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

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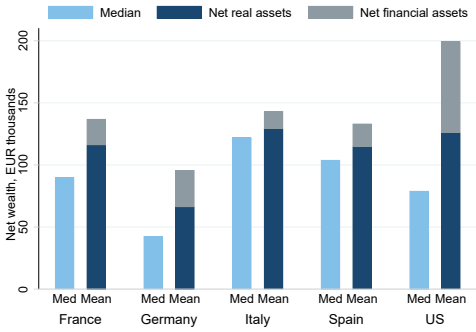
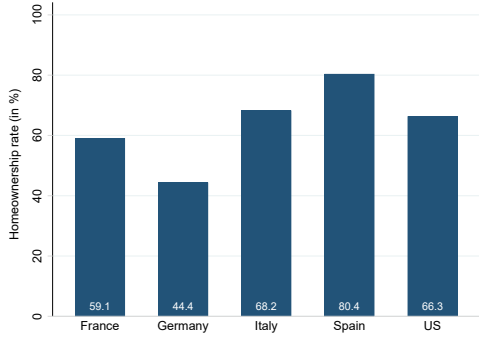
Striking differences in wealth/housing across countries

Median / mean net wealth (EUR)

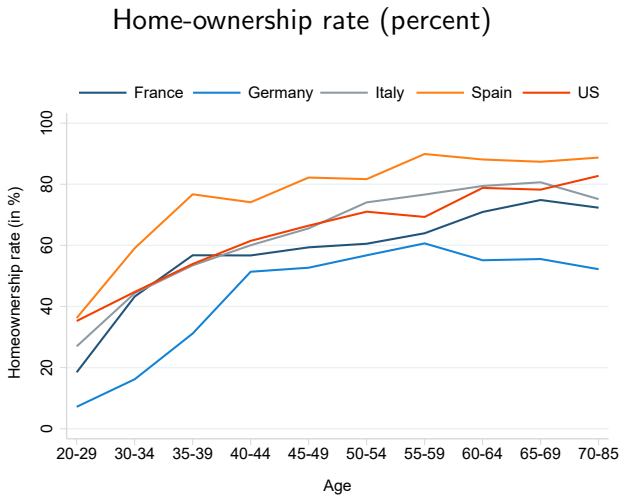


Home-ownership rate (percent)



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

1. **Estimate across five countries life-cycle model with illiquid housing**
   - Discrete house owning–renting choice
   - Illiquid housing (continuous size, subject to adjustment cost)
   - Collateral constraints
   - Stochastic house price (relative to nonhousing, permanent shocks): $\pi_t = G\eta_t\pi_{t-1}$
   - Permanent (ψ)–transitory (θ) 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
2. **Systematically quantify drivers of diff's in ext & int margins of housing:**
   - House price beliefs (mean, variance)
   - Housing market institutions (transaction costs, rental wedge, collateral constraints)
   - Preferences (discount factor, bequest motive, weight of housing)
3. **Takeaway**
   - Rental wedge and HP beliefs matter for homeownership (extensive margin); Maintenance costs matter for housing wealth of owners (intensive margin)

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Literature review

- **Modeling housing:** Typically single country (or two)
  Cocco 2005, Yao & Zhang 2005, Li & Yao 2007, Li et al 2016, Attanasio et al 2012, Landvoigt 2017, 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, Kaas et al 2021 ...
- **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.

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

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

$\widehat{\alpha}$: rental cost, λ: maintenance cost, ϕ: selling cost, δ: downpayment, η: 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: $0 \leq a_t + (1-\delta)\widehat{h}_t$; Region of inaction: due to $\phi \overline{h}_t$

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

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 π 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: $\widehat{G} \sim \text{uniform}([\dot{G} - \widetilde{G}, \dot{G} + \widetilde{G}])$

Calibration

Parameter description	Symbol	Value					Source
		Germany	France	Italy	Spain	U.S.A.	
Preferences							
CRRA coefficient	ρ	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(η)	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(ψ)	0.13	0.13	0.13	0.13	0.10	Le Blanc Georgarakos; CGM
Std dev of transitory income shock	std(θ)	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(ψ)	0.14	0.14	0.18	0.12	0.13	Le Blanc Georgarakos; CGM
Std dev of transitory income shock	std(θ)	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	μ_U	0.59	0.68	0.74	0.78	0.59	OECD, 2020
Net Pension replacement rate	τ	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	δ	0.35	0.20	0.40	0.25	0.20	EDW; ECB (2019), Chart 6
Cost of selling house (roundtrip)	ϕ	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

