The Perils of Narrowing Fiscal Spaces*

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Abstract

Do large fiscal deficits constrain the central bank's response to inflation? If so, when? Local projections suggest that they do, particularly when inflationary pressures originate from supply shocks. Market real interest rates rise following oil-supply news shocks when fiscal space is ample but fall when it is narrow, consistent with markets anticipating weaker monetary tightening under fiscal pressure. We formalize this mechanism in a nonlinear general-equilibrium model with limited fiscal responsibility. The government stabilizes debt in the long run but resists rapid fiscal adjustment in the short run. When debt accumulates too quickly, it pressures monetary policy to limit rate increases, creating a state-contingent ceiling on the policy rate. As fiscal space narrows and the volatility of inflationary supply shocks rises, agents expect this constraint to bind more often, raising inflation expectations, trend inflation, and upside inflation risk. The model accounts for much of the rise and fall of U.S. trend inflation between 1965 and 1990 and interprets the post-pandemic rise in inflation as reflecting a greater risk that fiscal constraints bind amid narrower fiscal space and heightened supply-shock volatility.

Keywords: Macroeconomic risks, oil news shocks, supply shocks, monetary and fiscal policy, limited fiscal responsibility, fiscal capacity, trend inflation, nonlinear models.

JEL classification: E31, E52, E62, E63.

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1 Introduction

Most of the time, inflation rises and falls with shocks, returning to its starting point once they dissipate. Sometimes, however, it ratchets, settling on a persistently different plateau after the shocks have faded. Postwar U.S. inflation displays an upward ratchet from the mid-1960s to the early 1980s, a downward ratchet over the following two decades, and possibly a new upward ratchet since the pandemic.

Figure 1 relates these shifts to two forces: fiscal conditions and the risk of supply disruptions. The upward ratchet began in the mid-1960s, when the Vietnam War and Great Society programs turned persistent primary surpluses into deficits, while geopolitical tensions and resource nationalism raised disruption risk, culminating in the oil shocks of the 1970s. Both forces subsequently reversed. Fiscal consolidation rebuilt fiscal space, while détente, expanding non-OPEC supply, declining OPEC pricing power, and deeper global integration progressively reduced disruption risk. By the 1990s and 2000s, globalization had entrenched a much safer supply environment. Since 2021, the two forces have again moved together. Exceptionally large peacetime deficits have coincided with renewed supply disruptions from the pandemic, the war in Ukraine, and increasing fragmentation of global trade. Inflation has remained above target since.

Critically, neither force appears sufficient on its own. Disruption risk was elevated in the 1950s and early 1960s, yet fiscal discipline kept inflation anchored. Conversely, deficits were sometimes large in the two decades before the pandemic, but low disruption risk coincided with stable trend inflation.

We show that U.S. financial markets expect monetary tightening in response to inflationary supply shocks to weaken when fiscal space is narrow. Using the oil-supply news shocks identified by Känzig (2021), we find that the five-year real yield rises when fiscal space is ample but falls when it is narrow, by roughly 40 basis points over much of the following two years. Disinflationary oil-supply shocks show no comparable asymmetry. These findings suggest that fiscal pressures constrain monetary tightening precisely when adverse supply shocks call for higher interest rates.

We develop a nonlinear model in which large deficits may induce the government to resist interest-rate increases, and greater supply-disruption risk strengthens this pressure. Neither margin is present in conventional models: trend inflation is unaffected by macroeconomic risk, the monetary–fiscal policy mix does not depend on the state of public finances, and inflation therefore returns to target once shocks dissipate. In our model, by contrast, state-dependent fiscal pressure constrains monetary tightening and causes inflation to converge to a higher, endogenously determined trend. Moreover, when the fiscal limit binds, inflation becomes

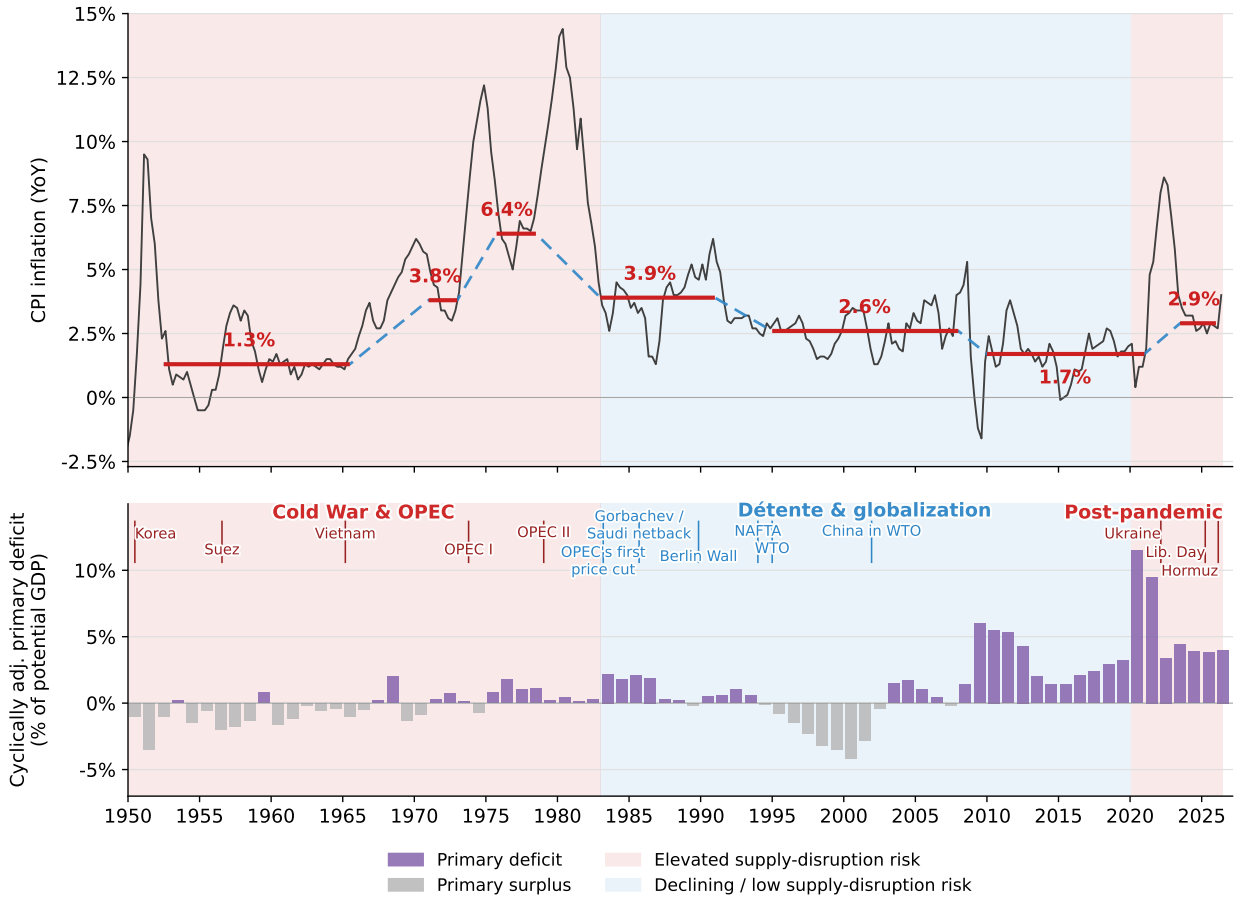


Figure 1: Top Panel: Ratcheting inflation. Bottom Panel: Deficits and supply-disruption risks

more responsive to shocks.

The pressure on monetary policy arises because the government, though committed to stabilizing debt in the long run, resists short-run deficits so large that they would eventually require costly fiscal adjustment. The government acts on this resistance by pressing the central bank to ease monetary policy rather than by adjusting its own budget. We call this friction *limited fiscal responsibility*. We model it as a fiscal limit on the total deficit the government is willing to accept. The economy's distance from this limit –the fiscal space– evolves endogenously, depending on the primary deficit, inflation, the interest rate, economic growth, and the stock of public debt. Monetary tightening consumes fiscal space by weakening activity while raising debt-service costs. The fiscal limit therefore imposes a state-contingent ceiling on the nominal interest rate, which is lower when past shocks have depleted fiscal space.

Inflationary supply disturbances set monetary and fiscal policy on a collision course. Unlike inflationary demand shocks, they depress economic activity, widening the deficit just

as tighter monetary policy is needed to rein in inflation. To contain debt accumulation and the ensuing post-recession fiscal adjustment, the government presses for a looser monetary stance. The central bank therefore raises rates less aggressively, amplifying the inflationary response while cushioning the contraction in activity.

The mechanism operates through expectations even before the limit binds. When deficits are large and supply-disruption risk is high, agents anticipate that future monetary tightening will more often be curtailed by the fiscal limit. They incorporate this prospect of weaker future responses into current inflation expectations, raising trend inflation.

Trend inflation is therefore an equilibrium object, jointly shaped by fiscal behavior and macroeconomic risk–both empirically measurable. Inflation can ratchet upward even if the government's tolerance for deficits is unchanged, because the risk that the fiscal limit will bind raises inflation expectations today.

The same mechanism generates persistence and state dependence in short-run inflation dynamics. Because fiscal space is rebuilt only gradually, an economy that has recently experienced a sequence of adverse supply shocks while failing to address persistent primary deficits confronts the next disturbance with less room for monetary tightening than one with a more benign history and sounder public finances. Absent fiscal adjustment to rebuild the lost space, short-horizon inflation expectations remain elevated and inflation persists even as the latest shock dissipates.

Our quantitative analysis delivers two main results. First, fiscal-limit risk depends strongly on the economic environment. It rises when supply shocks become more volatile and when the fiscal limit is tighter. Raising supply-shock volatility from half to one-and-a-half times its baseline level, or lowering the fiscal limit by two percentage points of GDP, raises the probability that the constraint binds from virtually zero to more than 10 percent. Thus, greater supply-side volatility makes the fiscal constraint on monetary policy bind more often.

Second, the fiscal limit binds asymmetrically across shocks: inflationary supply shocks are the ones that push monetary policy against the constraint. An adverse markup shock raises inflation while contracting output, so the tightening needed to contain it deepens the recession and increases the debt burden, moving debt toward the fiscal limit and intensifying fiscal pressure on the central bank. The central bank still raises rates, but by less: inflation rises more on impact, while the real interest rate falls rather than rises. The resulting output contraction is milder and debt dynamics are more favorable—consistent with limited fiscal responsibility. Higher prices and lower real rates erode the real value of outstanding liabilities, bringing the debt-to-GDP ratio close to its pre-shock level, albeit at the cost of persistently above-target inflation.

Demand shocks, by contrast, do not create this tension. Inflationary demand shocks relax

the fiscal constraint by raising both prices and output, while disinflationary demand shocks call for rate cuts rather than hikes. Nor are disinflationary supply shocks problematic: as inflation falls and output expands, the central bank cuts rates while the fiscal constraint eases. A binding constraint on monetary tightening is therefore the distinctive signature of adverse inflationary supply shocks.

The model accounts for the major movements in U.S. trend inflation between 1965 and 1990. To assess its empirical performance, we run a particle filter that recovers the underlying shocks needed to explain the joint dynamics of output, inflation, and debt-to-GDP growth, with the latter providing information about the evolution of fiscal space. We hold the fiscal limit fixed throughout the 25-year sample. We then conduct two counterfactual exercises, each using a version of the model that shuts down the interaction between supply-shock volatility and the fiscal limit

In the first, we show that the model can replicate the ratcheting up of inflation from the mid-1960s through the 1970s and its subsequent decline in the 1980s. Viewed through the lens of the model, the Great Inflation emerges as a period in which eroding fiscal space progressively raised the likelihood that monetary policy would be unable to respond to inflationary shocks, feeding the upward drift in trend inflation; the disinflation of the 1980s, conversely, coincided with a restoration of fiscal space that re-anchored expectations by restoring the central bank's perceived room to act.

In the second exercise, we turn to the post-pandemic period and add long-run inflation expectations to the set of observables. We account for the rise in supply-side volatility using estimates from a time-varying VAR and ask how much of the increase in long-run inflation expectations reflects narrowing fiscal space. We find that fiscal space declined considerably after the pandemic and that this decline is essential for explaining the rise in long-run expectations. Through the lens of the model, their post-pandemic drift reflects the anticipation that fiscal pressures may limit the central banks ability to contain persistent inflationary pressure.

Related Literature Our paper is related to a growing empirical literature documenting political pressure on central banks, the central mechanism formalized in our model. Drechsel (2026) shows that such pressure on the Federal Reserve has been recurrent and raises inflation persistently, primarily through inflation expectations. Complementary evidence shows that political opposition can delay and weaken monetary tightening and that even legally independent central banks remain exposed to pressure to ease (Weise, 2012, Binder, 2021). Using President Trump's tweets criticizing the Fed, Bianchi et al. (2023b) find that political pressure lowered expected policy rates, raised stock prices, and reduced long-term

Treasury yields, with further effects on actual policy and the macroeconomy.[1] Our model of limited fiscal responsibility provides a quantitative framework for studying the implications of such political pressure on the central bank. In an alternative approach, Bianchi and Melosi (2019) model a conflict in which the fiscal authority refuses to stabilize debt while the central bank refuses to accommodate the inflation needed to do so.

Bocola et al. (2025a) study an inflation-targeting central bank whose mandate the government can revoke, at a stochastic institutional cost, to generate seigniorage. The likelihood of fiscal dominance depends on fiscal fundamentals and the institutional cost of reneging. Their mechanism captures the formal revocation of monetary mandates, as when Argentina abandoned its currency board in 2002. Ours pertains more directly to advanced economies, where central bank independence remains intact de jure but fiscal and political pressures may discourage sufficient tightening, as during the U.S. Great Inflation (Burns, 1979, Meltzer, 2009). More fundamentally, however, our model features time-varying supply-side risk, whose interaction with endogenous fiscal space generates low-frequency movements in trend inflation, greater inflation tail risk, and more persistent inflation, even though fiscal policy remains Ricardian.

Davig et al. (2010, 2011) show that anticipated fiscal stress can weaken monetary control before a fiscal limit is reached. We show that the interaction of the fiscal limit with supply-side risk generates a two-way ratchet in trend inflation and changes in inflation tail risks, which we take to the data. Corsetti and Maćkowiak (2024) also emphasize anticipation, but through self-fulfilling long-term yields. The central bank maintains price stability despite a fiscal imbalance, gambling that fiscal adjustment occurs before inflation becomes unavoidable. Expectations of a collapse raise long-term yields and can become self-fulfilling.

Our central mechanism differs from two prominent routes through which fiscal effects on inflation are modeled. In the fiscal theory of the price level, active fiscal policy and passive monetary policy make the price level adjust to satisfy the government's intertemporal budget constraint (e.g., Leeper, 1991, Sims, 1994, Woodford, 1994, 1995, 2001, Bianchi and Melosi, 2017, Cochrane, 2023, Bassetto and Miller, 2025). A second literature breaks Ricardian equivalence through finite horizons, uninsurable income risk, or borrowing constraints, so deficits stimulate household demand even under active monetary policy (for a review Kaplan, 2025).

Bianchi et al. (2023a) allow monetary- and fiscally-led policy mixes to coexist, with policy coordination depending on the nature of the shock, and develop a computationally efficient

[1]The historical record also reveals a sharp change during the Volcker disinflation: in July 1981, Kansas City Fed President Roger Guffey observed that, "for the first time ever," the Fed had the administration's support for monetary restraint (Bianchi and Melosi, 2022).

linear approach to measuring unfunded debt. Smets and Wouters (2024) extend this approach beyond transfer shocks and find that fiscal backing weakens more after supply shocks than after demand shocks. In this framework, however, monetary-fiscal interactions are driven by shocks orthogonal to business-cycle disturbances. We instead provide a structural link: inflationary supply shocks reduce fiscal space precisely when the central bank needs to tighten.

Bocola et al. (2025b) study supply-shock propagation when agents infer the central bank's objective from its policy choices. Weakly anchored expectations amplify inflation, while reputation-building induces more aggressive tightening at the cost of lower output. They provide an elegant empirical test of this mechanism. Their analysis complements ours by describing an environment with ample fiscal space, where monetary policy can build credibility unconstrained by fiscal considerations. We instead study limited fiscal space, where aggressive tightening raises debt-service costs and pushes monetary policy against the fiscal limit, increasing trend inflation and inflation tail risk.[2] In the presence of limited fiscal responsibility, fiscal pressures can undermine even an initially credible central bank.[3]

2 Motivating Evidence: Fiscal Space and the Transmission of Supply Shocks

Does the transmission of supply shocks depend on fiscal space? We begin with evidence from U.S. financial markets, asking whether markets anticipate a different monetary-policy response to supply disturbances when fiscal space is narrow. The empirical exercise focuses on a prediction that will play a central role in the model: following inflationary supply news, markets should anticipate weaker monetary tightening when fiscal space is narrow, resulting in a weaker response of real interest rates. The same state dependence should be much less pronounced or even absent following disinflationary supply news, which lowers inflation while supporting economic activity.

