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

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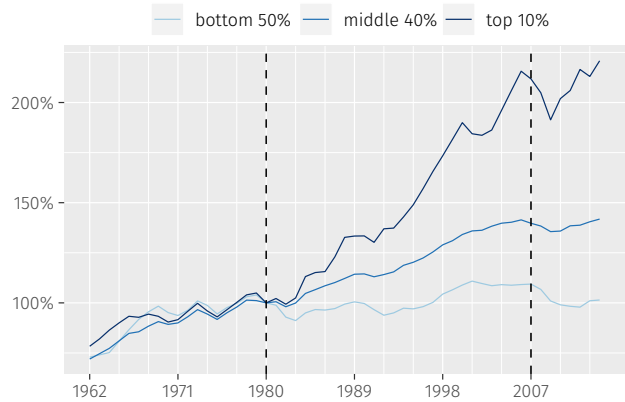
Dutch Institute for Emergent Phenomena | February 2, 2023

Outline

Mechanism: Keeping up with the *richer* Joneses

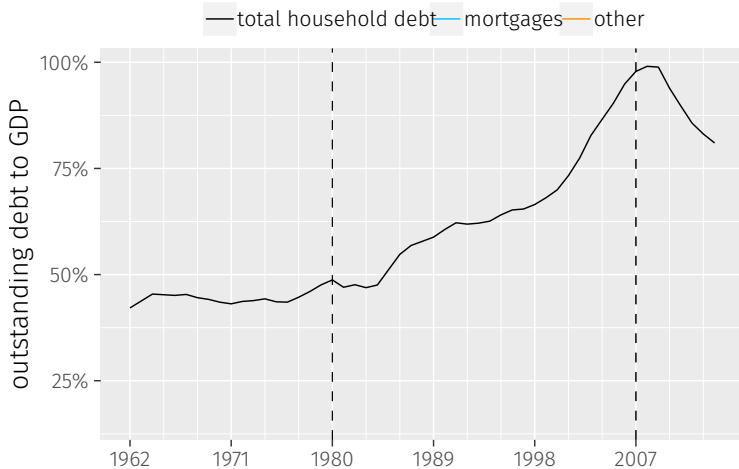
- when somebody wins in the lottery their neighbors buy bigger cars (Kuhn et al., 2011)
- when top incomes rise, the bottom 80% shift expenditures towards visible goods (like housing; see Bertrand and Morse, 2016a)
- when someone builds a big house, their neighbors will lose satisfaction with their own house (Bellet, 2019)

Fact I: Top Incomes Drive Inequality



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

Fact II: US Household Debt Boom



Source: US Flow of funds

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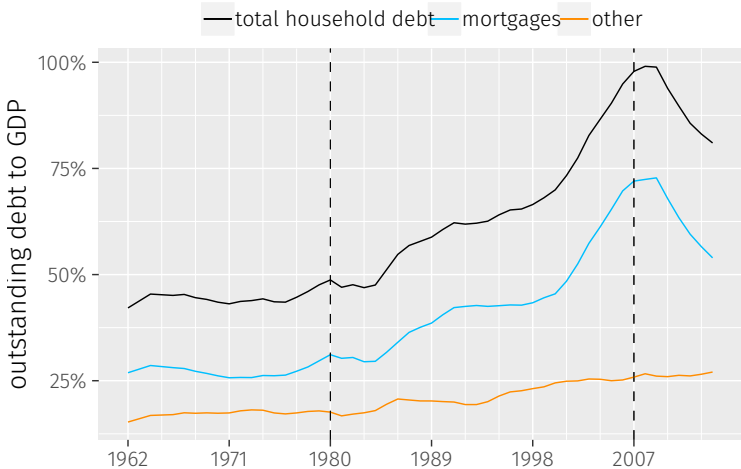

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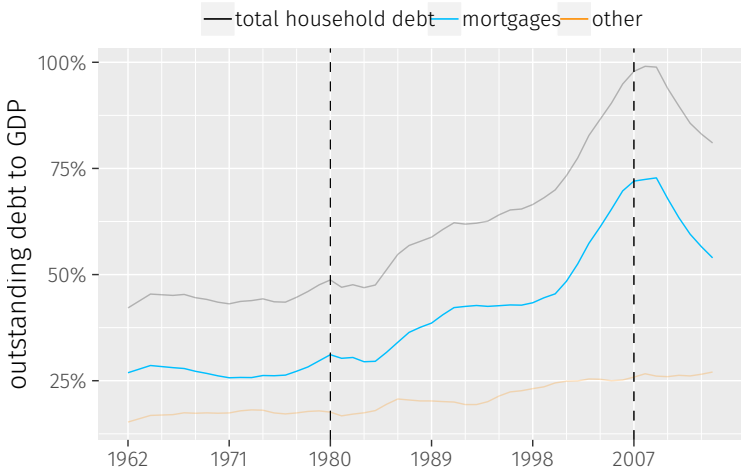

