Reference Dependence in the Housing Market: Preferences and Beliefs

Expectations Surveys, Central Banks and the Economy
5th Joint BoC - ECB - NY FED Conference

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October 2, 2024

Research agenda in collaboration with Cristian Badarinza (National University of Singapore), Vimal Balasubramaniam (Queen Mary, University of London), Aditya Polisetty (Imperial College, London), Juhana Siljander (Imperial College, London), Jagdish Tripathy (Bank of England).

Housing in the Macroeconomy

- Housing markets are central to public policy debates around the world.
  Han et al. (2023); Coven et al. (2024).

- Substantial micro-level evidence for the importance of behavioral frictions in this market, in particular, nominal anchors.
  Genesove and Mayer (2001); Bracke and Tenreyro (2021); Andersen et al. (2022); Badarinza et al. (2024a).

- Such anchoring can change effects of both monetary and fiscal policy.
  Stimulative effect of inflation; changes in standard elasticities to property taxation.

- What is the source of this anchoring? Non-standard preferences or non-rational beliefs? Different implications for conduct of policy.

- Household surveys can potentially help to unpack channels.

Roadmap

1. Nominal anchoring in the housing market: Micro evidence
2. Nominal anchoring in the housing market: Macro consequences
3. Dynamic rational expectations equilibrium housing search model
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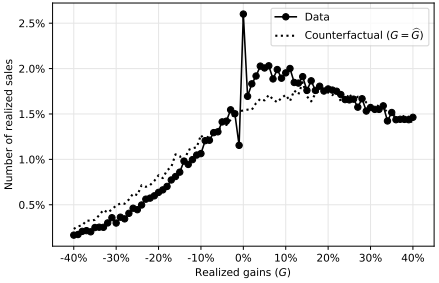
Evidence at the micro level

- Andersen et al. (2022) and Badarinza et al. (2024a), using:
  - High-quality administrative data on Danish housing listings, transactions, and the housing stock, as well as demographic and financial information about house sellers.
  - Administrative housing market data from Rightmove, HM Land Registry, and the Bank of England in the U.K.
- Find nominal anchoring in the form of strong excess bunching effects in the distribution of realized gains.
- The distribution of realized gains (nominal sale price less nominal purchase price) has a sharp peak at zero, missing mass immediately below zero, and diffuse excess mass to the right of zero.
  - Counterfactual is hedonic estimate of “fair value”.

Realized nominal gains bunch at 0.

- Realized gain $\equiv \frac{\text{Transaction price}}{\text{Initial purchase price}} - 1$.
  (Initial purchase price $\equiv$ reference point).

Denmark



Source: Andersen et al. (2022)

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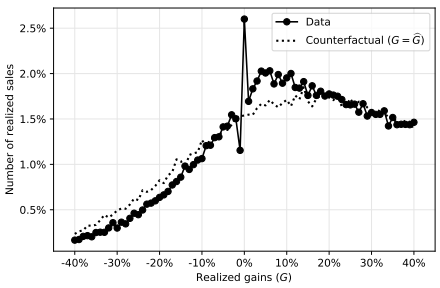
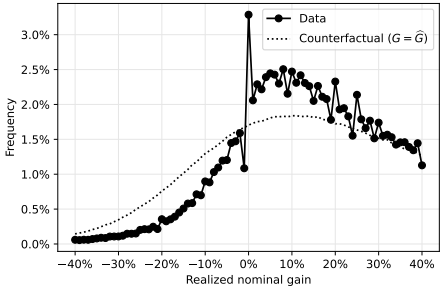


Source: Andersen et al. (2022)

U.K.



Source: Badarinza et al. (2024a)

Holding periods

The home seller's problem

- Specification of behavioral preferences:

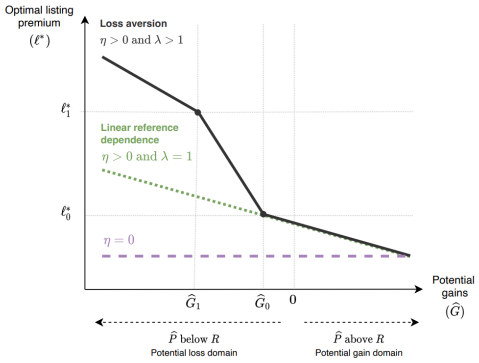
$$u(P(\ell), R) = \begin{cases} P(\ell) + \lambda\eta G(\ell), & \text{if } G(\ell) < 0 \\ P(\ell) + \eta G(\ell), & \text{if } G(\ell) \geq 0 \end{cases}$$

  where $P(\ell)$ is the realized price, R is the reference price level, $G(\ell) = P(\ell) - R$ is realized nominal gain, η and λ capture the degree of reference dependence and loss aversion respectively.

