The Perils of Narrowing Fiscal Spaces

Hanno Kase[1], Leonardo Melosi[2], Sebastian Rast[3], Matthias Rottner[4]

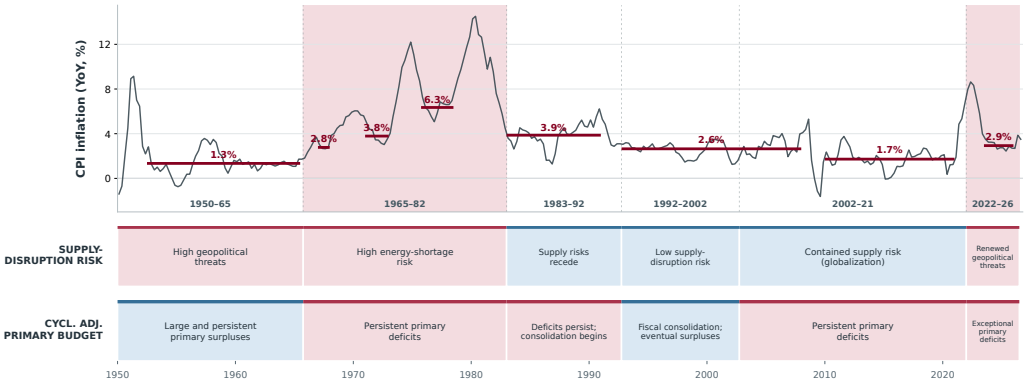
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Motivation

Inflation ratchets up when persistent deficits coincide with elevated risks of supply disruptions.



A model of limited fiscal responsibility

A nonlinear model with a time-varying limit on new debt the government accepts.

- Debt is backed, but fiscal policy does not adjust further when the limit binds.
- Monetary policy then keeps interest rates lower to stay within the limit.

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- Asymmetry: adverse supply shocks erode fiscal space more than other shocks.

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- Endogenous monetary–fiscal policy mix: narrow fiscal space constrains tightening.
- Asymmetry: adverse supply shocks erode fiscal space more than other shocks.
- Endogenous trend inflation and tail risks: driven by supply risk and fiscal space.

Main contributions

- **Model**: endogenous monetary–fiscal interactions, with debt always backed.
- **Evidence**: local projections of real yields on oil-supply news, by fiscal space.
  - Inflationary news: real yields rise with ample fiscal space but fall when it is narrow.
  - Disinflationary news: no state dependence, as the model predicts.
- **Estimation**: full likelihood of a nonlinear model with stochastic volatility and endogenous fiscal space.
- **Results**: the fiscal limit bound in 2021–22, as supply risk peaked.
  - In 2022, it raised 5-year inflation expectations by about 0.5 pp.
  - It raised near-term inflation expectations by about 1.5 pp, with more upside risk.
  - The effect persists even after the limit stops binding.

A Nonlinear New Keynesian Model with Limited Fiscal Responsibility

The model of limited fiscal responsibility

- A nonlinear New Keynesian model: no capital accumulation, flex wages, and one-period bonds, preference and cost-push shocks. ▸ NK block
- Fiscal authority runs a primary surplus τ_t and issues one-period bonds

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

b_t: face-value debt/GDP; Θ_t: government's financing need/GDP.

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- Fiscal rule responds to inherited face-value debt and output deviations

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

- Parameter δ ensures **long-run debt stabilization** through fiscal adjustment.

Fiscal capacity and the ceiling on the policy rate

- Fiscal limit: per-period accumulation of face-value debt/GDP is capped

$$a_t \equiv b_t - b_{t-1}\frac{Y_{t-1}}{\Pi_t Y_t} = \underbrace{(R_t - 1)\Theta_t}_{\text{Interest committed}} - \underbrace{\tau_t}_{\text{Primary surplus}} \leq \bar{\xi}_t$$

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- When the limit binds, monetary policy satisfies it by capping the policy rate at $\bar{R}_t$:

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

  - Fiscal space $\equiv \bar{\xi}_t - a_t^N = \Theta_t(\bar{R}_t - R_t^N)$: the limit binds when it turns negative.

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- The ceiling is endogenous: it depends on inflation, real activity, and inherited debt.
- Limited fiscal responsibility: debt is backed by future primary surpluses, but fiscal policy does not adjust further when the limit binds.

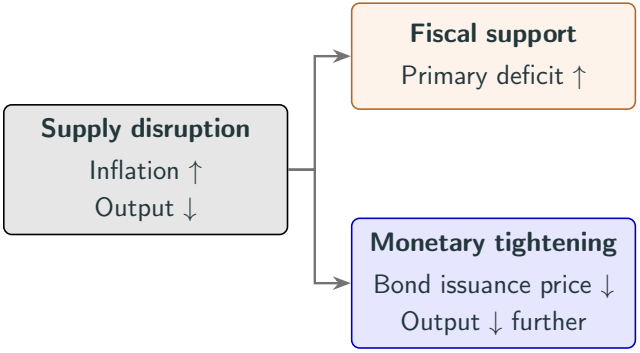
A supply disruption when fiscal space is limited

