

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

Juan Castellanos

European University Institute

Andrew Hannon

European Central Bank

Gonzalo Paz-Pardo

European Central Bank

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Disclaimer: The views expressed in this presentation are our own and do not necessarily reflect those of the ECB or the Eurosystem.

- Housing has a **dual role** . . .
 - * As a *consumption good* → if households don't buy a house, they must rent it
 - * As an *asset/investment* → 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**.

- Build an equilibrium model of the **rental and housing markets**
 - * 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 (distribution of losses)
- Model is also useful to understand other types of credit shocks such as a changes in the real interest rate

- Empirically:

- * LTV & LTI limits \implies $\left\{ \begin{array}{l} \downarrow \text{house price growth (Acharya et al., 2022)} \\ \uparrow \text{growth of rental prices} \end{array} \right.$

- Model mechanisms:

- * Increased rental demand by constrained households
- * More rental properties need to be supplied: higher rental rates (key: **landlord heterogeneity**)
- * Lower house prices over the transition, persistently if rental \neq owner-occupied properties

- Implications:

- * Along the transition, the reform **benefits the old** and **hurts the young**
- * Largest welfare losses for middle of income distribution
- * Drivers of welfare loss: credit constraint + increase in rents
- * Increase in wealth concentration

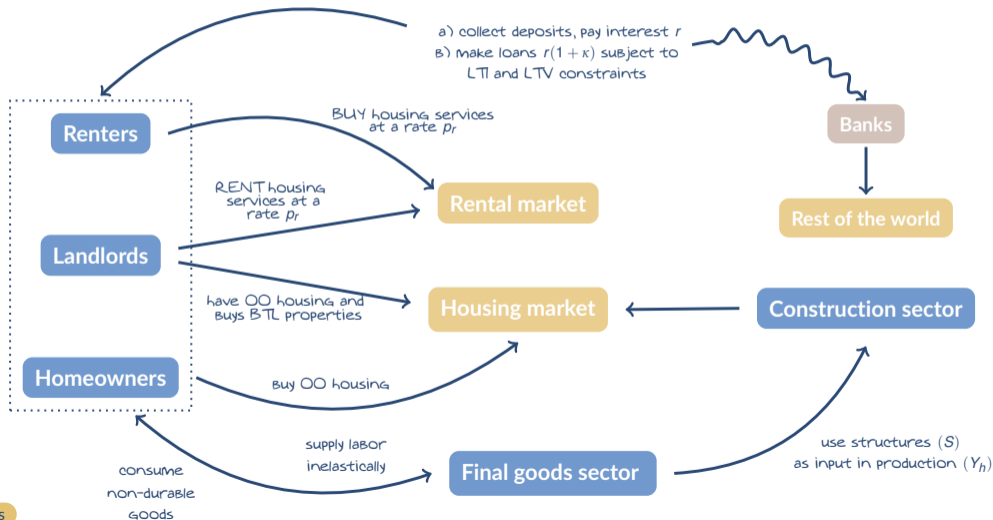
- Model mechanisms:

- * More **expensive credit** deters homeownership leading to higher rental prices & lower house prices
- * Differently from the macro-pru reform, there are counteracting effects as the **higher return on savings** helps HHs to save for downpayment
- * However, the substitution effect between financial assets and housing dominates

- Implications:

- * At fixed prices, the increase in interest rates is on average welfare improving as the economy has a positive net asset position
- * Price adjustments in the housing and rental market, lead to **heterogenous effects on welfare** with HHs below the median income losing (high rents) while those above benefiting (lower house prices)

