Fiscal Redistribution Risk in Treasury Markets*

Roberto Gómez-Cram Howard Kung Hanno Lustig David Zeke

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Abstract

Unfunded fiscal shocks are a significant source of risk premia in Treasury markets when central banks and governments decide to insulate taxpayers and expose bondholders' wealth to government funding needs. We illustrate this bond risk premium mechanism analytically in a two-agent model featuring monetary-fiscal interactions and a fraction of constrained agents. Surprise government transfer spending devalues real Treasury payoffs through fiscal inflation, while fiscal redistribution makes these high marginal utility states for bond investors, leading to risky government debt. We show that this fiscal redistribution mechanism can quantitatively explain the nominal term premium in a TANK framework.

*Gomez-Cram: London Business School and CEPR, rgomezcram@london.edu. Kung: London Business School and CEPR, hkung@london.edu. Lustig: Stanford Graduate School of Business, NBER and CEPR, hlustig@stanford.edu. Zeke: Federal Reserve Board of Governors, david.zeke@frb.gov. We thank seminar participants from Stanford and the Minneapolis Fed for comments and suggestions. The views expressed herein are those of the authors alone and do not necessarily reflect those of the Federal Reserve System.

1 Introduction

Governments in mature economies have been running large deficits and accumulating debt in recent decades. The extraordinary surge in government spending following the pandemic corresponded to a significant erosion in the real market value of government debt. For example, the real cumulative return to the US Treasury portfolio fell by 26% while deficits increased by 139% over the three years following the pandemic, with the majority of the devaluation occurring on days with news about fiscal spending.[1] When governments and central banks pursue policies protecting taxpayers while having bondholders pay for fiscal expansions makes government debt risky: The redistribution from bondholders to constrained taxpayers when the real payoff to bonds is low makes nominal government debt command a real risk premium.

We demonstrate how the risk exposure of nominal government debt to fiscal shocks hinges on whether central banks and governments coordinate on a safe debt regime that insulates bondholders or a risky debt regime that protects taxpayers against government spending shocks. We start by formalizing these tradeoffs in a stylized endowment economy model using approximate analytical solutions. The model features monetary-fiscal interactions and only a single shock to government spending that is uniformly transferred back to households. We assume that a fraction of the households is unconstrained in owning assets with Epstein and Zin (1989) preferences, and the remaining fraction are hand-to-mouth agents (e.g., Campbell and Mankiw (1989)). We consider two distinct monetary and fiscal policy regimes as in Leeper (1991) labeled fiscal dominance and monetary dominance.

Our key theoretical result is to show how fiscal dominance in the presence of constrained agents produces a risky debt regime even without default risk. The fiscal authority in this regime is not committed to fully funding higher spending through future taxation. Surprise unfunded spending reduces the real fiscal backing for debt. This regime requires nominal devaluations of debt to satisfy the intertemporal government budget equation. The monetary authority accommodates fiscal expansions

[1] Gomez Cram, Kung, and Lustig (2023, 2024) identify days with deficit news from individual legislation using the CBO cost releases and other media sources.

by preventing nominal interest rates from rising aggressively in response to fiscal inflation. In general equilibrium, unfunded spending in the form of stimulus checks to households redistributes wealth away from asset holders to pay for the higher consumption of the hand-to-mouth agents. The reduction in wealth for the risk-sensitive asset holders increases their marginal utility. Consequently, surprise fiscal expansions under fiscal dominance reduce the real return to government bonds while increasing the marginal utility of asset holders, implying a positive real risk premium on government debt.

Monetary dominance generates a safe debt regime. The monetary authority aggressively targets inflation, insulating it from fiscal disturbances. The fiscal authority is committed to paying for higher government spending through increased future taxation. Fully funding any surprise fiscal stimulus packages insulates real bond returns and asset holders' wealth from the temporary fiscal expansion. When the taxes and transfers are distributed uniformly and lump-sum, the initial redistribution in consumption from asset holders and hand-to-mouth agents is then offset in present-value terms by the impact of the tax policy on future consumption. We show that bond returns and the pricing kernel are both neutral to fiscal shocks under monetary dominance in our stylized model, resulting in safe debt.

Our analytical framework characterizes how monetary and fiscal authorities coordinating to protect 'taxpayers' over 'bondholders' in fiscal expansions generate risky debt through fiscal redistribution. Fiscal dominance inflates away the unfunded portion of government spending, reducing real debt returns. Accounting for household heterogeneity is important for the fiscal shocks to have a positive price of risk. In the frictionless representative agent case, the drop in the real value of debt is offset by the higher transfers to the representative household, leaving consumption and the pricing kernel unaffected. However, when there is a mass of constrained agents, the unfunded fiscal expansion redistributes current consumption and the present value of future consumption away from asset holders ('bondholders') to fund the higher consumption of constrained agents ('taxpayers') today. The decline in asset holders' wealth raises their marginal utility when real debt returns fall, leading to a positive bond risk premium.

We quantify the effects of this fiscal risk redistribution mechanism by extending our stylized model to a standard two-agent New Keynesian framework (TANK) as in Galí, López-Salido, and Vallés (2007) and Bilbiie (2008). We have three standard shocks to aggregate productivity, nominal interest rates, and government spending. A fixed fraction of the households are risk-sensitive asset holders, and the remaining fraction is hand-to-mouth households like the stylized model, but now with both types of agents supplying labor to firms in competitive labor markets. The supply side is modeled with monopolistically competitive firms that use labor as the only input in production and set nominal goods prices subject to adjustment costs. The monetary authority follows a nominal interest rate rule, while the fiscal authority follows a tax rule and issues nominal geometric debt to fund an exogenous net spending process.

Calibrating the TANK model to post-war macroeconomic fluctuations and government spending dynamics, we show that government spending shocks can explain most of the average nominal term premium under fiscal dominance. The model produces an average bond return spread between the 5-year and 1-quarter nominal zeros of around 1% as in the data, with government spending shocks accounting for most of the unconditional term premium.

The simple model illustrates how fiscal redistribution under fiscal dominance makes nominal debt risky through an inflation risk premium. The quantitative model additionally highlights how the fiscal inflation risk premium increases with bond maturity and is quantitatively important. A surprise increase in government spending without tax policy fully funding it generates persistent fiscal inflation, devaluing nominal government debt to satisfy the intertemporal government budget equation. Fiscal inflation is propagated through the nominal interest rate rule, which passively responds to inflation deviations in order to stabilize government debt.

When the unfunded government spending is used to increase household transfers, asset holders effectively subsidize the higher consumption of hand-to-mouth households. Fiscal inflation devalues the nominal bond holdings of asset holders, reducing their real wealth and consumption significantly, which increases the marginal utility of asset holders. Consequently, the persistent increase in fiscal inflation erodes the real value of long nominal bonds more than short ones in bad states of the world for

marginal investors, implying a positive nominal term premium.

The combination of a fraction of constrained households and fiscal dominance in our benchmark model is key for government spending shocks to play a quantitatively large role in generating a positive and sizable nominal term premium in an otherwise standard textbook NK model. We illustrate the importance of these two ingredients for the yield curve by contrasting the benchmark fiscal TANK model with three alternative specifications: fiscal dominance with a representative agent (Fiscal RANK), monetary dominance with a fraction of constrained agents (monetary TANK), and monetary dominance with a representative agent (monetary RANK). In contrast to the fiscal TANK case, these three alternatives generate a small nominal term premium like in standard NK models.

In the Fiscal RANK case, a positive spending shock also devalues nominal debt because of higher fiscal inflation. However, the representative agent receives the entire aggregate transfer, offsetting most of the decline in real financial wealth. Instead, the real effect of government spending is driven by a New-Keynesian mechanism in this case: The higher fiscal inflation in the presence of sticky nominal goods prices stimulates aggregate demand, raising aggregate consumption. Nominal government bonds act as a hedge against government spending risk in the RANK case of fiscal dominance, contributing negatively to the nominal term premium.

In the monetary TANK and monetary RANK cases, monetary dominance implies that the the government spending shocks are mostly absorbed by a fiscal rule committed to fully funding any surprise fiscal expansion today through higher future taxation or reduction in spending. The tax policy in this regime stabilizes debt by strongly responding to debt fluctuations while insulating government bond returns from fiscal disturbances. Monetary policy stabilizes inflation by aggressively responding to inflation fluctuations through the nominal interest rate rule. Consequently, government spending shocks have a small effect on the nominal term premium.

Our paper relates to the growing literature studying asset prices in New Keynesian models. Rudebusch and Swanson (2012), Palomino (2012), Kung (2015), Campbell, Pflueger, and Viceira (2014), Hsu, Li, and Palomino (2021), Caballero and Simsek (2022), Pflueger and Rinaldi (2022), Bianchi, Kung, and Tirskikh (2023b), link monetary policy

to asset prices in the representative agent setting, and Kekre and Lenel (2022), Bianchi, Ludvigson, and Ma (2022), and D'Avernas and Vandeweyer (2024) in a heterogeneous agents setting. Pastor and Veronesi (2012), Croce, Kung, Nguyen, and Schmid (2012), Bretscher, Hsu, and Tamoni (2020), Corhay, Kind, Kung, and Morales (2023), and Li, Zha, Zhang, and Zhou (2022) examine the link between fiscal policy and equilibrium asset prices. We differ from these papers by highlighting that fiscal redistribution risk under fiscal dominance generates a bond risk premium.

