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, borrower-based macroprudential policies, 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**.

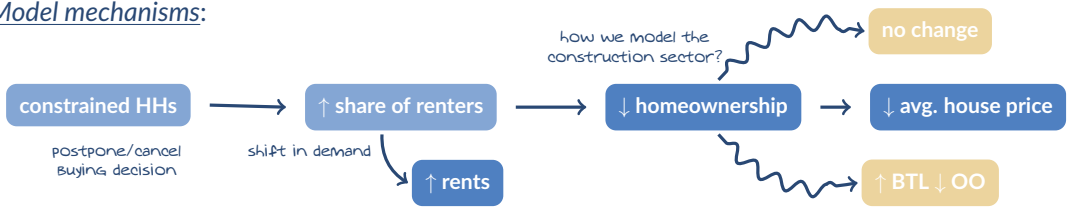
What we do

- Build an equilibrium model of the **rental and housing markets** with the following key ingredients:
  * Heterogenous households (age, income and wealth)
  * Endogenous housing tenure choices (renters, homeowners or landlords)
  * Long-term mortgages with constraints that only bind at origination
- Use the model to study the effects of the **2015 macro-prudential intervention in Ireland** and its impact on:
  * House prices and rents
  * Homeownership rates
  * Welfare (losses)
- 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, hurts the poor and slightly benefits the middle-age and the very rich
  - **Full transition**: quantitatively small role for the drop in house prices.

A macro-prudential reform: the case of Ireland

Institutional framework

- No official limits prior the reform
- First discussed in October 2014, and officially announced and directly implemented in **February 2015**
- **Loan-to-Value (LTV) requirements**:
  * General limit: 80%
  * For *first time buyers* (FTB): 90% if property value is below €220,000
  * For *buy-to-let* (BTL): 70%
  * 15% of new lending can be above limit
- **Loan-to-Income (LTI) requirements**:
  * 3.5 times household income (only for FTB)
  * 20% of bank lending can be above limit

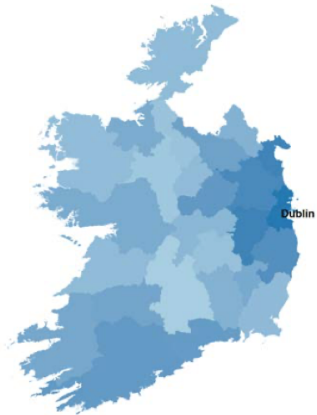
▷ Relaxation of the rules announced in October 2022 ▷ House prices and rents

Empirical evidence

Intended effect on house prices

- Acharya, Bergant, Crosignani, Eisert, McCann (2022) study the effect of the reform on house prices

- What do they do?
  * Use data on newly originated mortgages before the reform
  * Construct a `Distance` measure that captures the exposure to lending limits (LTI & LTV) across counties and the income distribution
  * Regress house price changes on the `Distance` measure
  * Main finding: house prices increased more in more distant counties



Note: darker means less distance from limits

What about rents?

