Brothers in Arms? Monetary-Fiscal Interactions Without Ricardian Equivalence

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This paper

Monetary-fiscal interaction:

- Classic work by Sargent & Wallace (1981), Leeper (1991), Sims (1994).
- **Institutional design of both policy branches** matter jointly for equilibrium outcomes including inflation.
- Whether CB controls inflation depends also on fiscal policy.
- Under fiscal dominance, inflation determined by fiscal policy.

Recent inflation experience $\Rightarrow$ surge in interest in monetary-fiscal interaction and FTPL:

- Covid-19 fiscal expansions were mostly unfunded (military investment as well?).
- $\Rightarrow$ fiscal policy contributing factor to post Covid-19 inflation.
- What will happen with fiscal space going forward? Austerity or fiscal dominance?

This paper

Macro literature typically studies policy-design in simple NK models.

- **Orthodox policy regime**: Active monetary policy, passive fiscal policy.
- Local determinacy, inflation and output insulated from deficits.
- **Unorthodox policy regime**: Passive monetary policy, active fiscal policy.
- local determinacy, inflation and output affected by deficits.

We study monetary-fiscal interaction **in an OLG Setting**:

- **Sizeable empirical relevant MPCs** (short-cut to HANK).
- **Ricardian Equivalence violated: Direct route** from deficits to output and inflation.
- **Blurs the lines** between monetary and fiscal policy.

Our main point:

Violation of RE overturns orthodox policy conclusions

Non-Ricardian Demand and Policy Conclusions

1. **Taylor Principle is no longer paramount.**
   - Local determinacy even when TP is violated outside FTPL.
   - Stable equilibria may not exist even if TP satisfied.
   - Reaching for the Taylor principle may be too swift.

2. **Passive-active dichotomy is less meaningful.**
   - Fiscal and monetary policies always interact.
   - Deficits tend to be inflationary due to debt $\Rightarrow$ demand.

3. **Preannoucement matters.** Consider fiscal shocks:
   - RANK: Whether deficits are current or prospective - irrelevant for their impact.
   - w/o Ricardian Equivalence: Prospective deficits are inflationary and contractionary.

We Are Family

1. **Determinacy, fiscal-theory of the price level, equilibrium selection**
   - Sargent and Wallace (1981), **Leeper (1991)**, Sims (1994)
   - Kocherlakota & Phelan (1999), Buiter (2002), Canzoneri et al. (2001), Niepelt (2004)
   - **Bianchi et al (2023)**, **Bigio et al (2024)**.
   - Atkeson et al. (2010), Angeletos & Lian (2023), Kaplan et al (2023)
   - Bassetto (2002), Cochrane (2005), Cochrane (2023), Bassetto & Cui (2018)
   - Cushing (1999), Canzoneri and Diba (2005)
2. **Fiscal and monetary policies in NK models with non-Ricardian consumers**
   - **Richter (2015)**, Angeletos et al (2024, 2025), **Dupraz & Rogantini Picco** (2025)
   - Gali et al. (2007), Bilbiie (2020), Aguiar et al. (2024)
   - Auclert et al. (2024), Kaplan et al (2018), Ravn & Sterk (2021), Bayer et al (2023)
3. **Papers studying the post-COVID episode**
   - **Bianchi et al. (2023)**, **Anderson & Leeper** (2023), **Barro & Bianchi (2024)**

1. Framework

The Model

Demand side: Finitely lived households.

- Blanchard (1985)
- Used e.g. in Richter (2015), Gali (2021), Angeletos, Lian and Wolf (2024, 2025)
- This is the kraftwerk of the analysis.

Supply side: Textbook NKPC (Woodford 2003, Gali 2008).

Monetary policy: Central bank controls nominal interest rate via Taylor Rule.

Fiscal policy: Government issues nominal debt, operates fiscal policy rule.

+ Medium Scale Model: Sticky wages, capital, adjustment costs, long-term debt

Households

Households of cohort s choose $\{C_{s,t}, B_{s,t}\}$ to maximize

$$\mathcal{U}_{s,0} = \mathbb{E}_0 \sum_{t=0}^{\infty} (\beta q)^t \left(\log C_{s,t} - \psi \log(1 - N_{s,t})\right)$$

s.t.

$$P_t C_{s,t} + \frac{B_{s,t}}{I_t} = P_t Y_{s,t} - P_t S_{s,t} + \frac{B_{s,t-1}}{q} + P_t Z_s$$

$$\Rightarrow$$

$$C_{s,t} + \frac{V_{s,t}}{I_t} = \underbrace{Y_{s,t}}_{\text{income}} - \underbrace{S_{s,t}}_{\text{taxes}} + \underbrace{\frac{V_{s,t-1}}{\Pi_t q}}_{\text{wealth}} + \underbrace{Z_s}_{\text{social fund}}$$

- Mortatility risk through $1 - q \geq 0$ ≈ borrowing constraints (Farhi-Werning)
- Insurance company redistributes wealth from diseased to survivors
- Social fund redistributes wealth from "old" to newborns $\Rightarrow R^{ss} = 1/\beta$.

Consumption choices

$$C_t = \overbrace{(1-\chi\beta)}^{\text{MPC effect}} \times \tilde{A}_t$$

$$\tilde{A}_t = \mathbb{E}_t \left[\sum_{h=0}^{\infty} \overbrace{\frac{q^h}{\prod_{j=0}^{h} R_{t+j}}}^{\text{discounting}} Y_{t+h} + \sum_{h=0}^{\infty} \overbrace{\left(\frac{1-q^h}{\prod_{j=0}^{h} R_{t+j}} \right)}^{\text{debt} \Rightarrow \text{wealth}} S_{t+h} - \overbrace{\frac{1-q}{q}}^{\text{soc.fund}} V \left(\sum_{h=0}^{\infty} \frac{q^h}{\prod_{j=0}^{h} R_{t+j}} - 1 \right) \right]$$

Log-linearized Euler equation

$$y_t = \mathbb{E}_t y_{t+1} - (i_t - \mathbb{E}_t \pi_{t+1}) + \chi \underbrace{(v_t - \gamma \mathbb{E}_t \pi_{t+1})}_{\text{exp. value assets tomorrow}},$$

$$\chi := (1-q\beta)(1-q)/q, \gamma := V/Y$$

Evolution of nominal government debt:

$$\frac{B_t}{I_t} = (B_{t-1} - \overbrace{P_t S_t}^{\text{primary surpl.}})$$

Real debt:

$$V_t = I_t \left(\frac{V_{t-1}}{\Pi_t} - S_t \right) \qquad \overset{NPG}{\Rightarrow} \qquad \frac{V_{t-1}}{\Pi_t} = \mathbb{E}_t \sum_{h=0}^{\infty} \left(\frac{1}{\prod_{j=0}^{h} R_{t+j}} \right) S_{t+h}$$

Log-linearized:

$$v_t = \frac{1}{\beta} (v_{t-1} - s_t) + \gamma \left(i_t - \frac{1}{\beta} \pi_t \right)$$

Closing the model: supply side and policy

Supply side: Textbook NKPC:

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \kappa y_t$$

Monetary policy:

$$i_t = \phi_\pi \pi_t + e_t^i$$

Fiscal policy:

$$s_t = \alpha_b v_{t-1} + (1 - \alpha_b) e_t^s$$

- $\alpha_b \in [0, 1]$ governs the strength of gov debt stabilization
- $\alpha_b = 0$: deficits do not react to the level of debt.
- $\alpha_b = 1$: full stabilization.