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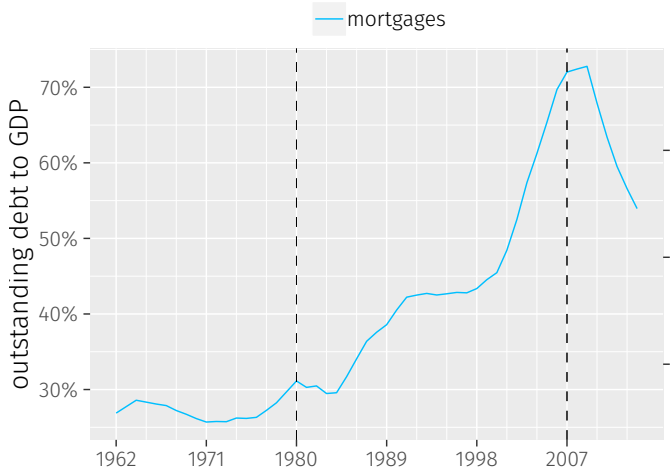

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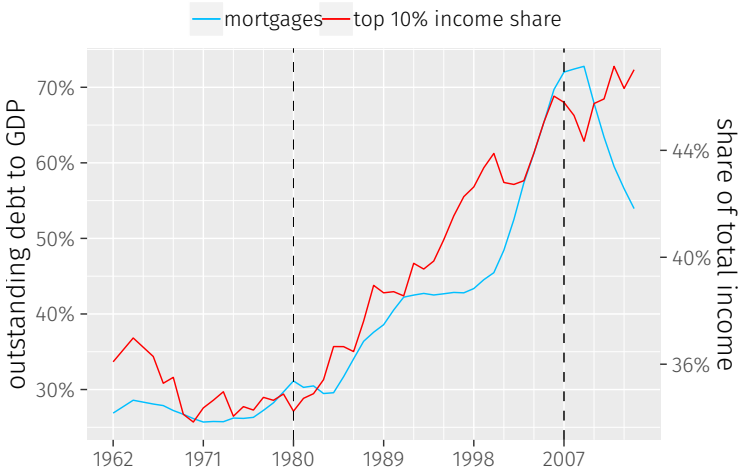
Fact II: US Household Debt Boom and Income Inequality



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

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

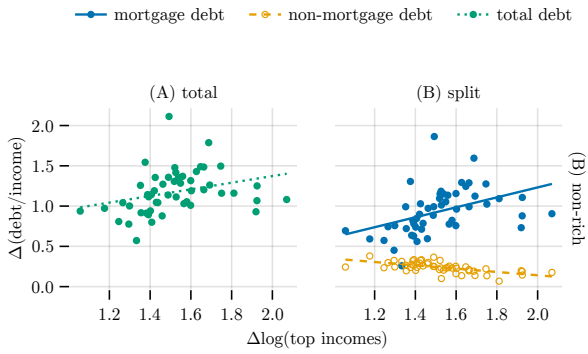


Figure shows changes between 1980 and 2007 for mortgages of the bottom 90% and incomes of the top 10%. Data: Distributional National Accounts.

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/income is increasing in top incomes if rich are *sufficiently popular*
3. house prices are increasing in top incomes if the rich are *sufficiently popular*

Empirical Results

1. non-rich mortgages are associated with lagged top incomes
2. house prices are associated with lagged top incomes

Quantitative Result

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

How rising income inequality induces demand for mortgages

rising top inequality $\xrightarrow{\text{Keeping up with the } \textit{richer} \text{ Joneses}}$ 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 mortage
5. higher debt-to-income ratios across the distribution

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

Outline

Relation to the Literature

- Macroeconomics with housing and mortgages, housing (debt) boom
  e.g. Kumhof et al. (2015, AER), Favilukis et al. (2017, JPE), Kaplan et al. (2020, JPE), Mian et al. (2021, QJE)
  $\rightsquigarrow$ 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)
  $\rightsquigarrow$ heterogenous agent model, use micro-evidence for parameterization
- "Distributional macroeconomics"
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  $\rightsquigarrow$ another reason why "inequality matters for macro"
- Empirical consumption externalities
  e.g. De Giorgi et al. (2019, REStud), Bertrand and Morse (2016b, REStat), Bellet (2019)
  $\rightsquigarrow$ quantify effects on macroeconomic outcomes
- Network economics e.g. Ballester et al. (2006, Ecma), Ghiglino and Goyal (2010, JEEA)
  $\rightsquigarrow$ infinite-horizon network model