The fiscal dominance regime relates to the work of Sargent and Wallace (1981), Leeper (1991), Sims (1994), Woodford (1995), Cochrane (1998), and Bassetto (2002). Our quantitative framework connects to NK models with heterogeneous agents considering monetary-fiscal interactions (e.g., Bianchi, Faccini, and Melosi (2023a), Diamond, Landvoigt, and Sánchez (2024), Angeletos, Lian, and Wolf (2024), and Elenev, Landvoigt, Van Nieuwerburgh, and Schultz (2021)). We distinguish our paper by illustrating how the monetary-fiscal policy stance and the presence of hand-to-mouth households dictate the riskiness of government debt with respect to government spending shocks. In that sense, we also relate to the literature considering the role of government policies in manufacturing safe or risky debt (e.g., Barro (1979), Lucas and Stokey (1983), and Buera and Nicolini (2004)) and more recent contributions include Jiang, Lustig, Van Nieuwerburgh, and Xiaolan (2020), Liu, Schmid, and Yaron (2021), and Jiang, Sargent, Wang, and Yang (2022)).

Our general quantitative framework relates to the broader literature studying the transmission of fiscal policy shock in New Keynesian models with heterogeneous agents (e.g., Galí et al. (2007), Kaplan, Moll, and Violante (2018), Hagedorn, Manovskii, and Mitman (2019), Aguiar, Amador, and Arellano (2023), and Auclert, Rognlie, and Straub (2024)). We complement this literature by showing how redistribution risk from government spending shocks is an important source of risk premia in bond markets under fiscal dominance. The endogenous risk premia response in our framework also acts as a source of fiscal discipline.

2 Analytical Framework

We start with an endowment economy to cleanly articulate our novel mechanisms for generating risky debt with respect to fiscal shocks, focusing on the role of limited asset market participation and monetary-fiscal policy interactions. To this end, we consider an endowment economy that abstracts from sticky prices, growth, and other structural shocks besides disturbances to government spending. This model features only one friction (a fraction of hand-to-mouth households) and one shock (government spending). Monetary and fiscal policy are characterized by interest rate and tax policy rules. The government issues one-period non-defaultable nominal debt. We assume that the government spending is evenly transferred to all households.

We analyze the endogenous bond pricing and consumption dynamics across agents under regimes of monetary dominance and fiscal dominance separately. The policy regimes are determined by the parametrization of the policy rules. Using a risk-adjusted approximate analytical solution, we show in our simple framework that the presence of hand-to-mouth households generates a positive bond risk premium under fiscal dominance, but government debt is risk-free in real terms under monetary dominance. Fiscal dominance exposes bond returns to fiscal disturbances, and the presence of constrained households makes fiscal expansions high marginal utility states for asset holders. Section 3 then quantifies the mechanisms in a small-scale New Keynesian model with long-term debt and additional structural shocks.

2.1 Households

There is a continuum of households on the unit interval with the same utility function and preference parameters. We assume that the fraction ζ is unconstrained ("asset holding" agents) and the fraction $1-\zeta$ is constrained ("hand-to-mouth" agents). Each household receives the constant real endowment $\overline{Y} > 0$ in each period.

2.1.1 *Unconstrained households*

An asset holder has recursive Epstein-Zin (EZ) preferences defined over consumption according to

$$U_{At} = \left\{(1-\beta)C_{At}^{\frac{1-\gamma}{\theta}} + \beta\left(\mathbb{E}_t\left[U_{At+1}^{1-\gamma}\right]\right)^{\frac{1}{\theta}}\right\}^{\frac{\theta}{1-\gamma}} \tag{1}$$

where C_{At} is the consumption of an asset holder, γ is the coefficient of relative risk aversion, $\theta \equiv (1-\gamma)/(1-1/\psi)$, and ψ is the intertemporal elasticity of substitution (IES).

We assume that the asset holders can trade in one-period nominal government bonds in positive supply in addition to a set of assets in zero net supply that can be used to create a full set of Arrow securities. The asset holders are subject to a sequence of budget constraints given by

$$P_t C_{At} + \mathbb{V}'_{At}\iota + \mathcal{B}_{At} \leq P_t\overline{Y} + \mathbb{V}'_{At-1}\mathbb{R}_t + \mathcal{B}_{At-1}R_{gt} + P_t T_{At}, \tag{2}$$

where P_t is the price level, $\mathbb{V}_{At} \equiv \mathbb{Q}_t \circ \mathbb{S}_{At}$ is the vector of asset holdings (excluding nominal government bonds) in nominal market values with $\mathbb{Q}_t$ as the vector of nominal prices per share and $\mathbb{S}_{At}$ corresponding to the shares, $\mathcal{B}_{At} \equiv Q_t^b \cdot B_{At}$ are the one-period nominal bond holdings in nominal market values with Q_t^b as the nominal bond price and B_{At} as the face value, $\log(R_{gt}) = i_{t-1}$ is the nominal government portfolio return (equals the short rate because we assumed that the government only issues one-period nominal debt), $\mathbb{R}_{pt}$ is the vector of nominal asset returns excluding bonds, and T_{At} are real net government transfers to the asset holder.

The intertemporal budget equation can be expressed recursively in terms of the wealth dynamics according to

$$V_{ct+1} \geq (V_{ct} - C_{At})\omega_t'\hat{\mathbb{R}}_{t+1}, \tag{3}$$

where V_{ct+1} is the asset holder's real wealth, $\hat{\mathbb{R}}_{t+1} \equiv \mathbb{R}_{t+1}/\Pi_{t+1}$ is the vector of spanning real asset returns, ω_t is the corresponding vector of portfolio weights, $R_{ct+1} = \omega_t'\mathbb{R}_{t+1}$

is the return on wealth.

For cleaner analytical expressions, we focus on the limit case of an infinite IES ($\psi \to \infty$) when deriving the approximate closed-form solutions in this section. This limit case implies a "CAPM" equilibrium pricing kernel that only depends on the return to wealth of asset holders. We later show that the main qualitative results carry through in the finite IES case.[2] The log real pricing kernel in this limit case can be expressed as

$$m_{t+1} = (1-\gamma)\log(\beta) - \gamma r_{ct+1}, \tag{4}$$

where $m_{t+1} \equiv \log(M_{t+1})$ is the log one-period real stochastic discount factor and r_{ct+1} is the log real return on wealth for asset holders.

The optimal consumption and savings decision yields the following asset holder's Euler equation

$$1 = \mathbb{E}_t \left[M^{\$}_{t+1} R_{gt+1} \right], \tag{5}$$

where $M^{\$}_{t+1} \equiv M_{t+1}/\Pi_{t+1}$ is the nominal stochastic discount factor.

2.1.2 Constrained agents

Constrained households have the same preferences as unconstrained households, but they do not hold assets (i.e., "hand-to-mouth" agents). The budget equation of a constrained agent is given by

$$P_t C_{Ht} \leq P_t \overline{Y} + P_t T_{Ht}, \tag{6}$$

where C_{Ht} is the real consumption of the constrained household and T_{Ht} is the real transfers.

[2] We can also obtain an analytical solution for the finite IES case, but the expressions are significantly more complex. The limit case yields neater analytical expressions that help to elucidate the key economic forces.

2.2 *Monetary policy*

The monetary authority follows a nominal interest rate rule specified as

$$i_t = i^\star + \rho_\pi(\pi_t - \pi^\star), \tag{7}$$

where i_t is the log nominal short rate, $i^\star$ is the risk-adjusted steady state for the short rate, ρ_π captures the monetary policy stance towards the inflation gap, π_t is log inflation, and $\pi^\star$ is the risk-adjusted inflation target set by the central bank.

2.3 *Fiscal policy*

The fiscal authority follows a real tax revenue rule according to

$$\tau_t = \tau^\star + \delta_b(b_{t-1} - b^\star), \tag{8}$$

where τ_t is the real tax revenue, $\tau^\star$ is the risk-adjusted steady-state tax revenue, δ_b captures the fiscal stance towards debt deviations from target, b_t is the log real market value of debt, $b^\star$ is the risk-adjusted log real value of debt.

Real government spending follows a stochastic process

$$g_t = g^\star + x_t, \quad x_t = \rho x_{t-1} + \sigma\epsilon_t, \tag{9}$$

where $g^\star$ relates to the government spending target, x_t represents a net spending shock, ρ captures the persistence of the shock, σ represents the volatility of the innovation, and $\epsilon_t \sim$ i.i.d. $N(0,1)$ is standard normal. Primary real surpluses are tax revenues minus government expenditures, $s_t = \tau_t - g_t$. The surplus target is therefore given by $s^\star \equiv \tau^\star - g^\star$.

The government budget equation is given by

$$B_{t-1} = P_t s_t + Q_t^b B_t \tag{10}$$

where B_{t-1} is the face value of one-period nominal bonds issued by the government.

