

Falling Behind: Has Rising Inequality Fueled the American Debt Boom?

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Outline

Introduction

Relation to the Literature

Model

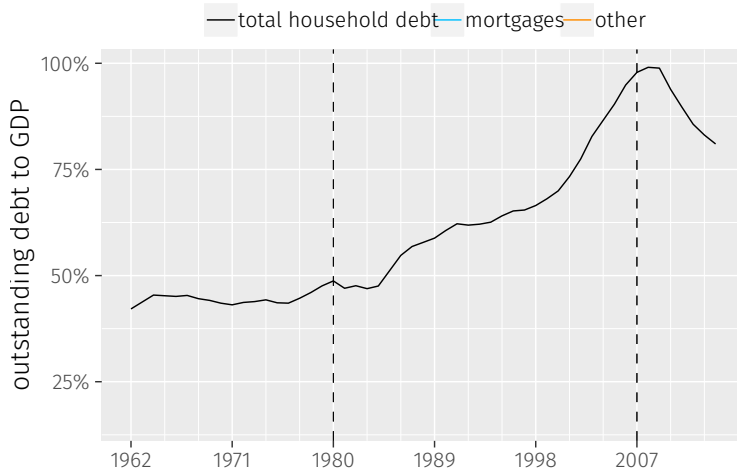
Analytical Results

Empirical Evidence

Quantitative Results

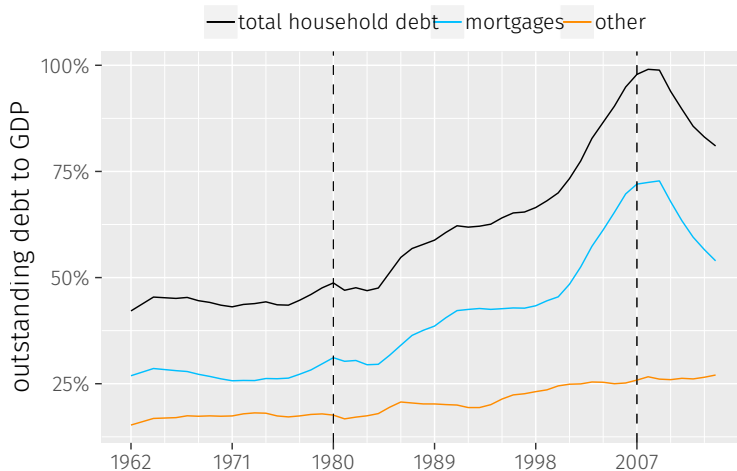
Conclusion

Fact I: US Household Debt Boom



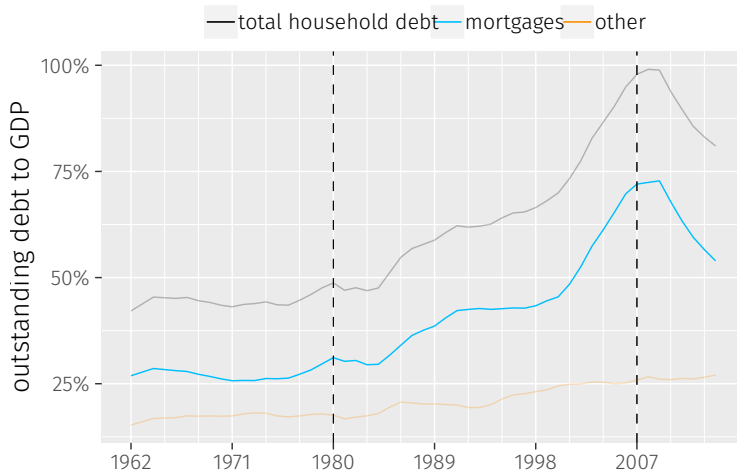
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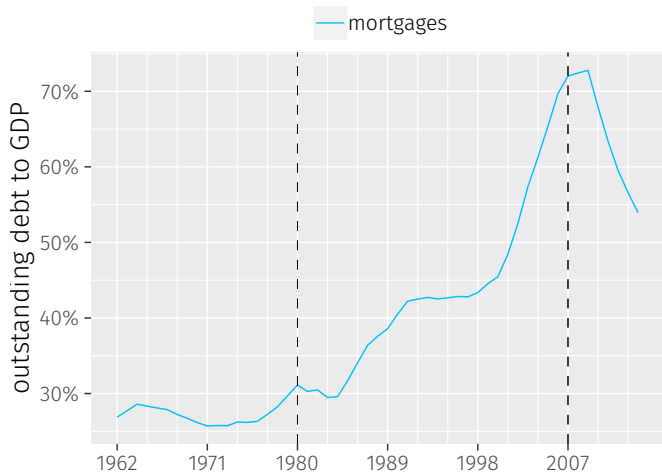
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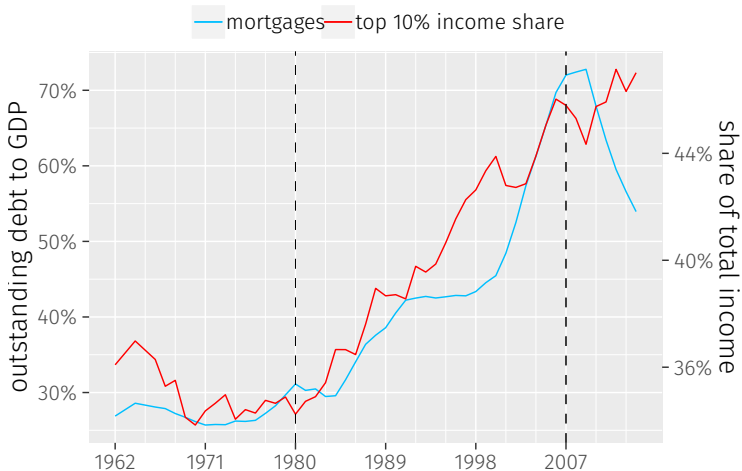
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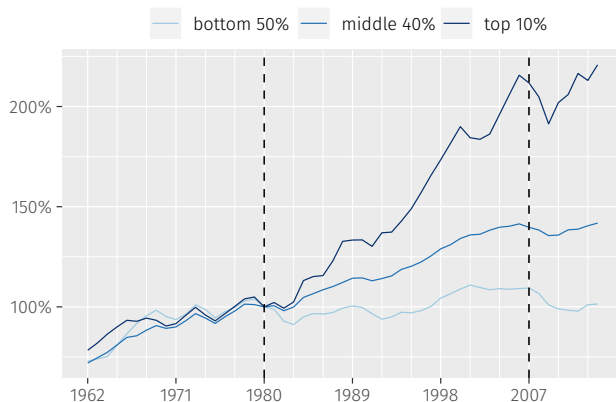
Fact I: US Household Debt Boom and Income Inequality