[2]This resembles Sims's stepping on a rake" (Sims, 2011), but operates through the erosion of fiscal space rather than the revaluation of nominal debt.

[3]Burns's tenure as Fed chair is a canonical example motivating our approach. Despite his formidable academic standing and his role as Milton Friedman's teacher and mentor, the political and fiscal environment constrained his ability to control inflation. In his account, this was "the anguish of central banking": monetary restraint was technically feasible but politically difficult to sustain given the government's commitments and society's resistance to its costs (Burns, 1979). Meltzer (2009, ch. 7) offers a more critical reading, assigning the Fed greater responsibility for choosing accommodation. Both accounts, however, place the fiscal and political environment at the center of the Fed's failure to restrain inflation–the key constraint formalized in our model.

2.1 Empirical specification

We use the oil-supply news shocks of Känzig (2021). Känzig identifies changes in expectations about future oil supply from high-frequency movements in oil futures around OPEC announcements. Adverse oil-supply news raises oil prices, lowers economic activity, and raises prices and inflation expectations, providing a particularly clean source of inflationary supply disturbances.

We estimate state-dependent local projections (Jordà, 2005, Ramey and Zubairy, 2018) at monthly frequency over 2003M1–2025M12:

$$y_{t+h} - y_{t-1} = \alpha_h + \delta_h n_{t-1} + \beta_h^+ s_t^+ + \beta_h^- s_t^- + \gamma_h^+ (s_t^+ n_{t-1}) + \gamma_h^- (s_t^- n_{t-1}) + \Gamma_h' X_t + \varepsilon_{t+h}, \quad (1)$$

for $h = 0, \ldots, 24$. The outcome y_t is the five-year TIPS constant-maturity yield. It captures the medium-term response of real yields and therefore contains information about the expected path of monetary policy, while potentially also reflecting real term premia and TIPS-specific liquidity. The sample begins in 2003M1, when the series becomes available.

The shock, standardized to zero mean and unit variance over the estimation sample, is split into inflationary and disinflationary innovations,

$$s_t^+ = \max(s_t, 0), \qquad s_t^- = \min(s_t, 0).$$

Each shock is allowed to interact with the fiscal state. The indicator n_{t-1} equals one when fiscal space is narrow and zero when fiscal space is ample; we describe its construction in the next subsection. Because n_{t-1} is binary, $\beta_h^\pm$ govern the response of real yields when fiscal space is ample, while $\beta_h^\pm + \gamma_h^\pm$ govern the response when fiscal space is narrow. Thus, $\gamma_h^\pm$ measures how the market response to supply news changes across fiscal regimes, providing evidence on how fiscal space shapes expectations of the subsequent monetary-policy response. Allowing separate coefficients for s_t^+ and s_t^- also permits the fiscal-state dependence to differ between inflationary and disinflationary disturbances.

The controls X_t contain four lags of Δy_t and of the shock, together with a dummy for the Federal Reserve's pandemic-era asset-purchase program (2020M3–2022M3) and its interactions with s_t^+ and s_t^-; the earlier purchase programs of 2009–2014 fall within the effective-lower-bound period, which we treat separately below. Because the dependent variable is expressed as a long difference, we do not include a deterministic trend. As in Ramey and Zubairy (2018), the state is dated before the shock; unlike their fully interacted design, only the intercept and the shock coefficients vary with the state, while the coefficients on the controls are common to both regimes.

2.2 Fiscal space

Fiscal space in the structural model is the distance between the total deficit and the limit $\bar{\xi}$ the government is willing to tolerate. Its empirical counterpart should therefore isolate deficits that are not simply explained by the business cycle: a deficit generated by a recession need not create the same fiscal pressure as one prevailing near full employment. We construct the cyclically adjusted primary deficit, expressed as a percentage of GDP and averaged over four quarters. The primary deficit is constructed from NIPA net federal government saving net of federal interest outlays. The cyclical adjustment removes the component associated with contemporaneous labor-market conditions; the elasticity combines the CBO estimate of automatic stabilizers with an Okun coefficient near 2, broadly consistent with estimates commonly used in the literature. The benchmark U.S. unemployment rate is set to 5 percent, a conventional reference value for the natural rate of unemployment.

We classify fiscal space as narrow when

$$n_{t-1} = \mathbb{1}[x_{q-1} > 1.25], \tag{2}$$

where x_{q-1} is the cyclically adjusted primary deficit in the last completed quarter before month t. Thus, q denotes the quarter containing month t, and the fiscal state is determined using information available before the monthly oil-supply news shock.

The cutoff is not chosen to maximize the empirical result. It corresponds approximately to the 90th percentile of the 1948–2019 distribution of the cyclically adjusted primary deficit, excluding the pandemic ($P_{90} = 1.27$), and follows the same convention used below to discipline the fiscal limit $\bar{\xi}$ in the structural model. Narrow fiscal space therefore corresponds to a structural primary deficit in roughly the top decile of its postwar distribution. The indicator uses the last completed quarter and is thus predetermined relative to the monthly oil shock. Under this definition, fiscal space is narrow during 2009Q1–2013Q1 and 2017Q1–2025Q3, accounting for 57 percent of the estimation sample.[4]

2.3 Fiscal space changes the response to inflationary supply shocks

Figure 2 presents the impulse responses. The top-left panel contains the central result. When fiscal space is ample, an inflationary oil-supply news shock initially raises the five-year real yield. The response peaks at roughly 20 basis points after five months and remains positive through much of the first year, consistent with markets expecting monetary policy to tighten.

[4]The cutoff can be placed anywhere between the postwar 80th and 90th percentiles of x, or replaced by a smooth transition centered on the debt-stabilizing primary balance, without altering the conclusion.

Table 1: Response of the five-year real yield to oil-supply news, by fiscal regime

Horizon (months)	$h = 6$	$h = 12$	$h = 18$	$h = 24$
Ample regime, β_h^+	0.124	0.095	−0.094	−0.148
	(1.09)	(0.70)	(−0.60)	(−0.73)
Narrow regime, $\beta_h^+ + \gamma_h^+$	−0.270	−0.350	−0.410	−0.391
	(−2.16)	(−1.90)	(−2.12)	(−1.86)
Difference, γ_h^+	−0.394	−0.445	−0.317	−0.242
	(−2.45)	(−2.14)	(−1.31)	(−0.92)
Disinflationary difference, γ_h^-	+0.063	+0.086	−0.041	−0.135
	(0.44)	(0.38)	(−0.17)	(−0.45)

Estimates of (1), 2003M1–2025M12, in percentage points per one-standard-deviation shock. Newey–West t-statistics in parentheses, bandwidth $\lfloor 1.5(h+1) \rfloor$. Joint tests over $h = 0, \ldots, 24$: $\bar{\gamma}^+ = -0.344$ ($p = 0.030$, one-sided) and $\bar{\gamma}^- = +0.048$ ($p = 0.79$, two-sided).

Confidence bands at individual horizons are based on Newey–West standard errors with bandwidth $\lfloor 1.5(h+1) \rfloor$.

The response reverses when fiscal space is narrow. Real yields fall almost immediately and remain below zero throughout the horizon. At six months, the estimated response is −27 basis points, compared with +12 basis points when fiscal space is ample. At twelve months it is −35 basis points and remains close to −40 basis points at longer horizons. Thus, narrow fiscal space does not merely attenuate the increase in real rates following an inflationary supply shock: it reverses it.

The top-right panel isolates the regime difference by plotting γ_h^+. It is negative at every horizon and reaches roughly −50 basis points around the middle of the projection window. Averaged over the 25 horizons, $\bar{\gamma}^+ = -0.344$, with a one-sided bootstrap p-value of 0.030. The evidence therefore points to a systematic weakening of the expected real-rate response to inflationary supply disturbances when fiscal space is narrow.

The bottom panels shows that, following disinflationary oil-supply news, real yields behave similarly in the two fiscal regimes. The interaction γ_h^- is small, changes sign over the horizon, and is never statistically distinguishable from zero. Averaged across horizons, $\bar{\gamma}^- = 0.048$, with a two-sided p-value of 0.79.

This asymmetry helps distinguish the fiscal-space mechanism from more generic explanations. A shift in risk premia or in monetary-policy behavior during periods of large deficits could generate different real-yield responses across fiscal states, but would not naturally account for why this difference appears after inflationary supply news and is absent after disinflationary news. The evidence instead points to an interaction between the direction of the supply disturbance and the fiscal position prevailing when it arrives. In the structural

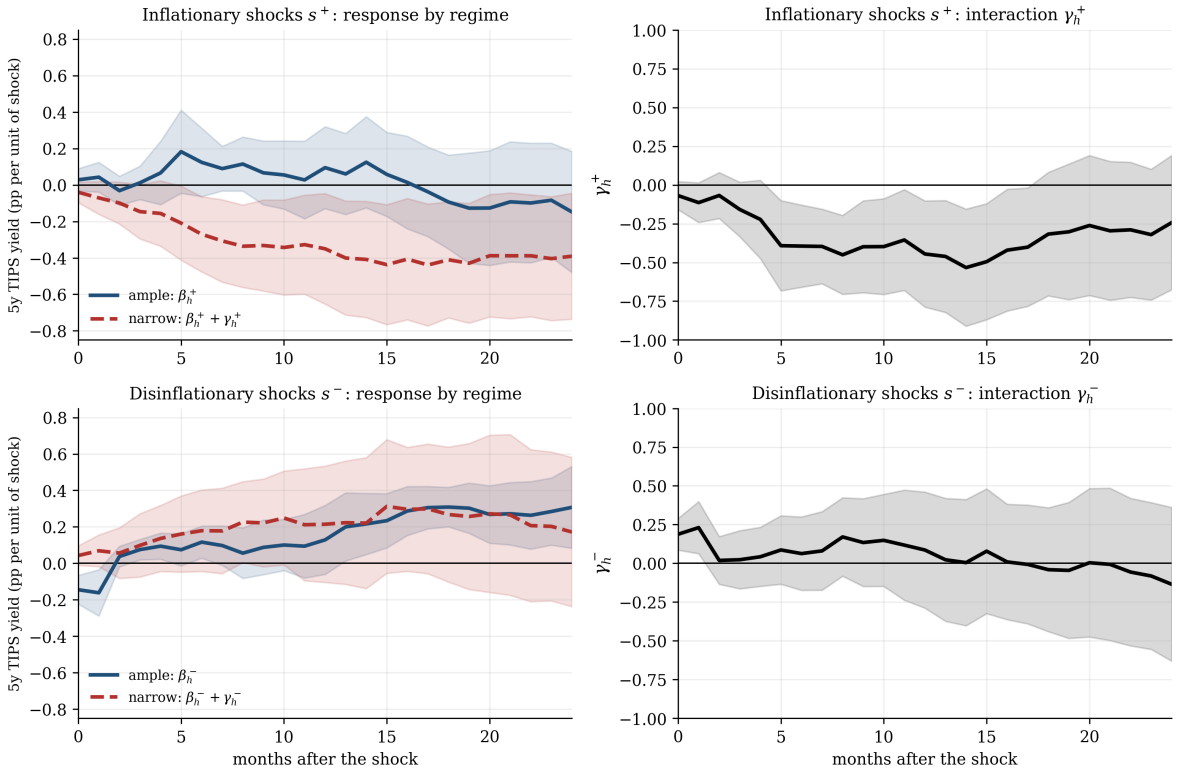


Figure 2: Fiscal space and the transmission of oil-supply news shocks. Estimates of (1) with 90 percent Newey–West confidence bands, 2003M1–2025M12. The left panels report the slope of the five-year TIPS yield with respect to the shock when fiscal space is ample (solid blue) and narrow (dashed red); the right panels report the corresponding interaction coefficient. *Top row,* inflationary oil-supply news: the two regimes separate within a quarter, the narrow-regime slope turns negative, and γ_h^+ lies below zero throughout ($\bar{\gamma}^+ = -0.344$, bootstrap $p = 0.030$). *Bottom row,* disinflationary oil-supply news: the two regimes overlap at every horizon and γ_h^- is indistinguishable from zero ($\bar{\gamma}^- = +0.048$, two-sided $p = 0.79$). The restriction $\gamma_h^- = 0$ is not imposed. Vertical scales are common across rows within each column; both main effects are estimated freely, so β_h^+ and β_h^- differ at longer horizons.

model, this distinction arises naturally: favorable supply shocks raise activity while lowering inflation, thereby improving the primary balance and relaxing, rather than tightening, the fiscal constraint.

The roughly symmetric response to disinflationary oil-supply news also suggests little evidence of strategic policy behavior aimed at rebuilding fiscal space after favorable supply shocks. We therefore abstract from this form of strategic monetary–fiscal interaction in the structural model.

Because our hypothesis is that narrow fiscal space weakens the real-yield response to inflationary supply shocks across the impulse-response path, we test this state dependence jointly using

$$\bar{\gamma}^+ = \frac{1}{25} \sum_{h=0}^{24} \gamma_h^+ .$$

We obtain its distribution under $H_0 : \gamma_h^+ = 0$ for all h from a block-wild bootstrap that imposes the null, using Gaussian weights, 27-month blocks, and 1,999 replications.[5] We construct the analogous statistic $\bar{\gamma}^-$ for disinflationary shocks.

We find $\bar{\gamma}^+ = -0.344$, with a bootstrap p-value of 0.030, indicating that markets systematically price a weaker real-yield response to inflationary supply news when fiscal space is narrow. The joint test therefore indicates that this state dependence is a feature of the response path as a whole, rather than being driven by a particular horizon.

2.4 Threshold, nonlinearity, and robustness

Because fiscal space enters through an indicator, the coefficients $\gamma_h^{\pm}$ capture a *regime effect*: shock transmission changes discretely between ample and narrow fiscal space. They do not estimate a smooth dose–response relationship between the size of the deficit and the size of the effect. Indeed, replacing the indicator with a continuous standardized fiscal state yields no comparable relationship ($\bar{\gamma}^+ = 0.23$, $p = 0.91$), and winsorized and rank-transformed versions give similar results. The evidence therefore points to threshold-like state dependence rather than a smooth gradient. This nonlinearity is distinct from the asymmetry between inflationary and disinflationary shocks captured by s_t^+ and s_t^-.

The result is not specific to the baseline cutoff reports the full set of checks). Moving the threshold between 0.75 and 1.25 percent of GDP—roughly the 87th through 90th percentiles of the postwar distribution—produces estimates of $\bar{\gamma}^+$ between -0.34 and -0.40, significant at the 5 percent level. The interaction for disinflationary shocks remains close to zero throughout.

The historical anchor matters. The estimation window is itself concentrated in the upper tail of the postwar deficit distribution: the mean and median of x over 2003–2025 lie around the 92nd and 91st postwar percentiles. A sample-relative median split therefore classifies historically elevated deficits as normal and produces essentially no interaction, $\bar{\gamma}^+ = -0.03$ ($p = 0.42$). By contrast, cutoffs anchored at the postwar 80th and 85th percentiles give $\bar{\gamma}^+ = -0.32$ ($p = 0.033$) and -0.38 ($p = 0.014$).

As an alternative that dispenses with a discrete cutoff, we use a smooth-transition weight centered on the debt-stabilizing primary balance,

$$pd_q^* = \frac{g_q - r_q}{1 + g_q} b_{q-1},$$

[5] The joint statistic and its bootstrap distribution are computed on the common sample available at $h = 24$, so that the same observations enter every horizon.

the largest primary deficit consistent with a non-rising debt ratio. Because the center has an independent economic interpretation, it does not require choosing a location parameter from the estimation sample. This specification strengthens the interaction to $\bar{\gamma}^{+} = -0.75$ ($p = 0.011$).

Two limitations qualify the reduced-form interpretation. First, the 2009–2013 narrow-fiscal-space episode overlaps with the effective lower bound. During this period, weak economic conditions may have led markets to expect the Federal Reserve to accommodate the recessionary effects of inflationary supply shocks, independently of fiscal pressures. This concern is mitigated by our focus on the five-year real yield, which can respond through changes in the expected future path of monetary policy even when the current policy rate is constrained. Allowing the response to inflationary oil-supply news to differ during the lower-bound period leaves the fiscal-space effect negative and economically large, $\bar{\gamma}^{+} = -0.27$, although its p-value rises to 0.081.

