Fiscal Dominance Risk According to HANK*

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Abstract

I study the positive and normative implications of fiscal dominance risk in heterogeneous-agent economies with non-Ricardian households. I develop a HANK model featuring stochastic transition to fiscal dominance and contrast its dynamics with those of RANK in response to a deficit-financed lump-sum transfer. In both models, fiscal dominance risk raises inflation expectations, prompting a monetary tightening. However, output dynamics differ markedly. In RANK, the higher real interest rate persistently depresses output; in HANK, this contractionary effect is offset by an endogenously higher neutral rate of interest, allowing the output to return to the steady state despite persistent inflation and elevated interest rates. When inflation stabilization is the primary concern, optimal monetary policy accommodates part of the deficit by reducing the nominal rate, regardless of household heterogeneity.

Keywords: Monetary-Fiscal Coordination, Regime Uncertainty, HANK

JEL Classification Numbers: E31, E61, E63

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1 Introduction

The U.S. government's fiscal response to the COVID-19 pandemic and the Great Recession has left a deep and persistent imprint on its fiscal position. Between 2005 and 2025, federal debt held by the public increased from approximately 35% to nearly 100% of GDP. Looking ahead, the fiscal outlook remains bleak. The Congressional Budget Office projects that the debt-to-GDP ratio will rise further to 156% by 2055, driven by growing interest outlays and persistent primary deficits (CBO, 2025). This deteriorating fiscal trajectory, together with heightened political pressure on the Fed, has renewed concerns about the emergence of fiscal dominance, namely the situation where monetary policy is constrained by fiscal considerations. These concerns have been voiced prominently by policymakers, including former Treasury Secretary and Fed Chair Janet Yellen, who remarked at the AEA meeting, "Should we be concerned about the potential for fiscal dominance? In my opinion, the answer is 'yes'" (Yellen, 2026).

This paper studies the aggregate implications of fiscal dominance *risk*—the anticipated possibility of fiscal dominance—within a Heterogeneous Agent New Keynesian (HANK) framework. While a growing literature analyzes fiscal dominance risk in Representative Agent New Keynesian (RANK) models (e.g., Bigio et al. 2025, Bianchi and Melosi 2019, Bianchi et al. 2023), its macroeconomic consequences in New Keynesian environments with non-Ricardian households and incomplete markets remain largely unexplored.

Addressing this gap is particularly important for two reasons. First, recent advances in the HANK literature demonstrate that monetary–fiscal interactions differ fundamentally from those in RANK. In particular, equilibrium selection is not required under an active-fiscal, passive-monetary policy regime (Angeletos et al., 2024b; Kaplan, 2025b), and the Taylor principle is neither necessary nor sufficient for ensuring local determinacy (Rachel and Ravn, 2025; Auclert et al., 2025a).[1] These results suggest that insights derived from representative-agent frameworks may not generalize to heterogeneous-agent economies with non-Ricardian households. Second, HANK models have become increasing popular for evaluating fiscal stabilization policies—precisely the policies that have contributed to rising public debt in the U.S. and other advanced economies. Incorporating fiscal dominance risk into HANK therefore provides a consistent framework for assessing effectiveness of fiscal policies and offers new guidance for the conduct of monetary policy when fiscal dominance risk is non-negligible.

To this end, I incorporate stochastic regime transition into an otherwise standard HANK model. The economy starts in the monetary-led regime, where the Taylor Principle is satisfied and all government debt is backed by future surplus, and faces a constant risk of transitioning to the fiscal-dominant regime, where the government debt is unfunded and the monetary authority keeps the nominal interest rate constant. Because the regime-switching HANK model can only be solved numerically, I begin by analyzing two simplified but analytically tractable environments, namely a

[1] For a comprehensive overview, see Kaplan (2025a).

RANK model and a two-agent bond-in-utility (TABU) model, to develop intuition on the working of fiscal dominance risk.

In RANK, because of Ricardian Equivalence, deficit-financed stimulus transfers have no effect on the output and inflation in the monetary-led regime. However, the fiscal dominance risk creates an expectation channel through which the government debt affects the output and inflation dynamics even in the monetary-led regime. Intuitively, since inflation is high and the real rate is low in the fiscal-dominant regime, the fiscal dominance risk raises the inflation expectation and lowers the expected real rate in the monetary-led regime. The monetary authority, in turn, reacts to the higher inflation by tightening the monetary policy, which depresses the output, raises the interest burden of the government, and exacerbates the government debt level. The higher debt level then implies an even higher inflation in the fiscal-dominant regime, creating a diabolic loop. When the fiscal dominance risk is high, this mechanism can render the non-existence of a bounded equilibrium even if the Taylor Principle is satisfied.

In HANK, this expectation channel operates as is, resulting in higher inflation and real interest rate in the monetary-led regime. However, in HANK where households are non-Ricardian, the persistently higher real interest rate does not necessarily depress the output as in RANK. This is because the neutral rate of interest—the equilibrium real interest rate consistent with a zero output gap—is endogenous in HANK. If the neutral rate rises along with the real interest rate, then the contractionary effect of monetary tightening is neutralized. The dynamics of the neutral rate under fiscal dominance risk is thus crucial.

To understand the drivers of the neutral rate, I resort to the TABU model as a tractable approximation of HANK. Through the lens of the TABU model, I analytically identify three mechanisms behind the neutral rate dynamics. The first mechanism is the asset supply effect. Since the asset demand in HANK is not infinitely elastic, a higher supply of government debt raises the neutral rate. This channel is absent in RANK where the asset demand is infinitely elastic. The second mechanism is the intertemporal substitution effect. The fiscal dominance risk decreases the expected real rate, prompting a higher neutral rate to close the output gap in the monetary-led regime. This channel is absent in models without fiscal dominance risk. The third mechanism is the income effect. In the event of fiscal dominance, explicit labor tax is replaced by implicit inflation tax, effectively redistributing income to poor households who have high MPC and in turn raising the aggregate income. Fiscal dominance risk thus increases expected income and hence the neutral rate today. This channel is stronger when the average MPC is higher. Overall, the theory implies that the neutral rate will increase by more following a deficit-finance stimulus in the presence of fiscal dominance risk.

I calibrate the regime-switching HANK model to the U.S. data and contrast its dynamics with those of RANK in response to a lump-sum transfer of the size of the stimulus payment in the CARES Act. Consistent with the expectation mechanism, I find that the fiscal dominance risk leads to a a persistently higher inflation in both models. The output dynamics, however, are markedly different.

In RANK, the higher real interest rate persistently depresses the output below the steady-state level. In HANK, consistent with the theory, this contractionary effect is offset by an endogenously higher neutral rate of interest, leaving the output expansion resulting from the direct effect of the lump-sum transfer unaffected. Quantitatively, the neutral rate remains about 50 basis points higher than the steady-state level even 15 years after the one-time stimulus, a pattern that is broadly consistent with the post-pandemic movement of the 10-year TIPS yield and estimates of the natural rate (Benigno et al., 2024).

Motivated by the experience in the post-Covid high-inflation period, I further explore how the slope of the Phillips curve and the monetary policy rule affect the results. When the slope of the Phillips curve is steep, the fiscal dominance risk dampens the output expansion but generates an even higher inflation in HANK. The intuition is simple: the resulted real rate is now higher than the increased neutral rate, contributing negatively to the output dynamics. In this case, the output quickly converges to the steady-state level, while the inflation remains elevated. Surprisingly, in RANK, the slope of the NKPC does not meaningfully affect the output and inflation dynamics. This is because the inflation driven by the fiscal dominance risk is almost completely determined by the government debt level. Given that the real rate movement is determined by the inflation dynamics and intertemporal substitution is the primary channel in RANK, the output dynamics is also unaffected.

In both HANK and RANK, monetary policy plays a central role in shaping the effects of fiscal dominance risk. I first examine the positive implications of different monetary policy rules, characterized by the speed and strength of reaction to inflation. I find that the qualitative pattern is the same in both models. A faster monetary reaction to inflation leads to a substantially stronger inflation response and a lower output response in the short run. This is because a fast monetary reaction raises the interest payment of the government early on, which exacerbates the debt level and hence the inflation expectation. On the other hand, a stronger monetary reaction to inflation has the conventional effects of lower output and inflation. Similar to the case of a steep NKPC, in HANK, output quickly converges to the steady-state level while inflation remains elevated.

Lastly, I study optimal monetary policy in the presence of fiscal dominance risk in a standard LQ programming setup with dual-mandate objectives. Specifically, the monetary authority anticipates the possibility of fiscal dominance, which constrains their policy to accommodate the fiscal deficits, and chooses optimally a path of nominal rate with full commitment conditional on not being in the fiscal-dominant regime. The headline result is that optimal monetary policy tends to accommodate part of the fiscal deficit by *reducing* the nominal rate, regardless of household heterogeneity. In particular, when inflation stabilization is the only objective, optimal monetary policy in HANK and RANK agrees—stabilizing the government debt by significantly lowering the nominal rate below the steady-state level. When output stabilization is concerned, however, optimal monetary policy in HANK is to raise the nominal rate to counteract the direct aggregate-demand effect of deficit-financed transfer, even though this policy increases the government debt level, amplifying the expectation channel of fiscal dominance risk. As a result, the neutral rate remains high in the long run, and optimal monetary policy implements a persistently higher real-rate path to stabilize output relative to the benchmark of no fiscal dominance risk. In contrast, optimal policy in RANK is always to reduce the nominal rate to accommodate the deficits, as the real effects of deficit-financed transfers depend solely on the expectation of fiscal dominance.

Related literature This paper contributes to the long literature on monetary and fiscal interaction. The classic "unpleasant monetarist arithmetic" of Sargent and Wallace (1981) first highlights the importance of fiscal backing to the ability of the monetary authority in controlling inflation. Leeper (1991) characterizes equilibrium determinacy under different monetary and fiscal policy mix and shows that both a monetary-led regime where fiscal backing is guaranteed and a fiscal-dominant regime where the inflation is determined by the government debt are determinate. In a series of papers (Bianchi and Melosi, 2017; Bianchi and Ilut, 2017; Bianchi and Melosi, 2019), the authors develop and estimate a RANK model with regime switching to understand the importance of policy uncertainty and coordination in accounting for the aggregate dynamics of the US economy in the postwar period and the Great Recession. This paper complements this line of research by extending the analyses to HANK models.

The recent literature has studied how monetary-fiscal interaction shapes the inflation dynamic in heterogeneous-agent economies. Hagedorn (2016) points out that in economies with non-Ricardian households, the price level is determined by demand, sidestepping the need of the Fiscal Theory of the Price Level (FTPL). Relatedly, Angeletos et al. (2024b) further shows that in a stylized HANK model, the inflation response under the fiscal dominant regime is equivalent to the prediction of the FTPL. Kwicklis (2025) studies the inflation-output tradeoff in HANK under the fiscal-dominant regime. Kaplan et al. (2023) studies the inflation consequences of permanent deficit in a heterogeneous-agent economy. Campos et al. (2025) shows that in HANK, a permanent fiscal reform changes the neutral rate of interest, so a standard Taylor rule with constant intercept leads to a long-run inflation higher than the target. All of these papers consider a certain policy regime, abstracting away the possibility of regime change. This paper contributes to this literature by analyzing the consequences of regime uncertainty in HANK.

The rest of the paper is structured as follows. Section 2 lays out the modeling framework. Section 3 characterizes the effects of fiscal dominance risk in tractable models to develop intuition. Section 4 quantifies the HANK model with fiscal dominance risk and compares the aggregate dynamics following a deficit-financed lump-sum transfer in HANK and RANK. Section 5 studies optimal monetary policy under fiscal dominance risk. Section 6 concludes.

2 Model

In this section, I describe the HANK model I use to analyze the aggregate consequences of the anticipated risk of fiscal dominance. At the core of the model is the canonical HANK setup with sticky wages and an active-monetary, passive-fiscal policy regime (Auclert et al. 2025b), which I extend to incorporate the risk of a policy-regime change à la Bigio et al. (2025).

2.1 Environment

Time is discrete and runs forever, $t = 0, 1, \ldots$.

Household The economy is populated by a unit measure of infinitely-lived ex-ante identical households. Households face idiosyncratic uninsurable risk to their labor productivity z_{it} which follows a first-order Markov process. I normalize the mean productivity to be $\mathbb{E}[z_{it}] = 1$. Financial markets are incomplete. Households can save in a risk-free nominal asset with gross return R_t^n, subject to a borrowing limit $\underline{a}$. They have CRRA preferences over consumption c_{it} and separable isoelastic disutility from hours worked h_{it}.

To isolate the fiscal dominance risk channel from the direct inflationary effect of distortionary labor taxes, I assume that households pay lump-sum taxes T_{it} that replicate a progressive labor income tax system à la Heathcote et al. (2017) in equilibrium. That is, in equilibrium we have

$$T_{it} = y_{it} - (1 - \tau_t) y_{it}^{1-\xi} \tag{1}$$

where y_{it} is labor income and τ_t is the labor tax rate. Assuming lump-sum taxation is common in the FTPL literature because it implies that lump-sum transfers from the government have no effect on inflation or output in RANK.

The Bellman equation of a household with initial asset a_{it} and productivity z_{it} at time t is given by:

$$\begin{aligned} V_t(a_{it}, z_{it}) = \max_{c_{it}, a_{it+1}} \; & \frac{c_{it}^{1-\sigma}}{1-\sigma} - \varphi \frac{h_{it}^{1+\phi}}{1+\phi} + \beta \mathbb{E}_t \left[V_{t+1}(a_{it+1}, z_{it+1}) | z_{it} \right] \\ c_{it} + \frac{a_{it+1}}{R_t^n} &= y_{it} - T_{it} + \mathcal{T}_t + \frac{a_{it}}{\Pi_t} \\ y_{it} &= w_t h_{it} z_{it} \\ a_{it+1} &\geq \underline{a} \end{aligned} \tag{2}$$

where Π_t is the gross inflation rate, $\mathcal{T}_t$ is uniform lump-sum transfer from the government, and w_t is the real wage. Following Auclert et al. (2025b), the hours worked h_{it} is not chosen by the household but is instead set by labor unions according to current labor demand.

Labor union The setup of the union block follows closely Auclert et al. (2023) and Erceg et al. (2000). There is a continuum of monopolistically competitive labor unions which set nominal wages to maximize a stand-in representative household's utility subject to quadratic adjustment costs. The unions allocate all labor hours uniformly across households, so that $h_{it} = h_t$ for all i.

Optimal wage setting gives rise to the following wage New Keynesian Phillips Curve:

$$\log \Pi_t^w = \xi^w \left(\varphi h_t^{1+\phi} - C_{it}^{-\sigma} w_t h_t \right) + \beta \, \mathbb{E}_t \log \Pi_{t+1}^w \tag{3}$$

where Π_t^w is the gross wage inflation rate and ξ^w is the wage stickiness parameter. This formulation ensures that consumption inequality does not manifest as a wedge on the aggregate labor supply condition, facilitating the comparison with RANK.

Production The goods market is perfectly competitive. The production function is given by:

$$Y_t = N_t := \int h_{it} z_{it} \, di = h_t \tag{4}$$

Profit maximization by the representative firm implies that the real wage is constant, $w_t = 1$. Note that this also means that the price inflation rate is equal to the wage inflation rate, $\Pi_t = \Pi_t^w$.

Government The government collects labor taxes T_t and issues nominal debt B_{t+1} to finance exogenous expenditure G_t and lump-sum transfers to households $\mathcal{T}_t$. The government budget constraint can be written as:

$$B_{t+1} = R_t^n \left(\frac{B_t}{\Pi_t} + G_t + \mathcal{T}_t - T_t \right) \tag{5}$$

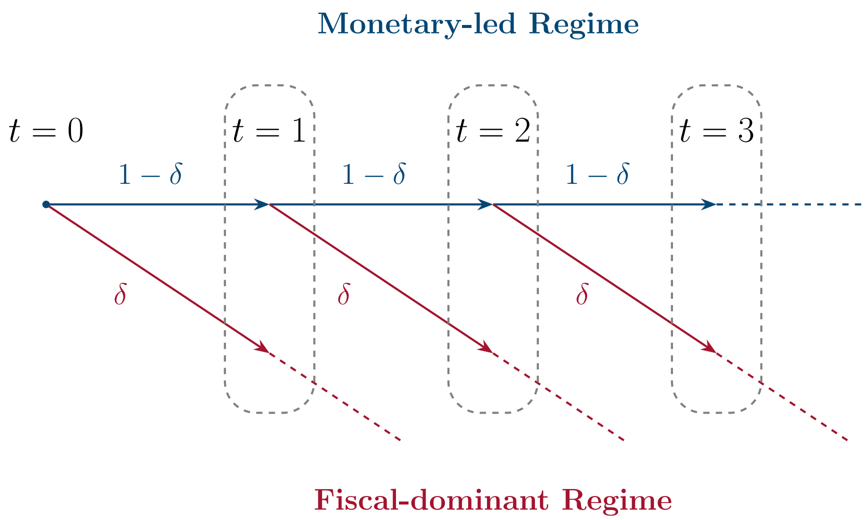
I assume that the government expenditure is constant over time, $G_t = G_{ss} \; \forall t$. The choice of the tax revenue, instrumented by the labor tax rate, depends on the prevailing fiscal policy.