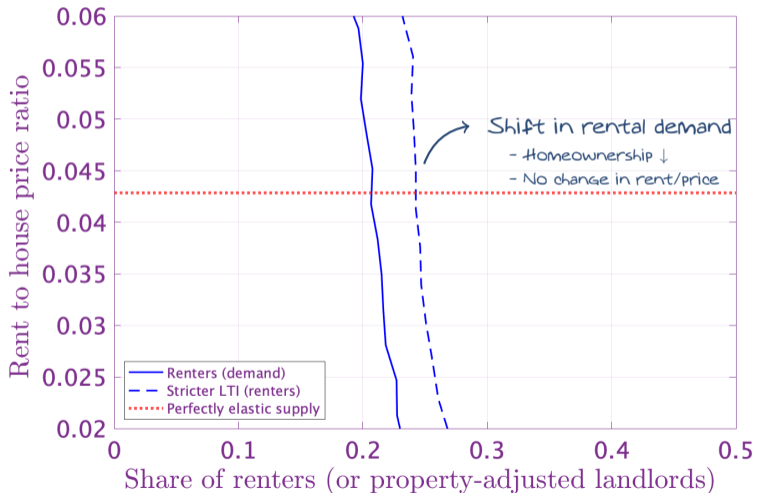
THE MODEL ECONOMY



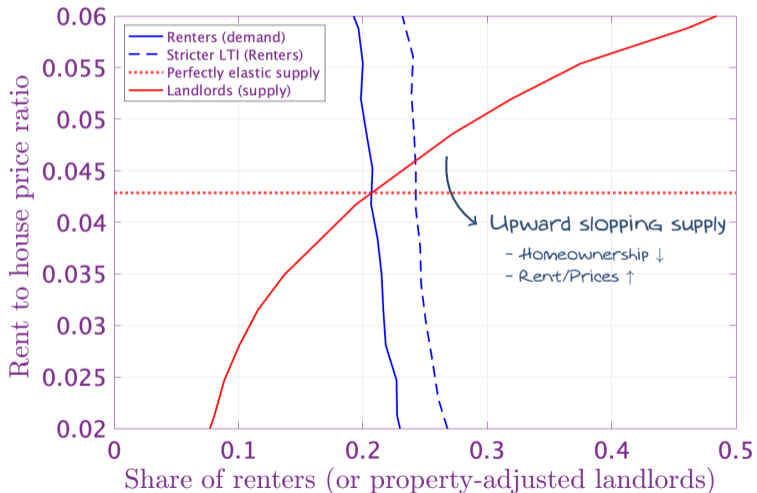
A CREDIT CRUNCH

(MODEL'S INTUITION)

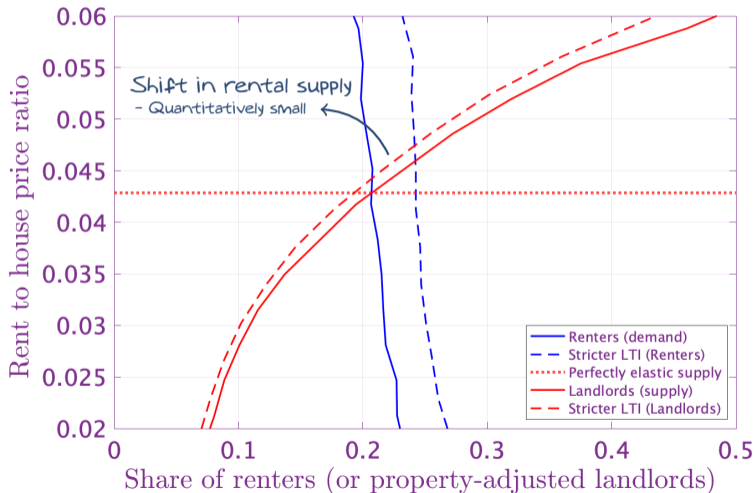
Model intuition: perfectly elastic supply



Model intuition: landlord heterogeneity



Model intuition: mostly unconstrained landlords

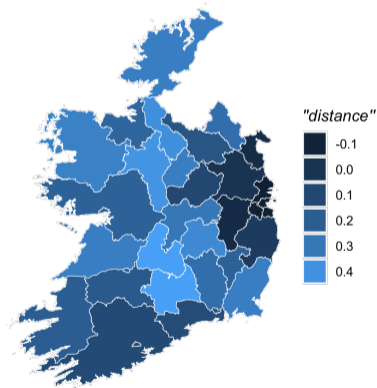


THE IRISH MACROPRUDENTIAL REFORM

- First discussed in October 2014
- 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