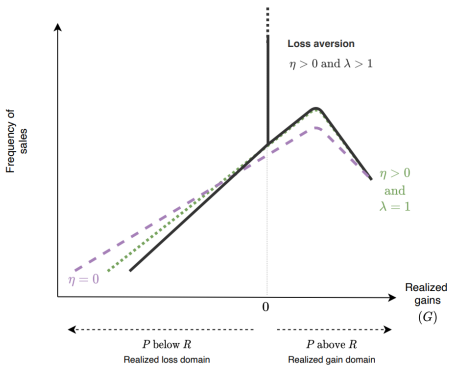
- Utility function is piecewise linear with a kink at zero.
- The degree of loss aversion λ dictates the slope of the piecewise linear function in the loss region.
- Important controls include home owner's mortgage balance, anticipated demand conditions, and bargaining frictions.

The home seller's problem

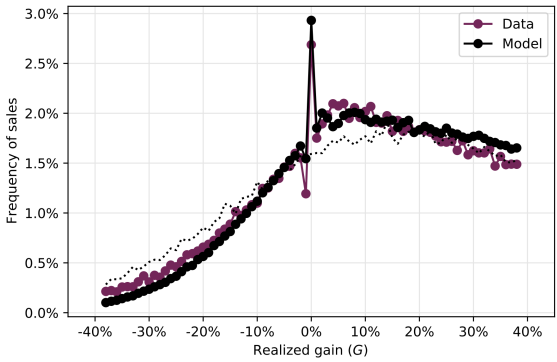
Optimal Listing Premium by Potential Gains



Realized Gains Distribution



Empirical fit: Model vs. data



Source: Andersen et al. (2022)

- Micro-level empirical moments fitted: Probability of listing; probability of sale, and prices conditional on a sale (“concave demand”); listing premium by potential gain; listing premium by potential home equity.

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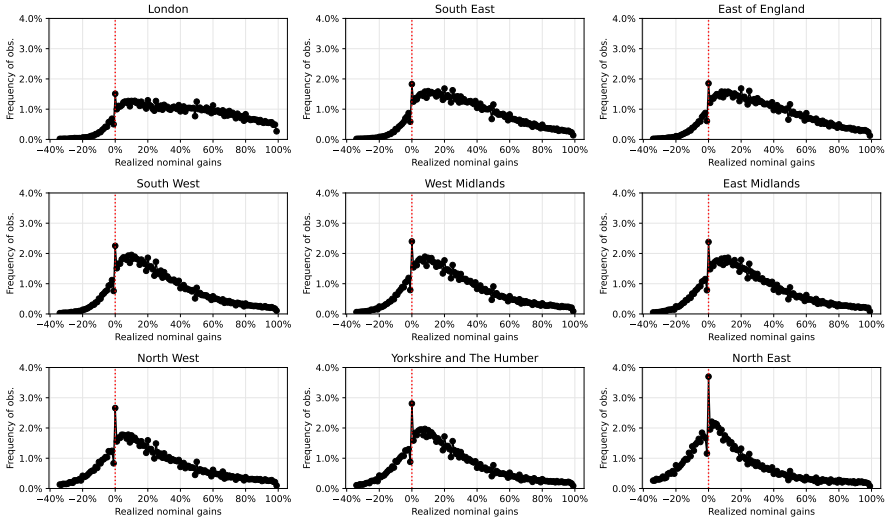
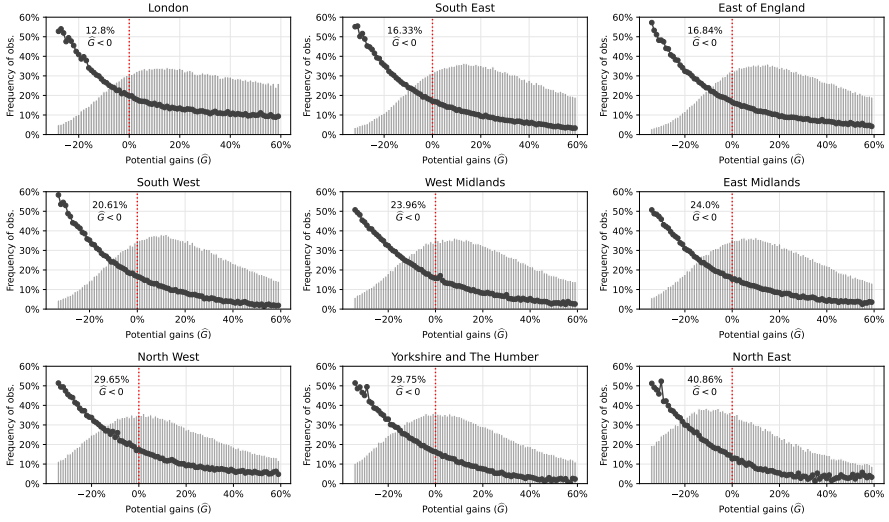
Realized losses vary across regions: U.K. evidence



“Paper losses” vary across regions. Consistent “hockey stick” pattern.