Structural estimation

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

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

- 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; Ω 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. Rental wedge α: determined by level of home-ownership (higher wedge makes renting less appealing)
2. Mean house price belief $\grave{G}$: pinned by mean actual HP growth ($\sim$Rational exp)
3. Spread of house price beliefs $\widetilde{G}$: determined by slope of home-ownership profile (pessimistic people buy house later in life)
4. Maintenance cost λ: identified by housing wealth–income ratio (cond. on owning)
5. Interaction b/w (log) time preference rates and house price beliefs κ: spread b/w net wealth of owners and renters (positive κ: optimistic HH more impatient and less wealth accumulation, negative κ: owners accumulate more)
6. Center and spread of (log) time preference rate $\grave{\vartheta}, \widetilde{\vartheta}$: determined by slope of wealth accumulation and difference mean - median
7. Weight of housing in utility function ω: pinned down by rent-income ratio
8. Bequest magnitude L: determined by shape of wealth profile late in life, stronger if less decline

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Estimates

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

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$\grave{G}$	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)
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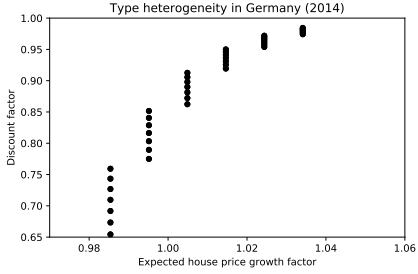
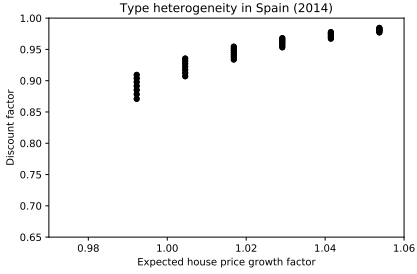
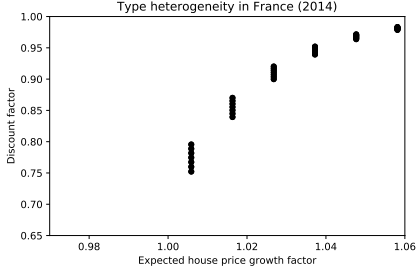
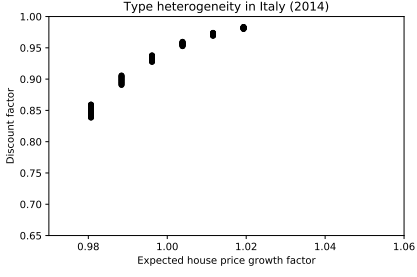
Positive correlation between discount factor and mean house price beliefs





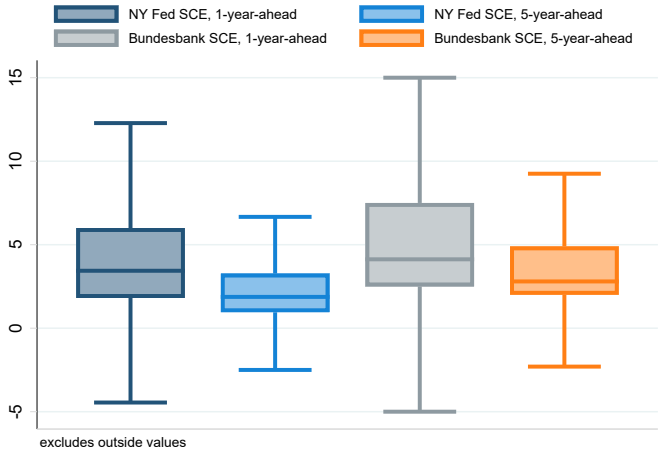




Heterogeneity in survey-based house price expectations:

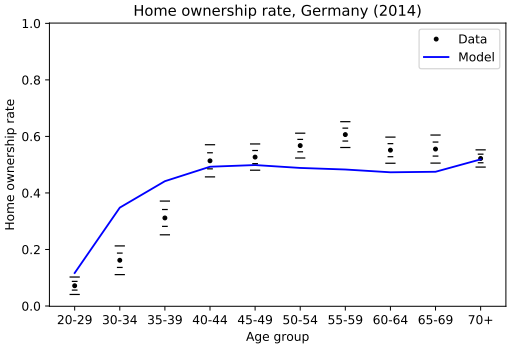
5-year-ahead less dispersed than 1-year-ahead

