# Housing Wealth Across Countries: The Role of Expectations, Institutions and Preferences

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European Economic Association

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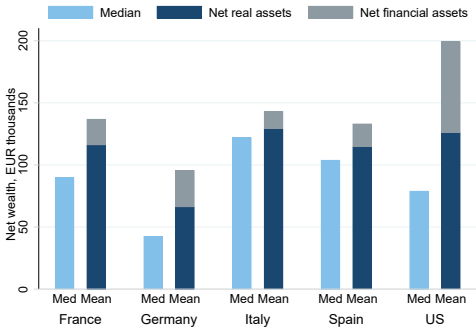
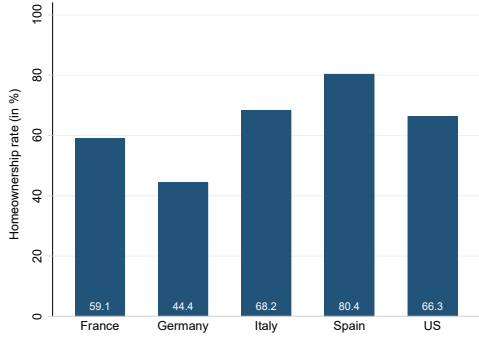
# Striking differences in wealth/housing across countries

Median / mean net wealth (EUR)

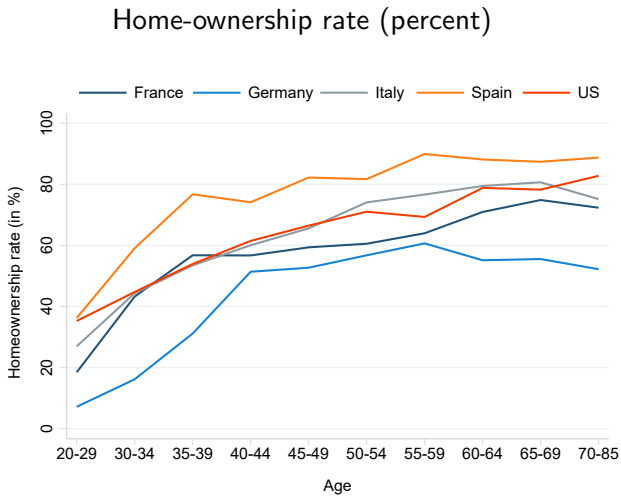



Home-ownership rate (percent)




*Source:* Eurosystem Household Finance and Consumption Survey 2014; Survey of Consumer Finances 2016.

# Differences in home-ownership persist over life cycle




*Source:* Eurosystem Household Finance and Consumption Survey 2014; US Survey of Consumer Finances 2016.

# Preview: Decomposing cross-country differences in housing

## Estimate across five countries life-cycle model with illiquid housing

- **Housing**
  - Discrete house owning–renting choice
  - Illiquid housing (continuous size, subject to adjustment cost)
  - Stochastic house price (relative to nonhousing, permanent shocks): $\pi_t = G\eta_t\pi_{t-1}$
- Permanent ($\psi$)–transitory ($\theta$) income process: $Y_{it} = \theta_{it}P_{it}, \quad P_{it} = \Gamma_j\psi_{it}P_{it-1}$
- Allows for some heterogeneity in preferences (impatience) and house price beliefs
- Collateral constraints

## Systematically quantify drivers of diff's in ext & int margins of housing:

- House price beliefs (mean, variance)
- Housing market institutions (transaction costs, rental costs, collateral constraints)
- Preferences (discount factor, bequest motive, weight of housing)
- Other factors (mortality, incomes, . . . )

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# Literature review

- **Modeling housing:** Typically single country (or two)
  Yao Zhang 2005, Li Yao 2007, Li et al 2016, Attanasio et al 2012, Landvoigt 2017, Kaas et al 2020, Kindermann Kohls 2018, Hintermaier Koeniger 2018
- **House price beliefs:** Little work connecting data and models
  Adelino et al 2018, Ben-David et al 2018, Kuchler Zafar 2019, Kindermann et al 2021, Kaplan et al 2020, Giglio et al 2021, Li et al 2023
- **Housing market institutions:** Often reduced-form
  Chiuri Jappelli 2003, Chambers et al 2009, Calza et al 2013, ...
- **Preference heterogeneity: Impatience**
  Calvet et al 2019, Epper et al 2020, Krueger et al 2016, Aguiar et al 2023, ...

# 'Canonical' model of housing, normalized problem (ratios of perm income)

Budget constraints and value functions depend on housing status $d$: R, S, M

$$v_j(m_t, \overline{h}_t) = \max_{\{d_t, c_t, h_t\}} \left\{ U(c_t, h_t) + (1 - \mathrm{D}_j)\beta \mathbf{E}_t \left[ v_{j+1}(m_{t+1}, \overline{h}_{t+1}) \left( \frac{\Gamma_{j+1}\psi_{t+1}}{(G\eta_{t+1})^{\omega}} \right)^{1-\rho} \right] + \mathrm{D}_j B(\widehat{w}_t) \right\}$$

s.t.

$$a_t = \begin{cases} m_t + (1-\phi)\overline{h}_t - c_t - \alpha h_t & \text{if } d_t = 0 \quad \textbf{Renter (R)} \\ m_t - c_t - \lambda h_t, \quad h_t = \overline{h}_t & \text{if } d_t = 1 \quad \textbf{Stayer (S)} \\ m_t + (1-\phi)\overline{h}_t - c_t - (1+\lambda)h_t & \text{if } d_t = 2 \quad \textbf{Mover (M)} \end{cases}$$

$m$: market resources, $\overline{h}$: house already owned ($= 0$ for renter), $h$: house to live in (buy or rent)

$\alpha$: rental cost, $\lambda$: maintenance cost, $\phi$: selling cost, $\delta$: downpayment, $\eta$: house price shocks

$$m_{t+1} = \frac{R}{\Gamma_{j+1}\psi_{t+1}} a_t + \theta_{t+1} \quad \text{Housing: } \overline{h}_{t+1} = \frac{G\eta_{t+1}}{\Gamma_{j+1}\psi_{t+1}} \widehat{h}_t \quad \text{for } \widehat{h}_t = \mathbf{1}(d_t > 0) h_t$$

