

Monetary Transmission Through the Housing Sector

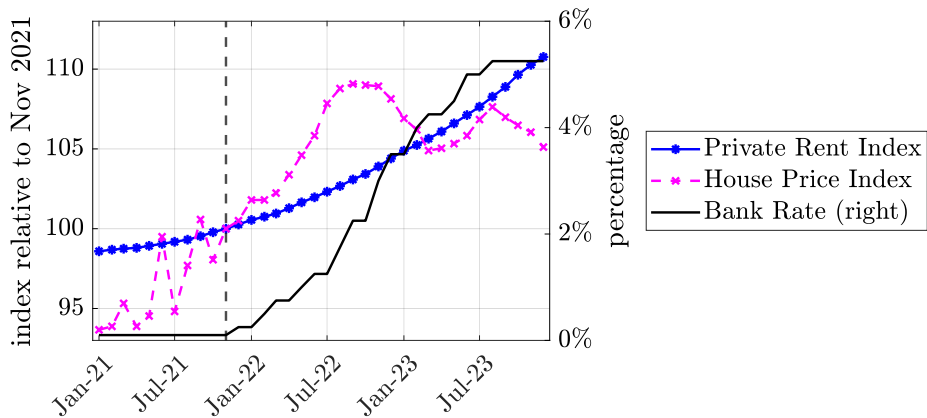
Daniel Albuquerque Thomas Lazarowicz Jamie Lenney

BoE Macro Brownbag

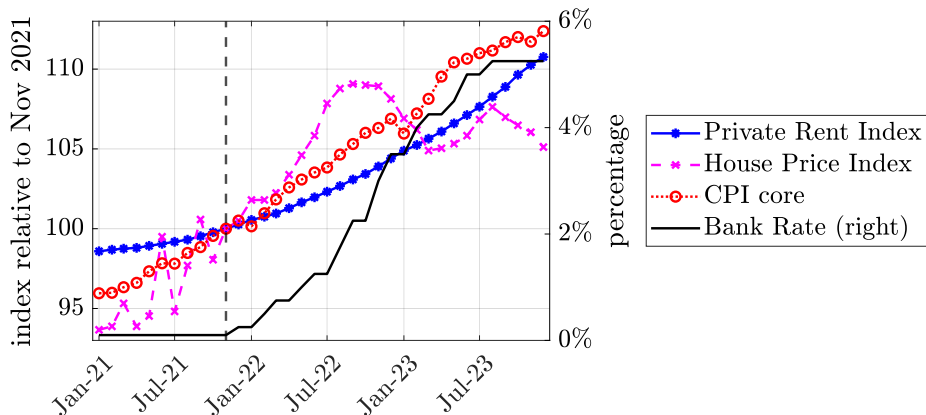
18 September 2024

The views expressed in this paper are those of the authors and do not represent those of the Bank of England.

Rents ↑ & house prices (?) since Nov/2021



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1. What is the impact of monetary policy on the housing sector?
2. Can we rationalise it in a HANK framework?

Motivation

- ▶ Housing/rents are usually either the biggest investment or biggest expense
→ an important channel of the monetary transmission mechanism
- ▶ Extensive literature has looked at house prices ...
- ▶ ...but other dimensions, in particular the rental sector, remain underexplored
 - especially in HANK models

Contributions

1. Empirical results for monetary policy shock in the UK:
 - i **house prices are slow to fall**, but magnitude is large
 - ii **rents are stable** for 1-2 years, then fall

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 - renter / owner-occupier / **private landlord**
 - match the model to the data
 - **sticky house price expectations** → i & ii

Contributions

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 - i **house prices are slow to fall**, but magnitude is large
 - ii **rents are stable** for 1-2 years, then fall
2. Build upon canonical HANK model: housing tenure
 - renter / owner-occupier / **private landlord**
 - match the model to the data
 - **sticky house price expectations** → i & ii
3. Answer policy questions
 - quantify the **housing channel of monetary policy**
 - **private landlords vs commercial** rental housing
 - *ongoing*: optimal policy response to rental market supply shock

Outline

1. **Empirical strategy**
2. **Empirical results**
3. **HANK model with housing**