Supply disruption

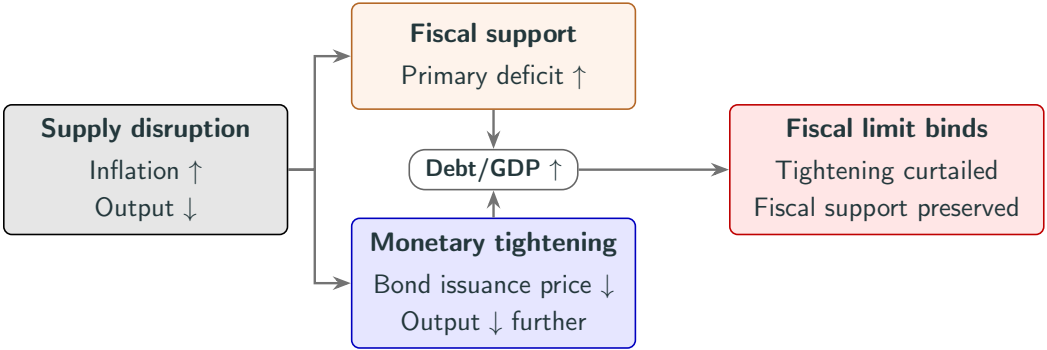
Inflation $\uparrow$

Output $\downarrow$

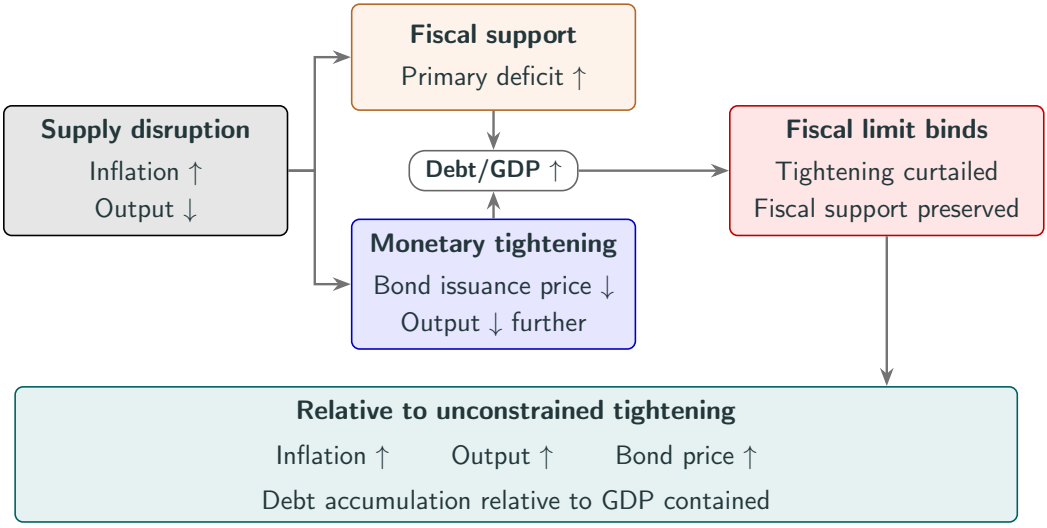
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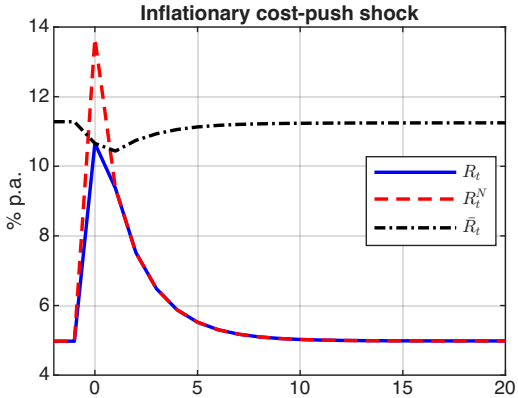
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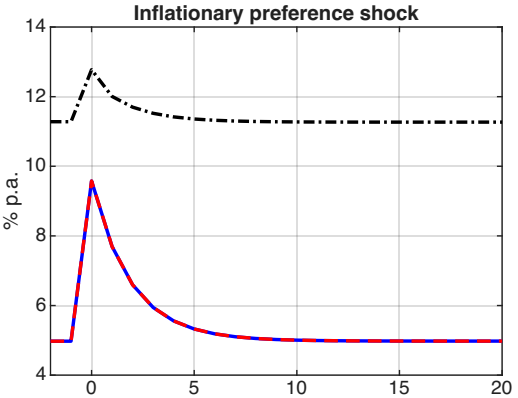


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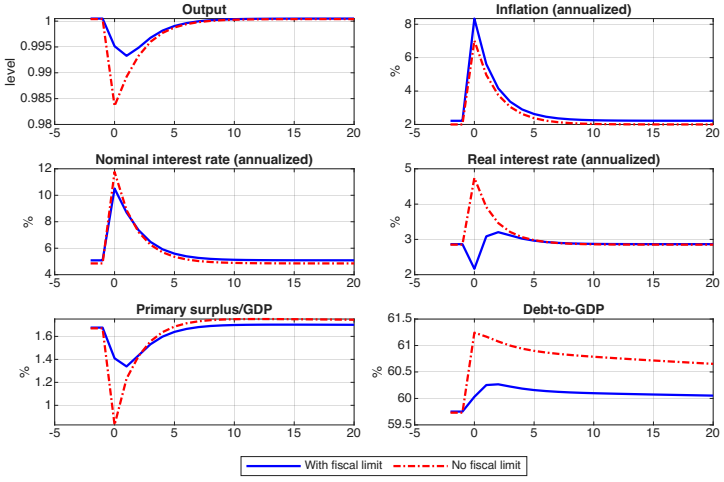
Inflationary shocks and the fiscal limit





Calibration based on postwar U.S. data (1960Q1–2025Q4); global solution Detailed table ▸ Narrower fiscal space

Economic impact of an inflationary cost-push shock



- Inflation rises, output contracts
- The fiscal limit weakens the response: central bank tightens, but less than the notional rule
- Real rate decreases

$\Rightarrow$ higher inflation, stronger activity and lower debt accumulation

Calibration based on postwar U.S. data (1960Q1–2025Q4); global solution Detailed table IRFs