Collateral constraint: $0 \leq a_t + (1-\delta)\widehat{h}_t$

# Model—Preferences

$$v_j(m_t, \overline{h}_t) = \max_{\{d_t, c_t, h_t\}} \left\{ U(c_t, h_t) + (1 - \mathrm{D}_j)\beta \mathbf{E}_t \left[ v_{j+1}(m_{t+1}, \overline{h}_{t+1}) \left( \frac{\Gamma_{j+1}\psi_{t+1}}{(G\eta_{t+1})^{\omega}} \right)^{1-\rho} \right] + \mathrm{D}_j B(\widehat{w}_t) \right\}$$

## Preferences

- CRRA utility in Cobb–Douglas aggregate of $c$ and $h$: $U(c, h) = \dfrac{(c^{1-\gamma}h^{\gamma})^{1-\rho}}{1-\rho}$
- Bequest motive: $B(\cdot) = L \times \dfrac{(\cdot)^{1-\rho}}{1-\rho}$
- Discount factor heterogeneity: $\beta \sim \text{uniform}\left([\grave{\beta} - \widetilde{\beta},\ \grave{\beta} + \widetilde{\beta}]\right)$

# Model—Housing

Budget constraints and value functions depend on housing status $d$: R, S, M

$$v_j(m_t, \overline{h}_t) = \max_{\{d_t, c_t, h_t\}} \left\{ U(c_t, h_t) + (1 - \mathrm{D}_j)\beta \mathbf{E}_t \left[ v_{j+1}(m_{t+1}, \overline{h}_{t+1}) \left( \frac{\Gamma_{j+1}\psi_{t+1}}{(G\eta_{t+1})^{\omega}} \right)^{1-\rho} \right] + \mathrm{D}_j B(\widehat{w}_t) \right\}$$

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$m$: market resources, $\overline{h}$: house already owned, $h$: house to live in (buy or rent)

$\alpha$: rental cost, $\lambda$: maintenance cost, $\phi$: selling cost, $\delta$: downpayment, $\eta$: house price shocks

- **Discrete choice:** Three homeownership states $d$: Renter, Stayer, Mover
- Illiquid housing subject to linear selling costs $\phi \times \overline{h}_t \Rightarrow$ **Region of inaction**

# Model—House price beliefs

Budget constraints and value functions depend on housing status $d$: R, S, M

$$
\begin{aligned}
v_j(m_t, \overline{h}_t) &= \max_{\{d_t, c_t, h_t\}} \left\{ U(c_t, h_t) + (1 - \mathrm{D}_j)\beta \mathbf{E}_t \left[ v_{j+1}(m_{t+1}, \overline{h}_{t+1}) \left( \frac{\Gamma_{j+1}\psi_{t+1}}{(G\eta_{t+1})^{\omega}} \right)^{1-\rho} \right] \right. \\
&+ \left. \mathrm{D}_j B(\widehat{w}_t) \right\} \\
\text{s.t.} \quad m_{t+1} &= \frac{R}{\Gamma_{j+1}\psi_{t+1}} a_t + \theta_{t+1} \quad \text{Housing: } \overline{h}_{t+1} = \frac{G\eta_{t+1}}{\Gamma_{j+1}\psi_{t+1}} \widehat{h}_t \quad \text{for} \quad \widehat{h}_t = \mathbf{1}(d_t > 0) h_t
\end{aligned}
$$

Collateral constraint: $0 \leq a_t + (1 - \delta)\widehat{h}_t$

## House prices $\pi$ and house price beliefs $\widehat{G}$

- House prices: Geometric random walk, $\pi_t = G\eta_t \pi_{t-1}$
- Heterogeneity in mean HP growth beliefs: $\widehat{G} \sim \text{uniform}([\dot{G} - \widetilde{G}, \dot{G} + \widetilde{G}])$

# Structural estimation

- Match model to data using method of simulated moments, country by country
- Estimate beliefs, housing market institutions, preferences:

$$\xi \equiv \{ \underbrace{\grave{G}, \widetilde{G};}_{\text{House price beliefs}} \quad \underbrace{\alpha,}_{\text{Rental cost}} \quad \underbrace{\lambda;}_{\text{Maintenance cost}} \quad \underbrace{\grave{\beta}, \widetilde{\beta},}_{\text{Impatience}} \quad \underbrace{\omega,}_{\text{Weight on housing}} \quad \underbrace{L;}_{\text{Bequest}} \quad \underbrace{\widehat{\mu}}_{\text{Interaction b/w } \beta \text{ and } \widehat{G}} \}$$

- Minimize

$$\widehat{\xi} = \arg\min \left(m(x) - \widehat{m}(\widetilde{x}|\xi)\right)' \Omega^{-1} \left(m(x) - \widehat{m}(\widetilde{x}|\xi)\right)$$

$x = \{x_1, \ldots, x_N\}$ data; $m(x)$ data moments; $\widetilde{x} = \{\widetilde{x}_1, \ldots, \widetilde{x}_S\}$ $S$ simulations from model; $\widehat{m}(\widetilde{x}|\xi) = 1/S \sum_{s=1}^{S} m(\widetilde{x}_s|\xi)$ moments simulated from model; $\Omega$ weighting matrix

- Moments $m$:
  homeownership rate; mean house value–income ratio (owners); mean rent–income ratio (renters); mean, median net wealth–income ratio (owners and renters)

