Indebted Demand

Atif Mian, Princeton
Ludwig Straub, Harvard
Amir Sufi, Chicago Booth

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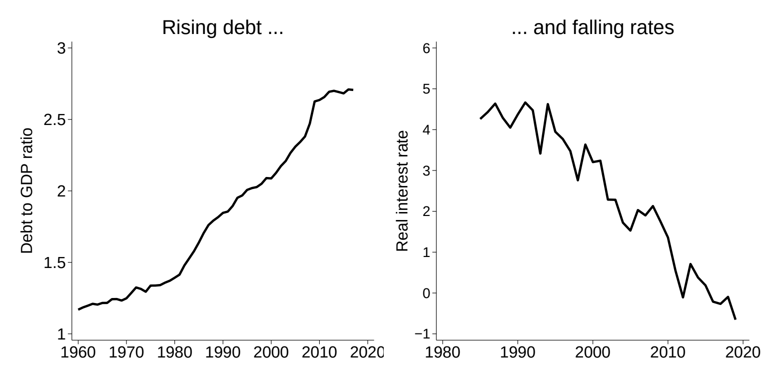
Motivation: rise in debt and decline in r^* in advanced economies



- How did this happen? What are the implications?
- Answers more pressing with COVID-19 crisis (more debt, even lower rates)

This study: the rich save more

- We introduce non-homothetic consumption-saving behavior into a conventional, deterministic, two-agent endowment economy
- Such non-homotheticity:
  - is strongly supported by empirical evidence
  - yields a macro model that can explain why rising income inequality and financial liberalization lead to lower interest rates and higher debt
  - generates the concept of **indebted demand**
- **“Indebted demand”**: stimulating demand today through debt creation reduces demand in the future by shifting resources from borrowers to savers

Policy implications of indebted demand

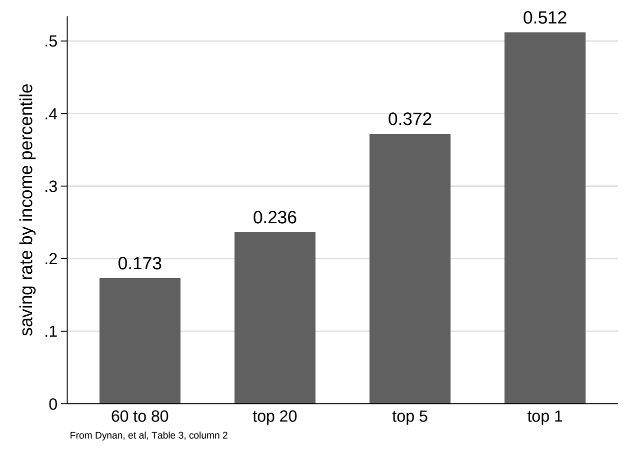
- Expansionary fiscal and monetary policy push down natural interest rate
  - Intuition: both boost short-run demand through debt accumulation ...
  - ... but such debt depresses demand in the long run, as it shifts income to savers with lower MPC
  - Interest rates must fall to clear the goods market
- Factors boosting debt can push economy into a low growth liquidity trap
  - Such a **debt trap** is a well defined steady state of the model
  - Conventional policies don't help escape the trip, and may make it worse
  - **Redistribution** can be particularly effective

Literature

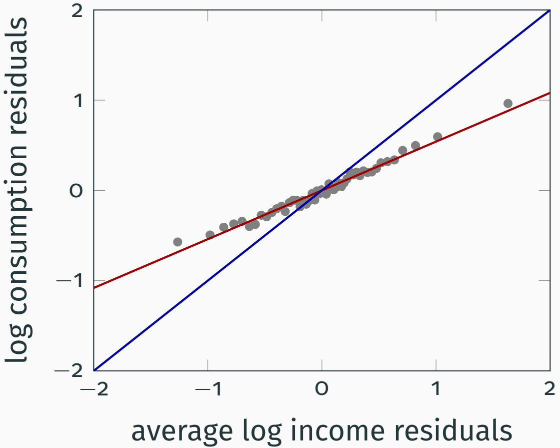
1. **Secular stagnation + theories:** Summers (2013), Rachel Summers (2019), Eggertsson Mehrotra Robbins (2019), Auclert Rognlie (2018), Caballero Farhi (2017), Straub (2019)
2. **Non-homothetic preferences:** Old idea (Böhm-Bawerk, Hobson, Fisher), old models (Schlicht, Bourguignon). New: Uzawa (1968), Carroll (2000), Dynan Skinner Zeldes (2004), De Nardi (2004), Illing Ono Schlegl (2018), Straub (2019), Fagereng Holm Moll Natvik (2019), Benhabib Bisin Luo (2019)
3. **Inequality and debt (theory):** Kumhof Ranciere Winant (2015), Cairo Sim (2018)
4. **Inequality and debt (empirics):** Cynamon Fazzari (2015), Mian Straub Sufi (2019)
5. **Debt and demand:** Dynan (2012), Mian Sufi (2015), Mian Sufi Verner (2017), Jorda Schularick Taylor (2016), Bhutta and Keys (2016), Di Maggio et al. (2017), Beraja Fuster Hurst Vavra (2018), Di Maggio Kermani Palmer (2019), Cloyne Ferreira Surico (2019)
6. **Deleveraging:** Eggertsson Krugman (2012), Guerrieri Lorenzoni (2017)