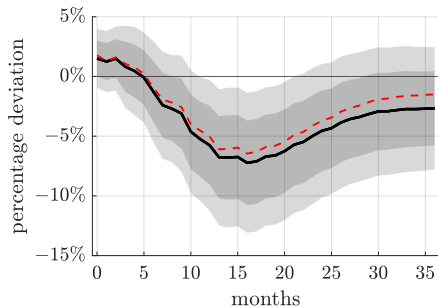
Empirical strategy

- ▶ Estimate a monthly VAR from 1997-2023, with dummies for the Covid period
- ▶ Baseline VAR with 6 variables: GDP, CPI core ex-rent, bank rate, mortgage spread, FTSE and house prices
 - whenever there is need for another variable, it's 6 + 1 VAR
- ▶ Use target factor from Braun et al. (2024) as instrument for bank rate

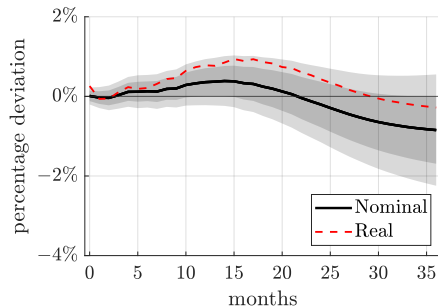
◀ baseline IRFs

Empirical results

House prices: prolonged decline; rents: stable for at least year



(A) House prices



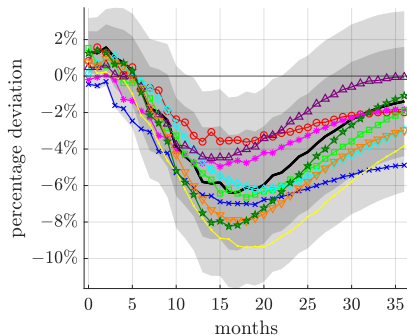
(B) Rents

Figure IRFs to 1p.p. monetary policy shock

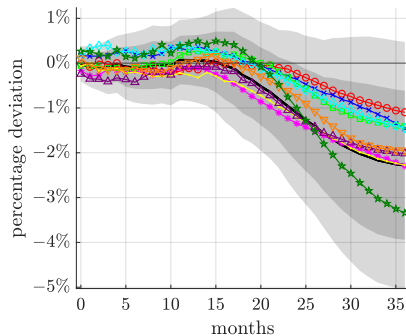
◀ 1997-2019

◀ 2005-2023

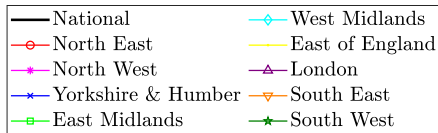
Regional responses: some variation, mostly robust



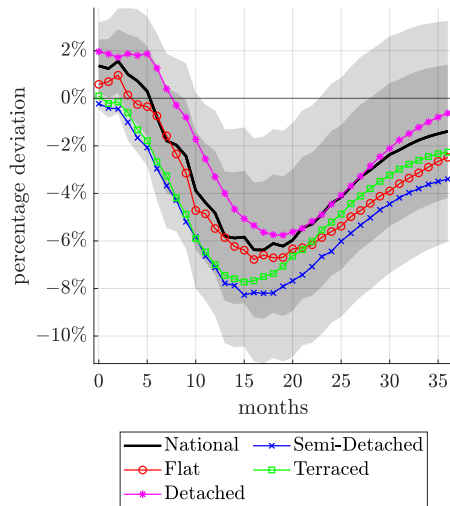
(A) Regional house prices



(B) Regional rents

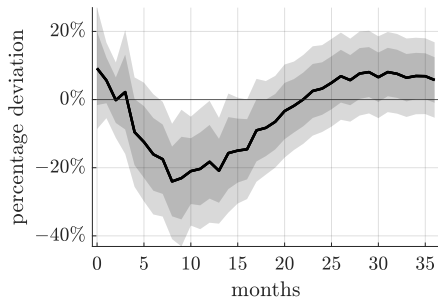


Dwelling types: similar co-movement

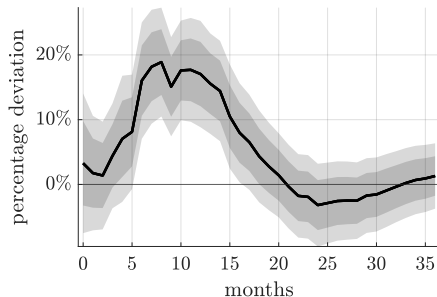


→ prices across regions and types react in the same way → single p_h

Sales and stocks: reduced activity for at least one year



(A) Sales volume



(B) Stock of unsold houses

- prices fall, but not as much to keep activity in housing market

Model

Housing market

- ▶ HANK model, with 2 assets: financial wealth and housing
 - flats H_1 and houses H_2 , $H_2 > H_1$, only flats can be rented
 - renters r , owner occupiers oo , or landlords ll
 - borrowing against your home(s) subject to LTV/LTI constraints
 - short-run analysis: fixed housing supply
 - sticky rental transitions with probability $\theta_r = 0.25$

