

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 they do, particularly following inflationary supply shocks. Market real interest rates rise in response to oil-supply news shocks when fiscal space is ample but fall when it is narrow, consistent with expectations of weaker monetary tightening under fiscal strain. We formalize this mechanism in a nonlinear general-equilibrium model with limited fiscal responsibility. The government commits to stabilizing debt in the long run but wants monetary policy to help slow debt growth during recessions or periods of large primary deficits. We capture this preference through a limit on the total deficit, creating a state-contingent ceiling on the policy rate. Narrowing fiscal space and greater supply-shock volatility make this constraint more likely to bind, 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 of binding fiscal constraints due to narrower fiscal space, heightened supply-shock volatility, and reduced government tolerance for deficits.

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. In the 1980s, inflation declined despite persistent primary deficits, as expanding non-OPEC supply and declining OPEC pricing power reduced disruption risk. Fiscal consolidation subsequently rebuilt fiscal space, while easing geopolitical tensions and deeper global integration further reduced disruption risk. By the 1990s and 2000s, globalization had entrenched a much safer supply environment. Even as persistent primary deficits returned in the 2010s, inflation remained low. Since 2021, the two forces have again moved together. Exceptionally large peacetime deficits have coincided with renewed supply-disruption risks associated with the pandemic, the war in Ukraine, and increasing fragmentation of global trade. Inflation has remained above its pre-pandemic level ever since.¹

Critically, neither force appears sufficient on its own. Disruption risk was elevated in the 1950s and early 1960s, yet persistent primary surpluses coincided with no sustained inflation ratchet. Conversely, persistent deficits in the 1980s and 2010s did not generate an upward inflation ratchet when disruption risk was declining or remained contained. These patterns suggest that the interaction between fiscal conditions and supply-disruption risk may help explain inflation ratcheting.

Motivated by these observations, 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 resistance. This interaction generates two departures from conventional monetary–fiscal models: the monetary–fiscal policy mix, trend inflation, and upside inflation tail risks all depend endogenously on fiscal conditions and macroeconomic risk. In particular, fiscal conditions and supply-disruption risk can raise the trend toward which inflation converges, leaving inflation persistently above target even after shocks dissipate.

¹Appendix A corroborates this historical narrative using news-based indicators of geopolitical threats and energy shortages (Caldara and Iacoviello, 2022, Iacoviello and Tong, 2026) to proxy for supply-disruption risk. The resulting patterns are consistent with the interaction between fiscal conditions and supply-disruption risk emphasized here.

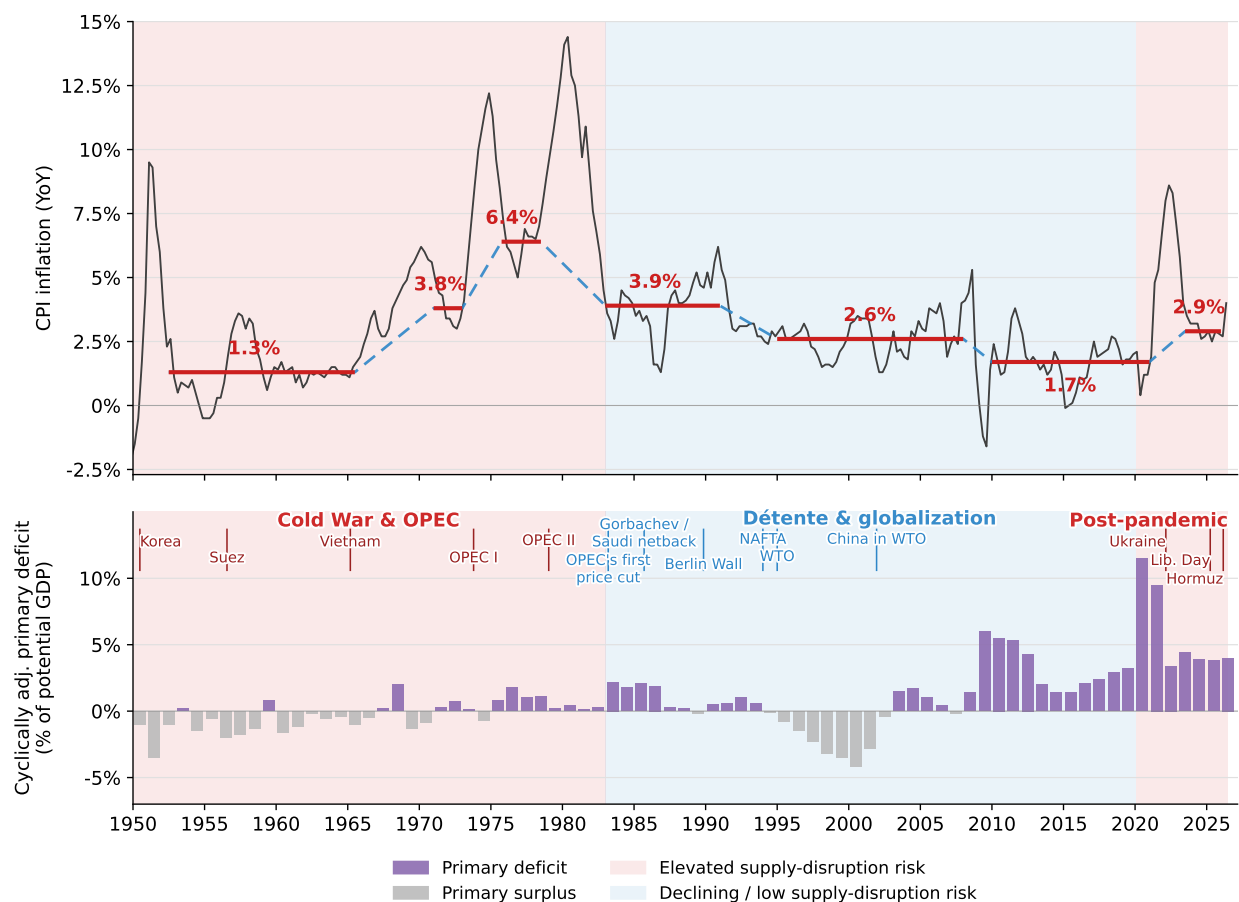


Figure 1: Top Panel: Ratcheting inflation. Bottom Panel: Deficits and supply-disruption risks

The mechanism rests on a friction we call *limited fiscal responsibility* (LFR). The government commits to stabilizing debt in the long run, but only within limits: during recessions or periods of large primary deficits, it wants monetary policy to lower borrowing costs and slow debt growth. We model this friction as a limit on the total deficit the government is willing to tolerate. 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. Because monetary tightening weakens activity and raises debt-service costs, it erodes fiscal space and is therefore subject to an endogenous ceiling that tightens as debt and primary deficits rise or economic activity weakens.

Inflationary supply disturbances are particularly likely to 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. At the same time, to contain debt accumulation and the ensuing need for fiscal adjustment, the government calls for a looser monetary stance. When the fiscal limit binds, the central bank

therefore raises rates less aggressively, amplifying the inflationary response while cushioning the contraction in activity.

We provide empirical evidence consistent with the LFR mechanism. Using the oil-supply news shocks identified by Känzig (2021), we find that U.S. financial markets appear to anticipate weaker monetary tightening in response to inflationary supply shocks when fiscal space is narrow. The five-year real yield rises when fiscal space is ample but falls when it is narrow, by roughly 30 basis points over much of the following two years. These findings are consistent with limited fiscal responsibility constraining monetary tightening precisely when adverse supply shocks call for higher interest rates.

In the model the LFR mechanism operates through expectations even when the fiscal limit is not binding. When fiscal space is narrow or supply-disruption risk is high, agents anticipate that future monetary tightening will more often be curtailed by the fiscal limit. This prospect of weaker future monetary responses raises current inflation expectations and, with them, trend inflation. Trend inflation is therefore an equilibrium object, jointly shaped by fiscal behavior and macroeconomic risk. Unlike in conventional models, inflation can ratchet upward even without a change in the government’s tolerance for deficits, simply because the likelihood of future fiscal constraints has increased.

The same mechanism generates persistence and path dependence in inflation dynamics. Because fiscal space is rebuilt only gradually, past adverse supply shocks and persistent primary deficits leave less room for monetary tightening when new inflationary shocks arrive. The resulting increase in the likelihood of future monetary accommodation keeps inflation expectations elevated, making inflation more persistent even after the latest shock dissipates.

Our analysis of the calibrated structural model delivers two main results. First, fiscal-limit risk rises sharply with supply-shock volatility and tighter fiscal limits. The probability that the constraint binds increases from virtually zero to more than 10 percent when high supply-shock volatility coincides with a tight fiscal limit. These two forces reinforce each other: greater volatility increases the likelihood of large inflationary supply disturbances, while a tighter fiscal limit leaves less room for monetary tightening. Consequently, the fiscal constraint can become a quantitatively important restriction on monetary policy when limited fiscal space and elevated supply-side risk coincide, even though the government remains committed to stabilizing debt in the long run.

Second, the constraint binds asymmetrically across shocks, with adverse supply shocks most likely to trigger it. When the constraint binds, the central bank raises rates less aggressively, causing inflation to rise more and the real interest rate to fall rather than rise. The output contraction is milder, while higher inflation and lower real rates help contain debt accumulation, albeit at the cost of persistently elevated inflation. Demand shocks and

disinflationary supply shocks are less likely to trigger the constraint, although inflationary demand shocks can also do so when fiscal space is sufficiently narrow.

Finally, we use the model to interpret two episodes in U.S. inflation history. A particle filter recovers the shocks that jointly account for inflation, output, and debt-to-GDP growth. We then conduct counterfactual exercises in which we shut down the interaction between supply-shock volatility and the fiscal limit.

First, holding the fiscal limit fixed over 1965–1990, the model reproduces the upward inflation ratchet of the 1970s and its reversal in the 1980s. In the model, the Great Inflation emerges from the erosion of fiscal space amid elevated supply-disruption risk, while the subsequent rebuilding of fiscal space and declining risk contribute to the disinflation of the 1980s.

Second, we examine the post-pandemic period, incorporating long-run inflation expectations and VAR-based estimates of time-varying supply-shock volatility. We find that fiscal space narrowed substantially after the pandemic and that this deterioration is crucial for the model to account for the observed rise in long-run inflation expectations.

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.² 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

²The 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).

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. Using nominal and inflation-protected bonds,

Bocola et al. (2024) find that financial markets perceived a weakening of the Federal Reserve’s response to inflation during 2020–2022. We complement this evidence by showing that expected monetary tightening following inflationary supply shocks depends on fiscal conditions. 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 mechanism differs from two prominent channels through which fiscal policy affects inflation. In the fiscal theory of the price level, non-Ricardian fiscal policy determines the price level through 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). Our mechanism does not rely on equilibrium selection under non-Ricardian fiscal policy. Instead, the government remains committed to stabilizing debt in the long run, but its limited tolerance for large deficits constrains monetary tightening in the short run. A second literature emphasizes departures from Ricardian equivalence arising from finite horizons, uninsurable income risk, or borrowing constraints, through which fiscal deficits stimulate private demand (e.g., Angeletos et al., 2024a,b, Kaplan, 2025). Unlike these demand-based mechanisms, our channel operates through fiscal constraints on the monetary-policy response to inflationary shocks. The nonlinear nature of these constraints makes their anticipated effects sensitive to fiscal space and supply-disruption risk, endogenously raising trend inflation and upside inflation tail risks even when the constraints are not binding.

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 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.³ In the presence of limited fiscal responsibility, fiscal pressures can undermine even an initially credible central bank.⁴

2 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.

2.1 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

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

³This resembles Sims’s “stepping on a rake” (Sims, 2011), but operates through the erosion of fiscal space rather than the revaluation of nominal debt.

