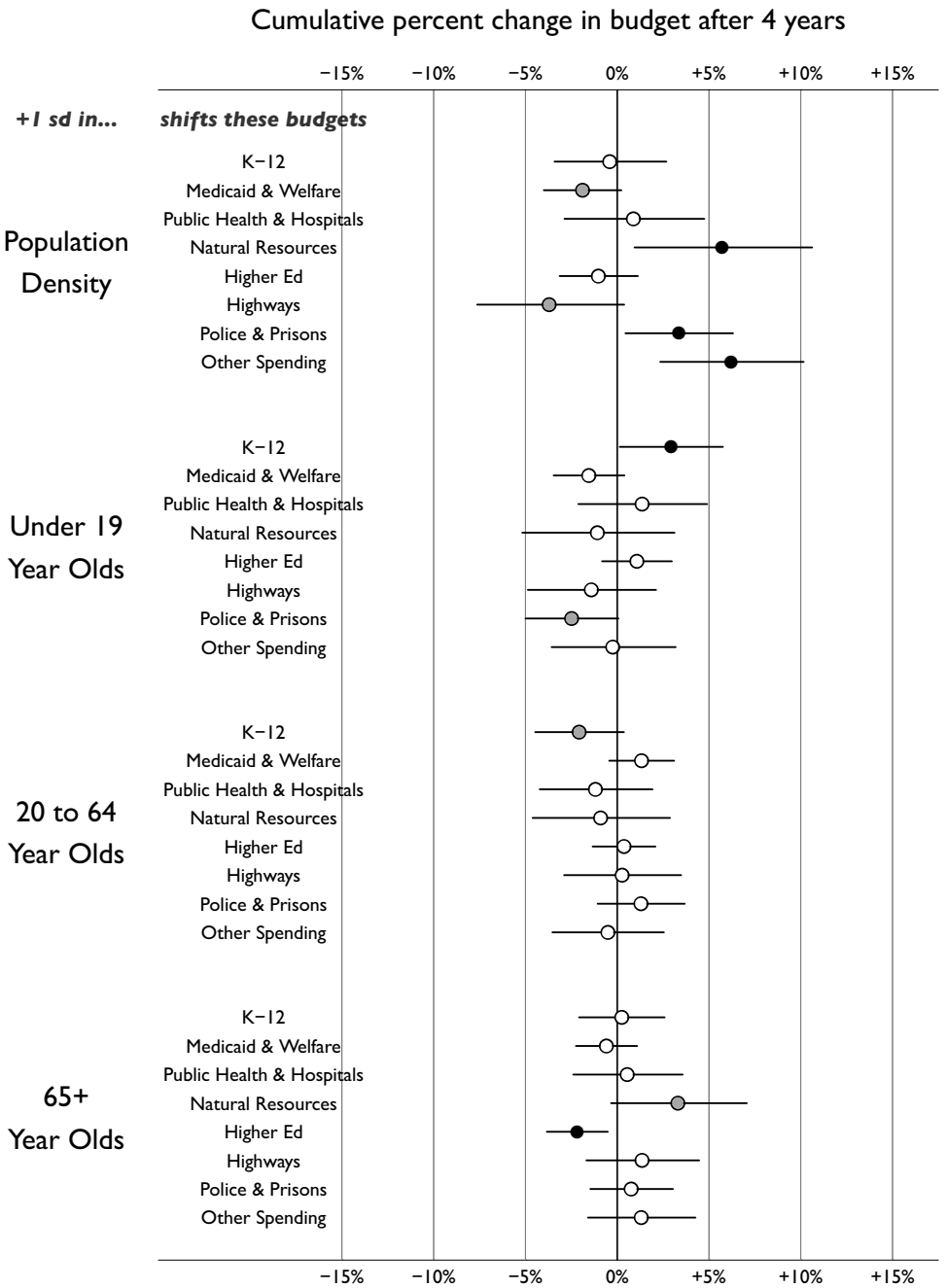

Figure 5. Estimated change in each budget component four years after demographic change. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states. See Figure 2 for further details.

prisonment, respectively.[14] Likewise, states with relatively more working-age adults (and thus relatively fewer children and elderly) appear to spend less on K-12 education, though this result is only significant at the 0.1 level. Finally, when the state has one standard deviation higher than average elderly population, higher education spending falls by 2.2 percent (95% CI: -0.5% to -3.8%). An older population has fewer adults of university age and fewer parents of university-age children, suggesting a similar demand effect; more speculatively, it is worth noting that during the period studied, elderly Americans came from earlier generations with much lower levels of college attainment and thus less personal connection to college as a state budget priority.

6 Conclusions

While the compositional data approach offers improvements in estimation efficiency and in the sensible prediction of budget shares by category when compared to single-equation models of budget categories, the main payoff from our methodology is that we can provide a clearer picture on the forces that are at play when budgeting are made. These insights can complement studies of the size of government and directly improve on isolated studies of single categories. And though our empirical work here is exploratory and our model specification tentative, the budget tradeoffs associated with many of our covariates appear both substantively important and theoretically interesting. Two determinants are worth highlighting.

First, we find that partisan governments not only fund policy areas dear to their constituents but also pay for those priorities with targeted cuts to areas less important to the party's agenda and electoral prospects. To our knowledge the partisan literature – with the partial exception of recent work on education policy – fails to highlight this aspect of government spending: partisan governments can punish the opposition by reducing spending on opposition items. The combination of increases for the winner and losses for the loser raise the stakes in budget battles and bring out substantive differences between political parties starkly.

14 Careful readers will note that the age composition of state residents is itself a set of compositional variables, but on the right-hand-side of our regression model. Compositional covariates require carefully constructed counterfactuals to preserve their unit sum and avoid logically impossible results; here we assume hypothetical increases in one age category are offset by proportional reductions in each other age group; see Adolph (2013) and Adolph, Quince, and Prakash (2017) for further details and examples on constructing counterfactuals for compositional covariates.

Second, economic downturns have broad effects on the budget. Most areas of policy give up relative resources to pay for increases in welfare spending, with only public health and hospitals, higher education, and to a lesser extent the stimulative category of highways standing immune, at least before the Great Recession. Our results also suggest that as states grow richer, their priorities shift from policies that invest in the state economy towards welfare state programs.

Although we find some effects on budget priorities of budget institutions deemed critical by the literature, the magnitude of these relationships for the most part falls short of the impact of partisanship or economic shocks. We find hints that states under different budgetary institutions allocate resources differently across entitlements and discretionary programs. Budget stringency may protect entitlements at the expense of discretionary spending, and powerful governors may indeed favor some categories over others. But these effects are fairly small. Partly, this reflects a lack of variation in these institutions – almost all states have very strict balanced budget requirements and governors with significant powers of the budget agendas. Perhaps state institutions are so similar that the variation in their budget priorities usually reduces to a simple mix of political interests and economic forces. Or perhaps institutional tools aren't consistently employed. For example, governors rarely use vetos but when they do they prioritize some spending items (Lauth and Reese, 2006). This logic corresponds to our small estimated effects.

Our analysis also speaks to the changes in the mix of spending priorities. Welfare, though also an entitlement, appears highly responsive to economic and political conditions. Spending on welfare programs rises in response to unemployment, grows disproportionately as personal income rises, and is sharply affected by the partisanship of government. And because welfare spending is such a large component of the budget, its fluctuations have large countervailing effects on other categories.

Gains in the share of welfare spending often coincide with deep cuts in spending on K-12 education, highways, other spending, natural resources, and police and prisons, but the nature of the trade-off between welfare and other areas depends on the cause of the change in welfare spending. Rising welfare spending threatens K-12 budgets when led by poor economic conditions, but not when driving by change in the partisan control of government. Generally, shifts in a given budget category depend not only on shifts in specific other budget categories, but in the determinants of shifts in other categories. This web of interlocking effects make it clear that a model relating political, economic, and institutional covariates to budget tradeoffs is critical to understanding when those tradeoffs work in one direction or another.

In general, we hope compositional models of budget allocations will uncover new insights as their use is expanded and see at least three further ways this model can help us understand budget politics and public policy more broadly. First, while we have divided spending into programmatic categories, other decompositions of the budget may yield interesting complementary results. For example, some of the hypotheses investigated here could be more sharply tested using budget compositions that distinguish capital and non-capital spending, or discretionary and entitlement spending. These distinctions could be drawn within our programmatic categories or even across them. Likewise, studies could take a closer look at the composition of specific budget areas, examining, for instance, how funds are allocated to different types of welfare programs. We can use the same compositional methods to gain insights on the politics and trade-offs within budget areas that we use to understand tradeoffs across them.

Second, we can use these methods to understand the setting of political priorities not just in the United States, but across and within other countries. Cross-national applications of compositional data analysis would give greater scope to institutional explanations by dramatically increasing the institutional diversity of the sample. It would also help move the comparative welfare state literature, a close cousin to the budgeting literature, away from studies of aggregate spending, towards an understanding of the varied composition of that spending, and what the trade-offs wrung from political conflicts over scare resources represent.

Finally, compositional models present powerful tools to study policy processes more broadly. Theories of agenda-setting stress that governments attend to some issues while ignoring others, as a function of institutional structure and finite information processing capacity (Kingdon, 1995; Baumgartner and Jones, 1993). Some policy domains are ripe for government action, while other domains are perceived as unimportant and remain dormant. The compositional analysis we present here offers a way for policy scholars to determine what factors shift the finite supply of attention from one domain to another. Future work might consider alternative mechanisms of allocating decisions space such as time devoted to issues in the media, hearings in congress, or rules. We could envision compositional analysis used to answer questions on how and when policy-making occurs across distinct policy domains. Are trade-offs starker in domains that deal with more problems and fewer policymakers? Does the institutional setting of policymaking influence composition of items considered on the policy agenda? Our use of compositional methods shows the importance of thinking about the interdependence of decisions in policymaking and there is more work to be done.

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APPENDIX

To supplement Christopher Adolph, Christian Breunig, and Chris Koski, "The Political Economy of Budget Trade-offs," forthcoming in the Journal of Public Policy.

This appendix contains several pieces of supporting material for "The Political Economy of Budget Trade-offs," including: a detailed description of the construction and contents of each of the eight state budget categories analyzed in the main text; summary statistics for all the outcome and covariate data analyzed in baseline model and supplemental models; a table of regression coefficients for the baseline model; and simulation results for the regional controls from the baseline model contained in the main text. Finally, the appendix concludes with a series of "robustness movies" exploring in detail how the simulation results from the baseline model change in each of four alternative model specifications.

A.1 Data Description

Data are constructed from the detailed annual spending data provided by the Census of Governments State Government Finances database. We define eight areas – Medicaid & Welfare, K–12 Education, Higher Education, Other Spending, Highways, Public Health & Hospitals, Police & Prisons, and Natural Resources – to capture the functions described in Table A1. Our categories are slightly modified aggregations of the original State Government Finances broad categories, chosen to better test the extant theoretical explanations of budget priorities. Specifically, we combine total social service spending, medical vendor payments, housing, and spending on insurance trust funds to form the Welfare and Medicaid category, we define Health and Hospitals as all health related spending excluding Medicaid, include in Higher Education all education spending except K-12, and include in Natural Resources all environmental and utility expenditures. Construction of K-12, Police and Prisons, and Highways spending is straightforward, while Other Spending includes all remaining budget categories, including general government, liquor, ports, airports, mass transit subsidies, and interest payments on government debt.

Constructing each of the eight policy areas is slightly complicated: because SGF data are further subdivided by accounting functions, within each of the abovementioned budgetary areas, we must aggregate spending per budget area made in different

accounts. Depending on the policy area, budget data on spending in an area may be available disaggregated into budgets for construction (category F), current operations (category E), other capital outlays (category G), assistance and subsidies (category J), transfers to local government entities (category M), transfers to school districts (category Q) and/or payments to federal welfare programs (category S). For each of the eight spending areas reported in the paper, we have combined all available relevant budget categories above.

A summary of the variation in both our budget categories and the covariates included in our compositional data models can be found in Table A2. Note that all variables are continuous (or at least ordered indexes) except for the partisan government and tax and expenditure limits control variables. For Governor Powers, "(B)" indicates Beyle's index, and "(K&S)" indicates Krupnikov and Shipan's alternative index.

Table A1. Description of state budget categories.

Budget category	Spending falling within this category
Medicaid & Welfare	Cash assistance programs (SSI, TANF); vendor payments for medical care (Medicaid); emergency relief; housing assistantce; welfare administration costs.
K–12 Education	Spending on elementary and secondary education.
Higher Education	Post-secondary education; other schools including those for the blind and vocational schools.
Other Spending	Government administration; judicial and legal expenditures; central staff services; public building costs; mass transit subsidies; airports and seaports; parks; liquor regulation; scientific and cultural facilities; stadiums; general debt service.
Highways	Construction and maintenance of roads and highways; ferries.
Public Health & Hospitals	Construction and maintenance of state hospitals, university hospitals, and mental health facilities; subsidies to private hospitals; health inspections; regulation of air and water quality; environmental cleanup.
Police & Prisons	State police; sheriffs; state highway patrol; training academies; crime labs; vehicle inspection; construction and maintenance of prisons and jails; funding for inmate rehabilitation programs; salary for prison workers and probation officers.
Natural Resources	Agriculture spending; fish and game expenditures; state administration of forests.

Table A2. Summary statistics of budget components and covariates, 1984–2009.

	Min	25th ptile	Med	Mean	SD	75th ptile	Max
Budget components							
Medicaid & Welfare	0.14	0.26	0.31	0.31	0.07	0.36	0.53
K–12 Education	0.03	0.16	0.19	0.19	0.04	0.23	0.29
Higher Education	0.06	0.11	0.13	0.13	0.03	0.16	0.22
Other Spending	0.04	0.09	0.12	0.13	0.05	0.16	0.35
Highways	0.02	0.07	0.08	0.09	0.03	0.10	0.22
Public Health & Hospitals	0.02	0.05	0.07	0.07	0.02	0.08	0.13
Police & Prisons	0.01	0.03	0.04	0.04	0.01	0.05	0.08
Natural Resources	0.01	0.02	0.03	0.04	0.02	0.04	0.14
Covariates							
Unified Democratic	0.00	0.00	0.00	0.25	0.43	1.00	1.00
Unified Republican	0.00	0.00	0.00	0.18	0.39	1.00	1.00
Governor powers (B)	0.00	7.50	8.00	7.95	1.59	9.00	10.00
Budget stringency	0.00	6.00	10.00	8.04	2.63	10.00	10.00
Unemployment rate	2.30	4.40	5.30	5.67	1.91	6.60	17.40
Real income, $k pc	13.51	22.12	25.62	26.17	5.66	29.75	46.71
Population density	0.00	0.04	0.09	0.18	0.24	0.18	1.14
Share $\leq$18 years	0.23	0.27	0.28	0.29	0.02	0.30	0.41
Share $\geq$65 years	0.08	0.12	0.13	0.13	0.02	0.14	0.19
Real pc spending growth	-0.15	0.00	0.03	0.03	0.05	0.06	0.30
Governor powers (K&S)	1.00	3.00	3.50	3.46	0.90	4.00	6.00
Tax & expenditure limits	0.00	0.00	0.00	0.45	0.50	1.00	1.00

A.2 Baseline Model Results: Coefficients and Regional Counterfactuals

Table A3 contains the estimated coefficients and goodness of fit measures for the baseline model discussed in the main text.

