

Can Deficits Finance Themselves?

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will get some “**self-financing**”: deficit today \rightarrow demand boom \rightarrow **tax base** \uparrow , **inflation** \uparrow
- **Result**: if fiscal adjustment is sufficiently *delayed*, then all financing is **self-financing**
Split depends on nominal rigidities. All via output/tax base \uparrow if rigid, all via prices \uparrow if flexible.

Environment

Non-policy block

- **Aggregate demand**

- Unit continuum of OLG households with survival probability $\omega \in (0, 1]$. Nests standard PIH model with $\omega = 1$, and mimics HANK with $\omega < 1$. Implies $\beta(1 + \bar{r}) = 1$, so $\bar{r} > 0 = g$.

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- Optimal consumption-savings behavior yields aggregate demand relation: [► Details](#)

$$c_t = \underbrace{(1 - \beta\omega)}_{\text{MPC}} \times \left(\underbrace{d_t}_{\text{wealth}} + \underbrace{\mathbb{E}_t \left[\sum_{k=0}^{\infty} (\beta\omega)^k (y_{t+k} - t_{t+k}) \right]}_{\text{post-tax income}} - \underbrace{\gamma \mathbb{E}_t \left[\sum_{k=0}^{\infty} (\beta\omega)^k r_{t+k} \right]}_{\text{real rates}} \right) \quad (1)$$

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Key features: (i) elevated MPC + (ii) add'l discounting of future income & taxes

• Aggregate supply

- Standard labor supply + nominal rigidities + lump-sum taxes yields NKPC [Details](#)

$$\pi_t = \kappa y_t + \beta \mathbb{E}_t [\pi_{t+1}] \quad (2)$$

- **Monetary policy**

- Set rate on 1-period bonds. Let ϕ index the cyclicalness of the implied real rate:

$$\underbrace{i_t - \mathbb{E}_t[\pi_{t+1}]}_{\equiv r_t} = \phi \times y_t \quad (3)$$

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- Taxes [lump-sum] adjust **gradually** to balance gov't budget, where τ_d parameterizes **delay**:

$$t_t = \underbrace{\tau_d \times (d_t + \varepsilon_t)}_{\text{fiscal adjustment}} + \underbrace{\tau_y y_t}_{\text{tax base financing}} - \underbrace{\varepsilon_t}_{\text{“stimulus checks”}} \quad (5)$$

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For transparent intuition look at H -rule: $\tau_{d,t} = 0$ initially, then = 1 after H , giving $d_{H+1} = 0$.

Equilibrium & sources of financing

- Eq'm existence & uniqueness ▶ Full eq'm characterization

Proposition

Suppose that $\omega < 1$ and $\tau_y > 0$. The economy (1) - (5) has a unique bounded eq'm.

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Suppose that $\omega < 1$ and $\tau_y > 0$. The economy (1) - (5) has a unique bounded eq'm.

- Our **Q**: how are fiscal deficits in this eq'm financed?
 - From the intertemporal gov't budget constraint:

$$\underbrace{\varepsilon_0}_{\text{deficit}} = \underbrace{\tau_d \times \left(\varepsilon_0 + \sum_{k=0}^{\infty} \beta^k \mathbb{E}_0(d_k) \right)}_{\text{fiscal adjustment: } (1 - \nu) \times \varepsilon_0} + \underbrace{\frac{\bar{d}}{\bar{y}} (\pi_0 - \mathbb{E}_{-1}(\pi_0)) + \sum_{k=0}^{\infty} \beta^k \tau_y \mathbb{E}_0(y_k)}_{\text{self-financing: } \nu \times \varepsilon_0}$$

$\overbrace{\hspace{15em}}^{p \text{ self-financing}}$ $\overbrace{\hspace{15em}}^{y \text{ self-financing}}$

- Next: characterize ν as a function of fiscal adjustment delay (τ_d or H)

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1. **[Monotonicity]** It is increasing in the delay of fiscal adjustment (i.e., it is increasing in H and decreasing in τ_d).
2. **[Limit]** As fiscal financing is delayed more and more (i.e., as $H \rightarrow \infty$ or $\tau_d \rightarrow 0$), ν converges to 1. In words, delaying the tax hike makes it vanish.