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

$$\Delta HP_i = \beta_0 + \beta_1 \texttt{Distance}_i + \epsilon_i \quad (1)$$

$$\Delta HR_i = \gamma_0 + \gamma_1 \texttt{Distance}_i + \nu_i \quad (2)$$

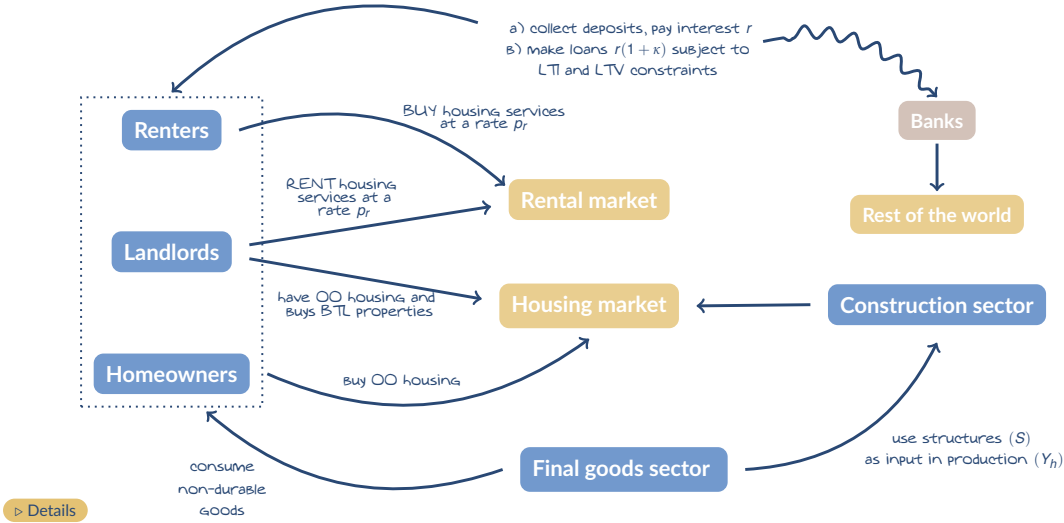
where i is county, Δ is change between 2014Q3 and 2016Q4