⁴Burns’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.

subject to the flow budget constraint

$$P_t C_t + Q_t B_t = W_t N_t + B_{t-1} - P_t T_t + P_t D_t, \quad (2)$$

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

$$\zeta_t = \rho_\zeta \zeta_{t-1} + \sigma^\zeta \epsilon_t^\zeta, \quad \text{where } \epsilon_t^\zeta \sim N(0, 1). \quad (3)$$

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:

$$Y_t = \left(\int_0^1 Y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon-1}}, \quad (4)$$

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:

$$P_t = \left[\int_0^1 P_t(j)^{1-\epsilon} dj \right]^{\frac{1}{1-\epsilon}}. \quad (5)$$

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:

$$\varphi \left(\frac{\Pi_t}{\Pi} - 1 \right) \frac{\Pi_t}{\Pi} = (1 - \epsilon) + \epsilon MC_t + \varphi \mathbb{E}_t \left[\Lambda_{t,t+1} \left(\frac{\Pi_{t+1}}{\Pi} - 1 \right) \frac{\Pi_{t+1}}{\Pi} \frac{Y_{t+1}}{Y_t} \right] + \mu_t. \quad (6)$$

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:

$$\mu_t = \rho_\mu \mu_{t-1} + \sigma^\mu \epsilon_t^\mu, \quad \text{where } \epsilon_t^\mu \sim N(0, 1). \quad (7)$$

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

$$Q_t B_t = B_{t-1} - P_t T_t. \quad (8)$$

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:

$$\tau_t = \tau + \delta(b_{t-1} - b) + \delta_Y(Y_t - Y) \quad (9)$$

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

$$C_t = Y_t \left(1 - 0.5\varphi \left(\Pi_t/\Pi - 1\right)^2\right). \quad (10)$$

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.

$$R_t^N = R \left(\frac{\Pi_t}{\Pi}\right)^{\phi_\Pi} \left(\frac{Y_t}{Y}\right)^{\phi_Y} \quad (11)$$

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

$$b_t = R_t \underbrace{\left(b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t\right)}_{\equiv \Theta_t} = R_t \Theta_t, \quad (12)$$

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 (12) 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.⁵

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,

$$\iota_t \equiv (1 - Q_t)b_t = \left(1 - \frac{1}{R_t}\right)b_t = (R_t - 1)\Theta_t. \quad (13)$$

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,

$$\iota_t - \tau_t = (R_t - 1)\Theta_t - \tau_t \leq \bar{\xi}. \quad (14)$$

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

⁵Wolf 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 than lowers debt issuance.

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 when the total deficit would exceed the fiscal limit $\bar{\xi}$, the central bank accommodates the government's desire to contain debt accumulation by lowering the policy interest rate relative to its notional level. The fiscal limit thus translates into an endogenous upper bound on the policy rate. Formally, solving (14) for the policy rate, the fiscal constraint faced by the monetary authority is given by:

$$R_t \leq \bar{R}_t \equiv 1 + \frac{\bar{\xi} + \tau_t}{\Theta_t}. \quad (15)$$

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

$$R_t = \min \left[R_t^N, \bar{R}_t \right]. \quad (16)$$

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 D.1.

2.2 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 (15) 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.

2.3 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 D.2.

The model is calibrated as shown in Table 1. 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 1: 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	$(\Pi-1)^*4$	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 ± 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).⁶ The estimated volatility is shown in Figure 2 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 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.

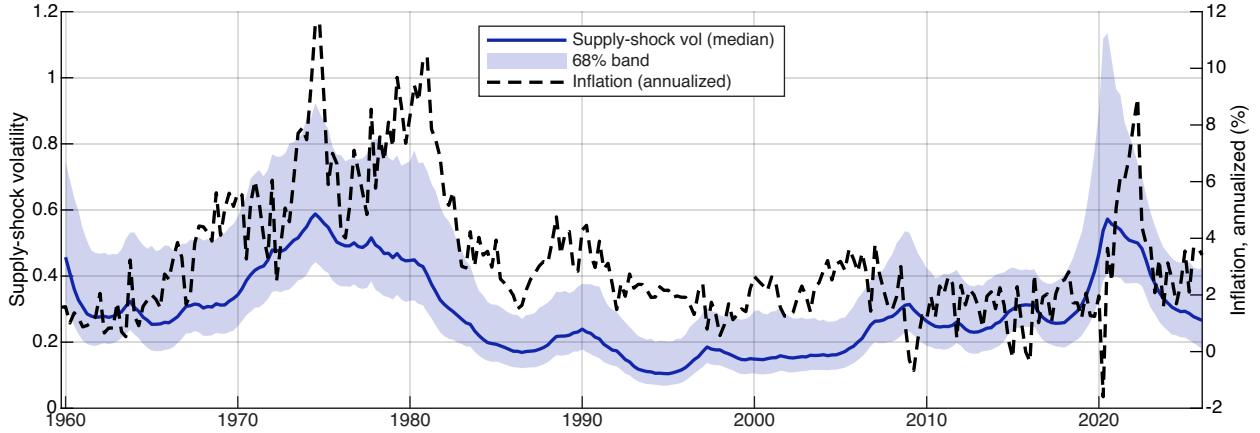


Figure 2: Supply shock volatility and inflation over time. Estimated structural supply shock volatility from bivariate TVP-BVAR and annualized GDP deflator inflation. Sample period from 1960Q1-2025Q4.

3 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,

⁶For estimates of debt-based fiscal limits, see Ghosh et al. (2013), Collard et al. (2015) and Renne and Pallara (2024).

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 1. We then simulate the model for 1,000 periods in the absence of shocks, ensuring convergence to the stochastic (or risky) steady-state equilibrium.

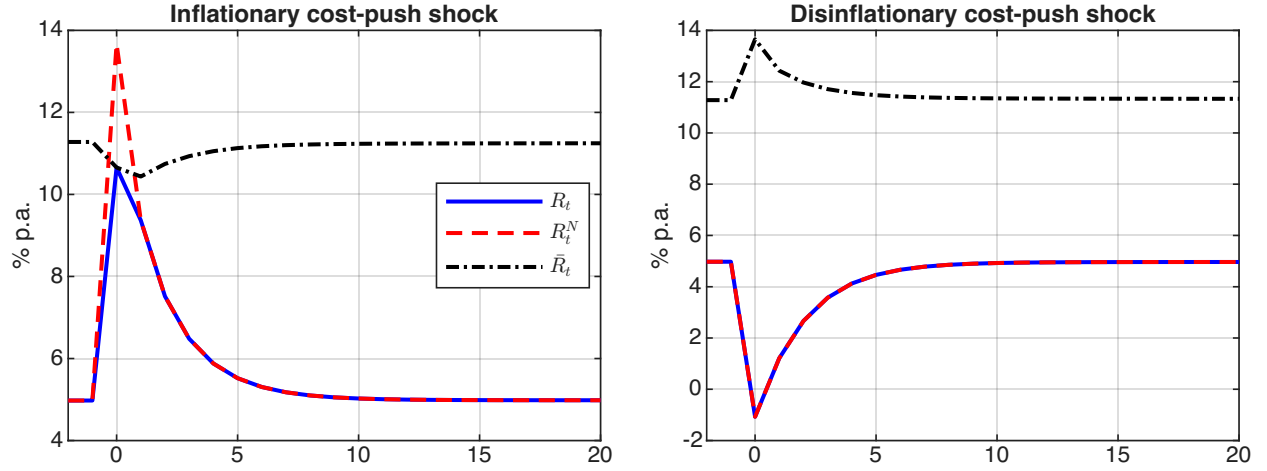


Figure 3: Interest rate dynamics in response to cost-push shock. Dynamics of nominal, notional and upper bound interest rate in response to a three-standard-deviation inflationary (left panel) and disinflationary (right panel) cost-push shock. Interest rates transformed to net interest rates in % per annum. Shock happens in period 0.

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 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 3. 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.

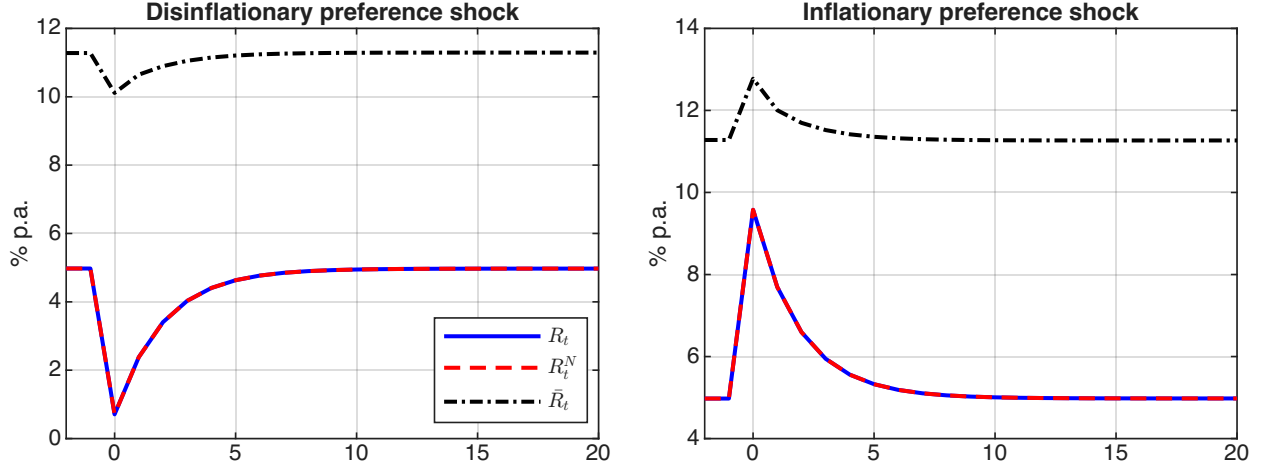


Figure 4: Interest rate dynamics in response to preference shock. Dynamics of nominal, notional, and upper bound interest rate in response to a three-standard-deviation disinflationary (left panel) and inflationary (right panel) preference shock. Interest rates are transformed to net interest rates in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

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, $\bar{R}_t$.

We now turn to demand shocks. The results are reported in Figure 4. 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 4, $\bar{R}_t$ 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 (15). The policy rate, however, declines by considerably more than the fiscal constraint, as shown in the left panel of Figure 4: 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 3 and 4 show the role of the fiscal limit under a given fiscal limit configuration ($\bar{\xi}$) and supply shock volatility. Figure 5 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.

