Mortgage market design and wealth inequality: Evidence from interest-only mortgages in Denmark

Young Scholars Nordic Finance Workshop

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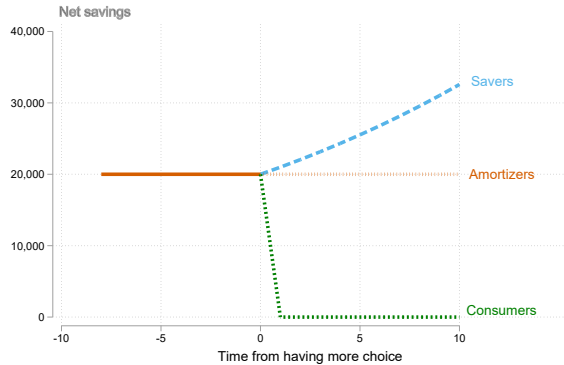


Introduction and research question

Motivation

In many countries, households who borrow are forced to make debt repayments

- In the United States and Denmark, debt repayments are similar in magnitude to pension savings

Research question: How do mandatory amortization payments affect wealth inequality?

1. Forced amortization may raise savings rates and reduce wealth inequality
2. Forced amortization payments constrain portfolio choice and may increase wealth inequality
3. (Forced amortization are undone by refinancing or higher borrowing)

This paper: Study savings behavior around switching to an interest-only mortgage across the wealth distribution + heterogenous agent model

Roadmap

Background

Motivation

Data and empirical strategy

Results

- Savings behavior
- Effect on net wealth

Model

Introduction of IO mortgages

Interest-only mortgages introduced on October 1, 2003

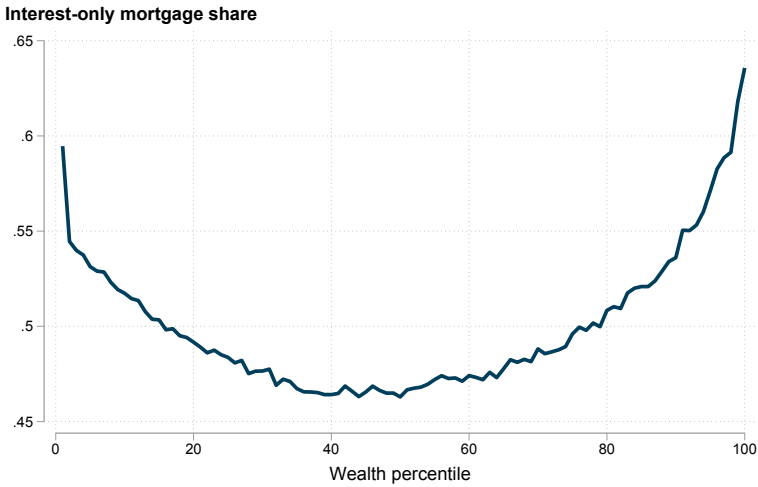
- Allow for a 10-year period with no amortization
- Mortgage loan still has to be repaid in 30 years
- Since 2013, higher fees for IO mortgages

Other dimension of mortgage borrowing unchanged

- Regulatory loan to value ratios unchanged at 80% + 15% bank debt
- Variable rate mortgages introduced in 1997

Interest-only mortgages by wealth percentile Year-by-year

Background



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Stylized framework (Bernstein & Koudijs, 2020)

Motivation

To fix ideas, consider a stylized decomposition of net savings including capital gains

