The Inflationary Footprint of Fiscal Policy: Evidence from Disaggregated U.S. Spending*

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Abstract

Under the Fiscal Theory of the Price Level (FTPL), wealth effects arise when government spending is fiscally unfunded—that is, not backed by future fiscal adjustment. Under U.S. statutory budget rules, Medicare and Medicaid are granted priority access to general revenues and thus enjoy stronger fiscal backing; correspondingly, their expansions generate negligible wealth effects in the data. By contrast, defense spending undertaken when discretionary fiscal space is constrained or during major wars is more likely to be unfunded and, in the data, generates wealth effects and inflation. An asymmetry in Social Security's trust-fund design implies that pre-1974 benefits were actuarially funded but fiscally unfunded, whereas an actuarial deficit after 1974 implied fiscal backing. Accordingly, only pre-1974 Social Security expansions generated wealth effects and inflation, consistent with the FTPL.

Keywords: Fiscal backing, wealth effects, Ricardianity, Monetary and fiscal interactions, anticipated shocks, fiscal shocks.

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1 Introduction

The fiscal theory of the price level holds that fiscally unfunded government spending raises households' perceived wealth, boosting demand and inflation until the real value of public debt is consistent with expected future primary surpluses. In recent years, economic research has made important progress in showing that the fiscal theory of the price level provides a coherent framework for understanding macroeconomic dynamics across countries and time (Bianchi and Ilut, 2017; Bianchi and Melosi, 2017; Leeper et al., 2017; Eusepi and Preston, 2018; Cochrane, 2023; Bianchi et al., 2023; Jacobson et al., 2024; Barro and Bianchi, 2025). Nonetheless, whether government spending is fiscally funded or unfunded hinges on the government's willingness to adjust future primary surpluses to repay the public debt issued to finance the increase in spending. This willingness—commonly referred to as fiscal backing—must be assessed intertemporally and is inherently forward-looking, which makes it difficult to observe directly. Given this challenge, most empirical work evaluates fiscal backing *ex post*, by examining the joint responses of monetary and fiscal variables to unexpected innovations in government spending.

This paper introduces a novel strategy to assess whether fiscal shocks are fiscally funded or unfunded. Our approach exploits program-specific funding mechanisms established under U.S. law to measure fiscal backing across major categories of U.S. government spending—Medicaid and Medicare, Social Security, and national defense. We leverage cross-category heterogeneity in funding regimes to identify whether spending expansions require the government to eventually adjust taxes, cut other spending, or draw on future tax revenues, or instead allow expenditures to be financed through debt issuance without a statutory fiscal backstop. Only in the latter case does the fiscal theory of the price level predict positive effects on output and inflation –i.e., non-Ricardian effects– following the announcement of an expansion in government spending. The proposed framework provides a new and more direct way to evaluate the fiscal theory of the price level empirically.

Our analysis highlights a fundamental distinction between discretionary and mandatory spending in their financing structures. Discretionary spending—such as National security—is subject to the congressional appropriations process and lacks fiscal backing when available

fiscal resources are scarce, typically because mandatory spending absorbs a large share of available fiscal resources. Mandatory spending, by contrast, operates under fundamentally different financing rules and is largely insulated from short-run budgetary constraints.

A large share of Medicare —Medicare Part B and D— and Medicaid programs are fiscally backed by statute, as U.S. budgetary law grants these programs priority access to general tax revenues. Medicare Parts B and D are financed through the Supplementary Medical Insurance (SMI) trust fund, which receives automatic transfers from general revenues sufficient to cover projected expenditures. In addition, beneficiary premiums are reset annually to finance a fixed share of program costs (roughly one-quarter), with income-related premium surcharges further reinforcing revenue adequacy. Medicaid spending is similarly fiscally backed, as the federal government is legally obligated to finance its share of eligible outlays through the Federal Medical Assistance Percentage (FMAP), with federal transfers adjusting automatically to program costs. As a result, increases in these categories of spending have historically been perceived as fiscally backed by the full force of federal law and the U.S. Treasury's full revenue.

An important consideration applies to Medicare and Medicaid. By absorbing fiscal space, these programs tighten the constraint on discretionary spending. We show that when this constraint binds, increases in defense spending generate Ricardian effects and upward pressure on inflation. These effects are also present during periods in which the U.S. government financed the three most expensive wars of the past 75 years—a phenomenon we label *warflation*.

Social Security occupies a distinct position within the framework of U.S. federal budgetary rules. It is financed through dedicated trust funds—the Old-Age and Survivors Insurance and Disability Insurance (OASI/DI) funds—which are legally segregated from general federal revenues. When these trust funds are projected to become dynamically insolvent (as it was the case after 1974), existing law requires either legislative action to adjust benefits or payroll taxes; absent such action, benefits would be reduced mechanically to the level of incoming payroll tax revenues, with across-the-board cuts administered by the Social Security Administration. In practice, however, Congress has never allowed such benefit

reductions to take effect, most likely because they would be politically untenable. Instead, it has repeatedly intervened to restore solvency through adjustments to benefits and payroll taxation, most notably through the 1977 amendments, the Social Security Amendments of 1983, the expansion of benefit taxation in 1993, the 1994 DI Reallocation, and repeated adjustments to the payroll tax base through increases in the taxable earnings cap.

Taken together, this recurring pattern of legislative intervention and statutory backstops constitutes a strong and credible commitment to ensure that Social Security spending remains fiscally backed. Importantly, this commitment operates within a strict legal framework: the OASI/DI trust funds are separate from general fiscal revenues, and neither the Social Security Administration nor the U.S. Treasury is authorized to borrow to stabilize them. As a result, fiscal backing for Social Security must ultimately be delivered through explicit legislative action, reinforcing the perception that these spending commitments will be honored through either future fiscal adjustments or spending cuts.

Prior to 1974, however, the prevailing view was that the Social Security system was solvent and was projected to remain so indefinitely (Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, 1973; U.S. General Accounting Office, 1974).[1] During this period, the OASI and DI trust funds generated persistent surpluses, which by statute were invested in special, nonmarketable Treasury securities. The proceeds were transferred to the U.S. Treasury's General Fund, where they were commingled with general federal revenues and used to finance other government expenditures, thereby reducing the Treasury's need to borrow from the public in the short run.

Under the prevailing belief that Social Security would generate surpluses indefinitely, no

[1]Prior to 1974, official long-run projections suggested only a modest actuarial imbalance in the Social Security system, reinforcing the prevailing view that the program was broadly solvent under then-prevailing demographic and economic assumptions (Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, 1973; U.S. General Accounting Office, 1974). This perception changed sharply with the release of the 1974 Trustees Report (House Document No. 93–313), which documented a substantial deterioration in long-run finances—amounting to nearly 3 percent of taxable payroll—driven primarily by revised population projections and the interaction of high inflation with the benefit indexation rules enacted in 1972 (Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, 1974). In response to the severity of this reassessment, the Senate Committee on Finance commissioned an independent expert review, whose January 1975 report, chaired by George C. Hsiao, confirmed and in some respects worsened the Trustees' diagnosis, concluding that earlier projections had been overly optimistic and that significant policy adjustments would be required to restore long-run balance (Hsiao et al., 1975).

explicit provision was made to accumulate resources for the eventual repayment of these intragovernmental obligations. Moreover, because the proceeds were commingled with general federal revenues and no explicit mechanism was established to fund their repayment, it was unclear how these intragovernmental Treasury obligations would be honored should the trust funds later run deficits.

From the perspective of the Fiscal Theory of the Price Level, hence, pre-1974 Social Security spending was fiscally unfunded precisely because it was expected to be actuarially funded. Let us explain this apparently paradoxical point. A funding system centered on Social Security trust funds provides credible fiscal backing only when the system is perceived to be dynamically insolvent—either inducing congressional intervention or mechanically triggering automatic benefit reductions. By contrast, when the system is expected to remain solvent over an extended horizon and to accumulate rising reserves, the trust-fund framework offers no clear mechanism for reallocating or returning the excess resources being accumulated. The Fiscal Theory is symmetric: just as a deficit without a plan to tax causes inflation, a surplus without a plan to distribute causes downward inflationary pressures, as such a situation of persistent fiscal abundance amounts to a lack of effective fiscal backing. Therefore, although pre-1974 Social Security was expected to be dynamically solvent, the asymmetry in its trust-fund design rendered it fiscally unfunded; the same mechanism implies fiscal (though not actuarial) funding once trust-fund insolvency became anticipated after 1974.

Therefore, an announcement of an enlargement of Social Security programs prior to 1974 would be inflationary, as it alleviated deflationary pressures by redistributing a portion of the excess reserves the system was expected to accumulate indefinitely. Intuitively, such program expansions were fiscally unbacked —meaning they were not accompanied by expectations of future fiscal tightening— thereby generating positive wealth effects. By contrast, once Social Security was perceived as actuarially insolvent after 1974 and thus entered a regime of full fiscal backing. In this context, announcements of program expansions no longer generated wealth effects or inflationary pressures, as they gave rise to expectations of future tax increases or benefit offsets. We formalize this apparently paradoxical result using a

stylized general equilibrium model.

Finally, Medicare Part A, which covers hospital insurance, is financed in a manner analogous to Social Security in that it relies on a dedicated trust fund —the Hospital Insurance (HI) Trust Fund— and is effectively off-budget, in the sense that its financing needs cannot be met through general federal revenues. There is, however, one key distinction relative to Social Security. Since its inception, the Hospital Insurance (HI) Trust Fund has repeatedly been projected to face insolvency.[2] Yet, like Social Security, it has never actually become insolvent. Rather, projected insolvency dates have been postponed on multiple occasions through legislative interventions. In the early years of the program, for example, payroll tax rates were periodically adjusted to maintain the financial adequacy of the HI Trust Fund.[3]

Although the HI Trust Fund is required to remain financially balanced, this balance has been maintained through intermittent legislative interventions in response to projected shortfalls, rather than through an ex-ante commitment to long-run actuarial balance as in Social Security. These repeated interventions have been politically acceptable because projected solvency horizons depend on many unpredictable factors, including highly volatile health care cost drivers (e.g., provider prices and utilization) and a weak linkage between contributions and benefits. In addition, Medicare does not operate under the same earned-benefit norm that disciplines Social Security, where benefits are closely tied to lifetime payroll contributions and are widely perceived as entitlements earned through prior work rather than as discretionary transfers.

Taken together, these institutional features lead us to treat Medicare Part A as effectively fiscally backed. Accordingly, despite differences in statutory financing rules, we do not distinguish it from the other components of Medicare, which, as argued above, are likewise fiscally backed under existing statutory arrangements.

We examine the responses of public debt, inflation, and real interest rates to news about

[2]See, for example, Congressional Research Service, *Medicare's Insolvency Projections*, updated October 25, 2021, available at Link to report.

[3]In the early years of the program, for example, Congress repeatedly adjusted the HI payroll tax rate and tax base—most notably through the Social Security Amendments of 1972 and the Social Security Amendments of 1977—to maintain the financial adequacy of the HI Trust Fund. More recently, revenue increases and spending adjustments under the Affordable Care Act substantially extended the projected exhaustion date. This pattern reflects a financing regime in which Medicare Part A is sustained through discretionary policy adjustments rather than adherence to a stable, actuarially balanced funding rule.

increases in national defense, Medicare and Medicaid, and Social Security spending, by using for the latter category of spending samples that both include and exclude pre-1974 data.

Adopting the shock construction methodology of Forni and Gambetti (2016), we depart from standard measures of government spending by calculating distinct time series of shocks for each relevant spending category directly from U.S. Federal Budget expenditure forecasts. We then study their effects using state-dependent local projections, , where the state variable is defined by the long-term actuarial balance associated with each spending category. This forward-looking measure captures the degree of fiscal strain and serves as a proxy for fiscal backing.

Our empirical results show that these variables behave consistently with FTPL predictions, with their responses depending systematically on whether our identification methodology classifies each spending category as fiscally backed or fiscally unbacked.

Announcements of expansions in Medicare and Medicaid, as well as in Social Security after the 1974 Pivot —when the system became widely recognized as dynamically insolvent (Board of Trustees, Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, 1974; Hsiao et al., 1975)— are followed by Ricardian responses, characterized by negligible wealth effects and declines in inflation. This pattern is consistent with theory, as these spending categories are fiscally backed in this regime. By contrast, when Social Security was perceived as self-financing in the pre-1974 period, the system was dynamically solvent but fiscally unbacked; correspondingly, we show that announced expansions in Social Security spending during this regime generated non-Ricardian effects. These announcements redistributed part of the excess reserves the system was expected to accumulate indefinitely, generating inflationary pressures by mitigating the otherwise negative contribution of this category of spending to inflation. Finally, increases in defense spending produce sizable wealth effects and significant inflationary pressures only when discretionary fiscal space is constrained by large mandatory outlays.

Literature Review. This paper is related to four different streams of literature. The first encompasses the broad research on monetary-fiscal policy interactions, with a particular focus on the Fiscal Theory of the Price Level (FTPL). Foundational theoretical contributions

include the seminal works by Sargent and Wallace (1981), Leeper (1991), Sims (1994) and Woodford (2001), which formalize the conditions under which fiscal policy can be a key driver of the price level. More recent studies embed FTPL mechanisms in structural models to explore their implications for macroeconomic dynamics and policy design (see, among others, Cochrane (2023) and Leeper and Leith (2016)). Building on this framework, a growing number of empirical studies investigate the presence of different monetary-fiscal policy regimes in U.S. data (see, among the others, Bianchi, 2012; Bianchi and Ilut, 2017; Ascari et al., 2020; Bianchi and Melosi, 2014; Jacobson et al., 2024).

The second stream of literature deals with fiscal foresight and the identification of fiscal policy shocks. This literature examines the impact on the economy of fiscal policy in VAR models (e.g., see Blanchard and Perotti, 2002; Ramey, 2011; Auerbach and Gorodnichenko, 2012; Forni and Gambetti, 2016; Ramey and Shapiro, 1998; Mertens and Ravn, 2011, 2012; Ben Zeev and Pappa, 2017; Fisher and Peters, 2010) and stresses the importance of accurately distinguishing between anticipated and unanticipated government shocks. Legislative and implementation lags imply that private agents can adjust their behavior during the time between the announcement of a fiscal measure and its actuation. In fact, those who analyze the effects of an anticipated increase in taxes (see Mertens and Ravn, 2012, 2011) find that the production increases during the anticipation period and, as happens for unanticipated shocks, decreases once the tax increase is implemented. Ramey (2011), who analyses the effects of an anticipated government spending shock, finds that such a shock increases output but decreases consumption.

A relevant paper for our analysis is Ascari et al. (2023). They extend the results by Beck-Friis and Willems (2017), who study unanticipated changes in government expenditures under a backed monetary regime and an unbacked fiscal regime, to consider anticipated public spending shocks. Theoretically, they show that fiscal foresight leads anticipated government spending shocks to have very different effects if one considers a monetary rather than a fiscal regime. In the monetary regime, increases in government expenditure are assumed to be fiscally backed. Following an anticipated spending shock, output, consumption, investment, and inflation decrease while real interest rates and debt increase. These vari-

ables show an opposite reaction in the fiscal regime, under unbacked fiscal expansions, as consumption increases through the expectation of positive wealth effects. Anticipated shocks can thus provide a potential identification mechanism in the data to distinguish these two regimes. They thus look at two sample periods that have been identified in the literature as a monetary and a fiscal regime and find that anticipated government spending shocks have very different effects during the anticipation period, as theory would predict: in the monetary regime they are contractionary; in the fiscal regime they are expansionary.

The third stream of literature is the one on the state dependence of spending multipliers (see Auerbach and Gorodnichenko, 2012; Ramey and Zubairy, 2018; Caggiano et al., 2015). Unlike these studies, however, our focus is not on fiscal multipliers per se. Rather, we are interested in the broader macroeconomic consequences of spending shocks, following the tradition of research inspired by the FTPL, such as Leeper et al. (2017), who emphasizes the central role of the policy regime in determining the size and sign of fiscal multipliers. In particular, our analysis, which examines anticipated federal spending shocks while conditioning on a proxy for the expected fiscal backing of different spending categories, is closely related to Ascari et al. (2024). They show that the effects of anticipated government spending shocks critically hinge on the state of tax expectations – that is, whether agents expect taxes to increase or decrease.

A fourth and relatively recent strand of the literature emphasizes the heterogeneity of public expenditure. Cox et al. (2024), for example, look at government spending not as a single large transaction, "one big G", but as the aggregation of numerous smaller transactions, examining federal government procurement contracts through this lens. While we draw inspiration from their granular perspective, our approach is broader in scope. Rather than focusing on a specific subset of spending, we consider a broader set of government expenditures, disaggregated in a manner consistent with how U.S. lawmakers structure the federal budget. This approach allows us to capture different dimensions of fiscal heterogeneity and offers a complementary angle to studies focused solely on procurement spending.

The remainder of the paper is structured as follows. Section 2 describes the data, the institutional features underlying each spending category, and the evolution of actuarial pro-

jections of trust fund solvency. Section 3 presents the methodology used to construct our new measure of anticipated, disaggregated spending shocks. Section 4 presents the results for each spending category and develops a stylized general equilibrium model to rationalize the apparently paradoxical findings for Social Security. Section 5 concludes.

2 Data and Institutional Background

2.1 Federal Spending Categories and Composition

Rather than considering aggregate government expenditures, we disaggregate them according to the predominant type of spending: mandatory or discretionary. Mandatory spending refers to expenditures that are required by law and are generally not subject to annual review by Congress. It comprises entitlement programs that are difficult to modify or reduce, as their funding is set by eligibility criteria rather than through the annual appropriations process. Examples include Social Security, Medicare, and Medicaid, which offer guaranteed benefits to eligible individuals and are usually financed by payroll taxes.[4] Discretionary spending, on the other hand, encompasses expenditures that Congress must review and approve annually through the appropriations process. This category covers a wide range of government programs, including National Defense (which constitutes about half of the total) and non-defense spending such as education, infrastructure, and many federal agency budgets. Congress decides the specific funding levels for each program within this category every fiscal year. It can be adjusted or reduced according to the policy priorities and available funds. In 2023, health care programs, primarily Medicare and Medicaid, constituted around 28% of the total budget. Defense spending, part of discretionary spending, received about 13-14% of the budget. The other large category of mandatory spending is Social Security, which received about 23% of the federal budget.