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Outline

Households

- types $j \in \{1, \ldots, N\}$
- population weights ω_j
- constant incomes $\tilde{y}^1 < \tilde{y}^2 < \cdots < \tilde{y}^N$
- consumption c, durable housing h
- asset a (savings device and mortgage)
- house price p, interest rate $r = \rho$

Endogenous States

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

Preferences

- $\int_0^\infty e^{-\rho t} u(c_t, s(h_t, \bar{h}_t))\, dt$
- flow utility is $\frac{((1-\xi)c^{1-\varepsilon} + \xi s(h,\bar{h})^{1-\varepsilon})^{\frac{1-\gamma}{1-\varepsilon}}}{1-\gamma}$

Social comparisons

- housing status $s(h, \bar{h}) = h - \phi\bar{h}$
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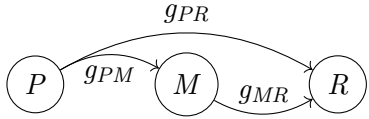

How optimal debt depends on others' incomes

Equilibrium debt (given p, r) is

$$-\begin{pmatrix} a_P \\ a_M \\ a_R \end{pmatrix} = \kappa_1 \begin{pmatrix} y_P \\ y_M \\ y_R \end{pmatrix} + \kappa_2 \underbrace{\left(\sum_{i=1}^{\infty} \tilde{\phi}^i G^i\right)}_{\approx \text{Leontief inverse of } G} \begin{pmatrix} y_P \\ y_M \\ y_R \end{pmatrix}$$

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

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- $\rightsquigarrow$ Households need not be directly linked! (effects trickle-down)
- $\rightsquigarrow$ Impact determined by column sums of $\sum_{i=1}^{\infty} \tilde{\phi}^i G^i$

Why Is Debt Increasing in Others' Incomes?

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2. own house increases with others' houses

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

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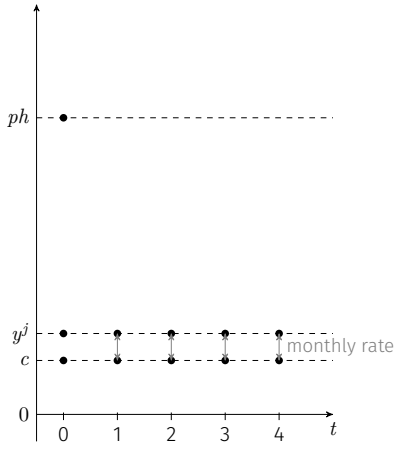
3. bigger house means more debt
   - use debt to smooth payments



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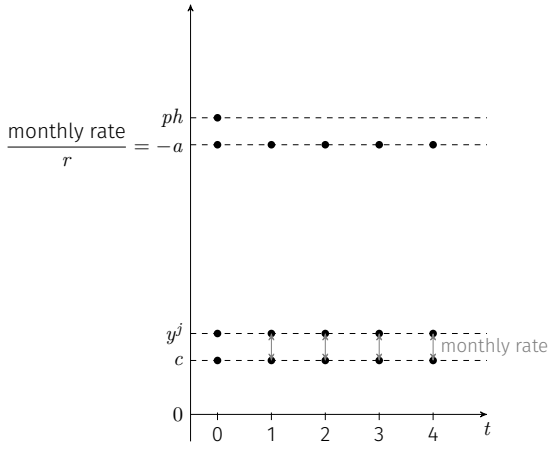

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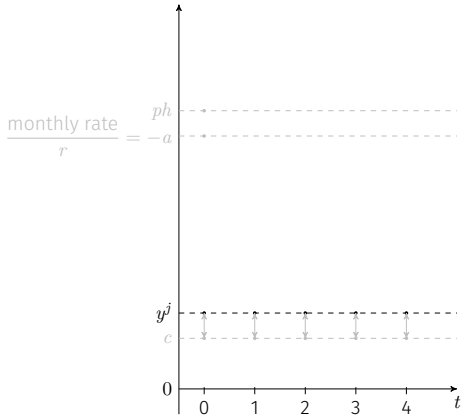

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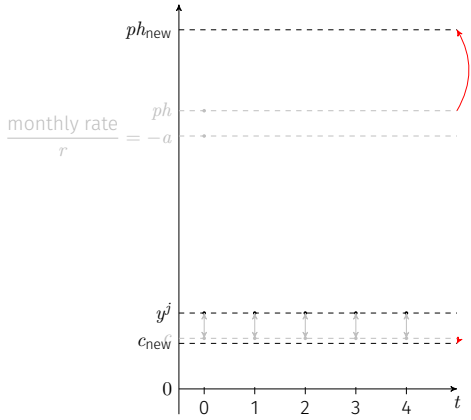