Figure A1 elaborates on the regional differences captured by the four region dummies for this model using the counterfactual simulation techniques used in the main text to show partisan, economic, institutional, and demographic effects on budget shares. As in the main text, filled black circles indicate changes that are significant at the 0.05 level, filled gray circles indicate significance at the 0.1 level, and open circles are non-significant results. Horizontal lines are 95% confidence intervals. All results simulated from the model presented in Table A3; all other covariates are held constant.

We find a number of strong regional differences in budgets that persist when controlling for partisan governments, economic conditions, institutions, and demography, many of which appear to fit with well-known biases in regional priorities. For example, Midwestern states – home of many of the oldest and largest public flagship universities – spend larger shares of their budgets on higher education (significant at the 0.1 level), but less on prisons and natural resources. Northeastern states, home to many private universities, spend less on higher education (significant at the 0.1 level) and especially police and prisons, but, as befits their liberal reputation, much more than the average state on Medicaid & Welfare. The Southern states spend significantly more than the average region on police and prisons, as do Western states. Western states also spend noticeably less on Medicaid and welfare and more on natural resources than states in other regions.

Nevertheless, we think the results for regions should be treated with caution. Fundamentally, we include region dummies to account for omitted variables that might be strongly correlated with the states of different regions. Thus, what the region dummies "show" the aggregate effect of the omitted characteristics of each region; these will naturally change as we add or remove observed covariates from the model. Rather than estimate what is "intrinsic" to a region, these dummy variable reveal what is left unexplained, which is in large part a function of the model itself.

Table A3. Seemingly unrelated regressions of additive-logratio–transformed state budget components, 1984–2009: Baseline results.

	Response variables are logratios: log(Component k/Other Spending)						
Covariates	K–12 Ed	Medicaid & Welfare	Public Health & Hospitals	Natural Resources	Higher Ed	Highways	Police & Prisons
Unified Democratic	0.021	0.016	0.004	0.018	0.000	0.009	0.005
	(0.011)	(0.010)	(0.011)	(0.012)	(0.009)	(0.011)	(0.009)
Unified Republican	-0.028	-0.027	-0.019	-0.004	-0.011	-0.001	-0.000
	(0.012)	(0.012)	(0.012)	(0.014)	(0.010)	(0.013)	(0.011)
Governor powers	-0.003	-0.001	0.002	0.006	-0.003	4.378	-0.002
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Budget stringency	0.005	0.007	0.004	0.001	0.005	0.007	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Unemployment rate	-0.000	0.007	0.002	-0.004	0.002	0.000	-0.003
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Real income, $k pc	0.004	0.005	0.004	0.003	0.002	0.001	0.004
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Population density	-0.076	-0.097	-0.057	-0.005	-0.082	-0.122	-0.031
	(0.032)	(0.030)	(0.031)	(0.035)	(0.027)	(0.035)	(0.028)
Share $\leq$18 years	0.362	-0.230	0.166	-0.045	0.055	-0.152	-0.295
	(0.335)	(0.322)	(0.332)	(0.375)	(0.279)	(0.350)	(0.300)
Share $\geq$65 years	-0.055	-0.400	-0.064	0.295	-0.554	-0.042	-0.185
	(0.409)	(0.397)	(0.408)	(0.458)	(0.347)	(0.429)	(0.370)
Lagged logratio	0.910	0.887	0.950	0.931	0.920	0.880	0.925
	(0.007)	(0.008)	(0.007)	(0.008)	(0.006)	(0.011)	(0.007)
Trend	0.001	0.005	0.001	-0.000	0.003	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
South	0.006	0.006	0.018	0.024	0.005	0.001	0.026
	(0.013)	(0.013)	(0.013)	(0.015)	(0.011)	(0.014)	(0.012)
Northeast	-0.007	0.023	0.009	0.016	-0.012	-0.020	-0.016
	(0.019)	(0.018)	(0.019)	(0.021)	(0.016)	(0.020)	(0.017)
West	-0.009	-0.022	0.003	0.023	-0.020	-0.011	0.022
	(0.014)	(0.013)	(0.014)	(0.015)	(0.011)	(0.014)	(0.012)
Constant	-0.191	-0.090	-0.275	-0.258	-0.071	-0.077	-0.043
	(0.156)	(0.150)	(0.156)	(0.177)	(0.130)	(0.164)	(0.140)
Im-Pesaran-Shin test	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
McElroy's R^2	0.922						
N	1222						

Table entries are additive logratio coefficients with standard errors in parentheses. Im-Pesran-Shin test shows p-values from panel unit root tests where the null hypothesis is that a unit root process is present. McElroy's R^2 measures the goodness of fit of the entire system of equations. N indicates the number of state-years analyzed. Data are fully observed for all states, years, and components excluding Alaska, Hawaii, and Nebraska.

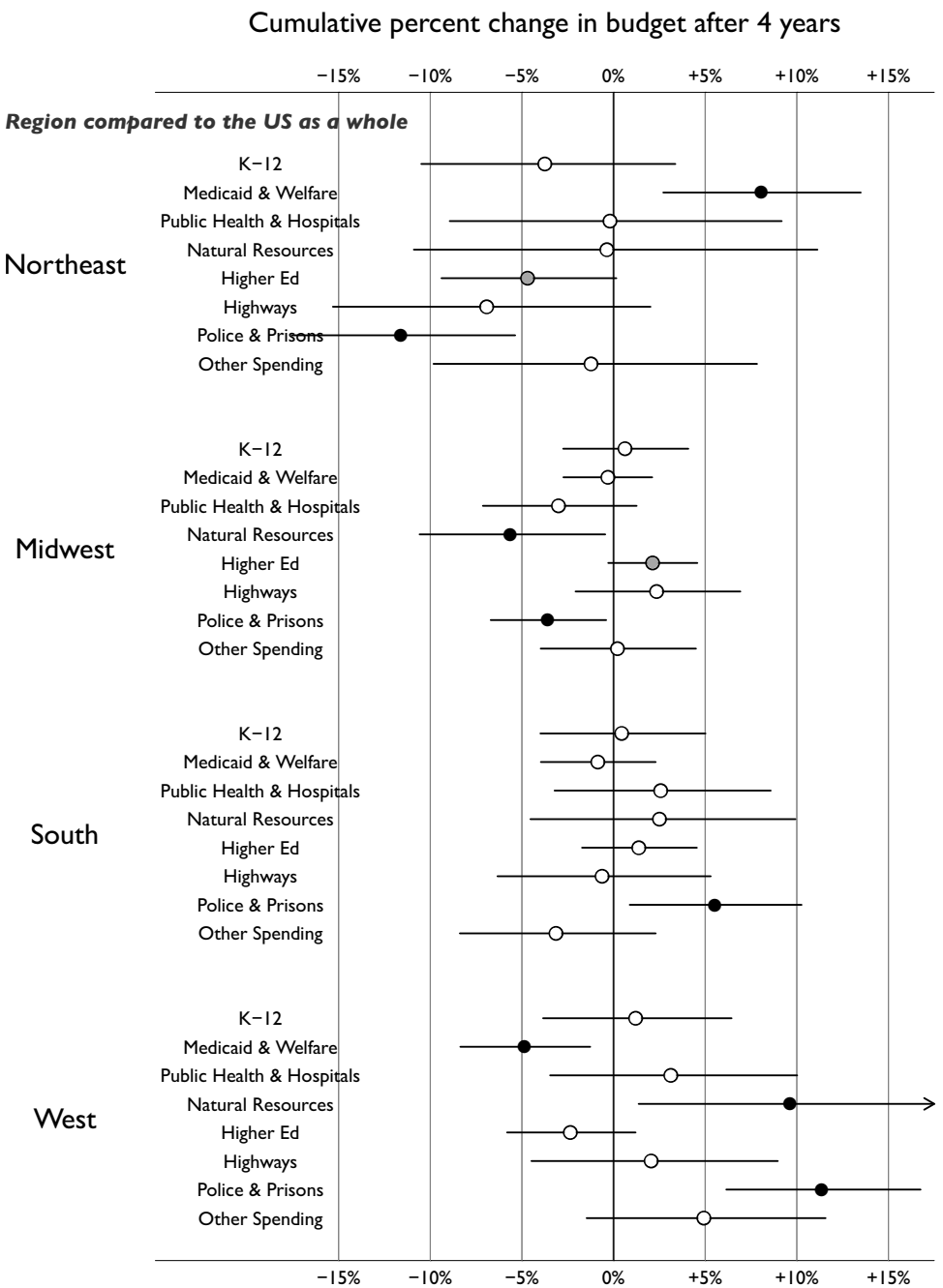

Figure A1. Estimated change in each budget component four years after hypothetical "region" change. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

A.3 Alternative Models

Beyond the baseline model discussed in the main text, we consider four alternative specifications to explore the sensitivity of our results to debatable assumptions and measurements. Thus our five models are:

- M1 The baseline model
- M2 The baseline plus a control for real growth in total spending
- M3 The baseline omitting the control for budget stringency (ACIR)
- M4 The baseline plus a control for tax and expenditure limits
- M5 The baseline with Beyle's Governor Power index replaced by Krupnikov & Shipan's measure

The rationale for each robustness check is straightforward. While our compositional data models are focused on relative shifts in budgets (division of the pie), these changes may be confounded with shifts in the total budget (the size of the pie). M2 thus includes the real growth rate of total government spending as a control. While this simple model does not cover all possible interactions between the size and division of the pie, it provides a basic check on whether our results on budget trade-offs are conflated in any obvious way with changes in the total budget.

The next two models address the issue of restrictions on changes in the size of the budget. Because most (but not all) states operate under fairly strict fiscal rules against borrowing, one might wonder whether the budget stringency variable in the baseline model captures enough variation to say anything useful about the effects of rules against deficit spending. Accordingly, M3 checks whether our other results depend on the inclusion of the ACIR measure of budget stringency. On the other hand, if stringent limits on debt spending matter, so too might extra hurdles for raising taxes or total spending levels; hence M4 adds a control for the presence of either tax or expenditure limits (coded as dummy variable equal to one if any tax or expenditure limit is present, and zero otherwise).

Finally, there is debate over the appropriate way to construct indexes of governors' powers. In the main text, we use Beyle's measure, which Krupnikov and Shipan (2012) have criticized. For our purposes, the Beyle index is useful because it contains a broader range of potential options for the powers in which we are interested – budget and veto powers. Moreover, Krupnikov and Shipan use NASBO surveys which suffer from some non-response bias in ways that Beyle's data relying on the Book of the States data

do not. Nevertheless, we consider M5, a model replacing Beyle's index of governor powers with Krupnikov and Shipan's measure.

In the main text, we used a series of dotplots to explore the substantive implication of a single model.[1] To compare the results from five separate models, we create a series of "robustness movies" made up of identically constructed dotplots. For example, the next five figures (Figures A2 through A6, marked with blue titles at the top left) show the effect of partisan control on the eight budget categories for each of the five models. Our recommendation is that readers view these pages as a full-screen PDF file, then rapidly flip backwards and forwards between adjacent pages to create a moving picture of the differences across model specifications. Models with similar substantive and statistical implications produce figures that seem to jitter only slightly from page to page: because of random error, the estimated effects and confidence intervals should "dance" on the page a little bit, but not too much. Models with contrary results literally jump out, allowing readers to focus on exceptional results.

Readers are encouraged to explore the robustness of the results for themselves. As a guide, the rest of this section highlights key areas of robustness and a few cases of sensitivity.

Partisan effects on budget compositions are highly robust. Figures A2 though A6, marked in blue, reveal no noteworthy variation in the substantive or statistical significance of partisan effects, regardless of the model specification used or the budget category considered. The sole, minor exception is that in Model 3, which drops the control for budget stringency, the relationship between partisan control and Medicaid and welfare spending is significant at the 0.1 level rather than at the 0.05 level. The confidence interval and point estimate do not noticeably vary across models. As with other borderline results covered in this appendix, the stability of this result is a reminder to pay more attention to confidence intervals than significance thresholds. Sustantively, the robustness of the partisan results provides reassurance that the partisan raiding patterns highlighted in the main text are not artifacts of a fragile model specification, but instead robust features of the data.

Institutional effects: mostly robust, but the measures by Beyle and Krupnikov-Shipan differ somewhat. The effect of institutions – governor powers and budget stringency – are

1 As in the main text, filled black circles indicate changes that are significant at the 0.05 level, filled gray circles indicate significance at the 0.1 level, and open circles are non-significant results. Horizontal lines are 95% confidence intervals. All other covariates are held constant.

generally robust, with one minor and one major exception (Figure A7–A11, marked in red). The minor exception concerns the relationship between budget stringency and police and prisons spending, which is only significant at the 0.1 level in Model 5 (which uses Krupnikov and Shipan's alternative measure of governor powers); nevertheless, the difference is slight and barely visible when confidence intervals are compared across models.

The major exception concerns the measurement of governor powers. Beyle's index and Krupnikov and Shipan's index produce distinct effect on three of the eight budget categories – without altering the result of other covariates. Whereas Beyle's measure is associated with more spending on natural resources and less spending on higher education, Krupnikov and Shipan's index is only associated with less spending on police and prisons. We do not have an obvious explanation for the discrepancy, though it is worth noting that in our sample Beyle and Krupnikov-Shipan measure mostly different things: the simple correlation between these covariates is just $r = 0.31$. As noted above, we suspect Beyle's index is the more appropriate of the two for our purposes and emphasize that no other results depend on this choice.

Finally, Figure A10 shows what happens when we include a control for tax and expenditure limits (TELs) as well as a control for budget stringency. TELs themselves have no significant relationship with any budget category. Notably, the effects of budget stringency remain unchanged, no doubt in part because the simple correlation between the budget stringency and TELs covariates is low ($r = 0.16$), suggesting these two variables tap into often distinct processes in different states.

Economic effects are mostly robust, with a handful of exceptions. Figures A12 – A16 (marked in green) explore the robustness of our economic covariates. In general, the results for unemployment are quite stable across budget categories. We note just three minor sensitivity in the relationship between our economic variables and budget shares. First, in the model adding a control for tax and expenditure limits, the negative effect of unemployment on K-12 education spending is only significant at the 0.1 level, but is little changed substantively. Second, the relationship between real income per capita and Medicaid and welfare spending is not always significant: in the model controlling for TELs, it is only significant at the 0.1 level, and in the model dropping budget stringency, it loses significance altogether, but is still positively signed. Finally, dropping budget stringency strengthens the significance of the negative relationship between economic development and highway spending.

Controlling for real spending growth does not alter the results for other covariates but does reveal that total spending growth is associated with higher shares of the budget spent on Medicaid and Welfare (significant at the 0.1 level) and Public Health and Hospitals, and smaller shares for Highways (significant at the 0.1 level) and Other Spending. The direction of causality is unclear, though it seem reasonable to suspect this is an artifact of rising costs for medical care simultaneously driving up the total spending and share of spending devoted to health and medical care for states with high needs, costs, or generosity.

