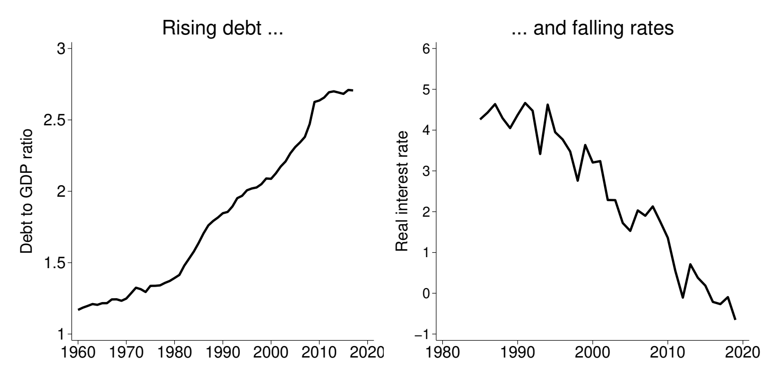
Indebted Demand

and Economic Policy in a Post-Covid World

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

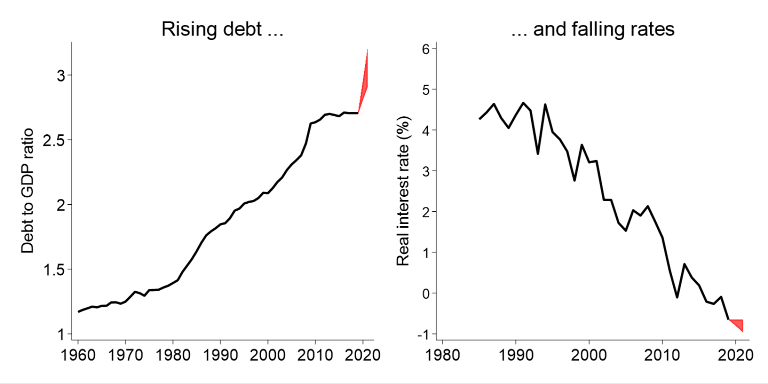
Virtual Macro Seminar
April 2020

Rise in debt and decline in r^* — especially relevant post-Covid!



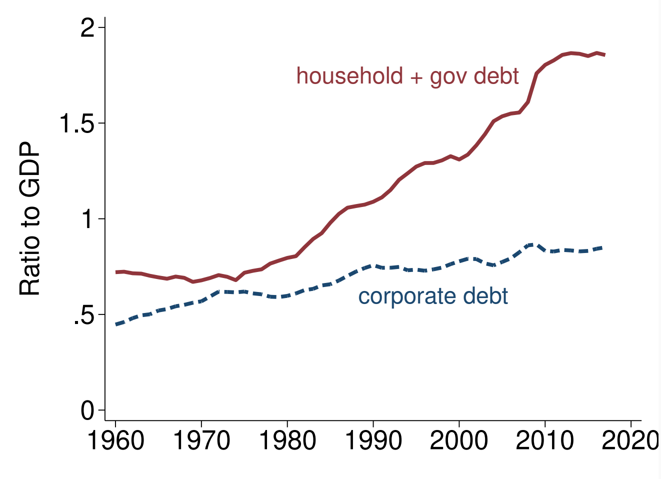
- How did this happen? Do the two plots interact? What are the implications?

Rise in debt and decline in r^* — especially relevant post-Covid!

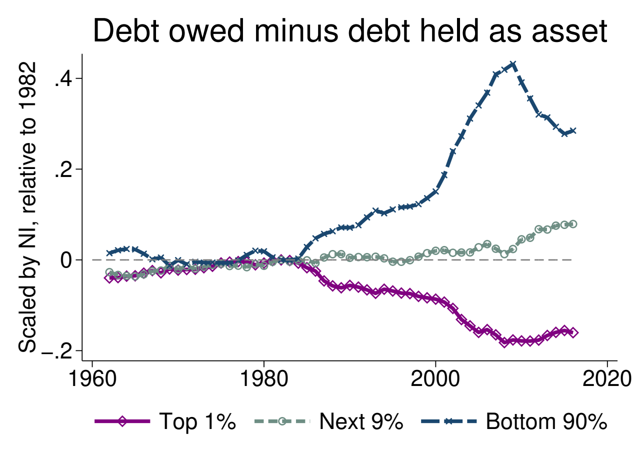


- How did this happen? Do the two plots interact? What are the implications?

Rise in debt driven by households and government



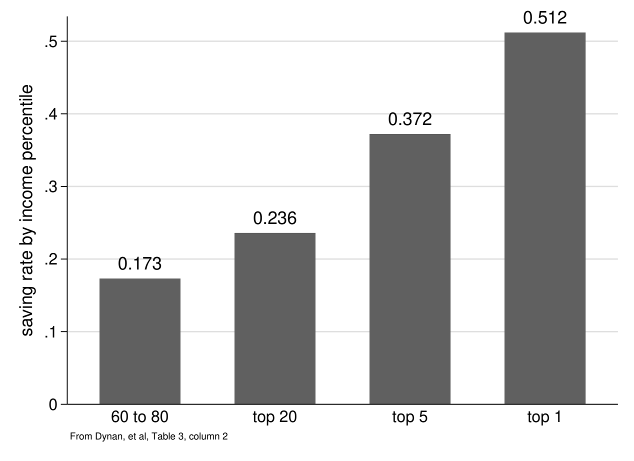
The rich lend to the non-rich



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

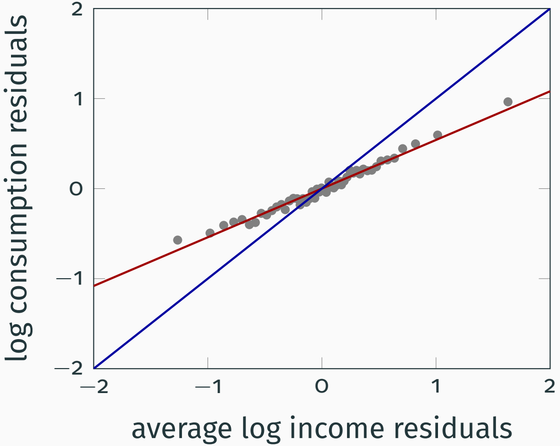
Why might this matter? — Rich & wealthy save more

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



Why might this matter? — Rich & wealthy save more

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



Why might this matter? — Rich & wealthy save more

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

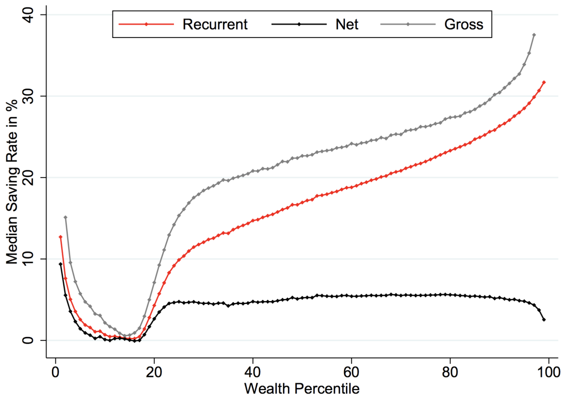


Figure 6: Saving rates across the wealth distribution.