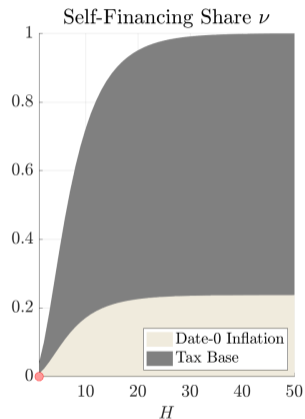
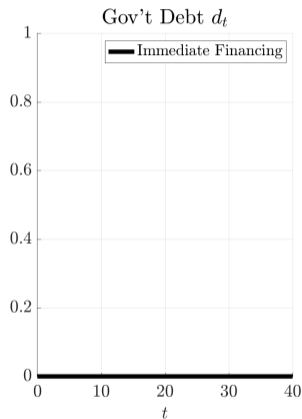
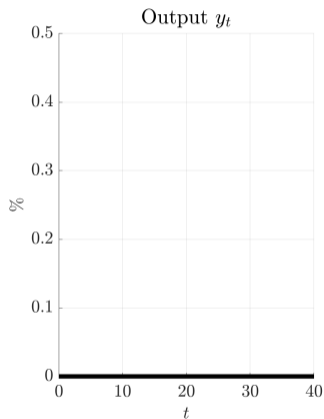
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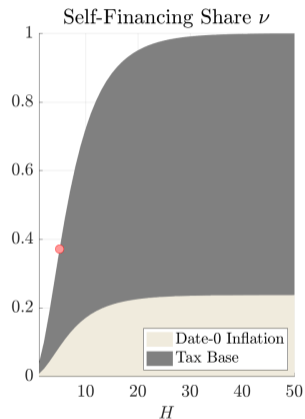
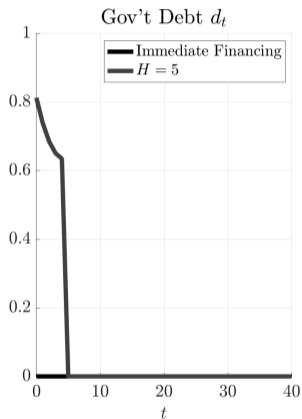
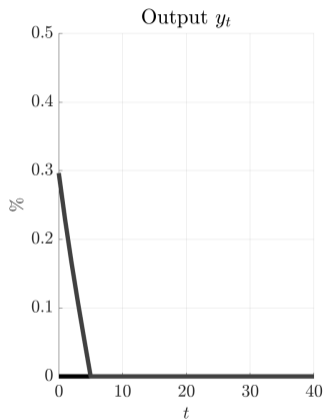
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2. **[Limit]** As fiscal financing is delayed more and more (i.e., as $H \rightarrow \infty$ or $\tau_d \rightarrow 0$), ν converges to 1. In words, delaying the tax hike makes it vanish. In this limiting eq'm:
 - a) Gov't debt returns to steady state even without any fiscal adjustment.
 - b) The share of self-financing coming from the tax base expansion is increasing in the strength of nominal rigidities. With rigid prices the cumulative output multiplier is $\frac{1}{\tau_y}$.

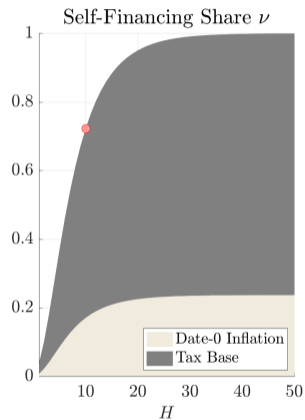
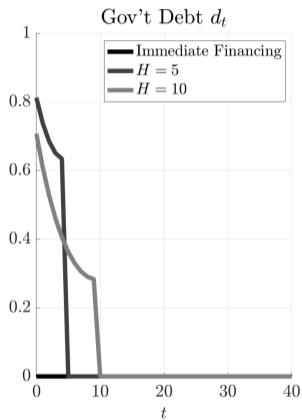
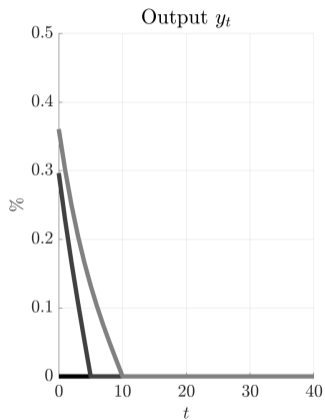
A graphical illustration



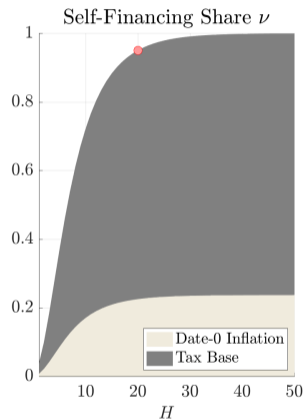
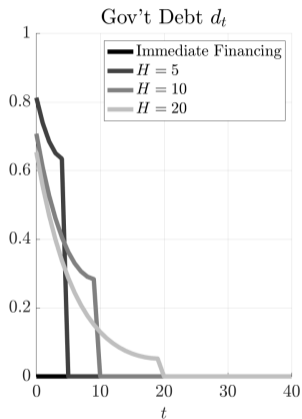
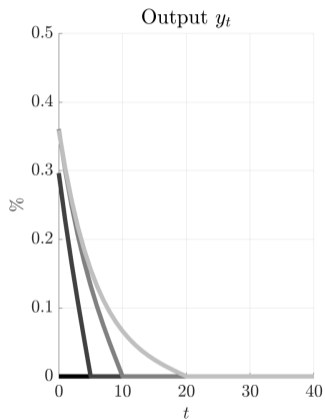
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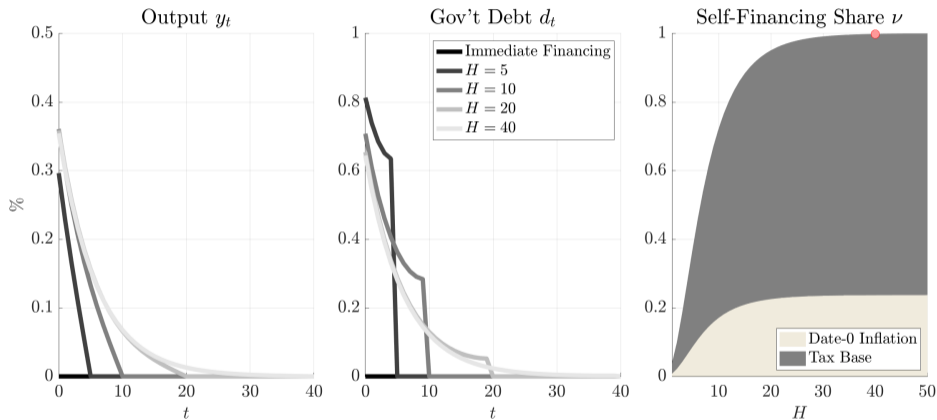
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if **fiscal adjustment** is delayed, then financing will come via eq'm **prices & quantities**

