# Long and Variable Lags via State Fiscal Policy

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**Abstract**

We find that rigid, multi-stage budgeting processes in U.S. state governments create substantial delays in the transmission of monetary policy to public spending. Using newly assembled data on proposed and enacted state budgets, we show that a 10-basis-point contractionary monetary shock reduces state expenditure growth by 1–3 percentage points. This effect is driven almost entirely by cuts to initial budget proposals—which account for about 72 percent of the variation in realized spending—while subsequent revisions remain largely inert. Consequently, current expenditures primarily reflect monetary shocks that occurred 18–24 months earlier, embodying "long and variable lags." We further document two mechanisms underlying this response: downward revisions in revenue expectations and precautionary cutbacks driven by higher debt-service costs. Together, these findings show that state-level institutional rigidities represent a significant source of macroeconomic inertia.

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# 1 Introduction

How does monetary policy influence local fiscal policy? Standard macroeconomic models typically assume that fiscal authorities adjust instantaneously to monetary shocks through changes in borrowing or spending. Yet, as Friedman (1961) famously observed, monetary policy operates with "long and variable lags" in its effects on the real economy. The existing literature has largely attributed these lags to behavioral and nominal rigidities in the private sector—such as inattentive consumers (Lucas, 1973; Mankiw and Reis, 2002) and sticky prices and wages (Woodford, 2003; Christiano et al., 2005; Smets and Wouters, 2007).[1] By contrast, the dynamics of adjustment within the public sector remain poorly understood. This omission is important: state and local governments account for more than 15% of U.S. GDP and finance essential services such as education, infrastructure, and public safety.

In this paper, we show that rigid, multi-stage budgeting processes in U.S. states generate significant delays, such that monetary shocks today shape state spending outcomes 18-24 months later. These delays stem from binding institutional constraints: sequential planning phases, legislative revisions, and balanced-budget requirements that prohibit deficit financing of operating expenditures.[2] While state governments exhibit some of the most stringent institutional constraints, similar frictions likely characterize other large economic entities such as federal agencies, corporations, and universities.

To uncover and empirically test this mechanism, we hand-collect and digitize a novel panel of line-item-level data on budgeted and realized revenues and operating expenditures for U.S. states from 1995 to 2024. Operating expenditures account for roughly 95% of total state spending as of 2021, with only 5% devoted to capital outlays, ensuring that our data capture the vast majority of states' fiscal activity.

Our central finding is that institutional frictions in state budget planning constitute a fundamental source of macroeconomic inertia. States adjust their fiscal plans proactively during the budget-planning stage, incorporating macroeconomic forecasts into proposed expenditures. Once budgets are enacted, however, subsequent deviations are severely limited

[1] Other explanations emphasize adjustment frictions arising from the slow and costly reallocation of capital and labor across heterogeneous firms and sectors (Ramey and Shapiro, 2001; Asker et al., 2014), as well as the time-to-build nature of investment projects (Kydland and Prescott, 1982; Abel and Eberly, 1994).

[2] On institutional constraints in state budgets, see foundational works such as Poterba (1994, 1996).

by procedural rigidity and political costs, rendering fiscal policy largely unresponsive to contemporaneous shocks. Consequently, contractionary monetary shocks reduce budgeted expenditures only when they occur within the initial planning window, whereas shocks arriving after budget approval have little to no effect. This institutional channel generates a delayed and asymmetric transmission of monetary policy to public spending, with lags extending up to 24 months. While our focus here is on monetary policy, these institutional constraints likely generalize to the transmission of other policies and shocks.

To formally establish these results, we exploit the structure of our new dataset to trace how states respond to monetary shocks throughout the budget cycle. The data provide three key advantages for identification and interpretation. First, by observing budgeted figures—which record policymakers' ex ante commitments—we can pinpoint the timing of fiscal decisions and identify when adjustments to monetary shocks actually occur. Second, by tracking revenue expectations in both initial and revised budgets, we can observe how policymakers update beliefs in response to new information and link these revisions to contemporaneous spending choices. Third, because these plans are formulated before the fiscal year begins, they are insulated from the reverse causality that typically confounds analyses based solely on realized spending, thereby sharpening identification of monetary policy's causal effect on fiscal behavior (Nakamura and Steinsson, 2018).

Three stylized patterns in our data underscore the central role of initial budgets in shaping fiscal outcomes. First, expenditures at all stages—budgeted, revised, and realized—move closely with contemporaneous revenues. This tight link is consistent with the binding nature of balanced-budget requirements and statutory restrictions on borrowing to finance operating expenditures (Poterba, 1994), establishing a fundamental institutional constraint. Second, initial budgets are not just forecasts but strong predictors of actual spending. Despite being formulated six to twelve months in advance, the initial budget explains roughly 72 percent of within-state variation in actual expenditures versus 48 percent of actual revenues. In contrast, mid-year revisions and execution-phase adjustments show only weak correlations with final outcomes. Thus, initial budgets are important commitments that largely determine fiscal outcomes. Finally, we document that only initial budgets respond systematically to contemporaneous macroeconomic shocks, such as changes in GDP or the S&P 500. This pattern identifies the planning stage as the primary—indeed, nearly exclusive—margin of fiscal adjustment to evolving economic conditions.

Guided by these facts, we develop a simple theoretical framework of state budgeting decisions. In the model, states commit to spending plans before uncertain revenues are realized, subject to two binding constraints: actual spending cannot exceed either the budgeted amount or realized revenues, and over-budgeting entails costs—such as reputational loss or political penalties—when revenues fall short. The framework yields two main testable predictions. First, contractionary shocks reduce expected revenues and raise debt-servicing costs, inducing states to cut planned—and consequently realized—expenditures. Second, the responsiveness of realized expenditures is concentrated in monetary shocks that materialize during the planning stage, with minimal adjustment to shocks that arrive after budgets are finalized.

We test these predictions by estimating the causal impact of monetary policy on state fiscal behavior using high-frequency identification. We employ monetary policy shocks (MPS) from Bauer and Swanson (2023) and Romer and Romer (2004), which capture exogenous changes in market yields during narrow windows around Federal Reserve announcements and speeches. These shocks are aggregated to align with the timing of each budgetary phase, allowing us to trace their effects throughout the budget cycle.

The empirical results provide strong support for both predictions. Regressing annual changes in realized spending on monetary policy shocks , we find that contractionary shocks during the initial budgeting phase—the six months preceding the budget proposal—significantly reduce total state expenditures. Specifically, a 10 basis point contractionary shock reduces expenditure growth by approximately 1-3 percentage points. Given total state operating expenditures of $2.7 trillion in 2021, this estimate implies an aggregate spending reduction of up to $81 billion. In contrast, and consistent with our first prediction, expansionary monetary shocks generate no statistically or economically significant effects.

To identify precisely when fiscal adjustments occur within the budget cycle, we decompose the total response of realized expenditures across the three phases of the budgeting process—planning, revision, and execution. The estimates reveal that expenditure reductions materialize almost entirely during the planning phase, with minimal adjustment during mid-year revisions or execution. This concentration of fiscal response demonstrates that binding budget commitments formed six to twelve months before execution create substantial delays in how monetary policy affects state spending.

We also corroborate these micro findings using aggregate National Income and Product

Accounts data and local projections (Jordà, 2005). Because most states formulate initial budgets in January, we treat calendar Q4 (October–December) as the planning window and estimate separate impulse responses to monetary policy shocks arriving in Q4 versus Q1–Q3. The responses exhibit sharp timing dependence: Q4 shocks generate large, statistically significant declines in aggregate state spending that appear about 21 months after the shock—consistent with the institutional lag from budget formulation to execution—whereas identically sized shocks in Q1–Q3 produce no detectable fiscal response. This asymmetry indicates that rigid, multi-stage budget institutions mediate a quantitatively meaningful and underappreciated channel of monetary transmission.

Through what mechanisms do monetary policy shocks affect state fiscal expenditures? Within our framework, two core channels emerge. First, there is a revenue-expectations channel, in which planners anticipate that tighter monetary policy will slow economic activity and reduce tax receipts, and therefore cut spending plans preemptively. Second, there is a debt-service channel, in which higher expected borrowing costs for capital projects raise future interest obligations and induce precautionary tightening of current operating expenditures. Moreover, the magnitude of fiscal response varies across states: those with more interest-sensitive revenues (e.g., from capital gains or corporate taxes) and debt service obligations exhibit stronger pass-through from monetary policy to spending, as do states facing more stringent balanced-budget rules.

Our empirical evidence strongly supports both channels. First, we find that states systematically revise their revenue expectations downward when monetary conditions tighten. Consistent with the revenue channel, contractionary shocks in the six months before budget proposals significantly reduce both budgeted and actual revenues. States with revenue streams most sensitive to monetary policy shocks—those with highly cyclical tax bases—display the largest cuts in planned expenditures. However, when we control for revenue revisions, the expenditure response, while attenuated, remains significant—indicating that additional channels are at work.

Second, our results confirm the debt-service channel predicted by the model. We document that higher policy rates increase state interest expense payments. States with greater exposure to interest-rate risk or wider credit spreads respond by implementing sharper cuts to budgeted expenditures following contractionary shocks, demonstrating how rising debt service costs constrain fiscal flexibility.

Beyond these financial channels, our evidence validates the model's emphasis on institutional rigidities. We find that states with more stringent balanced-budget requirements or lower per-capita income—where public expenditures have high marginal value and political costs of adjustment are higher—exhibit the strongest planning-phase responses to monetary tightening. This pattern confirms the model's prediction that institutional frictions create state-dependent heterogeneity in fiscal responses.

Together, these results provide comprehensive empirical validation for our theoretical framework. They demonstrate that monetary policy transmits to subnational spending not only through conventional revenue and cost channels but also through the institutional rigidities of the budget process itself—mechanisms that collectively explain the approximately 18-24 month lag in fiscal response documented throughout our analysis.

Understanding how monetary policy interacts with local fiscal policy holds important implications. First, we shed new light on the classic "long and variable lags" in monetary transmission (Friedman and Schwartz, 1963; Friedman, 1961). Unlike theories that attribute these lags to slow information diffusion or nominal rigidities (Lucas, 1973; Mankiw and Reis, 2002; Coibion and Gorodnichenko, 2015), our evidence shows that the delay stems from the budget process itself: planners appear to absorb new information promptly, but once budgets are enacted, balanced-budget rules and legislative procedures prevent mid-year revisions. Furthermore, analyzing monetary policy's impact on state fiscal behavior enhances our broader understanding of how financial frictions influence real economic outcomes. Given the central role that state fiscal institutions play in managing economic shocks, clearly identifying how these institutional constraints mediate monetary policy transmission is crucial. Lastly, amid growing debates on federal fiscal sustainability and increasing demands for tighter federal spending controls, examining state governments–which operate under more restrictive fiscal and institutional conditions–provides valuable insights into fiscal management and the potential implications of increased spending discipline at the national level.

Our work speaks to the interaction between monetary policy and fiscal policy, which typically focuses on the federal level (Samuelson, 1954; Leeper, 1991; Sargent, 2012; Bouscasse and Hong, 2023). One of the challenges in this literature is that when analyzing both monetary and fiscal policy at the federal level, a question arises of which policymaker may follow or react to the other, creating complicated interactions (Dixit and Lambertini, 2003a; Bianchi, 2012; Bianchi and Ilut, 2017). Wiegand (2025), for example, studies how revisions

to planned U.S. federal spending impact interest rates. Studying state governments helps simplify this problem somewhat, as it is much more likely that state-level fiscal decisions are responding to, rather than influencing directly, interest rates or monetary policy (similar to how Dixit and Lambertini (2003b) studies fiscal policy in the European monetary union). Thus, we can more directly study the first-order fiscal response to monetary policy while being less concerned with reverse causality. Contemporary macroeconomic models, including Kaplan et al. (2018) and Auclert (2019), model government's response to interest rate changes as immediate, via the government's budget constraint. Our contribution lies in empirically identifying how expectations of monetary policy and borrowing costs influence state-level fiscal decisions, particularly in the presence of institutional constraints. A recent paper Wilson (2022) documents a municipal channel of monetary policy, where municipal bond yields respond to changes in Treasury yields with a dampened pass-through, and uses a New Keynesian model to show that monetary transmission is affected by municipal borrowing costs. Unconventional policy targeting municipal bonds also eases credit constraints and helps smooth spending (Bi and Traum, 2023; Haughwout et al., 2022). We build on these works by going one step further and showing the real effects on spending in response to monetary policy changes.

A growing literature studies how expectations play a crucial role in economic decision-making (Manski, 2004). Many papers study the expectations of firms and how these expectations shape investment decisions (Ma et al., 2020; Gennaioli et al., 2016; Selgrad and Siani, 2025). Our work contributes to this literature by providing empirical evidence on how expectations of future interest expense and revenues shape fiscal planning and execution at the state level, which is an understudied but significant share of GDP.

Finally, we contribute to the literature on local government financing and the real effects of shocks to this market. Many papers document that shocks to local government borrowing can have real effects; Adelino et al. (2017) and Adelino et al. (2020) show that changes in municipal bond ratings can have significant effects on local economies, and Yi (2021) shows that changes in municipal credit access has a significant effect on local service provision. Giesecke et al. (2022) show that the financial health of municipal governments is experiencing a secular decline. Our study adds to this literature by analyzing how monetary policy shocks impact state government spending and borrowing decisions, considering the constraints imposed by institutional frictions. A related literature studies how political institutional constraints interact with spending and borrowing (Poterba, 1994, 1996; Liebman

and Mahoney, 2017); we contribute to this literature by constructing and analyzing the most comprehensive data on budgeted and actual state-level spending, providing direct evidence of the delays associated with budgeting processes. While the focus is on monetary policy effects, our results can be generalized to understanding delays in the transmission of broader financial market disruptions to the real economy as well.

The rest of the paper is organized as following: Section 2 discusses the institutional context and introduces the data. Section 3 presents stylized facts characterizing state budgeting and spending. Section 4 presents a model of fiscal spending motivated by these facts and lays out hypotheses we can empirically test with the new data. Section 5 presents our empirical results, Section 6 shows evidence of mechanisms, and Section 7 concludes.

# 2 Institutional Background and Data

## 2.1 The Composition and Financing of State Spending

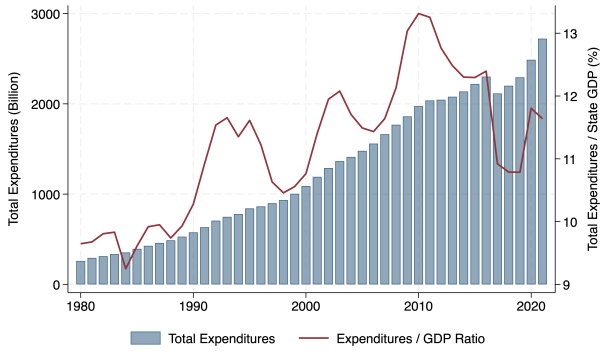
State governments play a substantial role in the U.S. economy. Over the past four decades, state expenditures have expanded from about $260 billion in 1980 to $2.7 trillion in 2021; as a share of GDP, this represents an increase from under 10% to nearly 12% (see Panel (a) of Figure 1).

Beneath this aggregate expansion lies a clear compositional shift. As shown in Panel (b) of Figure 1, operating expenditures—covering education, healthcare, and welfare programs—have increased from about 90% of total state spending in the early 1980s to more than 95% by 2021. In contrast, capital outlays—including infrastructure and other long-term investments—have declined from roughly 10% to less than 5% of total expenditures. The dominance of operating expenditures makes their responsiveness to macroeconomic conditions central to understanding state fiscal behavior.

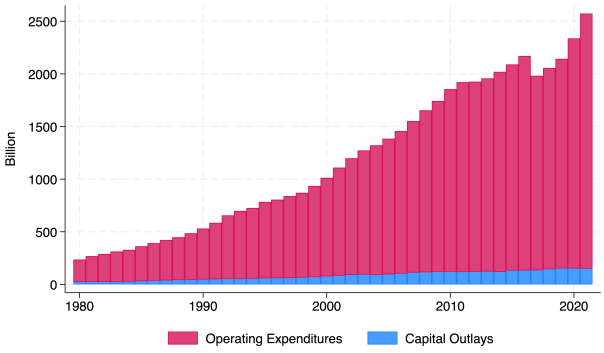
The financing of these two expenditure types also differs systematically. As Figure 2 shows, operating expenditures are financed primarily through general fund revenues—including taxes and fees (about 50%)—and federal transfers (roughly 25%), while municipal bonds account for less than 1%. Capital outlays, by contrast, rely heavily on debt markets, with municipal bonds funding roughly 30% of total spending.

**Figure 1:** Composition of State Expenditures Over Time

This figure presents U.S. state government spending trends from 1980 to 2021 using data from the Annual Surveys of State and Local Government Finance. Panel (a) shows total state expenditures as a share of GDP, while Panel (b) displays the composition of spending, distinguishing between current expenditures and capital outlays.




**(a)** Total Expenditure




**(b)** Expenditure Composition

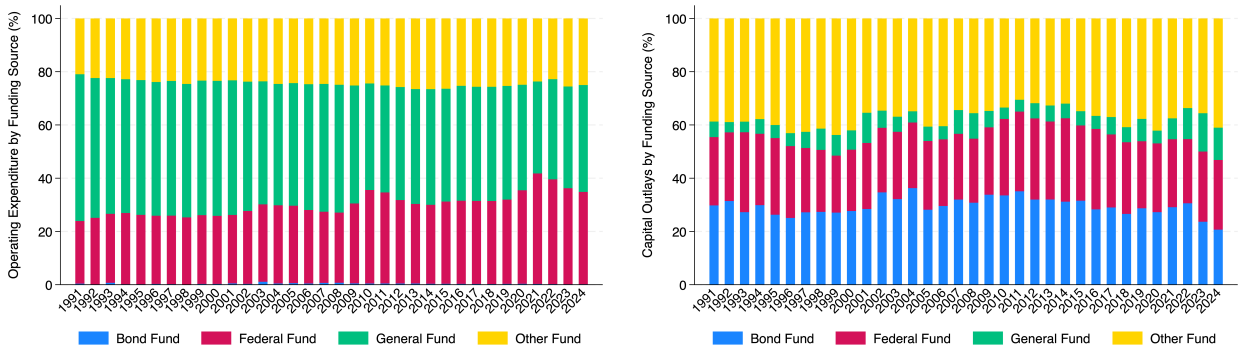
The near absence of debt financing for operating budgets stems from binding legal and institutional constraints that prohibit the use of bond proceeds for operating expenditures. These restrictions operate through multiple reinforcing mechanisms. First, constitutional balanced-budget requirements in all states except Vermont mandate that operating expenses be covered by current revenues rather than debt financing (Poterba, 1996). Second, federal tax code provisions limit the tax-exempt status of municipal bonds to capital projects, creating strong market incentives against issuing debt for operating expenses.[3] Together, these legal and market constraints create a sharp institutional separation between operating and capital financing.

It is important to note that although capital outlays are debt-financed, the debt service on those bonds is paid from operating budgets. State general funds are legally obligated to cover both principal and interest payments on outstanding general obligation debt as mandatory expenditures. As shown in Figure IA.1, interest payments account for about 3%

[3]The consequences of violating these institutional constraints are illustrated by the 1975 New York City fiscal crisis, when the city's extensive use of municipal bonds to finance operating expenses led to complete exclusion from credit markets and near-bankruptcy, requiring federal intervention. See National Conference of State Legislatures, "State Balanced Budget Provisions: Provisions and Practice" (2014); Kim Phillips-Fein, "A Crisis without Keynes: The 1975 New York City Fiscal Crisis Revisited," The Gotham Center for New York City History, available at source.

**Figure 2:** Funding Sources of State Expenditures Over Time

This figure shows the composition of funding sources for U.S. state government spending from 1991 to 2024, using data from NASBO. Panel (a) displays operating expenditures, while Panel (b) presents capital outlays. Funding sources are categorized into four groups: general funds, federal funds, other state funds, and municipal bonds.




**(a)** Operating Expenditures

**(b)** Capital Outlays

of total operating expenditures but reached nearly $50 billion in 2020. These payments, while modest in share, represent fixed claims on revenue and reduce fiscal flexibility when revenues decline or borrowing costs increase.

