

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

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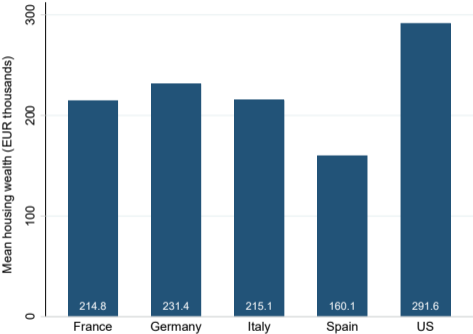
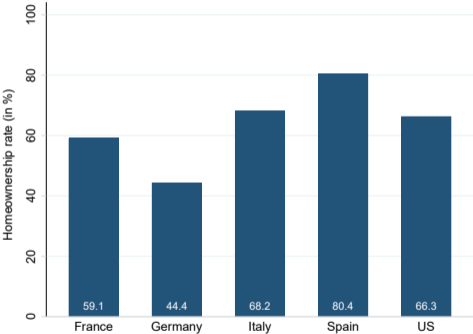
Research Seminar, Eesti Pank

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Striking differences in housing wealth across countries

Extensive margin: home-ownership rate (%) Intensive margin: mean housing wealth (EUR)

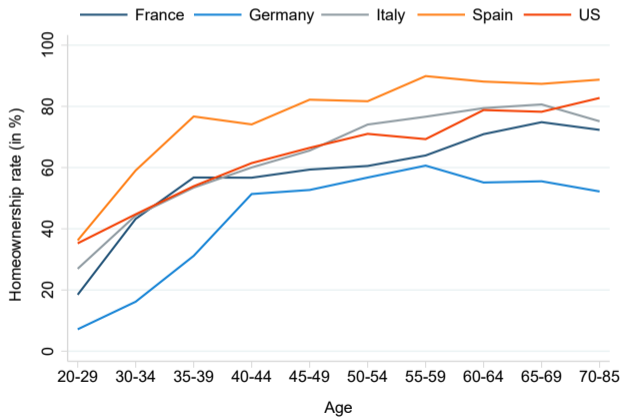


Source: Eurosystem Household Finance and Consumption Survey 2014; Survey of Consumer Finances 2016.

Differences in home-ownership persist over life cycle

~30 pp gap between Germany and Spain

Home-ownership rate (percent)



Preview: Decomposing cross-country differences in housing

1. Estimate in micro data from 5 countries life cycle model w illiquid housing

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

2. Systematically quantify drivers of differences in extensive and intensive margins of housing: home-ownership and € value of housing wealth

- (i) House price beliefs (mean, variance)
- (ii) Housing market institutions (transaction costs, rental wedge, collateral constraints)
- (iii) Preferences (discount factor, bequest motive, weight of housing)

3. Takeaways: Drivers of housing

- (i) Rental wedge and HP beliefs matter for home-ownership (extensive margin)
- (ii) Maintenance costs matter for housing wealth of owners (€ value, 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 structural 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, ...
- ▶ **Solution method:** Endogenous grid method (EGM)
Carroll 2006, Iskhakov et al 2017, ...

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

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

$$v_j(m_t, \bar{h}_t) = \max_{\{c_t, h_t, d_t\}} \left\{ U(c_t, h_t) + \underbrace{(1 - D_j)}_{\text{Mortality}} \beta \mathbf{E}_t \left[v_{j+1}(m_{t+1}, \bar{h}_{t+1}) \left(\frac{\Gamma_{j+1} \psi_{t+1}}{(G \eta_{t+1})^\omega} \right)^{1-\rho} \right] \right. \\ \left. + D_j B(\hat{w}_t) \right\} \quad \text{state vars: } m, \text{ house owned } \bar{h}, \text{ (house price } \pi, \text{ perm inc } P)$$

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

m : liquid mkt resources, \bar{h} : house owned (= 0 for renter), h : new house to live in (buy or rent)

$\hat{\alpha}$: rental cost, λ : maintenance costs, ϕ : selling cost, δ : downpayment, η : house price shocks

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

Collateral constr: $0 \leq a_t + (1 - \delta) \hat{h}_t$; Norm: $m \equiv M/P, h \equiv H\pi/P, v \equiv V/(P/\pi^\omega)^{1-\rho}$

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Model—House price beliefs

$$v_j(\cdot) = \max_{\{c_t, h_t, d_t\}} \left\{ U(c_t, h_t) + (1 - D_j)\beta \mathbf{E}_t \left[v_{j+1}(\cdot) \left(\frac{\Gamma_{j+1}\psi_{t+1}}{(G\eta_{t+1})^\omega} \right)^{1-\rho} \right] + D_j B(\hat{w}_t) \right\}$$

Actual house prices π and house price beliefs \hat{G}

- ▶ House prices follow geometric random walk: $\pi_t = G\eta_t\pi_{t-1}$

Housing of homeowners risky, subject to HP shocks η_{t+1} : $\bar{h}_{t+1} = \frac{G\eta_{t+1}}{\Gamma_{j+1}\psi_{t+1}} \hat{h}_t$

- ▶ Households (permanently) differ in beliefs about HP growth:

$$\hat{G}_i = \bar{G} + \tilde{G}\epsilon_{i1}, \quad \epsilon_{i1} \sim \text{Uniform}([-1, 1])$$

Model—Preferences

$$v_j(\cdot) = \max_{\{c_t, h_t, d_t\}} \left\{ U(c_t, h_t) + (1 - D_j)\beta \mathbf{E}_t \left[v_{j+1}(\cdot) \left(\frac{\Gamma_{j+1}\psi_{t+1}}{(G\eta_{t+1})^\omega} \right)^{1-\rho} \right] + D_j B(\widehat{w}_t) \right\}$$

Preferences

- ▶ CRRA utility over Cobb–Douglas aggregate of c and h : $U(c, h) = \frac{(c^{1-\omega} h^\omega)^{1-\rho}}{1-\rho}$
- ▶ Bequest motive: $B(\cdot) = L \times \frac{(\cdot)^{1-\rho}}{1-\rho}$
- ▶ Discount factor heterogeneity, allows for **correlation w/ HP beliefs** ϵ_{i1} [estimated]:

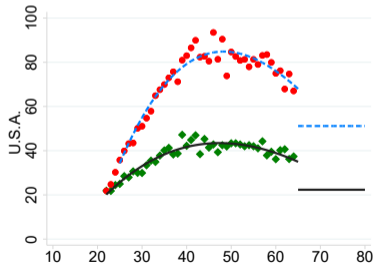
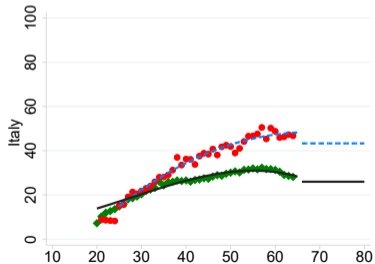
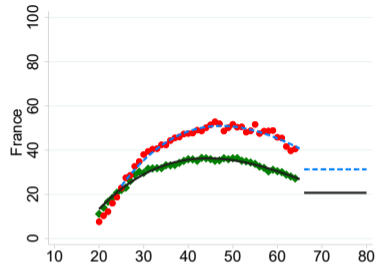
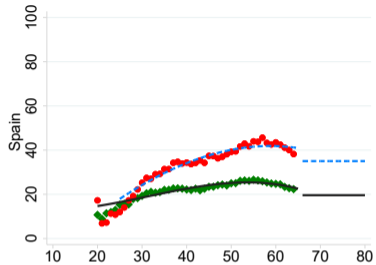
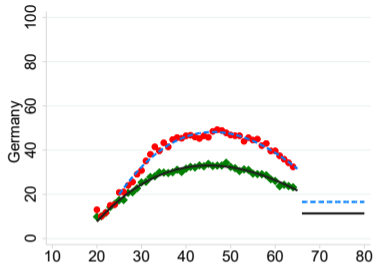
$$\beta_i = (1 + \exp(\vartheta_i))^{-1}, \quad \vartheta_i = \vartheta + \tilde{\vartheta} \epsilon_{i2} + \kappa \epsilon_{i1}, \quad \epsilon_{i2} \sim \text{Uniform}[-1, 1]$$

If $\kappa < 0 \Rightarrow$ Optimistic Hhs are more patient; homeowners accumulate more wealth

Calibration

Parameter description	Symbol	Value					Source
		Germany	France	Italy	Spain	U.S.A.	
Preferences							
CRRRA 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	$\text{std}(\eta)$	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	$\text{std}(\psi)$	0.13	0.13	0.13	0.13	0.10	EU SILC, Cocco et al. (2005)
Std dev of transitory income shock	$\text{std}(\theta)$	0.22	0.22	0.27	0.34	0.30	EU SILC, Cocco et al. (2005)
Household head with a college degree							
Std dev of permanent income shock	$\text{std}(\psi)$	0.14	0.14	0.18	0.12	0.13	EU SILC, Cocco et al. (2005)
Std dev of transitory income shock	$\text{std}(\theta)$	0.21	0.21	0.29	0.28	0.24	EU SILC, Cocco et al. (2005)
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	$1 - D$						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

Median non-asset disposable income by age



Notes: EUR thousand; EU Statistics on Income and Living Conditions, 2009–2019; PSID 1997–2017.

Structural estimation

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

$$\xi \equiv \left\{ \underbrace{\tilde{G}}_{\text{House price beliefs}}, \underbrace{\alpha}_{\text{Rental wedge}}, \underbrace{\lambda}_{\text{Maintenance costs}}, \underbrace{\vartheta, \tilde{\vartheta}}_{\text{Impatience}}, \underbrace{\omega}_{\text{Weight on housing}}, \underbrace{L}_{\text{Bequest}}, \underbrace{\kappa}_{\text{Interaction b/w } \vartheta \text{ and } \tilde{G}} \right\}$$

- ▶ Minimize

$$\hat{\xi} = \arg \min (m(x) - \hat{m}(\tilde{x}|\xi))' \Omega^{-1} (m(x) - \hat{m}(\tilde{x}|\xi))$$

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

- ▶ Moments m :

home-ownership 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 $\alpha \equiv$ rental cost $\hat{\alpha}$ – maintenance costs λ : determined by level of home-ownership (higher wedge makes renting less appealing)
2. Mean house price belief \hat{G} : pinned by mean actual HP growth (\sim Rational exp)
3. Spread of house price beliefs \tilde{G} : determined by slope of home-ownership profile (pessimistic people buy house later in life)
4. Maintenance costs 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 (negative κ : optimistic households more patient and accumulate more (housing) wealth, positive κ : accumulate less)
6. Center and spread of (log) time preference rate $\vartheta, \tilde{\vartheta}$: determined by slope of wealth accumulation and difference mean vs median
7. Weight of housing in utility function ω : pinned down by rent–income ratio
8. Bequest magnitude L : determined by shape of net wealth profile late in life, stronger if less decline

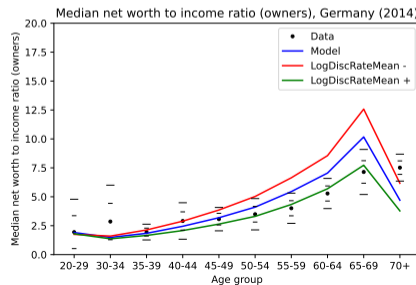
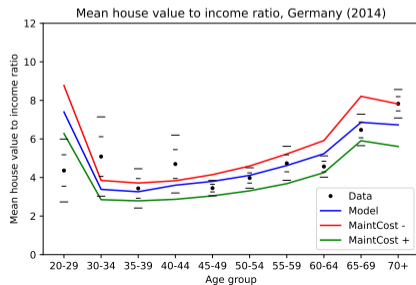
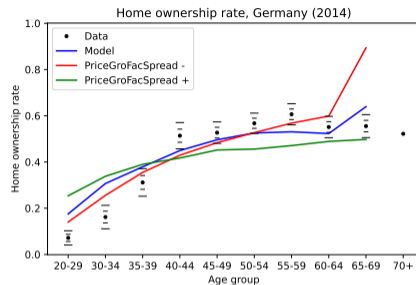
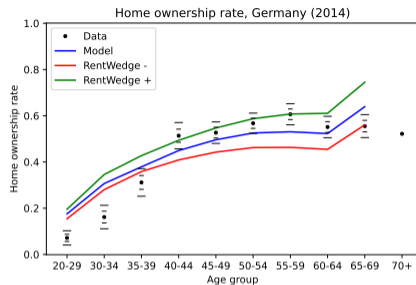
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Estimates