Motivating the model

- **Dynan Skinner Zeldes (2004)**: saving rates increase in current income



- **Straub (2019)**: consumption has elasticity < 1 w.r.t. average income



- **Fagareng Holm Moll (2019)**: saving rate across wealth distribution

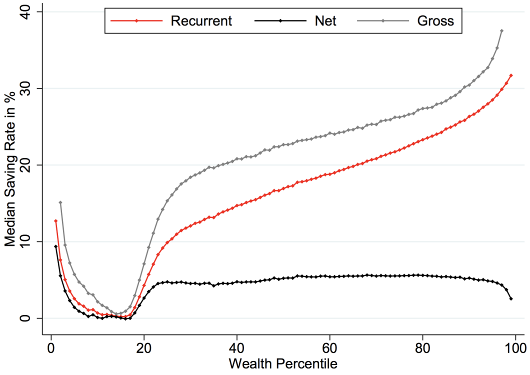
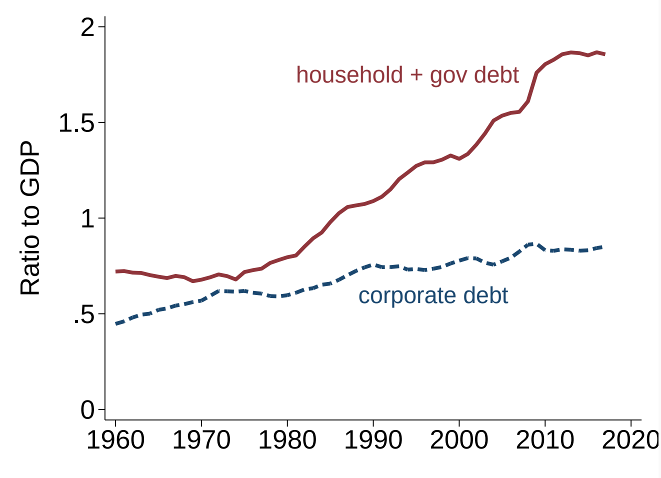
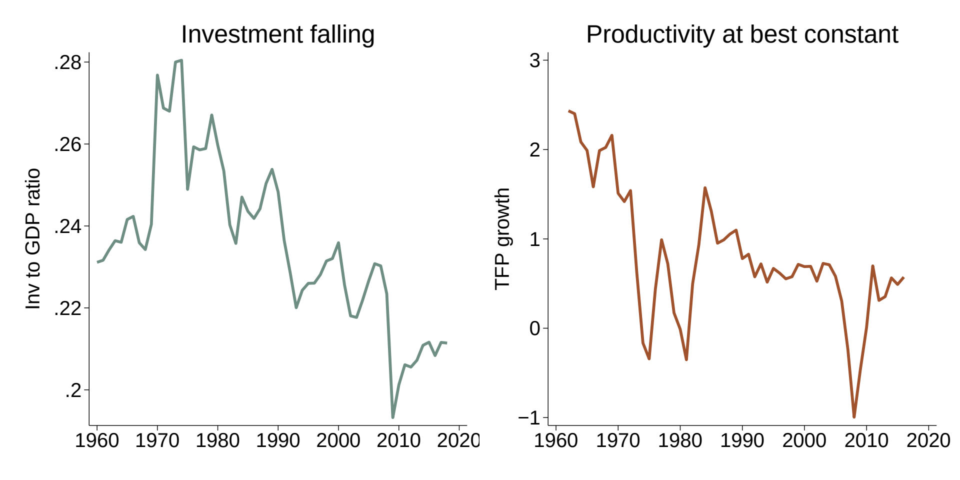


Figure 6: Saving rates across the wealth distribution.

Rise in debt driven by households and government

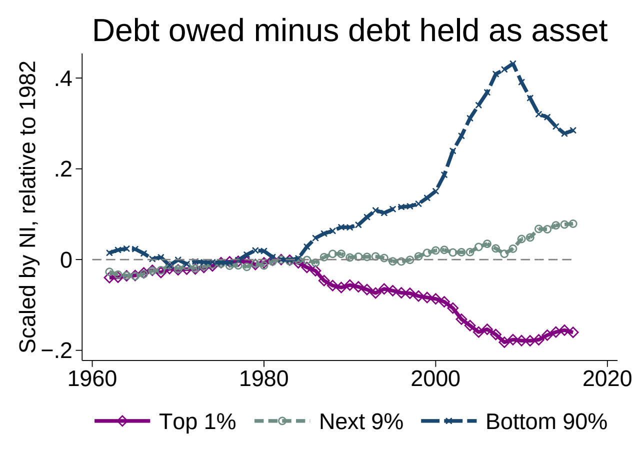


Investment and productivity



- No investment in baseline model, considered in an extension

The rich lend to the non-rich



- “Saving glut of the rich and the rise in household debt”

Model

Model of indebted demand

- Deterministic ∞-horizon endowment economy with real assets ("trees")
- Populated by **two separate dynasties**
- Same preferences, but **different endowments** of trees
  - mass 1 of **borrowers** $i = b$: endowment ω^b
  - mass 1 of **savers** $i = s$: endowment $\omega^s > \omega^b$
  - total endowment $\omega^b + \omega^s = 1$
- Trees are nontradable, **dynasties trade debt contracts**
- Agents within a dynasty die at rate $\delta > 0$, wealth inherited by offspring

Preferences

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- Budget constraint

$$c_t^i + \dot{a}_t^i \leq r_t a_t^i$$

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- $v(a)$ = utility from bequest [future consumption, "status" benefits from wealth, artwork, gifts (to relatives or charities), adjustment frictions in illiquid accounts]

- Key object: $\eta(a) \equiv av'(a)$ — marginal utility of $v(a)$ **relative to log**
  - **homothetic model:** $\eta(a) = const \Rightarrow v(a) \propto \log a$
  - **non-homothetic model:** $\eta(a)$ increases in a

Borrowing constraint & asset market

- Total wealth = **real asset wealth** net of **debt**

$$a_t^i = \omega^i p_t - d_t^i$$

where p_t = price of a Lucas tree: $r_t p_t = 1 + \dot{p}_t$

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$$d_t^i \leq p_t \ell$$

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- Market clearing $d_t^s + d_t^b = 0$ pins down interest rate r_t

- Focus on **debt of borrowers:** $d_t \equiv d_t^b$ (**state variable**)

Scale invariance

- Non-homothetic model is typically **not scale invariant** in aggregate
  - economic growth $\Rightarrow$ \$28,000 today is like \$200,000 around 1900
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  - so ... someone with \$28,000 today should save a ton?!
- In reality, savings preferences probably closer to $v(a/A)$ or $v(a/Y)$
- **We work with** $v(a/Y)$, where so far $Y = 1$ (total endowment = 1)

Equilibria & indebted demand

Saving supply curves

- Savers' Euler equation

$$\frac{\dot{c}_t^s}{c_t^s} = r_t - \rho - \delta + \delta \frac{c_t^s}{\rho a_t^s} \cdot \eta(a_t^s)$$

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$$r = \rho \cdot \frac{1 + \rho/\delta}{1 + \rho/\delta \cdot \eta(a^s)}$$