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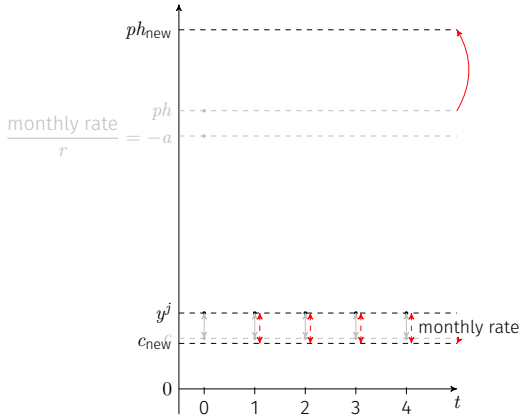

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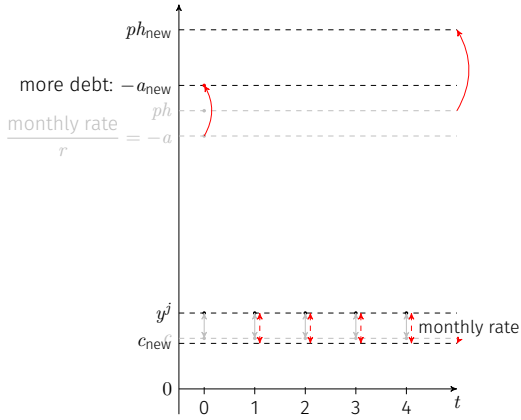
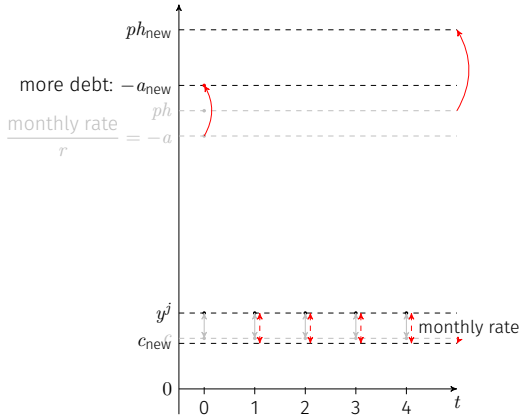


Why Is Debt Increasing in Others' Incomes?

1. others' houses (and $\bar{h}$) increase in others' incomes
2. own house increases with others' houses
3. bigger house means more debt
   - use debt to smooth payments
   - bigger house means more debt



$\rightsquigarrow$ Own credit demand is increasing in others' income!

Helpful definition

Let $\boldsymbol{\omega}^T = (\omega_P, \omega_M, \omega_R)$ be the types' population weights.

Popularity

The vector of *popularities* are *population-weighted column sums*

$$\boldsymbol{b}^T = \boldsymbol{\omega}^T \sum_{i=1}^{\infty} \tilde{\phi}^i G^i$$

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 (Bonacich-Katz *in*-centrality)
- how strongly the other types care about type i
- $b_i \geq 0$ for all i

Four examples

	no Joneses	mean Joneses	richer Joneses	rich Joneses
G	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 & x & 1-x \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$
$\boldsymbol{b}$	$(0,0,0)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(\omega_P, \omega_M, \omega_R)$	$\left(0, \omega_P \tilde{\phi} x, (*)\right)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(0,0,1)$

where $(*) = \omega_P(\tilde{\phi}(1-x) + \tilde{\phi}^2 x) + \omega_M \tilde{\phi}$

Effects on aggregates

Lemma

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

$$\sum_i \omega_i h_i = \kappa_4(\boldsymbol{\omega} + \boldsymbol{b})^T \boldsymbol{y}, \quad -\sum_i \omega_i a_i = \kappa_5(\boldsymbol{\omega} + \boldsymbol{b})^T \boldsymbol{y}$$

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.

The Consequences of Redistribution

Redistribute income from type i to type j

$$(\omega_j \underbrace{\Delta y_j}_{+} + \omega_i \underbrace{\Delta y_i}_{-} = 0)$$

Result

- housing & debt rise iff j is more popular than i

Definition: Type j is more popular than type i

$$\frac{b_j}{\omega_j} > \frac{b_i}{\omega_i}$$

The Consequences of Uneven Income Growth

Income grows *only* for type j

($\Delta y_j > 0$, but $\Delta y_i = 0$ for all $j \neq i$)

Result

- housing-to-income & debt-to-income rises iff j's popularity is above average

Definition: Type j's popularity is above average

$$\frac{b_j}{\omega_j} > \sum_{i \neq j} \lambda_i \frac{b_i}{\omega_i}$$

Towards General Equilibrium: Clearing the housing market

Housing demand

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

Housing supply (as in Favilukis et al., 2017; Kaplan et al., 2020)