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

▷ Data ▷ Pre-Trends

The Model

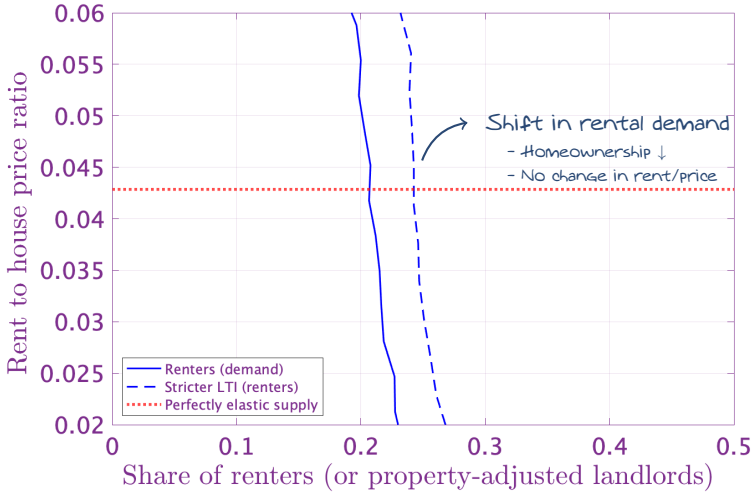
Model sketch



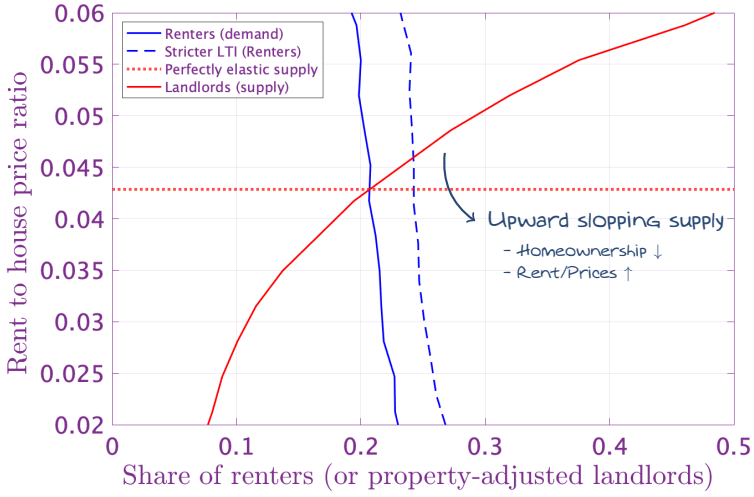
▷ Details

Constraining credit:
tighter LTI & LTV limits

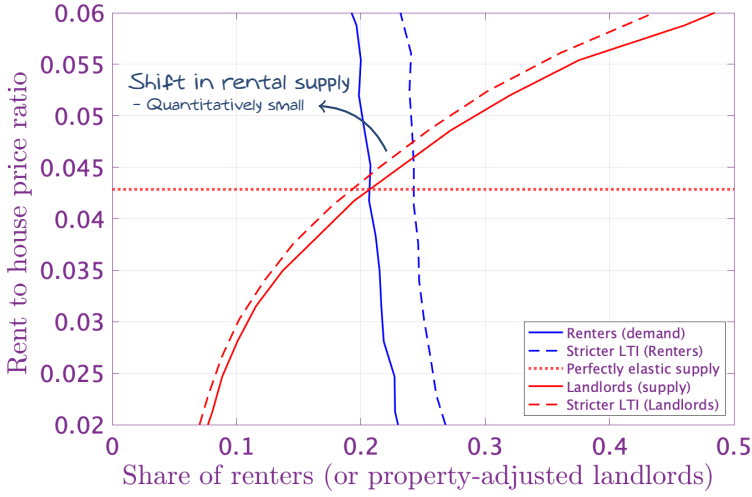
Model intuition: perfectly elastic supply



Model intuition: landlord heterogeneity



Model intuition: mostly unconstrained landlords



Steady State comparison

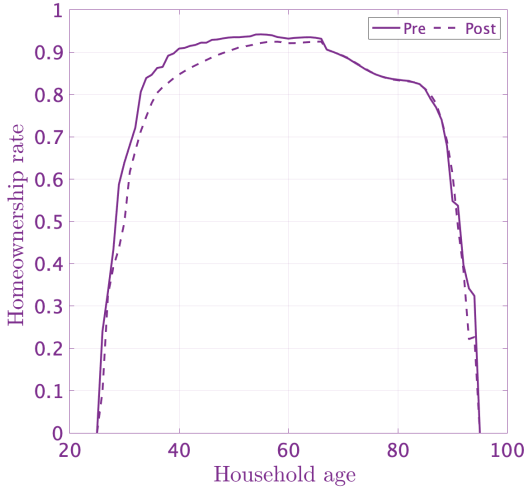
- First, study the effects of the reform if it were to be permanent. Later, we will look at the transition.

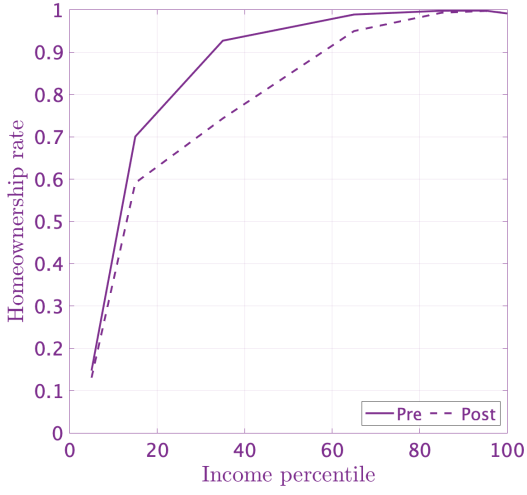
	Pre-Reform	Post-Reform	Only LTI
	LTV = 100%, LTI = 6	LTV = 80%, LTI = 3.5	LTV = 100%, LTI = 3.5
Rent-to-Price	4.38%	4.73%	4.73%
Average house price to income	4.90	4.87	4.87
Rent to Income	0.21	0.23	0.23
Homeownership rate	79.13%	76.34%	76.36%
Share of households with 3 properties	3.97%	4.65%	4.66%
Share of houses in hands of 3-property landlords	38.06%	39.29%	39.47%

- Rent/Price $\rightarrow 8.76\% \uparrow = \begin{cases} \text{Prices} & \rightarrow 0.65\% \downarrow \\ \text{Rents} & \rightarrow 8.06\% \uparrow \end{cases}$ Homeownership rate $\rightarrow 2.79\text{pp} \downarrow$
- Most of the effects are originated by the tighter LTI limit