EMPIRICAL EVIDENCE

- 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



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

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

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

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

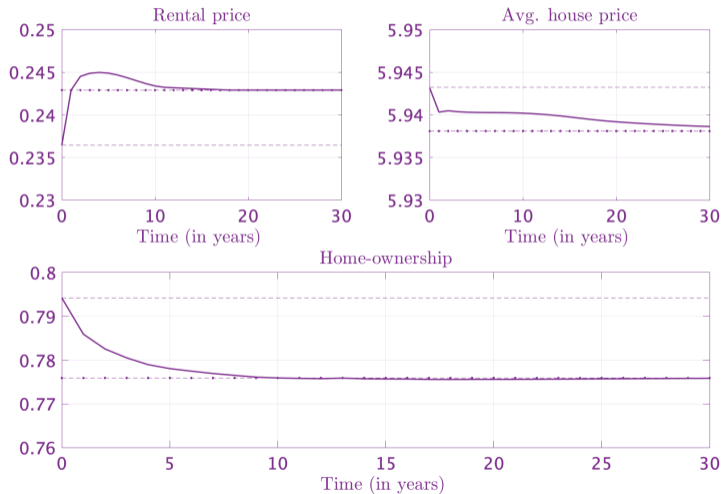
| | Δ House prices | Δ Rents |
|----------|-----------------------|-------------------|
| Distance | 0.289 (0.068) | -0.171 (0.039) |
| Obs. | 54 | 54 |
| R^2 | 0.34 | 0.31 |

AGGREGATE & DISTRIBUTIONAL EFFECTS

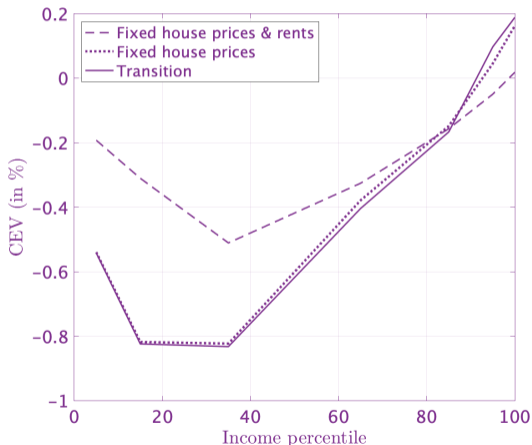
(STEADY STATES, TRANSITION & WELFARE)

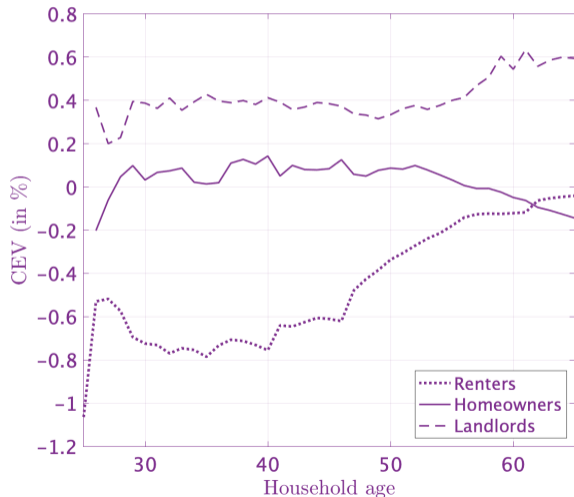
| | Pre-Reform | Post-Reform |
|---------------------------------------|---------------------|----------------------|
| | LTV = 100%, LTI = 6 | LTV = 80%, LTI = 3.5 |
| Rent-to-Price | 3.98 % | 4.09 % |
| Average house price to income | 4.930 | 4.925 |
| Rent to Income | 0.196 | 0.201 |
| Homeownership rate | 79.42 % | 77.59 % |
| Share of HHs living in big house | 50.41 % | 50.03 % |
| Share of households with 3 properties | 4.29 % | 4.51 % |