We can rewrite the budget equation in terms of market values according to

$$R_{gt}\mathcal{B}_{t-1} = P_t s_t + \mathcal{B}_t, \tag{11}$$

where $\mathcal{B}_t \equiv Q_t^b B_t$ is the aggregate nominal market value of government debt held by the public, R_{gt} represents the corresponding nominal portfolio return on government debt, P_t denotes the price level, and s_t corresponds to real primary surpluses. Rearranging the budget identity, we can express it equivalently in terms of returns as

$$R_{gt}/\Pi_t = R_{st}, \tag{12}$$

where $\Pi_t \equiv P_t/P_{t-1}$ is the gross inflation rate, let $\widetilde{\mathcal{B}}_t \equiv \mathcal{B}_t/P_t$ be real market value of nominal debt, and $R_{st} \equiv (\widetilde{\mathcal{B}}_t + s_t)/\widetilde{\mathcal{B}}_{t-1}$ is the gross return on a hypothetical claim to real surplus.

We assume that each dollar spent generates η_g units of consumption that are distributed to households as transfers. Let ζ^G denote the fraction of transfers to asset holders and ζ^T denote the fraction of taxes levied on asset holders. Thus, net transfers to an asset holder (scaled by GDP) are $T_{At} = g_t\eta_g\zeta^G/\zeta - \tau_t\zeta^T/\zeta$ and net transfers to a hand-to-mouth agent (scaled by GDP) are $T_{ht} = g_t\eta_g(1-\zeta^G)/(1-\zeta) - \tau_t(1-\zeta^T)/(1-\zeta)$. We focus on the case of full government efficiency where all government spending is transferred back to households ($\eta_g = 1$), and the transfers are uniformly distributed across all agents ($\zeta^T = \zeta^G = \zeta$). Therefore, the transfer to each agent is given by $T_{At} = T_{Ht} = g_t - \tau_t$.

2.4 Market clearing

Asset market clearing requires that the unconstrained agents hold all outstanding nominal government bonds according to $\zeta\mathcal{B}_{At} = \mathcal{B}_t$. All other assets are held in zero net supply. Final consumption goods market clear, given by the following resource constraint $\overline{Y} = \zeta C_{At} + (1-\zeta)C_{Ht}$.

The market clearing conditions allow us to express consumption in terms of government surpluses and aggregate output, which illustrate the fiscal redistribution

effects on realized consumption. The constrained household's consumption can be expressed in terms of government spending and taxation using their budget constraint, yielding $C_{Ht} = \overline{Y} + g_t - \tau_t = \overline{Y} - s_t$. We can then use the resource constraint to solve for the consumption of an unconstrained agent given spending and taxation according to $C_{At} = \overline{Y} - \frac{1-\zeta}{\zeta}(g_t - \tau_t) = \overline{Y} + \frac{1-\zeta}{\zeta}s_t$.

A fiscal expansion raises the consumption of constrained agents and lowers the consumption of the unconstrained. However, we show below in the model solution that the impact of government spending shocks on the entire consumption path of each agent (and, therefore, wealth of the asset holders) is dictated by the policy regime, which is critical for the pricing kernel response.

2.5 *Log-linear approximations*

We implement a risk-adjusted log-linear approximation around stochastic steady states.[3] We rely on two approximations for analytical tractability. First, we linearize the log stochastic discount factor, implying that the log pricing kernel depends linearly on wealth innovations. Second, we log-linearize the return on surplus as Corhay et al. (2023).

2.5.1 *Pricing kernel approximation*

Using the approximation $\log(\mathbb{E}_t[U_{At+1}^{1-\gamma}]) \approx \mathbb{E}_t[(1-\gamma)u_{at+1}]$ in the pricing kernel yields

$$m_{t+1} = \log(\beta) - \gamma\Big(u_{At+1} - \mathbb{E}_t[u_{At+1}]\Big), \tag{13}$$

where $u_{At+1} \equiv \log(U_{At+1})$ is log utility for the asset holder. We can use the equilibrium relation between wealth and utility $v_{ct} = u_{At} - \log(1-\beta)$ to get

$$m_{t+1} = \log(\beta) - \gamma\Big(v_{ct+1} - \mathbb{E}_t[v_{ct+1}]\Big), \tag{14}$$

[3] We verify that this approximation is accurate for a wide range of parameter values with a nonlinear numerical solution.

where $v_{ct} = \log(V_{ct})$ is log wealth of the asset holder. For notational convenience, we define the innovation to log wealth as $\epsilon_{vt} \equiv (v_{ct+1} - \mathbb{E}_t[v_{ct+1}])$.

2.5.2 *Return approximation*

To obtain approximate analytical solutions for the model, we use a Campbell and Shiller (1988) style approximation of the log return on surplus

$$r_{st+1} = \kappa_0 + \kappa_1 b_{t+1} + \kappa_2 s_{t+1} - b_t, \tag{15}$$

where κ_0, κ_1, and κ_2 are approximating constants that depend on the risk-adjusted steady state of the real value of debt, $b^\star$. To solve for these constants, we employ an iterative procedure following Campbell and Koo (1997). Additionally, we approximate around the level of the surplus to accommodate deficits.

We focus on bounded solutions for inflation and the real market value of debt as in Leeper (1991). The stability conditions depend on the policy parameters ρ_π and δ_b. The two determinacy regions are the regimes of monetary dominance and fiscal dominance, which we characterize next.

2.6 *Monetary dominance (safe debt regime)*

Monetary dominance relates to the standard textbook monetary model (e.g., Woodford (2015) and Galí (2015)). This regime is characterized by a monetary authority that determines inflation by adjusting the nominal short rate more than one-for-one with the inflation gap ($\rho_\pi > 1$). The fiscal authority adjusts real taxes sufficiently with respect to debt deviations ($\delta_b > s^\star$) to stabilize the real market value of debt.

This policy regime produces safe government debt. We show below that the Ricardian tax adjustments ensure that the intertemporal government budget equation holds, and insulates inflation and bond returns from fiscal shocks. This policy stance also protects asset holders' wealth against fiscal disturbances as the tax rule offsets the effects of government spending on current asset holders' consumption with future tax adjustments. Consequently, the spending shocks have a neutral effect on the pricing

kernel which only depends on wealth innovations.

2.6.1 *Inflation solution*

We solve inflation forward using the nominal bond pricing Euler equation given by

$$\exp(-i_t) = E_t\left[\exp\left(m_{t+1} - \pi_{t+1}\right)\right], \tag{16}$$

and then, substitute in the the interest rate rule to give us

$$\exp\Big(-i^\star - \rho_\pi(\pi_t - \pi^\star)\Big) = \mathbb{E}_t\left[\exp\left(\log(\beta) - \gamma\epsilon_{vt+1} - \pi_{t+1}\right)\right], \tag{17}$$

where the stability condition in the steady state for solving inflation forward is given by $\rho_\pi > 1$.[4] The inflation solution is independent of the fiscal disturbances, leading to the constant inflation policy anchored at the target $\pi_t = \pi^\star$. The interest rate target $i^\star$ is chosen to anchor inflation at the target $\pi_t = \pi^\star = \pi^\star$ according to $i^\star = \pi^\star - \log(\beta)$.

2.6.2 *Debt solution*

Given the inflation solution, we solve for the debt policy backward using the budget identity (equation 12) expressed as log returns according to

$$r_{gt} - \pi_t = r_{st}.$$

The government bond return is equal to the nominal short rate $r_{gt} = i_{t-1}$ since the government only issues one-period nominal debt. Given the constant inflation policy anchored around the target and substituting in the interest rate rule, we get that the nominal government bond return is constant $r_{gt} = i^\star$, implying that the ex-post real bondholder return is also constant

$$r_{gt} - \pi_t = i^\star - \pi^\star.$$

[4]The two-sided condition is $\rho_\pi > 1$ and $\rho_\pi < -1$.

Therefore, in the monetary regime, the real return on nominal government debt (or, equivalently, the return on surplus) is constant, as tax adjustments insulate bond returns.

We can then plug in the linearized return on surplus and surplus rule into the budget identity along with the constant equilibrium real return to bondholders to solve for debt backward according to

$$i^\star - \pi^\star \quad = \quad \kappa_0 + \kappa_1 b_t + \kappa_2 \Big(s^\star + \delta_b (b_{t-1} - b^\star) - \rho x_{t-1} - \sigma \epsilon_t \Big) - b_{t-1}, \tag{18}$$

where the stability condition is given by $\delta_b > s^\star$, implying active fiscal policy.[5] Equation (18) implies the following equilibrium debt policy

$$b_t = \Gamma_b + \left(\frac{1 - \kappa_2 \delta_b}{\kappa_1} \right) b_{t-1} + \left(\frac{\kappa_2 \rho}{\kappa_1} \right) x_{t-1} + \left(\frac{\kappa_2 \sigma}{\kappa_1} \right) \epsilon_t \tag{19}$$

where $\Gamma_b \equiv \frac{1}{\kappa_1}(i^\star - \pi^\star - \kappa_0 - \kappa_2 s^\star + \kappa_2 \delta_b b^\star)$.

2.6.3 *Consumption solution*

We can solve for the consumption policy of the hand-to-mouth agent by using $C_{Ht} = \overline{Y} - s_t$ from market clearing and plugging in the debt policy function into the tax rule to obtain

$$C_{Ht} = \overline{Y} + g^\star + \delta_b b^\star - \tau^\star + \rho x_{t-1} - \delta_b b_{t-1} + \sigma \epsilon_t.$$

The realized consumption of the hand-to-mouth agent increases with a positive spending shock today $\epsilon_t > 0$. The Ricardian tax rule ($\delta_b > s^\star$) in this regime generates higher future taxation in response to the positive spending shock, leading to an eventual drop in consumption.