Param	Description	Germany	Spain	France	Italy	U.S.A.
\bar{G}	Mean of house price growth factor beliefs (calibrated)	1.010 (—)	1.023 (—)	1.032 (—)	1.000 (—)	1.026 (—)
\tilde{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)
λ	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)
α	Rental wedge	2.05e-2 (0.19e-2)	4.09e-2 (0.09e-2)	2.56e-2 (0.07e-2)	4.04e-2 (0.07e-2)	1.76e-2 (0.18e-2)
ϑ	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)
$\tilde{\vartheta}$	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)
ω	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)
κ	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)

Estimates

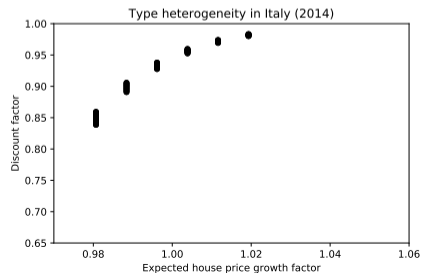
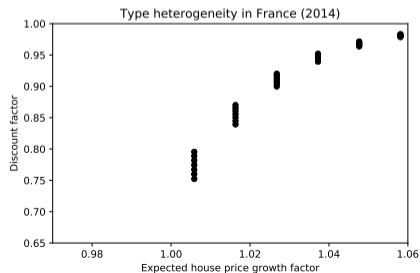
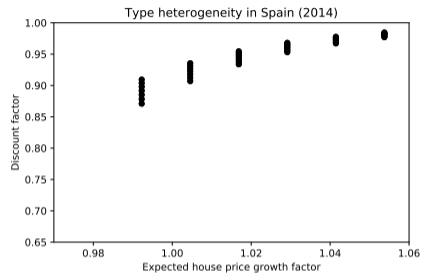
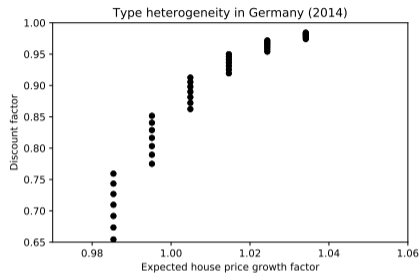
Param	Description	Germany	Spain	France	Italy	U.S.A.
\bar{G}	Mean of house price growth factor beliefs (calibrated)	1.010 (—)	1.023 (—)	1.032 (—)	1.000 (—)	1.026 (—)
\tilde{G}	Spread of house price growth factor beliefs	2.92e-2 (0.19e-2)	3.69e-2 (0.03e-2)	3.13e-2 (0.07e-2)	2.65e-2 (0.03e-2)	1.71e-2 (0.04e-2)
λ	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)
α	Rental wedge	2.05e-2 (0.19e-2)	4.09e-2 (0.09e-2)	2.56e-2 (0.07e-2)	4.04e-2 (0.07e-2)	1.76e-2 (0.18e-2)
ϑ	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)
$\tilde{\vartheta}$	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)
ω	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)
κ	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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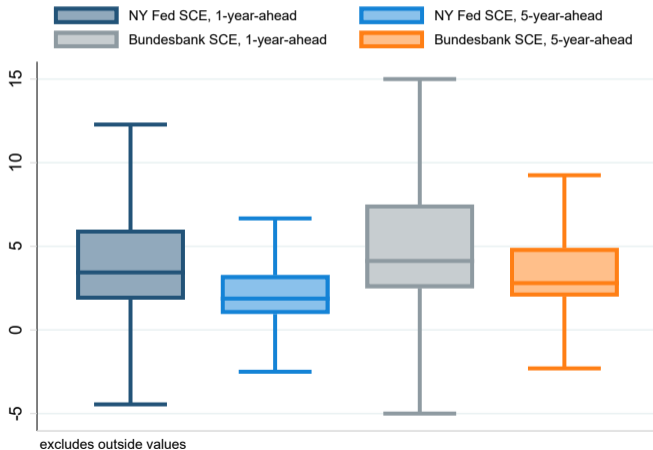
Positive correlation between discount factor and mean house price beliefs

$\kappa < 0$: Optimistic households more patient; owners accumulate more wealth

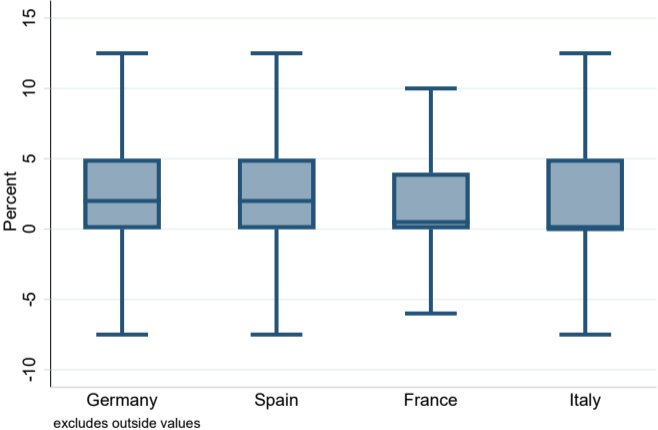


Cross-check—Heterogeneity in survey-based house price expectations: 5-year-ahead less dispersed than 1-year-ahead

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



Cross-check—Heterogeneity in survey-based house price expectations: Dispersion of expectations similar across countries



Source: ECB Consumer Expectations Survey, April 2020–May 2023; 1-year-ahead expectations.

