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

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Motivation I: Keeping up with the *richer* Joneses

Empirical Evidence of Social Comparisons

- When somebody wins in the lottery their neighbors buy bigger cars and borrow more (Kuhn et al., 2011; Agarwal et al., 2020)
- When top incomes rise, the bottom 80% shift expenditures towards visible goods (like housing; see Bertrand and Morse, 2016)
- When someone builds a big house, their neighbors will lose satisfaction with their own house and invest in home improvements (Bellet, 2024)

Kuchler and Stroebel (2021):

peer effects in household financial decisions are pervasive, large in magnitude, and come through several channels, including [...] "social utility" channels.

Open Question

What are the aggregate effects of social comparisons in light of increasing inequality?

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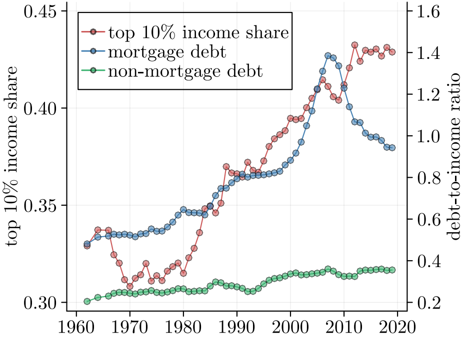
Motivation II: Income Inequality and Household Debt

Aggregate inequality and debt



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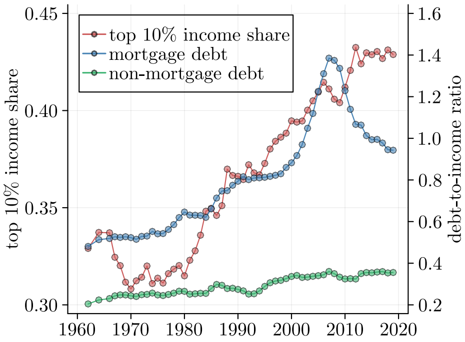
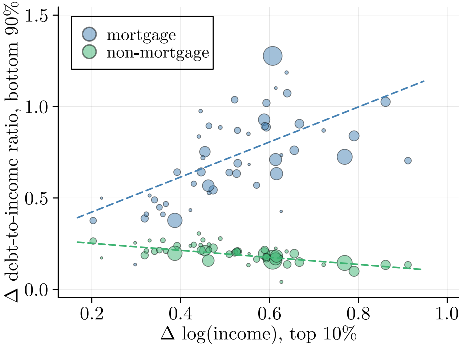


State-level inequality and debt



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This Paper

Research Questions

- How does redistribution affect aggregates through social comparisons?
- Can rising income inequality account for (part of) the mortgage debt boom?

A Tractable Macro Model with Social Externalities in Housing

- Time-invariant heterogeneity in income
- Arbitrary social comparisons in housing (Keeping up with the Joneses)

Findings

- Optimal choices are linear functions of incomes of reference agents
- With asymmetric comparisons, redistribution affects aggregates
  housing & debt increase iff redistribution towards more popular agents
- Rising inequality & upward-looking comparisons $\rightarrow$ up to 20% of debt boom

How Rising Income Inequality Raises Demand for Housing and Debt

$$\text{rising top inequality} \xrightarrow{\substack{\text{Keeping up with} \\ \text{the } \textit{richer} \text{ Joneses}}} \text{mortgage boom}$$

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

Model & Results

Conclusion

Relation to the Literature

- Macroeconomics with housing and mortgages, housing (debt) boom
  e.g. Kumhof et al. (2015), Favilukis et al. (2017), Kaplan et al. (2020), Mian et al. (2021)
  $\rightsquigarrow$ new (demand-side) mechanism to complement supply-side factors
- External habits (Keeping up with the Joneses)
  e.g. Abel (1990), Campbell and Cochrane (1999), Ljungqvist and Uhlig (2000)
  $\rightsquigarrow$ heterogenous agent model, use micro-evidence for parameterization
- Network economics e.g. Ballester et al. (2006), Ghiglino and Goyal (2010)
  $\rightsquigarrow$ infinite-horizon model with general comparison network
- Empirical consumption externalities
  e.g. De Giorgi et al. (2020), Bertrand and Morse (2016), Bellet (2024)
  $\rightsquigarrow$ quantify effects on macroeconomic outcomes