Economic intuition

- Background: self-financing in a “static” Keynesian cross w/ our tax base channel
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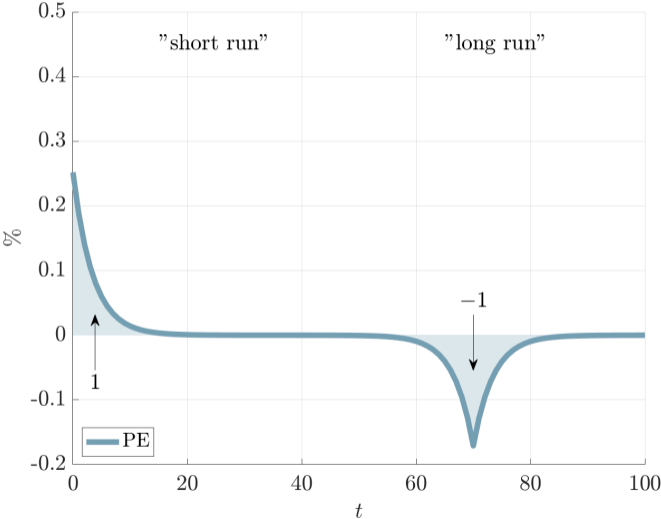
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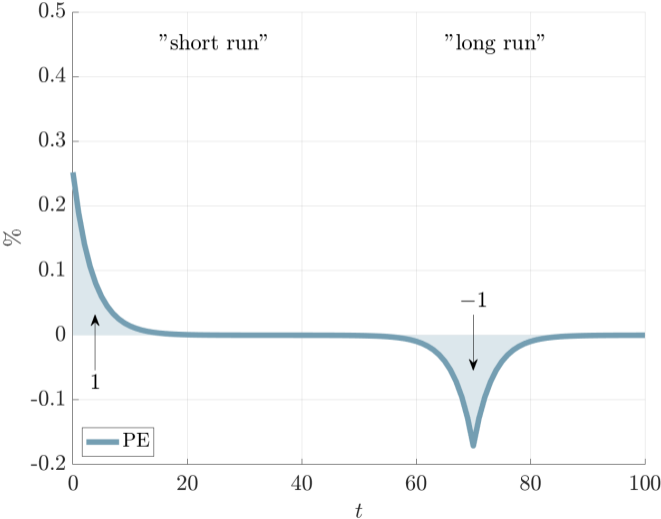
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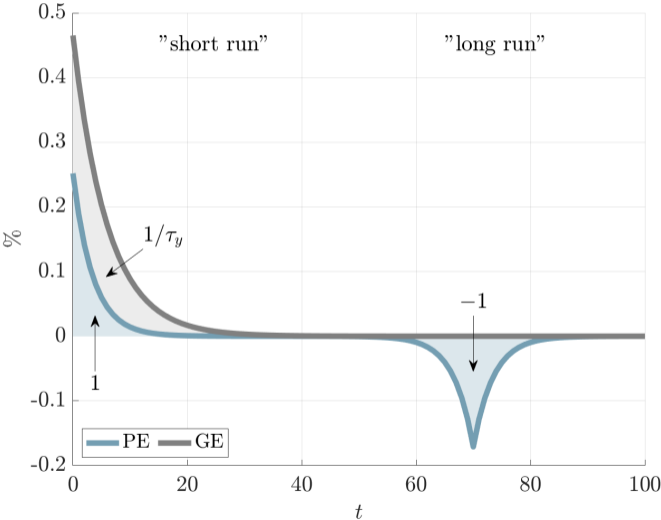
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With imperfectly rigid prices: boom partially leaks into **prices** instead of **quantities**.

Practical Relevance

Extensions & generality

1. Policy [▶ Details](#)

- Fiscal policy: distortionary taxes, gov't purchases
- **Monetary response**
 - Intuition: $\phi < 0$ accelerates the Keynesian cross, $\phi > 0$ delays it
 - Length of eq'm boom is increasing in ϕ . Full self-financing as long as ϕ is not too big.