▷ Calibration

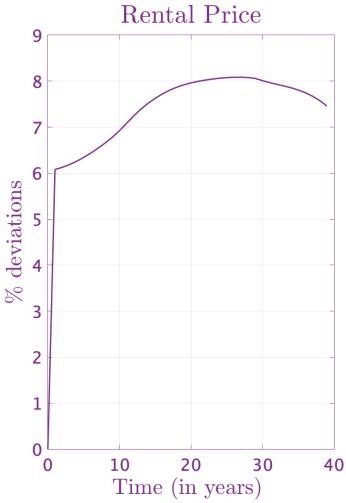
Homeownership rate by age and income

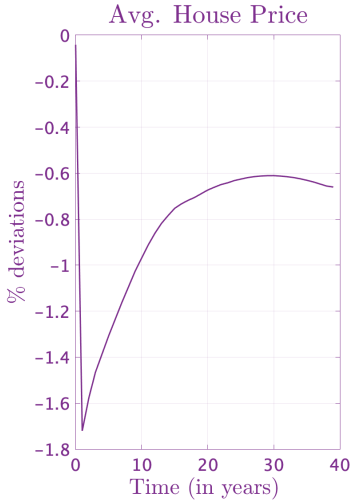


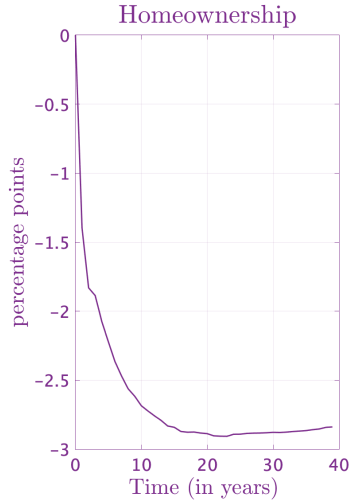


Transition & Welfare

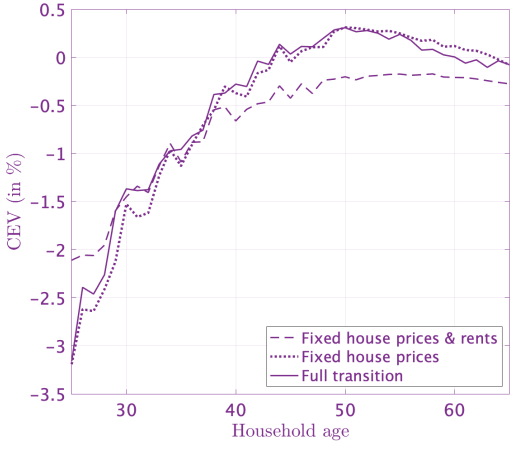
Transition paths

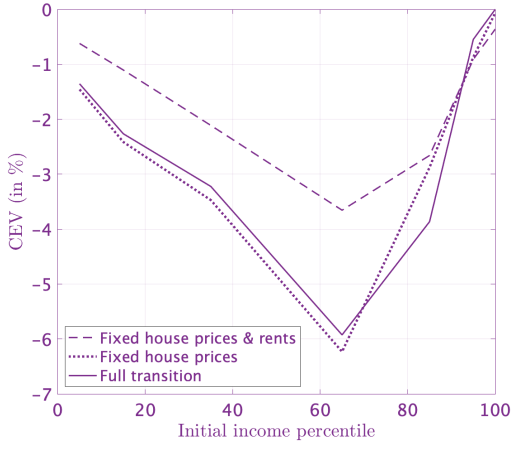






Lifetime CEV





▷ By ownership status

Concluding remarks

Main Takeaways

- We have **empirically** shown that the Irish macroprudential reform had **opposite effects on house prices and rents**