Cross-check—Households tend to permanently differ in expectations

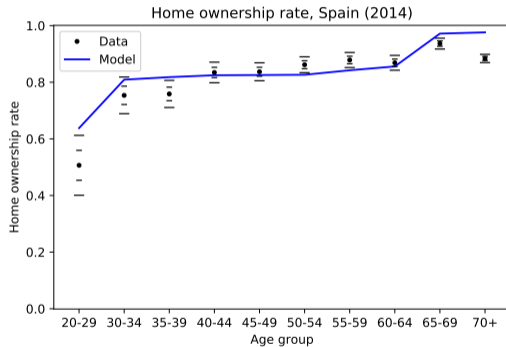
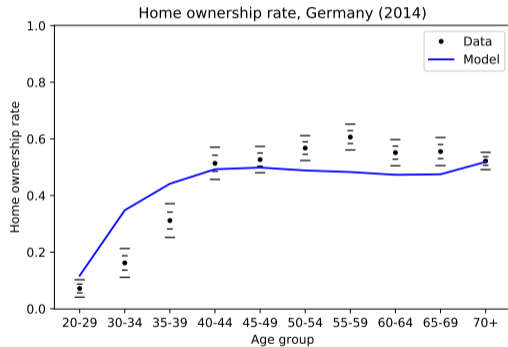
Reg's à la Giglio 2021: Indiv fixed effects explain bulk of expl variation (time FEs don't)

$$\text{Mean house price beliefs: } \hat{G}_{i,t} = x_i + z_t + \varepsilon_{i,t}$$

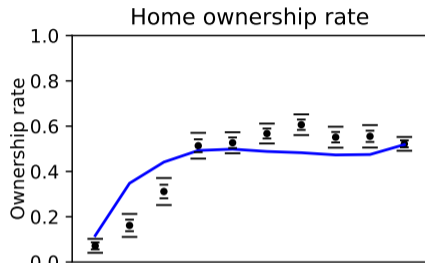
Country	R^2 (percent) of panel regression			Observations
	Time FE	Individual FE	Time + individual FE	
Germany	1.5	41.9	43.0	2,342
France	0.4	32.9	33.2	2,397
Italy	0.7	37.2	37.8	2,539
Spain	1.7	37.3	38.4	2,399
United States	0.7	42.3	42.7	953

Note: Source: ECB Consumer Expectations Survey, waves April 2020–September 2023—42 monthly waves; U.S. Survey of Consumer Expectations, Federal Reserve Bank of New York, January 2020–February 2023. The table reports R^2 from the regressions of average house price beliefs on time fixed effects (column 2), on individual fixed effects (column 3) and on both time and individual fixed effects (column 4). Column 4 (rightmost) reports the average number of households across waves. The structure of the table follows Giglio et al. (2021), Table 6. The sample is restricted to households for whom at least 8 observations are available.

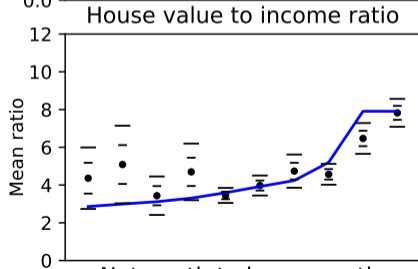
Model fit: Home-ownership Germany, Spain



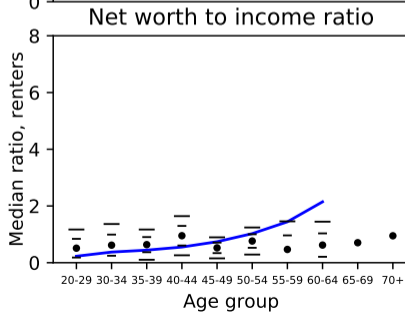
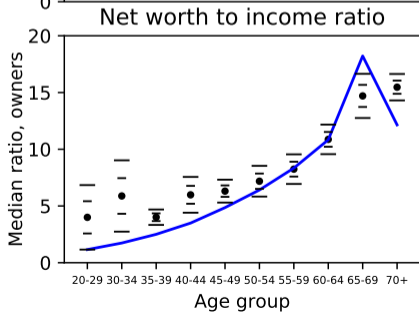
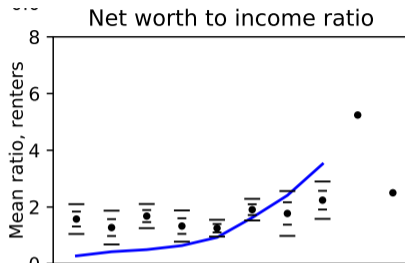
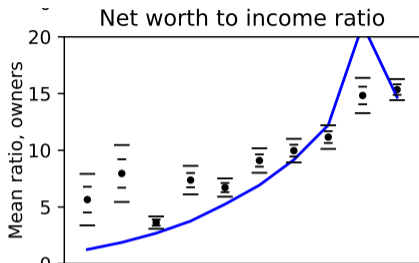
Model fit: Germany; housing, rents



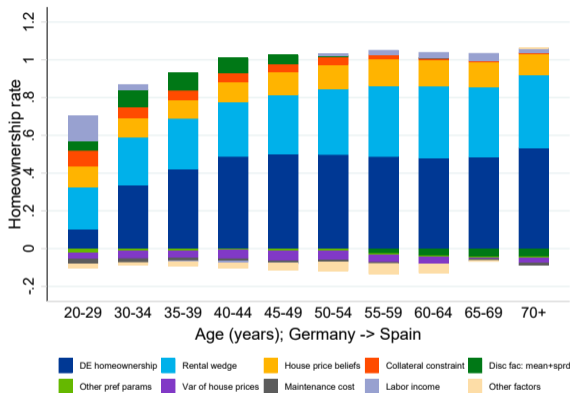
Estimated model fit:
Germany (2014)



Model fit: Germany; net wealth



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%

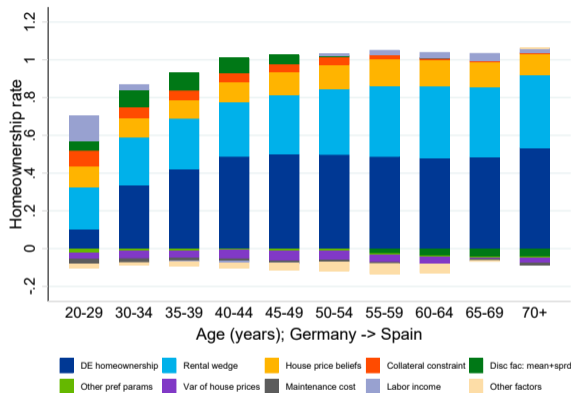
▶ Households compare:

$$\underbrace{r + \lambda - \dot{G}}_{\text{user cost of owning}} \quad \text{to} \quad \hat{\alpha} \equiv \underbrace{\alpha + \lambda}_{\text{rental wedge}} + \lambda \quad \underbrace{\hspace{10em}}_{\text{cost of renting } \hat{\alpha}}$$

$$\text{or } r - \dot{G} \text{ to } \alpha$$

▶ 1pp Δ in $\dot{G}, \alpha \Rightarrow 15\text{pp } \Delta\text{HO}$
Very powerful!

