Can Deficits Finance Themselves?

George-Marios Angeletos\textsuperscript{1}  Chen Lian\textsuperscript{2}  Christian Wolf\textsuperscript{3}

\textsuperscript{1}Northwestern and NBER
\textsuperscript{2}UC Berkeley and NBER
\textsuperscript{3}MIT and NBER

March 24, 2023
How Are Deficits Financed? \( [r > g] \)

\[
\frac{B_0}{P_0} = \text{PV of Surpluses} = f(\text{tax rate} \times \text{tax base}, \ldots)
\]

Basic answer: **Fiscal adjustment**: raise tax rate in the future

This paper: **Self-financing** with finite lives/liquidity constraints [HANK, OLG, ...]

- Deficit \( \Rightarrow \) Keynesian boom \( \Rightarrow \) tax base \( \uparrow \) and debt erosion \( (P_0 \uparrow) \)
  - improve budget without tax rate/spending adjustment
- Q: How important is such **self-financing**? can there ever be full self-financing?
**Environment:** finite lives/liquidity constraints + nominal rigidities
Policy: full *fiscal adjustment* promised at future date $H$ + monetary policy “neutral” (fix $\mathbb{E}[r]$)

- **Main result:** complete *self-financing* by delaying *fiscal adjustment*
  - *Monotonicity:* as $H$ increases, the actual required future tax hike gets smaller and smaller
  - *Limit:* the future tax hike vanishes, i.e., we converge to full self-financing
  - *Split* depends on price rigidities. [All via tax base ↑ if rigid, all via prices ↑ if approx. flexible.]
How Big Can “Self-financing” Be?

Environment: finite lives/liquidity constraints + nominal rigidities
Policy: full fiscal adjustment promised at future date $H$ + monetary policy “neutral” (fix $\mathbb{E}[r]$)

Main result: complete self-financing by delaying fiscal adjustment
- Monotonicity: as $H$ increases, the actual required future tax hike gets smaller and smaller
- Limit: the future tax hike vanishes, i.e., we converge to full self-financing
- Split depends on price rigidities. [All via tax base ↑ if rigid, all via prices ↑ if approx. flexible.]

Intuition: finite-lives/liq. constraints: “discount” far-future tax & front-loaded Keynesian cross

Difference from FTPL: not by the force of eq’m selection
[no threat to violate government budget]

Practical relevance: holds in many environments & quantitatively powerful
[general AD (incl. HANK), active monetary policy, investment, distortionary taxation, …]
Outline

1 Environment: OLG-NK
2 Equilibrium Characterization
3 Self-financing of Fiscal Deficits
4 Extensions & Generality
5 Conclusion
Households and Firms

**Perpetual youth** consumers with survival rate $\omega$ [$\omega = 1$: RANK; $\omega < 1$: proxy for HANK, later]

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

- Invests in actuarially fair annuities [transfer to newborns: all cohorts have same $C$ in steady state].

$$A_{i,t+1} = \left( \frac{l_t}{\omega} \right) \left( A_{i,t} + P_t \cdot \left( W_t L_{i,t} + Q_{i,t} - C_{i,t} - T_{i,t} + \text{Transfer to Newborns} \right) \right)$$

- Abstract from income heterogeneity: $Y_{i,t} = Y_t$ and $T_{i,t} = \mathcal{T}_t(Y_{i,t}) = T_t$ [Details]

- Key features with $\omega < 1$ [(i) elevated MPC + (ii) discounting future income & taxes, breaking Ricardian Equiv.]

Firms as in textbook NK model: **standard NKPC** [in log: $\pi_t = \kappa y_t + \beta \mathbb{E}[\pi_{t+1}]$]
Policy, Market Clearing, and Log-Linearization

- **Government budget** [no \( G_t, T_t \) is the primary surplus]

\[
\frac{1}{l_t}B_{t+1} = B_t - P_t T_t \quad \text{(plus no Ponzi)}
\]

and define \( D_t = B_t / P_t \) as **real value** of public debt outstanding.

