Demographic Change and the Housing Market

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Motivation

- major shifts in demographic structure since WW2
  - baby boom
  - baby bust
  - longer lives
- age is important determinant of individual housing demand

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⇝ How does demographic change affect the aggregate housing market?

In a nutshell

Research questions

- How does demographic change effect aggregate housing market?
- What are the welfare implications across cohorts? Which cohorts win, which cohorts lose?

Method

- quantitative general equilibrium life-cycle model with housing
- analyze demographic transition 1945–2100

Preliminary results

- demographic change drives house prices
- welfare: some cohorts are worse off than others

Literature

Relation to the Literature

- Macroeconomics of demographic change
  e.g. Auclert, Malmberg, Martenet, and Rognlie (2024)
  $\rightsquigarrow$ add housing; analyse house prices
- Demographic change and housing markets (empirical)
  e.g. Francke and Korevaar (forthcoming), Mankiw and Weil (1989)
  $\rightsquigarrow$ prediction, decomposition, welfare
- Macroeconomics of housing
  e.g. Piazzesi and Schneider (2016), Kaplan, Mitman, and Violante (2020)
  $\rightsquigarrow$ add demographics

Model

Household Problem

$$\max \left[\sum_j \beta^j \Phi_{j,t} \frac{\left(c_{j,t}^{1-\xi_j} h_{j,t}^{\xi_j} \right)^{1-\sigma}}{1-\sigma} \right]$$

$$\text{s.t.} \quad c_{j,t} + p_t h_{j,t} + \phi_{j,t} a_{j+1,t+1} \leq w_t e_j + p_t (1-\delta_H) h_{j-1,t-1} + (1+r_t) a_{j,t}$$

$$a_{j+1,t+1} \geq -(\theta p_t h_{j,t} + \bar{a})$$

- $\phi_{j,t}$: survival probability at age j and time t $\quad (\Phi_j = \prod_i \phi_i)$
- ξ_j: utility share on housing at age j
- e_j: effective labor at age j
- p_t: house price; $\quad \delta_H$: housing depreciation rate
- θ: collateralizable share of housing; $\quad \bar{a}$: additional borrowing limit

Prices and Demographics

- Prices (from standard production side):

$$r_t = F_K(K_t, L_t) \; - \; \delta_K$$

$$w_t = F_L(K_t, L_t)$$

$$p_t = \kappa \left(H_t - (1 - \delta_H) H_{t-1}\right)^{\epsilon}$$

- Demographic evolution:

$$N_{0,t} = N_{0,t-1} + f_t \qquad f_t : \text{fertility in period } t$$

$$N_{j+1,t+1} = \phi_{j,t} \, N_{j,t}$$

Welfare Effect of Change in House Prices

Lagrange multipliers

- $\lambda_j = \beta^j \Phi_j \, u_{c,j}\big(c_j, h_j\big) \; > \; 0$: on the *budget constraint*
- $\mu_j \geq 0$: on the *borrowing (collateral) constraint*

Proposition. For a *small change* $\{\Delta p_j\}_{j=J_0}^{J}$, the change in lifetime utility is

$$\boxed{\Delta U = \sum_{j=J_0}^{J} \Big[\lambda_j \Big((1-\delta_H) h_{j-1} - h_j \Big) + \mu_j \, \theta \, h_j \Big] \, \Delta p_j}$$

Intuition — Two Channels of a Price Increase

1. Wealth effect

$$\boxed{\lambda_j\Big((1-\delta_H)h_{j-1}-h_j\Big)}$$

- **Net buyers:**
  $h_j > (1-\delta_H)h_{j-1} \;\Rightarrow$ welfare ↓
- **Net sellers / downsizers:**
  $h_j < (1-\delta_H)h_{j-1} \;\Rightarrow$ welfare ↑

2. Collateral effect

$$\boxed{\mu_j\,\theta\,h_j}$$

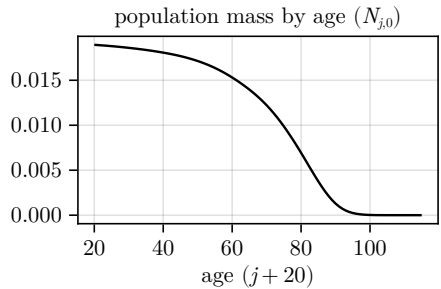
- **Binding limit** ($\mu_j > 0$):
  price ↑ loosens credit ⇒ welfare ↑
- **Slack limit** ($\mu_j = 0$):
  no collateral effect

Discounting via $\beta^j\Phi_j$ puts more weight on early years, so young net buyers typically bear the brunt of house-price booms.