# Identification

1. Mean house price belief $\grave{G}$: pinned by mean actual HP growth ($\sim$Rational exp)
2. Spread of house price beliefs $\widetilde{G}$: determined by slope of home-ownership profile (pessimistic people buy house later in life)
3. Maintenance cost $\lambda$: pinned by housing wealth–income ratio (cond on owning)
4. Cost of rental housing $\alpha$ is implied by rental wedge $\alpha - \lambda$: determined by level of home-ownership (higher wedge makes renting less appealing)
5. House selling cost $\phi$: calibrated
6. Mean discount factor $\grave{\beta}$: determined by mean net wealth–income ratio
7. Spread of the discount factor $\widetilde{\beta}$: determined by median net wealth–income ratio
8. Weight of housing $\omega$: pinned down by rent–income ratio
9. Bequest magnitude $L$: determined by shape of wealth profile late in life
10. Interaction b/w discount factor and house price beliefs $\widehat{\mu}$: spread b/w net wealth of owners and renters (positive b/c renters have much lower wealth than owners)

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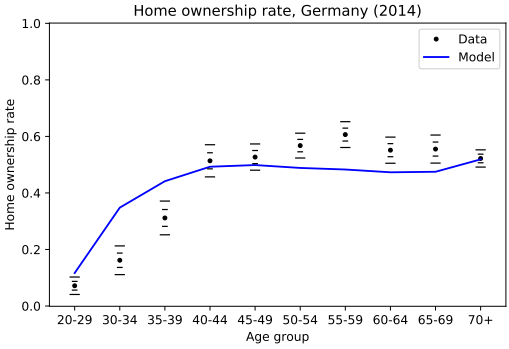
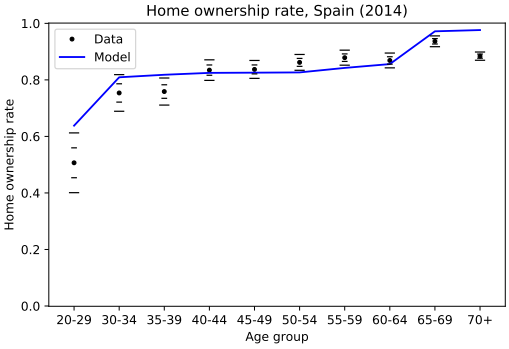
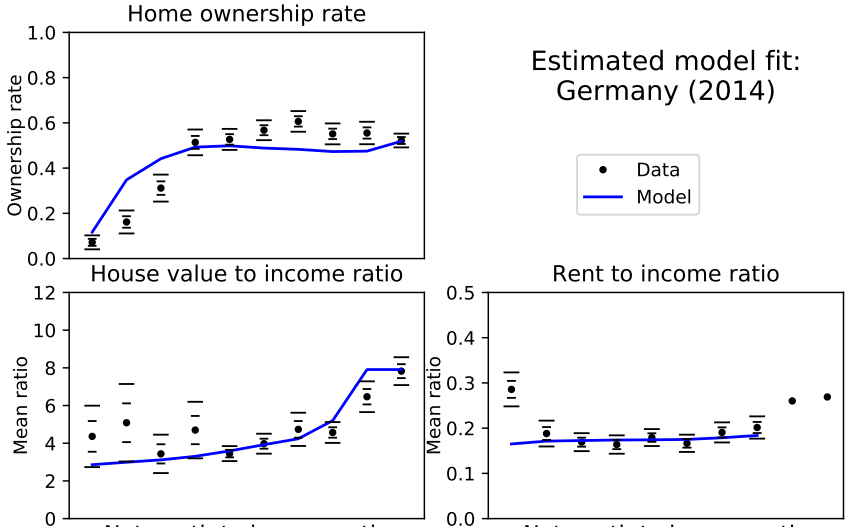
# Model fit: Home-ownership Germany, Spain