- **Market clearing**

\[
Y_t = \int C_{i,t} \, di \quad \text{and} \quad \int A_{i,t} \, di = B_t.
\]

- **Initial condition**

\[
A_{i,0} = B_0.
\]

- **Log-linearization**: a lower case capture log-deviations from steady state

[with the exception of fiscal variables, e.g., \( d_t = \frac{d_t - D_{ss}}{Y_{ss}} \), to accommodate \( D_{ss} = 0 \)]
Monetary Policy

- **Baseline:** no monetary accommodation [expected real rate in variant to debt & deficit]

  \[ r_t \equiv i_t - E_t[\pi_{t+1}] = 0 \]

- **Extension:** different degrees of monetary accommodation

  \[ r_t = \phi y_t \]
  
  - \( \phi < 0 \): an “accommodative” monetary authority
  - \( \phi > 0 \): leans against the wind
Fiscal Policy

- **Baseline:** Markovian Fiscal Policy [extension of Leeper (1991)]

\[ T_{i,t} = T_t = \bar{T} + \tau_d (D_t + \varepsilon_t) + \tau_y Y_{i,t} - \varepsilon_t, \]

or after (log-)linearization

\[ t_{i,t} = t_t = \tau_d \cdot (d_t + \varepsilon_t) + \tau_y y_t - \varepsilon_t \]

- \( \tau_d \in [0,1] \): a lower \( \tau_d \) captures **delay in fiscal adjustment**
- \( \tau_y > 0 \): self financing through endogenous **adjustment in tax base**

- **Variant:** a Non-Markovian FP with **delayed full fiscal adjustment**

\[ t_t = \begin{cases} \tau_y y_t - \varepsilon_t & t < H \text{ initially no fiscal adjustment} \\ d_t & t \geq H \text{ eventually full fiscal adjustment} \end{cases} \]

- High \( H \), similar to low \( \tau_d \), captures **delay in fiscal adjustment**
Outline

1 Environment: OLG-NK
2 Equilibrium Characterization
3 Self-financing of Fiscal Deficits
4 Extensions & Generality
5 Conclusion
Aggregate Demand

- **Optimal consumption + aggregation** 
  \[ \gamma = \sigma \beta \omega - (1 - \beta \omega) \beta \frac{D^{ss}}{Y^{ss}} \]
  \[ c_t = (1 - \beta \omega) \times \left( at \right)_{\text{MPC}} + \left( \text{wealth} \times \text{post-tax income} \right)_{\text{wealth}} + \left( \text{wealth} \times \text{real rates} \right)_{\text{wealth}} \]

- Using monetary, fiscal policy and market clearing

  \[ y_t = \mathcal{F}_1 \cdot (d_t + \varepsilon_t) + \mathcal{F}_2 \cdot E_t \left[ \sum_{k=0}^{+\infty} (\beta \omega)^k y_{t+k} \right], \quad (3) \]

  with \( \mathcal{F}_1 = \frac{(1-\beta\omega)(1-\omega)(1-\tau_d)}{1-\omega(1-\tau_d)} \) and \( \mathcal{F}_2 = (1 - \beta \omega) \left( 1 - \tau_y \frac{1-\omega}{1-\omega(1-\tau_d)} \right) \).

  - \( \mathcal{F}_1 \) captures **PE effect** of debt/deficits on AD
    - \( \mathcal{F}_1 > 0 \) iff \( \omega < 1 \) (failure of Ricardian Equiv)
    - deficits are transfer from future generations to current generations

  - \( \mathcal{F}_2 \) captures **GE effect** through **intertemporal Keynesian cross**
    - jointly governed by FP (\( \tau_d \) and \( \tau_y \)), and MPC (\( \omega \))
The economy in 3 equations

1. AD:

\[ y_t = \varphi_1 \cdot (d_t + \varepsilon_t) + \varphi_2 \cdot \mathbb{E}_t \sum_{k=0}^{+\infty} (\beta \omega)^k y_{t+k}, \]

2. AS:

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

3. Evolution of real value of public debt:

\[ d_{t+1} = \beta^{-1} (d_t - t_t) - \frac{D^{ss}}{Y^{ss}} (\pi_{t+1} - \mathbb{E}_t [\pi_{t+1}]) \]

self financing: debt erosion

\[ \text{with} \quad t_t = \tau_d \cdot (d_t + \varepsilon_t) + \tau_y y_t - \varepsilon_t \]

fiscal adjustment self financing: tax base
Equilibrium Existence and Uniqueness

Theorem

Let $\omega < 1$ and $\tau_y > 0$. There exists unique bounded eq’m taking the form:

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

Moreover, $\chi > 0$ (deficits trigger boom) and $0 < \rho_d < 1$ (debt converges to steady state).

