WORKING paper

BANQUE DE FRANCE
EUROSYSTÈME

Fiscal Sustainability when Public Debt is High: The Role of Portfolio Liquidity

Cristiano Cantore[1], Matteo Gatto[2], Francesco Saverio Gaudio[3], and Pascal Meichtry[4]

July 2026, WP #1055

Abstract

This paper studies how the prevailing level of public debt shapes the transmission of fiscal and monetary policy shocks in a tractable heterogeneous three-agent New Keynesian model. When households rely on the liquidity services of government bonds to self-insure against idiosyncratic risk, higher public indebtedness amplifies the deterioration in debt sustainability after expansionary government spending shocks. In such economies, fiscal expansions weaken precautionary bond demand, requiring the central bank to keep real interest rates higher for longer and thereby raising debt servicing costs and narrowing fiscal space. By contrast, the transmission of monetary expansions is largely invariant to the initial debt level, as such shocks have little effect on the insurance value of government bonds. These results highlight the central role of the liquidity premium and self-insurance motive in linking initial public indebtedness to long-run fiscal sustainability.

Keywords: Monetary–fiscal interactions, Heterogeneity, Liquidity, Self-insurance, Government debt, Debt sustainability

JEL classification: E21, E52, E58, E62, E63

[1] Sapienza University of Rome. Email: cristiano.cantore@uniroma1.it
[2] Sapienza University of Rome. Email: matteo.gatto@uniroma1.it
[3] Sapienza University of Rome. Email: francescosaverio.gaudio@uniroma1.it
[4] Banque de France. Email: pascal.meichtry@banque-france.fr
An earlier version of this paper circulated under the title "Monetary–Fiscal Interactions and the Liquidity Channel of Debt Sustainability".

NON-TECHNICAL SUMMARY

Public debt in many advanced economies has increased substantially following recent crises. At the same time, higher interest rates have raised debt-servicing costs and renewed concerns about fiscal space. When debt is already high, governments may have less room to respond to future shocks or finance priority spending. Understanding how public indebtedness shapes the effects of fiscal and monetary policy is therefore important for assessing debt sustainability.

This paper studies how different initial levels of public debt affect the transmission of fiscal and monetary policy shocks. The analysis is based on a tractable New Keynesian model with three household types (capitalists, savers, and hand-to-mouth consumers) that differ in their access to financial assets and may move between types over time, reflecting idiosyncratic economic risk. In this environment, some households can save in assets with different liquidity profiles, notably liquid government bonds and illiquid capital. Government bonds are therefore valued not only for their return, but also because they help households self-insure against future changes in their economic circumstances.

The main finding is that fiscal expansions can pose greater risks to debt sustainability when public debt is initially high. For the same increase in government spending, real government debt rises more and remains elevated for longer when the economy starts from a higher debt-to-GDP ratio. The reason is that, at high debt levels, government bonds are already abundant liquid assets, so newly issued bonds provide a smaller additional insurance benefit to households. This weakens precautionary demand for bonds and lowers the liquidity premium – the expected return spread between illiquid capital and liquid government bonds which captures the value of bond liquidity. To induce households to absorb the additional public debt, real interest rates must remain higher for longer, raising debt-servicing costs and reducing fiscal space.

Figure: Fiscal expansions are more costly for debt sustainability when public debt is initially high

Notes: The figure shows model responses to a temporary increase in government spending equal to 1% of GDP, for different steady-state debt-to-GDP ratios. Higher initial debt leads to a more persistent decline in the liquidity premium, a more persistent rise in the real interest rate, and a larger increase in real government debt. All variables are reported as percentage-point deviations from their own steady state, except real government debt, which is expressed relative to steady-state output. For example, a value of −0.06 corresponds to a decline of about 0.06 percentage points in the liquidity premium.

By contrast, the effects of monetary policy shocks are much less sensitive to the initial level of public debt. In the model, a monetary expansion lowers real interest rates, stimulates economic activity, and reduces debt-servicing costs. Because this shock has only a limited effect on the insurance value of government bonds, changing the initial debt-to-GDP ratio does not meaningfully alter its transmission. Overall, the results show that fiscal sustainability depends not only on debt levels and primary balances, but also on the liquidity value of government bonds and on households' use of these bonds for self-insurance.

Soutenabilité de la dette en période d’endettement public élevé : le rôle de la liquidité des portefeuilles

RÉSUMÉ

Cet article étudie comment le niveau d’endettement public façonne la transmission des chocs de politique budgétaire et monétaire dans un modèle néo-keynésien hétérogène et maniable à trois types de ménages. Lorsque les ménages s’appuient sur les services de liquidité offerts par les obligations publiques pour se prémunir contre le risque idiosyncratique, un endettement plus élevé amplifie la détérioration de la soutenabilité de la dette à la suite de chocs expansionnistes sur les dépenses publiques. Dans de telles économies, les expansions budgétaires affaiblissent la demande d’obligations publiques à des fins de précaution, ce qui oblige la banque centrale à maintenir les taux d’intérêt réels plus élevés pendant plus longtemps, augmentant ainsi les coûts du service de la dette et réduisant l’espace budgétaire. En revanche, la transmission des chocs expansionnistes de politique monétaire est largement indépendante du niveau initial d’endettement, car ces chocs ont peu d’effet sur la valeur d’assurance des obligations publiques. Ces résultats mettent en évidence le rôle central de la prime de liquidité et du motif de précaution dans le lien entre l’endettement public initial et la soutenabilité de la dette à long terme.

Mots-clés : interactions entre politiques monétaire et budgétaire, hétérogénéité, liquidité, auto-assurance, dette publique, soutenabilité de la dette

1 Introduction

The COVID-19 pandemic and Russia's invasion of Ukraine have led to a marked deterioration in the fiscal outlook of many advanced economies, including the United States. The rise in public debt to historically high levels calls for fiscal adjustments to preserve debt sustainability, as higher debt servicing costs constrain fiscal space and limit governments' ability to finance essential investments. Although debt is projected to stabilize or decline in many countries by 2029, it is still expected to remain well above pre-pandemic levels (see International Monetary Fund, 2025). In this context, understanding the macroeconomic and policy implications of a permanent shift in debt levels has become an issue of first-order importance.

In this paper, we examine how the average (steady-state) level of the debt-to-GDP ratio shapes the transmission of fiscal and monetary policy shocks, with a focus on their implications for debt sustainability. We show that when households value public bonds for their liquidity services — i.e., for self-insurance against idiosyncratic risk — changes in the average debt-to-GDP ratio significantly alter the transmission of government spending shocks, with higher initial debt producing a greater deterioration in fiscal space. A larger supply of liquid assets reduces investors' willingness to accumulate them for precautionary purposes, implying that the central bank needs to engineer a higher-for-longer real interest rate to clear the bond market. As a result, for a given fiscal expansion, debt-servicing costs rise more persistently when the initial debt level is higher, thereby weakening debt sustainability. Conversely, the aggregate and fiscal dynamics induced by expansionary monetary shocks are largely independent of the steady-state debt-to-GDP ratio, because the insurance value of public bonds is virtually unaffected by this disturbance.

Overall, our findings suggest that the liquidity value of government debt is a key determinant of debt sustainability. In a heterogeneous-agent economy where households rely on the liquidity properties of public bonds, fiscal expansions undertaken at already high debt levels can significantly undermine the government's ability to control debt dynamics.

The analysis is based on a New Keynesian model with limited household heterogeneity in which three types of agents differ in their ability to trade financial assets. As in Cantore and Leonardi (2025), capitalists have access to both capital and bond markets, whereas savers can invest only in the latter. Hand-to-mouth households, on the other hand, cannot save and finance their consumption only with labor income and previously accumulated bonds. Due to idiosyncratic risk, households face exogenous probabilities of switching among types. Only government bonds are portable across states, implying that capital (bonds) represents an illiquid (liquid) form of investment. Time variation in the liquidity premium — the expected return spread between capital and bonds — reflects fluctuations in the relative attractiveness of illiquid capital and liquid government bonds. A decline in the premium can arise because the self-insurance value of bonds falls, because liquid assets become more abundant, or because bonds become more highly remunerated.

Unlike Cantore and Leonardi (2025), we consider a fiscal authority that sets the *real* (rather than nominal, as in Hagedorn, 2021) level of tax revenues as a function of the dynamics of real government spending and the real debt-to-GDP ratio. This real-fiscal specification allows us to isolate the role of the liquidity premium and self-insurance for debt sustainability from purely nominal valuation effects. Furthermore, rather than considering different combinations of active/passive fiscal or monetary policy in the sense of Leeper (1991), we restrict our attention to a monetary dominance regime: the central bank raises the nominal rate more than one-for-one with inflation (active monetary policy), while the government adjusts the primary surplus strongly enough to real debt to stabilize it (passive fiscal policy).

In this setup, we study the macroeconomic, redistributive, and fiscal consequences of expansionary fiscal or monetary policy shocks across different steady-state levels of the debt-to-GDP ratio, calibrated to match US debt levels in the 1980s–1990s versus the 2010s. An exogenous increase in public spending raises output and inflation while crowding out private consumption and investment. At the same time, it redistributes resources toward hand-to-mouth households through higher labor income, whereas capitalists and savers reduce spending to absorb the larger supply of government bonds. Crucially, the liquidity value of bonds (i.e., the liquidity premium) falls because the hand-to-mouth state becomes less undesirable under a fiscal expansion. Indeed, in our setup, real debt dynamics under fiscal shocks reflect both (i) a supply channel, operating through the quantity and remuneration of government debt, and (ii) a self-insurance channel, operating through the insurance value of bonds reflected in the liquidity premium. This self-insurance channel implies that capitalists' precautionary demand for bonds declines, requiring the central bank to maintain the real interest rate high to keep bonds sufficiently attractive. We show that these effects are significantly amplified at higher initial (steady-state) debt-to-GDP ratios. With a larger stock of outstanding debt, capitalists are already sufficiently buffered against idiosyncratic risk. The liquidity premium then declines persistently after a fiscal expansion, and the central bank must keep rates elevated to restore bond market equilibrium. For a given fiscal shock, real debt therefore rises more when initial debt is high, further compressing fiscal space and undermining sustainability.

An exogenous monetary expansion also yields standard dynamics by raising output, consumption, and investment while causing inflationary pressures. Since the shock benefits capitalists, savers, and hand-to-mouth households alike, capitalists' precautionary bond demand is almost irrelevant, and the liquidity premium barely moves. A lower real interest rate reduces debt-servicing costs and, in turn, the stock of government debt, thereby shrinking the supply of liquid assets and mechanically lowering capitalists' bond holdings. With the self-insurance motive muted, differences in the steady-state debt level do not meaningfully impact the transmission of monetary shocks, conditional on which the real interest rate channel dominates.

