The aggregate and distributional implications of credit shocks on house and rental markets

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Motivation

- Housing has a **dual role** . . .
  * As a *consumption good* $\rightarrow$ if households don't buy a house, they must rent it
  * As an *asset/investment* $\rightarrow$ capital gains + cash flows for landlords

- Housing and rental markets are economically and politically very relevant and thus **subject to regulation**, e.g. tax advantages, subsidies, etc.

- Understanding the effects of these policies on household's welfare as well as on the dynamics of house prices and rents requires a **joint study of both markets**
  * Tax advantages to incentivize homeownership $\implies \uparrow$ house prices, $\downarrow$ rents
  * Financial shocks that limit credit $\implies \downarrow$ house prices, $\uparrow$ rents

What we do

- Build a life cycle heterogenous agents model with **two key features**:
  * *Endogenous housing tenure choices* $\implies$ renters, homeowners or landlords
  * *Equilibrium in housing and rental markets* $\not\Rightarrow$ $cov(\text{house prices}, \text{rents}) > 0$

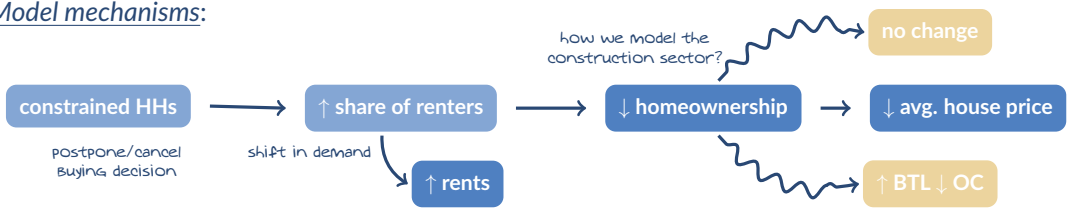
- Use the model to study the effects of a **credit shock**: the introduction of maximum LTV and LTI limits in Ireland in 2015.
  * There were no limits before the reform
  * After reform: 20% minimum downpayment + maximum loan to income of 3.5
  * It was unexpected: first discussion October 2014

- Possible to study empirically. Done already for its effects on house prices. We extend the analysis to rents.

What we find

- *Empirically*: LTV & LTI limits $\Longrightarrow$ $\begin{cases} \downarrow \text{house price growth (Acharya et al., 2022)} \\ \uparrow \text{growth of rental prices} \end{cases}$

- *Model mechanisms*:



- *Welfare analysis*:
  - **At fixed prices**: losses concentrated among the young and the middle income households
  - **Movements in rents**: further harms the young and the middle income hh's, and slightly benefits the middle-age and the very rich.
  - **Full transition**: quantitatively small role for the drop in house prices

Roadmap

Related Literature

Housing in macroeconomics: state-of-the-art models

- Mostly concerned with explaining **boom-bust cycles in house prices** with conflicting findings
- Leading examples:
  * Favilukis, Ludvigson, and Van Nieuwerburgh (2016, JPE)
    - Relaxing credit constraints lead to large booms in house prices
  * Justiniano, Primiceri, and Tambalotti (2019, JPE)
    - Importance of increase in credit supply for the boom
  * Kaplan, Mitman, and Violante (2020, JPE)
    - Large role of fluctuations in beliefs
  * Garriga and Hedlund (2020, AER)
    - Key role of liquidity in generating house price dynamics
  * Arslan, Guler and Kuruscu (2022)
    - Focus on the bank lending channel
- **Greenwald and Guren (2021)** point to the degree of *market segmentation* to explain the distinct findings: no segmentation, no house price changes; segmentation, rise in house prices if demand increases

Macroprudential policy: what about the costs?