The combination of these features—operating budgets financed entirely from current revenues and constrained by mandatory debt service—implies limited room for mid-year fiscal adjustment. This raises a question: how and when are state spending commitments actually determined? We turn next to the budget process itself, which governs the timing, sequencing, and rigidity of these decisions.

## 2.2 The State Budget Process

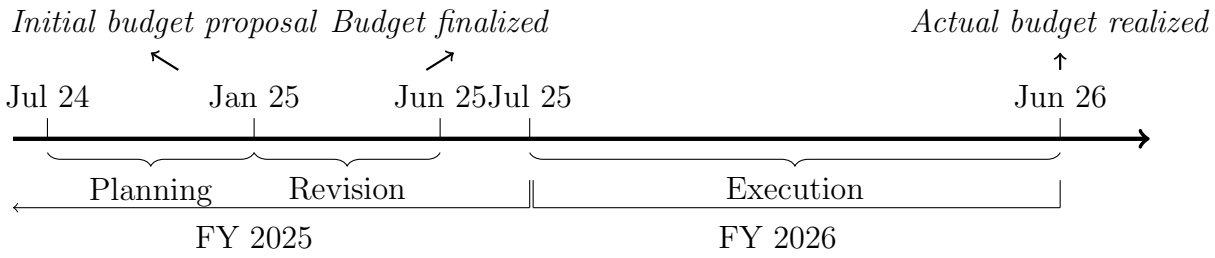
State operating budgets are developed through a sequential process involving distinct phases of planning, legislative revision, and ratification. Although procedural details vary across states, the overall structure is remarkably uniform. We illustrate this institutional framework using Massachusetts as a representative example.

The operating budget for fiscal year (FY) 2026 (July 1, 2025 - June 30, 2026) begins

development in July 2024—a full year before execution begins. During the fall of 2024, representatives from the state legislature and the Governor's office meet with economists to establish a consensus revenue projection for the upcoming fiscal year. Using these revenue projections and incorporating the administration's political priorities, the Governor submits an initial budget proposal by the third week of January 2025. Following the Governor's proposal, the Ways and Means Committees in both the Massachusetts Senate and House hold budget hearings, gathering input from various stakeholders. By the end of April, the House votes on its revised version of the operating budget proposal, while the Senate votes on its own version by the end of May.[4] In June, members of the House and Senate Ways and Means Committees negotiate to reconcile their differences, developing a unified budget proposal. This reconciled budget is then submitted to the full legislature for ratification. Upon approval by both the House and Senate, the Governor signs the final operating budget into law around June 30, 2025.

As illustrated in Figure 3, this process can be divided into three phases: *Planning* (July 2024–January 2025), *Revision* (January–June 2025), and *Execution* (July 2025–June 2026). Initial spending commitments are thus determined six to twelve months before the fiscal year begins, creating substantial temporal distance between decisions and realized outcomes. We manually collect budget calendar information for all states, summarized in Table IA.1.

**Figure 3:** Timing of budgeting process for representative state




Capital investment planning and borrowing follow a distinct yet parallel timeline that substantially overlaps with the operating budget process. Although managed by separate departments, the two processes are highly synchronized. Planning for FY 2026 capital projects begins in late summer 2024, coinciding with the early stages of operating budget formulation. During this period, representatives from the State Treasurer's office, the Governor's

[4] Although the budgets proposed by the House and Senate must be balanced, the Governor's initial budget proposal is not required to be balanced.

office, and infrastructure agencies such as the Department of Transportation collaborate to finalize the state's capital plan and a bond issuance proposal by December 2024—a timeline that aligns with the operating budget's revenue forecasting and initial proposal phase.[5] The legislature then authorizes this debt issuance through the passing of bond bills, often concurrently with its deliberations on the operating budget. This institutional overlap ensures fiscal coordination but also creates interdependent constraints.

Taken together, these institutional features—the multi-stage budget process, the prohibition of deficit financing for operations, and mandatory debt service obligations—create a fiscal environment in which most spending decisions are predetermined well before revenues are realized. This institutional rigidity shapes both the timing and the mechanism through which macroeconomic shocks are transmitted to fiscal policy.

## 2.3 Data

One of the contributions of this paper is the construction of a comprehensive state-level panel that integrates multiple data sources on planned and realized fiscal outcomes and institutional features spanning several decades. First, we hand-collect the Annual Comprehensive Financial Reports (ACFR) produced by each state from 1995-2024 by downloading PDFs from state websites, contacting state officials by email or phone, and filing formal records requests.[6] We digitize the data using Python and hire undergraduates to manually check the digitization quality. The ACFR data provide detailed line-item information on expenditures and revenues for each fiscal year at the initial budget, final budget, and actual phases across forty-seven states with annual budget cycles, see for example Massachusetts in Figure IA.2.[7] The initial and final budgeted data offer a forward-looking window into each state's expected fiscal decisions and allow us to measure how expectations of revenues and borrowing costs translate into planned spending. Line items include specific appropriation categories–such as K-12 education, highways, corrections, and Medicaid–as well as subaccounts for capital outlays and detailed revenue sources, including individual and corporate income taxes, sales

[5] See Table 18: Coordinating the Capital Budget With the Operating Budget in NASBO, Capital Budgeting in the States.

[6] The availability of ACFR information varies across states. We obtained 84 reports by directly emailing state officials, 11 additional reports from phone calls, and 35 by formal record request; the remainder of the reports were available on state websites.

[7] Four states—Wyoming (WY), Washington (WA), North Dakota (ND), and Oregon (OR)—report biennial budget information and are excluded from our sample.

taxes, and federal grants.[8] Because this data is produced and published by each respective state government finance office, we consider the ACFR the most accurate representation of expected and actual spending and revenues.

To extend the time series, we supplement our manually collected ACFR data with information from the National Association of State Budget Officers (NASBO), which publishes annual State Expenditure Reports based on voluntary survey responses covering fiscal years 1984–2023.[9] For each state, NASBO reports aggregate budgeted and actual totals for expenditures, capital outlays, operating outlays, revenues, and planned versus realized borrowing (see Figure IA.3 for an example). Because the data are survey-based, reported figures do not always align with ACFR numbers, and no itemized line-item detail is available. We therefore treat the NASBO series as supplementary, using it primarily to corroborate findings from the ACFR data. Figure IA.4 documents the coverage of both datasets over time.

We obtain additional variables such as debt outstanding and interest expenses from the Census Bureau's Annual Surveys of State and Local Government Finance. Unlike the ACFR and NASBO series, these data provide only realized (actual) fiscal outcomes, not budgeted figures. A further limitation is that the Census Bureau reclassifies state-reported figures into standardized categories, which can lead to discrepancies relative to the official numbers published in state ACFR reports.[10]

To measure the cost of external borrowing, we utilize Municipal Securities Rulemaking Board (MSRB) price data beginning in 2005. These records provide daily yields on benchmark state general-obligation and revenue bonds, which we aggregate into a state-level time series of interest rates. We also use issuance amounts from the Mergent municipal finance database (1985-2024), which contains transaction-level details on each state bond issue–such as par amount, coupon, maturity, and sale date–and allows us to confirm actual volumes of debt financing.

Finally, we account for broader economic and demographic heterogeneity using annual state-year characteristics from the U.S. Census Bureau–such as population, real personal income per capita, unemployment rates, and urbanization measures–ensuring that our estimates of institutional frictions are not confounded by underlying macroeconomic conditions.

[8] There is substantial heterogeneity in the line items reported across states. We manually classify these items into high-level categories.

[9] The NASBO data has been used in prior literature, including Poterba (1994).

[10] See U.S. Census Bureau, Government Finance and Employment Classification Manual, available here.

We also control for economic conditions, including US Treasury yields, GDP growth rates, and employment growth, which we gather from FRED, and changes in the S&P 500 index from Yahoo Finance.

# 3 Stylized Facts in State Budget Adjustments

The institutional framework described in Section 2.2 implies that state fiscal policy operates under stringent timing and financing constraints. To understand how these constraints shape fiscal behavior in practice, this section documents three stylized facts using our comprehensive dataset on state budgets extracted from ACFR. Together, these facts reveal (i) when spending adjustments occur, (ii) how predictive budgets are of actual spending and revenues, and (iii) what economic forces drive budgets.

We begin by decomposing annual changes in actual expenditures into distinct phases of the budget cycle—planning, revision, and execution—using the accounting identity:

$$\begin{aligned}(1)\quad \Delta \log(\text{Act}_t) = &\underbrace{\log\big(\text{Init. Budget}_t/\text{Final Budget}_{t-1}\big)}_{\text{Planning}} - \underbrace{\Big(\log\big(\text{Act}_{t-1}/\text{Final Budget}_{t-1}\big)\Big)}_{\text{Lagged Execution}} \\ &+ \underbrace{\log(\text{Final Budget}_t/\text{Init. Budget}_t)}_{\text{Revision}} + \underbrace{\log(\text{Act}_t/\text{Final Budget}_t)}_{\text{Execution}}.\end{aligned}$$

This specification requires careful benchmarking. The planning component, which conceptually captures the intended growth from last year's actual outcome ($\log(\text{Init. Budget}_t/\text{Act}_{t-1})$), must be constructed from observable data at the time of initial budget formulation. However, the actual outcome for fiscal year $t-1$ ($\text{Act}_{t-1}$) is not yet realized when the initial budget for FY $t$ is formulated (e.g., the FY 2026 initial proposal is set in January 2025, while FY 2025 actuals are not realized until June 2025, as shown in Figure 3). We therefore anchor the calculation to the final budget of FY $t-1$ ($\text{Final Budget}_{t-1}$), which is established roughly eight months prior to initial budget formulation (e.g., May 2024 relative to January 2025). This approach cleanly separates the novel policy intent of the new initial budget (Planning) from the unforeseen shocks that affected the previous year's execution (Lagged Execution). The summary statistics for each decomposed component are reported in Table 1.

**Fact 1: Expenditures Track Revenues Throughout the Budget Cycle** Our first fact establishes that balanced-budget constraints bind tightly in practice. If these institutional requirements were merely procedural formalities, we would expect expenditures to respond weakly to revenue fluctuations, with states using various mechanisms to smooth spending. Instead, we find tight coupling between expenditure adjustments and revenue changes at every phase of the budget cycle.

Figure 4 displays the average log changes in total real revenues (Panel a) and total real expenditures (Panel b) across the four phases of the fiscal cycle. Two key patterns emerge. First, expenditure adjustments closely track revenue changes throughout the budget cycle. This tight linkage is confirmed in Panel A of Table 2, which reports state-level regressions of expenditure changes on revenue changes. Revenue fluctuations alone explain 35–43% of the variation in expenditure adjustments in specifications without state fixed effects. The economic and statistical significance of this relationship is particularly pronounced in the planning and revision stages ($t$-statistics $> 9$), indicating that expenditure decisions are most responsive to revenue changes during the initial formulation and legislative amendment of the budget. These results provide compelling evidence of the binding nature of balanced budget constraints.

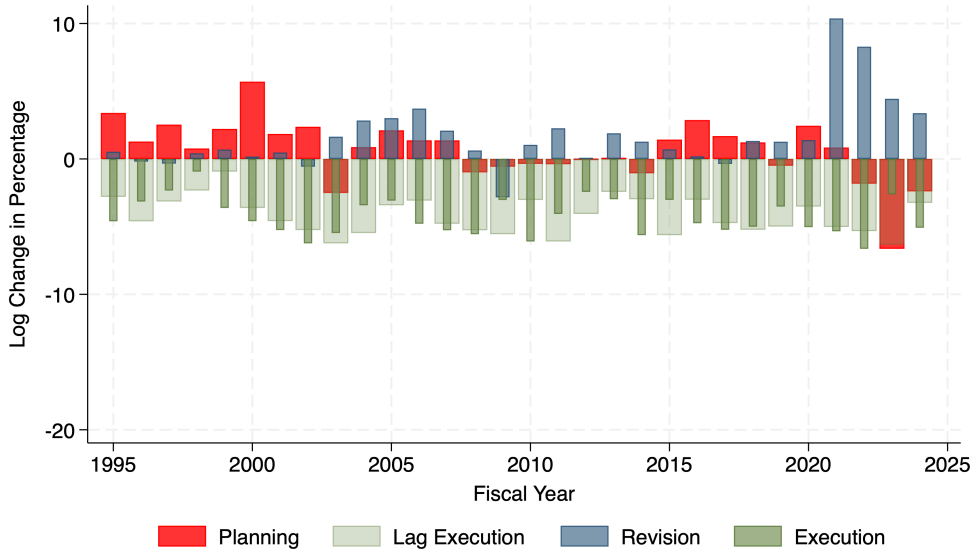
Second, states systematically overestimate their fiscal capacity: actual revenues consistently fall short of projections, leading to corresponding under-execution of expenditures. This pattern is pervasive: in 75% of state-year observations, budgeted revenues exceed realizations, and in 97%, budgeted expenditures exceed actual outlays (see the supporting histogram in Figure IA.5).

Panel B of Table 2 further examines the determinants of expenditure adjustments during the execution phase, testing whether spending responds asymmetrically to revenue shortfalls versus surpluses. The results show that spending adjusts sharply to shortfalls but little to surpluses: a 1 percentage point revenue shortfall is associated with a 0.69 percentage point (0.97 - 0.28) reduction in spending without state fixed effects and a 0.46 percentage point (0.72 - 0.26) reduction with state fixed effects, whereas the corresponding expenditure responses to revenue surpluses are smaller in magnitude and even correlate with underspending relative to budget.

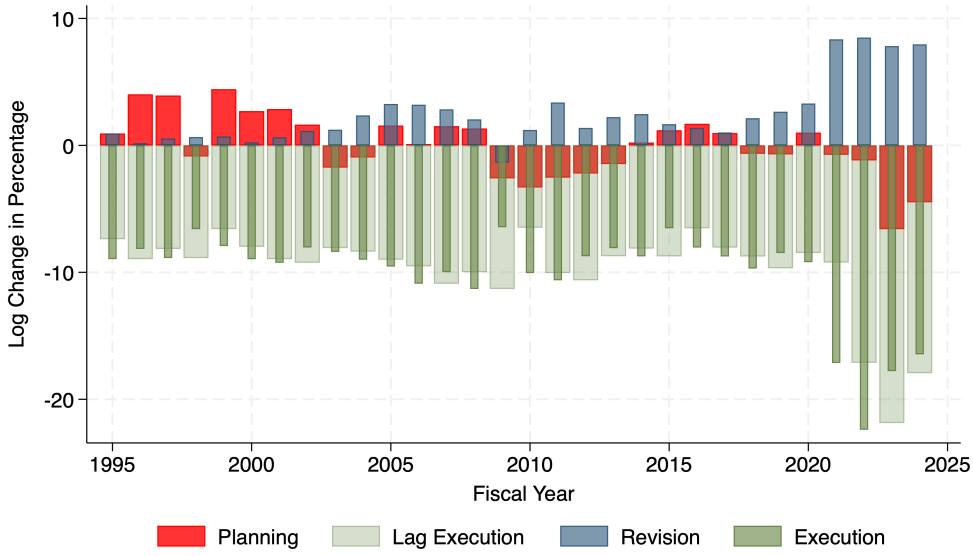
Together, these results demonstrate that balanced-budget requirements impose binding constraints in practice: states cannot smooth expenditures when revenues fall short but

**Figure 4:** Average Log changes Over Planning, Revision and Execution Phases

This figure displays the average log changes in total real revenues (Panel a) and total real expenditures (Panel b) across four phases of the fiscal planning cycle: *Planning*, *Lagged Execution*, *Revision*, and *Execution*. The calculations are based on ACFR data from 1995 to 2024. Each phase is defined as in Equation (1), and the averages are computed across all available states and years within each phase.




**(a)** Total Revenue




**(b)** Total Expenditure

must immediately adjust spending to match realized revenues, while revenue windfalls are not automatically spent.

**Fact 2: Initial Budgets Account for Most Variation in Actual Expenditures** We next explore how predictive budgets are of actual spending and revenues. We find that the initial budget—formulated six to twelve months before start of the execution period—has substantial predictive power for realized expenditures, whereas subsequent revisions and execution-phase adjustments contribute little.

To quantify the contribution of each budgetary phase to realized fiscal outcomes, we decompose the variance of annual changes in actual revenues and expenditures using Equation (1). Specifically, we take the covariance of each side of Equation (1) with respect to $\Delta \log(\text{Act}_t)$, and then divide by the variance of $\Delta \log(\text{Act}_t)$:

$$
\begin{aligned}
1 = & \frac{\text{cov}\Big( \log(\text{Init}_t/\text{Final}_{t-1}), \Delta \log(\text{Act}_t) \Big)}{\text{var}\big(\Delta \log(\text{Act}_t)\big)} - \frac{\text{cov}\Big( \log(\text{Act}_{t-1}/\text{Final}_{t-1}), \Delta \log(\text{Act}_t) \Big)}{\text{var}\big(\Delta \log(\text{Act}_t)\big)} \\
& + \frac{\text{cov}\Big( \log(\text{Final}_t/\text{Init}_t), \Delta \log(\text{Act}_t) \Big)}{\text{var}\big(\Delta \log(\text{Act}_t)\big)} + \frac{\text{cov}\Big( \log(\text{Act}_t/\text{Final}_t), \Delta \log(\text{Act}_t) \Big)}{\text{var}\big(\Delta \log(\text{Act}_t)\big)}.
\end{aligned} \tag{2}
$$

Equation 2 represents the variance decomposition of actual changes in expenditures into the different budgetary phases. The contribution of the initial budgetary phase to the total variance, for example, can then be represented as:

$$
\beta_{initial} = \frac{\text{cov}\Big( \log(\text{Init}_t/\text{Final}_{t-1}), \Delta \log(\text{Act}_t) \Big)}{\text{var}\Big(\Delta \log(\text{Act}_t)\Big)}, \tag{3}
$$

which we can estimate via OLS by regressing $\log(\text{Init}_t/\text{Final}_{t-1})$ on $\log(\Delta\text{Act}_t)$, with state fixed effects. When implementing, we winsorize each difference at the 0.5% and 99.5% level to avoid undue influence of outliers.

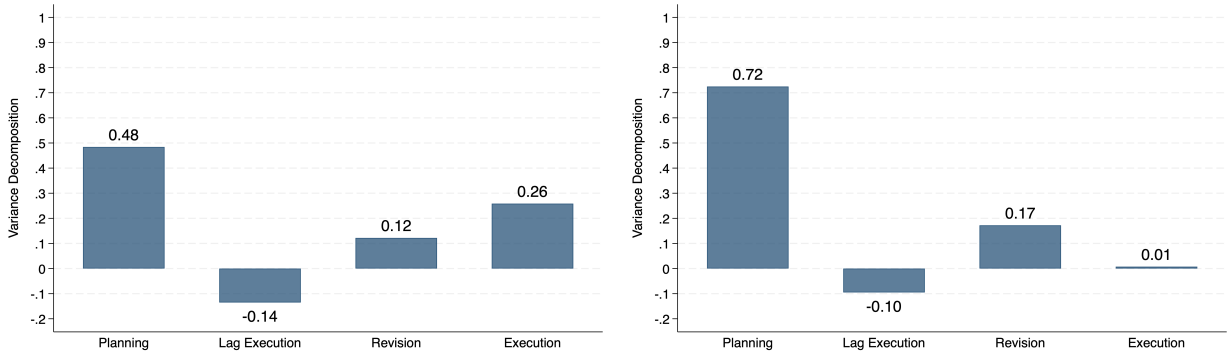
Figure 5 shows the results for the betas estimated for each planning stage. The initial planning stage alone explains 48 percent of the variation in revenues and 72 percent in expenditures. By contrast, the revision and execution phases contribute little explanatory power, underscoring the importance of initial budget decisions in shaping realized fiscal spending.

**Figure 5:** Decomposing the Sources of Variation in Actual Growth

This figure plots estimated $\beta$ from the following regression for real total revenues in Panel (a) and real total expenditures in Panel (b):

$$\text{Component}_{s,t} = \beta \times \Delta \log(\text{Act}_{s,t}) + \alpha_s + \epsilon_{s,t},$$

where $\text{Component}_{s,t}$ denotes one of the four components of the budget decomposition for state $s$ in year $t$, as defined in Equation (1). The estimated $\beta$ represents the share of each component in explaining the variation in actual outcomes. The analysis uses ACFR data from 1995 to 2024, conditional on state-years with data from all components.