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 - borrowing against your home(s) subject to LTV/LTI constraints
 - short-run analysis: fixed housing supply
 - sticky rental transitions with probability $\theta_r = 0.25$
- ▶ Equilibrium in the housing market

$$\bar{H} = H_1(s_{r,t} + s_{ooF,t}) + H_2(s_{oo,t} + s_{ll,t})$$

- ▶ Equilibrium in the rental market

$$H_1 s_{r,t} = H_1 s_{ll1,t} + 2H_1 s_{ll2,t} + \overline{HA}$$

- Passive price taking housing association \overline{HA} to match the share of renters

Households

- ▶ Choose their transition $h_t : \{r, oo, ll\} \rightarrow \{r, oo, ll\}$ subject to:
 1. costs to each transition (financial & utility) \rightarrow match transition rates
 2. idiosyncratic taste shocks \rightarrow transition solution continuous on the state-space

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- ▶ Get utility from consumption c , from the house they live in H , disutility from labour l , and extra utility ω_{oo} if owner of their home

$$u(c, H, l) = \frac{(c^{1-\phi_h} x(H)^{\phi_h})^{1-\sigma_c}}{1-\sigma_c} - \phi_l \frac{l^{1+\psi_l}}{1+\psi_l}, \quad x(H) = H(1 + \omega_{oo} \mathbf{1}_{oo})$$

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- Constraints:

$$a_{t+1} + c_t + C_h(p_{h,t}, p_{r,t}, h_t) = (1 + r_t + \mathbf{1}_{a_t < 0} \bar{r}) a_t + z_{i,t} w_t l_t (1 - \tau) + \Pi(z_t)$$

$$a_{t+1} \geq \bar{a}(h_t, p_{h,t}, z_t, w_t, l_t)$$

Expectations

- ▶ Sticky information: **households readjust their forecasts of prices with prob.** θ_{SE}
 - long literature: Gabaix and Laibson (2001), Mankiw and Reis (2002), Sims (2003)
 - Auclert et al. (2020), Carroll et al. (2020): key for matching IRFs of macro variables
- ▶ Contribution: **specific probability** θ_{SE, p_h} **for house prices** p_h
 - ↑ households pay more attention to prices that are more important
 - ↓ behavioural traits due to their purchase prices and capital gains expectations

Expectations

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- ▶ Contribution: **specific probability θ_{SE, p_h} for house prices p_h**
 - ↑ households pay more attention to prices that are more important
 - ↓ behavioural traits due to their purchase prices and capital gains expectations
- ▶ Evidence on expectations on house prices?
 - a lot evidence that house price expectations are not rational
 - expectations (short-term) seem to be sluggish: Adam et al. (2024), Armona et al. (2018), Case et al. (2012)
 - lack of evidence on what happens after monetary policy shock
 - **estimate through IRF matching**

House price expectations: RICS - professional surveyors

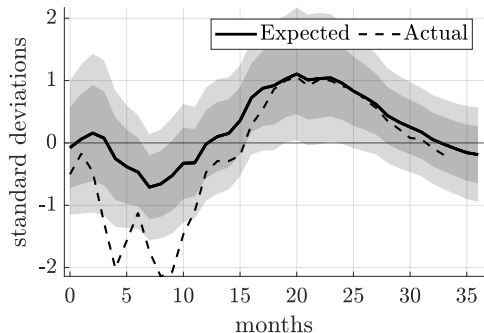


Figure 3 3 months house price growth: expected vs actual

- ▶ RICS net balance measure: % that think \uparrow - % that think \downarrow
 - measure of extensive rather than intensive margin of price expectations
- ▶ both variables are normalised for comparison

Rest of the model

1. Monopolistic competition for intermediate goods firms, with: $y_{j,t} = n_{j,t}$
2. Phillips curve for prices/wages, due to adjustment costs of firms/unions
3. Taylor rule for monetary policy
4. Labour tax adjusts to keep debt to gdp ratio stable in the long run