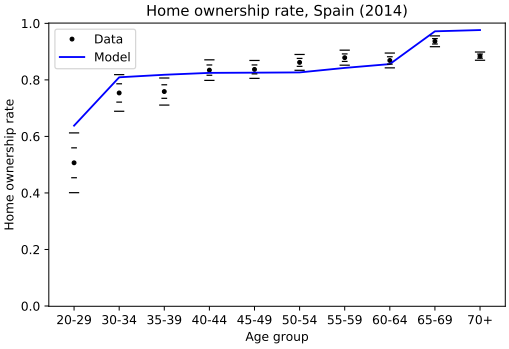
In line with model estimates of HP expectations: $[\grave{G} \mp \widetilde{G}]$ $\quad$ $\widetilde{G} \approx 0.02$ to 0.04



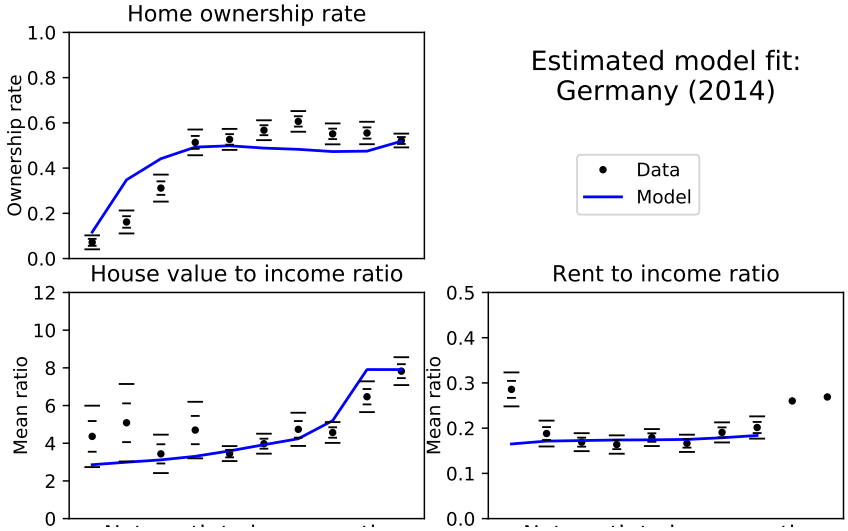
Source: Bundesbank Survey on Cons Expectations 2019; NY Fed Survey of Cons Expectations 2014–2019.