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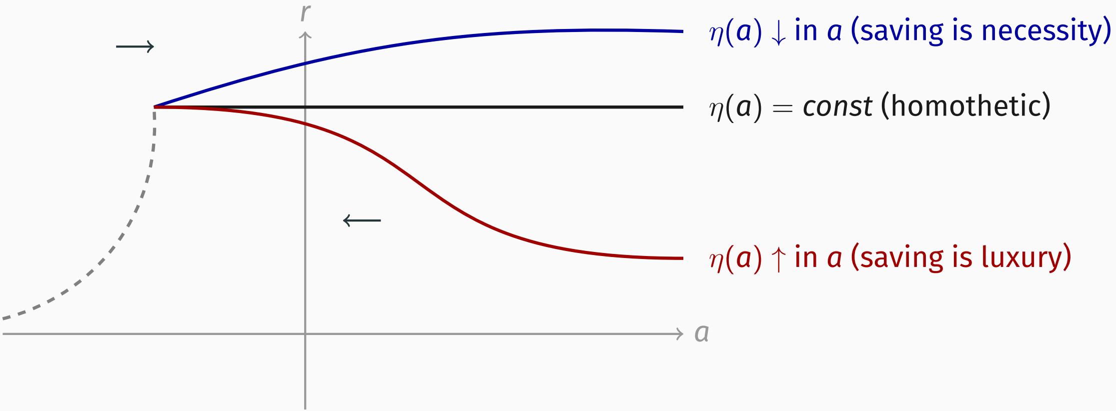
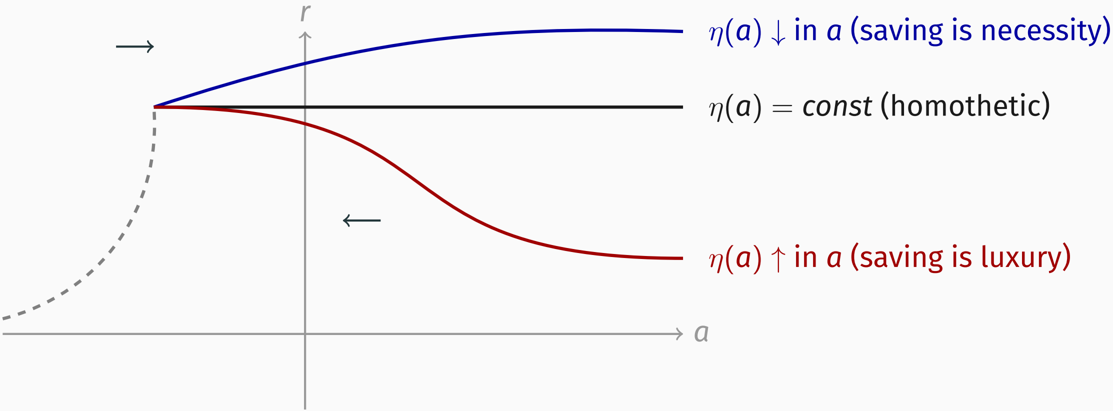
- This is a **long-run saving supply curve:**
    - r necessary for which saver keeps wealth constant at a^s
- $\eta(a^s)$ determines the shape of the saving supply curve


r
a
$\longrightarrow$
$\longleftarrow$
$\eta(a) \downarrow$ in a (saving is necessity)
$\eta(a) = const$ (homothetic)
$\eta(a) \uparrow$ in a (saving is luxury)

Long-run saving supply curves



- If $\eta(a^s)$ increasing: **larger wealth** a^s requires **lower return on wealth** r for saver to be indifferent about saving!

Steady state equilibria

- **Steady state:** intersect long-run **supply curve** with **debt demand curve**

$$r = \rho \cdot \frac{1 + \rho/\delta}{1 + \rho/\delta \cdot \eta(\omega^s/r + d)} \qquad\qquad d = \frac{\ell}{r}$$

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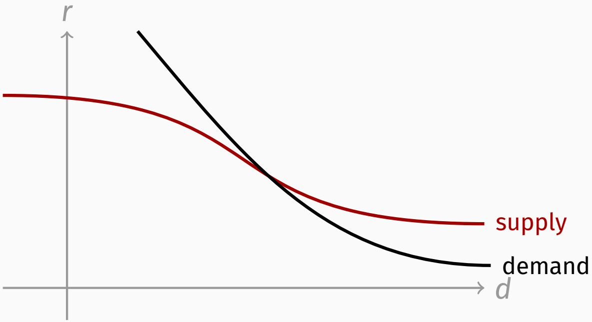

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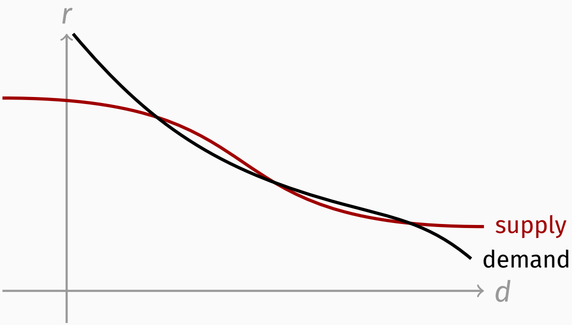

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$$dC = dc^s + dc^b = -\frac{\rho+\delta}{r}\frac{1}{2}\left(1-\sqrt{1-4\left(1-\frac{r}{\rho+\delta}\right)\frac{\eta'(a)a}{\eta(a)}}\right)dx$$

$\Rightarrow$ Thus increase in debt service costs weighs on aggregate demand

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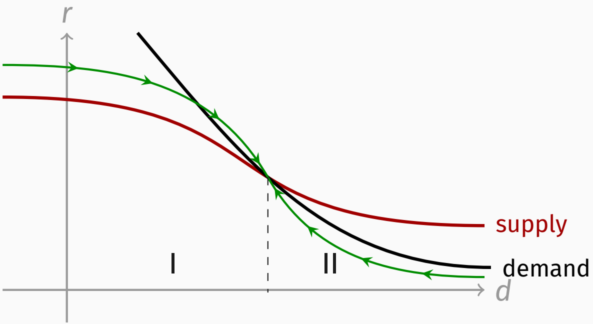
- Call this phenomenon **"indebted demand"**

Equilibrium transitions

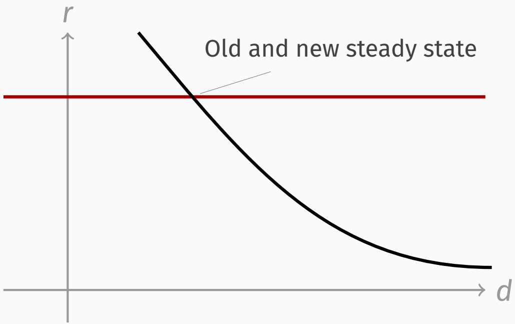


Inequality & financial liberalization

Rising inequality $\omega^s \uparrow$: lowers r and raises debt

▸ plot

Homothetic model



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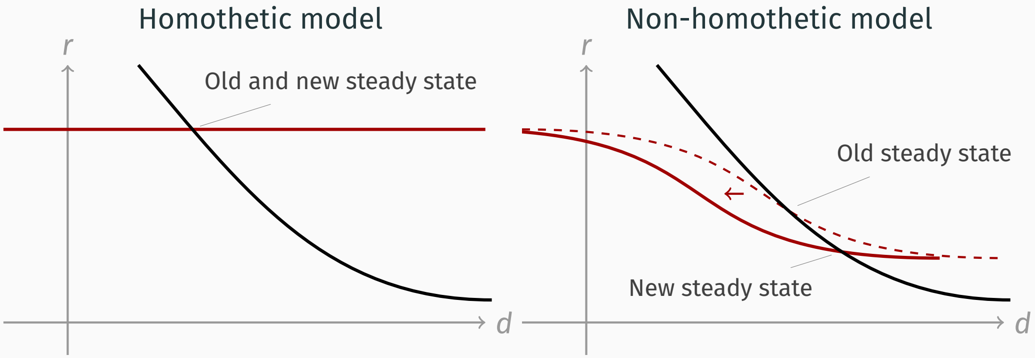