**(a)** Total Revenues

**(b)** Total Expenditures

Table IA.2 further quantifies the economic magnitude of this relationship by regressing actual annual changes in revenues and expenditures on variations across different budget phases. The coefficient on the planning phase is 0.61 for revenues and 0.51 for expenditures, implying that a 10 percent increase in the initial budget translates into roughly a 5 percent rise in realized spending. This predictive relationship remains robust after controlling for revenue planning, realized revenue changes, and revenue shortfalls relative to budgeted expenditures. Taken together, these results indicate that most of the variation in expenditure growth is already embedded in the initial budget, reflecting substantial foresight at the planning stage.

This concentration of predictive power at the planning stage indicates that fiscal adjustments occur predominantly when budgets are first formulated, not during subsequent budgeting phases.

**Fact 3: Macroeconomic Conditions Shape Budgets Only at the Planning Stage.** Next, we ask what economic forces shape initial budget decisions. Specifically, we examine

whether macroeconomic conditions prevailing during the planning phase influence the expenditure decisions in the initial budget. We regress the log change in planned expenditures on contemporaneous national changes in real GDP, the S&P 500 index, employment, and the Treasury yield-curve slope.[11] The results, reported in Table 3, show that planning-stage expenditure growth responds significantly to macroeconomic conditions: higher GDP growth and equity-market gains are associated with larger planned outlays, while a steepening of the Treasury yield curve dampens them. In contrast, when we repeat the analysis for the execution phase—examining how realized expenditures deviate from the final budget—none of these macro variables are significant.

This sharp contrast across phases underscores that the planning stage captures the true economic response to changing conditions. Budget officials incorporate available macroeconomic information into their initial proposals, adjusting expenditures in line with expected growth prospects. Once the fiscal year is underway, however, spending is largely unresponsive to new economic information.

Importantly, because we do observe planning-stage budgets responding to contemporaneous shocks, the differential response cannot solely be due to delays in acquiring and analyzing information (Lucas, 1973; Mankiw and Reis, 2002; Coibion and Gorodnichenko, 2015). Instead, this could be due to institutional factors: legal constraints requiring legislative approval for major budget modifications, administrative costs of reallocating resources across departments, procurement contracts that lock in spending commitments, or the political difficulty of justifying mid-year spending changes, especially budget cuts to stakeholders. Moreover, even when conditions weaken, agencies may face a "use-it-or-lose-it" incentive to execute approved spending (Liebman and Mahoney, 2017).

In sum, these results highlight two key constraints on state fiscal policy. First, financing restrictions preclude borrowing for operations, forcing expenditures to track revenues tightly (Fact 1). Second, institutional rigidity confines meaningful adjustment to the planning stage—the very phase that explains most variation in realized spending (Fact 2)—and during which economic conditions shape budget targets (Fact 3). These findings motivate the theoretical model in the next section, which formalizes how monetary policy shocks transmitted during the planning phase affect both budgeted and realized expenditures.

[11] Because comparable quarterly macro data are unavailable at the state level, we use national indicators as explanatory variables, which naturally limits the model's explanatory power.

# 4 A Model of Budgeted and Realized Expenditures

## 4.1 Model Setup

Building on the above stylized facts, we develop a parsimonious one-period model of operating expenditure budgeting that incorporates the twin frictions shaping state spending: financing constraints and institutional rigidity. This tractable framework examines how these features govern the pass-through of monetary policy to both planned and realized operating expenditures.

In the model, state governments set budgeted expenditures for the upcoming fiscal year at the start of the year, while final expenditures are constrained by realized revenues at year-end. This structure reflects three key features documented above. First, actual revenues are uncertain: realized tax receipts may deviate from expectations and interest-rate movements can shift the distribution of revenues. Governments therefore incorporate revenue forecasts into their budgeting decisions. Second, as shown in Figure 4, actual spending cannot exceed either realized revenues or the amount originally budgeted, capturing both the absence of borrowing capacity for operating expenditures and the legal requirement to balance the budget. Third, over-budgeting is costly. There may by political fallout from unmet spending commitments, operational disruptions from canceling planned projects, and the long-term institutional risk of a "ratchet effect" (Freixas et al., 1985), whereby unspent budgets lead to future funding cuts—a pattern evidenced by inefficient year-end spending surges (Liebman and Mahoney, 2017).

For simplicity, we begin with a one-period budgeting problem. A dynamic setting would be valuable if saving, spending, or borrowing decisions affected resources in subsequent periods. In future work we plan to extend the model to a dynamic framework to capture a precautionary budgeting motive. We also abstract from potential effects on tax revenues arising from interstate migration in response to differences in public service provision (e.g., Tiebout (1956)), which is a reasonable simplification given empirical evidence that such migration responses are small (Levine and Zimmerman, 1999; Yasenov et al., 2020).

More formally, the state's realized resources in each period are given by $X \equiv R - D + f$, where $R \sim F_R(\cdot)$ denotes stochastic tax revenues, $D$ is the fixed obligation for debt service (principal and interest), and $f$ represents exogenous income from an endowment fund.

Because of the financing constraint and the balanced-budget requirement, actual spending equals the minimum of budgeted spending $B$ and realized resources $X$. The planner chooses a budget $B$ to maximize expected utility, which balances the benefit of public good provision against the cost of potential fiscal shortfalls:

$$\max_{B} \quad U(B) = \mathbb{E}\big[\min\{B, X\}\big] - \lambda \mathbb{E}\big[(\psi B - X)_+\big]. \tag{4}$$

The second term introduces a penalty associated with a shortfall for essential services, where $\psi \in (0, 1]$ denotes the share of the budget classified as essential and $\lambda$ represents the marginal cost per dollar of shortfall. This penalty admits two natural interpretations. From an ex-ante perspective, the penalty term captures the shadow cost of fiscal discipline, reflecting institutional pressure to ensure the essential budget $\psi B$ is financeable with high probability. In this interpretation, the parameter $\lambda$ represents the marginal cost of a tighter risk constraint—or equivalently, the marginal value of greater fiscal flexibility.[12] Alternatively, from an ex-post perspective, the penalty captures the political and administrative costs of mid-year fiscal adjustments. If essential spending exceeds resources ($\psi B > X$), the government must undertake costly measures such as breaking contracts, reducing services, or imposing emergency taxes to balance the budget. The parameter $\lambda$ governs the marginal cost of these disruptive adjustments. The shortfall penalty ensures a finite, internally determined optimal budget, consistent with the empirical finding that budgeted expenditures strongly predict actual spending.

The trade-off between the benefit of higher spending and the cost of potential shortfalls is captured by the first-order condition for utility maximization:

$$\underbrace{1 - \Pr(X < B)}_{\text{marginal benefit}} = \underbrace{\lambda\psi \Pr(X < \psi B)}_{\text{marginal cost}}, \tag{5}$$

The left-hand side represents the marginal benefit of increasing the budget: the probability that an additional dollar can be fully spent, i.e., that resources $X$ exceed the budget $B$. The right-hand side represents the expected marginal cost: the probability of a shortfall in essential spending $\Pr(X < \psi B)$ multiplied by the cost per dollar of that shortfall $\lambda\psi$. The

[12] This can be formalized by introducing a risk constraint $\Pr(\psi B > X) \leq \varepsilon$ into the planner's problem. Here, $\lambda$ is the Lagrange multiplier associated with this constraint, representing the shadow value of relaxing the maximum shortfall probability $\varepsilon$. The penalty form $\lambda\mathbb{E}[(\psi B - X)_+]$ arises as a smooth convex approximation to the non-smooth constraint function $\Pr(\psi B > X)$.

unique optimum occurs where the government equates these marginal values.[13]

**Interest rate effect via debt service.** As discussed in Section 3, debt service represents a mandatory claim on revenues that directly reduces the net resources available for other operating expenditures. Suppose debt service $D$ is an increasing function of the current interest rate $i$, such that $D'(i) > 0$. Thus, for any given realization of revenues $R$, an increase in interest rates reduces the net resources $X = R - D(i) + f$ available for expenditures, effectively shifting the entire resource distribution downward.

We define two revenue thresholds at the optimal $B^*$: $y_B(i) \equiv B^* + D(i) - f$, the revenue required to fully fund budget $B$, and $y_\psi(i) \equiv \psi B^* + D(i) - f$, the revenue needed to cover essential spending $\psi B$. An increase in the interest rate raises both thresholds, making it more difficult to achieve any given level of budgeted or essential spending. We rewrite Equation (5) as a function of interest rate $i$:

$$1 - F_R(y_B(i)) = \lambda\psi F_R(y_\psi(i)). \tag{6}$$

To align with the empirically observed data on total expenditures, we derive the response of total budgeted expenditures, $B^* + D(i)$, to changes in the interest rate $i$. Applying the implicit function theorem to the first-order condition yields:[14]

$$\frac{d(B^* + D(i))}{di} = -D'(i)\frac{\lambda\psi(1-\psi)f_R(y_\psi)}{f_R(y_B) + \lambda\psi^2 f_R(y_\psi)} \in \Big[ - D'(i)\tfrac{1-\psi}{\psi}, 0\Big] \tag{7}$$

The intuition is as follows. A rise in interest rates increases debt service costs, which elevates the revenue thresholds $y_B$ and $y_\psi$ required to fund total and essential spending, respectively. This upward shift in thresholds simultaneously reduces the marginal benefit of additional budgetary spending—since a dollar is less likely to be executable—and raises the expected marginal cost of over-budgeting, by increasing the probability of a costly essential spending shortfall. In response, the government engages in precautionary cuts of the budget, disproportionately cutting non-essential spending to protect essential commitments.

Inspecting Equation (7) further yields intuitive comparative statics. We show in Appendix IAI that given reasonable assumptions, budgeted expenditures are even more sensitive

[13] The optimal budgeted spending is unique because $\frac{d^2U}{dB^2} = -f(B) - \lambda\psi^2 f(\psi B) < 0$.
[14] See Appendix IAI for derivations.

to interest rates when interest rates are higher ($\frac{d^2B^*}{di^2} < 0$). This implication maps to the classic asymmetric real response to monetary policy (Tenreyro and Thwaites, 2016). A higher $\lambda$ (per-dollar shortfall cost) increases the pass-through, as policymakers become more averse to falling short of essential spending and budget more conservatively. In addition, a higher essential spending share $\psi$ attenuates the transmission of interest rate shocks to the budget, as it leaves a smaller buffer of non-essential spending available to absorb fiscal adjustments.

**Interest-rate effect via revenues.** Higher interest rates can influence government finances through a revenue channel: a higher policy rate $i$ depresses consumption and labor income, thereby lowering tax revenues. To capture this, let the revenue distribution depend on the interest rate, $R(i)$. Net resources are $X \equiv R(i) - D(i) + f$, whose cdf is $F_X(x;i) \equiv \Pr[X \le x] = F_R\big(x + D(i) - f; i\big)$. Holding the debt–service schedule fixed (so $D'(i) = 0$), if higher $i$ shifts the revenue distribution left in first-order stochastic dominance, the response of the optimal budget is

$$\frac{dB^*}{di} = -\frac{\partial_i F_R(y_B;i) + \lambda\psi\partial_i F_R(y_\psi;i)}{f_R(y_B;i) + \lambda\psi^2 f_R(y_\psi;i)} \le 0, \tag{8}$$

The intuition is straightforward. When higher interest rates reduce potential revenues, the probability that essential spending $\psi B^*$ cannot be funded rises. This raises the marginal cost of expanding the budget relative to its marginal benefit. To re-establish the first–order condition, the planner lowers $B^*$ so that the essential threshold $\psi B^*$ moves into a safer part of the revenue distribution, resulting in a precautionary cut in planned spending.

**Combining the two channels.** The revenue channel complements the debt–service channel: monetary tightening affects state budgets not only by increasing required interest payments but also by shifting the distribution of tax revenues. Assume revenues are log-normally distributed with mean $\mu(i)$ that declines with $i$ and variance $\sigma(i)$ that rises with $i$. Writing $B^* + D$ as total budgeted expenditures under optimal planning and differentiating with respect to interest rates gives

$$\frac{d(B^* + D(i))}{di} = \kappa(i)\Big(a(i)\mu'(i) + b(i)\sigma'(i) - c(i)D'(i)\Big), \tag{9}$$

where

$$\kappa(i) \equiv \frac{1}{f_R(y_B; i) + \lambda\psi^2 f_R(y_\psi; i)} \quad (> 0) \tag{10}$$

$$a(i) \equiv y_B f_R(y_B; i) + \lambda\psi y_\psi f_R(y_\psi; i), \tag{11}$$

$$b(i) \equiv y_B z_B f_R(y_B; i) + \lambda\psi y_\psi z_\psi f_R(y_\psi; i), \tag{12}$$

$$c(i) \equiv \lambda\psi(1-\psi) f_R(y_\psi; i). \tag{13}$$

This expression highlights three distinct monetary-policy transmission mechanisms: higher $i$ (i) raises $D(i)$, reducing available resources; (ii) lowers the mean of revenues ($\mu'(i) \leq 0$), cutting expected resources; and (iii) raises revenue volatility ($\sigma'(i) \geq 0$), making essential shortfalls more likely and more severe.

This unified, parsimonious framework delivers sharp, testable predictions for how state budgeted expenditures respond to monetary policy through both the debt-service and revenue channels. These predictions can be taken directly to our new data on state budgets and realized expenditures; the main hypotheses are summarized below.

## 4.2 Hypotheses

In this section, we discuss the testable hypotheses derived from the model that will guide our empirical analysis. We first restrict our analysis to a reasonable parameter space by making the following assumption:

*Assumption* 1. The cutoffs for sufficient revenues to meet full (or essential) budgeted spending $(y_B, y_\psi)$ lie weakly below the log–mean of realized revenues.

Under Assumption 1, $b(i) < 0$ (volatility weight is negative), and with $\mu'(i) \leq 0$, $\sigma'(i) \geq 0$, $D'(i) > 0$, each channel in Equation (9) pushes $dB^*/di$ negative. See IAI for the derivations where applicable.

**Hypothesis 1 Budgets respond to monetary policy shocks** We can see this directly from taking the derivative of optimal total expenditures with respect to interest rates:

$$\frac{d(B^* + D(i))}{di} \leq 0 \tag{14}$$

**Hypothesis 2 Shocks during planning stage matter more for realized spending.** Let realized (ex post) spending in state $\omega$ be given by the resource constraint:

$$S(i,\omega) = \min\{B(i), X(i,\omega)\}.$$

Let $S_{\text{plan}}$ denote realized spending when an interest rate shock arrives during the budget planning stage (so the budget $B^*(i)$ is set optimally in response to the shock). Let $S_{\text{exec}}$ denote realized spending when a shock arrives during the execution stage (and thus does not affect the pre-determined budget $\widehat{B}$). We compare the effects of a marginal change in the interest rate $i$ of equal size under both timing scenarios. The difference in the marginal response of realized spending is

$$\frac{dS_{\text{plan}}}{di}(i,\omega) - \frac{dS_{\text{exec}}}{di}(i,\omega) = \mathbf{1}\{X(i,\omega) \geq B^*(i)\}B'(i) \leq 0. \tag{15}$$

Hence, if $B'(i) < 0$ (a tightening lowers the adopted budget) and $\Pr\big(X(i,\omega) \geq B^*(i)\big) > 0$, then for those realizations with $X \geq B^*$ the early shock reduces realized spending by more than the late shock.

**Hypothesis 3 Cross-sectional variation.** States with (a) revenues that are more exposed to interest rates and (b) debt service that is more exposed to interest rates exhibit larger (more negative) budget slopes $dB^*/di$. From (9), holding the weights fixed,

$$\frac{\partial}{\partial|\mu'(i)|}\Big(\frac{d(B^* + D(i))}{di}\Big) < 0, \qquad \frac{\partial}{\partial|D'(i)|}\Big(\frac{d(B^* + D(i))}{di}\Big) < 0. \tag{16}$$

Under Assumption 1 ($b < 0$) and with $\mu'(i) \leq 0$, $D'(i) > 0$, each exposure makes $dB^*/di$ more negative.

**Hypothesis 4 Institutional adjustment costs increase pass through.** The more costly it is for states to miss their spending targets due to limited resources, as proxied by $\lambda$ in the model, the more conservatively they adjust budgets downwards in response to tightening shocks.

Differentiating Equation (5) shows that, holding $(F_R, D)$ fixed,

$$\frac{\partial}{\partial \lambda}\left(\frac{d(B^* + D(i))}{di}\right) < 0,$$

so higher per-dollar shortfall cost $\lambda$ increases the absolute pass-through of interest rates to budgets.

In the following section, we lay out the empirical tests and results motivated by these hypotheses. Our novel dataset that covers initial and final budgets as well as actual expenditures and revenues allows us to directly test these hypotheses by providing a clear view into how states update revenue expectations and budgeted spending in response to shocks at different points in the budgeting process.

# 5 Monetary Policy Impact on State Expenditures

## 5.1 Empirical Strategy

We employ monetary policy surprises to identify causal effects on state fiscal decisions. Our identification strategy leverages high-frequency monetary policy shocks measured during 30-minute windows around FOMC announcements, following the approach of Bauer and Swanson (2023). Their shocks further residualize for potentially predictable components of policy, thus capture the unexpected component of monetary policy, orthogonal to pre-existing public information. Importantly for our identification, these policy surprises are unlikely to be anticipated by state budgetary authorities. Given states likely borrow at longer duration yields, to complement this approach and assess robustness, we also employ changes in the 5-year Treasury yield during the 30-minute window following FOMC announcements as an alternative shock measure.

The timing of monetary policy shocks relative to state budget cycles provides crucial identifying variation. We construct cumulative shock measures for three distinct phases: (i) the six-month period preceding initial budget proposals (planning stage), (ii) the legislative revision period, and (iii) the fiscal year execution phase. This temporal decomposition enables us to test Hypothesis 2, which posits differential responsiveness across budgetary

stages.

Our empirical specification examines how state expenditure growth responds to these phase-specific monetary policy shocks (Hypothesis 1). Furthermore, we interact the monetary policy shocks with an indicator for expansionary shocks, allowing differential responses to positive and negative monetary surprises.

$$
\begin{aligned}
(17)\quad \Delta Y_{s,t} = {} & \beta_1 MPS_t^{\text{Plan.}} + \beta_2 MPS_t^{\text{Plan.}} \times \mathbb{1}\{Neg_t^{\text{Plan.}}\} + \beta_3 \mathbb{1}\{Neg_t^{\text{Plan.}}\} \\
& + \beta_4 MPS_t^{\text{Revision}} + \beta_5 MPS_t^{\text{Revision}} \times \mathbb{1}\{Neg_t^{\text{Revision}}\} + \beta_6 \mathbb{1}\{Neg_t^{\text{Revision}}\} \\
& + \beta_7 MPS_t^{\text{Fiscal Year}} + \beta_8 MPS_t^{\text{Fiscal Year}} \times \mathbb{1}\{Neg_t^{\text{Fiscal Year}}\} + \beta_9 \mathbb{1}\{Neg_t^{\text{Fiscal Year}}\} \\
& + \gamma X_{s,t-1} + \alpha_s + \varepsilon_{s,t},
\end{aligned}
$$

where $Y_{s,t}$ represents logged real expenditures for state $s$ in fiscal year $t$. $MPS$ denotes cumulative monetary policy surprises during each budget phase, and $\mathbb{1}\{Neg_t\}$ is an indicator for expansionary (negative) shocks. We include state fixed effects ($\alpha_s$) and control for macroeconomic conditions ($X_{s,t}$), including log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year), measured over the six-month window preceding the initial budget phase. Standard errors are two-way clustered at the state and year levels to account for potential serial correlation and cross-sectional dependence.

## 5.2 Testing Hypotheses 1-2: Asymmetric Responses to Shocks in Planning Stage

We begin by testing the model's first two hypotheses by regressing spending changes on monetary policy shocks at different budget stages. We find evidence that state budgets respond systematically to monetary policy shocks. Consistent with our first two hypotheses, responsiveness is particularly pronounced for contractionary shocks occurring during the planning stage of the budget cycle.