The model for the magazine

Three equation model, once the policy rules are plugged in:

$$y_t = \mathbb{E}_t y_{t+1} - (\phi_\pi \pi_t - \mathbb{E}_t \pi_{t+1}) + \chi \left(v_t - \gamma \mathbb{E}_t \pi_{t+1} \right)$$

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \kappa y_t$$

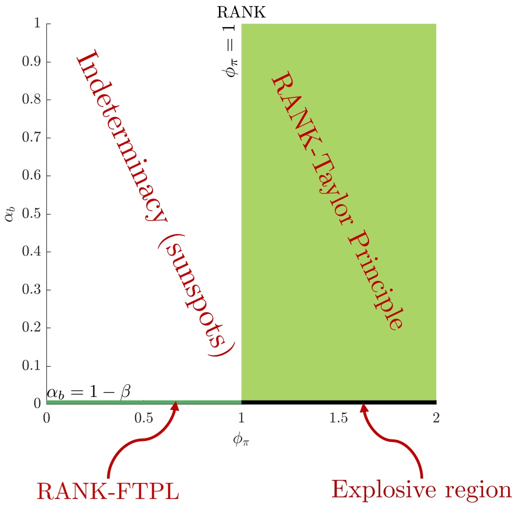
$$v_t = \frac{1-\alpha_b}{\beta} v_{t-1} + \gamma \left(\phi_\pi - \frac{1}{\beta} \right) \pi_t$$

- Monetary policy impacts on debt dynamics in general.
- (y, π)-block independent of debt and deficits unless RE is violated.
- $\frac{1-\alpha_b}{\beta} < 1$: v convergent if π_t indepedent of debt $\Rightarrow \alpha_b = 1 - \beta = r/(1+r)$ critical.

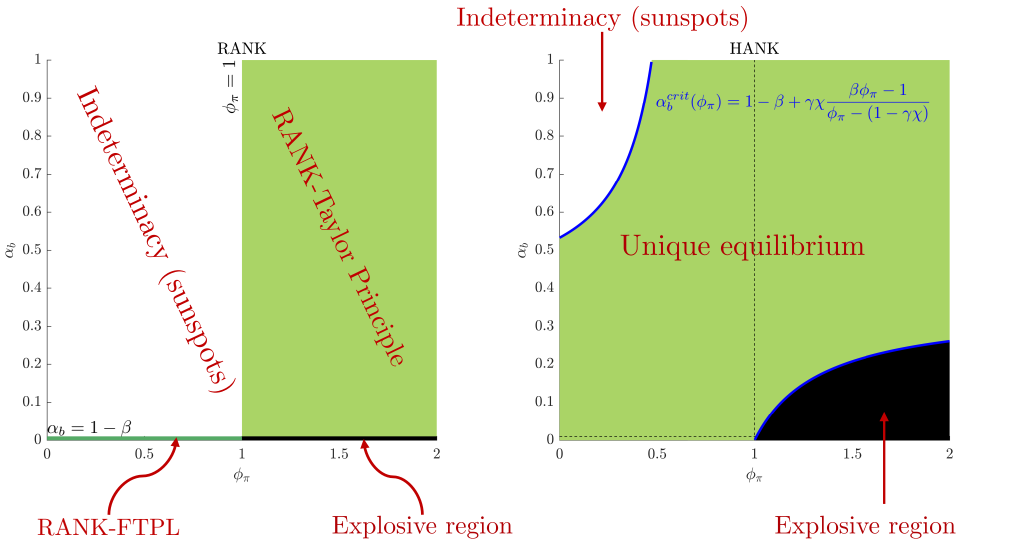
Results

We provide characterization of key properties with closed form solutions - will skip details here but consult paper for details.

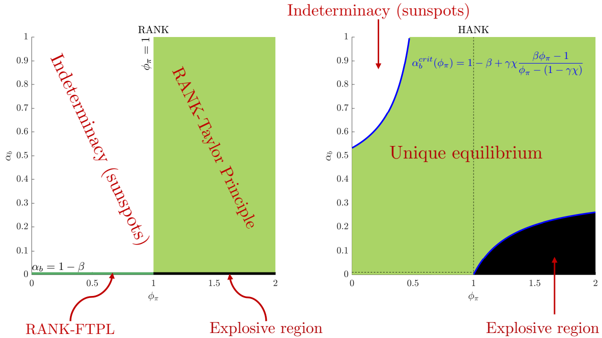
Result 1: Determinacy in RANK



Result 1: Determinacy in RANK and HANK



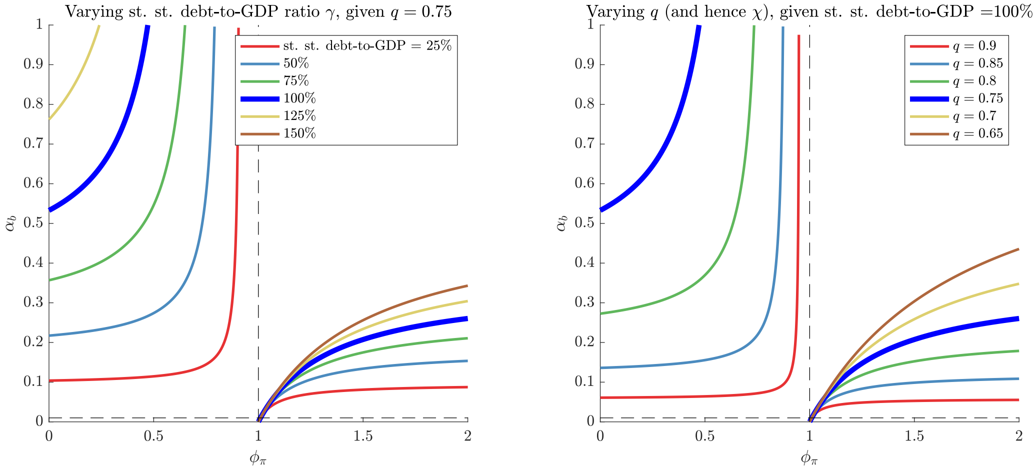
Result 1: Determinacy in HANK: implications



1. **Taylor Principle** neither necessary nor sufficient w/o Ricardian Equivalence
2. **The classic taxonomy** of active vs. passive policies does not apply.
3. **MP reform** (raising ϕ_π) requires more stabilizing fiscal policy to avoid the explosive region

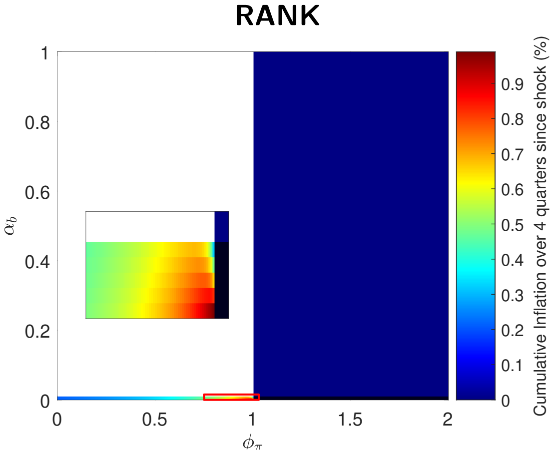
Result 1A: Importance of Indebtedness and MPC

$$\alpha_b^{crit}(\phi_\pi) = 1 - \beta + \gamma\chi \frac{\beta\phi_\pi - 1}{\phi_\pi - (1 - \gamma\chi)}$$



Result 2: Fiscal transfer shocks

Consider a one-off **fiscal transfer** shock of 1% of GDP. Is it inflationary?