The left panel of Figure 1 shows the total federal spending data for Fiscal Year 2023. Mandatory spending is more than double the discretionary spending. This has not al-

[4] A few mandatory programs, for example, veterans' disability compensation and pensions and Medicaid, are also funded through appropriation acts. While pure mandatory programs receive automatic funding, these *appropriated mandatory programs* require funds to be approved through an annual budget process, even though the provision of benefits remains mandatory.

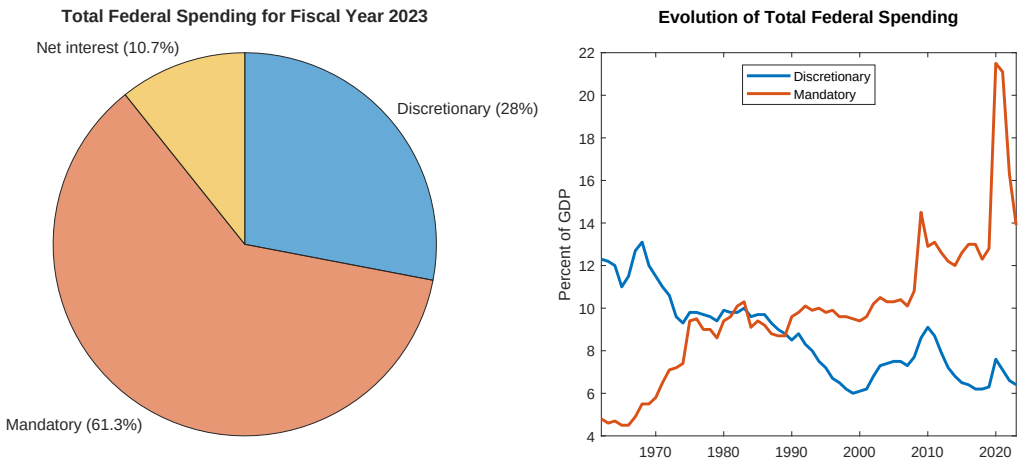


Figure 1: **Mandatory and discretionary spending.**
Left panel: composition of total federal spending in Fiscal Year 2023, highlighting the shares of mandatory, discretionary, and net interest spending. Right panel: evolution of yearly mandatory and discretionary spending as a share of GDP from 1962 to 2023.

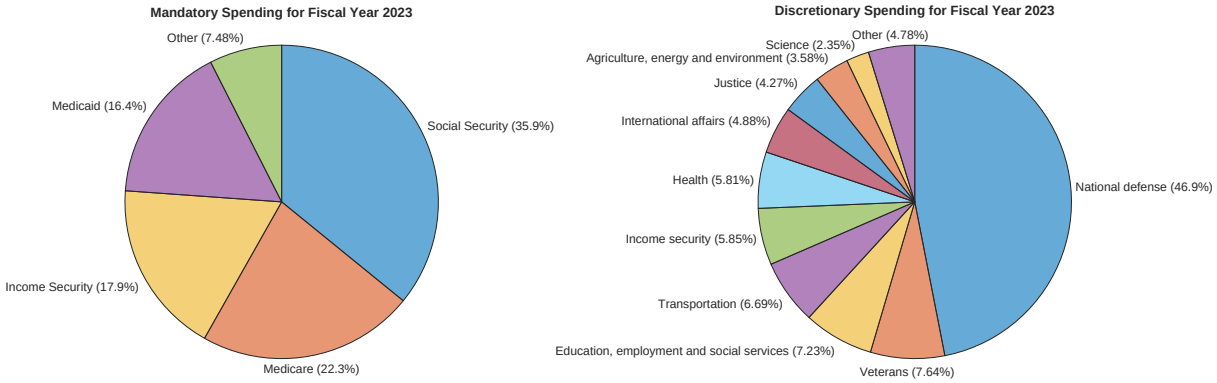


Figure 2: **Composition of mandatory and discretionary spending in Fiscal Year 2023**.
Left panel: breakdown of mandatory spending. Right panel: breakdown of discretionary spending. Mandatory spending is largely driven by Social Security, Medicare, and income security programs, while discretionary spending is dominated by national defense.

ways been the case: the right panel shows how mandatory and discretionary spending have evolved since the 1960s. Note that, before the 1990s, mandatory spending was lower than discretionary spending.

Figure 2 shows the composition of mandatory and discretionary spending in 2023, respectively. Among the mandatory spending categories, Social Security (SS) has the largest share at 36%, followed by Medicare and Medicaid (MM) at 22.3% and 16.4%, respectively. In contrast, slightly half of discretionary spending is allocated to National Defense (ND)

expenditures, with the remainder going towards non-defense spending (education, transportation, environmental programs, and R&D).[5]

2.2 Institutional Financing Rules and Fiscal Backing

To interpret our results, it is essential to clarify how major U.S. federal spending programs are financed and how their institutional design shapes fiscal spillovers across the budget. A striking difference emerges between programs that operate through trust funds but are automatically backed by general revenues, and programs whose trust funds impose binding solvency constraints. From a financing perspective, Medicare Supplementary Medical Insurance (SMI), which covers Medicare Parts B and D, is formally organized as a trust fund; however, it differs fundamentally from the Social Security and Medicare Part A trust funds. SMI is financed roughly one quarter by beneficiary premiums and three quarters by transfers from general revenues. Its trust fund is explicitly designed to remain solvent at all times: contribution rates and general revenue transfers are adjusted automatically each year to match projected expenditures. As a result, SMI cannot experience a solvency crisis in the legal sense. When costs rise or revenues fall, additional general revenues are transferred into the SMI trust fund without requiring new legislation or benefit reductions.

Medicaid shares this key feature despite not having a trust fund. It is a mandatory entitlement program financed through open-ended federal matching payments to states. Federal Medicaid spending is not subject to an annual appropriations cap, and the federal government is legally obligated to finance its matching share through general revenues. Consequently, neither SMI nor Medicaid can "run out of money." In both cases, higher spending mechanically translates into higher claims on general revenues.

The implication is that SMI and Medicaid have a first claim on federal revenues. When fiscal resources become scarce, these programs continue to be fully financed, generating direct spillovers to the rest of the federal budget. The burden of adjustment is therefore shifted to programs without automatic revenue backing, most notably discretionary spending such as

[5] As a major component of mandatory spending, Medicare comprises four distinct parts—A through D—each covering different health services. See Appendix E for a description of the components of mandatory and discretionary spending, including Medicare Parts A–D, and for figures showing their evolution in levels and growth rates since the 1970s.

national defense, education, infrastructure. As mandatory programs financed from general revenues expand, fiscal space contracts and the degree of fiscal backing for discretionary shocks weakens, increasing their reliance on borrowing and future fiscal adjustment. The contrast with Social Security and Medicare Part A is sharp. The Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds of Social Security, together with the Medicare Hospital Insurance (HI) trust fund, are legally binding financing mechanisms that constrain benefit payments to available trust fund resources.

They are financed primarily by dedicated payroll taxes and have no authority to issue debt, no routine access to general revenues, and no automatic Treasury backstop. When these trust funds run surpluses, when payroll tax revenues and other income exceed benefit payments, the federal government does not retain these resources as idle cash. Instead, a legally mandated investment and transfer mechanism is triggered. Under current law, all surplus funds must be invested in interest-bearing securities guaranteed by the U.S. government. They consist of special-issue Treasury bonds and certificates of indebtedness that are not available to the general public. They are backed by the full faith and credit of the United States, making them effectively risk free. The interest rate paid on these securities is tied to the average market yield on outstanding marketable Treasury obligations. When the trust funds purchase these special Treasury securities, the corresponding cash is transferred to the U.S. Treasury's General Fund. Once deposited, these resources are combined with general revenues and used to finance other federal expenditures, including defense, education, infrastructure, and the servicing of publicly held debt. By providing additional internal financing, these surplus funds reduce the amount the government must borrow from the public. When trust funds later run cash deficits, those securities must be redeemed, requiring the federal government to raise taxes, cut other spending, or issue public debt. If trust fund balances are exhausted, current law prohibits benefit payments in excess of incoming revenues, triggering automatic benefit reductions absent congressional action.

An important feature of the U.S. trust-fund system is the asymmetric nature of its adjustment mechanism. Under current law, payroll taxes and benefit payments are not

continuously adjusted in response to fluctuations in trust-fund balances. When trust funds are solvent and projected exhaustion is distant, no corrective action is required, and none is automatically triggered. By contrast, when insolvency risks become salient, the institutional framework effectively forces sufficiently strong corrective measures to restore solvency. Historically, approaching depletion of Social Security and Medicare Hospital Insurance trust funds has prompted legislative interventions—such as increases in payroll tax rates, changes in benefit formulas, or adjustments to eligibility rules—aimed at stabilizing trust fund balances. In the absence of such interventions, benefit payments would be constrained by incoming revenues once trust-fund assets are exhausted, a scenario that creates strong political incentives for action. This asymmetry implies that fiscal correction is contingent on insolvency risk rather than on contemporaneous budgetary imbalances, shaping expectations about future policy adjustments and the perceived fiscal backing of trust-fund-financed programs. In addition, the very existence of an interest rate credited to the fund further reinforces this asymmetry.[6]

Taken together, these features imply a clear pecking order of federal revenues. SMI—despite having a trust fund—and Medicaid enjoy automatic access to general revenues, while OASI, DI, and HI are constrained by trust fund solvency. Discretionary spending absorbs the residual fiscal pressure. As open-ended mandatory programs expand and fiscal space narrows, the financing of discretionary spending becomes increasingly reliant on borrowing and future adjustment, potentially giving rise to non-Ricardian outcomes.

2.3 Changing Expectations of Actuarial Soundness

Expectations about the actuarial soundness of Social Security financing have not been stable over time. In the decades leading up to the mid-1970s, the U.S. Social Security system was widely viewed as actuarially sound and expected to generate persistent long-run surpluses under then-current law. This perception was reflected in the official actuarial assessments

[6] As noted in the 1969 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance (OASI and DI) Trust Funds, "in the case of a surplus, the excess contributions actually earn interest, while a deficit grows because of the absence of the annual interest that would have been earned if the contributions required for balance had been paid" (House Document No. 91-46, p. 38).

reported in the Trustees Reports of the late 1960s and early 1970s, which consistently presented actuarial balance estimates clustered around zero or mildly positive under prevailing assumptions. Under the legislation in force at the time, most importantly the 1967 Amendments, projected benefit costs stabilized as a share of the taxable payroll, while scheduled payroll tax rates exceeded long-run actuarial cost rates. As a result, the system was projected to accumulate substantial trust fund balances and remain solvent indefinitely. These assessments implied the absence of anticipated future policy adjustments. Payroll tax rates and benefit formulas were perceived as more than adequate to finance promised benefits, and official projections did not frame trust fund solvency as a binding constraint requiring corrective fiscal action. This perception was reinforced by favorable macroeconomic and demographic conditions: high fertility rates during the baby boom, rapid real wage growth, strong employment, and relatively stable mortality projections. In this environment, Social Security was often viewed as "overfinanced",[7] a perception that contributed to repeated benefit expansions throughout the 1950s and 1960s and culminated in the large legislated benefit increase of 1972. This regime changed abruptly in the mid-1970s. Beginning in 1974, the Social Security system came to be recognized as actuarially insolvent in the sense that, absent policy changes, trust fund balances would eventually be exhausted. Trustees Reports issued from 1974 onward marked a clear break with earlier assessments, replacing near-zero actuarial balances with large and persistent deficits over the long horizon. Under revised assumptions reflecting lower fertility, faster improvements in longevity, slower real wage growth, and, critically, the introduction of automatic cost-of-living adjustments (COLAs), projected benefit costs rose sharply relative to payroll tax revenues. The error in the benefit formula embedded in the 1972 legislation ("double indexing"), combined with the high inflation of the 1970s, caused real benefit obligations to grow much faster than anticipated. As a result, projected actuarial balances turned decisively negative, and trust fund exhaustion dates became a central focus of official reporting. From this point onward, expectations shifted fundamentally. This shift in expectations was reinforced by contemporaneous external reviews commissioned by Congress, most notably the Hsiao et al. (1975)

[7] The 1969 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance (OASI and DI) Trust Funds, House Document No. 91-46, p. 37

Report of the Consultant Panel on Social Security, which confirmed that the deterioration documented by the Trustees reflected structural flaws rather than temporary deviations. Social Security was no longer viewed as a permanently self-financing program, but as one requiring periodic legislative intervention to restore solvency. This new regime manifested itself in a sequence of major reforms, including the Social Security Amendments of 1977 and the crisis-driven reforms of 1983, which raised payroll taxes, reduced benefit generosity, increased the retirement age, and expanded the contributory base. Importantly, these adjustments were not automatic but were triggered by the growing importance of insolvency risk. Once trust fund depletion became imminent, sufficiently strong corrective measures were undertaken to stabilize the system. Since the mid-1970s, therefore, expectations about Social Security financing have been state-contingent: no action is anticipated when trust fund balances are ample, but future tax increases or benefit reductions are expected once solvency deteriorates.

Medicare Hospital Insurance (HI) presents a contrasting case. From its inception, actuarial projections for HI have consistently indicated long-run financing shortfalls under current law. Unlike Social Security, HI was never perceived as actuarially overfunded. Trustees Reports from the late 1960s onward routinely projected finite trust fund balances and emphasized the sensitivity of HI solvency to medical cost growth and economic assumptions. As a result, expectations of future adjustments have always been embedded in the program's financing outlook. In this sense, HI has operated under a regime of persistent actuarial stress, in contrast to the regime shift observed for Social Security in the mid-1970s.

The historical evidence underscores that expectations about fiscal backing are shaped not only by institutional design but also by the prevailing actuarial narrative and the program's broader institutional role. Prior to 1974, Social Security expansions occurred in an environment of perceived long-run solvency, reinforced by legislative expansions and the introduction of automatic indexation that effectively converted the program into a "retirement wage," with benefits designed to substitute for labor income and maintain living standards after retirement (Myles, 1988). Because actuarial balance was interpreted as evidence of sustainability rather than as a signal of impending adjustment, these expansions did not trigger

expectations of offsetting future fiscal measures. In the mid-1970s, however, the combination of high inflation, indexing errors, and revised demographic and macroeconomic assumptions led to a sharp reassessment of Social Security's long-run finances. From that point onward, the recognition of actuarial imbalance altered expectations, anchoring Social Security policy to anticipated corrective action once insolvency risks arise and changing how trust-fund balances were interpreted. Medicare Hospital Insurance, by contrast, has consistently been associated with adverse long-run projections and thus with a distinct expectation structure from the outset.

3 Empirical Methodology

We use data from the U.S. federal budget to construct a measure of government spending shocks. The fiscal year runs from October 1 to September 30 of the following year and it is named after the calendar year in which it ends.[8] The U.S. Federal Budget for a given fiscal year is typically released in March/April of the previous year. Because the budget is released before the start of the fiscal year, many of the data points and financial projections it contains are estimates. We exploit these estimates to construct our anticipated measure of government spending shock.

Following Forni and Gambetti (2016), we construct a quarterly measure of the one-year-ahead expected growth rate in real spending by subcategory. For instance, for Defense spending in 2022Q1, the measure is defined as:

$$f^{\text{ND}}_{2022q1} = \log\left\{\frac{\mathbb{E}_{2022q1}(\text{real defense spending in 2023})}{\mathbb{E}_{2022q1}(\text{real defense spending in 2022})}\right\}$$

This measure is non-zero only in the quarter in which the budget is released; it is set to zero in all other quarters. We construct such a measure for the two broad spending categories (mandatory and discretionary), as well as for key subcategories such as Medicare and Medicaid combined, National Defense, and Social Security.

An important caveat must be addressed here: projected government spending may adjust

[8] For example, fiscal year 2025 begins on October 1, 2024, and ends on September 30, 2025.

to expected macroeconomic conditions, which would render our measure of fiscal shocks endogenous. To mitigate this concern, we adopt two alternative strategies. First, still taking National Defense as an example, we regress f_t^{ND} on the projected growth rate of real GDP reported in the budgets, and denote the residuals of this regression as f_t^{ND}. Second, we exploit information from the Survey of Professional Forecasters (SPF), regressing $f_t^{\text{ND, purged}}$ on the expected growth rate of GDP and the expected change in unemployment, and denote the corresponding residuals as $f_t^{\text{ND, SPF-purged}}$. The same procedure is applied to the fiscal shocks for each subcategory of spending. The time series of both the original and the purged fiscal shocks for all spending subcategories are reported in Appendix D. The series are highly similar, and the correlation between the original and purged shocks is consistently very high (always above 0.95), supporting the view that unpurged shocks still capture the exogenous component of government spending and suggesting that the potential endogeneity problem is not particularly severe. In the main text, we therefore report only the impulse responses to the baseline unpurged shocks, while leaving those obtained from the purged shocks to Appendix D.[9]

We employ the measures of fiscal shocks within Jorda's (2005) local projection framework to evaluate the macroeconomic effects of anticipated government spending, disaggregated by subcategory. More in detail, each subcategory-specific measure is used as the shock variable in a series of local projections regressions, allowing us to estimate impulse response functions for a range of macroeconomic outcomes.

We consider both linear and state-dependent local projections. In the linear case, the local projection for horizon h is specified as

$$y_{t+h} = \alpha_h + \beta_h x_t + \sum_{i=1}^{p} \boldsymbol{\gamma}_i' \boldsymbol{w}_{t-i} + v_{t+h}, \tag{1}$$

[9] A second issue arises from the fact that budgets report spending projections only in nominal terms, requiring a deflator to convert them into real quantities. However, projections of the GDP deflator are available only from 1976 onwards. Consequently, we construct our baseline measure of fiscal shocks using the actual GDP deflator series. As a robustness check, we also generate an alternative fiscal shock series using an expected GDP deflator series that we build by combining soft information from the budgets (1963–1968), SPF forecasts (1969–1975), and the projected deflator reported in the budgets (1976 onwards). Results are highly consistent across specifications. Therefore, the main text only reports the impulse responses to our baseline measures of fiscal shocks, which rely on actual inflation. Results based on projected inflation are available from the authors upon request.

where y_t is the outcome variable, x_t is the measure of disaggregated government spending shocks, and $\boldsymbol{w}_t$ is the set of control variables. The outcomes include quarterly NIPA variables such as aggregate federal government purchases, aggregate federal transfers, GDP, private consumption and private investment. Following Ramey (2016), we adopt the Gordon-Krenn (2010) transformation: all NIPA variables are first deflated by the GDP deflator and then divided by potential GDP, estimated as a quadratic trend fitted on real GDP. We also consider other variables such as inflation, the differential between the interest rate and output growth $(r - g)$, and debt over GDP. The combined reactions of the interest-rate–growth differential $(r - g)$, inflation, output, and the debt-to-GDP ratio to anticipated fiscal shocks reveal the type of monetary–fiscal coordination – indicating whether the regime is one of monetary or fiscal dominance.[10] The set of controls always includes four lags of output, of the outcome variable, and of the shock, to account for the presence of autocorrelation on our measures of anticipated government spending. We also include lagged transfers when computing impulse responses to MM and SS shock, as these subcategories are classified in NIPA tables as government social benefits to persons. We instead include lagged government purchases when computing impulse responses to ND and discretionary spending shocks. Finally, we include both transfers and purchases in the case of mandatory spending shocks.[11] Results are robust to including taxes as controls.