Table 4 reports the estimated relationship between monetary policy shocks occurring during different budgetary phases and the growth rate of actual state expenditures. The results provide strong support for Hypothesis 1, and also reveal a pronounced asymmetry in the fiscal response to monetary contractions versus expansions. Contractionary

shocks—particularly those occurring in the six months preceding the fiscal year (the planning stage)—generate large, statistically significant reductions in expenditure growth (e.g., $\hat{\beta} = -0.293^{***}$ in Column 2). In contrast, the effects of expansionary shocks are markedly weaker and often statistically indistinguishable from zero, calculated by summing the baseline and interaction term coefficients. This asymmetry aligns with the concept that expansionary monetary policy may "push on a string" (Tenreyro and Thwaites, 2016), though here it likely reflects state-specific institutional constraints. Balanced budget requirements and prohibitions on deficit-financed operating expenditures create powerful incentives to cut spending during downturns but provide little capacity to increase spending during booms.

In support of Hypothesis 2, we find substantial heterogeneity in fiscal responses across budget phases. Contractionary monetary policy shocks occurring during the six-month planning stage preceding initial budget proposals significantly reduce subsequent fiscal year expenditures. In contrast, identical shocks occurring during the revision period and the fiscal year itself—the execution phase—produce muted and statistically insignificant effects. The economic magnitude of this planning-stage channel is substantial. Based on the Bauer-Swanson shock measure, a 10 basis point contractionary shock reduces expenditure growth by approximately 3 percentage points. This implies an aggregate spending reduction of roughly $81 billion relative to the $2.7 trillion in total state operating expenditures observed in 2021.[15] This is larger in magnitude relative to existing estimates in the literature; Adelino et al. (2017) finds a 14 basis point decline in credit costs (driven by an exogenous credit rating upgrade) is associated with an increase in local government spending and employment of 0.5%.

These results are robust to alternative measures of monetary policy surprises and data sources. Columns (1)–(4), based on the ACFR data, show consistent effects using both the Bauer-Swanson and 5-year yield shock measures. The patterns hold when examining disaggregated expenditure categories with state-by-line-item fixed effects, confirming that the effects are not driven by a single spending component. Furthermore, columns (5)–(8) replicate the analysis using the longer NASBO time series (1985–2023), which spans diverse economic conditions and policy regimes, and supplementing the Bauer-Swanson shocks (which begin in 1988) with shocks constructed from Romer and Romer (2004). The persistence of the planning-phase responsiveness across both datasets reinforces that our findings capture

[15] We use a 10 basis point contractionary shock for interpretation as it approximates the average size of positive shocks in our sample (13 basis points).

strong monetary policy transmission to planned spending during the planning period.

## 5.3 Further Exploring Hypothesis 2: Planning vs. Other Stages

Leveraging our novel dataset which includes planning at multiple stages, we further test Hypothesis 2 by examining how fiscal adjustments across the three distinct phases of the budgeting process respond to contemporaneous monetary policy shocks. We estimate the following equation for each budget phase $k$:

$$\Delta Y_{s,t}^{k} = \alpha_s + \beta_1 \text{MPS}_{s,t}^{k} + \beta_2 \big(\text{MPS}_{s,t}^{k} \times \mathbb{1}\{Neg_t^k\}\big) + \beta_3 \mathbb{1}\{Neg_t^k\} + \gamma^k X_{s,t}'^{k} + \varepsilon_{s,t}^{k}, \tag{18}$$

where $k \in \{\text{Planning}, \text{Revision}, \text{FiscalYear}\}$ represents the budget phase, and $\Delta Y_{s,t}^{\text{Planning}} = \log\big(\text{Init}_{s,t}^{E}\big)/\text{Final}_{s,t-1}^{E}\big)$, $\Delta Y_{s,t}^{\text{Revision}} = \log\big(\text{Final}_{s,t}^{E}/\text{Init}_{s,t}^{E}\big)$, and $\Delta Y_{s,t}^{\text{FiscalYear}} = \log\big(\text{Act}_{s,t}^{E}/\text{Final}_{s,t}^{E}\big)$. All specifications include state fixed effects and control variables, with standard errors clustered by state and year.

The results, presented in Table 5, demonstrate that the transmission of monetary policy is overwhelmingly concentrated in the planning phase. As shown in Column (1), a contractionary shock during the six months preceding the initial budget proposal significantly reduces planned expenditures. The economic magnitude is substantial: a 10 basis point shock reduces planned spending growth by approximately 1.3 percentage points. In stark contrast, monetary policy shocks during both the revision phase (column 2) and the execution phase (column 3) yield statistically insignificant and economically negligible effects. These patterns hold using the NASBO sample in last two columns.[16]

This concentrated responsiveness during the planning phase implies that states undertake meaningful fiscal adjustments predominantly at the initial budget formulation stage—a result aligning with Fact 5, wherein economic conditions drive expenditure variation primarily during planning. Once budgets are established, institutional rigidities—such as balanced-budget rules, legislative approval requirements, and mid-year adjustment costs—introduce substantial inertia. Consequently, expenditures in later phases exhibit minimal responsiveness to monetary policy surprises, even when new information emerges. This timing asymmetry strongly supports Hypothesis 2: monetary policy shocks affect state spending only

[16]The NASBO survey, conducted in June, approximately coincides with the final budget deadlines for most states; we therefore treat these figures as the budgeted numbers.

if they occur before budgetary commitments are fixed; shocks arising during the fiscal year exhibit negligible effects.

This institutional friction generates a delayed transmission mechanism whereby monetary policy shocks affect public expenditures only after the lag inherent in the budgetary process—typically 12 to 24 months. Such delays align with the classic concept of long and variable lags in monetary policy transmission (Friedman and Schwartz, 1963), with contemporary evidence confirming lag lengths of one to two years (Aruoba and Drechsel, 2024). However, our mechanism differs fundamentally from conventional explanations: rather than stemming primarily from slow information diffusion or nominal rigidities, the delay emerges from the institutional structure of the budget process itself. Although economic agents respond promptly to new information during planning phases, institutional constraints prevent mid-year adjustments once budgets are established. This creates a binding commitment that extends the effects of monetary shocks beyond the fiscal year in which they occur, generating persistence through institutional rather than behavioral channels.

## 5.4 Implications

### 5.4.1 Composition of Spending Cuts and Long-Run Effects

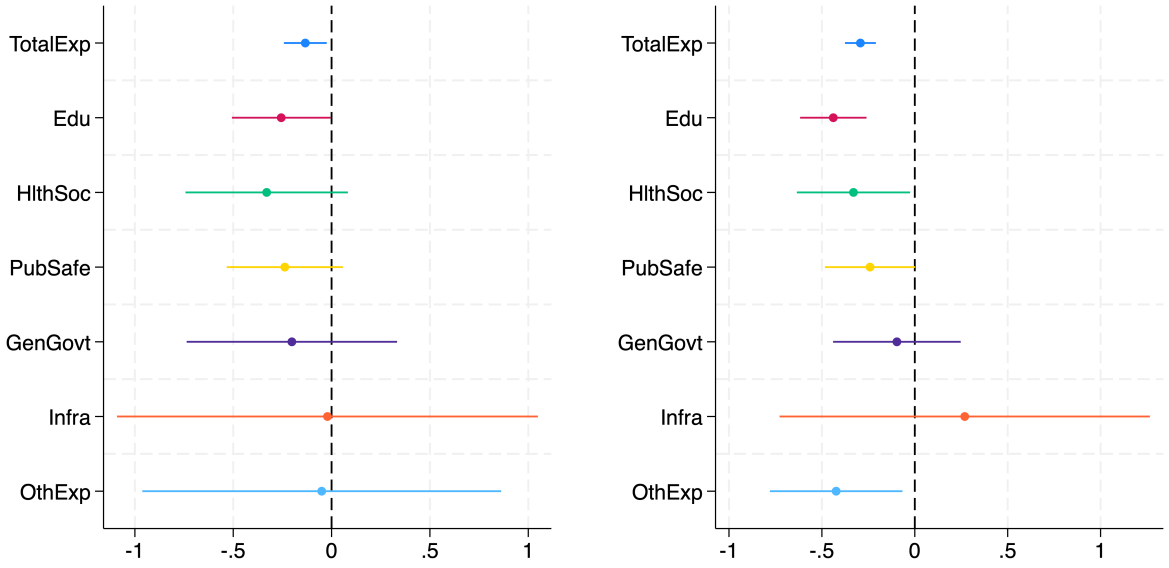
While our main analysis focuses on total expenditure responses, the composition of spending cuts has important implications for long-run economic outcomes. Cuts to current consumption (e.g., employee compensation) may have limited persistent effects, whereas reductions in categories with significant inter-temporal spillovers—such as education, infrastructure, and health services—could generate lasting impacts on human capital accumulation, public capital stocks, and population health.

To explore which categories bear the burden of fiscal adjustment, we exploit the detailed line-item data from the ACFR and estimate separate regressions for seven expenditure categories, following our main specification in Equation (17). Figure 6 reports the estimated effects of contractionary monetary policy shocks occurring during the six months preceding the initial budget proposal.

The results reveal substantial heterogeneity in fiscal adjustment across spending cate-

**Figure 6:** Effects of Contractionary Monetary Policy Shocks on Itemized State Expenditures

This figure plots the estimated effects of contractionary monetary policy shocks (MPS) occurring during the six months preceding the initial budget proposal on itemized expenditure categories, using ACFR data from 2002 to 2023. Panel (a) reports results where the dependent variable is the real log change in total state expenditures during the fiscal year ($\Delta\text{Actual}_t$), based on the regression specification in Column (1) of Table 4. Panel (b) focuses on the planning phase, with the dependent variable defined as the real log change from the prior year's actual expenditures to the current year's initial proposal ($\log(\text{Initial}_t) - \log(\text{Actual}_{t-1})$), following the specification in Column (1) of Table 5. The figure displays point estimates for the coefficient on $\text{MPS}_{\text{Plan.}}$ along with 95% confidence intervals.




**(a)** Planning Stage

**(b)** $\Delta\log(\text{Act}_t^E)$

gories. Education, health and social services, and public safety—which collectively represent over 70% of state operating budgets (Figure IA.7)—show the largest and most statistically significant responses to contractionary shocks. These are precisely the categories that, while representing long-term commitments, offer the most operational flexibility for adjustment: states can reduce classroom sizes, limit enrollment in public programs, or delay hiring without violating legal obligations. By contrast, infrastructure spending and general government expenditures exhibit more muted responses.

The concentration of cuts in education, health, and social services has important long-run implications. A substantial literature documents that public investments in these categories generate significant returns through enhanced human capital, improved labor market outcomes, and better child development (Card, 1999; Finkelstein et al., 2012; Hoynes et al., 2016). Moreover, state budget cuts often become permanent: eliminated programs face high reconstitution costs, constituencies dissipate, and fiscal constraints persist through hysteresis in tax policy (Romer, 1999). By forcing states to reduce high-return investments that prove difficult to restore, contractionary monetary policy during planning phases may generate persistent negative effects on economic potential—effects that extend well beyond the immediate demand impacts typically emphasized in monetary transmission studies.

### 5.4.2 Timing of Monetary Policy Shocks Matters

The micro-level evidence so far shows that monetary policy shocks influence state fiscal behavior primarily when they occur during the budget planning stage. We now examine whether this timing-dependence manifests in aggregate spending dynamics, using publicly available national accounts data to assess the broader macroeconomic relevance of our findings.

We estimate a quarterly local projection model (Jordà, 2005) of the cumulative response of state expenditures to orthogonalized monetary policy shocks, following the specification:

$$\frac{(\text{Expenditures}_{t+h} - \text{Expenditures}_{t-1})}{\text{GDP}_{t-1}} = \beta_h BS_t + \epsilon_{t+h},$$

where $\text{Expenditures}_t$ denotes real state and local government spending from the National Income and Product Accounts (NIPA), $\text{GDP}_t$ is real national output, and $BS_t$ represents

high-frequency monetary policy shocks from Bauer and Swanson (2023). The coefficient $\beta_h$ traces the cumulative effect of a monetary policy shock on state spending $h$ quarters ahead, scaled by lagged GDP.

Our key prediction is that only monetary policy shocks during the budget planning stage should generate significant spending responses. Because most states have initial budget proposal deadlines between December and February (as shown in Figure IA.6), the planning phase predominantly occurs in the fourth quarter of the calendar year—October through December—when governors' offices formulate revenue projections and draft budget proposals.[17] We therefore estimate separate impulse responses for shocks occurring in Q4 (the planning phase for most states) versus Q1–Q3:

$$\frac{\text{Expenditures}_{t+h} - \text{Expenditures}_{t-1}}{\text{GDP}_{t-1}} = \beta_h^{Q4}(BS_t \times \mathbb{1}_{Q4}) + \beta_h^{Q1-Q3}(BS_t \times \mathbb{1}_{Q1-Q3}) + \epsilon_{t+h}.$$

**Results** Figure 7 presents the results. Panel (a) shows the average impulse response to monetary policy shocks occurring throughout the year. While there is a gradual decline in spending, the effect is not statistically significant at 10% levels.

Panels (b) and (c) decompose this average effect by the timing of shocks within the budget cycle, revealing a striking contrast. Monetary policy shocks during Q4—when states are formulating initial budgets—generate large, statistically significant, and persistent declines in spending. The effects become significant starting around quarter 7 (approximately 21 months after the shock), precisely matching the lag between initial budget formulation (January) and the middle of fiscal year execution documented in Figure 3. The cumulative effect reaches approximately 0.2% of GDP per 10 basis point increase in the policy rate by quarter 20, a magnitude similar to our micro-level estimates in Table 4.[18]

By contrast, shocks in Q1–Q3 produce minimal and statistically insignificant responses. The confidence intervals include zero at all horizons, indicating no detectable fiscal adjustment. This stark asymmetry confirms our micro-level findings at the aggregate level: the

[17] Among the 47 states in our sample with annual budget cycles, 36 states (76%) have budget proposal deadlines between January and February, implying that planning activities are concentrated in Q4 of the prior calendar year.

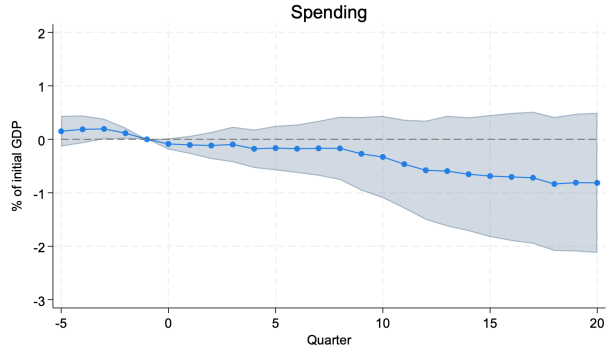
[18] This magnitude is consistent with our micro-level estimates in Table 4, which show 1–3% reductions in state expenditures per 10 basis point contractionary shock. Given that state and local expenditures account for 15% of GDP, these micro estimates imply aggregate effects of 0.15–0.45% of GDP, closely matching the local projection results.

**Figure 7:** Impulse Response of State Expenditure to Monetary Policy Shocks

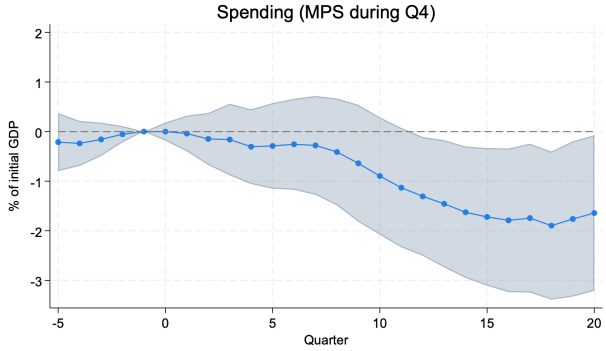
The figure reports local projection estimates of the cumulative response of state government spending to orthogonalized Bauer–Swanson monetary policy shocks, based on the specification

$$\frac{(\text{Expenditures}_{t+h} - \text{Expenditures}_{t-1})}{\text{GDP}_{t-1}} = \beta_h BS_t + \epsilon_{t+h},$$

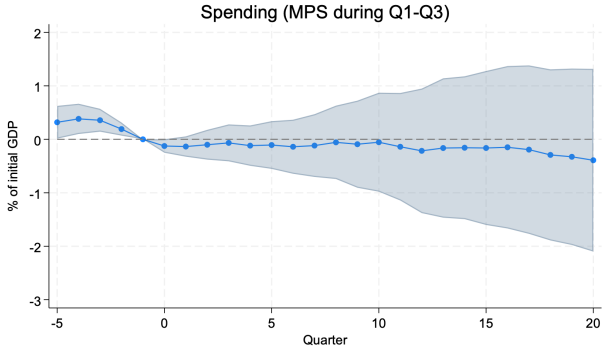
where Expenditures denotes aggregate quarterly state spending from the National Income and Product Accounts (NIPA), and GDP is national output; both variables are expressed in real terms. Panel (a) shows the average response to shocks occurring throughout the year round, while Panels (b) and (c) separate shocks by their timing within the budget cycle—those in the final quarter (Q4) versus the first three quarters (Q1–Q3). Shaded regions represent 90 percent confidence intervals based on heteroskedasticity-robust standard errors.




**(a)** MPS All Year Round




**(b)** MPS during Q4




**(c)** MPS during Q1-Q3

institutional rigidities that prevent states from adjusting budgets during execution generate timing-dependent sensitivity to monetary policy.

**Interpretation and Broader Implications** The differential responsiveness by shock timing has three important implications. First, it demonstrates that the "long and variable lags" of monetary policy (Friedman, 1961) may partly reflect public-sector institutional constraints rather than solely household and firm behavior. The fiscal institutions—multi-stage budgeting processes and balanced-budget requirements—contribute an additional source of delay that has received limited attention in the monetary policy literature.

Second, the timing-dependence of fiscal responses introduces state-dependence in monetary policy effectiveness (Olivei and Tenreyro, 2007; Tenreyro and Thwaites, 2016). The impact of monetary policy on aggregate demand depends not only on the size and direction of the shock, but also on when during the fiscal year it occurs. This creates predictable variation in the fiscal channel of monetary transmission: policy changes in Q4 will generate larger ultimate effects on state spending than identically-sized changes in other quarters.

Third, these findings speak to the literature on monetary–fiscal interactions (Nakamura and Steinsson, 2018; Ramey and Zubairy, 2018). While most work emphasizes federal responses, our evidence shows that state governments constitute a distinct transmission margin shaped by budgeting institutions that generate both delays and timing-dependent sensitivity. Given that state and local governments account for roughly 15% of GDP and employ about 20 million workers, this channel is quantitatively important yet underappreciated.

Finally, the delayed fiscal response we document has potentially significant macroeconomic consequences. Note that in a world of fully Ricardian agents, the timing of government expenditures would be irrelevant: perfectly rational and forward-looking households would anticipate that lower public spending today implies lower taxes tomorrow and would offset any temporary income loss by increasing their own spending (Barro, 1974). But a large empirical literature shows that households are not fully Ricardian.[19] For such households, the timing of government expenditures is critical: when public expenditures are delayed by the budget cycle, the associated boost to aggregate demand is also postponed. Moreover, if

[19]Studies of tax rebates and stimulus payments find that consumers spend a substantial share of these windfalls rather than saving in anticipation of future taxes (Johnson et al., 2006; Parker et al., 2013). Building on this evidence, modern macro models incorporate a significant share of "hand-to-mouth" consumers who spend out of current income (Campbell and Mankiw, 1989).

governments cut spending with larger multipliers, this has greater long-run consequences.

Taken together, the micro-level evidence from state budget data and the macro-level evidence from aggregate spending dynamics paint a consistent picture: institutional rigidities in public-sector budgeting create a distinct transmission channel for monetary policy, one characterized by substantial delays and sensitivity to the timing of shocks relative to budget cycles.

# 6 Channels of Monetary Policy Transmission

We now investigate the economic mechanisms underlying this transmission. Through the lens of the model, the mechanism through which states reduce budgeted expenditures in response to increased interest rates is twofold: via lower revenue expectations or increased debt service burdens. Here, we examine these two potential channels directly.