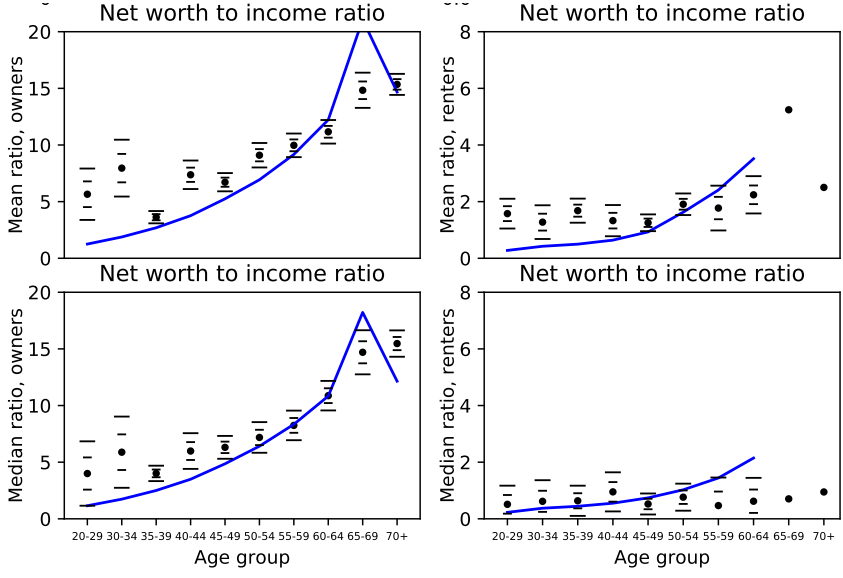


# Model fit: Germany; housing, rents



# Model fit: Germany; net wealth



# Estimates

| Param | Description | Germany | Spain | France | Italy | U.S.A. |
|---|---|---|---|---|---|---|
| $\grave{G}$ | Mean of house price growth factor beliefs (calibrated) | 1.010 (—) | 1.023 (—) | 1.032 (—) | 1.000 (—) | 1.026 (—) |
| $\widetilde{G}$ | Spread of house price growth factor beliefs | 2.92e-2 (0.19e-2) | 3.69e-2 (0.03e-2) | 3.13e-2 (0.07e-2) | 2.65e-2 (0.03e-2) | 1.71e-2 (0.04e-2) |
| $\alpha$ | Cost of rental housing | 5.08e-2 (0.19e-2) | 6.16e-2 (0.09e-2) | 7.47e-2 (0.07e-2) | 4.74e-2 (0.07e-2) | 8.55e-2 (0.18e-2) |
| $\lambda$ | Owned housing maintenance cost | 3.03e-2 (0.21e-2) | 2.07e-2 (0.09e-2) | 5.91e-2 (0.07e-2) | 7.04e-3 (0.64e-3) | 6.79e-2 (0.18e-2) |
| $\alpha - \lambda$ | **Rental wedge** | **2.05e-2** | **4.09e-2** | 2.56e-2 | 4.04e-2 | 1.76e-2 |
| $\phi$ | Cost of selling house (calibrated) | 7.83e-2 | 0.110 | 0.120 | 0.120 | 4.75e-2 |
| $\grave{\delta}$ | Mean of log intertemporal discount rate | 9.17e-2 (0.02e-2) | 4.84e-2 (0.02e-2) | 7.49e-2 (0.01e-2) | 5.57e-2 (0.04e-2) | 3.50e-2 (0.08e-2) |
| $\widetilde{\delta}$ | Spread of log intertemporal discount rate | 0.298 (0.005) | 0.231 (0.001) | 0.145 (0.000) | 9.50e-2 (0.09e-2) | 8.08e-2 (7.87e-2) |
| $\omega$ | Share of housing in utility function | 0.177 (0.003) | 0.207 (0.007) | 0.271 (0.002) | 0.198 (0.003) | 0.233 (0.002) |
| $L$ | Bequest motive magnitude | 20.26 (0.81) | 21.21 (0.32) | 10.51 (0.18) | 17.87 (0.44) | 4.488 (0.641) |
| $\hat{\mu}$ | Interaction factor between discount rate and house price growth beliefs | -1.80e-2 (0.04e-2) | -1.11e-2 (0.00e-2) | -1.63e-2 (0.01e-2) | -1.37e-2 (0.07e-2) | -1.53e-2 (0.02e-2) |

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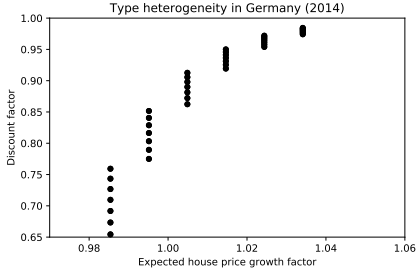
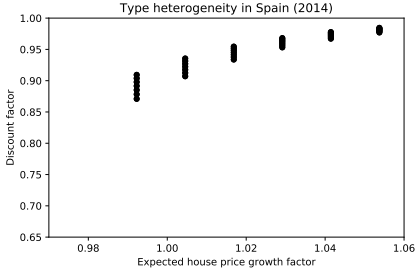
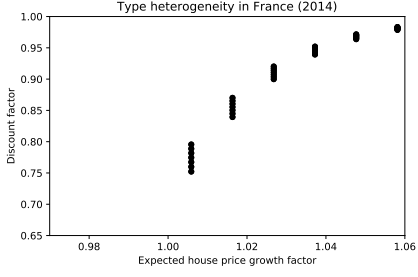
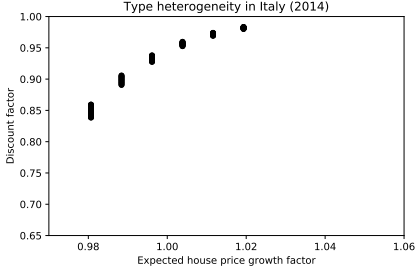
# Positive correlation between discount factor and mean house price beliefs



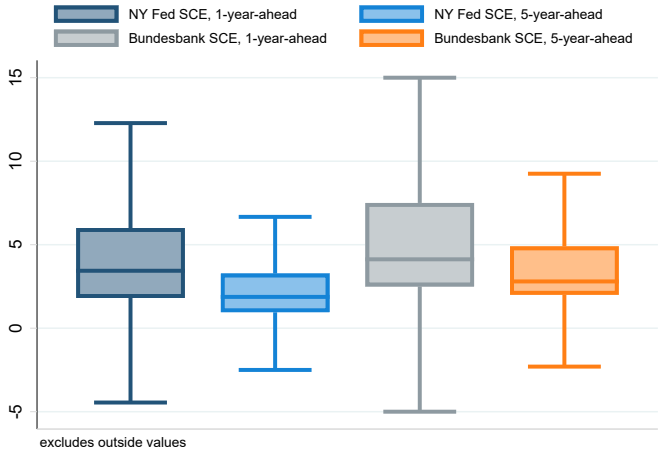



# Heterogeneity in survey-based house price expectations:

# 5-year-ahead less dispersed than 1-year-ahead

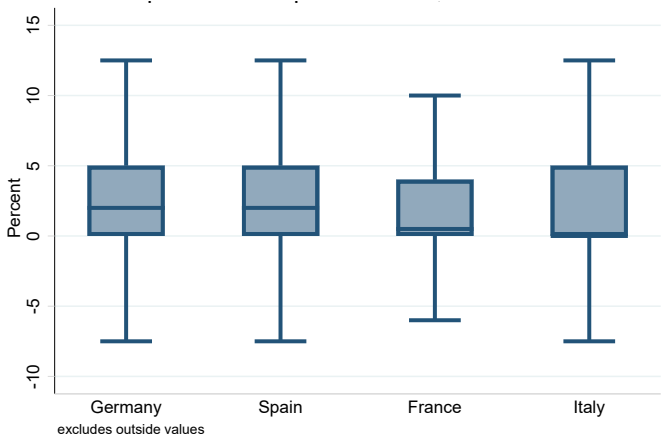
In line with model estimates of HP expectations: $[\grave{G} \mp \widetilde{G}]$ $\quad$ $\widetilde{G} \approx 0.02$ to $0.04$




*Source:* Bundesbank Survey on Cons Expectations 2019; NY Fed Survey of Cons Expectations 2014–2019.