Fiscal and monetary policy To model the risk of fiscal dominance, I follow Bigio et al. (2025) and assume that the economy starts in a *monetary-led* regime and stochastically transitions to a *fiscal-dominant* regime with a constant probability $\delta \in (0, 1)$ every period. Once entering the fiscal-dominant regime, the economy only switches back to the monetary-led regime when the government debt is back to the steady-state level. Figure 1 illustrates the regime switching process.

In the following, I elaborate on the two policy regimes.

- *Monetary-led regime.* This regime corresponds to the familiar active-monetary and passive-fiscal policy mix, where the monetary authority acts to control inflation by satisfying the Taylor principle and the government actively stabilizes the debt by adjusting the tax rate (Leeper 1991, Bianchi and Melosi 2017). Specifically, the monetary authority sets the nominal

Figure 1: Stochastic Regime Transition



interest rate R_t^n according to an inertial Taylor rule:

$$\left(\frac{R_t^n}{R_{ss}}\right) = \left(\frac{R_{t-1}^n}{R_{ss}}\right)^{\rho_R} \left(\frac{\Pi_t}{\Pi_{ss}}\right)^{(1-\rho_R)\phi_\pi} \tag{6}$$

where R_{ss} is the steady-state nominal interest rate and Π_{ss} is the steady-state inflation rate. I impose $\phi_\pi > 1$ so that the monetary authority is actively stabilizing inflation.

For the fiscal policy, as in Angeletos et al. (2024a), the government follows a fiscal rule of the form:

$$T_t = T_{ss} + (1 - \rho_B)\left(\frac{B_t}{\Pi_t} - B_{ss}\right) \tag{7}$$

where T_{ss} and B_{ss} are the steady-state level of tax revenue and government debt, respectively. The fiscal rule is implemented by adjusting the labor tax rate τ_t. Importantly, I impose $\rho_B R_{ss} < 1$ so that the tax revenue increases enough with the government debt to stabilize the debt level in the long run—the so-called *passive* fiscal policy (Leeper 1991).

- *Fiscal-dominant regime.* This regime corresponds to the inflationary-finance scenario where the monetary authority allows inflation to rise freely to reduce the debt burden of the government. Specifically, I assume that the monetary authority fixes the nominal interest rate at the steady-state level,

$$R_t^n = R_{ss}, \tag{8}$$

regardless of the inflation rate. On the fiscal side, the government holds the tax revenue at the steady-state level,

$$T_t = T_{ss}, \tag{9}$$

regardless of the debt level. Note that this fiscal policy is equivalent to setting $\rho_B = 1$ in the fiscal rule (7). Under this monetary and fiscal policy coordination, higher inflation reduces the interest burden of the government, thereby stabilizing the debt level in the long run.

2.2 Equilibrium in the sequence space

I am interested in the trajectory of the economy after a one-time unanticipated uniform lump-sum transfer at time 0, which I refer to as fiscal stimulus. Given the stylized regime-switching structure illustrated in Figure 1, an equilibrium can be described by a collection of contingency paths indexed by the realization time of fiscal dominance.

I make the following notational convention. Let X_t denote a generic variable at time t under the monetary-led regime. Let $X_{\tau,t}$ denote a generic variable at time $\tau + t$ conditional on fiscal dominance occurring at time τ. Lastly, let $X \equiv (X_0, X_1, \dots)$ and $X^\tau \equiv (X_{\tau,0}, X_{\tau,1}, \dots)$ denote the sequence of a variable along a particular contingency path. We are ready to define an equilibrium in the sequence space.

Equilibrium Given an exogenous path of fiscal stimulus $\mathcal{T}$, a *rational expectation equilibrium* consists of contingency paths of policy functions $\{c, a, (c^\tau, a^\tau)_\tau\}$, household value functions $\{V, (V^\tau)_\tau\}$, prices $\{R^n, \Pi, \Pi^w, w, (R^{n,\tau}, \Pi^\tau, \Pi^{w,\tau}, w^\tau)_\tau\}$, fiscal instruments $\{B, \tau, (B^\tau, \tau^\tau)_\tau\}$, aggregates $\{Y, C, A, T, (Y^\tau, C^\tau, A^\tau, T^\tau)_\tau\}$, household distribution $\{\mathbf{D}, (\mathbf{D}^\tau)_\tau\}$, and a sequence of beliefs over prices such that

1. Given the sequence of value functions, prices, and policy functions, the household Bellman equation holds.
2. Given the sequence of beliefs over prices, all agents optimize.
3. The evolution of the distribution is consistent with the policy.
4. The sequence of beliefs over prices and aggregates is rational.
5. Monetary and fiscal policy follows the prescribed rules.
6. All markets clear.

Although the fiscal stimulus is deterministic and known to the agents in the model, the duration of the monetary-led regime is uncertain. In equilibrium, households and firms are fully aware of the fiscal dominance risk and behave accordingly. In this paper, I focus on the path of the economy under the monetary-led regime, where the fiscal dominance risk is present but has never been realized.

The equilibrium system under the monetary-led regime can be casted into the following sequence-space form:

$$
\begin{aligned}
Y &= \mathbf{C}\left(Y - T, R^n, \Pi, \left\{Y^\tau - T^\tau, R^{n,\tau}, \Pi^\tau\right\}_\tau; \mathcal{T}, \mathbf{D}_0\right) + G \qquad \text{(Monetary-led regime)} \\
\Pi &= \mathbf{\Pi}\left(Y, \left\{\Pi_{\tau,0}\right\}_\tau\right) \\
R^n &= \mathbf{R}(\Pi) \\
T &= \mathbf{T}(B, \Pi) \\
B &= \mathbf{B}(R^n, \Pi; \mathcal{T}, B_0)
\end{aligned}
$$

where $\mathbf{C}$ is the aggregate consumption function induced by the household problem (2), $\mathbf{\Pi}$ is the generalized Phillips curve (3), $(\mathbf{R}, \mathbf{T})$ is the monetary and fiscal rule (6), (7) in the sequence space, and $\mathbf{B}$ is the government budget constraint (5). Since households and firms are forward-looking, the aggregate outcomes under the fiscal-dominant regime enter the aggregate consumption function and the generalized Phillips curve. Note that only inflation in the first period of fiscal dominance, $\left\{\Pi_{\tau,0}\right\}_\tau$, enters the generalized Phillips curve because firm intertemporal pricing decision is optimal. In contrast, the entire path of after-tax income, nominal rate, and inflation under the fiscal dominant regime matters for household decisions.[2]

Similarly, for each $\tau \geq 1$, the equilibrium path under the fiscal dominant regime is determined by the following sequence-space system:

$$
\begin{aligned}
Y^\tau &= \mathbf{C}^\mathbf{F}\left(Y^\tau - T^\tau, R^{n,\tau}, \Pi^\tau; \mathbf{D}_\tau\right) + G \qquad \text{(Fiscal-dominant regime)} \\
\Pi^\tau &= \mathbf{\Pi}^\mathbf{F}\left(Y^\tau\right) \\
R^{n,\tau} &= R^n_{ss} \cdot \mathbf{1} \\
T^\tau &= T_{ss} \cdot \mathbf{1} \\
B &= \mathbf{B}(R^{n,\tau}, \Pi^\tau; B_\tau)
\end{aligned}
$$

where $\mathbf{1} := (1, 1, \dots)$ is the unit sequence and $\mathbf{C}^\mathbf{F}$ and $\mathbf{\Pi}^\mathbf{F}$ are the aggregate consumption function and the generalized Phillips curve under the fiscal-dominant regime, respectively. Notice that only the realized equilibrium path enters $\mathbf{C}^\mathbf{F}$ and $\mathbf{\Pi}^\mathbf{F}$ because there is no more regime uncertainty.

The two equilibrium systems are linked through the backward-looking household distribution $\mathbf{D}$ and government debt B. In the monetary-led regime, expectations about future equilibrium paths under the fiscal-dominant regime feed back into households' consumption-saving decisions and firms' pricing decision. In turn, the evolution of the distribution and government debt is affected by these expectations. When the economy switches into the fiscal-dominant regime, the existing

[2] The Bellman equation implies that the value function in the first period of fiscal dominance, $\{V_{\tau,0}\}$, is a sufficient statistic for household decisions. Nonetheless, unlike the aggregate objects, the value function is infinite-dimensional.

distribution and the level of government debt serve as the initial conditions that pin down the subsequent equilibrium path. The rational expectation equilibrium is characterized as the fixed point of this mapping.

3 Analytical Results from Tractable Models

Because the HANK model introduced in Section 2 is not analytically tractable, I begin by examining two simplified environments before turning to the full numerical solution in Section 4. The first is a RANK limit of the HANK model, which sheds light on the expectation channel through which the two policy regimes interact. The second is a two-agent bond-in-utility (TABU) model, which serves as an analytically tractable approximation to the HANK model and yields clear insights into how household heterogeneity and incomplete market leads to aggregate outcomes that differ from those in RANK.

3.1 Expectation channel – insights from RANK

Consider the representative-agent limit of the HANK model obtained by relaxing the borrowing constraint ($\underline{a} \to -\infty$) and eliminating idiosyncratic risk ($z_{it} = 1$ for all i, t). This RANK limit retains the production block and the policy-regime strucuture of the HANK model but entails a different household-block setup. Importantly, we can analyze this model using standard log-linearization techniques.

First, consider the monetary-led regime. Let $\hat{x}_t$ denote log deviation from the steady state under the monetary-led regime and $\hat{x}_t^F$ the corresponding variable when the economy transitions to the fiscal-dominant regime at time t. Log-linearize the model around the deterministic steady state yields the following system for the monetary-led regime:

$$\hat{y}_t = -\bar{\sigma}^{-1}\left\{\hat{r}_t^n - [(1-\delta)\hat{\pi}_{t+1} + \delta\hat{\pi}_{t+1}^F]\right\} + (1-\delta)\hat{y}_{t+1} + \delta\hat{y}_{t+1}^F. \tag{10}$$

$$\hat{\pi}_t = \kappa\hat{y}_t + \beta[(1-\delta)\hat{\pi}_{t+1} + \delta\hat{\pi}_{t+1}^F] \tag{11}$$

$$\hat{r}_t^n = \rho_R\hat{r}_{t-1}^n + (1-\rho_R)\phi_\pi\hat{\pi}_t \tag{12}$$

$$\hat{b}_{t+1} = \hat{r}_t^n + \rho_B R_{ss}(\hat{b}_t - \hat{\pi}_t) + \epsilon_t^{\mathcal{T}} \tag{13}$$

where $\bar{\sigma} := \sigma/(1 - G_{ss}/Y_{ss})$ and $\kappa := \xi^w(\phi + \sigma)$ are the reduced-form parameters and $\epsilon_t^{\mathcal{T}}$ represents the fiscal stimulus. The first three equations are identical to the textbook New Keynesian model, except that all the expectation terms take into account the possibility of a regime change next period. The last two equations, obtained by combining the fiscal rule and the government budget constraint, describes the dynamics of the government debt and its initial condition. By assumption, $\rho_B R_{ss} < 1$ so the dynamics of the government debt by itself is stable. Therefore, in the absence of the expectation terms $\hat{\pi}_{t+1}^F, \hat{y}_{t+1}^F$, the first three equations completely determine the dynamics of output and inflation. The need to keep track of the government debt is due to the fact that these expectations depend on the debt level when the regime change occurs, as we shall see next.

Consider the paths of the economy under the fiscal-dominant regime. Let $\hat{x}_{\tau,t}$ denote the log deviation from the steady state at time $\tau + t$ given that the fiscal-dominant regime starts at time τ. The log-linearized system is given as follows:

$$\hat{y}_{\tau,t} = \bar{\sigma}^{-1}\hat{\pi}_{\tau,t+1} + \hat{y}_{\tau,t+1} \tag{14}$$

$$\hat{\pi}_{\tau,t} = \kappa\hat{y}_{\tau,t} + \beta\hat{\pi}_{\tau,t+1} \tag{15}$$

$$\hat{r}^n_{\tau,t} = 0 \tag{16}$$

$$\hat{b}_{\tau,t+1} = R_{ss}(\hat{b}_{\tau,t} - \hat{\pi}_{\tau,t}) \tag{17}$$

$$\hat{b}_{\tau,0} = \hat{b}_\tau \tag{18}$$

Once the economy switches into the fiscal-dominant regime, there is no more regime uncertainty. By assumption, the monetary authority fixes the nominal interest rate at the steady-state level ($\hat{r}^n_{\tau,t} = 0$), and the government does not adjust the tax revenue in response to the debt level ($\rho_B = 1$). As a result, the dynamic of the government debt is explosive unless inflation adjusts accordingly to stabilize the debt—the celebrated fiscal theory of the price level (FTPL) (Cochrane, 2023; Woodford, 1995).

Solving the system forward, we obtain the following lemma:

Lemma 1. *The output and inflation dynamics under the fiscal-dominant regime satisfy*

$$\hat{\pi}_{\tau,t} = (1 - \beta\gamma)\hat{b}_{\tau,t} \tag{19}$$

$$\hat{y}_{\tau,t} = \bar{\sigma}^{-1}\frac{\gamma}{1-\gamma}\hat{\pi}_{\tau,t} \tag{20}$$

where γ *is the unique root of the equation* $\beta\gamma^2 - (1 + \beta + \kappa\bar{\sigma}^{-1})\gamma + 1 = 0$ *over the interval* $(0, 1)$.

The proof can be found in Appendix A. In the fiscal-dominant regime, the inflation rate is increasing in the debt level, as explained by the FTPL logic. The output is increasing with the inflation rate, as higher inflation reduces the real interest rate given that the monetary authority is passive in controlling inflation. Most importantly, both the inflation and output response when the economy enters the fiscal-dominant regime are determined by the initial level of government debt $\hat{b}_{\tau,0} = \hat{b}_\tau$. This result links the inflation and output expectation during the monetary-led regime to the prevailing level of government debt, even though the fiscal policy has been passive.

To see explicitly the role of government debt in the monetary-led regime, we can use Lemma 1 and the fact that $\hat{\pi}^F_t = \hat{\pi}_{t,0}, \hat{y}^F_t = \hat{y}_{t,0}$ to rewrite the equilibrium system as follows:

Proposition 1. *The equilibrium system under the monetary-led regime can be written as*

$$\hat{y}_t = -\bar{\sigma}^{-1}\big[\hat{r}^n_t - (1-\delta)\hat{\pi}_{t+1}\big] + (1-\delta)\hat{y}_{t+1} + \delta\bar{\sigma}^{-1}\frac{1-\beta\gamma}{1-\gamma}\hat{b}_{t+1} \tag{21}$$

$$\hat{\pi}_t = \kappa\hat{y}_t + \beta(1-\delta)\hat{\pi}_{t+1} + \beta\delta(1-\beta\gamma)\hat{b}_{t+1} \tag{22}$$

$$\hat{r}^n_t = \rho_R\hat{r}^n_{t-1} + (1-\rho_R)\phi_\pi\hat{\pi}_t \tag{23}$$

$$\hat{b}_{t+1} = \hat{r}^n_t + \rho_B R_{ss}(\hat{b}_t - \hat{\pi}_t) + \epsilon^{\mathcal{T}}_t \tag{24}$$

with initial condition $\hat{b}_0 = 0$.

Equations (21)-(24) resembles the four-equation New Keynesian model in Bigio et al. (2025). Compared to the textbook model, the debt level now enters the Euler equation (21) and the Phillips curve (22) through the expectation of a regime change. This has two consequences for the output and inflation dynamics. First, by consumption smoothing, a higher debt level directly increases current output because it generates a output boom in the fiscal-dominant regime. Second, a higher debt level also increases current inflation because it raises the expected inflation rate in the fiscal-dominant regime. Since the economy is still in the monetary-led regime, the monetary authority actively controls inflation by raising the real rate, which in turn reduces output. The net effect of a higher debt level on output thus depends on the monetary policy response to inflation.