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Model: Households I

- types $j \in \{1, \ldots, N\}$
- population weights ω_j
- constant incomes $y^1 < y^2 < \cdots < y^N$
- utility depends on
  - consumption c
  - housing status $s(h, \tilde{h}) = h - \phi\tilde{h}$
- reference housing of type-i agents

$$\tilde{h}_i = \sum_{j=1}^{n} g_{ij} h_j, \quad \text{where } g_{ij} \geq 0$$

- comparison matrix $G = (g_{ij})_{ij}$
- $\underset{N\times 1}{\tilde{\boldsymbol{h}}} = \underset{N\times N}{G} \cdot \underset{N\times 1}{\boldsymbol{h}}$

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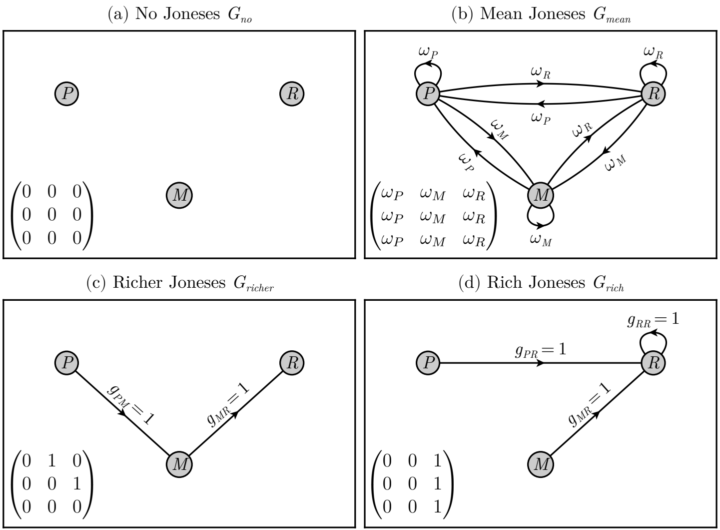
Simple Comparison Networks



Model: Households II

Preferences

- $\sum_{t=0}^{\infty} \beta^t u(c_t, s(h_t, \tilde{h}_t))$
- flow utility $u(c, s) = \log\left(c^{1-\xi} s^{\xi}\right)$ (paper: CRRA-CES)

Endogenous states

- durable housing $h_{t+1} = (1-\delta)h_t + x_t$
- asset $a_{t+1} = y_t + (1+r)a_t - c_t - px_t$ (savings device and mortgage)
- $a_0 = 0$ for convenience

Equilibrium objects

- house price p, interest rate $r = 1/\beta - 1$
- reference housing $\underset{N\times 1}{\tilde{\boldsymbol{h}}}$

Proposition 1: Agents' Optimal Choices Depend on Others' Incomes

Optimal housing and debt are given by:

$$\begin{aligned} \boldsymbol{h} &= \kappa_2 (I + L)\boldsymbol{y}. \\ -\boldsymbol{a} &= \kappa_3 (I + L)\boldsymbol{y} \end{aligned}$$

where $L = \sum_{\ell=1}^{\infty} (\kappa_1 \phi G)^{\ell}$ is the social externality matrix and $\kappa_1 \in (0, 1)$, $\kappa_2, \kappa_3 > 0$.

L measures the strength of all externalities between any pair of agents (from all direct and indirect paths in the network of comparisons)

L_{ij} = externality of j on i (how much does j's income impact i's decisions?)