The indebted demand framework

- Introduce **non-homothetic consumption-saving behavior** into conventional two-agent endowment economy
  - $\rightarrow$ the rich have a higher saving rate

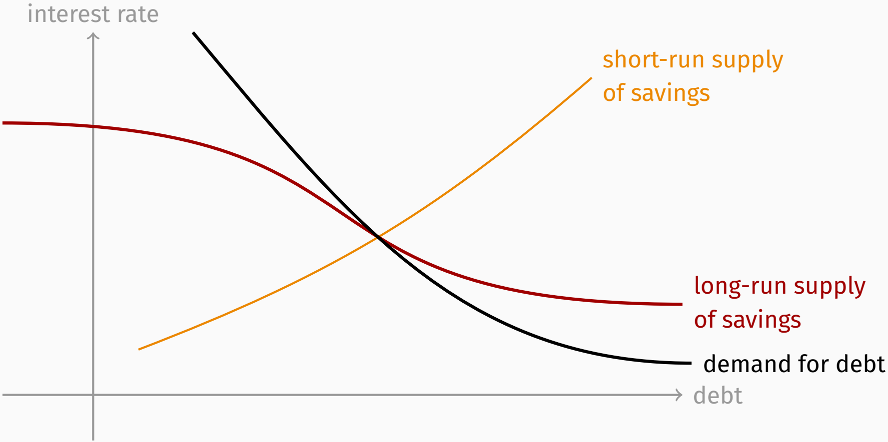
The indebted demand framework

- Introduce **non-homothetic consumption-saving behavior** into conventional two-agent endowment economy
  - $\rightarrow$ the rich have a higher saving rate
- Main insight: **“Indebted demand”**
  - $\equiv$ shifts & policies that stimulate demand today through debt creation, reduce demand in the future by shifting resources from borrowers to savers

The indebted demand framework

- Introduce **non-homothetic consumption-saving behavior** into conventional two-agent endowment economy
  - $\rightarrow$ the rich have a higher saving rate
- Main insight: **"Indebted demand"**
  - $\equiv$ shifts & policies that stimulate demand today through debt creation, reduce demand in the future by shifting resources from borrowers to savers
- Implications:
  - **rising inequality depresses** r, amplified by rising debt levels
  - monetary + fiscal policy have **limited ammunition** when they create debt
  - economies can fall into a **"debt trap"** — liquidity trap driven by too much debt
  - once in it, **debt-financed stimulus deepens recession** in the future
  - **redistributive policies help**

At the center of our analysis is a simple diagram



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), Straub (2019), Fagereng Holm Moll Natvik (2019), Benhabib Bisin Luo (2019)
3. **Inequality and debt (theory):** Kumhof Ranciere Winant (2015), Cairo Sim (2018), Illing Ono Schlegl (2018), Rannenberg (2019)
4. **Inequality and debt (empirics):** Cynamon Fazzari (2015), Mian Straub Sufi (2019)
5. **Debt + 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)

Outline

1. Model
2. Equilibria & indebted demand
3. Inequality & financial liberalization
4. Fiscal & monetary policy
5. Debt trap
6. Indebted demand post-Covid
7. Extensions & conclusion

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

- Dynasty i consumes c_t^i, owns wealth a_t^i.

Preferences

- Dynasty i consumes c_t^i, owns wealth a_t^i. Preferences:

$$\int_0^{\infty} e^{-(\rho+\delta)t} \left\{ \log c_t^i + \frac{\delta}{\rho} \cdot v(a_t^i) \right\} dt$$

- Budget constraint

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

Preferences

- Dynasty i consumes c_t^i, owns wealth a_t^i. Preferences:

$$\int_0^\infty e^{-(\rho+\delta)t}\left\{\log c_t^i + \frac{\delta}{\rho}\cdot v(a_t^i)\right\}dt$$

- Budget constraint

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

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

- Key object: $\eta(a) \equiv a v'(a)$ — 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: $r_t p_t = 1 + \dot{p}_t$

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: $r_t p_t = 1 + \dot{p}_t$

- Agents can pledge ℓ trees each to borrow d_t^i

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

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: $r_t p_t = 1 + \dot{p}_t$

- Agents can pledge ℓ trees each to borrow d_t^i ($\lambda \equiv$ bond "decay rate")

$$\underbrace{\dot{d}_t^i + \lambda d_t^i}_{\text{new debt issuance}} \leq \lambda p_t \ell$$

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: $r_t p_t = 1 + \dot{p}_t$

- Agents can pledge ℓ trees each to borrow d_t^i ($\lambda \equiv$ bond "decay rate")

$$\underbrace{\dot{d}_t^i + \lambda d_t^i}_{\text{new debt issuance}} \leq \lambda p_t \ell$$

  - steady state: $d^i \leq p\ell$ [paper: generalize to $\ell = \ell(\{r_s\}_{s\geq t})$]

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: $r_t p_t = 1 + \dot{p}_t$

- Agents can pledge ℓ trees each to borrow d_t^i ($\lambda \equiv$ bond "decay rate")

$$\underbrace{\dot{d}_t^i + \lambda d_t^i}_{\text{new debt issuance}} \leq \lambda p_t \ell$$

  - steady state: $d^i \leq p\ell$ [paper: generalize to $\ell = \ell(\{r_s\}_{s \geq t})$]

- 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
  - so ... someone with \$28’000 today should save a ton?!

Scale invariance

- Non-homothetic model is typically **not scale invariant** in aggregate
  - economic growth $\Rightarrow$ \$28'000 today is like \$200'000 around 1900
  - 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

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

Saving supply curves

- Savers' Euler equation

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

- Setting $\dot{c} = 0$ in Euler and use $c^s = ra^s \Rightarrow$

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

Saving supply curves

- Savers' Euler equation

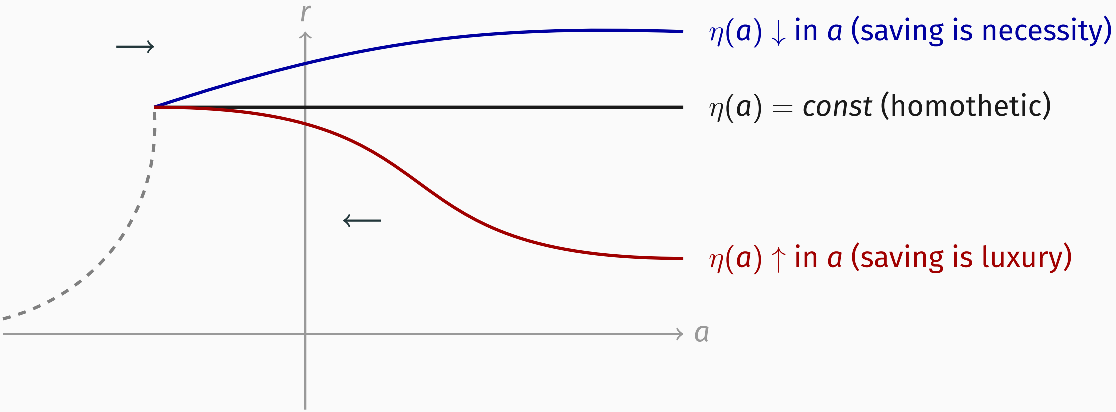
$$\frac{\dot{c}_t^s}{c_t^s} = r_t - \rho - \delta + \delta \frac{c_t^s}{\rho a_t^s} \cdot \eta(a_t^s)$$

- Setting $\dot{c} = 0$ in Euler and use $c^s = ra^s \Rightarrow$

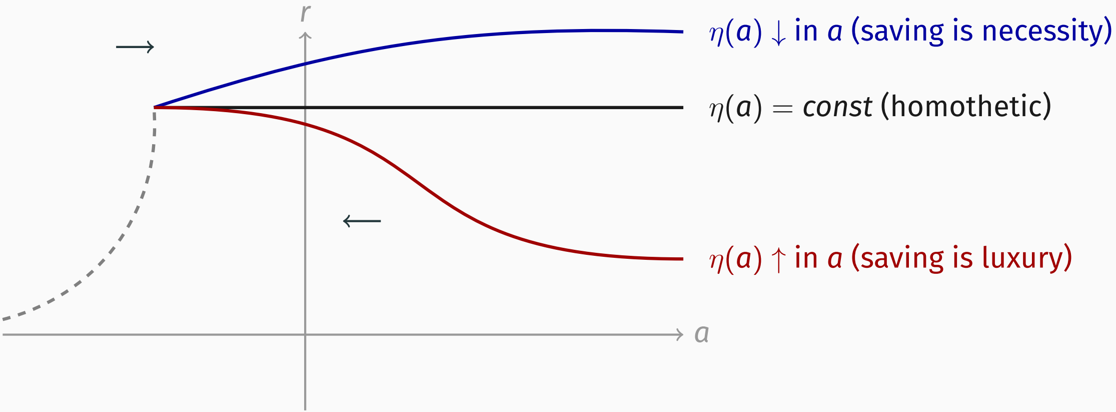
$$r = \rho \cdot \frac{1 + \rho/\delta}{1 + \rho/\delta \cdot \eta(a^s)}$$