Second, fiscal space can itself deteriorate after an inflationary supply shock. Our local projections classify the economy according to the fiscal position prevailing when the shock arrives, even though the shock may subsequently push the economy into the narrow-fiscal-space regime. Indeed, a one-standard-deviation inflationary oil-supply news shock raises the probability of entering that regime twelve months later by 0.24. This provides direct evidence for an important part of our mechanism: adverse supply shocks can themselves erode fiscal space. It also makes the estimated difference between the initial ample- and narrow-fiscal-space regimes more conservative, because some observations that start with ample fiscal space subsequently become fiscally constrained.

In sum, the evidence establishes a simple empirical pattern. Real yields rise following inflationary supply disturbances when fiscal space is ample but fall when it is narrow, while no comparable regime difference appears following disinflationary disturbances. The model developed next provides a mechanism for both facts. Inflationary supply shocks contract activity, narrowing fiscal space through weaker revenues and larger deficits. Monetary tightening then reinforces these pressures by raising debt-service costs and worsening the recession. When fiscal space is already narrow, these forces make aggressive monetary tightening increasingly costly from a fiscal perspective. Favorable supply shocks instead lower inflation while supporting activity and therefore relax, rather than tighten, the fiscal constraint.

A randomization placebo. Could choosing any two long periods as the narrow regime produce our result? We check this by shifting the regime indicator to different dates, wrapping around at the end of the sample. This preserves the lengths and spacing of the two narrow-

regime periods and their 57 percent share of the sample. Across 48 shifts, the placebo estimates average -0.005, with a standard deviation of 0.225. Even the most negative estimate, -0.291, is less negative than the actual estimate of -0.328. Even the most negative estimate, -0.291, is less negative than the actual estimate of -0.328.

These results provide evidence against the concern that the estimated state dependence arises mechanically from the persistence and two-block structure of the regime indicator. Appendix A reports a more comprehensive version of this test using all 275 possible shifts.

3 A Model of Limited Fiscal Responsibility

In this section, we introduce a New Keynesian model featuring a fiscal limit on the government's total deficit. The fiscal limit leads to a constraint on the nominal interest rate set by the monetary authority. The model is solved with global methods in its nonlinear specification to capture the state-dependence of the fiscal constraint on monetary policy.

3.1 Model Description

The economy consists of a representative household, firms, a monetary authority, and a fiscal authority.

Representative household. The representative household consumes (C_t), supplies labor (N_t), and invests in one-period government bonds (B_t). The household maximizes

$$\max_{\{C_t,N_t,B_t\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t e^{\zeta_t} \left[\frac{C_t^{1-\sigma}}{1-\sigma} - \psi \frac{N_t^{1+\eta}}{1+\eta} \right], \tag{3}$$

subject to the flow budget constraint

$$P_t C_t + Q_t B_t = W_t N_t + B_{t-1} - P_t T_t + P_t D_t, \tag{4}$$

where β is the households' discount factor, P_t denotes the price of consumption, W_t the nominal wage, T_t real lump-sum net taxes, D_t real dividends paid by firms, and $Q_t = \frac{1}{R_t}$ is the price of the one-period bond which is equal to the inverse of the gross nominal interest rate. ζ_t is a preference shock which follows an AR(1) process as follows

$$\zeta_t = \rho_\zeta \, \zeta_{t-1} + \sigma^\zeta \, \epsilon_t^\zeta, \quad \text{where } \epsilon_t^\zeta \sim N(0,1). \tag{5}$$

Final good firm. On the production side, competitive final good firms buy intermediate goods and aggregate them into a homogeneous final good (Y_t) using the following technology:

$$Y_t = \left(\int_0^1 Y_t(j)^{\frac{\varepsilon-1}{\varepsilon}} \, dj \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{6}$$

where $Y_t(j)$ is the consumption of the good of the variety produced by intermediate good firm j.

The price index for the aggregated good is given as:

$$P_t = \left[\int_0^1 P_t(j)^{1-\varepsilon} \, dj \right]^{\frac{1}{1-\varepsilon}}. \tag{7}$$

Intermediate good firms. Intermediate goods are imperfect substitutes, and the firms behave as monopolistically competitive setting the price of their good subject to price adjustment costs a la Rotemberg. Labor is the only factor of production. The first order conditions yield the following standard New-Keynesian Phillips Curve:

$$\varphi \left(\frac{\Pi_t}{\Pi} - 1 \right) \frac{\Pi_t}{\Pi} = (1-\epsilon) + \epsilon MC_t + \varphi \mathbb{E}_t \left[\Lambda_{t,t+1} \left(\frac{\Pi_{t+1}}{\Pi} - 1 \right) \frac{\Pi_{t+1}}{\Pi} \frac{Y_{t+1}}{Y_t} \right] + \mu_t. \tag{8}$$

where $\Pi_t \equiv \frac{P_t}{P_{t-1}}$ denotes inflation, MC_t real marginal costs, $\Lambda_{t,t+1}$ the household's stochastic discount factor and Π steady-state inflation. φ measures the cost of price adjustment in units of the final good, and ϵ is the elasticity of substitution between varieties (price elasticity of demand). Firms face a cost-push (markup) shock, μ_t, that evolves as an AR(1) process:

$$\mu_t = \rho_\mu \, \mu_{t-1} + \sigma^\mu \, \epsilon_t^\mu, \quad \text{where } \epsilon_t^\mu \sim N(0,1). \tag{9}$$

Fiscal authority. The fiscal authority collects taxes T_t and issues one-period bonds satisfying the following budget constraint

$$Q_t B_t = B_{t-1} - P_t T_t. \tag{10}$$

In this setting, net taxes coincide with the real primary surplus and we assume the fiscal authority follows a fiscal rule where the surplus-to-output ratio is responding to debt and

output deviations:

$$\tau_t = \tau + \delta(b_{t-1} - b) + \delta_Y(Y_t - Y) \tag{11}$$

where $\tau_t \equiv \frac{T_t}{Y_t}$, $b_t \equiv \frac{B_t}{P_t Y_t}$ is the debt-to-GDP ratio and τ, b and Y denote steady-state values.

Resource constraint. The resource constraint is

$$C_t = Y_t \left(1 - 0.5\varphi \left(\Pi_t/\Pi - 1\right)^2\right). \tag{12}$$

Monetary authority. The monetary authority sets the nominal interest rate–equivalently, the inverse price of a one-period bond, ($R_t = Q_t^{-1}$)–in response to deviations of inflation and output from their respective targets.

$$R_t^N = R \left(\frac{\Pi_t}{\Pi}\right)^{\phi_\Pi} \left(\frac{Y_t}{Y}\right)^{\phi_Y} \tag{13}$$

where R is the steady-state interest rate, Π the inflation target and R_t^N is the notional interest rate that the monetary authority would set without any constraints. Without the fiscal limit $R_t = R_t^N$.

Fiscal limit. We can rewrite the government budget constraint by dividing by $P_t Y_t$ as

$$b_t = R_t \underbrace{\left(b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t\right)}_{\equiv \Theta_t} = R_t \, \Theta_t, \tag{14}$$

where Θ_t denotes the government's financing need in period t: the inherited stock of debt expressed relative to current nominal output—and therefore adjusted for realized inflation and output growth—net of the primary surplus.

Crucially, Θ_t does not depend on R_t. Since R_t is the reciprocal of the price of a one-period bond, equation (14) implies that the government must issue debt equal to its financing need divided by the price at which the debt is sold, $b_t = \Theta_t / Q_t$. Thus, when the bond price falls—for example, because the central bank raises the policy rate—the government must issue more debt to meet the same financing need.[6]

[6] Wolf and Zessner-Spitzenberg (2024) show in a sovereign default framework that when debt is high and fiscal space—tax revenue net of non-discretionary spending—is limited, a rise in interest rates raises rather

With one-period discount bonds, the interest committed on debt issued in period t is the issuance discount $(1 - Q_t)B_t$. As a share of output,

$$\iota_t \equiv (1 - Q_t)\, b_t = \left(1 - \tfrac{1}{R_t}\right) b_t = (R_t - 1)\Theta_t. \tag{15}$$

We assume that the fiscal limit is a ceiling $\bar{\xi}$ on the *total deficit*—the interest bill net of the primary surplus—above which the government cannot borrow further, that is,

$$\iota_t - \tau_t = (R_t - 1)\Theta_t - \tau_t \leq \bar{\xi}. \tag{16}$$

The fiscal space, that is, the gap between the total deficit and $\bar{\xi}$, is endogenous and state dependent. Specifically, it depends on the previous period's debt-to-output ratio as well as current inflation, output growth, and the nominal interest rate. Higher inflation and stronger output growth reduce the real value of the outstanding debt that must be serviced in the current period, thereby alleviating fiscal pressure. Conversely, a higher nominal interest rate increases debt servicing costs, raising the fiscal imbalance and reducing fiscal space.

When the initial debt-to-output ratio b_{t-1} is high, the effects of inflation, growth, and the interest rate on the fiscal imbalance become more pronounced. Monetary policy affects fiscal sustainability both directly, through the interest rate it sets, and indirectly, by influencing output and inflation in response to shocks. In particular, monetary tightening lowers inflation and output growth, increasing the effective burden of outstanding debt. These effects are especially strong when public debt is already elevated, generating a leverage-type amplification of monetary policy on government finances.

Fiscal policy further amplifies these mechanisms. By conducting countercyclical policy ($\delta_Y > 0$), the fiscal authority increases the sensitivity of the fiscal space to macroeconomic conditions. During recessions, fiscal policy becomes expansionary, pushing the total deficit closer to its ceiling $\bar{\xi}$.

The key assumption of the model is that if the total deficit exceeds the fiscal limit $\bar{\xi}$, the central bank intervenes by correcting the policy interest rate downward to avert political pressures on monetary policy. As a result, the fiscal limit translates directly into a constraint on monetary policy. Formally, solving (16) for the policy rate, the fiscal constraint faced by the monetary authority is given by:

$$R_t \leq \bar{R}_t \equiv 1 + \frac{\bar{\xi} + \tau_t}{\Theta_t}. \tag{17}$$

than lowers debt issuance.

Taken together this implies the monetary authority sets the interest rate as

$$R_t = \min \left[R_t^N, \bar{R}_t \right]. \tag{18}$$

To sum up, the fiscal limit introduces a potential upper bound on the policy space of the monetary authority. Crucially, this upper bound is endogenous, as it depends on the component Θ_t, which in turn reflects prevailing macroeconomic conditions. The full set of model equations is presented in Appendix B.1.

3.2 The Endogeneity of the Fiscal Constraint on Monetary Policy

Similarly to the ZLB, the fiscal limit constrains the range over which the central bank can adjust interest rates. Unlike the ZLB, however, the fiscal limit imposes an upper bound on the policy rate and is not a hard, exogenously fixed constraint. Instead, it is endogenous: current output and inflation determine how costly it is to service the fiscal imbalance inherited from the previous period, while the primary surplus determines how much room remains under the deficit ceiling to absorb the resulting interest bill, and thus how tightly the constraint binds.

The variable Θ_t captures the endogeneity of the fiscal constraint on the interest rate set by the central bank. When Θ_t declines, the government has less to borrow, a given interest rate generates a smaller interest bill, and the fiscal constraint becomes more lax, expanding the room for monetary tightening. This occurs when inflation and economic growth rise, as both contribute to lowering the debt-to-output ratio today. Conversely, when Θ_t rises, the fiscal constraint tightens, reducing the scope for interest rate increases. This typically happens when inflation falls and economic activity contracts, causing the debt-to-output ratio to rise.

The primary surplus τ_t is a second source of endogeneity, and it enters (17) directly: a higher surplus leaves more room under the deficit ceiling for interest payments and thereby raises $\bar{R}_t$, while a lower surplus lowers it. Since the surplus falls with economic activity through the fiscal rule, a contraction tightens the constraint on this account as well.

Inflation and output growth are endogenous variables, and their joint dynamics depend on the full set of shocks and model equations. In general, preference (demand) shocks move output and inflation in the same direction and therefore have an unambiguous effect on Θ_t. In particular, a positive demand shock relaxes the fiscal constraint on the interest rate, whereas a negative demand shock tightens it. The primary surplus moves in the same direction as output, reinforcing the effect.

By contrast, the effects of markup shocks on Θ_t, taken alone, are more ambiguous, since

these shocks move output and inflation in opposite directions. The net effect depends crucially on the slope of aggregate demand, which is influenced by the conduct of monetary policy among other factors (i.e., preference parameters). For instance, a central bank that places greater weight on inflation stabilization will induce larger movements in output relative to inflation. The primary surplus, by contrast, responds unambiguously: the contraction in activity lowers τ_t and tightens the constraint. As this channel dominates, an inflationary markup shock lowers $\bar{R}_t$ on impact.

The degree of countercyclicality in fiscal policy, captured by the parameter δ_Y, is therefore a key determinant of how sensitive the fiscal constraint is to output fluctuations. For example, following a markup shock, economic activity contracts and countercyclical fiscal policy leads the government to cut taxes, thereby increasing the current fiscal imbalance. All else equal, this reduces the room available to the central bank to raise interest rates to counteract the inflationary consequences of the shock.

Finally, consider the role of inherited debt. A higher b_{t-1} raises Θ_t, and hence the interest bill due at any given policy rate, tightening the constraint. Through the fiscal rule, however, it also raises taxes, which works in the opposite direction. Fiscal space erodes with debt—so that the fiscal limit indeed acts as a limit—only if the first effect dominates, which requires a sufficiently weak response of taxes to debt. Our calibration satisfies this restriction.

3.3 Solution and Calibration

The model is solved using time iteration with linear interpolation of policy functions following the approach by Richter et al. (2014), and as used in Bianchi et al. (2021). Expectations are calculated using numerical integration based on Gauss-Hermite quadrature. We provide more details of the algorithm in Appendix B.2.

The model is calibrated as shown in Table 2. The discount factor β is set to 0.993, which corresponds to an annualized nominal interest rate of almost 5%, which is in line with the average US Federal Funds rate since 1960, and implies a steady-state annualized real interest rate of almost 3%. The coefficients of the monetary policy rule are set to $\phi_\Pi = 1.5$ and $\phi_Y = 0.1$. The coefficients of the fiscal rule are set to $\delta = 0.02$ and $\delta_Y = 0.5$, implying a stronger response to output than debt in line with empirical literature and the important role of automatic stabilizers (see Bohn (1998), Galí and Perotti (2003), Leeper et al. (2010), among others). The value of $\delta = 0.02$ implies that the government stabilizes debt in the long-run. The persistence parameters of the shock processes are set to 0.6 for simplicity. The shock volatilities are calibrated based on US postwar data (since 1960Q1) for annual inflation and quarterly real GDP growth. In particular, we aim to broadly match the standard deviation

of annualized GDP deflator inflation, the standard deviation of quarterly real GDP growth, and the correlation of inflation and GDP growth. Over this sample, annual inflation has been more than 2.5 times as volatile as quarterly real GDP growth, and the correlation between inflation and GDP growth has been weakly negative but close to zero. The steady-state level of debt-to-output is calibrated in line with a debt-to-GDP ratio of 60% as observed on average for the US over the sample since 1960. The fiscal limit is set to $\bar{\xi}$=0.061, corresponding to 6.1% deficit-to-GDP ratio. This is the 90th percentile of the US total deficit-to-GDP ratio over the post-1960 sample, excluding the Covid-19 period.

Table 2: Model calibration

Parameters	Sign	Value	Parameters	Sign	Value
Discount factor	β	0.993	Relative risk aversion	σ	1
Inverse Frisch elasticity	η	1.33	Disutility of labor	ψ	0.87
Price elasticity of demand	ϵ	7.67	Rotemberg pricing	φ	78.36
Fiscal response to debt	δ	0.02	Fiscal response to output	δ_Y	0.5
Monetary response to inflation	ϕ_Π	1.5	Monetary response to output	ϕ_Y	0.1
Persistence Pref. Shock	ρ_ζ	0.6	Std. Dev. Pref. Shock	σ^ζ	0.01
Persistence Markup Shock	ρ_μ	0.6	Std. Dev. Markup Shock	σ^μ	0.19
Inflation target	(Π-1)*4	2%	Steady-state debt-to-output	b	2.4
Fiscal limit	$\bar{\xi}$	0.061			

Capturing time-variation in fiscal responsibility and supply-shock risks Both the deficit that the fiscal authority is prepared to tolerate and the volatility of supply-side disturbances vary over time in practice. We capture this by treating the fiscal limit $\bar{\xi}$ and the volatility of the markup shock σ^μ as pseudo-states in line with Kase et al. (2025) and Krane et al. (2026) and solving the model under anticipated utility: agents take the prevailing values of the two parameters as permanent when forming expectations, while the economy moves across the corresponding policy functions over time. We therefore solve the model on a grid over the two pseudo-states. For fiscal tolerance, we let $\bar{\xi}$ vary by $\pm$0.02 around its baseline value, that is, between 4.1 and 8.1 percent of GDP. For supply-shock risk, we use the time-varying volatility of structural supply shocks obtained from a TVP-BVAR estimated on US GDP deflator inflation and output gap and identified following the algorithm of Arias et al. (2026).[7] The estimated volatility is shown in Figure 3 together with realized inflation. Rather than importing the estimated volatility in levels, which is not comparable across the two models, we retain only its relative variation: in each period we scale the calibrated σ^μ

[7]For estimates of debt-based fiscal limits, see Ghosh et al. (2013), Collard et al. (2015) and Renne and Pallara (2024).

by the ratio of the estimated median volatility to its sample average, so that supply-shock volatility is time-varying in the model but averages to its calibrated value. The cost of the anticipated-utility approach is that agents do not anticipate future movements in either pseudo-state. Given the smooth, low-frequency variation of both pseudo-states, we regard this as a reasonable first approximation, and leave a specification in which agents anticipate their evolution to a future version of the paper.