Show maps

What could “paper losses” indicate?

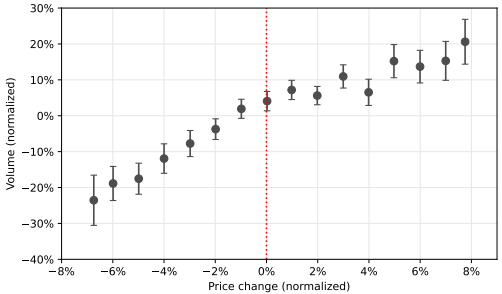
- At the individual (micro) level:
  - Sellers are unwilling to realize a loss.
  - Tolerate higher times-on-the-market (low selling probabilities).

- At the aggregate (macro) level:
  - Prices respond sluggishly to price-relevant shocks/policy interventions = Nominal rigidity.
  - Volumes absorb variation that would otherwise show up in prices.
  - In some regions: Low transaction volume = Behavioral lock-in.

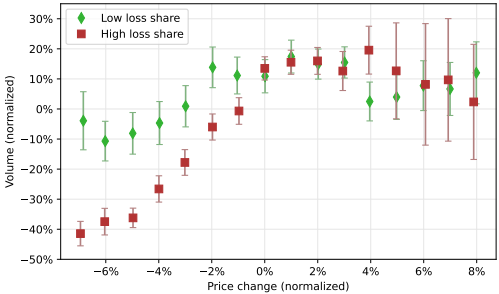
Share of “paper losses”: Interactive effect

- Calculate prices and volumes at the level of 35 ITL2 regions (UK) and states (USA), for the period between January 2010 and December 2022.

USA (Zillow)



UK (Rightmove)

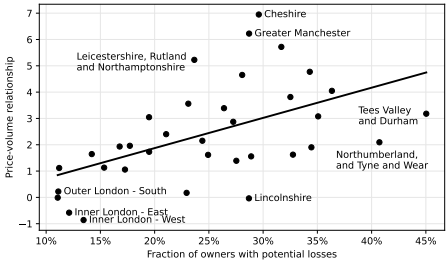


Note: Year-on-year price changes and volumes less location fixed effects.

Price-volume comovement depends on the “paper loss” share

- Calculate share of sellers with “paper losses” in each location.

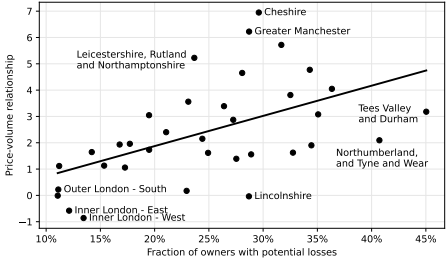
Full sample



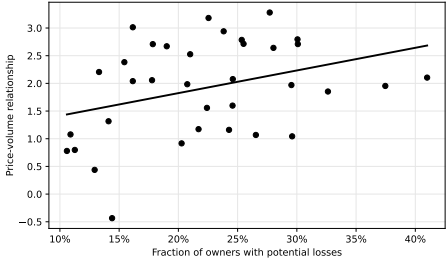
Price-volume comovement depends on the “paper loss” share

- Calculate share of sellers with “paper losses” in each location.

Full sample



Non-mortgage sample



Note: The non-mortgage sample refers to transaction volumes and “paper loss” shares computed using Land Registry transactions for which neither the buyer nor the seller are associated with a mortgage contract.

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Heterogeneous-agents setup with search and matching frictions

- **The seller's problem**:
  - Dynamically optimizing homeowner with reference price r and mortgage m draws moving opportunity shock, decides whether to list, and sets asking price in each period.
  - Upon a sale, utility has two components:
    - Behavioral: Reference dependence and loss aversion.
    - Financial: Tightness of down-payment constraint depends on current home equity position.
- **The buyer's problem:**
  - Forward-looking buyers search for properties.
  - Match rate given by the aggregate matching function (Badarinza et al., 2024b).
  - Upon a meeting, draw:
    - A taste shock and optimally choose whether to accept the offer.
    - A random mortgage balance calibrated to match Bank of England mortgage data.
- **Equilibrium:**
  - Endogenous distribution of reference prices and mortgage amounts.
  - Consistency between expectations, actions, and matching outcomes.