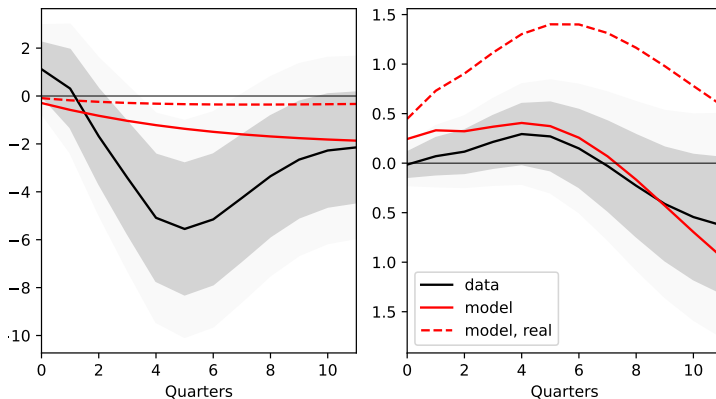
1. Estimated labour income process with transitory and persistent components
2. Internally calibrated parameters

| Targeted Moment | Model | Data | Parameter | Source |
|---|-------|-------|---------------------------------|--------------|
| Ann. Debt to GDP | 0.69 | 0.65 | β | ONS |
| Share of Renters | 0.38 | 0.33 | $\phi_h, \omega_{oo}, p_{r,ss}$ | EHS (97-23) |
| Share of Flat Owners | 0.08 | 0.10 | $\phi_h, \omega_{oo}, p_{r,ss}$ | EHS (97-23) |
| Share of Landlords | 0.06 | 0.06 | $\phi_h, \omega_{oo}, p_{r,ss}$ | WAS (08-20) |
| Annual rate $oo \rightarrow r$ | 0.008 | 0.008 | η_m | EHS (97-23) |
| Annual rate $LL(n) \rightarrow LL(n-1)$ | 0.16 | 0.10 | η_{ll} | EPLS (97-23) |

3. Untargeted Moments:

| Moment | Model | Data | Source |
|---------------------------------------|-------|------|-------------|
| Housing Wealth to Financial Net Worth | 7.2 | 7.0 | WAS (08-20) |
| Top 10 pct. Total Wealth Share | 0.30 | 0.48 | WAS (08-20) |
| Share of Homeowners with Mortgage | 0.48 | 0.53 | EHS (97-23) |
| Share of Landlords with Mortgage | 0.12 | 0.57 | WAS (07-20) |
| Avg Rent to Renter Disposable Income | 0.28 | 0.33 | EHS (97-23) |

IRF Matching

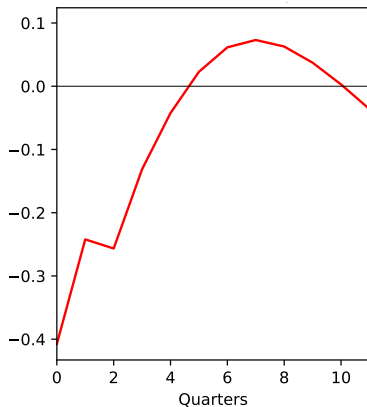


(A) House prices

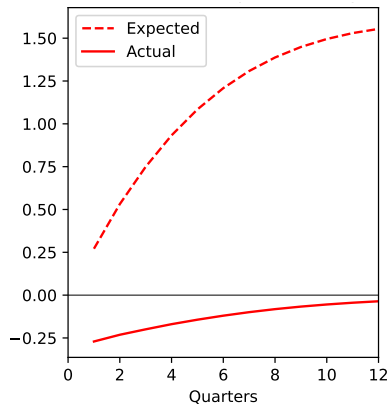
(B) Rents

► $\theta_{SE} = 0.08 > 0.01 = \theta_{SE, p_h}$: **house prices are updated less frequently**

