

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

Moritz Drechsel-Grau
LMU Munich

Fabian Greimel
University of Vienna

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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., 2016)
- 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, 2024a)

Kuchler and Stroebe (2021)'s Review of "Social Finance" Literature:
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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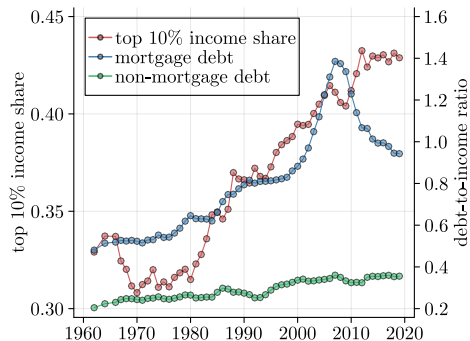
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Motivation II: Income Inequality and Household Debt

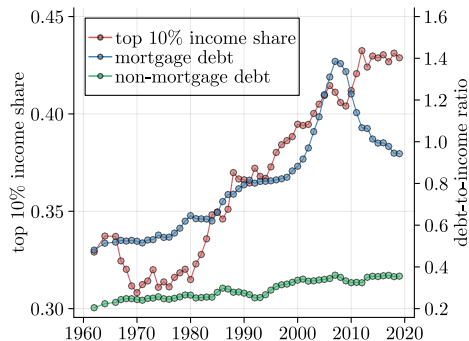
Aggregate inequality and debt



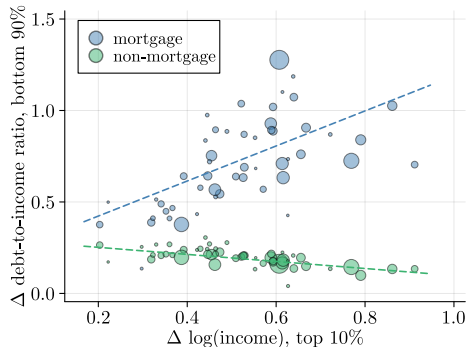
Notes: Panel A shows the evolution of the debt-to-income ratio and the top 10% income share in the US.

Motivation II: Income Inequality and Household Debt

Aggregate inequality and debt



State-level inequality and debt



Notes: Panel A shows the evolution of the debt-to-income ratio and the top 10% income share in the US. Panel B plots the change in the mortgage-to-income ratio and the non-mortgage-to-income ratio of the bottom 90% of the income distribution in each state against the change in the log of average incomes of the state's top 10% between 1980-1982 and 2005-2007. The size of the markers corresponds to the state's population size in the base period.

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 (and wealth)
- 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 → up to 20% of debt boom

How Rising Income Inequality Raises Demand for Housing and Debt

rising top inequality $\xRightarrow{\text{Keeping up with the richer Joneses}}$ 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!)

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)
⇒ 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)
⇒ heterogenous agent model, use micro-evidence for parameterization
- Network economics e.g. Ballester et al. (2006), Ghiglino and Goyal (2010)
⇒ infinite-horizon model with general comparison network
- Empirical consumption externalities
e.g. De Giorgi et al. (2019), Bertrand and Morse (2016), Bellet (2024a)
⇒ quantify effects on macroeconomic outcomes

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Model: Households I

- types $j \in \{1, \dots, N\}$
- population weights ω_j
- constant incomes $y^1 < y^2 < \dots < y^N$
- 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 $G = (g_{ij})_{ij}$
- $\tilde{\mathbf{h}} = \underset{N \times 1}{G} \cdot \underset{N \times 1}{\mathbf{h}}$

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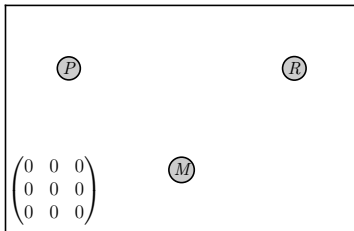
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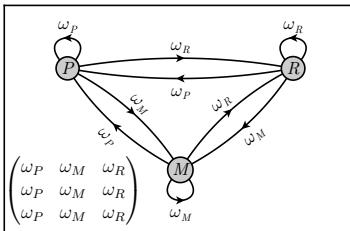
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Simple Comparison Networks

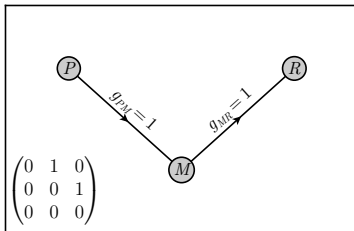
(a) No Joneses G_{no}



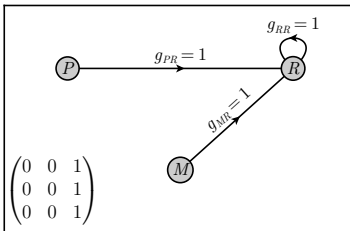
(b) Mean Joneses G_{mean}



(c) Richer Joneses G_{richer}



(d) Rich Joneses G_{rich}



Model: Households II

Preferences

- $\sum_{t=0}^{\infty} \beta^t u(c_t, s(h_t, \tilde{h}_t))$
- flow utility $u(c, s) = \log(c^{1-\xi} s^{\xi})$ (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 $\tilde{h}_{N \times 1}$