- Rent/Price $\rightarrow 2.82\% \uparrow = \begin{cases} \text{Prices} \rightarrow 0.01\% \downarrow \\ \text{Rents} \rightarrow 2.73\% \uparrow \end{cases}$
 - Homeownership rate $\rightarrow 1.83\text{pp} \downarrow$
 - Share of HHs living in big $\rightarrow 0.38\text{pp} \downarrow$
- Increased rental demand is met by owners starting the landlord business (1.39pp) rather than by landlords purchasing extra units ($0.22 \times 2 = 0.44\text{pp}$)



- **Tighter LTV & LTI** limits affects primarily potential (constrained) homebuyers who are in the **middle** of the income distribution
- The **increase in rental prices** hurts the **very poor** (as they have to still pay more rent) and those at **bottom-mid** of the income distribution (as it is more difficult to save for downpayment)
- Limited role for house prices





- **Renters are the biggest losers** from the reform as it is more difficult to access homeownership and they pay higher rental prices
- **Homeowners are indifferent** because they have already purchased their homes
- **Landlords benefit** from the higher cash flows from their housing portfolio

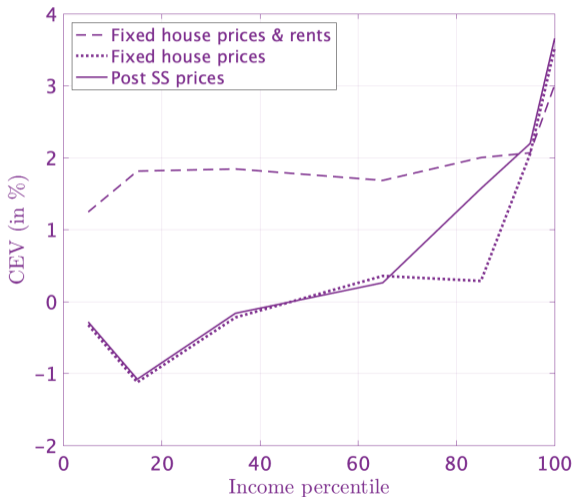
RISING THE REAL INTEREST RATE

- $\uparrow r = \begin{cases} \uparrow r^s \rightarrow \text{substitution effect (financial assets) + positive income effect (downpayment)} \\ \uparrow r^b \rightarrow \text{negative income effect (mortgage payments)} \end{cases}$

| | Low Int. Rate | Decomposition | High Int. Rate |
|-----------------------------------|--------------------------|--------------------------|--------------------------|
| | $r^s = 0.02, r^b = 0.04$ | $r^s = 0.03, r^b = 0.04$ | $r^s = 0.03, r^b = 0.05$ |
| Rent-to-Price | 4.09 % | 4.58 % | 4.69 % |
| Average house price to income | 4.925 | 4.899 | 4.846 |
| Rent to Income | 0.201 | 0.224 | 0.227 |
| Homeownership rate | 77.59 % | 76.99 % | 76.67 % |
| Share of HHs living in big houses | 50.03 % | 47.74 % | 43.02 % |

- $\uparrow r^s$ (SE > IE) \rightarrow homeownership $\downarrow 0.6p.p.$, $p_r \uparrow 11.38\%$, $p_h^{avg} \downarrow 0.50\%$
- $\uparrow r^b \rightarrow$ homeownership $\downarrow 0.33p.p.$, $p_r \uparrow 1.22\%$, $p_h^{avg} \downarrow 1.1\%$
- $\uparrow r \rightarrow$ homeownership $\downarrow 0.92p.p.$, $p_r \uparrow 12.70\%$, $p_h^{avg} \downarrow 1.62\%$

Welfare: CEV across steady states



CONCLUDING REMARKS

- 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:
 - * across steady states: homeownership ↓ 1.83 pp, rents ↑ 2.73%, house prices ↓ 0.01%
 - * 😞 poor and middle income → higher rents + postpone/cancel buying
 - * 😊 top-earners → not constrained, higher returns at lower costs