Untargeted IRFs

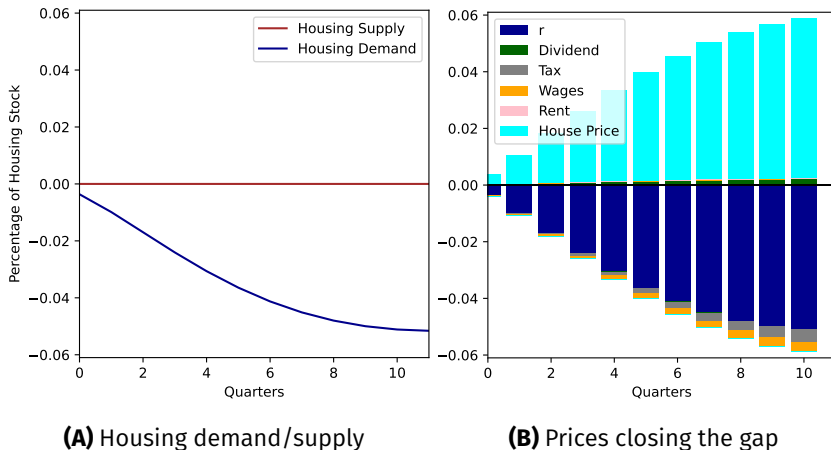


(A) Sales volume



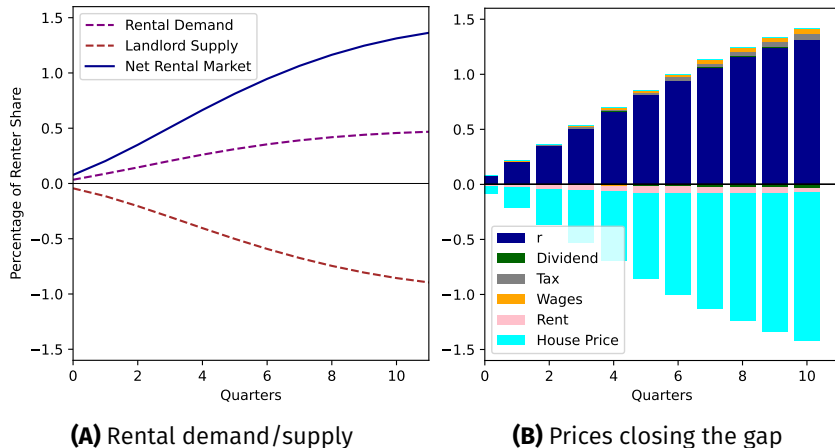
(B) House price changes:
quarter ahead-on-quarter growth

Housing market equilibrium after interest rate shock



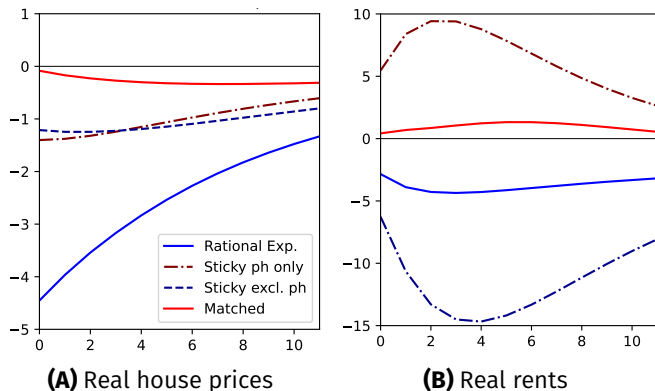
- ▶ Partial equilibrium response: $\bar{H} = \uparrow H_1(s_{r,t} + s_{ooF,t}) + \downarrow H_2(s_{oo,t} + s_{ll,t})$
- ▶ To close the gap **house prices dominate** → lower cost + capital gains

Rental market equilibrium after interest rate shock



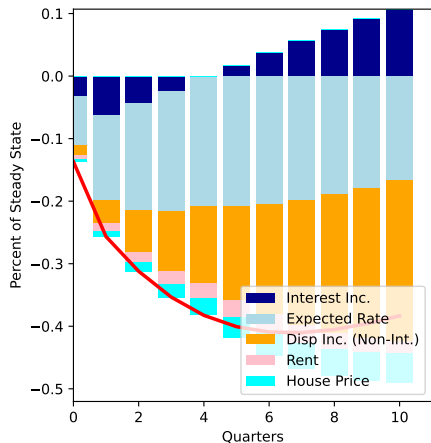
- ▶ Partial equilibrium response: $\uparrow H_1 s_{r,t} = \downarrow H_1 s_{ll1,t} + \downarrow 2H_1 s_{ll2,t} + \overline{HA}$
- ▶ **House prices still dominate** in GE \rightarrow high price/income + lumpy investment