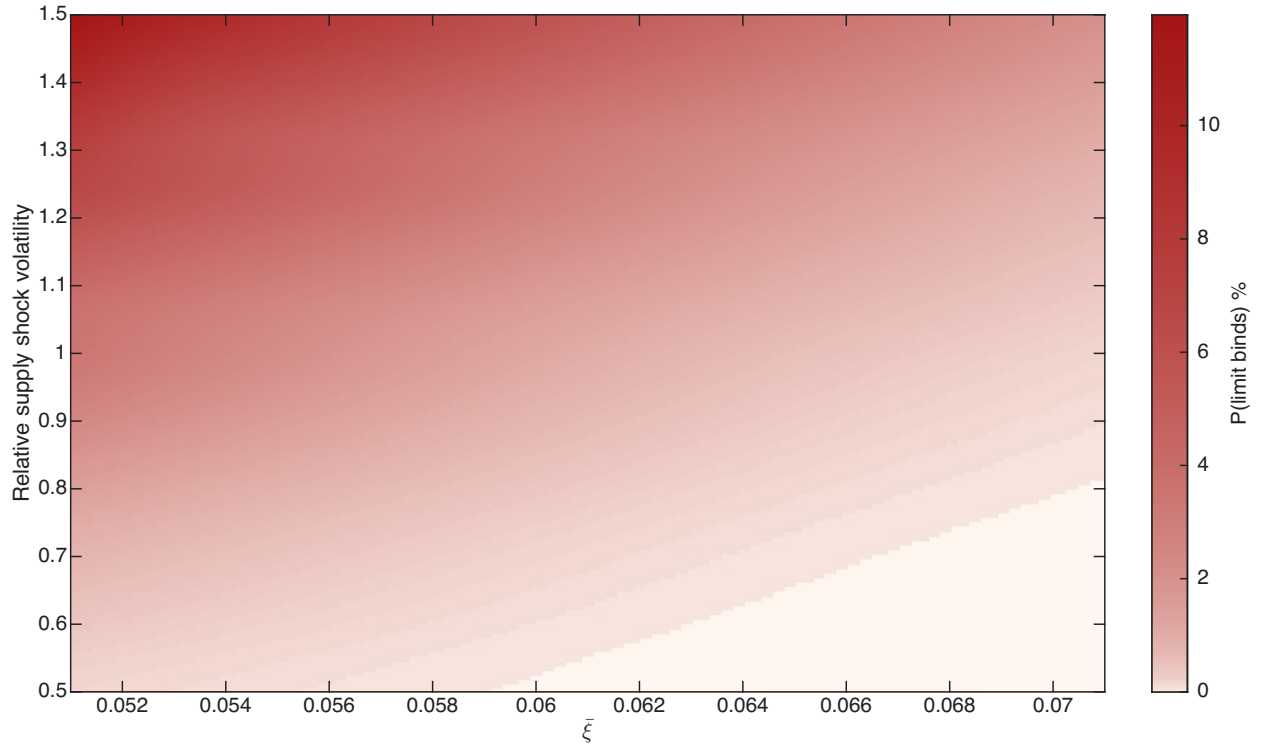


Figure 5: Probability of binding fiscal limit under different fiscal limit and supply shock volatility configurations Average probability of binding fiscal limit as fiscal limit ($\bar{\xi}$) and supply shock volatility varies. Relative supply shock volatility of 1 corresponds to sample average. Estimates 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 6 illustrates this for 4 different combinations of fiscal space and supply shock volatility. In line with Figure 5 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.

4 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 7 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

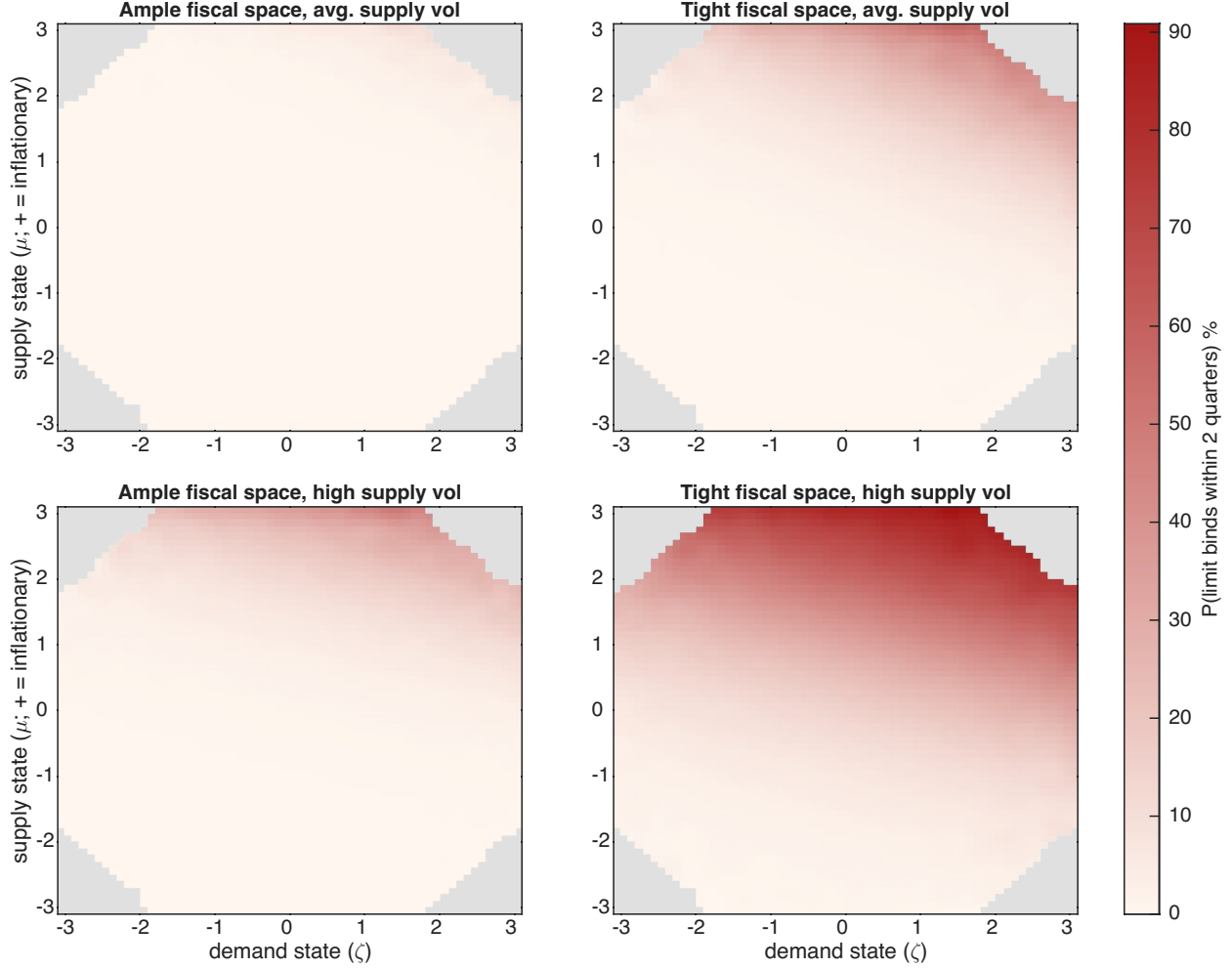


Figure 6: Probability of binding fiscal limit under different demand and supply shock configurations as fiscal space and supply-side risks vary. Probability of binding fiscal limit within next two quarters conditional on demand (ζ) and supply (μ) state. Top left: ample fiscal space and average supply 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.

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

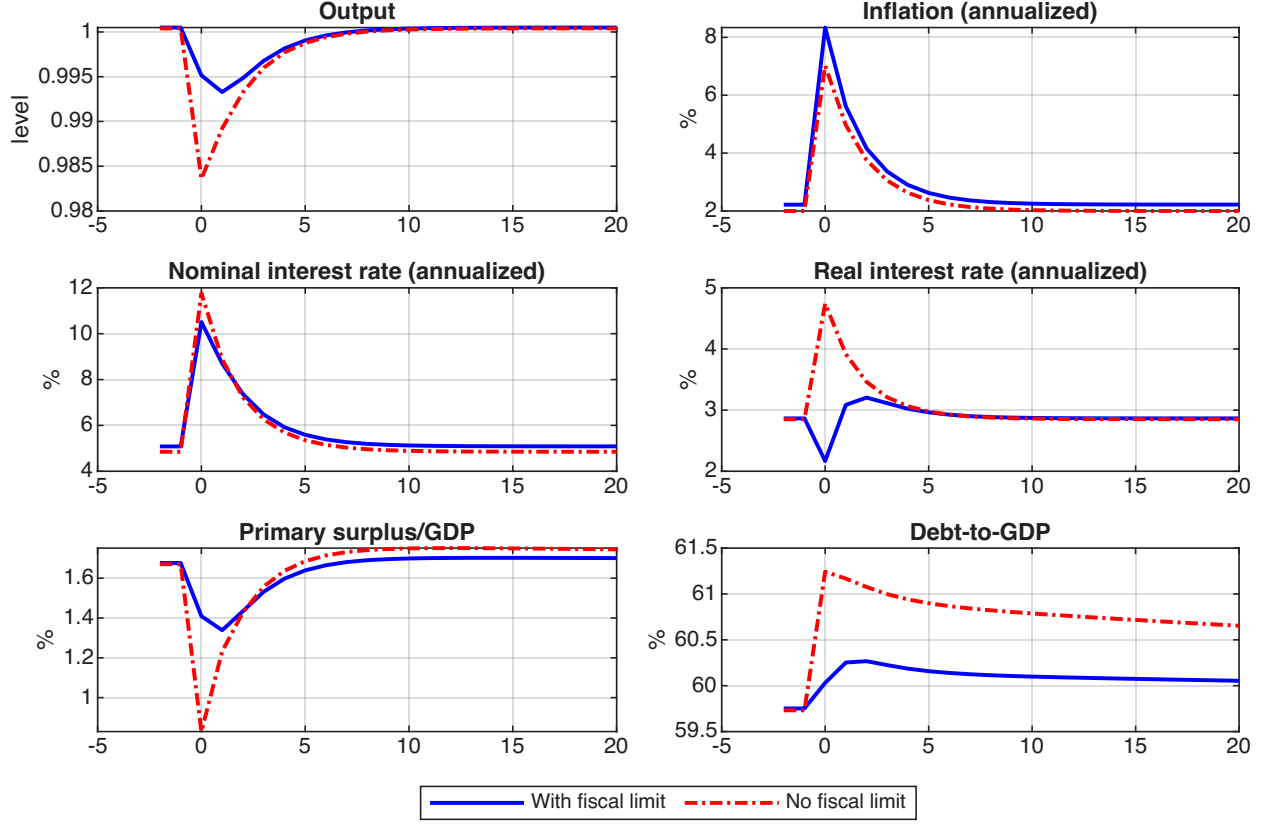


Figure 7: Responses to inflationary cost-push shock. Impulse response functions to a three-standard-deviation inflationary cost-push shock. Responses from the model with a fiscal limit shown in blue and without a fiscal limit in dashed red. Shock happens in period 0.

significantly less than in counterfactual scenario.

The expectation channel. Figures 16-18 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 (9). 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 8 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.

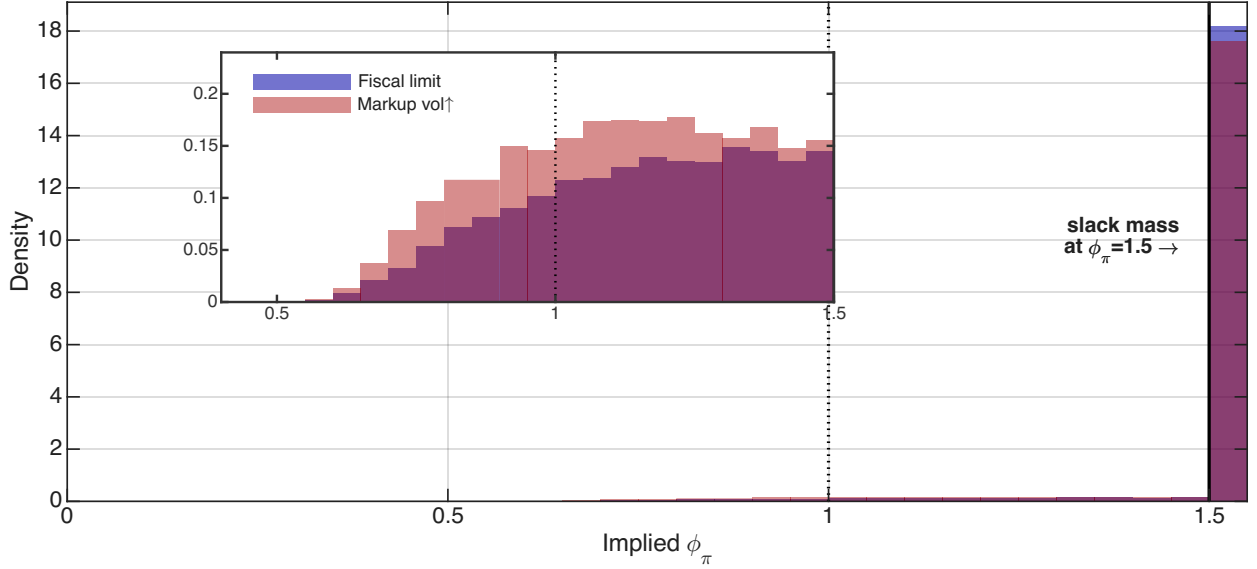


Figure 8: Distribution of implied Taylor rule coefficient ϕ_π . Distribution is computed by solving Taylor rule for ϕ_π and using model-simulated outcomes for inflation, output gap and the interest rate.