## 6.1 Revenue Expectation Channel

States may reduce expenditure plans in response to contractionary monetary policy if they anticipate that tighter monetary conditions will reduce future economic activity and, consequently, state revenues. As most states are unable to borrow to finance operating expenditures directly, revenue shortfalls can be quite costly. Our collected data include not only budgeted expenditures but also budgeted revenues throughout the budget cycle, allowing us to directly test whether monetary policy shocks affect revenue forecasts and whether this mediates the expenditure response. Given that balanced budget requirements mandate that planned spending align with anticipated revenues, any downward revision in revenue projections should constrain expenditure plans, making this a natural first channel to examine.

We first test how budgeted and realized revenues respond to monetary policy shocks across various budget stages. We estimate regressions following Equation (17) for actual revenue growth during the fiscal year and Equation (18) for revenue responses during the planning, revision, and execution phases, replacing the dependent variable $Y_{s,t}$ with total revenues while keeping the rest of the specification unchanged.

Table 6 reports the revenue response to monetary policy shocks and reveals a significant, asymmetric impact concentrated in the planning phase. Column (1) shows that a contractionary shock in the six months preceding the budget proposal significantly lowers total real revenue growth: the estimated coefficients are –0.22 in the ACFR sample and –0.12 in the NASBO sample. Although the coefficient on the fiscal-year shock ($\text{MPS}_{FY}$) is also negative, the phase-by-phase decomposition in columns (2)–(4) and (6)–(7) shows that this effect does not persist once revenues are separated into planning, revision, and execution components. By contrast, the planning-stage coefficients remain negative—and for the NASBO sample, statistically significant—closely paralleling the expenditure patterns documented earlier. This concentration of responsiveness in the planning phase indicates that state budget officers incorporate anticipated economic slowdowns into their revenue forecasts when monetary policy tightens.

To further test the revenue channel, we examine whether states with greater revenue sensitivity to monetary policy exhibit correspondingly stronger expenditure responses (Hypothesis 3 in Section 4.2). We implement this test in two stages. First, we estimate state-specific revenue sensitivities to monetary policy shocks using the specification from Column (1) of Table 6. Second, we classify states into "High" and "Low" sensitivity groups based on whether their estimated revenue response falls above or below the median, with the "High" group comprising states whose revenues decline most sharply following contractionary monetary policy. We then estimate heterogeneous treatment effects by interacting this high-sensitivity indicator with monetary policy shocks and all controls in the specification (18) for the planning stage.

As shown in Panel A of Table 7, the interaction term between a contractionary pre-proposal shock and the high-sensitivity indicator is negative and statistically significant (coefficient = -0.330). This result indicates that the planning-phase expenditure contraction is significantly more pronounced in states where revenues are more sensitive to monetary policy, providing strong supporting evidence for Hypothesis 3.

We also examine whether revenue volatility amplifies the effect, as greater volatility may make revenue shortfalls more likely and severe during monetary contractions. We test this by redefining the "High" group indicator based on whether a state's revenue growth volatility exceeds the sample median. Column (2) shows a negative but statistically insignificant interaction effect (coefficient = -0.105). However, when we focus specifically on tax revenue

volatility—which excludes more stable income sources like fees and transfers—Column (3) reveals a significantly negative interaction effect (coefficient = -0.227). This suggests that expenditure responses are stronger in states where tax revenues, the more discretionary and cyclically sensitive component of the revenue base, exhibit higher volatility. These heterogeneous effects are consistent with our model's cross-sectional predictions, and provide compelling evidence that the revenue channel represents a key transmission mechanism linking monetary policy to state fiscal decisions.

However, a critical question remains: do downward revisions in revenue expectations fully account for the expenditure effects documented in Tables 4 and 5? If revenue were the sole channel, controlling for it should render the estimated impact of monetary policy shocks statistically insignificant. To test this hypothesis of full mediation, Table 8 re-estimates the expenditure response while controlling for contemporaneous revenue changes.

The results reveal that revenue adjustments mediate only part of the overall fiscal response. This conclusion is supported by two key findings. First, while the strong positive coefficients on $\Delta \log(\text{Revenue})$ confirm expenditures are highly responsive to revenues, the attenuation of the shock coefficients is only partial. For instance, the coefficient on pre-proposal shocks for actual expenditure growth declines from -0.29 to -0.21 in the ACFR sample. Second, the shock coefficients remain statistically significant even after including revenue controls. The robust asymmetric responses indicate that expenditure adjustments are not merely a passive response to revenue shocks. Thus, while the revenue channel is an important mediating factor, it provides an incomplete explanation, suggesting states respond to monetary policy through additional channels. In the next section, we examine the debt service channel.

## 6.2 Increased Debt Service Channel

Monetary policy tightening also transmits to state budgets through the debt-service channel. A contractionary shock directly increases municipal bond yields (Wilson, 2022), raising the cost of refinancing existing debt. Because debt service is a mandatory component of the operating budget, these higher future payments heighten the risk of a fiscal shortfall. To preemptively mitigate this risk and avoid potential penalties, states engage in precautionary saving by reducing current operating expenditures.

We provide three pieces of evidence supporting this debt service channel. First, we test whether contractionary monetary policy directly increases state interest expenses. As the ACFR data lack comprehensive interest expense information, we utilize the Annual Surveys of State and Local Government Finance, which provides consistent yearly data from 1980-2021. We estimate Equation (17) using the log change in total interest expenses and the change in the average interest rate (interest expenses divided by prior-year debt) as dependent variables.

The results, presented in Table 9, confirm a significant pass-through of monetary policy to state borrowing costs. As shown in Columns (1)–(2) of Panel A, a contractionary pre-proposal shock significantly increases interest expenses. On average, a 10 basis point shock raises interest expenses by approximately 0.3 to 0.7 percentage points. Columns (3) and (4) corroborate this finding, showing a corresponding increase in the average interest rate on outstanding debt of 2 to 4 basis points for the same shock magnitude. These effects are not confined to the planning phase: shocks occurring during the fiscal year also significantly increase interest costs. The results are further validated in Panel B, which uses changes in the federal funds rate and shows consistent patterns—rate hikes lead to significant increases in both interest expenses and borrowing costs.

The significant sensitivity of state interest expenses to monetary policy shocks elevates debt service burdens. We next examine whether states with greater exposure to these borrowing cost channels exhibit stronger expenditure responses. Specifically, we test whether states characterized by above-median interest rate sensitivity to monetary policy and wider municipal credit spreads implement larger cuts in budgeted expenditures following contractionary shocks.

Using heterogeneous treatment effects specifications, we interact monetary policy shocks with indicators for states with above-median interest rate sensitivity and municipal spreads. The results, presented in Panel B of Table 7, provide strong support for Hypothesis 3 in Section 4.2. We find that states facing higher borrowing constraints—those with above-median interest sensitivity and credit spreads—exhibit significantly larger planning-phase expenditure reductions following contractionary monetary policy (coefficients of -0.295 and -0.252, respectively). This pattern demonstrates that debt-service burdens create an important transmission channel through which monetary policy affects state fiscal decisions, operating alongside the revenue channel.

Finally, beyond expenditure cuts, do states employ other fiscal strategies to reduce budgetary pressures under contractionary monetary policy? The evidence suggests they do: states also significantly reduce new debt issuance. We construct state-level debt issuance data during budget cycles using Mergent FISD and apply specification (18) to examine borrowing responses across budget phases.

Figure 8 reveals that contractionary monetary policy significantly reduces state debt issuance, with the most pronounced effects occurring during the budget planning stage. A contractionary shock in the initial planning phase reduces debt issuance by approximately 0.6-0.9 percentage points. The substantially weaker responses during both the revision and fiscal year phases indicate that debt issuance decisions are primarily determined early in the budget cycle, when states retain greater flexibility to adjust their financing strategies. This timing closely parallels the expenditure adjustment patterns documented earlier, suggesting that states coordinate their borrowing and spending decisions holistically in response to tightening monetary conditions. Together, these findings reinforce that institutional constraints increasingly limit fiscal flexibility as the budget process advances, making early-stage adjustments—in both expenditures and debt financing—the primary mechanisms through which states respond to monetary policy shocks.

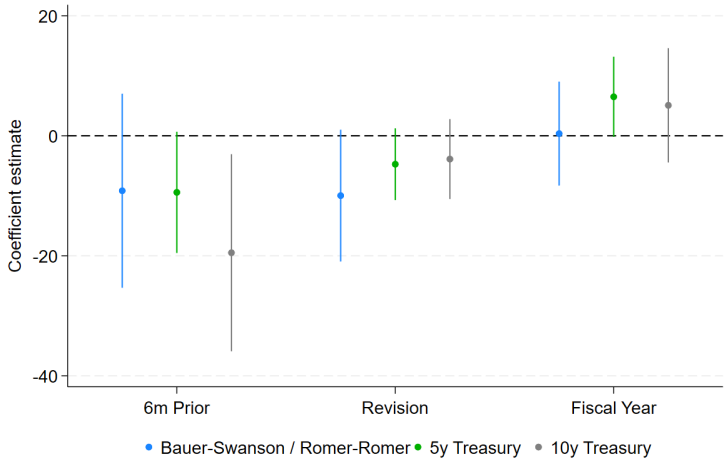
## 6.3 Institutional Rigidity Channel

Beyond the revenue and debt-service channels, our model emphasizes institutional rigidity as a central mechanism shaping fiscal responses to monetary policy. This rigidity is formalized through the parameter $\lambda$, which captures the political and social costs associated with spending cuts. As outlined in Hypothesis 4 in Section 4.2, a higher $\lambda$ implies that states assign greater weight to the welfare penalty stemming from shortfalls in essential public expenditures. Consequently, these states respond to contractionary monetary shocks by cutting budgeted expenditures more aggressively to avoid violating fiscal constraints or triggering even costlier adjustments in the future.

Since $\lambda$ is not directly observable, we employ two empirical proxies to test its implications. First, we use the stringency of state-level balanced-budget requirements, drawing on classifications from Yarbrough (2016). States with stricter rules face stronger incentives to preemptively adjust expenditures when anticipating revenue shortfalls induced by monetary

**Figure 8:** How do MPS Affect Debt Issuance?

This figure plots the estimated effect of monetary policy shocks on fiscal-year state debt issuance normalized by prior year state total expenditures across three budget phases—six months prior to the initial proposal, the budget revision window, and the fiscal year. Blue markers use the orthogonalized Bauer–Swanson/Romer-Romer shock; green and gray use changes in the 2-year and 10-year Treasury rates, respectively. Error bars show 95% confidence intervals. Standard errors are clustered by state and year.




contractions, effectively reflecting a higher $\lambda$ in the model. Second, we use per capita income to capture heterogeneity in the marginal value of public spending. In lower-income states, public expenditures typically provide higher marginal benefits to households, raising the political and social costs of spending cuts. This translates empirically into a higher effective $\lambda$, as policymakers in these states face greater resistance to reducing budgets—even when confronted with negative revenue shocks from monetary tightening.

These proxies allow us to examine how cross-state variation in institutional and political constraints influences the transmission of monetary policy to fiscal adjustments. The results in Panel C of Table 7 provide compelling evidence consistent with this mechanism. We interact the six-month pre-proposal monetary policy shock with indicators for states exhibiting higher institutional rigidity. The estimated coefficients on these interaction terms are both negative and statistically significant: –0.18 for balanced-budget stringency and –0.19 for lower per-capita income. These results indicate that contractionary monetary shocks reduce planned expenditure growth more substantially in states with tighter fiscal constraints or more limited fiscal capacity. This pattern supports Hypothesis 4 and reinforces the view that institutional rigidities affect the transmission of monetary policy to state fiscal behavior.

# 7 Conclusion

This paper shows that institutional rigidities in state budget processes fundamentally shape the transmission of monetary policy to fiscal spending. Our findings reveal that contractionary monetary shocks reduce state expenditures primarily when they occur during the budget planning phase, with effects materializing after an approximately 18- to 24-month lag inherent to governmental budgeting cycles. Through both theoretical and empirical analysis, we identify two key transmission channels—the revenue expectations channel and the debt-service channel—that operate within the constraints imposed by balanced budget requirements and borrowing limitations. The planning-phase concentration of fiscal adjustments along with our cross-state heterogeneity results provide compelling evidence that institutional frictions rather than nominal rigidities or information delays drive the observed persistence in policy transmission.

These findings have important implications for both macroeconomic theory and policy design. Our results challenge the standard assumption in macroeconomic models that fiscal policy adjusts immediately to monetary shocks, instead highlighting how institutional constraints create persistent delays in policy transmission. Furthermore, our identification of institutional rigidities as a source of macroeconomic persistence suggests that similar mechanisms may operate in other large organizations with structured decision-making processes, including corporations and public agencies. As debates continue about fiscal sustainability and the appropriate role of fiscal rules at various levels of government, our research provides valuable insights into how institutional design affects economic stabilization and the transmission of macroeconomic policy.

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**Table 1:** Summary Statistics

The table reports summary statistics for total actual revenues and expenditures and for their changes during planning, revision, and execution. The planning component, measured as $\log(\text{Init}_t/\text{Final}_{t-1})$, captures how initial budget proposals deviate from the previous year's final budgeted outcomes. The revision component, $\log(\text{Final}_t/\text{Init}_t)$, reflects adjustments to the initial enacted budget. The execution component, $\log(\text{Act}_t/\text{Final}_t)$, measures deviations between final budgeted and realized outcomes. The first rows in each section are in nominal U.S. dollars, billions, and log changes are expressed in real terms.

| | Mean | SD | P5 | P25 | Median | P75 | P95 |
|---|---|---|---|---|---|---|---|
| Expenditures | | | | | | | |
| Actual total spending amount (Bn) | 19.681 | 24.066 | 1.624 | 4.940 | 10.952 | 25.281 | 66.545 |
| Planning-$\log(\text{Init}^E_t/\text{Final}^E_{t-1})$ | -0.004 | 0.100 | -0.158 | -0.039 | 0.004 | 0.041 | 0.137 |
| Revision-$\log(\text{Final}^E_t/\text{Init}^E_t)$ | 0.027 | 0.083 | -0.056 | -0.011 | 0.005 | 0.047 | 0.192 |
| Execution-$\log(\text{Act}^E_t/\text{Final}^E_t)$ | -0.103 | 0.103 | -0.336 | -0.124 | -0.071 | -0.042 | -0.019 |
| Revenues | | | | | | | |
| Actual total revenue amount (Bn) | 20.688 | 25.328 | 2.040 | 5.116 | 10.999 | 27.664 | 68.421 |
| Planning-$\log(\text{Init}^R_t/\text{Final}^R_{t-1})$ | 0.003 | 0.090 | -0.132 | -0.027 | 0.013 | 0.040 | 0.109 |
| Revision-$\log(\text{Final}^R_t/\text{Init}^R_t)$ | 0.019 | 0.067 | -0.051 | -0.012 | -0.001 | 0.032 | 0.138 |
| Execution-$\log(\text{Act}^R_t/\text{Final}^R_t)$ | -0.044 | 0.110 | -0.177 | -0.058 | -0.024 | -0.004 | 0.049 |

## **Table 2:** Revenue Constraints and Expenditure Responses Across Budget Phases

This table examines how revenue changes drive expenditure adjustments across different phases of the budget process using the decomposition specified in Equation (1). Panel A presents the core revenue-expenditure linkage results, where each column represents a separate regression with the respective expenditure component (Planning, Lag Execution, Revision, or Execution) as the dependent variable and the corresponding revenue-based measure as the key explanatory variable. Panel B examines the determinants of expenditure adjustments during the execution phase, distinguishing between responses to positive and negative revenue shocks. The sample covers 1995 to 2024 using the ACFR database and includes all available states with complete data. Standard errors are clustered at the state level and reported in parentheses. ***, , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

**Panel A: How Revenue Shocks Affect Expenditures Through State Budget Processes?**

| | Total Expenditures | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Planning $\log(\text{Init}^E_t/\text{Final}^E_{t-1})$ | | Lag Execution $\log(\text{Act}^E_{t-1}/\text{Final}^E_{t-1})$ | | Revision $\log(\text{Final}^E_t/\text{Init}^E_t)$ | | Execution $\log(\text{Act}^E_t/\text{Final}^E_t)$ | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\log(\text{Init}^R_t/\text{Final}^R_{t-1})$ | 0.656*** | 0.578*** | | | | | | |
| | (0.0787) | (0.0731) | | | | | | |
| $\log(\text{Act}^R_{t-1}/\text{Final}^R_{t-1})$ | | | 0.568*** | 0.259*** | | | | |
| | | | (0.0811) | (0.0782) | | | | |
| $\log(\text{Final}^R_t/\text{Init}^R_t)$ | | | | | 0.797*** | 0.687*** | | |
| | | | | | (0.0754) | (0.0782) | | |
| $\log(\text{Act}^R_t/\text{Final}^R_t)$ | | | | | | | 0.568*** | 0.271*** |
| | | | | | | | (0.0805) | (0.0823) |
| State FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Obs. | 989 | 989 | 1,007 | 1,007 | 1,024 | 1,024 | 1,040 | 1,040 |
| Adj.$R^2$ | 0.35 | 0.50 | 0.43 | 0.66 | 0.39 | 0.58 | 0.42 | 0.63 |

**Panel B: What Drives Negative Adjustment in Expenditures during Execution Phase?**

| | Execution $\log(\text{Act}^E_t/\text{Final}^E_t)$ | |
|---|---|---|
| | (1) | (2) |
| $\log(\text{Act}^R_t/\text{Final}^R_t) \times \mathbb{1}(\text{Act}^R_t < \text{Final}^R_t)$ | 0.972*** | 0.720*** |
| | (0.0969) | (0.174) |
| $\log(\text{Act}^R_t/\text{Final}^R_t)$ | -0.282*** | -0.256** |
| | (0.0756) | (0.106) |
| $\mathbb{1}(\text{Act}^R_t < \text{Final}^R_t)$ | -0.0000558 | 0.00237 |
| | (0.00774) | (0.00627) |
| State FE | | ✓ |
| Obs. | 1,040 | 1,040 |
| Adj.$R^2$ | 0.51 | 0.66 |

**Table 3:** Impact of Macroeconomic Factors on State Expenditures

This table examines how macroeconomic conditions influence state expenditure adjustments during the planning and execution phases of the budget cycle. The dependent variable in Panel A is the log change of total expenditures in planned expenditures, defined as $\log\left(\text{Init}_t^E/\text{Final}_{t-1}^E\right)$. The dependent variable in Panel B is the log change in executed expenditures, defined as $\log\left(\text{Act}_t^E/\text{Final}_t^E\right)$. The key explanatory variables are contemporaneous changes in real GDP, the S&P 500 index, employment, and the Treasury yield curve slope (10-year minus 1-year). Standard errors are calculated using a wild cluster bootstrap, clustered by state and year; these are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

**Panel A: Planning Stage**

| | $\log(\text{Init}_t^E/\text{Final}_{t-1}^E)$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta$log(GDP) | 0.667*** | 0.550** | | | | | | |
| | (0.195) | (0.239) | | | | | | |
| $\Delta$log(SP500) | | | 0.0437* | 0.0474* | | | | |
| | | | (0.0252) | (0.0247) | | | | |
| $\Delta$log(EMP) | | | | | 0.385 | 0.314 | | |
| | | | | | (0.586) | (0.631) | | |
| $\Delta$Treasury Slope | | | | | | | -0.965* | -0.825 |
| | | | | | | | (0.560) | (0.638) |
| State FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Obs. | 1,122 | 1,122 | 1,122 | 1,122 | 1,122 | 1,122 | 1,122 | 1,122 |
| Adj.$R^2$ | 0.01 | 0.24 | 0.00 | 0.23 | 0.00 | 0.23 | 0.00 | 0.23 |

**Panel B: Execution Stage**

| | $\log(\text{Act}_t^E/\text{Final}_t^E)$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta$log(GDP) | -0.241 | -0.284 | | | | | | |
| | (0.145) | (0.181) | | | | | | |
| $\Delta$log(SP500) | | | -0.0238 | -0.0315 | | | | |
| | | | (0.0565) | (0.0587) | | | | |
| $\Delta$log(EMP) | | | | | -0.510 | -0.545 | | |
| | | | | | (0.314) | (0.331) | | |
| $\Delta$Treasury Slope | | | | | | | 0.427 | 0.545 |
| | | | | | | | (0.778) | (0.852) |
| State FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Obs. | 1,175 | 1,175 | 1,175 | 1,175 | 1,175 | 1,175 | 1,175 | 1,175 |
| Adj.$R^2$ | 0.00 | 0.65 | 0.00 | 0.65 | 0.02 | 0.67 | 0.00 | 0.65 |