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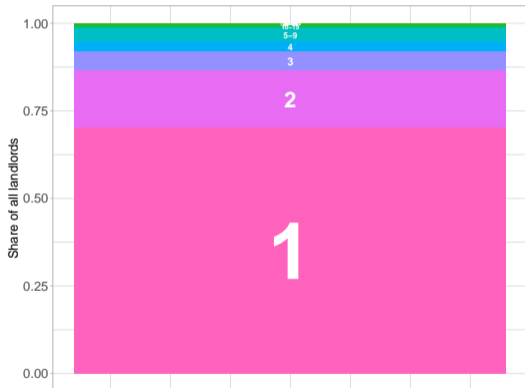
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THANK YOU!

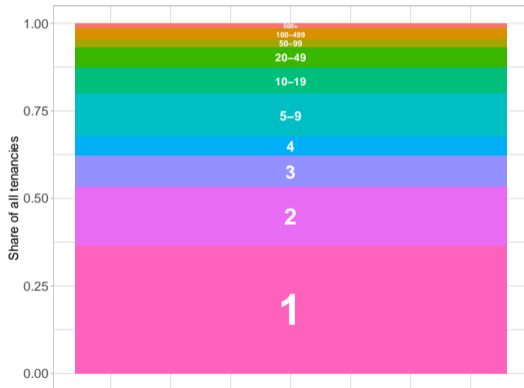
APPENDIX

Why we only model small landlords?

Share of landlords by number of registered tenancies (RTB)

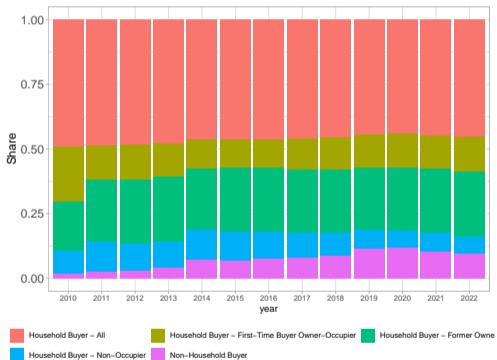


Share of tenancies by number of registered tenancies (RTB)

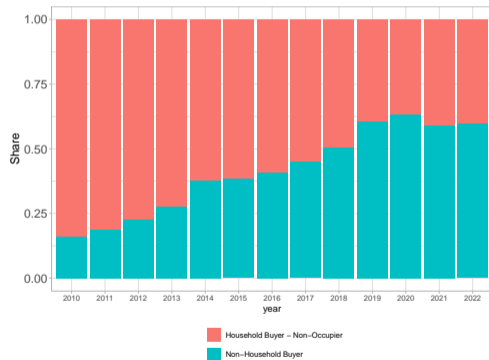


Who is the marginal investor?

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

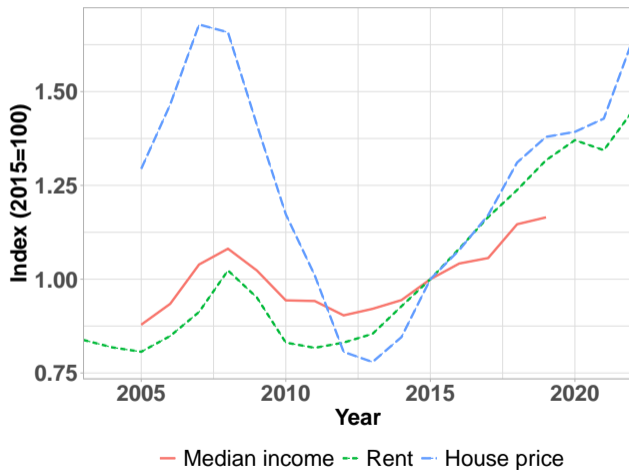


Share of all property transactions, by type of buyer and year (CSO data), excluding owner-occupiers.