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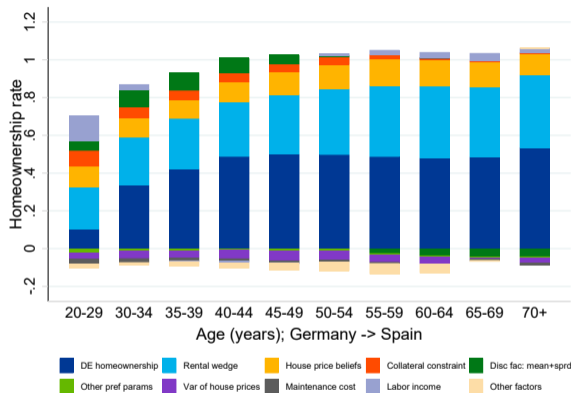
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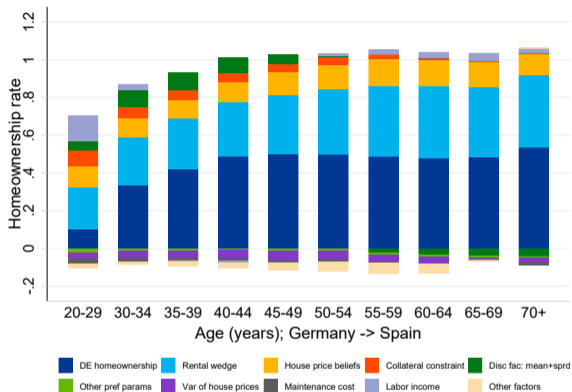
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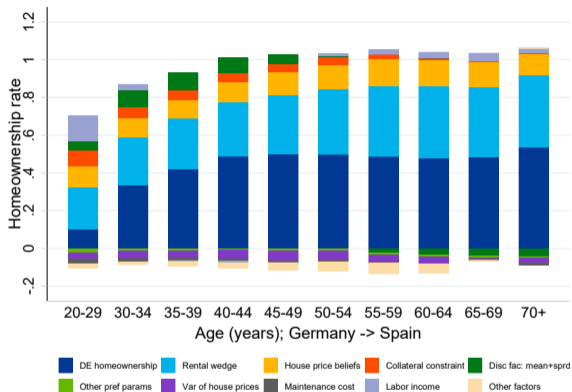
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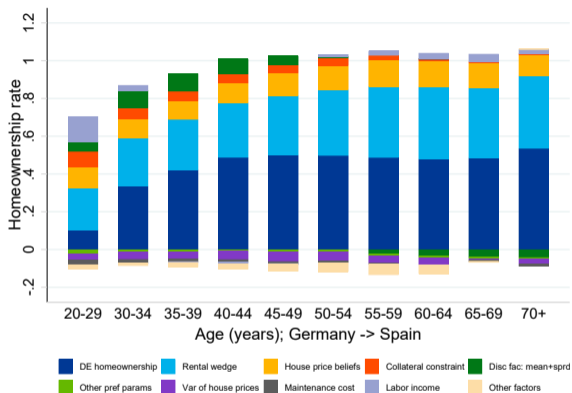
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- ▶ **Variance of house prices:** higher var lowers ES HO

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



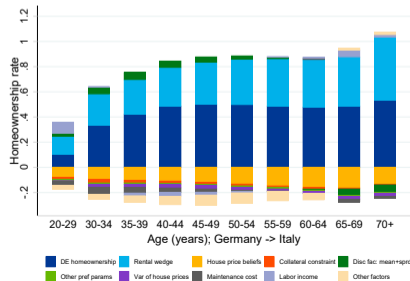
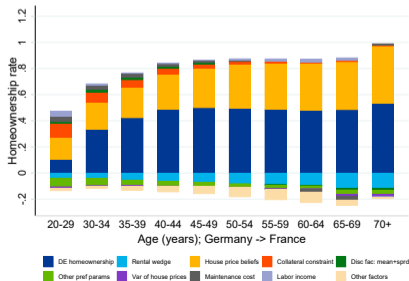
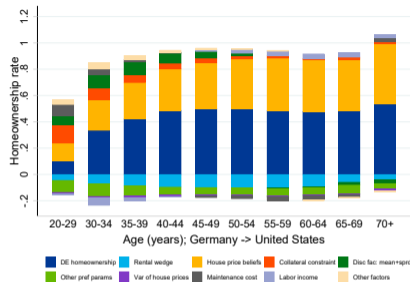
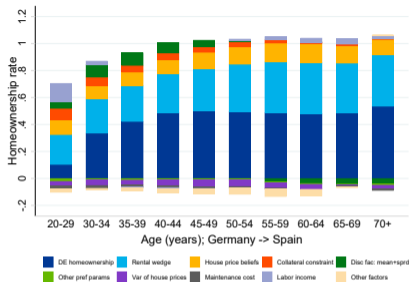
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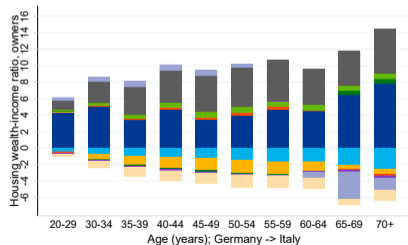
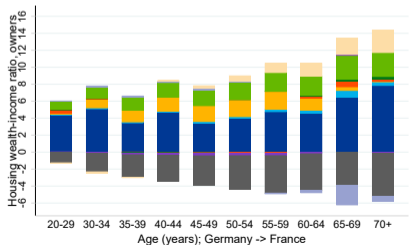
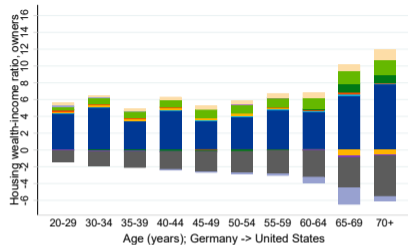
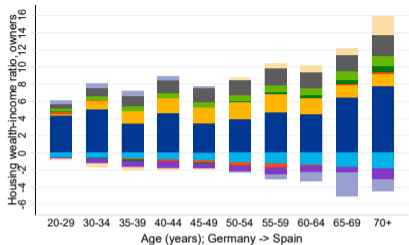