Source: US Flow of funds and World Inequality Database (Piketty et al.)

► alternative inequality measure

Fact II: Top Incomes Drive Inequality



Pre-tax incomes in the US. Base year: 1980. Based on Piketty et al. (2018).

Fact III: Mortgages of Non-Rich and Top Incomes Across US States

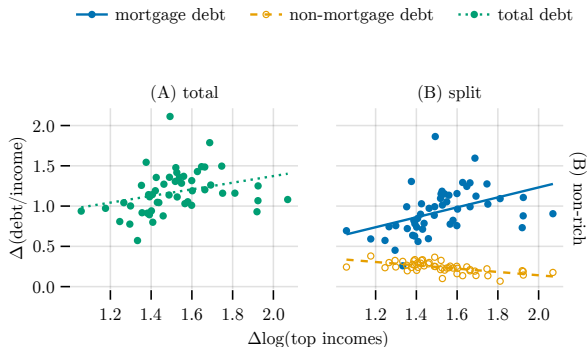


Figure shows changes between 1980 and 2007 for mortgages of the bottom 90% and incomes of the top 10%. Data: Distributional National Accounts.

In the paper: various specifications that confirm this result.

Research Question and Method

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Can **rising income inequality** account for (part of) the **mortgage debt boom**?

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Macroeconomic Model

- heterogeneous agents (income and wealth)
- durable housing and non-durable consumption, mortgages
- **social preferences** (Keeping up with the Joneses)

Data

- US State-Level Distributional National Accounts (Piketty et al., 2018; Mian et al., 2020)

Findings

Analytical Results

1. individual debt is increasing in the incomes of the reference group
2. aggregate debt-to-income is increasing in top incomes when somebody cares about the rich

Empirical Results

1. top incomes drive mortgages of the non-rich
2. top housing wealth drives housing wealth of the non-rich

Quantitative Result

1. Rising inequality and social comparisons **generate about 50%** of observed mortgage and house price booms

How Rising Income Inequality Leads to a Mortgage Boom

rising top inequality $\xRightarrow{\text{Keeping up with the Joneses}}$ mortgage boom

1. rich become richer (exogenously)
2. rich improve their houses, raise reference point
3. non-rich want to keep up with the richer Joneses
4. non-rich improve their houses using a mortgage
5. higher debt-to-income ratios across the distribution

Note: non-rich \approx bottom 90 % (almost everyone!)