- 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

Long-run saving supply curves



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

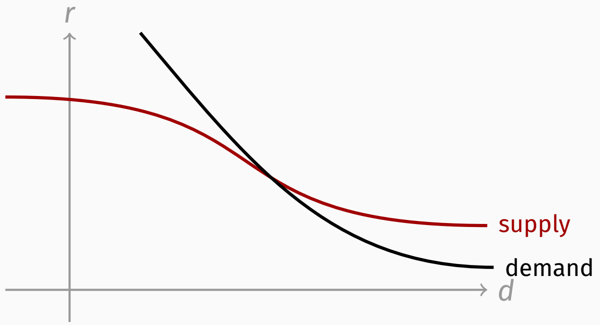
- **Steady state:** intersect long-run **supply curve** with **debt demand curve**

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

Steady state equilibria

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

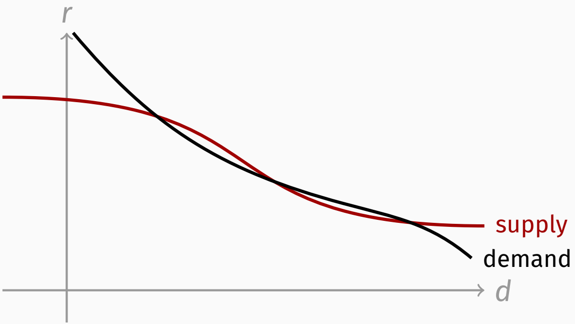
$$r = \rho \cdot \frac{1 + \rho/\delta}{1 + \rho/\delta \cdot \eta(\omega^s/r + d)} \qquad d = \frac{\ell}{r}$$



Steady state equilibria

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

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



Indebted demand

- Start from a steady state & **raise debt service costs** by some dx
- What is **response of aggregate spending**? (partial equilibrium, r fixed)

Indebted demand

- Start from a steady state & **raise debt service costs** by some dx

- What is **response of aggregate spending**? (partial equilibrium, r fixed)

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

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

  - $dC < 0$ if $\eta' > 0$

Indebted demand

- Start from a steady state & **raise debt service costs** by some dx

- What is **response of aggregate spending**? (partial equilibrium, r fixed)

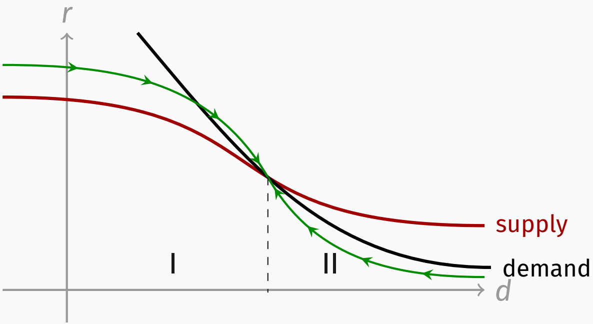
$$dC = dc^s + dc^b = -\frac{\rho+\delta}{r}\frac{1}{2}\left(1 - \sqrt{1 - 4\left(1 - \frac{r}{\rho+\delta}\right)\frac{\eta'(a)a}{\eta(a)}}\right)dx$$

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

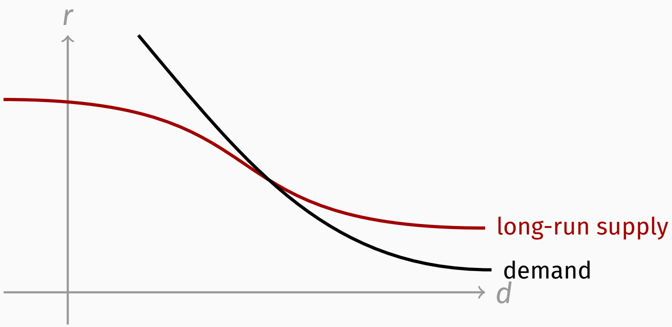
  - $dC < 0$ if $\eta' > 0$

- Call this phenomenon **“indebted demand”**

Equilibrium transitions

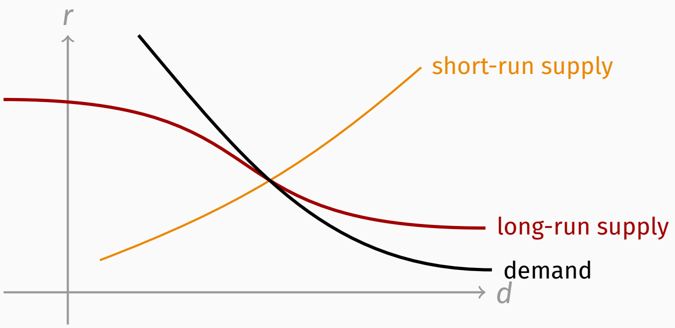


The indebted demand diagram



- **Saving supply curve** = how low does r have to be given % resources controlled by savers
- **Debt demand** = how much do borrowers want to borrow given r

The indebted demand diagram



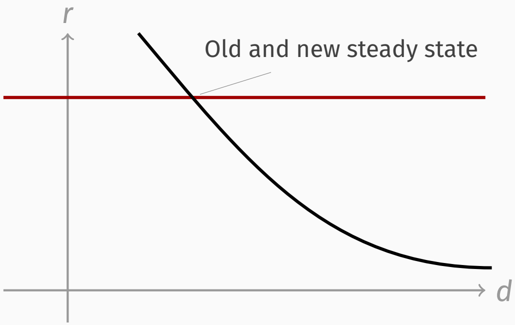
- **Saving supply curve** = how low does r have to be given % resources controlled by savers
- **Debt demand** = how much do borrowers want to borrow given r

Inequality & financial liberalization

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

▸ plot

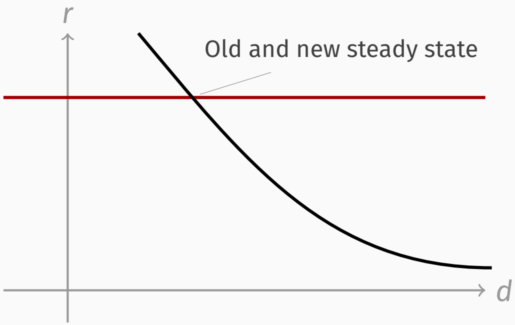
Homothetic model



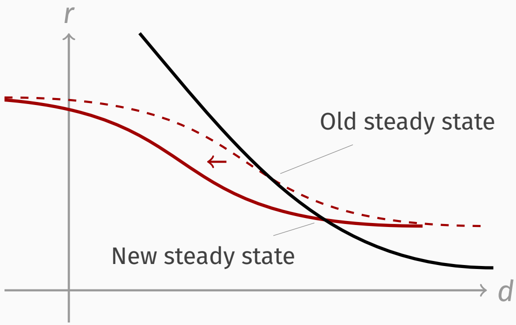
Rising inequality $\omega^s \uparrow$: lowers r and raises debt