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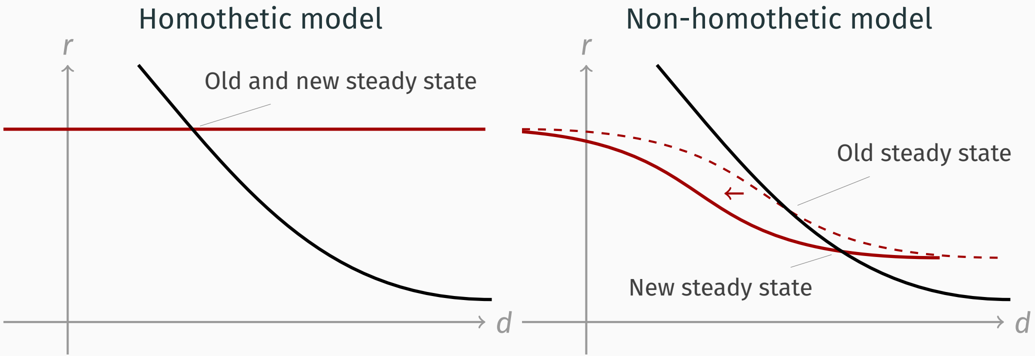
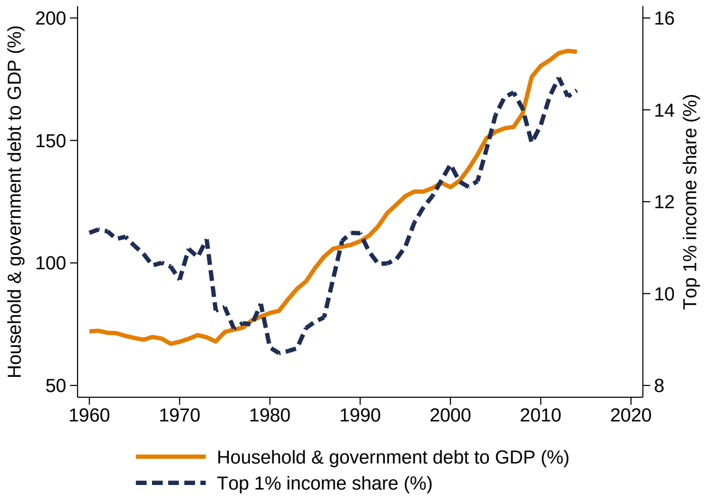


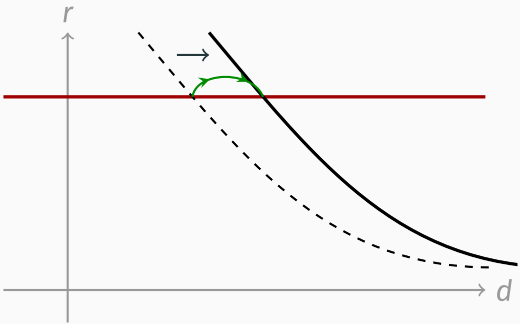
- **Effects** of rising inequality $\omega^s \uparrow$ in non-homothetic model:
    1. inequality $\uparrow \Rightarrow$ more saving by the rich $\Rightarrow r \downarrow \Rightarrow$ debt $\uparrow$
    2. debt $\uparrow$ first **raises** demand, pushing against decline in r
    3. high debt eventually **lowers** demand, aggravating decline in r

Inequality and debt across 14 advanced economies



Financial liberalization: raising pledgability ℓ

Homothetic model



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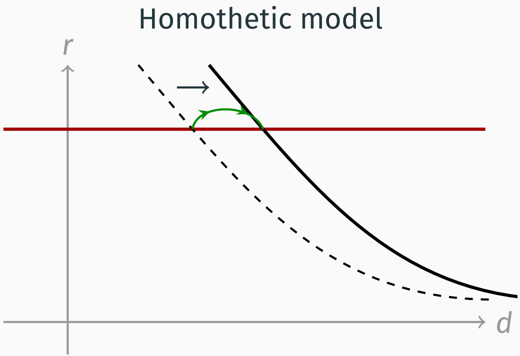

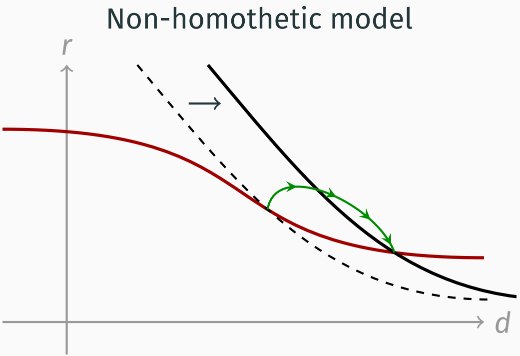

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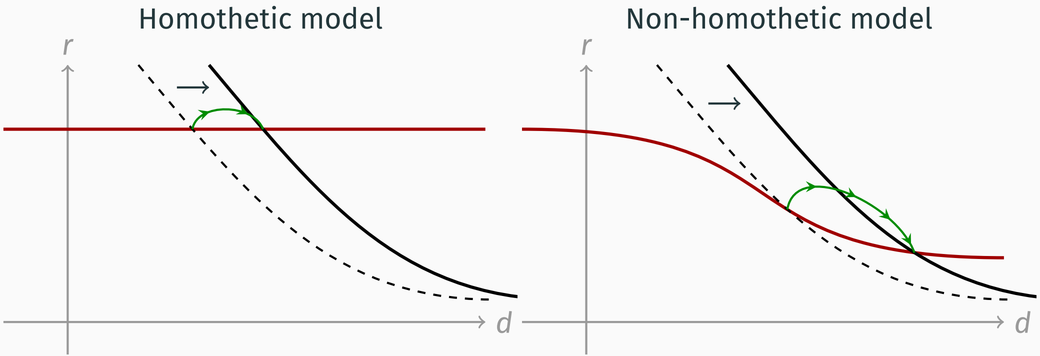

- **Mechanism** in non-homothetic model:
    1. **raises debt & demand**, pushing r up (short-run saving supply slopes up)
    2. ultimately **high debt weighs on demand**, lowering r, **stimulating further debt**!