- A broad theoretical literature on the **benefits of macroprudential policies** in terms of *financial and macroeconomic stability*.
  * Lambertini, Mendicino, and Punzi (2013, JEDC)
  * Farhi and Werning (2016, Ecta)
  * Muñoz and Smets (2022)

- Fewer have studied their **negative consequences** for *household welfare* . . .
  * Queiró and Oliveira (2022) $\rightarrow$ housing model à la Kaplan et al. (2020)

- Some recent empirical contributions that study these reforms include:
  * Acharya, Bergant, Crosignani, Eisert and McCann (2022, J Finance)
  * Van Bekkum, Irani, Gabarro and Peydró (2019)

The Model

Households

Environment

- Economy is populated by OLG of households whose **life cycle** is divided between *working* ($j = 1, \ldots, J^{ret} - 1$) and *retirement* ($j = J^{ret}, \ldots, J$). After age J, they die with certainty.
- Households derive **utility** from *non-durable consumption* c and *housing services* s^h

$$\mathbb{E}_0 \left\{ \sum_{j=1}^{J} \beta^{j-1} \frac{\left(c\, s^h \right)^{1-\gamma}}{1-\gamma} \right\} \tag{1}$$

  where $\beta > 0$, $c > 0$ and s^h varies depending on the quality of the house where the household resides.
- *Working age* households receive an **idiosyncratic labor income endowment**

$$\log y = \log A_c + f(j) + \eta \tag{2}$$

  where A_c is an index of aggregate productivity, $f(j)$ is a polynomial in age and η is the stochastic persistent component. *Retirees* receive a fixed fraction of their last period income.
- Households can **save in liquid assets**, whose return r is fixed, or **in real estate**, whose prices are determined in equilibrium.

Housing & mortgages

- We think of the **housing state** as the number of houses owned:

$$h \in \{0, 1, 2, 3\} \tag{3}$$

so we can distinguish between *renters*, *homeowners* and *landlords* (with 1 or 2 rented out properties).

- Houses differ in their quality $\mathcal{H}$ which in turn affect their price $p^h(\mathcal{H}) = \mathcal{H}p^h$ where p^h is the per-unit/average price.

- Houses are **illiquid**, i.e. they are subject to transaction costs when bought and sell, $\tau_h\, p^h(\mathcal{H})$. They are also **costly to maintain**, $\delta_h\, p^h(\mathcal{H})$.

- Households can **borrow** ($a < 0$) at a rate $r(1 + \kappa)$ but the amount borrowed is limited by two **financial constraints**:

$$a' \geq -\lambda_{LTV}\, p^h(\mathcal{H})h' \tag{4}$$

$$a' \geq -\lambda_{LTI}\, y \tag{5}$$

that can only *bind at origination*. For the remaining life of the mortgage, households must at least pay interests and **amortize** a minimum amount per period.

Household's problem

$$V(a,h,y,j) = \max_{a',h'} \left\{ \frac{(c\, s^h)^{1-\gamma}}{1-\gamma} + \sigma_\varepsilon\, \varepsilon(h) + \beta \mathbb{E}\, V(a',h',y',j+1) \right\} \tag{6}$$

s.t.

$$\begin{aligned} c + a' + p^h(\mathcal{H})h' + \tau^h p^h(\mathcal{H})|h'-h| + \delta_h p^h(\mathcal{H})h \;\leq \\ y + (1 + r\,(1 + \mathbb{I}_{a'<0}\,\kappa))\, a + p^h(\mathcal{H})h + p_r(h-1) \end{aligned} \tag{7}$$

$$a' \geq \begin{cases} \max\{-\lambda_{LTV} p^h(\mathcal{H})h', -\lambda_{LTI} y\} & \text{if } h' > h \\ a(1 + r(1+\kappa) - m(j)) & \text{if } h > 0 \text{ and } a < 0 \\ 0 & \text{otherwise} \end{cases} \tag{8}$$

$$\varepsilon(h) \sim F, \text{ extreme value type I dtb} \tag{9}$$

$$m(j) = \frac{r(1+\kappa)(1+r(1+\kappa))^{J-j}}{(1+r(1+\kappa))^{J-j} - 1} \tag{10}$$

Production

Final Good & Construction Sectors

- **Final Good Producer**
  * Linear technology: $Y_c = A_c N$, where A_c is the constant aggregate productivity and N are the unit of labor services.
  * Profit maximization $\implies$ wage $= A_c$