Fiscal Constraints on Monetary Tightening: Empirical Evidence

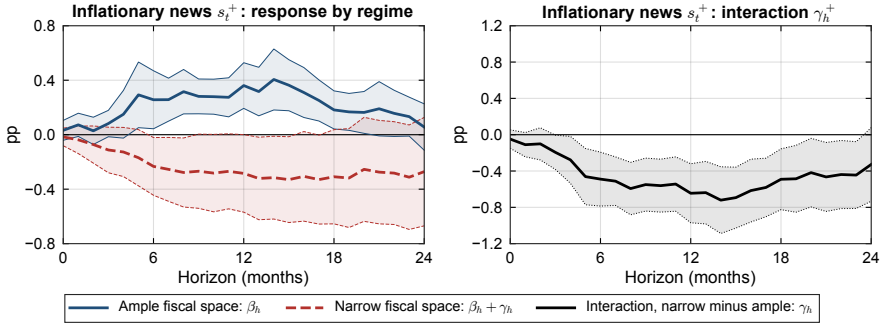
Evidence on Fiscal Constraints

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

- y_t: Five-year TIPS yield.
- $s_t^+ = \max(s_t, 0)$, $s_t^- = \min(s_t, 0)$: Oil-supply news shocks (Känzig 2021).
- $n_{t-1} = \mathbf{1}[x_{q-1} > 1.25] \Rightarrow$ fiscal space is narrow, where x_q: cyclically adjusted primary deficit, in percent of GDP, averaged over four quarters.
- X_t: Four lags of Δy_t, the shock, CPI inflation, industrial-production growth, real oil-price growth, and policy-rate changes. Includes a pandemic QE dummy (2020M3–2022M3) interacted with both shock signs.

U.S. monthly data, 2003M1–2025M12; $h = 0, \ldots, 24$. Narrow fiscal space: 2009Q1–2013Q1 and 2017Q1–2025Q3.

Inflationary Supply News: Real Yields Reverse Sign



Months after the shock; percentage points per one-standard-deviation shock. 90% Newey–West bands.

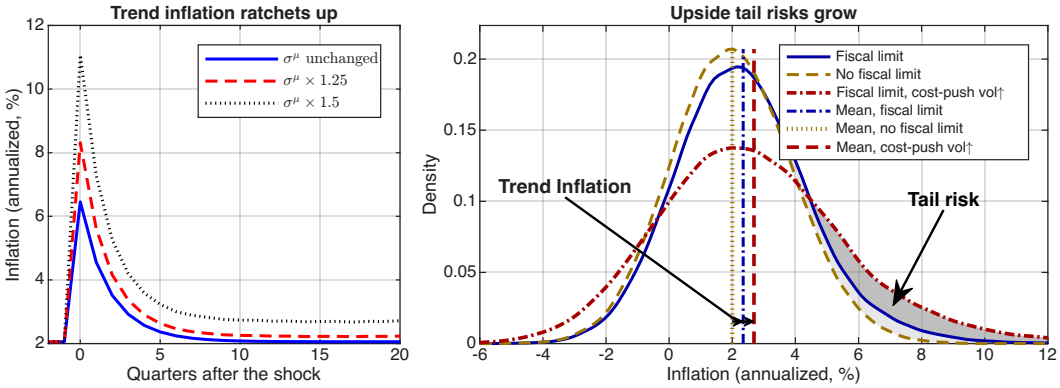
- Narrow fiscal space weakens the real-yield response to inflationary supply news.
- The estimated effect may be conservative: the shock can push initially ample economies into the narrow regime, reducing the difference between the two groups.

Disinflationary news | Robustness | Regime placebo | ZLB | Breakeven inflation | Adjustment for real term premium

Endogenous trend inflation and inflation risks

Endogenous trend inflation and upside tail risks

Both rise with the risk that the limit binds: higher supply risk or narrower fiscal space.



Left: inflation after a supply shock, by supply-shock volatility σ^μ. Right: inflation distribution.

Quantitative analysis

Quantitative model

A large nonlinear NK model with stochastic volatility and an endogenous constraint

- Fiscal–monetary: fiscal limit, long-term debt, interest-rate smoothing, fiscal response to the interest bill
- Frictions: capital with adjustment costs, consumption habits, sticky prices and wages with indexation
- Eight shocks: cost-push, TFP, preference, monetary policy, transfers, bond risk premium, cost-push shocks volatility, government's preference on fiscal limit.

How long-term debt changes the fiscal limit

- Same limit: face-value debt accumulation in % of GDP is capped each period.
- The geometric maturity structure gives surviving bonds the same price as new issuance. Financing needs are met at that price, so the limit sets a floor on it.
- The price reflects the expected path of rates, so the limit constrains the path:
  - persistent hikes lower the price more and use up more fiscal space;
  - bond-premium shocks also lower the price and use up fiscal space.

▸ Details

Solution and likelihood estimation

Solution **Kase, Melosi, and Rottner (2026)**

- Global solution with **neural networks**
- Parameters as pseudo-states $\Rightarrow$ **solve once** over the estimation range

Estimation: seven observables

- CPI inflation, fed funds rate (shadow rate at the ELB),**5-year Treasury yield**, **5-year breakeven inflation**, Real GDP per capita growth, real debt per capita growth, hours gap.
- Sample period: 2003Q1 until 2026Q1,

Computing time **MacBook, no GPU**

- Solution: 2 hours without the fiscal limit, 2 hours with it
- Estimation (particle filter + Metropolis–Hastings): 7 hours