Another consequence of the monetary policy reaction to inflation is the increased interest expenditure of the government, as can be seen in the debt evolution equation (24). This interaction between monetary policy and government debt can create a diabolic loop: a high initial debt level raises inflation through the fiscal dominance risk channel, prompting a monetary tightening that raises the interest burden, which in turn exacerbates the debt level. In fact, when the fiscal dominance risk is sufficiently high, a bounded equilibrium may not exist:

Proposition 2. *Suppose* $\rho_R = 0$ *and* $\beta = 1$. *A unique bounded equilibrium exists if and only if*

$$(\phi_\pi - 1)\Phi(\delta) > -\gamma(1-\rho_B)\delta^2 \tag{25}$$

where $\Phi(\delta) := \frac{\kappa}{\bar{\sigma}}(1-\rho_B-\delta) - (1-\gamma)\delta^2$ *is decreasing in* δ *over* $[0,1]$.

Inequality (25) generalizes the Taylor Principle — if $\delta = 0$, the inequality collapses to $\phi_\pi > 1$. However, the implication of the inequality is remarkably different. When δ is sufficiently large, we have $\Phi(\delta) < 0$ and hence the inequality imposes an upper bound on the Taylor coefficient ϕ_π:

$$\phi_\pi < 1 - \frac{\gamma(1-\rho_B)\delta^2}{\Phi(\delta)} \tag{26}$$

That is, a unique bounded equilibrium ceases to exist if the monetary policy rule is too sensitive to inflation.[3] Intuitively, a more hawkish monetary policy exacerbates the diabolic loop mechanism,

[3] More precisely, there is no bounded equilibria rather than multiplicity.

destabilizing the inflation dynamics. Notice that in this case, a unique bounded equilibrium always exists if the Taylor Principle is *violated*.

Summary Fiscal dominance risk creates a channel through which the government debt affects the output and inflation dynamics even in the monetary-led regime with Ricardian households. This channel operates through the expectation of a regime change, which raises current inflation and output via the forward-looking behaviors of firms and households. The monetary authority, in turn, reacts to the higher inflation by tightening the monetary policy, which raises the interest burden of the government and exacerbates the debt level. This interaction can lead to a prolonged period of high inflation and low output following a deficit-financed fiscal stimulus or even non-existence of a bounded equilibrium.

3.2 HANK vs. RANK – insights from TABU

The RANK model clarifies that fiscal dominance risk influences output and inflation dynamics through expectations and through the interaction between monetary policy and government debt. This expectation channel is equally present in HANK for two reasons. First, as recently shown by Angeletos et al. (2024b), fiscal dominance induces substantial increases in both inflation and output in HANK as well as RANK. Second, the supply side and policy environment are identical across the two models. In particular, the diabolic loop operating through the Phillips curve and the monetary and fiscal policy is entirely independent of the structure of the household block.

How, then, does HANK differ from RANK? The key distinction is that households in HANK are non-Ricardian, implying that fiscal stimulus has real effects even under a monetary-led policy regime. In particular, a deficit-financed lump-sum transfer directly boosts aggregate demand, partially offsetting the contractionary impact of the monetary tightening required to counter the inflationary pressures arising from fiscal dominance risk. Moreover, the persistently elevated government debt produced by the diabolic loop raises the neutral rate of interest. As a result, restoring output to its steady state may require a more prolonged period of higher real interest rates. Neither of these mechanisms operates in RANK.

We can build further intuition for the HANK mechanisms by considering an alternative household-block setup within the RANK environment, namely the two-agent bond-in-utility (TABU) model. Specifically, the economy is populated by two types of households that are identical with respect to labor income and tax liabilities but differ in their consumption–saving behavior. A fraction $\lambda \in [0,1]$ consists of hand-to-mouth households, who are constrained to consume their entire disposable income each period:

$$C_t^H = w_t N_t - T_t + \mathcal{T}_t + T_{ss}^H \tag{27}$$

where T_{ss}^H is the steady-state redistributive transfer to the hand-to-mouth type. This type corresponds to the households at the borrowing constraint in HANK who have unit marginal propensity to consume (MPC). The remaining share $1-\lambda$ are unconstrained, forward-looking households who smooth consumption intertemporally and hold bonds that enter their utility function:

$$U(C^U, B) := \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t^U)^{1-\sigma}}{1-\sigma} + \varphi^b \frac{(B_t^U/\Pi_t)^{1-\eta}}{1-\eta} \right] \tag{28}$$

where the parameters η, φ^b satisfy $\eta > 0, \varphi^b > 0$.[4] Note that households derive utility from the real value of the government debt, as is natural. This type corresponds to the unconstrained households in HANK who engage in precautionary saving. To see this, take first-order conditions for the unconstrained type:

$$(C_t^U)^{-\sigma} = \beta\, \mathbb{E}_t \left\{ \frac{R_t^n}{\Pi_{t+1}} \left[(C_{t+1}^U)^{-\sigma} + \varphi^b \left(\frac{B_{t+1}^U}{\Pi_{t+1}} \right)^{-\eta} \right] \right\} \tag{29}$$

Compared to the standard Euler equation, savings by itself provides an additional marginal pecuniary benefit that resembles the insurance benefit of savings in incomplete market models. The parameter restriction $\eta > 0, \varphi^b > 0$ ensures that this marginal pecuniary benefit of savings is diminishing with wealth, consistent with the notion that the precautionary saving motive weakens as households become more affluent.

As shown by Auclert et al. (2024), this class of model approximates well the intertemporal MPC (iMPC) of the one-asset model in equation (2). Since the iMPC encapsulates the partial-equilibrium consumption responses to aggregate income, the TABU model effectively captures the non-Ricardian aspect of HANK. In Appendix A.4, I extend the analysis of Auclert et al. (2024) to the intertemporal substitution channel and show that the consumption Jacobian with respect to interest rates in TABU also resembles its counterpart in HANK. Therefore, the TABU model can provide useful analytical insights into the mechanisms prevailing in HANK.

Log-linearizing the TABU model leads to the following system for the monetary-led regime:[5]

$$\hat{c}_t^U = -\sigma^{-1}[\hat{r}_t^n - \mathbb{E}_t\, \tilde{\pi}_{t+1} - (1-\alpha)\eta(\hat{b}_{t+1} - \mathbb{E}_t\, \tilde{\pi}_{t+1})] + \alpha\, \mathbb{E}_t\, \tilde{c}_{t+1}^U \tag{30}$$

$$\hat{y}_t = (1-g)\hat{c}_t^U - \frac{\lambda}{1-\lambda}\hat{T}_t \tag{31}$$

$$\hat{\pi}_t = \kappa \hat{y}_t + \beta\, \mathbb{E}_t\, \tilde{\pi}_{t+1} \tag{32}$$

$$\hat{r}_t^n = \rho_R \hat{r}_{t-1}^n + (1-\rho_R)\phi_\pi \hat{\pi}_t \tag{33}$$

$$\hat{b}_{t+1} = \hat{r}_t^n + R_{ss}\rho_B(\hat{b}_t - \hat{\pi}_t) + \epsilon_t^{\mathcal{T}} \tag{34}$$

$$\hat{T}_t = (1-\rho_B)B_{ss}\left(\hat{b}_t - \hat{\pi}_t\right) \tag{35}$$

where $\alpha = \beta R_{ss} \in (0,1)$ and the expectation operator $\mathbb{E}_t\, \tilde{x}_{t+1} = (1-\delta)\hat{x}_{t+1} + \delta \hat{x}_{t+1}^F\ \forall x$ takes into account the fiscal dominance risk. The first equation is the log-linearized version of equation (29)

[4] I omit the labor disutility for brevity.

[5] See Appendix A.4 for the derivation.

and corresponds to the forward-looking component of the aggregate demand. The second equation is obtained by combining the resource constraint with the consumption rule of the hand-to-mouth type. The remaining four equations describe the NKPC and policy rules, all of which are identical to RANK (and HANK).

There are three important differences between TABU and RANK. First, the neutral rate of interest, defined as the real rate that closes the output gap *in the monetary-led regime*, depends on fiscal and monetary policy.[6]

Proposition 3. *Up to first order, the log-deviation of the neutral rate of interest in TABU under the monetary-led regime satisfies*

$$r_t^* = \xi_b(\hat{b}_{t+1} - \mathbb{E}_t \hat{\pi}_{t+1}) + \xi_y \hat{y}_{t+1}^F + \frac{\lambda\bar{\sigma}}{1-\lambda}\left[-\hat{T}_t + \xi_\pi(\hat{\pi}_{t+1}^F - \hat{\pi}_{t+1})\right] \tag{36}$$

where $\xi_b = \alpha\frac{\lambda\bar{\sigma}}{1-\lambda}(1-\delta)(1-\rho_B)B_{ss} + (1-\alpha)\eta$, $\xi_y = \alpha\delta\bar{\sigma}$, *and* $\xi_\pi = \alpha\delta(1-\delta)(1-\rho_B)B_{ss}$.

Equation (36) represents the equilibrium in the government debt market. The first term captures the equilibrium adjustment along the asset demand curve: when the government issues more debt, say as a result of deficit-financed stimulus, the neutral rate increases because households require a higher return to hold the additional debt. This is not true in RANK where the household demand for government debt is infinitely elastic.

The second term captures the expectation effect of fiscal dominance risk: output expands under the fiscal-dominant regime and increases current output through consumption smoothing. Note that monetary tightening increases the government debt through the higher real rate, raising the neutral rate directly through the first channel. In addition, since the output expansion under the fiscal-dominant regime is larger when the prevailing government debt is higher, it also raises the neutral rate through the second channel.[7] Therefore, the diabolic loop created by the fiscal dominance risk will not only lead to a persistently high level of government debt and inflation, but also a significantly higher neutral rate.

In the presence of the hand-to-mouth type (i.e., $\lambda > 0$), the neutral rate is additionally shaped by the demand effect captured in the last term of equation (36). Lower taxes today raises the neutral rate because the hand-to-mouth type consumes immediately all the saved income, pushing up the aggregate demand and forcing the unconstrained type to reduce consumption to satisfy the resource constraint, which can only be achieved by a higher interest rate. On the other hand, the excessive inflation $(\hat{\pi}_{t+1}^F - \hat{\pi}_{t+1})$ driven by the fiscal dominance risk is essentially an implicit redistribution to the hand-to-mouth type, as the required tax payment is replaced by inflation under fiscal dominance. In turn, the expected future consumption of the unconstrained type falls, raising the neutral rate today.

[6] Another reasonable definition for the neutral rate is the real rate that closes the output gap in both regimes. Since monetary policy is passive under the fiscal-dominant regime, this alternative definition does not correspond to the real rate policy that the monetary authority should implement to close the output gap in face of fiscal dominance risk.

[7] See Appendix A.4 for a characterization of output dynamics under the fiscal-dominant regime in TABU.

Second, the intertemporal substitution channel is significantly weakened. Iterating equation (30) forward and combining with equation (31) to obtain the aggregate demand equation:

$$\hat{y}_t = -\bar{\sigma}^{-1}\,\mathbb{E}_t \sum_{j=0}^{\infty} \alpha^j [\hat{r}^n_{t+j} - \hat{\pi}_{t+j+1} - (1-\alpha)\eta(\hat{b}_{t+j+1} - \hat{\pi}_{t+j+1})] - \frac{\lambda}{1-\lambda}\hat{T}_t \tag{37}$$

Given $\alpha \in (0,1)$, the direct effect of the real rate on output is exponentially decreasing in its horizon.[8] The long-lasting monetary tightening resulted from the fiscal-risk-driven inflation will thus cause a less severe output contraction compared to RANK.

Lastly, a lump-sum transfer to households can directly stimulate output, violating Ricardian equivalence. This is most evident in the last term of equation (37), which captures the increase in demand caused by the hand-to-mouth type. Due to the bond-in-utility preference, the unconstrained type is also non-Ricardian. Nonetheless, their consumption responses to the lump-sum transfer are more smooth to be consistent with the Euler equation (29). Overall, a deficit-financed lump-sum transfer stimulates output, offsetting or even dominating the contractionary effect of monetary tightening caused by the fiscal dominance risk.

Summary In TABU and HANK, a deficit-financed fiscal stimulus directly increases the output and the neutral rate. The fiscal dominance risk operates through the expectation channel as in RANK, creating a diabolic loop between government debt and monetary tightening. However, the contractionary effect of monetary tightening is substantially weaker and is offset by the expansionary effect of the fiscal stimulus and the endogenously higher neutral rate induced by the high level of government debt. Consequently, the output may return to the steady-state level, despite persistent inflation and elevated interest rates.

4 Quantitative Results

The tractable models in the last section provide some intuitions into the operating mechanisms of fiscal dominance risk in HANK. In this section, I corroborate these intuitions by solving the HANK model with fiscal dominance risk numerically and analyzing the output and inflation dynamics following a deficit-financed uniform transfer.

4.1 Quantification

Calibration Table 1 summarizes the baseline calibration. One period is a quarter. The calibration strategy follows closely the HANK literature. The coefficient of relative risk aversion is set to $\sigma = 2$, and the inverse Frisch elasticity of labor supply is set to $\phi = 1$. The labor disutility parameter φ is chosen to normalize the steady-state output to be $Y_{ss} = 1$. Households face a zero

[8] This dampening of the output sensitivity to future interest rates is also present in models with cognitive discounting (Gabaix, 2020) and incomplete information (Angeletos and Huo, 2021).

borrowing constraint $\underline{a} = 0$. The annual real rate at the steady state is set to $r = 1\%$, and the discount factor β is calibrated to match the U.S. government debt held by domestic private investors $B_{ss}/Y_{ss} = 55\% \times 4$, as in Hall and Sargent (2025).

The idiosyncratic productivity z_{it} follows a standard log AR(1) process: $\log z_{it+1} = \rho_z \log z_{it} + \sigma_z \epsilon_{it+1}$, where ϵ_{it+1} is an i.i.d. standard normal shock. Following Bayer et al. (2024), I use the estimates $\rho_z = 0.98$ and $\sigma_z = 0.12$ from Storesletten et al. (2004).

The slope of the NKPC is an important parameter for the inflation dynamics. In my baseline calibration, I set the slope to $\kappa = 0.0138$, taken from the empirical estimates in Hazell et al. (2022). This value corresponds to a rather flat NKPC. As some recent studies have argued that the NKPC has steepened during the post-COVID period (e.g., Cerrato and Gitti 2022; Harding et al. 2023), I discuss how a steeper NKPC affects the results in Section 4.3.

As explained in Section 3.1, the monetary policy reaction is central to the transmission mechanism of fiscal dominance risk. In my baseline calibration, I choose conventional values for the monetary policy rule, with the inertia parameter $\rho_r = 0.80$ and the coefficient on inflation $\phi_\pi = 1.5$. I discuss how different monetary policy rules affect the dynamics in Section 4.4.

Following Angeletos et al. (2024a), I set the fiscal rule parameter to $\rho_b = 0.974$, which implies that in the absence of inflation and nominal rate variation, the half-life of excessive debt is about 6.5 years. This value corresponds to a relatively slow fiscal adjustment, which is consistent with the recent U.S. fiscal policy (Auerbach and Yagan, 2025) and DSGE estimates (e.g., Bianchi et al. 2023; Bayer et al. 2024). The progressivity of the labor tax system is set to $\xi = 0.181$, taken from Heathcote et al. (2017). The proportional labor tax rate τ is calibrated to satisfy the government budget constraint, given the steady-state level of government spending $G_{ss} = 0.20$ and government debt $B_{ss} = 2.2$.