Demographic effects are mostly robust, though population density depends on controlling for budget rules. Figure A17 – A21 (marked in purple) explore the robustness of our demographic findings. The associations between age composition and budget category are mostly robust, in some cases rising or dropping a significance level but not varying in substantive size or approximate confidence interval width. The statistical significance of relationships between population density and budget allocation is notably sensitive to models that drop budget stringency, though we remain skeptical of such models.

Regional dummies capture different effects when other variables are included or omitted. Figures A22 – A26 (marked in brown) show how the results for our region dummies vary across model specifications. Here there is considerable more variation across models, as one should expect: the region dummies are included in the models to soak up omitted variables that happen to be strongly correlated with the states of each regions. Thus, when we either include or exclude additional covariates from the model, we necessarily alter the mix of omitted covariates proxied by the region dummies. We leave exploration of this variation to interested readers.

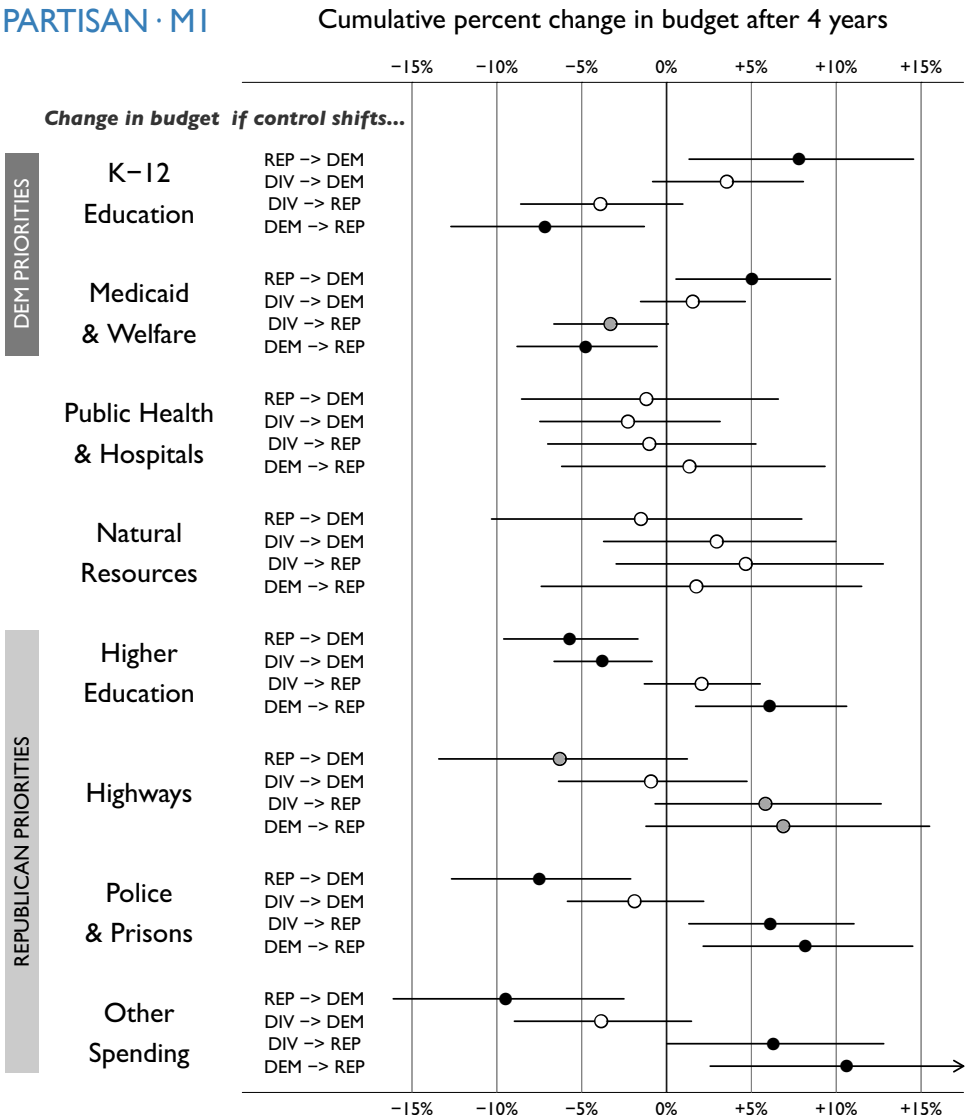

Figure A2. Estimated change in each budget component four years after a shift in partisan control: Baseline Model (repeated as reference). Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

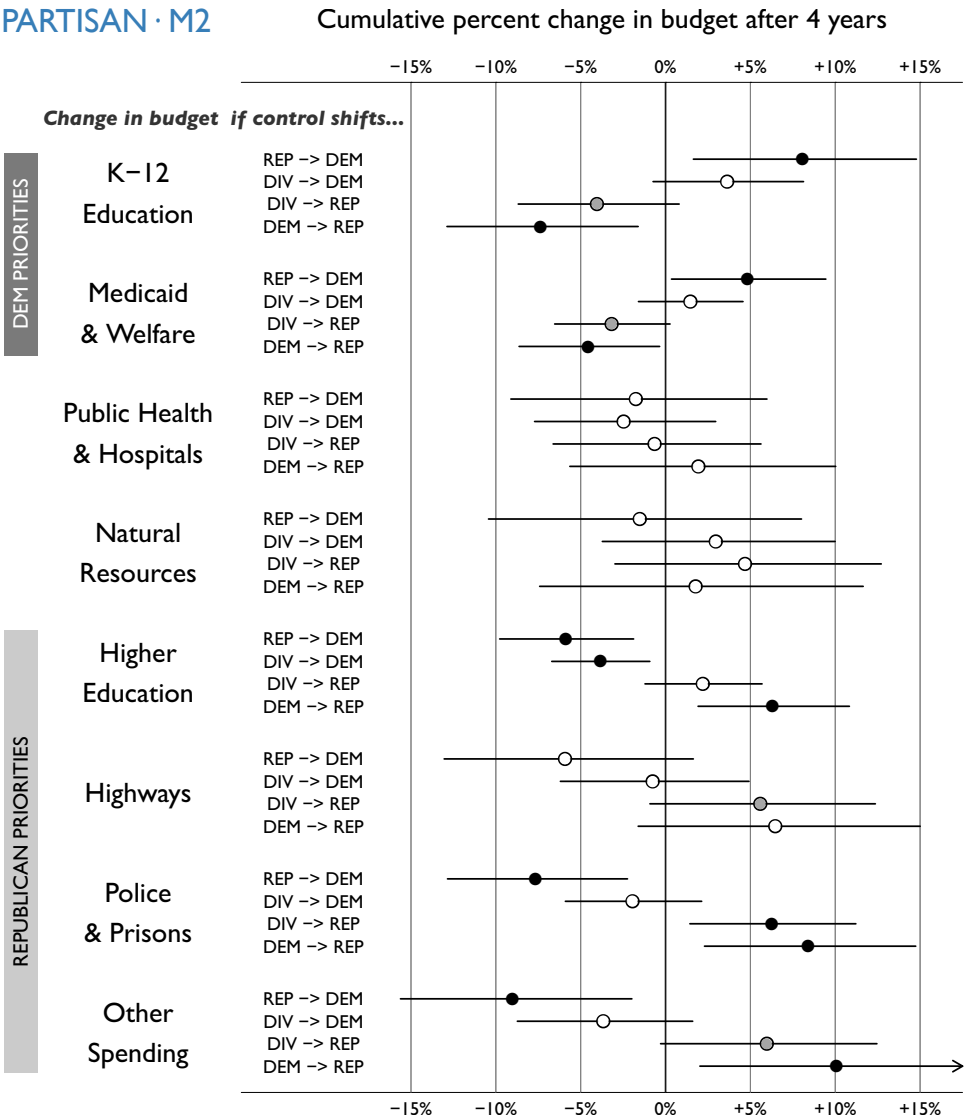

Figure A3. Estimated change in each budget component four years after a shift in partisan control: Control for Total Budget. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

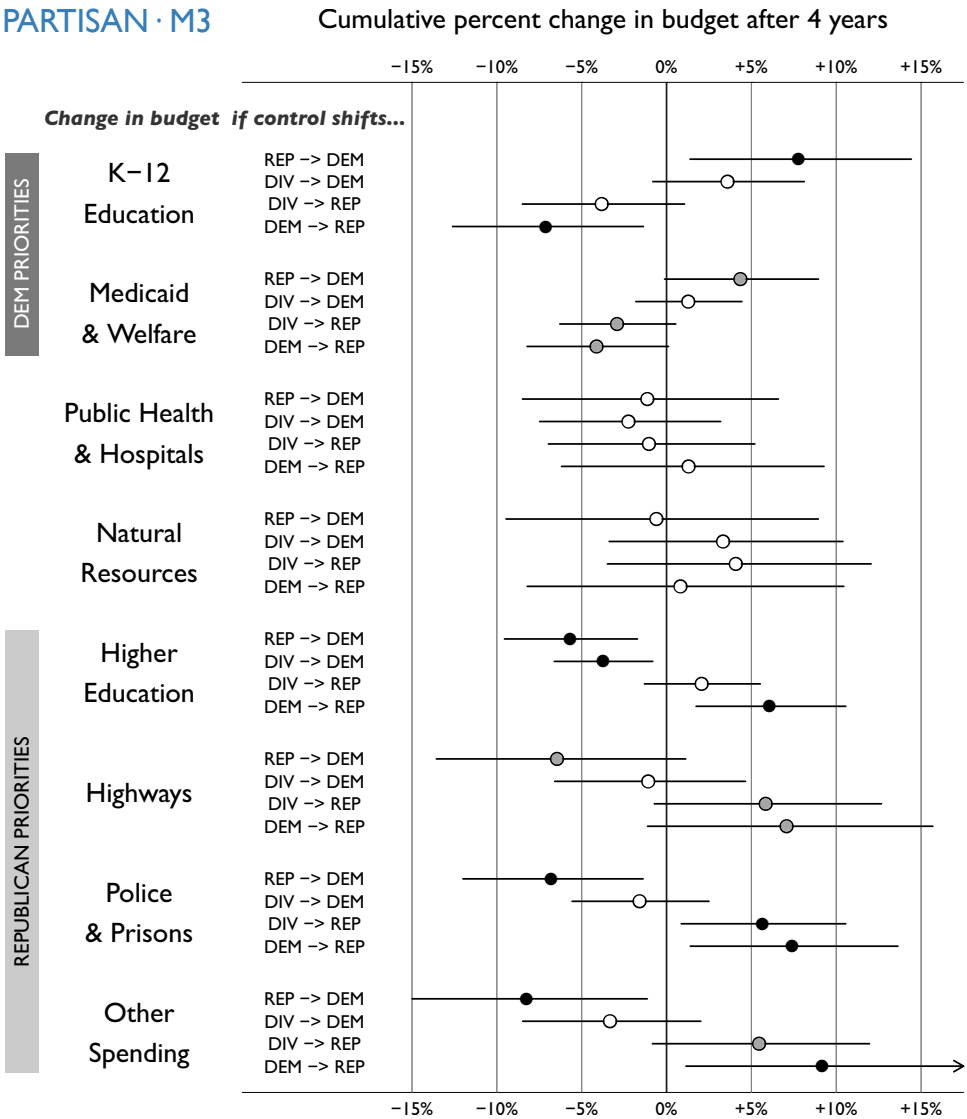

Figure A4. Estimated change in each budget component four years after a shift in partisan control: Drop Budget Stringency control. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

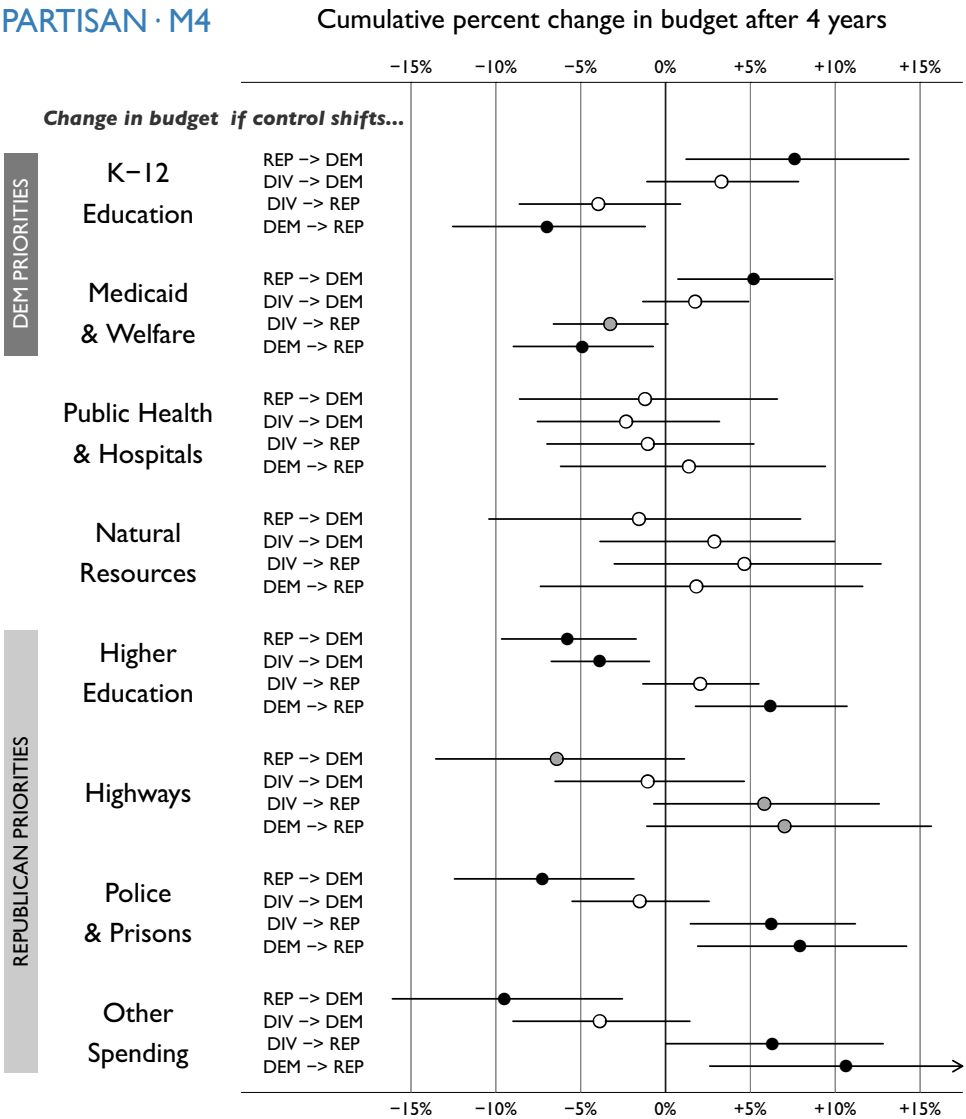

Figure A5. Estimated change in each budget component four years after a shift in partisan control: Control for tax and expenditure limits. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