Following Ramey and Zubairy (2018), we also account for state dependence by incorporating several state variables in our local projection framework. These variables allow us to assess whether the impulse responses to an anticipated shock in a specific spending category vary depending on whether the fiscal capacity in that category is high or low. For the model with state dependence, we estimate a set of regressions such as

$$y_{t+h} = \mathcal{I}_{\{z_{t-1}=1\}} \left(\alpha_h^1 + \beta_h^1 x_t + \sum_{i=1}^{p} \left(\boldsymbol{\gamma}_{h,i}^1\right)' \boldsymbol{w}_{t-i} \right)$$

[10] The 'growth-augmented Taylor principle' (see Elfsbacka Schmöller and McClung, 2024) claims that, to maintain economic stability under a debt-stabilizing fiscal policy, central banks must raise $(r - g)$. This helps control inflation, as higher growth can contribute to inflationary pressures. In contrast, under a fiscal authority which does not stabilize debt, central banks can stabilize the public debt by letting $r - g$ fall with inflation.

[11] While most mandatory spending consists of transfers to individuals, a small share includes government purchases of services, such as administrative costs for programs like Medicare, which are not classified as transfers. Results are barely unchanged if we use just transfers.

$$+\mathcal{I}_{\{z_{t-1}=0\}}\left(\alpha_h^0+\beta_h^0 x_t+\sum_{i=1}^{p}\left(\boldsymbol{\gamma}_{h,i}^0\right)'\boldsymbol{w}_{t-i}\right)+v_{t+h}, \tag{2}$$

where $\mathcal{I}$ is a dummy variable that indicates the state of the economy when the shock hits. In particular, coefficient β_h^1 is the impulse response at horizon h conditional on the subcategory-specific fiscal capacity being low ($z_t = 1$), signaling fiscal strain; conversely, coefficient β_h^0 is the impulse response in the presence of high fiscal capacity ($z_t = 0$), that is, absent fiscal strain.

We estimate local projection coefficients using the smooth local projection methodology of Barnichon and Brownlees (2019), applied both in the linear and in the state-dependent case. In this approach, impulse response coefficients at different horizons are expressed as linear combinations of B-spline basis functions, and the corresponding coefficients are estimated through generalized ridge regression, with a penalty parameter governing the degree of shrinkage.[12] As in Barnichon and Brownlees (2019), we construct confidence intervals for the impulse response coefficients, employing a modified Newey and West (1987) heteroskedasticity- and autocorrelation-consistent estimator, adjusted to account for the penalty parameter. As shown by Li et al. (2024), smooth local projections typically outperform least-squares local projections under mean squared error loss, owing to their substantially lower variance at the cost of a modest increase in bias.

Unless otherwise stated, impulse responses are computed on the sample 1968q1-2019q4.

4 Empirical Findings

Using linear local projections (1), we analyze the impulse responses over the full sample period, from 1968q1 to 2019q4, to an anticipated shock to Medicare & Medicaid and to Social Security – which together account for the largest component of mandatory spending – but even to National Defense, the largest component of discretionary spending. Figure 3 presents the impulse responses to a shock to each of the three spending components. Estimates are obtained using linear local projections, and are normalized such that the peak response in

[12] The shrinkage parameter is selected by k-fold cross-validation, following Barnichon and Brownlees (2019).

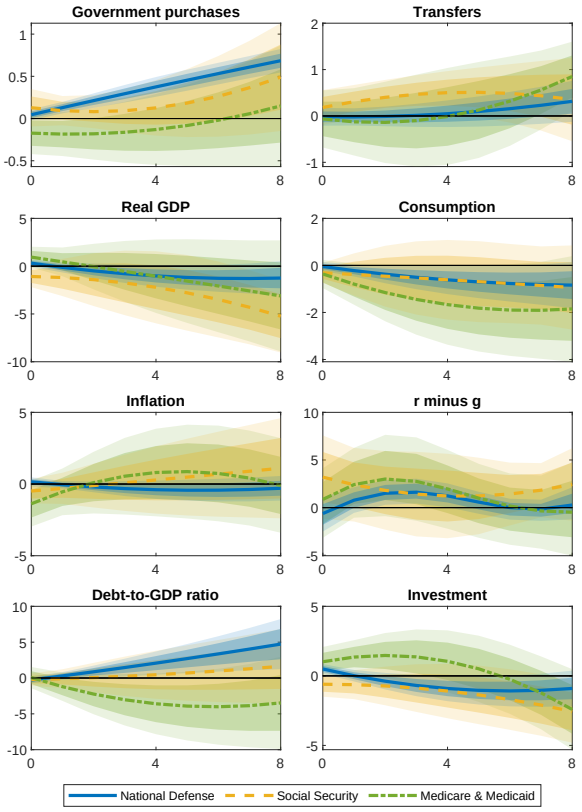


Figure 3: **Effects of anticipated spending shocks by category: Medicare & Medicaid, Social Security, and National Defense.**

Blue lines: responses to an anticipated shock to National Defense. Yellow lines: responses to an anticipated shock to Social Security. Green lines: responses to an anticipated shock to Medicare & Medicaid. The set of controls always includes four lags of the shock, output, and the outcome variable, plus four lags of transfers for panel Medicare & Medicaid and Social Security, or four lags of government purchases for National Defense. Each panel reports impulse responses from linear local projections estimated over the sample 1968q1-2019q4. Shaded areas: 68% (dark) and 90% (light) confidence bands.

government purchases plus transfers equals one. Following the approach in Ramey (2016), the graphs for NIPA variables should be interpreted as variations in dollars; for example, a one-dollar peak increase in government purchases plus transfers corresponds to a peak decrease in GDP of 1.15 dollars. The scales of the other graphs are in percentage points. We report 68% and 90% confidence bands based on Newey-West corrections of standard errors. As the figure shows, one can not detect any statistically significant difference in the response of these components. Output, consumption and investment decrease following an anticipated shock while $(r - g)$ increases. A slightly different behavior can be seen in inflation, but again none of the impulse responses is statistically significant.

Fiscal backing. The responses to the three spending categories shown in Figure 3 are not conditioned on the availability of resources specific to each category. A key feature of our approach is instead to focus on anticipated shocks across spending categories, conditioning on the degree of fiscal strain at the time of the announcement. We measure fiscal strain using the long-term actuarial balance associated with each category, which provides a forward-looking proxy for fiscal backing in the sense of Bianchi et al. (2023).

In what follows, we make our local projections dependent on the fiscal strain in the corresponding budget categories. Section 4.1 examines the effects of an anticipated shock to Medicare & Medicaid, while Section 4.2 looks at National Defense spending, two sub-components of mandatory and discretionary spending, respectively. Section 4.3 analyses Social Security, the largest component of mandatory spending, and formalise the apparently paradoxical result we find using a stylized general equilibrium model. While the main text concentrates on these key subcomponents, Appendix B extends the analysis to assess whether the results for these sub-components can be generalized to their aggregate categories of mandatory and discretionary spending.

4.1 Medicare & Medicaid

We begin by analyzing the effects of anticipated shocks to Medicare and Medicaid (MM), two major components of mandatory spending. A key feature of these programs is their institutional funding structure, which shapes the extent of fiscal backing.

Identifying fiscal capacity. A large share of Medicare, namely Parts B and D, and Medicaid are financed through mechanisms that ensure automatic access to general revenues. Medicare Parts B and D are funded through the Supplementary Medical Insurance (SMI) trust fund, which receives transfers from general revenues sufficient to cover projected expenditures, alongside beneficiary premiums. Similarly, Medicaid operates as an open-ended entitlement program, with federal transfers automatically adjusting to eligible expenditures. As a result, these components of MM are expected to be fiscally backed, as increases in spending are systematically matched by higher claims on general revenues.

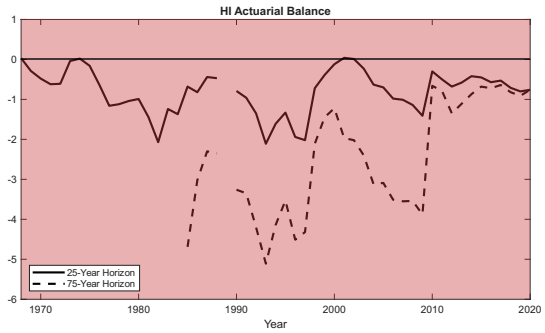


Figure 4: **Actuarial fiscal position of Medicare Part A (HI).**
Evolution of the Hospital insurance (HI) actuarial balance over 25-year and 75-year horizons, based on data from the Trustees Reports. The balance is persistently negative, indicating that Medicare Part A is consistently perceived as actuarially unfunded. The 75-year horizon becomes available starting in 1985, while the 1989 observation is omitted because the corresponding Trustees Report did not provide long-horizon projections.

Medicare Part A (Hospital Insurance, HI) differs in its financing structure, as it relies on a dedicated trust fund funded primarily through payroll taxes, with no automatic backing by general revenues. However, the extent of fiscal backing for HI crucially depends on expectations about its future financial position. To capture this forward-looking dimension, we consider the degree of actuarial fiscal strain, as measured by the projected actuarial balance over long horizons.

Figure 4 reports the evolution of the HI actuarial balance over both a 25-year and a 75-year horizon. The figure shows that, throughout our sample, the HI trust fund is consistently projected to be in deficit. This implies that, absent policy changes, the system is expected to become insolvent, thereby generating expectations of future fiscal adjustment. Historically, such projected imbalances have triggered legislative interventions—such as increases in payroll taxes or reductions in expenditure growth—aimed at restoring solvency.

Taken together, these features imply that MM spending is effectively perceived as fiscally backed. While Parts B, D, and Medicaid are backed by construction through general revenues, Part A is backed through expectations of future fiscal adjustment induced by persistent actuarial deficits. As a result, the degree of fiscal backing for MM does not vary meaningfully over time.[13]

[13]For more details on the MM (and SS) trust funds, including data sources, see Appendix A.

Results. Consistent with this interpretation, we estimate impulse responses to anticipated shocks to Medicare & Medicaid (MM) without conditioning on different fiscal states, as the degree of expected fiscal backing does not vary over time. Figure 5 reports the results from linear local projections over the sample 1968q1–2019q4. Given that MM spending largely consists of transfers to individuals, each local projection includes four lags of transfers, along with four lags of the shock, output, and the outcome variable.

The impulse responses display a pattern consistent with fiscally backed spending. Transfers increase gradually and become statistically significant after a few periods, reflecting the anticipated nature of the shock and the delayed implementation of spending. Real GDP, consumption, and investment decline following the announcement, indicating a contractionary effect during the anticipation period. At the same time, the interest rate–growth differential rises, while the debt-to-GDP ratio falls. Inflation shows no persistent increase and remains broadly contained, further supporting the absence of wealth effects. Overall, these dynamics are consistent with Ricardian behavior, as agents anticipate that increases in MM spending will be offset by future fiscal adjustments.

These findings reinforce the view that the institutional design of MM programs,combining automatic access to general revenues and persistent expectations of future adjustment driven by actuarial imbalances, anchors fiscal backing. As a result, the macroeconomic effects of MM shocks are stable over time and do not depend on fluctuations in fiscal capacity.

4.2 National Defense

We now turn to National Defense (ND), the largest component of discretionary spending. Unlike Medicare and Medicaid, which either have automatic access to general revenues or are associated with persistent actuarial imbalances that give rise to expectations of future fiscal adjustment, discretionary spending is subject to the congressional appropriations process and does not enjoy a built-in fiscal backstop.

As a result, the fiscal backing of ND depends critically on the availability of residual fiscal resources. By absorbing fiscal space, mandatory programs such as Medicare and Medicaid tighten the constraint on discretionary spending. When this constraint binds, increases in

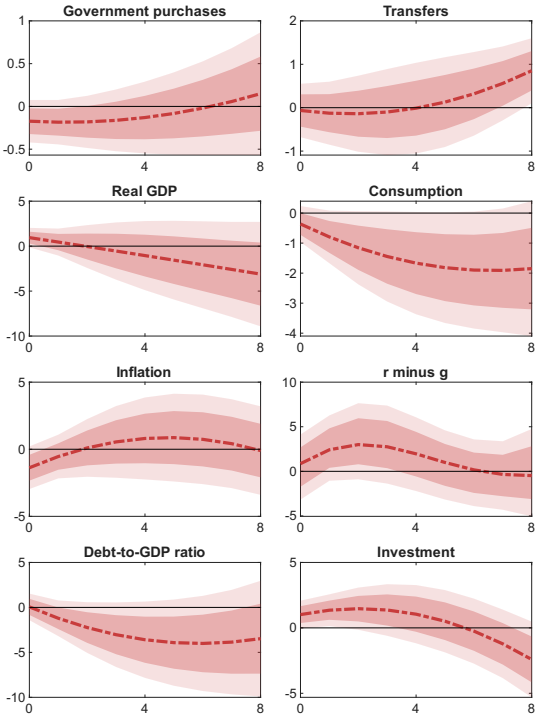


Figure 5: **Impulse responses to anticipated shocks to Medicare and Medicaid (MM).**
Impulse responses to anticipated shocks to Medicare & Medicaid (MM), estimated using linear local projections over 1968q1–2019q4. Controls include four lags of the shock, output, the outcome variable, and transfers. Shaded areas indicate 68% and 90% confidence bands.

defense spending are more likely to be perceived as unfunded, as they are not accompanied by credible expectations of future fiscal adjustment.

This distinction is central to our analysis. While MM spending is consistently backed due to its institutional funding structure and forward-looking fiscal adjustments, the fiscal backing of ND is inherently state-dependent and varies with the availability of fiscal space over time.

Identifying fiscal capacity. In the case of National Defense, we identify periods of scarce fiscal resources by exploiting time variation in the availability of fiscal space for discretionary spending. While for Medicare and Medicaid fiscal backing is assessed using forward-looking measures of actuarial strain, for ND we rely on a measure that captures the evolution of residual fiscal resources over time. In the case of National Defense, we identify periods of

scarce fiscal resources by looking at the so called fiscal democracy index (henceforth, Fiscal index or FI), introduced by Steuerle (2010). This index measures the share of federal tax revenues not allocated to mandatory spending programs, indicating the percentage of taxes available for discretionary spending over time.

$$\text{Fiscal index} \equiv 1 - \frac{\text{Mandatory spending} + \text{Interest}}{\text{Total revenues}}$$

The higher the index, the stronger the fiscal democracy, as more funds are available for non-predetermined spending. As Figure 6a shows, over the past fifty years this index has dropped significantly, from 65% in 1962 to below zero in 2009. There were two notable declines: the first occurred between 1969 and 1976 (although the index remained positive), and the second began in 2009, when it turned negative.[14] We define periods of scarce fiscal resources for discretionary spending as those during which the Fiscal democracy Index experiences a marked decline, such as from 1969Q1 to 1976Q4 and from 2009Q1 onward. Red (blue) areas in Figure 6b identify periods with decreasing (non-decreasing) FI.

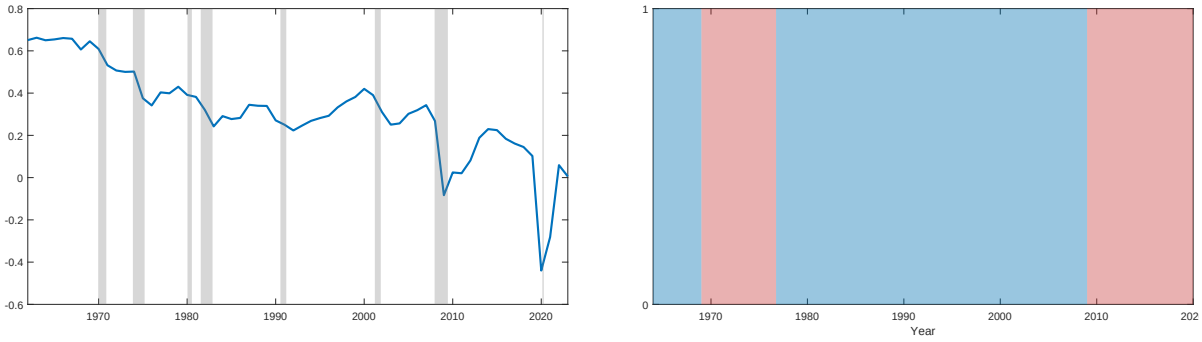
The results are robust even if one assigns a value of one only to the post-2009 period. This period, as Table 1 in Appendix D shows, is characterized by more frequent changes in the debt ceiling and numerous suspensions and, according to Bianchi et al. (2023), a resurgence of unfunded transfers spending.[15]

Results. Figure 7 shows the results for state-dependent local projections, described by equation (2), for an anticipated shock to National Defense spending in the period 1968q1-2019q4.

In this scenario, we include four lags of government purchases instead of transfers, and condition on the presence of slack (red lines) or tightness (blue lines) in the Fiscal index.

[14] "(...) in the year after the beginning of the current "financial crisis," mandatory expenses including interest payments exceeded total government income. This was caused by a simultaneous decline in revenue and a rapid increase in mandatory spending. As a result, all discretionary spending, including military expenditure, had to be debt-financed. (...) The global financial crisis that began in 2008 has undone any gains in fiscal democracy made in the late 1990s and the mid-2000s. In effect, the crisis seems about to eliminate almost completely any space for fiscal discretion in the foreseeable future unless governments are willing, and able economically and legally, to take up new, additional debt." (Streeck and Mertens, 2010)

[15] The debt ceiling limits total federal borrowing. Once reached, Congress must raise or suspend it to allow the Treasury to meet existing legal obligations.