- Finding the equilibrium: fixed-point relation $\rho_d \leftrightarrow \chi$
  - $\chi \rightarrow \rho_d$ follows from the evolution of real value of public debt:

$$\rho_d = \frac{1}{\beta} (1 - \tau_d - \tau_y \chi)$$

  - $\rho_d \rightarrow \chi$ follows from the aggregate demand/IKC

$$\chi = \frac{F_1}{1 - F_2 / (1 - \beta \omega \rho_d)}$$
Outline

1. Environment: OLG-NK
2. Equilibrium Characterization
3. Self-financing of Fiscal Deficits
4. Extensions & Generality
5. Conclusion
Channels of Self Financing

- Start with $d_0 = 0$ (steady state) and consider $\varepsilon_0 > 0$ (MIT positive deficit shock)
- Gov’s intertemporal budget constraint $\Rightarrow$

$$
\varepsilon_0 = \tau_d \left( \varepsilon_0 + \sum_{k=0}^{+\infty} \beta^k E_0 [d_k] \right) + \frac{D^{ss}}{Y^{ss}} (\pi_0 - E_{-1} [\pi_0]) + \sum_{k=0}^{+\infty} \tau_y \beta^k E_0 [y_k]$$

- debt erosion $\equiv v_p \varepsilon_0$
- tax base $\equiv v_y \varepsilon_0$
- fiscal adjustment $\equiv (1 - v)\varepsilon_0$
- self-financing $\equiv v \varepsilon_0$

where $v \equiv$ fraction of deficit that is self-financed, contrast with fiscal adjustment.

- RANK benchmark ($\omega = 1$)
  1. Standard eq’m ($\phi \to 0^+$): zero self financing, $v = 0$
  2. FTPL: full self financing $v = 1$ through the force of eq’m selection
     [non-Ricardian FP, threat to violate government budget]

- Now ($\omega < 1$): **Full self financing** with delayed fiscal adjustment $[\tau_d \to 0$ or $H \to +\infty]$
The Self Financing Result

**Theorem**

Suppose that $\omega < 1$ and $\tau_y > 0$.

- **[Monotonicity]** Self-financing share $\nu$ increases in the **delay of fiscal adjustment** (i.e., it is increasing in $H$ and decreasing in $\tau_d$).
The Self Financing Result

Theorem

Suppose that $\omega < 1$ and $\tau_y > 0$.

1. **[Monotonicity]** Self-financing share $\nu$ increases in the delay of fiscal adjustment (i.e., it is increasing in $H$ and decreasing in $\tau_d$).

2. **[Limit]** As fiscal financing is delayed further (i.e., as $H \to \infty$ or $\tau_d \to 0$), there is complete self financing: $\nu$ converges to 1.
   - In this limit, self-financing is strong enough to return $d$ to SS without any fiscal adjustment.
     
     $[\tau_d \to 0 : \lim_{k \to \infty} E_t [d_{t+k}] \to 0; H \to \infty : \lim_{H \to \infty} E_0 [d_H] \to 0]$
A Graphical Illustration \[ t_t = \tau y_t - \varepsilon t \text{ for } t < H \text{ and } t_t = d_t \text{ for } t \geq H \]
A Graphical Illustration \[ t_t = \tau_y y_t - \varepsilon_t \text{ for } t < H \text{ and } t_t = d_t \text{ for } t \geq H \]
A Graphical Illustration \[ t_t = \tau_y y_t - \varepsilon_t \text{ for } t < H \text{ and } t_t = d_t \text{ for } t \geq H \]
A Graphical Illustration \[ t_t = \tau_y y_t - \varepsilon_t \text{ for } t < H \text{ and } t_t = d_t \text{ for } t \geq H \]
A Graphical Illustration \[ t_t = \tau_y y_t - \varepsilon_t \text{ for } t < H \text{ and } t_t = d_t \text{ for } t \geq H \]
A Graphical Illustration \[ t_t = \tau_d (d_t + \varepsilon_t) + \tau_y y_t - \varepsilon_t \]
Economic Intuition [Fully Rigid Price, \( \kappa = 0 \)]