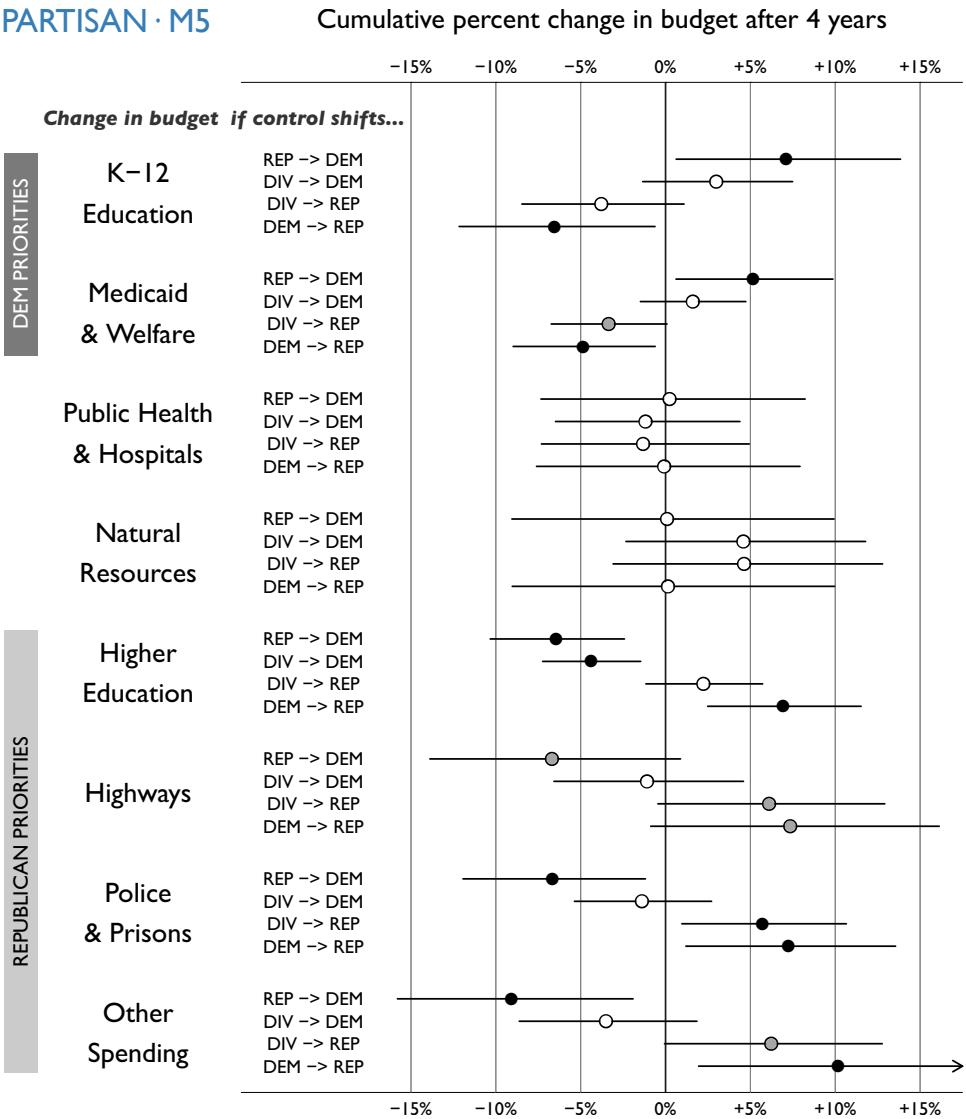

Figure A6. Estimated change in each budget component four years after a shift in partisan control: Alternative measure of Governor Power. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

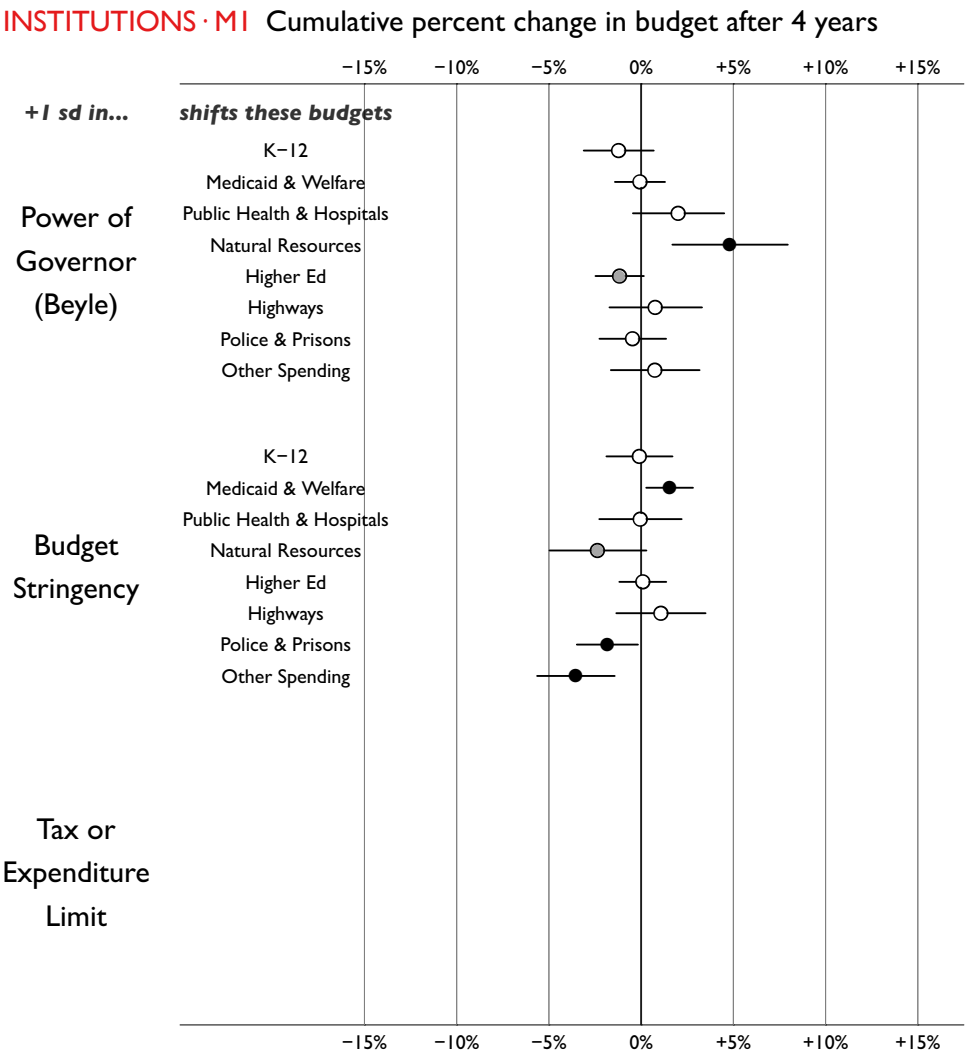

Figure A7. Estimated change in each budget component four years after institutional change: Baseline Model (repeated). Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

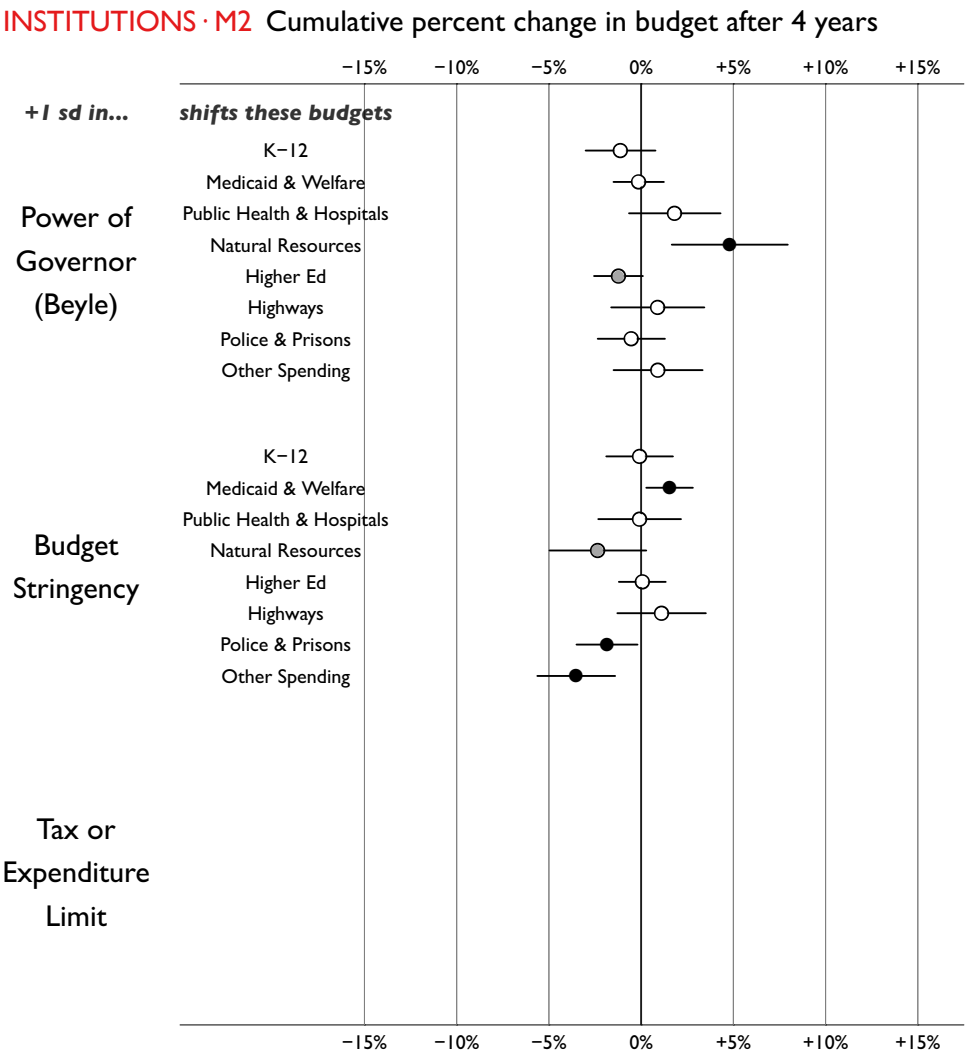

Figure A8. Estimated change in each budget component four years after institutional change: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

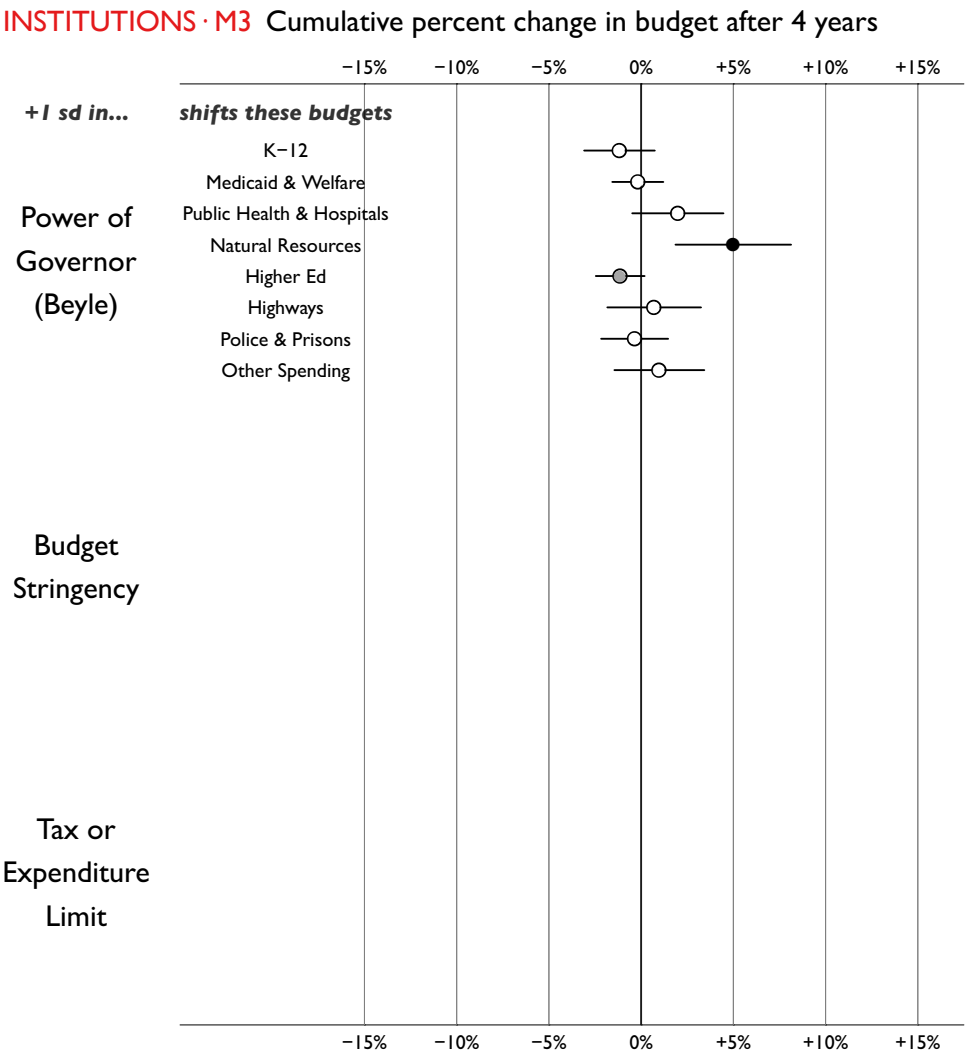

Figure A9. Estimated change in each budget component four years after institutional change: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