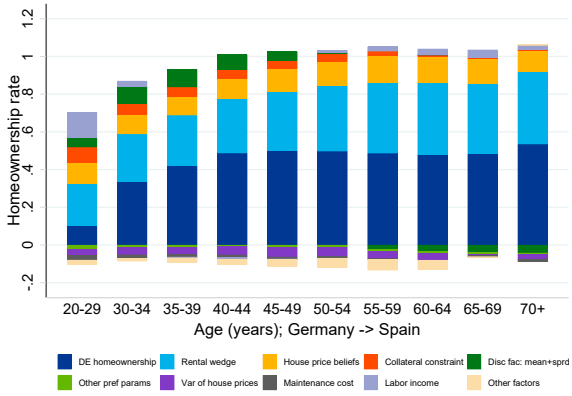
# Heterogeneity in survey-based HP expectations: 1-year-ahead

In line with model estimates of HP expectations: $[\grave{G} \mp \widetilde{G}]$ $\widetilde{G} \approx 0.05$




*Source:* ECB Consumer Expectations Survey, April 2020–May 2023.

# Extensive margin: Home-ownership decomposition, Germany → Spain (ES)




- **Home-ownership, Ger**
- **Rental wedge:** Spain has worse rental market → higher HO ∼**+60%**
- **HP beliefs:** ES more optimistic → higher HO ∼**+25%**
- **Collateral constraints:** ES less tight → higher HO early in life ∼**+10%**
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- **Variance of house prices:** higher var lowers ES HO

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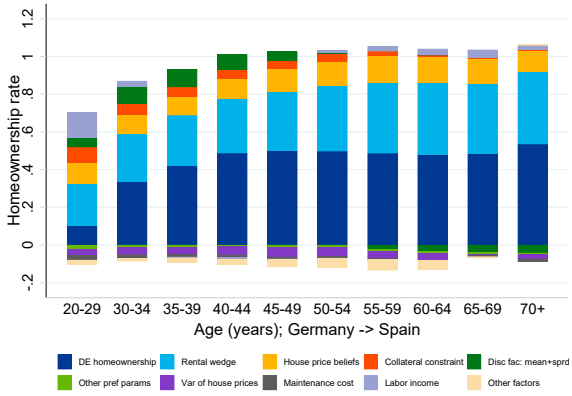


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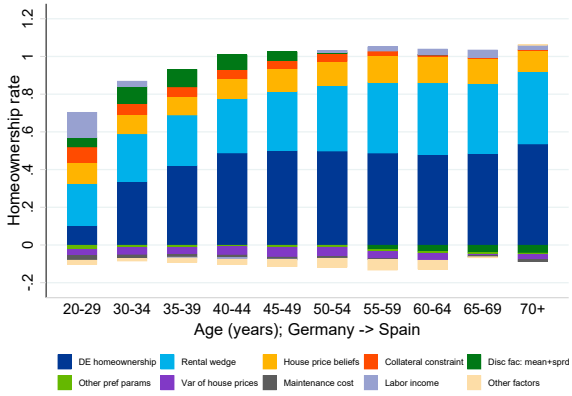


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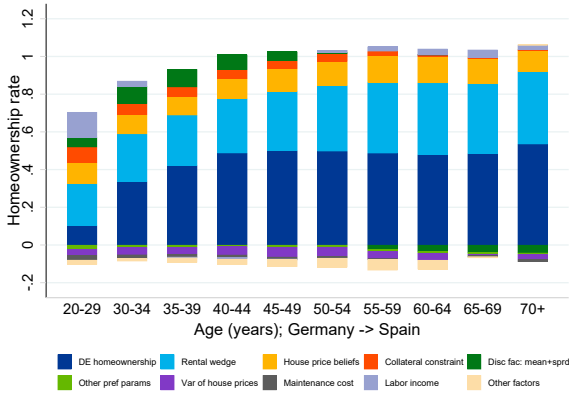


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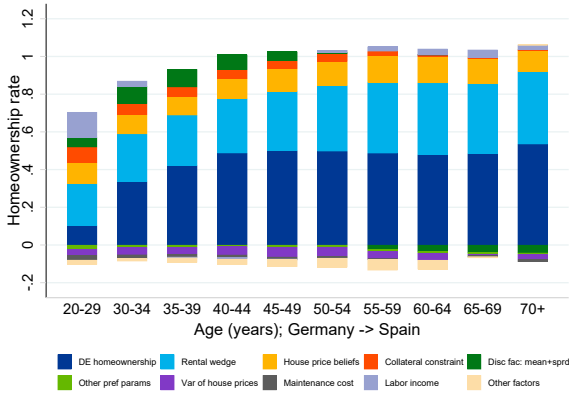


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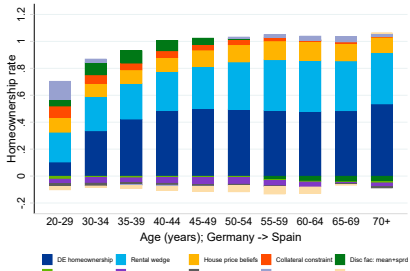
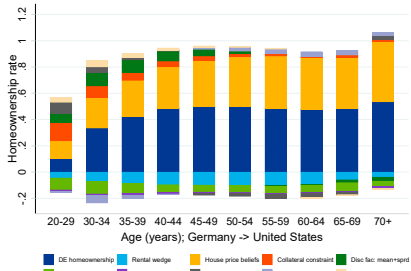
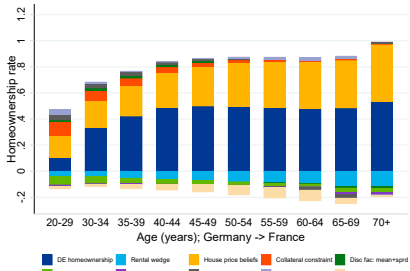
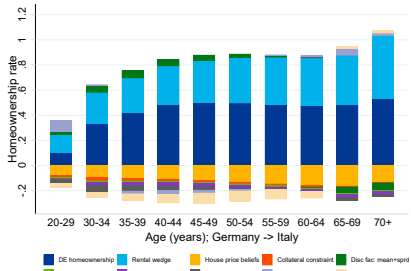
# Home-ownership across countries: Rental wedge, HP beliefs matter ∼50–50