We can use $C_A = \overline{Y} + \frac{1-\zeta}{\zeta} s_t$ and the debt solution to obtain

$$C_{At} = \overline{Y} + \frac{1 - \zeta}{\zeta} \Big(- g^\star - \rho x_{t-1} - \sigma \epsilon_t + \tau^\star + \delta_b b_{t-1} - \delta_b b^\star \Big)$$

[5] The two-sided stability condition is $2 \exp(b^\star) + s^\star > \delta_b > s^\star$.

Consumption of the asset holders decreases with a positive spending shock today $\epsilon_t > 0$ but with a reversal in the future for the same reason as above.

The consumption policies highlight how the impact of the future tax offsets on the consumption path is dictated by the debt coefficient δ_b from the tax rule. With the passive fiscal policy rule $\delta_b > s^\star$, the magnitude of the consumption path reversal for both agents is sufficient to make the effect neutral on the present value of current and future consumption.

2.6.4 Endogenous pricing kernel

The return on wealth to asset holders can be expressed as a portfolio of a riskfree consol bond and government bonds. The returns of both assets are independent of government spending shocks (constant), implying that the stochastic discount factor is also unaffected as it depends linearly on the wealth innovation of asset holders given in equation (14).

2.6.5 Bond pricing

The real return on nominal bonds and pricing kernel in this regime are constant and independent of government spending shocks, either of which implies that the real risk premium on debt is zero. Monetary dominance produces safe debt.

2.7 Fiscal dominance (risky debt regime)

Fiscal dominance relates to the work of Sargent and Wallace (1981), Leeper (1991), Sims (1994), Woodford (1995), Cochrane (1998), and Bassetto (2002). This regime is characterized by a monetary authority passively responding to the inflation gap ($\rho_\pi < 1$) and a non-Ricardian fiscal authority that does not fully fund surprise government spending by raising taxes sufficiently ($\delta_b < s^\star$) to offset the government spending in present value terms. Consequently, a positive spending shock lowers the real fiscal backing for government debt. Inflation increases to devalue debt under fiscal dominance to satisfy the intertemporal government budget equation, pinning down inflation. The value of debt is stabilized by the passive stance of monetary policy that

prevents explosive interest rate paths. The nominal revaluations make the real return on government debt sensitive to spending shocks.

The non-Ricardian fiscal policy exposes asset holders' wealth to government spending shocks. Because a surprise increase in government spending (used to pay for transfers) is not funded by promises of higher future taxation, asset holders absorb the costs of the unfunded portion of the fiscal expansion from their wealth through the devaluation of their bond holdings that effectively pays for the higher consumption path of constrained agents. The fiscal redistribution lowers asset holders' real wealth, making surprise fiscal expansions risky states (high pricing kernel states), while reducing real returns on government debt through higher fiscal inflation. Consequently, government bonds command a positive risk premium in this risky debt regime.

2.7.1 Debt solution

We solve for the log real value of debt forward in this regime using the Euler equation for the return on real surplus according to

$$1 = E_t\left[\exp\left(m_{t+1} + r_{st+1}\right)\right], \tag{20}$$

and substituting in the approximated log return on surplus and tax rule to give us

$$1 = \mathbb{E}_t\left[\exp\left(\log(\beta) - \gamma\epsilon_{vt+1} + \kappa_0 + \kappa_1 b_{t+1} + \kappa_2\left(s^\star + \delta_b(b_t - b^\star) - \rho x_t - \sigma\epsilon_{t+1}\right) - b_t\right)\right], \tag{21}$$

where the stability condition in the steady state for solving debt forward is given by $\delta_b < s^\star$ (active fiscal policy).

We guess that the solution for the log real value of debt is linear in x_t, given by

$$b_t = A_0 + A_1 x_t \tag{22}$$

where we solve for the coefficients using the method of undetermined coefficients.

We also need to solve for the endogenous wealth innovation in the pricing kernel. The return on wealth for asset holders is given by $R_{ct+1} = V_{ct+1}/(V_{ct} - C_{At})$. The price of a hypothetical claim delivering asset holders' consumption as dividends is

the ex-consumption value of wealth ($P_{ct} \equiv V_{ct} - C_{At}$). We approximate log wealth according to

$$v_{ct+1} = \log\Big(\exp(p_{ct+1}) + C_{At+1}\Big) \approx \alpha_0 + \alpha_1 p_{ct+1} + \alpha_2 C_{At+1}, \tag{23}$$

where p_{ct} is the log price of consumption. We can then approximate the log return to wealth as

$$r_{ct+1} = \alpha_0 + \alpha_1 p_{ct+1} + \alpha_2 C_{At+1} - p_{ct}, \tag{24}$$

where the coefficients are α_0, α_1, and α_2 are approximating constants that depend on the risk-adjusted steady states of debt and the price of consumption. We solve for these constants using an iterative procedure.

We solve for the log price of consumption by starting with the Euler equation given by

$$1 = \mathbb{E}_t\Big[\exp(m_{t+1} + r_{ct+1})\Big], \tag{25}$$

and then plug in our approximated pricing kernel and return approximation to obtain

$$0 = \log \mathbb{E}_t\Big[\exp\Big(\log(\beta) - \gamma\Big(v_{ct+1} - \mathbb{E}_t[v_{ct+1}]\Big) + \alpha_0 + \alpha_1 p_{ct+1} + \alpha_2 C_{At+1} - p_{ct}\Big)\Big]. \tag{26}$$

We next substitute in the consumption expression from market clearing $C_A = \overline{Y} + \frac{1-\zeta}{\zeta} s_t$, process for government spending, and the tax rule to obtain

$$\begin{aligned} 0 \;=\; & \log \mathbb{E}_t\Big[\exp\Big(\log(\beta) - \gamma\Big(v_{ct+1} - \mathbb{E}_t[v_{ct+1}]\Big) + \alpha_0 + \alpha_1 p_{ct+1} \\ & + \alpha_2\Big(\overline{Y} + \frac{1-\zeta}{\zeta}\Big(-g^\star - \rho x_t - \sigma\epsilon_{t+1} + \tau^\star + \delta_b b_t - \delta_b b^\star\Big)\Big) - p_{ct}\Big)\Big]. \end{aligned} \tag{27}$$

We use the wealth approximation from equation (23) to obtain a linear log wealth innovation.

Given that the guess for debt is $b_t = A_0 + A_1 x_t$, we therefore guess that the log price

of the claim to asset holders' consumption is also linear in x_t according to

$$p_{ct} = D_0 + D_1 x_t.$$

Our guesses for b_t and p_{ct} imply that the log wealth innovation can be expressed in terms of these coefficients as

$$v_{ct+1} - \mathbb{E}_t[v_{ct+1}] = \left\{ \alpha_1 D_1 - \alpha_2 \left(\frac{1-\zeta}{\zeta} \right) \right\} \sigma \epsilon_{t+1}. \tag{28}$$

We can then express the log real pricing kernel in terms of the government spending shock as

$$m_{t+1} = \log(\beta) - \gamma \Phi_v \sigma \epsilon_{t+1}, \tag{29}$$

where $\Phi_v \equiv \alpha_1 D_1 - \alpha_2 \left(\frac{1-\zeta}{\zeta} \right)$. After solving for the debt policy in terms of the coefficients D_0 and D_1, we will later solve for these coefficients and show that $D_1 < 0$, which implies that $\Phi_v < 0$ so that a surprise fiscal expansion is a high pricing kernel state.

Substitute the guess for debt and the pricing kernel innovation into equation (21) to get

$$\begin{aligned} 1 \;=\; \mathbb{E}_t \Bigg[\exp \Big\{ & \log(\beta) - \gamma \Phi_v \sigma \epsilon_{t+1} + \kappa_0 + \kappa_1 A_0 + \kappa_1 A_1 x_{t+1} + \kappa_2 s^\star + \kappa_2 \delta_b A_0 + \kappa_2 \delta_b A_1 x_t \\ & - \kappa_2 \delta_b b^\star - \kappa_2 \rho x_t - \kappa_2 \sigma \epsilon_{t+1} - A_0 - A_1 x_t \Big\} \Bigg]. \end{aligned} \tag{30}$$

The coefficients in the debt solution $b_t = A_0 + A_1 x_t$ are given by

$$A_0 \;=\; \frac{1}{1 - \kappa_1 - \kappa_2 \delta_b} \left(\log(\beta) + \kappa_0 + \kappa_2 s^\star - \kappa_2 \delta_b b^\star + \frac{1}{2} \Big(-\gamma \Phi_v + \kappa_1 A_1 - \kappa_2 \Big)^2 \sigma^2 \right) \tag{31}$$

$$A_1 \;=\; \frac{\rho}{(\delta_b - s^\star) + (\rho - 1) \exp(b^\star)}. \tag{32}$$

The real value of debt decreases with an increase in government spending ($A_1 < 0$) because of non-Ricardian fiscal policy ($\delta_b - s^\star) < 0$ and $\rho < 1$. The debt devaluation in response to the spending shock in this regime is due to the fiscal authority not

committing to fully fund the spending with higher future taxation. The devaluation effect is magnified as fiscal authority responds more to the debt burden and if the shock is more persistent.