Model equations

Structural estimation

- Target well-studied micro-level empirical moments:
  - Unconditional probability of listing, and conditional probability of sale ("concave demand").
  - Listing premium by potential gain; listing premium by home equity.
- Structural parameters:
  - Estimate reference dependence $\eta = 0.51$ and loss aversion $\lambda = 3.46$.
  - Estimate moving and taste shock parameters.
- Generate model-implied (untargeted) aggregate moments:
  - Price-volume comovement.
  - Variation in price-volume comovement with share of "paper losses".

Mortgage interest by LTV

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Household welfare and the Laffer curve

- Consider two types of fiscal policy:
  - Transaction tax (flow-based).
  - Ongoing property tax (stock-based).
- Behavioral frictions affect the shape of the Laffer curve for ongoing property tax:
  - Prices are higher, and less sensitive to a tax change.
  - Higher level of revenue-maximizing tax rate.
- Need to account for buyer and seller surplus:
  - Denote by w the contribution of government tax revenue to total welfare and calculate the weighted sum of government revenue and total surplus.

    (Saez, 2001; Saez and Stantcheva, 2016; Anagol et al., 2024).

$$\text{Welfare} = w \cdot \underbrace{\text{Tax revenue}}_{\text{Laffer curve}} + (1 - w) \cdot \text{Total surplus} \tag{1}$$

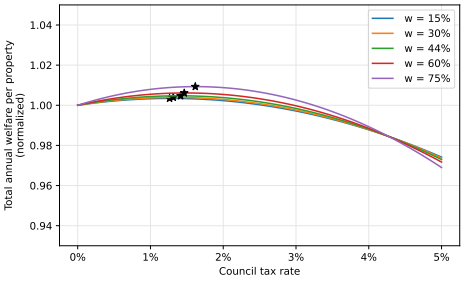
Effect of higher housing market taxes on welfare

	Frictionless model		Behavioral model
	Tax revenue	Total welfare	
Transaction tax	• Property values and transaction volumes decrease.	• Total welfare curve does not peak. • Governments can raise taxes since only small decline in transaction volumes.	• Higher tax revenue and lower surplus than frictionless. • Behavioral lock-in: Sellers and buyers reluctant to trade.
Ongoing property tax	• Large decline in property values. • But: Transaction volumes unaffected.	• Household surplus is not affected by the level of the tax rate. • Total welfare curve peaks because prices eventually decrease.	• Behavioral frictions make prices unresponsive; raise welfare- maximizing level of ongoing property taxes.

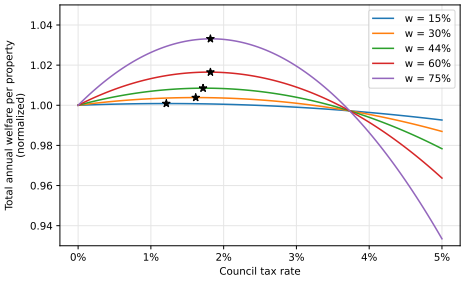
More details

Optimal level of ongoing property taxes

Frictionless model



Behavioral model



- Consider different welfare weights on government revenue (w).
- Behavioral frictions increase the welfare-maximizing level of the tax.

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“Entanglement” of preferences and beliefs

- Bunching patterns in the data could also arise from non-rational beliefs of households about the value of their houses.
- In a simple version of the model with reference dependent preferences á la Andersen et al. (2022), a seller has a choice between:
  - The utility realized from a successful sale, $u(P(\ell), R)$.
  - The utility of the outside option, $\underline{u}$.
- By assumption in the model (and structural estimation), the utility of the outside option is pegged at the hedonic price of the house ($\underline{u} = \hat{P}$) i.e. seller receives hedonic value of the house if they cannot sell.

“Entanglement” of preferences and beliefs

- Alternatively, the seller could value the outside option using the reference price, i.e. they might falsely believe the current value is a function of the initial price paid (e.g., think about someone who overpaid for their house).

- Interestingly, excess bunching could arise from a combination of the:

  - **Beliefs-based explanation**: Seller falsely believes the value of the house equals the initial price paid, and does not want to sell below that value.
    (Bordalo et al., 2018, 2021, 2022, 2024).

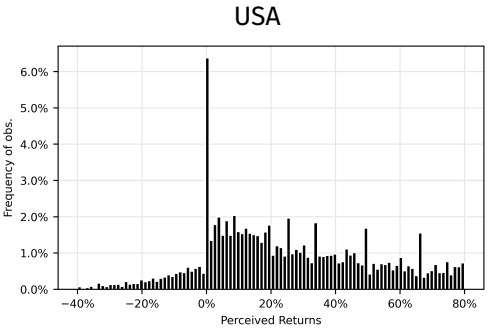
  - **Preference-based explanation**: Seller *objectively* weighs the hedonic price against the reference price, but derives utility from gains and losses.

- Recent work that tries to ascertain strength of behavioral channels analyses the responses of households to questions in expectations surveys.
  (Coibion and Gorodnichenko, 2015; Coibion et al., 2024).