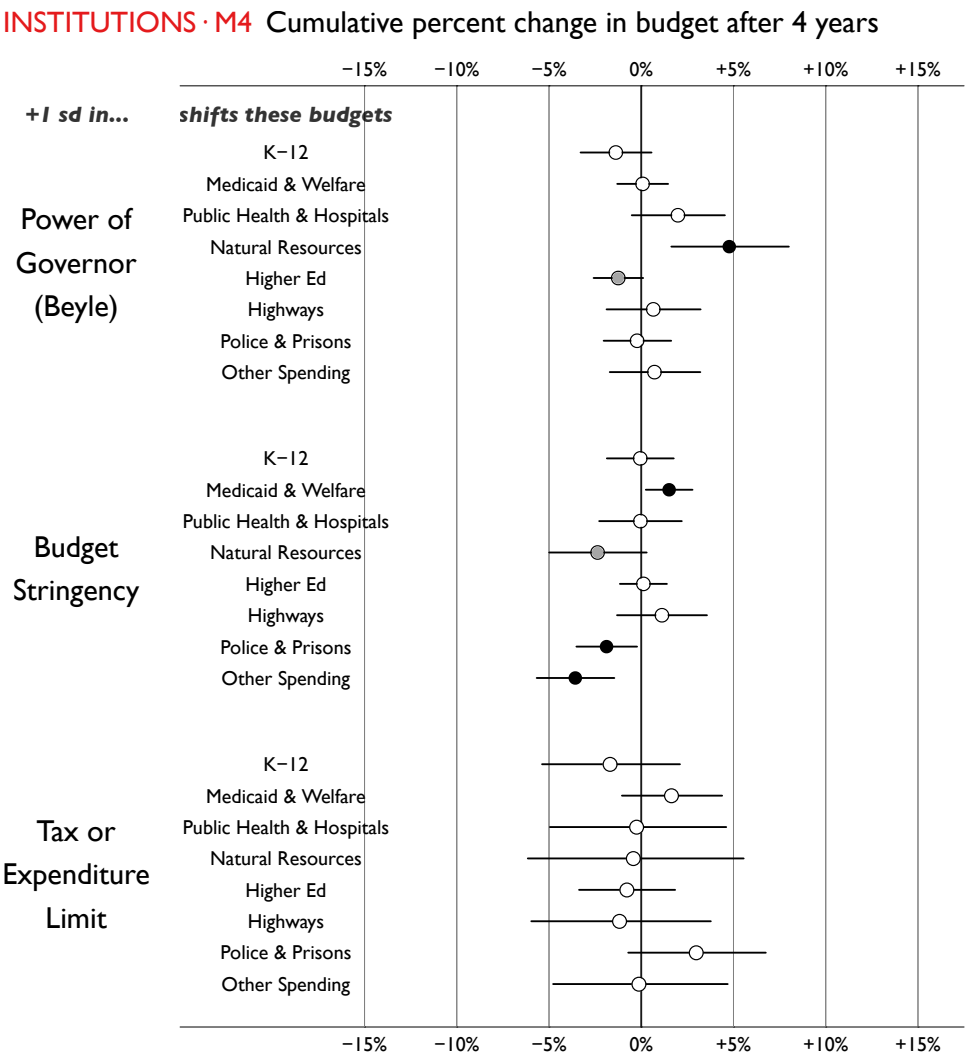

Figure A10. Estimated change in each budget component four years after institutional change: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

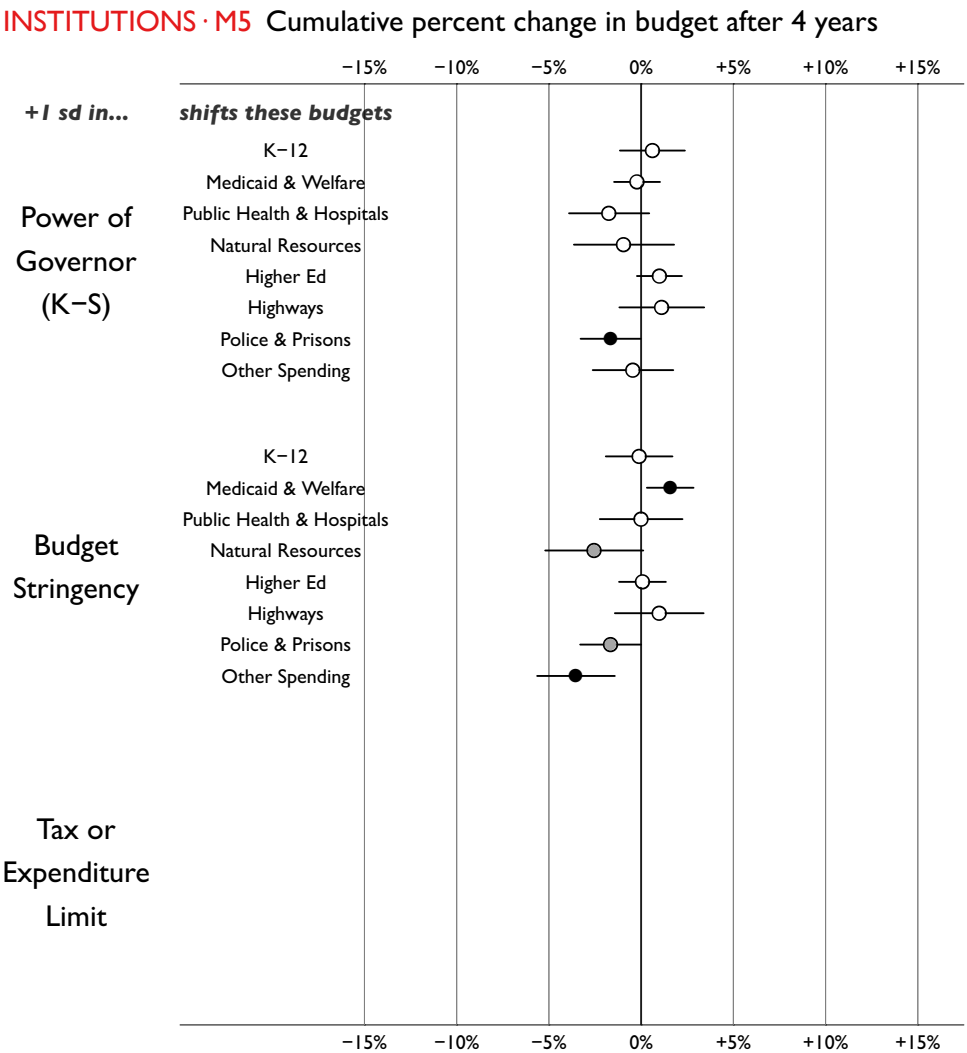

Figure A11. Estimated change in each budget component four years after institutional change: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

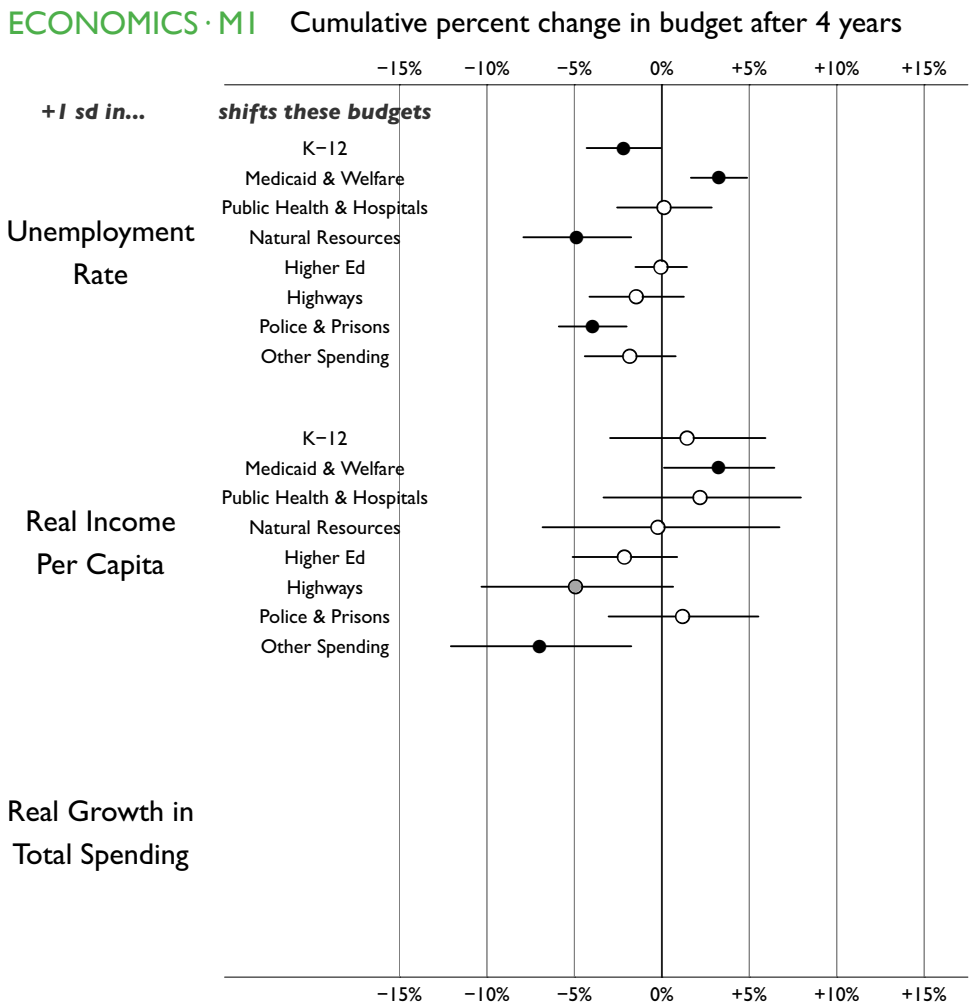

Figure A12. Estimated change in each budget component four years after a permanent economic shock: Baseline model (repeated as reference). Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

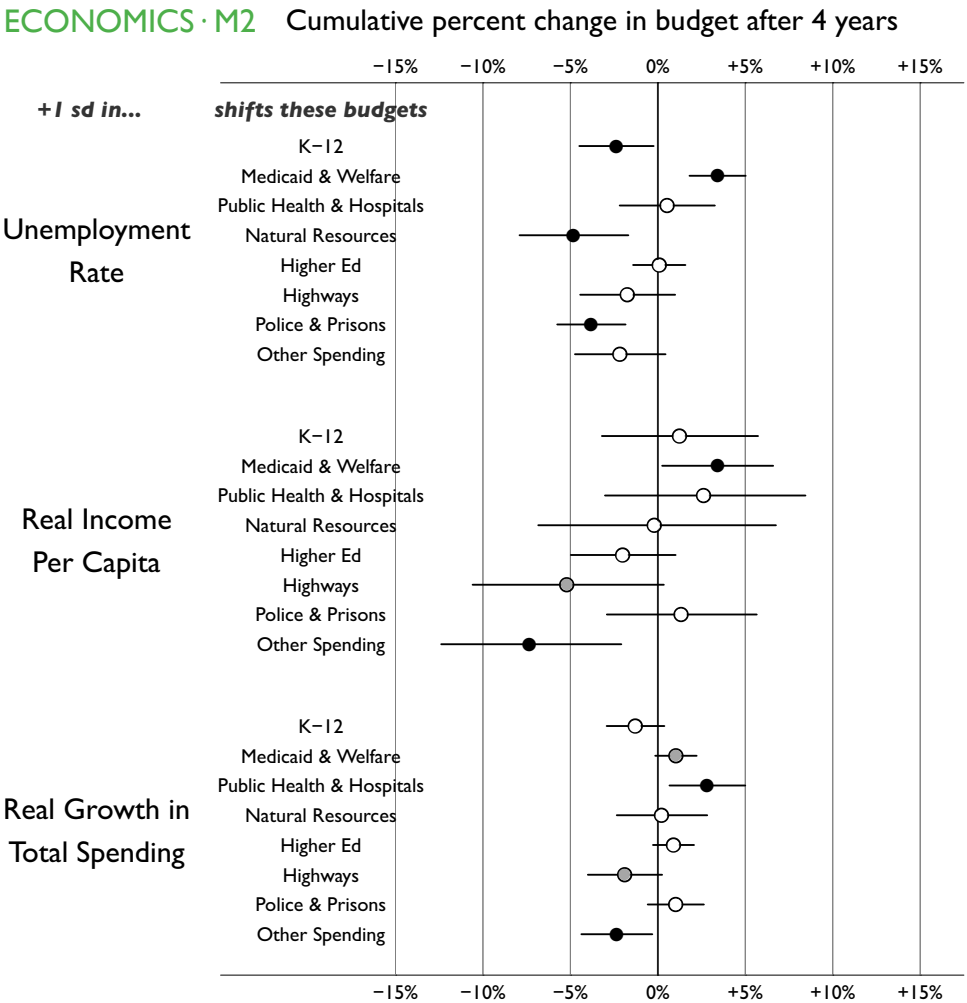

Figure A13. Estimated change in each budget component four years after a permanent economic shock: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

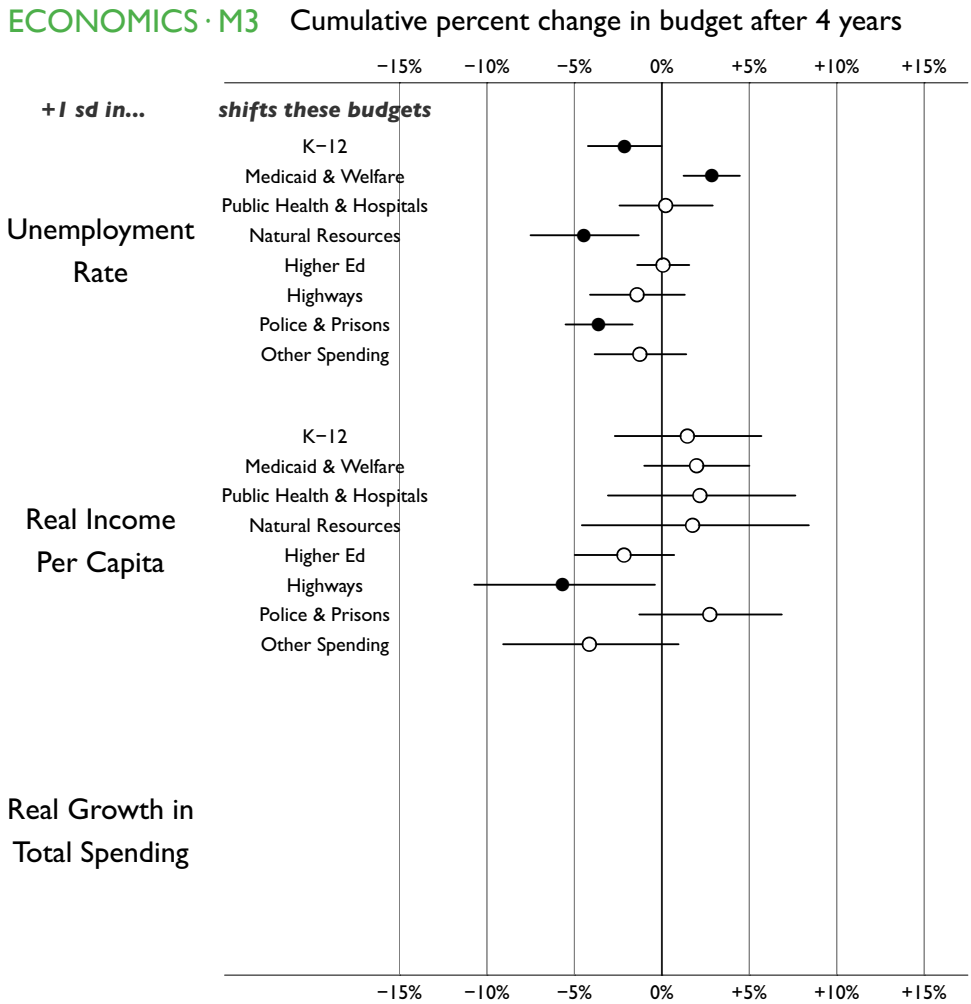

Figure A14. Estimated change in each budget component four years after a permanent economic shock: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

