Housing & rental markets, mortgage policies, and the wealth distribution

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Motivation

- It is well-known that **housing is a key component of household's wealth**.
  - This feature highlights the role of housing as an asset
  - But it is also an important consumption good
- Particularly after the *Great Financial Crisis*, many economists have studied the **relationship between house prices and household's mortgage debt**.
  - What is the role of credit in generating cyclical movements in real estate prices?
  - How does these dynamics affect the cyclical fluctuations of the economy?
  - As a result, many countries implemented **borrowing based macro-prudential policies**
- Studying housing policies requires looking also at the **rental market** because
  - All households must choose between *owning* or *renting*
  - Landlords make *portfolio choices* that involve both markets

What we do

- We focus on a particular **macro-prudential intervention in Ireland** where they have imposed regulatory LTI and LTV limits for mortgages
  - What has been its impact on house prices and rents?
- We build a **life-cycle heterogenous agent model** with two key components:
  - *Endogenous housing tenure choices*
  - *Equilibrium in rental and housing markets*
- Our setup allow us to analyze
  - Homeownership rates
  - Price to rent ratios and housing affordability
  - Welfare (losses)
- Framework also useful to study the housing cycle, but not the goal of this paper

What we find

- *Empirically*:
  - **LTV & LTI limits reduced house prices** in areas where they were high as shown in Acharya, Bergant, Crosignani, Eisert and McCann (2022, J Finance) . . .
  - But it is also associated to **increased rents**!
- *Model mechanisms*:
  - The **increased rental demand by constrained households** is the main mechanism through which rental prices go up.
  - Landlords (mostly unaffected by the reform) increase supply but they cannot meet all the demand. Hence, in addition to the increase in rental prices we also obtain a **reduction in homeownership rates**.
- *Welfare analysis*:
  - Along the transition, the reform **benefits the old** and **hurts the young**
  - Largest welfare losses for percentiles 20-30 in the income distribution

Roadmap

Literature

State-of-the-art models

- Mostly concerned with explaining **boom-bust cycles in house prices**
  - 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
- **What happens in the rental market?**

Understanding of housing and rental markets

- Traditional assumptions
  - No renting $\rightarrow$ 100% homeownership
  - Inelastic rents
  - Fully elastic rents
- Greenwald and Guren (2021)
  - Segmentation between rental and owner-occupied housing matters.
  - Stronger reaction of house prices to credit conditions.
- This paper
  - Endogenous decisions to be renter, homeowner, or landlord
  - Portfolio decisions of (relatively small) landlords
  - Endogenous movement of rent to price ratios
  - Implications for homeownership, rents, house prices, welfare, etc.

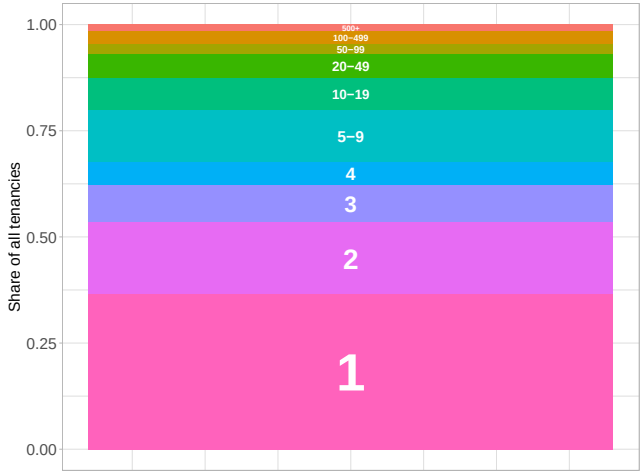
Housing & Rental Markets in Ireland

Structure of the housing and rental markets in Ireland

- **Homeownership rate**
  - Around 70-80%
  - Higher than in the US ($\approx$ 65%)
- **Mortgages**
  - Most common: variable interest rate.
  - Also very frequent: short term fixed rates with 2 or 5 year contracts
  - Very limited mortgages with fixed rate until maturity
- **The rental stock**
  - Mostly owned by *small investors* with 1 or 2 properties
  - *Institutional investors* are not so relevant after all