- **Housing Good Producer**
  * Combines land L (fixed) and structures S through a Cobb-Douglas technology: $Y_h = A_h L^{\alpha_l} S^{1-\alpha_l}$ where α is the share of land in production.
  * Profit maximization $\implies$ $p^h = \frac{1}{A_h} \left(\frac{S}{L} \right)^{\alpha} \frac{1}{1-\alpha}$

Equilibirum

Equilibrium Definition

Definition 1: Competitive Equilibrium

A competitive equilibrium is a value function $\{V\}$ and policy functions for the **households** $\{c, h', a'\}$, policy functions for the **firms** $\{N, L, S\}$, **prices** $\{w, p_h, p_r, p_l\}$ and a **stationary distribution** μ that jointly solve the household, final-good firm and construction firm problems, as well as the **market clearing** conditions

$$\text{Housing:} \quad Y_h = \delta_h H \tag{11}$$

$$\text{Aggregate Housing:} \quad H = \sum_{n=1}^{N} \mathcal{H}_n H_n \quad \text{where} \quad \sum_{n=1}^{N} H_n = 1 \tag{12}$$

$$\text{Housing Permits:} \quad L = \bar{L} \tag{13}$$

$$\text{Resources:} \quad Y = C + S \tag{14}$$

A macro-prudential reform: the case of Ireland

Institutional framework

- First discussed in October 2014.
- Officially announced and directly implemented in **February 2015**.
- **Loan-to-Value (LTV) requirements**:
  * In general, the limit was set to 80%.
  * For *first time buyers* (FTB) can be 90% if the property value is below €220,000.
  * For *buy-to-let* (BTL) properties the limit is even more stringent: 70%.
  * 15% of new lending can be above limit.
- **Loan-to-Income (LTI) requirements**:
  * 3.5 times household income.
  * 20% of bank lending can be above limit.

Relaxation of the rules announced in October 2022

Empirical evidence

Parametric Evidence

- We **replicate Acharya et al. (2020)** empirical strategy using also **data on rents**:

$$\Delta HP_i = \beta_0 + \beta_1 \text{Distance}_i + \epsilon_i \quad (15)$$

$$\Delta HR_i = \gamma_0 + \gamma_1 \text{Distance}_i + \nu_i \quad (16)$$

where i is county, Δ is change between 2014Q3 and 2016Q4

	Δ House prices	Δ Rents
Distance	0.289	-0.171
	(0.068)	(0.039)
Obs.	54	54
R^2	0.34	0.31

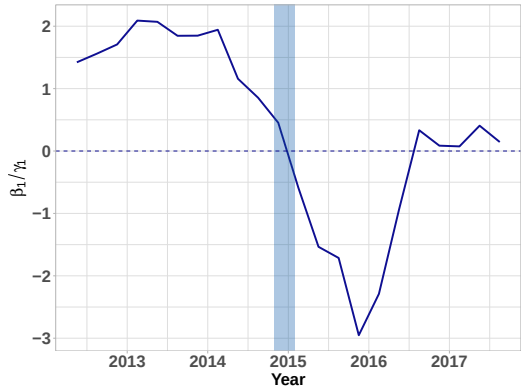
Data

Robustness: Pre-Trends?

- Run placebo regressions (15) - (16) using 9-quarter rolling windows to compute growth rates

- Plot ratio of regression coefficients
  * $\beta_1/\gamma_1 > 0 \implies cov(\Delta HP, \Delta HR) > 0$
  * $\beta_1/\gamma_1 < 0 \implies cov(\Delta HP, \Delta HR) < 0$

- Sign changes around the reform . . .
  * Rents do not longer co-move with house prices as a result of the credit shock