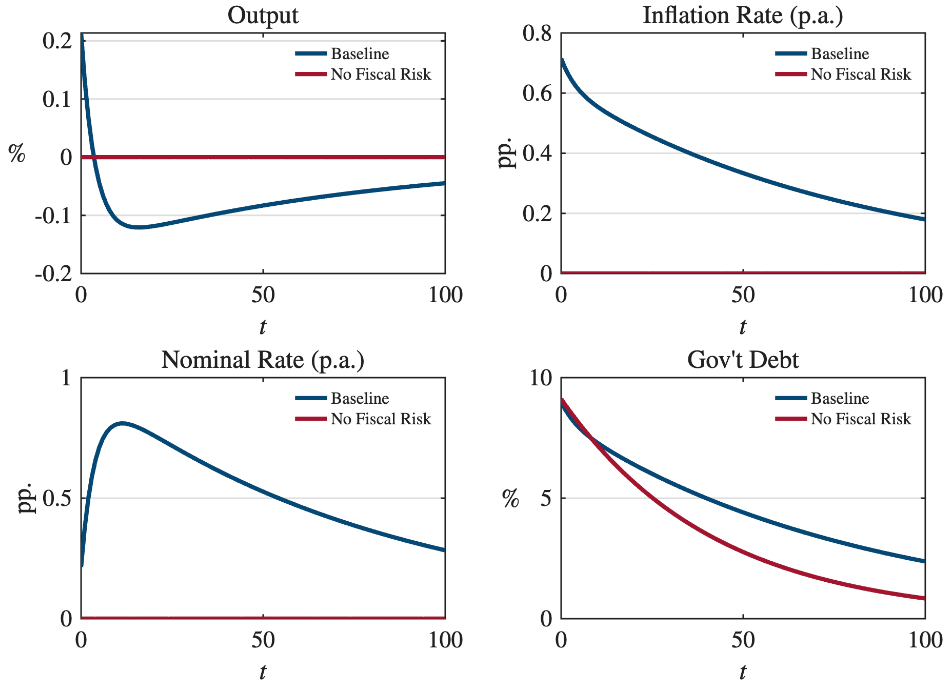
Finally, the probability of transition to the fiscal-dominant regime is set to $\delta = 1\%$ per quarter, which corresponds to an expected duration of the monetary-led regime of 25 years. Based on a regime-switching DSGE model, Bianchi and Melosi (2017) estimated that $\delta = 0.8\%$ for the postwar period 1955–2013. Given that the fiscal dominance risk has likely increased during the post-COVID period, as argued in the introduction, I regard the chosen level of fiscal dominance risk as a conservative benchmark.

Solution method I solve the regime-switching HANK model using the sequence-space method developed by Lin and Peruffo (2024). The main idea is to note that once the economy transitions to the fiscal-dominant regime, the economy follows a deterministic path, which can be solved efficiently using the sequence-space Jacobian method of Auclert et al. (2021). Given these deterministic paths indexed by the transition time, I can then solve the monetary-led regime non-linearly by iterating on the expectations using a modified quasi-Newton algorithm. See Appendix B.1 for the details of the solution method.

Table 1: Baseline Calibration

Parameter	Interpretation	Value	Source/Target
Households			
σ	CRRA coeff.	2	Standard
ϕ	Inverse Frisch elas.	1	Standard
r	Real rate (p.a.)	0.01	Standard
$\underline{a}$	Borrowing limit	0	Standard
β	Discount factor	0.98	$B_{ss}/Y_{ss} = 2.2$
ρ_z	Autocorr. z	0.98	Storesletten et al. (2004)
σ_z	Std. z	0.12	Storesletten et al. (2004)
Nominal Rigidities			
κ	Slope of NKPC	0.0138	Hazell et al. (2022)
Monetary and Fiscal Policy			
ρ_r	Taylor rule (inertia)	0.80	Baseline
ϕ_π	Taylor rule (inflation)	1.5	Baseline
ρ_b	Fiscal rule	0.974	Angeletos et al. (2024a)
ξ	Labor tax progressivity	0.181	Heathcote et al. (2017)
G_{ss}/Y_{ss}	Gov't spending	0.20	Standard
B_{ss}/Y_{ss}	Gov't debt	2.2	Hall and Sargent (2025)
fiscal dominance risk			
δ	Prob. of fiscal dominance	0.01	Baseline

Figure 2: Impulse Response to Stimulus Transfer in RANK with Fiscal Dominance Risk



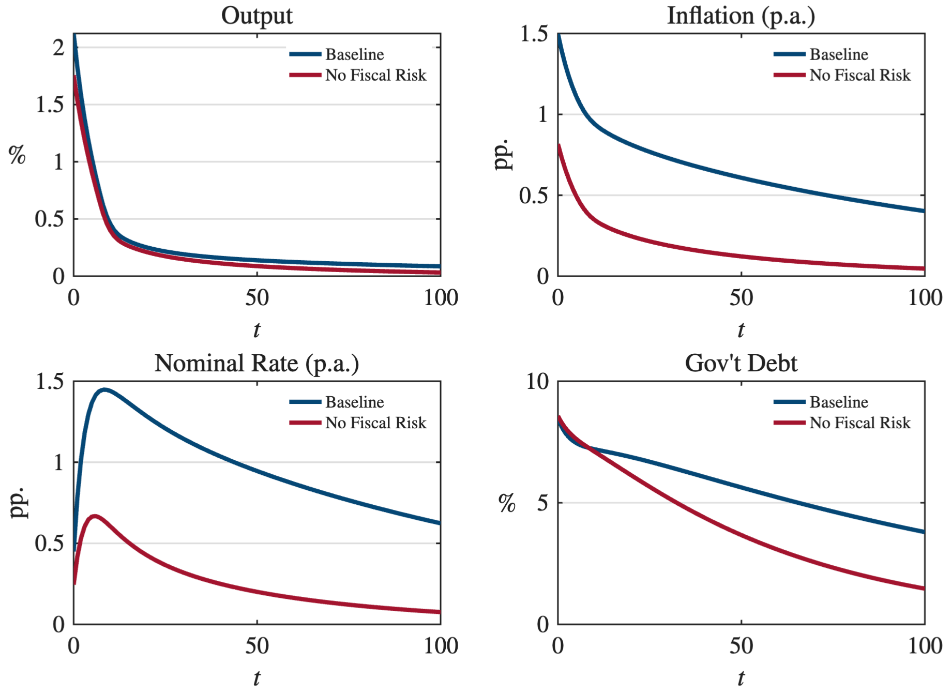
4.2 Aggregate responses to lump-sum transfers

In the following, I focus on the economy path under the monetary-led regime following an one-time lump-sum transfer shock at time 0. I set the size of the transfer to be 20% of the steady-state (quarterly) output, which is roughly the size of the first-round COVID stimulus transfer in 2020.

First, let's look at the responses in the RANK model which we studied in Section 3.1. Figure 2 shows the paths of output, inflation, nominal rate, and government debt following the fiscal stimulus. The blue lines represent the baseline calibration with fiscal dominance risk, while the red lines represent the paths when the fiscal dominance risk is set to zero ($\delta = 0$). Without fiscal dominance risk, the model reduces to the standard New Keynesian model, and the lump-sum transfer merely increases the government debt without affecting the output or inflation because of Ricardian equivalence.

In contrast, with fiscal dominance risk, both the output and inflation respond to the transfer even though the economy is still in the monetary-led regime. In particular, the inflation rate rises persistently after the *one-time* transfer, while the output increases temporarily and then becomes negative for a prolonged period. The non-monotonic response of output is due to the inertial monetary policy rule which limits the initial rise of the nominal rate. The persistence of the inflation and output response, however, is an endogenous result of the interaction between the monetary policy and government debt. The higher inflation rate raises the real interest rate, which prolongs the debt decumulation and in turn keeps the (expected) inflation rate elevated through the fiscal

Figure 3: Impulse Response to Stimulus Transfer in HANK with Fiscal Dominance Risk

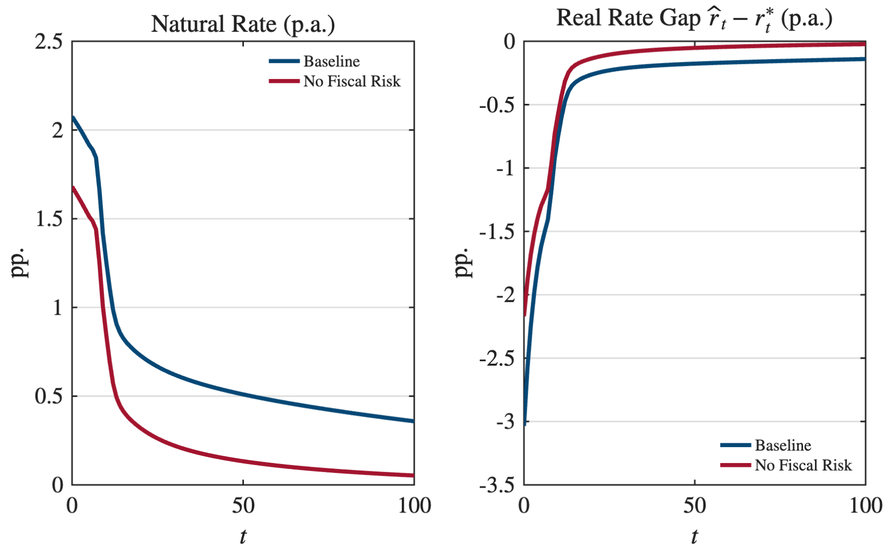


dominance risk channel. As can be seen in Figure 2, the government debt response is more persistent with fiscal dominance risk, confirming this mechanism.

Figure 3 shows the impulse responses of the same variables in the HANK model with fiscal dominance risk. Because households are non-Ricardian and have high MPCs, the transfer shock significantly increases the output and inflation rate even without fiscal dominance risk. Similar to RANK, the fiscal dominance risk further raises the inflation rate through the expectation channel, prompting a stronger monetary tightening that keeps the government debt persistently elevated. However, unlike RANK, the higher and longer real rate response does not lead to a prolonged output contraction. Instead, the output response is slightly stronger than in the case without fiscal dominance risk. Also, the inflation amplification from the fiscal dominance risk is stronger in HANK than in RANK—the (annualized) inflation rate rises by another 0.4 percentage points after 25 years in HANK, compared to 0.2 percentage points in RANK.

There are two equivalent explanations for these differences. The first explanation is based on the relative strength of the intertemporal substitution channel and the income channel. As pointed out by Kaplan and Violante (2018), in HANK, both channels are important in the transmission of fiscal stimulus, while in RANK, the intertemporal substitution channel dominates. In both models, we can regard the fiscal dominance risk as a transfer shock that increases the expected income of households by lowering the expected tax payment. In HANK, this income effect directly stimulates the aggregate demand, complementing the indirect intertemporal substitution effect of lower expected real rates, which is effectively the only channel in RANK. Therefore, the fiscal dominance risk amplifies the

Figure 4: neutral rate in HANK with Fiscal Dominance Risk



NOTE. The real rate gap on the right subplot is defined as the difference between the expected real rate $\hat{r}_t := \hat{r}_t^n - \mathbb{E}_t\, \tilde{\pi}_{t+1}$ and the neutral rate r_t^*.

output response in HANK more than in RANK. This result, however, depends on the slope of the NKPC and the monetary policy rule since they determine the equilibrium effect of demand expansion.

The second explanation is based on the neutral rate of interest, which is discussed extensively in Section 3.2. Because of precautionary motive, the aggregate supply of savings in HANK is not infinitely elastic as in RANK (Aiyagari, 1994; Kaplan et al., 2023; Campos et al., 2025). As a result, a persistent increase in the supply of government debt raises the neutral rate of interest in HANK. If the monetary policy is being too accommodative, as happens to be the case here, then the real rate will be lower than the neutral rate in equilibrium, which stimulates the aggregate output. This channel is absent in RANK, where the neutral rate is constant.

Figure 4 shows the path of the neutral rate and the real rate gap in the HANK model. Consistent with the theory, the neutral rate rises in response to the deficit-financed stimulus, regardless of the fiscal dominance risk. However, with the fiscal dominance risk, the increase in the neutral rate is larger and substantially more persistent—after 25 years, the neutral rate is still 0.4 percentage point higher than the steady-state level, while it virtually returns to the steady state when there is no fiscal dominance risk. Although the real rate also increases more due to the monetary policy reaction to the high inflation driven by fiscal dominance risk, the extent is smaller than the increase in the neutral rate, as shown in the right subplot of Figure 4. This widening of the real rate gap explains the stronger output expansion under fiscal dominance risk.

4.3 Slope of the NKPC

Our discussion has highlighted the role of aggregate demand stimulus as a key mechanism through which fiscal dominance risk affects the output and inflation dynamics in HANK. In New Keynesian models, the slope of the NKPC is a crucial determinant of the equilibrium effects of aggregate demand stimulus, so it is natural to ask how changing the slope affects the results. Moreover, there is empirical evidence that the NKPC has steepened in the post-COVID period (e.g., Cerrato and Gitti 2022; Harding et al. 2023), so it is empirically relevant to consider a steeper NKPC. To guide the choice of the steeper slope, I note that Cerrato and Gitti (2022) find that the slope of the NKPC has tripled in the post-COVID period. Thus, I consider a slope of $\kappa = 0.0138 \times 3 = 0.0414$ as my steep NKPC benchmark.

Figure 5 shows the inflation and output dynamics in both RANK and HANK models with different slopes of the NKPC. Interestingly, in RANK, both the output and inflation response are essentially unaffected by the steeper NKPC, except in the very short run. To understand why, recall that in RANK, all the output and inflation responses to the transfer shocks are driven by the fiscal dominance risk channel which operates through expectation of high inflation in the fiscal-dominant regime. By the FTPL logic, the cumulative inflation in the fiscal-dominant regime is determined by the initial level of government debt, which is unaffected by the slope of the NKPC. To see this, we can iterate forward the debt equation in the fiscal-dominant regime system to obtain

$$\sum_{j=0}^{\infty} \beta^j \hat{\pi}_{\tau,t+j} = \hat{b}_{\tau,t}. \tag{38}$$

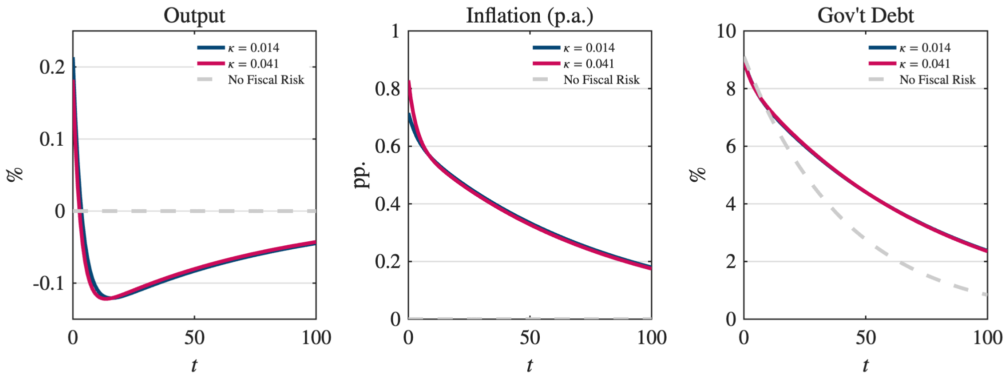
Given that $\beta \approx 1$ and $\hat{\pi}_{\tau,t+j} \to 0$, the LHS is approximately the cumulative inflation $\sum_{j=0}^{\infty} \hat{\pi}_{\tau,t+j}$. The Euler equation then implies that the output response in the first period of the fiscal-dominant regime is given by

$$\hat{y}_{\tau,t} = \bar{\sigma}^{-1} \sum_{j=1}^{\infty} \hat{\pi}_{\tau,t+j} \approx \bar{\sigma}^{-1} \gamma \hat{b}_{\tau,t}. \tag{39}$$

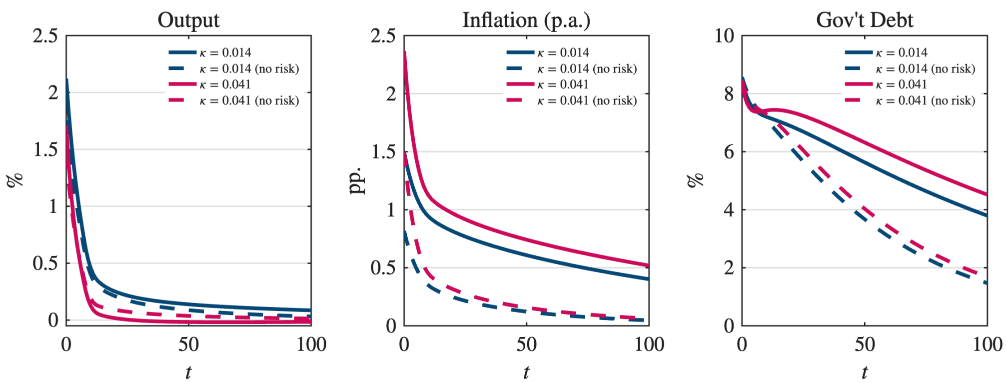
where γ is defined in Lemma 1 and its size is weakly affected by the slope of the NKPC. Since this initial response is a sufficient statistic for the fiscal dominance risk effect on the output in the monetary-led regime (see Proposition 1), it follows that the fiscal dominance risk effect on the output and inflation dynamics under the monetary-led regime is mostly unaffected by the slope of the NKPC.