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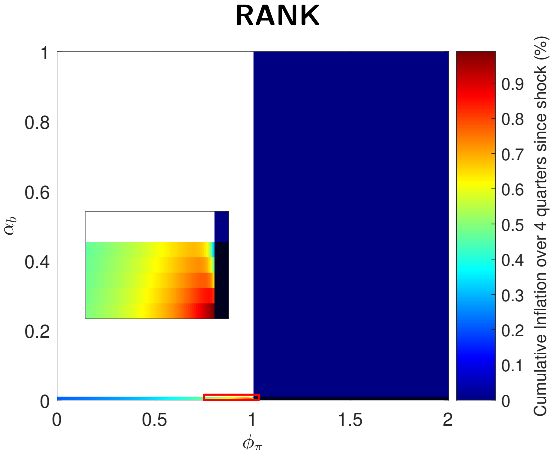
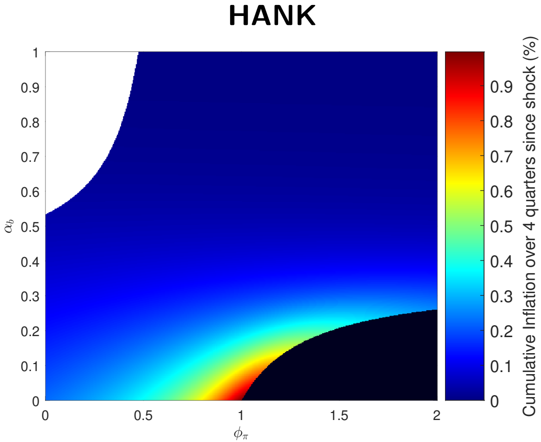
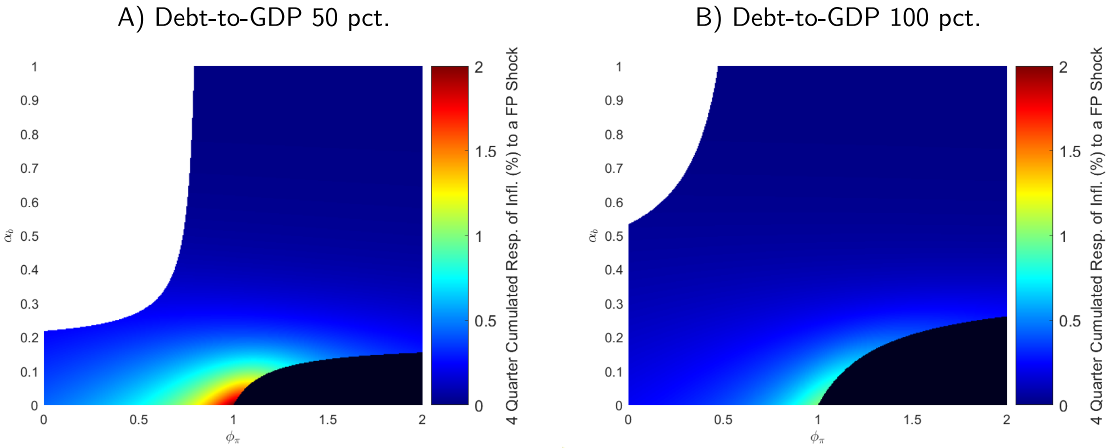


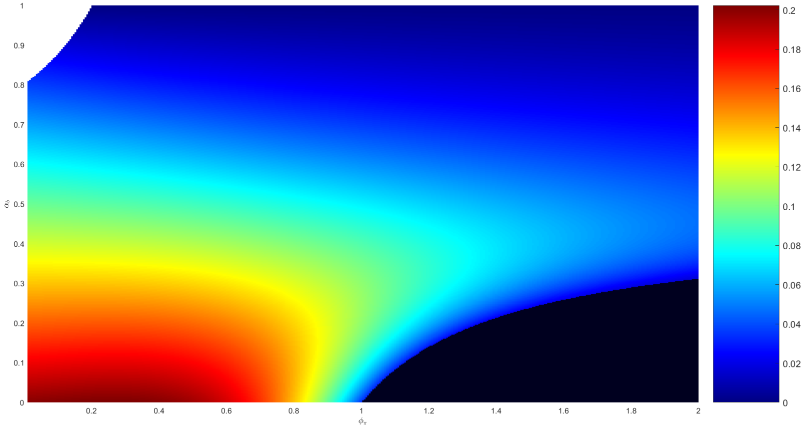


Output maps IRF RANK-TP IRF RANK-FTPL

Result 2A: Importance of Government Indebtedness



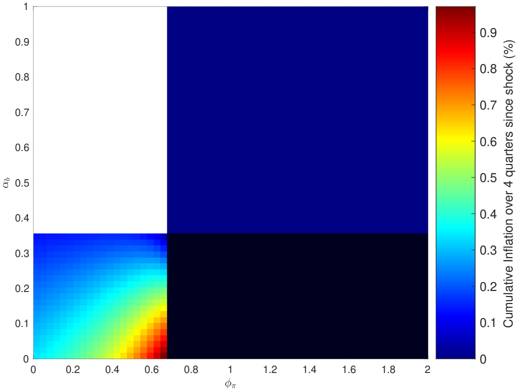
Result 2B: Long-term debt eliminates non-monotonic aspect



Due to response of longer term bond prices.

Result 3: Can you kill fiscal inflation? (Dupraz & Rogantini Picco)

$$
\begin{aligned}
i_t &= \phi_\pi \pi_t + \phi_v v_t, \Rightarrow \\
\hat{y}_t &= \mathbb{E}_t \hat{y}_{t+1} - \phi_\pi \hat{\pi}_t - \phi_v \hat{v}_t + \mathbb{E}_t \hat{\pi}_{t+1} + \chi \left(\hat{v}_t - \gamma \mathbb{E}_t \hat{\pi}_{t+1} \right).
\end{aligned}
$$



Result 4: Prospective Deficits - Call it another lovely day

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Result 4: Prospective Deficits

Government budget constraint must hold:

$$\frac{V_{t-1}}{\Pi_t} = \mathbb{E}_t \sum_{h=0}^{\infty} \left(\frac{1}{\prod_{j=0}^{h} R_{t+j}} \right) S_{t+h}$$

RANK: Anticipation irrelevant: NPV of future surpluses is only thing that matters

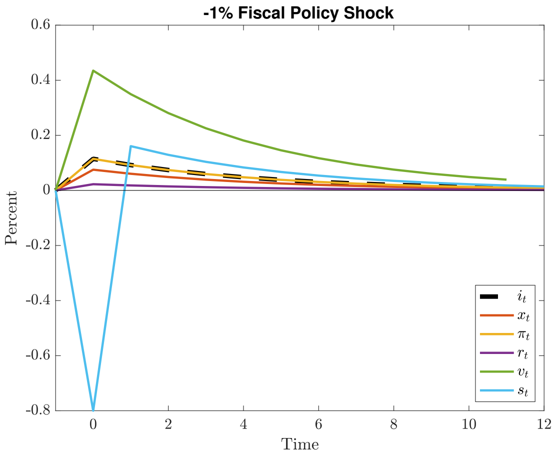
- Liz Truss & Kwasi Kwarteng: Unfunded future deficit announcement.
- Should stimulate economy today - but it tanked.

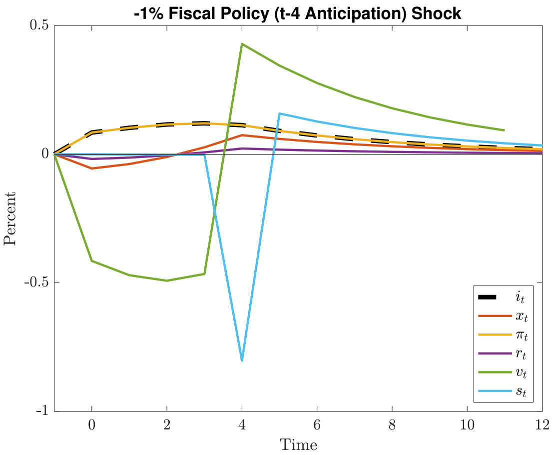
HANK: Same GBC as in RANK but deficits now impact on demand:

$$y_t = \mathbb{E}_t y_{t+1} - (i_t - \mathbb{E}_t \pi_{t+1}) + \chi (v_t - \gamma \mathbb{E}_t \pi_{t+1})$$

Absent RE timing of deficits matters: Inflation moves today regardless of timing, but timing determines who gets transfer and who pays.