Landlords in the US

Many small landlords



Source: *"Institutional Investment in the Housing Market"*, Department of Finance, Irish Government

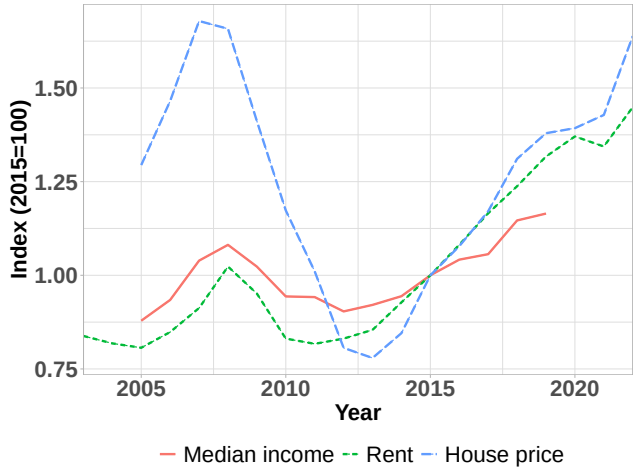
The Macro-Prudential Reform

Institutional details

- 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

Cyclical evolution of house prices and rents in Ireland



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

Empirical Findings

House prices reacted to policy changes ...

- Acharya, Bergant, Crosignani, Eisert, McCann (2022, J Finance) study the impact of the reform on house prices.
- Their **empirical strategy**:
  - Construct a *Distance* variable that captures the exposure to lending limits (LTI & LTV) across the 26 counties and the income distribution.
    - Counties with lower house prices are further from the limits.
    - High income borrowers are further from the limits.
  - They regress house price changes on the *Distance* measure.
  - *Main Finding*: house-prices increased more in more distant counties.
- **Implication**: the policy reform reduced prices where they were the highest.

But what about rents?

- We **replicate** their empirical strategy with **data on rents**:

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

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

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

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

- **In areas where limits were more stringent, rents increased by more!**

Data

The Model

Households

Environment

- Economy is populated by OLG of households whose **life cycle** is divided between:
  - *Work* $\rightarrow$ 25 to 65 years old
  - *Retirement* $\rightarrow$ 66 to 100 years old
- During the working stage, they are subject to uninsurable **idiosyncratic income shocks** to their efficient units of labor, which they supply inelastically. That is,

$$y = ws \tag{3}$$

  where w denotes the wage and s is the *persistent* labor productivity.
- Households can **save in financial assets** whose return r is fixed. They can also **save in real estate** whose prices $\{p_{h_1}, p_{h_2}, p_r\}$ are determined in equilibrium.
- Households derive **utility** from non-durable consumption c and housing h

$$u(c, h) = \frac{(c\,\theta(h))^{1-\gamma}}{1-\gamma} \tag{4}$$

  where $\theta(\cdot)$ is a step function that captures the extra utility from ownership.

Housing & mortgages

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

$$h \in \{0, 1, 2, 3\} \tag{5}$$

  so we can distinguish between *renters*, *homeowners* and *landlords*.

- Houses are **priced differently** depending if they are *owner-occupier* p_{h_1} or *buy-to-let* p_{h_2} properties.

- Houses are **illiquid**, i.e. they are subject to transaction costs when bought and sell, τ_h They are also **costly to maintain**, δ_h.

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

$$a' \geq -\lambda_{LTV}\, \mathcal{P}^b(h, h', p_{h_i}) \tag{6}$$

$$a' \geq -\lambda_{LTI}\, y \tag{7}$$

  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

$$V(a,h,y,j) = \max_{a',h'} \left\{ \frac{(c\,\theta(h))^{1-\gamma}}{1-\gamma} + \sigma_\varepsilon\,\varepsilon(h) + \beta \mathbb{E}\, V(a',h',y',j+1) \right\} \tag{8}$$

s.t.