We use the debt solution to write the return on surplus as

$$r_{st+1} = \bar{r}_s + \Big(\kappa_1 A_1 - \kappa_2\Big)\sigma\epsilon_{t+1}. \tag{33}$$

The loading on the spending innovation is negative since $A_1 < 0$ and $\kappa_1, \kappa_2 > 0$.

2.7.2 *Inflation solution*

We solve for realized inflation using the budget identity (equation (12)) written in terms of returns and inflation $\pi_t = r^{\$}_{gt} - r_{st}$. Given that the government only issues one-period debt, this implies that $r^{\$}_{gt} = i_{t-1}$. Using this fact and then plugging in the interest rate rule and the solution for r_{st} into the budget identity yields the inflation policy given by

$$\pi_t = \Gamma_\pi + \rho_\pi \pi_{t-1} - \Big(\kappa_1 A_1 - \kappa_2\Big)\sigma\epsilon_t, \tag{34}$$

where $\Gamma_\pi \equiv i^\star - \rho_\pi \pi^\star - \bar{r}_s$. This recursion allows us to solve inflation backward if monetary policy is passive ($\rho_\pi < 1$).[6] Positive spending shocks are inflated away in this regime since $-(\kappa_1 A_1 - \kappa_2) > 0$, reducing the ex-post real returns to bondholders.

2.7.3 *Endogenous pricing kernel*

The debt solution from above is still expressed in terms of the undetermined coefficient D_1 from the guess for the price of the consumption claim. We now solve for D_1 along with D_0, where the former also allows us to pin down the response of the real pricing kernel to government spending shocks. We substitute the debt solution into equation

[6] The two-sided condition is $-1 < \rho_\pi < 1$.

(27) to obtain

$$
\begin{aligned}
0 \;=\; & \log \mathbb{E}_t \Bigg[\exp \Big(\log(\beta) - \gamma \Phi_v \sigma \epsilon_{t+1} + \alpha_0 + \alpha_1 p_{ct+1} \\
& + \alpha_2 \Big(\overline{Y} + \frac{1-\zeta}{\zeta} \Big(-g^\star - \rho x_t - \sigma \epsilon_{t+1} + \tau^\star + \delta_b \Big(A_0 + A_1 x_t \Big) - \delta_b b^\star \Big) \Big) - p_{ct} \Big) \Bigg]. \qquad (35)
\end{aligned}
$$

Using our guess $p_{ct} = D_0 + D_1 x_t$ in the Euler equation, we find that the coefficients in the solution for the log price of the asset holders' consumption claim are given by

$$
\begin{aligned}
D_0 \;=\; & \frac{1}{1-\alpha_1} \Bigg\{ \log(\beta) + \alpha_0 + \alpha_2 \overline{Y} + \alpha_2 \left(\frac{1-\zeta}{\zeta} \right) \Big(-g^\star + \tau^\star + \delta_b A_0 - \delta_b b^\star \Big) \\
& + \frac{1}{2} \Big(-\gamma \Phi_v + \alpha_1 D_1 - \alpha_2 \left(\frac{1-\zeta}{\zeta} \right) \Big)^2 \sigma^2 \Bigg\}, \qquad (36)
\end{aligned}
$$

and

$$
D_1 = \frac{\alpha_2 \left(\frac{1-\zeta}{\zeta} \right) \Big(\rho - \delta_b A_1 \Big)}{\alpha_1 \rho - 1}. \qquad (37)
$$

We can show that the price of the claim to asset holders' consumption falls with higher government spending ($D_1 < 0$) when there is a positive mass of constrained agents ($1 - \zeta > 0$).[7] When $\zeta = 1$, the price of the consumption claim is constant, implying the pricing kernel is constant.

The negative value of D_1 captures how the non-Ricardian fiscal policy in this regime redistributes wealth away from asset holders to fund the higher consumption of constrained agents when there is a government spending shock. While asset holders receive part of the transfers from government spending, the costs of the transfers to constrained households are passed on to the asset holders in present value terms through the devaluation of their nominal government bond holdings. The wealth redistribution effects on asset holders are magnified (larger magnitude of D_1) when there is a larger fraction of unconstrained households, which increases the fiscal burden on asset holders with higher government spending.

The solution for the price of the consumption claim to asset holders then pins

[7] The coefficient $D_1 < 0$ because $\alpha_2 > 0$, $(1-\zeta)/\zeta > 0$, $\alpha_1 \rho - 1 < 0$, and $\rho - \delta_b A_1 > 0$.

down the real pricing kernel. Given that $D_1 < 0$, the coefficient of the pricing kernel to spending shocks Φ_v is also negative when there is a positive mass of unconstrained ($\zeta \in (0, 1)$)

$$\Phi_v = \alpha_1 D_1 - \alpha_2 \left(\frac{1-\zeta}{\zeta} \right) < 0. \tag{38}$$

since $\alpha_1, \alpha_2 > 0$. A fiscal expansion redistributes wealth away from asset holders, increasing their marginal utility and the real pricing kernel. These redistributive effects under fiscal dominance make fiscal expansions risky states of the world.

The pricing kernel effects in our framework critically hinge on fiscal dominance and the presence of constrained agents. Under monetary dominance, the higher government spending is fully paid for through future taxation, implying neutral effects on the present value of the consumption response. Under fiscal dominance but without constrained agents, the representative household would receive the entire stream of transfers, offsetting the debt devaluation in present value terms so that their wealth is unaffected.

2.7.4 Consumption solution

We can solve for the consumption policy of the hand-to-mouth agent by using $C_{Ht} = \overline{Y} - s_t$ from market clearing and the debt solution to obtain

$$C_{Ht} = \overline{Y} + g^\star - \tau^\star - \delta_b A_0 + \delta_b b^\star + (\rho - \delta_b A_1) x_{t-1} + \sigma \epsilon_t. \tag{39}$$

A positive spending shock ($\epsilon_t > 0$) raises the consumption of hand-to-mouth agents today.

We can use $C_A = \overline{Y} + \frac{1-\zeta}{\zeta} s_t$ and the debt solution to obtain

$$C_{At} = \overline{Y} - \frac{1-\zeta}{\zeta} \Big(g^\star - \tau^\star - \delta_b A_0 + \delta_b b^\star \Big) - \frac{1-\zeta}{\zeta} \Big(\rho - \delta_b A_1 \Big) x_{t-1} - \frac{1-\zeta}{\zeta} \sigma \epsilon_t. \tag{40}$$

A positive spending shock ($\epsilon_t > 0$) lowers the consumption of asset holders today.

We are given $s^\star$ and $\pi^\star$. We solve for the risk-adjusted steady states $b^\star$ and $i^\star$ so

that the policy rules are centered around the stochastic steady states. We also jointly solve a fixed-point problem for the log price of the consumption claim $p_c^\star$ with debt $b^\star$.

2.7.5 *Bond pricing*

Nominal bonds command a positive risk premium in real terms under fiscal dominance. Subsection 2.7.2 demonstrated that a surprise increase in government spending generates fiscal inflation, reducing the real return to nominal government bonds. When there are constrained households in this regime, subsection 2.7.3 showed that the pricing kernel increases in response to a fiscal expansion because of wealth being redistributed away from asset holders. Therefore, bond returns do poorly in high marginal utility states of asset holders. Fiscal dominance produces risky government debt.

To formalize this intuition, we compute risk premium on the real return to nominal bonds (equivalent to the return to surplus from the budget identity $r^{\$}_{gt} - \pi_t = r_{st}$) using the Euler equation given by

$$\begin{aligned} E_t[r_{st+1} - r_t] + \frac{1}{2}\text{Var}_t(r_{st+1}) &= -\text{Cov}_t(m_{t+1}, r_{st+1}), \\ &= \gamma\Phi_v\Big(\kappa_1 A_1 - \kappa_2\Big)\sigma^2 > 0. \end{aligned}$$

We established earlier that $\Phi_v < 0$ and that $\kappa_1 A_1 - \kappa_2 < 0$ which implies that the real risk premium on nominal government bonds is positive under fiscal dominance. We can show that the real risk premium to bondholders is increasing with δ_b and ρ, as they amplify the negative return response to spending shocks and the negative consumption response of asset holders. A larger coefficient of risk aversion γ and larger spending innovations σ also increase the risk premium.

2.8 *Contrasting regime dynamics*

To further elucidate and visualize the key mechanisms for generating risky debt in our framework, Figure 1 compares impulse responses to a positive government spending shock in four specifications. We label 'Fiscal Two Agent' as the fiscal dominance

regime ($\delta_b < s^\star$ and $\rho_\pi < 1$) with a positive fraction of constrained agents ($1 - \zeta > 0$) and 'Fiscal Rep Agent' as the fiscal dominance regime with a representative agent ($\zeta = 1$). We refer to 'Monetary Two Agent' as the monetary dominance regime ($\delta_b > s^\star$ and $\rho_\pi > 1$) with a positive fraction of constrained agents and 'Monetary Rep Agent' as the monetary regime with a representative agent.

The positive surprise to government spending is used to pay for transfers uniformly distributed across agents. For the fiscal dominance cases, we are plotting the specification with unfunded spending where taxes do not respond to fiscal shocks ($\delta_b = 0$). We use this specification to make a sharper contrast with the monetary dominance cases where all spending is fully funded through higher future taxation. The responses look qualitatively similar for other specifications of δ_b with more negative (positive) values smoothing (amplifying) the responses under fiscal dominance. The responses also look similar for the finite IES case, with the main difference being that there are small inflation responses from real rate movements in the two agent specifications.