In contrast, in HANK, the steeper NKPC leads to a significantly weaker output response but a stronger inflation response in the long horizon. This result is not driven by the weaker direct effect of the fiscal stimulus, as the dashed lines that represent the dynamics without fiscal dominance risk in Figure 6b are close to each other in the long horizon. In particular, the fiscal dominance risk now dampens the long run output response rather than amplifies it, as can be seen by comparing

Figure 5: Output and Inflation Dynamics and the Slope of the NKPC



(a) RANK

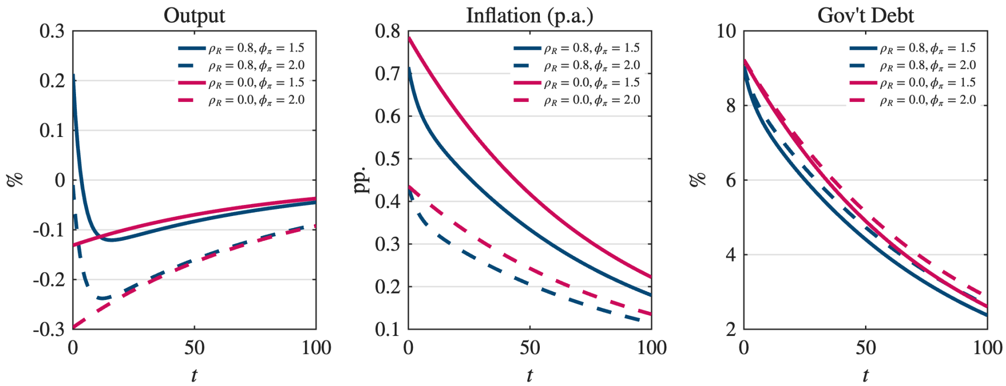


(b) HANK

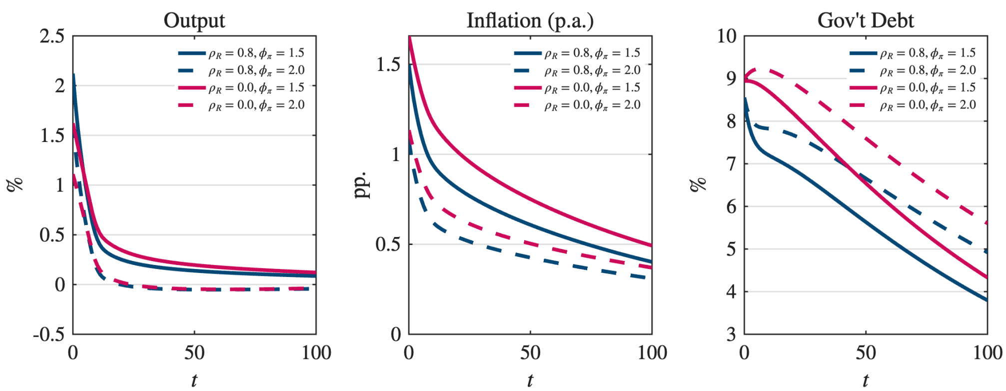
the red solid line and the red dashed line in Figure 6b. The reason for this difference is that the steeper NKPC implies a stronger inflation response to the transfer shock, prompting a stronger monetary tightening that raises the interest burden of the government and exacerbates the debt level. Although the higher debt level directly stimulates the aggregate demand, it also significantly raises the inflation rate and hence the real interest rate, offsetting the output stimulus. When the NKPC is steep, the latter effect dominates, leading to a negative net effect of the fiscal dominance risk channel.

Interestingly, with a steep NKPC and the fiscal dominance risk, the output is essentially back to the steady state 5 years after the fiscal stimulus, while the inflation rate remains 1% higher than the target level and declines very slowly—a phenomenon that is reminiscent of the post-COVID output-inflation dynamics. The result here thus highlights the importance of accounting for a steeper NKPC when analyzing the inflation consequences of fiscal stimulus in the presence of the risk of fiscal dominance.

Figure 6: Aggregate Dynamics under Different Monetary Policy Rules



(a) RANK



(b) HANK

NOTE. All the paths are under the monetary-led regime with fiscal dominance risk $\delta = 1\%$.

4.4 Alternative monetary policy rule

As discussed before, the monetary policy reaction to inflation is central to the transmission mechanism of fiscal dominance risk. In the following, I explore how different monetary policy rules affect the output and inflation dynamics following the fiscal stimulus. Recall that the (log-linearized) monetary policy rule takes the form:

$$\hat{r}^n_t = \rho_R \hat{r}^n_{t-1} + (1 - \rho_R)\phi_\pi \hat{\pi}_t \tag{40}$$

I consider different values of the parameters (ρ_R, ϕ_π). The inertia parameter ρ_R governs the speed of monetary reaction to inflation, while the inflation coefficient ϕ_π governs the strength of the reaction. The normalization $(1 - \rho_R)\phi_\pi$ ensures that the overall responsiveness to inflation is comparable across different values of ρ_R.

Figure 6 shows the output, inflation, and government debt dynamics in both RANK and HANK models under different monetary policy rules. The blue (red) color represents the slow (fast) monetary reaction $\rho_R = 0.8$ ($\rho_R = 0.0$), while the solid (dashed) line pattern represents the low (high) inflation responsiveness $\phi_\pi = 1.5$ ($\phi_\pi = 2.0$). In both models, a faster monetary reaction to inflation (lower ρ_R) leads to a lower immediate output response but a slightly higher output response in the long horizon. This is consistent with the intertemporal substitution induced by the equilibrium real rate path. Most interestingly, the inflation response is *larger* when the monetary reaction is faster. This is because a faster monetary reaction leads to an initially higher debt level by raising the interest burden of the government early on, generating a stronger fiscal dominance risk effect on inflation. Thus, in the presence of fiscal dominance risk, it can be optimal for a benevolent monetary authority to react more slowly to inflation. The result here suggests that this insight is robust to the presence of household heterogeneity.

The two models also show the same qualitative patterns regarding the strength of the monetary reaction to inflation. In both models, a stronger monetary reaction to inflation (higher ϕ_π) leads to a lower output and inflation response. This is consistent with the higher equilibrium real rates. Note that the output and inflation dynamics in the HANK model with a more hawkish monetary policy rule is similar to the HANK model with a steeper NKPC (Figure 6b)—the output quickly returns to the steady state while the inflation rate remains elevated for a prolonged period. Intuitively, both a stronger monetary reaction to inflation and a steeper NKPC imply a less elastic aggregate supply, limiting the equilibrium effect of aggregate demand expansion from the fiscal dominance risk channel.

5 Optimal Monetary Policy

In this section, I study the optimal monetary policy during the monetary-led regime in both models.

5.1 Optimal policy under commitment

Following the New Keynesian tradition, I posit that the objective of the monetary authority is to minimize the following dual-mandate quadratic loss function:

$$\mathcal{L} = \frac{1}{2}\,\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\alpha_y \tilde{y}_t^2 + \alpha_\pi \tilde{\pi}_t^2\right) \tag{41}$$

where $\tilde{y}_t$ and $\tilde{\pi}_t$ are the log-deviation of output and inflation at time t from their steady-state levels and the expectation is taken with respect to the fiscal dominance risk. This choice of the objective function has two motivations. First, since the steady state of the HANK model is inefficient due to incomplete markets, the usual choice of utilitarian welfare function necessarily involves inequality concerns, which do not exist in the RANK model. Therefore, this loss function facilitates the comparison of optimal policy in the two models by focusing on the inflation and output stabilization motive. Second, this loss function approximates the dual mandate of the Fed and is commonly used in the literature.

Using our notation, we can express the objective in terms of the equilibrium contingency paths:

$$\mathcal{L}\Big(\hat{y},\hat{\pi},\{\hat{y}^{\tau},\hat{\pi}^{\tau}\}_{\tau}\Big)=\underbrace{\sum_{t=0}^{\infty}[\beta(1-\delta)]^{t}\left(\hat{y}_t^2+\alpha\hat{\pi}_t^2\right)}_{\text{Monetary-led regime}}+\underbrace{\beta\delta\sum_{\tau=1}^{\infty}[\beta(1-\delta)]^{\tau-1}\left(\sum_{j=0}^{\infty}\beta^{j}\left(\hat{y}_{\tau,j}^2+\alpha\hat{\pi}_{\tau,j}^2\right)\right)}_{\text{Fiscal-dominant regime}} \tag{42}$$

The first term is the expected present value associated with the monetary-led regime, while the second term is the expected present value associated with the fiscal-dominant regime indexed by the realization time of fiscal dominance τ.

To be consistent with the notion of fiscal dominance, I assume that the monetary authority is constrained to follow the prescribed nominal interest rate rule $R^n_{\tau,j}=R_{ss}\ \forall\tau,j$ in the fiscal-dominant regime. In contrast, in the monetary-led regime, they are free to choose any interest rate path and have full commitment power. Each chosen interest rate path then implies a rational expectation equilibrium consistent with the equilibrium system in both regimes, which serve as the feasibility constraints of the policy maker.

Given the quadratic loss, it suffices to consider the linearized equilibrium constraints around the steady state to obtain a first-order approximation of the optimal policy. Following McKay and Wolf (2023), these linear equilibrium constraints can be compactly expressed as:

$$\mathcal{H}_x\hat{x}+\sum_{\tau=1}^{\infty}\mathcal{H}_x^{\tau}\hat{x}^{\tau}+\mathcal{H}_r\hat{r}^n+\mathcal{H}_{\mathcal{T}}\epsilon^{\mathcal{T}}=0 \tag{43}$$

where $x:=(y,\pi)$ denote the stacked vector of y and π and $\big(\mathcal{H}_x,\{\mathcal{H}_x^{\tau}\}_{\tau},\mathcal{H}_r,\mathcal{H}_{\mathcal{T}}\big)$ are conformable linear operators derived from differentiating the equilibrium system. Furthermore, we can equivalently express the linear constraints as follows:

$$\hat{x}=\mathcal{G}_r\,\hat{r}^n+\mathcal{G}_\epsilon\,\epsilon^{\mathcal{T}} \tag{44}$$

$$\hat{x}^{\tau}=\mathcal{G}_r^{\tau}\,\hat{r}^n+\mathcal{G}_\epsilon^{\tau}\,\epsilon^{\mathcal{T}}\quad\forall\tau\geq 1 \tag{45}$$

where the linear operators $\big(\mathcal{G}_r,\mathcal{G}_\epsilon,\{\mathcal{G}_r^{\tau},\mathcal{G}_\epsilon^{\tau}\}_{\tau}\big)$ are the conditional impulse response of $x=(y,\pi)$ to monetary policy shocks and the fiscal stimulus shock.[9] These operators summarize the equilibrium effects of monetary policy and lump-sum transfers.

Letting $\Omega_0:=\text{diag}(\alpha_y,\alpha_\pi)\otimes\text{diag}(1,\beta(1-\delta),\dots)$ and $\Omega_1:=\text{diag}(\alpha_y,\alpha_\pi)\otimes\text{diag}(1,\beta,\dots)$, the

[9] This expression is derived from inverting the equilibrium system (43), begging the question of implementability. Given an intended interest rate path $\hat{r}^{n*}$ and an inflation path $\hat{\pi}^*$ consistent with the equilibrium system, the equilibrium can be implemented by the policy rule $\hat{r}^n=\hat{r}^{n*}+\phi_\pi(\hat{\pi}-\hat{\pi}^*)$ with $\phi_\pi>1$ (Cochrane, 2011). In practice, I implement this rule by considering the standard Taylor rule $\hat{r}^n=\phi_\pi\hat{\pi}+z$ and optimizing with respect to the pseudo monetary policy shock z.

full LQ problem of the monetary authority can be written as:

$$\min_{\hat{x},\{\hat{x}^\tau\}_\tau,\hat{r}^n} \; \frac{1}{2}\left[\hat{x}'\Omega_0\hat{x} + \beta\delta\sum_{\tau=1}^{\infty}[\beta(1-\delta)]^{\tau-1}\left(\hat{x}^{\tau\prime}\Omega_1\hat{x}^\tau\right)\right] \tag{46}$$
$$s.t. \quad \hat{x} = \mathcal{G}_r\,\hat{r}^n + \mathcal{G}_\epsilon\,\epsilon^{\mathcal{T}}$$
$$\hat{x}^\tau = \mathcal{G}_r^\tau\,\hat{r}^n + \mathcal{G}_\epsilon^\tau\,\epsilon^{\mathcal{T}} \quad \forall\tau$$

It is then straightforward to derive the following optimality condition:

$$\mathcal{G}_r'\,\Omega_0\hat{x} + \beta\delta\sum_{\tau=1}^{\infty}[\beta(1-\delta)]^{\tau-1}\left(\mathcal{G}_r^{\tau\prime}\,\Omega_1\hat{x}^\tau\right) = 0 \tag{47}$$

The first term represents the inflation-output tradeoff in the monetary-led regime. When there is no fiscal dominance risk ($\delta = 0$), this is the only term left and the optimality condition collapses to the standard target criterion.[10] In particular, since the Phillips curve only depends on output, the optimal policy in this case is to fully offset the aggregate-demand effect of the fiscal stimulus.

When $\delta > 0$, because the monetary authority cannot freely choose the interest rate paths under fiscal dominance, the optimal monetary policy takes into account the expected tradeoffs in the fiscal-dominant regime, which is captured by the second term in equation (47). The inflation-output tradeoffs in the two regimes are fundamentally different. In the monetary-led regime, an increase in the interest rate contracts the aggregate demand, reducing the inflation and output. Yet, the same policy will raise the government's debt burden, thereby exacerbating the inflation and output in the fiscal-dominant regime. Optimal policy balances these two effects.

Lastly, substituting the implementability constraints into equation (47), we obtain a closed-form expression for the optimal policy:

$$\hat{r}^n = -\left[\mathcal{G}_r'\,\Omega_0\,\mathcal{G}_r + \beta\delta\sum_{\tau=1}^{\infty}[\beta(1-\delta)]^{\tau-1}\left(\mathcal{G}_r^{\tau\prime}\,\Omega_1\,\mathcal{G}_r^\tau\right)\right]^\dagger\left[\mathcal{G}_r'\,\Omega_0\,\mathcal{G}_\epsilon + \beta\delta\sum_{\tau=1}^{\infty}[\beta(1-\delta)]^{\tau-1}\left(\mathcal{G}_r^{\tau\prime}\,\Omega_1\,\mathcal{G}_\epsilon^\tau\right)\right]\epsilon^{\mathcal{T}} \tag{48}$$

where $[\cdot]^\dagger$ is the pseudo-inverse operator. Notice that this formula holds for both the HANK model in Section 2.1 and the RANK model in Section 3.1. The only differences between the two models are the implied impulse responses $\left(\mathcal{G}_r, \mathcal{G}_\epsilon, \{\mathcal{G}_r^\tau, \mathcal{G}_\epsilon^\tau\}_\tau\right)$.

5.2 Computational method

To apply the optimal policy formula (48), we need to compute the impulse responses $\left(\mathcal{G}_r, \mathcal{G}_\epsilon, \{\mathcal{G}_r^\tau, \mathcal{G}_\epsilon^\tau\}_\tau\right)$. One simple approach is numerical differentiation — perturb the model with a small shock once

[10] See Dávila and Schaab (2023) and McKay and Wolf (2023) for a detailed treatment of the optimal monetary policy problems in HANK.

at a time and compute the impulse responses using the nonlinear solution algorithm outlined in Section 4.1. However, this approach is computationally inefficient and unnecessarily introduces approximation errors.

A faster and more accurate approach is to work with the linearized equilibrium systems of the two regimes directly. The challenge here is to linearize the monetary-led regime which involves time-varying expectations of all contingency paths of output and inflation. In Appendix B.2, I show how to characterize the linearized system of the monetary-led regime with the conventional sequence-space Jacobians derived from the model without fiscal dominance risk. The key idea is to leverage certainty equivalence to represent the expectation of a contingency path by a sequence of unanticipated shocks. With the linearized systems in hand, we can apply the iterative algorithm as before to obtain the impulse responses. This step is fast because it only involves multiplication of low-dimensional matrices.