Role of sticky expectations

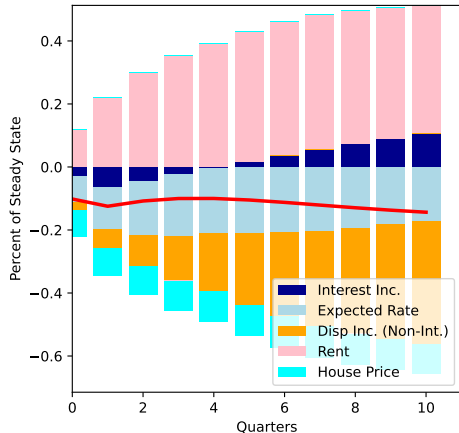


- ▶ RE: transaction costs, borrowing constraints, heterogeneity are not enough
- ▶ Sticky house price expectations:
 - key to generate slow response of prices and rent
 - house prices fall less because they are expected to increase by more

Policy I: consumption decomposition



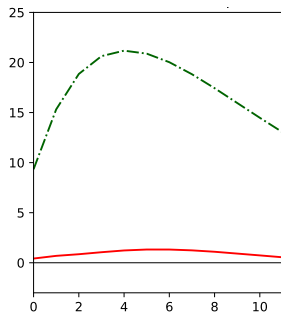
(A) $\theta_{SE,ph} = 0.01$



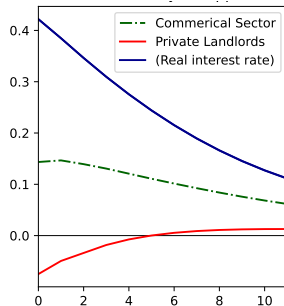
(B) $\theta_{SE,ph} = 1$

- housing channel is less relevant with sticky house price expectations

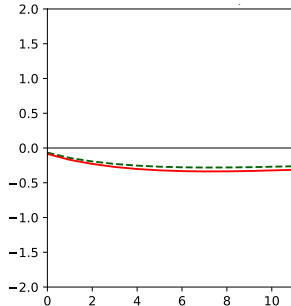
Policy II: commercial vs private landlords



(A) Rents



(B) Rental yield



(C) House prices

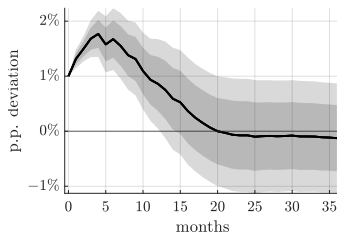
- ▶ Commercial sector borrows from banks and purchases rental housing $H_{CR,t}$
- ▶ Rents have limited impact on the (non-rental) housing market
- ▶ Higher pass-through of interest rates to rents

◀ Price Rents

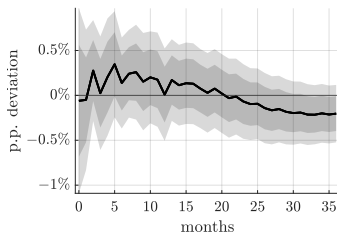
Conclusion

1. empirical evidence on the response of UK housing market to monetary policy shock
 - house prices show prolonged fall
 - rents are stable for a year
2. built a HANK + housing tenure model
 - housing tenure, including private landlords
 - sticky house price expectations
3. policy exercises:
 - housing channel less strong with sticky expectations
 - commercial rental sector increases pass-through to rents
 - *optimal monetary policy to rental shock*

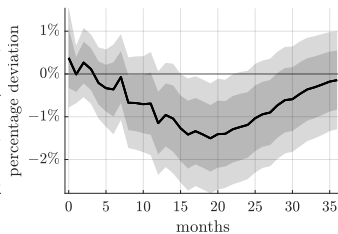
IRFs for baseline VAR

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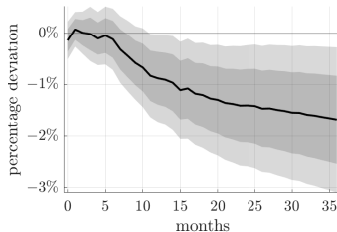
(A) Bank Rate