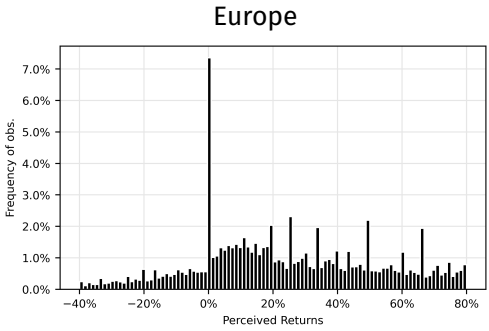
Data sources

- U.S. Federal Reserve Survey of Consumer Finances (SCF)
  - Pooled sample of 42,495 households across 8 survey years (2001-2022).
  - Data on initial purchase price of the primary residence of households, year of purchase and the perceived value of the residence in survey year.
- ECB Household Finance and Consumption Survey (HFCS)
  - Pooled sample of 243,754 households across 4 survey years (2010-2021) and Euro area countries.
  - Data on initial purchase price of the primary residence of households, year of purchase and the perceived value of the residence in survey year.
- Zillow data on state-level annual house price index for the U.S.
- OECD regional house price index data for the Netherlands.

Bunching in perceived returns

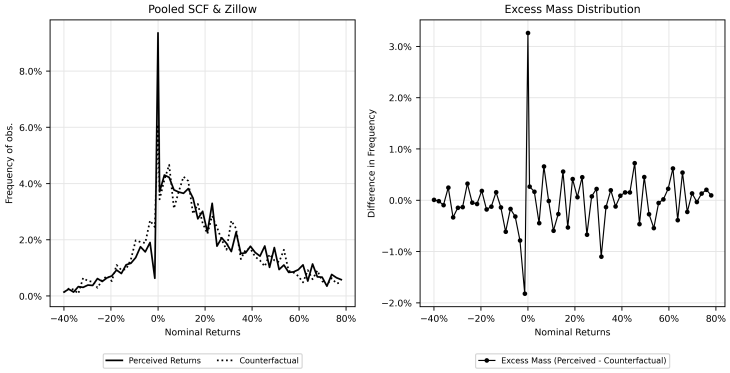


Source: Pooled SCF



Source: Pooled HFCS

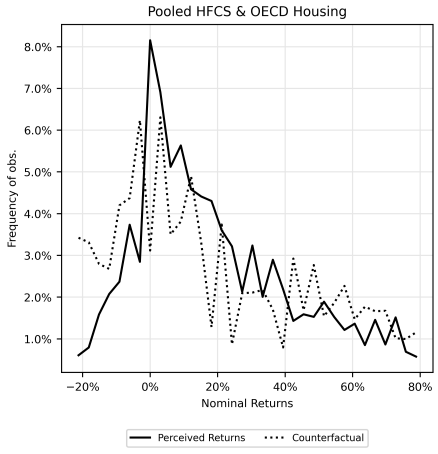
Excess bunching in perceived returns: USA (SCF)

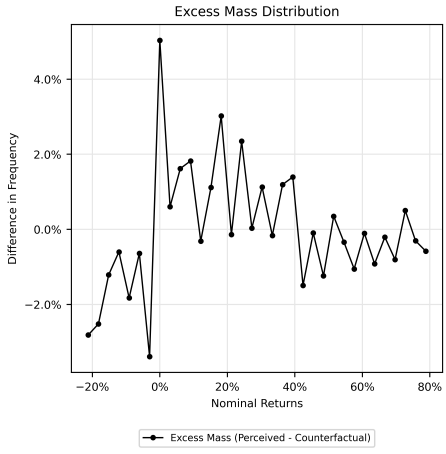


- Counterfactual nominal returns computed using regional house price indexes; estimated price appreciation between initial purchase year and time of the survey.

More details

Excess bunching in perceived returns: HFCS (Netherlands)



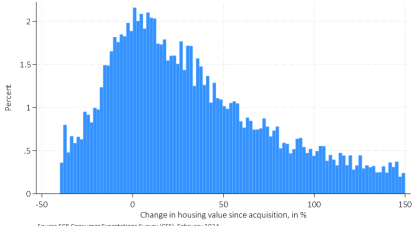


The ECB Consumer Expectations Survey

- High-frequency survey elicits individual estimates of households' perceived current value of their property. Self-reported initial acquisition price. Responses given by price ranges (bands).