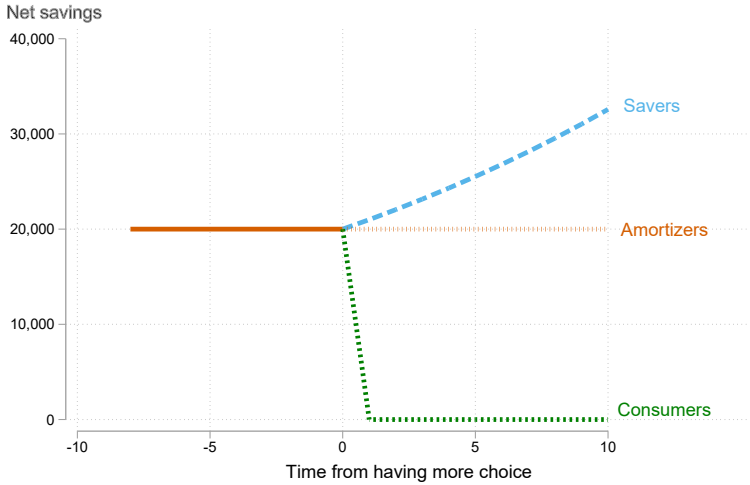
$$\underbrace{S}_{\text{Net savings}} = \underbrace{\Delta b}_{\text{Amortization}} + \underbrace{S_f}_{\text{Financial savings}}$$

What would happen to net savings if we add more choice over amortization?

1. Nothing, the individual is content with amortizing (Amortizer)
2. The individual could reduce net savings (set $\Delta b = 0$) (Consumer)
3. Net savings could increase because return on S^f is higher than the return on Δb (Saver)

Graphical illustration of net savings

Motivation



Decomposing savings after the reform

Change in savings for Amortizer (keep amortizing mortgage):

$$\Delta S^A = 0$$

Change in savings for Consumer (switch to IO mortgage):

$$\Delta S^C = -\Delta b$$

Change in savings for Saver (switch to IO mortgage):

$$\Delta S^S = \Delta S_f^S - \Delta b$$

Key point

Motivation

Aggregate change depends on the share α of each type:

$$\begin{aligned} \Delta S = & \quad \alpha^S \Delta S^S + \alpha^C \Delta S^C + \alpha^A \Delta S^A \\ = & \quad \alpha^S (\Delta S_f^C - \Delta b) - \alpha^C (\Delta b) \end{aligned}$$

Interest-only mortgage will increase net savings if the increase in savings by Savers outweigh the decrease in amortization by consumers

$\rightarrow$ The key is to identify savings behavior by households who switch to an interest-only mortgage in a credible way

Roadmap

Assumption behind empirical strategy

Empirical strategy

Fundamental problem of estimating causal effect of IO mortgage γ: Y_0 is not observed

$$\gamma = \overbrace{E(Y_1 - Y_0 \mid T = 1)}^{\text{Treatment effect}}$$

From the stylized framework: Amortizer can be used to impute Y_0

- Amortizers are not affected by the reform
- Absent spillover effects (house price effects? Bäckman & Lutz, 2021)

Covariates, individual FE and municipality-year FE to help address selection concerns

Danish register data from 1996 to 2016

Data and empirical strategy

Combine standard register (income, demographics, labor market, education) with mortgage data from 2009

- We use the origination date to track the mortgage back in time
- E.g. we observe the mortgage in 2009 and know that it was originated in 2004

Sample selection

- Individual-level data
- Select individuals aged 18-75
- Drop entrepreneurs
- Keep only homeowners

Variable definitions

Data and empirical strategy

Financial savings:

$$\underbrace{S^f_{i,t}}_{\text{Financial savings}} = \underbrace{S^l_{i,t}}_{\text{Liquid savings}} + \underbrace{p^p_{i,t}}_{\text{private pension contributions}}$$

Amortization:

$$\underbrace{\Delta b_{i,t}}_{\text{Amortization}} = \underbrace{-(b_{i,t} - b_{i,t-1})}_{\text{Debt today minus debt yesterday}}$$

Total savings:

$$\underbrace{S_{i,t}}_{\text{Total savings}} = \underbrace{\Delta b_{i,t}}_{\text{Amortization}} + \underbrace{S^f_{i,t}}_{\text{Financial savings}}$$

Empirical strategy

Comparison of savings behavior around first time that we observe refinancing

- Treated: refinance to an interest-only mortgage
- Control: refinance to a traditional mortgage

Estimated using:

- Two-way fixed effect estimator
- Wooldridge (2021)
- Callaway & Sant'Anna (2021)