Model fit: Home-ownership Germany, Spain

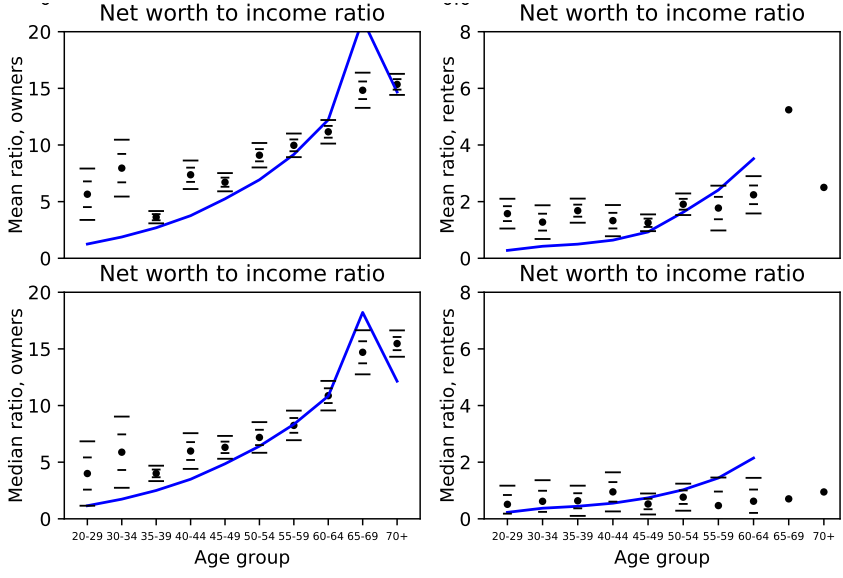




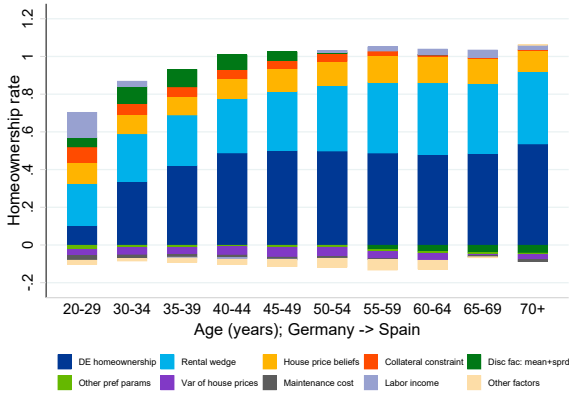
Model fit: Germany; housing, rents



Model fit: Germany; net wealth



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



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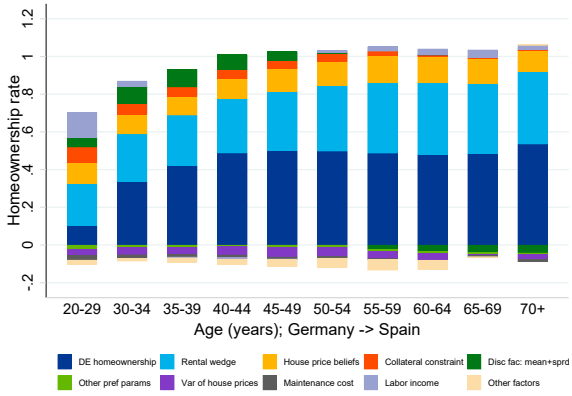

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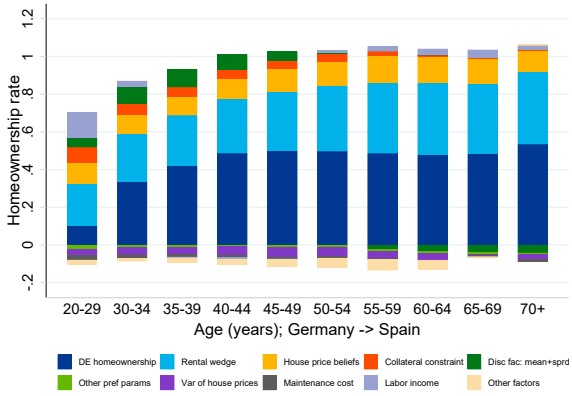

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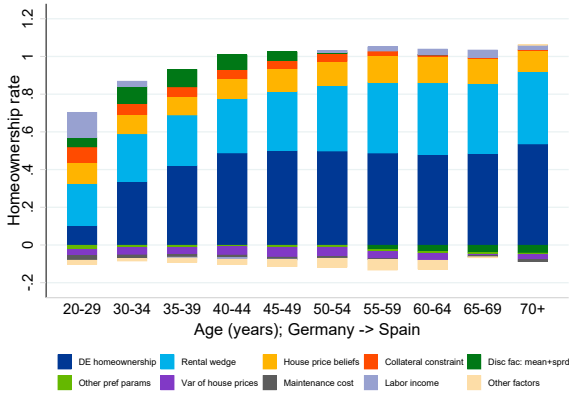

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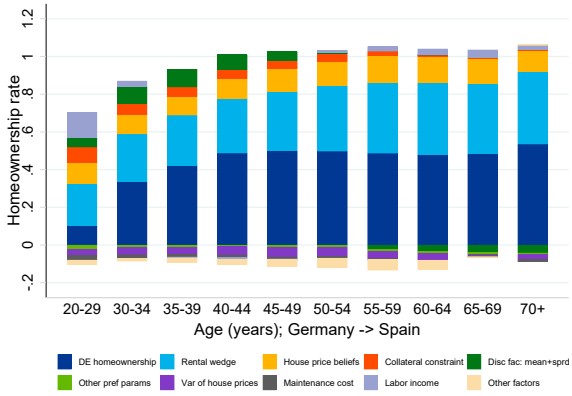