Random value within range

(Diffuse bunching)



Mid-point of the range

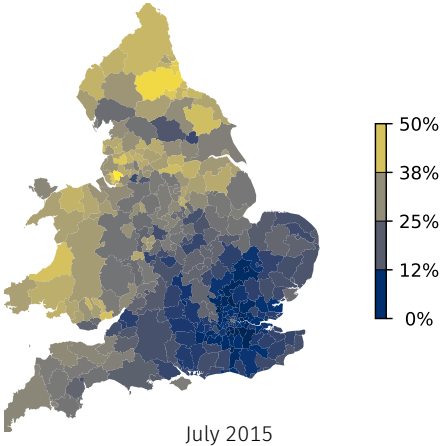
(Work in progress with Dimitris Georgarakos and Geoff Kenny.)

Conclusions

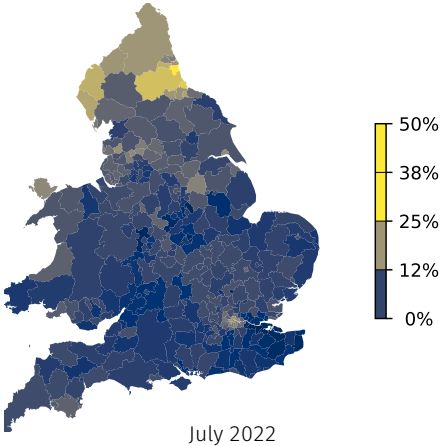
- Wide-spread evidence for nominal anchoring and loss aversion in housing market.
  - Identification at the individual level. Validated in multiple countries.
  - A new sufficient statistic to quantify aggregate (macro) impact: fraction of homeowners with "paper losses".
- Dynamic search-and-matching model of the housing market with behavioral frictions used to explain empirical findings.
  - Policy implications for tax design.
  - The "loss share" is an important determinant of tax policy impact.
  - Behavioral frictions increase the revenue-maximizing level of ongoing property taxes.
- Disentangling preferences and beliefs:
  - Novel results from surveys that elicit perceptions and expectations about property values.
  - Helps to inform required policy interventions to stimulate the housing market:
    - Information intervention?
    - Can we derive implications for the broader conduct of monetary policy?

Appendix

“Paper loss” shares vary both across regions and through time



July 2015



July 2022

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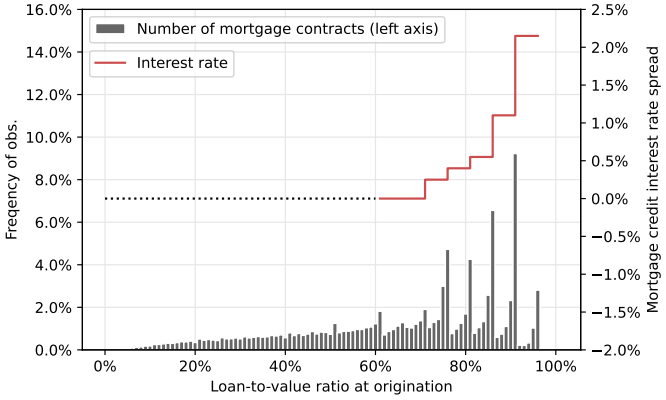
Mortgage costs higher for high LTVs

Loan-to-value ratio and mortgage spread at origination



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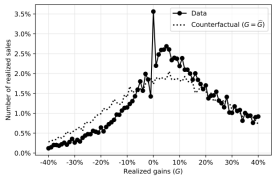
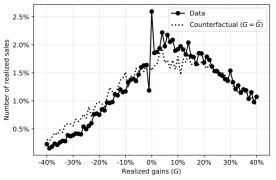
Excess bunching in the data - Even for long holding periods

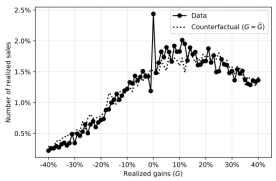
Below 3 years



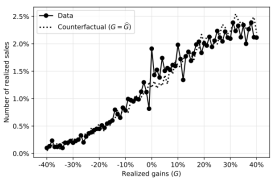
3–6 years



6–9 years



9–12 years



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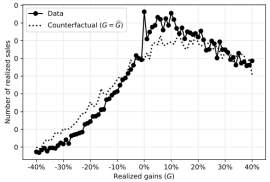
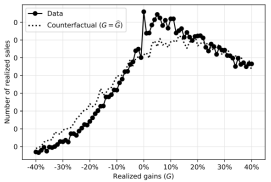
Excess bunching in the data - After removing certain round numbers