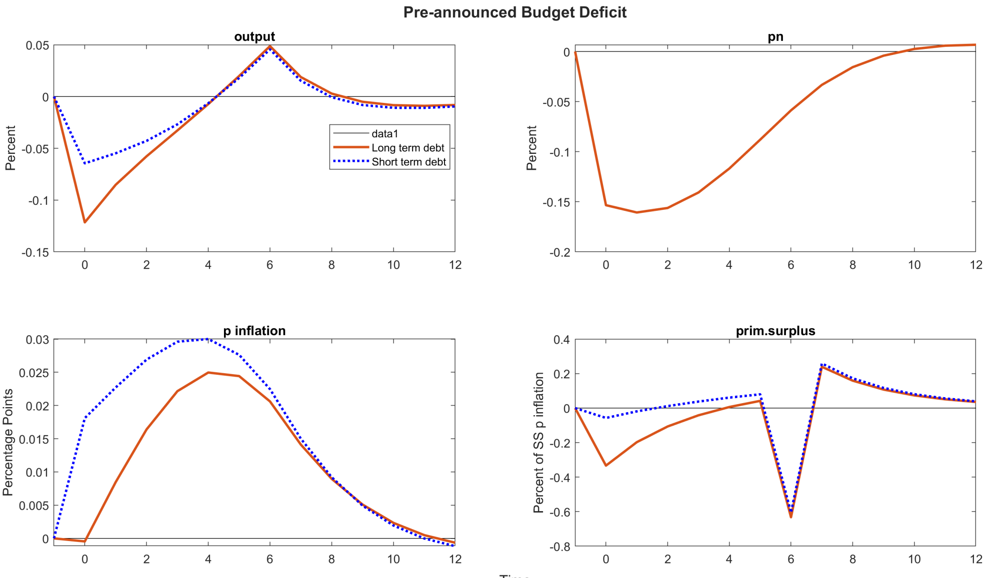
Result 4: Anticipated fiscal shocks in HANK





Timing of shock crucial: deficit news shock leads to inflation and recession

Result 4: Pre-implementation Recession Exacerbated by Long-Term Debt



Result 5: Impact of Monetary Policy Shocks

Key attraction of RANK-TP orthodoxy - account of MP shocks:

- Empirical evidence: Hiking nominal rate is (eventually) deflationary and contractionary.
- RANK-TP: Hiking nominal rate is deflationary and contractionary.
- RANK-FTPL: Hiking nominal rate is inflationary (reduces fiscal issues).

Cochrane (2011, 2023): With long term government debt - conventional effects.

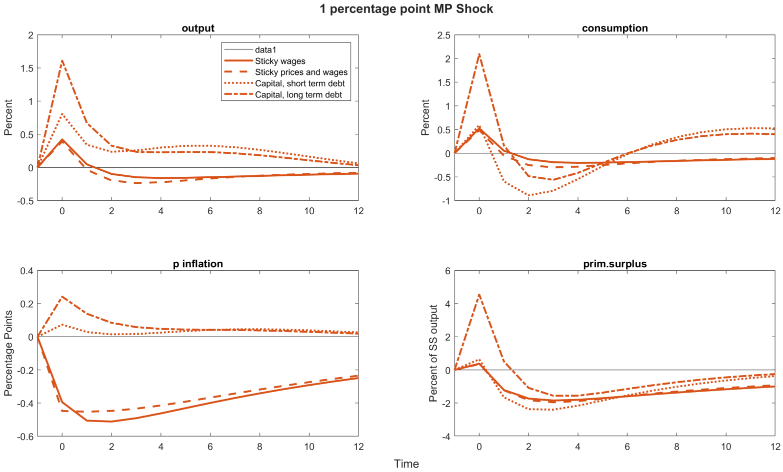
- Higher short term rates decrease price of long term debt.
- Reverses inflationary effects of interest rate hikes

Debt maturity matters first order also in absence of Ricardian Equivalence:

- Conventional impact of MP shocks
- Moderate fiscal multipliers even in FTPL.

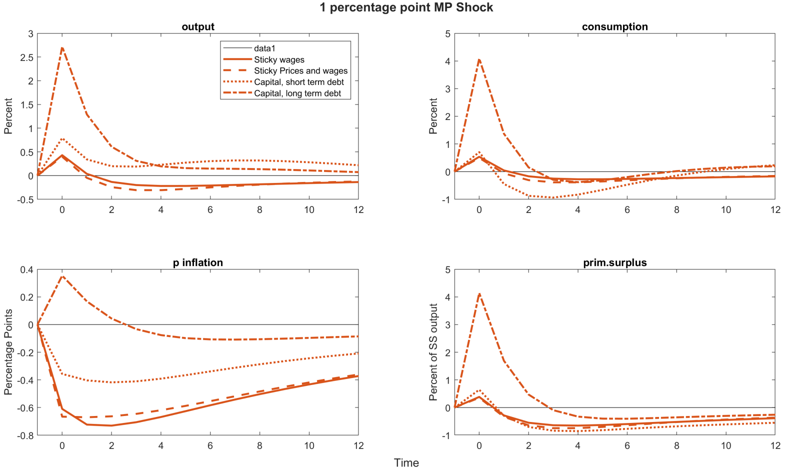
Result 5: Impact of Monetary Policy Shocks

A) When $(\phi_\pi, \alpha_b) = (1.5, 0.3)$



Result 5: Impact of Monetary Policy Shocks

B) When $(\phi_\pi, \alpha_b) = (0.9, 0.1)$



Conclusions

Non-Ricardian demand: Taylor principle neither necessary nor sufficient, active/passive distinction not valid, policies work hand-in-hand.

Are fiscal transfer shocks inflationary?

in RANK

- It depends: Either no (RANK-TP) or yes of RANK-FTPL).
- Answer sharply sensitive to policy rule parameters.
- High $\phi_\pi \rightarrow \frac{\partial \pi}{\partial \tau}$ high in RANK-FTPL.
- Answer insensitive to timing of policy.

in HANK

- Unambiguous effects: deficits are inflationary everywhere.
- Effects change gradually with policy rule parameters.
- High $\phi_\pi \rightarrow$ more inflation everywhere.
- Answer depends on timing of policy.

Robustness

Analysis so far: Simple NK model

Now extend to **medium-scale model**:

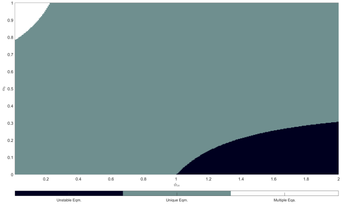
- Realistic Frisch labor supply elasticity.
- Sticky wages + sticky prices.
- Capital accumulation and adjustment costs.
- Government spending and distortionary taxation.
- Long term government debt and interest rate smoothing.

Introduction of **capital** and **long term government debt** most important aspects:

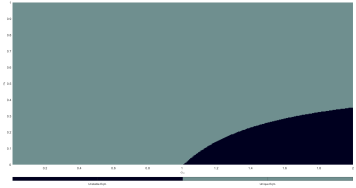
- Government debt only a share of private sector financial wealth.
- Long term government debt can reverse fiscal consequences of monetary actions.
- Long term asset price movements also key for household wealth effects.