5 Empirical validation

The previous section showed that, in the model, the transmission of supply shocks depends on fiscal space. In this section, we provide empirical validation using 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 central prediction of 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.

We use the oil-supply news shocks of Känzig (2021), who 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:

$$y_{t+h} - y_{t-1} = \alpha_h + \delta_h n_{t-1} + \beta_h^+ s_t^+ + \beta_h^- s_t^- + \gamma_h^+(s_t^+ n_{t-1}) + \gamma_h^-(s_t^- n_{t-1}) + \Gamma_h' X_t + \varepsilon_{t+h}, \quad (17)$$

for $h = 0, \dots, 24$. 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.⁷ The sample runs from January 2003, when the series becomes available, to December 2025.

The shock, expressed in units of its standard deviation, is split into inflationary and disinflationary innovations,

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

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 , of the shock, and of four macroeconomic variables: headline CPI inflation, industrial-production growth, real oil-price growth, and the change in the policy rate (the effective federal funds rate, replaced by Krippner’s shadow short rate at the effective lower bound). X_t also includes 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.

⁷The yield may also reflect real term premia and TIPS-specific liquidity. The interaction has the same sign when the outcome is instead the expected real short-rate component of the five-year real yield from the term-structure model of D’Amico et al. (2018), although it is estimated less precisely.

5.1 Fiscal space

Fiscal space in the structural model of Section 2 is the distance between the total deficit and the limit $\bar{\xi}$ the government is willing to tolerate. For the empirical analysis, we focus on the underlying fiscal stance, measured by the cyclically adjusted primary deficit. This measure removes estimated automatic cyclical effects and excludes interest payments, which depend directly on monetary policy. Persistent primary deficits near full employment indicate limited willingness to rebuild fiscal space through budgetary adjustment, leaving public finances more exposed to higher financing costs or a subsequent recession. The indicator captures this source of fiscal vulnerability; the full distance to the model’s fiscal limit also depends on the debt stock, financing costs, and economic activity.

We construct the cyclically adjusted primary deficit,

$$x_q = \text{primary deficit}_q - \varepsilon(u_q - u^*), \quad \varepsilon = 0.6, \quad u^* = 5\%, \quad (18)$$

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.⁸ 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

$$n_{t-1} = \mathbb{1}[x_{q-1} > 1.25], \quad (19)$$

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 to calibrate the fiscal limit $\bar{\xi}$ in Section 2. Narrow fiscal space therefore corresponds to a structural primary deficit in roughly the top decile of its postwar distribution. Under this definition, fiscal space is narrow during 2009Q1–2013Q1 and 2017Q1–2025Q3, accounting for 57 percent of the

⁸CBO’s published adjusted budget estimates are annual, whereas our construction allows the fiscal-state indicator to reflect within-year developments.

estimation sample.

These episodes align with identifiable shifts in the fiscal outlook. The first encompasses the Great Recession and its aftermath, ending around the fiscal tightening associated with the 2013 tax increases and sequestration under the *Budget Control Act*. The second begins following Trump’s election on a platform of substantial tax cuts, explicitly outlined in September 2016 and ultimately enacted in December 2017.⁹ Against an already unfavorable fiscal outlook and a strengthening labor market, this agenda signaled an unwillingness to stabilize debt through fiscal adjustment so as to restore fiscal space. Pandemic-related spending and persistent subsequent deficits reinforced that imbalance. These developments support interpreting the identified periods as episodes of narrow fiscal space.

5.2 Fiscal space changes the response to inflationary supply shocks

Figure 9 presents the impulse responses. The top-left panel contains the central result. When fiscal space is ample, an inflationary oil-supply news shock raises the five-year real yield, by roughly 35 basis points after one year, consistent with markets expecting monetary policy to tighten. When fiscal space is narrow, the response reverses: real yields fall almost immediately and remain about 30 basis points below zero throughout the horizon. 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^+ , which is negative at every horizon. Averaged over the 25 horizons, $\bar{\gamma}^+ = \frac{1}{25} \sum_{h=0}^{24} \gamma_h^+ = -0.467$, with a one-sided bootstrap p -value of 0.016.¹⁰ 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 show that, following disinflationary oil-supply news, narrow fiscal space does not weaken the real-yield response. Real yields fall slightly on impact when fiscal space is ample and rise modestly when it is narrow, and the interaction γ_h^- , averaged across horizons, is not significantly different from zero ($\bar{\gamma}^- = 0.185$, two-sided p -value of 0.26).

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

⁹In his September 15, 2016 speech to the Economic Club of New York, Donald Trump proposed cutting the corporate tax rate from 35 to 15 percent and lowering personal income-tax rates. Large tax cuts were thus a publicly stated part of his agenda well before the December 2017 legislation.

¹⁰The distribution of $\bar{\gamma}^+$ under $H_0: \gamma_h^+ = 0$ for all h is obtained from a block-wild bootstrap that imposes the null, using Gaussian weights, 27-month blocks, and 1,999 replications. The statistic and its bootstrap distribution are computed on the common sample available at $h = 24$, so that the same observations enter every horizon. The analogous statistic $\bar{\gamma}^-$ is used for disinflationary shocks.

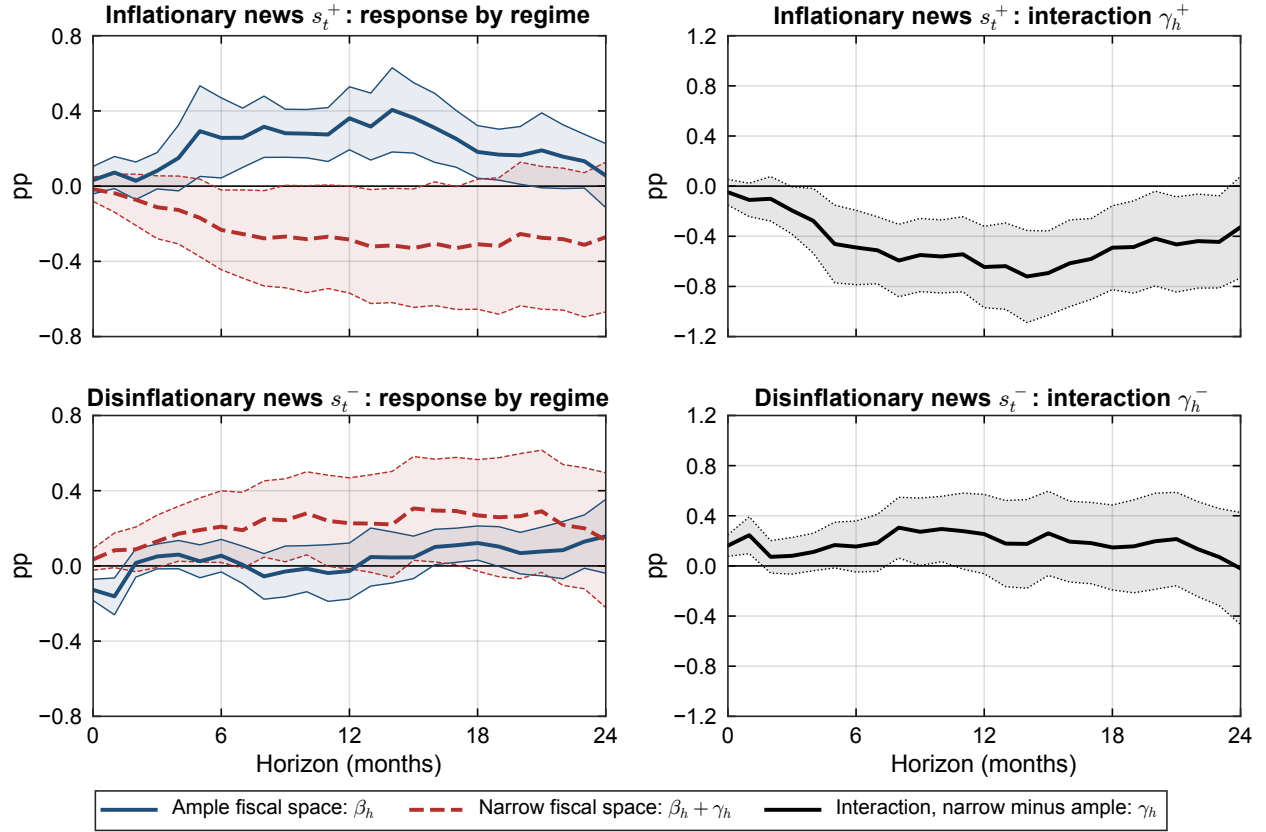


Figure 9: Fiscal space and the transmission of oil-supply news shocks. Estimates of (17) with 90 percent Newey–West confidence bands, 2003M1–2025M12. The left panels report the response of the five-year TIPS yield to a one-standard-deviation shock when fiscal space is ample ($\beta_h^\pm$, solid blue) and narrow ($\beta_h^\pm + \gamma_h^\pm$, dashed red); the right panels report the interaction $\gamma_h^\pm$. *Top row*, inflationary oil-supply news: $\bar{\gamma}^+ = -0.467$ (one-sided bootstrap $p = 0.016$). *Bottom row*, disinflationary oil-supply news: $\bar{\gamma}^- = +0.185$ (two-sided $p = 0.26$). Vertical scales are common across rows within each column.

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 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. This is consistent with the structural model, which abstracts from this form of strategic monetary–fiscal interaction.

5.3 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 ($\bar{\gamma}^+ = 0.03$, $p = 0.61$), and a winsorized version gives 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. Moving the threshold between 0.70 and 1.90 percent of GDP—roughly the 88th through 92nd percentiles of the postwar distribution—produces estimates of $\bar{\gamma}^+$ between -0.19 and -0.47 , all significant at the 10 percent level and, for cutoffs between 1.15 and 1.70, 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 postwar percentile, so a sample-relative split would classify historically elevated deficits as normal. Cutoffs anchored at the postwar 80th and 85th percentiles give $\bar{\gamma}^+ = -0.39$ ($p = 0.024$) and -0.32 ($p = 0.021$).

Two limitations qualify the reduced-form interpretation. First, approximately half of the quarters classified as having narrow fiscal space overlap with ZLB periods. However, inflation expectations rise following inflationary oil-supply news, so preserving real interest rates would require nominal tightening, which the ZLB does not prevent. Nevertheless, to allow for different monetary-policy conditions during the first ZLB episode, we add a dummy for December 2008–November 2015 and its interaction with inflationary oil-supply news, alongside the baseline pandemic controls. The estimated fiscal-state differential is unchanged at -51 basis points, compared with -47 basis points in the baseline ($p = 0.021$).

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.