2. Economic environment [▶ Details](#)

- Rest of the economy: different NKPC, wage rigidity, investment
- **Demand relation**
 - Need discounting—break Ricardian equivalence + front-load spending.
 - Same result (numerically) in HANK. Why? OLG AD f'n \approx HANK AD f'n. [Wolf (2023)]

Self-financing in the quantitative model

Environment: match evidence on dynamic (tail) MPCs + speed of fiscal adjustment

Rest of model: flat NKPC + acyclical real rate, consistent with pre-covid empirical evidence.

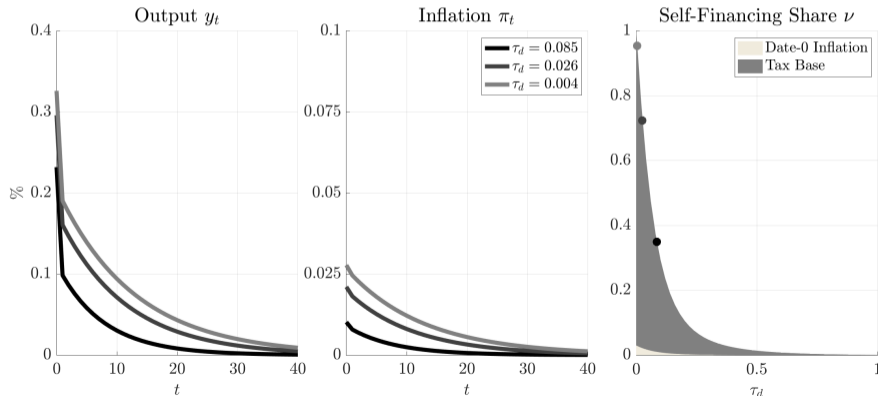
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- **Implications**
 - a) **Theory:** grounded in classical failure of Ricardian equivalence + emphasize y vs. p vs. FTPL: no discontinuity in adjustment horizon. Delayed adjustment = never adjust. [▶ Details](#)
 - b) **Practice:** self-sustaining stimulus may be less implausible than commonly believed
In particular if supply constraints are slack—get self-financing via protracted output boom.

Thank you!

Appendix

Aggregate demand

- **Consumption-savings problem**

- OLG hh's with survival probability $\omega \in (0, 1]$ [can interpret as ≈ 1 - prob. of liq. constraint]

$$\mathbb{E}_t \left[\sum_{k=0}^{\infty} (\beta\omega)^k [u(C_{i,t+k}) - v(L_{i,t+k})] \right]$$

- Invest in actuarially fair annuities. Budget constraint:

$$A_{i,t+1} = \underbrace{\frac{l_t}{\omega}}_{\text{annuity}} (A_{i,t} + P_t \cdot \underbrace{(W_t L_{i,t} + Q_{i,t} - C_{i,t} - T_{i,t} + \text{transfer to newborns})}_{Y_{i,t}})$$

- **Aggregate demand relation**

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Key features: (i) elevated MPC + (ii) add'l discounting of future income & taxes

Aggregate supply

- **Unions** equalize post-tax wage and average consumption-labor MRS. This gives

$$(1 - \tau_y)W_t = \frac{\chi \int_0^1 L_{i,t}^{\frac{1}{\varphi}} di}{\int_0^1 C_{i,t}^{-1/\sigma} di}$$

Log-linearizing:

$$\frac{1}{\varphi} \ell_t = w_t - \frac{1}{\sigma} c_t$$

- Combining with optimal firm pricing decisions we get the **NKPC**:

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

- Note: no time-varying wedge since distortionary taxes τ_y are fixed

Equilibrium characterization

- First step to eq'm characterization is a more concise representation of agg. demand
- Combining (1), (3), (4), (5), and output market-clearing, we get

$$y_t = \mathcal{F}_1 \cdot (d_t + \varepsilon_t) + \mathcal{F}_2 \cdot \mathbb{E}_t \left[\sum_{k=0}^{\infty} (\beta\omega)^k y_{t+k} \right] \quad (7)$$

- Here: $\mathcal{F}_1 \equiv \frac{(1-\beta\omega)(1-\omega)(1-\tau_d)}{1-\omega(1-\tau_d)}$ and $\mathcal{F}_2 = (1 - \beta\omega) \left(1 - \frac{(1-\omega)\tau_y}{1-\omega(1-\tau_d)} \right)$
 - Note: $\mathcal{F}_1 = 0$ if $\omega = 1$ —reflects lack of direct effect of deficit on consumer spending/aggregate demand under Ricardian equivalence
- Equilibrium: (2), (7) and law of motion for government debt

Equilibrium characterization

- We will look for **bounded equilibria** in the sense of Blanchard-Kahn
 - Note: in our case—with $\omega < 1$ and $\tau_y > 0$ —this is enough to rule out sunspot solutions. Recover same eq'm through limit $\phi \rightarrow 0^+$.
- The unique bounded eq'm takes a particularly simple form:

$$y_t = \chi(d_t + \varepsilon_t), \quad \mathbb{E}_t[d_{t+1}] = \rho_d(d_t + \varepsilon_t)$$

where $\chi > 0$ (deficits trigger boom) and $0 < \rho_d < 1$ (debt goes back to steady state).