Calibration

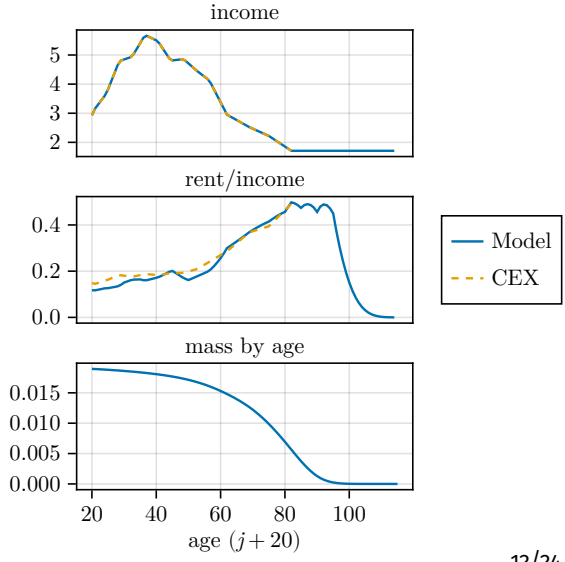
Demographics

- households enter the economy at age 20 ($\iff j = 0$)
- age dependent survival probability $\phi_{j,t}$
- Initial steady state
  - survival $\phi_{j,0}$ from current life tables
  - mass $N_{j,0} = f_0 \prod_{k=0}^{j-1} \phi_{k,0} = f_0 \cdot \Phi_j$
  - births f_0 such that population size $N_0 = \sum_j N_j = 1$



Lifecycle

- income profile from CEX 2015 (exogenous)
- housing profile from CEX 2015 (calibrate utility weights ξ_j)
- wealth profile from SCF (calibrate discount factors β_j)



Demographic change

Baby boom

- births f_t *temporarily* increase by 20%

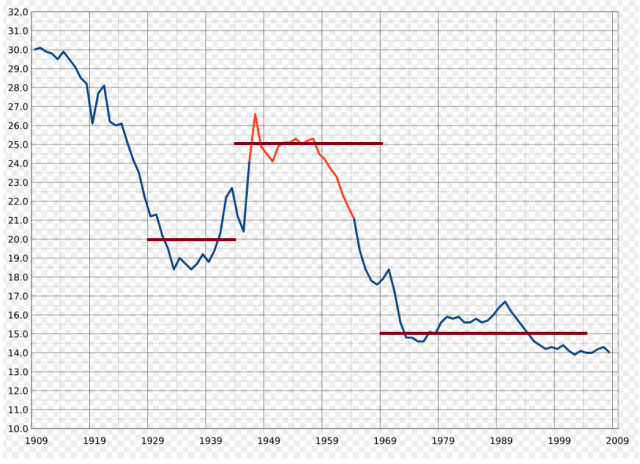
Baby bust

- births f_t *permanently* decrease by 20%

Longer lives

- life expectancy increases by 10 years
- survival probabilities go up uniformly $\phi_{j,t} > \phi_{j,0}$

Fertility in the USA



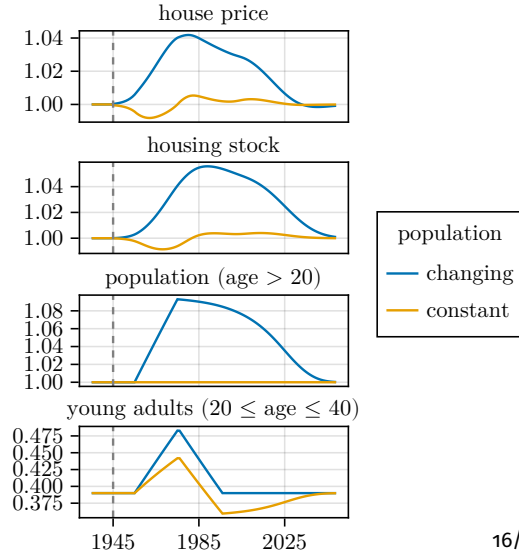
Results

Demographic change and the housing market

- demographic change as MIT shocks
  - three scenarios: baby boom, baby bust, longer lives
- study perfect foresight transitional dynamics
- effects on house prices, housing demand and welfare