$$\begin{aligned} & c + a' + \mathbb{I}_{h'>h}\,(1+\tau_h)\,\mathcal{P}^b(h,h',p_{h_i}) + \delta_h \mathcal{P}^k(h,h',p_{h_i}) \;\leq \\ & ws_j + (1 + r\,(1 + \mathbb{I}_{a'<0}\,\kappa))\,a + \mathbb{I}_{h'<h}\,(1-\tau_h)\,\mathcal{P}^s(h,h',p_{h_i}) + p_r(h-1) \end{aligned} \tag{9}$$

$$a' \geq \begin{cases} \max\{-\lambda_{LTV}\mathcal{P}^b(h,h',p_{h_i}), -\lambda_{LTI}y\} & \text{if } h' > h \\ a(1+r(1+\kappa)-m(t)) & \text{if } h > 0 \text{ and } a < 0 \\ 0 & \text{otherwise} \end{cases} \tag{10}$$

$$\varepsilon(h) \sim F, \text{ extreme value dtb} \tag{11}$$

$$m(j) = \frac{r(1+\kappa)(1+r(1+\kappa))^{J-j}}{(1+r(1+\kappa))^{J-j} - 1} \tag{12}$$

House Price Indicators

Supply Side & Markets

Production

- **Construction Firms**: combine land L (fixed) and structures S_i through a Cobb-Douglas technology:

$$Y_{h_i} = A_{h_i} L^{\alpha_l} S_i^{1-\alpha_l} \quad \text{for} \quad i = \{1, 2\} \tag{13}$$

  * Owner-occupied and BTL properties are produced with degrees of efficiency. We assume that $A_{h_1} < A_{h_2}$ which makes owner-occupied housing more expensive.

- **Final Goods Producer**: operates a Cobb-Douglas technology that uses labor and capital to produce the consumption good:

$$Y_c = A_c K^{\alpha_k} N^{1-\alpha_k} \tag{14}$$

$$Y_c = C + S_1 + S_2 \tag{15}$$

where C is consumption, K is capital (fixed) and N is the size of the labor force (normalized to 1).

Market clearing & equilibrium

- r is fixed $\rightarrow$ small open economy
- **Housing market**
  - Houses bought = houses produced + houses sold - depreciation

$$p_{h_i} = \frac{1}{1-\alpha_l}\left(\frac{1}{A_{h_i}}\right)^{\frac{1}{1-\alpha_l}} (\delta_h H_i)^{\frac{\alpha_l}{1-\alpha_l}} \tag{16}$$

  where H_1 corresponds to owner-occupied units while H_2 corresponds to BTL properties.
  - We get *house price variation* through the home-ownership rate (H_1) – an equilibrium object.
  - Our technology assumption together with market clearing imply

$$\frac{A_{h_1}}{A_{h_2}} = \left(\frac{p_{h_2}}{p_{h_1}}\right)^{1-\alpha_l}\left(\frac{H_1}{1-H_1}\right)^{\alpha_l} \tag{17}$$

- **Rental market**
  - Competitive, renters meet landlords
  - p_r is determined numerically using the household's equilibrium distribution

Equilibrium Definition

Calibration

External calibration

- Earnings process
  - The *average age profile* is taken from the Irish Household Finance and Consumption Survey (HFCS)
  - The *stochastic component* is recovered using the non-linear, age-varying approach proposed by De Nardi, Fella and Paz-Pardo (2020, JEEA)
- Initial conditions
  - Start households at low initial wealth (log-normal with mean € 5,000)
  - There are no initial homeowners
- Pick some parameters externally:

γ	α_l	A_c	δ_k	α_k	r	κ
2.00	0.33	0.90	0.02	0.30	0.02	0.02

Internal calibration: targeted moments

- For now, we pick $A_{h_2}, \delta_h, \beta, \theta$ and τ_h to match home-ownership rate, rent-to-house price ratio and wealth accumulation. A_{h_1} is a free parameter that is pinned down using (16)
  - Model fit:

	Data	Model
Wealth to income ratio	6.78	5.26
House price to income ratio	5	4.60
Owner occupied to BTL price ratio	1.37	1.37
Homeownership rate	80%	80.66%