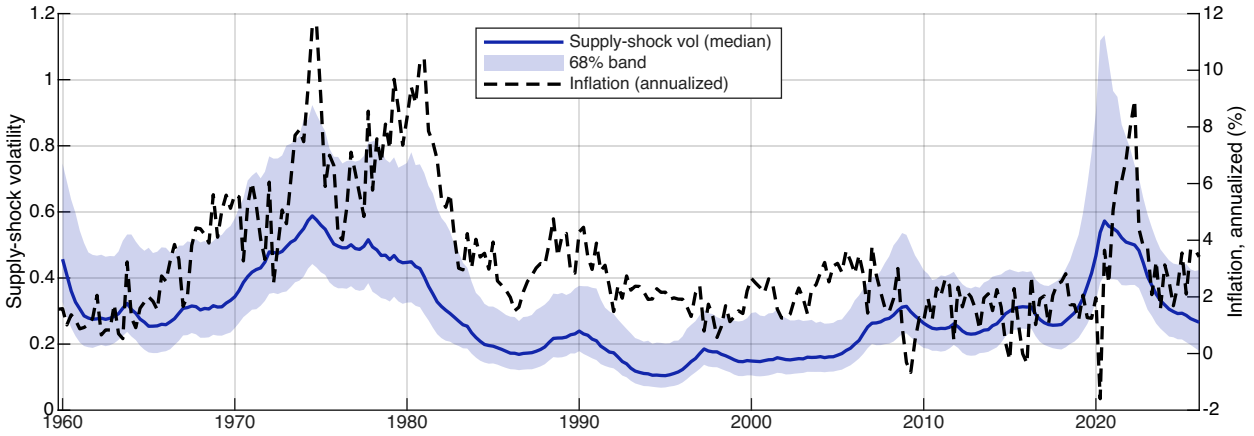


Figure 3: Supply shock volatility and inflation over time. Estimated structural supply shock volatility from bivariate TVP-BVAR and annualized GDP deflator inflation. Sample period from 1960Q1-2025Q4.

4 The Response of the Fiscal Limit to Supply and Demand Shocks

Earlier in the paper, we show that the fiscal limit can be interpreted as an endogenous upper bound on the interest rate set by the central bank. This constraint on monetary policy is endogenous, as it depends on output growth and inflation, which attenuate the impact of the previous period's fiscal burden on today's fiscal imbalance, and on the primary surplus, which determines how much room remains under the deficit ceiling; together these create additional room for monetary policy tightening in the current period.

We now illustrate how the model with a fiscal limit responds to demand and supply shocks. We initialize the model at its deterministic (non-risky) steady-state values, based on the calibration reported in Table 2. We then simulate the model for 1,000 periods in the absence of shocks, ensuring convergence to the stochastic (or risky) steady-state equilibrium.

We show the effects of markup and preference shocks on the fiscal constraint on monetary policy first. The size of the shock is set to 3 standard deviations.

First, consider a negative (favorable) markup shock, which lowers inflation and boosts output. Such a shock does not pose significant fiscal sustainability concerns, as higher economic growth—ceteris paribus—reduces the current fiscal imbalance and, through the

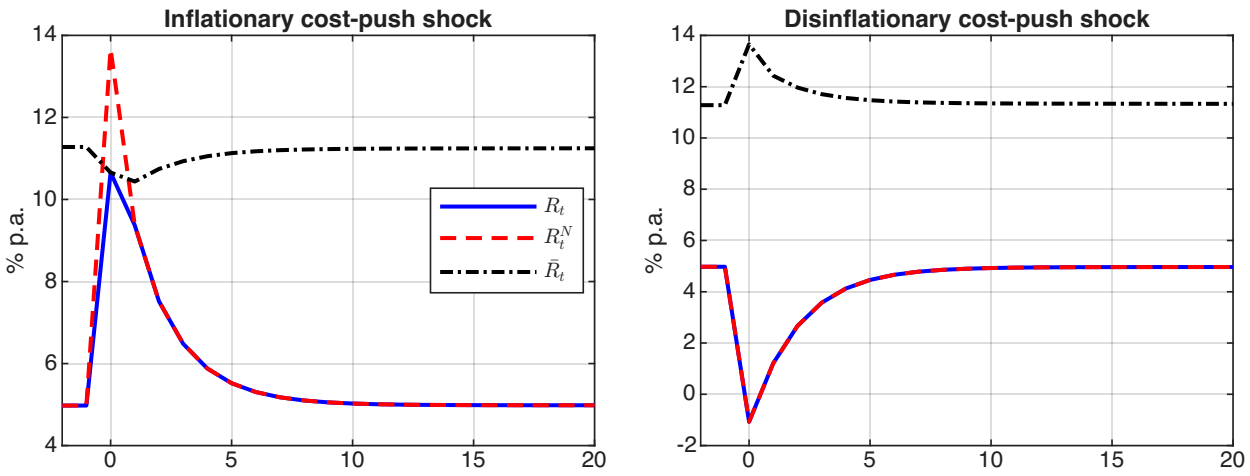


Figure 4: Interest rate dynamics in response to cost-push shock. Dynamics of nominal, notional and upper bound interest rate in response to a three-standard-deviation inflationary (left panel) and disinflationary (right panel) cost-push shock. Interest rates transformed to net interest rates in % per annum. Shock happens in period 0.

fiscal rule, raises the primary surplus, more than offsetting the effect of lower inflation on the real value of inherited debt. The fiscal constraint therefore rises, allowing greater scope for potential monetary tightening.'

Nevertheless, following a favorable markup shock, the central bank lowers the policy rate in response to the decline in inflation. Thus, a favorable markup shock is a benign disturbance that does not trigger fiscal sustainability concerns that would constrain monetary policy and, in fact, creates additional fiscal space for future monetary tightening.

This is illustrated in the right panel of Figure 4. Notice that the upper bound on the interest rate, $\bar{R}_t$ (the dash–dotted black line), increases following the favorable markup shock, while the central bank lowers the policy rate, R_t (the solid blue line), in response to deflationary pressures.

However, a positive markup shock creates a challenging environment for the central bank: inflation rises while output growth slows. Although higher inflation erodes the real value of outstanding debt, this channel is relatively weak under a deficit ceiling; the dominant effect runs through economic activity, as weaker growth raises the financing need and, through the fiscal rule, lowers the primary surplus. The fiscal constraint therefore declines on impact—precisely when the monetary rule calls for tightening. Consequently, although the central bank raises the policy rate, the adjustment is weaker than prescribed by the rule. The notional policy rate (dashed red line) is constrained by the fiscal constraint (dash–dotted black line), keeping the implemented rate below its notional level. To avoid breaching the deficit ceiling, the central bank tightens less aggressively, allowing higher inflation and supporting output growth, which in turn raises the upper bound, $\bar{R}_t$.

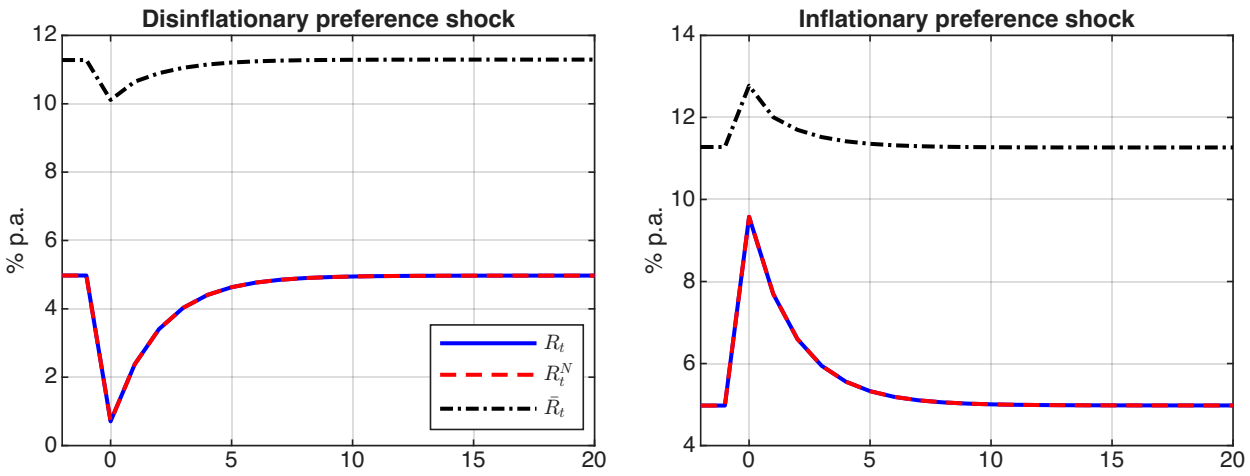


Figure 5: Interest rate dynamics in response to preference shock. Dynamics of nominal, notional, and upper bound interest rate in response to a three-standard-deviation disinflationary (left panel) and inflationary (right panel) preference shock. Interest rates are transformed to net interest rates in % per annum. Shock happens in period 0.

We now turn to demand shocks. The results are reported in Figure 5. Consider first a positive demand shock, which raises both output and inflation. Both effects raise the upper bound: the expansion induces the fiscal authority to raise taxes, and stronger nominal output erodes the financing need. As shown in the right panel of Figure 5, $\bar{R}_t$ indeed increases—but by less than the policy rate, because the notional rate is driven mainly by inflation, to which the deficit ceiling responds only weakly. Fiscal space therefore narrows somewhat, although the limit remains slack: an expansionary demand shock consumes fiscal space without threatening the constraint.

We finally consider a negative demand shock that depresses both economic activity and inflation, triggering a severe recession with falling prices. Fiscal policy is countercyclical and therefore becomes expansionary in an effort to stabilize the economy. However, this fiscal stabilization comes at the cost of narrowing the space for monetary policy accommodation, as it decreases the primary surplus, τ_t, and hence the upper bound on the interest rate, $\bar{R}_t$; see equation (17). The policy rate, however, declines by considerably more than the fiscal constraint, as shown in the left panel of Figure 5: while the fiscal expansion lowers $\bar{R}_t$ somewhat, the disinflation calls for a far larger cut in the notional rate, so that fiscal space widens on net. A disinflationary recession thus poses no challenge to the fiscal limit, even though it worsens the fiscal position.

The IRFs shown in Figures 4 and 5 show the role of the fiscal limit under a given fiscal limit configuration ($\bar{\xi}$) and supply shock volatility. Figure 6 shows how the average probability of hitting the fiscal limit depends on the tightness of the fiscal limit and supply shock volatility. Instead of using one particular shock, for each fiscal limit and supply shock configuration we

simulate the model for 100,000 periods and then compute the average number of periods at the fiscal limit. The highest probability of a binding limit appears when both fiscal space is limited (low $\bar{\xi}$) and the supply shock volatility is high.

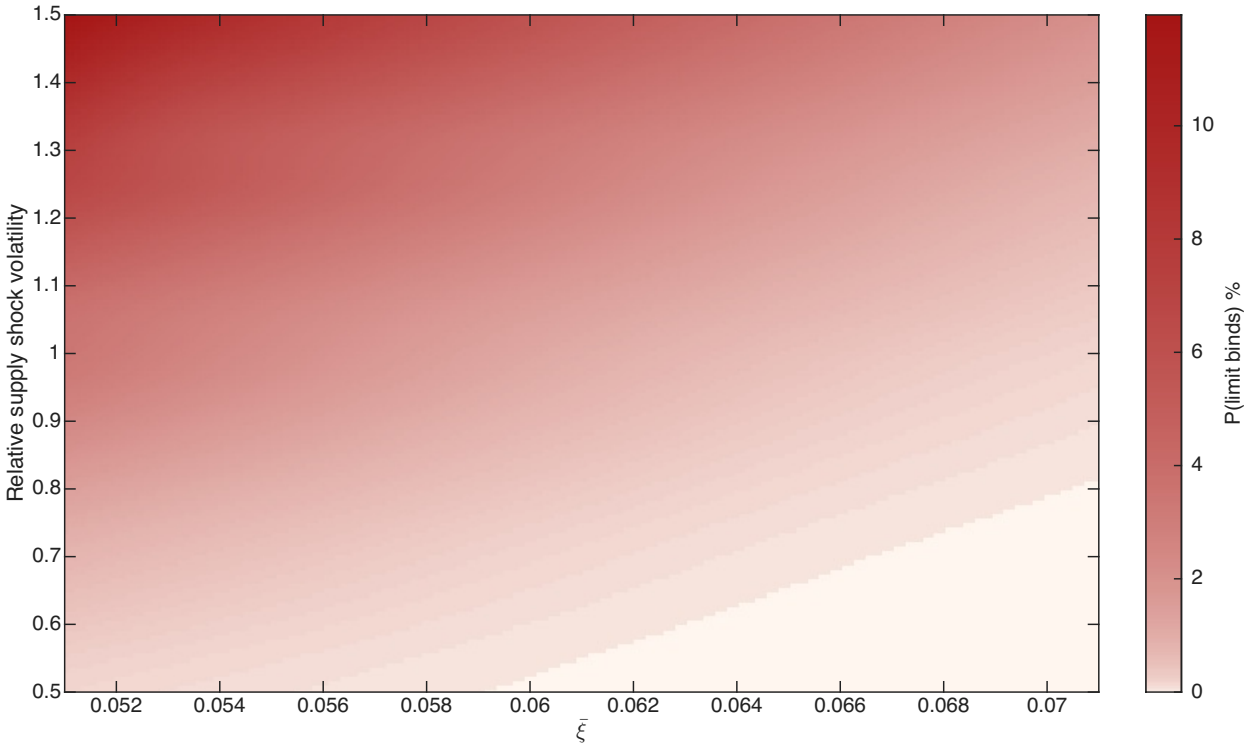


Figure 6: Probability of binding fiscal limit under different fiscal limit and supply shock volatility configurations Average probability of binding fiscal limit as fiscal limit ($\bar{\xi}$) and supply shock volatility varies. Relative supply shock volatility of 1 corresponds to sample average. Estimates are obtained via simulating the model 100,000 periods for each fiscal limit and supply shock configuration and then computing the average number of periods at the fiscal limit.

Given a configuration of fiscal limit and supply shock volatility, whether the limit actually binds or not depends on the state of the economy, in particular current and past realizations of shocks that move inflation, output and fiscal variables. Figure 7 illustrates this for 4 different combinations of fiscal space and supply shock volatility. In line with Figure 6 the probability of hitting the fiscal limit within the next two quarters is highest in an environment of tight fiscal space (low $\bar{\xi}$) and high supply shock volatility (see bottom-right panel). For each panel, the probability that the fiscal limit binds is primarily driven by the supply state (y-axis) with the probability increasing with more inflationary supply state. This means that the main driver of the constraint on monetary policy is either a single large inflationary supply shock or a sequence of adverse supply shocks that push the economy into the bottom region of the panel. The demand state plays a secondary role. For a given adverse supply state, the probability of hitting the fiscal limit is slightly higher during an expansionary

demand state, which puts additional upward pressure on interest rates.

Overall, this section shows that the combination of tight fiscal space and high supply-shock volatility can make the fiscal limit a serious constraint on monetary policy. In such an environment, adverse supply shocks are the main force pushing the economy against the limit, while demand shocks pose little challenge.