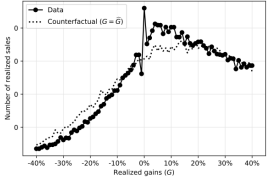
10,000 DKK



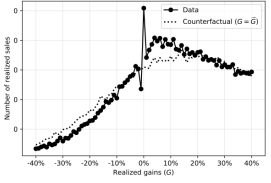
50,000 DKK



100,000 DKK



500,000 DKK



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Seller's problem

- Homeowner i with reference price r_i and mortgage m_{it} draws moving opportunity shock θ_{it}; decides whether to list, and sets asking price p_{it}.
  - Value function:

$$V_t^h(\theta_{it}, r_i, m_{it}) = \max\{ \max_{p_{it}} \underbrace{\alpha_t(p_{it})[U(\cdot) + \theta_{it} + \beta \mathbb{E}_t[V_{t+1}^b]]}_{\text{Listing success}} + \underbrace{(1 - \alpha_t(p_{it}))\beta \mathbb{E}_t[V_{t+1}^h(\cdot)]}_{\text{Listing failure}} - \phi, \underbrace{\mathbb{E}_t[\beta V_{t+1}^h(\cdot)]}_{\text{No listing}} \} + u_t - \tau^h. \tag{2}$$

  - Upon a sale, utility $U(p_{it}, r_i, m_{it}) + \theta_{it}$, where:

$$U(p_{it}, r_i, m_{it}) = p_{it} + \underbrace{\eta(p_{it} - r_i)_+ - \eta\lambda(p_{it} - r_i)_-}_{\text{Behavioral component}} - \underbrace{\mu(\gamma - (p_{it} - m_{it}))_+^2}_{\text{Downsizing penalty}}, \text{ with } \eta \geq 0, \lambda \geq 1.$$

- Equation (2) describes a threshold rule which gives rise to $\theta_t^*(\cdot)$.

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Search, matching, and buyer's problem

- Search and matching setup, where sellers N_{st} meet constant exogenous mass of buyers N_B at endogenous rate $\chi(q_t)$, where $q_t = N_B/N_{St}$.
  - Cobb-Douglas matching function $\chi(\cdot)$ with constant returns to scale (Badarinza et al, 2024).
- Upon meeting, buyer j draws match-specific taste shock ε_{jt}, and mortgage $m_{j,t+1}$.
  - Buyer's problem:

$$\max \left\{ \mathbb{E}_t[V^h_{t+1}(p_{it}, m_{j,t+1})] + \varepsilon_{jt} - p_{it} - \tau^b, \beta \mathbb{E}_t[V^b_{t+1}] \right\}. \tag{3}$$

- Buyers take into account future probabilities of meeting and full distribution of future prices (density function $\omega_t(p)$) they will face from sellers when making decisions.
- Equation (3) describes a threshold rule which gives rise to $\varepsilon^*_t(\cdot)$; real options problem.

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Equilibrium

- Consistency between expectations, actions, and matching outcomes:

$$\underbrace{\alpha_t(p)}_{\substack{\text{Probability of}\\ \text{transaction completion}}} = \underbrace{\chi(q_t)}_{\substack{\text{Probability that}\\ \text{seller meets a buyer}}} \times \underbrace{[1 - F_\varepsilon(\varepsilon_t^*(p))]}_{\substack{\text{Probability of acceptance}\\ \text{conditional on a meeting}}} . \tag{4}$$

- Endogenous distribution of reference prices and mortgage amounts:

$$\underbrace{f_{t+1}(r,m)}_{\substack{\text{Probability}\\ \text{density function}}} = \underbrace{f_t(r,m)}_{\text{Existing homeowners}} \times \underbrace{\left[1 - \int_{\theta_t^*(r,m)}^{\infty} \alpha_t(p_t(\theta))\, dF_\theta(\theta)\right]}_{\text{Non-sellers and failed sellers}}$$
$$+ \underbrace{N_{St} \times \omega_t(r) \times \alpha_t(r) \times f_m(m)}_{\text{New homeowners}} . \tag{5}$$

- In steady state $f_t(\cdot,\cdot) = f_{t+1}(\cdot,\cdot)$.

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Perceived nominal returns

- Perceived return is the household's "belief" about the nominal return on their primary residence since the time of initial purchase.
- We construct this measure using data from the household finance surveys on the reported initial purchase price, and the current perceived value of house (at the time of the survey).
- Plot distributions of perceived returns in the pooled samples of U.S. and European households.

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Counterfactual distribution of returns

- We also construct a distribution of counterfactual returns (dotted lines in left panel of Figures 21 and 22) using regional house price index data from Zillow for U.S. housing and OECD for Dutch housing.[1]
- This distribution serves as a proxy for the actual returns likely earned by the households in the survey.
- We compute counterfactual returns in the following manner:
  - The counterfactual return for each household in a region is the percentage change in the regional price index from the year of initial purchase to the survey year.
  - The distribution of counterfactual returns are constructed after taking into consideration the weights of each household's residence in each region which is the product of the population weight of the region with the survey weight of the household.