Parametrizing the model

Externally calibrated parameters

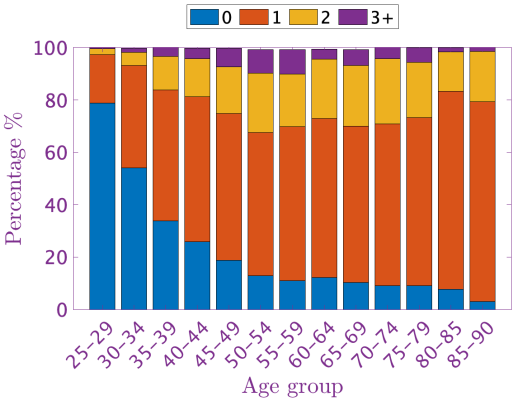
Parameter	Interpretation	Value
Earnings Process:		
ρ	Persistence parameter	0.9987
σ_0	Std. initial condition	0.36
σ_u	Std. innovation	0.0049
Externally calibrated:		
J^{ret}	Working life (years)	41
J	Length of life (years)	71
γ	Risk aversion coefficient	2.0
σ_ε	Scale parameter (taste shock)	0.05
$\{\tilde{h}^1, \tilde{h}^2\}$	Housing qualities	$\{1.0583, 0.7669\}$
τ^h	Proportional transaction cost	0.05
λ_{LTV}	Maximum loan-to-value ratio	1.0
λ_{LTI}	Maximum loan-to-income ratio	6.0
r	Risk-free rate	0.02
κ	Intermediation wedge	0.02
A_c	Aggregate labor productivity	1.25
$\bar{L}$	Amount of land	1.0
α	Share of land in production	0.5

Internally calibrated parameters, targets, & model fit

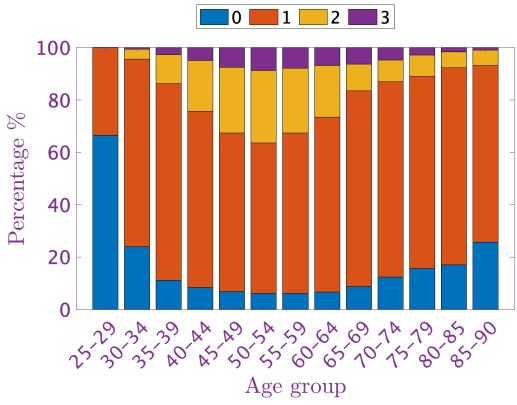
- The discount factor $\beta = 0.925$, the utility premium from ownership $s^h = 1.6$, the housing depreciation rate $\delta^h = 0.0106$, and the scaling factor in housing production $A_h = 0.0933$ are jointly chosen to match four moments of the data:

Moment	Model	Data	Source
Targeted:			
Wealth to income ratio	5.21	6.78	HFCS
Homeownership rate	79.39%	80%	EU-SILC
House price to avg. income ratio	4.70	5.0	CSO
House price to rents ratio	27.64	22.58	RTB/CSO
Untargeted:			
Rents to avg. income ratio	0.1702	0.2216	RTB/CSO
Share of households with 3+ properties	3.94%	5.11%	HFCS