$\rightarrow$ resolves puzzle in literature [e.g. Justiniano Primiceri Tambalotti]

Fiscal & monetary policy

Fiscal policy implications

- Gov't spends G_t, has debt B_t, raises income taxes τ_t^s, τ_t^b, subject to

$$G_t + r_t B_t \leq \dot{B}_t + \tau_t^s \omega^s + \tau_t^b \omega^b$$

- Total demand for debt now $d_t + B_t$

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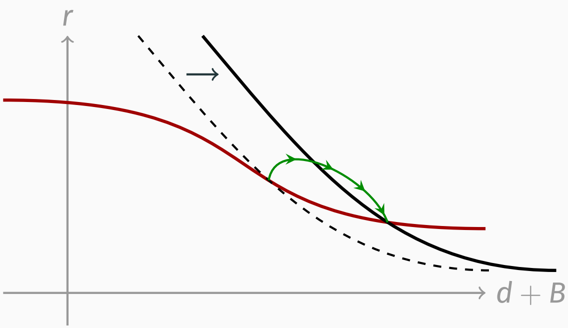
- **Result:** In the long run

  1. **larger gov't debt** $B \uparrow$**:** depresses interest rate $r \downarrow$, crowds in household debt $d \uparrow$
  2. **tax-financed spending** $G \uparrow$**:** raises $r \uparrow$, crowds out $d \downarrow$
  3. **fiscal redistribution** $\tau^s \uparrow, \tau^b \downarrow$**:** raises $r \uparrow$, crowds out $d \downarrow$

- With homothetic preferences none of these policies change r or d !

Deficit-financed fiscal policy



“Japanification” — how high public debt makes r less likely to rise

Imagine inequality falls exogenously. How much does the interest rate rise?

Low B **High** B

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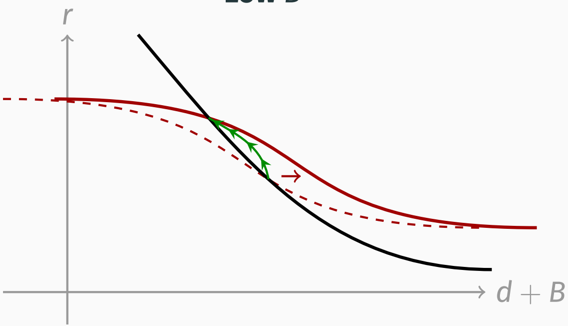

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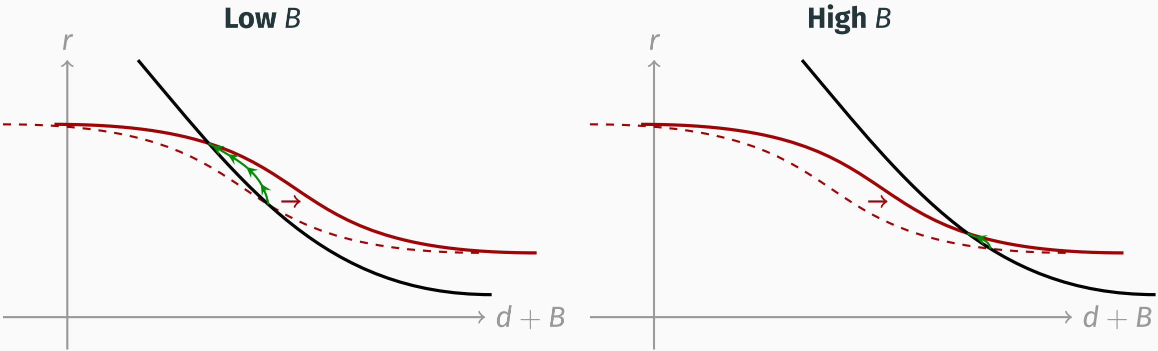

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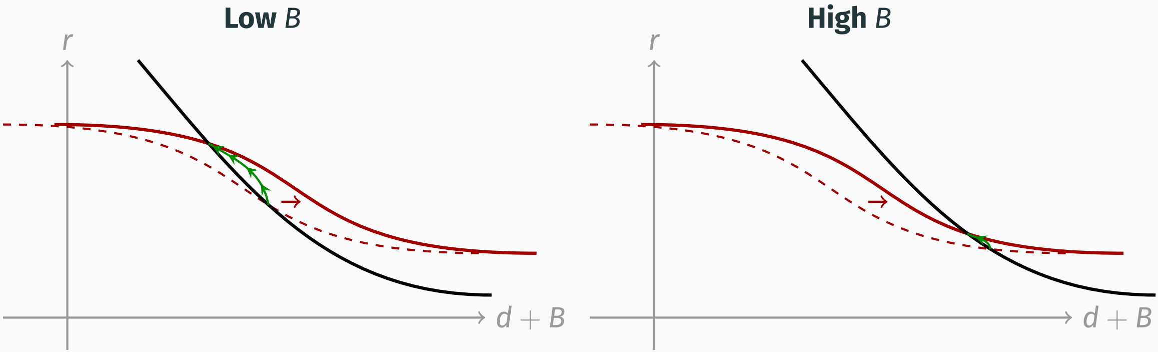

With **higher** B, any given increase in r **weighs down more on aggregate demand**

Introducing monetary policy

- Introduce monetary policy as in Werning (2015)
- Assume both agents supply labor L^i, separable disutility
- Actual output $\hat{Y} \neq$ "potential" $Y = 1$

$$\hat{Y} = (L^b)^{\omega^b} (L^s)^{\omega^s}$$

- Nominal wage rigidity, flexible prices $\rightarrow$ income shares still ω^i
- Central bank sets real rate r_t directly
- Define $r_t^n \equiv$ natural interest rate path, achieving $\hat{Y}_t = Y$

Monetary policy has limited ammunition

- Begin in steady state with r. Consider following monetary stimulus:

$$r_t = \begin{cases} \hat{r} < r & t < T \\ r_t^n & t \geq T \end{cases}$$

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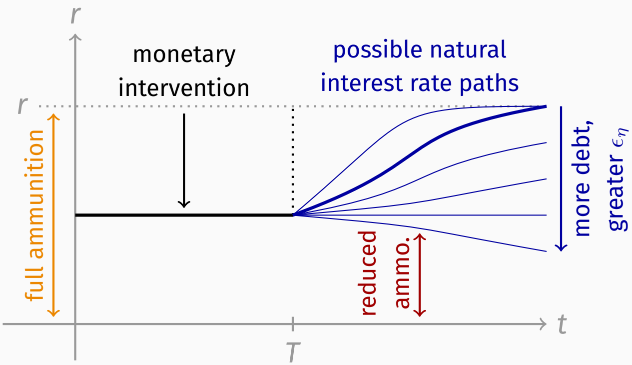
- **Result:**
    - stimulus generates demand partly by pulling forward spending, **raising debt**
    - indebted demand $\Rightarrow$ reduces **natural interest rates** r_t^n
    - effects are stronger if non-homotheticity $\frac{\eta'(a)a}{\eta(a)}$ is larger, T is longer
- **Natural rate** $=$ **ammunition of monetary policy** (proximity to ZLB)

Effects of monetary policy on natural interest rate paths



Expansionary monetary policy traps the policy-maker!