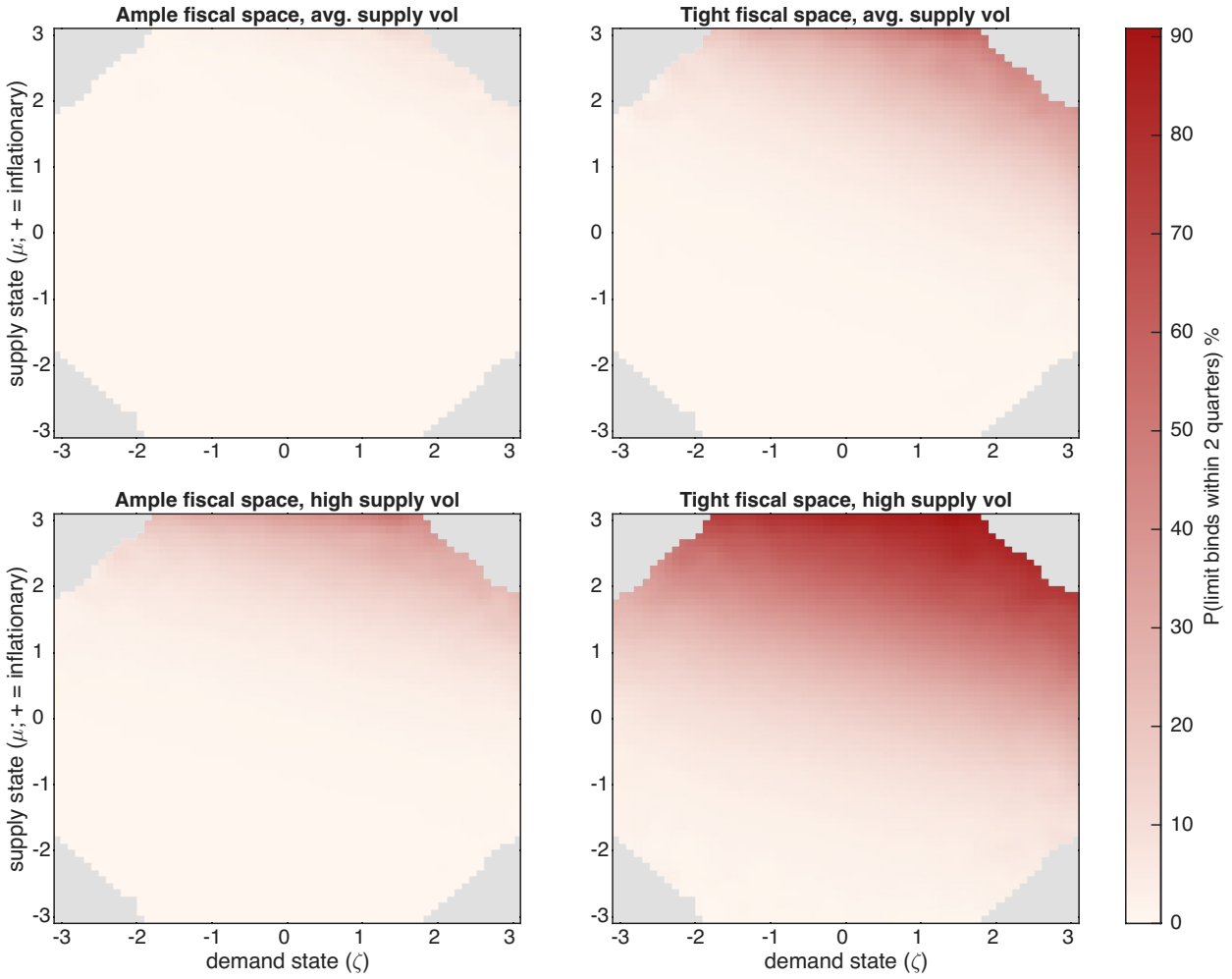


Figure 7: Probability of binding fiscal limit under different demand and supply shock configurations as fiscal space and supply-side risks vary. Probability of binding fiscal limit within next two quarters conditional on demand (ζ) and supply (μ) state. Top left: ample fiscal space and average supply shock volatility, top right: tighter fiscal space (i.e. lower $\bar{\xi}$) and average supply shock volatility, bottom left: average fiscal space and higher supply shock volatility, bottom right: tighter fiscal space and higher supply shock volatility. Estimates are obtained via simulating the model 4 million periods for each fiscal limit and supply shock configuration and then within each demand/supply state cluster computing the average number of periods at the fiscal limit. Grey area indicates states that are outside of ergodic distribution of model simulations.

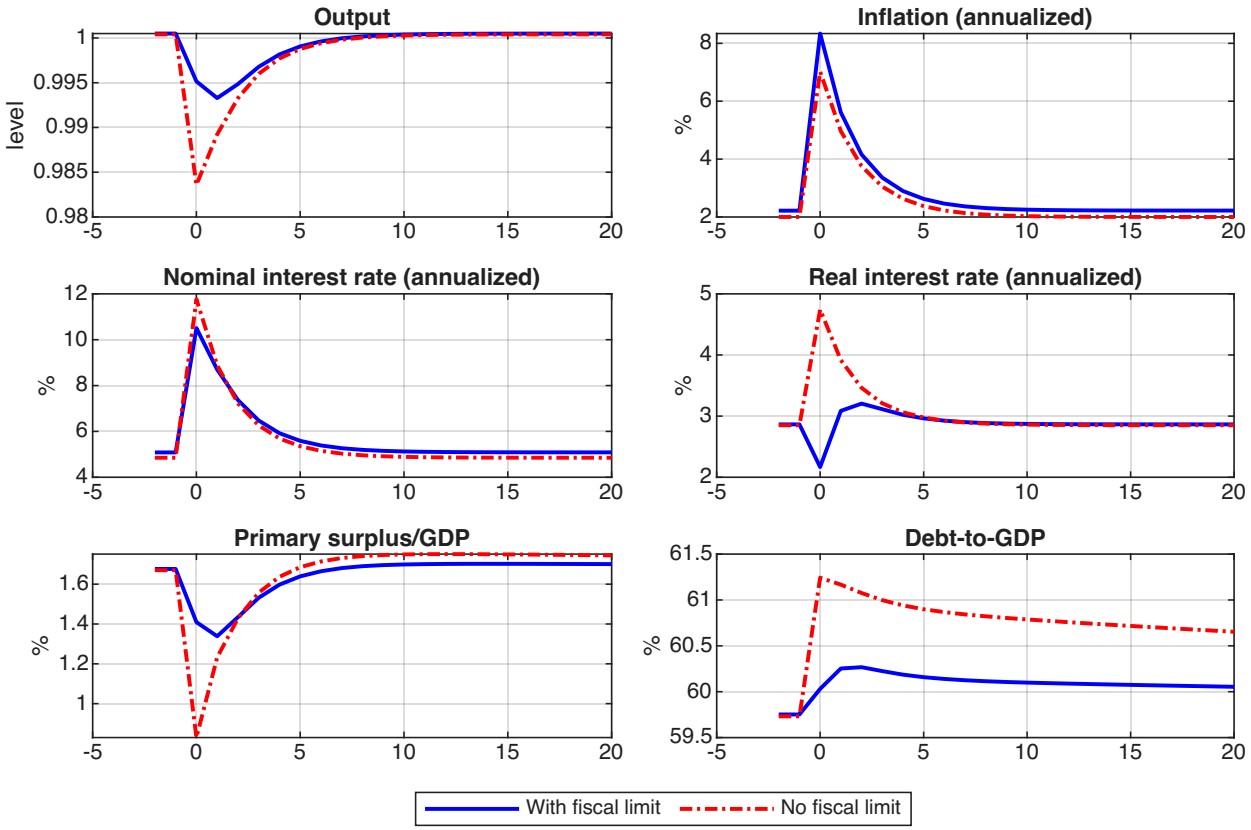


Figure 8: Responses to inflationary cost-push shock. Impulse response functions to a three-standard-deviation inflationary cost-push shock. Responses from the model with a fiscal limit shown in blue and without a fiscal limit in dashed red. Shock happens in period 0.

5 The Effects of the Shocks

We now study the propagation of shocks in the model and compare it with a counterfactual scenario in which the fiscal limit is not enforced. Figure 8 displays the impulse response functions to an inflationary markup shock, which, as shown earlier, causes the fiscal limit to bind for a few periods at the beginning of the simulation. The comparison between the blue solid line and the red dashed line–the latter representing the counterfactual case–captures both the impact of the fiscal constraint on monetary policy and the effects of changes in agents' beliefs about the likelihood that the fiscal limit will bind again.

When the fiscal limit binds, it constrains the central bank to adopt a more accommodative stance, resulting in stronger responses of both output and inflation. Importantly, this inflation is fiscal in nature, as it originates from the need to satisfy the fiscal limit. Nevertheless, it is not related to the fiscal theory of the price level: as long as the fiscal limit is respected, fiscal policy remains passive and is thereby always committed to stabilizing government debt in the long run. Inflation instead arises from the more accommodative monetary policy response to the inflationary pressures generated by the markup shock.

The accommodative stance of monetary policy is evident in the response of the real interest rate, which is lower when the fiscal limit binds (blue solid line). This outcome is directly driven by the fiscal constraint. Once the fiscal limit ceases to bind later on, the real interest rate converges to its level in the counterfactual scenario (red dashed line). Overall, the figure illustrates how the fiscal limit keeps the real interest rate temporarily lower, even though inflation and output are higher than in the absence of the fiscal constraint.

The effects of this accommodative monetary stance on inflation are both sizable and persistent, while output remains above its counterfactual no-limit path for roughly the first three quarters. As accommodative monetary policy supports economic activity and inflation, the primary surplus-to-GDP ratio declines by less and the debt-to-GDP ratio increases but significantly less than in counterfactual scenario.

The expectation channel. Figures 15-17 in the appendix report the impulse response functions for the shocks that do not cause the fiscal limit to become binding: the disinflationary markup shocks and the two demand shocks. Since the fiscal limit never binds in these simulations, any difference between the two responses can only arise from agents' beliefs about the probability of hitting the fiscal limit in the future. These effects are captured by the blue solid line, whereas the red dashed line assumes that the fiscal limit never binds.

Active vs passive monetary policy. The literature on monetary-fiscal interactions typically distinguishes between active and passive fiscal and monetary policy. In our setting fiscal policy always remains passive and follows the rule in equation (11). When the fiscal limit is not binding, monetary policy is active and follows the Taylor rule. When the limit binds, by contrast, it responds by less to inflation. Figure 9 shows the implied distribution of ϕ_π when simulating the model under random shocks for 100.000 periods. Under our calibration, we find that even when the fiscal limit is binding the implied response of the interest rate to inflation is mostly above 1, in line with predominantly active monetary policy. Because binding episodes are short-lived and agents expect the economy to return to the unconstrained region, the Taylor principle holds in the long-run sense even though the within-episode response is temporarily dampened.

6 Trend inflation and inflation risks

The previous section has focused on the effects of supply and demand shocks on the economy in the model with a fiscal limit. In this section we illustrate the implications for inflation outcomes over a longer period. Importantly, trend or long-run average inflation are equilibrium

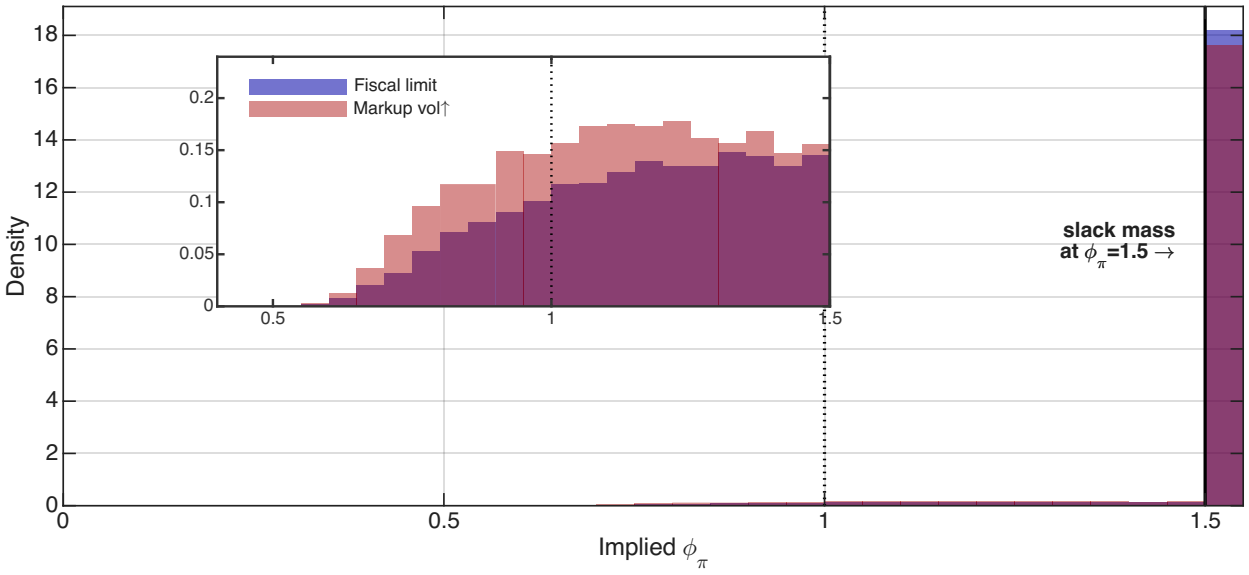


Figure 9: Distribution of implied Taylor rule coefficient ϕ_π. Distribution is computed by solving Taylor rule for ϕ_π and using model-simulated outcomes for inflation, output gap and the interest rate.

outcomes in our model. As in the previous section, we simulate the model for 100,000 periods. Figure 10 shows the distribution of inflation outcomes. In a model without fiscal limit and average supply shock volatility the distribution of inflation outcomes is centered symmetrically around 2%. Instead, in the model with fiscal limit (blue) the average inflation outcome is shifted to the right and the overall distribution exhibits upper tail risks. Under the combination of constrained fiscal space and higher supply shock volatility (red) the average inflation outcome is shifted even further to the right as under a given fiscal limit the higher shock volatility makes it more likely that the constraint binds.

While the vertical bars in Figure 10 show the average inflation outcomes, these hide important state-dependencies and nonlinearities. Figure 11 shows the gap in inflation outcomes between the model with fiscal limit and higher supply shock volatility relative to the model without fiscal limit as the degree of fiscal space varies. The inflation outcomes relative to model without fiscal limit are clearly state-dependent and the relationship between fiscal space and inflation outcomes is highly nonlinear. To the left of zero the limit binds, and the inflation gap widens to roughly 3 percentage points; to the right, the gap reflects pure anticipation effects, decaying only slowly as fiscal space grows.

7 Quantitative Analysis of Inflation Dynamics

We now take the nonlinear model with limited fiscal responsibility to U.S. data. The quantitative analysis has two objectives. First, we recover the sequence of shocks required for

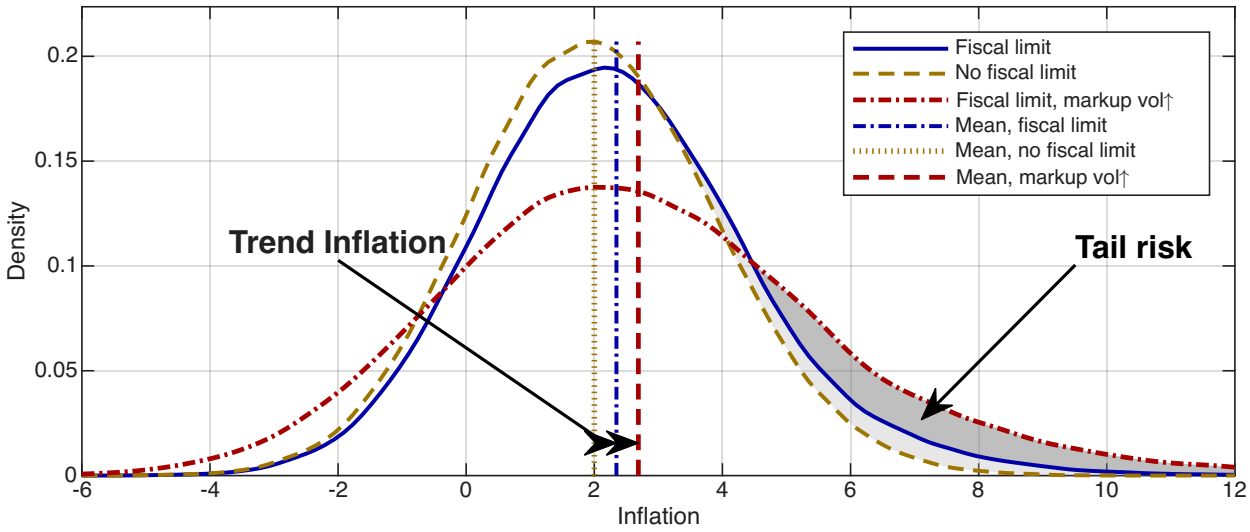


Figure 10: Distribution of inflation outcomes under model with and without fiscal limit. Model simulated for 100,000 periods under three model configurations: (i) no fiscal limit (yellow), (ii) fiscal limit and average supply shock volatility (blue) and (iii) fiscal limit and above sample average supply shock volatility (red).