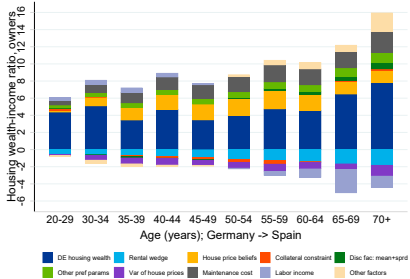


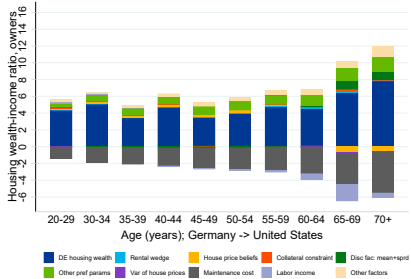



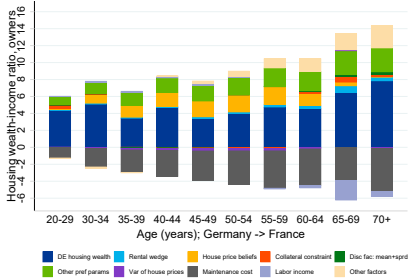



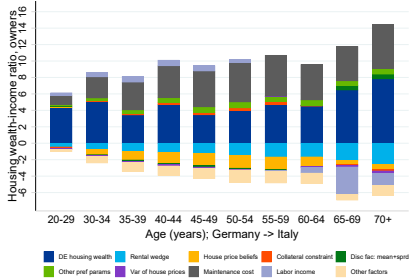



# Intensive margin—mean housing wealth–income ratios: Maintenance costs



# Conclusions

- We build 'canonical' life cycle model of housing
- Estimate it to match large differences in housing across five countries
- What drives cross-country differences in housing?
  - **Homeownership (ext margin):** HP beliefs [45%], institutions (rental wedge) [45%]
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## Next steps—Questions

- How do cross-country diffs in housing affect transmission of shocks?
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# Backup slides

# What we do

**Estimate across countries quantitative structural life-cycle model**

- Discrete house owning–renting choice
- Illiquid housing (continuous size, subject to adjustment cost)
- Idiosyncratic house price and income shocks
- Allows for some heterogeneity in preferences (impatience) and house price beliefs
- Collateral constraints
- Partial equilibrium (so far)

# Life-cycle model with housing—Summary

- **Preferences**
  CRRA utility in Cobb–Douglas aggregate of $C$ and $H$;
  discount factor heterogeneity: $\beta \sim \text{uniform}\big([\grave{\beta} - \widetilde{\beta},\ \grave{\beta} + \widetilde{\beta}\,]\big)$;
  bequest motive

- **Housing**
  **Discrete choice:** Three homeownership states Renter, Stayer, Mover;
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# Decomposing cross-country differences in wealth

Using model, quantify which factors drive cross-country differences in housing:

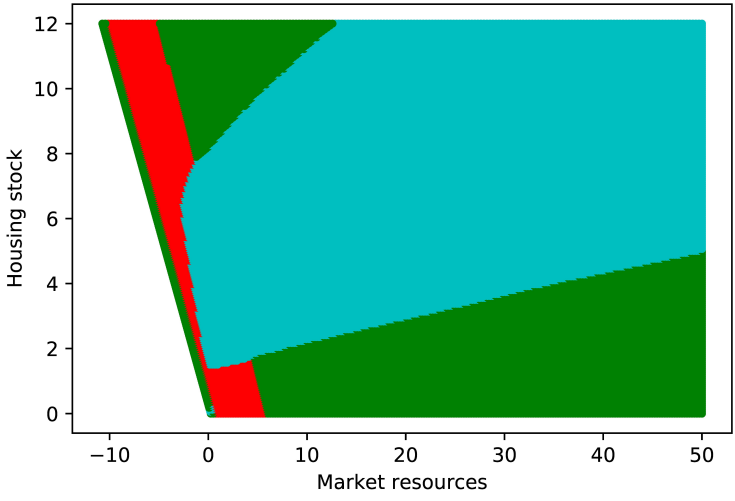
- House price beliefs (mean, variance)
- Preferences (discount factor, bequest motive, weight of housing)
- Housing market institutions (transaction costs, rental costs, collateral constraints)
- Other factors (mortality, incomes, . . . )

# Calibration

| Parameter description | Symbol | Value | | | | | Source |
|---|---|---|---|---|---|---|---|
| | | Germany | France | Italy | Spain | U.S.A. | |
| **Preferences** | | | | | | | |
| CRRA coefficient | $\rho$ | 2 | 2 | 2 | 2 | 2 | |
| **House prices** | | | | | | | |
| Mean growth of house prices | $G$ | 1.010 | 1.032 | 1.000 | 1.023 | 1.026 | Aggregate data, 1995–2020 |
| Std dev of growth of house prices | std($\eta$) | 0.027 | 0.047 | 0.065 | 0.093 | 0.056 | Aggregate data, 1995–2020 |
| **Income processes** | | | | | | | |
| Share of college graduates | | 0.311 | 0.274 | 0.134 | 0.287 | 0.350 | HFCN (2016), Table 1.3 |
| Household head without a college degree | | | | | | | |
| Std dev of permanent income shock | std($\psi$) | 0.13 | 0.13 | 0.13 | 0.13 | 0.10 | Le Blanc Georgarakos; CGM |
| Std dev of transitory income shock | std($\theta$) | 0.22 | 0.22 | 0.27 | 0.34 | 0.30 | Le Blanc Georgarakos; CGM |
| Household head with a college degree | | | | | | | |
| Std dev of permanent income shock | std($\psi$) | 0.14 | 0.14 | 0.18 | 0.12 | 0.13 | Le Blanc Georgarakos; CGM |
| Std dev of transitory income shock | std($\theta$) | 0.21 | 0.21 | 0.29 | 0.28 | 0.24 | Le Blanc Georgarakos; CGM |
| Unemployment probability | $\underline{\theta}$ | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | |
| Net Unemployment replacement rate | $\mu_U$ | 0.59 | 0.68 | 0.74 | 0.78 | 0.59 | OECD, 2020 |
| Net Pension replacement rate | $\tau$ | 0.50 | 0.75 | 0.90 | 0.85 | 0.58 | OECD, 2018 |
| Mandatory retirement period | $T$ | 45 | 45 | 45 | 45 | 45 | |
| Maximum life cycle period | $J$ | 65 | 65 | 65 | 65 | 65 | |
| Survival probability | $1 - \mathrm{D}$ | | | | | | Human Mortality Database |
| **Housing market institutions** | | | | | | | |
| Down payment requirement | $\delta$ | 0.35 | 0.20 | 0.40 | 0.25 | 0.20 | EDW; ECB (2019), Chart 6 |
| Cost of selling house (roundtrip) | $\phi$ | 0.0783 | 0.120 | 0.120 | 0.110 | 0.0475 | OECD (2012) |
| Risk-free interest rate | $r$ | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | Aggregate data |