  - Parameters:

A_{h_1}	A_{h_2}	δ_h	β	θ	τ_h
0.065	0.055	0.005	0.945	1.38	0.035

  - This calibration implies:

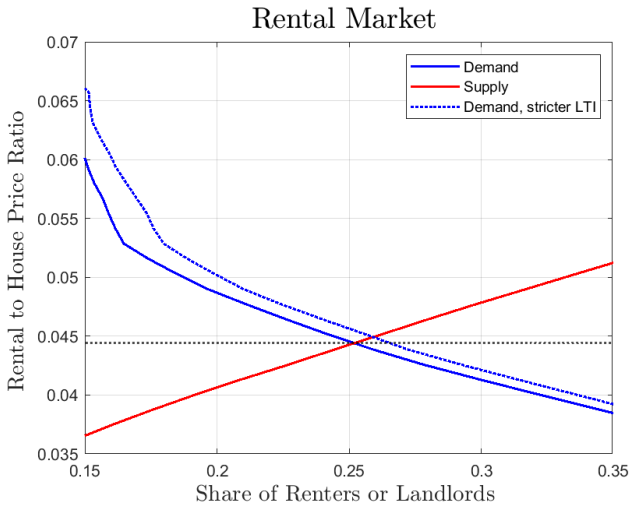
Rental rate to income	13.12%
Price to rent ratio	35.10
Share of landlords with two houses	3.78%

RESULTS

Main experiments

- **Baseline**
  - LTV = 100% and LTI = 6
  - Consistent with empirical evidence in Kelly, McCann and O'Toole (2018)
- **Full Reform**
  - LTV = 80% and LTI = 3.5
  - Current institutional framework in Ireland is more stringent (tighter limits)
- **Only LTI**
  - LTV = 100% and LTI = 3.5
  - Where is most of the action coming from?
- Other aspects of the reform, such as FTB exemptions, are still work in progress

Intuition

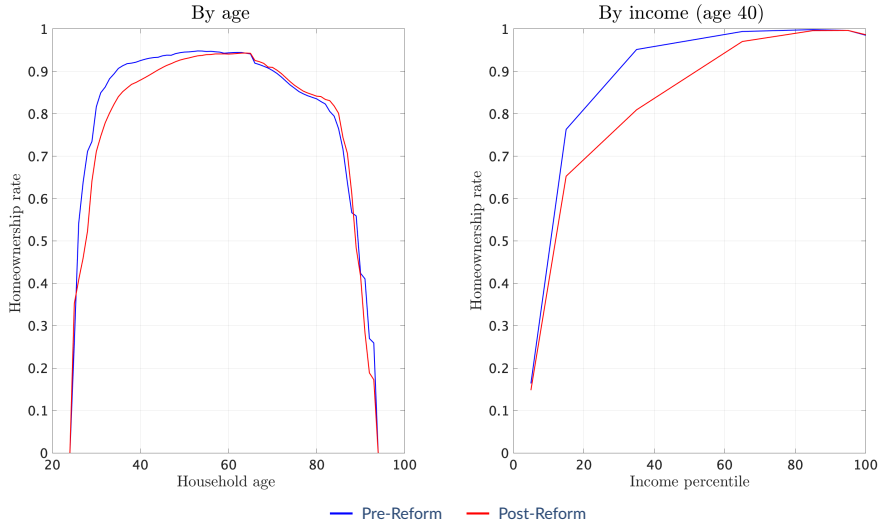

Rental Market
Demand
Supply
Demand, stricter LTI
Rental to House Price Ratio
0.07
0.065
0.06
0.055
0.05
0.045
0.04
0.035
0.15
0.2
0.25
0.3
0.35
Share of Renters or Landlords