**Table 4:** Impact of Monetary Policy Shocks on State Expenditures

This table reports the effects of monetary policy shocks (MPS) on state government expenditures, using a state-by-year panel. Columns (1)-(4) use expenditure data from the ACFR, covering the period 1995-2024, while columns (5)-(8) use data from the NASBO, spanning 1985-2023. The dependent variable is the real log change in total state expenditures during fiscal year $t$, $\Delta\text{Actual}_t^E$. We employ two measures of MPS: the Bauer–Swanson orthogonalized shocks (BS shocks) and changes in the 5-year Treasury yield during the 30-minute window following FOMC announcements (5Y shocks). MPS are constructed as cumulative shocks over three distinct periods: (i) the six months preceding the initial budget proposal, (ii) the budget revision period, and (iii) the fiscal year itself. `Neg` is a binary indicator equal to 1 if the corresponding shock is negative. Control variables include the log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year). All control variables are measured over the six-month window that precedes the six-month period leading up to the initial budget proposal phase. For brevity, coefficients on control variables and interactions are not reported. Standard errors are clustered by state and year (reported in parentheses). *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

| | $\Delta\log(\text{Act}_t^E)$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ACFR (1995-2024) | | | | NASBO (1985-2023) | | | |
| | BS shocks | | 5Y shocks | | BS shocks | | 5Y shocks | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\text{MPS}_{\text{Plan.}}$ | -0.281*** | -0.293*** | -0.107*** | -0.103*** | -0.162** | -0.161** | -0.101*** | -0.104*** |
| | (0.0721) | (0.0698) | (0.0282) | (0.0284) | (0.0616) | (0.0626) | (0.0360) | (0.0350) |
| $\text{MPS}_{\text{Plan.}} \times \text{Neg}$ | 0.330*** | 0.365*** | 0.0756* | 0.0686* | 0.0909 | 0.0852 | 0.103** | 0.107** |
| | (0.115) | (0.112) | (0.0390) | (0.0365) | (0.0943) | (0.0960) | (0.0413) | (0.0402) |
| $\text{MPS}_{\text{Rev.}}$ | 0.0135 | 0.0130 | -0.0696** | -0.0781** | -0.0537* | -0.0562* | -0.0409 | -0.0374 |
| | (0.105) | (0.114) | (0.0314) | (0.0378) | (0.0279) | (0.0301) | (0.0388) | (0.0374) |
| $\text{MPS}_{\text{Rev.}} \times \text{Neg}$ | -0.0330 | -0.0321 | 0.0794 | 0.0923 | 0.123*** | 0.131*** | 0.0637 | 0.0619 |
| | (0.116) | (0.122) | (0.0495) | (0.0559) | (0.0402) | (0.0418) | (0.0529) | (0.0525) |
| $\text{MPS}_{\text{FY}}$ | -0.00499 | -0.00583 | -0.0958* | -0.0996* | 0.0286 | 0.0263 | 0.0490* | 0.0497* |
| | (0.0450) | (0.0444) | (0.0533) | (0.0535) | (0.0341) | (0.0340) | (0.0245) | (0.0251) |
| $\text{MPS}_{\text{FY}} \times \text{Neg}$ | -0.113** | -0.104* | 0.0567 | 0.0618 | -0.0983* | -0.0943* | -0.0709** | -0.0729** |
| | (0.0546) | (0.0523) | (0.0523) | (0.0517) | (0.0533) | (0.0518) | (0.0294) | (0.0302) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Obs. | 1,141 | 1,141 | 1,141 | 1,141 | 1,946 | 1,946 | 1,946 | 1,946 |
| Adj.$R^2$ | 0.05 | 0.03 | 0.05 | 0.03 | 0.11 | 0.11 | 0.09 | 0.09 |

**Table 5:** Effects of Monetary Policy Shocks Across Budget Phases

This table decomposes the impact of monetary policy shocks (MPS) on real state expenditure growth, $\Delta\text{Actual}_t$, across three stages of the budget cycle: the planning phase $\log(\text{Init}_t/\text{Final}_{t-1})$, the revision phase $\log(\text{Final}_t/\text{Init}_t)$, and the execution phase $\log(\text{Act}_t/\text{Final}_t)$. Columns (1)-(3) use expenditure data from the ACFR, covering the period 1995-2024, while columns (4)-(5) use data from the NASBO, spanning 1985-2023. Cumulative Bauer–Swanson orthogonalized MPS are measured over three distinct periods: (i) the six months prior to the initial budget proposal, (ii) the budget revision period, and (iii) the fiscal year itself. `Neg` is an indicator equal to 1 if the corresponding shock is negative. Control variables include the log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year). All control variables are measured over the six-month window that precedes the six-month period leading up to the initial budget proposal phase. For brevity, coefficients on control variables and interactions are not reported. Standard errors are clustered by state and year (reported in parentheses). $^{*}$, $^{**}$, $^{***}$ represent statistical significance at 10%, 5% and 1% level, respectively.

| | ACFR (1995-2024) | | | NASBO (1985-2023) | |
|---|---|---|---|---|---|
| | Planning $\log(\text{Init}_t^E/\text{Final}_{t-1}^E)$ | Revision $\log(\text{Final}_t^E/\text{Init}_t^E)$ | Execution $\log(\text{Act}_t^E/\text{Final}_t^E)$ | Planning $\log(\text{Init}_t^E/\text{Final}_{t-1}^E)$ | Execution $\log(\text{Act}_t^E/\text{Final}_t^E)$ |
| | (1) | (2) | (3) | (4) | (5) |
| $\text{MPS}_{\text{Plan.}}$ | -0.134** | | | -0.0683** | |
| | (0.0618) | | | (0.0278) | |
| $\text{MPS}_{\text{Plan.}} \times \text{Neg}$ | 0.0397 | | | 0.0740** | |
| | (0.108) | | | (0.0354) | |
| $\text{MPS}_{\text{Rev.}}$ | | 0.0838 | | | |
| | | (0.139) | | | |
| $\text{MPS}_{\text{Rev.}} \times \text{Neg}$ | | -0.196 | | | |
| | | (0.166) | | | |
| $\text{MPS}_{\text{FY}}$ | | | -0.0325 | | 0.0454 |
| | | | (0.153) | | (0.0340) |
| $\text{MPS}_{\text{FY}} \times \text{Neg}$ | | | 0.0454 | | -0.0404 |
| | | | (0.156) | | (0.0618) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs. | 1,122 | 1,159 | 1,170 | 1,791 | 1,854 |
| Adj.$R^2$ | 0.24 | 0.40 | 0.70 | 0.11 | 0.09 |

**Table 6:** Impact of Monetary Policy Shocks on State Revenues?

This table reports the effects of monetary policy shocks (MPS) on state government revenues using a state-by-year panel. Columns (1)-(4) use expenditure data from the ACFR, covering the period 1995-2025, while columns (5)-(8) use data from the NASBO, spanning 1985-2023. The dependent variable is the real log change in total state revenues during fiscal year $t$, $\Delta \text{Act}_t^R$, and decomposed into three phases of the budget cycle: the planning phase $\log\left(\text{Init}_t^R/\text{Final}_{t-1}^R\right)$, the revision phase $\log\left(\text{Final}_t^R/\text{Init}_t^R\right)$, and the execution phase $\log\left(\text{Act}_t^R/\text{Final}_t^R\right)$). Cumulative Bauer–Swanson orthogonalized MPS (or Romer and Romer shocks for the pre-1989 period) are measured over three distinct periods: (i) the six months prior to the initial budget proposal, (ii) the budget revision period, and (iii) the fiscal year itself. `Neg` is an indicator equal to 1 if the corresponding shock is negative. Control variables include the log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year). All control variables are measured over the six-month window that precedes the six-month period leading up to the initial budget proposal phase. For brevity, coefficients on control variables and interactions are not reported. Standard errors are clustered by state and year (reported in parentheses). *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

| | ACFR (1995-2024) | | | | NASBO (1985-2023) | | |
|---|---|---|---|---|---|---|---|
| | $\Delta\log(\text{Act}_t^R)$ | Planning | Revision | Execution | $\Delta\log(\text{Act}_t^R)$ | Planning | Execution |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| $\text{MPS}_{\text{Plan.}}$ | -0.215*** | -0.0390 | | | -0.118** | -0.130*** | |
| | (0.0694) | (0.0770) | | | (0.0497) | (0.0471) | |
| $\text{MPS}_{\text{Plan.}} \times$ Neg | -0.0396 | -0.209* | | | -0.126 | 0.138** | |
| | (0.0955) | (0.119) | | | (0.1000) | (0.0654) | |
| $\text{MPS}_{\text{Rev.}}$ | 0.185 | | 0.138 | | -0.104** | | |
| | (0.169) | | (0.103) | | (0.0395) | | |
| $\text{MPS}_{\text{Rev.}} \times$ Neg | -0.376** | | -0.286* | | 0.00807 | | |
| | (0.181) | | (0.149) | | (0.0696) | | |
| $\text{MPS}_{\text{FY}}$ | -0.167*** | | | 0.0162 | -0.110** | | -0.0199 |
| | (0.0536) | | | (0.0276) | (0.0464) | | (0.0403) |
| $\text{MPS}_{\text{FY}} \times$ Neg | 0.153* | | | -0.00169 | 0.152* | | 0.149* |
| | (0.0772) | | | (0.0361) | (0.0803) | | (0.0805) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Obs. | 1,056 | 989 | 1,024 | 1,035 | 1,846 | 1,685 | 1,854 |
| Adj.$R^2$ | 0.04 | 0.12 | 0.35 | 0.60 | 0.08 | 0.08 | 0.10 |

**Table 7:** Heterogeneous Effects by State Characteristics—Mechanisms Analysis

This table examines how the relationship between monetary policy and state expenditures varies across different state characteristics and potential transmission channels. The dependent variable is $\log\left(\text{Init}_t^E/\text{Final}_{t-1}^E\right)$ during the planning stage. $MPS_{Pre6M}$ represents the monetary policy shock measure during the six months preceding the initial budget proposal, and "Above Median" indicates states above the median for each characteristic. Panel A examines revenue channels, testing whether monetary policy effects operate through revenue sensitivity, revenue volatility, or tax volatility. Panel B investigates debt-service channels, examining rate sensitivity to MPS and municipal bond spreads. Panel C explores institutional rigidity mechanisms, testing whether balanced budget rule tightness and per capita income levels affect responsiveness. All specifications include state and year fixed effects along with additional controls. Standard errors are clustered by state and year (reported in parentheses). *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

**Panel A: Revenue Channel**

| | Rev-MPS Sensitivity | Revenue Volatility | Tax Volatility |
|---|---|---|---|
| | (1) | (2) | (3) |
| $\text{MPS}_{\text{Plan.}}$ × Above Median | -0.331*** | -0.105 | -0.227** |
| | (0.105) | (0.0916) | (0.0829) |
| Controls | ✓ | ✓ | ✓ |
| State + Year FE | ✓ | ✓ | ✓ |
| Obs. | 1,122 | 1,122 | 1,122 |

**Panel B: Debt-Service Channel**

| | Rate-MPS Sensitivity | Muni Spread |
|---|---|---|
| | (1) | (2) |
| $\text{MPS}_{\text{Plan.}}$ × Above Median | -0.296** | -0.252** |
| | (0.123) | (0.116) |
| Controls | ✓ | ✓ |
| State + Year FE | ✓ | ✓ |
| Obs. | 1,122 | 1,122 |

**Panel C: Institutional Rigidity**

| | Tightness of Balanced Budget Rule | Low Per Capita Income |
|---|---|---|
| | (1) | (2) |
| $\text{MPS}_{\text{Plan.}}$ × Above Median | -0.179* | -0.189** |
| | (0.0936) | (0.0784) |
| Controls | ✓ | ✓ |
| State + Year FE | ✓ | ✓ |
| Obs. | 1,042 | 1,122 |

**Table 8:** The Role of Revenue in Mediating the Fiscal Effects of Monetary Policy Shocks

This table reports the effects of monetary policy shocks (MPS) on state government expenditures, controlling for contemporaneous revenue changes. Columns (1)-(2) use expenditure data from the ACFR, covering the period 1995-2025, while columns (3)-(4) use data from the NASBO, spanning 1985-2023. The dependent variable is the real log change in state expenditures during fiscal year $t$ $\Delta \text{Act}_t^E$ and during the planning phase $\log\left(\text{Init}_t^E/\text{Final}_{t-1}^E\right)$. Real log changes in state revenues during the planning phase and the fiscal year are included as control variables. Cumulative Bauer–Swanson orthogonalized MPS are measured over three distinct periods: (i) the six months prior to the initial budget proposal, (ii) the budget revision period, and (iii) the fiscal year itself. `Neg` is an indicator equal to 1 if the corresponding shock is negative. Control variables include the log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year). All control variables are measured over the six-month window that precedes the six-month period leading up to the initial budget proposal phase. For brevity, coefficients on control variables and interactions are not reported. Standard errors are clustered by state and year (reported in parentheses). *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

| | ACFR (1995-2024) | | NASBO (1985-2023) | |
|---|---|---|---|---|
| | $\Delta\log(\text{Act}_t^E)$ | Planning $\log(\text{Init}_t^E/\text{Final}_{t-1}^E)$ | $\Delta\log(\text{Act}_t^E)$ | Planning $\log(\text{Init}_t^E/\text{Final}_{t-1}^E)$ |
| | (1) | (2) | (3) | (4) |
| $\text{MPS}_{\text{Plan.}}$ | -0.206** | -0.108** | -0.158*** | -0.00907 |
| | (0.0787) | (0.0528) | (0.0579) | (0.0452) |
| $\text{MPS}_{\text{Plan.}} \times$ Neg | 0.334*** | 0.104 | 0.275*** | 0.00181 |
| | (0.0973) | (0.0916) | (0.0963) | (0.0487) |
| $\text{MPS}_{\text{Rev.}}$ | -0.0231 | | 0.0638 | |
| | (0.102) | | (0.0380) | |
| $\text{MPS}_{\text{Rev.}} \times$ Neg | 0.0767 | | 0.0424 | |
| | (0.110) | | (0.0621) | |
| $\text{MPS}_{\text{FY}}$ | 0.0344 | | 0.0838** | |
| | (0.0371) | | (0.0315) | |
| $\text{MPS}_{\text{FY}} \times$ Neg | -0.149** | | -0.131*** | |
| | (0.0543) | | (0.0480) | |
| $\Delta\log$(Revenue) | 0.346*** | 0.573*** | 0.389*** | 0.557*** |
| | (0.0780) | (0.0626) | (0.0837) | (0.0911) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| State FE | ✓ | ✓ | ✓ | ✓ |
| Obs. | 1,056 | 989 | 1,846 | 1,679 |
| Adj.$R^2$ | 0.21 | 0.50 | 0.24 | 0.41 |

**Table 9:** Impact of Monetary Policy Shocks on State Interest Expense

This table reports the effects of monetary policy shocks (MPS) on state interest expenses using data from the Annual Surveys of State and Local Government Finance, covering the period 1980–2021. In Columns (1) and (2), the dependent variable is the log change in interest expenses during fiscal year $t$. In Columns (3) and (4), the dependent variable is the annual change in the average interest expense rate, calculated as the ratio of interest expenses to total debt outstanding in the previous year. The two panels differ in how monetary policy shocks are measured. Panel A uses cumulative Bauer–Swanson orthogonalized shocks, measured over three distinct periods: (i) the six months preceding the initial budget proposal, (ii) the budget revision period, and (iii) the fiscal year itself. Panel B instead uses changes in the lagged annual federal funds rate. The variable `Neg` is an indicator equal to 1 if the corresponding shock is negative. Control variables include the log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year). In Panel A, all controls are measured over the six-month window preceding the six months leading up to the initial budget proposal. In Panel B, controls are lagged by one fiscal year. For brevity, coefficients on control variables and interactions are not reported. Standard errors are clustered by state and year (reported in parentheses). *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

**Panel A: Monetary Policy Shocks**

| | $\Delta\log(\text{IntExp}_t)$ | | $\Delta\text{Int Rate}_t$ | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $\text{MPS}_{\text{Plan.}}$ | 0.0685*** | 0.0330** | 0.416*** | 0.211** |
| | (0.0143) | (0.0147) | (0.0879) | (0.0861) |
| $\text{MPS}_{\text{Plan.}} \times \text{Neg}$ | -0.199*** | -0.136*** | -1.249*** | -0.879*** |
| | (0.0262) | (0.0384) | (0.195) | (0.265) |
| $\text{MPS}_{\text{Rev.}}$ | | 0.0344 | | 0.237 |
| | | (0.0407) | | (0.281) |
| $\text{MPS}_{\text{Rev.}} \times \text{Neg}$ | | -0.00910 | | -0.192 |
| | | (0.0590) | | (0.405) |
| $\text{MPS}_{\text{FY}}$ | | 0.0422* | | 0.231* |
| | | (0.0218) | | (0.136) |
| $\text{MPS}_{\text{FY}} \times \text{Neg}$ | | -0.113*** | | -0.606*** |
| | | (0.0260) | | (0.190) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| State FE | ✓ | ✓ | ✓ | ✓ |
| Obs. | 2,137 | 2,131 | 2,137 | 2,131 |
| Adj.$R^2$ | 0.27 | 0.30 | 0.12 | 0.15 |

**Panel B: Federal Fund Rate Changes**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $\Delta\text{FED}_{t-1}$ | 0.0437*** | 0.0446*** | 0.0905*** | 0.0937*** |
| | (0.00926) | (0.00762) | (0.0189) | (0.0241) |
| $\Delta\text{FED}_{t-1} \times \text{Neg}$ | -0.0727*** | -0.0782*** | -0.166*** | -0.167*** |
| | (0.0140) | (0.0119) | (0.0542) | (0.0536) |
| Controls | | ✓ | | ✓ |
| State FE | ✓ | ✓ | ✓ | ✓ |
| Obs. | 2,142 | 2,142 | 2,142 | 2,142 |
| Adj.$R^2$ | 0.10 | 0.13 | 0.01 | 0.02 |

# Long and Variable Lags via State Fiscal Policy
# Internet Appendix

**Figure IA.1:** State Interest Expenses Over Time

This figure plots total interest expenses (in billions of dollars) and interest expenses as a share of operating expenditures for U.S. state governments from 1980 to 2021, using data from the Annual Surveys of State and Local Government Finance.

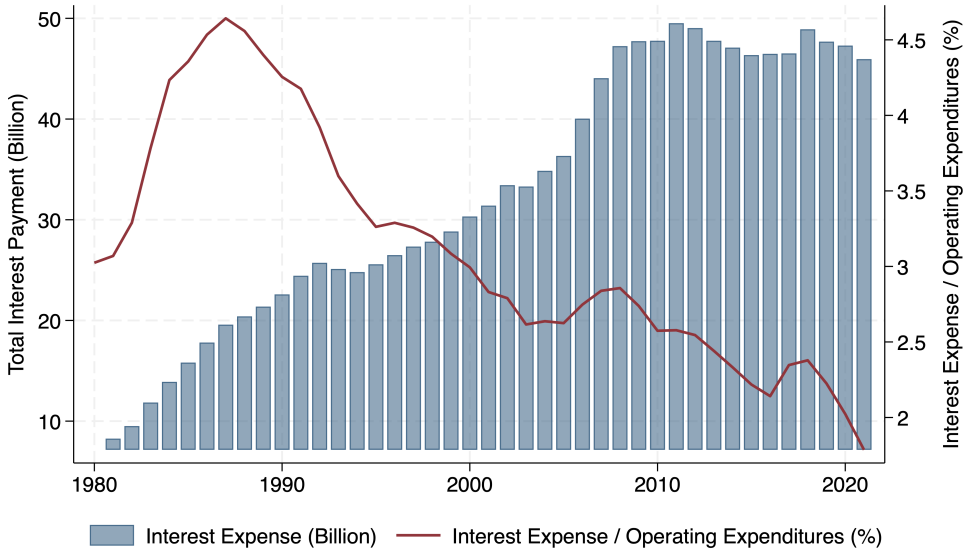


**Figure IA.2:** Example: ACFR for Massachusetts

This figure illustrates the structure of data from Massachusetts's ACFR for fiscal year 2002. The table reports statutory budget information, including the original budget, final budget, and actual outcomes, alongside the variance between actual and planned amounts. Revenues and expenditures are disaggregated by detailed line items.