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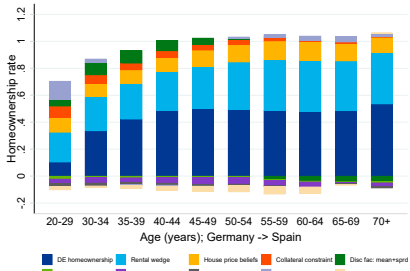
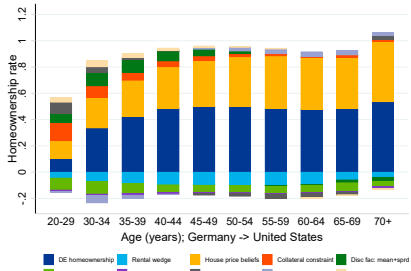
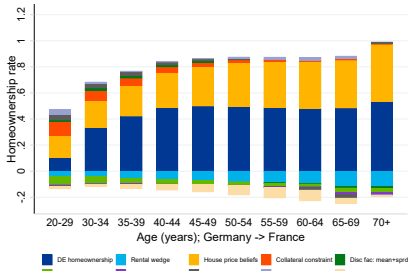
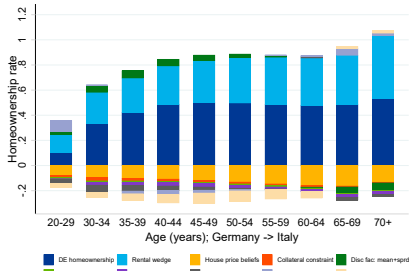
Home-ownership across countries: Rental wedge, HP beliefs matter ∼50–50

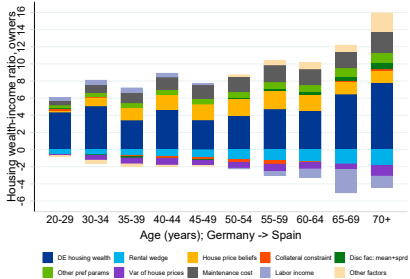


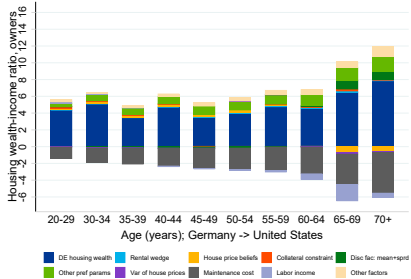


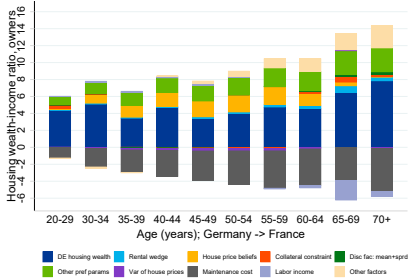


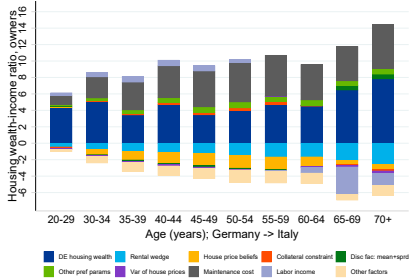


Intensive margin—mean housing wealth–income ratios: Maintenance costs









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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- How do cross-country diffs in housing affect transmission of shocks?
- Embed partial equilibrium model in (simple) general equilibrium setup
- How do differences in house price beliefs matter?
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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)

Model—Housing

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

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

s.t.

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

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

$\widehat{\alpha}$: rental cost, λ: maintenance cost, ϕ: selling cost, δ: downpayment, η: 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**

Life-cycle model with housing—Summary

- **Preferences**
  CRRA utility in Cobb–Douglas aggregate of C and H;
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Decomposing cross-country differences in wealth

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

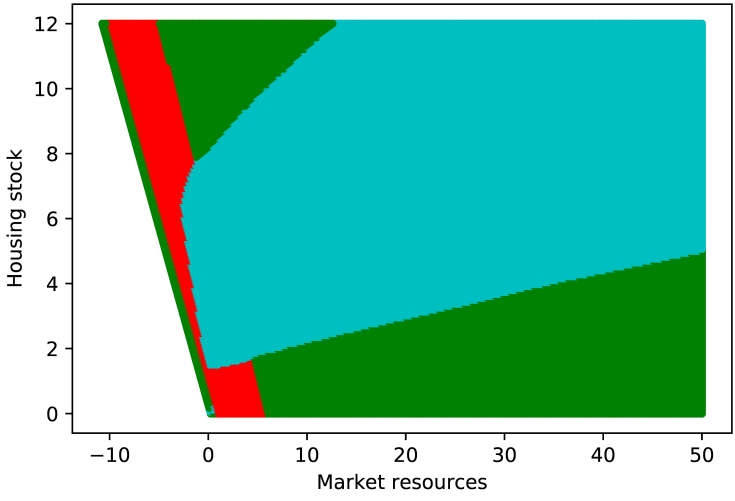
- House price beliefs (mean, variance)
- Preferences (discount factor, bequest motive, weight of housing)
- Housing market institutions (transaction costs, rental costs, collateral constraints)
- Other factors (mortality, incomes, . . .)