▸ plot

Homothetic model

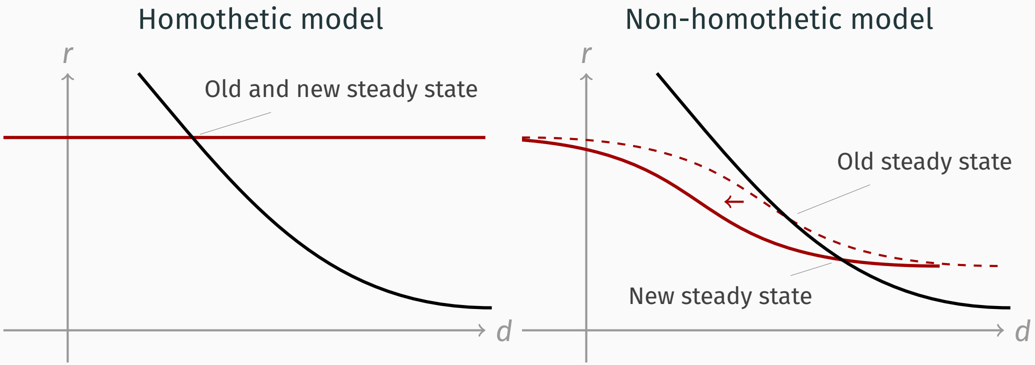


Non-homothetic model



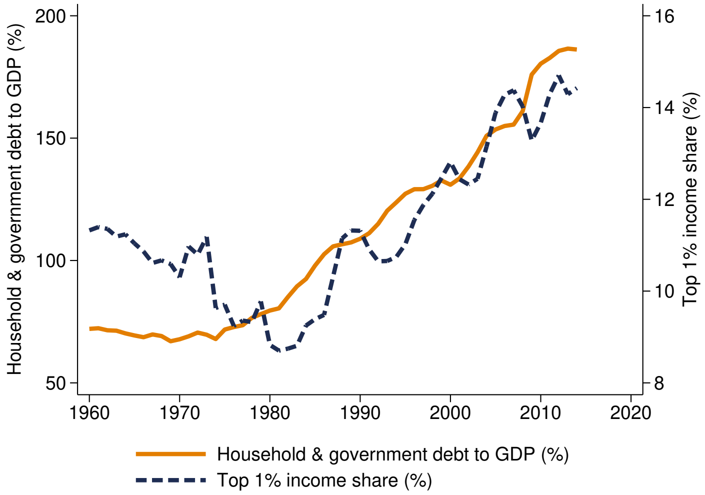
Rising inequality $\omega^s \uparrow$: lowers r and raises debt

▸ plot

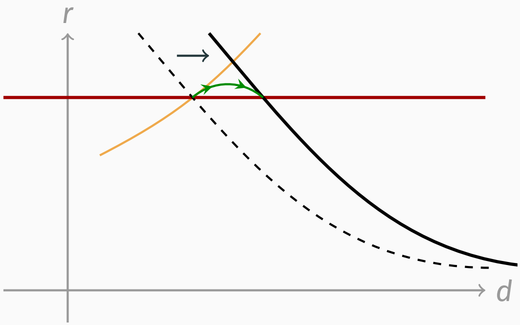


- **Effects** of rising inequality $\omega^s \uparrow$ in non-homothetic model:
  1. inequality $\uparrow \Rightarrow$ more saving by the rich $\Rightarrow r \downarrow \Rightarrow$ debt $\uparrow$
  2. debt $\uparrow$ first **raises** demand, pushing against decline in r
  3. high debt eventually **lowers**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

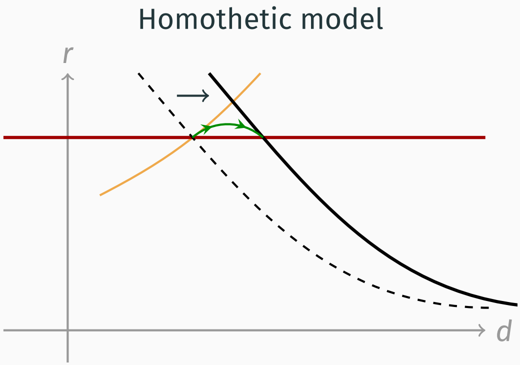
Inequality and debt across 14 advanced economies

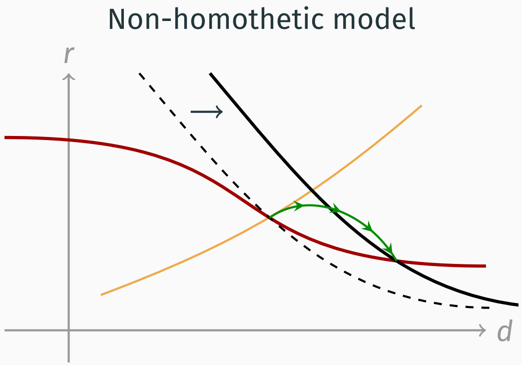


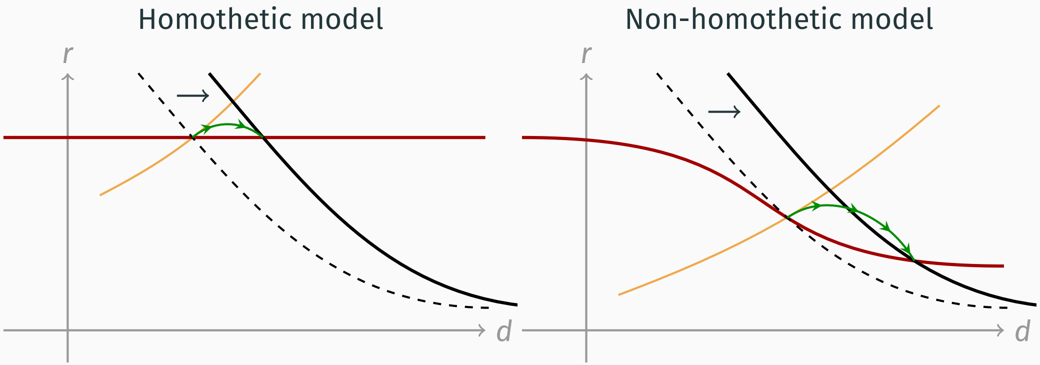
Homothetic model



Financial liberalization: raising pledgability ℓ







- **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 $d_t + B_t$

Fiscal policy implications

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

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

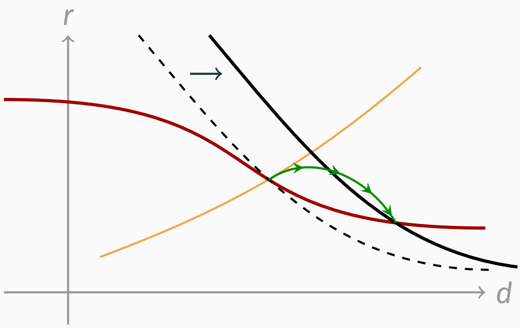
- Total demand for debt now $d_t + B_t$

- **Result:** In the long run

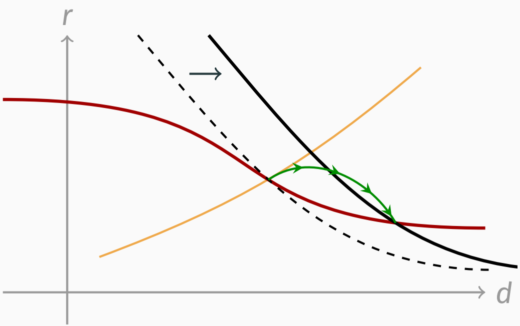
  1. **larger gov't debt** $B \uparrow$**:** depresses interest rate $r \downarrow$, crowds in household debt $d \uparrow$
  2. **tax-financed spending** $G \uparrow$**:** raises $r \uparrow$, crowds out $d \downarrow$
  3. **fiscal redistribution** $\tau^s \uparrow, \tau^b \downarrow$**:** raises $r \uparrow$,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

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

Deficit-financed fiscal policy

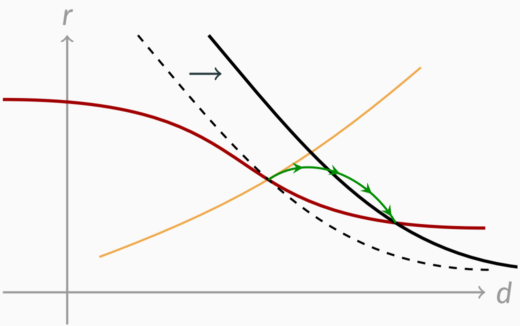


Deficit-financed fiscal policy



- Caveat: this assumed gov't pays same interest rate r
- In many advanced economies, gov't actually pays a lower rate
  - e.g. when investors derive other benefits from their debt (safety, convenience)

Deficit-financed fiscal policy



- Caveat: this assumed gov't pays same interest rate r
- In many advanced economies, gov't actually pays a lower rate
  - e.g. when investors derive other benefits from their debt (safety, convenience)
- In that case, what matters is how those benefits affect savers' investments

  → paper: natural case where things are unchanged

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

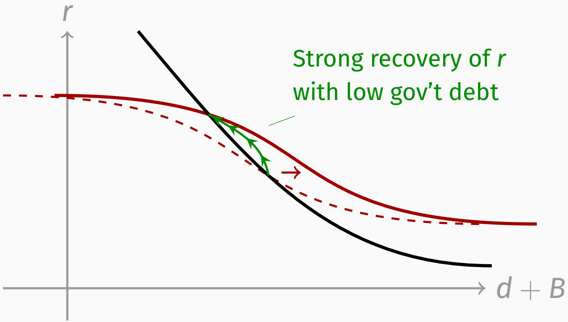
Imagine inequality falls exogenously. How much does the interest rate rise?