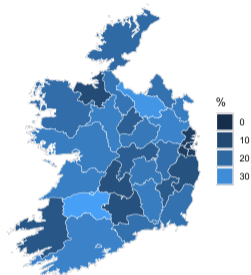
THE IRISH MACRO-PRUDENTIAL FRAMEWORK

- 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

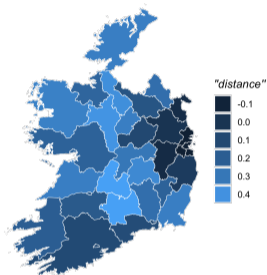


- Data on **house prices and rents** obtained from **daft.ie** property website (Lyons, 2022)
 - * 54 housing markets (26 counties + cities + all postcodes in Dublin)

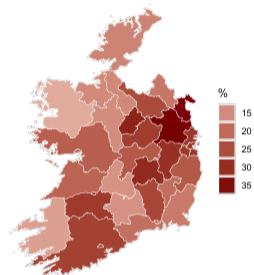
- **Distance measure** computed at borrower level (Acharya et al., 2022)
 - * Look at households who obtain a mortgage in year 2014
 - * Compute the distance of their mortgage from the new limits
 - * Group over 26 counties and over the income distribution
 - * Take averages



(a) House price growth



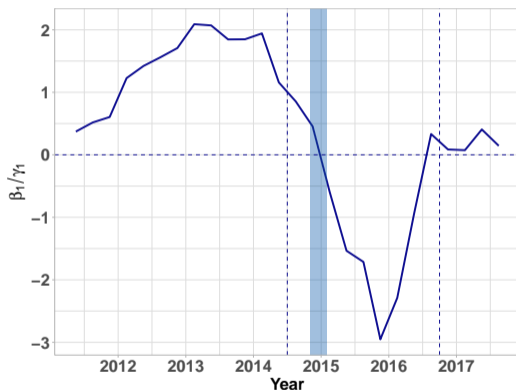
(b) Distance measure



(c) Rental price growth

- Counties where borrowers are close to the borrowing limits (low distance), e.g. around Dublin, experience *lower house price growth* (positive correlation) and *higher rental growth* (negative correlation).

- Run placebo regressions (6) - (7) 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



THE MODEL ECONOMY

- Final Good Producer

- * Linear technology: $Y_c = A_c N$, where A_c is a parameter and N is labor
- * Profit maximization: wage = A_c

- Housing Good Producer

- * Cobb-Douglas technology: $Y_h = A_h \bar{L}^{\alpha_L} S^{1-\alpha_L}$ where $\{A_h, \alpha_L\}$ are parameters, \bar{L} land permits and S structures
- * Profit maximization: $Y_h = A_h^{1/\alpha_L} ((1 - \alpha_L) p_h)^{(1-\alpha_L)/\alpha_L} \bar{L}$ (housing investment function)
- * *Housing stock* is composed by houses of two different qualities: $H = \tilde{h}_1 H_1^{sh} + \tilde{h}_2 H_2^{sh}$ where \tilde{h}_i denotes quality and H_i^{sh} is its share in the aggregate stock
 - Final transaction price depends on type: $p(\tilde{h}_i)$
 - Conversion between types is costly for the firm
 - Households will need to buy and sell to adjust their stock

- Life cycle model

- * Working age from $j = 1, \dots, J^{ret}$ → supply labor inelastically and receive idiosyncratic income
- * Retirement age from $j = J^{ret} + 1, \dots, J$ → receive fix fraction of their last period income
- * After age J → they die with certainty

- Preferences

$$u(c, \tilde{h}) = \frac{(c f(\tilde{h}_j))^{1-\gamma}}{1-\gamma} \quad \text{where} \quad f'(\cdot) > 0, f''(\cdot) < 0$$

- Assets and liabilities

- * Financial assets → r
- * Real estate → $p_r/p(\tilde{h})$
- * Mortgages → $r(1 + \kappa)$