5.3 Results

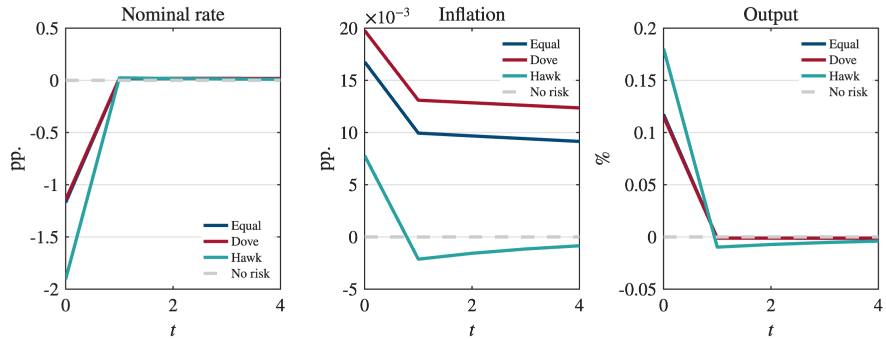
As a benchmark, I characterize the optimal policy response to a one-time stimulus shock of magnitude 1% of the steady-state output at $t = 0$ in the calibrated HANK and RANK model. To illustrate the trade-off between inflation and output stabilization, I evaluate three distinct weighting schemes (α_y, α_π) within the loss function: (i) Equal weighting ($\alpha_y = 1, \alpha_\pi = 1$); (ii) Dovish weighting ($\alpha_y = 1, \alpha_\pi = 0$), prioritizing output stability; and (iii) Hawkish weighting ($\alpha_y = 0, \alpha_\pi = 1$), prioritizing inflation stability.

Figure 7 shows the optimal policy rate and the implied inflation and output responses. In RANK, regardless of the weighting schemes, the optimal policy is to substantially reduce the nominal rate on impact, with size of the reduction largest under the hawkish objective. Intuitively, in RANK, the real effects of the stimulus shock are entirely driven by the expectation of fiscal dominance, of which the potency hinges on the size of the debts. Thus, by reducing the nominal rate and hence the real rate immediately after the stimulus, the monetary authority effectively neutralizes the deficit effect of the transfer, eliminating the effect of fiscal dominance. However, the rate cut by itself stimulates aggregate demand, so the monetary authority promises slightly higher nominal rate in the future to smooth out the demand effects. The result of this optimal policy is that both inflation and output are largely stabilized after the first period.

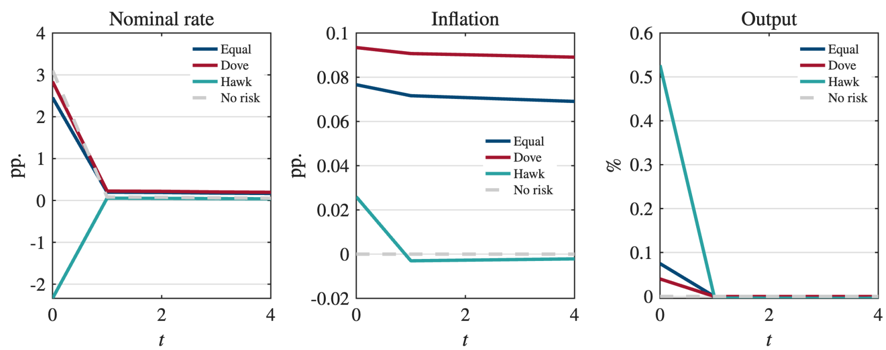
In HANK, the stimulus transfer has real effects even without the fiscal dominance risk because households are non-Ricardian. As discussed above, the optimal policy in this case is to fully offset the aggregate-demand effect of the stimulus, which is feasible thanks to the aggregate equivalence between interest rate policy and stimulus transfer policy in HANK (Wolf, 2025). Apparently, this policy is optimal for any weighting scheme.

In the presence of fiscal dominance risk, however, the optimal policy generally depends on the weighting scheme. When the monetary authority puts equal weights on output and inflation stabilization or cares only about output stabilization, the optimal policy is to raise the nominal rate

Figure 7: Optimal Monetary Policy



(a) RANK



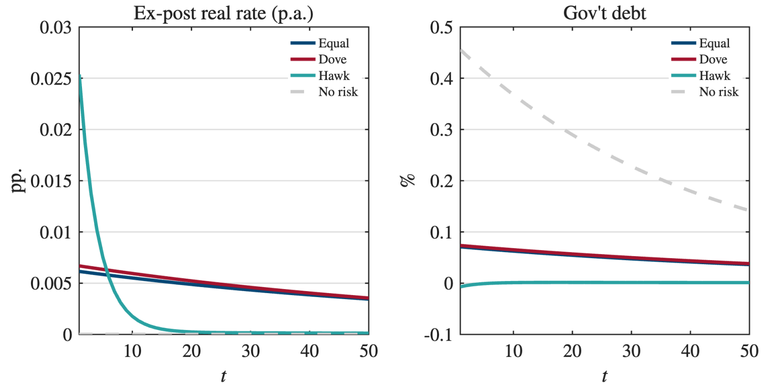
(b) HANK

on impact, albeit to an extent smaller than the optimal response without fiscal dominance risk. On the other hand, a hawkish monetary authority should reduce the nominal rate. The intuition is the same as in RANK — lowering the interest rate early on reduces the potency of fiscal dominance, counteracting the expectational effects of the fiscal dominance risk.

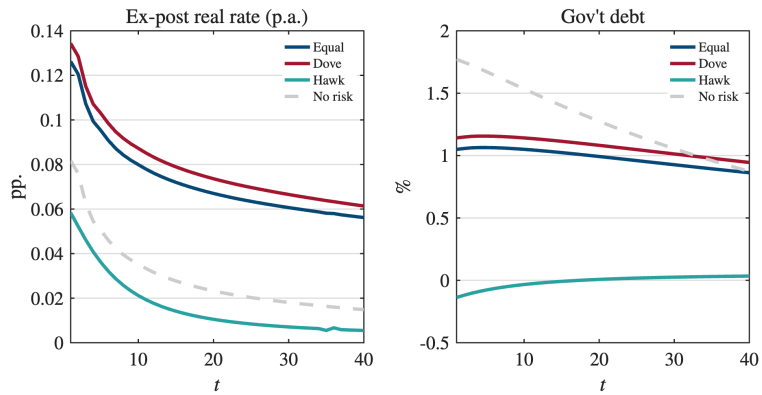
The key difference between HANK and RANK lies in the long-run behavior of the optimal real rate. Figure 8 shows the optimal path of the real rate along with the path of the government debt after the initial period in both models. In RANK, the government deficit is substantially offset by the initial rate cut, so a marginal increase in the long-term real rate is sufficient to stabilize output. Note that when the monetary authority is hawkish, the government debt is nearly completely stabilized and the real rate quickly converges to the steady state.

In HANK, when output stabilization is concerned, the scope for an initial rate cut relative to the no-risk benchmark is very limited. As a result, government debt remains persistently high under the optimal policy, increasing the neutral rate in the long run through the mechanisms discussed in Section 3.2. It follows that to stabilize output, the real rate has to be significantly higher in the long run as well, as can be seen in Figure 9b. Note that the higher real rate eventually raises the government debt above the level in the no-risk benchmark, underscoring the interaction between

Figure 8: Real Rate and Government Debt under Optimal Policy



(a) RANK



(b) HANK

the debt dynamics and the neutral rate. In contrast, when the monetary authority is dovish, the optimal policy is again to stabilize the government debt, and the real rate is lower than the no-risk benchmark in the long run — though it is still an order of magnitude higher than in RANK.

To sum up, regardless of household heterogeneity, optimal monetary policy tends to accommodate part of the deficits by initially reducing the nominal rate (relative to the no-risk benchmark) to alleviate the expectation channel of fiscal dominance risk. The more hawkish the monetary authority is, the larger fraction of the deficit is accommodated. In HANK, when output stabilization is concerned, the direct effect of the fiscal stimulus limits the scope for a rate cut, exacerbating the deficits and leading to a persistently higher real rate. Only when inflation stabilization is the mere objective, optimal monetary policy in HANK and RANK agrees—stabilizing the government debt.

6 Concluding Remarks

Fiscal stimulus has become a standard counter-cyclical measure in developed economies. Although this policy is particularly useful in supporting the economy during recessions, in the presence of fiscal dominance risk, it comes at the cost of persistently high inflation and neutral rate in the long run. Therefore, effective fiscal stimulus requires a firm commitment to central bank independence.

In ongoing works, I explore the robustness of the results to the self-financing channel (Angeletos et al., 2024a) and use the model to assess the contribution of fiscal dominance risk to the increase in the U.S. treasury yield after the pandemic.

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Appendix A Mathematical Derivation

A.1 Proof of Lemma 1

For the ease of notation, in the following, I drop the subscript τ and write $\hat{x}_t$ instead of $\hat{x}_{\tau,t}$. As is well known, the fiscal-dominant regime satisfies the determinacy condition, so there exists a unique bounded equilibrium. Conjecture that in equilibrium $\pi_{t+1} = \gamma\pi_t$ for some $\gamma \in \mathbb{R}$. Iterate forward the Euler equation:

$$\begin{aligned}\hat{y}_t &= \bar{\sigma}^{-1}\sum_{j=1}^{\infty}\hat{\pi}_{t+j}\\ &= \bar{\sigma}^{-1}\sum_{j=1}^{\infty}\gamma^j\hat{\pi}_t\\ &= \bar{\sigma}^{-1}\frac{\gamma}{1-\gamma}\hat{\pi}_t\end{aligned}$$

From the NKPC, we have

$$\begin{aligned}\hat{\pi}_t &= \kappa\hat{y}_t + \beta\gamma\hat{\pi}_t\\ &= \frac{\kappa}{1-\beta\gamma}\hat{y}_t\end{aligned}$$

Combine the two equations and we have

$$\begin{aligned}\frac{\kappa}{1-\beta\gamma} &= \bar{\sigma}\frac{1-\gamma}{\gamma}\\ \beta\gamma^2 - (1+\beta+\kappa\bar{\sigma}^{-1})\gamma + 1 = 0\end{aligned}$$

Let $\lambda := 1+\beta+\kappa\bar{\sigma}^{-1}$. Note that $\lambda^2 - 4\beta > (1+\beta)^2 - 4\beta = (1-\beta)^2 \geq 0$. Thus, there are two real roots which are given by

$$\gamma = \frac{\lambda \pm \sqrt{\lambda^2 - 4\beta}}{2\beta}$$

Note that

$$\gamma_1 := \frac{\lambda + \sqrt{\lambda^2 - 4\beta}}{2\beta} > \frac{\lambda}{\beta} > 1$$

and

$$\gamma_2 := \frac{\lambda - \sqrt{\lambda^2 - 4\beta}}{2\beta} > 0$$

Furthermore, we have $\gamma_2 < 1$ if and only if

$$\frac{\lambda - \sqrt{\lambda^2 - 4\beta}}{2\beta} < 1$$
$$\lambda^2 - 4\beta\lambda + 4\beta^2 < \lambda^2 - 4\beta$$
$$1 + \beta < \lambda$$

Clearly, the last inequality holds. Therefore, there exists $\gamma = \gamma_2 \in (0, 1)$ that is consistent with a bounded equilibrium. Finally, we can iterate forward the debt equation:

$$\begin{aligned}\hat{b}_t &= \sum_{j=0}^{\infty} R_{ss}^{-j} \hat{\pi}_{t+j} \\ &= \sum_{j=0}^{\infty} (\beta\gamma)^{-j} \hat{\pi}_t \\ &= \frac{1}{1 - \beta\gamma} \hat{\pi}_t\end{aligned}$$

where we have used the fact that $R_{ss} = 1/\beta$. Rearranging the equation yields the desired result.

A.2 Proof of Proposition 2

Given $\rho_R = 0$ and $\beta = 1 = R_{ss}$, we can recast the equilibrium system in the state-space form $A\,\mathbb{E}_t\, \mathbf{z}_{t+1} = B\mathbf{z}_t$, where $\mathbf{z}_t = (\hat{\pi}_t, \hat{y}_t, \hat{b}_t)'$ and the system matrices are:

$$A = \begin{bmatrix} 1-\delta & 0 & \delta(1-\gamma) \\ \frac{1-\delta}{\tilde{\sigma}} & 1-\delta & -\frac{\delta}{\tilde{\sigma}} \\ 0 & 0 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & -\kappa & 0 \\ \frac{\phi_\pi}{\tilde{\sigma}} & 1 & 0 \\ \phi_\pi - \rho_B & 0 & \rho_B \end{bmatrix}$$

The system features one predetermined variable ($\hat{b}_t$) and two jump variables ($\hat{\pi}_t, \hat{y}_t$). By the Blanchard-Kahn condition, the system is determinate if and only if the characteristic equation, $\det(\lambda A - B) = 0$, has exactly two roots outside the unit circle.

Since the system is determinate at $\delta = 0$ (where $\det(A - B) > 0$), by continuity the condition for uniqueness is $\det(A - B) > 0$. We compute the determinant of $A - B$:

$$\begin{aligned}\det(A - B) &= \det \begin{bmatrix} -\delta & \kappa & -\delta(1-\gamma) \\ -\frac{\phi_\pi - (1-\delta)}{\tilde{\sigma}} & -\delta & -\frac{\delta}{\tilde{\sigma}} \\ \rho_B - \phi_\pi & 0 & 1-\rho_B \end{bmatrix} \\ &= (\phi_\pi - 1)\left[\frac{\kappa}{\tilde{\sigma}}(1 - \rho_B - \delta) - (1-\gamma)\delta^2\right] + \gamma(1-\rho_B)\delta^2\end{aligned}$$

Substituting the definition of $\Phi(\delta)$, the condition $\det(A-B)>0$ becomes:

$$(\phi_\pi - 1)\Phi(\delta) > -\gamma(1-\rho_B)\delta^2$$

A.3 Proof of Proposition 3

Under flexible wage, the union's (log-linearized) first-order condition becomes

$$-\sigma \hat{c}_t = \phi \hat{n}_t$$

In equilibrium, $\hat{c}_t = \hat{n}_t = \hat{y}_t$. Thus, the neutral rate is such that $\hat{y}_t = 0$ in the monetary-led regime. By definition, the neutral rate satisfies the following system

$$\begin{aligned}
\hat{c}_t^U &= -\sigma^{-1}[r_t^* - (1-\alpha)\eta(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1})] + \alpha\,\mathbb{E}_t\,\hat{c}_{t+1}^U \\
\hat{y}_t &= (1-g)\hat{c}_t^U - \frac{\lambda}{1-\lambda}\hat{T}_t \\
\hat{y}_t &= 0
\end{aligned}$$

Combine to obtain

$$\frac{\lambda}{(1-g)(1-\lambda)}\hat{T}_t = -\sigma^{-1}[r_t^* - (1-\alpha)\eta(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1})] + \alpha\left[(1-\delta)\frac{\lambda}{(1-g)(1-\lambda)}\hat{T}_{t+1} + \frac{\delta}{1-g}\hat{y}_{t+1}^F\right]$$

where we have used the fact that under the fiscal-dominant regime $\hat{c}_t^{U,F} = \frac{1}{1-g}\hat{y}_t^F$. Let $\bar{\sigma} = \frac{\lambda\sigma}{(1-\lambda)(1-g)}$ and rearrange the above equation

$$r_t^* = -\bar{\sigma}\hat{T}_t + \alpha(1-\delta)\bar{\sigma}\hat{T}_{t+1} + \alpha\delta\bar{\sigma}\hat{y}_{t+1}^F + (1-\alpha)\eta(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1})$$

By the fiscal rule, we have

$$\begin{aligned}
\hat{T}_{t+1} &= (1-\rho_B)B_{ss}(\hat{b}_{t+1} - \hat{\pi}_{t+1}) \\
&= (1-\rho_B)B_{ss}(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1} + \mathbb{E}_t\,\hat{\pi}_{t+1} - \hat{\pi}_{t+1}) \\
&= (1-\rho_B)B_{ss}\big[\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1} + \delta(\hat{\pi}_{t+1}^F - \hat{\pi}_{t+1})\big]
\end{aligned}$$

where $\hat{\pi}_{t+1}$ ($\hat{\pi}_{t+1}^F$) is the inflation rate at time $t+1$ under the monetary-led (fiscal-dominant) regime. Substitute back and we have

$$r_t^* = \xi_b(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1}) + \xi_y\hat{y}_{t+1}^F + \frac{\lambda\bar{\sigma}}{1-\lambda}\left[-\hat{T}_t + \xi_\pi(\hat{\pi}_{t+1}^F - \hat{\pi}_{t+1})\right]$$

where $\xi_b = \alpha\frac{\lambda\bar{\sigma}}{1-\lambda}(1-\delta)(1-\rho_B)B_{ss} + (1-\alpha)\eta > 0$, $\xi_\pi = \alpha\delta(1-\delta)(1-\rho_B)B_{ss} > 0$, and $\xi_y = \alpha\delta\bar{\sigma} > 0$.

A.4 Two-Agent Bond-in-Utility (TABU) Model

Here I provide more details on the TABU model.