To clarify the crucial role of self-insurance in shaping how higher steady-state debt affects the transmission of policy shocks, we compare our baseline results with those obtained in three alternative setups: *i)* a two-agent economy with capitalists and hand-to-mouth households only, similar to Bilbiie et al. (2022); *ii)* an economy with a larger share of capitalists; and *iii)* a more hawkish Taylor rule. In the two-agent case, where savers are absent and capitalists must absorb all public debt, the portfolio margin is effectively shut down, and the self-insurance mechanism is absent by construction. In this scenario, the level of initial debt becomes largely irrelevant for the dynamic effects of a fiscal expansion. Similarly, when wealth (liquid and illiquid) is less concentrated — as is the case if capitalists make up a larger portion of the population — then rises in the stock of outstanding (steady-state) debt weaken the self-insurance channel by less, since each capitalist has a stronger incentive to accumulate liquid assets for precautionary reasons further. Thus, the initial-debt effect on impulse responses essentially disappears. Finally, adopting a more hawkish central bank policy leaves the main conclusions unaffected, consistent with Hänsel (2024), confirming that capitalists' self-insurance motive is the key driver of our findings.

Related literature Our analysis mainly contributes to two strands of the literature. First, our study adds to the growing literature emphasizing the aggregate implications of household portfolio heterogeneity in heterogeneous-agent New Keynesian (HANK) models, in which public debt provides liquidity services that influence interest rates and capital accumulation, as emphasized in early contributions by Woodford (1990) and Aiyagari and McGrattan (1998). For instance, Bayer et al. (2023) show how the supply of liquid assets — and the associated liquidity premium — shapes the aggregate effects of fiscal policy through its consequences for household portfolio choice. Similarly, the self-insurance channel of bond demand featured in our model is also present in Auclert et al. (2024), although they mainly stress the role of intertemporal marginal propensities to consume rather than portfolio rebalancing. Hänsel (2024) highlights the role of market segmentation between liquid and illiquid assets in shaping inflation and real interest rate responses to fiscal shocks. Relatedly, Albonico et al. (2021) analyze a pure debt-financed spending shock and find that the fiscal multiplier increases with the initial debt level: when debt is low, a temporary increase in government debt raises output only modestly, whereas the same shock is more expansionary at high debt ratios because liquidity-constrained agents value the extra bonds.

They also show that a higher steady-state debt-to-GDP ratio is associated with a higher steady-state real interest rate, thereby providing greater monetary space to counter deflation. On the empirical side, Ricco et al. (2016) and Pappa et al. (2020) explore the macroeconomic transmission of fiscal shocks. Our contribution complements these studies by showing how higher steady-state debt levels alter the *dynamic* effects of fiscal and monetary policy shocks, keeping the steady-state real interest rate fixed, and by tracing the implications for debt sustainability. The mechanism puts households' portfolio choice and the liquidity premium center stage. We use a tractable form of heterogeneity, in the spirit of Bilbiie et al. (2022) and Bilbiie (2025), to preserve analytical transparency while capturing liquidity and self-insurance motives in HANK settings.

Second, the paper relates to a large body of work investigating the interactions between monetary and fiscal policy, following the seminal contribution of Leeper (1991). Unlike most of this literature, we keep the policy regime fixed at monetary dominance rather than considering alternative active/passive monetary–fiscal configurations. In our framework, higher steady-state debt requires a higher-for-longer interest rate response by the central bank after a fiscal expansion in order to clear the bond market. This result highlights how movements in the liquidity premium shape the *dynamic* interaction between fiscal and monetary policy within a monetary-dominance regime, rather than across different policy regimes. In this respect, our paper is closely related to Cantore and Leonardi (2025). They study how the policy mix (i.e., active/passive monetary–fiscal regimes) affects the liquidity premium and household portfolio choice under nominal fiscal policy. By contrast, we focus on how higher steady-state debt levels shape (i) the fiscal and distributive consequences of government spending shocks and (ii) debt sustainability, through the liquidity premium and the self-insurance channel, under monetary dominance and real fiscal policy. Related theoretical contributions include Benigno and Woodford (2004), who study the coordination and transmission mechanisms between fiscal and monetary authorities in economies with nominal rigidities.

Outline The remainder of the paper is organized as follows. Section 2 presents the model setup. Section 3 discusses the model dynamics in response to fiscal and monetary policy shocks, focusing on how the self-insurance channel affects macroeconomic and fiscal outcomes as the initial debt-to-GDP ratio varies. Section 4 examines the role of portfolio liquidity and the central bank's responsiveness to inflation in driving our findings. Section 5 concludes.

2 Three-agent model

We employ a three-agent New Keynesian model with incomplete financial markets and limited asset market participation, similar to Cantore and Leonardi (2025). The household sector is populated by capitalists, savers, and hand-to-mouth households, who differ in their ability to trade financial assets and in the liquidity of the assets they can hold. On the production side, firms are modeled as in standard New Keynesian environments, with monopolistically competitive intermediate-goods producers and a perfectly competitive final-goods sector. Unlike Cantore and Leonardi (2025) setup, the government's fiscal policy — which finances public expenditure through bond issuance and lump-sum taxation — is defined in real (rather than nominal) terms. Finally, the central bank operates according to a conventional Taylor rule.

As the main novelty of our analysis does not lie in the model setup, we present here the core elements of the household and policy blocks, while additional details can be found in Appendix A.

2.1 Households

The economy features three household types that differ in their access to assets, namely capitalists (K), savers (S), and hand-to-mouth households (H). Capitalists can hold a liquid one-period government bond and an illiquid physical asset (capital), while savers hold only bonds and hand-to-mouth households consume current income and do not trade assets within the period.

Population dynamics. Household types can be seen as individual states or agent-specific islands rather than fixed labels. Each period, after portfolio choices are made, a fraction of households exogenously changes state according to a Markov chain with time-invariant transition probabilities. Let $\lambda_{i,j}$ for $(i,j) \in \{K,S,H\}^2$ denote the probability of moving from state i to state j, and let $\Lambda_{i,t}$ for $i \in \{K,S,H\}$ denote the population share in island i at time t. Normalizing the total population to one, the individual shares evolve as follows:

$$
\begin{aligned}
\Lambda_{K,t+1} &= \lambda_{K,K}\,\Lambda_{K,t} + \lambda_{S,K}\,\Lambda_{S,t} + \lambda_{H,K}\,(1-\Lambda_{K,t}-\Lambda_{S,t}),\\
\Lambda_{S,t+1} &= \lambda_{K,S}\,\Lambda_{K,t} + \lambda_{S,S}\,\Lambda_{S,t} + \lambda_{H,S}\,(1-\Lambda_{K,t}-\Lambda_{S,t}),\\
\Lambda_{H,t+1} &= 1-\Lambda_{K,t+1}-\Lambda_{S,t+1}.
\end{aligned}
$$

We focus on stationary equilibria with time-invariant population shares by assuming $\Lambda_{i,t+1} = \Lambda_{i,t} = \Lambda_i$.

Bond accounting. For each island $j \in \{K,S,H\}$, we distinguish end-of-period choices from beginning-of-period stocks of government bonds. Let Z^j_{t+1} denote the per-capita bond position in real terms chosen at the end of period t by a type-j household, after the consumption-saving decision but before state transitions. Denote by B^j_{t+1} the per-capita bond holdings in real terms at the beginning of period $t+1$ on island j, after state changes and after pooling across households on that island. In other words, households carry Z^i_{t+1} out of period t, may then change state between t and $t+1$ with probability $\lambda_{i,j}$, and upon arriving on island j at $t+1$, their bond holdings are pooled to form B^j_{t+1}. This mapping makes bonds portable across islands, so they constitute the liquid asset in the economy. By contrast, capital pays off only on the K-island: it is illiquid, offers a higher expected return, but makes consumption smoothing across future states harder.

Household problem. The utility function of household type $j \in \{K,S,H\}$ is given by

$$
U(C^j_t, N^j_t) = \frac{(C^j_t)^{1-\sigma}}{1-\sigma} - \psi\,\frac{(N^j_t)^{1+\varphi}}{1+\varphi},
$$

where C_t^j is consumption, N_t^j are hours worked, σ is the inverse of the elasticity of intertemporal substitution, φ is the inverse of the Frisch elasticity of labor supply, and ψ indicates the weight on labor.

Each type-j household maximizes its expected discounted utility from consumption and leisure, subject to its budget constraint expressed in real terms:

$$\begin{aligned}
\text{Capitalists:} \quad & C_t^K + I_t^K + Z_{t+1}^K = W_t N_t^K + R_{t-1} B_t^K + R_{k,t} K_t^K + D_t^K - T_t^K - \tau^K, \\
\text{Savers:} \quad & C_t^S + Z_{t+1}^S = W_t N_t^S + R_{t-1} B_t^S - T_t^S - \tau^S, \\
\text{Hand-to-mouth:} \quad & C_t^H = W_t N_t^H + R_{t-1} B_t^H - T_t^H + \tau^H,
\end{aligned}$$

where W_t is the real wage, capitalists choose investment $I_t^K = I_t/\Lambda_K$ and own capital stock $K_t^K = K_t/\Lambda_K$, $R_t = (1 + R_{b,t})/\Pi_{t+1}$ is the real gross return on the bond, $R_{k,t}$ the gross real rental rate of capital, $D_t^K = D_t/\Lambda_K$ are real dividends from total intermediate-firm profits D_t distributed to capitalists, T_t^j are real lump-sum taxes and τ^j are steady-state transfers to ensure cross-type consumption equality. As in Cantore and Leonardi (2025), the capital stock evolves subject to depreciation and a convex investment-adjustment cost that penalizes rapid changes in investment. Moreover, we impose a common lump-sum tax across types, so $T_t^j = T_t$.

Liquidity premium. Finally, we define the liquidity premium as the expected excess real return of the illiquid asset (capital) over the liquid asset (government bonds):

$$LP_t \;=\; \mathbb{E}_t \left[\frac{\{R_{k,t+1} + (1-\delta) Q_{t+1}\} \,/\, Q_t}{(1 + R_{b,t}) /\, \Pi_{t+1}} \right],$$

where Q_t denotes the relative price of capital goods due to the presence of investment adjustment costs. Intuitively, bonds are portable across islands and can be rebalanced by forward-looking types, providing self-insurance against future state changes. Capital pays only on the K-island and thus offers a higher expected return as compensation for its illiquidity. Consequently, the liquidity premium rises when the demand for insurance strengthens and falls when the supply of liquid assets expands.