Low B

High B

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

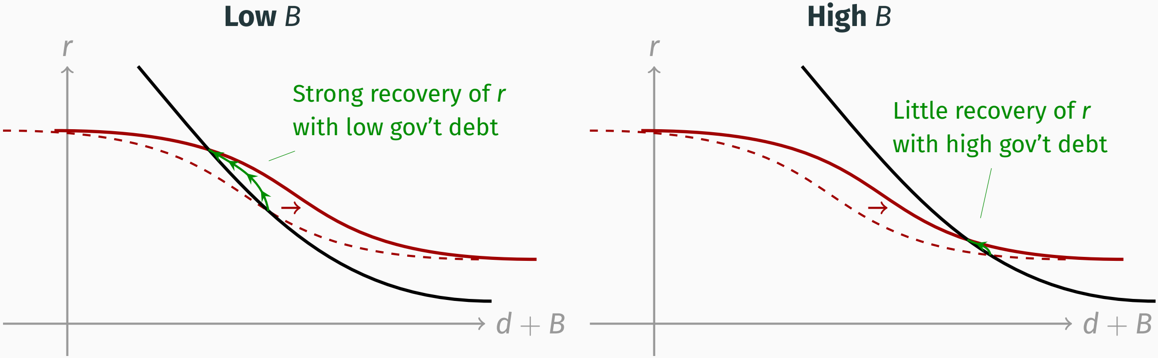
Low B



High B

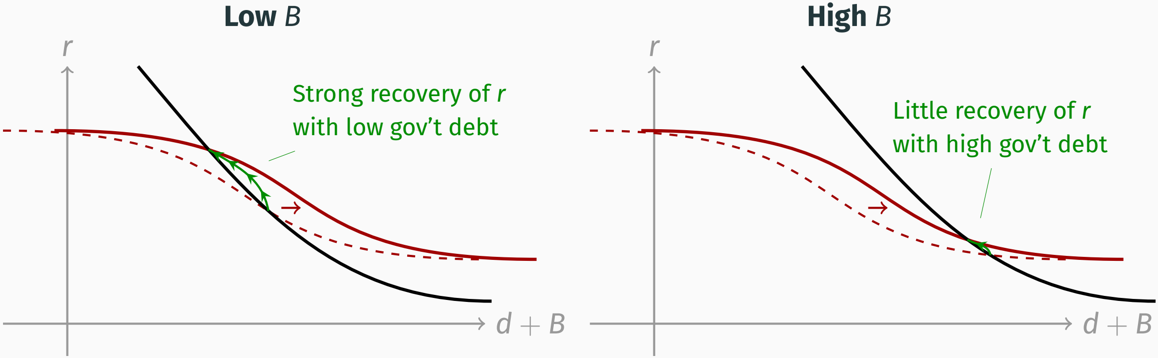
“Japanification” — how high public debt makes r less likely to rise

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



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

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

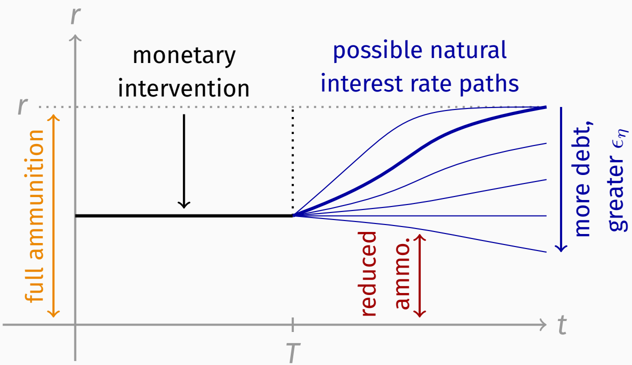


With **higher** B, any given increase in r **weighs down more on aggregate demand**

Monetary policy has limited ammunition when it raises debt

- Can extend our setup to include nominal rigidities (see paper)
- Monetary policy sets path of interest rates $\{r_t\}$, output is endogenous

Main result:



Debt trap

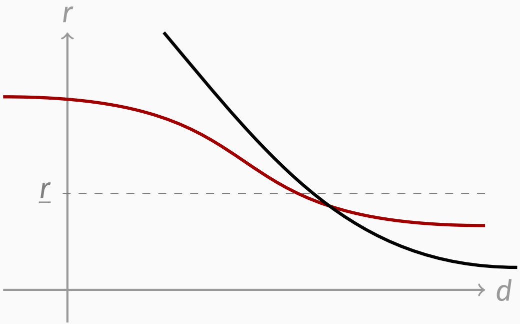
Introducing the lower bound

- Consider lower bound $\underline{r}$ on interest rate r
  - $\underline{r} > 0$ if r is return on wealth (e.g. $r \approx 3.5\%$ during recent US ZLB)

Introducing the lower bound

- Consider lower bound $\underline{r}$ on interest rate r
  - $\underline{r} > 0$ if r is return on wealth (e.g. $r \approx 3.5\%$ during recent US ZLB)

- 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**

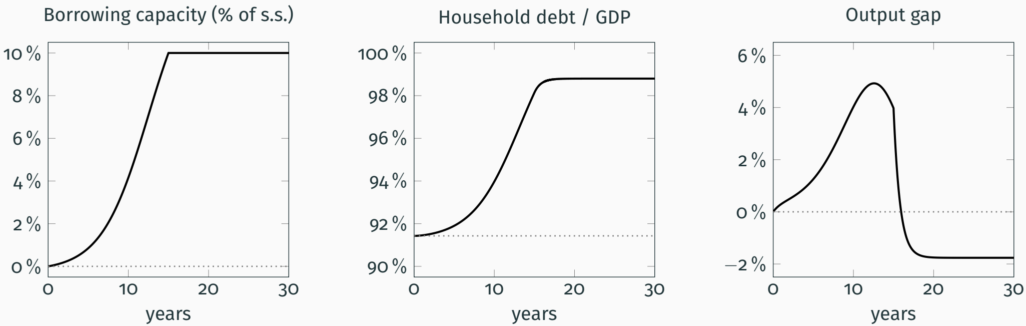
$$\hat{Y} = Y \frac{\underline{r}}{(1-\tau^s)\omega^s + \ell} \cdot \left[\eta^{-1} \left(\frac{\rho}{\underline{r}} (1 + \rho/\delta) - \rho/\delta \right) - B \right] < Y$$

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

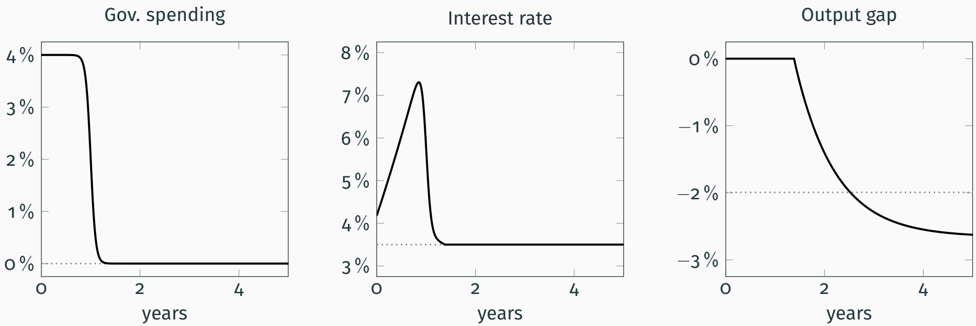
How does an economy fall into the debt trap? (i) Rising inequality