Life-cycle patterns: number of properties



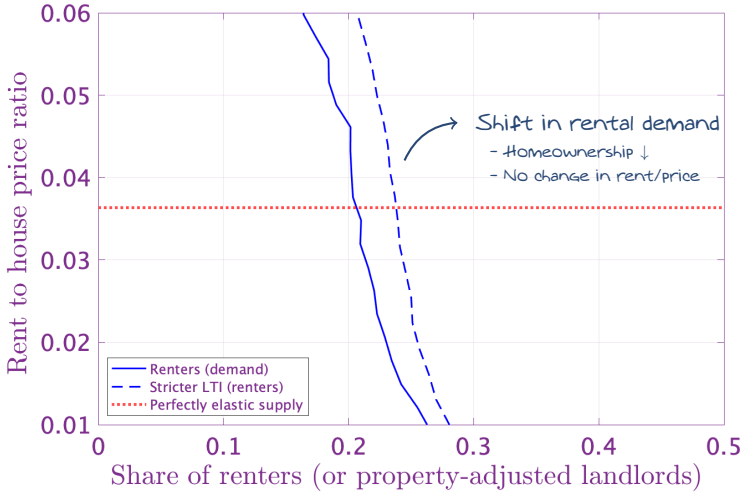
(a) Data



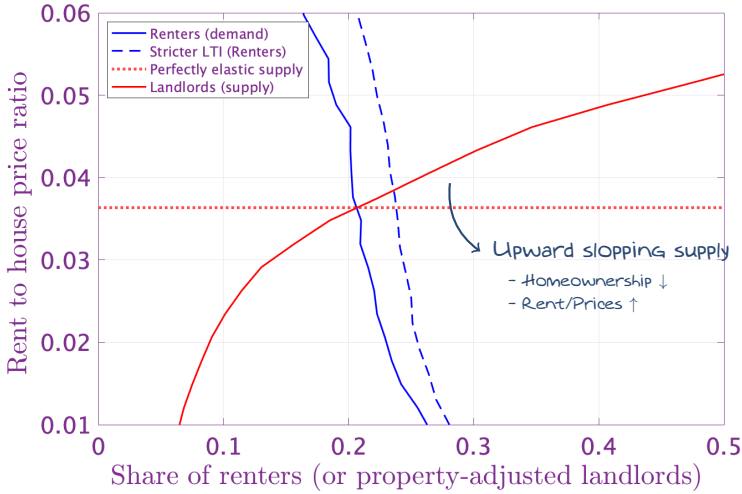
(b) Model

Constraining credit:
tighter LTI & LTV limits

Model intuition: perfectly elastic supply



Model intuition: landlord heterogeneity



Model intuition: mostly unconstrained landlords

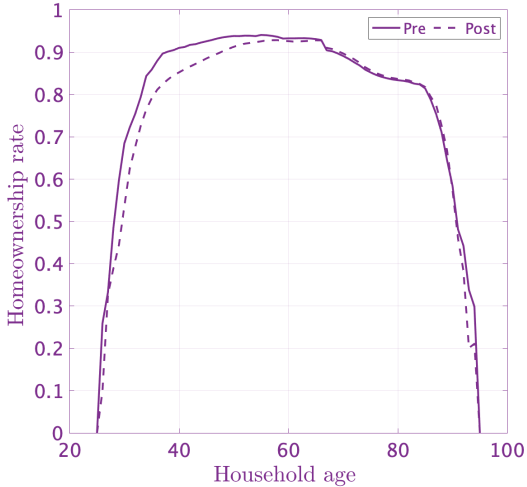
Steady State Comparison

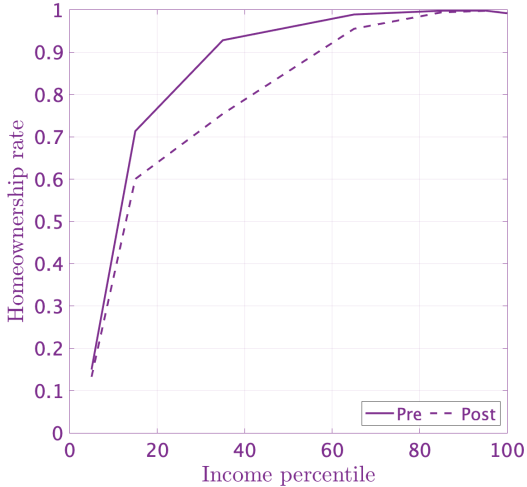
- First, study **aggregate effects** of the reform if it were to be permanent.
  * *Pre-reform* economy $\rightarrow \lambda_{LTI}^{pre} = 6, \lambda_{LTV}^{pre} = 100\%$
  * *Post-reform* economy $\rightarrow \lambda_{LTI}^{post} = 3.5, \lambda_{LTV}^{post} = 80\%$

	Pre-Reform	Post-Reform
Rent-to-Price	3.62%	3.93%
Average house price to income	4.70	4.63
Rent to Income	0.17	0.182
Homeownership rate	79.39%	76.57%
Share of households with 3 properties	3.94%	4.63%
Share of houses in hands of 3-property landlords	38.23%	39.61%

* Rent/Price $\rightarrow 8.5\% \uparrow = \begin{cases} \text{Prices} \rightarrow 1.8\% \downarrow \\ \text{Rents} \rightarrow 6.7\% \uparrow \end{cases}$ Homeownership rate $\rightarrow 2.82\text{pp} \downarrow$

What households cannot buy?