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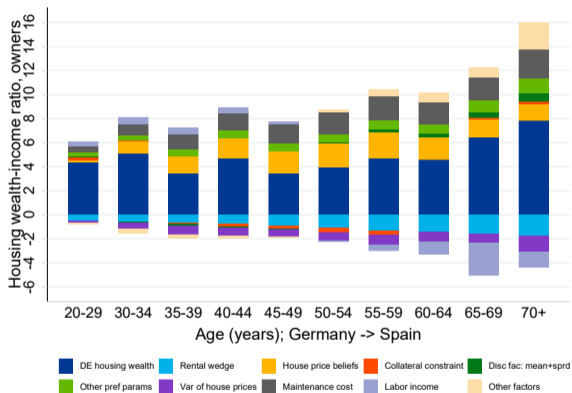
Home-ownership across countries: Rental wedge, HP beliefs matter ~50–50



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



Intensive margin: Mean housing wealth–income ratios, Germany → Spain (ES)



- ▶ **Housing wealth, Ger**
- ▶ **Maintenance costs:** ES lower maint costs increase housing wealth
- ▶ **Rental wedg:** Selection eff: Spain has worse rental mkt → more people own; but marginal owners buy lower housing wealth
- ▶ **HP beliefs:** ES more optimistic → owners accumulate more housing

Conclusions

- ▶ We estimate 'canonical' model of housing across five countries
- ▶ **What drives cross-country differences in housing?**
 - ▶ **Homeownership (ext margin):** HP beliefs [45%], institutions (rental wedge) [45%]
Households compare: $\underbrace{r + \lambda - \dot{G}}_{\text{user cost of owning}}$ to cost of renting $\hat{\alpha} \equiv \underbrace{\alpha}_{\text{rental wedge}} + \lambda$
 - ▶ **Housing wealth (intensive margin):** Maintenance costs account for the bulk; a few factors via composition effect (rental wedge, HP beliefs, housing share)
 - ▶ Other factors (demographics, income processes, preferences) matter only little

Next steps—Our setup can be applied to analyze other questions, eg:

- ▶ How do cross-country diffs in housing affect transmission of shocks?
- ▶ Embed our partial equilibrium model in general equilibrium setup
- ▶ How do differences in house price beliefs or institutions matter?
 - ▶ For wealth accumulation, response of consumption to shocks (scarring), ...

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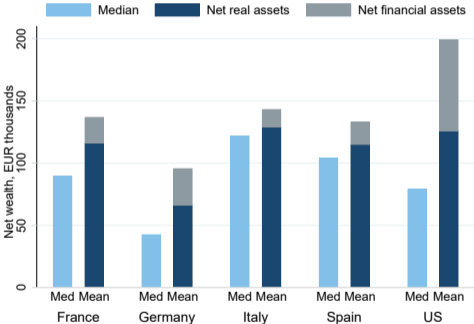
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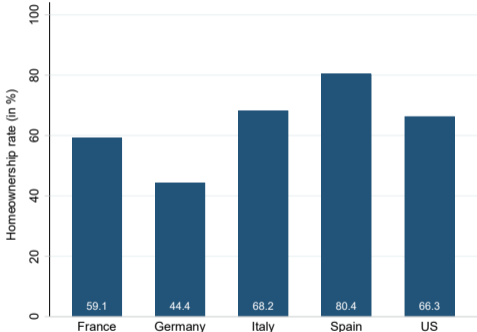
Backup slides

Striking differences in housing wealth across countries

Holdings of median, mean net wealth (EUR)



Extensive margin: home-ownership rate (%)



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

'Canonical' model of housing, non-normalized problem Normalized problem

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

$$V_j(M_t, \bar{H}_t, P_t, \pi_t) = \max_{\{C_t, H_t, d_t\}} \left\{ U(C_t, H_t) + \underbrace{(1 - D_j)\beta}_{\text{Mortality}} \mathbf{E}_t \left[V_{j+1}(M_{t+1}, \bar{H}_{t+1}, P_{t+1}, \pi_{t+1}) \right] + D_j B(\widehat{W}_t) \right\}$$

4 state vars: M , \bar{H} , house price π , perm inc P

s.t.

$$A_t = \begin{cases} M_t + (1 - \phi)\pi_t \bar{H}_t - C_t - \hat{\alpha}\pi_t H_t & \text{if } d_t = 0 \quad \text{Renter (R)} \\ M_t - C_t - \lambda\pi_t H_t, \quad H_t = \bar{H}_t & \text{if } d_t = 1 \quad \text{Stayer (S)} \\ M_t + (1 - \phi)\pi_t \bar{H}_t - C_t - (1 + \lambda)\pi_t H_t & \text{if } d_t = 2 \quad \text{Mover (M)} \end{cases}$$

M : liquid mkt resources, \bar{H} : house owned (= 0 for renter), H : new house to live in (buy or rent)

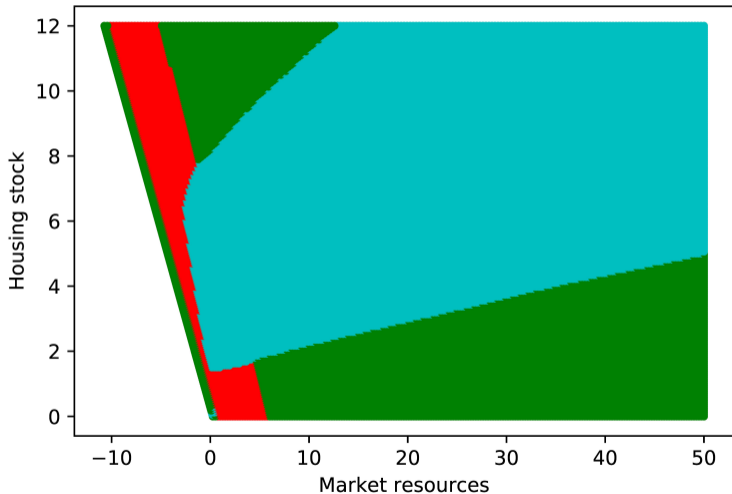
$\hat{\alpha}$: rental cost, λ : maintenance costs, ϕ : selling cost, δ : downpayment, η : house price shocks

$$M_{t+1} = RA_t + Y_{t+1} \quad \text{Housing: } \bar{H}_{t+1} = \hat{H}_t \quad \text{for } \hat{H}_t = \mathbf{1}(d_t > 0)H_t$$

$$\text{Collateral constraint: } 0 \leq A_t + (1 - \delta)\pi_t \hat{H}_t; \quad \text{House price: } \pi_{t+1} = G\eta_{t+1}\pi_t$$