(a) Fiscal index

(b) Fiscal capacity for National Defense

Figure 6: **Fiscal index and fiscal capacity for National Defense spending.**
Panel (a): evolution of Fiscal index. Note that the higher the index, the larger are funds available for discretionary spending and hence for ND spending. Grey bands indicate recessions. Panel (b): fiscal capacity for National Defense implied by the Fiscal index. Periods of fiscal strain are characterized by decreasing Fiscal index (in red), while periods of no fiscal strain are characterized by non-decreasing Fiscal index (in blue).

Our findings indicate a significant increase in government purchases under both fiscal states. On the other hand, the availability of resources to fund discretionary spending seems to play a crucial role in shaping the responses of real activity, inflation, and the debt-to-GDP ratio. Specifically, the responses of these variables are flipped in the two cases: when fiscal resources are abundant, the effects are muted and broadly consistent with Ricardian behavior; when resources are scarce, the shocks generate pronounced non-Ricardian effects. In the latter case, the anticipated increase in ND spending is more likely to be perceived as unbacked by future fiscal adjustment. This result aligns closely with theoretical predictions: Unbacked fiscal expansions are inflationary, stimulate economic activity and decrease the growth-interest rate differential, thus reducing the debt-to-GDP ratio.[16]

In Appendix C, we assess the robustness of these findings across two distinct macroeconomic regimes. We split the sample in the Great Inflation and the ZLB period (1964q1-1979q2 and 2009q1-2015q4, respectively), and the Great Moderation years (1984q1-2008q4). The literature typically identifies the former as unbacked *fiscal regimes* and the latter as a backed *monetary regime*. We find that the effects of ND spending are Ricardian under the

[16]To complement this analysis, Appendix B extends the classification to a broader distinction between mandatory and discretionary spending, using the fiscal index to proxy the degree of fiscal strain across the two categories, as it reflects the residual resources available to discretionary spending after mandatory obligations are met. We confirm that mandatory spending shocks generally elicit Ricardian responses, irrespective of short-run fiscal strain, while discretionary shocks are more likely to generate non-Ricardian effects, particularly during periods of limited fiscal space.

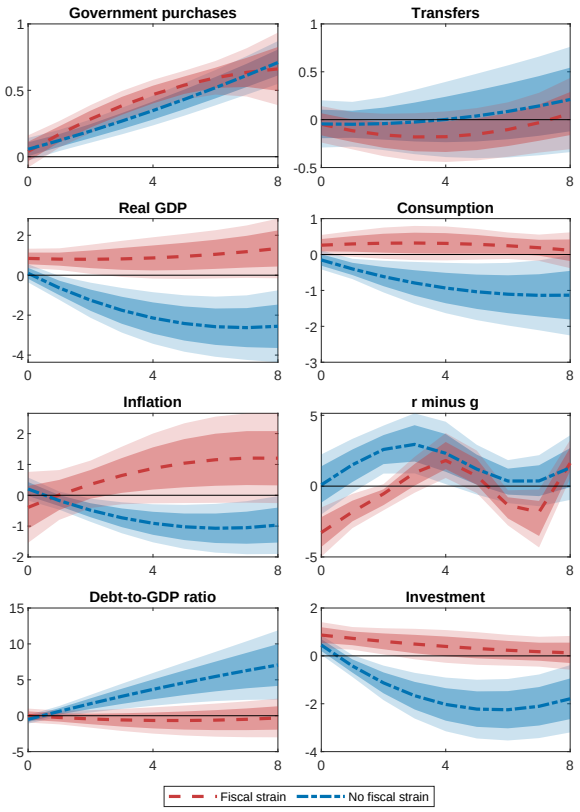


Figure 7: **Impulse responses to anticipated shocks to National Defense (ND), conditional on fiscal capacity.** Red (blue) lines denote periods of fiscal strain (no fiscal strain) based on the Fiscal index (Figure 6b). Estimates are obtained from state-dependent local projections over 1968q1–2019q4. Controls include four lags of the shock, output, the outcome variable, and government purchases. Shaded areas indicate 68% and 90% confidence bands.

monetary regime and non-Ricardian under the fiscal regime. These findings are consistent with those in Ascari et al. (2023).[17]

A closer look at Defense Spending: 'Warflation'. In this section, we are going to dig deeper into the inflationary effect of ND spending by focusing on specific historical episodes. This exercise should be read as a validation of the main mechanism we have discussed throughout the paper, namely, the distinction between Ricardian and non-Ricardian responses of ND spending, depending on the fiscal context. Rather than relying on regime indicators or fiscal indices, we now leverage the variation in defense outlays associated with historical U.S. war efforts.

[17]This is not surprising given that they primarily focus on defense spending shocks.

To this end, we adopt an alternative classification of states based on war periods.[18] War-related buildups in defense spending provide a natural experiment to test Ricardian versus non-Ricardian effects, as such spending is typically large and unexpected – driven by external geopolitical needs.

We examine average annual ND spending as a percentage of GDP during each U.S. war period in our sample considering, when defense outlays remained elevated, even mobilization and demobilization quarters. With this definition, average ND spending amounted to 13.4% of GDP during the Korean War (1950Q2–1954Q3), 7.5% during the Vietnam War (1964Q1–1975Q4), and 5.15% during the Gulf War (1990Q1–1991Q4). From 2001 to 2011, during the Iraq and Afghanistan wars, defense spending averaged 4.1%, and in the subsequent period 2011-2021, corresponding to the later years of the Afghanistan war, it averaged 3.4%. Based on the relative size of ND spending during different war periods, we consider yet another binary indicator variable, which takes the value of one during the periods corresponding to the three more expensive wars (i.e., Korean war, Vietnam war and Gulf war) and zero otherwise. This indicator is then used within the local projection framework of equation (2) to estimate state-dependent responses of inflation and other macroeconomic variables.

We find (see Figure 8) that outside these dates (highlighted in blue), impulse responses behave as Ricardian, whereas during high-cost war periods (in red), they reflect a non-Ricardian pattern. Anticipated defense shocks lead to a sustained increase in government purchases in both states, with a much stronger response in periods of high war expenditure. In such episodes, defense spending significantly boosts GDP: output rises markedly and remains elevated, whereas it contracts during more ordinary times. Consumption does not increase in either case, and investment—although not statistically significant—performs better in war episodes, while it falls sharply otherwise.

Inflation also shows a clear divergence: it declines in ordinary circumstances but rises significantly when wars are costly, thereby reducing the interest–growth differential $(r - g)$.

[18] While the previous analysis of defense spending was restricted to the 1968q1-2019q4 period to ensure comparability with MM spending, in what follows we extend the sample back to 1950q1 This allows us to capture the onset of the Korean War and more accurately study the inflationary dynamics associated with major U.S. military conflicts.

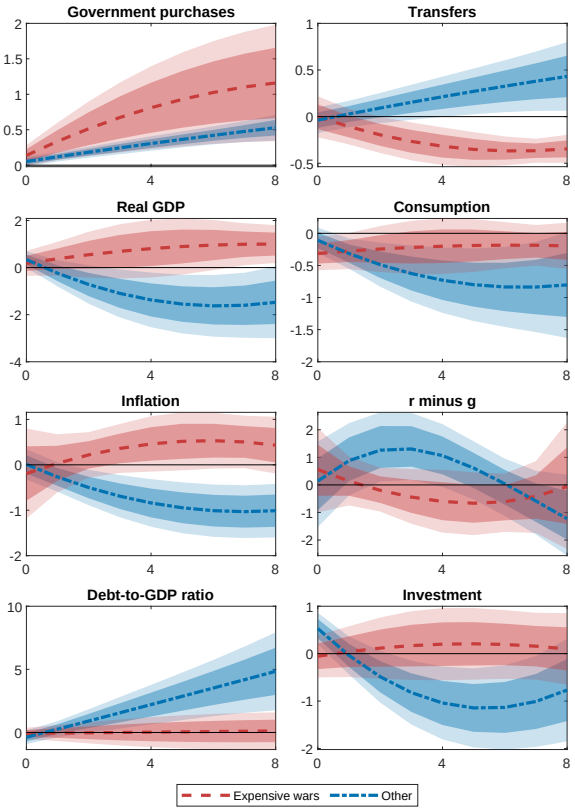


Figure 8: **Impulse responses to anticipated shocks to National Defense, distinguishing between high-cost war periods versus other periods.**
Responses to an anticipated shock to National Defense, distinguishing between relatively more expensive war periods (red lines) and other times (blue lines). We classify as high-cost war periods the Korean war (1950q2-1954q3) with average ND spending at 13.4% of GDP, the Vietnam War (1964q1-1975q4) at 7.5%, and the Gulf War (1990–1991), at 5.15%. For reference, defense spending averaged 4.1% of GDP during the Iraq War and the first years of the Afghanistan War (2001-2011), and 3.4% of GDP in the subsequent years (2011-2021). Each panel reports impulse responses from state-dependent local projections estimated over the sample 1950q1-2019q4. The set of controls always includes six lags of the shock, output, government purchases, and the outcome variable. Shaded areas: 68% (dark) and 90% (light) confidence bands.

This leads to very different debt dynamics: the debt-to-GDP ratio increases steadily in peacetime conditions, while it remains broadly stable, or even slightly declines, when fiscal pressures are driven by major wars.

These findings suggest that military spending shocks generate large multipliers and strong inflationary pressures, particularly during wartime. This historical episode analysis thus reinforces the main mechanism proposed in the paper: the fiscal context crucially conditions the macroeconomic effects of ND spending, with high-cost wartime periods displaying markedly non-Ricardian dynamics.

4.3 Social Security

We now turn to the effects of anticipated changes in projected Social Security spending, the largest component of mandatory spending. As in the case of Medicare and Medicaid, assessing fiscal backing requires a forward-looking measure of fiscal capacity, reflecting expectations about the long-run sustainability of the program.

Identifying fiscal capacity. The Social Security Act of 1935 established Social Security. This program is administered by the Social Security Administration (SSA) and is primarily funded through payroll taxes. These revenues are allocated to two trust funds: the Federal Old-Age and Survivors Insurance (OASI) and the Federal Disability Insurance (DI) funds. Although these are two legally separate funds, assessments of the system's financing often consider the combined programs (OASDI).

Unlike most components of Medicare and Medicaid, Social Security is subject to a strict trust fund constraint, as it does not have automatic access to general revenues. As a result, fiscal backing depends critically on expectations about the future solvency of the trust funds and the associated likelihood of policy adjustments.

To capture this forward-looking dimension, we rely on the projected actuarial balance over a 75-year horizon, as reported in the Trustees Reports. This measure summarizes the expected long-run imbalance between revenues and expenditures under current law and therefore provides a direct proxy for expected fiscal strain.

Figure 9 shows the evolution of the 75-year actuarial balance for OASDI. Over our sample period (1968–2019), the system is projected to be in actuarial surplus only in the early years, from 1968 to 1973. Starting in the mid-1970s, the actuarial balance turns persistently negative and remains so for the rest of the sample, reflecting a regime in which future imbalances are anticipated.

Based on this measure, we define two regimes. Periods of positive actuarial balance correspond to a regime of perceived long-run solvency, in which no future fiscal adjustment is expected. By contrast, periods of negative actuarial balance correspond to a regime of fiscal strain, in which agents anticipate that restoring solvency will require future policy

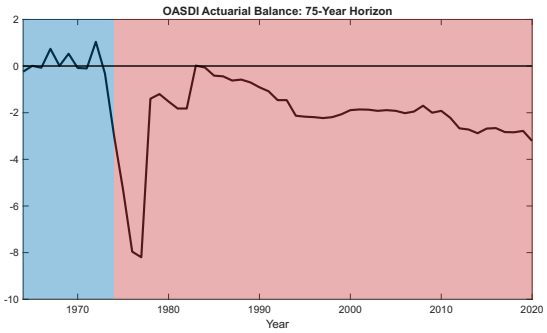


Figure 9: **Actuarial fiscal position of Social Security (OASDI).**
Evolution of the 75-year actuarial balance for the combined Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds (OASDI), based on data from the Trustees Reports. Shaded areas distinguish periods in which the system is perceived as actuarially funded (blue areas), when the projected balance is positive and no fiscal adjustment is expected, from periods in which it is actuarially unfunded (red areas), when projected deficits give rise to expectations of future fiscal adjustment.

interventions, such as increases in payroll taxes or reductions in benefits.

This distinction is central to our analysis. When Social Security is perceived as self-financing, expansions in spending may not be associated with expectations of future fiscal adjustment. Conversely, when actuarial deficits are anticipated, spending increases are expected to trigger future corrections, implying fiscal backing.

Results. Figure 10 presents impulse responses to an anticipated shock to Social Security spending for the period 1968q1-2019q4. Similar to Medicare and Medicaid, Social Security spending primarily consists of transfers to individuals; hence, each local projection includes four lags of transfers, as well as four lags each of the shock, output, and the outcome variable. The red (blue) lines indicate periods in which the OASDI trust funds are actuarially unfunded (funded). The transmission of news shocks to SS spending differs from those of healthcare programs and National Defense: when Social Security funding is expected to be ample, anticipated increases in spending appear to be more inflationary. That said, the responses of real activity, the growth-interest rate differential, and the debt-to-GDP ratio are less definitive, lacking clear evidence to consistently support Ricardian behavior.

How should we interpret these findings? The very nature of SS spending makes it more challenging to assess the extent of fiscal backing. Such programs typically create

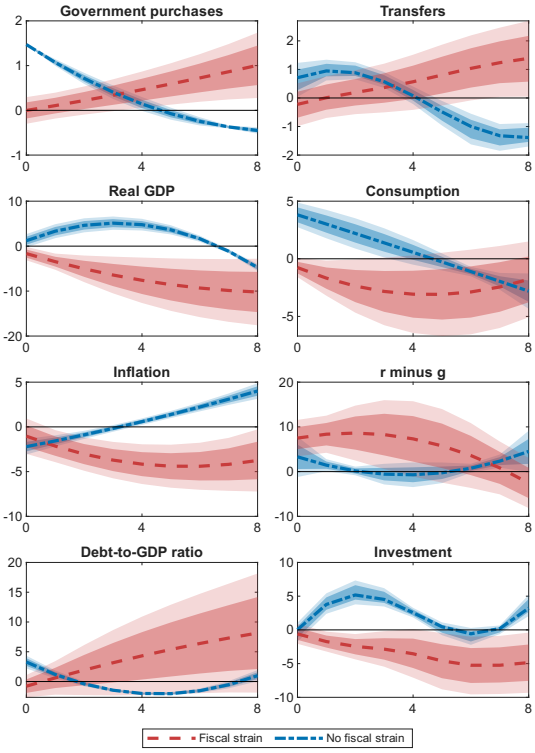


Figure 10: **Impulse responses to anticipated shocks to Social Security, conditional on OASDI actuarial balance.**

Impulse responses to anticipated shocks to Social Security (SS), conditional on the actuarial position of the OASDI trust funds. Red (blue) lines denote periods in which the system is actuarially unfunded (funded), based on the 75-year actuarial balance reported in the Trustees Reports. Estimates are obtained from state-dependent local projections over the sample 1968q1–2019q4. The set of controls always includes four lags of the shock, output, transfers, and the outcome variable. Shaded areas: 68% (dark) and 90% (light) confidence bands.

entitlements that are hard to reverse – benefits that are persistent, politically sensitive, and often seen as permanent commitments. For example, pensions that individuals incorporate into their long-term financial planning cannot easily be reduced or revoked. At the same time, the fiscal capacity to support these entitlements can change over time, influenced by demographic trends, economic growth, and broader macroeconomic conditions.

On the other hand, a more relaxed budget constraint for social spending may lead economic agents to expect more ambitious and sustained expansions in welfare programs, which are more likely to raise concerns about fiscal sustainability in the long run, especially when demographic and economic fundamentals are likely to change. This combination of entitlement rigidity and the inherent difficulty in assessing the long-run fiscal sustainability of

such programs heightens concerns about the financial viability of the long-term spending commitments introduced in the 1960s.

During this period, U.S. President Lyndon Johnson launched the Great Society initiatives – an ambitious effort to expand social spending and entitlements over several years. The U.S. economy was experiencing rapid growth, and a favorable demographic structure provided supportive conditions for increased government funding of social programs. Indeed, the OASI and DI trust funds, used here as proxies for financial strain in social spending, were largely in surplus at the time.

To support these interpretations, we present two key findings.First, as Figure 11 shows, the largest SS shocks in our sample occurred during the 1960s and the first half of the 1970s, a period characterized by positive actuarial balances and thus by the absence of expected future fiscal adjustment.[19] Second, as Figure 12 shows, if we restrict the sample to the post-1974 period, thereby excluding the shocks from 1960s and early 1970s, the effects of SS spending become consistently Ricardian. In this subsample, the actuarial balance is persistently negative, implying a regime in which future fiscal adjustment is always anticipated. Accordingly, the impulse responses are no longer state-dependent and display a stable pattern consistent with fiscal backing.

This finding echoes the results for the other major components of mandatory spending, Medicare and Medicaid. Moreover, it suggests that the inflationary effects of anticipated shocks to SS spending are primarily driven by the sizable shocks of the 1960s and early 1970s, a period when the U.S. government launched an ambitious expansion of entitlement sand Social Security was perceived as self-financing and not subject to binding fiscal constraints.

4.3.1 A model to study asymmetric fiscal backing

The institutional design of Social Security gives rise to an important asymmetry in the trust-fund adjustment mechanism that, as we argue, is key to interpreting the empirical results. Fiscal backing for Social Security is state-contingent: corrections are triggered only when insolvency risk becomes salient, while no offsetting mechanism operates when surpluses are

[19] See Appendix, Part D, for analogous figures displaying anticipated shocks to Medicare & Medicaid and ND.

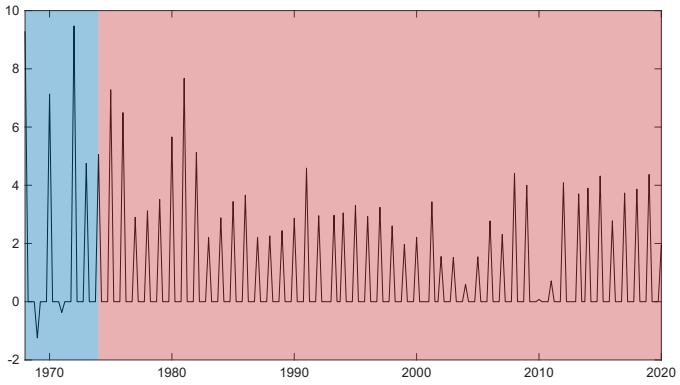


Figure 11: **Anticipated shocks to Social Security and actuarial OASDI regimes.** Black line: time series of anticipated shocks to Social Security, in percentage points. Shaded areas distinguish periods in which the OASDI system is actuarially funded (blue areas), when the 75-year actuarial balance is positive and no fiscal adjustment is expected, from periods in which it is actuarially unfunded (red areas), as described in Figure **??**. Data on actuarial balances are drawn from the Trustees Reports.

expected to persist indefinitely. To formalize this asymmetry and derive testable predictions, we develop a stylized general equilibrium model.