Estimated parameters

Table 1: Prior and posterior distributions

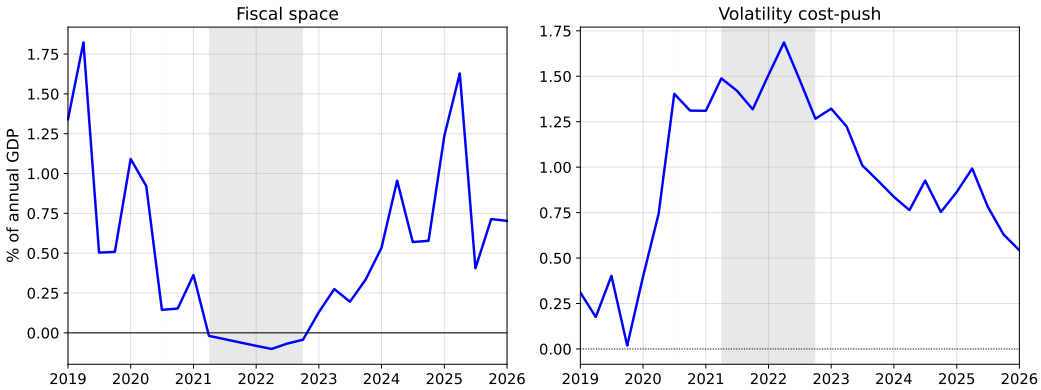
Parameters		Prior					Posterior		
		Type	Mean	Std.	L Bound	U Bound	Mean	5%	95%
Std. dev. cost-push shock	$100\sigma_\mu$	Trc.N	10.0	3.00	1.000	17.5	4.90	3.08	7.47
Std. dev. preference shock	$100\sigma_\zeta$	Trc.N	1.000	0.100	0.100	2.75	1.53	1.43	1.63
Std. dev. MP shock	$100\sigma_m$	Trc.N	0.100	0.0100	0.0100	0.350	0.139	0.124	0.154
Std. dev. transfer shock	$100\sigma_{tr}$	Trc.N	1.50	1.000	0.100	2.00	1.37	1.24	1.50
Std. dev. ceiling shock	$100\sigma_\xi$	Trc.N	0.100	0.0100	0.0100	0.150	0.101	0.085	0.117
Std. dev. risk premium	$100\sigma_{rp}$	Trc.N	0.500	0.100	0.100	1.10	0.395	0.337	0.455
Std. dev. TFP shock	$100\sigma_z$	Trc.N	0.500	0.500	0.100	1.000	0.238	0.195	0.284
Std. dev. volatility shock	$100\sigma_{sv}$	Trc.N	14.0	2.00	2.50	20.0	19.1	17.5	19.9
Deficit ceiling	$\bar{\xi}$	Trc.N	0.070	0.0025	0.065	0.130	0.085	0.081	0.089

The model fit



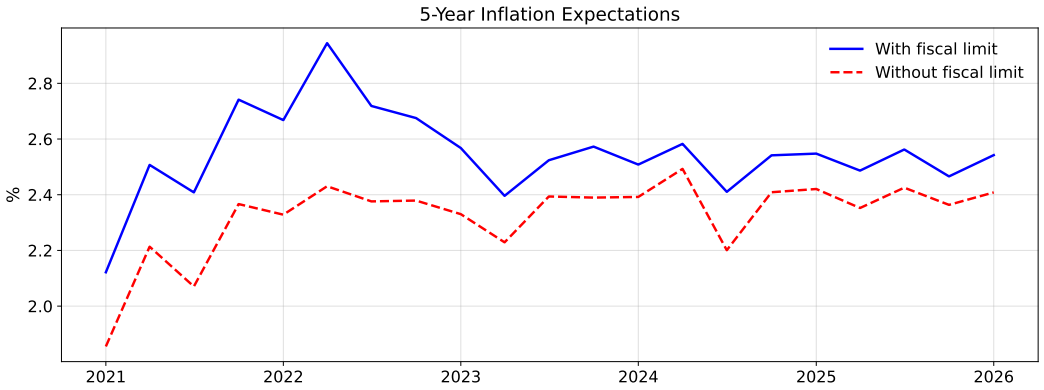
▸ Estimated shocks

Estimated fiscal space and supply risk



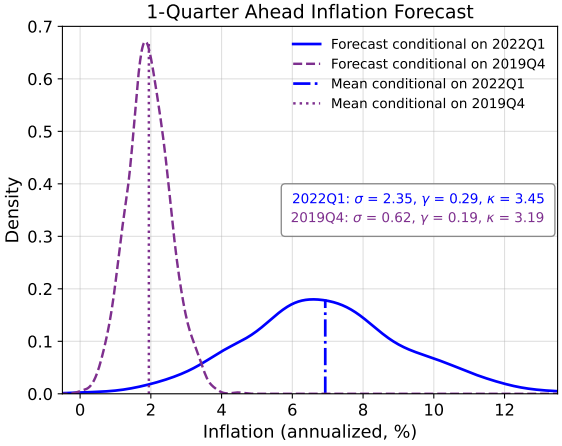
Fiscal space turns negative in 2021–22 (shaded), just as supply risk peaks: the limit binds.

Fiscal limit and inflation expectations



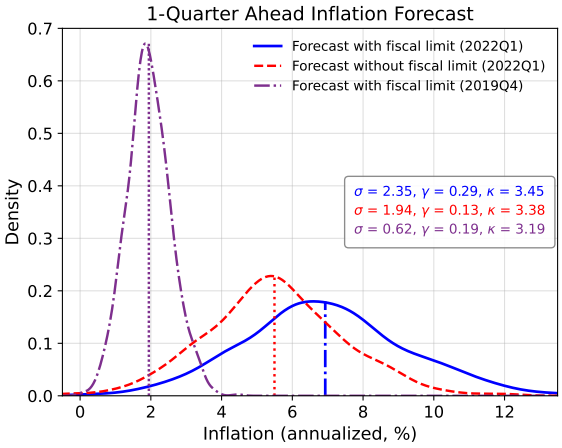
The fiscal limit adds about 0.5 pp at the 2022 peak; 0.1–0.2 pp persists after the limit stops binding.