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

Assume the Leontief inverse $(I - \phi G)^{-1}$ exists. (\implies it is equal to $\sum_{i=0}^{\infty} \phi^i G^i$)

Then, optimal housing and debt are given by:

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

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

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

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Examples: Social Externality Matrix

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

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

How optimal debt depends on others' incomes

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

- ⇒ 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)

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

- 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}, \dots, L_{Nj}
- how many of them exist in the population: $\omega_1, \dots, \omega_N$

(Bonacich-Katz *in*-centrality)

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Examples of Popularities

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

Effects on aggregates

Lemma

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

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

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.

The Consequences of Redistribution

Redistribute income from type i to type j

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

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

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

- **Redistribution** increases $p \iff j$ is more popular than i

Does inequality drive debt and house prices? (I)

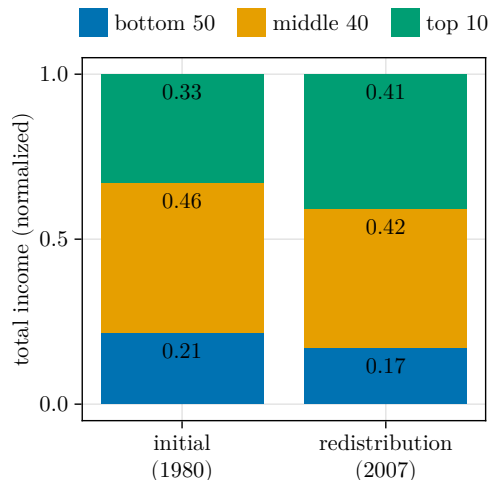
	no Joneses	mean Joneses	richer Joneses	rich Joneses
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b	$(0, 0, 0)$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(\omega_P, \omega_M, \omega_R)$	$(0, \omega_P\tilde{\phi}, \omega_P\tilde{\phi}^2 + \omega_M\tilde{\phi})$	$\frac{\tilde{\phi}}{1-\tilde{\phi}}(0, 0, 1)$
$\frac{b_R}{\omega_R} > \frac{b_P}{\omega_P}$	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, 2024a)
 - 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**

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 (2024a) as upper bound



Calibration

Parameter description		Value	Source
<i>Preferences</i>			
$\frac{1}{m}$	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
<i>Technology</i>			
$\frac{\alpha}{1-\alpha}$	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 (2024b)
empl. share in construction sector	0.05	0.05	Kaplan et al. (2020)

For reference: Inequality and Mortgage Boom

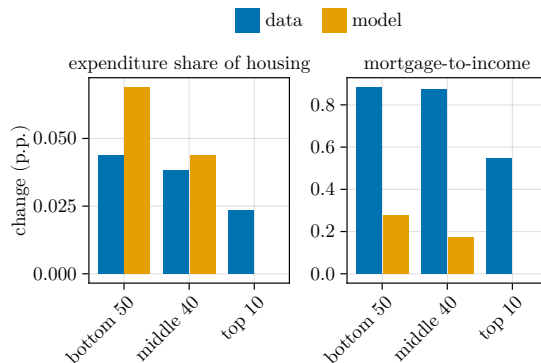
Moment	1980	2007	Source
<i>Rising Income Inequality</i>			
bottom 50% income share	0.21	0.17	DINA
middle 40% income share	0.46	0.42	DINA
top 10% income share	0.33	0.41	DINA
<i>Housing and mortgage booms</i>			
expenditure share of housing	0.162	0.2	CEX
mortgage-to-income	0.646	1.39	DINA
real house price index	100.0	158.6	Case-Shiller

Wealth inequality: Model and Data

Income group	Δ income share		Δ wealth share	
	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.

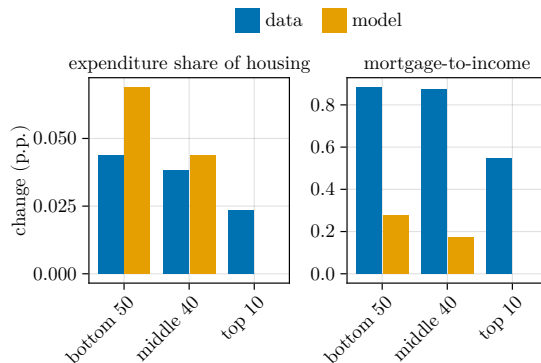
Take-away: Consistent with Decoupling of income inequality and wealth inequality Kuhn et al. (2020)

The Effect on Housing Expenditures and Debt (I)



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

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The Effect on Housing Expenditures and Debt (II)

Variable	1980	2007	
	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

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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)

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- 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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