Federal Government Budget Constraint. The federal government budget constraint is given by

$$B_t^{\text{Fed}} = i_{t-1} B_{t-1}^{\text{Fed}} - S_t, \tag{3}$$

where i_{t-1} denotes the interest rate paid on debt issued in period $t-1$ and maturing in period t, and S_t denotes the primary surplus. The federal government issues only one-period bonds.

Social Security Trust Funds. Any surplus funds of the Social Security program must be invested in interest-bearing securities guaranteed by the U.S. government. These include special-issue Treasury bonds and certificates of indebtedness that are not available to the general public. All such securities are backed by the full faith and credit of the United States, making them among the safest investments in the world. They earn interest at a rate based on the average market yield on all outstanding marketable government obligations.

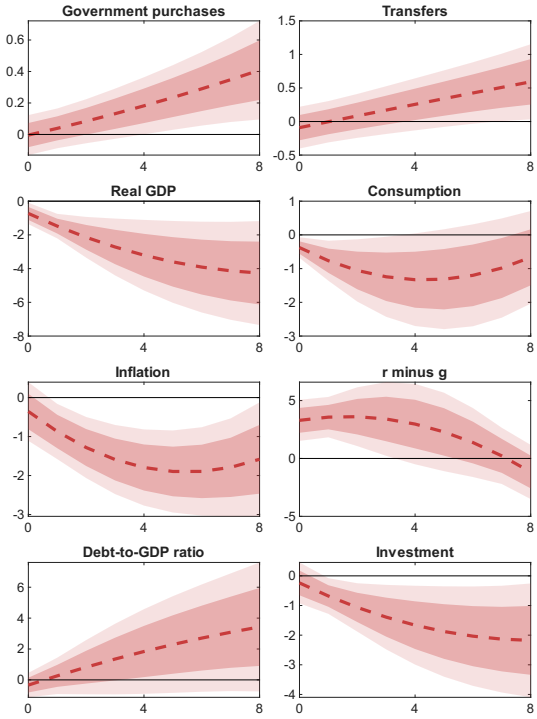


Figure 12: **Impulse responses to anticipated shocks to Social Security (SS), post-1974 sample.**

Impulse responses to anticipated shocks to Social Security (SS), estimated using linear local projections over the subsample 1974q1–2019q4. In this period, the 75-year actuarial balance of the OASDI trust funds is persistently negative, implying a regime in which future fiscal adjustment is always anticipated. Accordingly, the responses are not state-dependent and display dynamics consistent with fiscal backing. The set of controls always includes four lags of the shock, output, transfers, and the outcome variable. Shaded areas: 68% (dark) and 90% (light) confidence bands.

When the trust funds "purchase" Treasury bonds, the corresponding cash is transferred to the U.S. Treasury's General Fund. Once deposited in the General Fund, these resources are used to finance general government expenditures–such as defense, education, infrastructure–and to service other outstanding obligations. By providing additional internal financing, these surplus funds reduce the amount the government must borrow from the public. Accordingly, total federal government debt can be decomposed into debt held by the public, B_t^{Pub}, and intragovernmental debt held by the Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) trust funds, R_t^{SS}.

$$B_t^{\text{Fed}} = B_t^{\text{Pub}} + R_t^{SS}, \tag{4}$$

where R_t^{SS} denotes the reserves accumulated by the Social Security program in special interest-bearing securities issued by the federal government. Note that $R_t^{SS} \geq 0$, as these reserves represent a liability of the federal government, though not at the consolidated level, where only B_t^{Pub} constitutes net public debt.

The evolution of Social Security reserves is given by

$$R_t^{SS} = i_{t-1} R_{t-1}^{SS} + F_t^{SS}, \tag{5}$$

where F_t^{SS} denotes the surplus of the OASI/DI funds in period t, defined as payroll tax revenues minus benefit payments. These surpluses follow a general adjustment rule:

$$F_t^{SS} = \mathcal{T}_t + \sum_{j=0}^{J} \tau_{t-j}^{j}, \tag{6}$$

where $\mathcal{T}_t$ captures discretionary policy corrections enacted by Congress in period t to prevent depletion of the trust funds. These corrections are modeled as

$$\mathcal{T}_t = \left(\frac{R_{t-1}^{SS}}{R^{SS}} \right)^{-\eta}, \tag{7}$$

where R^{SS} denotes the threshold level below which the OASI/DI funds are considered insolvent, that is, their minimum acceptable reserve level. As noted, the payroll tax adjustment mechanism is *asymmetric*, implying $\eta > 1$ to ensure sufficiently strong corrective actions are undertaken to stabilize the trust funds whenever insolvency risks arise. Specifically, $\eta > 1$ if $E_t R_{t+j}^{SS} < R^{SS}$ for some $j > 0$. Otherwise, $\eta = 0$, reflecting the absence of legislated corrective mechanisms under U.S. law in this case.

While the variable $\mathcal{T}_t$ captures the feedback from insolvency risk to the net payroll tax position (payroll taxes minus benefits), the second component, $\sum_{j=0}^{J} \tau_{t-j}^{j}$, represents the time-$t$ balance of the trust funds that was anticipated in the past under current law–that is, abstracting from contemporaneous policy corrections $\mathcal{T}_t$. For example, the realization of τ_t^J corresponds to the expectation formed at time t of the OASI/DI surplus J periods ahead, namely $E_t F_{t+J}^{SS}$. Similarly, the projected surplus in period $t + J - 1$ as of time t satisfies

$E_t F^{SS}_{t+J-1} = \tau^J_{t-1} + \tau^{J-1}_t$, and so on.

Therefore, the array $\{\tau^j_t\}_{j=1}^J$ released in period t represents revisions to projected OASI/DI surpluses under current law. These projections explicitly abstract from potential future congressional interventions that may turn out to be necessary to stabilize the trust funds; that is, they are formed under the assumption that $\mathcal{T}_{t+j} = 0$ for all $j \in \{1, \ldots, J\}$. As a result, the sequence of random variables $\{\tau^j_t\}_{j=1}^J$, computed and released each period, captures period-by-period revisions to expectations of future OASI/DI surpluses driven by demographic developments and long-run economic growth, abstracting from ad hoc legislative adjustments.

Hence, total federal debt can be written as

$$\underbrace{B^{\text{Pub}}_t + R^{SS}_t}_{B^{\text{Fed}}_t} = i_{t-1} \underbrace{\left(B^{\text{Pub}}_{t-1} + R^{SS}_{t-1}\right)}_{B^{\text{Fed}}_{t-1}} - S_t. \tag{8}$$

Using the law of motion for Social Security reserves, $R^{SS}_t = i_{t-1} R^{SS}_{t-1} + F^{SS}_t$, this expression implies

$$B^{\text{Pub}}_t = i_{t-1} B^{\text{Pub}}_{t-1} - S_t - F^{SS}_t. \tag{9}$$

Thus, for a given primary surplus S_t, a Social Security surplus (deficit) reduces (increases) federal debt held by the public. The key asymmetry is that while Social Security surpluses do not trigger automatic policy responses, sustained deficits that threaten insolvency require congressional intervention by law.

The Interest Rate. To close the model, we specify the determination of the interest rate. We assume that the Fisher equation holds, so that

$$i_t = r E_t \pi_{t+1}, \tag{10}$$

where π_t denotes the (gross) inflation rate. Inflation expectations evolve according to

$$E_t \pi_{t+1} = \phi \pi_t, \tag{11}$$

where $\phi \in [0, 1)$ is an equilibrium-selection parameter. In what follows, this parameter affects inflation dynamics only insofar as inflation is influenced by fiscal developments. A value $\phi = 0$ implies immediate adjustment of inflation expectations, while $0 < \phi < 1$ generates persistent inflation dynamics. Values $\phi > 1$ imply non-mean-reverting inflation expectations and lead to non stable REE.

Parameterization. We set the discount factor to $\beta = 0.95$ and the ratio of Social Security reserves to publicly held federal debt to $\xi = 0.25$. The primary surplus, S_t, is assumed to follow an exogenous process. All remaining parameters are scenario-specific. The projection horizon is set to $J = 20$ periods. Throughout the analysis, we set $\phi = 0.85$ to select an equilibrium. This choice ensures comparability across the two scenarios considered. Importantly, selecting any value of $\phi \in (0, 1)$ does not affect our main qualitative results.

The Pre-1974 Scenario. In the years leading up to 1974, the Social Security system was viewed as actuarially funded and expected to generate persistent surpluses. Accordingly, we set $\eta = 0$, reflecting the absence of anticipated adjustments to payroll taxes or benefits given the perceived long-run solvency of the system. To capture this feature, we assume that, at time t, increases in Social Security reserves are projected according to

$$\tau_t^j = 0.05j, \qquad j \in \{1, \ldots, 20\}. \tag{12}$$

We then consider an alternative specification in which a reduction in reserve accumulation is anticipated five periods ahead. Specifically, in this alternative scenario, we set $\tau_t^5 = \tau_t^4 - 0.15$, while the remainder of the projected surplus path remains unchanged. We interpret this deviation as the announcement of an increase in Social Security benefits of the type identified in our local projection analysis.[20]

[20] To ensure determinacy of a stable rational expectations equilibrium (REE), we drop the law of motion

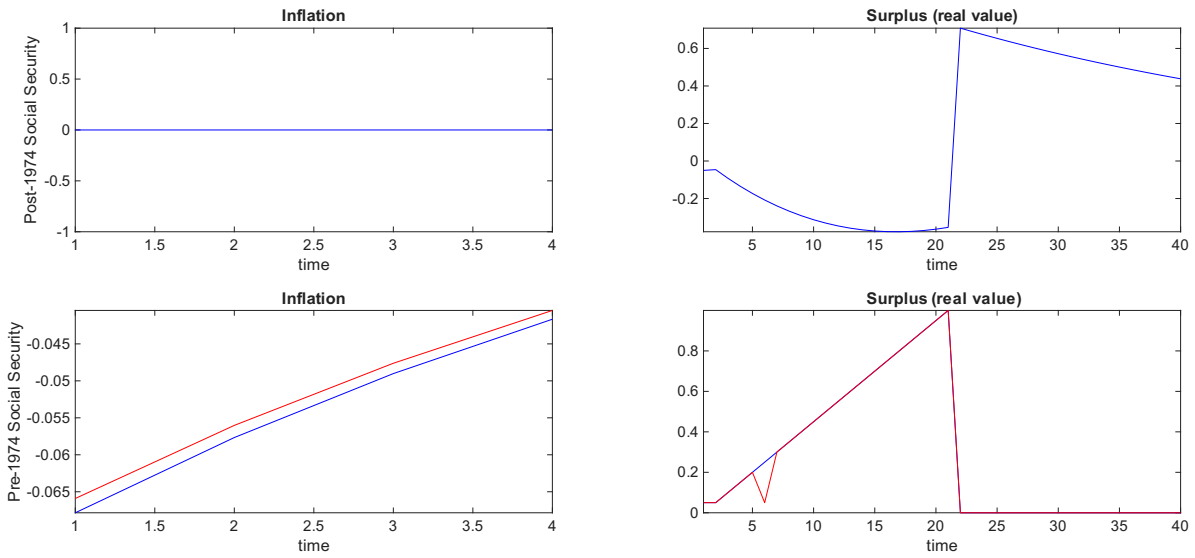


Figure 13: All variables are in log deviations from steady state.

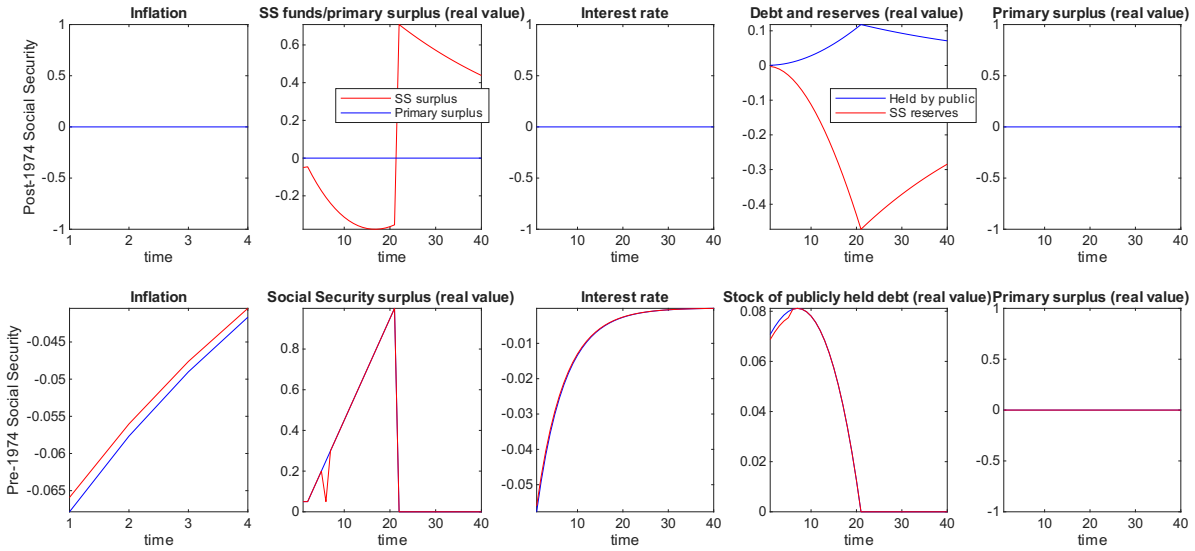


Figure 14: All variables are in log deviations from steady state.

for Social Security reserves –equation (5)– and the definition of total debt (b_t^{Fed}) –equation (4)–, which are both residual variables that do not affect equilibrium outcomes of the other variables in this case. Absent this modification, the assumption of no fiscal backing ($\eta = 0$) required to generate monotonically increasing reserves r_t^{SS} without payroll tax adjustments in expectations cannot be implemented. In particular, unbounded reserve accumulation is, by construction, inconsistent with a stable rational expectations equilibrium (REE), preventing a direct analysis of the pre-1974 case under the standard reserve accumulation equation. It is therefore important to emphasize that expectations in this framework are not projections formed under current law. In the scenario considered here, reserves are expected to grow indefinitely, while agents nonetheless anticipate that they will eventually stabilize for reasons that are not explicitly modeled and without the need for payroll tax increases. Tracking r_t^{SS} is only required to determine the necessary payroll tax adjustments to ensure that social security spending is backed; see equation 7. This backing is imposed only when the system is expected to be actuarially insolvent. In the pre-1974 scenario, tracking reserves is not necessary.

The Post-1974 Scenario. Since 1974, the U.S. Social Security system has been recognized as actuarially insolvent, in the sense that, absent policy changes, the trust funds would eventually be depleted. This outlook necessitates congressional intervention, albeit with delay, in the form of higher payroll taxes or reduced benefits. To capture this institutional feature, we set $\eta = 1.50 > 1$. We assume that the anticipated insolvency of the system is reflected in news of declining reserves over the next $J = 20$ periods. Specifically, we set

$$\tau_t^j = -0.05j, \qquad j \in \{1, \ldots, 20\}. \tag{13}$$

Figure 14 illustrates the resulting dynamics.[21] In the upper panel, we observe that the asymmetric backing of the Social Security system implies the absence of inflationary effects in the post-1974 scenario. Let's start with the pre-1974 scenario –the bottom panels. Because fiscal policy is active, publicly held debt must return to its steady-state level by the end of the simulation, where it can remain permanently. Given the expectation that Social Security will generate positive surpluses for an extended period, inflation must initially fall sharply and remain below its steady-state level in order to raise the real value of outstanding debt at the beginning of the simulation. The resulting stream of steady-state Social Security surpluses is remitted to the federal government –equation (9)– and used to reduce publicly held debt until it is driven back to steady state. Once these surpluses cease (in period $t = 21$), debt is no longer reduced and remains at its steady-state level indefinitely. Inflation initially declines and then gradually increases over time, while remaining below its steady-state value throughout. This inflation path depends on the equilibrium selected through the choice of ϕ: the closer ϕ is to zero, the more front-loaded the decline in inflation. Importantly, our main qualitative conclusions are robust to this choice.

The red line illustrates the case in which, in period t, agents anticipate an increase in Social Security spending in period $t + 5$. This anticipation implies a one-off reduction in reserves relative to their otherwise monotonically increasing path, visible in the lower panels of the second figure. The expected increase in spending reduces the accumulation of publicly held federal debt, since part of the surplus in period $t+5$ is no longer remitted to the federal

[21] See Appendix G for the steady-state characterization of the model.

government but instead used to finance Social Security expenditures. As a consequence, inflation declines by less than in the baseline case; equivalently, anticipated increases in Social Security spending lead to higher inflation relative to the baseline.

In the upper panels, we provide a possible explanation for our results in the post-1974 period. In that year, it became clear that the Social Security system was no longer sustainable absent major increases in payroll taxes or cuts in benefits. We capture this realization as a sequence of anticipated negative surplus shocks, $\{\tau_t^j\}_{j=1}^J < 0$, observed in period $t = 0$. As shown in the second graph of the upper panel, Social Security funds run persistent deficits through period $t = 20$. In the fourth graph, the OASI/DI trust funds begin drawing down their reserves –held by the Treasury– to finance these deficits, leading to a decline in reserves (red line). At the same time, debt held by the public increases, as Social Security surpluses cease to flow into the general Treasury (blue line).

In period $t = 21$, Congress enacts a major Social Security reform that rebalances the system. This reform has a pronounced effect on surpluses, which turn positive, as illustrated by the sharp increase in the second graph (red line).[22] As a result, Social Security reserves begin to rise and eventually converge to their steady-state level from below. Publicly held debt also starts to decline, as Social Security surpluses are once again remitted to the general Treasury. Despite the prolonged deficits and the subsequent major reform, there are no non-Ricardian effects: inflation remains at its steady-state level throughout. Inflation does not need to adjust to stabilize either outstanding federal debt or the real value of Social Security reserves. This result hinges on the assumption that publicly held debt earns the same rate of return as the reserves held by the Social Security trust funds.