Cantore and Leonardi (2025) show that two forces drive the liquidity premium: a demand channel through a self-insurance motive, linking the premium to expected consumption differentials across household types, and a supply channel coming from movements in the stock and remuneration of government debt. The first operates because a shock that makes the hand-to-mouth state less painful reduces the desire to hold liquid bonds, compressing the premium. The second operates because greater issuance of safe, liquid assets eases liquidity scarcity and also compresses the premium. In addition, a higher real return on bonds makes liquid assets more attractive relative to capital and mechanically compresses the capital–bond spread. As shown by the authors, the relative strength of these channels and thus the behavior of LP_t depends on the policy mix and the nature of the shock. We will later show that the dynamics of the liquidity premium also critically affects the interaction between (steady-state) debt levels and the real and fiscal consequences of policy shocks.

2.2 Fiscal and monetary policy

The government budget constraint, expressed in real terms, is given by

$$B_{t+1} = R_{t-1} \, B_t + G_t - T_t,$$

where B_t is real government debt, R_{t-1} its gross real return, and G_t is real public spending which follows an AR(1) process with persistence ρ_g. Real lump-sum taxes T_t can respond to their own lag, real debt, and real public spending:

$$\frac{T_t}{T} = \left(\frac{T_{t-1}}{T}\right)^{\rho_\tau} \left(\frac{B_{t-1}}{B}\right)^{(1-\rho_\tau)\,\gamma_{\tau b}} \left(\frac{G_t}{G}\right)^{(1-\rho_\tau)\,\gamma_{\tau g}},$$

where ρ_τ is a smoothing parameter and where government spending follows an AR(1) process:

$$\frac{G_t}{G} = \left(\frac{G_{t-1}}{G}\right)^{\rho_g} \varepsilon_{g,t}.$$

The fact that fiscal policy is expressed entirely in real terms is a central departure from Cantore and Leonardi (2025). Government spending, taxes, and debt are all defined in real units rather than nominal ones, so changes in the price level do not mechanically revalue the government's position. Inflation then matters only through real interest rates, asset returns, and relative prices, and the intertemporal budget constraint becomes an allocation of real resources rather than nominal accounting.

The specification with real fiscal variables also shuts down the debt-valuation channel that exists under nominal debt, whereby unexpected inflation shrinks the real value of outstanding liabilities. Debt therefore evolves only through primary balances and real interest payments. In turn, the supply of liquid assets changes mainly through new issuance, so the liquidity premium responds primarily through the self-insurance channel rather than through nominal revaluation effects.

The central bank sets the nominal interest rate $R_{b,t}$ via a conventional Taylor rule:

$$\frac{1+R_{b,t}}{1+R_b} = \left(\frac{1+R_{b,t-1}}{1+R_b}\right)^{\rho_r} \left(\frac{\Pi_t}{\Pi}\right)^{(1-\rho_r)\,\phi_\pi} M_t,$$

where ρ_r governs smoothing, ϕ_π the response to inflation, and M_t is a monetary policy shock following

$$\frac{M_t}{M} = \left(\frac{M_{t-1}}{M}\right)^{\rho_m} \varepsilon_{m,t}.$$

2.3 Aggregation and market clearing

Consumption and hours aggregated across all three household types yield

$$C_t = \Lambda_K\, C_t^K + \Lambda_S\, C_t^S + \Lambda_H\, C_t^H,$$

$$N_t = \Lambda_K\, N_t^K + \Lambda_S\, N_t^S + \Lambda_H\, N_t^H.$$

Capital is owned and accumulated by capitalists, so aggregate capital and investment are given by

$$K_t = \Lambda_K \, K_t^K,$$
$$I_t = \Lambda_K \, I_t^K.$$

Market clearing for bonds requires

$$B_t = \Lambda_K \, Z_t^K + \Lambda_S \, Z_t^S.$$

Finally, the aggregate resource constraint is given by

$$Y_t = C_t + I_t + G_t.$$

2.4 Calibration

Table 1 summarizes the parameter values of our model. We closely follow the calibration in Cantore and Leonardi (2025), with standard values for preferences, technology, and pricing, and with heterogeneity and policy blocks disciplined by a small set of steady-state and dynamic targets.

Beyond the conventional parameters, we follow Cantore and Leonardi (2025) also in the approach to discipline heterogeneity. On the one hand, drawing on data from the U.S. Survey of Consumer Finances, we set population shares $\Lambda_H = 0.2$ (hand-to-mouth), $\Lambda_K = 0.1$ (capitalists), and $\Lambda_S = 1 - \Lambda_K - \Lambda_H = 0.7$ (savers). On the other hand, we calibrate the transition matrix by choosing a few intuitive switching probabilities and pinning down the remaining entries from stationarity (constant population shares in the long run) and row sums equal to one. We impose high persistence for capitalists and savers and allow some upward mobility from hand-to-mouth to capitalist status: $\lambda_{K,K} = 0.8$, $\lambda_{K,H} = 0.02$, $\lambda_{S,S} = 0.95$, and $\lambda_{H,K} = 0.0541$. Given these four margins and the population shares, the other probabilities are implied mechanically by the stationary-distribution condition.[1] This configuration delivers persistent types with rare transitions into H and limited upward mobility out of hand-to-mouth status, in line with the portfolio-access and consumption-sensitivity patterns that we aim to preserve.

We differ from Cantore and Leonardi (2025) in two respects. First, we vary the steady-state debt-to-GDP ratio to study how fiscal space and liquidity supply shape transmission under our real-fiscal specification. We consider shifts from an average debt-to-GDP ratio of 57% to 100%, approximating the evolution of U.S. debt from 1984–2000 to 2010–2020. Second, we restrict our attention to a regime with active monetary policy and passive fiscal policy as characterized by Leeper (1991). This implies that the central bank raises the nominal interest rate more than one-for-one with inflation, satisfying the Taylor principle ($\phi_\pi = 1.2$), while the government adjusts primary surpluses to stabilize debt ($\gamma_{\tau b} = 1$) rather than letting fiscal needs determine the price level. This policy mix is the benchmark in New Keynesian frameworks and provides a useful approximation of the post-Volcker policy environment in advanced economies. We abstract from episodes in which a standard Taylor rule does not adequately describe monetary policy, such as at the effective lower bound, and from periods of exceptional monetary–fiscal coordination, such as during the COVID-19 pandemic. Throughout the paper, we set $\rho_r = 0$, so there is no interest-rate smoothing, and $\rho_\tau = 0$, so taxes respond only to contemporaneous debt and government spending.

3 Liquidity premium and the level of debt

In this section, we study the dynamics of the three-agent model after fiscal or monetary policy shocks across different steady-state levels of the debt-to-GDP ratio. We show that, when households demand liquid bonds not only for their real return but also for self-insurance reasons, the stock of government outstanding debt significantly

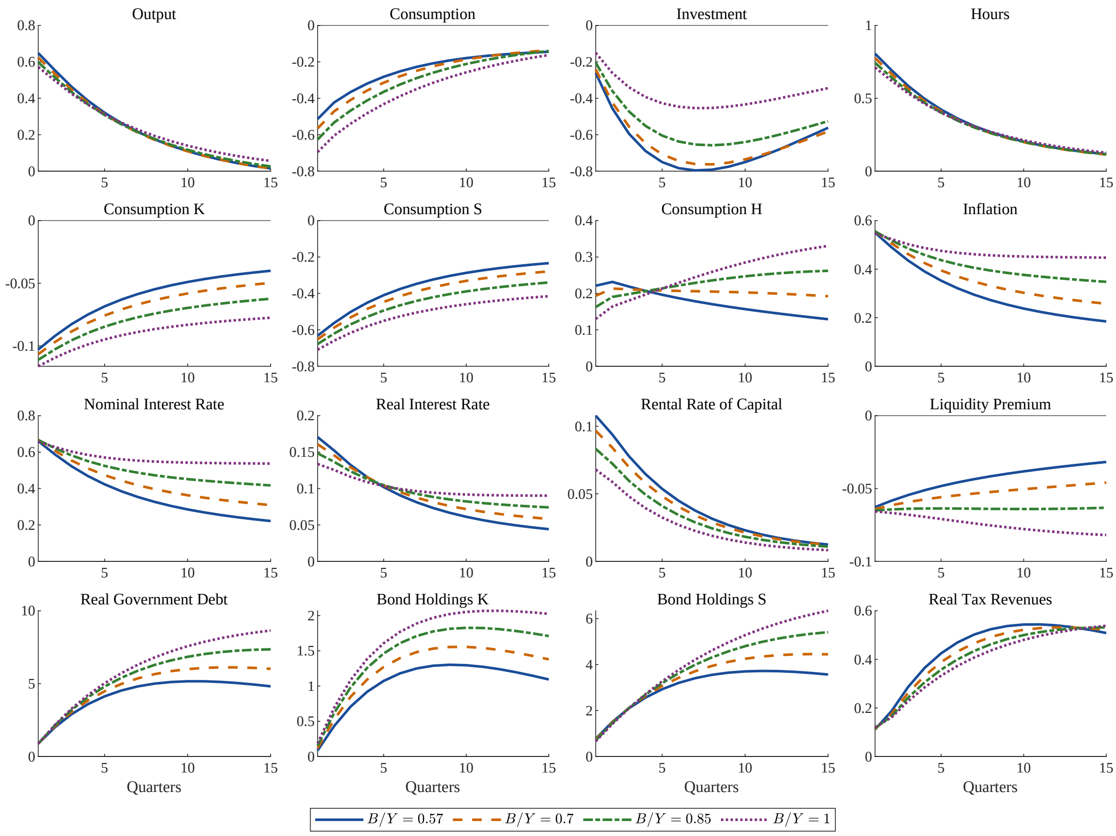
[1] Specifically, we get $\lambda_{K,S} = 1 - \lambda_{K,K} - \lambda_{K,H} = 0.18$, $\lambda_{S,K} = \dfrac{(1-\lambda_{K,K})\,\Lambda_K - \lambda_{H,K}\,\Lambda_H}{\Lambda_S} = 0.0131$, $\lambda_{H,S} = \dfrac{(1-\lambda_{S,S})\,\Lambda_S - \lambda_{K,S}\,\Lambda_K}{\Lambda_H} = 0.085$, $\lambda_{S,H} = 1 - \lambda_{S,S} - \lambda_{S,K} = 0.0369$, and $\lambda_{H,H} = 1 - \lambda_{H,K} - \lambda_{H,S} = 0.8609$.