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- We build an **equilibrium model with landlord heterogeneity** and use it to evaluate the *aggregate* and *distributional* effects of the reform:
  * upon impact: rent/price $\uparrow$ 7.8% $\rightarrow$ house prices $\downarrow$ 1.7% & rents $\uparrow$ 6.1%
  * across steady states: homeownership $\downarrow$ 2.79 pp & market concentration $\uparrow$1.2 pp
  * ☹ Young, poor, middle-income and renters $\rightarrow$ higher rents + postpone/cancel buying
  * ☺ Middle-aged, top-earners, landlords $\rightarrow$ not constrained, higher returns at lower costs

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- We have **empirically** shown that the Irish macroprudential reform had **opposite effects on house prices and rents**

- We build an **equilibrium model with landlord heterogeneity** and use it to evaluate the *aggregate* and *distributional* effects of the reform:
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  * ☹ Young, poor, middle-income and renters → higher rents + postpone/cancel buying
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THANK YOU!

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Appendix

The Model

Final good & construction sectors

- **Final Good Producer**
  - $Y_c = A_c N$, where A_c is constant and N are the unit of labor services.
  - Profit maximization $\implies$ wage $= A_c$
  - Consumption good is also input to housing production (structures)

- **Housing Good Producer**
  - Combines land permits L (fixed) and structures S through a Cobb-Douglas technology where α is the share of land in production.
  - Profit maximization implies the following *housing investment function*

$$Y_h = A_h^{1/\alpha} \left((1-\alpha)\, p_h \right)^{(1-\alpha)/\alpha} \bar{L} \tag{3}$$

▷ Back

Aggregate housing stock

- In general, aggregate housing stock is given by

$$H = \int H_i dF(i) \tag{4}$$

where H_i denotes the different types of houses in which HHs will live in

- We constrain H_i to be **discrete**
  - There are only **two types**: owner-occupied (oo) and buy-to-let (btl)
  - They differ in their **quality/size**: $\tilde{h}_{oo} > \tilde{h}_{btl}$
  - Final transaction **price depends on type**: $p^h(\tilde{h}_j) = \tilde{h}_j p_h$ for $j = \{oo, btl\}$
- In practice, aggregate amount of housing is given by

$$H = \tilde{h}_{oo} H_{oo} + \tilde{h}_{btl}(1 - H_{oo}) \tag{5}$$

where H_{oo} is the share of owner-occupied housing, which also coincides with the homeownership rate.

▷ Back

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* $s(\tilde{h})$

$$\mathbb{E}_0 \left\{ \sum_{j=1}^{J} \beta^{j-1} \frac{\left(c\, s(\tilde{h})\right)^{1-\gamma}}{1-\gamma} \right\} \tag{6}$$

  where $\beta \in (0, 1)$, $c > 0$ and $s(\tilde{h})$ varies depending on the quality of the house where the household resides.
- *Working age* households receive an **idiosyncratic labor income endowment**

$$\log y = \log A_c + f(j) + \eta \tag{7}$$

  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.

▷ Back

Housing & mortgages

- **Housing state** is the number of houses owned (*renters*, *homeowners*, and *landlords*):

$$h \in \{0, 1, 2, 3\} \tag{8}$$

  * Owner-occupied has quality $\rightarrow \tilde{h}_{oo}$
  * Buy-to-let housing has lower quality $\rightarrow \tilde{h}_{btl} < \tilde{h}_{oo}$

- Houses are **illiquid** (proportional transaction costs, τ_h) and **costly to maintain**, δ_h.

- Households can **borrow** ($a < 0$) at a rate $r(1 + \kappa)$ with $\kappa > 0$

- The amount borrowed is limited by two **financial constraints** that can only *bind at origination*:

$$a' \geq -\lambda_{LTV}\, p^h(\tilde{h}) h' \tag{9}$$

$$a' \geq -\lambda_{LTI}\, y \tag{10}$$

- For the remaining life of the mortgage, households must at least pay interests and **amortize** a minimum amount per period, $m(j)$.