5 Conclusions

Fiscal policy is inherently complex, raising questions about whether different categories of spending in the U.S. Federal Budget have a larger impact on output and prices, and whether they have historically received varying levels of fiscal backing. Does the choice of fiscal tools

[22] This sharp rebalancing is driven by the backing of reserves with payroll taxes, $\mathcal{T}_t$, which, in our model, occurs because the parameter η exceeds one.

matter to stimulate the economy during a recession? And, importantly, which spending categories pose a greater risk to price stability? This paper shows that not all spending is alike in its macroeconomic impact.

Shifts in discretionary spending, particularly in National Defense, display pronounced non-Ricardian effects, especially during times of limited or sharply reduced funding. In such contexts, insufficient fiscal resources can undermine the credibility of support for military expenditures, generating wealth effects that translate into higher output and inflation.

By contrast, changes in mandatory spending, especially in Medicare and Medicaid, generally produce Ricardian effects, irrespective of funding pressures for these programs. Social Security spending presents a more nuanced case: large and sustained expansions of entitlements, such as those enacted during the Great Society era, have historically created expectations of permanent transfers, with meaningful upward pressure on prices.

Overall, these findings suggest that the macroeconomic consequences of fiscal policy depend not only on the size and category of spending, but also on the credibility and persistence of its fiscal backing.

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Appendix

A Data

The outcomes of our local projections are quarterly data from NIPA tables of aggregate federal purchases & investment, aggregate federal transfers, real GDP, real consumption, real investment, inflation, the interest rate-growth differential $(r - g)$, and debt over GDP. All variables are expressed in levels. The interest rate-growth differential $(r-g)$ is calculated as the difference between the nominal interest rate and the nominal GDP growth rate, both measured at quarterly frequency.

Trust funds for MM Medicare is funded through two main trust funds: The Hospital Insurance (HI) Trust Fund and Supplementary Medical Insurance (SMI) Trust Fund. The Hospital Insurance (HI) Trust Fund is primarily financed through payroll taxes collected under the Federal Insurance Contributions Act (FICA) for employees and employers, and under the Self-Employment Contributions Act (SECA) for self-employed individuals. Employees and employers each contribute a fraction of their wages, while high-income earners

pay an additional Medicare surtax. The HI Trust Fund faces solvency challenges, and its balance depends on the balance of incoming payroll taxes and outgoing Medicare Part A expenses. The SMI Fund is primarily funded by general tax revenues and monthly premiums paid by Medicare enrollees and relies heavily on annual appropriations.

Trust funds for SS The Social Security Act mandates that Social Security spending be primarily financed through payroll taxes collected under the Federal Insurance Contributions Act (FICA). The OASI Trust Fund finances benefits for retirees and their survivors. It is primarily supported by payroll taxes levied on employees and employers, with a portion of earnings subject to these taxes capped at a specific threshold. The funds collected are used to pay monthly benefits to eligible retirees and to the survivors of deceased workers. The Disability Insurance (DI) Trust Fund provides benefits to individuals who become disabled and can no longer work. Like the OASI Trust Fund, the DI Trust Fund is also funded through payroll taxes. However, the DI Trust Fund has faced challenges in recent years due to increasing claims and demographic shifts, raising concerns about the sustainability of its funding.

Periods of fiscal strain To assess the availability of funds for Medicare & Medicaid and Social Security, we use their projected actuarial balances. These are obtained, respectively, from the Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds and the Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, both available on the Social Security Administration website (https://www.ssa.gov/OACT/tr/). For a detailed overview of the current financial status of both Social Security and Medicare trust funds, see Table 13.1, Cash Income, Outgo, and Balances of the Social Security and Medicare Trust Funds: 1936–2028, in the U.S. Budget.

B Mandatory and Discretionary spending

Does the variation in behavior across states appear only when examining specific subcategories of expenditure, or is it also evident in broader, aggregated categories like mandatory or discretionary spending? We divide government expenditure into its two main components – mandatory and discretionary – and examine the impulse responses following an anticipated shock to each, using the longest time span covered by the data (1964q1-2019q4). The specification includes four lags of the control variables, namely the outcome variable, output, and both transfers and public purchases for mandatory expenditures and only public purchases for discretionary spending. We begin by estimating a linear model, as in equation (1). As Figure 15 shows, there are no marked differences in the responses of the variables between the two types of spending.

We employ the FI to distinguish a state with high fiscal capacity (where federal tax revenues exceed the amount required to cover mandatory expenses, with the surplus available to fund discretionary spending) (in red) from a state with a low capacity (in blue), using (2). Unlike in the linear case, mandatory and discretionary spending now exhibit different behaviors. As shown in Figure 16, the impulse response functions for mandatory spending consistently follow the pattern of a *funded* spending shock. In contrast, impulse responses for discretionary spending behave like those following *funded* shocks when the FI is high but resemble *unfunded* shocks when the FI is low, most evidently with respect to the response of output and consumption.

The result for mandatory spending is not surprising. PAYGO, applied to mandatory spending to control deficit increases, requires that any rise in direct spending or revenue decrease must be offset by other spending cuts or revenue increases.[23] These mechanisms ensure that such expenditures are consistently funded. Notably, PAYGO does not apply to discretionary spending, which is instead subject to annual budget caps and the appropriations process. Overall, the behavior of mandatory and discretionary spending mirrors the

[23]PAYGO, introduced in 1990 to curb deficits, was waived in the late 1990s due to surpluses and abandoned in 2002 after deficit-financed tax cuts. It was reinstated in 2007 and codified in the 2010 Statutory PAYGO Act, which mandates that new deficit-increasing legislation be offset or trigger automatic spending cuts (sequestration). Social Security and Medicaid are exempt, while Medicare can be reduced by up to 4%.

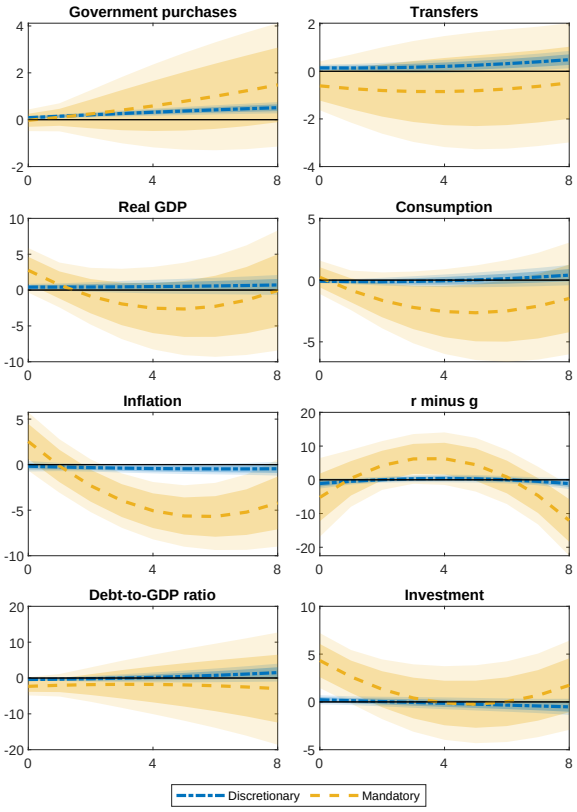


Figure 15: **Effects of anticipated spending shocks to mandatory and discretionary spending.**

Blue lines: responses to an anticipated shock to mandatory spending. Yellow lines: responses to an anticipated shock to discretionary spending. Each panel reports impulse responses from linear local projections estimated over the sample 1964q1-2019q4. The set of controls always includes four lags of the shock, output, and the outcome variable, plus four lags of both transfers and government purchases for mandatory spending and only government purchases for discretionary spending. Shaded areas: 68% (dark) and 90% (light) confidence bands.

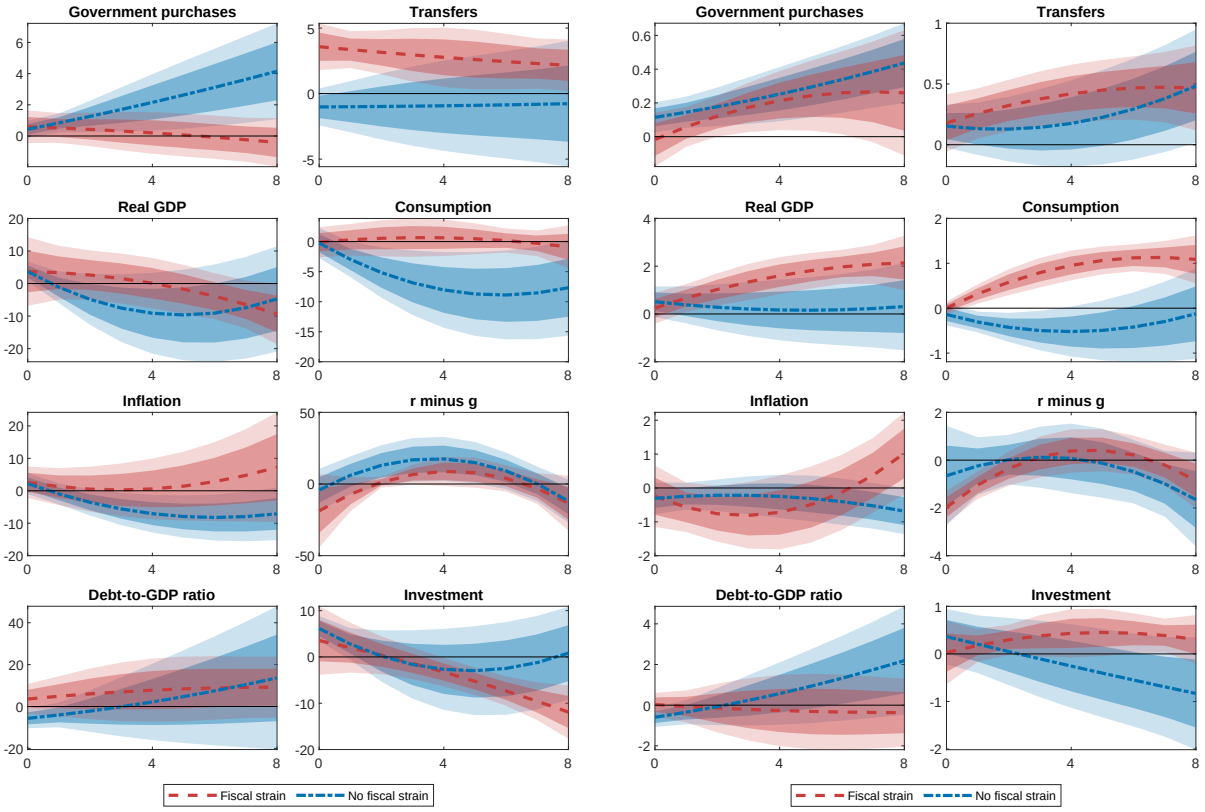
results we obtained for their respective sub-components, respectively, MM that is always funded, and ND whose financing depends on fiscal capacity.[24]

C Evidence with alternative states

C.1 The Monetary-Fiscal regime (MF)

Instead of relying on the previously fiscal Index, we now turn to a different approach to capture episodes of fiscal strain. Specifically, we now exploit the well-known distinction

[24]Note that while the distinction in behavior between high and low FI states is neat for ND, it becomes less so when looking at discretionary spending. This is likely because discretionary spending is an aggregate that encompasses various subcategories, whose behavior may not be as clear-cut as that of ND.



(a) Anticip. shock to mandatory, FI.

(b) Anticip. shock to discretionary, FI

Figure 16: **Impulse responses to anticipated shocks to mandatory and discretionary spending, conditional on the Fiscal index.**

Panel (a): responses to anticipated shocks to mandatory spending. Panel (b): Responses to anticipated shocks to discretionary spending. Each panel reports impulse responses from state-dependent local projections estimated over the sample 1964q1-2019q4. Responses are conditioned on the periods of fiscal strain (red lines) or absence of fiscal strain (blue lines) in the Fiscal index, as described in Figure 6b. The set of controls always includes four lags of the shock, output, and the outcome variable plus four lags of both transfers and government purchases for panel (a) and only government purchases for panel (b). Shaded areas: 68% (dark) and 90% (light) confidence bands.

between a monetary-led regime (regime M) and a fiscally-led regime (regime F) found in the literature on monetary-fiscal interactions (see Bianchi, 2012; Bianchi and Ilut, 2017; Bianchi and Melosi, 2014, 2017; Chung et al., 2007).[25]

We assign a value of one to the unfunded fiscal sub-periods: the Great Inflation years (1964q1-1979q2) and the periods when monetary policy operated at the zero lower bound (2009q1-2015q4), while we assign a value of zero to the funded monetary regime: the Great

[25] According to Leeper (1991), the monetary regime assumes an active monetary policy, adhering to the Taylor principle, and a passive fiscal policy. In this regime, fiscal expansions are always backed by future fiscal surpluses. Conversely, the fiscal regime assumes a passive monetary policy and an active fiscal policy: here, fiscal expansions are unbacked and generate wealth effects.

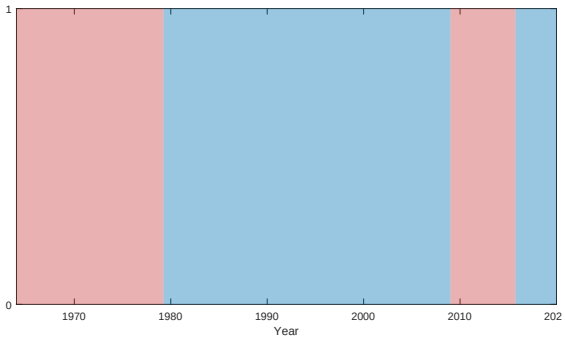


Figure 17: **Monetary and fiscal regimes.**
Periods of unfunded fiscal regime (in red) correspond to the Great Inflation years (1964q1-1979q2) and the years when monetary policy operated at the zero lower bound (2009q1-2015q4). Periods of funded monetary regime (in blue) correspond to the Great Moderation years (1984q1-2008q4).

Moderation years (1984q1-2008q4).[26] Blue (red) areas in Figure 17 identify a fiscal unfunded (monetary funded) regime.

The decision to extend the fiscal regime beyond the Great Inflation years to the post-2009 period is motivated by several factors. Firstly, the post-2009 period is characterized by the zero lower bound (ZLB), indicating a passive monetary policy typical of a fiscal regime. Secondly, while pre-2009 changes in debt ceilings were relatively limited, in the post-2009 period, changes in debt ceilings were much more frequent, with different suspensions occurring. This implies that the ability to finance discretionary spending in general, and ND spending in particular, was subject to greater uncertainty and variability. Third, as Bianchi et al. (2023) stress, the amount of unfunded spending accelerates in the aftermath of the Great Recession.

Given that this regime-based indicator is now used in place of the fiscal index, we reassess the baseline results presented in the paper. In particular, we evaluate how the responses to government spending shocks vary under this new specification – both for defense spending and across the discretionary and mandatory components of government expenditures. Figure 18 shows, for the sample 1964q1-2019q4, the responses of the variables to an anticipated

[26] While there is a broad consensus on considering the Great Moderation as a monetary regime, the Great Inflation regime is more debated. Papers assuming a constantly passive fiscal policy detect, in the Great Inflation period, a double passive (hence, indeterminate) regime (see Lubik and Schorfheide, 2004)). However, when allowing for a possible switch in fiscal policy, the pre-Volcker era is found to be consistent with a fiscally-led regime (see Davig and Leeper, 2007, 2011; Sims, 2011)), in which the increasing inflation is attributed to a lack of fiscal discipline.