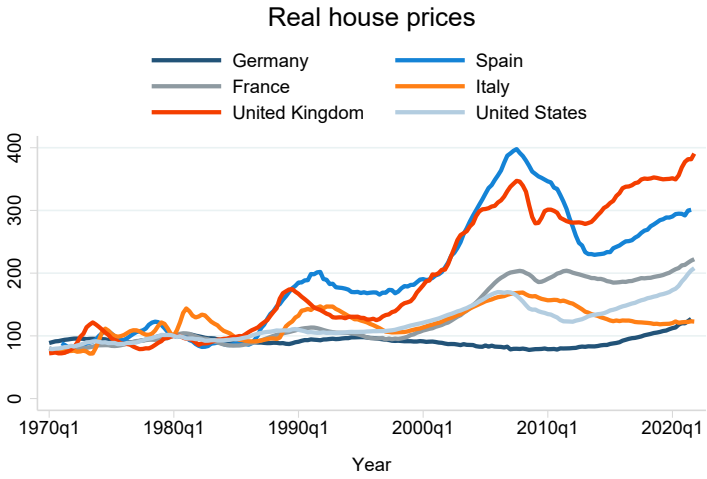
# Optimal housing status: Renter/stayer/mover

Optimal housing status as function of (liquid) market resources $m$ and housing wealth $h$



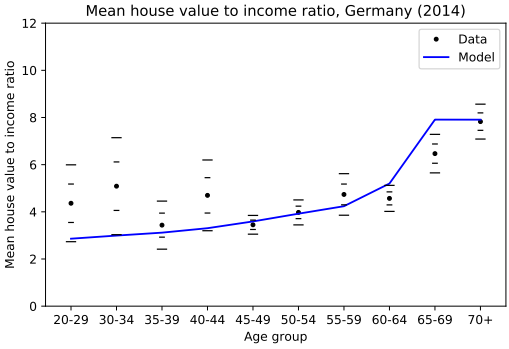

**Red**: Renter, **Cyan**: Stayer, **Green**: Mover ("Go")

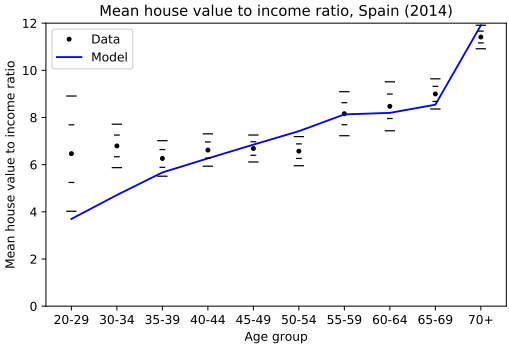
# Aggregate house prices



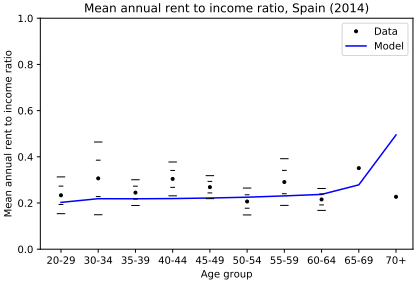

*Source:* OECD, 1970–2021.

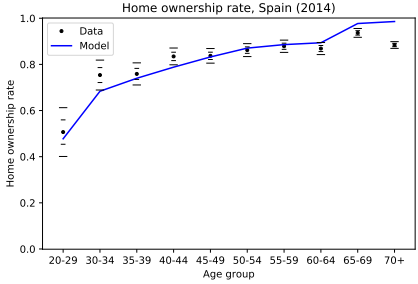
# Model fit: Mean housing wealth–income ratio, Germany, Spain