The pandemic shifted inflation beliefs



From 2019Q4 to 2022Q1, expectations rise from 2% to 7% and their dispersion almost quadruples.

The fiscal limit and inflation beliefs



The fiscal limit raises expectations by about 1.5 pp and adds dispersion and upside risk.

Conclusions

A new monetary–fiscal interaction: debt is always backed, but a limit on debt accumulation occasionally constrains monetary tightening.

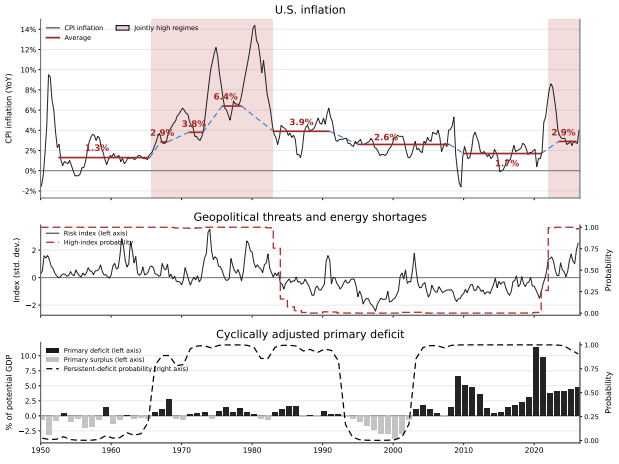
- Fiscal space shapes the policy mix, trend inflation, and upside tail risks.
- Inflationary supply shocks are the critical case: they erode fiscal space just when tightening is needed. Real yields after oil-supply news support this.
- In the estimated model, the limit bound in 2021–22 and lifted inflation expectations, with lasting effects.

$\Rightarrow$ Narrow fiscal space can turn supply disruptions into persistent inflation.

Appendix

Motivation

U.S. inflation ratchets upward when persistent deficits coincide with high risk of supply disruptions.



▸ Chart construction

Chart construction: data

- **Inflation:** quarterly U.S. CPI year-on-year inflation, 1950Q1–2026Q2; horizontal annotations summarize selected windows.
- **Monthly geopolitical inputs:** historical GPR threats (1950 onward), AI geopolitical threats and energy shortages (1960 onward), through June 2026.
- **Annual fiscal inputs:** primary-deficit proxy for 1950–64; CBO-derived cyclically adjusted primary deficits for 1965–2024.
- The pre-1965 proxy is unadjusted. Fiscal bars for 2025–26 are illustrative; recent CPI observations include partial/interpolated values.

Back to chart

Monthly geopolitical composite

Log-transform and standardize each observed channel, then estimate separately:

$$z_{j,t} = x_{j,t} + \epsilon_{j,t}, \qquad x_{j,t} = \rho_j x_{j,t-1} + u_{j,t}.$$

Kalman likelihood estimates the parameters; RTS smoothing gives $m_{j,t|T}$ and $V_{j,t|T}$. Missing observations skip the measurement update.

$$R_t = \log\left[\frac{1}{3}\sum_{j=1}^{3}\exp\{m_{j,t|T} + \tfrac{1}{2}(V_{j,t|T} - V_j^0)\}\right].$$

- V_j^0: stationary latent-state variance; the composite emphasizes elevated signals.
- Quarterly means, standardized, give the plotted black index. Twelve-month means enter the annual regime model.

Back to chart

Annual geopolitical regimes

Standardize the complete-year averages over 1950–2025:

$$A_y = \mathrm{zscore}\left(\frac{1}{12}\sum_{t\in y} R_t\right), \qquad A_y \mid S_y = j \sim N(\mu_j, \sigma^2).$$

- Two-state Markov chain, switching means, common variance; estimated by maximum likelihood. High state: $\mu_H > \mu_L$.
- Annual aggregation is an arithmetic mean, not multiplication by twelve. Incomplete 2026 is excluded from the likelihood.

$$\mu_L = -.7532, \quad \mu_H = .7411, \quad \sigma^2 = .4418, \qquad P^G = \begin{pmatrix} .9632 & .0368 \\ .0193 & .9807 \end{pmatrix}.$$

The red dashed line is the smoothed probability of a high *index level*. Transition probabilities describe persistence.

Back to chart

Annual fiscal regimes

Positive d_y denotes a primary deficit:

$$d_y = \begin{cases} -b_y - n_y, & 1950\text{–}64, \\ -(B_y^{CA} + 100 N_y / Y_y^{pot}), & 1965\text{–}2024. \end{cases}$$

Here b_y, n_y are total balance and interest as % of actual GDP; B_y^{CA} is the cyclically adjusted balance as % of potential GDP; N_y is net interest and Y_y^{pot} potential GDP, in matching currency units.

$$D_y = \mathbf{1}\{d_y > 0\}, \qquad D_y \mid F_y = j \sim \text{Bernoulli}(e_j).$$

Estimate the two-state Markov model by maximum likelihood over 1950–2024:

$$e_L = .1469, \quad e_H = .8343, \qquad P^F = \begin{pmatrix} .9242 & .0758 \\ .0467 & .9533 \end{pmatrix}.$$

The high state has greater *deficit incidence*; deficit size does not enter beyond its sign.

Smoothed regime probabilities

For either model, let $b_y(j)$ be its Gaussian or Bernoulli emission likelihood. Initialize at the stationary distribution.

$$a_y(j) = \sum_i \alpha_{y-1}(i) P_{ij}, \qquad c_y = \sum_j a_y(j) b_y(j),$$

$$\alpha_y(j) = a_y(j) b_y(j) / c_y, \qquad \ell(\theta) = \sum_y \log c_y.$$

Starting with $\beta_T(j) = 1$, compute backward:

$$\beta_y(i) = \frac{\sum_j P_{ij} b_{y+1}(j) \beta_{y+1}(j)}{c_{y+1}}, \qquad \gamma_y(j) = \frac{\alpha_y(j)\beta_y(j)}{\sum_k \alpha_y(k)\beta_y(k)}.$$

- The plotted historical probabilities are $\gamma_y(H)$: they use the full estimation sample, including later observations.
- Inference conditions on fitted parameters and the estimated composite.