- To illustrate consider the **total adj. of tax base** from static Keynesian cross

\[
c = \text{MPC} \cdot y_{\text{disp}} \quad \text{and} \quad y_{\text{disp}} = (1 - \tau_y)y + \varepsilon \implies y = \frac{\text{MPC}}{1 - (1 - \tau_y)\text{MPC}} \times \varepsilon
\]

- $1$ increase in transfer leads to $\text{MPC}$ increase in AD
- $1$ increase in AD leads to $(1 - \tau_y)$ GE increase in post-tax income
- $(1 - \tau_y)$ increase in post-tax income lead to $\text{MPC} \times (1 - \tau_y)$ increase in AD

- **Self-financing** through tax base adjustment: \( \nu \equiv \frac{\tau_y y}{\varepsilon} = \frac{\tau_y \text{MPC}}{1 - (1 - \tau_y)\text{MPC}} \) is increasing in the MPC
- future tax hike needed: \( R(1 - \nu)\varepsilon \)

- **Full self-financing** would require \( \text{MPC} = 1 \), giving \( y = \frac{1}{\tau_y} \times \varepsilon \).

[Hint: Dynamic: cumulative \( \text{MPC} = 1 \)]
Our th’m: features of static model have analogues in dynamic economy

1. Static: expected “future” tax hike does not affect “current” spending behavior
   \[\Rightarrow\text{ Dynamic: discount (}\omega < 1) \Rightarrow \text{ far future } H\text{-tax’s impact on short-run consumption vanishes}\]

   [IKC matrix: income change at \(t + \ell\) has a vanishing effect on \(t\) consumption: \(\lim_{\ell \to \infty} \beta^{-\ell} M_{t,t+\ell} = 0\)]
Economic Intuition \[ \kappa = 0, \text{ PE effect of tax-and-transfer vector } \mathcal{M} \cdot t^{PE}, \text{ with } t^{PE} = (-1, \cdots, \beta^{-H}) \]
Economic Intuition  [Fully Rigid Price, $\kappa = 0$]

Our th’m: features of static model have analogues in dynamic economy

1. Static: expected “future” tax hike does not affect “current” spending behavior
   $\implies$ Dynamic: discount $(\omega < 1) \implies$ far future $H$-tax’s impact on short-run consumption vanishes
   [IKC matrix: income change at $t + \ell$ has a vanishing effect on $t$ consumption: $\lim_{\ell \to \infty} \beta^{-\ell} M_{t,t+\ell} = 0$]

2. Static: “current” transfer & additional GE income are fully spent currently ($MPC \to 1$)
   $\implies$ Dynamic: front-loaded MPCs $(\omega < 1) \implies$ cumulative short-run MPCs approach 1 far before $H$
   [IKC matrix: income change at $t + \ell$ has a vanishing effect on $t$ consumption: $\lim_{\ell \to \infty} \beta^{-\ell} M_{t,t+\ell} = 0$]
   $\implies$ Transfer receipt (and higher-order GE income) is spent quickly
   $\implies$ Thus debt stabilizes on its own before $H$, and tax hike is not needed.
Economic Intuition \[ \kappa = 0, \text{ PE and GE effect of tax-and-transfer vector} \]
Economic Intuition: The Role of Nominal Rigidities, $\kappa > 0$

A simple **rescaling** of the perfect rigid price case $\kappa = 0$

- From NKPC, self financing through tax base is **proportional** to through debt erosion:

$$\pi_0 - E_{-1} [\pi_0] = \kappa \cdot \text{NPV}(y) = \kappa \cdot \sum_{k=0}^{+\infty} \beta^k E_0 [y_k]$$

- Split between sources of self financing:

  tax base: $v_y = \frac{\tau_y}{\tau_y + \kappa \frac{D_{ss}}{Y_{ss}}} v$  &  debt erosion: $v_p = \frac{\kappa \frac{D_{ss}}{Y_{ss}}}{\tau_y + \kappa \frac{D_{ss}}{Y_{ss}}} v$

When price is appr. flexible ($\kappa \to +\infty$), full self financing through debt erosion ($v_p \to 1$)