Determinacy properties

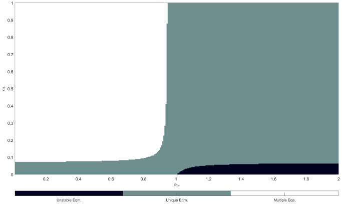
A) No capital, sticky wages



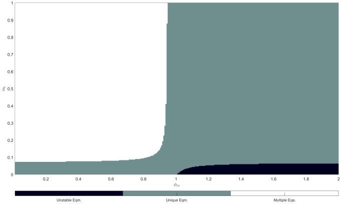
B) No capital, sticky prices and wages



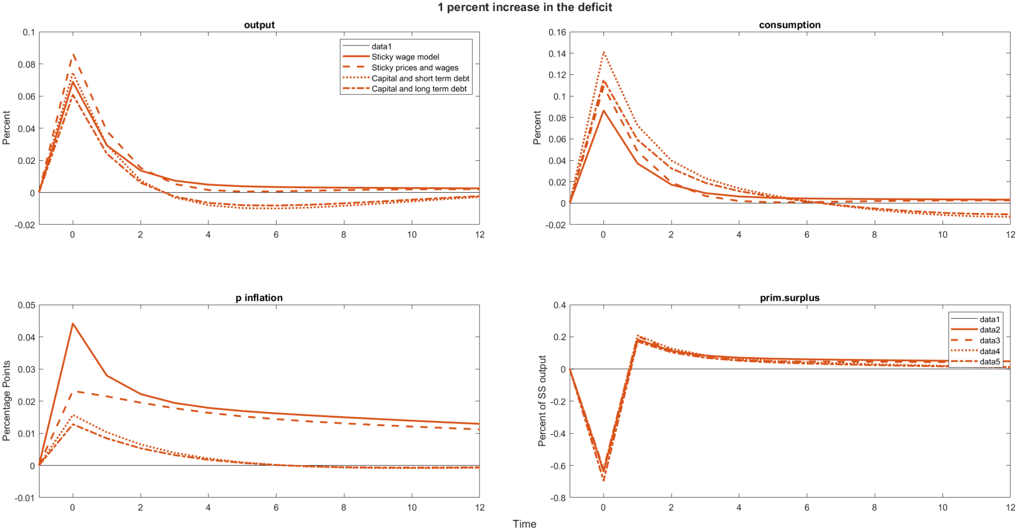
C) Capital, short term debt



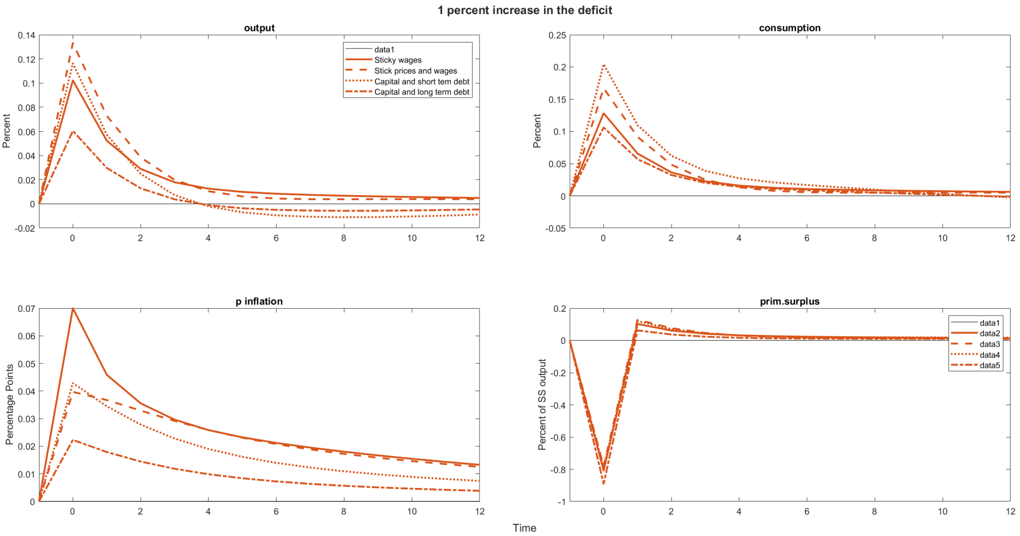
D) Capital, long term debt



Deficit shock, $\phi_\pi = 1.5$ and $\alpha_b = 0.3$

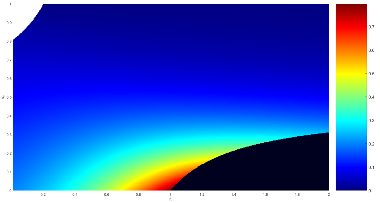


Deficit shock, $\phi_\pi = 0.9$ and $\alpha_b = 0.1$

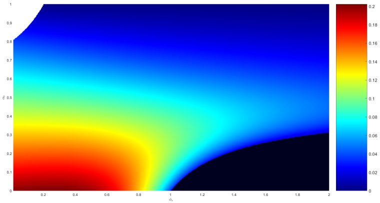


Deficit shock

A) No capital, short term debt



B) No capital, long term debt



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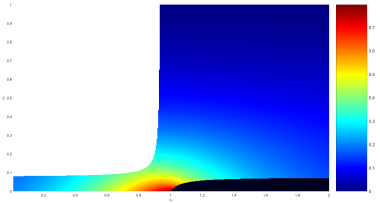

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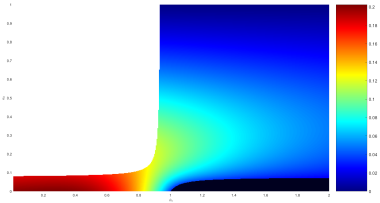


THANK YOU

and now on to drinks before tea gets cold

Conclusions

We study fiscal-monetary interactions in a tractable HANK setting.

Taylor Principle is dead

Inflation and output determinate even if TP not satisfied

Ratcheting up of debt might arise if TP is satisfied

Passive-active dichotomy is dead

Continuous combinations of policy rule parameters pin down existence and uniqueness of equilibrium

Endogenous mechanisms within the model operate – and not just policy directly

“Independent” monetary policy is dead

Monetary policy leaves a long and persistent fiscal shadow

Calibration

Parameter	Description	Target	Parameter value
Households			
β	Discount factor	4% annual real rate	0.99
ψ	Preference weight on leisure	45% of time spent working	1
Firms			
κ	Phillips curve slope	Literature	0.31
Fiscal Policy			
V/Y	Government debt to annual GDP	Current debt levels	100%

We explore the model properties for different values of q (and hence χ), ϕ_π and α_b.

back

Proof that the sequence $\{y_t\}$ is increasing if $\phi_\pi > 1$

Start with the Euler equation:

$$y_t = \mathbb{E}_t y_{t+1} - (\phi_\pi \pi_t - \mathbb{E}_t \pi_{t+1}). \quad \text{The NKPC implies:}$$

$$y_t = \mathbb{E}_t y_{t+1} - \kappa \mathbb{E}_t \left(\phi_\pi \sum_{j=0}^{\infty} \beta^j y_{t+j} - \sum_{j=0}^{\infty} \beta^j y_{t+j+1} \right), \quad \text{let } S_t := \sum_{j=0}^{\infty} \beta^j y_{t+j} :$$

$$y_t = \mathbb{E}_t y_{t+1} - \kappa \mathbb{E}_t (\phi_\pi S_t - S_{t+1}), \quad \text{and using} \quad (1 - \beta L) S_t = y_t, \; L y_t := y_{t+1}$$

we obtain:

$$\beta \mathbb{E}_t y_{t+2} - (1 + \beta + \kappa) \mathbb{E}_t y_{t+1} + (1 + \kappa \phi_\pi) y_t = 0.$$

Solution is a sequence $y_t = A(\lambda^*)^t$, where λ^* is a root of the characteristic polynomial:

$$P(\lambda) = \beta \lambda^2 - (1 + \beta + \kappa)\lambda + (1 + \kappa \phi_\pi)$$

If $\phi_\pi > 1$, $P(\lambda)$ has a smaller root $\lambda^* \in \left(1, \frac{1}{\beta}\right)$. Therefore, $\mathbb{E}_t y_{t+1} > y_t$. $\square$ back

Extension to $\alpha_x > 0$: automatic stabilizers

Proposition: With $\alpha_x > 0$, the relevant threshold for α_b is:

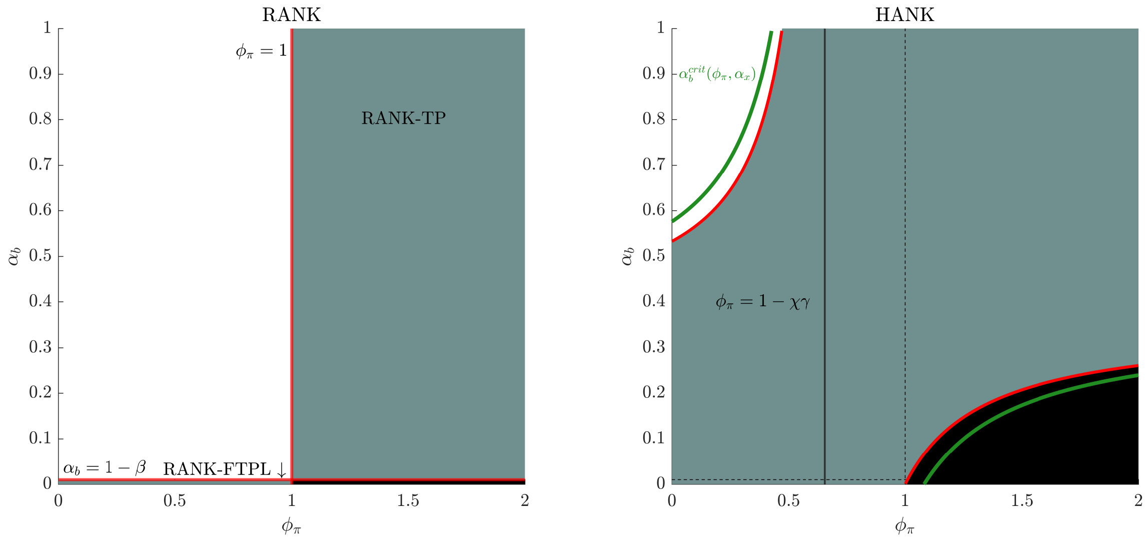
$$\alpha_b^{crit}(\phi_\pi, \alpha_x) = 1 - \beta + \chi\gamma \frac{\beta\phi_\pi - 1}{\phi_\pi - (1 - \chi\gamma)} - \chi\alpha_x \frac{1 - \beta}{\kappa(\phi_\pi - (1 - \chi\gamma))}$$