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~> new (demand-side) mechanism, extended time-horizon
- External habits (Keeping up with the Joneses)
e.g. Abel (1990, AER P&P), Campbell and Cochrane (1999, JPE), Ljungqvist and Uhlig (2000, AER)
~> heterogenous agent model, use micro-evidence for parameterization
- “Distributional macroeconomics”
e.g. Kaplan and Violante (2014, Ecma), Kaplan et al. (2016, AER), Achdou et al. (2015)
~> another reason why “inequality matters for macro”
- Empirical consumption externalities
e.g. De Giorgi et al. (2019, REStud), Bertrand and Morse (2016, REStat), Bellet (2019a)
~> quantify effects on macroeconomic outcomes
- Network economics e.g. Ballester et al. (2006, Ecma), Ghiglino and Goyal (2010, JEEA)
~> infinite-horizon network model

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- risky post-tax earnings \tilde{y}
- non-durable consumption c , durable housing h
- asset a (savings device and mortgage)
- social comparisons
 - housing status $s(h, \bar{h})$
 - reference measure \bar{h}
- house price p , interest rate r

Preferences

$$\mathbb{E}_0 \int_0^\infty e^{-\rho t} u(c_t, s(h_t, \bar{h}_t))$$

Endogenous States

$$\dot{a}_t = \tilde{y}_t + r_t a_t - c_t - p_t x_t$$

$$\dot{h}_t = -\delta h_t + x_t$$

Collateral constraint

$$-a_t \leq \omega p_t h_t$$

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- flexible reference groups $\bar{h} = Gh$

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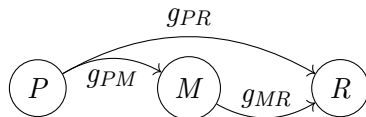
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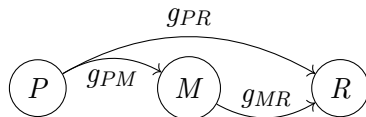


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- flow utility is
$$\frac{((1 - \xi)c^{1-\varepsilon} + \xi s(h, \bar{h})^{1-\varepsilon})^{\frac{1-\gamma}{1-\varepsilon}}}{1 - \gamma}$$
- $s(h, \bar{h}) = h - \phi \bar{h}$
- interest rate $r = \rho$
- life-time budget constraint
- for convenience: $a_0 = \delta = 0$

General Result

Lemma

Equilibrium debt (given p, r) is

$$-\begin{pmatrix} a_1 \\ \vdots \\ a_N \end{pmatrix} = \kappa_1 \begin{pmatrix} y_1 \\ \vdots \\ y_N \end{pmatrix} + \kappa_2 \phi \underbrace{\left(\sum_{i=1}^{\infty} \kappa_3^i G^i \right)}_{\approx \text{Leontief inverse of } G} \begin{pmatrix} y_1 \\ \vdots \\ y_N \end{pmatrix},$$

where $\kappa_1, \kappa_2 > 0, \kappa_3 \in (0, 1)$.

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where $\kappa_1, \kappa_2 > 0$, $\kappa_3 \in (0, 1)$.

Proposition

Type j 's debt is increasing in type k 's income as long as j cares about k (directly or indirectly).

Result: Example with three income types

$$\text{Let } \begin{pmatrix} \bar{h}_P \\ \bar{h}_M \\ \bar{h}_R \end{pmatrix} = \underbrace{\begin{pmatrix} 0 & g_{PM} & g_{PR} \\ 0 & 0 & g_{MR} \\ 0 & 0 & 0 \end{pmatrix}}_G \begin{pmatrix} h_P \\ h_M \\ h_R \end{pmatrix}$$

then equilibrium debt (given p, r) is

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where $\tilde{\phi} = \kappa_3 \phi$, $\kappa_1, \kappa_2 > 0$, $\kappa_3 \in (0, 1)$.

↪ Households need not be directly linked! (effects trickle-down)

Why Is Debt Increasing in Others' Incomes?

1. others' houses (and \bar{h})
increase in others' incomes

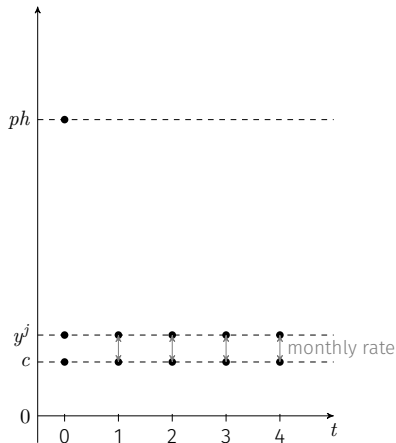
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$$h = c \left(\frac{\xi}{(1 - \xi)rp} \right)^{\frac{1}{1-\varepsilon}} + \phi \bar{h}$$