▶ back

Relation to classical FTPL

Only difference in non-policy block is **non-PIH consumers**. How does that change things?

- Key implication: can get “**self-financing**” with *conventional* policy mix
 - Recall: fiscal policy is “Ricardian” in the usual sense + Taylor principle is satisfied
 - This takes care of some of the literature’s **conceptual concerns** with the classical FTPL:
 - a) No need for fiscal authority to *never* adjust. A *finite* delay is enough.
 - b) Not vulnerable to behavioral frictions that complicate coordination [Angeletos-Lian]
- Secondary insight: focus attention away from **prices** and on **tax base channel**
Robust insight is that eq’m outcomes adjust to finance the deficit—not whether it’s prices or quantities.

▶ back

Distortionary fiscal financing

- **Environment**

- **Fiscal adjustment** now instead through distortionary tax adjustments. Specifically:

$$\tau_{y,t} = \tau_y + \tau_{d,t}(D_t - D^{SS})$$

- Only effect is to change (2) to

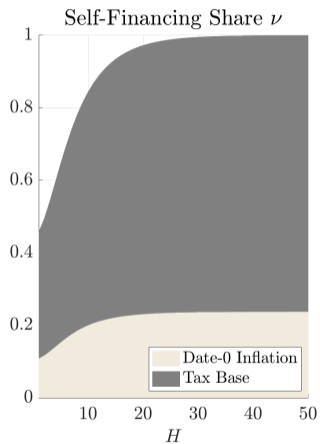
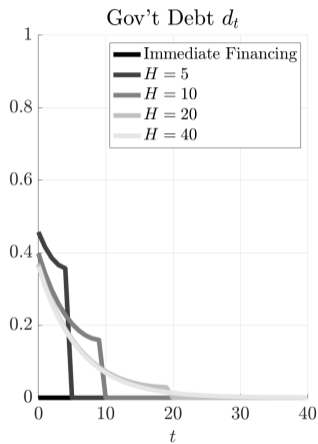
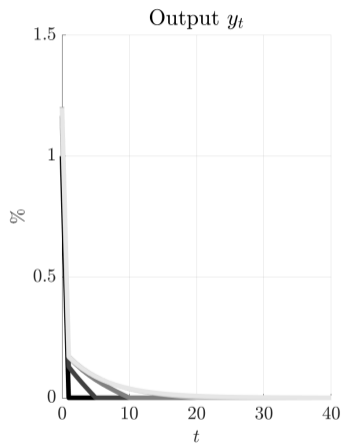
$$\pi_t = \kappa y_t + \beta \mathbb{E}_t [\pi_{t+1}] + \zeta_t d_t$$

- **Self-financing result**

- Easy to see: exactly the same limiting self-financing eq'm as before
- Why? tax adjustment not necessary, so distortionary vs non-distortionary is irrelevant

▶ back

Government purchases



Monetary policy reaction

- **Intuition:** $\phi < 0$ accelerates the Keynesian cross, $\phi > 0$ delays it

Proposition

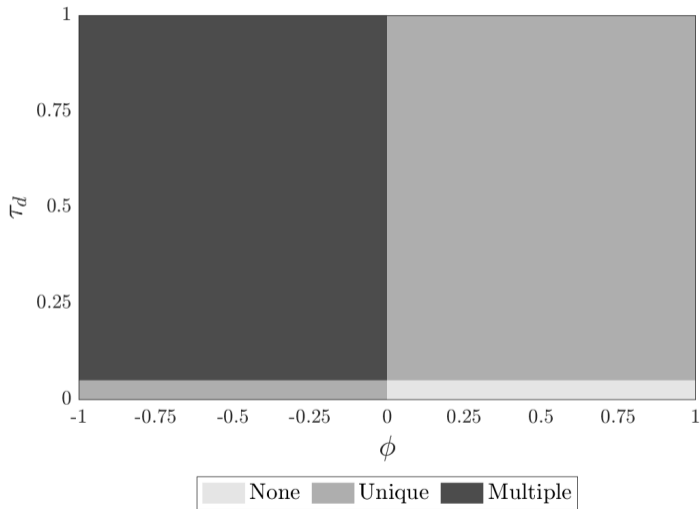
There exists a $\bar{\phi} > 0$ such that:

1. An equilibrium with **full self-financing** exists if and only if $\phi < \bar{\phi}$.
2. The persistence of $\rho_d(\phi)$ of gov't debt (and output) in the equilibrium with full self-financing is increasing in ϕ , with $\rho_d(0) \in (0, 1)$ and $\rho_d(\bar{\phi}) = 1$.

Note: same logic for standard Taylor-type rules like $i_t = \phi \times \pi_t$.