Steady state comparison

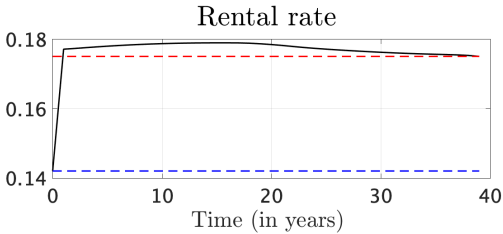
	Pre-Reform	Post-Reform	Only LTI
	LTI = 6, LTV = 100%	*LTI = 3.5, LTV = 80%*	*LTI = 3.5, LTV = 100%*
Rent-to-Price	2.84 %	3.39 %	3.34 %
Owner-occupied house price to income	4.86	4.78	4.79
Buy-to-let house price to income	3.55	3.78	3.75
Rent to Income	13.12 %	15.47 %	15.25 %
Homeownership rate	80.66 %	78.07 %	78.32 %

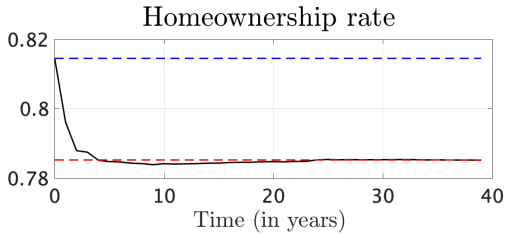
- *Lower* average house prices (↓ 1%) , but homeownership rate *decreases* (↓ 2.59 p.p) and rental prices *rise* (↑ 17.94 %)
- Owner-occupied house prices drop, while BTL properties rise due to the decrease home-ownership rate
- Largest effects come from the LTI reform