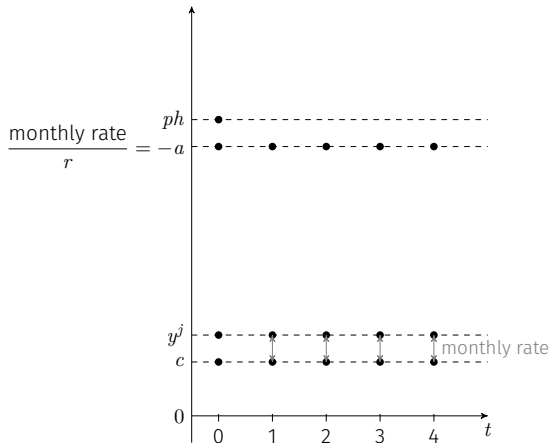
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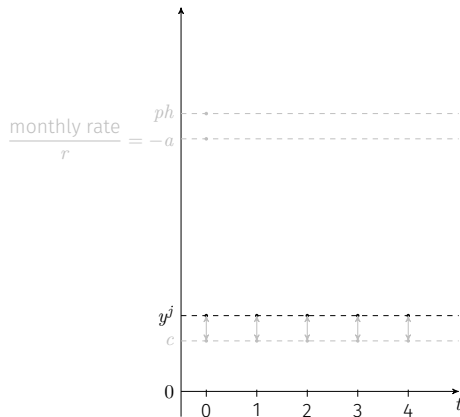
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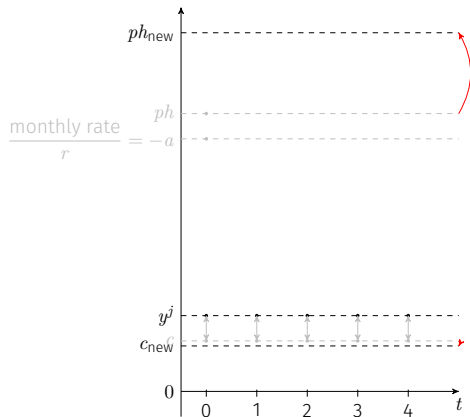
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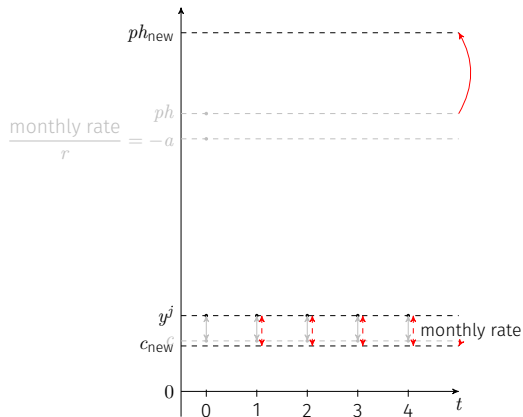
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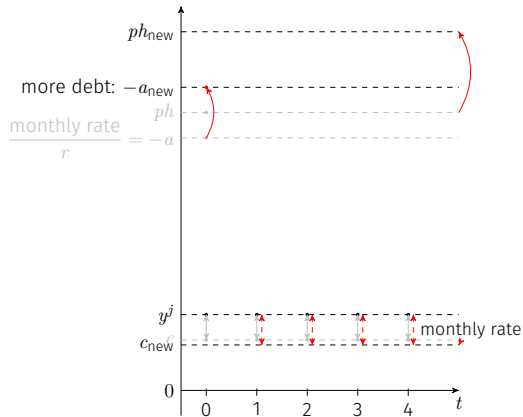
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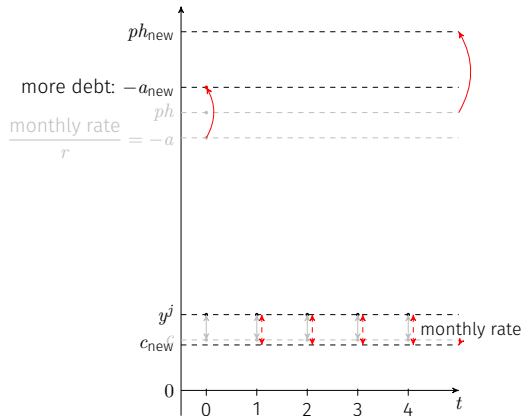
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⇒ Own credit demand is increasing in others' income!

Durability, Renters, Unsecured Debt

- debt is **only increasing** in incomes of reference group **if h is durable**
- non-durable housing \iff model with renters where δ is rent
- expect similar mechanism for cars, jewelry; but not for fancy food and hotels

Helpful definition: Popularity

Definition (Popularity)

Let the vector of *popularities* be

$$\mathbf{b}^T = \boldsymbol{\omega}^T \sum_{i=0}^{\infty} (\kappa_3 \phi G)^i = \boldsymbol{\omega}^T (I - \kappa_3 \phi G)^{-1}$$

and Type i 's popularity be the i^{th} component b_i .