Table 1: Parameter values

Parameter	Value	Description
β	0.99	Discount factor
$1/\sigma$	1	Elasticity of intertemporal substitution
$1/\varphi$	1	Frisch elasticity of labor supply
δ	0.025	Capital depreciation rate
ι	2.5	Investment adjustment cost
Λ_K	0.1	Share of capitalists K
Λ_H	0.2	Share of hand-to-mouth households H
Λ_S	0.7	Share of savers S
$\lambda_{K,K}$	0.8	Probability of a K-type staying K
$\lambda_{K,H}$	0.02	Probability of a K-type moving to H-type
$\lambda_{K,S}$	0.18	Probability of a K-type moving to S-type
$\lambda_{H,K}$	0.0541	Probability of an H-type moving to K-type
$\lambda_{S,S}$	0.95	Probability of an S-type staying S
$\lambda_{S,K}$	0.0131	Probability of an S-type moving to K-type
$\lambda_{H,S}$	0.0850	Probability of an H-type moving to S-type
$\lambda_{S,H}$	0.0369	Probability of an S-type moving to H-type
$\lambda_{H,H}$	0.8609	Probability of an H-type staying H
ρ_m	0.3	Persistence of monetary policy shock
ρ_r	0	Interest rate smoothing
ϕ_π	1.2	Taylor rule coefficient on inflation
ρ_g	0.9	Persistence of government spending shock
ρ_τ	0	Tax smoothing in fiscal rule
$\gamma_{\tau b}$	1	Tax response to debt
$\gamma_{\tau g}$	0.1	Tax response to government spending
α	0.33	Capital share of income
ϵ	6	Elasticity of substitution between goods
ξ	42.68	Rotemberg price adjustment cost
N	0.33	Steady-state labor supply
Π	1	Steady-state gross inflation rate
G/Y	0.2	Steady-state government spending-to-output ratio
B/Y	$0.57 \mid 0.70 \mid 0.85 \mid 1$	Annualized steady-state debt-to-output ratio

shapes fluctuations in real, nominal, and fiscal variables. Higher debt levels imply larger amounts of available liquid assets, weakening capitalists' self-insurance motive and inducing them to rebalance their portfolios (in relative terms) towards illiquid capital. As a consequence, bond market clearing requires a higher real interest rate,

Figure 1: Responses to a government spending shock: Three-agent model



Notes: Impulse responses to a temporary government spending shock (1% increase in G) across different steady-state debt-to-GDP ratios in the baseline three-agent model. All variables are expressed in real terms except for hours, inflation, and the nominal interest rate. Variables related to fiscal policy are reported as percent deviations from steady-state output. The remaining variables are in percent deviations from their own steady states.

which limits the government's fiscal space.

3.1 Fiscal policy shock

How does a fiscal shock affect the macroeconomy for different initial debt-to-GDP ratios? To answer this question, we consider an exogenous shock to government spending. Figure 1 shows the dynamic responses of key model variables to a temporary increase in G of 1% in terms of output, varying the steady-state debt-to-GDP ratio $B/Y \in \{0.57, 0.70, 0.85, 1\}$.

Consider first the baseline calibration with $B/Y = 57\%$ (blue solid lines). As standard in New Keynesian models, the increase in government spending raises aggregate demand, which induces firms to raise their prices, generating inflationary pressures.

As a consequence, the central bank lifts the nominal interest rate more than one-for-one with inflation, and the real interest rate rises. At the same time, as prices are sticky, firms need to accommodate the higher demand by demanding more labor, thus raising output. The fiscal shock has, however, redistributive effects: while hand-to-mouth households use their higher labor income to consume more, both capitalists and savers cut their spending to absorb the increase in public debt — a result of both the government spending shock itself and the higher interest rate on debt. In particular, capitalists reduce both consumption and capital holdings, which in turn depresses aggregate investment. Finally, passive fiscal policy implies that real tax revenues also rise in response to higher debt. Overall, the fiscal shock generates an expansion in output at the expense of aggregate private consumption and investment — a standard ”crowding out” result.

Raising the steady-state debt-to-GDP ratio to 70% (orange dashed lines), 85% (green dash-dotted lines), or 100% (purple dotted lines) produces sizable changes in both aggregate and type-specific dynamics. Regarding output, the response remains broadly similar across ratios. At higher debt levels, it tends to be somewhat smaller on impact but more persistent over time. The same increase in public expenditure, however, generates much more persistent inflation, mirrored by longer-lived hikes in nominal and real interest rates, the more so the higher the steady-state debt-to-GDP ratio (consistent with Hänsel, 2024). Furthermore, higher debt levels entail a markedly stronger fall in aggregate consumption, driven by lower spending by capitalists and savers, while aggregate investment declines significantly less.[2] Concurrently, when $B/Y = 100\%$, real government debt increases almost twice as much as the baseline after four years (16 quarters).

Why does the steady-state debt-to-GDP ratio so strongly shape the dynamics of real, nominal, and fiscal variables? The mechanism follows Cantore and Leonardi (2025): the effect on real debt in our model can be decomposed into demand-side and

[2]This is consistent with Bayer et al. (2023), who argue that, since liquid and illiquid assets are imperfect substitutes, an increase in public debt does not displace physical assets one-for-one as a savings vehicle, thereby reducing the crowding-out of investment.

supply-side forces. On the one hand, capitalists and savers want to invest in public bonds because of the real interest rate they pay (supply-side effect). As the increase in public expenditure induces the government to issue more debt and the central bank to raise the policy rate, households demand more bonds. For capitalists, who face a non-trivial portfolio choice, the higher interest rate, by itself, tilts the portfolio toward bonds and away from capital. On the other hand, capitalists may want to save in liquid bonds also for self-insurance reasons (demand-side effect). As bonds are liquid and can be used to self-insure against the hand-to-mouth state, capitalists have an incentive to rebalance their portfolio out of or towards capital depending on how bad such a state looks. When the hand-to-mouth state looks less painful, the self-insurance motive weakens and capital becomes relatively more attractive. In contrast, the supply-side effect dominates for savers, as they only access the bond market and, therefore, do not face a portfolio choice.

Due to its redistributive effects, a fiscal shock in our model always weakens the self-insurance motive, as the consumption of hand-to-mouth households actually rises, reducing capitalists' demand for self-insurance. Indeed, the liquidity premium, which measures the insurance value of government bonds, falls for any value of steady-state debt. However, its drop becomes *larger and more persistent* as the debt-to-GDP ratio rises, suggesting that the self-insurance mechanism progressively vanishes. This is because a larger stock of outstanding debt implies that capitalists hold more liquid wealth on average (see Section 4.1). Therefore, the need to accumulate additional liquid assets for insurance reasons almost disappears at very high debt, and the marginal insurance value of bonds falls more. Consistently, higher debt levels imply that investment in physical capital falls much less — with the peak response being halved when $B/Y = 100\%$, relative to the baseline. This indicates that, while saving more in total, capitalists progressively rebalance their portfolios towards illiquid capital.[3] As the liquidity premium remains persistently lower, clearing the bond market requires a more prolonged increase in the real interest rate, which substantially worsens the govern-

[3]It is important to stress that this is a *relative* effect: bond holdings still increase and investment still falls, but both do so by *comparatively* less.

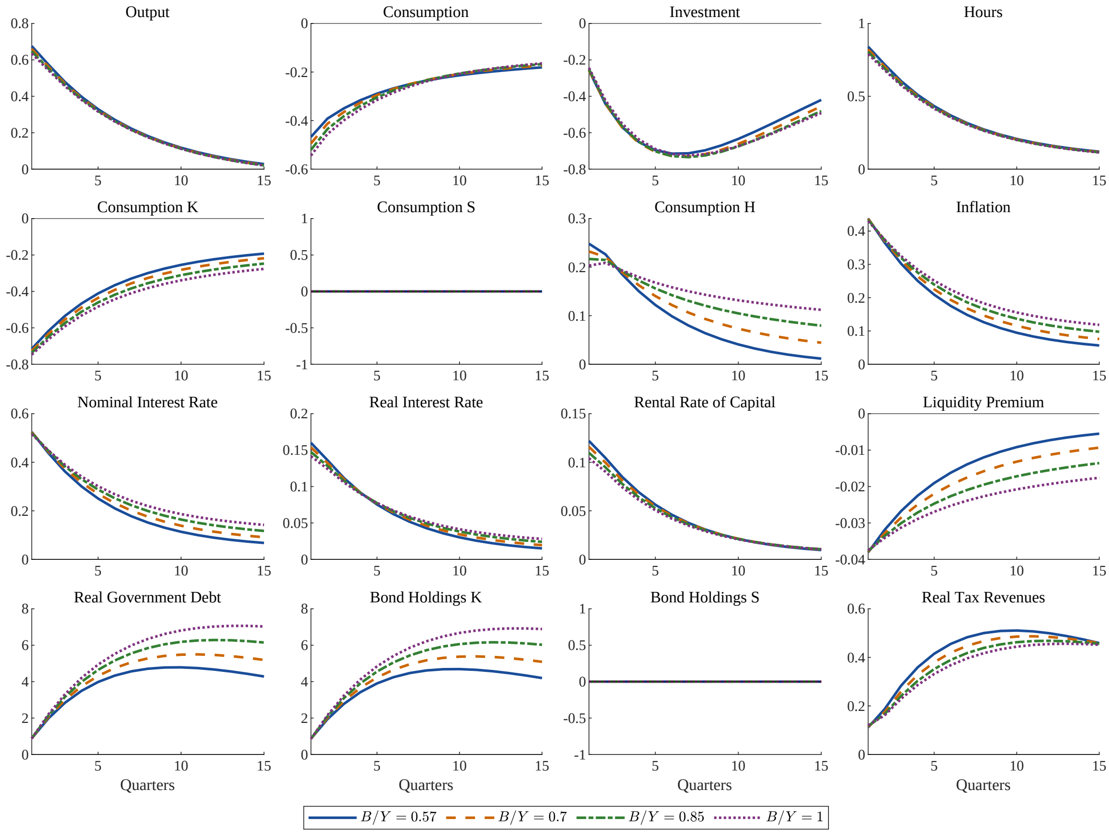
ment's fiscal space.

To isolate the role of portfolio choice and liquidity-premium dynamics in how steady-state debt shapes the macroeconomic and fiscal implications of a government spending shock, we consider an alternative economy in which only capitalists participate in financial markets, investing in both capital and bonds. Figure 2 reports impulse responses from a two-agent version of the model that removes savers.[4] The absence of savers implies that all government debt must be absorbed by capitalists, entailing that the latter cannot freely choose how to rebalance across assets, but can only choose their total demand for savings.

The results show that, without a meaningful portfolio margin — and thus without a significant self-insurance channel — the steady-state debt level becomes almost irrelevant for aggregate and type-specific dynamics, as the differences in the impulse responses across B/Y values are an order of magnitude smaller than in the baseline. Although the *qualitative* responses mirror the three-agent baseline, a government spending shock now implies a much more contained decline in aggregate consumption but a larger drop in investment, especially for higher levels of debt. Indeed, absent the demand-side effect, capitalists do not substitute bonds for capital even when they already hold large amounts of liquid assets in their portfolios, generating a significant decline in aggregate investment. Furthermore, the surge in inflation and the drop in the liquidity premium are smaller and much less long-lasting, indicating that a larger stock of outstanding debt does little to alter the insurance value of government bonds. Consistently, as the central bank needs a less persistent hike in the policy rate to counter the fiscally-induced inflationary pressure and to clear the bond market, the stock of real government debt now grows substantially less, implying more contained detrimental consequences on the government's fiscal space.