**Budgeted Funds**

Combined Schedule Of Revenues, Expenditures And Changes In Fund Balances - Statutory Basis - Budget and Actual
Fiscal Year Ended June 30, 2002
(Amounts in thousands )

| | Original Budget | Final Budget | Actual | Variance over/(under) |
|---|---|---|---|---|
| **REVENUES AND OTHER FINANCING SOURCES** | | | | |
| **Revenues:** | | | | |
| Taxes | $ 14,930,000 | $ 14,930,100 | $ 13,622,710 | $ (1,307,390) |
| Assessments | - | 2,700 | 129,354 | 126,654 |
| Federal grants and reimbursements | 4,126,300 | 4,126,300 | 4,334,934 | 208,634 |
| Departmental | 1,672,300 | 1,422,389 | 1,205,629 | (216,760) |
| Miscellaneous | - | 92,483 | 265,492 | 173,009 |
| **Total revenues** | **20,728,600** | **20,573,972** | **19,558,119** | **(1,015,853)** |
| **Other financing sources:** | | | | |
| Fringe benefit cost recovery | - | - | 161,524 | 161,524 |
| Lottery reimbursements | - | 87,341 | 87,341 | - |
| Lottery distributions | - | 857,700 | 871,136 | 13,436 |
| Caseload increase mitigation transfer | - | - | 4,878 | 4,878 |
| Tobacco settlement transfer | - | 154,728 | 154,728 | - |
| Operating transfers in | 1,062,000 | 221,911 | 515,531 | 293,620 |
| Transfer for transitional escrow | - | - | 579,215 | 579,215 |
| Stabilization transfer | - | - | 1,030,000 | 1,030,000 |
| Capital projects funds year end transfer | - | - | 51,369 | 51,369 |
| Federal reimbursement transfer in | - | - | 1,902 | 1,902 |
| Transfer for tax reduction | - | - | 33,605 | 33,605 |
| **Total other financing sources** | **1,062,000** | **1,321,680** | **3,491,229** | **2,169,549** |
| **Total revenues and other financing sources** | **21,790,600** | **21,895,652** | **23,049,348** | **1,153,696** |
| **EXPENDITURES AND OTHER FINANCING USES** | | | | |
| **Expenditures:** | | | | |
| Legislature | 88,227 | 72,850 | 58,909 | 13,941 |
| Judiciary | 584,123 | 587,686 | 580,057 | 7,629 |
| Inspector General | 2,019 | 1,975 | 1,973 | 2 |
| Governor and Lieutenant Governor | 5,611 | 5,655 | 5,542 | 113 |
| Secretary of the Commonwealth | 35,088 | 35,028 | 34,693 | 335 |
| Treasurer and Receiver-General | 187,159 | 121,024 | 119,114 | 1,910 |
| Auditor of the Commonwealth | 15,380 | 15,351 | 15,347 | 4 |
| Attorney General | 35,687 | 36,335 | 35,674 | 661 |
| Ethics Commission | 1,415 | 1,412 | 1,411 | 1 |
| District Attorney | 79,566 | 81,253 | 81,056 | 197 |
| Office of Campaign & Political Finance | 1,089 | 1,088 | 1,440 | (352) |
| Sheriff's Departments | 193,220 | 215,292 | 211,973 | 3,319 |
| Disabled Persons Protection Commission | 1,616 | 1,714 | 1,708 | 6 |
| Board of Library Commissioners | 7,251 | 7,270 | 6,984 | 286 |
| Comptroller | 8,352 | 8,415 | 8,410 | 5 |
| Administration and finance | 1,429,507 | 1,386,683 | 1,344,343 | 42,340 |
| Environmental affairs | 226,182 | 234,966 | 221,717 | 13,249 |
| Communities and development | 122,269 | 123,018 | 116,790 | 6,228 |
| Health and human services | 4,241,579 | 4,403,293 | 4,312,159 | 91,134 |
| Transportation and construction | 129,104 | 151,990 | 145,917 | 6,073 |
| Education | 464,899 | 462,232 | 412,846 | 49,386 |
| Higher education | 1,014,147 | 1,039,047 | 1,029,516 | 9,531 |
| Public safety | 850,519 | 945,382 | 917,982 | 27,400 |
| Economic development | 46,362 | 46,241 | 34,008 | 12,233 |
| Elder affairs | 276,755 | 291,729 | 273,759 | 17,970 |
| Consumer affairs | 46,909 | 48,552 | 46,872 | 1,680 |
| Labor | 83,542 | 89,750 | 59,319 | 30,431 |
| Direct local aid | 5,191,844 | 5,193,357 | 5,189,116 | 4,241 |
| Medicaid | 4,985,458 | 5,282,868 | 5,259,275 | 23,593 |
| Pension | 931,029 | 797,064 | 795,782 | 1,282 |
| Debt service: | | | | |
| Principal retirement | 659,802 | 710,674 | 692,001 | 18,673 |
| Interest and fiscal charges | 691,889 | 641,017 | 612,734 | 28,283 |
| **Total expenditures** | **22,637,599** | **23,040,211** | **22,628,427** | **411,784** |

**Figure IA.3:** Example: NASBO for Year 2006

This figure illustrates the structure of data reported in the NASBO's Fiscal Survey of States (June 2006). Panel (a) shows actual fiscal outcomes for 2005, including beginning balances, revenues, adjustments, total resources, expenditures, ending balances, and stabilization fund contributions. Panel (b) shows recommended (planned) figures for fiscal year 2007, reported in the same format. These tables highlight the distinction between ex post realized numbers and ex ante budget proposals, which is central to our empirical analysis.

THE FISCAL SURVEY OF STATES: JUNE 2006 23

**TABLE A-1**

**Fiscal 2005 General Fund, Actual (Millions)**

| Region/State | Beginning Balance | Revenues | Adjustments | Total Resources | Expenditures | Adjustments | Ending Balance | Budget Stabilization Fund |
|---|---|---|---|---|---|---|---|---|
| **NEW ENGLAND** | | | | | | | | |
| Connecticut** | $0 | $14,214 | $0 | $14,214 | $13,909 | $0 | $305 | $607 |
| Maine** | 15 | 2,791 | 12 | 2,818 | 2,784 | 0 | 34 | 47 |
| Massachusetts* ** | 1,893 | 24,373 | 0 | 26,266 | 23,799 | 0 | 2,487 | 1,728 |
| New Hampshire | 15 | 1,392 | 0 | 1,407 | 1,325 | 0 | 82 | 17 |
| Rhode Island** | 35 | 3,005 | -61 | 2,979 | 2,927 | 0 | 52 | 91 |
| Vermont** | 0 | 1,035 | 48 | 1,083 | 1,038 | 45 | 0 | 46 |
| **MID-ATLANTIC** | | | | | | | | |
| Delaware* | 646 | 2,878 | 0 | 3,524 | 2,822 | 0 | 701 | 148 |
| Maryland** | 453 | 11,548 | 438 | 12,438 | 11,264 | 0 | 1,174 | 521 |
| New Jersey* ** | 834 | 28,132 | 0 | 28,966 | 27,844 | 344 | 778 | 289 |
| New York* ** | 2,302 | 43,863 | 0 | 46,165 | 43,619 | 0 | 2,546 | 872 |
| Pennsylvania** | 77 | 23,309 | 98 | 23,483 | 23,054 | 64 | 365 | 329 |
| **GREAT LAKES** | | | | | | | | |
| Illinois | 182 | 26,160 | 0 | 26,342 | 25,845 | 0 | 497 | 276 |
| Indiana** | 0 | 11,488 | 158 | 11,647 | 11,800 | -272 | 119 | 317 |
| Michigan** | 0 | 8,163 | 701 | 8,865 | 8,644 | 0 | 221 | 2 |
| Ohio** | 158 | 25,551 | 0 | 25,708 | 24,831 | 739 | 138 | 575 |
| Wisconsin* ** | 105 | 11,446 | 221 | 11,773 | 11,860 | 91 | 4 | 0 |

**(a)** Actual numbers

THE FISCAL SURVEY OF STATES: JUNE 2006 29

**TABLE A-3**

**Fiscal 2007 State General Fund, Recommended (Millions)**

| Region/State | Beginning Balance | Revenues | Adjustments | Resources | Expenditures | Adjustments | Ending Balance | Budget Stabilization Fund |
|---|---|---|---|---|---|---|---|---|
| **NEW ENGLAND** | | | | | | | | |
| Connecticut | $0 | $14,911 | $0 | $14,911 | $14,911 | $0 | $0 | $943 |
| Maine** | 8 | 2,900 | -27 | 2,881 | 2,869 | 0 | 12 | 77 |
| Massachusetts* | 2,601 | 26,505 | 0 | 29,107 | 26,522 | 0 | 2,585 | 2,419 |
| New Hampshire | 16 | 1,352 | 0 | 1,368 | 1,365 | 0 | 2 | 61 |
| Rhode Island** | 14 | 3,204 | -64 | 3,154 | 3,154 | 0 | 0 | 97 |
| Vermont** | 0 | 1,093 | 34 | 1,126 | 1,123 | 3 | 0 | 55 |
| **MID-ATLANTIC** | | | | | | | | |
| Delaware* ** | 569 | 3,178 | 1 | 3,747 | 3,262 | 0 | 485 | 170 |
| Maryland** | 1,208 | 12,833 | 780 | 14,821 | 14,789 | 0 | 32 | 644 |
| New Jersey* | 815 | 30,119 | 0 | 30,934 | 30,334 | 0 | 600 | 300 |
| New York* ** | 3,301 | 50,209 | 0 | 53,510 | 49,677 | 0 | 3,833 | 945 |
| Pennsylvania** | 204 | 25,225 | 0 | 25,429 | 25,425 | 1 | 3 | 414 |
| **GREAT LAKES** | | | | | | | | |
| Illinois** | 507 | 28,338 | 0 | 28,845 | 28,320 | 0 | 525 | 276 |
| Indiana** | 135 | 12,465 | 0 | 12,600 | 12,322 | 277 | 1 | 443 |
| Michigan** | 80 | 8,436 | 739 | 9,255 | 9,253 | 0 | 2 | 2 |
| Ohio** | 447 | 25,860 | 0 | 26,307 | 26,053 | 88 | 167 | 575 |
| Wisconsin* ** | 11 | 13,066 | 86 | 13,163 | 13,128 | 25 | 10 | 0 |

**(b)** Planned numbers

**Figure IA.4:** Coverage of data

The figure plots the number of U.S. states with available expenditure data by fiscal year. The blue bars report coverage from the National Association of State Budget Officers (NASBO), which consistently provide near-universal coverage from 1984 to 2023. The red bars report manually collected data from Annual Comprehensive Financial Reports (ACFRs), which expand steadily over time and reach nearly full coverage by the early 2000s.

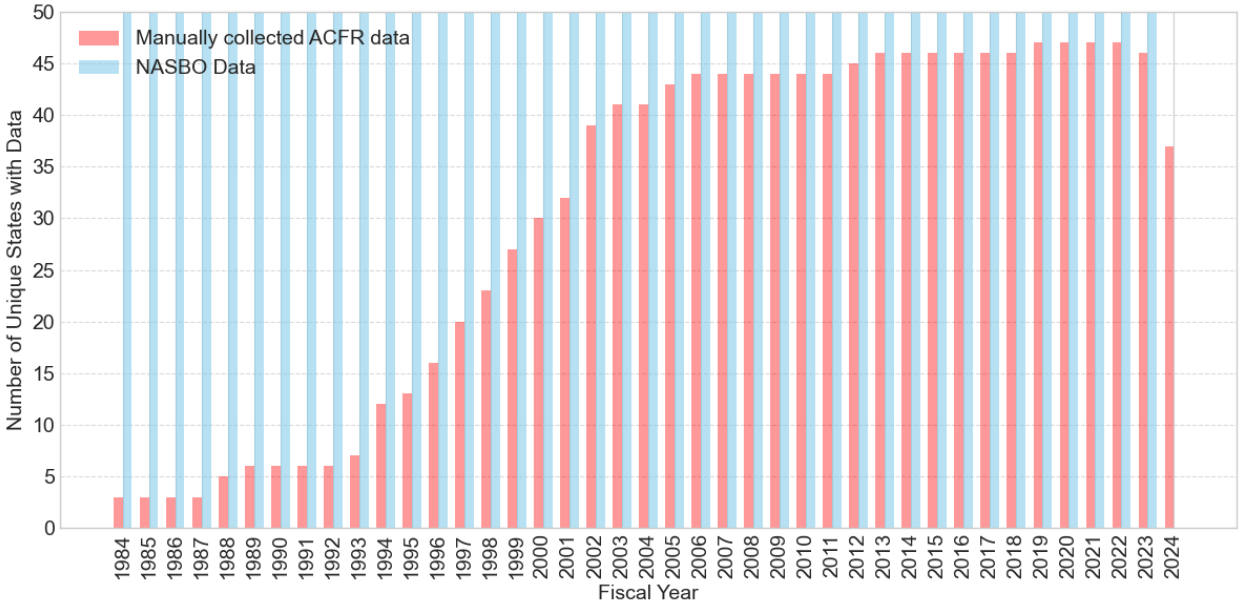
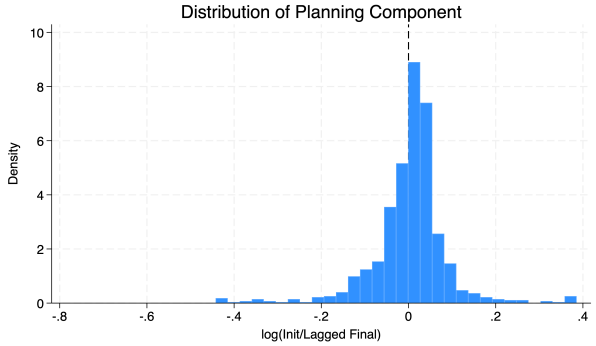
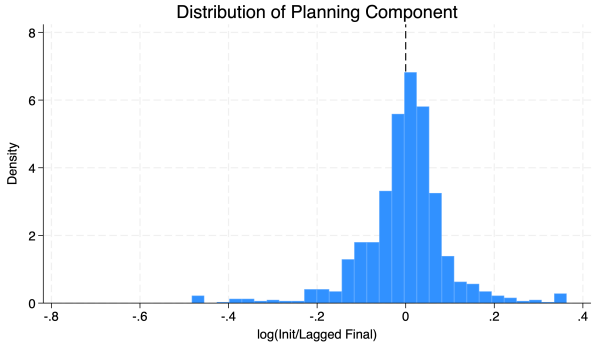


**Figure IA.5:** Distribution of State Revenue and Expenditure Changes over the Budget Cycle

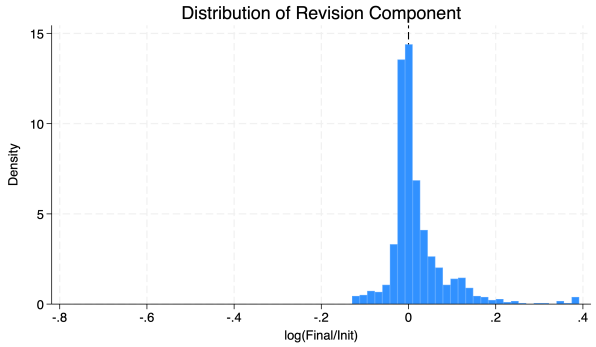
The figure shows the distributions of the three components of the state budgeting process—planning, revision, and execution—for both revenues and expenditures. Panels (a)–(b) display the planning component, measured as $\log(\text{Init}_t/\text{Final}_{t-1})$, which captures how initial budget proposals deviate from the previous year's final budgeted outcomes. Panels (c)–(d) plot the revision component, $\log(\text{Final}_t/\text{Init}_t)$, reflecting adjustments to initial plans. Panels (e)–(f) present the execution component, $\log(\text{Act}_t/\text{Final}_t)$, representing deviations between final budgeted and realized outcomes. All variables are expressed in real terms.



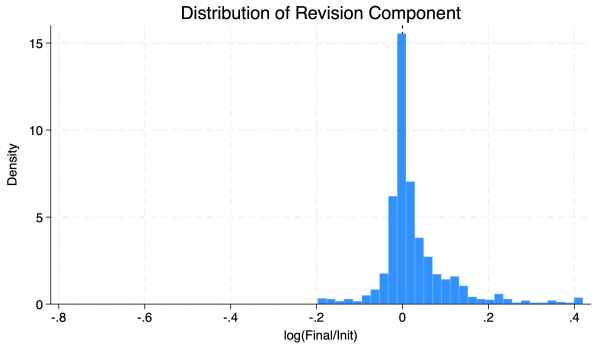

**(a)** Revenues



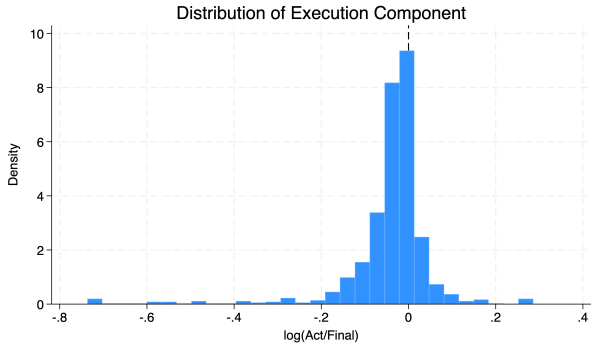

**(b)** Expenditures



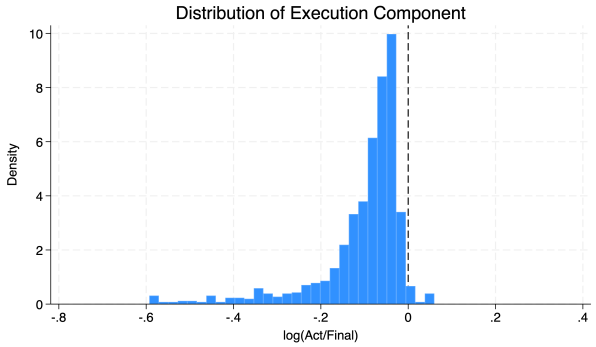

**(c)** Revenues




**(d)** Expenditures




**(e)** Revenues




**(f)** Expenditures

**Figure IA.6:** Distribution of Initial Budget Proposal Months across U.S. States

The figure displays the timing of initial state budget proposals across U.S. states using a rose (polar) plot. Each slice represents one month, and the area of each segment is proportional to the number of states whose initial budget proposals are released in that month. The data indicate strong seasonality, with most states submitting proposals in January and February, and a smaller concentration in November and December.

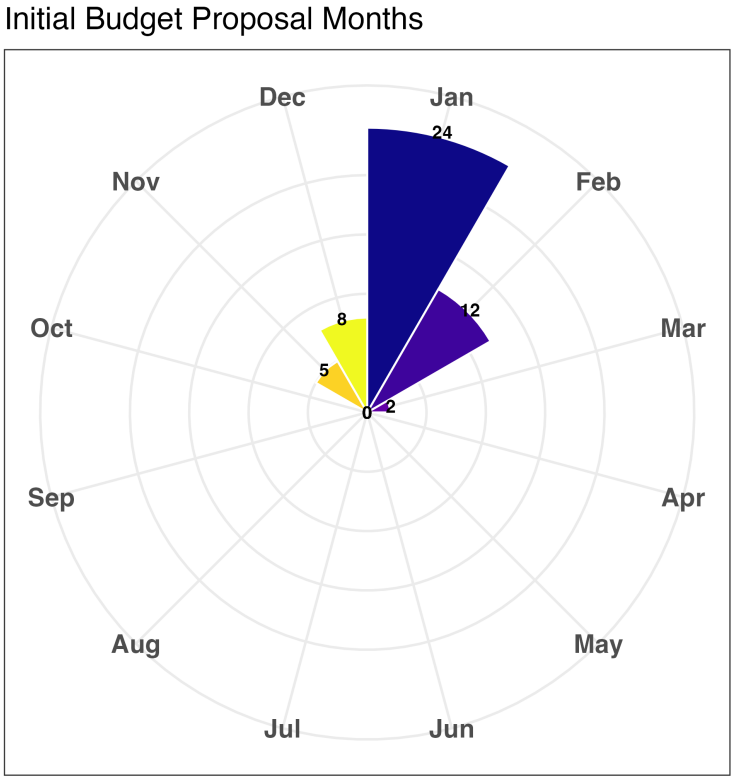


**Figure IA.7:** State Expenditure Composition by Category Over Time

This figure plots the composition of state government expenditures by functional category using data from the Annual Comprehensive Financial Reports (ACFR). Categories are self-assigned based on reported expenditure descriptions and grouped into education, general government, health and social services, infrastructure, public safety, and other expenditures. Each bar represents the share of total expenditures across all states in a given fiscal year.