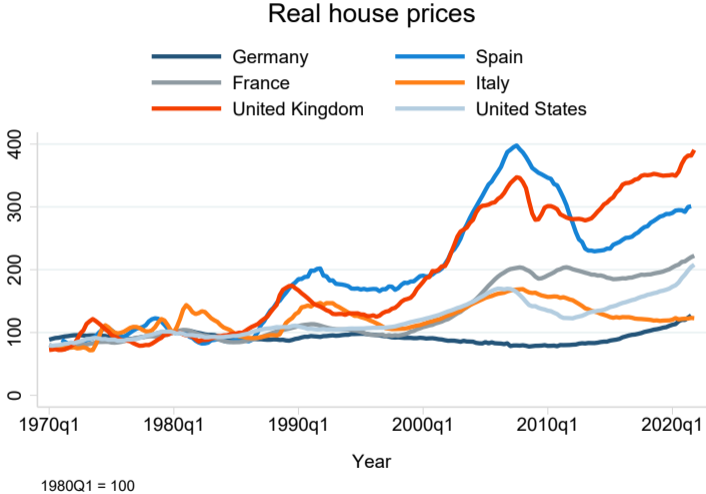
Optimal housing status: Renter/stayer/mover

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



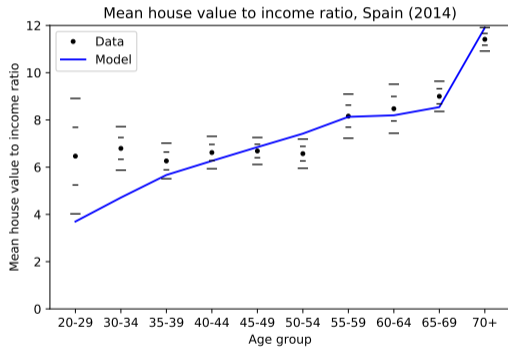
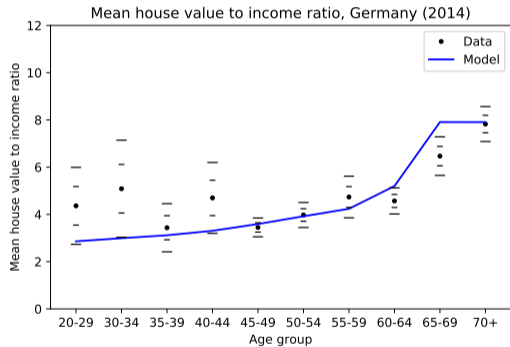
Red: Renter, **Cyan:** Stayer, **Green:** Mover ("Go")

Aggregate house prices

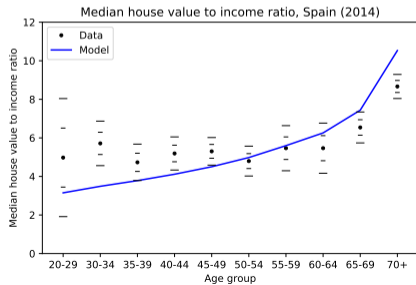
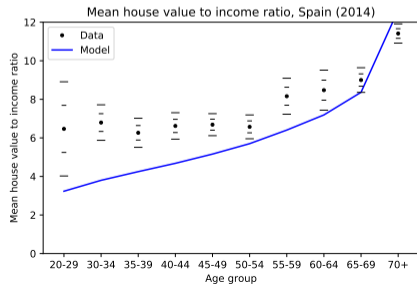
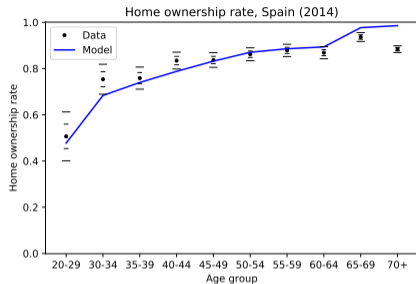
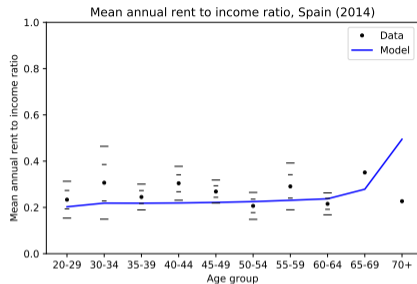


Source: OECD, 1970-2021.

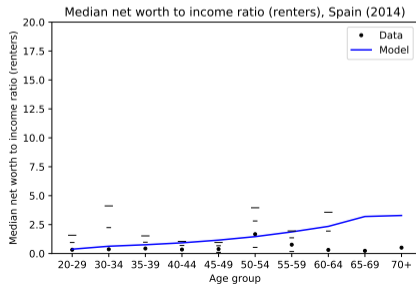
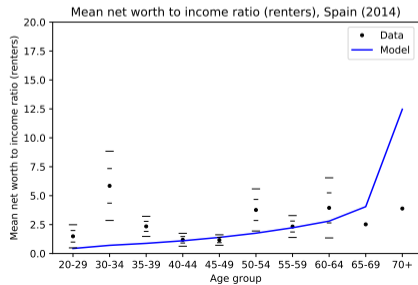
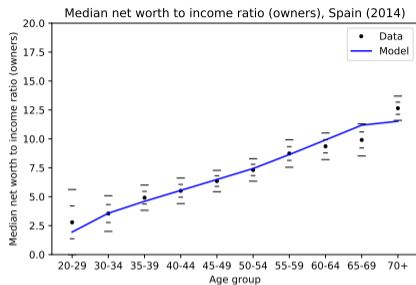
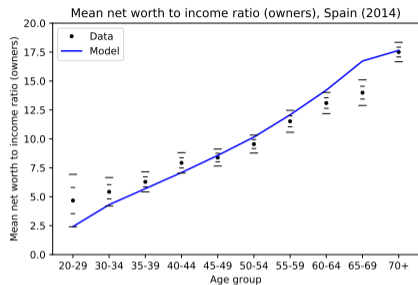
Model fit: Mean housing wealth–income ratio, Germany, Spain