A randomization placebo. The disinflationary interaction tests a restriction the theory implies; a second placebo asks whether any regime split of this shape would deliver the result. We circularly shift the narrow-regime indicator through the sample, which preserves its length, its two-block structure, its 57 percent share and its autocorrelation while breaking its alignment with the shocks and yields. Across all 275 shifts the placebo estimates are centered at -0.01 with a standard deviation of 0.27 , and twelve draws, all from a single cluster of adjacent shifts, are at least as negative as the actual estimate of -0.467 , giving a randomization p -value of 0.047 . The state dependence is therefore specific to when fiscal space was in fact narrow, not a mechanical consequence of splitting the sample into two long blocks. Appendix C gives details.

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 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.

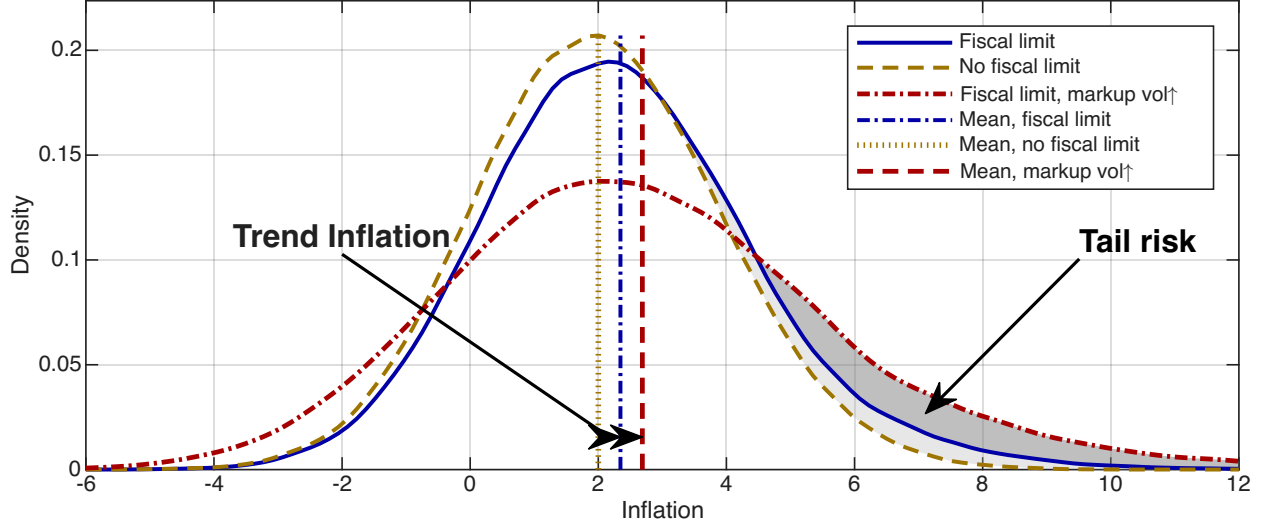


Figure 10: Distribution of inflation outcomes under model with and without fiscal limit. Model simulated for 100,000 periods under three model configurations: (i) no fiscal limit (yellow), (ii) fiscal limit and average supply shock volatility (blue) and (iii) fiscal limit and above sample average supply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

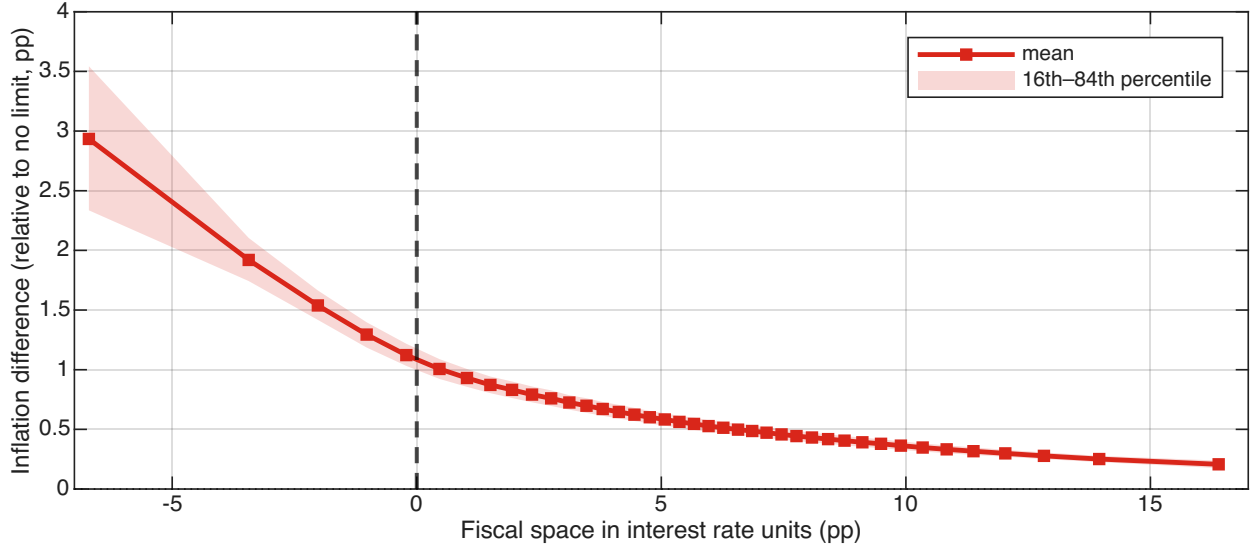


Figure 11: Fiscal inflation for varying fiscal space. Model is simulated for 100,000 periods. Fiscal space is computed as $400 * (\bar{R}_t - R_t^N)$ and inflation outcomes are grouped within fiscal space bins. The solid line shows the mean inflation difference and the shaded area the 16th-84th percentile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

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 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,

$$X_t = f(X_{t-1}, \Omega_t, \nu_t), \quad (20)$$

$$Y_t = g(X_t) + \mu_t, \quad (21)$$

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 (20) is the transition equation. The nonlinear function f is obtained directly from the global solution of the model. Equation (21) 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 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 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

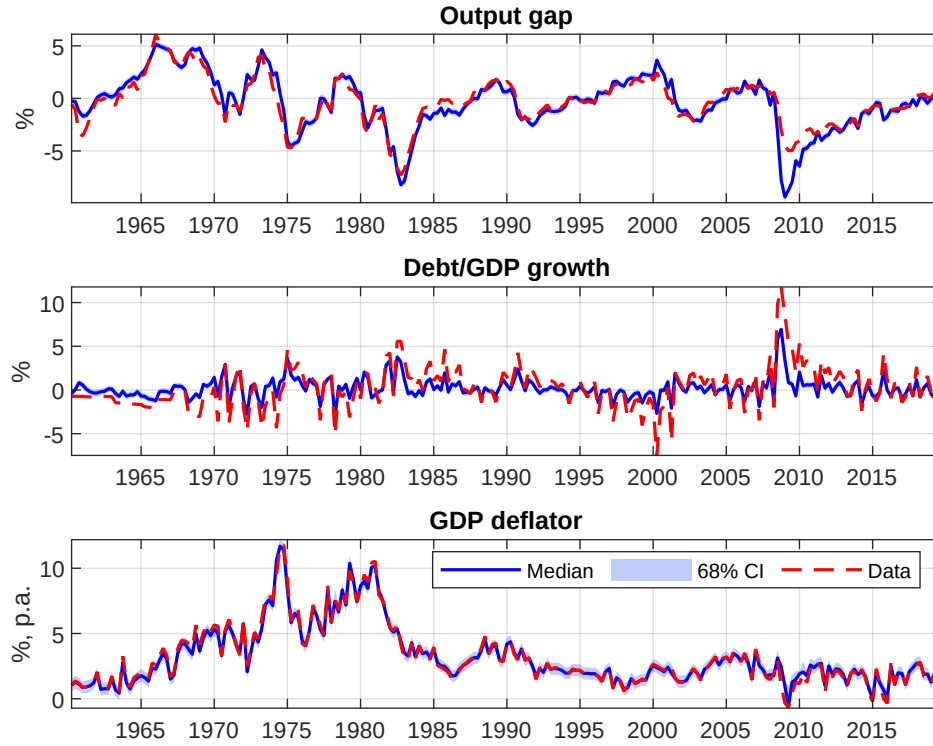


Figure 12: Estimated paths of the observables. Posterior medians and 68 percent credible intervals from the particle filter, together with the observed output gap, debt-to-GDP growth, and annualized GDP-deflator inflation. The sample runs from 1960:Q1 through 2019:Q4.

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.

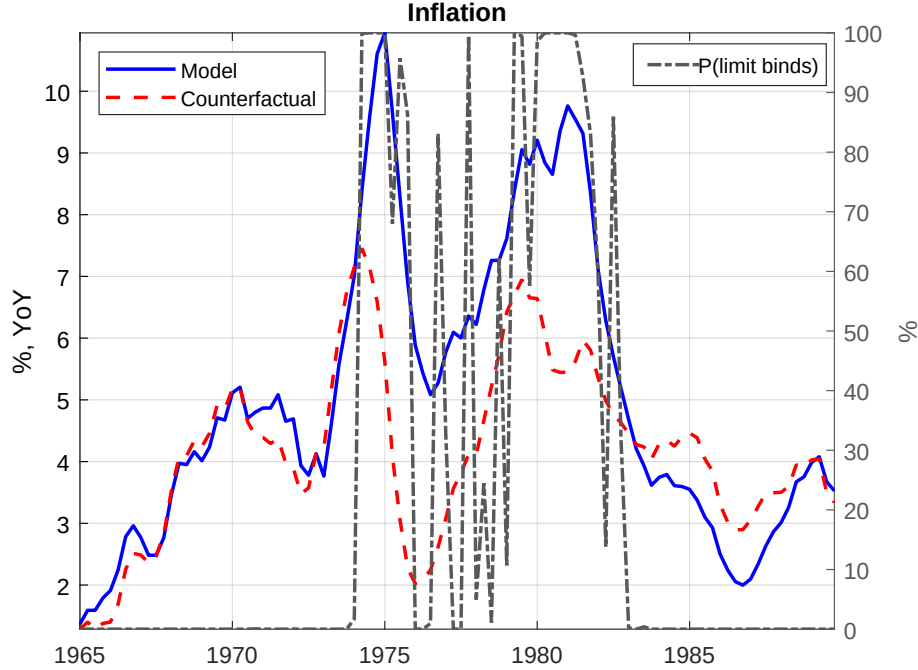


Figure 13: Inflation dynamics in the 1970s and 1980s. The solid blue line shows inflation generated by the filtered baseline model, while the dashed red line shows inflation in the counterfactual model that shuts down the interaction between supply-shock volatility and the fiscal limit. The dashed black 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.