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Sketching the proof

optimality conditions

$$\left.\begin{aligned} h_1 \quad &= \kappa_2 y_1 + \kappa_1 \varphi \tilde{h}_1 \\ &\vdots \\ h_n \quad &= \kappa_2 y_n + \kappa_1 \varphi \tilde{h}_n \end{aligned}\right\}$$

Sketching the proof

- Stack the optimality conditions

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- Stack the optimality conditions and use that $\tilde{\boldsymbol{h}} = G\boldsymbol{h}$

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- Solve for $\boldsymbol{h}$,

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- Solve for $\boldsymbol{h}$, assuming Leontief inverse $(I - A)^{-1}$ exists

$$\boldsymbol{h} = \kappa_2 \boldsymbol{y} + \kappa_1 \phi G \boldsymbol{h} \implies \boldsymbol{h} = \kappa_2 (I - \kappa_1 \phi G)^{-1} \boldsymbol{y}$$

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Examples: Social Externality Matrix

	(a) no Joneses	(b) Mean Joneses	(c) Richer Joneses	(d) Rich Joneses
G	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$
L	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$	$\frac{\tilde{\phi}}{1-\tilde{\phi}} \begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 & \tilde{\phi} & \tilde{\phi}^2 \\ 0 & 0 & \tilde{\phi} \\ 0 & 0 & 0 \end{pmatrix}$	$\frac{\tilde{\phi}}{1-\tilde{\phi}} \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$

where $\tilde{\phi} = \kappa_1 \phi \in (0,1)$ and $\boldsymbol{\omega}^T = (\omega_P, \omega_M, \omega_R)$ are the population weights.

How optimal debt depends on others' incomes

$$-\begin{pmatrix} a_P \\ a_M \\ a_R \end{pmatrix} = \kappa_3 \begin{pmatrix} y_P \\ y_M \\ y_R \end{pmatrix} + \kappa_3 \underbrace{\left(\sum_{\ell=1}^{\infty} \tilde{\phi}^{\ell} G^{\ell}\right)}_{\substack{\text{social externality} \\ \text{matrix } L}} \begin{pmatrix} y_P \\ y_M \\ y_R \end{pmatrix}$$

- ⇝ Households need not be directly linked! (effects trickle-down)
- ⇝ Impact of changing y_i determined by column sums of L

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- ⇝ Impact of changing y_i determined by column sums of L

Aggregate Effects of Redistribution

- Assume: Redistribute income from type i to type j (keeping the aggregate constant)
  $(\omega_j \underbrace{\Delta y_j}_{+} + \omega_i \underbrace{\Delta y_i}_{-} = 0)$
- What will happen to aggregate debt and house prices?

Useful Definition: Popularity

Agent j's popularity is the weighted sum of externalities from j onto other types i.

$$b_j = \sum_{i=1}^{N} \omega_i L_{ij} \geq 0$$

Population-weighted column sum of the social externality matrix L

Intuitively, type-j agents' popularity measures

- how many other types are affected by type j, and how strongly: $L_{1j}, \ldots, L_{Nj}$
- how many of them exist in the population: $\omega_1, \ldots, \omega_N$

(Bonacich-Katz *in*-centrality)

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Examples of Popularities

	(a) no Joneses	(b) Mean Joneses	(c) Richer Joneses	(d) Rich Joneses
G	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$
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$\boldsymbol{b}$	$\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$	$\frac{\alpha}{1-\alpha} \cdot \begin{pmatrix} \omega_P \\ \omega_M \\ \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 \\ \omega_P \alpha \\ \omega_P \alpha^2 + \omega_M \alpha \end{pmatrix}$	$\frac{\alpha}{1-\alpha} \cdot \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$

Effects on aggregates

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

$$\sum_i \omega_i h_i = \kappa_2(\boldsymbol{\omega} + \boldsymbol{b})^T \boldsymbol{y}, \quad -\sum_i \omega_i a_i = \kappa_3(\boldsymbol{\omega} + \boldsymbol{b})^T \boldsymbol{y}$$

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

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

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

$$I_h = \delta H$$

General Equilibrium I: Top incomes and house prices

- 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 $p \iff j$ is more popular than i