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Popularity measures

- how many weighted paths end at a given type i
- how strongly the other types care about type i
- $b_i \geq \omega_i$ for all i

Effects on aggregates

Lemma

Aggregate housing demand and aggregate debt can be written in terms of popularity.

$$\sum_i \omega_i h_i = \kappa_4 \mathbf{b}^T \mathbf{y}, \quad \sum_i \omega_i a_i = (1 - \kappa_2) \mathbf{b}^T \mathbf{y}$$

Proposition

The impact of a change in type j 's income y_j on aggregate housing and aggregate debt is proportional to j 's popularity.

Towards General Equilibrium: Clearing the housing market

Housing demand

$$H = \sum_{i=1}^N \omega_i h_i$$

Housing supply

- use *effective labor* ΘN_h and *land permits* \bar{L} for new construction

$$I_h = (\Theta N_h)^\alpha \bar{L}^{1-\alpha}$$

- optimal construction is $I_h^* = (p\alpha)^{\frac{\alpha}{1-\alpha}} \bar{L}$

Market clearing

$$I_h = \delta H$$

General Equilibrium I: Top incomes and house prices

Special case: Cobb-Douglas ($\varepsilon \rightarrow 1$)

- optimal **debt** is independent of p
- the equilibrium **house price** is

$$p = \alpha^{-\alpha} \left(\frac{\delta \xi \mathbf{b}^T \mathbf{y}}{\bar{L}(r + \delta)} \right)^{1-\alpha}$$

- recall that **absent social comparisons** $\mathbf{b}^T \mathbf{y} = \boldsymbol{\omega}^T \mathbf{y}$
- That is, house prices are increasing in incomes even if there are no social comparisons. But house prices rise *more strongly with social comparisons*.

General Equilibrium Beyond Cobb-Douglas: Pick parameters

1. income types: Bottom 50%, Middle 40%, Top 10%

- match income shares in 1980

2. strength of the comparison motive

- match *sensitivity w.r.t others' housing*
- use estimate from Bellet (2019a) as upper bound

3. comparison matrix

$$\text{upward } \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix} \text{ vs rich } \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix} \text{ vs average } \begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$$

4. elasticity (c vs h)

- literature uses $\frac{1}{1-\epsilon} \in \{0.15, 1.0, 1.25\}$
- structural estimation using micro data vs time series data

Calibration

Parameter description		Source	Value
<i>Preferences</i>			
$\frac{1}{m}$	average life-time	working age 20–65	45.0
ρ	discount factor	internally calibrated	0.271
ξ	utility weight of housing	internally calibrated	
$\frac{1}{1-\varepsilon}$	elasticity of substitution ($s(h, \bar{h})$ vs c)	literature, see text	{0.15, 1.0, 1.25}
ϕ	strength of the comparison motive	internally calibrated	0.351
<i>Technology</i>			
$\frac{\alpha}{1-\alpha}$	housing supply elasticity	Saiz (2010)	1.5
δ	depreciation rate of housing	internally calibrated	0.052
\bar{L}	flow of land permits	ad hoc	1.0

Model Fit

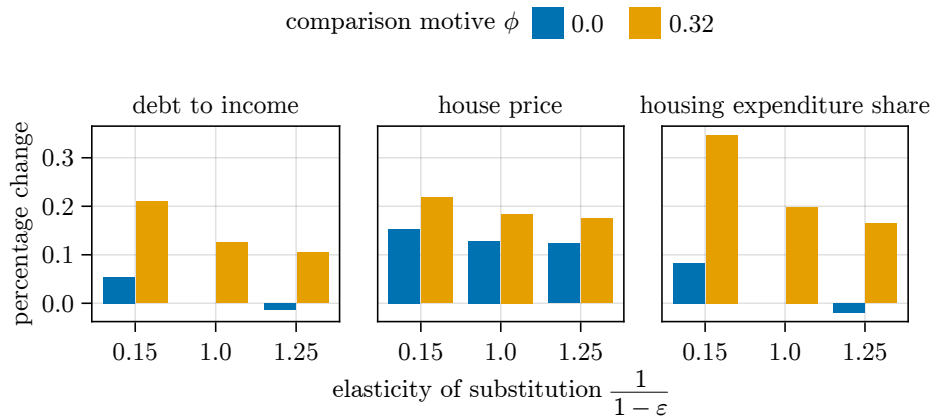
Moment	Model		Target	Source
	KURJ	Standard		
employment share in construction sector	0.05	0.05	0.05	Kaplan et al. (2020)
loan-to-value	0.294	0.294	0.294	DINA (1980)
mortgage-to-income	0.462	0.462	0.462	DINA (1980)
sensitivity to top housing	0.7		0.7	Bellet (2019a)