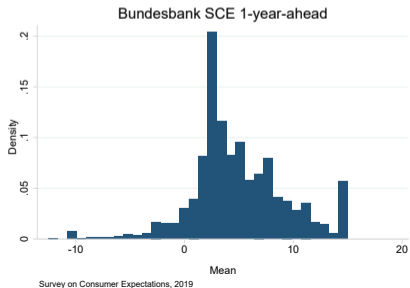
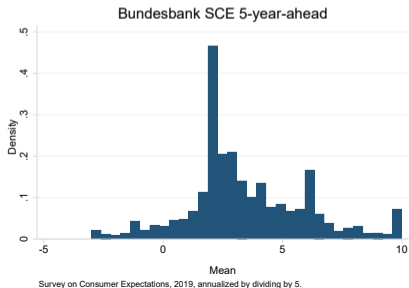
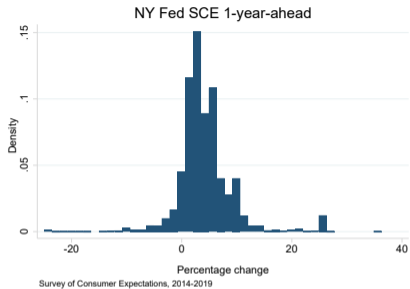
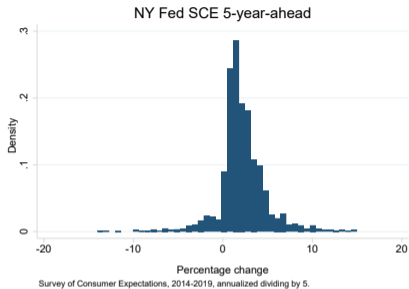
Model fit: Spain



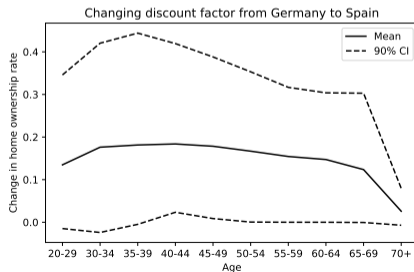
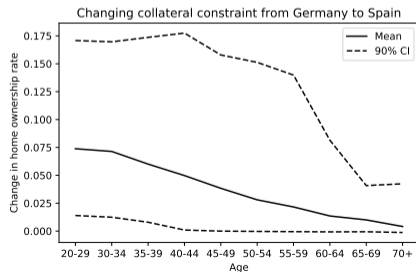
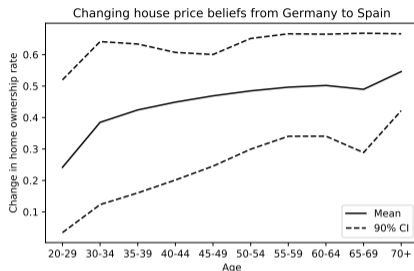
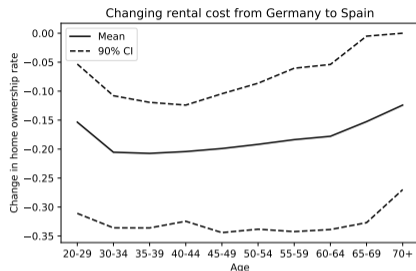
Model fit: Spain



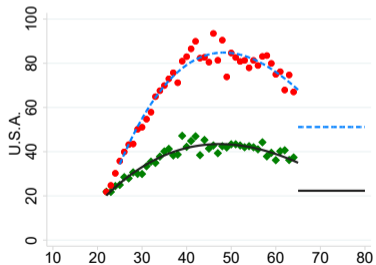
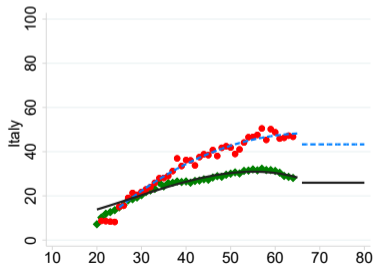
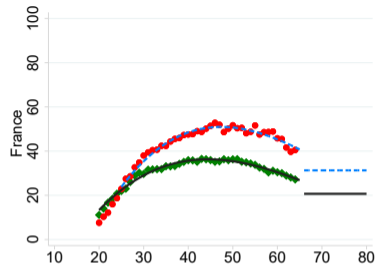
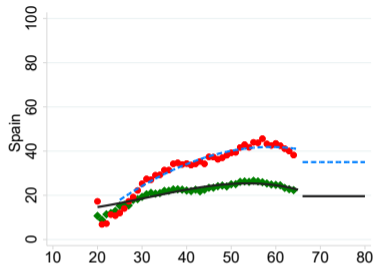
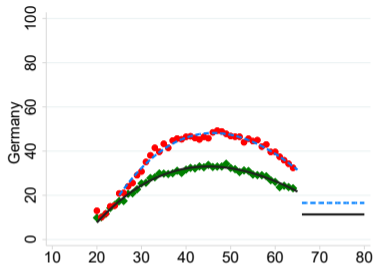
Heterogeneity in survey HP growth expectations: US & DE, 1Y- & 5Y-ahead



The model is substantially non-linear



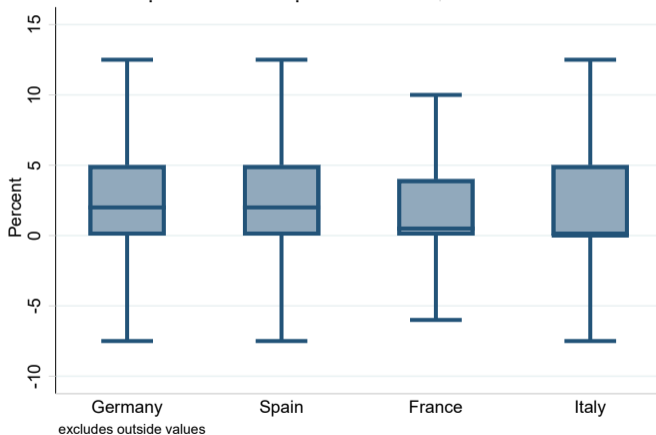
Median non-asset disposable income by age



Notes: EUR thousand; EU Statistics on Income and Living Conditions, 2009–2019; PSID 1997–2017.

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

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



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