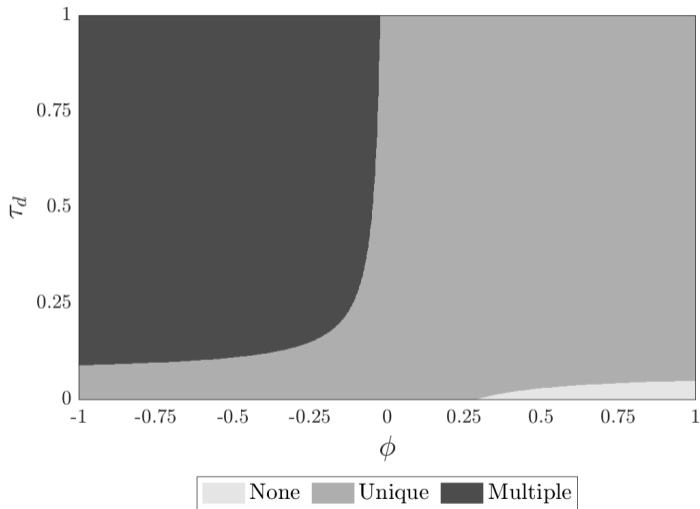
- What happens if $\phi > \bar{\phi}$? Depends on **fiscal adjustment**:
 - If too delayed then no bounded eq'm exists. For such an aggressive monetary policy **fiscal adjustment** needs to be *fast enough*.
 - If adjustment is fast enough then there is **partial** but not **complete self-financing**.

Leeper regions



▶ back

Leeper regions



▶ back

A generalized aggregate demand relation

- **Important:** our results are *not* tied to the particular **OLG** microfoundations
- Instead: it's all about two empirically plausible features of **consumer demand**
 1. *Discounting:* households at date $t = 0$ respond little to expectations of far-ahead tax hikes
 2. *Front-loaded spending:* transfer receipt (and higher-order GE income) is spent quickly

⏟
in **OLG** both of these are ensured by $\omega < 1$
- Will formalize this using the following **generalized AD relation:**

$$c_t = M_d d_t + M_y \left(y_t - t_t + \delta \mathbb{E}_t \left[\sum_{k=0}^{\infty} (\beta \omega)^k (y_{t+k} - t_{t+k}) \right] \right)$$

Rich enough to nest PIH, OLG, spender-saver, spender-OLG, behavioral discounting, Also can provide very close reduced-form fit to consumer behavior in quantitative HANK models.

A generalized aggregate demand relation

- **Headline result:** sufficient conditions for **self-financing**

A1 Discounting

$$\omega < 1$$

Transfer today and taxes in the future redistribute from future generations to the present.

A2 Front-loading

$$M_d + \frac{1 - \beta}{\tau_y} (1 - \tau_y) M_y \left(1 + \delta \frac{\beta \omega}{1 - \beta \omega} \right) > \frac{1 - \beta}{\tau_y}$$

Self-financing boom is front-loaded enough to deliver $\rho_d < 1$.

- Note: the self-financing result *fails* if there are **PIH households**

“Deep-pocket” rational investor intuition—infinately elastic PIH hh’s link infinite future & present.

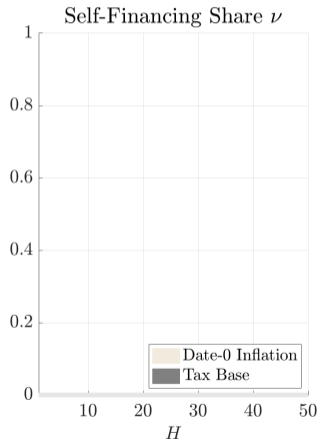
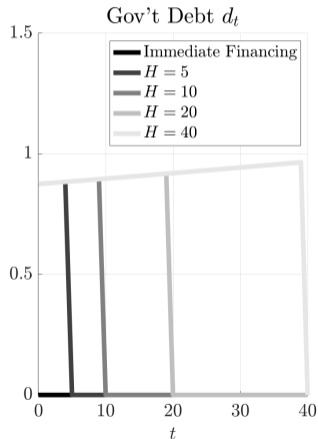
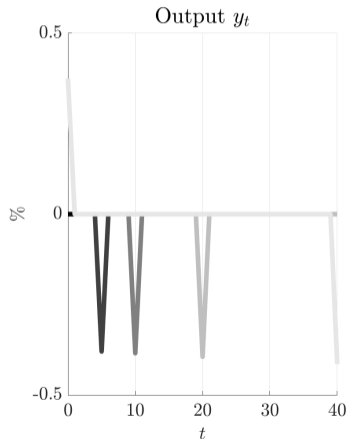
▶ back

Adding permanent-income consumers

- Adding a margin of **PIH consumers** connects the present with the (infinite) future
 - Implication: policy at H invariably affects short-run, for any H . No more separation.
 - With our baseline policy ($\phi = 0$, uniform taxes): invariably get $\nu = 0$, since otherwise PIH consumption would be permanently away from steady state
- Is this a practically relevant consideration? **Not really:**
 1. Result driven by extreme feature of PIH model: **infinite elasticity of hh asset demand**
 - In multi-type OLG model: self-financing th'm applies iff interest rate elasticity is finite
 - Quantitative analysis [incl. HANK]: finite elasticity, obtain self-financing
 2. **Other policy mixes** at H deliver smoothness of ν in PIH share
 - Alternatives at H : MP stabilizes the bust around H , or date- H taxes only on PIH consumers
 - Then ν is continuous in PIH share θ : $\nu \rightarrow \frac{\tau_y(1-\theta)}{1-(1-\tau_y)(1-\theta)} < 1$