Empirical strategy - TWFE

Empirical strategy

Estimate a semi-dynamic specification with indicator for first refinancing to an interest-only mortgage $\mathbf{1}[T_{i,t} = \tau_i]$ at time τ :

$$S_{i,t} = \overbrace{\alpha_i}^{\text{Individual FE}} + \underbrace{\sum_{\tau=0}^{10} \gamma_\tau \mathbf{1}[T_{i,t} = \tau_i]}_{\text{Event study coefs.}} + \overbrace{\sum_{\tau=0}^{10} \lambda_\tau X_i}^{\text{Controls} \times \text{treat-time}} + \underbrace{\delta_{k,t}}_{\text{Mun-Year}} + \epsilon_{i,t}$$

Cluster on individual level

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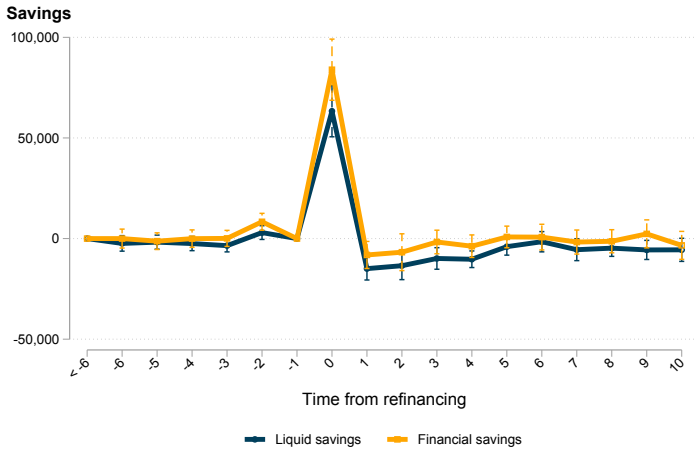
Baseline results using TWFE

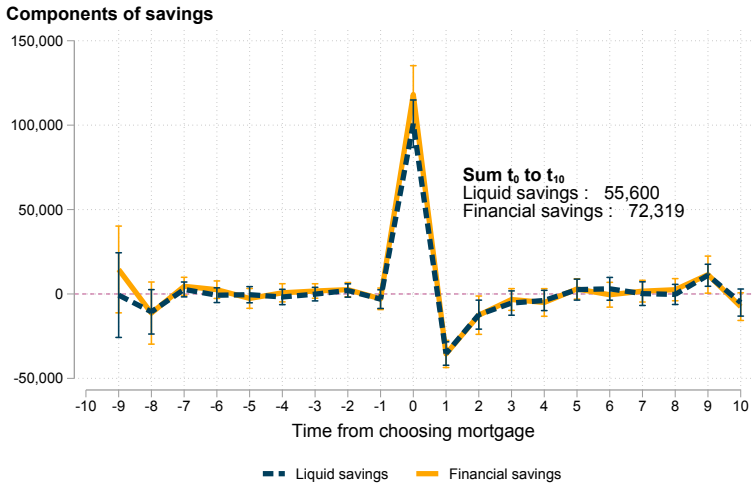
Results

$$S_{i,t} = \alpha_i + \delta_t + \sum_{\tau=0}^{10} \gamma_\tau \mathbf{1}[T_{i,t} = \tau_i] + \sum_{\tau=0}^{10} \lambda_\tau X_i + \delta_{k,t} + \epsilon_{i,t}$$



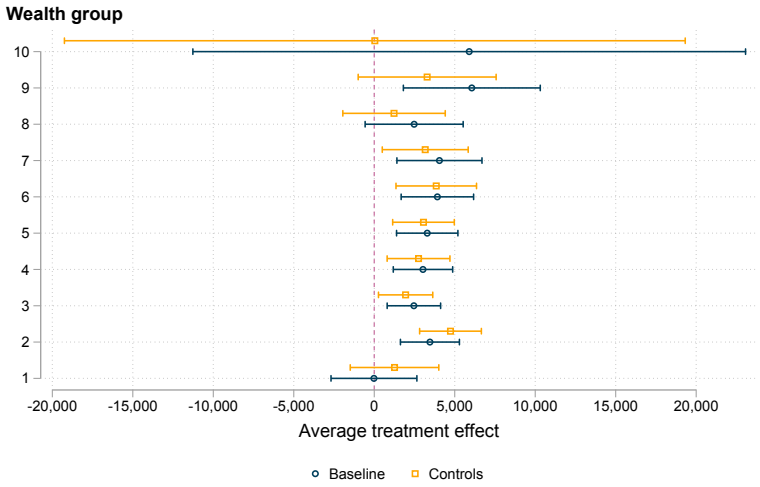
Callaway & Sant'Anna (2021) event study coefficients (no covariates)