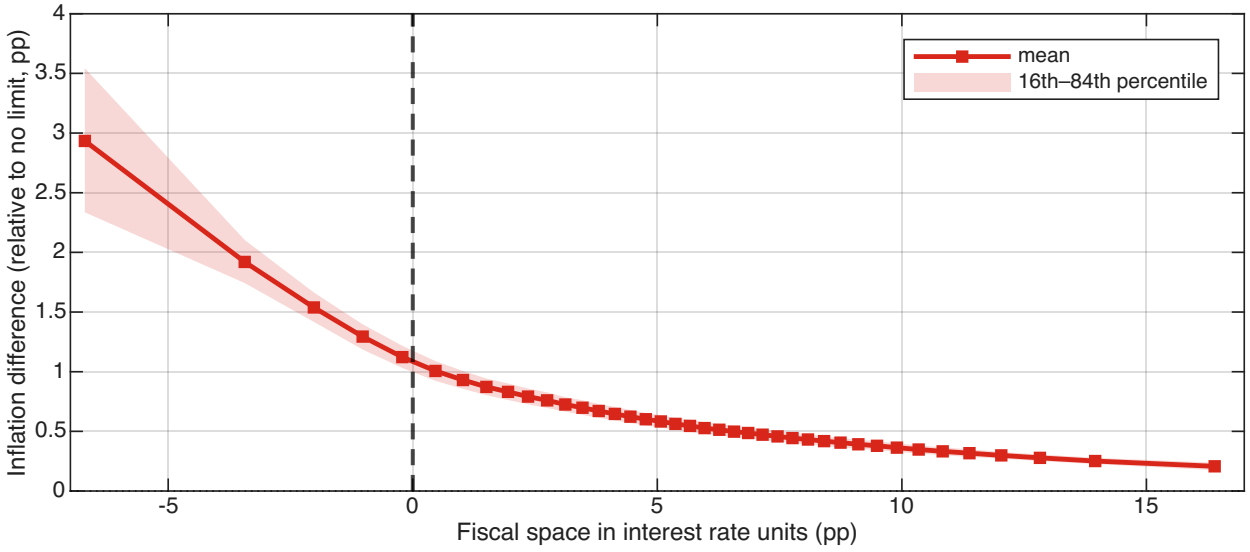


Figure 11: Fiscal inflation for varying fiscal space. Model is simulated for 100,000 periods. Fiscal space is computed as $400^*(\bar{R}_t - R_t^N)$ and inflation outcomes are grouped within fiscal space bins. The solid line shows the mean inflation difference and the shaded area the 16th-84th percentile range.

the model to account jointly for inflation, economic activity, and the evolution of the public finances. Second, we use the filtered shocks to construct counterfactual inflation paths that isolate the interaction between supply-side risk and the fiscal limit. We apply this approach to two episodes: the ratcheting of inflation between the mid-1960s and the end of the 1980s, and the post-pandemic rise in long-run inflation expectations. This section develops the

empirical framework and then presents the first application.

7.1 A Particle Filter for the Nonlinear Model

The global solution of the model provides a nonlinear state-space representation,

$$X_t = f(X_{t-1}, \Omega_t, \nu_t)\,, \tag{19}$$

$$Y_t = g(X_t) + \mu_t, \tag{20}$$

where X_t denotes the vector of endogenous state variables, Ω_t collects the pseudo-state variables in the sense of Kase et al. (2025), ν_t contains the structural innovations, and μ_t denotes measurement error. Equation (19) is the transition equation. The nonlinear function f is obtained directly from the global solution of the model. Equation (20) maps the model states into the observables.

The observables are GDP-deflator inflation, the output gap, and debt-to-GDP growth from 1960:Q1 through 2019:Q4. Inflation and the output gap discipline the demand and supply disturbances needed to account for the macroeconomic dynamics, while debt-to-GDP growth provides information about the evolution of fiscal space. We feed the time-varying volatility of the supply shock estimated from the TVP-BVAR into the model as a pseudo-state, relying on the assumption of anticipated utility. The particle filter then recursively updates the conditional distributions of the latent states and structural shocks as each new observation becomes available.

This procedure is particularly useful in our setting because both the transition law and the policy functions are nonlinear. The probability that the fiscal limit binds depends on the full state of the economy, so the same structural shock can have different effects depending on the inherited fiscal position and the prevailing level of supply-side risk. The particle filter takes this state dependence into account and provides filtered shock distributions that can be fed back through alternative versions of the model. We use these counterfactual simulations to assess how inflation would have evolved had the interaction between supply-shock volatility and the fiscal limit been absent. The filtered distribution of the states also yields, for each period in the sample, the probability that the fiscal limit binds conditional on the data and the model.

7.2 Inflation Dynamics in the 1970s and 1980s

Our first application asks how much of the rise and subsequent decline in U.S. inflation between the mid-1960s and the end of the 1980s can be explained by the interaction between

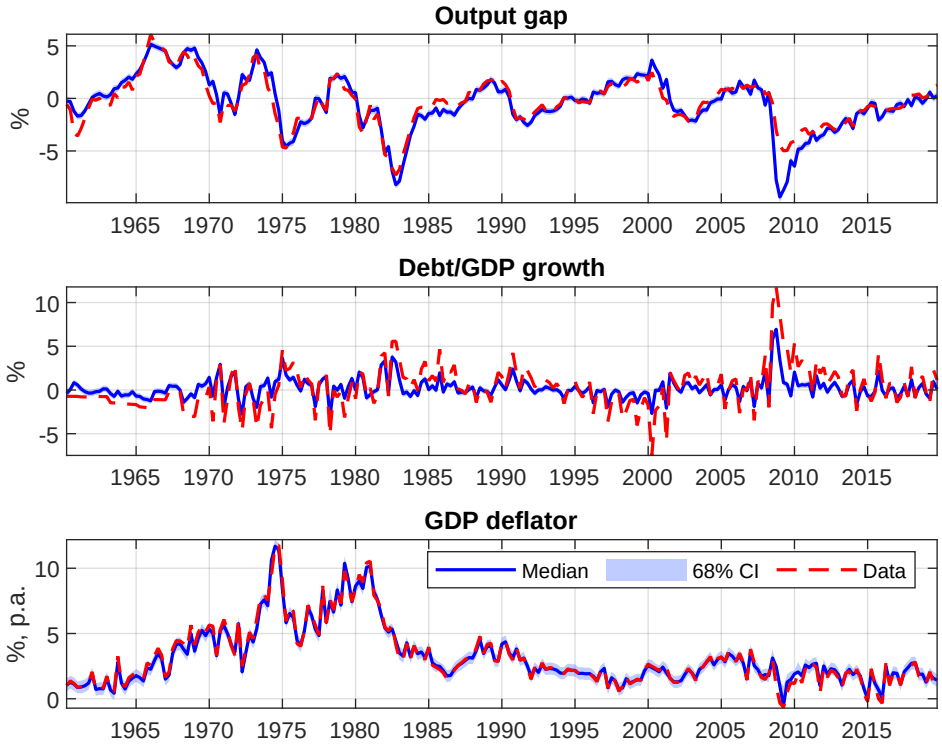


Figure 12: Estimated paths of the observables. Posterior medians and 68 percent credible intervals from the particle filter, together with the observed output gap, debt-to-GDP growth, and annualized GDP-deflator inflation. The sample runs from 1960:Q1 through 2019:Q4.

the fiscal limit and supply-side risk. Throughout this exercise, we hold the fiscal limit fixed at its baseline value. Changes in observables therefore cannot be attributed to exogenous shifts in the deficit the government is willing to tolerate. This restriction limits the filter's degrees of freedom in fitting the data. Fiscal space evolves endogenously with the filtered history of output, inflation, debt growth, and the shocks, while supply-shock volatility follows the path estimated from the TVP-BVAR.

Figure 12 reports the fitted paths of the three observables. The solid lines show the posterior medians, the shaded regions report the 68 percent credible intervals, and the dashed lines denote the data. The model closely tracks the output gap and GDP-deflator inflation over the sample. It also captures the movements in debt-to-GDP growth that are informative about the evolution of fiscal space. The joint fit is important: the filter cannot explain inflation by selecting shocks independently of the associated movements in activity and public debt.

We next feed the filtered shocks into the baseline model to construct the inflation path shown by the solid blue line in Figure 13. The dashed red line is the counterfactual path

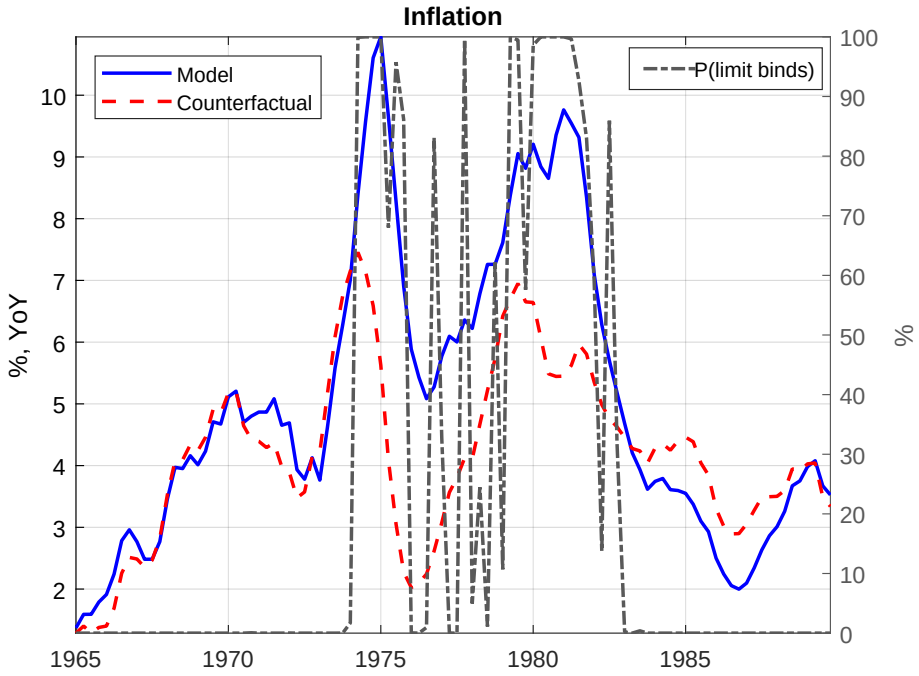


Figure 13: Inflation dynamics in the 1970s and 1980s. The solid blue line shows inflation generated by the filtered baseline model, while the dashed red line shows inflation in the counterfactual model that shuts down the interaction between supply-shock volatility and the fiscal limit. The dashed black line, measured on the right axis, reports the filtered probability that the fiscal limit binds. Inflation is measured year over year. The fiscal limit is held fixed at its baseline value throughout the exercise.

obtained from a version of the model that shuts down the interaction between supply-shock volatility and the fiscal limit. Both simulations use the shocks recovered from the particle filter, so their difference isolates the contribution of the mechanism emphasized in the paper.

The two paths are similar during the second half of the 1960s, when inflation begins to rise but fiscal pressures remain comparatively contained. They separate sharply in the mid-1970s. In the full model, the combination of adverse supply disturbances, elevated supply-shock volatility, and shrinking fiscal space raises the probability that monetary tightening will be constrained. Agents anticipate the weaker response of monetary policy, and inflation rises well above the counterfactual path. Around the largest gaps, shutting down the interaction lowers inflation by roughly four percentage points.

The mechanism remains important around the second oil shock. The renewed sequence of inflationary supply disturbances arrives after the fiscal position has already deteriorated, leaving less room for monetary tightening and generating another pronounced increase in inflation relative to the counterfactual. The model therefore produces an upward ratchet rather than a sequence of purely transitory inflation spikes: past shocks deplete fiscal space, and the higher probability of future constraint keeps inflation elevated after each individual

disturbance has begun to dissipate.

The dashed black line provides a useful summary of how the fiscal pressure facing monetary policy evolves over the episode. The probability that the fiscal limit binds rises sharply during the 1970s and is particularly high around the major inflationary supply disturbances. These are also the periods in which inflation in the baseline model moves most clearly above the counterfactual path. As the probability of a binding limit declines after 1981, inflation in the baseline model moves progressively closer to the counterfactual path and eventually falls below it.

This reversal reflects the same mechanism operating in the opposite direction. The decline in supply-shock volatility reduces the likelihood that the fiscal limit will bind, lowering inflation expectations and bringing model inflation down. As fiscal space is rebuilt in the second half of the 1980s, agents anticipate greater room for future monetary tightening, pushing inflation below that in the counterfactual economy, where the interaction between supply risk and the fiscal limit is shut down. Thus, with the fiscal limit itself held fixed, the interaction between endogenous fiscal space and changing supply-side risk accounts not only for the upward ratcheting of inflation in the 1970s, but also for its downward ratcheting during the 1980s.

After 1981, the process reverses. As supply-shock volatility declines, the probability that the fiscal limit will bind falls, lowering inflation expectations and bringing model inflation down. The key twist is that the blue line eventually crosses below the red counterfactual line: the same mechanism that amplified inflation in the 1970s now reinforces disinflation. As fiscal space is rebuilt in the second half of the 1980s, agents anticipate greater room for future monetary tightening, pushing inflation below that in the counterfactual economy, where the interaction between supply risk and the fiscal limit is shut down.

To sum up, with the fiscal limit held fixed, the interaction between endogenous fiscal space and changing supply-side risk accounts not only for the upward ratcheting of inflation in the 1970s, but also for its downward ratcheting during the 1980s.

7.3 Post-Pandemic Long-Run Inflation Expectations

Our second application turns to the post-pandemic period. Unlike the 1970s–1980s exercise, we now allow the fiscal limit to vary over time and add average long-run PCE inflation expectations from the *Survey of Professional Forecasters* (SPF) to the set of observables. The purpose of the exercise is to infer the path of the fiscal limit required for the model to account for the observed movement in long-run expectations. In particular, we ask whether the rise in expectations can be explained by a contraction in the central bank's anticipated

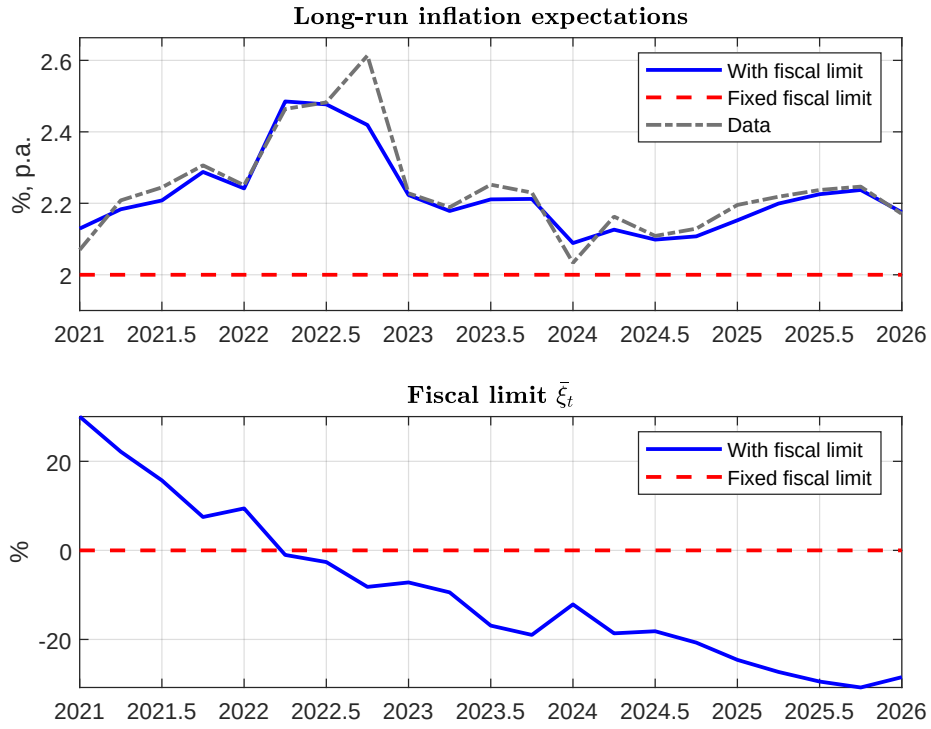


Figure 14: Long-run inflation expectations and the time-varying fiscal limit. The upper panel reports average long-run PCE inflation expectations from the Survey of Professional Forecasters, together with the model-implied paths under a time-varying fiscal limit and under a fiscal limit fixed at its baseline value. The lower panel reports the filtered fiscal limit as a percentage deviation from its baseline value.

room for future monetary tightening.