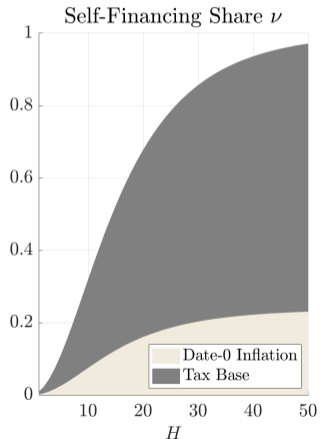
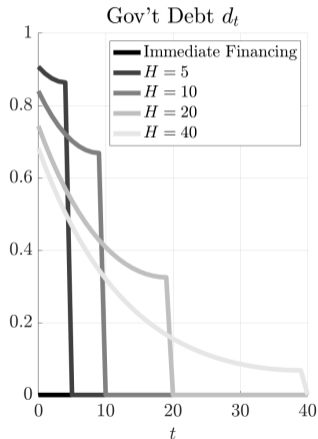
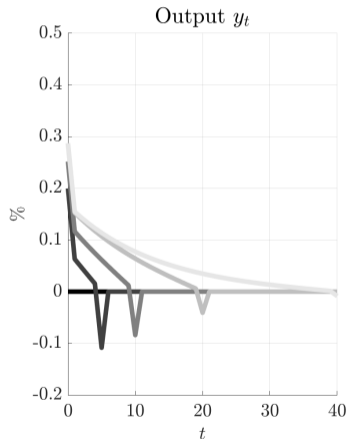
The importance of discounting

spender-saver model



The importance of discounting

hybrid spender-OLG model



Adding investment

- **Environment**

- **Households:** receive labor income plus dividends e_t . Pay taxes τ_y on both.
- **Production:** standard DSGE production block. Key twist: no tax payments anywhere.

- **Self-financing result**

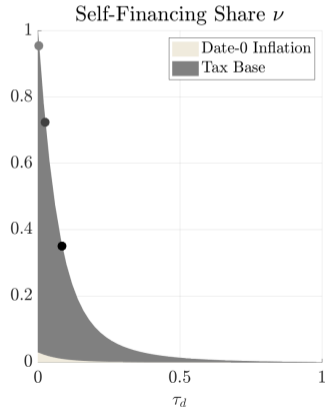
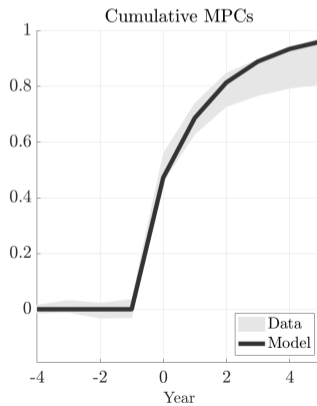
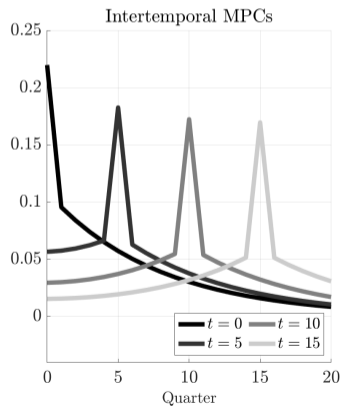
- For rigid prices exactly the same self-financing eq'm as before. Why? Keynesian cross & gov't budget both have c_t rather than y_t in them, so same pair of equations as before
- Partially sticky prices: more complicated mapping from $\{c_t\}_{t=0}^{\infty}$ back to π_0 , so fixed point is more complicated, but can still show that self-financing eq'm exists
Perfectly analogous to change in NKPC. Just change mapping into π_0 .

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Alternative calibration strategies

Baseline: match impact and short-run MPCs, then extrapolate

Note: also consistent with evidence on long-run elasticity of asset supply.

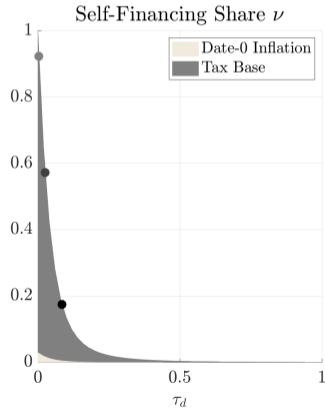
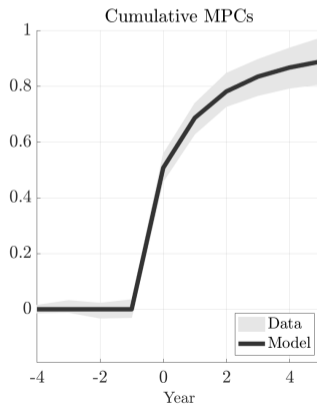
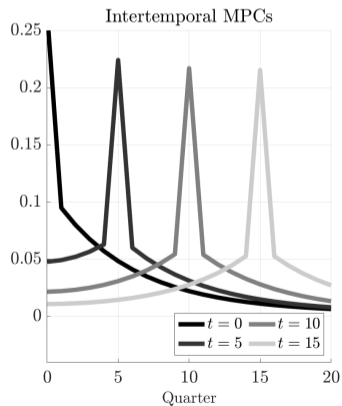


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Alternative calibration strategies

Extension: two-type OLG + spender model to match cumulative MPC time profile

This gives $\omega_2 = 0.97$, and thus counterfactually elastic asset supply ($\approx 7\times$ emp. upper bound).