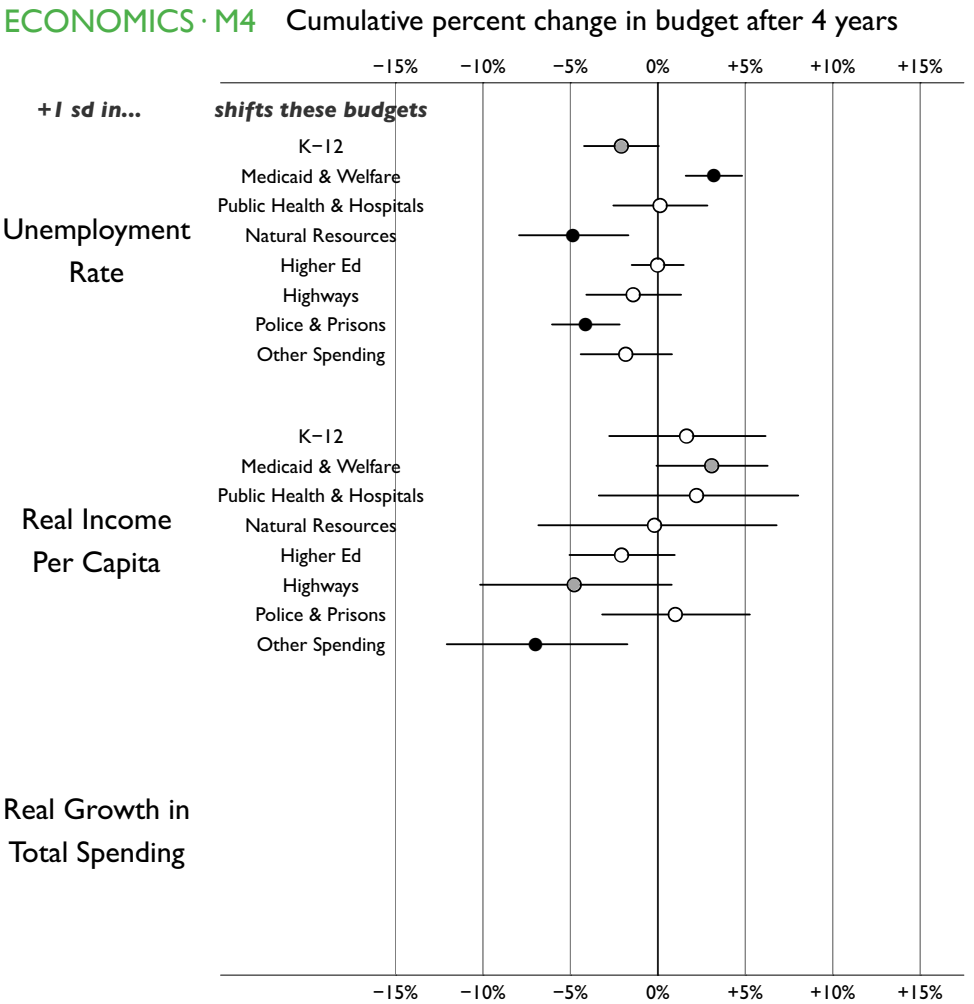

Figure A15. Estimated change in each budget component four years after a permanent economic shock: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

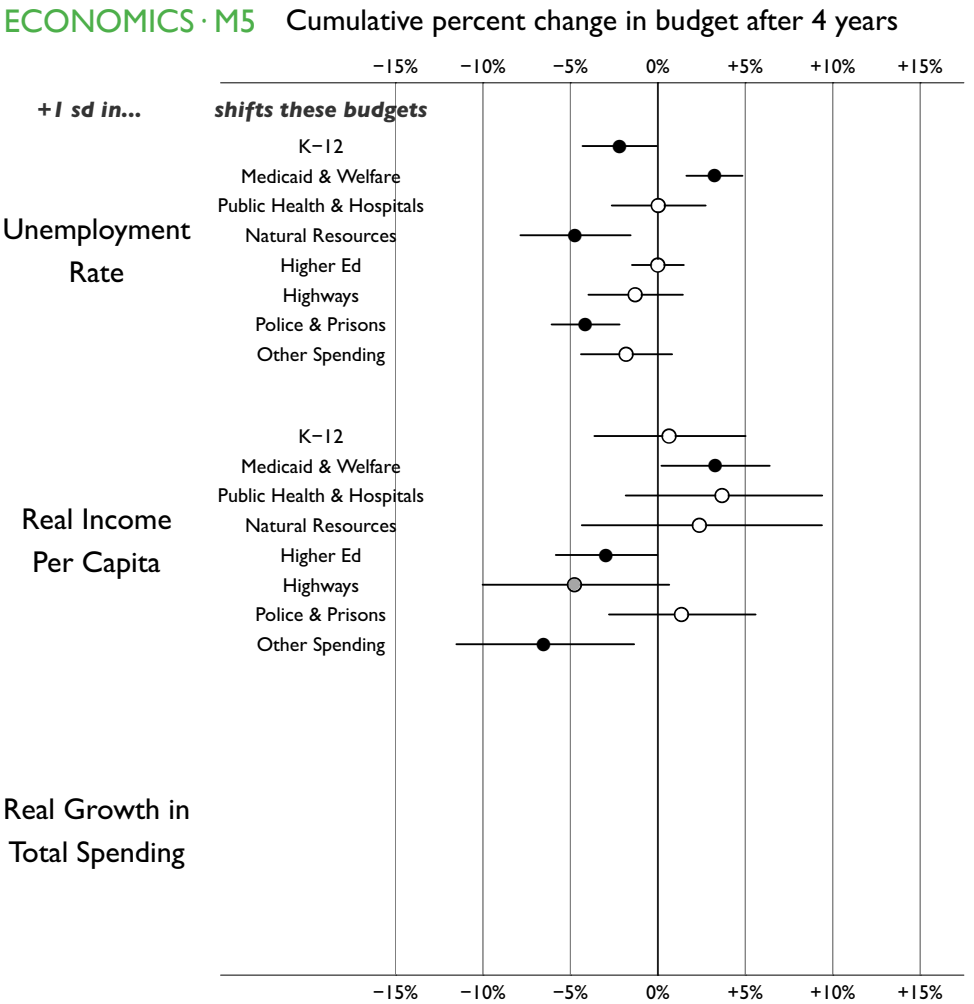

Figure A16. Estimated change in each budget component four years after a permanent economic shock: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

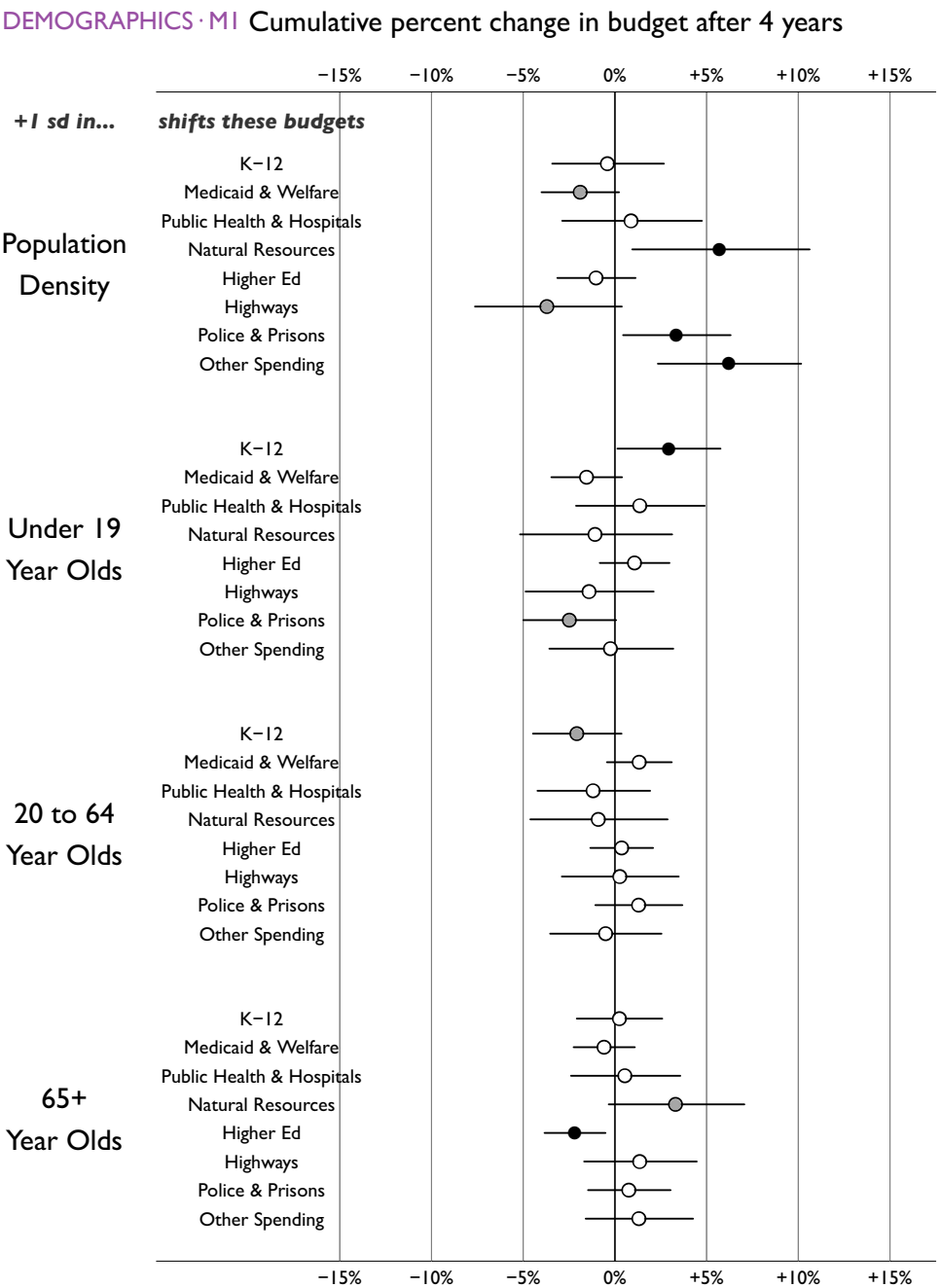

Figure A17. Estimated change in each budget component four years after demographic change: Baseline model (repeated as reference). Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

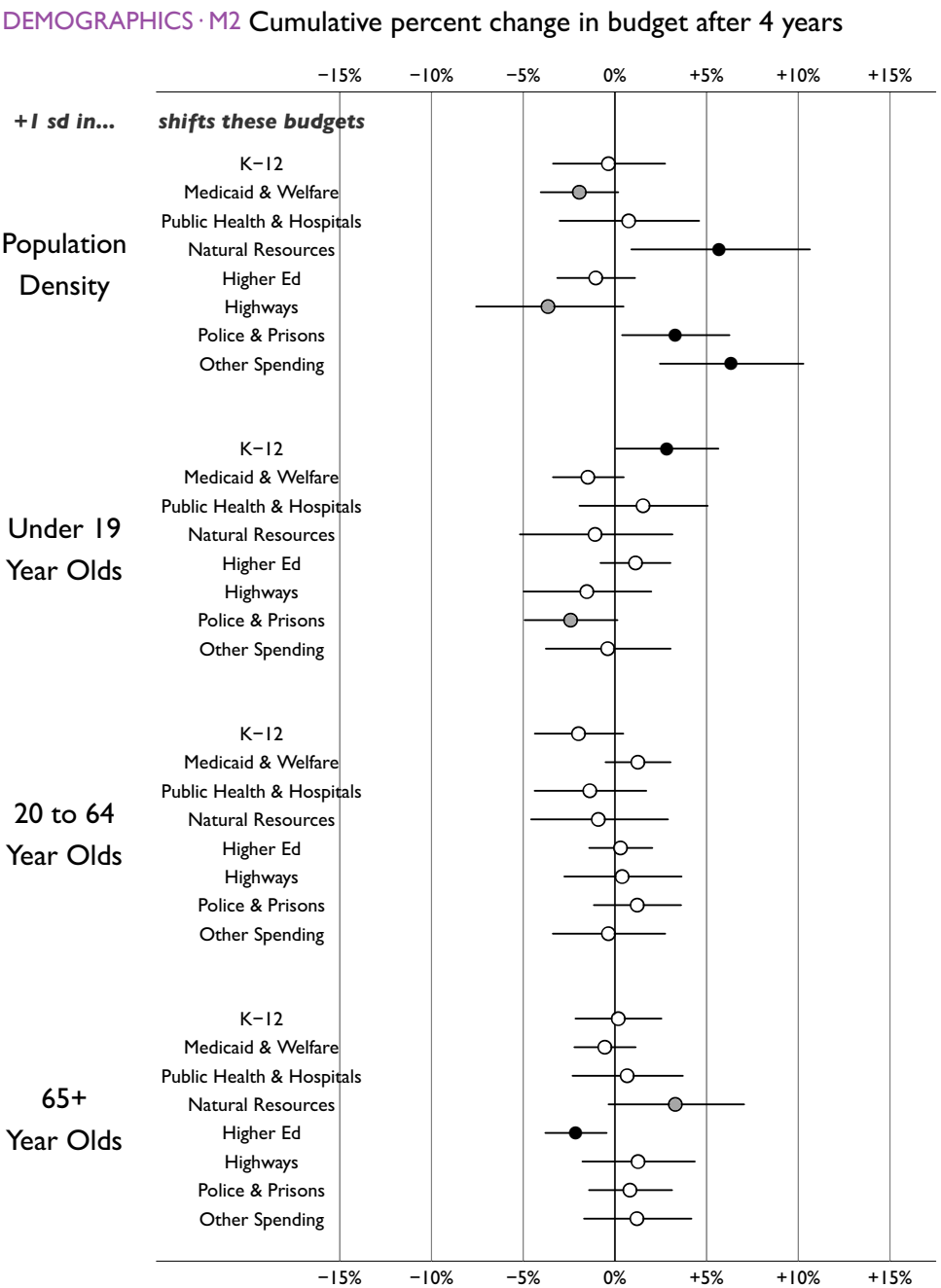

Figure A18. Estimated change in each budget component four years after a permanent economic shock: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