[4] The two-agent model merges savers and capitalists by setting $\Lambda_S = 0$ and $\Lambda_K = 0.8$, and assumes greater persistence among K-types with $\lambda_{K,K} = 0.98$ as in Bilbiie et al. (2022). Steady-state flow balance is imposed so that the inflow and outflow of each group are equal.

Figure 2: Responses to a government spending shock: Two-agent model



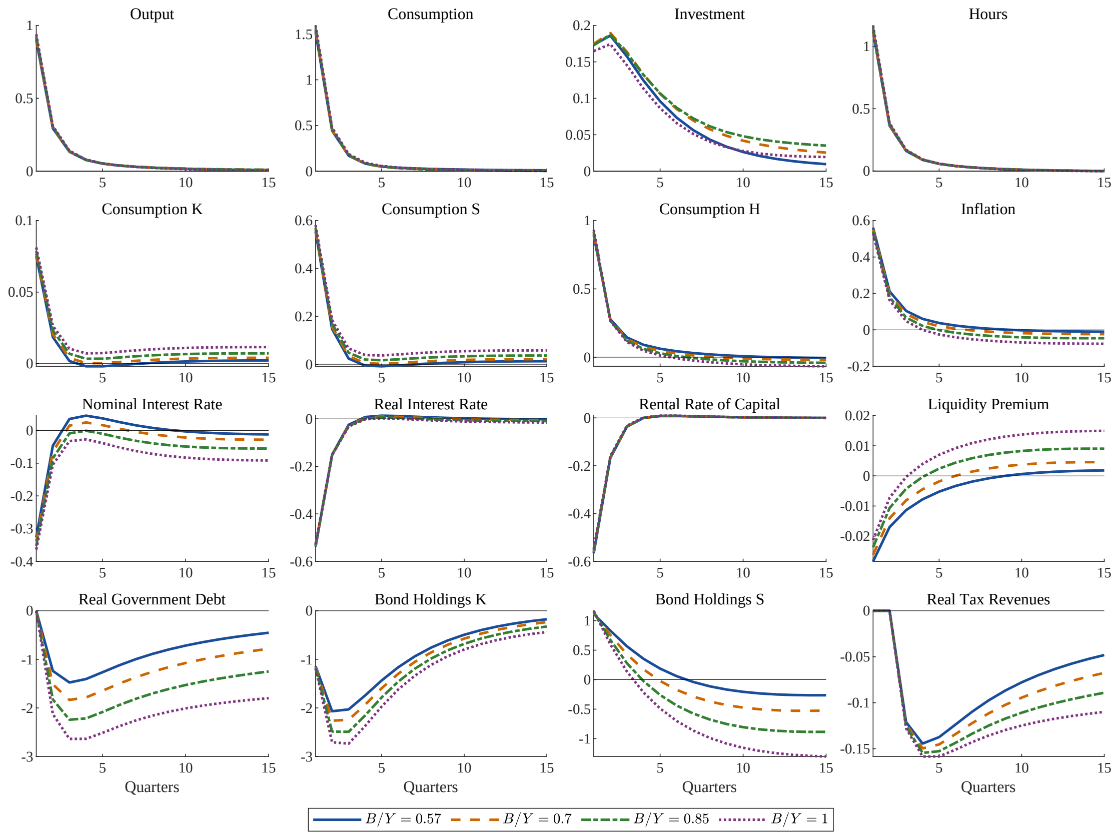
Notes: Impulse responses to a temporary government spending shock (1% increase in G) across different steady-state debt-to-GDP ratios in the two-agent model version with capitalists and hand-to-mouth households. All variables are expressed in real terms except for hours, inflation, and the nominal interest rate. Variables related to fiscal policy are reported as percent deviations from steady-state output. The remaining variables are in percent deviations from their own steady states.

3.2 Monetary policy shock

We now turn our attention to the transmission of an exogenous monetary policy shock. Figure 3 depicts the dynamic responses of key model variables to a temporary increase in M of 1%, for varying steady-state debt-to-GDP ratios.

Lower nominal and real interest rates boost output, consumption, aggregate investment, and hours worked. Concurrently, stronger aggregate demand puts upward pressure on inflation. From a redistributive perspective, the monetary expansion increases the consumption of capitalists, savers, and hand-to-mouth households, with the largest relative gains for the latter. Furthermore, the decline in interest expenses implies a drop in real government debt and, due to the passive nature of the fiscal rule, also in real tax revenues. Interestingly, however, the fall in government bond supply

Figure 3: Responses to a monetary policy shock: Three-agent model

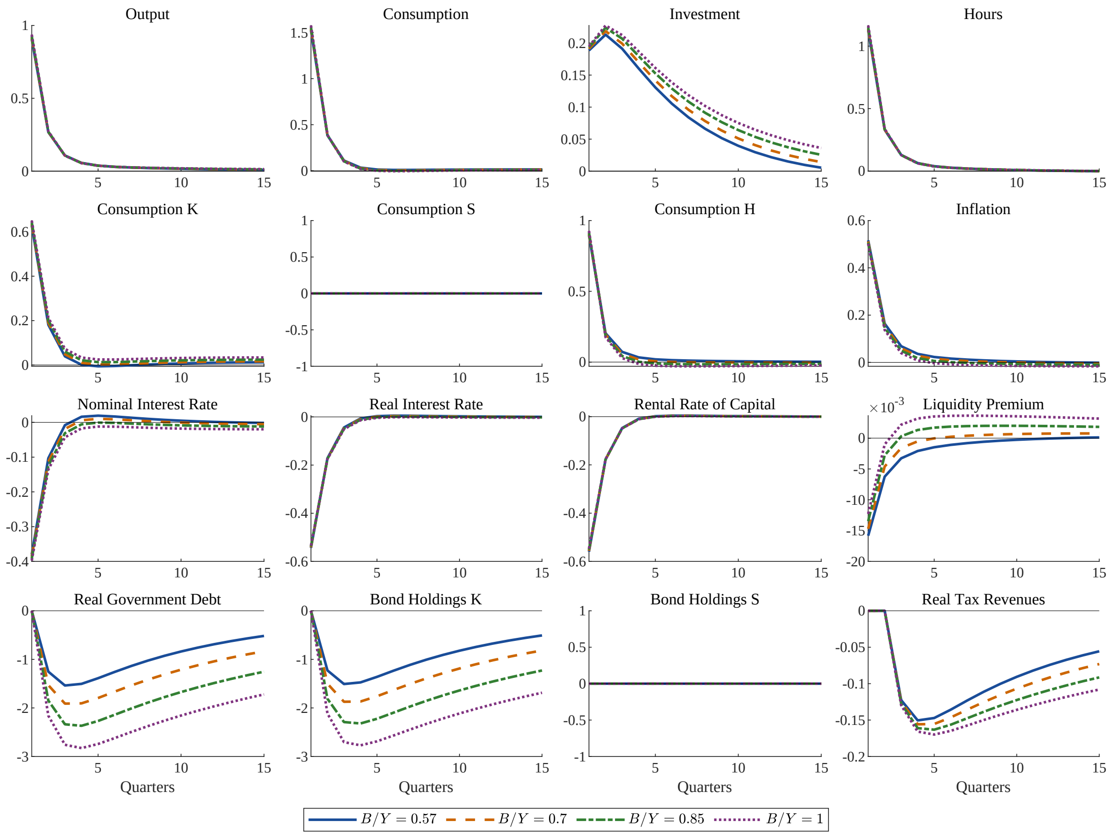


Notes: Impulse responses to a temporary monetary policy shock (1% increase in M) across different steady-state debt-to-GDP ratios in the baseline three-agent model. All variables are expressed in real terms except for hours, inflation, and the nominal interest rate. Variables related to fiscal policy are reported as percent deviations from steady-state output. The remaining variables are in percent deviations from their own steady states.

is mirrored by a decrease in capitalists' bond holdings, whereas savers temporarily increase them. For capitalists, government debt supply and demand effects work in the same direction, conditional on a monetary policy shock. Lower real interest rates make bonds a less attractive asset. At the same time, hand-to-mouth households benefit relatively more from the monetary easing, reducing capitalists' bond demand for insurance reasons. Indeed, the liquidity premium decreases, albeit only slightly and temporarily. Capitalists, therefore, shift savings out of bonds and into illiquid capital, with savers partly offsetting this shift to keep the bond market in equilibrium.

However, the small movements in the liquidity premium indicate that, under monetary shocks, the self-insurance mechanism is negligible and the supply-side effect — working through the lower stock of bonds and real interest rates — dominates. As

Figure 4: Responses to a monetary policy shock: Two-agent model



Notes: Impulse responses to a temporary monetary policy shock (1% increase in M) across different steady-state debt-to-GDP ratios in the two-agent model version with capitalists and hand-to-mouth households. All variables are expressed in real terms except for hours, inflation, and the nominal interest rate. Variables related to fiscal policy are reported as percent deviations from steady-state output. The remaining variables are in percent deviations from their own steady states.

a result, varying the amounts of available liquidity in the economy (i.e., the steady-state debt-to-GDP ratio) has only minor effects on aggregate dynamics, inducing a quantitatively less relevant portfolio rebalancing by capitalists. The similar responses obtained in the two-agent version of the model, as reported in Figure 4, confirm that the demand-side channel is essentially absent. Even in this economy, where the liquidity premium barely moves in response to monetary shocks, the initial debt level is almost irrelevant for aggregate dynamics and yields fiscal implications equivalent to the baseline three-agent model.

In sum, the results shown so far demonstrate that the strength of the self-insurance motive in bond demand depends critically on the amount of liquidity available in the economy, as captured by the steady-state debt-to-GDP ratio. Under fiscal shocks, the self-insurance channel is quantitatively relevant and implies that raising average debt levels has non-trivial implications for aggregate dynamics and portfolio allocation. As the self-insurance motive reduces capitalists' bond demand, a higher real interest rate is required to induce them to absorb newly issued debt, putting the government's budget under more pressure. Conversely, under monetary shocks, the supply-side channel dominates, implying that varying debt-to-GDP ratios marginally affect aggregate dynamics, and the self-insurance channel does not alter the debt sustainability conclusions. These implications are therefore similar in the three- and two-agent models. In the next section, we investigate how these findings depend on the degree of wealth concentration among capitalists and on the central bank's responsiveness to inflation.