The Consequences of Doubling Top Incomes in General equilibrium

comparison motive ϕ ■ 0.0 ■ 0.32



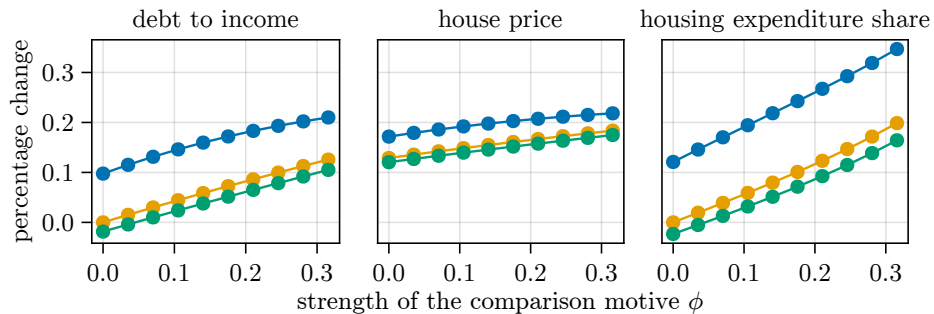
The Consequences of Doubling Top Incomes in General equilibrium



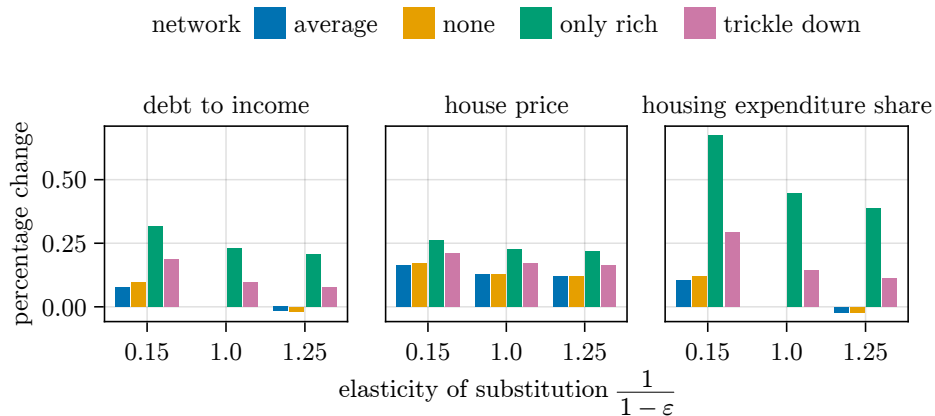
Take-away: Social comparisons not needed to drive house prices, but to drive debt

Varying the Strength of the Comparison Motive ϕ

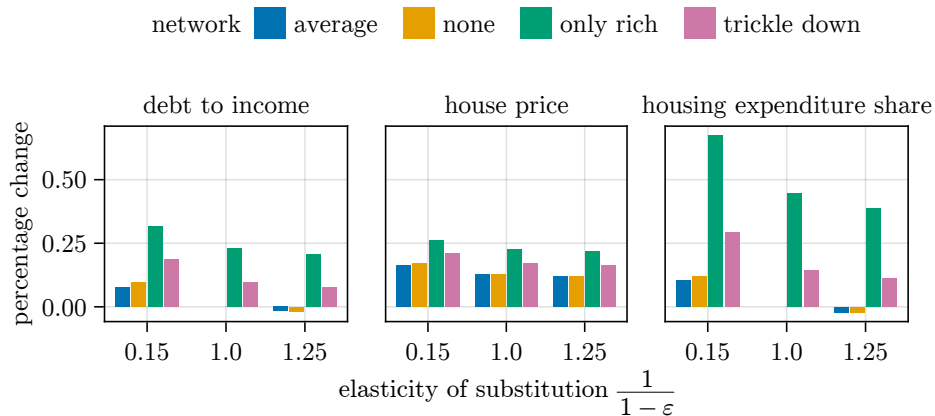
$$\text{CES } \frac{1}{1-\varepsilon} \quad \text{0.15} \quad \text{1.0} \quad \text{1.25}$$