Figure 14 reports the results. The upper panel compares the SPF inflation expectations with their model counterpart under a time-varying fiscal limit and with a counterfactual that holds the limit fixed at its baseline value. The fixed-limit model keeps long-run expectations essentially at the two-percent inflation target and therefore cannot account for their post-pandemic increase. By contrast, once the fiscal limit is allowed to vary, the model closely tracks both the rise in expectations through 2022 and their subsequent moderation.

The lower panel shows the corresponding filtered path of the fiscal limit. The limit moves from above its baseline value in early 2021 to below baseline during 2022 and continues to contract thereafter, reaching roughly 30 percent below baseline around 2025. Because a lower fiscal limit means that the government is willing to tolerate a smaller total deficit, this decline narrows the room available for the central bank to raise interest rates in a period when inflation is rising quickly. limit to its pre-contraction level.

Through the lens of the model, the post-pandemic rise in long-run inflation expectations reflects an anticipation effect. Agents do not need to observe the fiscal constraint binding today. It is enough that a narrower fiscal limit makes future monetary tightening more likely

to be curtailed when inflationary shocks occur. The expected weakening of the monetary response raises long-run inflation expectations in the present. The sharp difference from the fixed-limit counterfactual shows that the contraction in the fiscal limit is essential for matching the post-pandemic drift in expectations.

8 Conclusions

We develop a nonlinear model of limited fiscal responsibility in which the government remains committed to stabilizing debt in the long run but resists deficits that would eventually require costly fiscal adjustment. Because monetary tightening weakens activity and raises debt-service costs, this resistance translates into a state-contingent ceiling on the policy rate. Inflationary supply shocks are particularly consequential: they widen the deficit precisely when tighter monetary policy is needed, inducing a less aggressive interest-rate response. When fiscal space is narrow and supply-side risk is high, agents anticipate that this constraint will bind more often, raising inflation expectations before it is reached. Trend inflation is therefore an endogenous outcome of the interaction between fiscal space and supply risk.

The quantitative analysis suggests that this mechanism helps explain both the upward and downward ratcheting of U.S. inflation between 1965 and 1990 and the post-pandemic rise in long-run inflation expectations. Eroding fiscal space and elevated supply-side risk raised the perceived likelihood of constrained monetary tightening during the Great Inflation, while declining supply risk and the subsequent restoration of fiscal space helped re-anchor expectations. In the post-pandemic period, the rise in long-run expectations requires a substantial contraction in the fiscal limit. Fiscal space thus matters for price stability even when debt remains fully backed: preserving it safeguards the central bank's room to respond to inflationary supply shocks and helps keep long-run expectations anchored when supply-side risks are elevated.

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A A Randomization Placebo for the Fiscal Regime

The narrow-regime indicator in Section 2 identifies two long periods that together account for 57 percent of the sample, 2003M1–2025M12. Could choosing any two similarly long periods produce the state dependence we find? This concern is particularly relevant because both the regime indicator and the outcome are persistent. We address it by moving the narrow-regime periods to different dates and repeating the estimation.

Design. We shift the entire regime indicator forward through the sample, one month at a time. Whenever part of the indicator moves past the end of the sample, it wraps around to the beginning. For a shift of k months, we replace n_{t-1} with

$$\tilde{n}_{t-1}^{(k)} = n_{t-1-k \bmod T}, \qquad T = 276.$$

This procedure preserves the number of narrow-regime months and the lengths and spacing of the two blocks on the circular sample. It changes only their calendar dates.

We re-estimate (1) for all 275 nonzero shifts, keeping the outcome, shocks, controls, and estimation sample unchanged. If the estimated state dependence simply reflected the persistence and shape of the indicator, many of these alternative dates should produce estimates as negative as the actual estimate.

Results. Table 3 summarizes the resulting placebo estimates. Their mean is close to zero, at -0.028, compared with the actual estimate of -0.344. Only one of the 275 placebo estimates is at least as negative as the actual estimate. Using the formula in the table notes, this gives a one-sided randomization p-value of 0.007.

Small shifts leave the placebo regime close to the actual regime. To check that these cases do not drive the result, we restrict attention to shifts with less than 75 percent and less than 50 percent overlap with the actual regime. The corresponding p-values are 0.008 and 0.009. Excluding shifts of fewer than 18 months in either direction also leaves the result unchanged, with $p = 0.008$.

Table 3: Placebo estimates of $\bar{\gamma}^+$ after shifting the fiscal regime

Shifts included	n	Mean	S.d.	Minimum	p
All shifts	275	-0.028	0.213	-0.351	0.007
Overlap with actual $< 75\%$	237	-0.004	0.218	-0.351	0.008
Overlap with actual $< 50\%$	106	$+0.083$	0.248	-0.342	0.009
Shift ≥ 18 months	241	-0.007	0.218	-0.351	0.008
Actual regime: $\bar{\gamma}^+ = -0.344$					

Each placebo estimate is obtained by re-estimating (1) after circularly shifting the narrow-regime indicator. All estimates use the same estimation sample. The one-sided randomization p-value is $(1 + r)/(1 + n)$, where n is the number of shifts included and r is the number producing an estimate at least as negative as the actual estimate. The final row excludes shifts of fewer than 18 months in either direction. For shifts with less than 75 percent overlap, the 1st, 5th, and 10th percentiles are -0.321, -0.278, and -0.256; the median is -0.041.

Interpretation. The placebo estimates are centered near zero, and almost none are as negative as the actual estimate. Thus, the persistence and two-block structure of the indicator do not by themselves explain the result: the dates assigned to the narrow regime matter.

This exercise complements the test of $\gamma_h^- \approx 0$ in the main text. That test asks whether state dependence is confined to the shocks for which the model predicts it. The placebo asks whether shifting the same regime indicator to other dates produces similarly negative estimates. Together, these tests assess two implications of the model that are not imposed in estimation.

B New Keynesian Model with a Fiscal Limit and Constrained Monetary Policy

B.1 Model equations

Household problem The representative household chooses $\{C_t, N_t, B_t\}_{t=0}^{\infty}$ to maximize expected discounted utility:

$$\max_{\{C_t, N_t, B_t\}} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \, e^{\zeta_t} \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \psi \frac{N_t^{1+\eta}}{1+\eta} \right) \tag{21}$$

subject to the flow budget constraint

$$P_t C_t + Q_t B_t = W_t N_t + B_{t-1} - P_t T_t + P_t D_t, \qquad \text{where } Q_t = \frac{1}{R_t}. \tag{22}$$

Let λ_t be the Lagrange multiplier on equation (22) the first order conditions are given by

$$\zeta_t C_t^{-\sigma} = \lambda_t P_t \tag{23}$$

$$\zeta_t \psi N_t^{\eta} = \lambda_t W_t \tag{24}$$

$$Q_t \lambda_t = \beta \, \mathbb{E}_t[\lambda_{t+1}] \tag{25}$$

Using $Q_t = 1/R_t$, and combining we get

$$\frac{W_t}{P_t} = \psi \, N_t^{\eta} C_t^{\sigma} \tag{26}$$

$$C_t^{-\sigma} = \beta R_t \, {}_t \left[e^{\zeta_{t+1} - \zeta_t} \, C_{t+1}^{-\sigma} \, \frac{P_t}{P_{t+1}} \right] \tag{27}$$

The preference shock ζ follows an AR(1) process in logs

$$\zeta_t = \rho_\zeta \, \zeta_{t-1} + \sigma^\zeta \, \epsilon_t^\zeta, , \quad \text{where } \epsilon_t^\zeta \sim N(0,1). \tag{28}$$

Firm problem The firm problem is standard. The final goods producers buy intermediate goods and aggregate them into a homogeneous final good using a CES technology as follows:

$$Y_t = \left(\int_0^1 Y_t(j)^{\frac{\epsilon-1}{\epsilon}} \, dj \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{29}$$

where $Y_t(j)$ is the output of intermediate goods firm firm j. The price index for the aggregate homogeneous good is:

$$P_t = \left(\int_0^1 P_t(j)^{1-\epsilon} \, dj \right)^{\frac{1}{1-\epsilon}}, \tag{30}$$

and profit maximization implies that the demand for an individual good $j \in (0,1)$ is:

$$Y_t(j) = \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t. \tag{31}$$

The intermediate good firms use labor as the only factor of production

$$Y_t(j) = N_t(j) \tag{32}$$

and demand labor to produce the amount of differentiated goods to be sold to households in a monopolistic competitive market

$$\min_{N_t(j)} \quad W_t N_t(j) \tag{33}$$

$$\text{s.t.} \quad N_t(j) \geq \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t \tag{34}$$

Defining $\theta(j)$ as the Lagrange multiplier this yields

$$\theta_t(j) = W_t \qquad \forall j \tag{35}$$

Each intermediate goods firm j sets the price of its differentiated good j so as to maximize its profits and subject to price adjustment costs a la Rotemberg

$$\max_{P_t(j)} \quad \left(\frac{P_t(j)}{P_t} \right)^{1-\epsilon} Y_t - MC_t \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t - \frac{\varphi}{2} \left(\frac{P_t(j)}{\Pi P_{t-1}(j)} - 1 \right)^2 Y_t \tag{36}$$

where $MC_t \equiv \frac{W_t}{P_t}$ are real marginal costs. The parameter $\varphi > 0$ measures the cost of price adjustment in units of the final good. The first order condition is

$$\begin{aligned} (\epsilon - 1) \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} \frac{Y_t}{P_t} = \epsilon \, MC_t \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon-1} \frac{Y_t}{P_t} - \varphi \left(\frac{P_t(j)}{\Pi P_{t-1}(j)} - 1 \right) \frac{Y_t}{\Pi P_{t-1}(j)} \\ + \varphi \mathbb{E}_t \Lambda_{t,t+1} \left(\frac{P_{t+1}(j)}{\Pi P_t(j)} - 1 \right) \frac{P_{t+1}(j)}{\Pi P_t(j)} \frac{Y_{t+1}}{P_t(j)}. \end{aligned} \tag{37}$$

where the stochastic discount factor is

$$\Lambda_{t,t+1} = \beta \mathbb{E}_t \left[\left(\frac{\zeta_{t+1}}{\zeta_t} \right) \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \right]. \tag{38}$$

In equilibrium all firms choose the same price. Thus, the New Keynesian Phillips curve is

$$\varphi\left(\frac{\Pi_t}{\Pi}-1\right)\frac{\Pi_t}{\Pi}=(1-\epsilon)+\epsilon MC_t+\varphi\mathbb{E}_t\left[\Lambda_{t,t+1}\left(\frac{\Pi_{t+1}}{\Pi}-1\right)\frac{\Pi_{t+1}}{\Pi}\frac{Y_{t+1}}{Y_t}\right]+\mu_t. \tag{39}$$

where μ is a cost-push (markup) shock that follows an AR(1) process

$$\mu_t=\rho_\mu\,\mu_{t-1}+\sigma^\mu\,\epsilon_t^\mu,\quad \text{where } \epsilon_t^\mu\sim N(0,1). \tag{40}$$

Finally, in equilibrium we have

$$Y_t=N_t. \tag{41}$$

Fiscal and Monetary Policy The government collects taxes T_t and issues one-period bonds satisfying the following budget constraint

$$Q_tB_t=B_{t-1}-P_tT_t \tag{42}$$

We can rewrite the government budget constraint by dividing by P_tY_t as

$$b_t=R_t\left(b_{t-1}\frac{Y_{t-1}}{\Pi_tY_t}-\tau_t\right) \tag{43}$$

Taxes are adjusted based on the following fiscal rule responding to debt and output deviations

$$\tau_t=\tau+\delta(b_{t-1}-b)+\delta_Y(Y_t-Y) \tag{44}$$

where $\tau_t\equiv\frac{T_t}{Y_t}$, $b_t\equiv\frac{B_t}{P_tY_t}$ is the debt-to-GDP ratio and τ, b and Y denote steady-state values.

The monetary authority sets the nominal interest rate based on a standard monetary rule but taking into account the fiscal limit $b_t\leq\bar{b}$ such that the interest rate is constrained by an upper bound

$$R_t\leq\bar{R}_t\equiv\frac{b_{t-1}\frac{Y_{t-1}}{\Pi_tY_t}+\bar{\xi}}{b_{t-1}\frac{Y_{t-1}}{\Pi_tY_t}-\tau_t} \tag{45}$$

Taken together this implies the monetary authority sets the interest rate as

$$R_t=\min\left[R_t^N,\bar{R}_t\right]. \tag{46}$$

where R_t^N is the notional interest rate based on a standard monetary rule responding to inflation and output from their corresponding targets/steady-state values

$$R_t^N=R\left(\frac{\Pi_t}{\Pi}\right)^{\phi_\Pi}\left(\frac{Y_t}{Y}\right)^{\phi_Y}. \tag{47}$$

The resource constraint is

$$C_t = Y_t \left[1 - \frac{\varphi}{2} \left(\frac{\Pi_t}{\Pi} - 1 \right)^2 \right]. \tag{48}$$

Taken together, the model can be summarized by equations (26), (27), (28), (35), (38), (39), (40), (41), (43), (44), (45), (47) and (48), which we repeat for convenience below:

$$\frac{W_t}{P_t} = \psi \, N_t^{\eta} C_t^{\sigma} \tag{49}$$

$$C_t^{-\sigma} = \beta R_t \, \mathbb{E}_t \left[e^{\zeta_{t+1} - \zeta_t} C_{t+1}^{-\sigma} \frac{1}{\Pi_{t+1}} \right], \tag{50}$$

$$\theta_t = W_t, \tag{51}$$

$$\Lambda_{t,t+1} = \beta \mathbb{E}_t \left[\left(\frac{\zeta_{t+1}}{\zeta_t} \right) \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \right], \tag{52}$$

$$\varphi \left(\frac{\Pi_t}{\Pi} - 1 \right) \frac{\Pi_t}{\Pi} = (1 - \epsilon) + \epsilon MC_t + \varphi \mathbb{E}_t \left[\Lambda_{t,t+1} \left(\frac{\Pi_{t+1}}{\Pi} - 1 \right) \frac{\Pi_{t+1}}{\Pi} \frac{Y_{t+1}}{Y_t} \right] + \mu_t, \tag{53}$$

$$Y_t = N_t, \tag{54}$$

$$b_t = R_t \left(b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t \right), \tag{55}$$

$$\tau_t = \tau + \delta(b_{t-1} - b) + \delta_Y (Y_t - Y), \tag{56}$$

$$R_t = \min \left[R_t^N, \frac{b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} + \bar{\xi}}{b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t} \right], \tag{57}$$

$$R_t^N = R \left(\frac{\Pi_t}{\Pi} \right)^{\phi_\Pi} \left(\frac{Y_t}{Y} \right)^{\phi_Y}, \tag{58}$$

$$C_t = Y_t \left[1 - \frac{\varphi}{2} \left(\frac{\Pi_t}{\Pi} - 1 \right)^2 \right], \tag{59}$$

$$\zeta_t = \rho_\zeta \, \zeta_{t-1} + \sigma^\zeta \, \epsilon_t^\zeta, \tag{60}$$

$$\mu_t = \rho_\mu \, \mu_{t-1} + \sigma^\mu \, \epsilon_t^\mu \tag{61}$$

B.2 Model solution

The model is solved with global methods. The agents take the presence of the fiscal limit into account and form their expectations accordingly. Therefore, the possibility of a bounded interest rate due to the fiscal space in the future affects potentially the equilibrium outcome in times of unconstrained monetary policy. We use time iteration with piecewise linear interpolation of policy functions as in Richter et al. (2014).[8] Expectations are calculated using numerical integration based on Gauss-Hermite quadrature.

[8] This approach can handle the nonlinearities associated with the monetary policy rule.

The state variables $\mathbb{X}_t$ are b_{t-1}, Y_{t-1}, μ_t and ζ_t while the policy variables are Π_t, labor N_t and the upper bound on the interest rate due to the fiscal limit $\bar{R}_t$:

$$\Pi_t = g^1(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{62}$$
$$N_t = g^2(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{63}$$
$$\bar{R}_t = g^3(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{64}$$

where $g = (g^1, g^2, g^3)$ and $g^i : R^1 \to R^1$. To solve the model, we approximate the unknown policy functions with piecewise linear functions $\tilde{g}^i$ that can be written as:

$$\Pi_t = \tilde{g}^1(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{65}$$
$$N_t = \tilde{g}^2(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{66}$$
$$\bar{R}_t = \tilde{g}^3(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{67}$$

The time iteration algorithm to solve for the policy functions is summarized below:

(i) Define a discretized grid for the states $\left\{\left[\underline{b}, \bar{b}\right], \left[\underline{Y}, \overline{Y}\right], \left[\underline{\mu}, \overline{\mu}\right], \left[\underline{\zeta}, \overline{\zeta}\right]\right\}$ and the integration nodes $\epsilon = \left\{\left[\underline{\epsilon}^{\mu,I}, \overline{\epsilon}^{\mu,I}\right], \left[\underline{\epsilon}^{\zeta,I}, \overline{\epsilon}^{\zeta,I}\right]\right\}$.