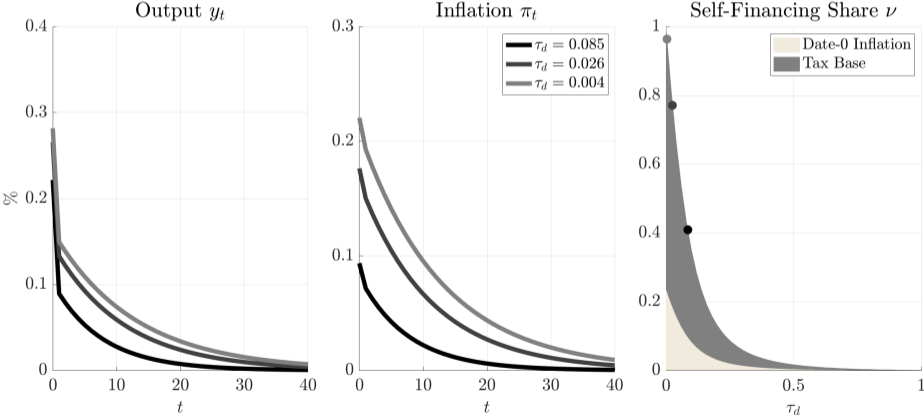


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More flexible prices

Steeper NKPC: arguably more informative about post-covid episode

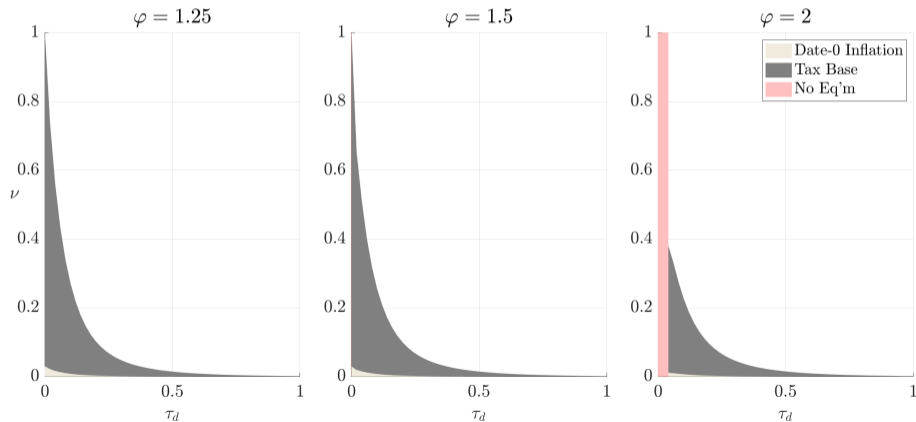
Takeaways: (i) change ν_y/ν_p split & (ii) faster convergence to self-financing limit



Active monetary policy reaction

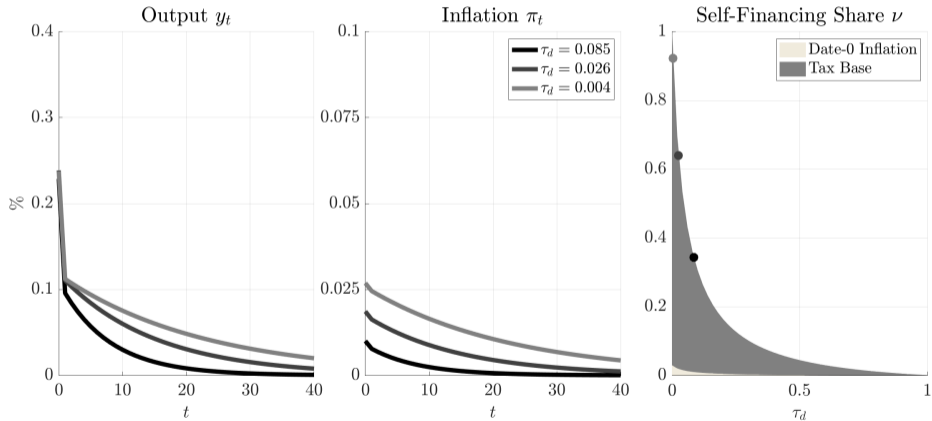
Monetary response: consider standard Taylor rule $i_t = \phi \times \pi_t$

Takeaways: (i) slower convergence & (ii) no self-financing eq'm exists for sufficiently large ϕ



Other models

Environment: baseline + behavioral friction [strong cognitive discounting]



Other models

Environment: HANK model [similar to Wolf (2023)]