Forecasts, alignment, and red shading

$$H_q = \mathbf{1}\{p^G_{y(q)} > 0.76\}\,\mathbf{1}\{p^F_{FY(q)} > 0.76\}.$$

- Both probabilities must exceed 76%; the threshold does not affect estimation.
- Geopolitical probabilities follow calendar years. Fiscal Q1–Q3 use the same FY label; Q4 uses the next FY.
- Shading uses those annual values. The fiscal line connects annual points at April 1, so interpolated crossings can differ.
- Beyond the sample, use $\alpha_T P^h$: geopolitical 2026 and fiscal 2025–26 are forecasts, without new observations.
- Red intervals: October 1965–December 1982 and January 2022 through the chart endpoint.

Thresholds and Robustness

Specification	$\bar{\gamma}^+$ (bp)	p-value
Baseline	-46.7	0.016
Cutoffs: 0.70–1.90% of GDP	-19 to -47	< 0.10
Cutoffs: 1.15–1.70% of GDP	-37 to -47	< 0.05
Postwar 80th / 85th percentiles	-39 / -32	0.024 / 0.021
ZLB dummy (2008M12–2015M11)	-51	0.021
Continuous standardized fiscal state	$+3$	0.61

Historical cutoffs matter; a regime split, not a smooth gradient, drives the result.

Back

Does the Calendar Alignment Matter?

Shift the fiscal-regime indicator through all 275 alternative dates, wrapping around the sample. Preserve the two blocks, their spacing, and the 57% narrow-regime share.

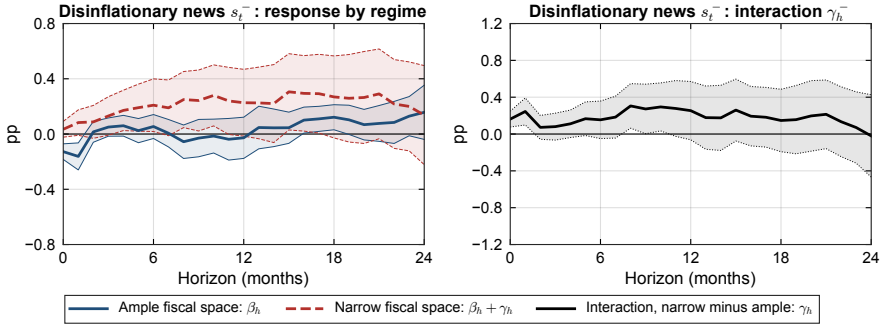
Shifts included	Number	Mean (bp)	p-value
All shifts	275	-1.2	0.047
Overlap with actual $< 75\%$	237	$+2.1$	0.055
Overlap with actual $< 50\%$	106	$+0.3$	0.065
At least 18 months in either direction	241	$+1.7$	0.054

Actual estimate: -46.7 bp. Twelve of the 275 placebo estimates are at least as negative, all from one cluster of adjacent shifts.

One-sided placebo $p = (1 + r)/(1 + n)$; r counts estimates at least as negative as the actual estimate.

Back

Disinflationary News: Little State Dependence

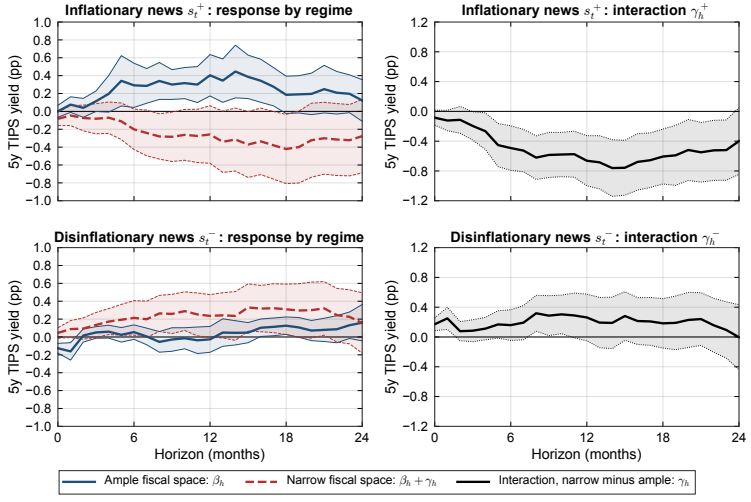


Months after the shock; percentage points per one-standard-deviation shock. 90% Newey–West bands.

- Less significant response to disinflationary shocks.
- Less state dependence after disinflationary news.

Back to main results

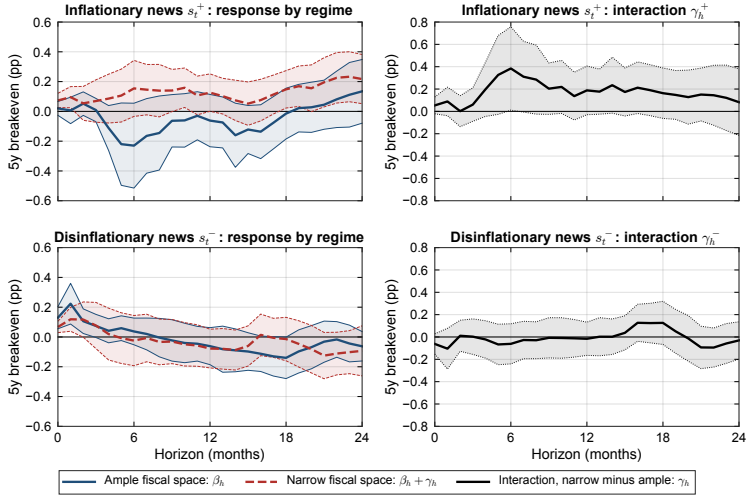
Controlling for ZLB



Months after the shock; percentage points per one-standard-deviation shock. 90% Newey–West bands.