The increase in unfunded spending in the fiscal dominance cases makes asset holders want to sell nominal government bonds because of the reduced fiscal backing. However, fiscal inflation rises to devalue the bonds to ensure that they hold the bonds in equilibrium. We get amplification in the inflation response when there are constrained households due to bonds commanding a positive bond risk premium. In contrast, in the representative agent case, the bond risk premium is zero. The spending shocks have a neutral effect on inflation in the monetary dominance cases because of the future offsets arising from the Ricardian tax policy that insulates inflation.

The intuition for why higher bond risk premia amplifies the inflation response to spending shocks under fiscal dominance is that the duration of a claim on a government spending shock is lower than the duration of the total claims on all future surpluses. When discount rates are higher, the relative impact of the shorter-duration claim is larger. We can see this effect reflected in the debt solution through the dependence of the coefficient A_1 on the debt steady state. There are two key margins for generating this amplification of inflation. First, the magnified response of real debt values to spending shocks requires a larger increase in inflation. Second, the amount of inflation required to offset a given change in current surpluses is decreasing in

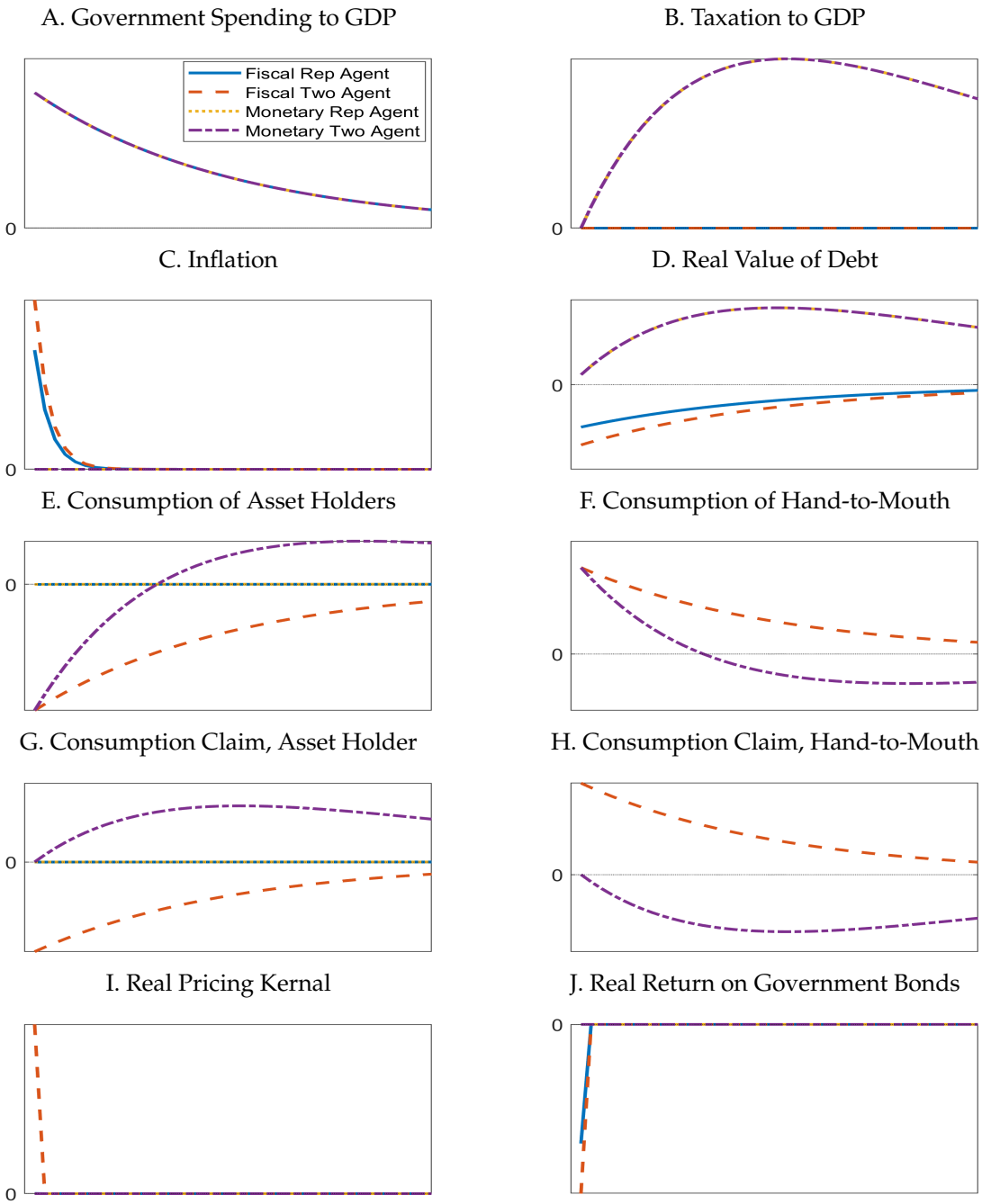


Fig. 1. **Impulse responses to a Government Spending Shock** This figure displays the impulse responses to a government spending shock for several equilibrium objects in four equilibria. The y-axis is the deviation from a risky steady-state and the x-axis is time periods since the shock. Panels A and B display the impulse responses of government spending and taxation, relative to output, following a government spending shock. Panels C and D display the impulse responses of inflation and the real value of government debt, both in logs. Panels E and F display the impulse responses of (log) consumption of asset holders and the hand-to-mouth, respectively. Panels G and H display the impulse responses of the (log) price of (cum dividend) consumption claims for asset holders and the hand-to-mouth, respectively. Panels I and J display the impulse responses of the real pricing kernel and the real return on government bonds.

the market value of government debt—if the current market value of debt is small, it requires a larger amount of inflation to offset a fixed amount of current surpluses.

When there are unconstrained and constrained agents, the spending shock and transfers generate the same initial consumption responses in both policy regimes since the spending is fully deficit-financed in the first period as the tax rule depends on lagged debt. An increase in transfers to constrained hand-to-mouth agents directly raises their consumption because they cannot save. Since supply is fixed, market clearing implies that unconstrained agents' consumption falls as they are crowded out in the goods market by constrained agents.

The impact on the future consumption path critically hinges on the policy regime. Under monetary dominance, the future tax offsets from the Ricardian tax rule generate a reversal in the consumption path: The constrained agents' consumption eventually reverses and drops below the steady state before returning, and vice versa for the unconstrained agents. The sign flip in the consumption path is due to future taxation eventually exceeding transfers, which leads constrained households to lower consumption. In contrast, the spending is not backed by future taxation under fiscal dominance, so there is not a sign flip in the consumption responses.

To fully quantify the effects on the consumption path, we also consider the price of hypothetical claims to the consumption of unconstrained agents and that of the constrained agents. The Ricardian tax offsets under monetary dominance imply that the response of the present value of the current and future consumption to government spending shocks is zero. For asset holders, the cum consumption price of a claim to their consumption is equivalent to their wealth. Insulating the wealth of the asset holders implies that the pricing kernel is neutral to government spending shocks. In the fiscal dominance regime, the wealth of asset holders and the corresponding wealth return are adversely affected by the spending shocks, increasing their marginal utility. Fiscal inflation reduces the real return to nominal government debt in these high marginal utility states for asset holders, leading to a positive bond risk premium.

3 Quantitative Framework

This section integrates and quantifies the insights from the analytical framework into a textbook New Keynesian model. There are three primary modifications to the analytical framework. First, we introduce production and endogenous labor supply. Second, monopolistic firms set goods prices subject to nominal rigidities. Third, we introduce monetary policy shocks and aggregate productivity shocks, in addition to the government spending shocks.

3.1 Households

There is a continuum of households on the unit interval with the same utility function and preference parameters. We assume that the fraction ζ is unconstrained ("asset holding" agents) and the fraction $1-\zeta$ is constrained ("hand-to-mouth" agents).

3.1.1 Unconstrained agents

An asset holder has recursive Epstein-Zin (EZ) preferences defined over defined over streams of consumption C_{At} and labor L_{At} given by

$$V_{At} = (1-\beta)u(C_{At}, L_{At}) + \beta\left(\mathbb{E}_t\left[V_{At+1}^{\theta}\right]\right)^{\frac{1}{\theta}} \tag{41}$$

where C_{At} is the consumption of an asset holder, $\theta \equiv (1-\gamma)/(1-1/\psi)$ is a parameter defined for notational convenience, γ is a parameter related to risk aversion, and ψ is the intertemporal elasticity of substitution. The utility kernel is additively separable in consumption and leisure,

$$u\left(C_{At}, L_{At}\right) = \frac{C_{At}^{1-1/\psi}}{1-1/\psi} + \chi_0 N_t^{1-1/\psi}\frac{\left(\bar{L}-L_{At}\right)^{1-\chi}}{1-\chi}, \tag{42}$$

where χ captures the Frisch elasticity of labor, $\chi_0 > 0$ is a scaling parameter, and $\bar{L}$ is the total time endowment. The component capturing utility over leisure is scaled by the exogenous trend component in productivity, N_t, to ensure that this component does not become trivially small along the balanced growth path.