$\alpha_x > 0$ expands the uniqueness region:

when $\phi_\pi < 1 - \chi\gamma$, $\alpha_x > 0$ reduces the multiplicity region

when $\phi_\pi > 1 - \chi\gamma$, $\alpha_x > 0$ reduces the non-existence region Back

Determinacy in RANK and in HANK



back

Sketch of proof

back

The system converges back along the stable eigenvalue. In RANK, the EE:

$$y_t = \mathbb{E}_t y_{t+1} - (\phi_\pi \pi_t - \mathbb{E}_t \pi_{t+1})$$

The NKPC implies

$$\beta \mathbb{E}_t y_{t+2} - (1 + \beta + \kappa)\mathbb{E}_t y_{t+1} + (1 + \kappa\phi_\pi) y_t = 0.$$

Solution: a sequence $y_t = A(\lambda)^t$, where λ is a root of

$$P(\lambda) = \beta\lambda^2 - (1 + \beta + \kappa)\lambda + (1 + \kappa\phi_\pi)$$

Sketch of proof

back

Closed form for λ is given in the proposition. Determined by macro block only $\Rightarrow$ independent of α_b, γ Gov IBC together with $\pi_t = \lambda^t \pi_0$ imply

$$\pi_0 = -e_0^s \frac{1}{\gamma} \frac{1 - \alpha_b - \beta\lambda}{1 - \beta\phi_\pi}$$

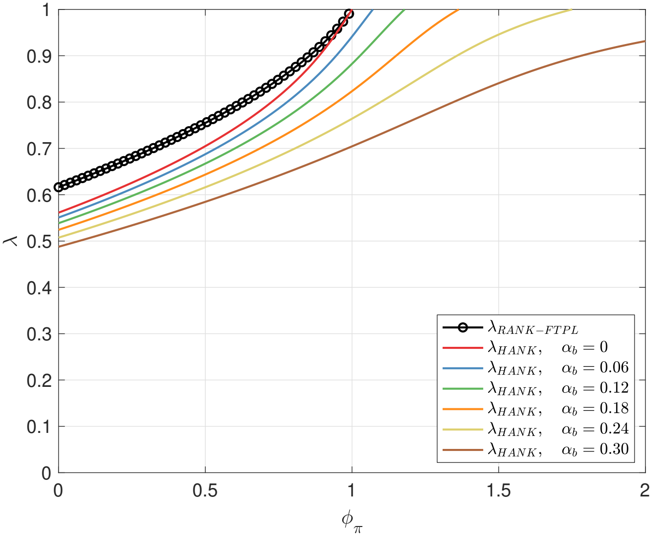
$\pi_0 = \kappa \frac{y_0}{1-\beta\lambda}$ implies

$$y_0 = -e_0^s \frac{1 - \beta\lambda}{\kappa\gamma} \frac{1 - \alpha_b - \beta\lambda}{1 - \beta\phi_\pi}$$

Gov flow BC implies

$$v_0 = \frac{\gamma}{\beta} (\beta\phi_\pi - 1) \left(-e_0^s \frac{1}{\gamma} \frac{1 - \alpha_b - \beta\lambda}{1 - \beta\phi_\pi} \right) - \frac{1 - \alpha_b}{\beta} e_0^s = \frac{1 - \alpha_b - \beta\lambda}{\beta} e_0^s - \frac{1 - \alpha_b}{\beta} e_0^s = -e_0^s \lambda$$

$\lambda_{RANK-FTPL}$ vs. λ_{HANK}



RANK-FTPL: the intuition behind the comparative dynamics

$$\frac{\partial \lambda}{\partial \phi_\pi} > 0 \qquad \frac{\partial \frac{\pi_t}{y_t}}{\partial \phi_\pi} > 0$$

- A more hawkish monetary policy means r_t declines by less. This makes the demand more persistent (recall the determinacy analysis)
- More persistent demand gives higher and more persistent inflation, all else equal.
- For a given financing need, the jump in demand must be smaller. This effect in turn pushes down on inflation.
- But the financing need might be larger because of increased interest payments. This pushes inflation up.
- In the end, the effect on inflation and output are ambiguous, but the ratio always increases.

RANK-FTPL: the intuition behind the comparative dynamics

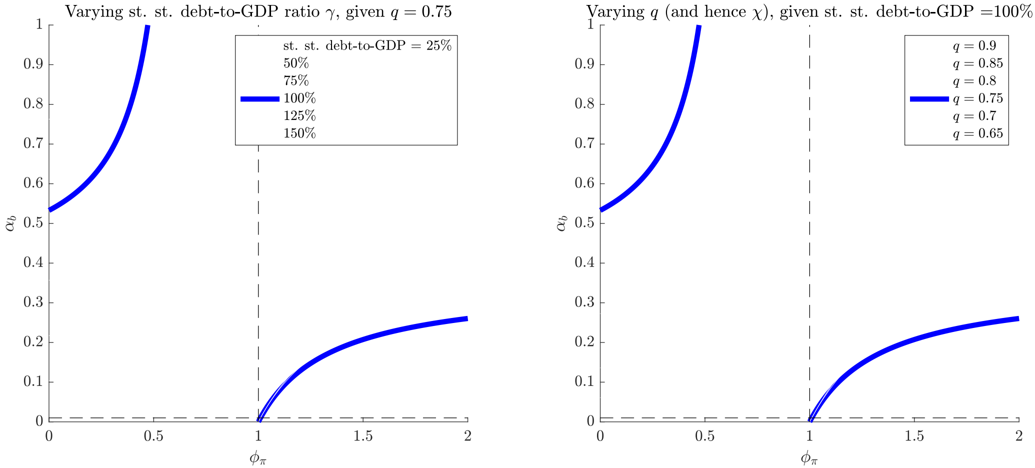
$$\frac{\partial \lambda}{\partial \alpha_b} = 0, \qquad \frac{\partial \pi_t}{\partial \alpha_b} < 0 \text{ and extremely large when } \phi_\pi \approx 1$$

- Counterintuitive (and undesirable?) property: dynamics of debt independent of α_b! Mathematically, it is the macro block that provides the stable eigenvalue
- Undesirable property: extreme sensitivity to tiny movements in α_b in vicinity of $\phi_\pi \approx 1$
- If inflation very persistent, even weak efforts to stabilize debt make a huge difference and reduce the need for inflation

back

Determinacy bounds in HANK as we vary st. st. debt-to-GDP (γ) and q

$$\alpha_b^{crit}(\phi_\pi) = 1 - \beta + \gamma\chi \frac{\beta\phi_\pi - 1}{\phi_\pi - (1 - \gamma\chi)}$$