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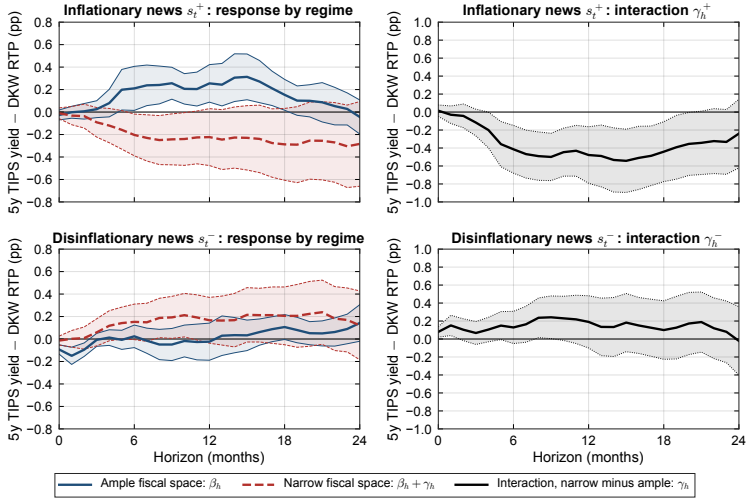
Response of breakeven inflation



Months after the shock; percentage points per one-standard-deviation shock. 90% Newey–West bands.

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Response of real yields adjusted for real term premium



Months after the shock; percentage points per one-standard-deviation shock. 90% Newey–West bands.

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The New Keynesian Model with the Fiscal Limit

- Representative household subject to preference shocks ζ_t

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

- Phillips curve (Rotemberg pricing) with cost-push shocks μ_t

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

- Monetary authority sets the nominal interest rate, responding to output and inflation

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

Without fiscal limit: $R_t = R_t^N$.

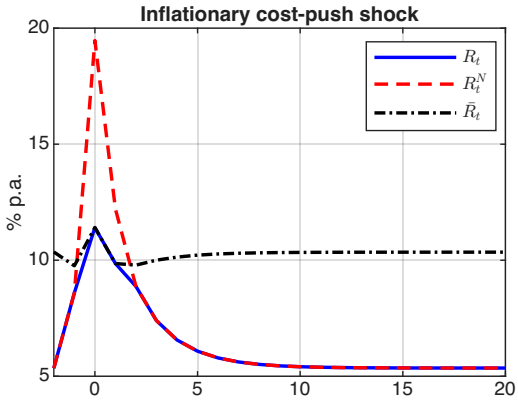
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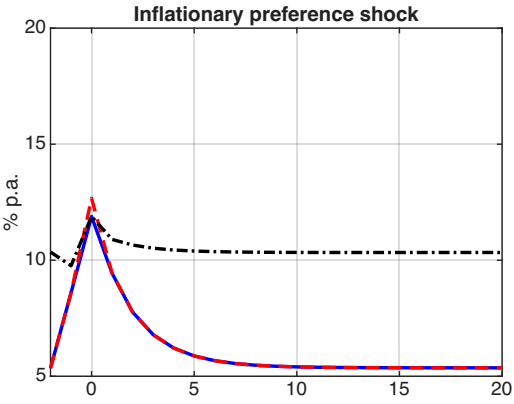
Calibration

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 cost-push Shock	ρ_μ	0.6	Std. Dev. cost-push Shock	σ^μ	0.19
Inflation target	(Π-1)*4	2%	Steady-state debt-to-output	b	2.4

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Inflationary shocks, tighter fiscal limit, and path dependence

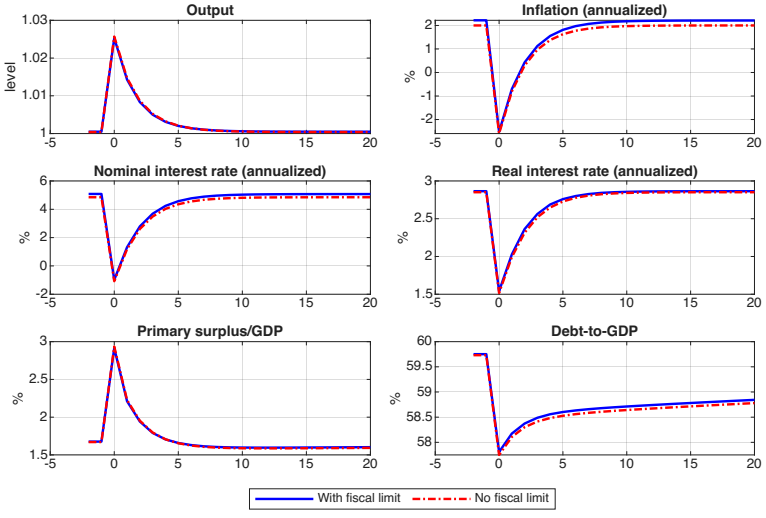




Case with narrower fiscal space. Calibration based on postwar U.S. data (1960Q1–2025Q4); global solution