Calibration

Parameter description	Symbol	Value					Source
		Germany	France	Italy	Spain	U.S.A.	
Preferences							
CRRA coefficient	ρ	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(η)	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(ψ)	0.13	0.13	0.13	0.13	0.10	Le Blanc Georgarakos; CGM
Std dev of transitory income shock	std(θ)	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(ψ)	0.14	0.14	0.18	0.12	0.13	Le Blanc Georgarakos; CGM
Std dev of transitory income shock	std(θ)	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	μ_U	0.59	0.68	0.74	0.78	0.59	OECD, 2020
Net Pension replacement rate	τ	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	δ	0.35	0.20	0.40	0.25	0.20	EDW; ECB (2019), Chart 6
Cost of selling house (roundtrip)	ϕ	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

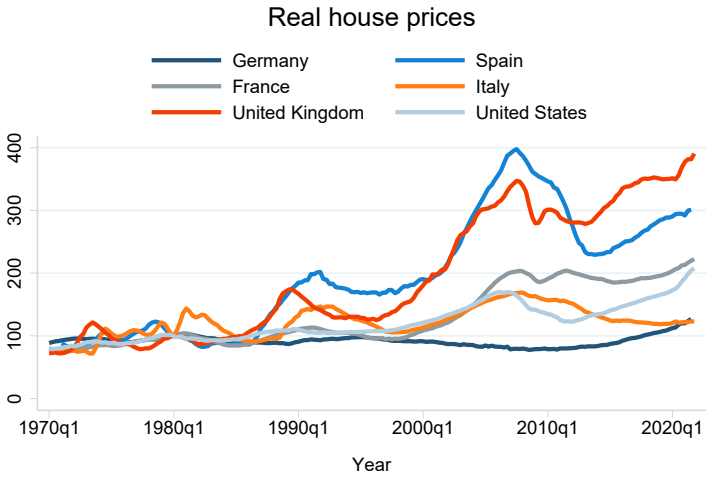
Optimal housing status: Renter/stayer/mover

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



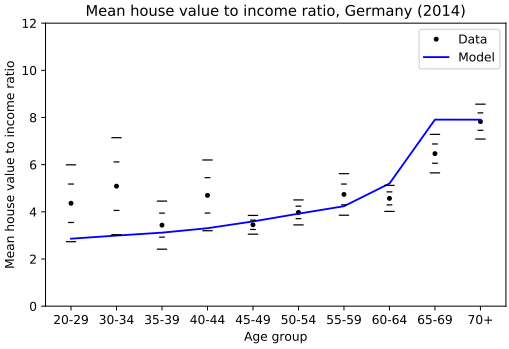
Red: Renter, **Cyan**: Stayer, **Green**: Mover ("Go")

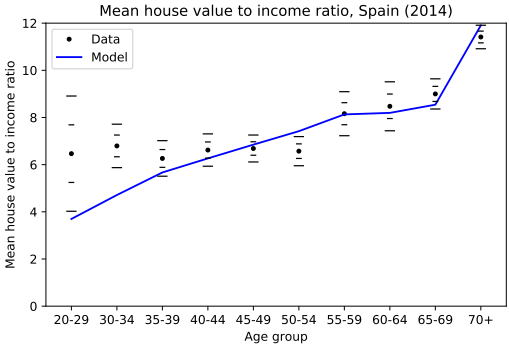
Aggregate house prices



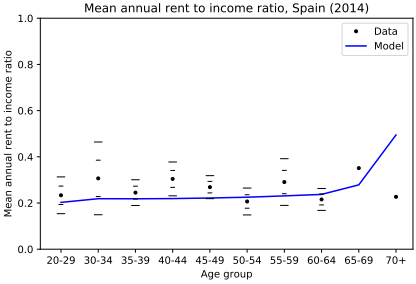
Source: OECD, 1970–2021.