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

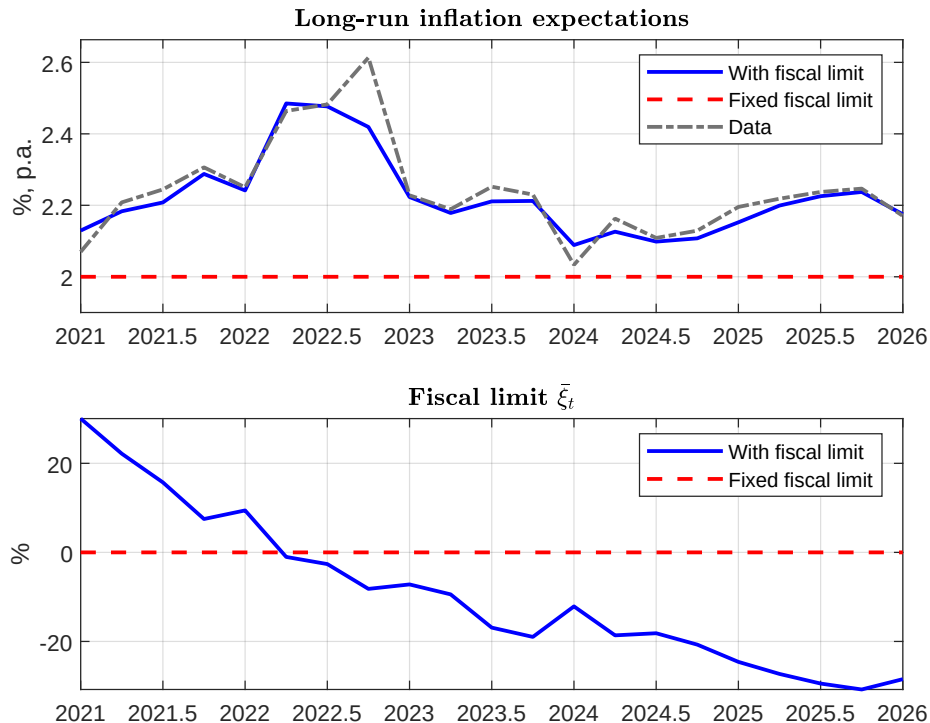


Figure 14: Long-run inflation expectations and the time-varying fiscal limit. The upper panel reports average long-run PCE inflation expectations from the Survey of Professional Forecasters, together with the model-implied paths under a time-varying fiscal limit and under a fiscal limit fixed at its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

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 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 commits to stabilizing debt in the long run but, during recessions or periods of large primary deficits, wants monetary policy to help slow debt growth. We capture this preference through a limit on the total deficit the government is willing to tolerate. Because monetary tightening weakens activity and raises debt-service costs, this limit creates 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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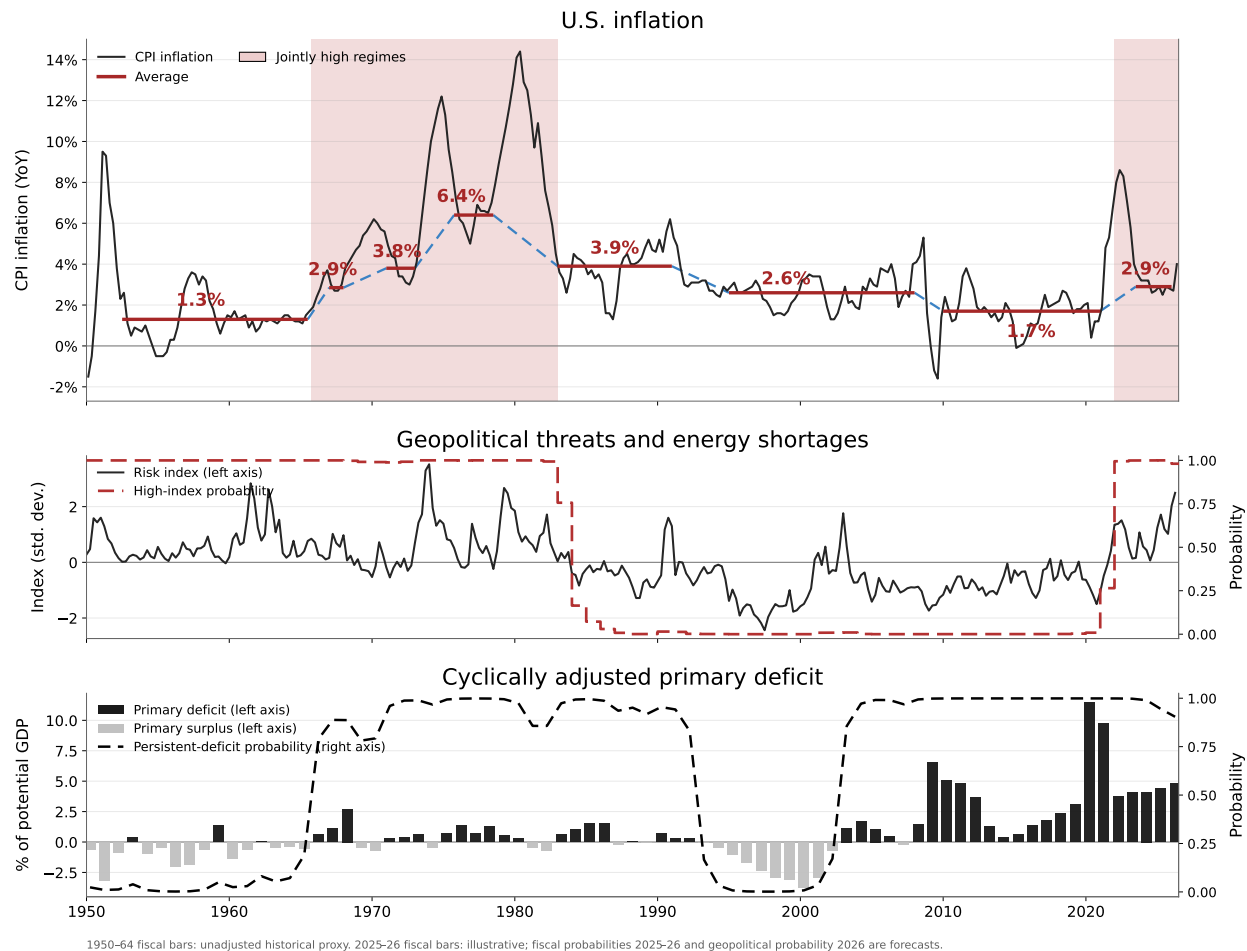


Figure 15: Geopolitical Risk, Primary Deficits, and Inflation

Notes: The top panel reports year-on-year U.S. CPI inflation, with horizontal red lines indicating average inflation across selected periods. The middle panel displays a news-based proxy for supply-disruption risk constructed from indicators of geopolitical threats and energy shortages (Caldara and Iacoviello, 2022; Caldara, Iacoviello, and Yu, 2025; Iacoviello and Tong, 2026), together with the probability of a high-risk regime. The bottom panel reports the cyclically adjusted primary deficit as a percentage of GDP and the probability of a persistent-deficit regime. Shaded areas identify periods in which elevated supply-disruption risk and persistent primary deficits coincide.

A Historical Evidence from News-Based Indicators of Supply-Disruption Risk

This appendix provides additional evidence for the historical narrative discussed in the introduction. We use news-based indicators of geopolitical threats and energy shortages (Caldara and Iacoviello, 2022, Caldara et al., 2025, Iacoviello and Tong, 2026) to construct a proxy for supply-disruption risk. Figure 15 compares this proxy with the cyclically adjusted primary deficit and U.S. inflation. The figure also reports the probabilities of elevated supply-disruption risk and persistent primary deficits, highlighting periods in which both conditions prevail.

The figure highlights four historical episodes. During the 1950s and early 1960s, geopolitical tensions elevated supply-disruption risk, but persistent primary surpluses coincided with no sustained upward inflation ratchet. Beginning in the mid-1960s, primary deficits became persistent while supply-disruption risk remained elevated, coinciding with the successive upward shifts in inflation during the late 1960s and 1970s. In the 1980s, inflation declined despite persistent primary deficits, as supply-disruption risk receded. Similarly, during the 2010s, persistent primary deficits coincided with contained disruption risk and low inflation. Since 2021, elevated supply-disruption risk has again coincided with exceptionally large primary deficits and a renewed increase in inflation.

The shaded regions identify the two episodes in which persistent primary deficits and elevated supply-disruption risk jointly prevailed: the late 1960s and 1970s, and the post-pandemic period. Both coincide with upward shifts in inflation. Conversely, periods in which only one of these conditions prevailed did not exhibit sustained upward inflation ratcheting. Although this evidence is descriptive, it corroborates the historical narrative in the introduction and motivates our emphasis on the interaction between fiscal conditions and supply-disruption risk in explaining inflation dynamics.

B Construction of the cyclically adjusted primary deficit

Our fiscal-state indicator measures the underlying federal primary deficit after removing its estimated cyclical component. We construct the quarterly primary deficit from National Income and Product Accounts (NIPA) data as

$$pd_q = 100 \frac{-S_q - I_q}{GDP_q}, \quad (22)$$

where S_q denotes net federal government saving, I_q denotes federal interest outlays, and GDP_q is nominal GDP. Because government saving is positive for a surplus, its negative measures the deficit; subtracting interest outlays yields the primary deficit. All flows are measured on a consistent annualized basis. Thus, pd_q is expressed as a percentage of GDP, with positive values indicating a primary deficit.

We estimate the cyclical component of the primary deficit using the unemployment gap:

$$\tilde{x}_q = pd_q - \varepsilon(u_q - u^*), \quad \varepsilon = 0.6, \quad u^* = 5, \quad (23)$$

where u_q is the quarterly average unemployment rate and u^* is the benchmark unemployment rate. Both rates are expressed in percentage points, so that an unemployment rate of 6 percent corresponds to $u_q = 6$. The coefficient $\varepsilon = 0.6$ implies that unemployment one percentage point above the benchmark raises the primary deficit by an estimated 0.6 percentage points of GDP through automatic stabilizers. We subtract this component to obtain the cyclically adjusted primary deficit. Conversely, when unemployment is below the benchmark, the adjustment removes the estimated cyclical improvement in the primary balance.

The adjustment combines a budget semi-elasticity with a gap version of Okun's law. Specifically, let

$$\hat{y}_q \simeq -\kappa(u_q - u^*), \quad (24)$$

where $\hat{y}_q$ is the output gap in percent and κ is approximately 2. If the cyclical component of the primary deficit is $-\eta\hat{y}_q$, the implied unemployment-gap coefficient is $\varepsilon = \eta\kappa$. Our calibration of $\varepsilon = 0.6$ therefore corresponds to a budget semi-elasticity of approximately 0.3 combined with an Okun coefficient of 2. This parsimonious adjustment is informed by CBO estimates of automatic stabilizers; it does not replicate CBO’s detailed adjustment of individual revenue and expenditure categories.

To capture persistent fiscal imbalances and smooth short-run fluctuations, we average the adjusted deficit over four quarters:

$$x_q = \frac{1}{4} \sum_{j=0}^3 \tilde{x}_{q-j}. \quad (25)$$

The resulting series remains expressed as a percentage of GDP. For each month t in quarter q , the baseline fiscal-state indicator uses x_{q-1} , the four-quarter average ending in the preceding quarter:

$$n_{t-1} = \mathbb{1}[x_{q-1} > 1.25]. \quad (26)$$

Thus, the fiscal measure is quarterly even though the local projections are estimated at monthly frequency.

The fixed unemployment benchmark provides a transparent reference for the cyclical adjustment. Nevertheless, the resulting measure is an approximation to the underlying fiscal stance, rather than a direct measure of discretionary fiscal policy or an exogenous fiscal shock.

C A Randomization Placebo for the Fiscal Regime

The narrow-regime indicator in Section 5 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

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

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 (17) 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 2 summarizes the resulting placebo estimates. Their mean is close to zero, at -0.01 , compared with the actual estimate of -0.467 . Twelve of the 275 placebo estimates are at least as negative as the actual estimate. Using the formula in the table notes, this gives a one-sided randomization p -value of 0.047. The twelve estimates come from a single cluster of adjacent shifts, of 178 to 193 months, which place nearly identical regimes on the sample and are therefore far from independent draws.

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, where overlap is the share of actual narrow-regime months that remain in the narrow regime after the shift. The corresponding p -values are 0.055 and 0.065. Excluding shifts of fewer than 18 months in either direction gives $p = 0.054$.

Table 2: Placebo estimates of $\bar{\gamma}^+$ after shifting the fiscal regime

Shifts included	n	Mean	S.d.	Minimum	p
All shifts	275	-0.012	0.266	-0.615	0.047
Overlap with actual $< 75\%$	237	$+0.021$	0.261	-0.615	0.055
Overlap with actual $< 50\%$	106	$+0.003$	0.270	-0.510	0.065
Shift ≥ 18 months	241	$+0.017$	0.262	-0.615	0.054
<i>Actual regime: $\bar{\gamma}^+ = -0.467$</i>					

Each placebo estimate is obtained by re-estimating (17) 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 -0.571 , -0.464 , and -0.408 ; the median is $+0.092$.