Determinacy bounds in HANK as we vary st. st. debt-to-GDP (γ) and q

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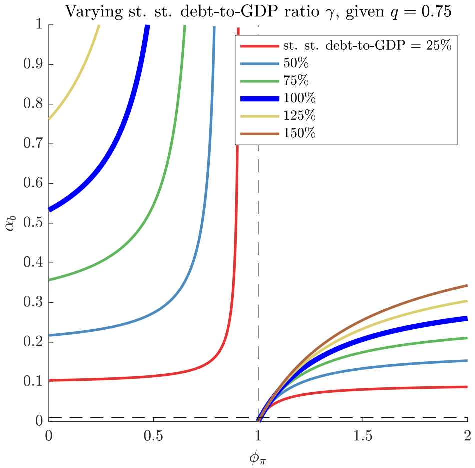
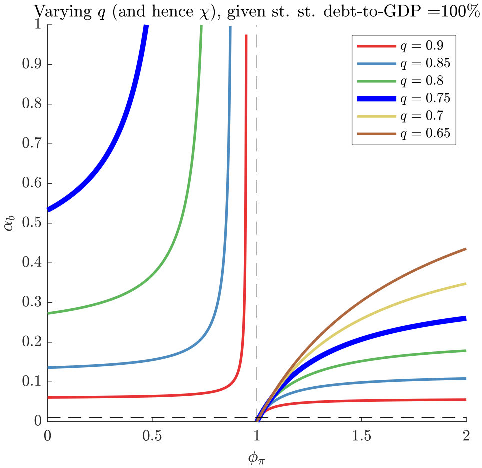
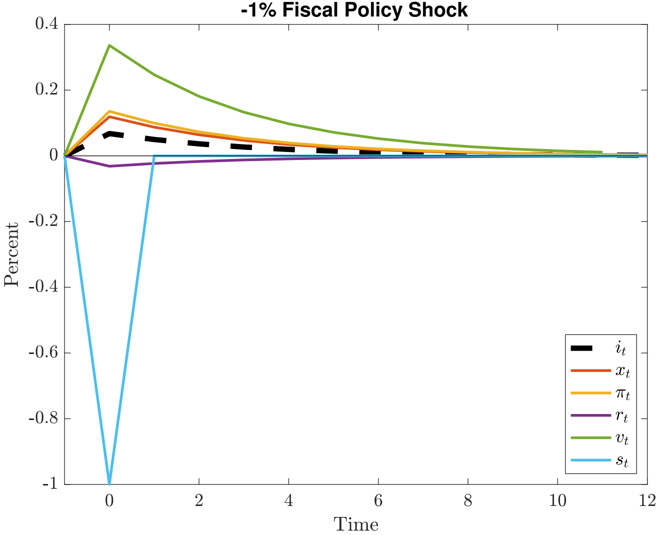




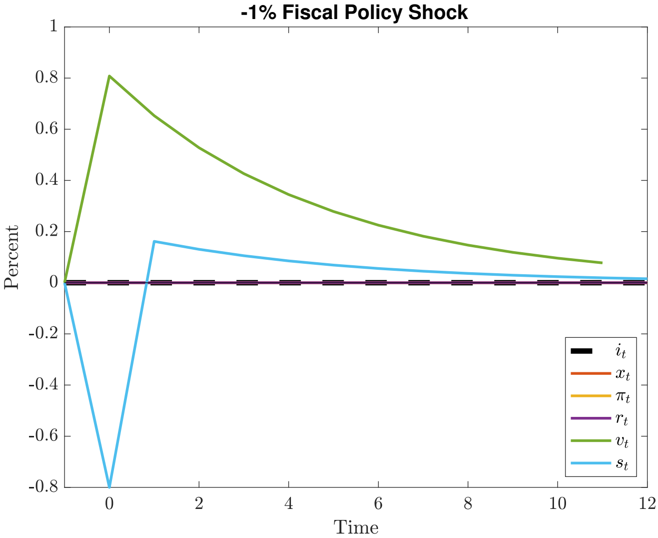
Response to a 1% of GDP transfer shock in RANK-FTPL

Policy rule coefficients: $\phi_\pi = 0.5$, $\alpha_b = 0$



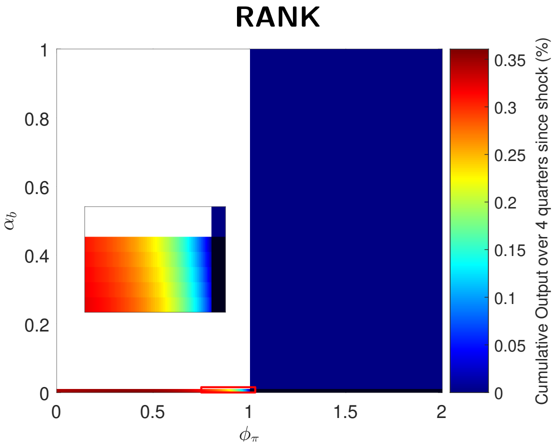
Response to a 1% of GDP transfer shock in RANK-Taylor principle

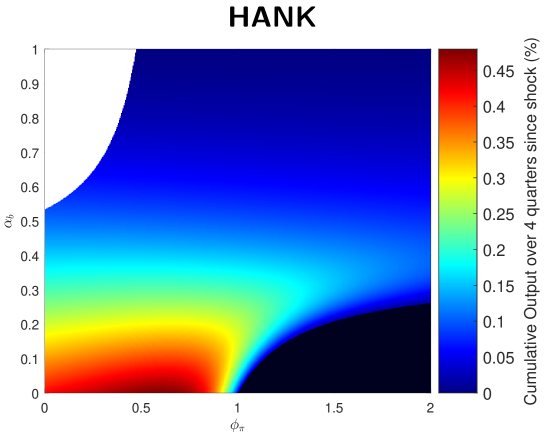
Policy rule coefficients: $\phi_\pi = 1.2$, $\alpha_b = 0.2$



Fiscal transfer shocks

Consider a one-off **fiscal transfer** shock of 1% of GDP. How does output respond?





Back

We Are Family

1. **Determinacy, Fiscal-theory of the price level, equilibrium selection**
    - Sargent and Wallace (1981), Leeper (1991)
    - Kocherlakota & Phelan (1999), Buiter (2002), Canzoneri et al. (2001), Niepelt (2004)
    - Atkeson et al. (2010), Angeletos & Lian (2023), Kaplan et al (2023)
    - Bassetto (2002), Cochrane (2005), Cochrane (2023), Bassetto and Cui (2018)
    - Cushing (1999), Canzoneri and Diba (2005)
2. **Fiscal and Monetary Policies in NK Models with Non-Ricardian Consumers**
    - Richter (2015), **Angeletos et al (2024, 2025)**
    - Gali et al. (2007), Bilbiie (2020), Aguiar et al. (2024)
    - Auclert et al. (2024), Kaplan, Moll & Violante (2018), Ravn & Sterk (2021)
    - Bayer et al (2023)
3. **Papers studying the post-COVID episode**
    - Bianchi et al. (2023), Anderson & Leeper (2023), Barro & Bianchi (2024)

Determinacy in HANK: analytics

Take it to the limit:

$$y = \overbrace{y}^{\text{Keynesian cross}} - \overbrace{(\phi_\pi \pi - \pi)}^{\text{intertemporal subst.}} + \\ + \underbrace{\chi\gamma(\phi_\pi \pi - \pi)}_{\text{real rate effect on wealth}} - \underbrace{\chi\gamma\frac{1}{\beta}\pi}_{\text{valuation effect on wealth}} \underbrace{+\chi\gamma\left(\sum_{s=1}^{j}\left(\frac{1-\alpha_b}{\beta}\right)^s\left[\left(\phi_\pi - \frac{1}{\beta}\right)\pi\right]\right)}_{\text{net-of-interest inflation tax rebate}}.$$

Rearranging:

$$\alpha_b^{crit}(\phi_\pi) = 1 - \beta + \gamma\chi\frac{\beta\phi_\pi - 1}{\phi_\pi - (1-\gamma\chi)}$$

Extension to $\alpha_x > 0$ (automatic stabilizers) Varying γ and q

Characteristic equation in RANK

The model in matrix form:

$$\mathbb{E}_t \begin{bmatrix} v_t \\ \pi_{t+1} \\ y_{t+1} \end{bmatrix} = \mathcal{D} \begin{bmatrix} v_{t-1} \\ \pi_t \\ y_t \end{bmatrix} + \mathcal{F} \begin{bmatrix} e_t^i \\ e_t^s \end{bmatrix}$$

Local determinacy requires one root < 1 of characteristic equation:

$$\det(\mathcal{D} - \lambda \mathbf{I}_3) = 0$$

In RANK ($q = 1$ and $\chi = 0$):