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

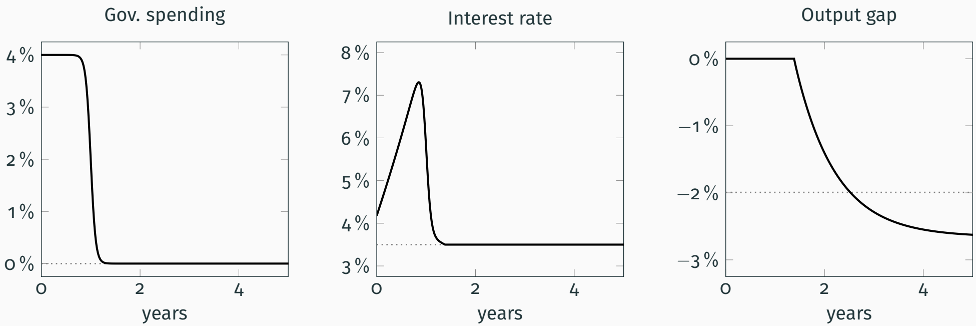
How does an economy fall into the debt trap? (ii) Credit boom-bust cycle



Fighting debt with debt? Deficit financing in the liquidity trap



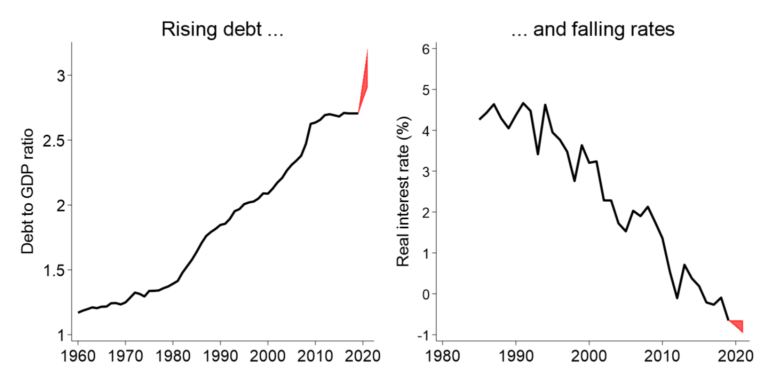
Fighting debt with debt? Deficit financing in the liquidity trap



- Here, deficit financing is only **temporary remedy** against a **chronic disease**
  - lessons for Covid crisis?

Indebted demand post-Covid

Covid shock set to further raise debt



Modeling Covid in our framework

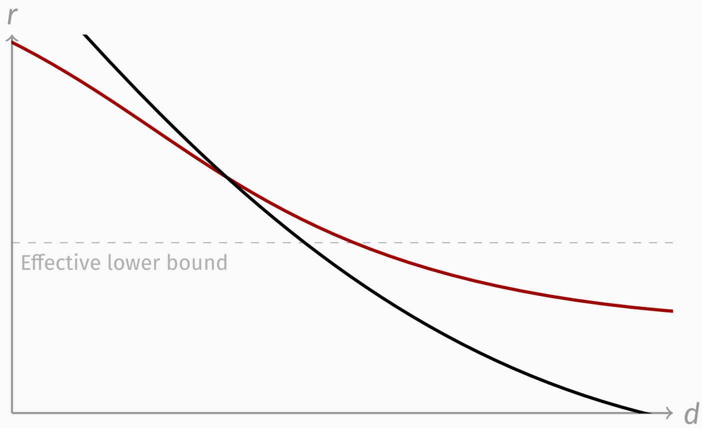
- Assume agents work in two sectors, “social” and “distant”
- Assume borrowers are over-represented in “social”

[Dingel-Neiman, Mongey-Weinberg, Leibovici et al]

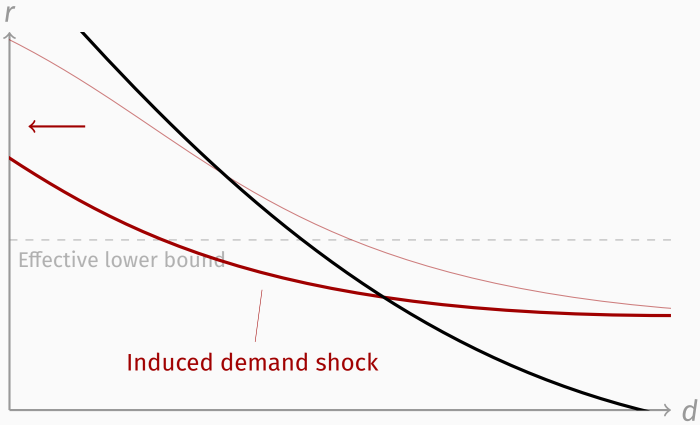
- Shock:
  - potential output falls $Y \downarrow$ and inequality rises $\omega^s \uparrow, \omega^b \downarrow$
  - assume this induces negative demand shock in “distant” sectors

[Guerrieri-Lorenzoni-Straub-Werning]

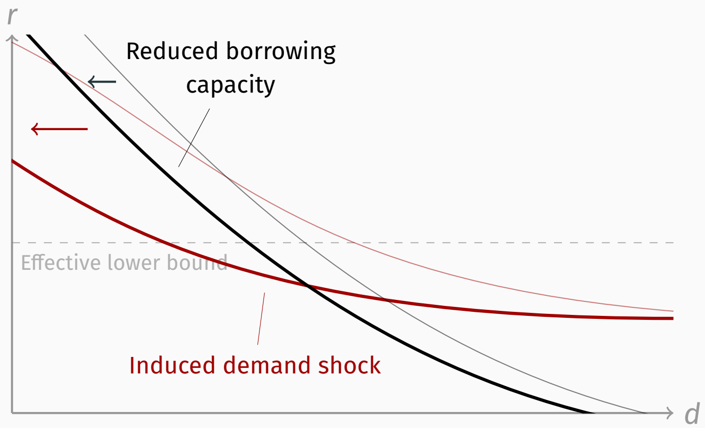
Covid in the indebted demand diagram



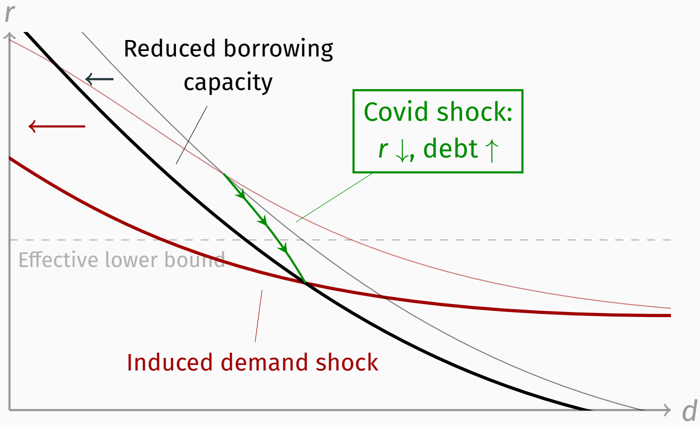
Covid in the indebted demand diagram



Covid in the indebted demand diagram



Covid in the indebted demand diagram



Three “archetypes” of policies in response to Covid shock

(A) Stimulating (non-productive) private debt to buffer the shock

- e.g. Fed’s lending facilities via SPV’s

→ model as increase in credit limit

(B) Government funds transfers using public debt, paid for by all taxpayers

- e.g. stimulus checks, UI, grants to businesses

→ model as increase in government debt

(C) Government funds transfers by taxing (now or later) very progressively

- e.g. Landais-Saez-Zucman, Greenwood-Thesmar

→ model as saver-financed increase in government debt

Three “archetypes” of policies in response to Covid shock

(A) Stimulating (non-productive) private debt to buffer the shock

- e.g. Fed’s lending facilities via SPV’s

$\rightarrow$ model as increase in credit limit

(B) Government funds transfers using public debt, paid for by all taxpayers

- e.g. stimulus checks, UI, grants to businesses

$\rightarrow$ model as increase in government debt

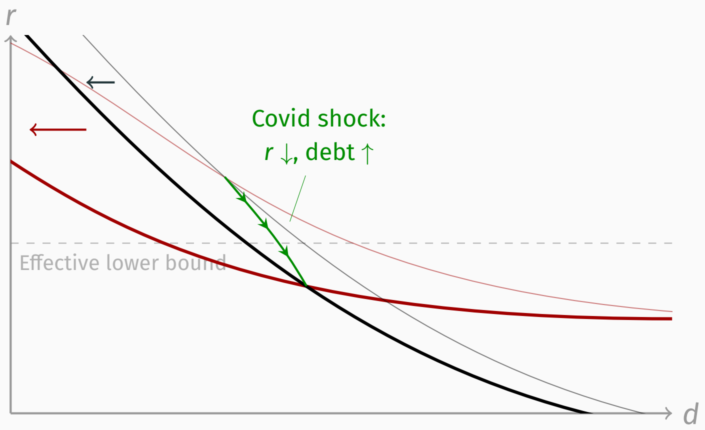
(C) Government funds transfers by taxing (now or later) very progressively