Does inequality drive debt and house prices? (I)

	no Joneses	mean Joneses	richer Joneses	rich Joneses
G	$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \\ \omega_P & \omega_M & \omega_R \end{pmatrix}$	$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$	$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix}$
$\boldsymbol{b}$	$(0,0,0)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(\omega_P, \omega_M, \omega_R)$	$\left(0, \omega_P\tilde{\phi}, \omega_P\tilde{\phi}^2 + \omega_M\tilde{\phi}\right)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(0,0,1)$
$\frac{b_R}{\omega_R} > \frac{b_P}{\omega_P}$	no	no	yes	yes
$\frac{b_R}{\omega_R} > \frac{b_M}{\omega_M}$	no	no	yes*	yes

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; Bellet, 2024)
  - this would correspond to *rich 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

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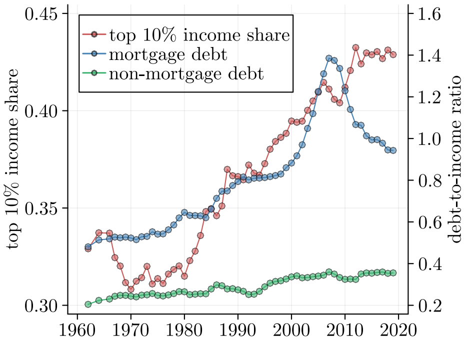
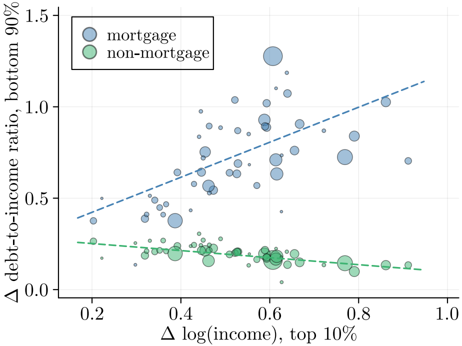
Aggregate inequality and debt



State-level inequality and debt



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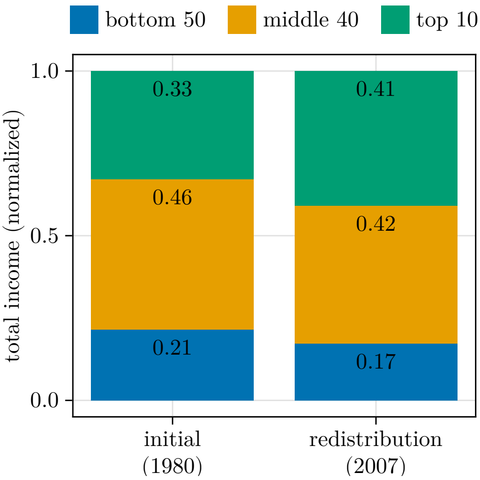
Quantifying the effect

1. income types: Bottom 50%, Middle 40%, Top 10%
   - start from 1980 income shares and redistribute to match 2007 income shares
2. strength of the comparison motive
   - match *sensitivity w.r.t others' housing*
   - use estimate from Bellet (2024) as upper bound



Calibration

	Parameter description	Value	Source
Preferences			
$\frac{1}{m}$	average life-time	45.0	working age 20–65
ρ	discount factor	0.0989	internally calibrated
ξ	utility weight of housing	0.0371	internally calibrated
$\frac{1}{1-\varepsilon}$	elasticity of substitution (s vs c)	1.0	literature, see text
φ_P	strength of comparison motive	0.105	internally calibrated
φ_M	strength of comparison motive	0.278	internally calibrated
φ_R	strength of comparison motive	0.8	internally calibrated
Technology			
$\frac{\alpha}{1-\alpha}$	housing supply elasticity	1.5	Saiz (2010)
δ	depreciation rate of housing	0.103	internally calibrated
$\bar{L}$	flow of land permits	1.0	ad hoc

Model Fit

Moment	Model	Target	Source
mortgage-to-income	0.646	0.646	DINA (1980)
expenditure share of housing	0.162	0.162	CEX (1982)
sensitivity to reference housing	$(0.8, 0.8, 0.8)$	0.8	Bellet (2024)
empl. share in construction sector	0.05	0.05	Kaplan et al. (2020)