Detailed table ◂ Back

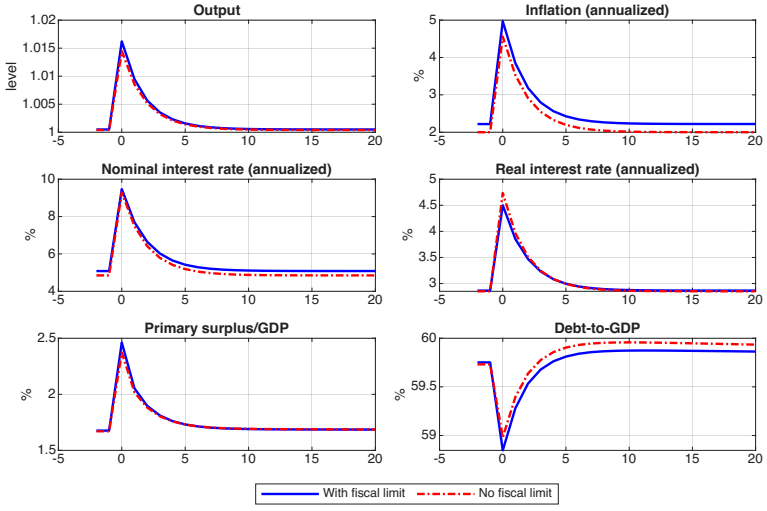
Economic effects of disinflationary cost-push shock



Notes: Dynamics in response to three-standard-deviation disinflationary cost-push shock. Shock happens in period 0. Initialization at ergodic mean.

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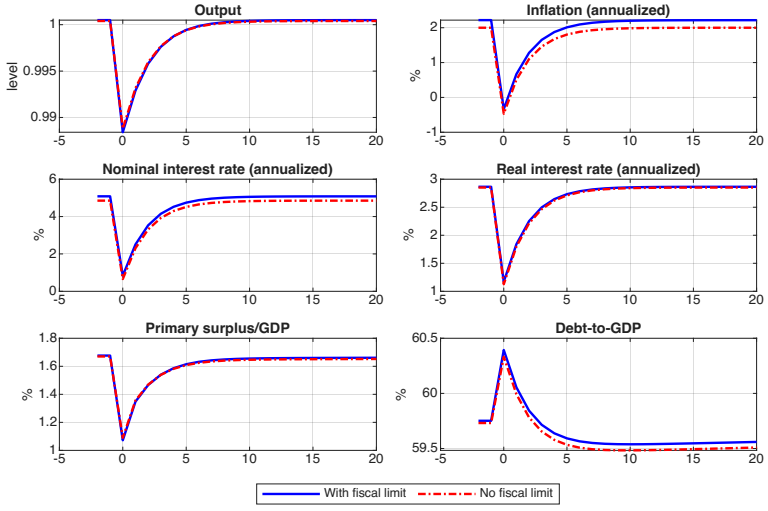
Economic effects of positive demand shock



Notes: Dynamics in response to three-standard-deviation inflationary preference shock. Initialization at ergodic mean. Shock happens in period 0.

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Economic effects of negative demand shock



Notes: Dynamics in response to three-standard-deviation disinflationary preference shock. Initialization at ergodic mean. Shock happens in period 0.

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The fiscal limit with long-term debt

- Each period, a share $1-\rho_m$ of principal is repaid and coupon k is paid per unit of face value.

$$b_t = \rho_m \widetilde{b}_{t-1} + \frac{\Theta_t^L}{Q_t^L}, \qquad \widetilde{b}_{t-1} \equiv b_{t-1}\frac{Y_{t-1}}{\Pi_t Y_t},$$

$$\Theta_t^L \equiv (1-\rho_m+k)\widetilde{b}_{t-1} - \tau_t \qquad \text{(financing need)}.$$

- The limit $b_t - \widetilde{b}_{t-1} \leq \bar{\xi}_t$ implies a price floor and a policy-rate ceiling:

$$Q_t^L \geq \underline{Q}_t \equiv \frac{\Theta_t^L}{\bar{\xi}_t + (1-\rho_m)\widetilde{b}_{t-1}},$$

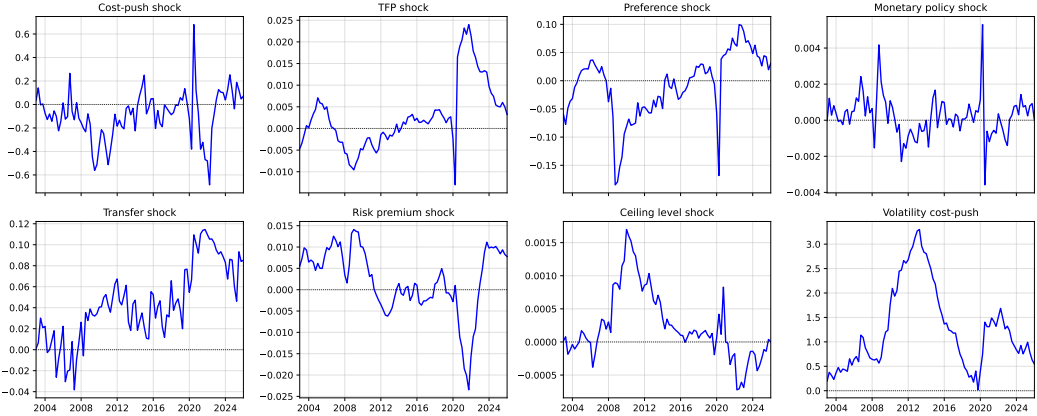
$$R_t \leq \bar{R}_t^L \equiv e^{-u_t^{rp}} \frac{1-\rho_m+k+\rho_m \widetilde{\mathbb{E}}_t Q_{t+1}^L}{\underline{Q}_t}.$$

$\widetilde{\mathbb{E}}_t$: risk-adjusted expectation; u_t^{rp}: exogenous bond-premium wedge.

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- With $\rho_m = k = 0$ and $u_t^{rp} = 0$, recover one-period bills: $Q_t^L = 1/R_t$ and $\bar{R}_t^L = \bar{R}_t$.

Estimated shocks



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