Varying the Comparison Network G

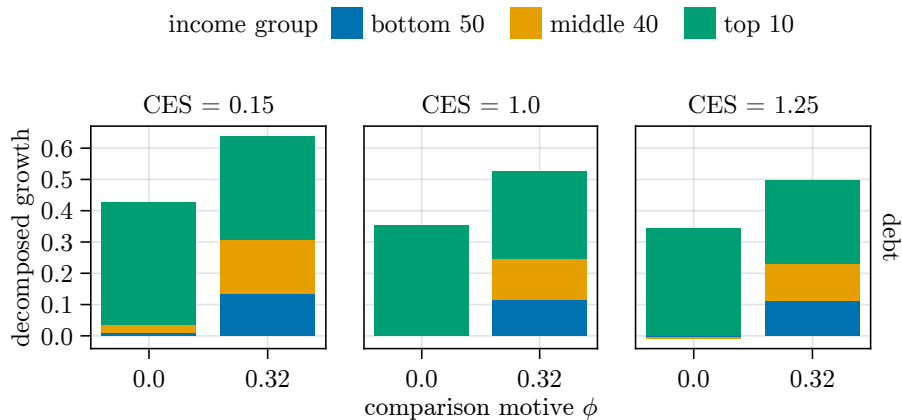


Varying the Comparison Network G

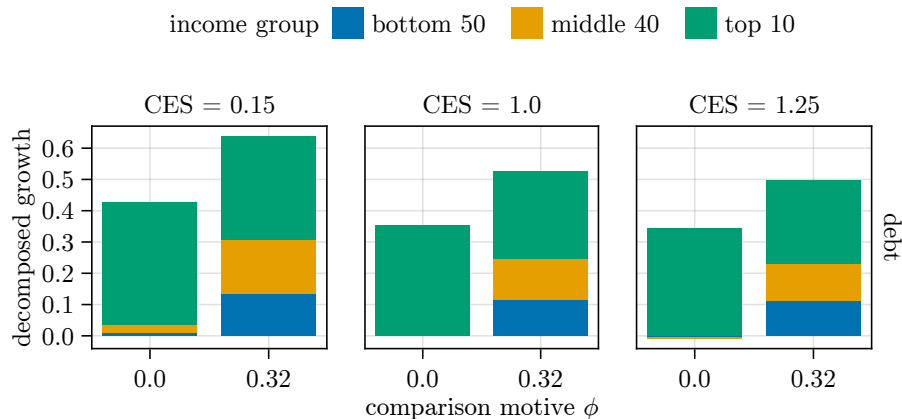


Take-away: *Classic* Keeping up with the average Joneses doesn't have a big effect
- price effect dominates

Decomposing the Aggregate Effect



Decomposing the Aggregate Effect



Take-away: Significant reaction of the Bottom 90%

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- US State-Level Distributional National Accounts (Piketty et al., 2018)
- state-level identifiers imputed from IRS data for top incomes (Mian et al., 2020)
- aggregate to state-year panel 1980–2007

Regressions I: Top Incomes and Mortgages of Non-Rich

	$\log(\text{NonRichMortgages}_t)$		HousePrice_t
	(1)	(2)	(3)
$\log(\text{TopIncomes}_{t-2})$	0.3218*** (0.0923)	0.2922*** (0.0862)	2.0311*** (0.4456)
HousePrice_t		0.0002 (0.0003)	
Non-Rich Income FE	Yes	Yes	–
Total Income FE	–	–	Yes
Demographic Controls	Yes	Yes	Yes
State & Year FE	Yes	Yes	Yes
Method	OLS	IV	OLS
F-test (first stage)	–	13.54	–

Regressions II: Result driven by owner-occupied housing

TABLE 4: Top Incomes and Household Debt-to-Income Ratios: Owner- vs. Renter-Occupied Housing

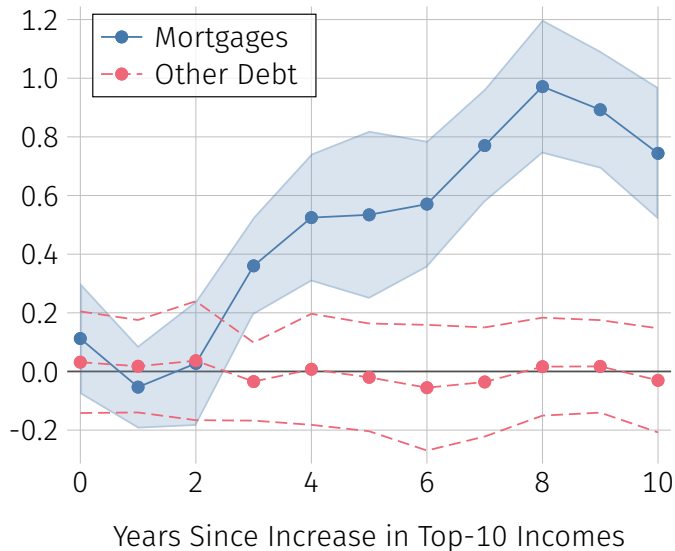
	(1) All Mortgages	(2) Owner-Occupied	(3) Renter-Occupied
$\Delta \log(\text{income}_{s,t-3}^{\text{top10}})$	0.154*** (0.045)	0.131*** (0.041)	0.023 (0.019)
Year FE	Yes	Yes	Yes
State Time Trends	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes
N	1,122	1,122	1,122
R^2	0.467	0.455	0.217

Notes: This table shows the estimated effect of lagged top incomes on non-rich mortgage-to-income ratios for mortgage debt on all houses (column 1) and separately for owner-occupied (column 2) and renter-occupied houses (column 3). Robust standard errors, clustered at the state level, are in parentheses. The stars indicate the range of the p value: $*** \leq 0.01 \leq ** \leq 0.05 \leq * \leq 0.1$.