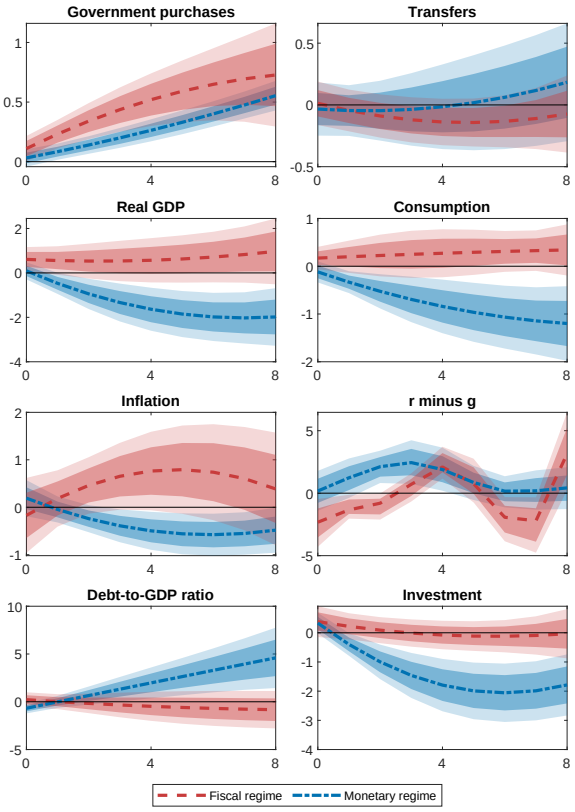
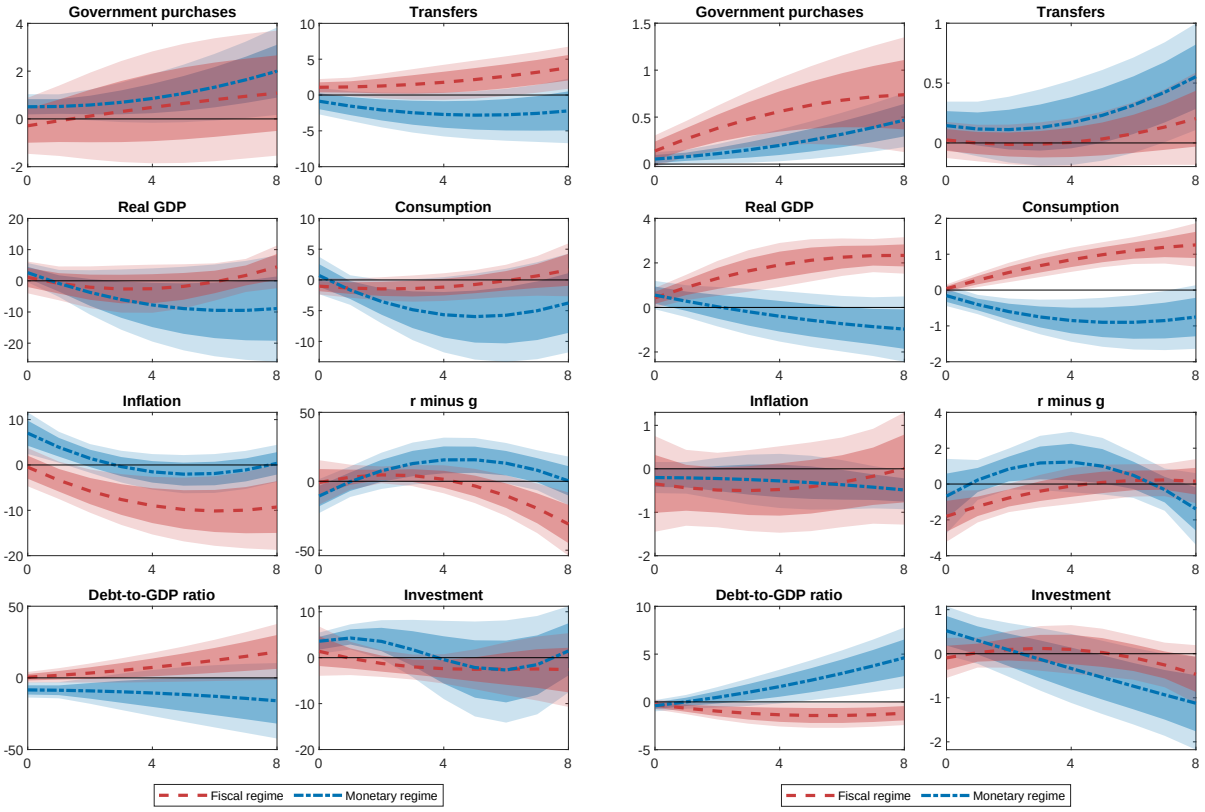


Figure 18: **Impulse responses to anticipated shocks to National Defense, conditional on monetary/fiscal regimes.**

Responses to an anticipated shock to National Defense, conditioning on unfunded fiscal regimes (red lines) or funded monetary regimes (blue lines), as described in Figure 17. Each panel reports impulse responses from state-dependent local projections estimated over the sample 1964q1-2019q4. The set of controls always includes four lags of the shock, output, government purchases, and the outcome variable. Shaded areas: 68% (dark) and 90% (light) confidence bands.

shock to Defense spending under the fiscal regime (in blue) and under the monetary regime (in red). Under regime M (F) output, consumption and investment decrease (increase), while the real rate and $(r - g)$ increase (decrease) or are not significant. Inflation decreases (increases) under M (F), increasing (reducing) debt. Therefore, in regime M, the impulses behave as those following an anticipated funded spending shock; in regime F, the impulses behave as those following an anticipated unfunded spending shock. The results we obtain employing the FI are therefore confirmed.

Looking at mandatory and discretionary spending across the MF states, we find that results under FI states are confirmed. As Figure 19 shows, discretionary spending behaves as Ricardian under the Monetary regime and as non-Ricardian under the Fiscal regime. On the other hand, mandatory spending has always a Ricardian behavior both under the



(a) Anticip. shock to mandatory, M/F regimes (b) Anticip. shock to discretionary, M/F regimes

Figure 19: **Impulse responses to anticipated shocks to mandatory and discretionary spending, conditional on the monetary/fiscal regimes.**

Panel (a): responses to anticipated shocks to mandatory spending. Panel (b): Responses to anticipated shocks to discretionary spending. Each panel reports impulse responses from state-dependent local projections estimated over the sample 1964q1-2019q4. Responses are conditioned on the unfunded fiscal regimes (red lines) or funded monetary regimes (blue lines), as described in Figure 14. The set of controls always includes four lags of the shock, output, and the outcome variable plus four lags of both transfers and government purchases for panel (a) and only government purchases for panel (b). Shaded areas: 68% (dark) and 90% (light) confidence bands.

Monetary regime and under the Fiscal regime.

D Purged shock measures

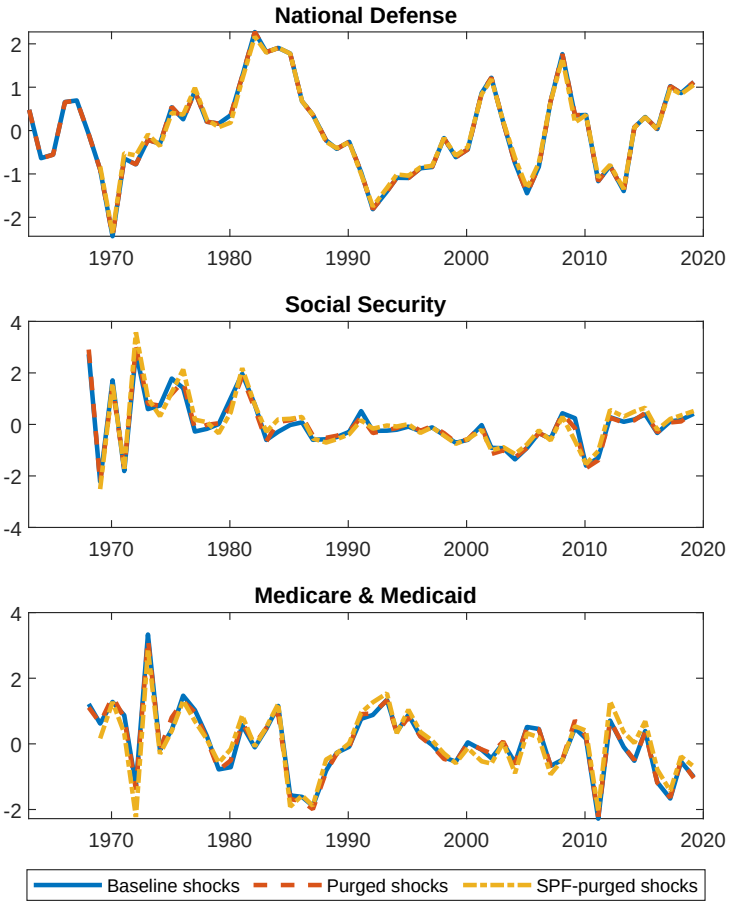


Figure 20: **Baseline vs. purged measures of shocks.**

The blue solid lines show the baseline measure of anticipated government spending shocks, constructed from the spending projections in U.S. budgets for each spending subcategory. The red dashed lines represent purged shocks obtained by regressing the baseline shocks on a constant and the expected growth rate of real GDP reported in the budgets. The yellow dash-dotted lines represent purged shocks obtained by regressing the baseline shocks on a constant, the expected growth rate of GDP, and the expected change in unemployment reported in the Survey of Professional Forecasters.

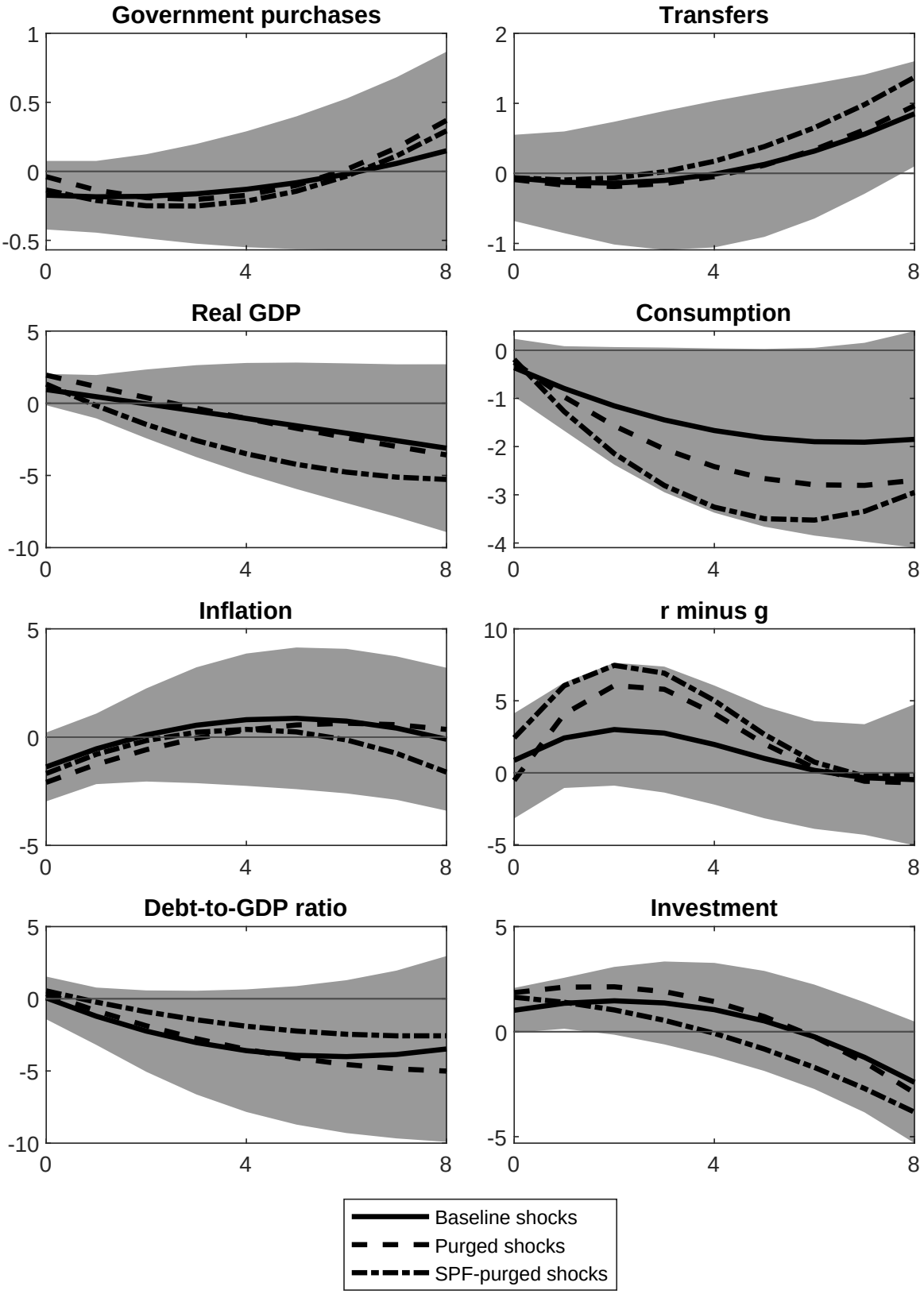
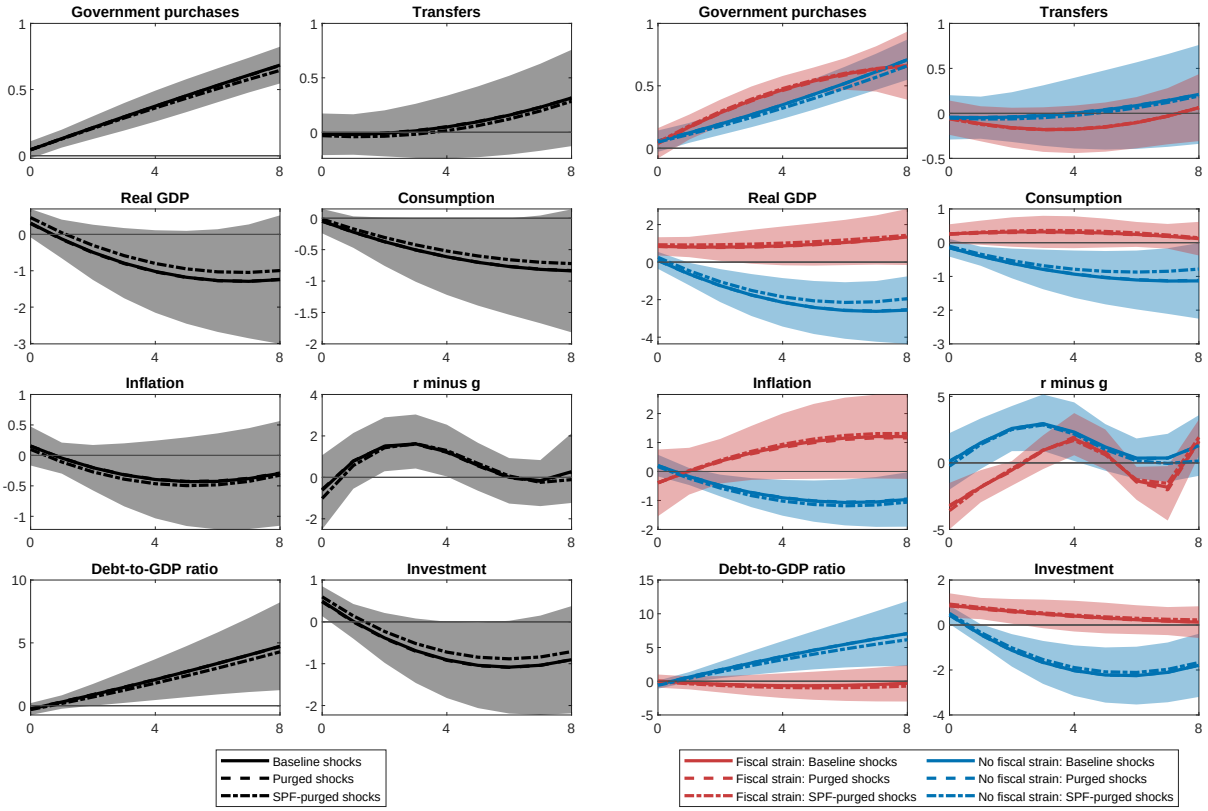


Figure 21: Anticip. shock to MM, linear

Figure 22: **Impulse responses to anticipated shocks to Medicare and Medicaid: Baseline vs. purged shocks.**

Linear responses to an anticipated shock to Medicare & Medicaid. The solid lines show the responses to the baseline shocks, the dashed lines to the purged shocks, and the dash-dotted lines to the SPF-purged shocks. All responses are estimated over the sample 1968q1-2019q4. The set of controls always includes four lags of the shock, output, and transfers. Shaded areas: 90% confidence bands for the baseline shocks.

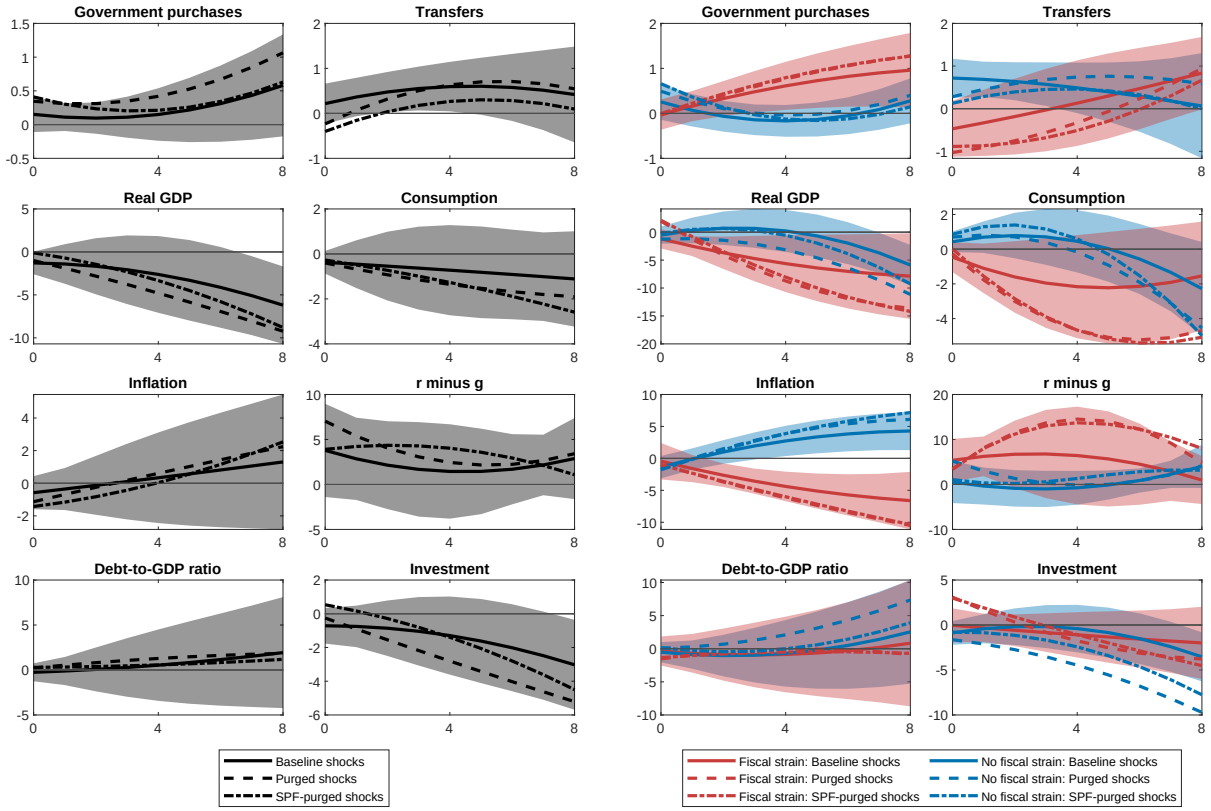


(a) Anticip. shock to ND, linear

(b) Anticip. shock to ND, FI

Figure 23: **Impulse responses to anticipated shocks to National Defense: Baseline vs. purged shocks.**

Panel (a): linear responses to an anticipated shock to National Defense. Panel (b): state-dependent responses to an anticipated shock to National Defense, conditioning on the periods of fiscal strain (red lines) or absence of fiscal strain (blue lines) in the Fiscal index. In all panels, the solid lines show the responses to the baseline shocks, the dashed lines to the purged shocks, and the dash-dotted lines to the SPF-purged shocks. All responses are estimated over the sample 1968q1-2019q4. The set of controls always includes four lags of the shock, output, and government purchases. Shaded areas: 90% confidence bands for the baseline shocks.