- Infinitesimal boom leads to large enough adjustment in $P_0$ to finance $\epsilon_0$

- Akin to FTPL, but from deficit-driven Keynesian boom [not by the force of eq’m selection, no threat to violate government budget]
Economic Intuition: The Role of Nominal Rigidities, \( \kappa > 0 \)

A simple **rescaling** of the perfect rigid price case \( \kappa = 0 \)

- From NKPC, self financing through tax base is **proportional** to through debt erosion:
  \[
  \pi_0 - E_{-1}[\pi_0] = \kappa \cdot \text{NPV}(y) = \kappa \cdot \sum_{k=0}^{+\infty} \beta^k E_0[y_k]
  \]

- Split between sources of self financing:
  \[
  \text{tax base: } v_y = \frac{\tau_y}{\tau_y + \kappa \frac{D^{ss}}{Y^{ss}}} v \quad \& \quad \text{debt erosion: } v_p = \frac{\kappa \frac{D^{ss}}{Y^{ss}}}{\tau_y + \kappa \frac{D^{ss}}{Y^{ss}}} v
  \]

- When price is appr. flexible (\( \kappa \to +\infty \)), **full self financing through debt erosion** (\( v_p \to 1 \))
  - Infinitesimal boom leads to large enough adjustment in \( P_0 \) to finance \( \varepsilon_0 \)
  - Akin to FTPL, but from deficit-driven Keynesian boom

[not by the force of eq'm selection, no threat to violate government budget]
Outline

1 Environment: OLG-NK
2 Equilibrium Characterization
3 Self-financing of Fiscal Deficits
4 Extensions & Generality
5 Conclusion
Extensions & Generality

- Fiscal policy
  - limit result unaffected if far-ahead adjustment is distortionary
  - result applies with little change to gov’t purchases instead of transfers

- More general aggregate demand [coming up]

- Monetary policy [coming up]

- Allow for investment, limit result unaffected [same IKC among consumers]
A Generalized Aggregate Demand Relation

- Our results are *not* tied to the particular OLG microfoundations
- Consider 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, ...]

- Complete self-financing with two empirically plausible features of consumer demand
  - **Discounting**: far future tax hike’s impact on current consumption *vanishes*
    \[ \omega < 1. \] \hspace{1cm} (4)
  - **Front-loaded** MPCs: transfer receipt (and higher-order GE income) is *spent quickly*
    \[ M_d + \frac{1-\beta}{\tau_y} (1-\tau_y) M_y \left( 1 + \delta \sum_{k=1}^{\infty} (\beta \omega)^k \right) > \frac{1-\beta}{\tau_y}. \] \hspace{1cm} (5)
    [Deficit-driven Keynesian boom is front-loaded enough to deliver \( \rho_d < 1 \).]
A Generalized Aggregate Demand Relation

Theorem

Under (4) and (5).

- As fiscal financing is **delayed further** (i.e., as $H \to \infty$ or $\tau_d \to 0$), there is **complete self financing**: $\nu$ converges to 1.

- In this limit, self-financing is strong enough to return $d$ to SS without any fiscal adjustment.

  \[ \tau_d \to 0 : \lim_{k \to \infty} E_t [d_{t+k}] \to 0; \quad H \to \infty : \lim_{H \to \infty} E_0 [d_H] \to 0 \]

- Models **satisfy** both assumptions: OLG OLG-spender, behavioral discounting

- Models **violate** either assumptions: PIH, spender-saver

  [Discounting fails. Empirically unrealistic, infinite elasticity of household asset demand to interest rates]
**Extension:** OLG + a Real Taylor Rule

\[ r_t = \phi y_t \]

[baseline \( \phi = 0; \phi < 0 \) accelerates the deficit-driven boom; \( \phi > 0 \) delays it]

**Proposition**

There exists \( \bar{\phi} > 0 \), such that, iff \( \phi \leq \bar{\phi} \), there is **full self financing** with **infinitely delayed fiscal adjustment**.

- **Complete self-financing** if MP does not lean against the boom “too aggressively.”