A.4.1 Setup

The model is identical to the RANK model in Section 3.1 except for the household block. The economy is populated by two types of households: a hand-to-mouth type with population share $\lambda \in (0,1)$ and a unconstrained type with population share $1-\lambda$. As in the HANK and RANK model, I assume a benevolent labor union that demands labor uniformly from the two types so that they earn the same labor income. The taxes they paid are also the same, except in the steady-state where a redistributive transfer is implemented to equalize the consumption of the two types.

The hand-to-mouth type is constrained to consume all of his disposable income every period:

$$C_t^H = w_t N_t - T_t + \mathcal{T}_t + T_{ss}^H \tag{A.1}$$

where w_t is real wage, N_t is labor supplied, T_t is lump-sum tax, $\mathcal{T}_t$ is exogenous lump-sum transfer, and T_{ss}^H is steady-state redistributive transfer to the hand-to-mouth type.

The unconstrained type has complete access to the government debt market and solves the following maximization problem

$$\begin{aligned} \max_{\{C_t^U, B_{t+1}^U\}_{t=0}^{\infty}} \quad & \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t^U)^{1-\sigma}}{1-\sigma} + \varphi^b \frac{(B_t^U/\Pi_t)^{1-\eta}}{1-\eta} \right] \\ s.t. \quad & C_t^U + \frac{B_{t+1}^U}{R_t^n} = w_t N_t - T_t + \mathcal{T}_t - T_{ss}^U + \frac{B_t^U}{\Pi_t} \end{aligned} \tag{A.2}$$

where T_{ss}^U is steady-state redistributive tax on the unconstrained type. Note that households derive utility from the real value of the government debt, as is natural. Take first-order conditions for the unconstrained type:

$$(C_t^U)^{-\sigma} = \beta\, \mathbb{E}_t \left\{ \frac{R_t^n}{\Pi_{t+1}} \left[(C_{t+1}^U)^{-\sigma} + \varphi^b \left(\frac{B_{t+1}^U}{\Pi_{t+1}} \right)^{-\eta} \right] \right\} \tag{A.3}$$

The FOC together with the budget constraint characterizes the consumption policy of the unconstrained type.

We can solve for the steady-state redistributive tax explicitly. Using the government budget constraint, we have

$$T_{ss} = B_{ss}(1 - R^{-1}) + g$$

where $g = G/Y$ is the steady-state government spending-to-GDP ratio. Let $C_{ss} = C_{ss}^H = C_{ss}^U$.

Market clearing implies

$$w_{ss}N_{ss} = Y_{ss} = C_{ss} + G_{ss}$$

By normalization, $Y_{ss} = 1$ so $C^H_{ss} = 1 - g$. Substitute back into the hand-to-mouth type's budget constraint (A.1):

$$T^H_{ss} = T_{ss} - g = B_{ss}(1 - R^{-1})$$

Resource constraint further implies

$$\begin{aligned}\lambda T^H_{ss} &= (1-\lambda)T^U_{ss} \\ T^U_{ss} &= \frac{\lambda}{1-\lambda} B_{ss}(1 - R^{-1})\end{aligned}$$

A.4.2 Log-linearization

In the following, $\hat{x}_t$ denote the log-linearized transform of variable X_t, and $\hat{X}_t$ denote the linearized transform. Log-linearize the unconstrained type's FOC (A.3):

$$-\sigma \hat{c}^U_t = \hat{r}^n_t - \mathbb{E}_t\,\hat{\pi}_t + \frac{\beta R_{ss}}{C^{-\sigma}_{ss}}\,\mathbb{E}_t\left[-\sigma C^{-\sigma}_{ss}\hat{c}^U_{t+1} - \varphi^b\eta(B^U_{ss})^{-\eta}(\hat{b}^U_{t+1} - \hat{\pi}_{t+1})\right]$$

Note that the steady state of equation (A.3) reads

$$C^{-\sigma}_{ss} = \beta R_{ss}\left(C^{-\sigma}_{ss} + \varphi^b(B^U_{ss})^{-\eta}\right)$$

Let $\alpha = \beta R_{ss}$. Rearrange

$$\varphi^b(B^U_{ss})^{-\eta} = \frac{1-\alpha}{\alpha}C^{-\sigma}_{ss}$$

Asset market clearing implies $(1-\lambda)B^U_{t+1} = B_{t+1}$. Thus,

$$\hat{b}^U_{t+1} = \hat{b}_{t+1}$$

Combine everything together and we have

$$\hat{c}^U_t = -\sigma^{-1}[\hat{r}^n_t - \mathbb{E}_t\,\hat{\pi}_{t+1} - (1-\alpha)\eta(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1})] + \alpha\,\mathbb{E}_t\,\hat{c}^U_{t+1}$$

Substitute the equilibrium condition $Y_t = w_t N_t$ into the hand-to-mouth type's budget constraint (A.1) and linearize it:

$$\hat{C}^H_t = \hat{y}_t - \hat{T}_t$$

Market clearing implies

$$\hat{y}_t = (1-\lambda)(1-g)\hat{c}_t^U + \lambda \hat{C}_t^H$$

Combine and rearrange

$$\hat{y}_t = (1-g)\hat{c}_t^U - \frac{\lambda}{1-\lambda}\hat{T}_t$$

The rest of the log-linearized system is the same as the RANK model. We conclude that the full system is given by

$$\begin{aligned}
\hat{c}_t^U &= -\sigma^{-1}[\hat{r}_t^n - \mathbb{E}_t\,\hat{\pi}_{t+1} - (1-\alpha)\eta(\hat{b}_{t+1} - \mathbb{E}_t\,\hat{\pi}_{t+1})] + \alpha\,\mathbb{E}_t\,\hat{c}_{t+1}^U \\
\hat{y}_t &= (1-g)\hat{c}_t^U - \frac{\lambda}{1-\lambda}\hat{T}_t \\
\hat{\pi}_t &= \kappa\hat{y}_t + \beta\,\mathbb{E}_t\,\hat{\pi}_{t+1} \\
\hat{r}_t^n &= \rho_R\hat{r}_{t-1}^n + (1-\rho_R)\phi_\pi\hat{\pi}_t \\
\hat{b}_{t+1} &= \hat{r}_t^n + R_{ss}\rho_B(\hat{b}_t - \hat{\pi}_t) \\
\hat{T}_t &= (1-\rho_B)B_{ss}\left(\hat{b}_t - \hat{\pi}_t\right)
\end{aligned}$$

A.4.3 Fiscal-dominant regime

In the following, I characterize the fiscal-dominant regime. Normalize $t = 0$ to be the time the economy transitions to the fiscal-dominant regime. The full system is now given by

$$\begin{aligned}
\hat{c}_t^U &= -\sigma^{-1}[-\hat{\pi}_{t+1} - (1-\alpha)\eta(\hat{b}_{t+1} - \hat{\pi}_{t+1})] + \alpha\hat{c}_{t+1}^U \\
\hat{y}_t &= (1-g)\hat{c}_t^U \\
\hat{\pi}_t &= \kappa\hat{y}_t + \beta\hat{\pi}_{t+1} \\
\hat{b}_{t+1} &= R_{ss}(\hat{b}_t - \hat{\pi}_t)
\end{aligned}$$

where we have substituted out the policy rules $\hat{r}_t^n = \hat{T}_t = 0$. Equivalently, we have

$$\begin{aligned}
\hat{y}_t &= -\bar{\sigma}^{-1}[-\hat{\pi}_{t+1} - (1-\alpha)\eta(\hat{b}_{t+1} - \hat{\pi}_{t+1})] + \alpha\hat{y}_{t+1} \\
\hat{\pi}_t &= \kappa\hat{y}_t + \beta\hat{\pi}_{t+1} \\
\hat{b}_{t+1} &= R_{ss}(\hat{b}_t - \hat{\pi}_t)
\end{aligned}$$

where $\bar{\sigma} = \frac{\sigma}{1-g}$. Guess that $\hat{\pi}_{t+1} = \gamma\hat{\pi}_t$ for some $\gamma \in (0, 1)$. Iterate forward the government debt equation:

$$\hat{b}_t - \hat{\pi}_t = \sum_{j=1}^{\infty} R_{ss}^{-j}\hat{\pi}_{t+j} = \sum_{j=1}^{\infty} \left(\frac{\gamma}{R_{ss}}\right)^j \hat{\pi}_t = \frac{\gamma}{R_{ss} - \gamma}\hat{\pi}_t$$

Substitute back to the IS curve

$$\begin{aligned}
\hat{y}_t &= -\bar{\sigma}^{-1}\left[-\hat{\pi}_{t+1} - (1-\alpha)\eta\frac{\gamma}{R_{ss} - \gamma}\hat{\pi}_{t+1}\right] + \alpha\hat{y}_{t+1} \\
&= \bar{\sigma}^{-1}\left[1 + (1-\alpha)\eta\frac{\gamma}{R_{ss} - \gamma}\right]\gamma\hat{\pi}_t + \alpha\hat{y}_{t+1}
\end{aligned}$$

Iterate forward the equation

$$\begin{aligned}
\hat{y}_t &= \bar{\sigma}^{-1}\left[1 + (1-\alpha)\eta\frac{\gamma}{R_{ss} - \gamma}\right]\gamma\sum_{j=0}^{\infty}\alpha^j\hat{\pi}_{t+j} \\
&= \bar{\sigma}^{-1}\left[1 + (1-\alpha)\eta\frac{\gamma}{R_{ss} - \gamma}\right]\gamma\sum_{j=0}^{\infty}(\alpha\gamma)^j\hat{\pi}_t \\
&= \bar{\sigma}^{-1}\left[1 + (1-\alpha)\eta\frac{\gamma}{R_{ss} - \gamma}\right]\frac{\gamma}{1-\alpha\gamma}\hat{\pi}_t
\end{aligned}$$

On the other hand, by the NKPC, we have

$$\begin{aligned}
\hat{\pi}_t &= \kappa\hat{y}_t + \beta\gamma\hat{\pi}_t \\
\hat{y}_t &= \frac{1-\beta\gamma}{\kappa}\hat{\pi}_t
\end{aligned}$$

Therefore, γ must satisfy

$$\bar{\sigma}^{-1}\left[1 + (1-\alpha)\eta\frac{\gamma}{R_{ss} - \gamma}\right]\frac{\gamma}{1-\alpha\gamma} = \frac{1-\beta\gamma}{\kappa} \tag{A.4}$$

Rearrange

$$(\alpha\beta)\gamma^3 + [\kappa\bar{\sigma}^{-1}((1-\alpha)\eta - 1) - (\alpha\beta R_{ss} + \alpha + \beta)]\gamma^2 + [\kappa\bar{\sigma}^{-1}R_{ss} + (\alpha+\beta)R_{ss} + 1]\gamma - R_{ss} = 0$$

Next, I show that $\gamma \in (0, 1)$ exists and is unique. Let $f(\gamma)$ be the polynomial function on the LHS. Clearly, $f(0) = -R_{ss} < 0$. We have

$$\begin{aligned}
f(1) &= \alpha\beta + [\kappa\bar{\sigma}^{-1}((1-\alpha)\eta - 1) - (\alpha\beta R_{ss} + \alpha + \beta)] + [\kappa\bar{\sigma}^{-1}R_{ss} + (\alpha+\beta)R_{ss} + 1] - R_{ss} \\
&= \kappa\bar{\sigma}^{-1}[(1-\alpha)\eta + R_{ss} - 1] + \alpha\beta - (\alpha+\beta) + 1 - R_{ss}[\alpha\beta - (\alpha+\beta) + 1] \\
&= \kappa\bar{\sigma}^{-1}[(1-\alpha)\eta + R_{ss} - 1] - (1-\alpha)(1-\beta)(R_{ss} - 1)
\end{aligned}$$

When $R_{ss} = 1$, $f(1) > 0$. Under typical calibration, $R_{ss} \approx 1$ so by continuity $f(1) > 0$ should typically hold. In particular, when $R_{ss} > 1$ and $\kappa > \bar{\sigma}(1-\alpha)(1-\beta)$, we have $f(1) > 0$. From now on, I maintain the assumption $f(1) > 0$. By the Intermediate Value Theorem, $\gamma \in (0,1)$ exists.

To prove uniqueness, go back to the original equation (A.4). Note that the LHS is strictly increasing in γ on $(0,1)$ and the RHS is strictly decreasing in γ. Therefore, there is at most one solution on $(0,1)$. We conclude that $\gamma \in (0,1)$ exists and is unique.

Given γ and initial condition $\hat{b}_0$, it is easy to derive the full solution:

$$\begin{aligned}
\hat{\pi}_0 &= (1 - R_{ss}^{-1}\gamma)\hat{b}_0 \\
\hat{\pi}_{t+1} &= \gamma\hat{\pi}_t \\
\hat{y}_t &= \frac{1-\beta\gamma}{\kappa}\hat{\pi}_t \\
\hat{b}_{t+1} &= \frac{R_{ss}}{R_{ss}-\gamma}\hat{\pi}_{t+1}
\end{aligned}$$

A.4.4 Interest Rate Jacobian

In the following, I extend the iMPC analysis of Auclert et al. (2024) to the sequence-space Jacobian with respect to interest rates. Formally, in HANK, RANK, or TABU, we can always write the aggregate consumption as a function of the sequences of after-tax income, real rate, and time-0 inflation:

$$C = C(\{Y_t - T_t, R_t\}_{t=0}^{\infty}, \Pi_0)$$

where $R_t = R_t^n/\Pi_{t+1}$ is the ex-ante real rate. The iMPC is defined as the (infinite-dimensional) Jacobian matrix $\mathcal{J}_Y^C := \left[\frac{\partial C_i}{\partial Y_j}\right]_{ij}$. Similarly, the interest rate Jacobian is defined as $\mathcal{J}_R^C := \left[\frac{\partial C_i}{\partial R_j}\right]_{ij}$.

I now characterize $\mathcal{J}_R^C$ in the TABU model. First, note that the consumption function of the unconstrained type is implicitly defined by the following system

$$\begin{aligned}
(C_t^U)^{-\sigma} &= \beta\,\mathbb{E}_t\left\{\frac{R_t^n}{\Pi_{t+1}}\left[(C_{t+1}^U)^{-\sigma} + \varphi^b\left(B_{t+1}^U\right)^{-\eta}\right]\right\} \\
C_t^U + \frac{B_{t+1}^U}{R_t} &= Y_t - T_t + \mathcal{T}_t - T_{ss}^U + B_t^U
\end{aligned}$$

Implicitly differentiate the system with respect to R_t

$$\begin{aligned}
\hat{c}_t^U &= -\sigma^{-1}[\hat{r}_t - (1-\alpha)\eta\hat{b}_{t+1}^U] + \alpha\hat{c}_{t+1}^U \\
\hat{b}_{t+1}^U &= \hat{r}_t - \gamma\hat{c}_t^U + R_{ss}\hat{b}_t^U
\end{aligned}$$

where $\gamma := \frac{R_{ss} C^U_{ss}}{B^U_{ss}}$. Define the geometrically-weighted summation operator:

$$\mathcal{S}^R := \begin{bmatrix} 1 & 0 & 0 & \dots \\ R_{ss} & 1 & 0 & \dots \\ R_{ss}^2 & R_{ss} & 1 & \dots \\ R_{ss}^3 & R_{ss}^2 & R_{ss} & \dots \\ \vdots & \vdots & \vdots & \ddots \end{bmatrix}$$

Let $\mathcal{F}$ be the shift-forward operator. Then we can rewrite the system in sequence-space form:

$$\begin{aligned} (\mathcal{I} - \alpha \mathcal{F})\hat{c}^U &= -\sigma^{-1}\big[\hat{r} - (1-\alpha)\eta \mathcal{F}\hat{b}^U\big] \\ \mathcal{F}\hat{b}^U &= \mathcal{S}^R(\hat{r} - \gamma \hat{c}^U) \end{aligned}$$

Combine to get

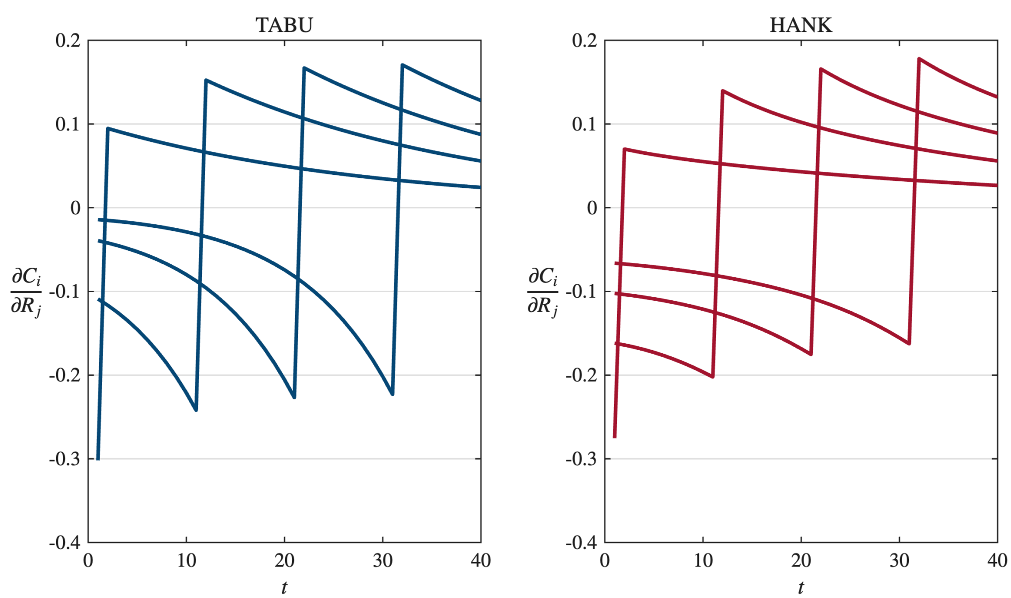
$$\begin{aligned} (\mathcal{I} - \alpha \mathcal{F})\hat{c}^U &= -\sigma^{-1}\big[\hat{r} - (1-\alpha)\eta \mathcal{S}^R(\hat{r} - \gamma \hat{c}^U)\big] \\ \big[\mathcal{I} - \alpha\mathcal{F} + \sigma^{-1}\eta\gamma(1-\alpha)\mathcal{S}^R\big]\hat{c}^U &= -\sigma^{-1}\big[\mathcal{I} - (1-\alpha)\eta\mathcal{S}^R\big]\hat{r} \end{aligned}$$

Invert and we have

$$\mathcal{J}_R^C = -(1-\lambda)\frac{C_{ss}}{R_{ss}}\big[\sigma(\mathcal{I} - \alpha\mathcal{F}) + \eta\gamma(1-\alpha)\mathcal{S}^R\big]^{-1}\big[\mathcal{I} - (1-\alpha)\eta\mathcal{S}^R\big]$$

Figure A.1 shows the interest rate Jacobians in TABU and HANK. Each line correspond to a particular column in the Jacobian. The three parameters (α, η, λ) of the TABU model are jointly calibrated to best approximate the HANK Jacobian. We can see that the TABU model does reasonably well in replicating the Jacobian. The main difference is that the HANK model features more anticipation effects due to the presence of wealthy households.