For reference: Housing boom in the data

Moment	1980	2007	Source
expenditure share of housing	0.162	0.2	CEX
mortgage-to-income	0.646	1.39	DINA
real house price index	100.0	158.6	Case-Shiller

The Effect on Housing Expenditures and Debt (I)

	1980	2007	
Variable	all scopes (1)	nation (2)	state (3)
expenditure share of housing	0.162	0.192	0.19
mortgage-to-income	0.646	0.766	0.758
real house price index	100.0	107.1	106.5
Δ top 10% income share (p.p.)		7.98	7.54
Δ middle 40% income share (p.p.)		-3.67	-3.37
Δ bottom 50% income share (p.p.)		-4.31	-4.17
number of regions		1	51

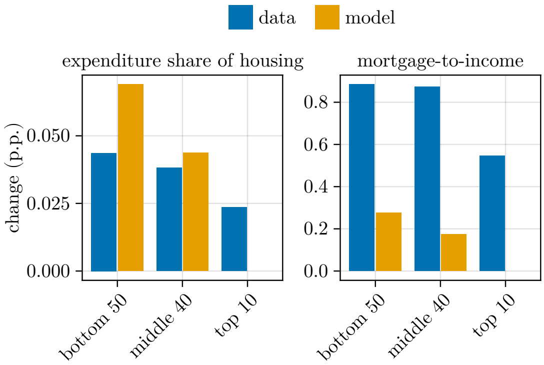
Take-away: Rationalize significant chunk of the debt boom

The Effect on Housing Expenditures and Debt (I)

	1980	2007	
Variable	all scopes (1)	nation (2)	state (3)
expenditure share of housing	0.162	0.192	0.19
mortgage-to-income	0.646	0.766	0.758
real house price index	100.0	107.1	106.5
Δ top 10% income share (p.p.)		7.98	7.54
Δ middle 40% income share (p.p.)		-3.67	-3.37
Δ bottom 50% income share (p.p.)		-4.31	-4.17
number of regions		1	51

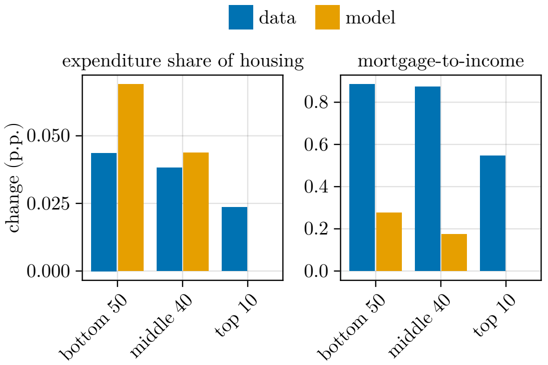
Take-away: Rationalize significant chunk of the debt boom

The Effect on Housing Expenditures and Debt (II)



Take-away: Significant reaction of the Bottom 90% (With upward looking comparisons)

The Effect on Housing Expenditures and Debt (II)



Take-away: Significant reaction of the Bottom 90% (With upward looking comparisons)

Robustness

- other upward-looking networks
- income deciles as reference groups
- more scopes: labor market areas and commuting zones from Census/ACS

Take-away: Quantitative results are robust (see paper)

Wealth inequality: Model and Data

	Δincome share		Δwealth share	
Income group	data	model	data	model
top 10%	8.0 p.p.	8.0 p.p.	3.8 p.p.	1.5 p.p.
middle 40%	-3.7 p.p.	-3.7 p.p.	-2.3 p.p.	-0.7 p.p.
bottom 50%	-4.3 p.p.	-4.3 p.p.	-1.5 p.p.	-0.8 p.p.

Take-away: Consistent with decoupling of income inequality and wealth inequality Kuhn et al. (2020)

Outline

Relation to the Literature

Model & Results

Conclusion

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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