- 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

$$I_h = \delta H$$

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

- optimal debt is independent of p (previous results survive)
- the equilibrium house price is

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

- Redistribution increases $p \iff j$'s popularity is above average
- Uneven income growth increases* $p \iff j$ is more popular than i

(*) increase *beyond the income effect*

Does inequality drive debt and house prices? (I)

	no Joneses	mean Joneses	richer Joneses	rich Joneses
G	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 & x & 1-x \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$
$\boldsymbol{b}$	$(0,0,0)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(\omega_P, \omega_M, \omega_R)$	$\left(0, \omega_P \tilde{\phi} x, (*)\right)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(0,0,1)$
$\frac{b_R}{\omega_R} > \frac{b_P}{\omega_P}$	no	no	yes	yes
$\frac{b_R}{\omega_R} > \frac{b_M}{\omega_M}$	no	no	yes*	yes

where $(*) = \omega_P(\tilde{\phi}(1-x) + \tilde{\phi}^2 x) + \omega_M \tilde{\phi}$

Does inequality drive debt and house prices? (II)

- What comparison matrix G is empirically relevant?
  - comparison motive is strongest (and best documented) with respect to the rich (e.g. Clark and Senik, 2010; Ferrer-i-Carbonell, 2005; Card et al., 2012)
  - this would correspond to *rich(er) Joneses*
- model suggests: yes, income inequality drives mortgages and house prices
- what about non-mortgage debt?
  - mechanism only holds for durable and conspicuous goods
  - expect similar mechanism for cars, jewelry; but not for fancy food and hotels
  - model predicts weaker correlation, if any

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 (2019) as upper bound
3. comparison matrix: no Joneses vs mean Joneses vs rich(er) Joneses
4. elasticity (c vs h)
   - literature uses $\frac{1}{1-\varepsilon} \in \{0.15, 1.0, 1.25\}$
   - structural estimation using micro data vs time series data

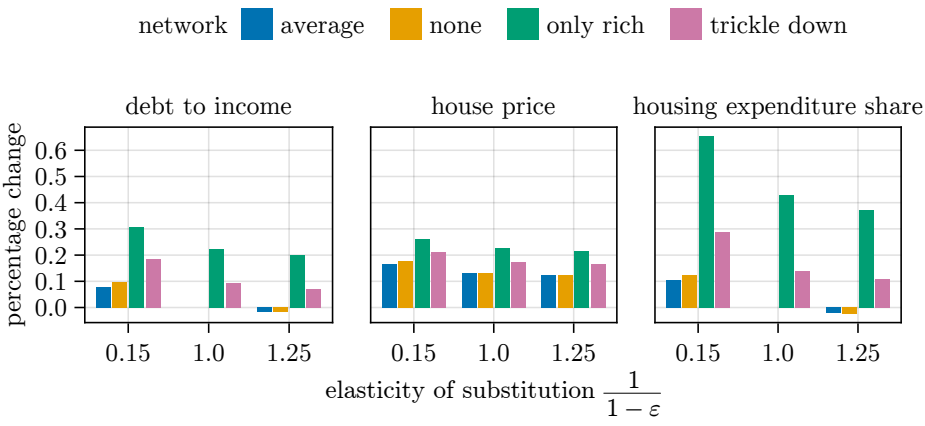
Calibration

Parameter description		Source	Value
Preferences			
$\frac{1}{m}$	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
Technology			
$\frac{\alpha}{1-\alpha}$	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

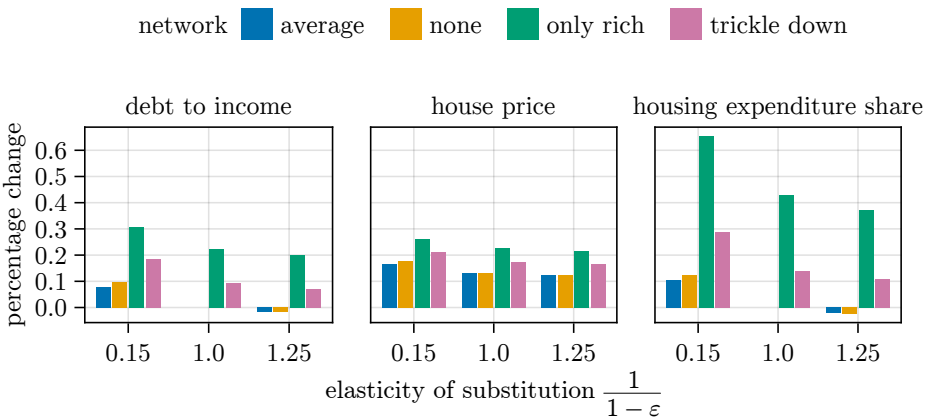
Model Fit

	Model			
Moment	KURJ	Standard	Target	Source
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 (2019)