Figure A.1: Interest Rate Jacobian in TABU and HANK



Appendix B Computation

B.1 Nonlinear solution

Below I describe the algorithm for solving the rational expectation equilibrium in the regime-switching HANK model. The algorithm is proposed by Lin and Peruffo (2024) and is built upon the Sequence-Space Jacobian method of Auclert et al. (2021).

In the following, the notation x_t^τ represents the value of a variable x at time t conditional on the regime switches at time τ.

1. Choose a truncation horizon $T \gg 0$ after which the economy is sufficiently close to the steady state. In practice, I choose $T = 300$ and do not find the results change when further increasing the value.

2. As an initial guess, solve for the perfect foresight equilibrium $(\mathbf{X}_t^{PF})_{t=0}^T$ with no fiscal dominance risk using the quasi-Newton algorithm and the sequence-space Jacobians. In particular, compute the path of distributions $(\mathbf{D}_t^{PF})_{t=0}^T$ and set $F_\tau^\tau = F_\tau^{PF}$ $\forall \tau > 0$.

3. For each $\tau > 0$, given the distribution F_τ^τ at the period when the regime switches, solve for the associated transition path to the steady state $(\mathbf{X}_t^\tau)_{t=\tau}^{\tau+T}$. Note that this step can be parallelized.

4. Use the value functions $(V_\tau^\tau)_{\tau=1}^T$ solved in step 3 to iterate backward the household Bellman equation under the monetary-led regime. Compute the implied aggregate output, inflation, and savings. Check the equilibrium conditions.

5. Using the quasi-Newton algorithm and the sequence-space Jacobians, update the stochastic paths $\{(\mathbf{X}_t^\tau)_{t=0}^{\tau-1}\}_{\tau=1}^T$. Note that for all $\tau > 0$, we have

$$\mathbf{X}_t^\tau = \mathbf{X}_t^{\tau+j} \quad \forall t < \tau,\ j \geq 0$$

   In particular, compute the path of distributions $(\mathbf{D}_\tau)_{\tau=1}^T$.

6. Repeat step 3-5 until the stochastic paths $\{(\mathbf{X}_t^\tau)_{t=0}^{\tau-1}\}_{\tau=1}^T$ converge and the equilibrium conditions are satisfied.

B.2 Linear solution

A linear approximation of the rational expectation equilibrium can be computed by applying the iterative algorithm outlined in Appendix B.1 to the linearized equilibrium systems of the two regimes. Here, I analytically characterize the linearized system.

Notation Let's assume that the state space of the household has been discretized by a grid and the model is truncated at some long horizon $T \gg 0$. Define the following sequence-space objects:

$$\mathcal{C}_t^x := \left(\frac{\partial c_0}{\partial x_t}\right)' \mathbf{D}_{ss}$$
$$\mathcal{D}_t^x := \left(\frac{\partial \Lambda_0}{\partial x_t}\right)' \mathbf{D}_{ss}$$
$$\mathcal{E}_t := (\Lambda_{ss})^t c_{ss}$$

where x denotes a generic aggregate variable such as inflation and Λ denote the transition matrix such that $\mathbf{D}_{t+1} = \Lambda_t' \mathbf{D}_t$. These objects can be computed by iterating backward the Bellman equation of the household problem. Define the expectation matrix

$$\mathcal{E} := \begin{bmatrix} \mathcal{E}_0 & \mathcal{E}_1 & \dots & \mathcal{E}_{T-1} \end{bmatrix}$$

Each row of $\mathcal{E}$ represents the expected time path of consumption in the steady state for a household starting at the corresponding grid point. Following Auclert et al. (2021), define the "fake-news" matrix for a generic aggregate variable x as follows:

$$\mathcal{F}^x := \begin{bmatrix} \mathcal{C}_0^x & \mathcal{C}_1^x & \dots & \mathcal{C}_{T-1}^x \\ \mathcal{E}_0'\mathcal{D}_0^x & \mathcal{E}_0'\mathcal{D}_1^x & \dots & \mathcal{E}_0'\mathcal{D}_{T-1}^x \\ \mathcal{E}_1'\mathcal{D}_0^x & \mathcal{E}_1'\mathcal{D}_1^x & \dots & \mathcal{E}_1'\mathcal{D}_{T-1}^x \\ \vdots & \vdots & & \vdots \\ \mathcal{E}_{T-2}'\mathcal{D}_0^x & \mathcal{E}_{T-2}'\mathcal{D}_1^x & \dots & \mathcal{E}_{T-2}'\mathcal{D}_{T-1}^x \end{bmatrix}$$

This matrix encapsulates the effect of a shock $\hat{x}$ announced at time 0 on the consumption path $\hat{c}$ when the shock is reverted at time 1 ex-post. Lastly, define the T-dimensional shift matrix

$$\mathcal{S} := \begin{bmatrix} 0 & 1 & 0 & \dots & 0 \\ 0 & 0 & 1 & & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & 1 \\ 0 & 0 & 0 & \dots & 0 \end{bmatrix}$$

This matrix shifts a path forward by one period: $(a_0, a_1, \dots, a_{T-2}, a_{T-1}) \mapsto (a_1, a_2, \dots, a_{T-1}, 0)$. Note that its transpose S' instead shifts a path backward by one period: $(a_0, a_1, \dots, a_{T-2}, a_{T-1}) \mapsto (0, a_0, \dots, a_{T-3}, a_{T-2})$.

Linearized fiscal-dominant regime Given that there is no more regime uncertainty in the fiscal-dominant regime, it is straight-forward to linearize the equilibrium system. The result is a system of two equations:

$$\hat{y}^{\tau} = \mathcal{J}_y \hat{y}^{\tau} + \mathcal{J}_\pi \hat{\pi}^{\tau} + \mathcal{E}' \hat{\mathbf{D}}_{\tau} \tag{B.1}$$
$$\hat{\pi}^{\tau} = \mathcal{K} \hat{y}^{\tau}$$

where $\mathcal{J}_x := \left[\frac{\partial C_i}{\partial X_j}\right]_{ij}$ is the conventional Jacobian of the aggregate consumption function with respect to $X \in \{Y, \Pi\}$ and $\mathcal{K} := \kappa(\mathcal{I} - \beta \mathcal{S})^{-1}$ is the generalized slope of the Phillips curve. The term $\mathcal{E}'\hat{\mathbf{D}}_{\tau}$ represents the first-order effect of a change in the initial distribution—namely, the distribution at time τ—on the time path of aggregate consumption. Combining the two equations in the system (B.1), we obtain a general solution of $(\hat{y}^{\tau}, \hat{\pi}^{\tau})$ as a function of $\hat{\mathbf{D}}_{\tau}$:

$$\hat{y}^{\tau} = (\mathcal{I} - \mathcal{J}_y - \mathcal{J}_\pi \mathcal{K})^{-1} \mathcal{E}' \hat{\mathbf{D}}_{\tau} \tag{B.2}$$

$$\hat{\pi}^{\tau} = \mathcal{K} (\mathcal{I} - \mathcal{J}_y - \mathcal{J}_\pi \mathcal{K})^{-1} \mathcal{E}' \hat{\mathbf{D}}_{\tau} \tag{B.3}$$

Note that the solution mapping does not vary with τ.

Linearized monetary-led regime Unlike the fiscal-dominant regime, linearizing the monetary-led regime requires computing the first-order effects of all contingency paths $\{\hat{x}^{\tau}\}_{\tau}$ on consumption and inflation in the monetary-led regime. It turns out that this can be done using a generalized fake-news algorithm.

To illustrate the algorithm, consider the effect of the first contingency path, $\hat{x}^1$. By certainty equivalence, from the time-0 perspective, this path is equivalent to the perfect-foresight shock $\hat{x}^{1*} := (0, \hat{x}^1_0, \ldots, \hat{x}^1_{T-2})'$ scaled by the probability of fiscal dominance δ. At time-1 of the monetary-led regime, this contingency path becomes impossible, which is equivalent to the shock being reverted. Thus, the first-order effect on aggregate consumption is exactly given by

$$\mathfrak{C}^1 = \mathcal{F}^x(\delta \cdot \hat{x}^{1*}) = \delta \cdot (\mathcal{F}^x \mathcal{S}')\hat{x}^1$$

where in the second equality we have used the fact that $\hat{x}^{1*} = S'\hat{x}^1$.

In general, a contingency path $\hat{x}^{\tau}$ is only rendered impossible after time τ. Before that, the perceived probability of this path is changing over time — in particular, the probability is $\delta(1-\delta)^{\tau-1-t}$ for time $t < \tau$. By certainty equivalence, we can regard these changes in probability as a sequence of unanticipated "fake-news" shocks that revert one period after its announcement. Formally, define the perfect-foresight shock

$$\hat{x}^{\tau*} := (\underbrace{0, \ldots, 0}_{\tau \text{ zeros}}, \hat{x}^{\tau}_0, \ldots, \hat{x}^{\tau}_{T-1-\tau})' = (S')^{\tau} \hat{x}^{\tau}.$$

At time 0, the perceived probability of this shock is $\delta(1-\delta)^{\tau-1}$, so its effect on the entire path of aggregate consumption is given by

$$\begin{aligned}\mathfrak{C}_0^{\tau} &= \mathcal{F}^x(\delta(1-\delta)^{\tau-1} \cdot \hat{x}^{\tau *}) \\ &= \delta \cdot [(1-\delta)^{\tau-1}\mathcal{F}^x](\mathcal{S}')^{\tau}\hat{x}^{\tau}\end{aligned}$$

At time 1, this time-0 shock is reverted, and another shock with perceived probability $\delta(1-\delta)^{\tau-2}$ hits such that the household's expectation remains rational. Similarly, its effect on the entire path of aggregate consumption is given by

$$\begin{aligned}\mathfrak{C}_1^{\tau} &= (\mathcal{S}'\mathcal{F}^x\mathcal{S})[(\delta(1-\delta)^{\tau-2} \cdot \hat{x}^{\tau *})] \\ &= \delta \cdot [(1-\delta)^{\tau-2}\mathcal{S}'\mathcal{F}^x\mathcal{S}](\mathcal{S}')^{\tau}\hat{x}^{\tau}\end{aligned}$$

The left-multiplication of $\mathcal{F}^x$ with $\mathcal{S}'$ shifts the effects to time-1 onward, while the right-multiplication with $\mathcal{S}$ pulls the shock one-period forward to match the perceived horizon.

Summing over all the effects up to time τ leads to the following result:

Lemma 2. *In the monetary-led regime, the consumption Jacobian with respect to a contingency path $\hat{x}^{\tau}$ is given by*

$$\mathfrak{J}_x^{\tau} = \delta \cdot \left(\sum_{t=0}^{\tau-1}(1-\delta)^{\tau-1-t}\left[(\mathcal{S}')^t\mathcal{F}^x\mathcal{S}^t\right]\right)(\mathcal{S}')^{\tau} \tag{B.4}$$

This generalized fake news algorithm also applies to the path along the monetary-led regime. Fix a path $\hat{x}$ and let $\Omega := \text{diag}(1, (1-\delta), \ldots, (1-\delta)^{T-1})$. At time 0, this path is equivalent to the shock $\Omega\hat{x}$. From the time-t perspective, the continuation of this path is equivalent to the shock $\Omega\mathcal{S}^t\hat{x}$. Summing over all the effects leads to the following result:

Lemma 3. *In the monetary-led regime, the consumption Jacobian with respect to a path $\hat{x}$ along the monetary-led regime is given by*

$$\mathfrak{J}_x = \sum_{t=0}^{T-1}(\mathcal{S}')^t\mathcal{F}^x\Omega\mathcal{S}^t \tag{B.5}$$

where $\Omega := diag(1, (1-\delta), \ldots, (1-\delta)^{T-1})$. In particular, $\mathfrak{J}_x = \mathcal{J}_x$ when $\delta = 0$.

We next linearize the Phillips curve. Given the recursive formulation, only inflation in the first period of a contingency path, $\hat{\pi}_0^{\tau}$, matters. Let $\mathfrak{s}^{\tau} := [\mathbf{1}\{i = \tau, j = \tau\}]_{ij}$ be the selection matrices. Then the linearized Phillips curve is given by

$$\hat{\pi} = \kappa\hat{y} + \beta\left((1-\delta)\mathcal{S}\hat{\pi} + \delta\sum_{\tau=1}^{T-1}\mathfrak{s}^{\tau}\hat{\pi}^{\tau}\right)$$

To sum up, the linearized moentary-led regime is given by

$$\hat{y} = \mathfrak{J}_y(\hat{y} - \hat{T}) + \mathfrak{J}_r \hat{r}^n + \mathfrak{J}_\pi \hat{\pi} + \mathfrak{J}_{\mathcal{T}} \epsilon^{\mathcal{T}} + \sum_{\tau=1}^{T-1} (\mathfrak{J}_y^\tau \hat{y}^\tau + \mathfrak{J}_\pi^\tau \hat{\pi}^\tau) \tag{B.6}$$

$$\hat{\pi} = \kappa \hat{y} + \beta \left((1-\delta)\mathcal{S}\hat{\pi} + \delta \sum_{\tau=1}^{T-1} \mathfrak{s}^\tau \hat{\pi}^\tau \right) \tag{B.7}$$

$$\hat{r}^n = \rho_R \mathcal{S}' \hat{r}^n + (1-\rho_R)\phi_\pi \hat{\pi} \tag{B.8}$$

$$\hat{T} = (1-\rho_B) \frac{B_{ss}}{T_{ss}} (\mathcal{S}' \hat{b} - \hat{\pi}) \tag{B.9}$$

$$\hat{b} = \hat{r}^n + \rho_B R_{ss} (\mathcal{S}' \hat{b} - \hat{\pi}) + \epsilon^{\mathcal{T}} \tag{B.10}$$

Lastly, the linearized dynamics of the distribution $\hat{\mathbf{D}}$, which serves as inputs into the fiscal-dominant regime, can be computed recursively using the Jacobian of the transition matrix $\{\mathcal{D}^x\}_x$ and the perceived probabilities of future paths.

Iterative algorithm To solve the model, we can apply the nonlinear solution algorithm in Appendix B.1 to the linearized system (B.2)-(B.3) and (B.6)-(B.10). In practice, I use the linearized solution without fiscal dominance risk as the initial guess.