4 The role of portfolio liquidity and monetary policy

This section further investigates the mechanism behind our results by examining (i) changes in the share of capitalists, and thus in the degree of wealth concentration, and (ii) a more active Taylor rule. First, we show that a larger population share of capitalists reduces the quantitative impact of changing initial debt levels. When liquid and illiquid wealth is more diluted across a larger number of capitalists, progressive increases in the stock of outstanding debt weaken the self-insurance channel by less than in an economy with highly concentrated wealth. Second, we show that a more active monetary policy does not alter the main insights of the baseline model, supporting the view that the initial debt-to-GDP ratio matters through the composition of capitalists' portfolios. For the remainder, we exclusively focus on fiscal policy shocks, as our previous results indicate that the self-insurance mechanism plays no role under monetary shocks in our setup.

4.1 Larger share of capitalists

The results discussed so far stress the importance of the amount of liquidity available to capitalists in determining the macroeconomic, redistributive, and fiscal impli-

Table 2: Steady-state bond holdings of capitalists across debt-to-GDP ratios

	Share of capitalists					
	$\Lambda_K = 0.10$		$\Lambda_K = 0.12$		$\Lambda_K = 0.15$	
B/Y	Island-wide	Per-capita	Island-wide	Per-capita	Island-wide	Per-capita
0.57	1.00	1.00	1.00	0.83	1.00	0.67
0.70	1.23	1.23	1.23	1.02	1.23	0.82
0.85	1.49	1.49	1.49	1.24	1.49	0.99
1.00	1.75	1.75	1.75	1.46	1.75	1.17

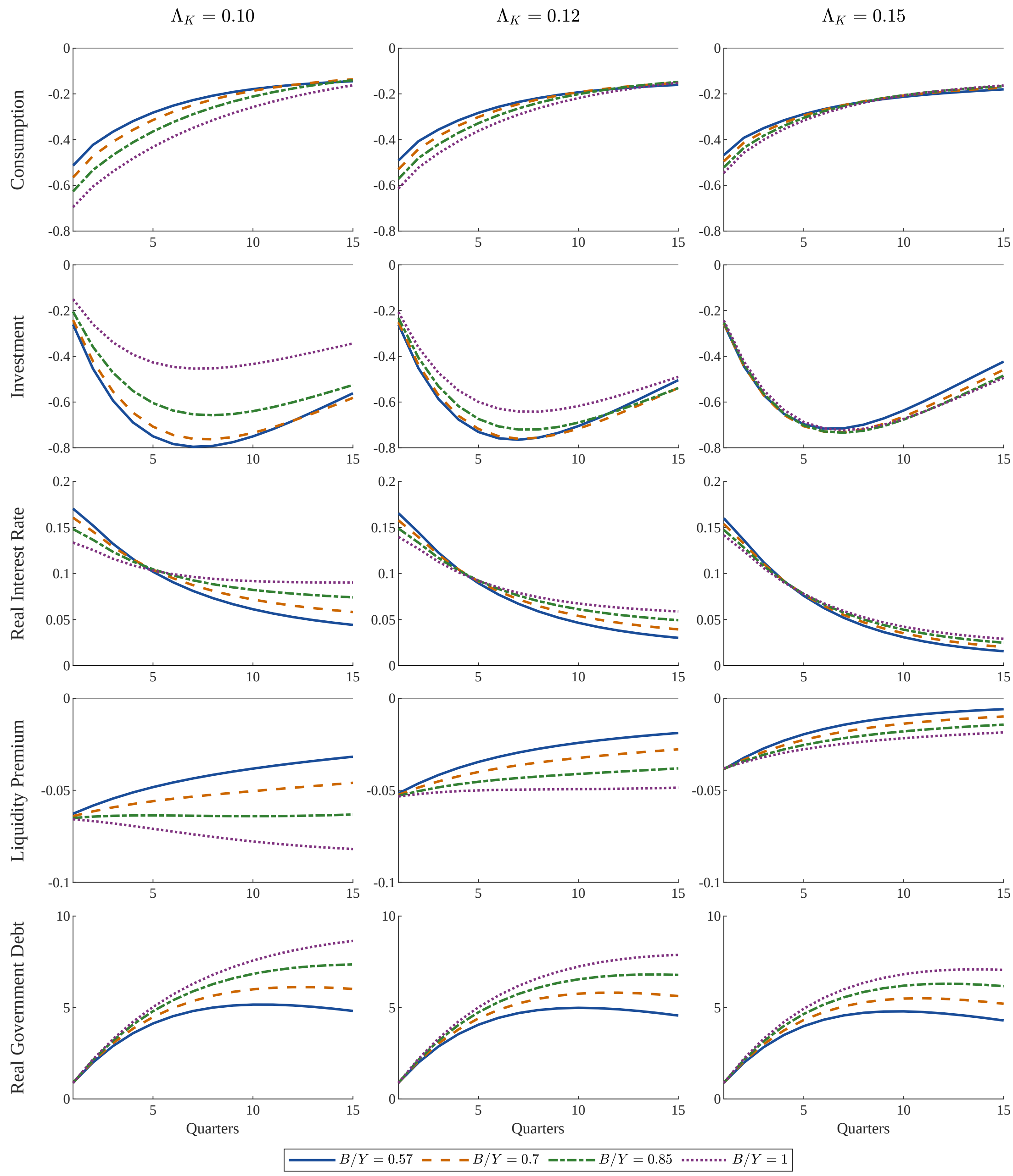
Notes: All values are steady-state, beginning-of-period bond holdings of individual capitalists K, expressed relative to the benchmark with $B/Y = 0.57$ and $\Lambda_K = 0.10$. Island-wide totals represent per-capita values multiplied by the respective population share Λ_K.

cations of fiscal policy shocks across different initial debt-to-GDP ratios. To clarify the key role played by portfolio composition and the liquidity premium, we now vary the population share of capitalists in a comparative statics exercise.

Specifically, we contrast the results when varying the population share of capitalists (Λ_K) from 0.10 (baseline value) to 0.12 and 0.15, holding the fraction of hand-to-mouth households constant. Table 2 reports capitalists' island-wide and individual beginning-of-period steady-state bond holdings. All values are normalized to 1 with respect to the case with $\Lambda_K = 0.10$ and $B/Y = 57\%$, so entries are relative to the low-debt, low-K benchmark.

Changing the fraction of capitalists has quantitatively relevant implications for the amount of liquidity accumulated in their portfolios. Consider first the left panel, which reports the values for the baseline calibration of Λ_K. As the steady-state debt-to-GDP ratio increases, both island-wide and per-capita holdings of liquid assets increase remarkably, reaching 75% above benchmark when $B/Y = 100\%$. When Λ_K increases (middle and right panels), island-wide bond holdings continue to rise with debt, but *per-capita* holdings are now substantially lower for any given B/Y. Indeed, conditional on the steady-state debt level, the same amount of liquidity is shared among a larger group when the share of capitalists increases, reducing individual holdings. For the baseline debt-to-GDP ratio ($B/Y = 57\%$), for example, per-capita holdings are 33% lower when $\Lambda_K = 0.15$. This drop is even more pronounced at higher levels of debt,

Figure 5: Responses to a government spending shock: Different capitalist shares



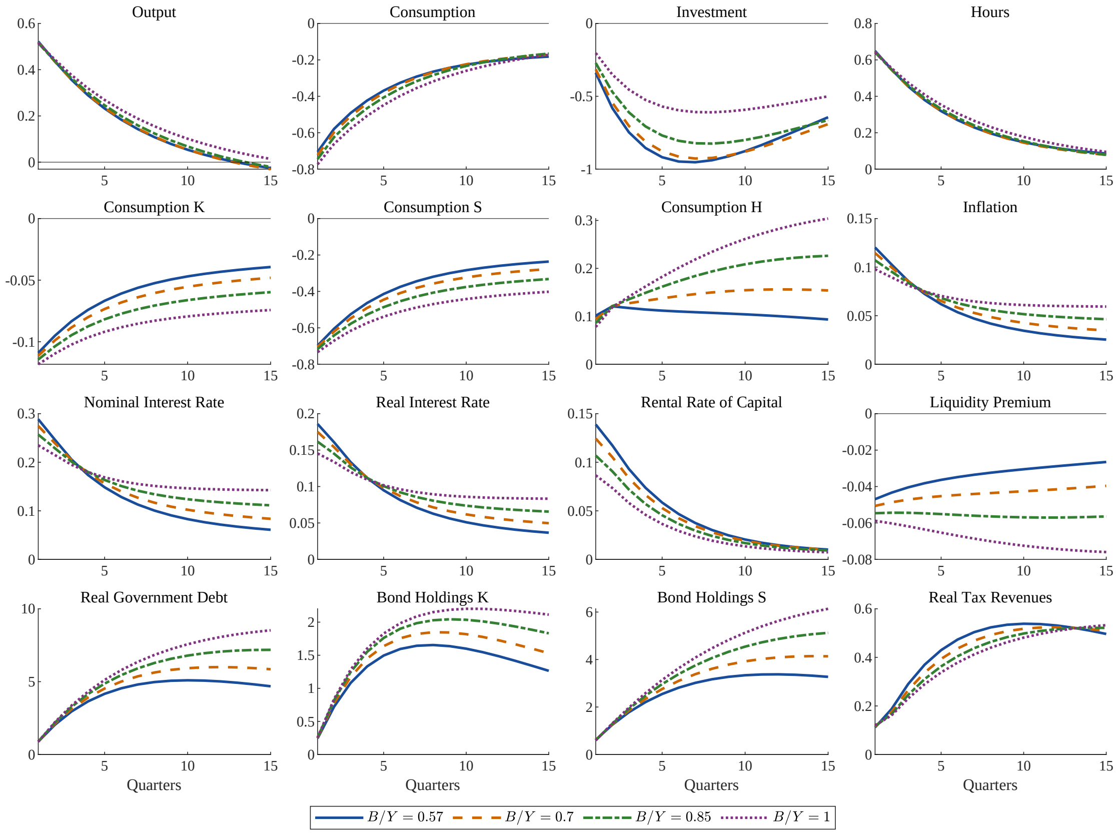
Notes: Impulse responses to a temporary government spending shock (1% increase in G) across different steady-state debt-to-GDP ratios and different capitalists' population shares, in the baseline three-agent model. All variables are expressed in real terms. Debt is reported as a percent deviation from steady-state output. The remaining variables are in percent deviations from their own steady states.

with holdings only being 17% above the baseline when $B/Y = 100\%$.

Figure 5 depicts the dynamic implications of the different degrees of liquidity of capitalists' portfolios, by showing the responses of key selected variables to a government spending shock for $\Lambda_K = \{0.10, 0.12, 0.15\}$ across columns. Two results stand out. First, as the share of capitalists rises, the differences in the impulse responses across B/Y values become progressively smaller; when $\Lambda_K = 0.15$, the dynamics closely resemble those of the two-agent model (see Figure 2). Second, as Λ_K increases, the responses of consumption and investment tend to converge toward the low-debt case (i.e., the blue solid lines), consistent with a stronger crowding out of capital investment. This supports the intuition that, when liquid wealth is less concentrated, the individual capitalist behaves *as if* liquid assets were relatively scarce, that is, as in the low-debt scenario. Turning to the liquidity premium, its decline becomes less pronounced and less persistent as the amount of liquidity available to the individual (marginal) capitalist decreases. This suggests that when liquid wealth is not highly concentrated among a small fraction of households, a larger supply of public debt does not materially affect the insurance value of government bonds. As a consequence, with a larger share of capitalists, the required increase in the real interest rate is less persistent, and real government debt rises by less for any given initial debt-to-GDP ratio.