Varying the Comparison Network G

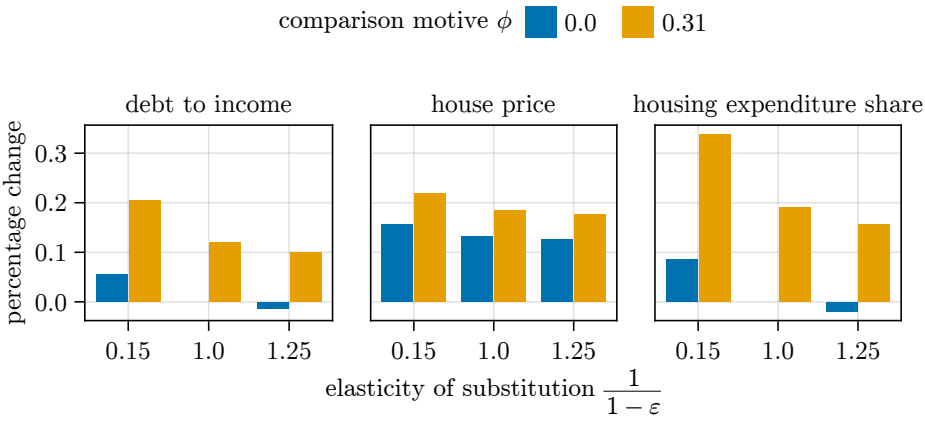


Varying the Comparison Network G



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

The Consequences of Doubling Top Incomes in General equilibrium



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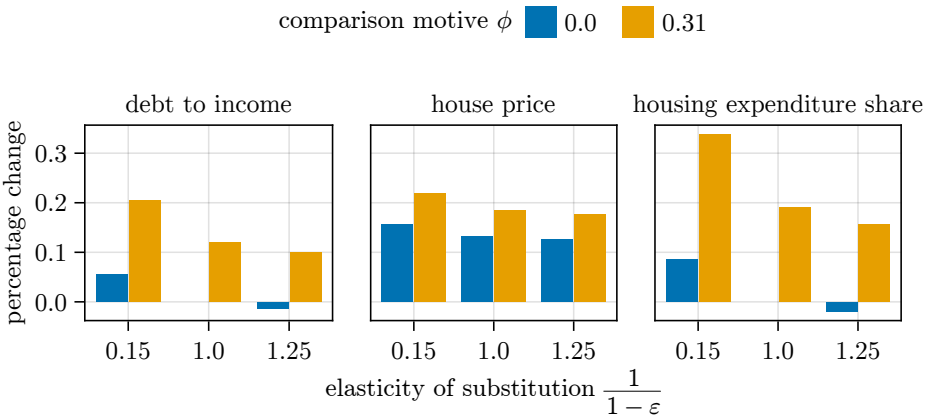
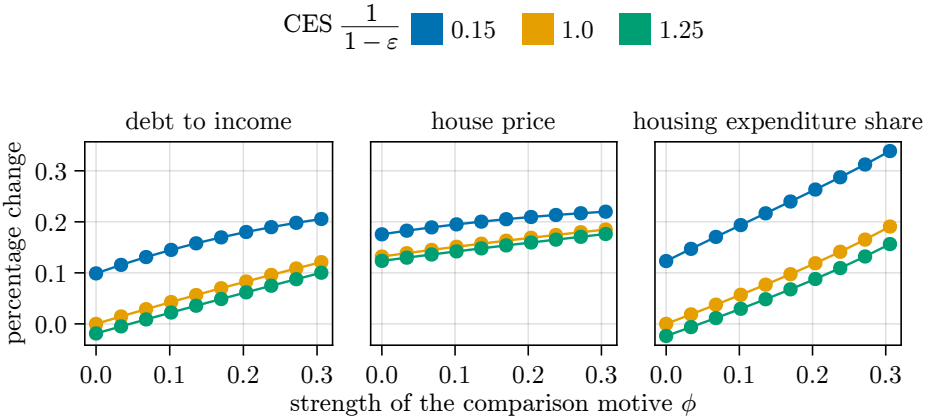
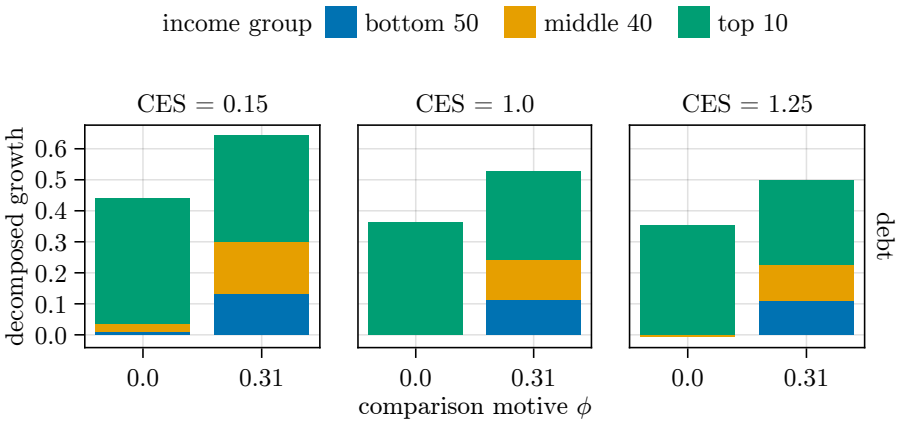