- e.g. Landais-Saez-Zucman, Greenwood-Thesmar

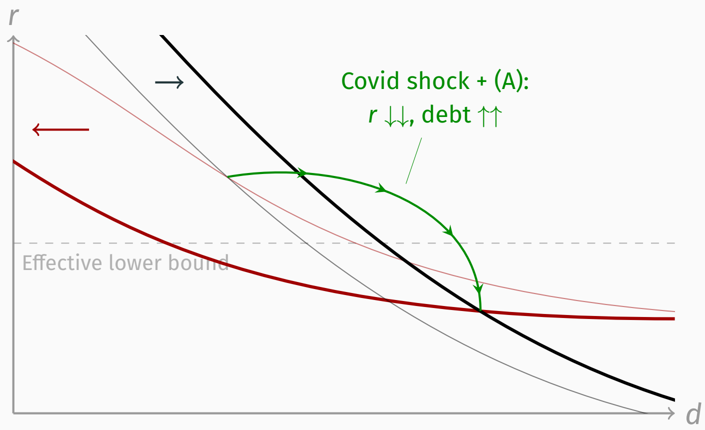
$\rightarrow$ model as saver-financed increase in government debt

Different across (A), (B), (C): whether there is a **transfer from savers to borrowers**

Policies in the indebted demand diagram

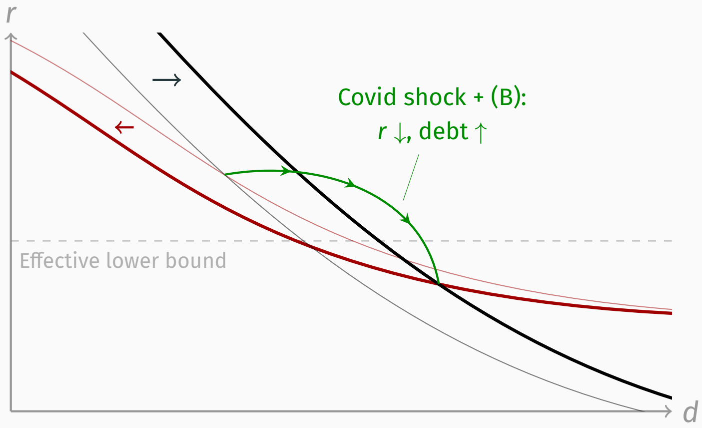


Policies in the indebted demand diagram



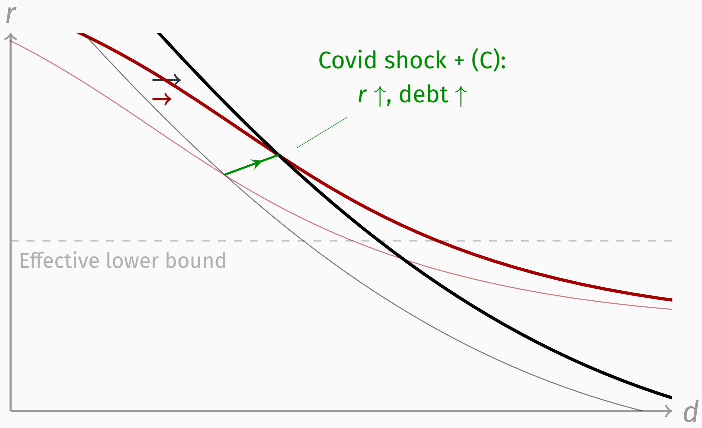
Policy (A) — Stagnation post-Covid

Policies in the indebted demand diagram



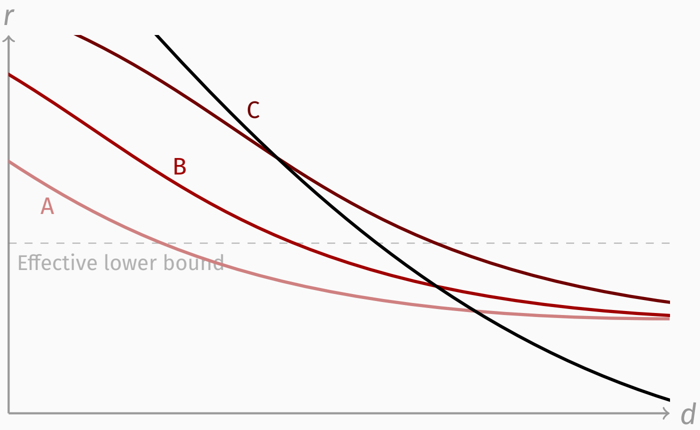
Policy (B) — Softer stagnation post-Covid

Policies in the indebted demand diagram



Policy (C) — No stagnation!

Policies in the indebted demand diagram



Bottom line: Transfers $>$ Debt

(long term $\rightarrow$ address any structural problems leading to greater inequality)

Extensions & conclusion

Extensions

- Redistribution (e.g. wealth tax) = Pareto improvement in debt trap
- Investment can help, especially if it complements borrowers' labor
- Similar results when there is gov't bond pay lower rate
- Intergenerational mobility helps
- Sufficient statistic exercise

In paper:

- Open economy model
- Uzawa preferences, relative wealth preferences

Indebted Demand:

Demand decreases in $r \times$ debt

Particularly relevant post-Covid!

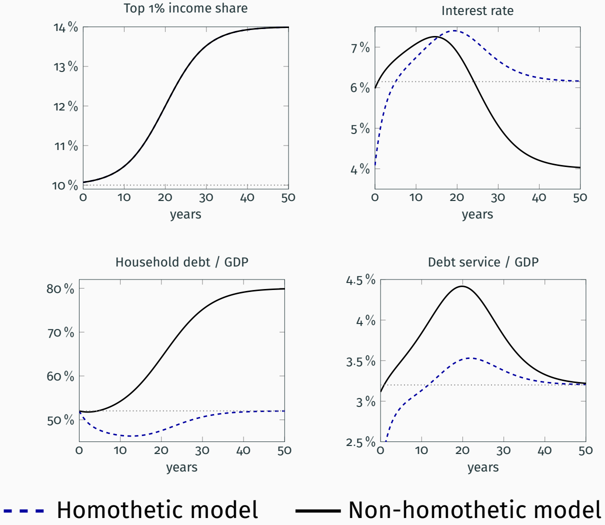
Indebted Demand:

Demand decreases in $r \times$ debt

Particularly relevant post-Covid!

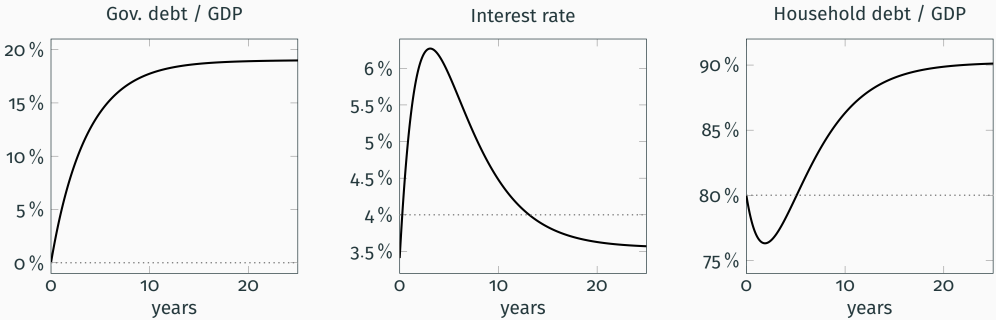
Extra slides

Inequality and debt



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 $r^B < g$?