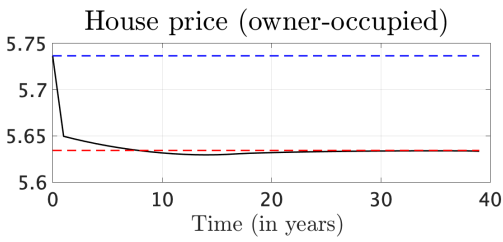
Home-ownership rate by age and income

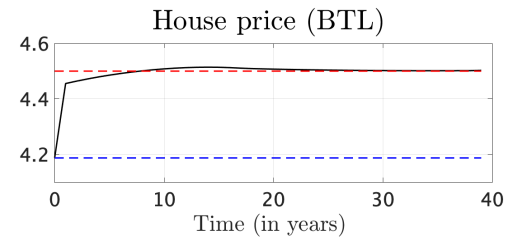


Transitional dynamics in the housing & rental markets



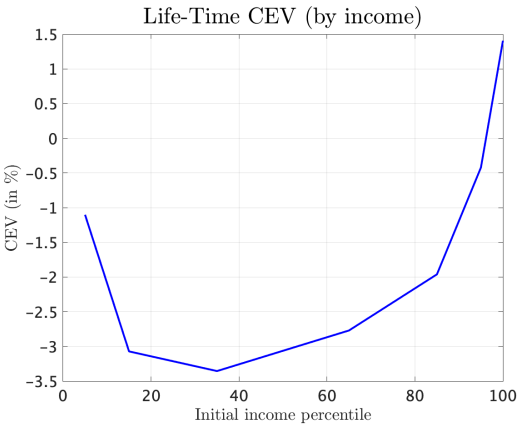


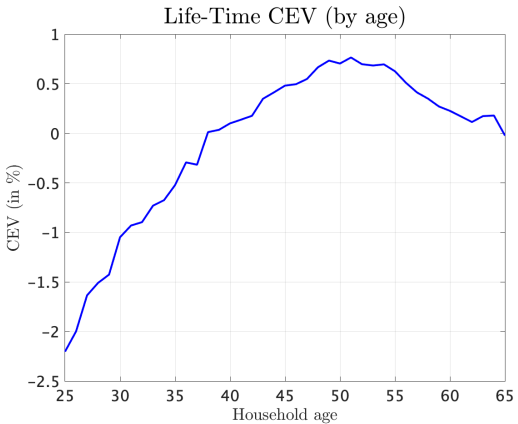




Transition path Pre-Reform Post-Reform

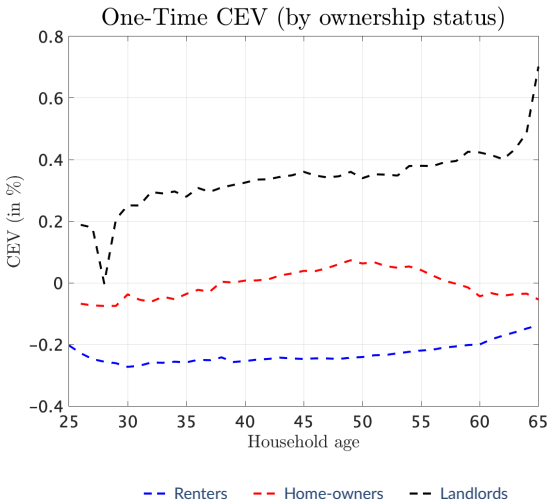
Welfare





Across Steady States | One-Time CEV

Welfare



Summary:

- Largest welfare losses for low-to-middle income households
- It benefits the old, but hurts the young
- Landlords gain by far the most from the reform
- Losses are concentrated on the renters
- Home-owners are marginally worse off

Conclusion

- We have evaluated a macro-prudential reform with a housing tenure model and find that *in the long-run* more stringent borrowing limits lead to
  - Lower house price growth
  - Higher rental prices
  - Lower home-ownership rates
- *Along the transition*, its effects are heterogenous over the age and income distribution
  - The young and low-income earners are significantly worse off
  - The old and high-income earners are marginally better off
- These interventions in the housing market have spillovers to the rental markets and have consequences for housing affordability
- Understanding rental markets is key for the study of house price cycles

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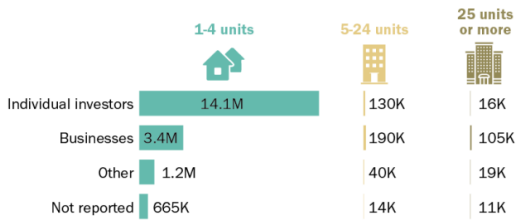
THANK YOU!

The landlord sector in the US

Most landlords are individuals who own just a few units

U.S. landlords by number of units owned, 2018



Note: "Other" includes nonprofits, cooperatives, trusteeships and other ownership forms.
Source: Census Bureau, "Rental Housing Finance Survey," 2018; Pew Research Center analysis.

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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

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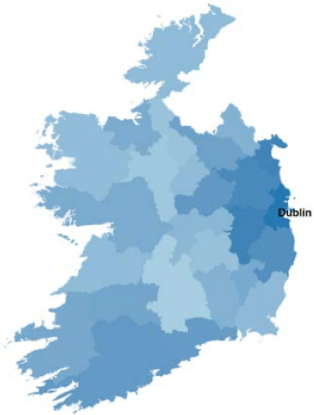
Data Sources

- 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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House Price Indicators

- If the household is a net *buyer*, i.e. $h' > h$, then

$$\mathcal{P}^b(h, h', p_{h_i}) = \mathbb{I}_{h=0} p_{h_1} + \mathbb{I}_{h'>1}\, p_{h_2}\,(h' - 1) \tag{18}$$

- When *selling*, i.e. $h' < h$, we have that

$$\mathcal{P}^s(h, h', p_{h_i}) = \mathbb{I}_{h'=0} p_{h_1} + \mathbb{I}_{h>1}\, p_{h_2}\,(h - 1) \tag{19}$$

- Finally, if the household *keeps* living in the same property next period the pricing function that holds is

$$\mathcal{P}^k(h, h', p_{h_i}) = \mathbb{I}_{h=1} p_{h_1} + \mathbb{I}_{h'>1}\, p_{h_2}\,(h' - 1) \tag{20}$$

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Construction Sector Optimization

- A competitive sector produces housing Y_h taking land L and structures S as inputs.
- Their operating profits are:

$$\Pi_h^i = p_{h_i} A_{h_i} L^{\alpha_l} S_i^{1-\alpha_l} - p_l L - S_i \tag{21}$$