Take-away: Social comparisons not needed to drive house prices, but to drive debt

Varying the Strength of the Comparison Motive ϕ



Decomposing the Aggregate Effect



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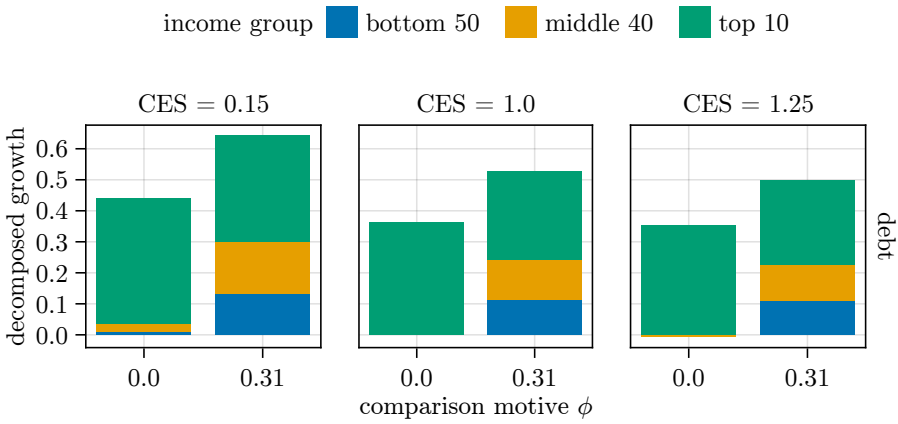
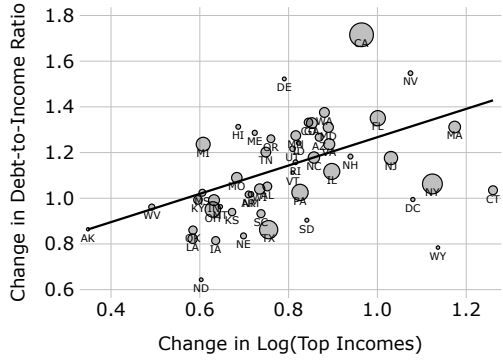


Take-away: Significant reaction of the Bottom 90%

Outline

Overview

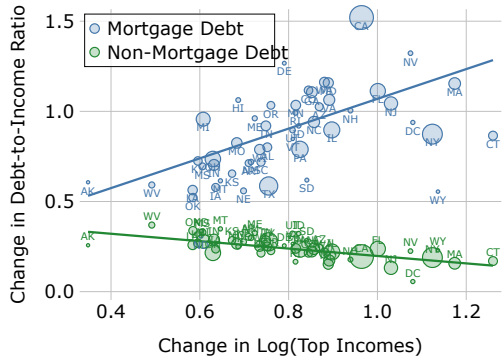
- positive correlation between top incomes and bottom debt



Notes: Change in debt/income of *bottom 90* vs change in log of average *top 10 incomes* across states between 1980/82 and 2005/07. Marker size corresponds to state's initial population.

Overview

- positive correlation between top incomes and bottom mortgage debt



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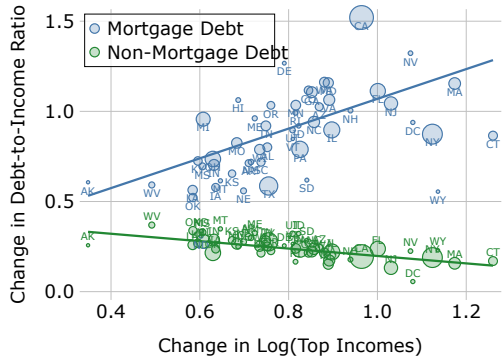
Overview

- positive correlation between top incomes and bottom mortgage debt
- robust to many specifications