▷ Back

Household's problem

$$V(a,h,y,j) = \max_{a',h'} \left\{ \frac{\left(c\, s(\tilde{h})\right)^{1-\gamma}}{1-\gamma} + \sigma_\varepsilon\, \varepsilon(h) + \beta \mathbb{E} V(a',h',y',j+1) \right\} \tag{11}$$

s.t.

$$\begin{aligned} c + a' + p^h(\tilde{h})h' + \tau^h p^h(\tilde{h})|h' - h| + \delta_h p^h(\tilde{h})h \;\leq \\ y + (1 + r\,(1 + \mathbb{I}_{a'<0}\,\kappa))\,a + p^h(\tilde{h})h + p_r(h-1) \end{aligned} \tag{12}$$

$$a' \geq \begin{cases} \max\{-\lambda_{LTV} p^h(\tilde{h})h', -\lambda_{LTI} y\} & \text{if } h' > h \\ a(1 + r(1+\kappa) - m(j)) & \text{if } h > 0 \text{ and } a < 0 \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

$$\varepsilon(h) \sim F, \text{ extreme value type I dtb} \tag{14}$$

$$m(j) = \frac{r(1+\kappa)(1+r(1+\kappa))^{J-j}}{(1+r(1+\kappa))^{J-j} - 1} \tag{15}$$

▷ Back

Market clearing & equilibrium

- r is fixed $\rightarrow$ small open economy
- **Housing market**
  * houses bought = houses produced + houses sold - depreciation
- **Rental market**
  * Competitive: renters meet landlords
  * p_r is determined using household's equilibrium distribution, μ

$$\underbrace{\sum_{i_a=1}^{n_a}\sum_{i_y=1}^{n_y}\sum_{j=1}^{J}\mu(a,y,0,j)}_{\text{renters}} = \underbrace{\sum_{i_a=1}^{n_a}\sum_{i_y=1}^{n_y}\sum_{j=1}^{J}\mu(a,y,2,j)}_{\text{landlords w/ 1 btl property}} + 2\underbrace{\sum_{i_a=1}^{n_a}\sum_{i_y=1}^{n_y}\sum_{j=1}^{J}\mu(a,y,3,j)}_{\text{landlords w/ 2 btl properties}} \tag{16}$$

▷ Back

Calibration

Externally calibrated parameters

Parameter	Interpretation	Value
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
$\{\tilde{h}_{oo}, \tilde{h}_{btl}\}$	Housing qualities	$\{1.036, 0.8562\}$
δ_h	Housing depreciation rate	0.012
τ^h	Proportional transaction cost	0.04
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	0.33

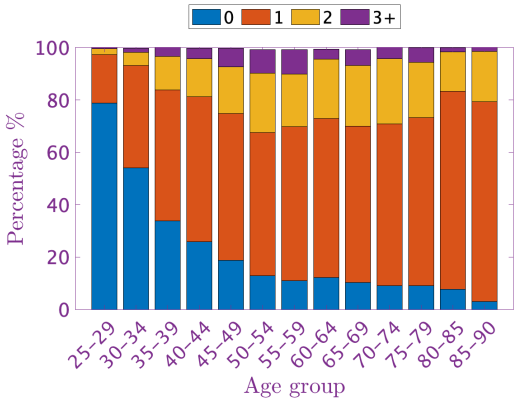
Internally calibrated parameters, targets, & model fit

- The discount factor $\beta = 0.9375$, the utility premium from ownership $s(\tilde{h}_{oo}) = 1.6$, and the scaling factor in housing production $A_h = 0.12$ are jointly chosen to match four moments of the data:

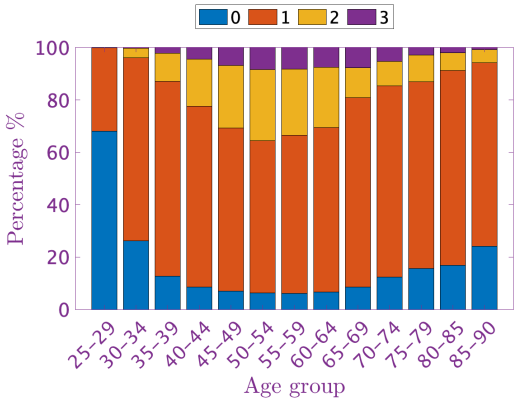
Moment	Model	Data	Source
Targeted:			
Wealth to income ratio	5.32	6.78	HFCS
Homeownership rate	79.13%	80%	EU-SILC
Avg. house price to income ratio	4.90	5.0	CSO
House price to rents ratio	23.00	22.58	RTB/CSO
Untargeted:			
Rents to avg. income ratio	0.2132	0.2216	RTB/CSO
Share of households with 3+ properties	3.97%	5.11%	HFCS

▷ Small landlords

Life-cycle patterns: number of properties



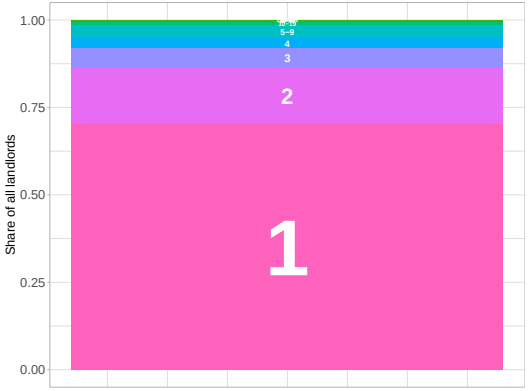
(a) Data



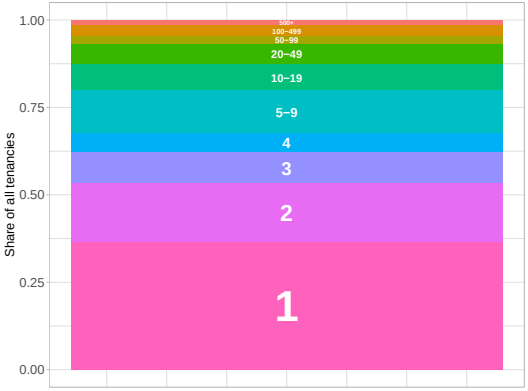
(b) Model

Why we only model small landlords?

Share of landlords by number of registered tenancies (RTB)



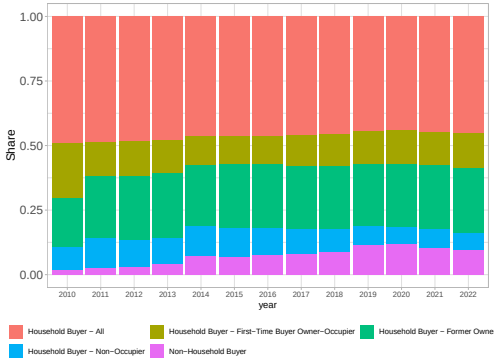
Share of tenancies by number of registered tenancies (RTB)



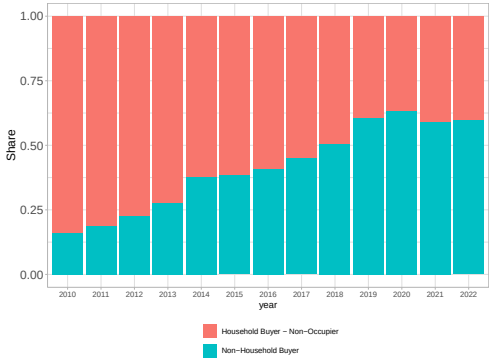
▷ Back

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**.