Results



Financial savings: Average Treatment Effect by wealth group

Results



Amortization response – Back of the envelope calculation

Result

A borrower with an annuity contract and a 3 percent interest rate has amortized 27 percent of the mortgage after 10 year

Initial mortgage debt at origination for IO holders: 960,000 kr.

- Would have reduced mortgage by $\approx$ 260,000 DKK

Initial mortgage debt at origination for amortizing mortgages: 680,000 kr.

- Would have reduced mortgage by $\approx$ 183,000 DKK

What is the effect on net wealth?

Net wealth

$$
\begin{aligned}
\Delta S = \quad & \alpha^S \Delta S^S + \alpha^C \Delta S^C + \alpha^A \Delta S^A \\
= \quad & \alpha^{IO} (\Delta S^{IO} - \Delta b^{IO}) \\
= \quad & 0.5 \times (72,000 - 260,000) = -94,000
\end{aligned}
$$

Or 9,400 DKK per year.

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Model setup

Model

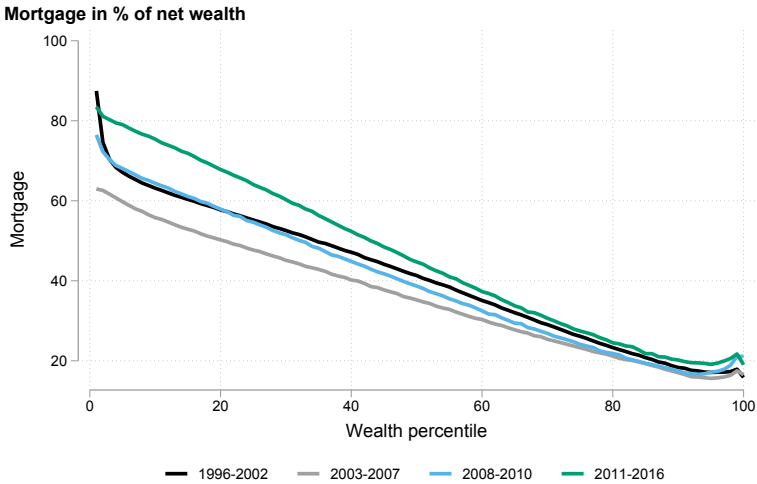
Merton (1992) partial equilibrium environment of risky and non-risky asset ("mortgage")

- Agents then chooses between amortization and investment in the risky asset.
- Heterogeneity through uninsurable idiosyncratic risk for risky asset

Production supply closes the model in a general equilibrium setting

Mortgage debt as a share of assets

Background



Two constraints decay in wealth to imitate amortization requirement

Model

Savings constraint: agents forced to save a fraction of their income every period

- Reduces inequality: Less wealthy agents are forced to save, which raises their wealth.
- Reduces inequality: The inflow of savings into risky assets drives down the risky return and reduces the optimal risky share

Portfolio constraint: upper threshold on the portion invested into the risky asset

- Increases inequality: by hindering some from investing optimally (more) in the risky asset.
- Small impact on interest rate

Conclusion

Interest-only mortgages reduce amortization payments with little offsetting effect on savings

- We find similar effects as in Bernstein & Koudijs (2020, R&R QJE)

New evidence that mortgage market design impacts portfolio composition and savings

- Fagereng *et al.* (2018, Econometrica) argues that positive correlation between wealth and return to wealth reflects skill and asset allocation
- Bach *et al.* (2017, AER) argues that heterogeneity in returns reflects risk aversion
- Epper *et al.* (2018, AER) documents that patience predicts saving and wealth

Thank you!