Discussion This mechanism yields testable implications, as illustrated, for example, by the convergence in investment responses in Figure 5. While direct evidence on how the crowding-out effect of public debt varies with liquid-wealth concentration is scarce, existing studies support the key elements of the mechanism. Brinca et al. (2016) document a positive correlation between wealth inequality and fiscal multipliers, driven by the share of credit-constrained agents, while Bayer et al. (2023) show that fiscal expansions compress the liquidity premium, particularly when they are accompanied by larger increases in public debt. Kaplan et al. (2014) and Luetticke (2021) further show that liquid wealth is highly concentrated and that wealthy households play a central role in portfolio rebalancing after policy shocks, which is precisely the dimension captured by changes in Λ_K in our exercise. More indirectly, Huang et al. (2018) and De Mendonça and Brito (2021) show that high public debt is associated with weaker private investment, partly through tighter credit conditions. Taken together, these findings suggest two policy implications. First, economies with concen-

Figure 6: Responses to a government spending shock: More active monetary policy



Notes: Impulse responses to a temporary government spending shock (1% increase in G) across different steady-state debt-to-GDP ratios in the baseline three-agent model with more active monetary policy ($\phi_\pi = 2.4$). All variables are expressed in real terms except for hours, inflation, and the nominal interest rate. Variables related to fiscal policy are reported as percent deviations from steady-state output. The remaining variables are in percent deviations from their own steady states.

trated liquid wealth face a steeper trade-off between fiscal expansion and debt sustainability, calling for greater caution with deficit-financed spending when public debt is already elevated. Second, broader participation in bond markets dilutes per-capita liquid holdings and helps preserve the insurance value of public debt, thereby mitigating these adverse dynamics.

4.2 Aggressive monetary policy

As a final exercise, we compare the model-implied responses to a fiscal policy shock under the baseline monetary rule ($\phi_\pi = 1.2$; Figure 1) and under a more aggressive rule ($\phi_\pi = 2.4$; Figure 6).

Consider again the initial case with $B/Y = 57\%$ (blue solid lines). Relative to the

$\phi_\pi = 1.2$ baseline, a more active monetary policy naturally implies a much smaller surge in inflation (about 0.1% instead of 0.4%) and a slightly stronger hike in the real interest rate (about 0.2% instead of 0.15%). The stricter policy also induces a deeper drop in private investment (almost 1% instead of 0.8% at the trough). However, the effects of rising steady-state levels of debt on model dynamics and the government's budget are unchanged: even with a very active central bank, the liquidity premium falls by more and for longer as the average debt-to-GDP ratio increases. Concurrently, capitalists' savings absorb the newly issued debt while portfolios tilt toward illiquid capital, so investment declines less the higher is government debt.

These results confirm that the gradual weakening of capitalists' self-insurance motive — as liquidity becomes more abundant — is the key driver of the sizable interaction between the macroeconomic and fiscal consequences of government spending shocks and initial debt levels. An active central bank entails that, in absolute terms, the supply-side channel always dominates, as capitalists generally increase their bond holdings when debt supply and real interest rates rise. However, when capitalists' portfolios are more liquid (i.e., for larger stocks of outstanding debt), the self-insurance channel of bond demand progressively fades, as reflected in a more persistent decline in the liquidity premium. In turn, keeping the bond market in balance requires higher-for-longer real interest rates, which amplifies the rise in real public debt relative to an economy without a meaningful portfolio choice.

5 Conclusion

Recent crises have pushed public debt in advanced economies to historic highs, tightening fiscal space and increasing debt servicing costs. Using a New Keynesian model with limited household heterogeneity, we show that when households value public bonds for their liquidity services, higher steady-state debt amplifies the fiscal costs of government spending shocks. Specifically, a larger supply of safe assets weakens precautionary bond demand, requiring persistently higher real interest rates and thereby worsening debt servicing costs. By contrast, the transmission of monetary policy shocks is largely invariant to initial debt levels. Overall, the liquidity value of government bonds and the self-insurance channel of bond demand emerge as key determinants of fiscal space, implying that fiscal expansions under high debt can significantly undermine debt sustainability.

An avenue for future research is to study these mechanisms in an open-economy setting, where government debt can also be absorbed by foreign investors. Allowing for international bond holdings could attenuate the sensitivity of domestic interest rates to fiscal expansions, shifting part of the adjustment from domestic self-insurance toward cross-border portfolio flows. The strength of this mitigating effect would naturally depend on the relative size of the home economy: in a small open economy, foreign demand could substantially ease domestic bond market pressures, whereas in a large or relatively closed economy, domestic households' liquidity and precautionary motives would remain dominant. Exploring these dimensions would help clarify how openness and international financial integration shape the relationship between public debt, liquidity premia, and debt sustainability.

References

Aiyagari, S. and McGrattan, E. R. (1998). The optimum quantity of debt. *Journal of Monetary Economics*, 42(3):447–469.

Albonico, A., Ascari, G., and Gobbi, A. (2021). Fiscal policy and the inflation–output trade-off in a model with sticky prices and search frictions. *Journal of Economic Dynamics and Control*, 127:104135.

Auclert, A., Rognlie, M., and Straub, L. (2024). The intertemporal Keynesian cross. *Journal of Political Economy*, 132(12):4068–4121.

Bayer, C., Born, B., and Lütticke, R. (2023). The liquidity channel of fiscal policy. *Journal of Monetary Economics*, 134:86–117.

Benigno, P. and Woodford, M. (2004). Optimal monetary and fiscal policy: A linear-quadratic approach. In Gertler, M. and Rogoff, K., editors, *NBER Macroeconomics Annual 2003*, pages 271–333. MIT Press.

Bilbiie, F. O. (2025). Monetary policy and heterogeneity: An analytical framework. *Review of Economic Studies*, 92(4):2398–2436.

Bilbiie, F. O., Känzig, D. R., and Surico, P. (2022). Capital and income inequality: An aggregate-demand complementarity. *Journal of Monetary Economics*, 126:154–169.

Brinca, P., Holter, H. A., Krusell, P., and Malafry, L. (2016). Fiscal multipliers in the 21st century. *Journal of Monetary Economics*, 77:53–69.

Cantore, C. and Leonardi, E. (2025). Monetary–fiscal interaction and the liquidity of government debt. *European Economic Review*, 173:104979.

De Mendonça, H. F. and Brito, Y. (2021). The link between public debt and investment: An empirical assessment from emerging markets. *Applied Economics*, 53(50):5864–5876.

Hagedorn, M. (2021). A demand theory of the price level. Mimeo.

Hänsel, M. (2024). Idiosyncratic risk, government debt and inflation. Mimeo.

Huang, Y., Panizza, U., and Varghese, R. (2018). Does public debt crowd out corporate investment? International evidence. CEPR Discussion Papers 12931, Centre for Economic Policy Research.

International Monetary Fund (2025). Annual report 2025: Getting to growth in an age of uncertainty. Report of the Executive Board to the Board of Governors, International Monetary Fund.

Kaplan, G., Violante, G. L., and Weidner, J. (2014). The wealthy hand-to-mouth. *Brookings Papers on Economic Activity*, 45(1):77–153.

Leeper, E. M. (1991). Equilibria under 'active' and 'passive' monetary and fiscal policies. *Journal of Monetary Economics*, 27(1):129–147.

Luetticke, R. (2021). Transmission of monetary policy with heterogeneity in household portfolios. *American Economic Journal: Macroeconomics*, 13(2):1–25.

Pappa, E., Vella, E., and Venter, C. (2020). Fiscal consolidation with tax evasion and corruption. *Journal of Monetary Economics*, 115:198–212.

Ricco, G., Callegari, G., and Cimadomo, J. (2016). Signals from the government: Policy uncertainty and the transmission of fiscal shocks. *Journal of Monetary Economics*, 82:107–118.

Woodford, M. (1990). Public debt as private liquidity. *American Economic Review*, 80(2):382–388.

Appendix to
Fiscal Sustainability when Public Debt is High: The Role of Portfolio Liquidity

Cristiano Cantore[†] Matteo Gatto[‡] Francesco Saverio Gaudio[§]
Pascal Meichtry[¶]

July 2026

A Model details

A.1 Households

Bond accounting. For $j \in \{K, S, H\}$, let Z^j_{t+1} be the end-of-period-t *per-capita* bond position chosen before moving across islands and B^j_{t+1} the beginning-of-period-$t+1$ *per-capita* bond holdings after migration and pooling, both expressed in real terms. Moreover, define *island-wide* beginning-of-period bond stocks $\mathbf{B}^j_{t+1} \equiv \Lambda_j B^j_{t+1}$. Pooling then implies the stocks on island j to satisfy the following condition:

$$\mathbf{B}^j_{t+1} = \lambda_{K,j}\,\Lambda_K\,Z^K_{t+1} + \lambda_{S,j}\,\Lambda_S\,Z^S_{t+1}.$$

Labor market. A common wage W_t prevails. A labor union equalizes hours across types so that $N^K_t = N^S_t = N^H_t \equiv N_t$, yielding the aggregate intratemporal condition

$$\psi N_t^{\varphi} = W_t C_t^{-\sigma}$$

where ψ is calibrated to ensure that the number of aggregate hours worked in steady state is 0.33.

[†]Sapienza University of Rome. Email: cristiano.cantore@uniroma1.it.
[‡]Sapienza University of Rome. Email: matteo.gatto@uniroma1.it.
[§]Sapienza University of Rome. Email: francescosaverio.gaudio@uniroma1.it.
[¶]Banque de France. Email: pascal.meichtry@banque-france.fr.

Investment adjustment costs. Capital owned by capitalists evolves subject to a depreciation rate δ and a convex adjustment cost ι:

$$K^K_{t+1} = (1-\delta)K^K_t + I^K_t \left[1 - \iota\left(\frac{I^K_t}{I^K_{t-1}} - 1\right)^2\right].$$

A.2 Firms

Final-goods producers. A perfectly competitive final-good firm aggregates differentiated varieties of intermediate goods i with CES preferences, implying a demand function:

$$Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\epsilon} Y_t$$

where $\epsilon > 1$ is the elasticity of substitution between varieties of goods, $P_t(i)$ is the price of an intermediate good, and $P_t^{1-\epsilon} = \int_0^1 P_t(i)^{1-\epsilon}\, di$ is the aggregate price index.