- **Housing state:** quantity and quality of housing $s := \{h, \tilde{h}\} \in \mathcal{H}$, $\dim(\mathcal{H}) = 5$
 - * Renter: doesn't own ($h = 0$), lives in a small rented house $\{\tilde{h}_1\}$, and pays rent p_r
 - * Homeowner: owns ($h = 1$) and lives in a house of either quality $\{\tilde{h}_1, \tilde{h}_2\}$
 - * Landlord: owns multiple houses ($1 < h \leq 3$), lives in the best quality $\{\tilde{h}_2\}$ and rents the remaining low quality $\{\tilde{h}_1\}$ at a rate p_r each
- Houses are **illiquid** (proportional transaction costs, τ_h) and **costly to maintain**, δ_h
- Mortgages ($a < 0$) are limited by two **financial constraints** that can only *bind at origination*:
$$a' \geq -\lambda_{LTV} p_h(\tilde{h}') h'$$
$$a' \geq -\lambda_{LTI} y$$
- Households must at least **pay interests** and **amortize** a minimum amount per period for the remaining life of the mortgage

$$V(a, \underbrace{\{h, \tilde{h}\}}_{=s}, y, j) = \max_{c, a', s} \left\{ \frac{(c f(\tilde{h}))^{1-\gamma}}{1-\gamma} + \sigma_{\varepsilon} \varepsilon(s) + \beta \mathbb{E} V(a', s', y', j+1) \right\} \quad (3)$$

s.t.

$$c + a' + p(\tilde{h}')h' + \mathbb{1}_{\text{sell}} \tau^h p(\tilde{h})h + \mathbb{1}_{\text{buy}} \tau^h p(\tilde{h}')h' + \delta^h p(\tilde{h})h \leq y + (1 + r(1 + \mathbb{1}_{a' < 0} \kappa))a + p(\tilde{h})h + p_r(h-1) \quad (4)$$

$$a' \geq \begin{cases} \max \{ -\lambda_{LTV} p(\tilde{h}')h', -\lambda_{LTI} y \} & \text{if } h' > h \\ a(1 + r(1 + \kappa)) - m(j) & \text{if } h > 0 \text{ and } a < 0 \\ 0 & \text{otherwise} \end{cases} \quad (5)$$

$$\varepsilon(s) \sim F, \text{ extreme value type I dtb} \quad (6)$$

$$m(j) = \frac{r(1 + \kappa)(1 + r(1 + \kappa))^{J-j}}{(1 + r(1 + \kappa))^{J-j} - 1} \quad (7)$$

- 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, $\mathcal{D}(a, s, y, j)$

$$\underbrace{\sum_{j=1}^J \int \int \mathcal{D}(a, s_1, y, j) da dy}_{\text{renters}} = \underbrace{\sum_{j=1}^J \int \int \mathcal{D}(a, s_4, y, j) da dy}_{\text{landlords w/ 1 btl property}} + 2 \underbrace{\sum_{j=1}^J \int \int \mathcal{D}(a, s_5, y, j) da dy}_{\text{landlords w/ 2 btl properties}}$$

Definition 1: Competitive Equilibrium

For a given risk free rate r , a competitive equilibrium in this economy consists of: (i) a value function, a housing choice probability, and a consumption and asset policy function for the **households**: $\{V, \mathbb{P}(s), c, a'\}$, (ii) a **stationary distribution** over households' state: $\{\mathcal{D}\}$, (iii) policy functions for the **firms**: $\{N, L, S\}$, and (iv) **prices**: $\{w, p_L, p_h, p_r\}$ such that they jointly solve the household, final-good firm and construction firm problems, as well as satisfy the following **market clearing** conditions:

$$\sum_{j=1}^J \int \int \mathcal{D}(a, s_1, y, j) da dy = \sum_{j=1}^J \int \int \mathcal{D}(a, s_4, y, j) da dy + 2 \sum_{j=1}^J \int \int \mathcal{D}(a, s_5, y, j) da dy \quad (8)$$