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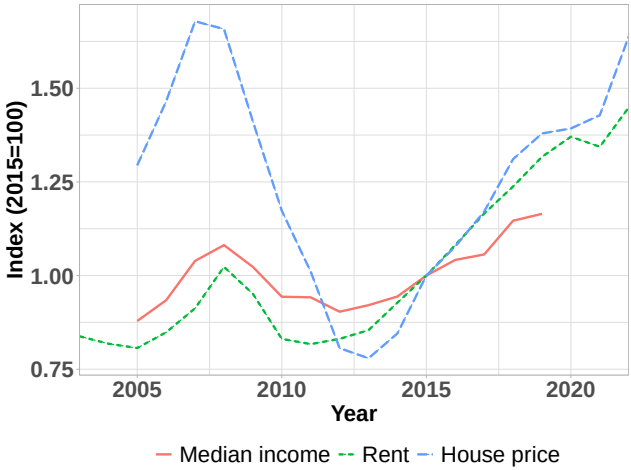
The Irish Macro-Prudential Framework

Cyclical evolution of house prices and rents in Ireland



Source: Daft.ie property website based on Keely and Lyons (2020, JREFE)

▷ Back

Mortgage Measures Framework Review

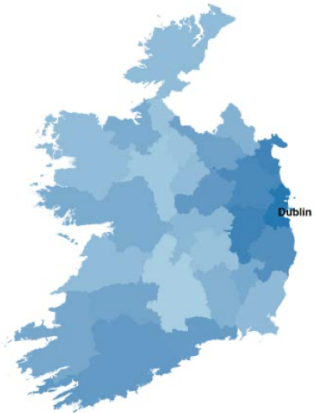
- Relaxation of the rules were announced in October 2022
- These measures will come into effect in **January 2023**
- *First-Time-Buyers (FTB)*
  * The **LTI limit** increases from 3.5 to **4 times household's income**
  * No changes in the LTV limit
- *Second and Subsequent Buyers (SSB)*
  * The **LTV 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

Empirical Evidence

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

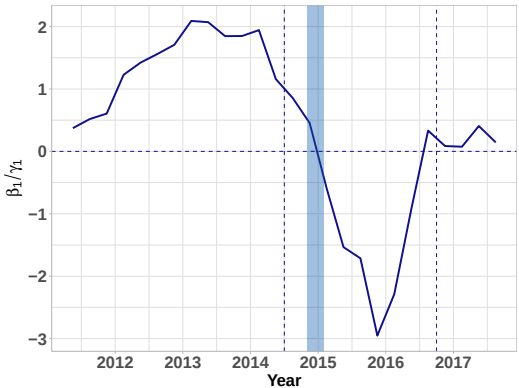
▷ Back

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



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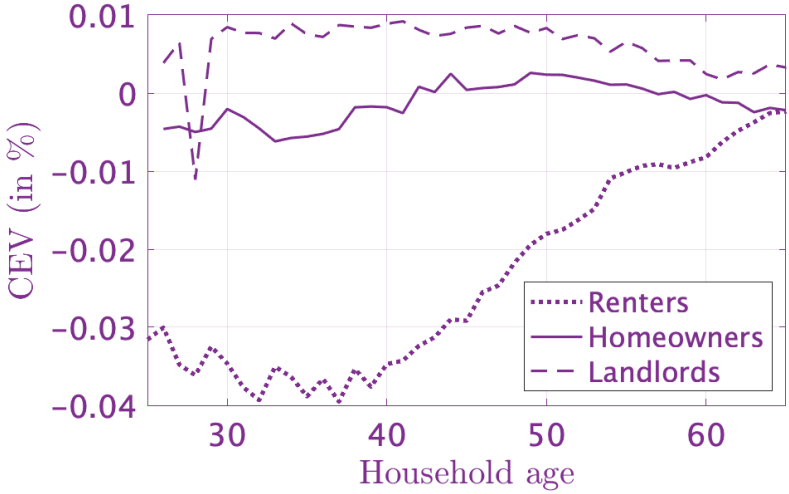
Transition and Welfare

Lifetime CEV: the role of housing tenure



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