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 $r^B < g$?
- Our model points to **two objects that matter** (see paper for details)

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 $r^B < g$?

- Our model points to **two objects that matter** (see paper for details)

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

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

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 $r^B < g$?

- Our model points to **two objects that matter** (see paper for details)

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

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

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

Redistribution and welfare

back

- What policy mitigates a debt trap? $\rightarrow$ **redistribution**
- Example: **wealth tax** of $\tau^a > 0$ on saver's wealth, redistributed to borrowers
- Saver's budget constraint becomes

$$c_t^s + \dot{a}_t^s = (r_t - \tau^a)\, a_t^s$$

$\rightarrow$ Wealth tax reduces return on wealth at ZLB to $\underline{r} - \tau^a$, raising $\hat{Y}$

- What about welfare?
  - borrower clearly benefits: lower r + wealth tax transfers + higher incomes
  - **saver also benefits:** greater incomes (& asset prices) *more* than compensate for tax!
- Thus: **Redistribution mitigates debt trap, at no welfare cost!**

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

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

- Key: savers' income share $\omega^s = \omega^s(r)$ **now a function of** $\boldsymbol{r}$**!**

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

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

- Key: savers' income share $\omega^s = \omega^s(r)$ **now a function of r!**

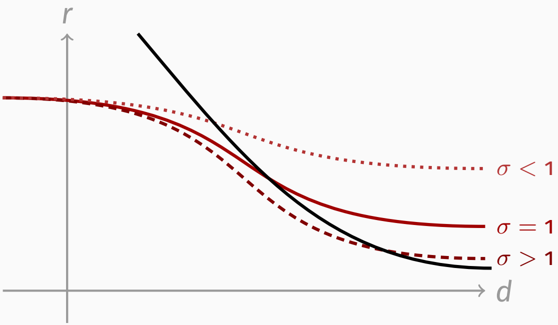
$$\omega^s(r) \equiv \frac{F_K K}{F} + \frac{F_{L^s} L^s}{F} = 1 - \frac{F_{L^b} L^b}{F}$$

  - $\omega^s(r)$ 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]

Indebted demand and investment

back

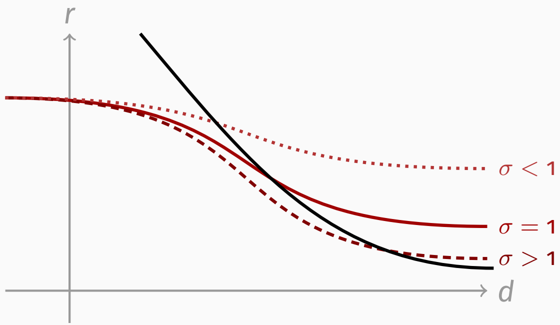
- **Main result:** Our results are unchanged if $\sigma = 1$. Amplified if $\sigma > 1$.



Indebted demand and investment

back

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



- 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 $\xi > 0$

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

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 $\xi > 0$

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

- 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

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
- **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:

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

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

▸ back

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

$$c(r(a), a) = r(a)a \Rightarrow \underbrace{\frac{c_r}{c}}_{\text{semi-elast. } \epsilon_r \text{ wrt } r} \frac{c}{a} \frac{dr}{d \log a} + \underbrace{c_a}_{MPC^{\text{cap. gains}}} = \frac{dr}{d \log a} + r$$

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

▸ back

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

$$c(r(a), a) = r(a)a \;\Rightarrow\; \frac{dr}{d\log a} = \frac{MPC^{\text{cap. gains}} - r}{1 - \epsilon_r \frac{c}{a}}$$

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

▸ back

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

$$c(r(a), a) = r(a)a \;\Rightarrow\; \frac{dr}{d\log a} = \frac{MPC^{\text{cap. gains}} - r}{1 - \epsilon_r \frac{c}{a}}$$

  - Standard PIH model: $MPC^{\text{cap. gains}} = r$ log preferences: $\epsilon_r = 0$

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

▸ back

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

$$c(r(a),a) = r(a)a \;\Rightarrow\; \frac{dr}{d\log a} = \frac{MPC^{\text{cap. gains}} - r}{1 - \epsilon_r \frac{c}{a}}$$

  - Standard PIH model: $MPC^{\text{cap. gains}} = r$ log preferences: $\epsilon_r = 0$

- 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]

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

back

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

$$c(r(a), a) = r(a)a \;\Rightarrow\; \frac{dr}{d\log a} = \frac{MPC^{\text{cap. gains}} - r}{1 - \epsilon_r \frac{c}{a}}$$

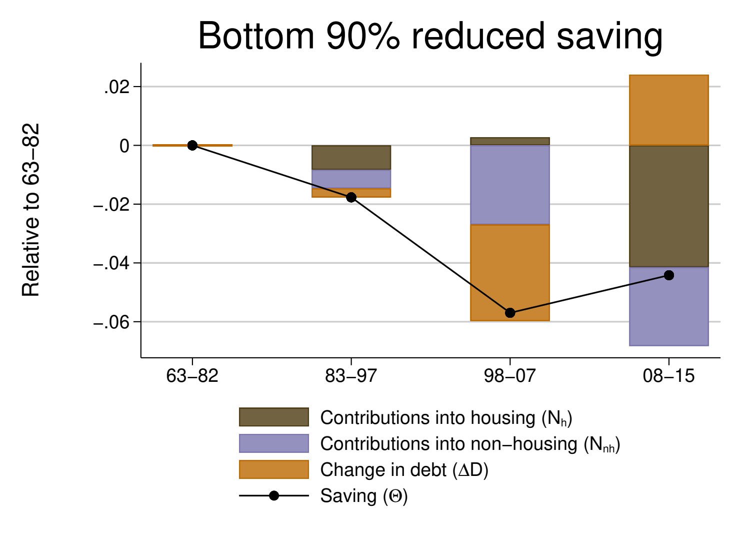
  - Standard PIH model: $MPC^{\text{cap. gains}} = r$ log preferences: $\epsilon_r = 0$

- 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]

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

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

Bottom 90% did not accumulate assets



How indebted is US demand?

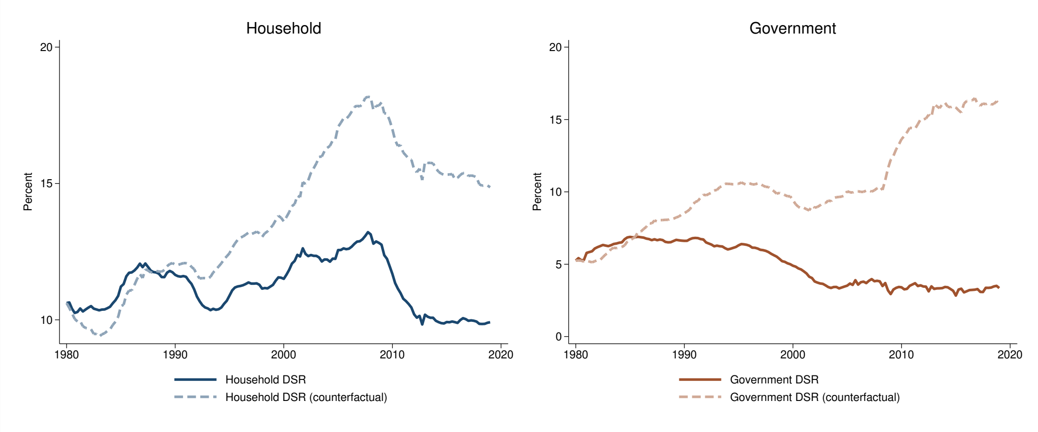
back

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

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?
- Counterfactual debt service burden, holding r constant:



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?
- Counterfactual debt service burden, holding r constant:

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