The objective of the asset holder is to choose the sequences of consumption C_{At}, labor hours L_{At}, and real balances of nominal government debt B_{At}/P_t that maximize lifetime utility subject to the budget constraint in nominal terms according to

$$P_t C_{At} + Q_t B_{At} = P_t D_{At} + W_t L_{At} + (1 + \delta Q_t) B_{At-1} + P_t T_{At}, \tag{43}$$

where Q_t is the nominal bond price, B_{At} is the face value of nominal bond holdings, D_{At} represents the aggregate payout received from firms, W_t is the nominal competitive wage rate, and T_{At} is the government transfer.

3.1.2 Constrained agents

The hand-to-mouth agents cannot save and, therefore, solve a static problem. They maximize period utility by choosing consumption C_{Ht} and labor L_{Ht}

$$u\left(C_{Ht}, L_{Ht}\right) = \frac{C_{Ht}^{1-1/\psi}}{1-1/\psi} + \chi_0 N_t^{1-1/\psi} \frac{\left(\bar{L} - L_{Ht}\right)^{1-\chi}}{1-\chi}, \tag{44}$$

subject to the budget constraint

$$P_t C_{Ht} \leq W_t L_{Ht} + P_t T_{Ht}, \tag{45}$$

where W_t is the competitive nominal wage rate and T_{Ht} is the government transfer.

3.2 Firms

Production in our economy consists of a final goods and an intermediate goods sector.

3.2.1 Final Goods

A competitive representative firm produces final consumption goods, Y_t, in a perfectly competitive market. The firm uses a continuum of differentiated intermediate goods, X_{it}, as input in a constant elasticity of substitution (CES) production technology, $Y_t = (\int_0^1 X_{it}^{(\nu-1)/\nu} di)^{\nu/(\nu-1)}$, where ν is the elasticity of substitution between intermediate

goods. Profit maximization yields an isoelastic demand schedule, $X_{it} = (P_{it}/P_t)^{-\nu} Y_t$, where P_{it} is the nominal goods price of firm i.

3.2.2 *Intermediate Goods*

The intermediate goods sector is characterized by a continuum of monopolistic firms. Each intermediate goods firm produces intermediate goods, X_{it}, using labor, L_{it}, with production technology $X_{it} = Z_t L_{it}$, where $\log(Z_t) = a_t + \mu \cdot t$ represents log measured total factor productivity. The productivity shock follows an autoregressive process, $a_t = \rho_a a_{t-1} + \sigma_a \varepsilon_{at}$. They face Rotemberg costs of adjusting their nominal price, $\frac{\phi_R}{2}(P_{it}/(\Pi^\star P_{it-1}) - 1)^2 Y_t$, where $\Pi^\star \geq 1$ is the gross risk-adjusted target inflation rate and ϕ_R dictates the magnitude of the costs. The firm's source-of-funds constraint is

$$D_{it} = (P_{it}/P_t)X_{it} - (W_t/P_t)L_{it} - (\phi_R/2)(P_{it}/(\Pi^\star P_{it-1}) - 1)^2 Y_t, \tag{46}$$

where D_{it} represents real firm payouts.

The optimal dynamic nominal price-setting decision maximizes the cum-dividend firm value, cast recursively as

$$\begin{aligned} V(P_{it-1}; \Gamma_t) \;=\; & \max_{P_{it}} \left(\frac{P_{it}}{P_t}\right)^{1-\nu} Y_t - \mathtt{MC}_t \left(\frac{P_{it}}{P_t}\right)^{-\nu} Y_t - \frac{\phi_R}{2}\left(\frac{P_{it}}{\Pi^\star P_{it-1}} - 1\right)^2 Y_t \\ & + \mathbb{E}_t\left[M_{t+1} V(P_{it}; \Gamma_{t+1})\right] \end{aligned}$$

where $\mathtt{MC}_t$ is real marginal costs and $\Gamma_t \equiv [Z_t, \mathtt{MC}_t, Y_t, P_t]'$ is a vector of aggregate states.

3.3 *Monetary policy*

The monetary authority follows a log nominal short rate, i_t, according to a Taylor rule that depends on inflation,

$$i_t = i^\star + \rho_\pi (\pi_t - \pi^\star) + \epsilon_{it}, \tag{47}$$

where $\pi^\star$ is a risk-adjusted log inflation target, $i^\star$ is the unconditional average of i_t, $\epsilon_{it} = \varphi_i \epsilon_{it-1} + \sigma_i e_{it}$ captures surprises to monetary policy, and e_{it} is a standard normal shock.

3.4 Fiscal policy

We assume that the government only issues nominal consol bonds whose coupons decay at a rate of δ. The government budget equation is given by

$$(1 + \delta Q_t) B_{t-1} = P_t S_t + Q_t B_t, \tag{48}$$

where B_t is the total nominal face value outstanding at time t.

The fiscal authority follows a level tax to GDP rule that depends on log debt to GDP according to

$$\tau_t = \tau^\star + \delta_b (b_{t-1} - b^\star) \tag{49}$$

where b_t is log market value of debt to GDP, $\tau^\star$ is the risk-adjusted tax-to-GDP target and $b^\star$ is a time-varying debt target that is regime-dependent. Government spending to GDP follows the process

$$g_t = (1 - \rho_g) g^\star + \rho_g g_{t-1} + \sigma_g \epsilon_{gt} \tag{50}$$

where $g^\star$ is the net spending target.

We assume that each dollar spent generates η_g units of consumption distributed to households as transfers. Let ζ^G denote the fraction of transfers to asset holders and ζ^T denote the fraction of taxes levied on asset holders. Thus, net transfers to an asset holder (scaled by GDP) are $T_{At}/Y_t = g_t \eta_g \zeta^G / \zeta - \tau_t \zeta^T / \zeta$ and net transfers to a hand-to-mouth agent (scaled by GDP) are $T_{ht}/Y_t = g_t \eta_g (1 - \zeta^G)/(1 - \zeta) - \tau_t (1 - \zeta^T)/(1 - \zeta)$.

3.5 *Market clearing*

Asset market clearing requires that unconstrained agents own all outstanding nominal government bonds according to $\zeta \mathcal{B}_{At} = \mathcal{B}_t$ and all equity claims $\zeta D_{At} = D_t$. The labor market clears according to $L_t = \zeta L_{At} + (1-\zeta)L_{Ht}$. Aggregate output is given by $Y_t = Z_t L_t$. Goods market clearing is given by

$$Y_t = C_t + \Phi_{Rt} + Y_t g_t (1 - \eta_g), \tag{51}$$

where $C_t = \zeta C_{At} + (1-\zeta)C_{Ht}$ is aggregate consumption, Φ_{Rt} corresponds to aggregate price adjustment costs, and $Y_t g_t (1-\eta_g)$ correspond to deadweight costs of inefficient government spending.

The model is solved as an affine approximation around a risky steady-state that incorporates endogenous risk premia. This requires solving for a fixed point, as risk premia affects the equilibrium dynamics of endogenous variables, which in turn affect the level of risk premia. We solve for this using a slow-updating iterative procedure: We guess the vector of risk premiums as 0, solve for equilibrium dynamics, compute the implied level of risk premia and (partially) update our guess until the vector of risk premia is consistent with the equilibrium dynamics of the pricing kernel and other endogenous variables.

3.6 *Calibration*

We summarize the calibration of the quantitative model in Table 1. Panel A displays the values for parameters related to preferences. We set the discount factor (β) to 0.994 quarterly. The risk aversion parameter (γ) is set to 10 and the intertemporal elasticity of substitution (ψ) is calibrated to 2 as in Kung (2015). We set the share of asset holding agents in the economy (ζ) to one-half following Galí et al. (2007). The curvature parameter of leisure in the utility function (χ) and the level shifter (χ_0) are calibrated to generate Frisch elasticities of approximately $3/4$ and agents spending, on average, 40% of their waking hours working.

Panel B displays the values for parameters related to production technology. We

Table 1. Calibration

This table reports the parameter values used in the quarterly calibration of the quantitative model, divided into three categories: preferences, technology, and policy. The choice of these parameter values is described in Section 3.6.

Parameter		Value	Parameter		Value
Panel A: Preferences					
β	Discount factor	0.9942	γ	Risk aversion	10
ψ	IES	2	ζ	Share of asset holders	0.5
χ	Leisure curvature	2	χ_0	Leisure level shifter	0.45
$\overline{L}$	Labor supply	1			
Panel B: Technology					
ν	Elasticity of substitution	4	ϕ_R	Price adjustment cost	20
σ_a	TFP shock volatility	0.80%	ρ_a	TFP shock persistence	0.90
Panel C: Policy					
$\pi^\star$	Inflation target	3.60%/4	δ	Debt maturity parameter	0.96
$\tau^\star$	Tax/GDP target	23%	$g^\star$	Government spending/GDP target	20%
ρ_π	Taylor rule inflation coefficient	0.8	δ_b	Tax rule debt coefficient	0
σ_g	Spending shock volatility	1.5%	ρ_g	Spending shock persistence	0.95
σ_i	Interest rate shock volatility	0.41%	φ_i	Interest rate shock persistence	0.11

set the price elasticity of demand (ν) to 4, which generates a steady-state markup of 33%, in line with estimates from De Loecker, Eeckhout, and Unger (2020). The price adjustment cost parameter (ϕ_R) is calibrated to a value of 20, which is similar as in Kung (2015). The parameters governing the dynamics of the stationary productivity shock (ρ_a and σ_a) are set to be consistent with the persistence and volatility of output growth.