- **WSJ**: “borrowing helped pull countries out of recession but made it harder for policy makers to raise rates”
- **Mark Carney**: “the sustainability of debt burdens depends on interest rates remaining low”
- **Philip Lowe**: “if interest rates were to rise … many consumers might have to severely curtail their spending to keep up their repayments.”

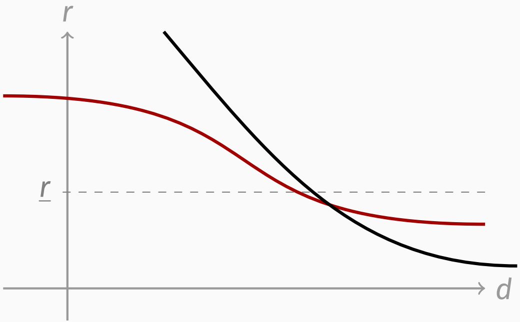
Debt trap

Introducing the lower bound

- Consider lower bound $\underline{r}$ on interest rate r
  - $\underline{r} > 0$ if r is return on wealth

Introducing the lower bound

- Consider lower bound $\underline{r}$ on interest rate r
  - $\underline{r} > 0$ if r is return on wealth
- What happens if the steady state natural rate falls below $\underline{r}$?



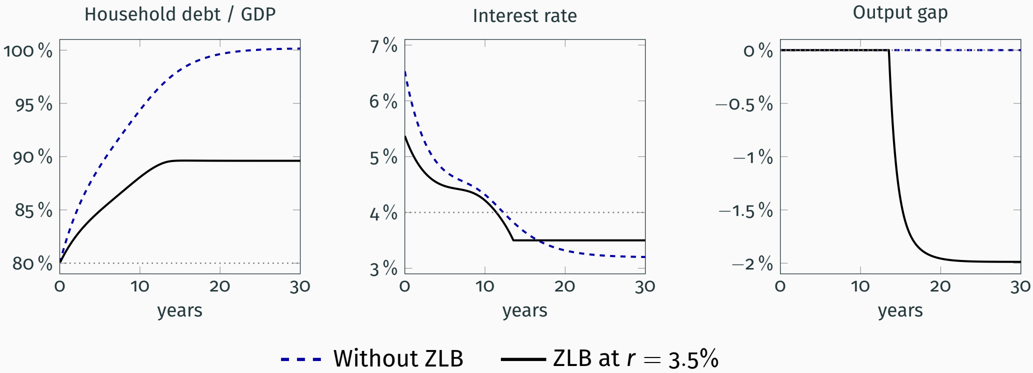
The debt trap ($\equiv$ a debt-driven liquidity trap)

- **Result:** if natural rate $< \underline{r}$, get **stable** liquidity trap steady state: **"debt trap"**
  - $\rightarrow$ **Output persistently below potential**

$$\hat{Y} = Y \frac{\underline{r}}{(1-\tau^s)\omega^s + \ell} \cdot \left[\eta^{-1} \left(\frac{\rho}{\underline{r}} (1 + \rho/\delta) - \rho/\delta \right) - B \right] < Y$$

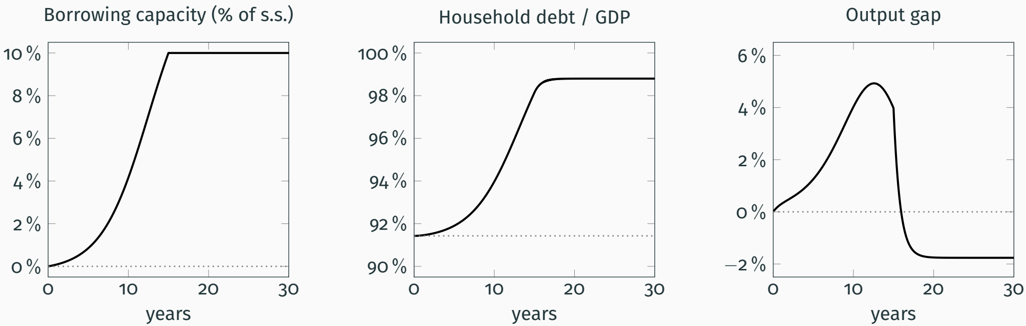
- Liquidity trap more likely if
  - income inequality ω^s is high, low taxes on savers τ^s
  - pledgability ℓ high, gov. debt B high

How does an economy fall into the debt trap? (i) Rising inequality

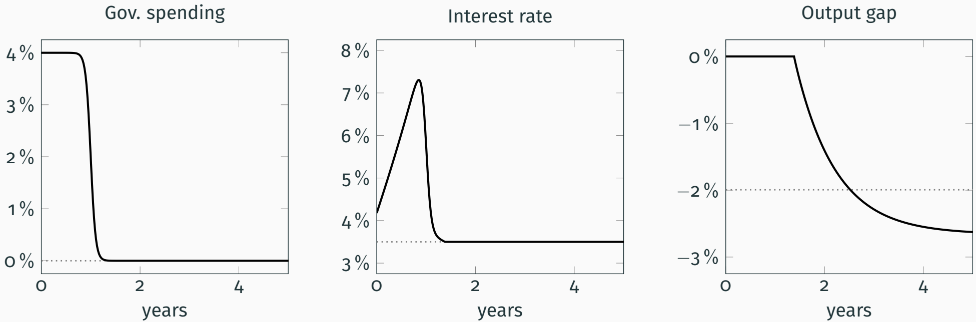


- Anticipation of the liquidity trap **pulls the economy in even faster**

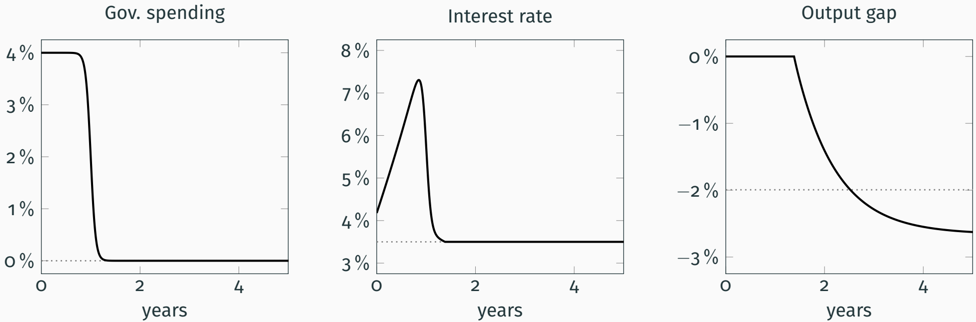
How does an economy fall into the debt trap? (ii) Credit boom-bust cycle