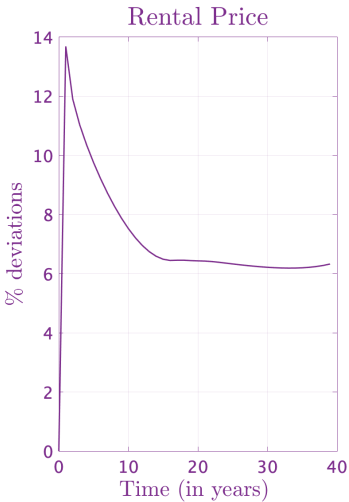
Steady State Comparison

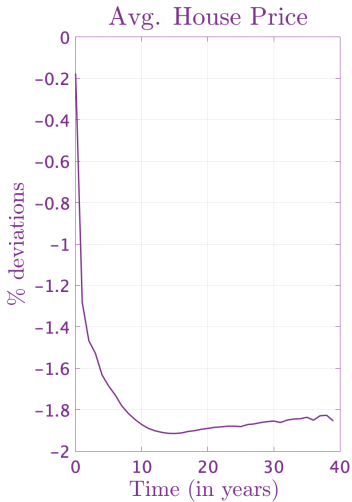
- Second, we **decompose the effect of each limit** by solving for a third equilibria
  * *Only LTI* economy $\rightarrow \lambda_{LTI}^{post} = 3.5, \lambda_{LTV}^{pre} = 100\%$

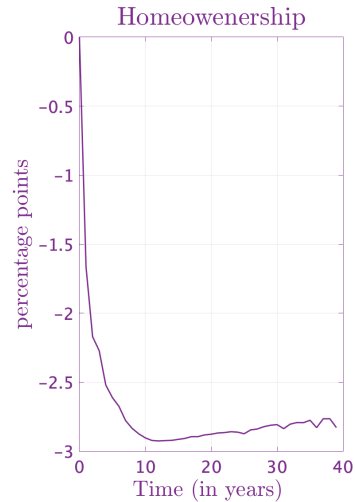
	Pre-Reform	Post-Reform	Only LTI
Rent-to-Price	3.62%	3.93%	3.94%
Average house price to income	4.70	4.63	4.62
Rent to Income	0.17	0.182	0.182
Homeownership rate	79.39%	76.57%	76.49%
Share of households with 3 properties	3.94%	4.63%	4.72%
Share of houses in hands of 3-property landlords	38.23%	39.61%	40.13%