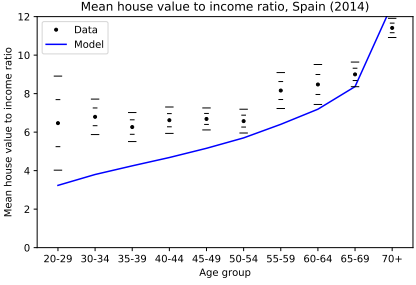


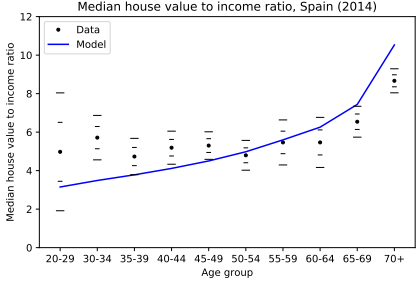



# Model fit: Spain



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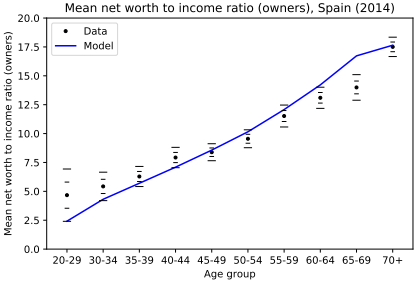
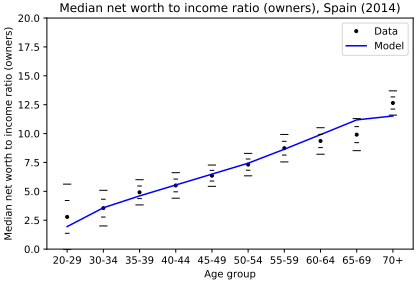
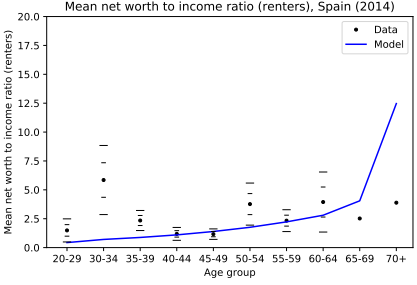
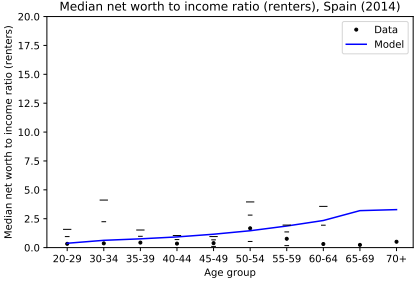
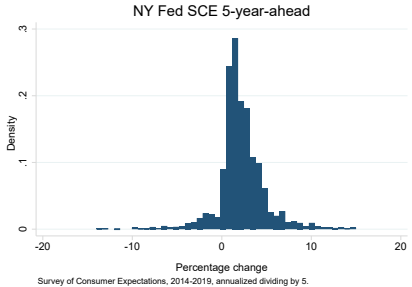


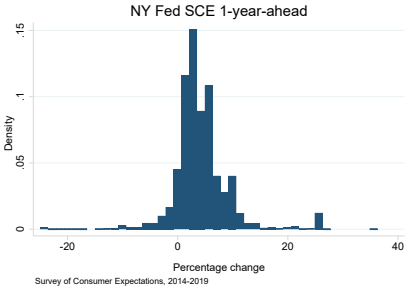



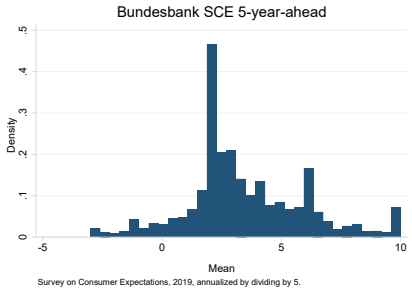



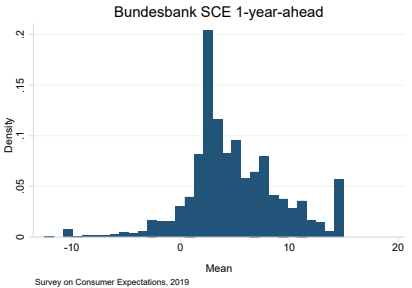



# Heterogeneity in survey HP growth expectations: US & DE, 1Y- & 5Y-ahead

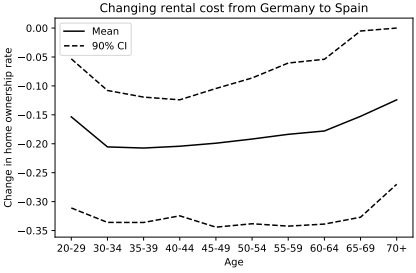


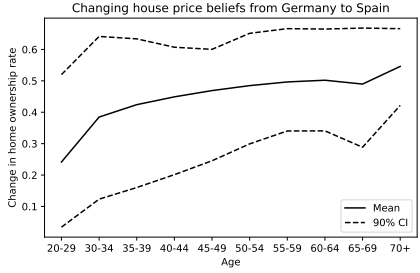



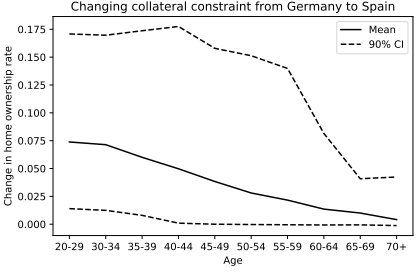



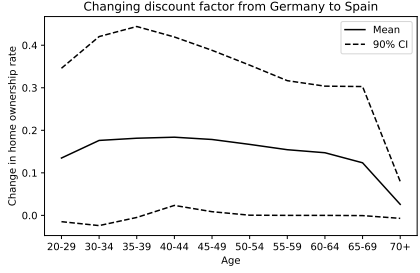



# The model is substantially non-linear

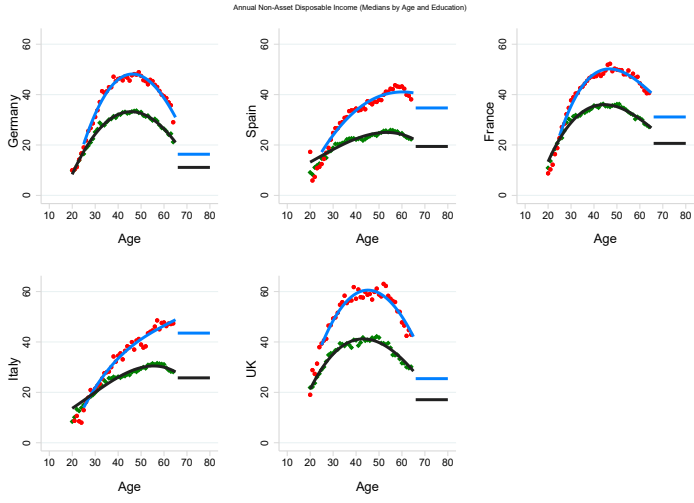


# Median non-asset disposable income by age




*Notes:* EU Statistics on Income and Living Conditions, 2009–2019.