Panel C displays the values for parameters related to policy. Target inflation ($\pi^\star$) is used to match average inflation. The persistence and volatility of the monetary policy shock (φ_i and σ_i) are set to values from Corhay et al. (2023). We focus on a fiscal dominance regime for our quantitative model. The inflation coefficient (ρ_π) of the interest rate rule is set to a value as in Cochrane (2022) and the debt coefficient in the tax rule is set to a value as in Bianchi and Ilut (2017). The parameters governing the net spending shock dynamics (ρ_g and σ_g) and target surplus to GDP ratio (τ_{star} and $g^\star$) are set to be consistent with the observed level and dynamics of the ratio. The duration of the geometric government bond is set to match the average duration of public debt.

Table 2 shows that the calibrated model produces an overall good fit of macroeconomic dynamics and government bond risk premia.

Table 2. Summary Statistics

Variable	Model	Data
Panel A: Averages		
Excess bond return	92 bps	107 bps
Inflation	2%	3.2%
Panel B: Standard Deviations		
Excess bond return	3.2%	4.2%
Inflation	3.0%	2.6%
Output growth	2.6%	2.3%
Δ Surplus to GDP	2.3%	2.3%

Note: This table presents summary statistics comparing the model's predictions to the data. Panel A shows the first moments (averages), while Panel B shows the second moments (standard deviations). All values are in percentage points and annualized.

3.7 Fiscal redistribution and bond risk premia

Table 2 shows that our benchmark model generates a sizable average excess return on the nominal geometric government bond relative to the short rate. Panel A of Table 3 decomposes the contributions by maturity by reporting the shadow zero-coupon nominal yield curve for maturities of one quarter to five years. Our model can reproduce the average five-year nominal yield spread of around 1% with standard macroeconomic shocks and moderate risk aversion. Panel B highlights that government spending shocks explain the majority of the nominal term premium in our benchmark model, labeled 'Fiscal TANK'.

Figure 2 illustrates how the fiscal redistribution mechanism outlined in our analytical framework—arising from the combination of a fiscal dominance regime and the presence of constrained households—makes government spending shocks a quantitatively significant source of inflation risk premia in government bonds. We plot the responses to a positive government spending shock set to match COVID spending (13.5% of GDP). We consider four cases to emphasize the importance of the policy regime and the fraction of constrained households. 'Fiscal TANK' corresponds to the benchmark model of fiscal dominance and a fraction of constrained agents. 'Fiscal

Table 3. Term Structure of Interest Rates

Panel A: Average Yields

	Maturity						
Nominal Yields (mean)	1Q	1Y	2Y	3Y	4Y	5Y	5Y - 1Q
Data (in %)	4.42	4.76	4.92	5.08	5.22	5.34	0.94
Model (in %)	4.88	5.23	5.51	5.67	5.76	5.81	0.93

Panel B: 5Y-1Q Average Yield Spread

	F-TANK	F-RANK	M-TANK	M-RANK
Total	0.93	-0.03	0.06	0.05
Contribution of shocks:				
Government spending	0.91	-0.06	0.01	0.00
Productivity	0.02	0.02	0.05	0.04
Monetary	0.00	0.01	0.00	0.00

Note: This table reports unconditional term structure statistics from both the model and the data. Panel A presents the mean of the one-quarter, one-, two-, three-, four-, and five-year yields, as well as the five-year minus one-quarter spread for nominal yields. Panel B shows the contribution of each shock to the 5Y-1Q average yield spread for each of the considered models.

RANK' is the fiscal dominance case with a representative agent ($\zeta = 1$). 'Monetary TANK' and 'Monetary RANK' correspond to the monetary dominance analogues of the fiscal dominance cases. We set the policy parameters for a monetary dominance regime to $\rho_\pi = 1.5$ and $\delta_b = 0.2$.

The benchmark Fiscal TANK case generates an increase in inflation because the spending surprise is unbacked by future taxation under fiscal dominance. The surge in inflation lowers the real government bond return. The cumulative excess inflation and bond return response are in the ballpark of the observed dynamics in the four years following COVID (14.5% and -26% in the data compared to 15% and -15% in the model). The nominal devaluation effect is stronger at longer maturities due to the persistence of the inflation response, which is dictated by the inflation coefficient from the interest rate rule. Fiscal redistribution from transfer spending reduces realized consumption and the wealth of asset holders, as described in the analytical model (Section 2.7). Because we consider a finite IES specification here, the decline in consumption and wealth both increases the marginal utility of asset holders. Government bonds (particularly longer maturity ones), therefore, perform poorly in high marginal utility states, leading to a

sizable positive bond risk premium and nominal term premium.

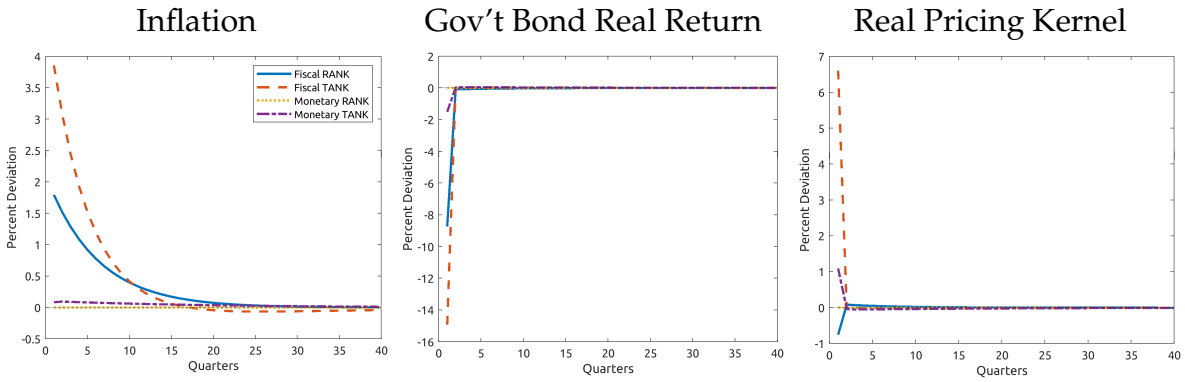


Fig. 2. Impulse Response Functions for Covid spending shock

The Fiscal RANK case also generates an increase in inflation in response to the positive spending shock, although the effects are muted compared to the Fiscal TANK case because of the risk premium channel articulated in Section 2.8. Higher inflation reduces the real return to government bonds. The representative agent receives the entire transfer that offsets the losses from their bond holdings in the Fiscal RANK specification. However, higher inflation stimulates aggregate demand because of sticky prices, generating temporarily higher consumption, thereby reducing the pricing kernel. Consequently, nominal government bonds act as a hedge against fiscal inflation, contributing negatively to the risk premium.

The Monetary TANK specification generates a consumption redistribution, lowering asset holders' consumption highlighted in Section 2.6.3. The temporary fall in consumption raises expected consumption growth and the real rate. An increase in the real rate lowers the one-period nominal bond price, requiring an increase in inflation for the nominal short rate set in the interest rate rule to be consistent with the bond pricing Euler equation. However, the inflation response is significantly smaller compared to the fiscal dominance cases as government spending under monetary dominance is backed by future taxation, eliminating the need for additional fiscal inflation to pay for the stimulus package. The increase in inflation lowers the real government bond return. The fall in asset holders' consumption increases the pricing kernel, but this response is muted compared to the fiscal TANK case that features sizable pricing kernel movements from the devaluation of assetholders' wealth. Gov-

ernment shocks therefore contribute to a positive, but quantitatively small, bond risk premium in the monetary TANK case.

The monetary RANK case is the textbook model (e.g., Galí (2015)) where the transfer spending shocks have a neutral effect. Overall, the key takeaways of the analytical framework extend to the quantitative model. Monetary dominance produces a safe debt regime insulating bondholders from fiscal disturbances. Fiscal dominance produces a risky debt regime when there is a sizable mass of constrained agents so that government stimulus checks redistribute wealth away from bondholders when bond returns are low. Panel B of Table 3 confirms the visual evidence from the impulse response by showing that the Fiscal TANK specification generates a realistic bond risk premia and government spending shocks are the main source of risk premia in our quantitative framework.

4 Conclusion

This paper shows that unfunded government spending surprises are an important source of risk premia in Treasury markets when central banks and governments commit to protecting taxpayers over bondholders. Fiscal expansions under a fiscal dominance policy mix and the presence of constrained households redistribute wealth away from unconstrained households while reducing real government bond returns, generating a bond risk premium. When monetary policy propagates fiscal inflation, the real payoffs of longer-maturity nominal bonds are devalued more than shorter-maturity ones, leading to a nominal term premium.

We first show the transmission mechanisms for fiscal shocks to bond markets analytically in an endowment economy featuring monetary-fiscal policy interactions along with unconstrained and constrained agents. We then quantify these mechanisms by extending the analytical framework into a textbook New Keynesian model. Calibrating the model to macroeconomic and surplus dynamics, we show that government spending shocks can explain most of the nominal term premium with modest risk aversion under fiscal dominance and a sizable mass of constrained households. We show that the inflation and bond return responses to a COVID spending shock from

the model are similar in magnitude to the dynamics from the data.

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