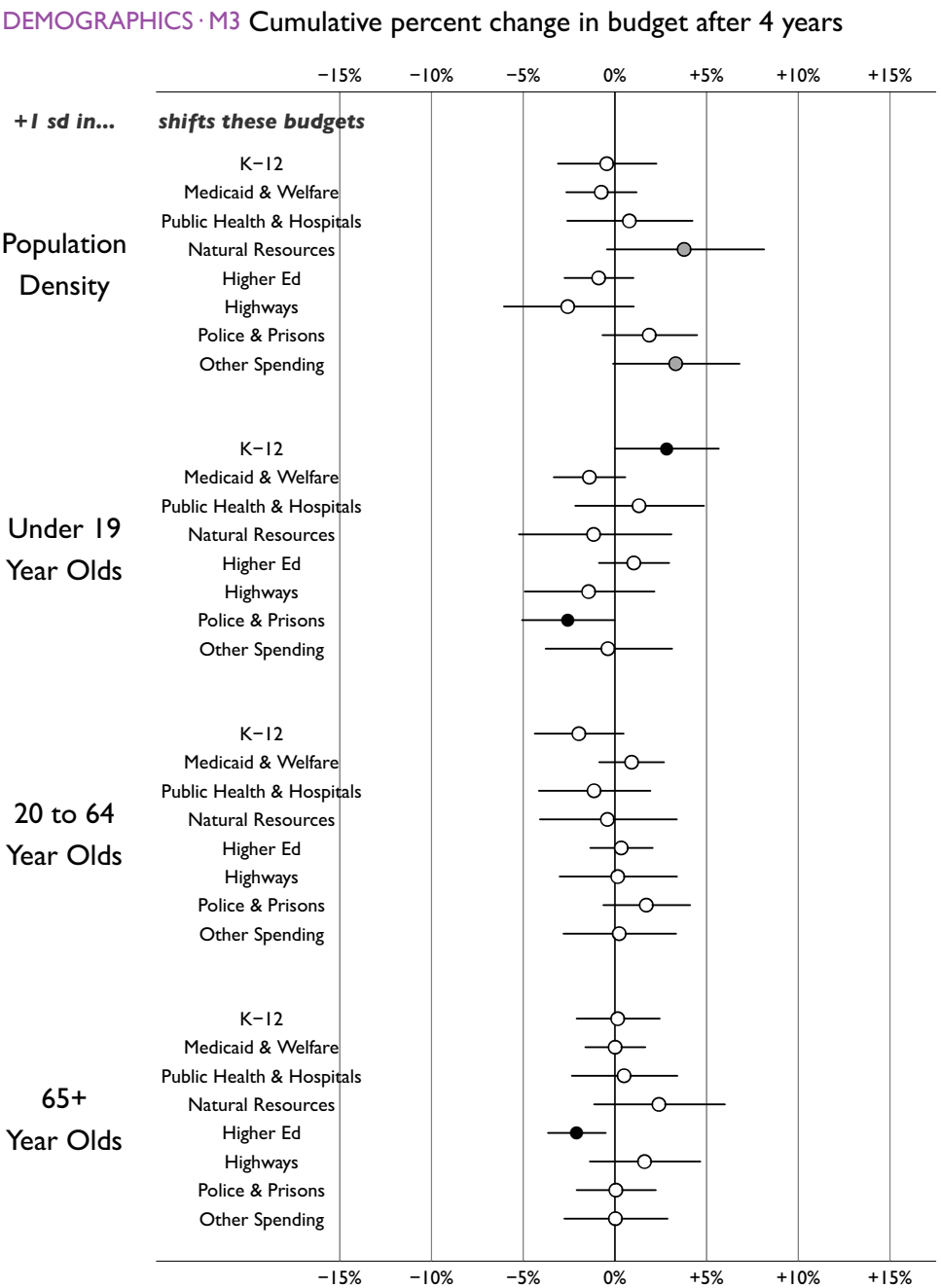

Figure A19. Estimated change in each budget component four years after a permanent economic shock: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

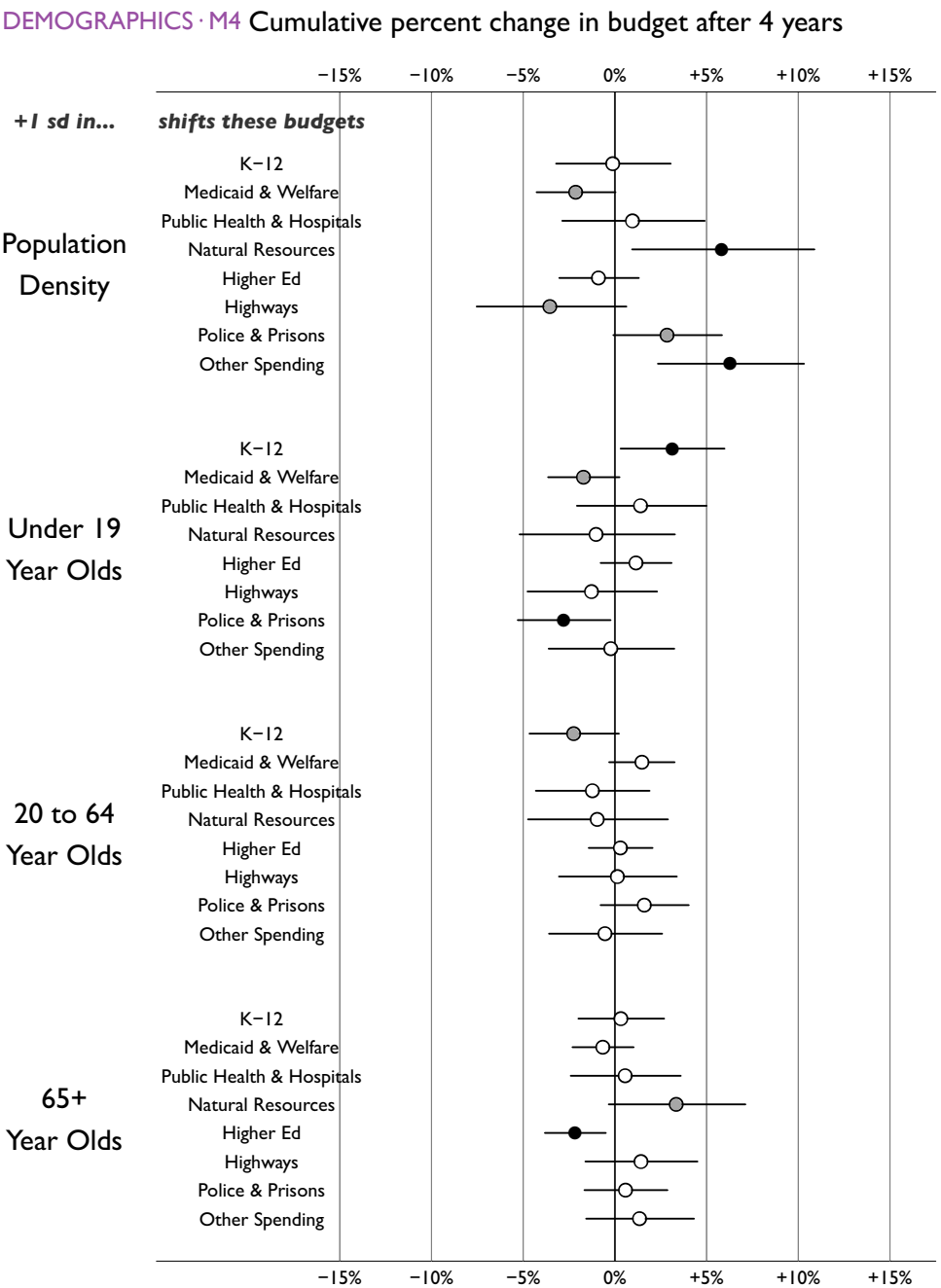

Figure A20. Estimated change in each budget component four years after a permanent economic shock: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

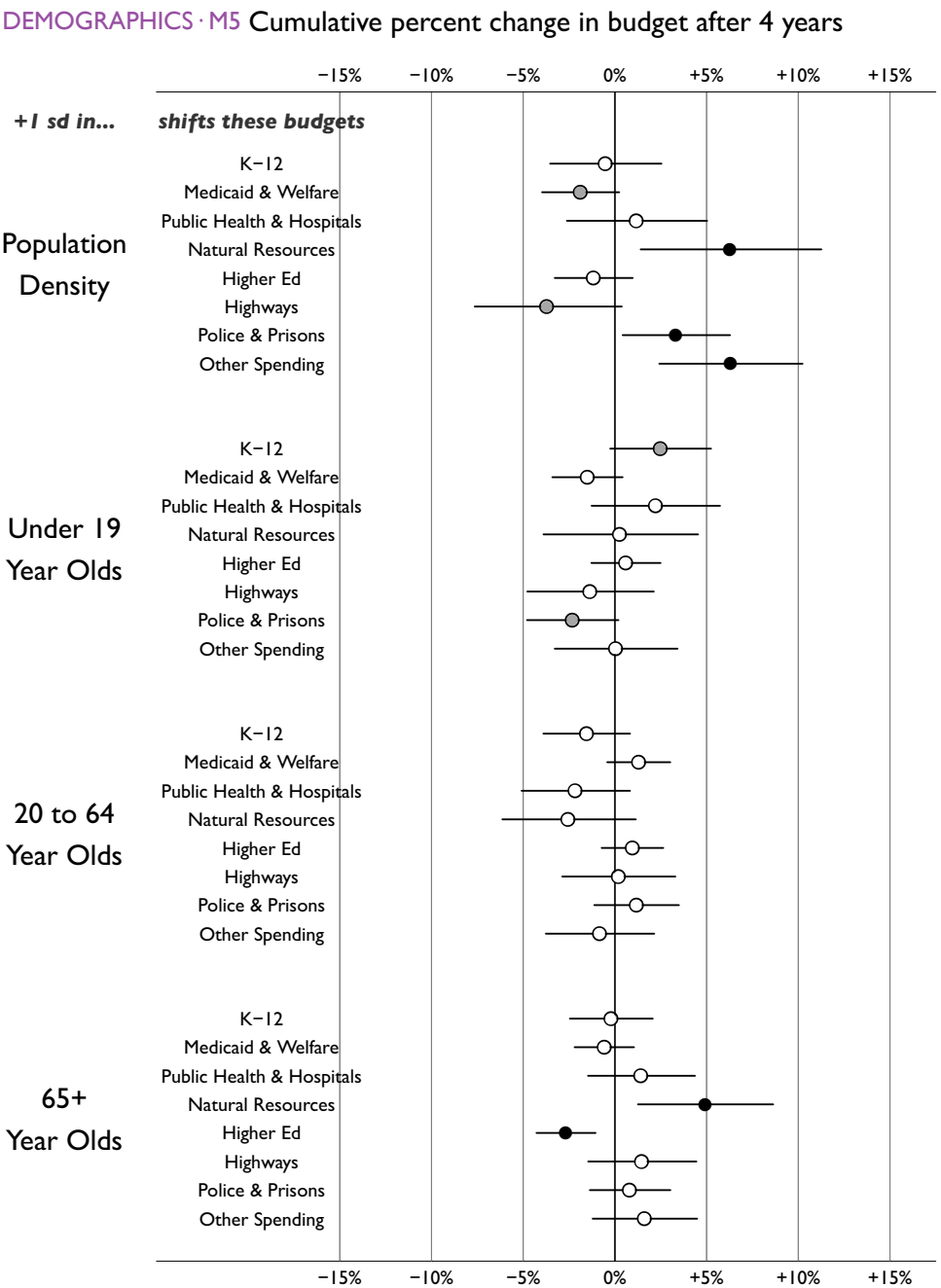

Figure A21. Estimated change in each budget component four years after a permanent economic shock: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

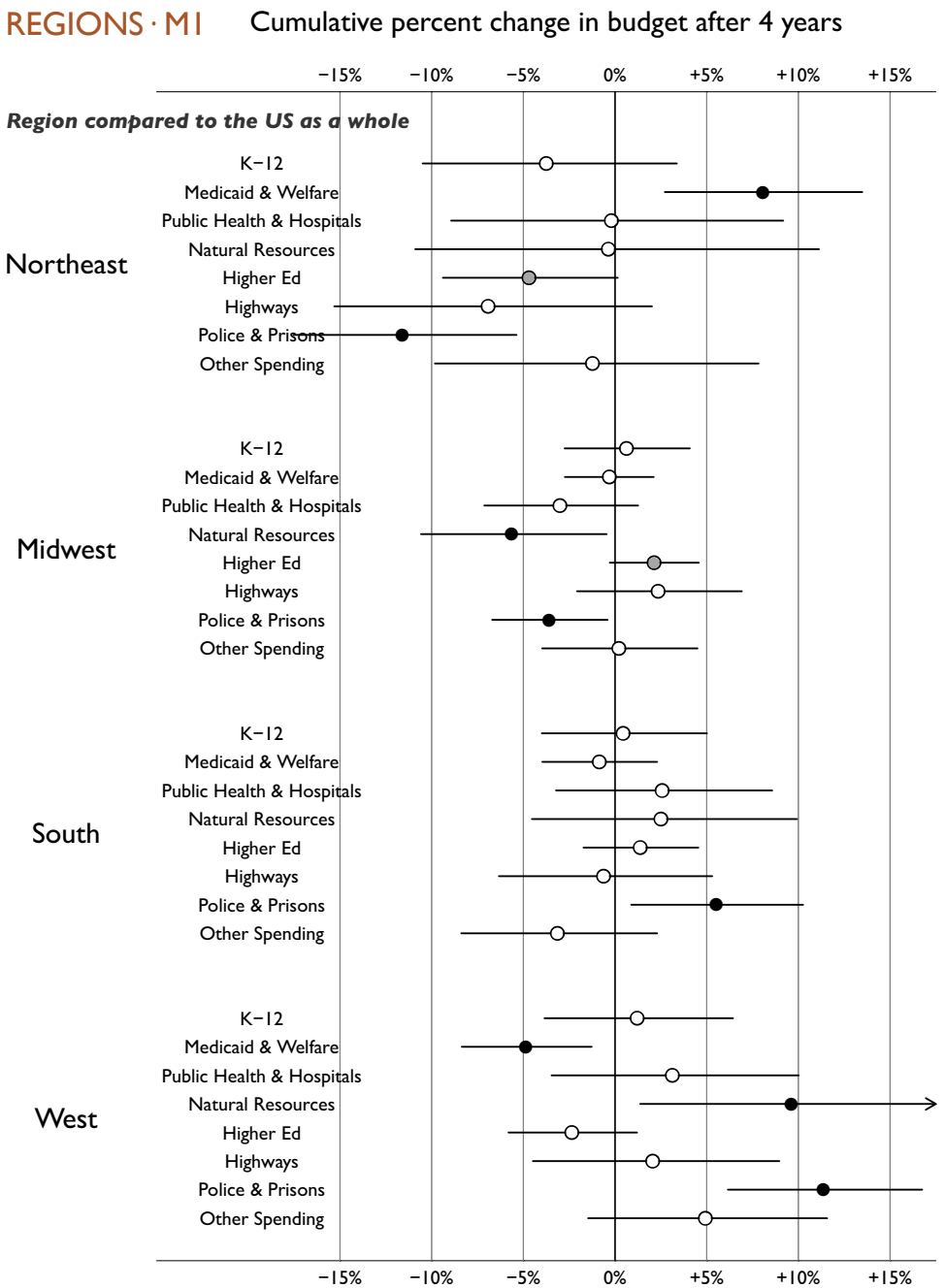

Figure A22. Estimated change in each budget component four years after hypothetical "region" change: Baseline model (repeated). Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