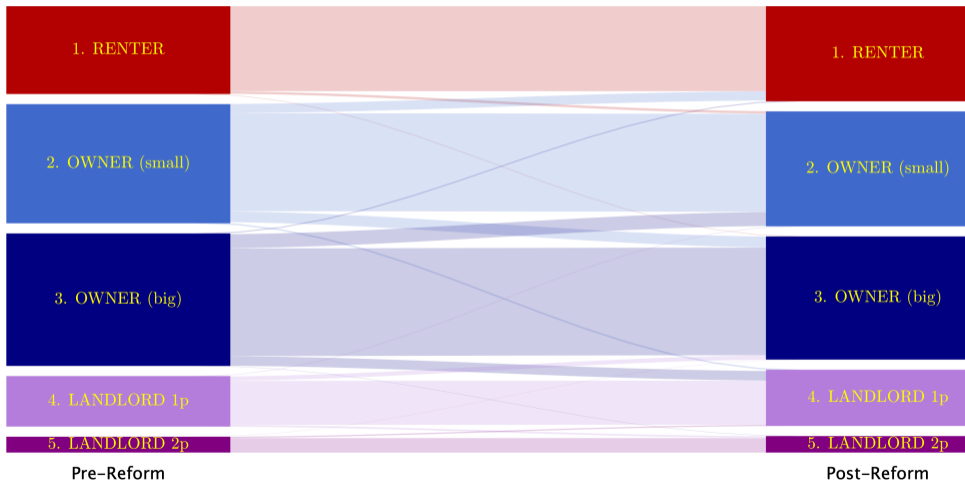
$$Y_h = \left(\delta_h + \frac{1}{J} \right) H \quad (9)$$

$$Y_c = C + S \quad (10)$$

TIGHTER LTV & LTI LIMITS

| | Full-Reform | Only LTI | Only LTV |
|-----------------------------|-------------|------------|------------|
| $\Delta\%$ Rent-to-Price | +2.82 % | +1.71 % | +0.73 % |
| Δ Homeownership rate | -1.83 p.p. | -1.13 p.p. | -0.53 p.p. |

- Non-linear interactions between the two borrowing constraints amplify the response of the rent to price ratio
 - * Similar to the constraint switching effect of Greenwald (2018)
- LTI constraint is the most impactful if imposed in isolation



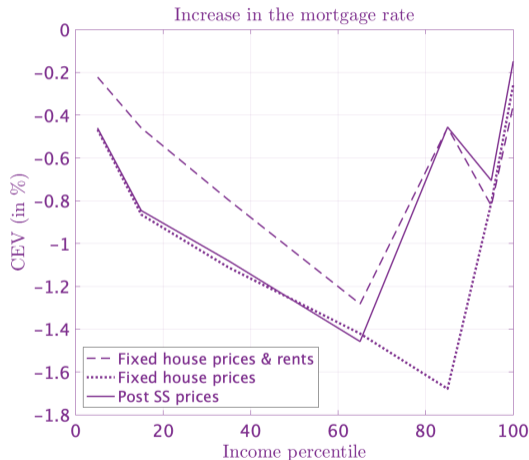
A RISE IN THE REAL INTEREST RATE

- Larger fall in the home-ownership rate and the average house price
- Similar rise in the rental price
- Prospective landlords are less sensitive to credit conditions than prospective homeowners

| | Low Int. Rate | Decomposition | High Int. Rate |
|-----------------------------------|--------------------------|--------------------------|--------------------------|
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| Share of HHs living in big houses | 50.41 % | 46.01 % | 42.02 % |

- $\uparrow r^s$ (SE > IE) \rightarrow homownership $\downarrow 0.49p.p.$, $p_r \uparrow 11.57\%$, $p_h^{avg} \downarrow 1.01\%$
- $\uparrow r^b \rightarrow$ homownership $\downarrow 0.58p.p.$, $p_r \uparrow 1.13\%$, $p_h^{avg} \downarrow 0.93\%$
- $\uparrow r \rightarrow$ homownership $\downarrow 1.07p.p.$, $p_r \uparrow 12.84\%$, $p_h^{avg} \downarrow 1.93\%$

CEV (across SS): increase in r^b or r^s



Housing tenure flows