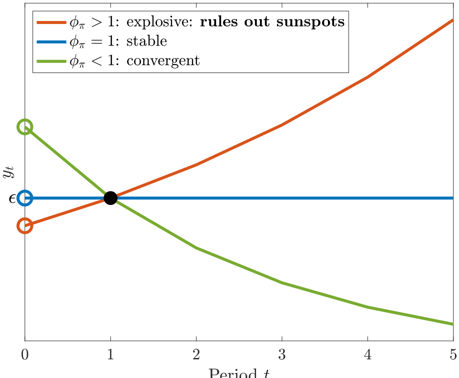
$$\det(\mathcal{D} - \lambda \mathbf{I}_3) = \left(\overbrace{\frac{1 - \alpha_b}{\beta} - \lambda}^{\text{“fiscal” root}} \right) \left(\overbrace{\lambda^2 - \frac{1 + \beta + \kappa}{1 + \kappa \phi_\pi} \lambda + \frac{\beta}{1 + \kappa \phi_\pi}}^{\text{two “monetary” roots}} \right)$$

Determinacy in RANK: economics

Consider sunspots: $\mathbb{E}_t y_{t+1} = \epsilon > 0$. Can we **r.u.l.e. this out?**

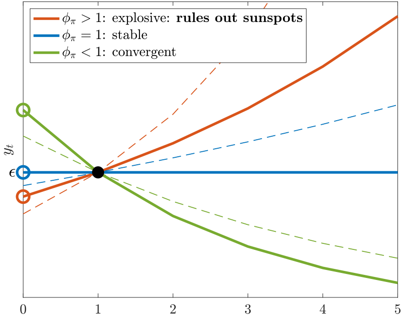
$$y_t = \mathbb{E}_t y_{t+1} - \overbrace{(\phi_\pi \pi_t - \mathbb{E}_t \pi_{t+1})}^{r_t}$$

Lemma: In RANK, $\{y_t\}$ and $\{\pi_t\}$ diverge iff $r_t > 0 \Leftrightarrow \phi_\pi > 1$. proof back



Determinacy in HANK: economics

$$
\begin{aligned}
y_{t+j} = &\overbrace{\mathbb{E}_{t+j} y_{t+j+1}}^{\text{Keynesian cross}} - \overbrace{\left(\phi_\pi \pi_{t+j} - \mathbb{E}_{t+j}\pi_{t+j+1}\right)}^{\text{intertemporal subst.}} + \overbrace{\chi\gamma\left(\phi_\pi \pi_{t+j} - \mathbb{E}_{t+j}\pi_{t+j+1}\right)}^{\text{real rate effect on wealth}} \\
- &\underbrace{\chi\gamma\frac{1}{\beta}\pi_{t+j}}_{\text{wealth val. effect}} + \underbrace{\chi\gamma\left(\sum_{s=1}^{j}\left(\frac{1-\alpha_b}{\beta}\right)^s\left[\left(\phi_\pi - \frac{1}{\beta}\right)\pi_{t+j-s}\right]\right)}_{\text{net-of-interest inflation tax rebate}}.
\end{aligned}
$$



Transfer shocks in RANK-FTPL: analytical solution

Proposition: Consider a transfer shock of 1% of GDP. In RANK-FTPL, i.e. with $q = 1, \phi_\pi \leq 1$ and $\alpha_b < 1 - \beta$, the unique bounded equilibrium takes the form:

$t = 0:$	$v_0 = \lambda_R$	$\pi_0 = \chi_\pi$	$y_0 = \chi_y$	**jump on impact**
$t \geq 1:$	$v_t = \lambda_R v_{t-1}$	$\pi_t = \lambda_R \pi_{t-1}$	$y_t = \lambda_R y_{t-1}$	**dynamics**

$$\lambda_R = \frac{1 + \frac{1+\kappa}{\beta} - \sqrt{\left(1 + \frac{1+\kappa}{\beta}\right)^2 - 4\frac{1+\kappa\phi_\pi}{\beta}}}{2} \qquad \chi_\pi = \frac{1}{\gamma}\frac{1 - \alpha_b - \beta\lambda_R}{1 - \beta\phi_\pi} \qquad \chi_y = \chi_\pi \cdot \frac{1 - \beta\lambda_R}{\kappa}$$

$$\frac{\partial \lambda_R}{\partial \phi_\pi} > 0, \qquad \frac{\partial \frac{\pi_t}{y_t}}{\partial \phi_\pi} > 0, \qquad \frac{\partial \pi_t}{\partial \alpha_b} < 0 \text{ and extremely large when } \phi_\pi \approx 1$$

Sketch of proof Intuition

Effects of transfer shocks: RANK-FTPL and HANK

Proposition: RANK-FTPL and in HANK have **identical analytical representations,** up to the persistence λ:

$$\begin{array}{lllll} t=0: & v_0 = \lambda_H & \pi_0 = \chi_\pi & y_0 = \chi_y & \text{jump on impact} \\ t \geq 1: & v_t = \lambda_H v_{t-1} & \pi_t = \lambda_H \pi_{t-1} & y_t = \lambda_H y_{t-1} & \text{dynamics} \end{array}$$

$$\chi_\pi = \frac{1}{\gamma} \frac{1-\alpha_b - \beta\lambda_H}{1-\beta\phi_\pi} \qquad \chi_y = \chi_\pi \cdot \frac{1-\beta\lambda_H}{\kappa}$$

and when $q < 1$, λ_H solves

$$\lambda_H = \frac{1}{\beta}(1-\alpha_b) + \frac{\gamma(\phi_\pi - \frac{1}{\beta})\frac{\kappa}{\beta^2}\chi(1-\alpha_b)}{{\lambda_H}^2 - \lambda_H\left(1+\frac{1}{\beta}+\frac{\kappa}{\beta}(1-\chi\gamma)\right)+\frac{\kappa}{\beta}\left(\phi_\pi(1-\chi\gamma)+\frac{1}{\kappa}+\frac{\chi\gamma}{\beta}\right)}.$$

HANK meets FTPL

RANK-FTPL and HANK have **identical representations** **up to the persistence λ.**

Corollary: When $\alpha_b = 0$ and $\phi_\pi = 1$,

$$\lambda_R = \lambda_H = 1$$

and thus the two models yield identical dynamic responses of all variables. (generalization of Angeletos et al. (2025)) Show λs

Fiscal shocks in HANK: shaped by monetary response

Proposition:

$$\underbrace{\frac{d\lambda_{HANK}}{d\phi_\pi} > 0}_{\substack{\text{persistence} \\ \text{increases in } \phi_\pi}} \qquad \underbrace{\frac{d\,\frac{\pi_t}{y_t}}{d\phi_\pi} > 0}_{\substack{\text{inflation-output} \\ \text{trade-off worse} \\ \text{with higher } \phi_\pi}}$$

Monetary policy shapes the persistence of the fiscal transfer shock

- Hawkish central bank $\rightarrow$ government debt persistently higher $\rightarrow$ demand boom more persistent
- Since $\pi_t = \kappa \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j y_{t+j}$, a more persistent demand boom adds to inflation
- This devalues nominal assets, making the boom smaller

Aggressive CB: Smaller and more persistent demand boom, and higher inflation.

Consensus amongst policy makers and most monetary economists:

1. **Paramount for the central bank to obey the Taylor Principle**.
   - Taylor principle shakes off indeterminacy.
2. **It's a good idea for monetary policy to be active, fiscal policy to be passive**.
   - Active MP means it obeys TP.
   - Passive FP means it is more stabilizing for debt dynamics than simply rolling it over.
3. **Monetary policy is and should be "independent"**.
   - Fiscal policy can *easily* mop up after monetary policy.
   - Deficits normally not a concern for MP apart from occasional unfunded plans.

Timing of the fiscal shock matters a lot in HANK

Same GBC as in RANK but deficits now impact on demand:

$$y_t = \mathbb{E}_t y_{t+1} - (i_t - \mathbb{E}_t \pi_{t+1}) + \chi (v_t - \gamma \mathbb{E}_t \pi_{t+1})$$

Increase in deficit today:

- Currently alive cohorts realize future generations will finance parts of it.
- Demand and output rise today.
- Output boom produces inflationary.

Increase in future deficit:

- Inflation rises in anticipation of future demand boom when prices are sticky.
- But currently alive cohorts may not be around when deficit rises.
- Demand and output fall today.

Anticipated future deficits can be both inflationary and recessionary