  * Most of the effects are originated by the tighter LTI limit

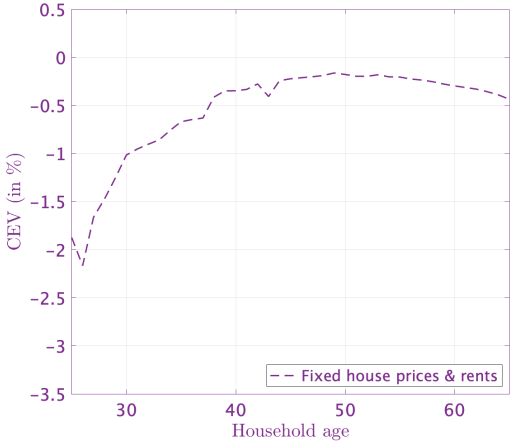
Transition paths

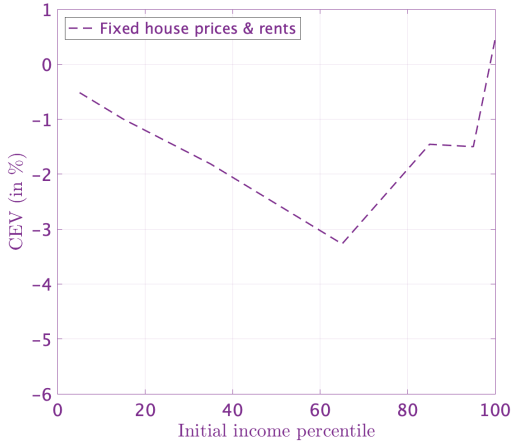




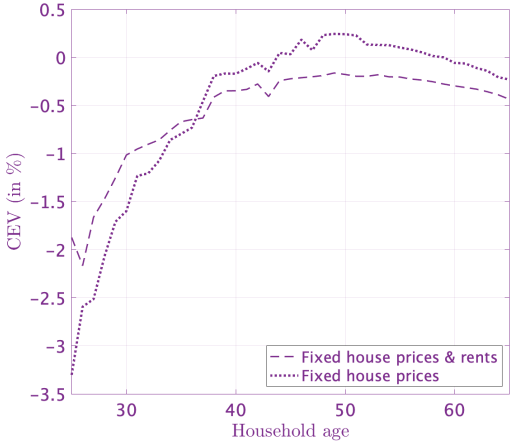


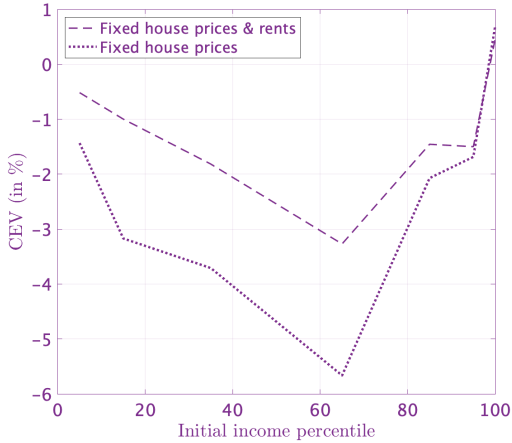
Lifetime CEV: fixed house prices & rents



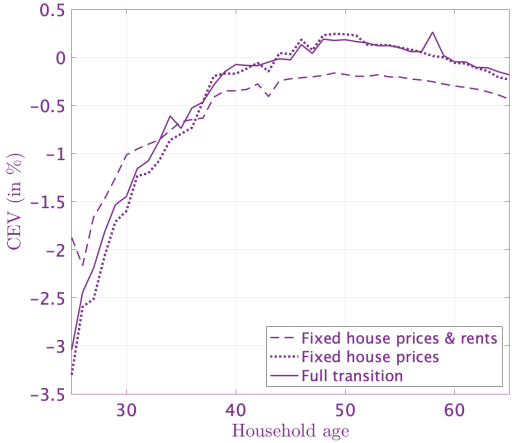


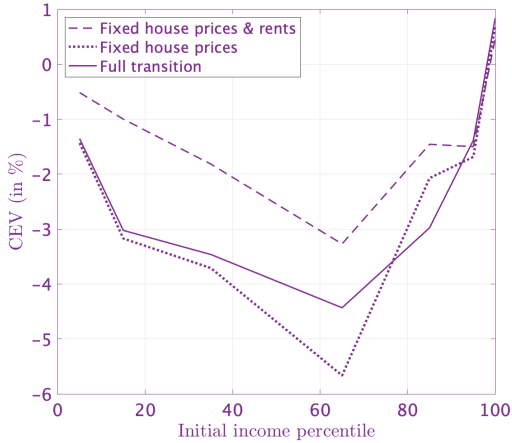
Lifetime CEV: movements in rents





Lifetime CEV: full transition





Concluding remarks

Main Takeaways

- We have **empirically** shown that the Irish macroprudential reform had **opposite effects on house prices and rents**.
- We build a **GE model with landlord heterogeneity** that is able to rationalize this finding.
- We use it to evaluate the **aggregate** and **distributional** effects of the reform:
  * rent/price $\uparrow$ 8.5% $\rightarrow$ house prices $\downarrow$ 1.8% & rents $\uparrow$ 6.7%
  * homeownership $\downarrow$ 2.8 pp & market concentration $\uparrow$1.4 pp
  * ☹ Young, middle-income and renters $\rightarrow$ postpone/cancel buying decisions + higher rents
  * ☺ Middle-aged, top-earners, landlords $\rightarrow$ not constrained, higher returns at lower costs