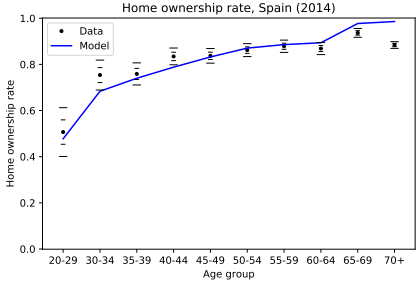
Model fit: Mean housing wealth–income ratio, Germany, Spain

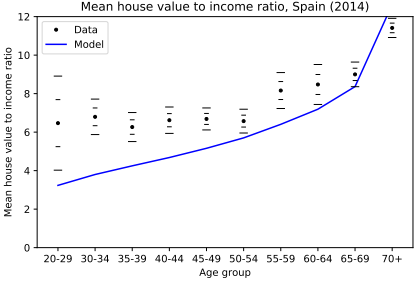


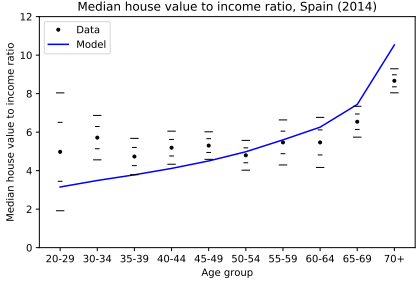


Model fit: Spain









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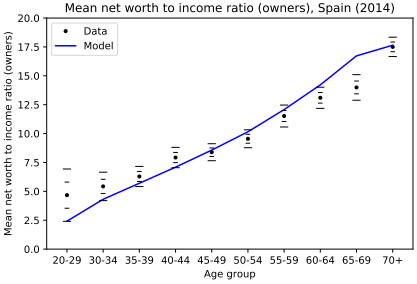
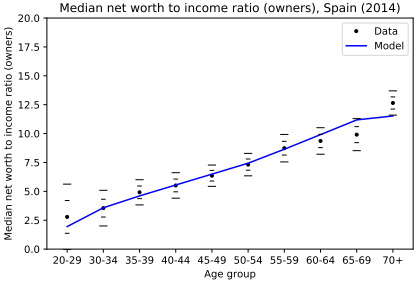
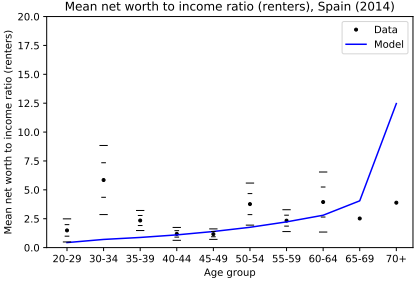
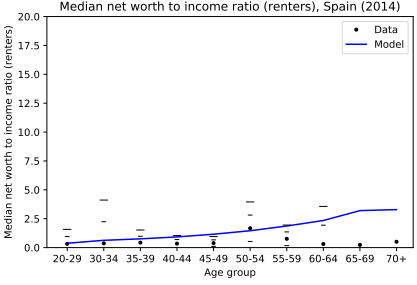
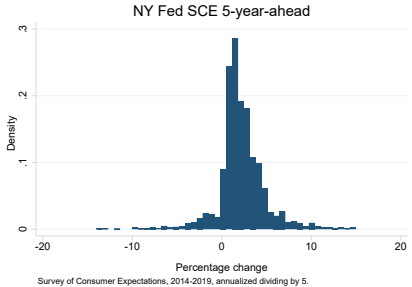