- What happens if \( \phi > \bar{\phi} \)?
  - No bounded *complete* self financing eq’em exists (with \( \tau_d \to 0 \))
  - If fiscal adjustment is fast enough (with \( \tau_d > \bar{\tau}_d (\bar{\phi}) \)), there is bounded *partial* self financing eq’em.
Model & Calibration Strategy

**Key targets**: (i) consumer spending behavior [iMPCs] & (ii) fiscal adjustment speed
Key targets: (i) consumer spending behavior [iMPCs] & (ii) fiscal adjustment speed

Model: generalize demand block to OLG-spender hybrid

[Why? disentangles level & slope of dynamic MPC profile, consistent with evidence.]
Model & Calibration Strategy

**Key targets:** (i) consumer spending behavior \([iMPCs]\) & (ii) fiscal adjustment speed

**Model:** generalize demand block to OLG-spender hybrid

[Why? disentangles level & slope of dynamic MPC profile, consistent with evidence.]

**Calibration strategy**

- Match evidence on iMPCs to lump-sum income receipt in Fagereng-Holm-Natvik
  [Later: other calibration targets, behavioral models, and a full-blown HANK model...]

- Consider range of \(\tau_d\) consistent with literature on fiscal adjustment rule estimation
  [Galí-López-Salido-Vallés, Bianchi-Melosi, Auclert-Rognlie, ...]
Application: Stimulus Checks

[Graphs showing the relationship between output ($y_t$), inflation ($\pi_t$), and self-financing share ($\nu$) with varying tax rates ($\tau_d$).]
**Baseline:** match impact and short-run MPCs, then extrapolate

[This gives $\omega = 0.88$]
**Variant I:** match lower bound of six-year cumulative spending share

[This gives $\omega = 0.96$, and thus counterfactually elastic hh asset demand to $r \approx 6 \times \text{emp. upper bound}$.]
Variant II: two-type OLG + spender model to match cumulative MPC time profile

[This gives $\omega_2 = 0.97$, and thus again counterfactually elastic hh asset demand to $r$ ($\approx 7x$ emp. upper bound).]
Outline

1. Environment: OLG-NK
2. Equilibrium Characterization
3. Self-financing of Fiscal Deficits
4. Extensions & Generality
5. Conclusion
Conclusion

- **Key**: delayed *fiscal adjustment* \(\Rightarrow\) strong *self-financing* from tax base adjust. & debt erosion
Conclusion

- **Key:** delayed *fiscal adjustment* ⇒ strong *self-financing* from tax base adjust. & debt erosion

- **Implications:**
  1. Theory: grounded in a failure of Ricardian equivalence + nominal rigidities
     [robust to info perturbations, consistent with Taylor principle, no threat to violate gov. budget]
  2. Practice: self-sustaining stimulus may be less implausible than commonly believed
Conclusion

- **Key**: delayed *fiscal adjustment* ⇒ strong *self-financing* from tax base adjust. & debt erosion

- **Implications**:
  1. Theory: grounded in a failure of Ricardian equivalence + nominal rigidities
     - [robust to info perturbations, consistent with Taylor principle, no threat to violate gov. budget]
  2. Practice: self-sustaining stimulus may be less implausible than commonly believed

- **Future work**: (optimal) policy implications for fiscal-monetary interaction
Unions equalize post-tax wage and average consumption-labor MRS. This gives

\[(1 - \tau_y) W_t = \frac{\chi L_t^{\frac{1}{\varphi}}}{\int_{0}^{1} C_{i,t}^{-\frac{1}{\sigma}} di} \quad \text{and} \quad L_{i,t} = L_t.\]
Main result: large initial boom [bigger PE] but slower convergence [dampen GE]
A Simple Hank Model

**Environment**: standard one-asset HANK model

**Calibration**

2. Tax-and-transfer system: \( \tau_y = 0.3, \frac{\text{transfer}}{y} = 0.07 \) [also as in Kaplan-Moll-Violante (2018)]
3. Total wealth: calibrate to U.S. economy liquid wealth/income ratio
4. GE income incidence: uniform [note that this is conservative for our purposes]

\[ \text{implies: average MPC somewhat below 0.3} \]
A Simple Hank Model

- **Output** $y_t$
  - $\tau_d = 0.09$
  - $\tau_d = 0.03$
  - $\tau_d = 0.01$

- **Inflation** $\pi_t$

- **Self-Financing Share** $\nu$
  - Date-0 Inflation
  - Tax Base