Interpretation. The placebo estimates are centered near zero, and few 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.

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

D.1 Model equations

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

$$\max_{\{C_t, N_t, B_t\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t e^{\zeta_t} \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \psi \frac{N_t^{1+\eta}}{1+\eta} \right) \quad (27)$$

subject to the flow budget constraint

$$P_t C_t + Q_t B_t = W_t N_t + B_{t-1} - P_t T_t + P_t D_t, \quad \text{where } Q_t = \frac{1}{R_t}. \quad (28)$$

Let λ_t be the Lagrange multiplier on equation (28) the first order conditions are given by

$$e^{\zeta_t} C_t^{-\sigma} = \lambda_t P_t \quad (29)$$

$$e^{\zeta_t} \psi N_t^\eta = \lambda_t W_t \quad (30)$$

$$Q_t \lambda_t = \beta \mathbb{E}_t[\lambda_{t+1}] \quad (31)$$

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

$$\frac{W_t}{P_t} = \psi N_t^\eta C_t^\sigma \quad (32)$$

$$C_t^{-\sigma} = \beta R_t \mathbb{E}_t \left[e^{\zeta_{t+1} - \zeta_t} C_{t+1}^{-\sigma} \frac{P_t}{P_{t+1}} \right] \quad (33)$$

The preference shock ζ follows an AR(1) process

$$\zeta_t = \rho_\zeta \zeta_{t-1} + \sigma^\zeta \epsilon_t^\zeta, \quad \text{where } \epsilon_t^\zeta \sim N(0, 1). \quad (34)$$

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:

$$Y_t = \left(\int_0^1 Y_t(j)^{\frac{\epsilon-1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon-1}}, \quad (35)$$

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

$$P_t = \left(\int_0^1 P_t(j)^{1-\epsilon} dj \right)^{\frac{1}{1-\epsilon}}, \quad (36)$$

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

$$Y_t(j) = \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t. \quad (37)$$

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

$$Y_t(j) = N_t(j) \quad (38)$$

and demand labor to produce the amount of differentiated goods to be sold to households in

a monopolistic competitive market

$$\min_{N_t(j)} W_t N_t(j) \quad (39)$$

$$\text{s.t. } N_t(j) \geq \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t \quad (40)$$

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

$$\theta_t(j) = W_t \quad \forall j \quad (41)$$

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

$$\max_{P_t(j)} \left(\frac{P_t(j)}{P_t} \right)^{1-\epsilon} Y_t - MC_t \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} Y_t - \frac{\varphi}{2} \left(\frac{P_t(j)}{\Pi P_{t-1}(j)} - 1 \right)^2 Y_t \quad (42)$$

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

$$\begin{aligned} (\epsilon - 1) \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} \frac{Y_t}{P_t} &= \epsilon MC_t \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon-1} \frac{Y_t}{P_t} - \varphi \left(\frac{P_t(j)}{\Pi P_{t-1}(j)} - 1 \right) \frac{Y_t}{\Pi P_{t-1}(j)} \\ &+ \varphi \mathbb{E}_t \Lambda_{t,t+1} \left(\frac{P_{t+1}(j)}{\Pi P_t(j)} - 1 \right) \frac{P_{t+1}(j)}{\Pi P_t(j)} \frac{Y_{t+1}}{P_t(j)}. \end{aligned} \quad (43)$$

where the stochastic discount factor is

$$\Lambda_{t,t+1} = \beta e^{\zeta_{t+1} - \zeta_t} \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma}. \quad (44)$$

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

$$\varphi \left(\frac{\Pi_t}{\Pi} - 1 \right) \frac{\Pi_t}{\Pi} = (1 - \epsilon) + \epsilon MC_t + \varphi \mathbb{E}_t \left[\Lambda_{t,t+1} \left(\frac{\Pi_{t+1}}{\Pi} - 1 \right) \frac{\Pi_{t+1}}{\Pi} \frac{Y_{t+1}}{Y_t} \right] + \mu_t. \quad (45)$$

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

$$\mu_t = \rho_\mu \mu_{t-1} + \sigma^\mu \epsilon_t^\mu, \quad \text{where } \epsilon_t^\mu \sim N(0, 1). \quad (46)$$

Finally, in equilibrium we have

$$Y_t = N_t. \quad (47)$$

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

$$Q_t B_t = B_{t-1} - P_t T_t \quad (48)$$

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

$$b_t = R_t \left(b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t \right) \quad (49)$$

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

$$\tau_t = \tau + \delta(b_{t-1} - b) + \delta_Y(Y_t - Y) \quad (50)$$

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.

The monetary authority sets the nominal interest rate based on a standard monetary rule but taking into account the fiscal limit on the total deficit, $(R_t - 1)\Theta_t - \tau_t \leq \bar{\xi}$ (see Section 2), such that the interest rate is constrained by an upper bound

$$R_t \leq \bar{R}_t \equiv \frac{b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} + \bar{\xi}}{b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t} \quad (51)$$

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

$$R_t = \min \left[R_t^N, \bar{R}_t \right]. \quad (52)$$

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

$$R_t^N = R \left(\frac{\Pi_t}{\Pi} \right)^{\phi_\pi} \left(\frac{Y_t}{Y} \right)^{\phi_Y}. \quad (53)$$

The resource constraint is

$$C_t = Y_t \left[1 - \frac{\varphi}{2} \left(\frac{\Pi_t}{\Pi} - 1 \right)^2 \right]. \quad (54)$$

Taken together, the model can be summarized by equations (32), (33), (34), (41), (44), (45), (46), (47), (49), (50), (51), (53) and (54), which we repeat for convenience below:

$$\frac{W_t}{P_t} = \psi N_t^\eta C_t^\sigma \quad (55)$$

$$C_t^{-\sigma} = \beta R_t \mathbb{E}_t \left[e^{\zeta_{t+1} - \zeta_t} C_{t+1}^{-\sigma} \frac{1}{\Pi_{t+1}} \right], \quad (56)$$

$$\theta_t = W_t, \quad (57)$$

$$\Lambda_{t,t+1} = \beta e^{\zeta_{t+1} - \zeta_t} \left(\frac{C_{t+1}}{C_t} \right)^{-\sigma}, \quad (58)$$

$$\varphi \left(\frac{\Pi_t}{\Pi} - 1 \right) \frac{\Pi_t}{\Pi} = (1 - \epsilon) + \epsilon M C_t + \varphi \mathbb{E}_t \left[\Lambda_{t,t+1} \left(\frac{\Pi_{t+1}}{\Pi} - 1 \right) \frac{\Pi_{t+1}}{\Pi} \frac{Y_{t+1}}{Y_t} \right] + \mu_t, \quad (59)$$

$$Y_t = N_t, \quad (60)$$

$$b_t = R_t \left(b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t \right), \quad (61)$$

$$\tau_t = \tau + \delta(b_{t-1} - b) + \delta_Y(Y_t - Y), \quad (62)$$

$$R_t = \min \left[R_t^N, \frac{b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} + \bar{\xi}}{b_{t-1} \frac{Y_{t-1}}{\Pi_t Y_t} - \tau_t} \right], \quad (63)$$

$$R_t^N = R \left(\frac{\Pi_t}{\Pi} \right)^{\phi_\Pi} \left(\frac{Y_t}{Y} \right)^{\phi_Y}, \quad (64)$$

$$C_t = Y_t \left[1 - \frac{\varphi}{2} \left(\frac{\Pi_t}{\Pi} - 1 \right)^2 \right], \quad (65)$$

$$\zeta_t = \rho_\zeta \zeta_{t-1} + \sigma^\zeta \epsilon_t^\zeta, \quad (66)$$

$$\mu_t = \rho_\mu \mu_{t-1} + \sigma^\mu \epsilon_t^\mu \quad (67)$$

D.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).¹¹ Expectations are calculated using numerical integration based on Gauss-Hermite quadrature.

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 $\bar{R}_t$:

$$\Pi_t = g^1(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (68)$$

$$N_t = g^2(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (69)$$

$$\bar{R}_t = g^3(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (70)$$

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

$$\Pi_t = \tilde{g}^1(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (71)$$

$$N_t = \tilde{g}^2(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (72)$$

$$\bar{R}_t = \tilde{g}^3(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (73)$$

¹¹This approach can handle the nonlinearities associated with the monetary policy rule.

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

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

$$\Pi_t = \tilde{g}^1(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (74)$$

$$N_t = \tilde{g}^2(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (75)$$

$$\bar{R}_t = \tilde{g}^3(b_{t-1}, Y_{t-1}, \mu_t, \zeta_t) \quad (76)$$

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

$$\tilde{Y}_t = N_t \quad (77)$$

$$\tilde{C}_t = \tilde{Y}_t (1 - 0.5\varphi \left(\frac{\Pi_t}{\Pi} - 1 \right)^2) \quad (78)$$

$$\tilde{w}_t = \psi N_t^\eta \tilde{C}_t^\sigma \quad (79)$$

$$R_t^N = R \left(\frac{\Pi_t}{\Pi} \right)^{\phi_\Pi} \left(\frac{\tilde{Y}_t}{\tilde{Y}} \right)^{\phi_Y} \quad (80)$$

$$\tilde{R}_t = \min [\bar{R}_t, R_t^N] \quad (81)$$

$$\tilde{\tau}_t = \tau + \delta(b_{t-1} - b) + \delta_Y(\tilde{Y}_t - Y) \quad (82)$$

$$\tilde{b}_t = \tilde{R}_t \left(b_{t-1} \frac{Y_{t-1}}{\Pi_t \tilde{Y}_t} - \tilde{\tau}_t \right) \quad (83)$$

$$MC_t = \tilde{w}_t \quad (84)$$

Given these variables we can also compute

$$\bar{R}_t^{new} = \frac{\bar{b}}{b_{t-1} \frac{Y_{t-1}}{\Pi_t \tilde{Y}_t} - \tilde{\tau}_t} \quad (85)$$

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

$$\mu_{t+1}^i = \exp \left(\rho_\mu \log(\mu_t) + \epsilon_{t+1}^{\mu, i} \right) \quad (86)$$

$$\zeta_{t+1}^i = \exp \left(\rho_\zeta \log(\zeta_t) + \epsilon_{t+1}^{\zeta, i} \right) \quad (87)$$

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:

$$\Pi_{t+1}^i = \tilde{g}^1(\tilde{b}_t, \tilde{Y}_t, \mu_{t+1}^i, \zeta_{t+1}^i) \quad (88)$$

$$N_{t+1}^i = \tilde{g}^2(\tilde{b}_t, \tilde{Y}_t, \mu_{t+1}^i, \zeta_{t+1}^i) \quad (89)$$

$$\tilde{Y}_{t+1}^i = N_{t+1}^i \quad (90)$$

$$\tilde{C}_{t+1}^i = \tilde{Y}_{t+1}^i (1 - 0.5\varphi \left(\frac{\Pi_{t+1}^i}{\Pi} - 1 \right)^2) \quad (91)$$

$$\tilde{\Lambda}_{t,t+1}^i = \beta \left(\frac{\zeta_{t+1}^i}{\zeta_t} \right) \left(\frac{\tilde{C}_{t+1}^i}{\tilde{C}_t} \right)^{-\sigma} \quad (92)$$

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

$$err_1 = 1 - \tilde{R}_t E_t \left[\tilde{\Lambda}_{t,t+1} \frac{1}{\tilde{\Pi}_{t+1}} \right] \quad (93)$$

$$err_2 = \varphi \left(\frac{\Pi_t}{\Pi} - 1 \right) \frac{\Pi_t}{\Pi} - (1 - \epsilon) - \epsilon MC_t - \quad (94)$$

$$\varphi E_t \tilde{\Lambda}_{t,t+1} \left(\frac{\tilde{\Pi}_{t+1}}{\Pi} - 1 \right) \left(\frac{\tilde{\Pi}_{t+1}}{\Pi} \right) \frac{\tilde{Y}_{t+1}}{\tilde{Y}_t} + \ln(\mu_t) \quad (95)$$

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

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 $[\epsilon^{\mu,i}, \epsilon^{\zeta,i}]$ and the corresponding weights $\xi(i)$ for all integration nodes $i \in \{1, 2, \dots, I\}$. We use 9 nodes for both shocks so that we evaluate the expectations using $I = 81$ weighted points.