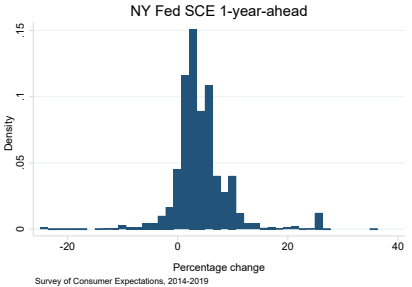


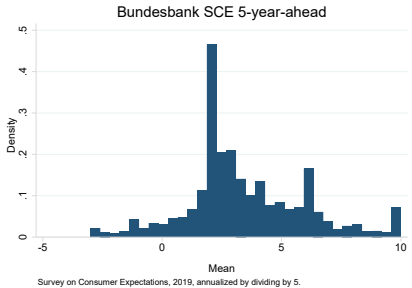


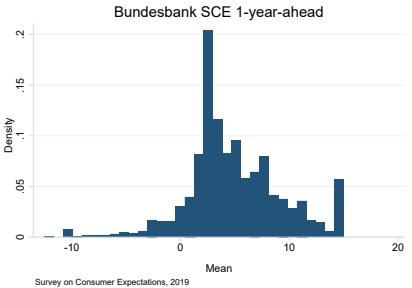


Heterogeneity in survey HP growth expectations: US & DE, 1Y- & 5Y-ahead

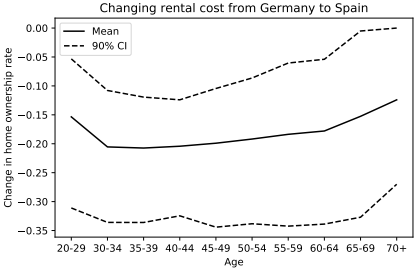


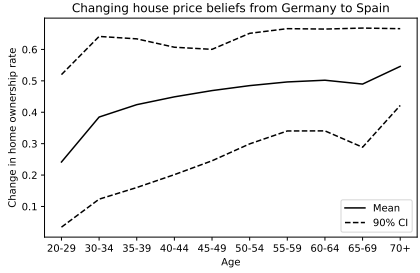


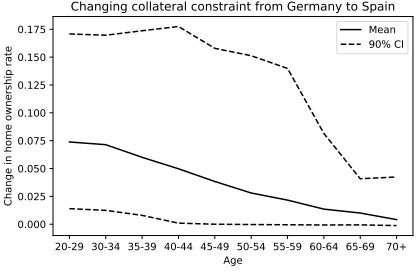


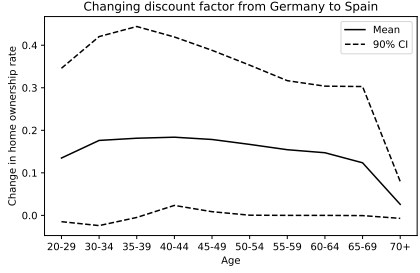


The model is substantially non-linear

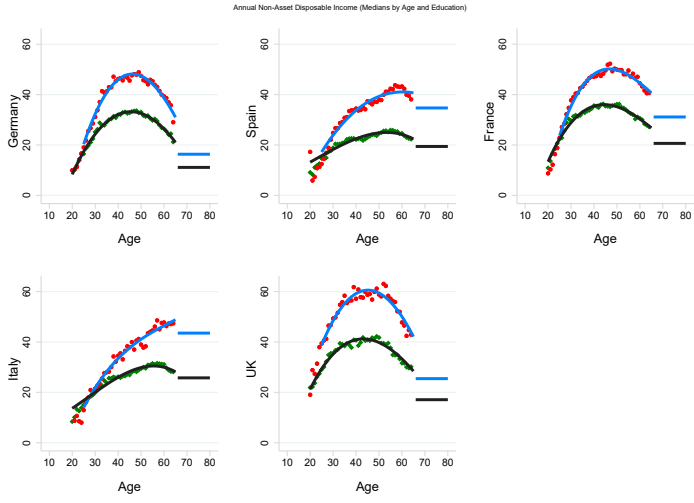








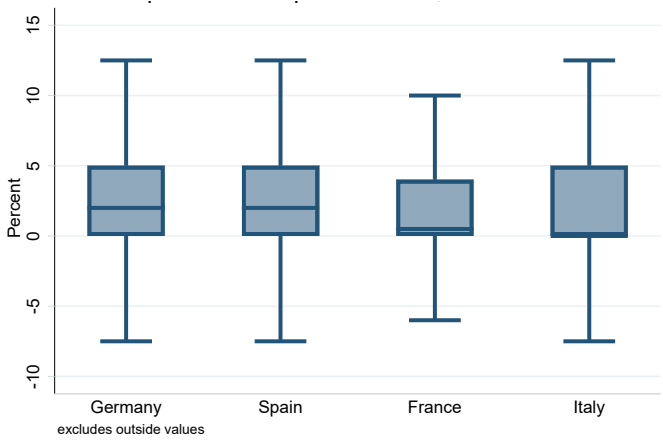
Median non-asset disposable income by age



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

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

In line with model estimates of HP expectations: $[\grave{G} \mp \widetilde{G}]$ $\quad \widetilde{G} \approx 0.025$



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