Fighting debt with debt? Deficit financing in the liquidity trap



Fighting debt with debt? Deficit financing in the liquidity trap



- Here, deficit financing is only **temporary remedy** against a **chronic disease**
- Indebted demand makes problem even worse in long run

Policies to escape the debt trap

- Recall output in debt trap is

$$\hat{Y} = Y \frac{\underline{r}}{(1-\tau^s)\omega^s + \ell} \cdot \left[\eta^{-1}\left(\frac{\rho}{\underline{r}}(1+\rho/\delta) - \rho/\delta\right) - B\right] < Y$$

- Debt jubilee? Government bailout of borrower? Only if combined with limits on future borrowing!
- **Redistributive income taxes** (higher τ^s) or **a wealth tax** of $\tau^a > 0$ on saver's wealth can by particularly effective
- Shown in paper: a wealth tax boosts output, increasing borrower welfare while leaving saver indifferent

Extensions & conclusion

Extensions

- Model with investment
- Modeling government yield spread $r - r^B$
- Intergenerational mobility
- Sufficient statistic exercise

In paper:

- Open economy model
- Uzawa preferences, relative wealth preferences

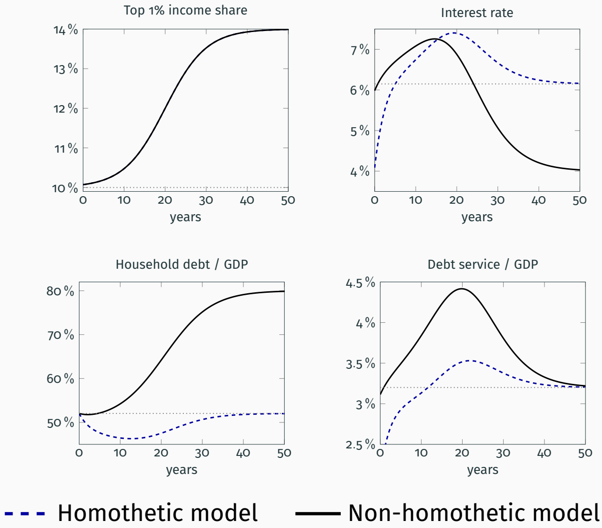
Takeaway

- New model to study **indebted demand**
  - amplifies recent trends
  - **“budget constraint”** for deficit-financed monetary & fiscal stimulus
- **COVID-19** policy response induces even more indebted demand
  - Extended liquidity trap/debt trap likely (inevitable?)
  - Government borrowing on behalf of non-rich
  - Initial evidence suggests lower income workers affected most

Extra slides

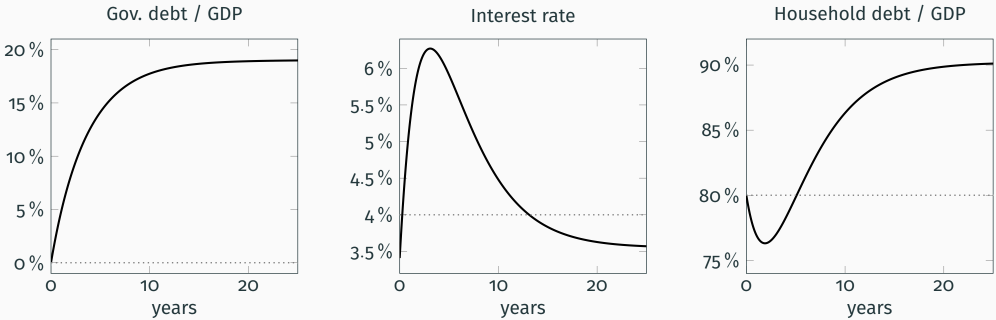
Inequality and debt

back



Deficit spending causes indebted (government) demand

back



But ... what about $r < g$? (here: g normalized to zero)

▸ back

- Our r is **return on wealth** so always $r > g$. But what if gov't pays $r^B < g$?

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1. **Derivative of debt service cost** of $(r^B - g)B$ w.r.t. B

$$\frac{\partial (r^B - g)B}{\partial B} = \underbrace{r^B - g}_{<0} + \underbrace{\frac{\partial r^B}{\partial B}}_{>0} \overset{?}{\gtrless} 0$$

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2. Where does the spread $r - r^B$ come from? Investors really like B!
   - B is **not negative for savers** just because $(r^B - g)B < 0$
   - $B \uparrow$ still makes savers wealthier, $a^s \uparrow$, lowering required return on wealth r

Introducing investment

back

- Assume goods are now produced from capital and both agents' labor

$$Y = F(K, L^b, L^s)$$

  - F is net-of-depreciation production, K pinned down by $F_K = r$
  - $\sigma \equiv$ (Allen) elasticity of substitution between K and L^b

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$$\omega^s(r) \equiv \frac{F_K K}{F} + \frac{F_{L^s} L^s}{F} = 1 - \frac{F_{L^b} L^b}{F}$$

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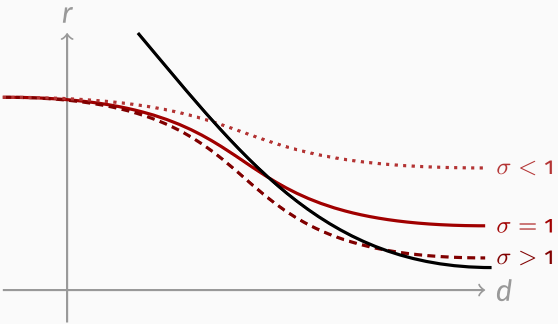
  - $\omega^s(r)$ independent of r if $\sigma = 1$ [e.g. Cobb-Douglas]
  - $\omega^s(r) \uparrow$ as $r \downarrow$ iff $\sigma > 1$ [e.g. capital-skill complementarity, robots]

back

- **Main result:** Our results are unchanged if $\sigma = 1$. Amplified if $\sigma > 1$.