E Additional figures

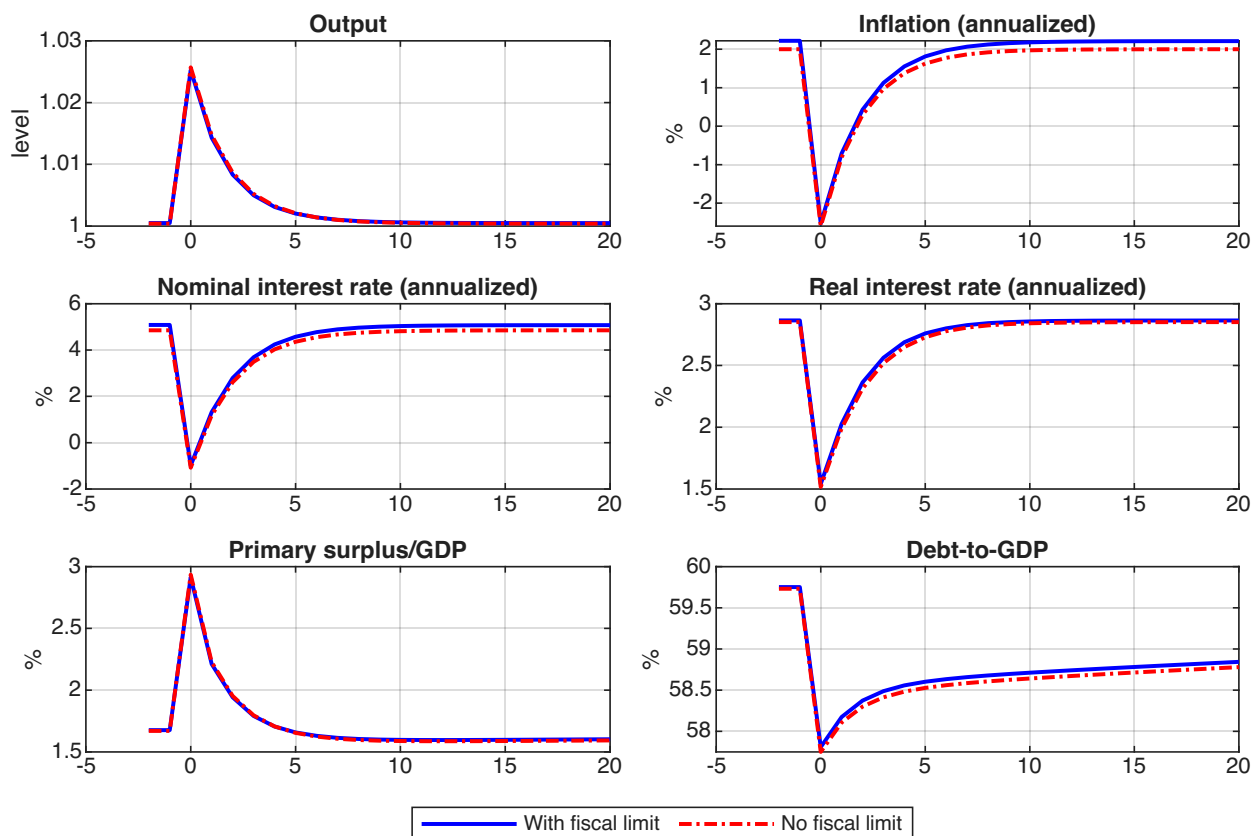


Figure 16: Responses to disinflationary cost-push shock. Impulse response functions to a three-standard-deviation disinflationary cost-push shock. Responses from the model with a fiscal limit shown in blue and without a fiscal limit in dashed red. Shock happens in period 0. Figures show dynamics in deviation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

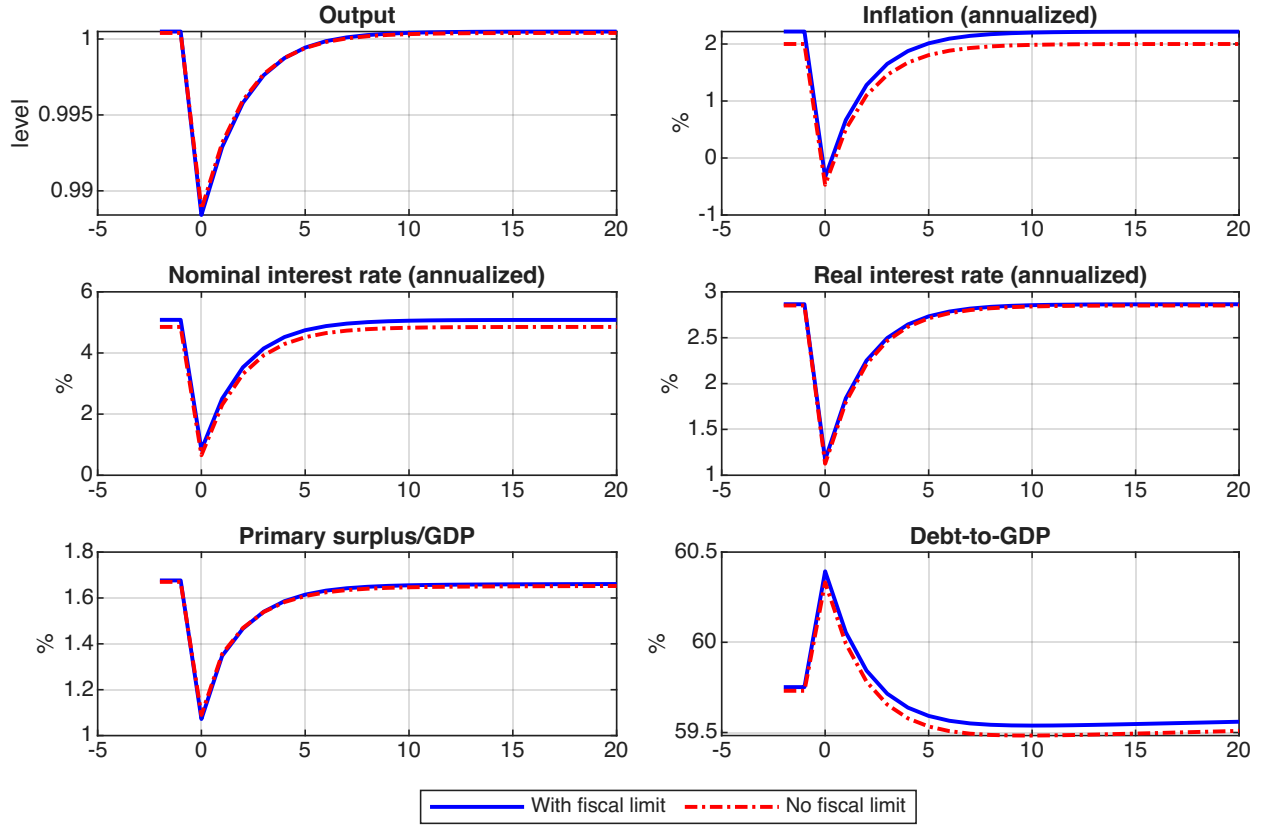


Figure 17: Responses to disinflationary preference shock. Impulse response functions to a three-standard-deviation disinflationary preference shock. Responses from model with fiscal limit shown in blue and without fiscal limit in dashed red. Shock happens in period 0. Figures show dynamics in deviation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

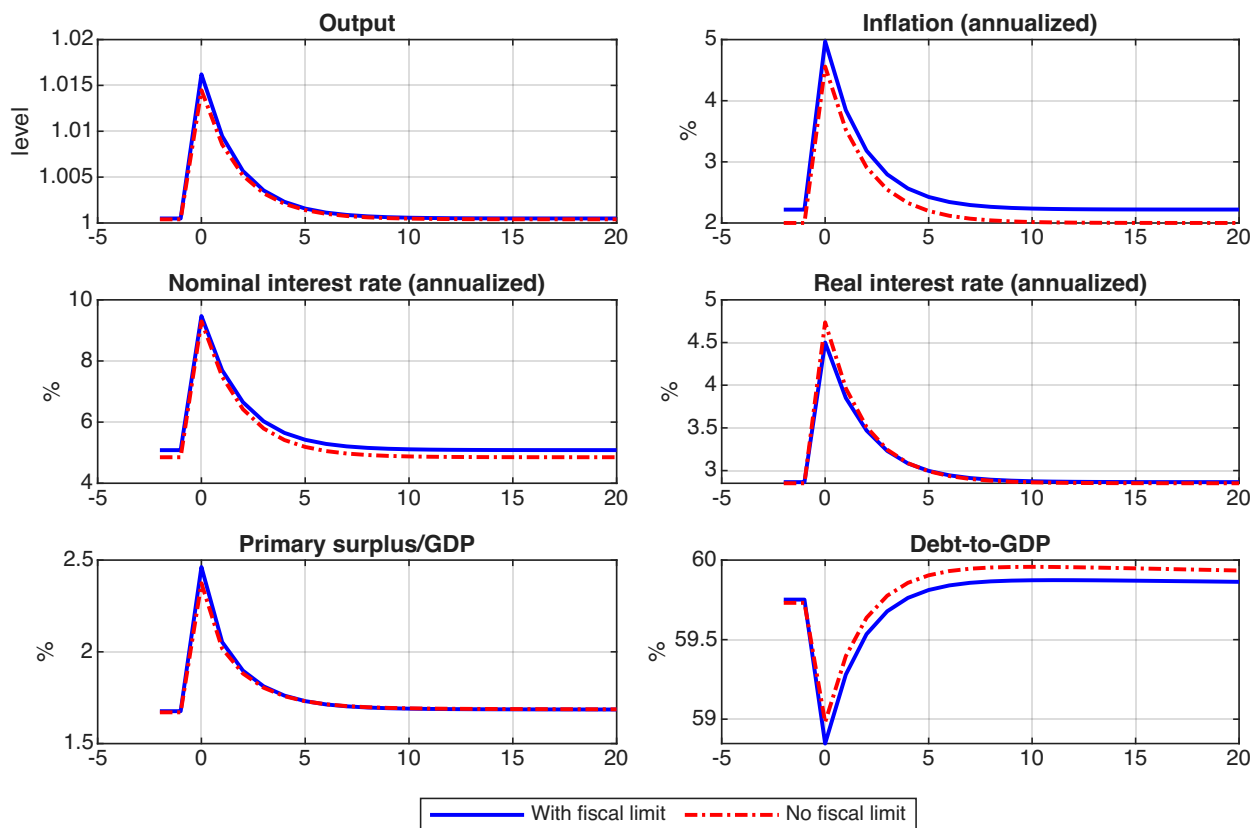


Figure 18: Responses to inflationary preference shock. Impulse response functions to a three-standard-deviation inflationary preference shock. Responses from model with fiscal limit shown in blue and without fiscal limit in dashed red. Shock happens in period 0. Figures show dynamics in deviation from pre-shock level.