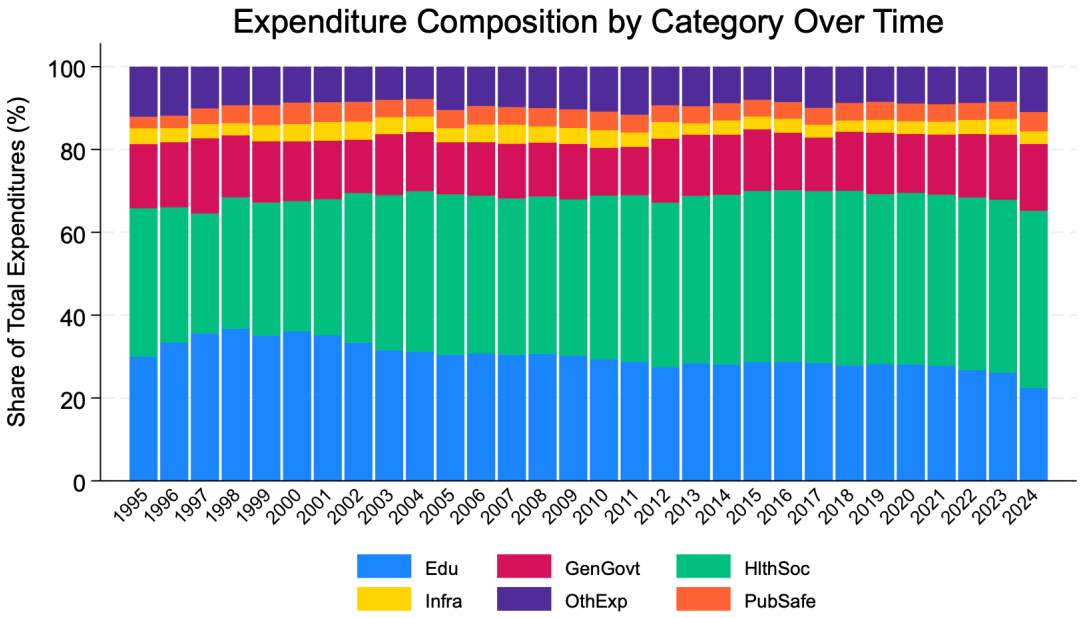


**Table IA.1:** State Budget Timeline and Data Sources

FY Start denotes the beginning of the fiscal year. Initial Proposal refers to the typical period in which governors submit their initial budget proposals to state legislatures, while Final Proposal indicates the deadline by which the budget must be formally approved. Date-related information is sourced from the Council of State Governments' Book of the States and Statescape's Legislative Timetable Resource.

| State | FY Start | Initial Proposal | Final Proposal |
|---|---|---|---|
| AL | Oct 1 | Feb | May |
| AK | Jul 1 | Dec | Jun |
| AZ | Jul 1 | Jan-Feb | Jun |
| AR | Jul 1 | Nov-Jan | Apr-May |
| CA | Jul 1 | Jan | Jun |
| CO | Jul 1 | Nov | Apr-Jun |
| CT | Jul 1 | Feb | Jun |
| DC | Oct 1 | Mar | Jun |
| DE | Jul 1 | Jan | Jun |
| FL | Jul 1 | Jan | Mar-May |
| GA | Jul 1 | Jan | May |
| HI | Jul 1 | Dec | May |
| ID | Jul 1 | Jan | Mar-Apr |
| IL | Jul 1 | Feb | Jun |
| IN | Jul 1 | Jan | Apr-May |
| IA | Jul 1 | Feb | May |
| KS | Jul 1 | Jan | May |
| KY | Jul 1 | Jan | May |
| LA | Jul 1 | Feb | Jun |
| ME | Jul 1 | Jan | Jun |
| MD | Jul 1 | Jan | Apr-May |
| MA | Jul 1 | Jan | Jun |
| MI | Oct 1 | Feb | Jul |
| MN | Jul 1 | Jan | May |
| MS | Jul 1 | Nov | Mar-Apr |
| MO | Jul 1 | Jan | May |
| MT | Jul 1 | Nov | May |
| NE | Jul 1 | Jan | Jun |
| NV | Jul 1 | Jan | Jun |
| NH | Jul 1 | Feb | Jun |
| NJ | Jul 1 | Feb | Jun |
| NM | Jul 1 | Jan | Mar-Apr |
| NY | Apr 1 | Jan | Mar |
| NC | Jul 1 | Mar | Jun |
| OH | Jul 1 | Feb | Jun |
| OK | Jul 1 | Feb | May-Jun |
| PA | Jul 1 | Feb | Jun |
| RI | Jul 1 | Jan | Jun |
| SC | Jul 1 | Jan | May |
| SD | Jul 1 | Dec | Mar-Apr |
| TN | Jul 1 | Feb | May-Jun |
| TX | Sep 1 | Jan | May |
| UT | Jul 1 | Dec | Mar-Apr |
| VT | Jul 1 | Jan | May-Jun |
| VA | Jul 1 | Dec | Apr-May |
| WV | Jul 1 | Jan | Apr |
| WI | Jul 1 | Jan | Jun |

**Table IA.2:** Revenue and Expenditure Growth Decomposition

This table examines the factors driving actual changes in total revenues and expenditures using planning variables as key predictors. Column (1) analyzes revenue growth as a function of initial revenue planning decisions. Columns (2) and (3) investigate expenditure growth, with column (2) including only expenditure planning variables and column (3) adding revenue controls to assess the relative importance of expenditure versus revenue factors in determining spending outcomes. The planning variables capture the initial policy intent relative to the previous year's final budget. The sample covers 1995 to 2024 using ACFR database and includes all available states with complete data. 6 Standard errors are clustered at the state level and reported in parentheses. ***, , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

| | Total Revenues $\Delta \log(\text{Act}_t^R)$ | | Total Expenditures $\Delta \log(\text{Act}_t^E)$ | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\log(\text{Init}_t^R/\text{Final}_{t-1}^R)$ | 0.522*** | 0.613*** | | | -0.0424 | -0.0432 |
| | (0.0961) | (0.0895) | | | (0.0683) | (0.0710) |
| $\log(\text{Init}_t^E/\text{Final}_{t-1}^E)$ | | | 0.374*** | 0.510*** | 0.282*** | 0.398*** |
| | | | (0.0711) | (0.0707) | (0.0579) | (0.0606) |
| $\log(\text{Act}_t^R/\text{Act}_{t-1}^R)$ | | | | | 0.312*** | 0.311*** |
| | | | | | (0.0847) | (0.0942) |
| $\log(\text{Act}_t^R/\text{Final}_t^E)$ | | | | | -0.0275 | -0.117** |
| | | | | | (0.0186) | (0.0518) |
| State FE | | ✓ | | ✓ | | ✓ |
| Obs. | 989 | 989 | 1,122 | 1,122 | 989 | 989 |
| Adj.$R^2$ | 0.23 | 0.25 | 0.25 | 0.35 | 0.35 | 0.42 |

**Table IA.3:** Impact of Monetary Policy Shocks on Nominal State Expenditures

This table reports the effects of monetary policy shocks (MPS) on state government expenditures, using a state-by-year panel. Columns (1)-(4) use expenditure data from the ACFR, covering the period 1995-2024, while columns (5)-(8) use data from the NASBO, spanning 1985-2023. The dependent variable is the nominal log change in total state expenditures during fiscal year $t$, $\Delta\text{Actual}_t^E$. We employ two measures of MPS: the Bauer–Swanson orthogonalized shocks (BS shocks) and changes in the 5-year Treasury yield during the 30-minute window following FOMC announcements (5Y shocks). MPS are constructed as cumulative shocks over three distinct periods: (i) the six months preceding the initial budget proposal, (ii) the budget revision period, and (iii) the fiscal year itself. `Neg` is a binary indicator equal to 1 if the corresponding shock is negative. Control variables include the log changes in real GDP, S&P 500 index, and employment, as well as changes in the slope of the Treasury yield curve (10-year minus 1-year). All control variables are measured over the six-month window that precedes the six-month period leading up to the initial budget proposal phase. For brevity, coefficients on control variables and interactions are not reported. Standard errors are clustered by state and year (reported in parentheses). *, **, *** represent statistical significance at 10%, 5% and 1% level, respectively.

| | $\Delta\log(\text{Act}_t^E)$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ACFR (1995-2024) | | | | NASBO (1985-2023) | | | |
| | BS shocks | | 5Y shocks | | BS shocks | | 5Y shocks | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\text{MPS}_{\text{Pre6M}}$ | -0.271*** | -0.283*** | -0.146*** | -0.142*** | -0.148** | -0.147** | -0.0982** | -0.102** |
| | (0.0812) | (0.0774) | (0.0344) | (0.0331) | (0.0623) | (0.0630) | (0.0481) | (0.0473) |
| $\text{MPS}_{\text{Pre6M}} \times$ Neg | 0.281** | 0.319** | 0.102* | 0.0945* | 0.0681 | 0.0628 | 0.0855 | 0.0898 |
| | (0.120) | (0.117) | (0.0503) | (0.0477) | (0.108) | (0.109) | (0.0544) | (0.0536) |
| $\text{MPS}_{\text{Rev.}}$ | 0.116 | 0.121 | -0.0436* | -0.0505 | -0.0338 | -0.0359 | 0.00133 | 0.00573 |
| | (0.118) | (0.126) | (0.0240) | (0.0302) | (0.0312) | (0.0328) | (0.0438) | (0.0428) |
| $\text{MPS}_{\text{Rev.}} \times$ Neg | -0.170 | -0.175 | 0.0112 | 0.0220 | 0.0627 | 0.0703 | -0.0108 | -0.0140 |
| | (0.129) | (0.135) | (0.0395) | (0.0456) | (0.0424) | (0.0440) | (0.0543) | (0.0542) |
| $\text{MPS}_{\text{FY}}$ | -0.0645 | -0.0660 | -0.0902 | -0.0932 | 0.0332 | 0.0311 | 0.0809*** | 0.0816*** |
| | (0.0942) | (0.0925) | (0.0550) | (0.0552) | (0.0480) | (0.0486) | (0.0287) | (0.0293) |
| $\text{MPS}_{\text{FY}} \times$ Neg | -0.0588 | -0.0481 | 0.0612 | 0.0656 | -0.114 | -0.111 | -0.0986*** | -0.101*** |
| | (0.111) | (0.108) | (0.0543) | (0.0539) | (0.0696) | (0.0691) | (0.0353) | (0.0363) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| State FE | | ✓ | | ✓ | | ✓ | | ✓ |
| Obs. | 1,141 | 1,141 | 1,141 | 1,141 | 1,946 | 1,946 | 1,946 | 1,946 |
| Adj.$R^2$ | 0.06 | 0.05 | 0.08 | 0.06 | 0.11 | 0.11 | 0.11 | 0.10 |

**Table IA.4:** Variable Definitions and Data Sources

This table provides definitions and data sources for the state-level characteristics used in the analysis. Each variable is constructed at the state level and averaged over the sample period indicated in parentheses. *CoG* refers to the Census of Governments; *ACFR* to the Annual Comprehensive Financial Reports; *NASBO* to the National Association of State Budget Officers; *IPPSR* to the Institute for Public Policy and Social Research; *BEA* to the Bureau of Economic Analysis; and *Mergent* to the Mergent Municipal Bond Securities Database.

| Variable | Description | Data Source |
|---|---|---|
| Rev-MPS Sensitivity | Sensitivity of state revenues to positive monetary policy shocks, measured as the coefficient on $\texttt{MPS}_{\texttt{Pre6M}}$ from column (1) of Table 8. | ACFR (1995–2024) |
| Rate-MPS Sensitivity | Sensitivity of state interest expenditures to positive monetary policy shocks, measured as the coefficient on $\texttt{MPS}_{\texttt{Pre6M}}$ from column (2) of Table 9. | CoG (1980–2021) |
| Muni Spread | The difference between municipal bond yields and matched-maturity U.S. Treasury yields. | MSRB (1980–2023) |
| Revenue Volatility | Annual volatility of the growth rate in own-source revenues. | CoG (1980–2021) |
| Tax Volatility | Annual volatility of the growth rate in taxes. | CoG (1980–2021) |
| Balanced Budget Rule | Tightness of balanced budget rule for each state | Table 1.1 in Yarbrough (2016) |
| Per Capita Income | Per capita personal income. | BEA (1980–2021) |
| GDP | Gross domestic product. | BEA (1980–2021) |
| Democratic | Average of three indicators for political control: governor, house, and senate, each coded as 1 if controlled by the Democratic party. | IPPSR (1984–2025) |

# IAI Proofs and Additional Derivations

## IAI.1 How Budgets Respond to Interest Rates

Proof of $\frac{dB^*}{di}$ in the case of interest-sensitive debt service $D$ and interest-insensitive revenues:

$$\frac{dB^*}{di} = -D'(i)\frac{f_R(y_B) + \lambda\psi F_R(y_\psi)}{f_R(y_B) + \lambda\psi^2 f_R(y_\psi)} \in \Big[ -\tfrac{D'(i)}{\psi}, -D'(i)\Big], \tag{IAI}$$

It is therefore natural to compute $\frac{\partial B^*}{\partial D}$ and then apply the chain rule. First, we can write (from the FOC):

$$G(B, D) \equiv 1 - F_R(B + D - f) - \lambda\psi F_R(\psi B + D - f) = 0 \quad \text{at } B = B^*(D).$$

Differentiate totally and solve via the implicit function theorem:

$$G_B\frac{\partial B^*}{\partial D} + G_D = 0 \quad \Rightarrow \quad \frac{\partial B^*}{\partial D} = -\frac{G_D}{G_B}.$$

Compute the partial derivatives using $F_R' = f_R$:

$$G_B = -\big[f_R(y_B) + \lambda\psi^2 f_R(y_\psi)\big], \qquad G_D = -\big[f_R(y_B) + \lambda\psi f_R(y_\psi)\big].$$

Hence

$$\frac{\partial B^*}{\partial D} = -\frac{f_R(y_B) + \lambda\psi F_R(y_\psi)}{f_R(y_B) + \lambda\psi^2 f_R(y_\psi)}. \tag{IAII}$$

Second, multiplying by $D'(i)$, we get the total derivative $\frac{dB^*}{di}$:

$$\frac{dB^*}{di} = \frac{\partial B^*}{\partial D}D'(i) = -D'(i)\frac{f_R(y_B) + \lambda\psi F_R(y_\psi)}{f_R(y_B) + \lambda\psi^2 f_R(y_\psi)}. \tag{IAIII}$$

## IAI.2 Hypothesis 1

From the FOC,

$$\frac{dB^*}{di} = -D'(i)\,\frac{f_B + \lambda\psi f_\psi}{f_B + \lambda\psi^2 f_\psi} \;\equiv\; -D'(i)\,r(i), \qquad r(i) \in \Big[1, \tfrac{1}{\psi}\Big]. \tag{IAIV}$$

**First derivative of the total expenditure $Y(i) \equiv B^*(i) + D(i)$.**

$$\text{(IAV)} \qquad Y'(i) \equiv \frac{d}{di}\big(B^* + D\big) = B'(i) + D'(i) = D'(i)\,\big(1 - r(i)\big) \;\le\; 0,$$

with equality iff $\psi = 1$ (then $r = 1$ and $B'$ offsets $D'$ one-for-one).

**Second derivative.** Differentiate (IAV):

$$\text{(IAVI)} \qquad Y''(i) = D''(i)\,\big(1 - r(i)\big) \;-\; D'(i)\,r'(i).$$

It remains to compute $r'(i)$. By the quotient rule, noting $f'_B = \partial_i f_R(y_B) = f'_B\,y'_B$ and $f'_\psi = \partial_i f_R(y_\psi) = f'_\psi\,y'_\psi$ with

$$\text{(IAVII)} \qquad y'_B = B'(i) + D'(i) = D'(i)\,(1 - r), \qquad y'_\psi = \psi B'(i) + D'(i) = D'(i)\,(1 - \psi r),$$

we obtain

$$r'(i) = \frac{\big(f'_B y'_B + \lambda\psi f'_\psi y'_\psi\big)\,\big(f_B + \lambda\psi^2 f_\psi\big) - \big(f_B + \lambda\psi f_\psi\big)\,\big(f'_B y'_B + \lambda\psi^2 f'_\psi y'_\psi\big)}{\big(f_B + \lambda\psi^2 f_\psi\big)^2}$$

$$\text{(IAVIII)} \qquad = \frac{\lambda\,\psi\,(1 - \psi)}{\big(f_B + \lambda\psi^2 f_\psi\big)^2}\;\underbrace{\Big(f_B f'_\psi\,y'_\psi \;-\; f_\psi f'_B\,y'_B\Big)}_{\mathcal{H}(i)}.$$

Assume the cutoffs lie on the rising limb of the density (standard in applications):

$$\text{(IAIX)} \qquad f'_B \ge 0, \qquad f'_\psi \ge 0.$$

Using (IAVII) and the bounds $r \in [1, 1/\psi]$,

$$y'_B = D'(1 - r) \;\le\; 0, \qquad y'_\psi = D'(1 - \psi r) \;\ge\; 0,$$

(with equalities only if $\psi = 1$). Hence $\mathcal{H}(i) = f_B f'_\psi\,y'_\psi - f_\psi f'_B\,y'_B \ge 0$, implying

$$\text{(IAX)} \qquad r'(i) \;\ge\; 0, \quad \text{with strict inequality unless} \;\; \psi = 1.$$

Plugging (IAX) into (IAVI) yields

(IAXI)

$$Y''(i) \;=\; \frac{d^2}{di^2}\big(B^*(i) + D(i)\big) \;\le\; 0 \quad \text{whenever } D'(i) > 0,\; D''(i) \ge 0, \text{ and (IAIX) holds.}$$

## IAI.3 Hypothesis 2

Let realized spending in state $\omega$ be

$$S(i,\omega) \;=\; \min\{B^*(i), X(i,\omega)\}, \qquad X(i,\omega) \equiv R(i,\omega) - D(i) + f,$$

where $B^*(i)$ is the optimal budget chosen at the planning/budgeting stage for interest rate $i$. Assume $X(\cdot,\omega)$ is differentiable in $i$ and $\Pr\big(X(i,\omega) = B^*(i)\big) = 0$.

We compare equal shocks to the interest rate $i$ arriving (i) during planning (budget adjusts optimally with $i$) and (ii) at the execution stage (budget fixed at the pre-shock optimum).

$$\begin{aligned}\frac{dS_{\text{plan}}}{di}(i,\omega) &= \frac{d}{di}\min\{B^*(i), X(i,\omega)\} \\ &= \mathbf{1}\{X(i,\omega) \geq B^*(i)\}B'(i) + \mathbf{1}\{X(i,\omega) < B^*(i)\}\partial_i X(i,\omega),\end{aligned} \tag{IAXII}$$

$$\begin{aligned}\frac{dS_{\text{exec}}}{di}(i,\omega) &= \frac{d}{di}\min\{\bar{B}, X(i,\omega)\}\Big|_{\bar{B}=B^*(i)} \\ &= \mathbf{1}\{X(i,\omega) < B^*(i)\}\partial_i X(i,\omega).\end{aligned} \tag{IAXIII}$$

Subtracting (IAXIII) from (IAXII),

$$\frac{dS_{\text{plan}}}{di}(i,\omega) - \frac{dS_{\text{exec}}}{di}(i,\omega) = \mathbf{1}\{X(i,\omega) \geq B^*(i)\}B'(i). \tag{IAXIV}$$

Thus, in non-rationing states ($X \geq B^*$) the planning-stage response loads on the budget channel $B'(i)$; in rationing states ($X < B^*$), the two timings coincide (both equal $\partial_i X$).