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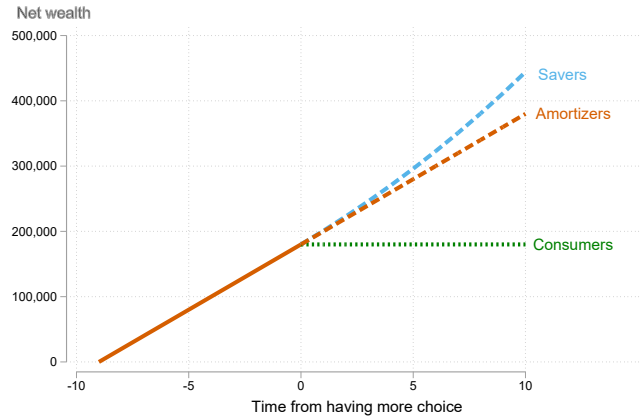
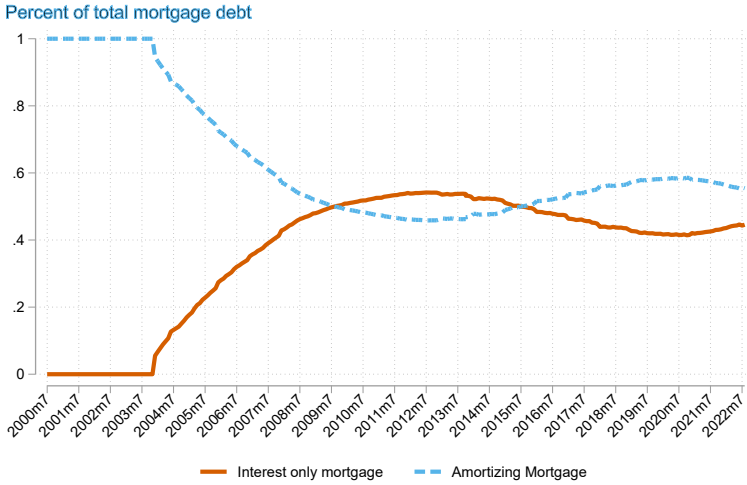