Intermediate-goods producers. A continuum of monopolistically competitive firms produce varieties of intermediate goods i, using labor and capital according to the following production function:

$$Y_t(i) = N_t(i)^{1-\alpha} K_t(i)^{\alpha} - F,$$

where α is the capital share of income and F are fixed costs in production to ensure zero profits in steady state. The cost minimization problem for the intermediate-goods firm reads:

$$\min_{N_t(i),\, K_t(i)} \quad W_t N_t(i) + R_{k,t} K_t(i)$$
$$\text{s.t.} \quad Y_t(i) = N_t(i)^{1-\alpha} K_t(i)^{\alpha} - F.$$

Solving this problem pins down the the real wage W_t and the rental rate of capital $R_{k,t}$.

Regarding price setting, intermediate-goods firms set prices subject to a quadratic Rotemberg adjustment cost, with the degree of nominal price rigidity governed by ξ:

$$\mathcal{AC}_t = \frac{\xi}{2}\left(\frac{P_t(i)}{P_{t-1}(i)} - 1\right)^2 Y_t.$$

Taking as given the demand for variety i and real marginal costs MC_t, firm i

chooses its price $P_t(i)$ to maximize the present value of real profits:

$$\Pi_t^f = \frac{P_t(i)}{P_t} Y_t(i) - MC_t\, Y_t(i) - \mathcal{AC}_t,$$

subject to the demand for its goods. Assuming a symmetric equilibrium ($P_t(i) = P_t$ for all i), this optimization problem yields the standard New Keynesian Phillips curve:

$$(1-\epsilon) + \epsilon MC_t - \Pi_t \xi (\Pi_t - 1) + \mathbb{E}_t \left[\Psi_{t,t+1}^K \Pi_{t+1} \xi (\Pi_{t+1} - 1) \frac{Y_{t+1}}{Y_t} \right] = 0,$$

where MC_t denotes the real marginal cost, ξ governs the size of Rotemberg adjustment costs, $\Pi_t = P_t / P_{t-1}$ represents gross inflation, and, since firms are owned by capitalists, the stochastic discount factor is given by $\Psi_{t,t+1}^K = \beta (C_{t+1}^K)^{-\sigma} / (C_t^K)^{-\sigma}$.

A.3 Equilibrium conditions and steady state

Table A.1: Summary of equilibrium conditions

#	Equation	Description
1	$U'(C_t^K) = (C_t^K)^{-\sigma}$	Marginal utility of consumption K
2	$U'(C_t^K) = \beta\,\mathbb{E}_t\left[R_t(\lambda_{K,K}U'(C_{t+1}^K) + \lambda_{K,S}U'(C_{t+1}^S) + \lambda_{K,H}U'(C_{t+1}^H))\right]$	Euler equation K
3	$U'(N_t^K) = -\psi(N_t^K)^{\varphi}$	Marginal utility of leisure K
4	$W_t = \psi N_t^{\varphi} C_t^{\sigma}$	Aggregate labor supply
5	$N_t^K = N_t$	Hours worked K
6	$\Lambda_K B_{t+1}^K = \lambda_{K,K}\Lambda_K Z_{t+1}^K + \lambda_{S,K}\Lambda_S Z_{t+1}^S$	Island-wide beginning-of-period K
7	$U'(C_t^S) = (C_t^S)^{-\sigma}$	Marginal utility of consumption S
8	$U'(C_t^S) = \beta\,\mathbb{E}_t\left[R_t(\lambda_{S,S}U'(C_{t+1}^S) + \lambda_{S,K}U'(C_{t+1}^K) + \lambda_{S,H}U'(C_{t+1}^H))\right]$	Euler equation S
9	$U'(N_t^S) = -\psi(N_t^S)^{\varphi}$	Marginal utility of leisure S
10	$N_t^S = N_t$	Hours worked S
11	$C_t^S + Z_{t+1}^S = W_t N_t^S + R_{t-1}B_t^S - T_t^S - \tau^S$	Budget constraint S
12	$\Lambda_S B_{t+1}^S = \lambda_{S,S}\Lambda_S Z_{t+1}^S + \lambda_{K,S}\Lambda_K Z_{t+1}^K$	Island-wide beginning-of-period bonds S
13	$U'(C_t^H) = (C_t^H)^{-\sigma}$	Marginal utility of consumption H
14	$U'(N_t^H) = -\psi(N_t^H)^{\varphi}$	Marginal utility of leisure H
15	$N_t^H = N_t$	Hours worked H
16	$Z_{t+1}^H = 0$	End-of-period per-capita bonds H
17	$\Lambda_H B_{t+1}^H = \lambda_{K,H}\Lambda_K Z_{t+1}^K + \Lambda_S \lambda_{S,H} Z_{t+1}^S$	Island-wide beginning-of-period H
18	$C_t^H = W_t N_t^H + R_{t-1}B_t^H - T_t^H + \tau^H$	Budget constraint H
19	$Y_t = N_t^{1-\alpha}K_t^{\alpha} - F$	Production function
20	$MPL_t = (1-\alpha)N_t^{-\alpha}K_t^{\alpha}$	Marginal product of labor
21	$W_t = MC_t\; MPL_t$	Real wage
22	$D_t = Y_t - N_t W_t - R_{k,t}K_t$	Profits
23	$MPK_t = \alpha N_t^{1-\alpha}K_t^{\alpha-1}$	Marginal product of capital
24	$R_{k,t} = MC_t\; MPK_t$	Rental rate of capital
25	$K_{t+1}^K = (1-\delta)K_t^K + I_t^K\left[1 - \iota\left(\frac{I_t^K}{I_{t-1}^K} - 1\right)^2\right]$	Capital law of motion
26	$X_t = \frac{I_t^K}{I_{t-1}^K}$	Investment growth rate
27	$S_t = \iota(X_t - 1)^2$	Adjustment cost function
28	$S_t' = 2\iota(X_t - 1)$	Derivative of adjustment cost function
29	$U'(C_t^K) = \beta\,\mathbb{E}_t\left[U'(C_{t+1}^K)\frac{R_{k,t+1}+(1-\delta)Q_{t+1}}{Q_t}\right]$	Capital Euler equation
30	$LP_t = \mathbb{E}_t\left[\frac{\{R_{k,t+1}+(1-\delta)Q_{t+1}\}/Q_t}{(1+R_{b,t})/\Pi_{t+1}}\right]$	Liquidity premium
31	$Q_t(1 - S_t - X_t S_t') + \beta\,\mathbb{E}_t\left[Q_{t+1}\frac{U'(C_{t+1}^K)}{U'(C_t^K)}S_{t+1}'X_{t+1}^2\right] = 1$	Investment equation
32	$I_t = \Lambda_K I_t^K$	Aggregate investment
33	$K_t = \Lambda_K K_t^K$	Aggregate capital
34	$D_t = \Lambda_K D_t^K$	Aggregate profits
35	$Y_t = C_t + I_t + G_t$	Aggregate resource constraint
36	$R_t = \frac{1+R_{b,t}}{\Pi_{t+1}}$	Fisher equation
37	$C_t = \Lambda_K C_t^K + \Lambda_S C_t^S + \Lambda_H C_t^H$	Aggregate consumption
38	$\Pi_t\xi(\Pi_t - 1) = (1-\epsilon) + \epsilon MC_t + \mathbb{E}_t\left[\Psi_{t,t+1}^K\Pi_{t+1}\xi(\Pi_{t+1}-1)\frac{Y_{t+1}}{Y_t}\right]$	New Keynesian Phillips curve
39	$\Psi_{t,t+1}^K = \beta(C_{t+1}^K)^{-\sigma}/(C_t^K)^{-\sigma}$	Stochastic discount factor
40	$\frac{1+R_{b,t}}{1+R_b} = \left(\frac{1+R_{b,t-1}}{1+R_b}\right)^{\rho_r}\left(\frac{\Pi_t}{\Pi}\right)^{(1-\rho_r)\phi_\pi} M_t$	Monetary policy rule
41	$\frac{M_t}{M} = \left(\frac{M_{t-1}}{M}\right)^{\rho_m}\varepsilon_{m,t}$	Monetary policy shock
42	$B_{t+1} = R_{t-1}B_t + G_t - T_t$	Government budget constraint
43	$B_t = \Lambda_K Z_t^K + \Lambda_S Z_t^S$	Aggregate bond market clearing
44	$\Pi_t = \frac{P_t}{P_{t-1}}$	Gross inflation
45	$S_t^b = \frac{B_t}{Y_t}$	Debt-to-GDP ratio
46	$\frac{G_t}{G} = \left(\frac{G_{t-1}}{G}\right)^{\rho_g}\varepsilon_{g,t}$	Government spending shock
47	$\frac{T_t}{T} = \left(\frac{T_{t-1}}{T}\right)^{\rho_\tau}\left(\frac{B_{t-1}}{B}\right)^{(1-\rho_\tau)\gamma_{\tau b}}\left(\frac{G_t}{G}\right)^{(1-\rho_\tau)\gamma_{\tau g}}$	Tax rule
48	$T_t^K = T_t^H = T_t^S = T_t$	Equal tax rates across household types

Table A.2: Steady State

#	Equation	Description
1	$P = \Pi$	Steady-state price level
2	$R = \frac{1}{\beta}$	Steady-state real interest rate
3	$R_b = \frac{\Pi}{\beta}$	Steady-state nominal interest rate
4	$MC = \frac{\epsilon - 1}{\epsilon}$	Steady-state marginal cost
5	$R_k = R - 1 + \delta$	Steady-state rental rate of capital
6	$N^K = N^S = N^H = N$	Steady-state labor allocation
7	$K = \left[\frac{R_k}{MC\,\alpha}\right]^{\frac{1}{\alpha-1}} N$	Steady-state capital stock
8	$W = MC\,(1-\alpha)N^{-\alpha}K^{\alpha}$	Steady-state wage
9	$F = N\left[\left(\frac{K}{N}\right)^{\alpha} - \left(W + R_k\,\frac{K}{N}\right)\right]$	Fixed cost ensuring zero profits
10	$Y = N^{(1-\alpha)}K^{\alpha} - F$	Steady-state output
11	$B/(4Y) = 0.57$	Steady-state debt to GDP ratio (baseline)
12	$I = \delta K$	Steady-state investment
13	$G = 0.2\,Y$	Steady-state government spending
14	$C = Y - I - G$	Steady-state consumption
15	$C^K = C^S = C^H = C$	Equal consumption across household types
16	$T = G + RB - B$	Steady-state total taxes
17	$T^K = T^H = T^S = T$	Equal taxes across household types
18	$Z^H = Z^S = 0$	No net assets for H and S household types
19	$Z^K = \frac{B}{\Lambda_K}$	Steady-state asset holdings K