- Land is fixed. Thus, taking derivatives only with respect to S_i:

$$\frac{\partial \Pi_h}{\partial S_i} = 0 \Leftrightarrow 1 = p_h A_h L^{\alpha_l} S^{-\alpha_l} (1 - \alpha_l) \tag{22}$$

- And solving for the house price, we get

$$p_{h_i} = \frac{1}{A_h} \left(\frac{S_i}{L} \right)^{\alpha_l} \frac{1}{1 - \alpha_l} \tag{23}$$

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Equliibrium Definition

Definition 1: Competitive Equilibrium

Given an interest rate r, a recursive competitive equilibrium is a value function V, policy functions for the households $\{c, h', a'\}$, policy functions for the firms $\{N, L, S\}$, prices $\{w, p_{h_1}, p_{h_2}, p_r, p_l\}$ and a stationary distribution μ such that:

1. Given prices, value and policy functions solve the households optimization problem
2. Producers maximize profits
3. All markets (labor, housing, land, rental) clear

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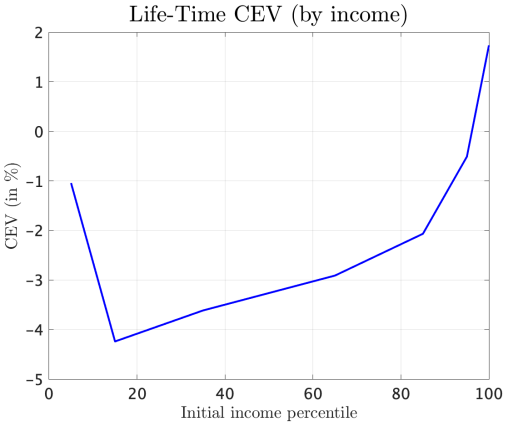
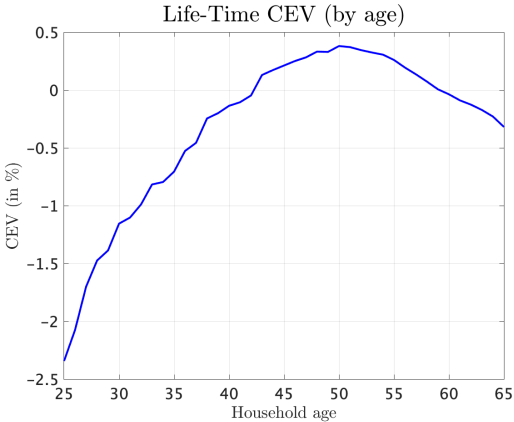
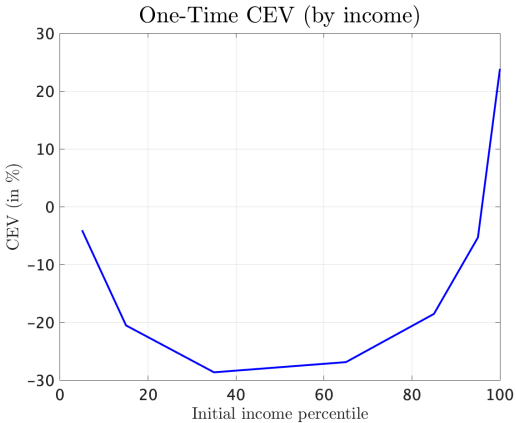
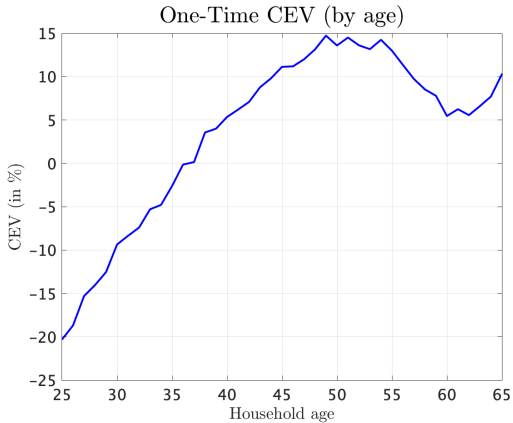
Welfare: CEV across steady states





Welfare: one-time compensation





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