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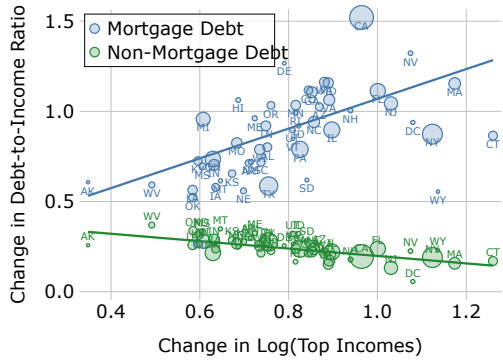
Overview

- positive correlation between top incomes and bottom mortgage debt
- robust to many specifications
- findings are consistent with theoretical predictions of KURJ



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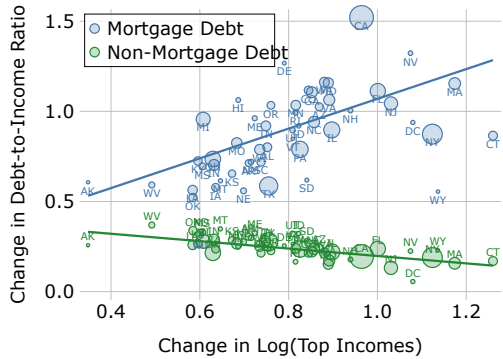
Overview

- positive correlation between top incomes and bottom mortgage debt
- robust to many specifications
- findings are consistent with theoretical predictions of KURJ
- Caveat: cannot claim causality from empirical analysis alone



Notes: Change in debt/income of *bottom 90* vs change in log of average *top 10 incomes* across states between 1980/82 and 2005/07. Marker size corresponds to state's initial population.

Data

- 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

Baseline regressions: Top Incomes and Mortgages of Non-Rich

	$\log(NonRichMortgages_t)$		$HousePrice_t$
	(1)	(2)	(3)
$\log(TopIncomes_{t-2})$	0.3218***	0.2922***	2.0311***
	(0.0923)	(0.0862)	(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	–

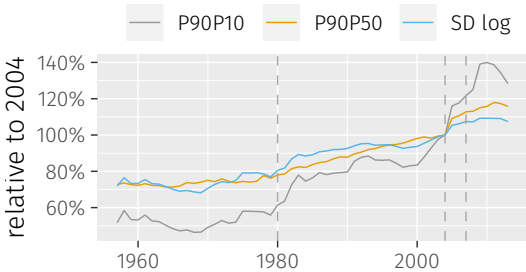
Additional results and robustness checks

- effect builds up over time: significant effects for lags $\in \{2, \ldots, 7\}$
- effect is strongest in reaction to top incomes
- effect survives controlling for house prices (though: bad control)
- plus: house prices correlate with lagged top incomes as well (consistent with model)

Outline

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

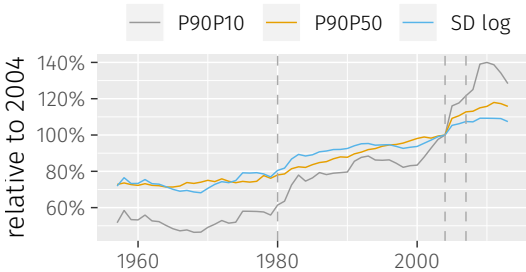
- inequality rises



Source: Guvenen et al. (2018)

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

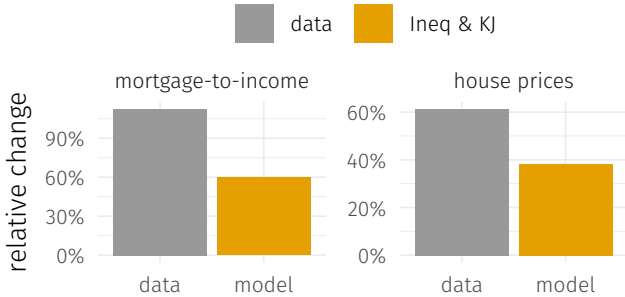
- inequality rises



Source: Guvenen et al. (2018)

- 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

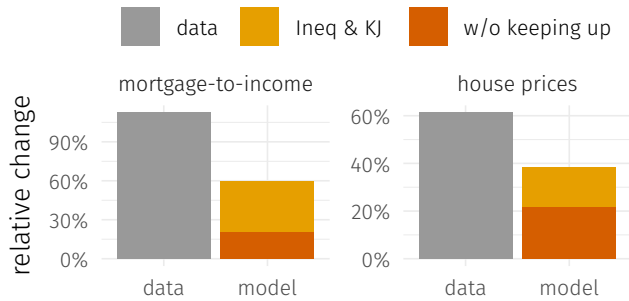
Rising inequality, mortgages and house prices 1980–2007 (2)



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

Outline

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 if the rich are *sufficiently popular*
- We show empirically that higher top incomes are associated with higher mortgage debt and house prices 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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