Regressions III: Evidence for Social Comparisons

	$\log(\text{NonRichMortgages}_t)$		$\log(\text{NonRichHousing}_t)$	
	(1)	(2)	(3)	(4)
$\log(\text{TopHousing}_{t-2})$	0.9934*** (0.3417)	0.7651** (0.2410)	0.4713*** (0.1720)	0.3498* (0.2025)
HousePrice_t		0.0005 (0.0004)		0.0003 (0.0004)
Non-Rich Income FE	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
State & Year FE	Yes	Yes	Yes	Yes
Method	IV	IV	IV	IV
F-test (first stage)	26.31	20.63	25.79	17.47

Dynamic Effects on Debt of Bottom 90% — Local Projections



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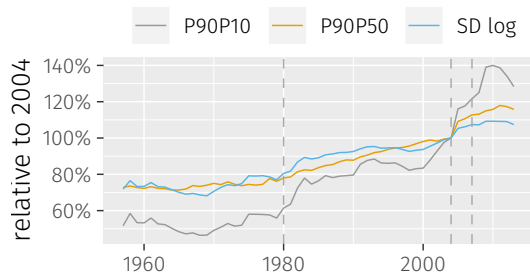
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Rising inequality, mortgages and house prices 1980–2007 (1)

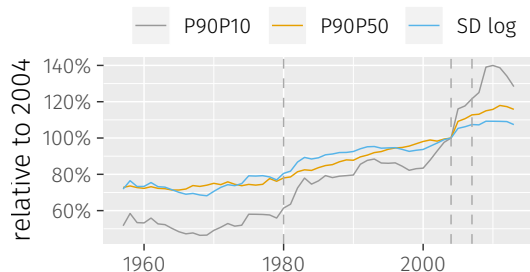
- inequality rises



Source: Guvenen et al. (2018)

Rising inequality, mortgages and house prices 1980–2007 (1)

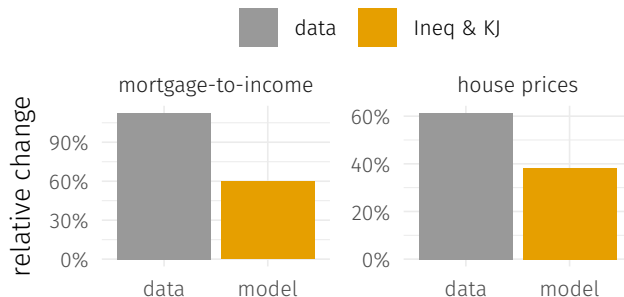
- inequality rises



- adjust permanent component of incomes (σ_α^2) to match difference in P90/P50 ratio between 1980 and 2007
- all other parameters are kept constant

Source: Guvenen et al. (2018)

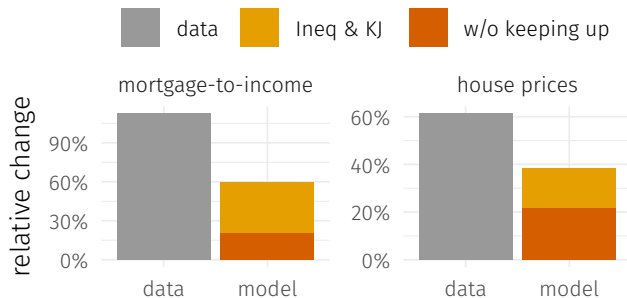
Rising inequality, mortgages and house prices 1980–2007 (2)



Take-away: Inequality & keeping up with the Joneses generate

- 40% of the observed mortgage boom
- 55% of the observed house price boom

Social Comparisons are an Important Amplifier — Rising Inequality is not Enough



Note: Keeping reference measure \bar{h} constant at \bar{h}_{1980} .

Take-away: Keeping up with the Joneses contributes 61% of the mortgage debt increase and 30% of the house price increase

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Conclusion

- We **formalize a causal link** between rising top incomes and the debt boom based on “keeping up with the richer Joneses”
- We show **analytically** that aggregate debt-to-income ratio is increasing in top incomes when somebody cares about the rich
- We show **empirically** that top incomes drive mortgage debt across states and time
- We show that rising income inequality “keeping up with the Joneses” are a **quantitatively important driver** of mortgage debt

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