(ii) Guess the piece-wise linear policy functions $\tilde{g}(\tilde{b}_{t-1}, Y_{t-1}, \mu_t, \zeta_t)$.

(iii) Solve for all time t variables for a given state vector. The policy variables are:

$$\Pi_t = \tilde{g}^1(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{68}$$
$$N_t = \tilde{g}^2(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{69}$$
$$\bar{R}_t = \tilde{g}^3(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \tag{70}$$

so that the remaining variables are given as (where we use the real wage $w_t =\equiv \frac{W_t}{P_t}$):

$$\tilde{Y}_t = N_t \tag{71}$$
$$\tilde{C}_t = \tilde{Y}_t(1 - 0.5\varphi\left(\frac{\Pi_t}{\Pi} - 1\right)^2) \tag{72}$$
$$\tilde{w}_t = \psi N_t^{\eta} \tilde{C}_t^{\sigma} \tag{73}$$
$$R_t^N = R\left(\frac{\Pi_t}{\Pi}\right)^{\phi_\Pi}\left(\frac{\tilde{Y}_t}{\tilde{Y}}\right)^{\phi_Y} \tag{74}$$
$$\tilde{R}_t = \min\left[\bar{R}_t, R_t^N\right] \tag{75}$$
$$\tilde{\tau}_t = \tau + \delta(b_{t-1} - b) + \delta_Y(\tilde{Y}_t - Y) \tag{76}$$
$$\tilde{b}_t = \tilde{R}_t\left(b_{t-1}\frac{Y_{t-1}}{\Pi_t \tilde{Y}_t} - \tilde{\tau}_t\right) \tag{77}$$
$$MC_t = \tilde{w}_t \tag{78}$$

Given these variables we can also compute

$$\bar{R}_t^{new} = \frac{\bar{b}}{b_{t-1}\frac{Y_{t-1}}{\Pi_t \tilde{Y}_t} - \tilde{\tau}_t} \tag{79}$$

Calculate the state variable for period $t+1$ at each integration node i:

$$\mu_{t+1}^i = \exp\left(\rho_\mu \log(\mu_t) + \epsilon_{t+1}^{\mu,i}\right) \tag{80}$$

$$\zeta_{t+1}^i = \exp\left(\rho_\zeta \log(\zeta_t) + \epsilon_{t+1}^{\zeta,i}\right) \tag{81}$$

For each integration node $\mu_{t+1}^i, \zeta_{t+1}^i$, calculate the policy variables and solve for output, consumption and the stochastic discount factor:

$$\Pi_{t+1}^i = \tilde{g}^1(\tilde{b}_t, \tilde{Y}_t, \mu_{t+1}^i, \zeta_{t+1}^i) \tag{82}$$

$$N_{t+1}^i = \tilde{g}^2(\tilde{b}_t, \tilde{Y}_t, \mu_{t+1}^i, \zeta_{t+1}^i) \tag{83}$$

$$\tilde{Y}_{t+1}^i = N_{t+1}^i \tag{84}$$

$$\tilde{C}_{t+1}^i = \tilde{Y}_{t+1}^i(1 - 0.5\varphi\left(\frac{\Pi_{t+1}^i}{\Pi} - 1\right)^2) \tag{85}$$

$$\tilde{\Lambda}_{t,t+1}^i = \beta\left(\frac{\zeta_{t+1}^i}{\zeta_t}\right)\left(\frac{\tilde{C}_{t+1}^i}{\tilde{C}_t}\right)^{-\sigma} \tag{86}$$

Calculate the errors for the Euler Equation, the New Keynesian Phillips curve and for $\bar{R}_t$

$$err_1 = 1 - \tilde{R}_t E_t\left[\tilde{\Lambda}_{t,t+1}\frac{1}{\tilde{\Pi}_{t+1}}\right] \tag{87}$$

$$err_2 = \varphi\left(\frac{\Pi_t}{\Pi} - 1\right)\frac{\Pi_t}{\Pi} - (1-\epsilon) - \epsilon MC_t - \tag{88}$$

$$\varphi E_t \tilde{\Lambda}_{t,t+1}\left(\frac{\tilde{\Pi}_{t+1}}{\Pi} - 1\right)\left(\frac{\tilde{\Pi}_{t+1}}{\Pi}\right)\frac{\tilde{Y}_{t+1}}{\tilde{Y}_t} + \ln(\mu_t) \tag{89}$$

$$err_3 = \bar{R}_t - \bar{R}_t^{new}$$

where the expectations in the first two equations are numerically integrated across the integration nodes. The nodes and weights are based on Gaussian-Hermite quadrature.

(iv) Use a numerical root finder to minimize the errors for the equations.

(v) Update the policy functions until the errors at each point of the discretized state are sufficiently small.

We discretize the two endogenous state variables b and Y in 15 evenly-spaced points with bounds at $[-4, +3]\%$ and $[-3, +3]\%$ around their respective deterministic steady state. The markup and preference shocks are discretized in 15 evenly-spaced points with bounds chosen

to be $\pm 4\sigma^{\mu}$ and $\pm 4\sigma^{\zeta}$ around the respective deterministic steady state. This results in a total of 50625 nodes. The Gauss-Hermite quadrature provides the integration nodes $\left[\epsilon^{\mu,i}, \epsilon^{\zeta,i}\right]$ and the corresponding weights $\xi(i)$ for all integration nodes $i \in \{1, 2, \ldots, I\}$. We use 9 nodes for both shocks so that we evaluate the expectations using $I = 81$ weighted points.

C Additional figures

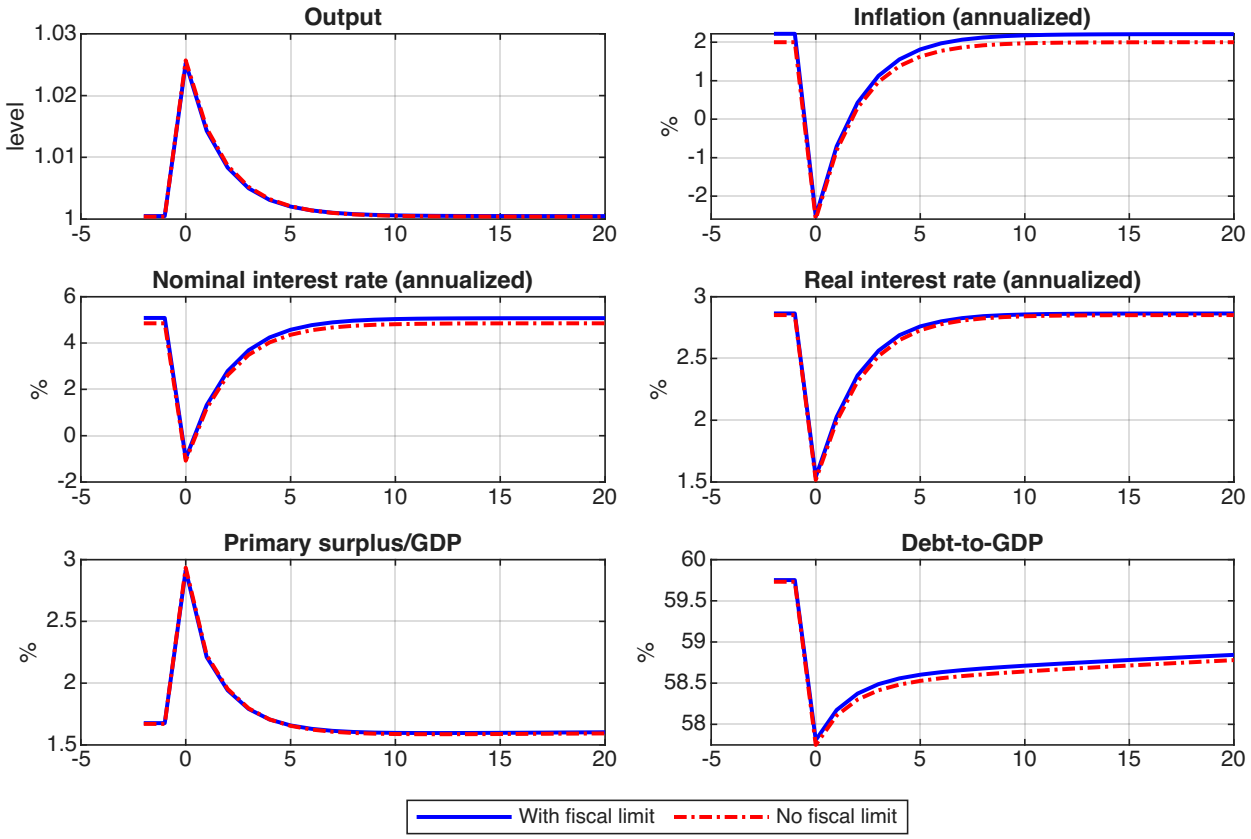


Figure 15: Responses to disinflationary cost-push shock. Impulse response functions to a three-standard-deviation disinflationary cost-push shock. Responses from the model with a fiscal limit shown in blue and without a fiscal limit in dashed red. Shock happens in period 0. Figures show dynamics in deviation from pre-shock level.

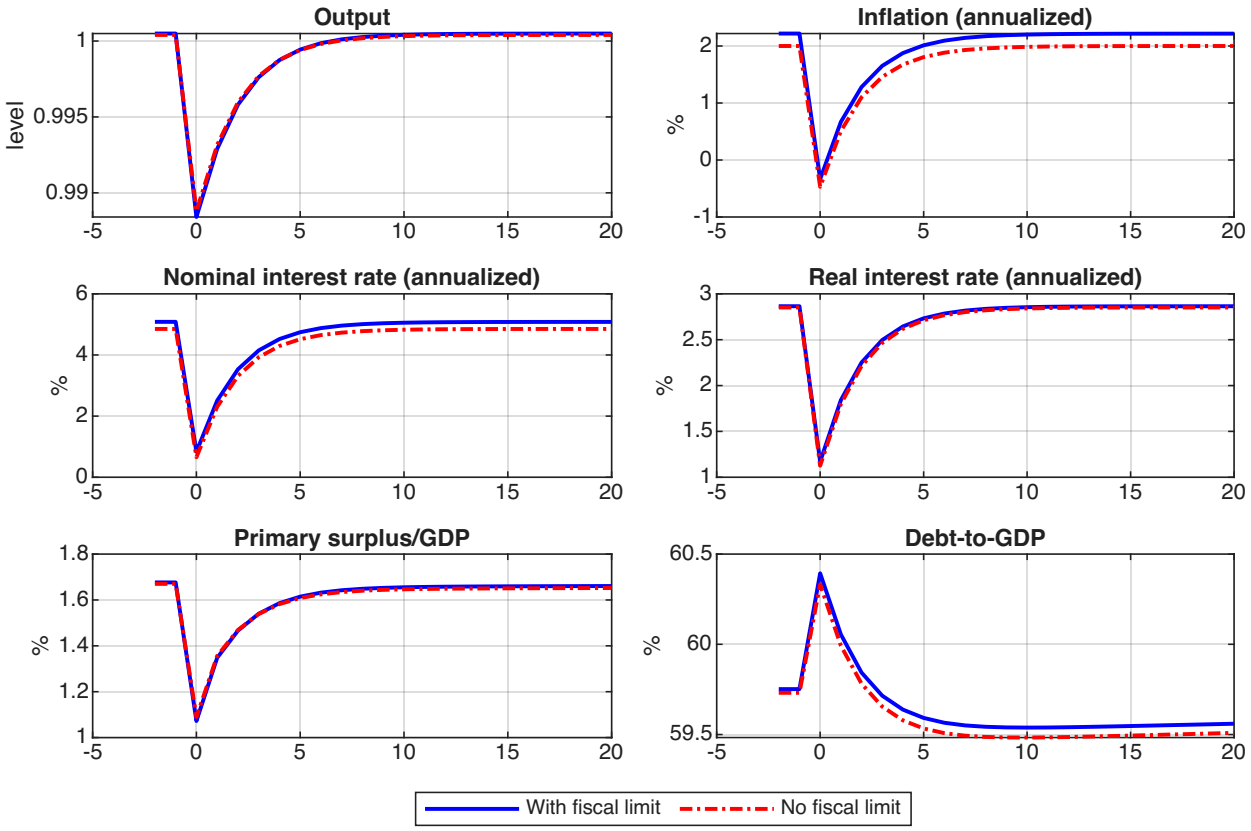


Figure 16: Responses to disinflationary preference shock. Impulse response functions to a three-standard-deviation disinflationary preference shock. Responses from model with fiscal limit shown in blue and without fiscal limit in dashed red. Shock happens in period 0. Figures show dynamics in deviation from pre-shock level.

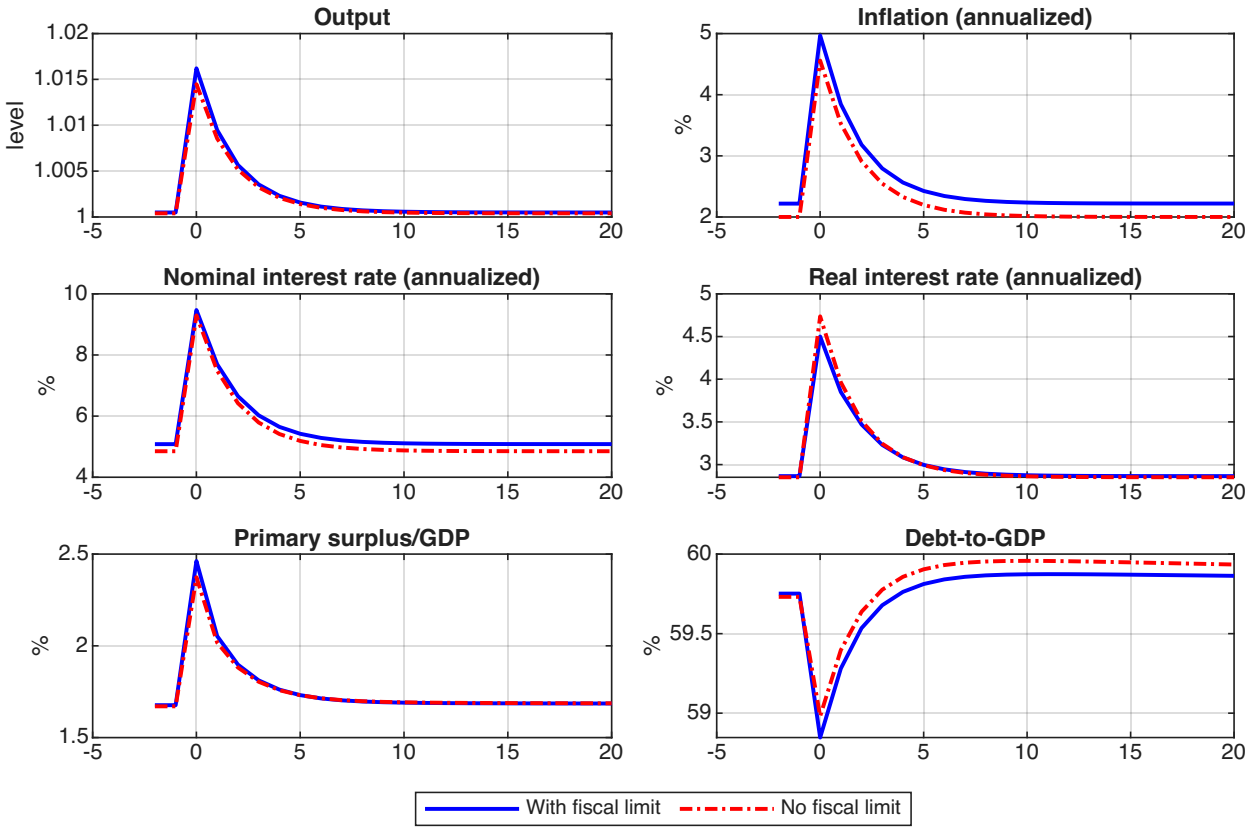


Figure 17: Responses to inflationary preference shock. Impulse response functions to a three-standard-deviation inflationary preference shock. Responses from model with fiscal limit shown in blue and without fiscal limit in dashed red. Shock happens in period 0. Figures show dynamics in deviation from pre-shock level.