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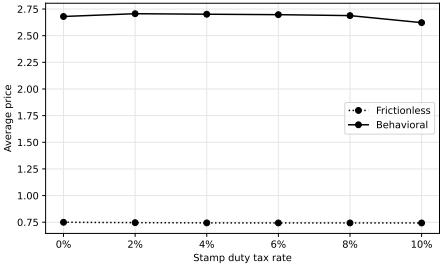
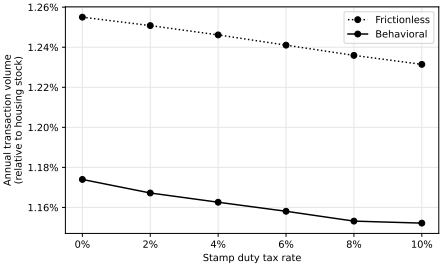
Effect of transaction tax on prices and volumes

Average transaction price



Transaction volume



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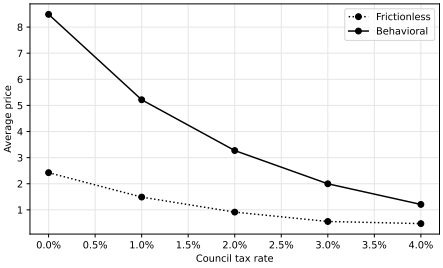
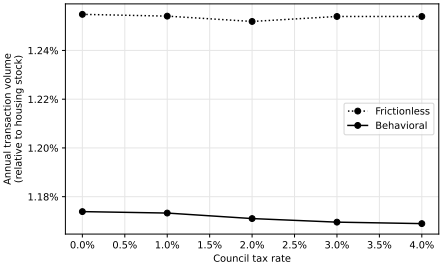
Effect of ongoing property tax on prices and volumes

Average transaction price



Transaction volume



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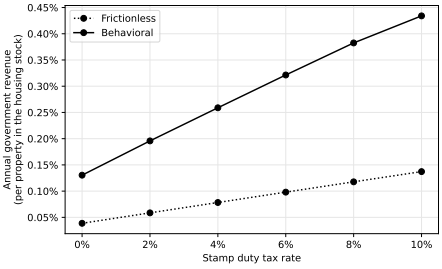
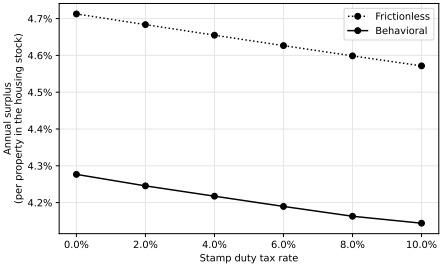
Effect of transaction tax on welfare

Tax revenue



Total surplus



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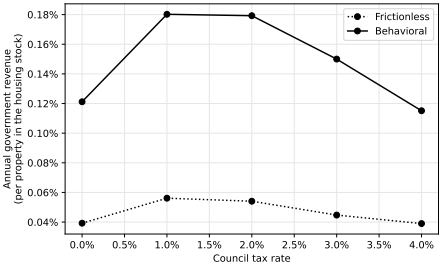
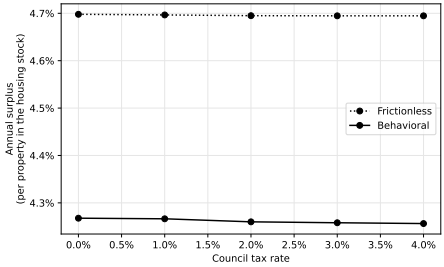
Effect of ongoing property tax on welfare

Tax revenue



Total surplus



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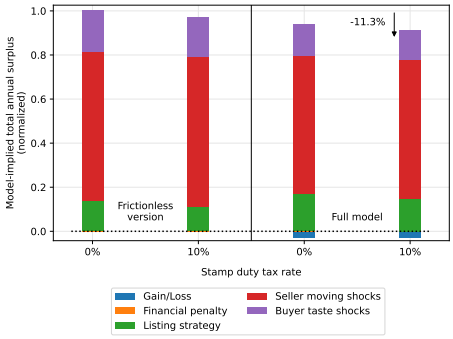
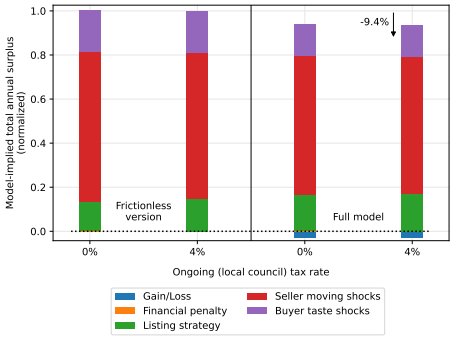
Total buyer and seller surplus in the model

- Quantify expected value of gains/losses, financial constraints, and the seller's trading surplus from "fishing" (listing strategy).

Stamp duty



Ongoing property tax



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