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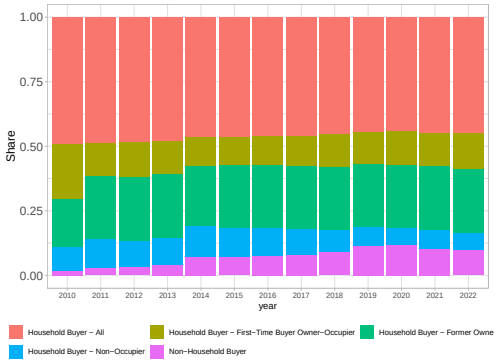
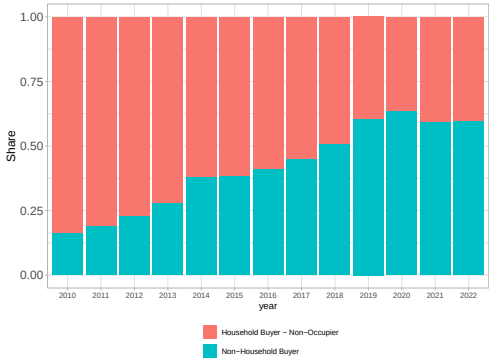
THANK YOU!

Who is the marginal investor?

Share of all property transactions, by type of buyer and year (CSO data)

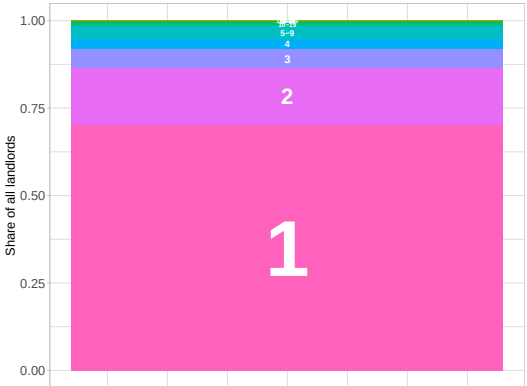


Share of all property transactions, by type of buyer and year (CSO data), **excluding owner-occupiers**.

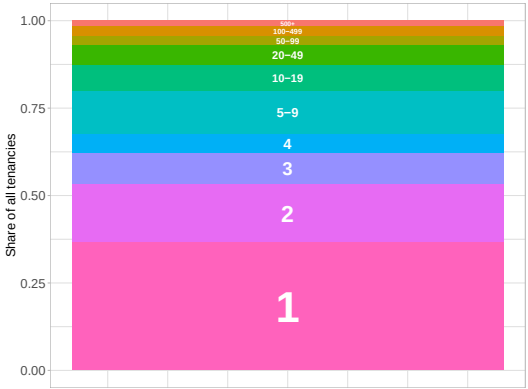


Why we only model small landlords?

Share of landlords by number of registered tenancies (RTB)



Share of tenancies by number of registered tenancies (RTB)



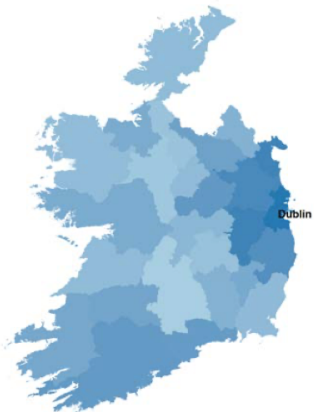
Mortgage Measures Framework Review

- Relaxation of the rules were announced in October 2022
- These measures will come into effect in **January 2023**
- *First-Time-Buyers (FTB)*
  * The **LTI limit** increases from 3.5 to **4 times household's income**
  * No changes in the LTV limit
- *Second and Subsequent Buyers (SSB)*
  * The **LTV limit** increases from 80% to **90%**
  * No changes in the LTI limit
- The proportion of lending above limits applies at the level of borrower type
  * 15% of FTB and SSB can be above limit
  * 10% of BTL lending can be above limit

Back

Data Sources

- Data on **house prices and rents** obtained from **daft.ie** property website (Lyons, 2022)
  * 54 housing markets (26 counties + cities + all postcodes in Dublin)
- **Distance measure** computed at borrower level (Acharya et al., 2022)
  * Look at households who obtain a mortgage in year 2014
  * Compute the distance of their mortgage from the new limits
  * Group over 26 counties and over the income distribution
  * Take averages



Note: darker means less distance from limits

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Lifetime CEV: the role of housing tenure