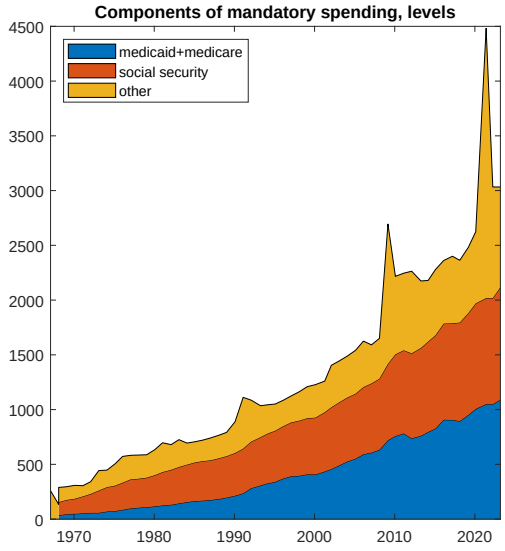
(a) Anticip. shock to SS, linear

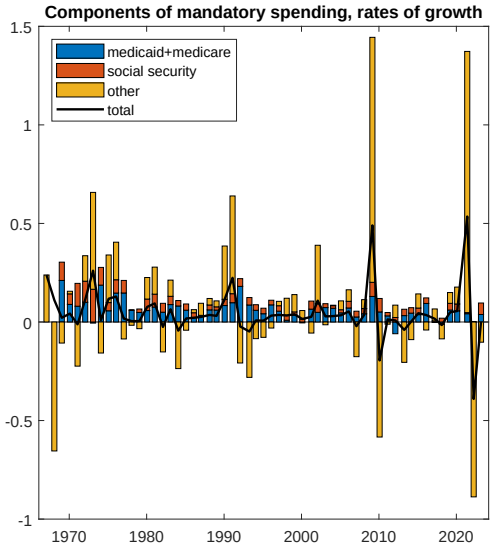
(b) Anticip. shock to SS, OASDI

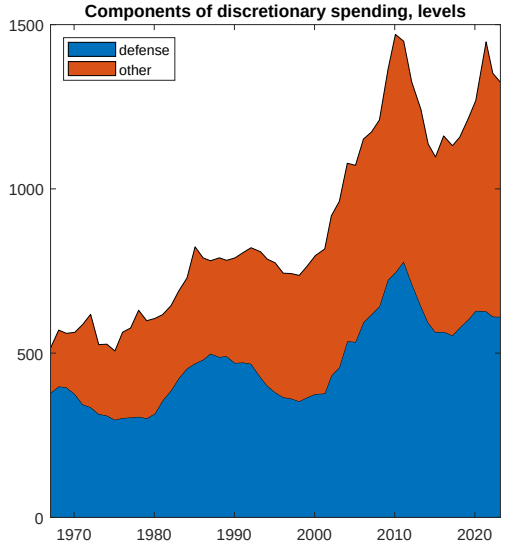
Figure 24: **Impulse responses to anticipated shocks to Social Security: Baseline vs. purged shocks.**

Panel (a): linear responses to an anticipated shock to Social Security. Panel (b): state-dependent responses to an anticipated shock to Social Security, conditioning on the periods of fiscal strain (red lines) or absence of fiscal strain (blue lines) in the OASDI funds. In all panels, the solid lines show the responses to the baseline shocks, the dashed lines to the purged shocks, and the dash-dotted lines to the SPF-purged shocks. All responses are estimated over the sample 1968q1-2019q4. The set of controls always includes four lags of the shock, output, and transfers. Shaded areas: 90% confidence bands for the baseline shocks.

E Supplementary Figures







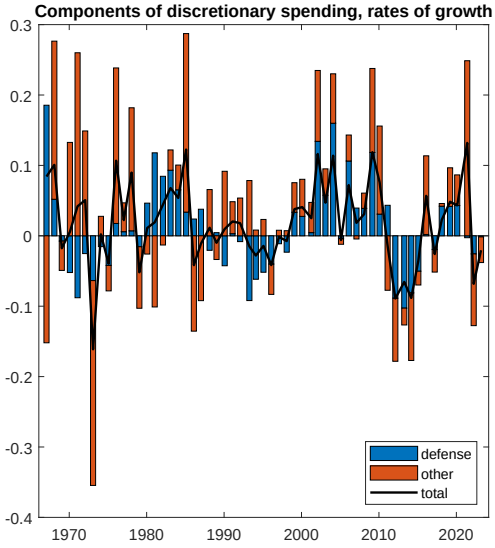


Table 1: Historical debt ceiling levels

Date	**Debt Ceiling**	**Change in Debt Ceiling**
August 5, 1997	5,95	450
June 11, 2002	6,4	450
May 27, 2003	7,384	984
November 16, 2004	8,184	800
March 20, 2006	8,965	781
September 29, 2007	9,815	850
June 5, 2008	10,615	800
October 3, 2008	11,315	700
February 17, 2009	12,104	789
December 24, 2009	12,394	290
February 12, 2010	14,294	1,900
January 30, 2012	16,394	2,100
February 4, 2013	Suspended	-
May 19, 2013	16,699	305
October 17, 2013	Suspended	-
February 7, 2014	17,212	213
March 15, 2015	18,113	901
October 30, 2015	Suspended	-
March 15, 2017	19,847 (de facto)	1,734
September 30, 2017	Suspended	-
March 1, 2019	22,030 (de facto)	2,183
August 2, 2019	Suspended	-
July 31, 2021	28,500 (de facto)	6,470
October 14, 2021	28,9	400
December 16, 2021	31,4	2,500

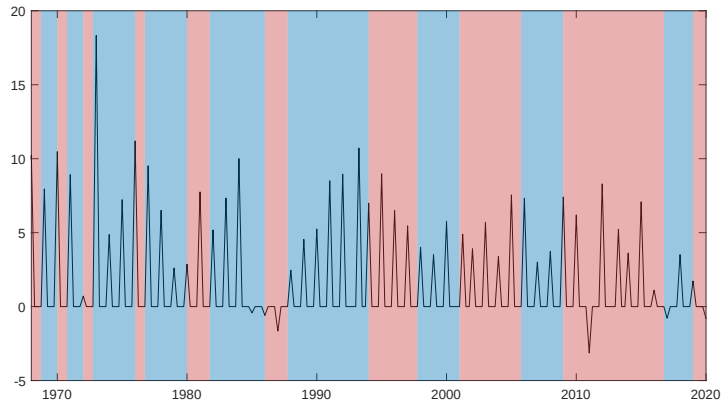


Figure 25: **Anticipated shocks to Medicare & Medicaid and fiscal capacity based on the HISMI funds.**

Black line: time series of anticipated shocks to Medicare & Medicaid, in percentage points. Shaded areas: periods of fiscal strain (red) or absence of fiscal strain (blue) in the HISMI funds.

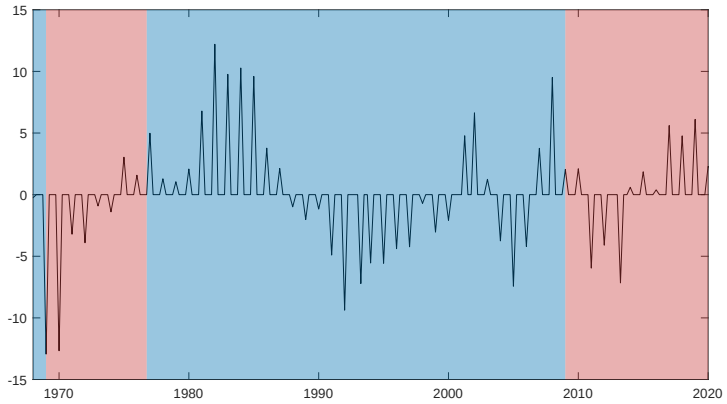


Figure 26: **Anticipated shocks to National Defense and fiscal capacity based on the Fiscal index.**

Black line: time series of anticipated shocks to National Defense, in percentage points. Shaded areas: periods of fiscal strain (red) or absence of fiscal strain (blue) in the Fiscal index.

F Trustees Reports and the Evolution of Actuarial Assessments, 1969–1976

Old-Age, Survivors, and Disability Insurance (OASDI)

This Section documents the evolution of official actuarial assessments of the Old-Age, Survivors, and Disability Insurance (OASDI) system as reported in the Trustees Reports from 1969 to 1976. The sequence of Tables (see Figure TOT) illustrates a sharp break in the interpretation of actuarial balance and trust fund solvency beginning in 1974.

1969–1971: Positive Actuarial Balances. The 1969 Trustees Report presents long-range actuarial balance estimates under low-cost, intermediate-cost, and high-cost assumptions (1969 Report, p. 37). Under both the low-cost and intermediate-cost scenarios, the total OASDI actuarial balance is clearly positive (1.14% and 0.53% of taxable payroll, respectively). Even under the high-cost scenario, the reported deficit is modest (-0.17%).

Similarly, the 1970 Trustees Report continues to report actuarial balances close to zero. Under the intermediate-cost assumptions, the total actuarial balance is -0.08% of taxable payroll, while the low-cost scenario yields a surplus of +0.54%. The 1971 Trustees Report shows a comparable pattern: a small surplus under low-cost assumptions (+0.58%) and a near-zero balance under intermediate-cost assumptions (-0.10%). Across these reports, two features stand out. First, actuarial balance estimates are clustered tightly around zero, indicating no perceived structural financing gap. Second, rather than framing projections in terms of binding solvency constraints or trust fund exhaustion, pre-1974 Trustees Reports present a range of alternative cost scenarios, treating actuarial balance as a sensitivity measure rather than as an indicator of impending insolvency.

1972–1973: Apparent Actuarial Stability. The 1972 Trustees Report presents actuarial balance estimates under both level-earnings assumptions (Table 17) and dynamic assumptions (Table 19). Under level-earnings assumptions, the total actuarial balance is essentially zero (+0.05%). Under dynamic assumptions, which incorporate rising nominal

earnings and automatic benefit increases, the actuarial balance is reported as strongly positive (+1.04%). The 1973 Trustees Report, using dynamic assumptions, shows a modest deterioration but still no indication of severe imbalance. The total actuarial balance is reported as -0.32% of taxable payroll. While negative, this value remains small in magnitude and is not framed as implying imminent trust fund exhaustion or the need for corrective legislation. Taken together, the 1972 and 1973 reports reinforce the prevailing perception that OASDI remained broadly actuarially sound under current law, even after the introduction of automatic cost-of-living adjustments. Dynamic assumptions were interpreted as benign, and automatic indexation was not yet viewed as a source of systemic risk.

1974: A Downward Revision in Actuarial Balance. The 1974 Trustees Report marks a clear break with earlier assessments. Table 20 reports a total actuarial balance of -2.98% of taxable payroll over the 75-year horizon (1974–2048) under dynamic assumptions. This represents an order-of-magnitude deterioration relative to earlier reports. This shift is driven by a sharp upward revision in the projected average cost of the system (13.89% of taxable payroll) relative to the average rate in the present tax schedule (10.91%). Unlike earlier reports, the 1974 assessment explicitly attributes this deterioration to revised demographic projections and to the interaction of high inflation with the automatic benefit indexation provisions enacted in 1972, including the benefit formula error later corrected in the 1977 amendments.

Importantly, the presentation now centers on long-run imbalance and implicitly on trust fund exhaustion. Actuarial balance is no longer treated as a near-zero accounting residual but as a measure of the permanent contribution increase or benefit reduction required to restore solvency.

1975–1976: Consolidation of the Insolvency Narrative. The 1975 Trustees Report shifts presentation from actuarial balance tables to explicit comparisons of expenditures and tax rates over successive 25-year periods (Table 21). Over the full 75-year horizon, the report shows a total actuarial deficit of -5.32% of taxable payroll, substantially larger than the already-negative 1974 estimate. Deficits widen dramatically in later subperiods,

underscoring the long-run nature of the imbalance. This reassessment was reinforced by contemporaneous external reviews commissioned by Congress, most notably the 1975 Report of the Consultant Panel on Social Security chaired by Hsiao et al. (1975), which independently validated the Trustees' diagnosis and emphasized that earlier projections had been overly optimistic. The 1976 Trustees Report confirms this perspective under alternative intermediate assumptions (Table 27). The total 75-year difference between expenditures and taxes is reported as -7.96% of taxable payroll, with particularly large shortfalls in the final 25-year period. The convergence between the Trustees Reports and the conclusions of the Hsiao Panel eliminated remaining ambiguity about the long-run outlook of OASDI financing. By this point, the Trustees Reports consistently frame OASDI financing in terms of persistent actuarial deficits and the inevitability of future corrective action. The sequence of Trustees Reports from 1969 to 1976 documents a clear regime shift in the interpretation of OASDI financing. Prior to 1974, actuarial balance estimates clustered around zero and were presented as evidence of long-run sustainability. Automatic indexation and dynamic earnings growth were viewed as compatible with actuarial soundness, and no expectation of future policy adjustment was embedded in official projections. Beginning in 1974, revised assumptions and the realization of sustained high inflation transformed this narrative. Actuarial balance became sharply negative, trust fund exhaustion emerged as a central organizing concept, and future tax increases or benefit reductions became an implicit component of the financing outlook. This shift in the actuarial narrative fundamentally altered expectations about fiscal backing and the role of the OASDI trust funds within the federal budget.

Medical Hospital Insurace (HI)

This section documents the evolution of actuarial assessments for the Medicare Hospital Insurance (HI) trust fund as reported in the Trustees Reports from 1969 to 1976. In contrast to OASDI, these reports reveal no regime shift in the interpretation of actuarial soundness. From the earliest assessments in the late 1960s, HI is consistently portrayed as subject to actuarial pressure, with projected costs closely tracking or exceeding scheduled contribution rates and trust fund balances described as finite and vulnerable to depletion. The 1969

Trustees Report, for instance, presents detailed projections of annual cash flows, interest earnings, and trust fund balances under intermediate-cost assumptions (Table 5), explicitly anticipating fund exhaustion within the projection horizon. Subsequent reports for 1970 and 1971 reinforce this view, with alternative assumptions for the earnings base (Tables 5a and 5b in the 1970 report and Table 5 in the 1971 report) continuing to project depletion rather than permanent surplus accumulation.

Beginning in 1972, the Trustees Reports introduce explicit actuarial balance calculations for HI. The 1972 report documents a negative actuarial balance over the 25-year horizon 1972–1996 (Table 9), reflecting an average cost rate exceeding the scheduled contribution rate, while the 1973 report reports a similarly small but still negative actuarial balance over 1973–1997 (Table 8). These near-zero balances are not framed as evidence of overfinancing or long-run sustainability, but rather as indicative of short- to medium-run imbalance. In 1974, actuarial balance turns marginally positive over the 1974–1998 horizon (Table 9), yet the accompanying discussion explicitly characterizes this outcome as conditional and short-horizon, without altering long-run expectations. The 1975 report returns to a negative actuarial balance over 1975–1999, again emphasizing the fragility of HI financing in the face of medical cost growth.

The 1976 Trustees Report further underscores the persistence of actuarial stress. Under intermediate assumptions, actuarial balance remains negative over the 1976–2000 horizon (Table 9), while alternative assumption sets explored in Table 11 generate a wide range of outcomes, from modest surpluses to sizable deficits. This sensitivity to assumptions reinforces the Trustees' long-standing emphasis on uncertainty and on the likelihood of future financing adjustments. Taken together, the Trustees Reports from 1969 to 1976 portray Medicare Hospital Insurance as a program under persistent actuarial pressure from its inception. Unlike OASDI, HI is never described as actuarially overfunded or as generating long-run surpluses; trust fund depletion is routinely projected, and actuarial balance fluctuates around zero without anchoring expectations of permanent solvency. As a result, expectations of future policy adjustment are embedded in the HI financing framework from the outset. Persistent actuarial imbalance is thus a defining feature of HI rather than a

regime shift, shaping expectations of fiscal backing and adjustment continuously over time.

G Steady state of the model for Social Security

$$b_t^{\text{Pub}} = \frac{i_{t-1}}{\pi_t} b_{t-1}^{\text{Pub}} - s_t - f_t^{SS} \tag{14}$$

where $b_t^{\text{Pub}} = \frac{B_t^{\text{Pub}}}{P_t Y}$, $s_t = \frac{S_t}{P_t Y}$, $f_t^{SS} = \frac{F_t^{SS}}{P_t Y}$ and $\pi_t = P_t / P_{t-1}$. In steady state

$$b^{\text{Pub}} = \frac{i}{\pi} b^{\text{Pub}} - s - f^{SS} \tag{15}$$

Since inflation is zero at steady state (gross inflation $\pi = 1$) and $i = \beta^{-1}$, we obtain

$$b^{\text{Pub}} = \beta^{-1} b^{\text{Pub}} - s - f^{SS} \tag{16}$$

$$(\beta^{-1} - 1) b^{\text{Pub}} = s + f^{SS} \tag{17}$$

Analogously

$$(\beta^{-1} - 1) r^{SS} = f^{SS} \tag{18}$$

So

$$b^{\text{Pub}} e^{b_t^{\text{Pub}}} = \beta^{-1} b^{\text{Pub}} e^{(i_{t-1} - \pi_t + b_{t-1}^{\text{Pub}})} - s e^{s_t} - f^{SS} e^{f_t^{SS}} \tag{19}$$

$$b^{\text{Pub}} e^{b_t^{\text{Pub}}} = \beta^{-1} b^{\text{Pub}} e^{(i_{t-1} - \pi_t + b_{t-1}^{\text{Pub}})} - [(\beta^{-1} - 1) b^{\text{Pub}} - (\beta^{-1} - 1) r^{SS}] e^{s_t} - (\beta^{-1} - 1) r^{SS} e^{f_t^{SS}} \tag{20}$$

$$e^{b_t^{\text{Pub}}} = \beta^{-1} e^{(i_{t-1} - \pi_t + b_{t-1}^{\text{Pub}})} - [(\beta^{-1} - 1) - (\beta^{-1} - 1)\chi] e^{s_t} - (\beta^{-1} - 1)\chi e^{f_t^{SS}} \tag{21}$$

where $\chi = r^{SS} / b^{\text{Pub}}$.

$$b_t^{\text{Pub}} = \beta^{-1}(i_{t-1} - \pi_t + b_{t-1}^{\text{Pub}}) + (1 - \beta^{-1})(1 - \chi) s_t + (1 - \beta^{-1}) \chi f_t^{SS} \tag{22}$$

The law of motion of the SS reserves:

$$r_t^{SS} = \beta^{-1}(i_{t-1} - \pi_t + r_{t-1}^{SS}) + (\beta^{-1} - 1) f_t^{SS}. \tag{23}$$

and the total federal debt

$$(1+\xi)b_t^{\text{Fed}} = b_t^{\text{Pub}} + \xi r_t^{ss}. \tag{24}$$