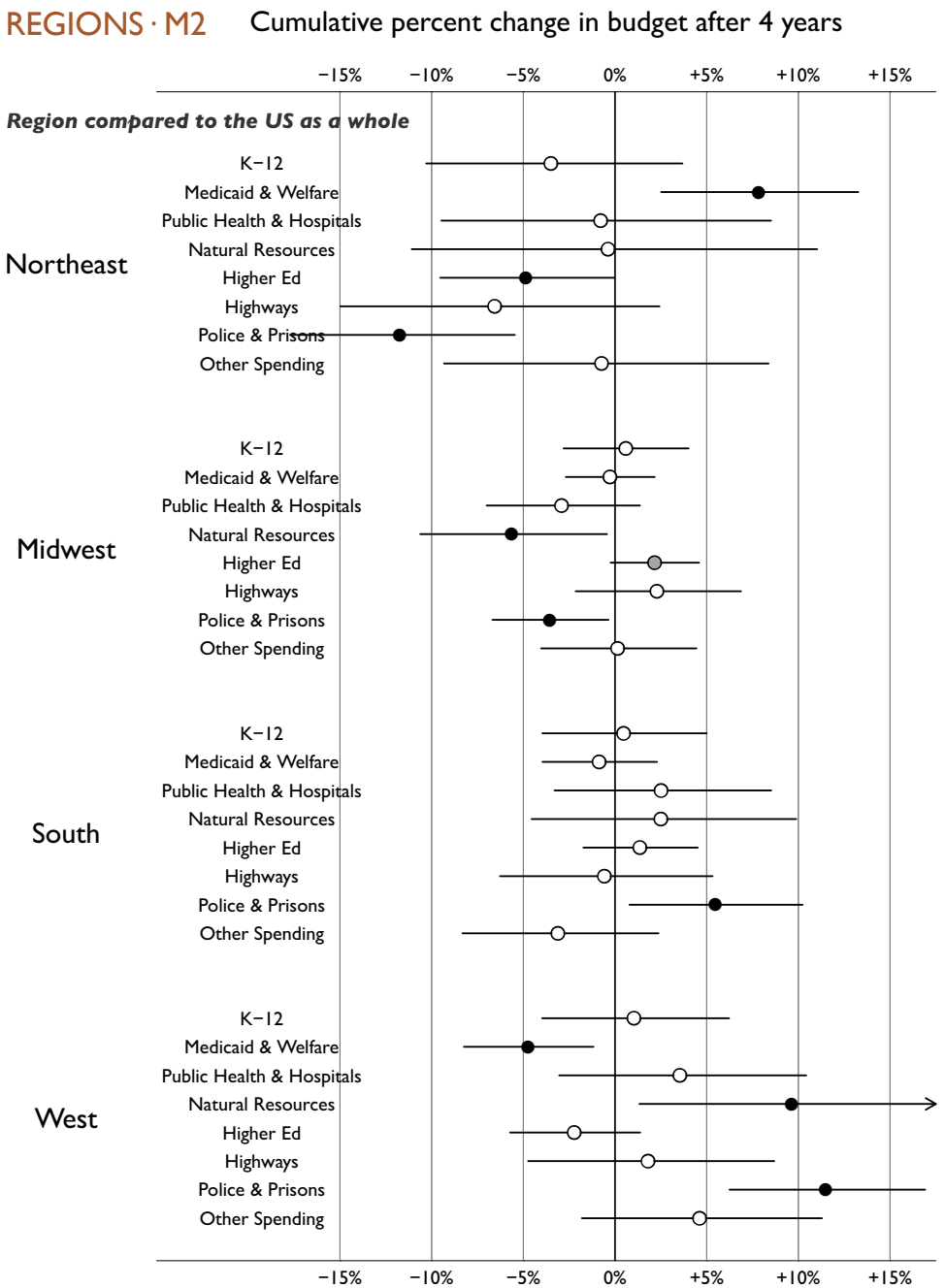

Figure A23. Estimated change in each budget component four years after hypothetical "region" change: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

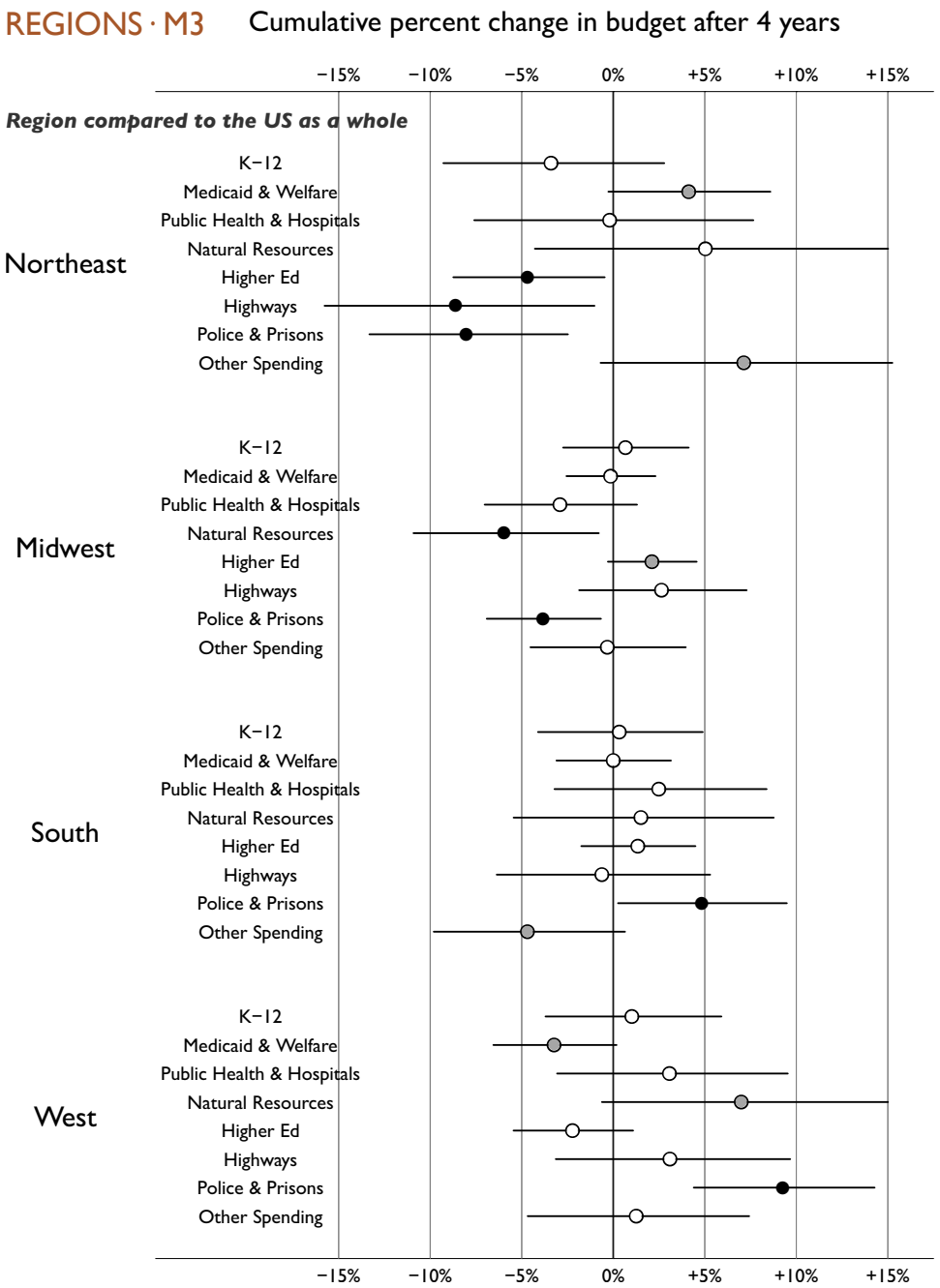

Figure A24. Estimated change in each budget component four years after hypothetical "region" change: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

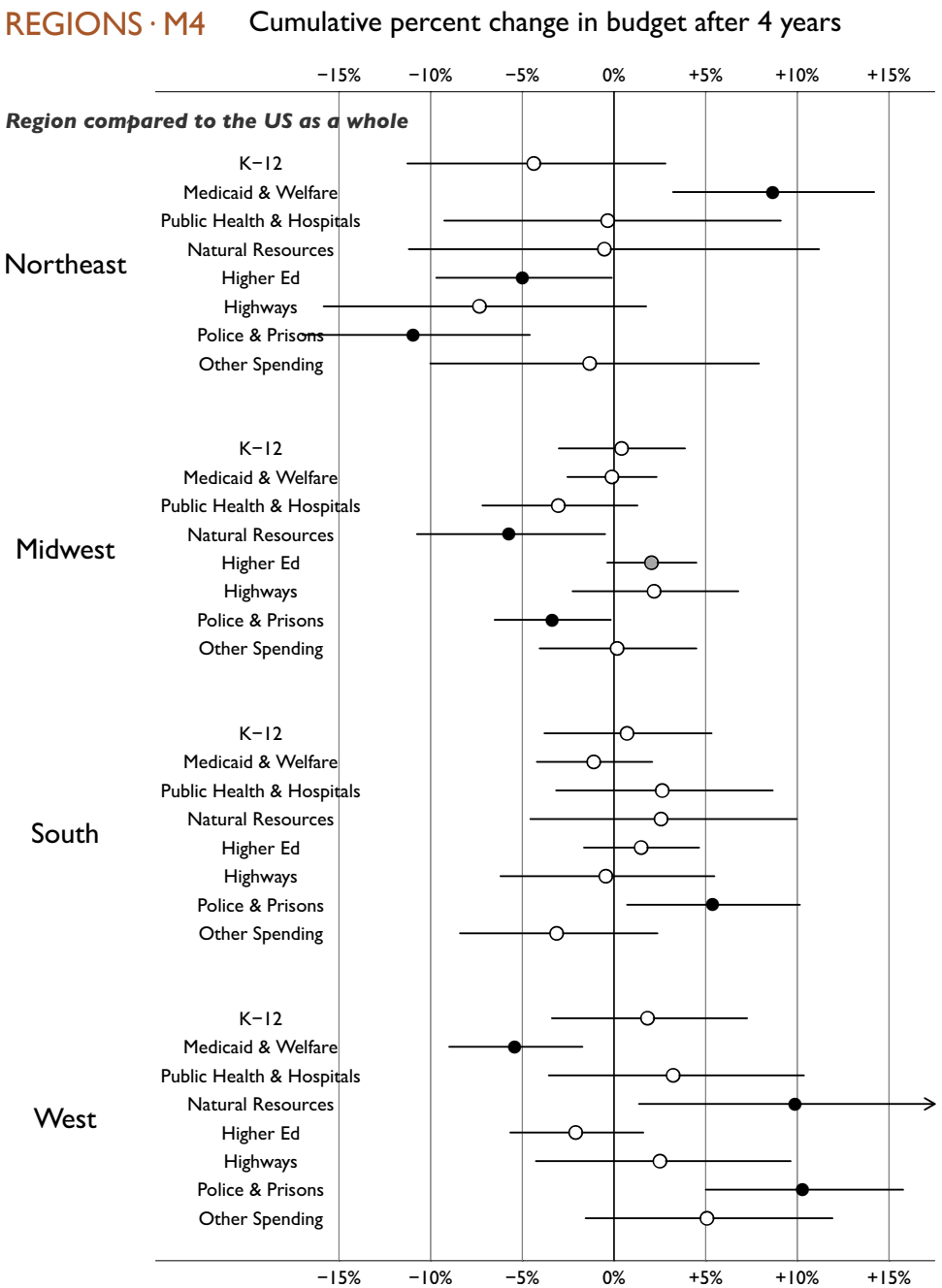

Figure A25. Estimated change in each budget component four years after hypothetical "region" change: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

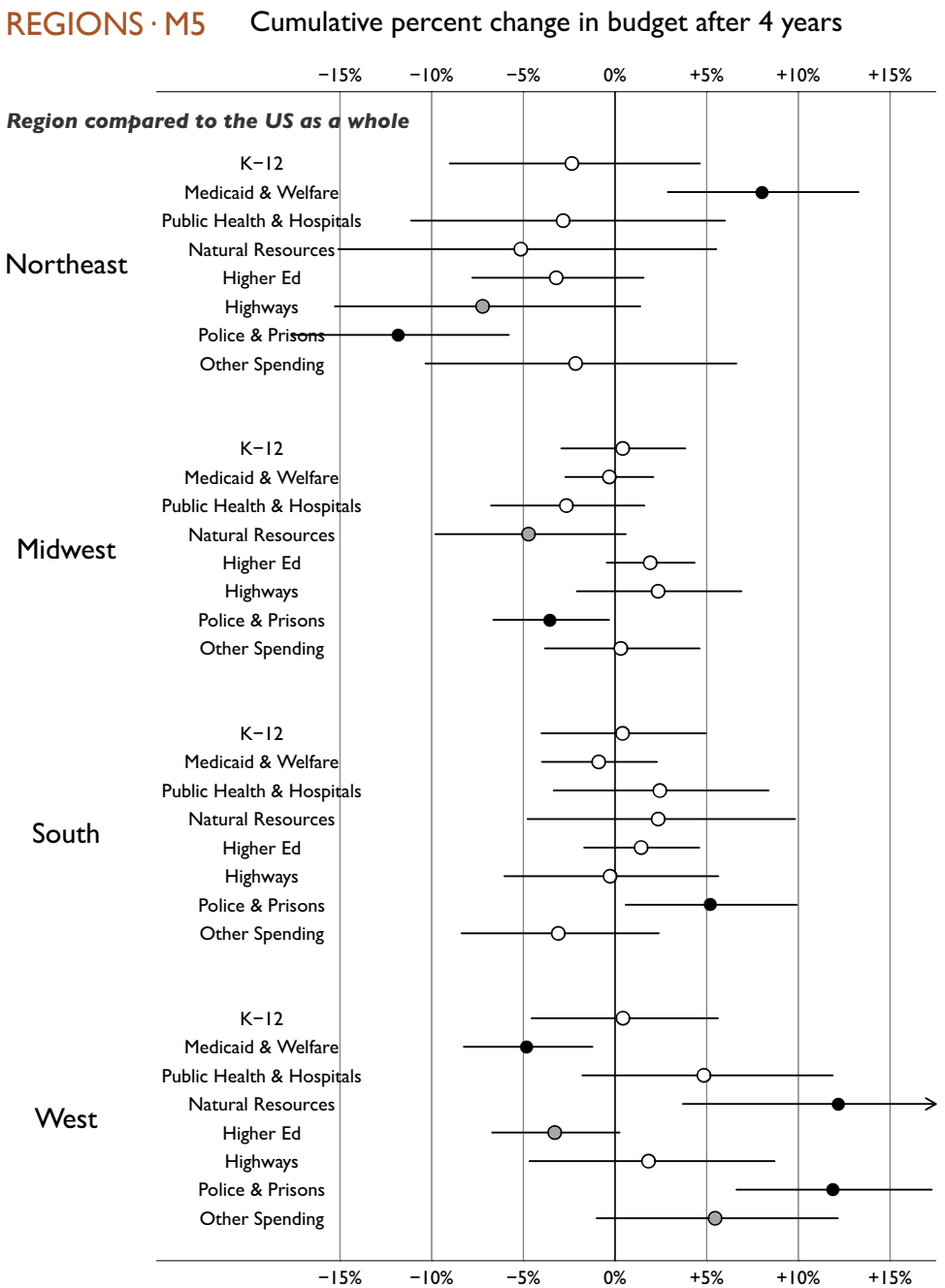

Figure A26. Estimated change in each budget component four years after hypothetical "region" change: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.