Appendix slides

Interest-only mortgages in Denmark

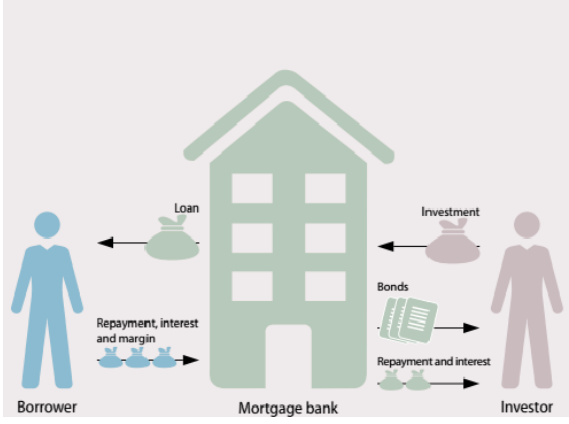
Outstanding debt

Background



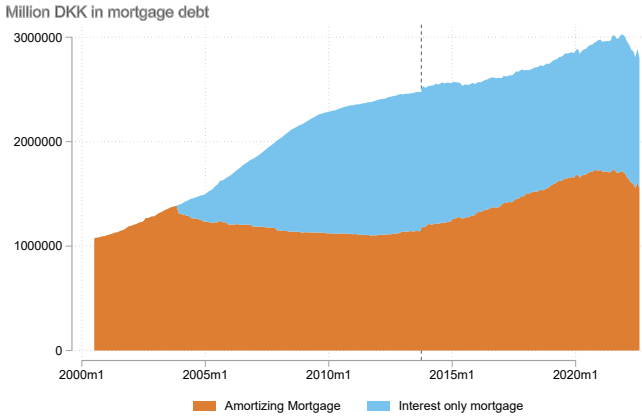
Mortgages in Denmark

Background



Outstanding debt

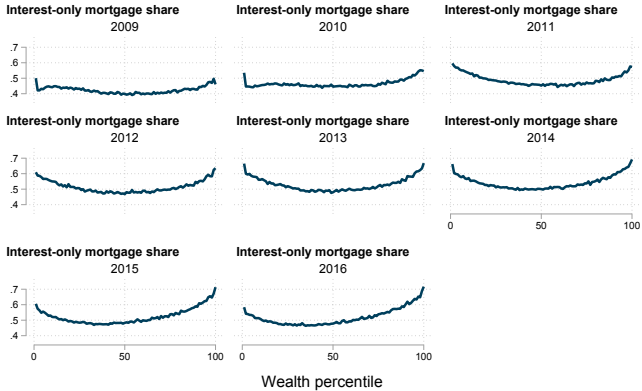
Background



Back

Interest-only mortgages by wealth, year by year

Background



Graphs by year

Back

Quick facts in our data

1. First year payments reduced by $\approx$ 20 percent (depends on interest rate)
2. Amortizing mortgages are paid off over time, interest-only mortgages are not
3. Large majority of borrowers choose either IO or amortizing (not combination)

F-tests for pre-treatment coefficients

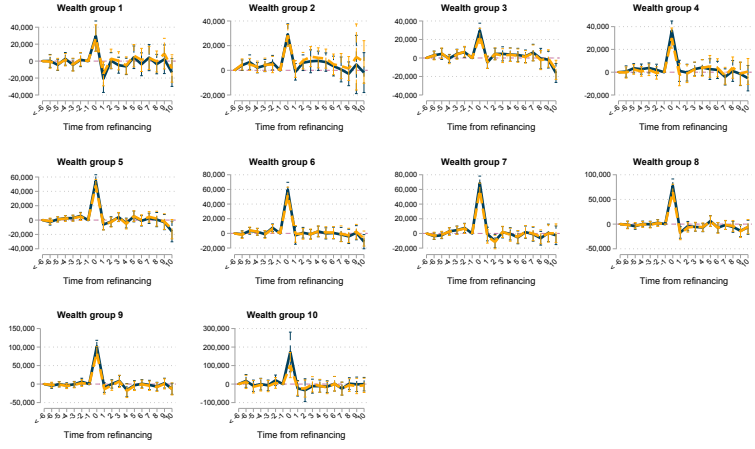
Back

Results

Specification	F-statistic (1)	P-value (2)
Liquid savings		
Baseline	2.701*	0.019
Mun-year	1.682	0.135
Demographics	1.647	0.144
Financial	1.191	0.311
Financial savings		
Baseline	4.445***	0.000
Mun-year	2.738*	0.018
Demographics	2.215*	0.050
Financial	1.008	0.411
Total savings		
Baseline	1.851	0.099
Mun-year	1.484	0.191
Demographics	2.118	0.060
Financial	1.346	0.241

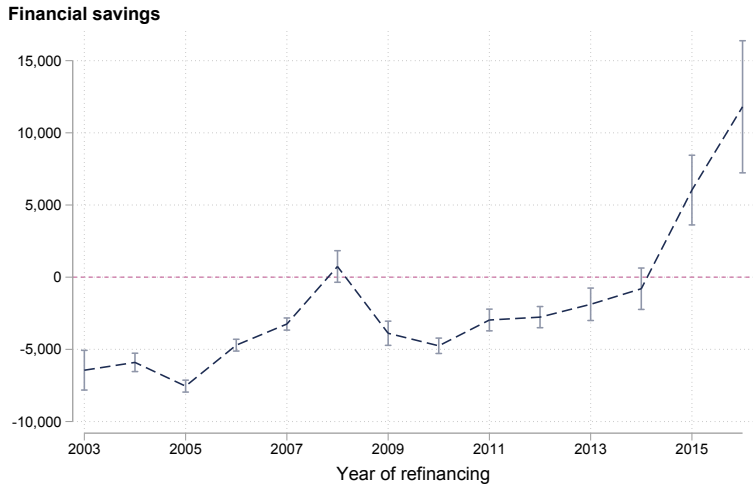
Results by wealth group

Results



Effect by year-of-refinancing (Wooldridge, 2021)

Results



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