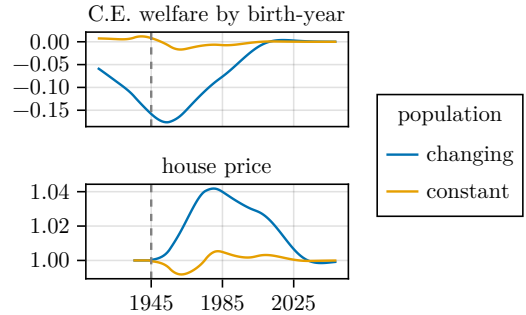
Scenario 1: Baby boom

- baby boom *still* affects house prices
- population change is main driver



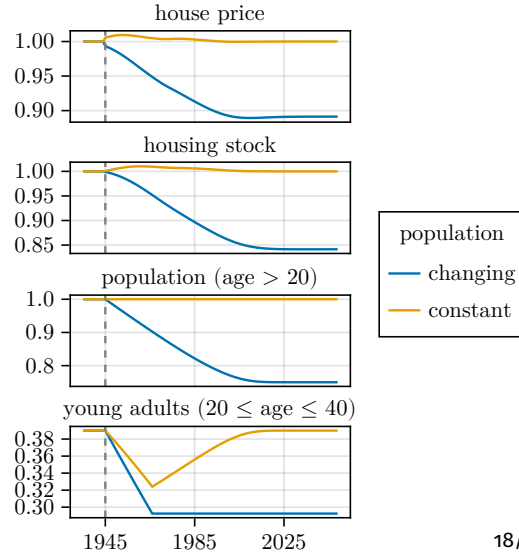
Scenario 1: Baby boom — Welfare

- cohorts are worse of if they buy at high prices
- enter housing market at age 20 $\Longrightarrow$ lag between prices and welfare change



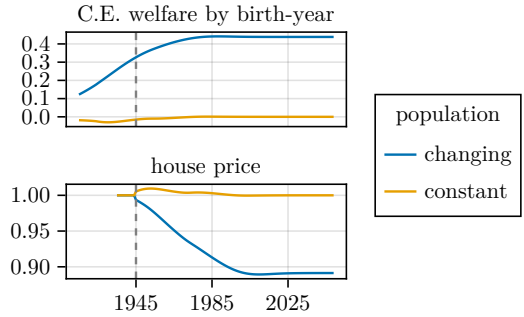
Scenario 2: Baby bust

- baby bust depresses house prices permanently (-10%)
- population count is major driver
- constant population: average age goes up, then down $\Longrightarrow$ house prices reflect that



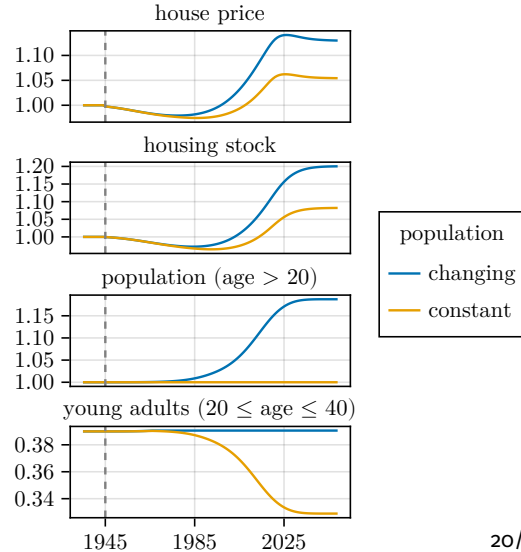
Scenario 2: Baby bust — Welfare

- lower house prices are welfare improving



Scenario 3: Longer lives

- higher survival probabilities $\Longrightarrow$ tilted lifecycle profile of housing ($h_{\text{young}} \downarrow$, $h_{\text{old}} \uparrow$)
- long run: more (old) people $\Longrightarrow$ prices go up



Summary

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- simulate demographic change in life-cycle model with housing
- demographic change affects house prices
  - baby boom: first up, then back to 0
  - baby bust: down $(\approx -20\%)$
  - longer lives: first down, then up $(\approx +10\%)$
- welfare
  - a cohort wins if it can buy low (when young) and sell high (when old)

Outlook

Outlook

- more serious calibration: e.g. match net worth profile
- better understand welfare effects
- adding features to the model (for quantitative credibility and/or robustness)
  - income risk
  - population & productivity growth
  - bequests
  - renters (?)
- interaction with effects on interest rate (cf. Auclert et al., 2024)
- more experiments

Literature i

Auclert, A., H. Malmberg, F. Martenet, and M. Rognlie (2024): "Demographics, wealth, and global imbalances in the twenty-first century," Working paper, National Bureau of Economic Research.

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