Indebted demand and investment

back

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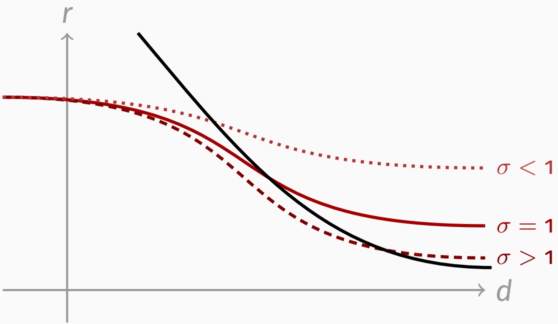

- Related **Q:** Can **corporate debt** also cause **indebted demand**?
  - yes, if $\sigma > 1$! but always **weaker** indebted demand than household debt
  - why? corporate debt **productive**, raising Y, easier to repay

Government yield spread

back

- Allow for benefits from gov't bonds [cf Krishnamurthy Vissing-Jorgensen (2012)]

$$\log\left(c_t^s + \xi B_t\right) + \frac{\delta}{\rho} \cdot v\left(a_t^s + \xi B_t / r\right)$$

- Implies fixed spread $\xi > 0$

$$r^B = r - \xi$$

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- Define **effective wealth** as including benefits ξB_t from bonds. In steady state:

$$a^{\text{eff}} \equiv \frac{\omega^s}{r} + d + \underbrace{\frac{r^B B}{r} + \frac{\xi B}{r}}_{=B}$$

- **Savings supply curve unchanged** in effective wealth

$$r = \rho \frac{1 + \rho/\delta}{1 + \rho/\delta \cdot \eta(a^{\text{eff}})}$$

Intergenerational mobility

back

- With probability $q > 0$, savers turn into borrowers and vice versa
- Saver-turned-borrowers consume down their wealth instantly
- Borrower-turned-savers get transfer from other savers to raise wealth

Intergenerational mobility

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- Borrower-turned-savers get transfer from other savers to raise wealth
- **Saving supply curve becomes flatter** with q

$$r = \rho \frac{1 + \delta/\rho}{1 + \delta/\rho \cdot \eta(a)} + \underbrace{q\gamma\delta \frac{\delta/\rho \cdot \eta(a)}{1 + \delta/\rho \cdot \eta(a)}}_{\text{contribution of mobility}}$$

- $q \uparrow$ thus **mitigates indebted demand**, especially if high **income inequality** γ

$$\gamma \equiv 1 - \frac{\omega^b - \ell}{\omega^s + \ell}$$

Is this first order? What is the slope of savings supply in the data?

▸ back

- Consumption function of rich $c(r, a)$. Along curve:

$$c(r(a), a) = r(a)a$$

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- Assume $\epsilon_r = 0$, $r \approx 0.06$, $MPC^{\text{cap. gains}} \approx 0.025$
  [Farhi-Gourio, Di Maggio-Kermani-Majluf, Baker-Nagel-Wurgler, Chodorow-Reich Nenov Simsek]

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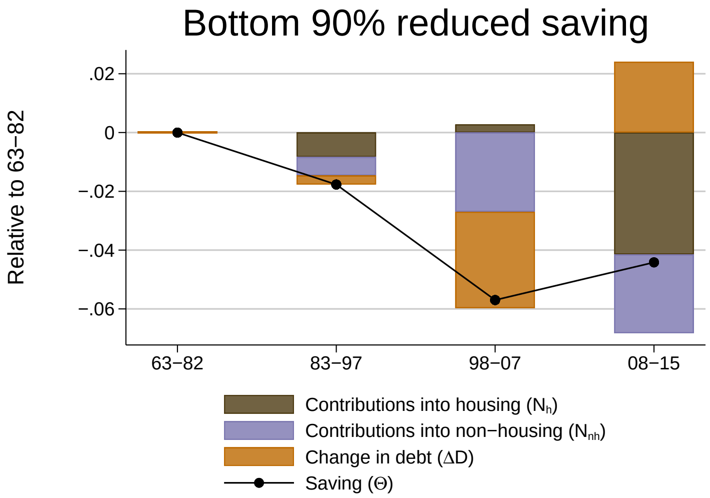
$$\frac{dr}{d\log a} = -0.035$$

- In words: **if wealth** $\uparrow$ **by** 10%**, required** $r \downarrow$ **by** 35bps

Bottom 90% did not accumulate assets



How indebted is US demand?

back

- Thought experiment: How large is dC implied by current levels of household & government debt, had interest rates **not** come down?

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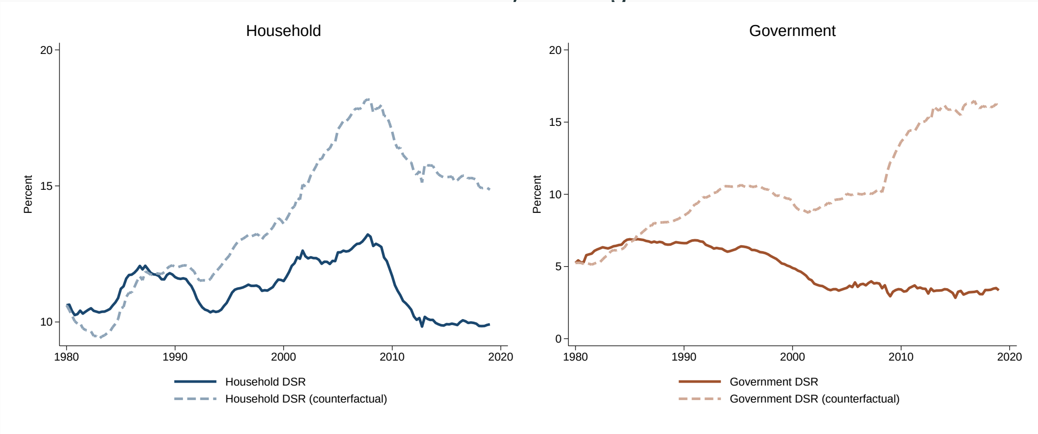

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- Thought experiment: How large is dC implied by current levels of household & government debt, had interest rates **not** come down?
- Counterfactual debt service burden, holding r constant:

$$dC \approx \underbrace{-15\%}_{\text{borrower debt service}} + \underbrace{\frac{MPC^{\text{cap. gains}}}{r} \cdot 15\%}_{\text{partial offset by savers}} = -8\%$$