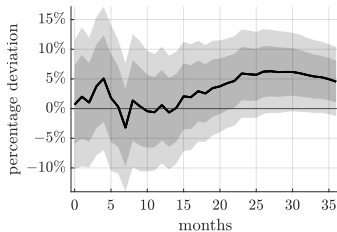
(B) Mortgage spread



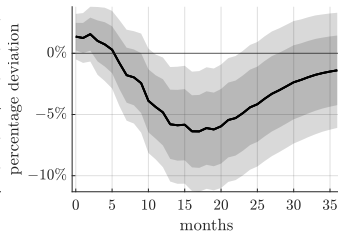
(C) GDP



(D) CPI core

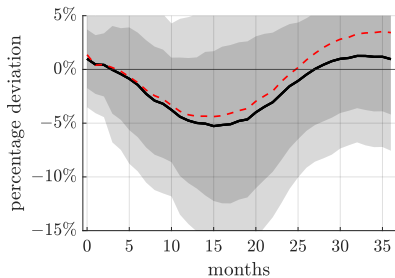


(E) FTSE

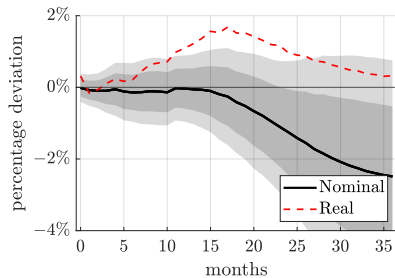


(F) House prices

House prices and rents: 2005-2023

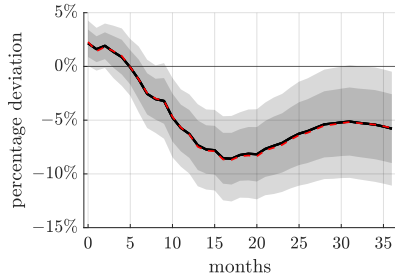


(A) House prices

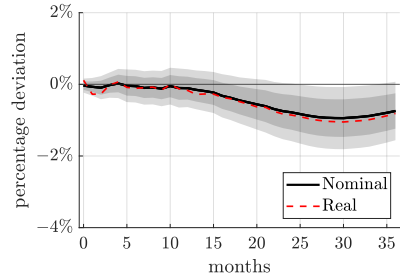


(B) Rents

House prices and rents: 1997-2019

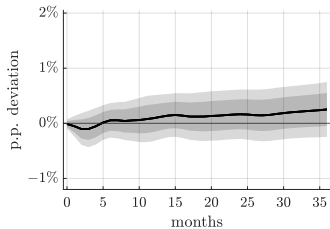


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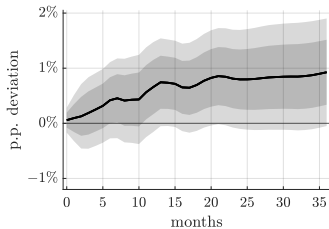


(B) Rents

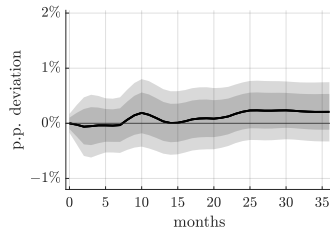
Renter share in the LFS

[◀ back](#)

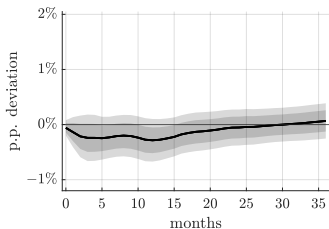
(A) Total



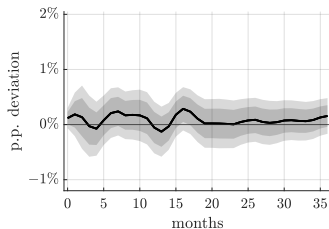
(B) 20 to 35 years



(C) 36 to 50 years



(D) 51 to 65 years



(E) 65+ years

Housing consumption costs: details

| Transition | C_h | \bar{a} |
|-------------|--|---|
| OOH - OOH | $-\delta_h H_2$ | $\min(a, \max(-\kappa_h p_h H_2, -\kappa_y y))$ |
| OOH - OOF | $-p_h(H_1 - H_2) - 2F - \delta_h H_1$ | $\max(-\kappa_h p_h H_1, -\kappa_y y)$ |
| OOH - Rent | $p_h H_2 - F - p_r^*$ | 0 |
| OOH - LL | $-p_h H_1 - F + p_r^* - \delta_h(H_1 + H_2)$ | $\max(-\kappa_h(p_h(H_1 + H_2), -\kappa_y y - \kappa_h H_1 p_h))$ |
| OOF - OOF | $-\delta_h H_1$ | $\min(a, \max(-\kappa_h p_h H_1, -\kappa_y y))$ |
| OOF - OOH | $-p_h(H_2 - H_1) - 2F - \delta_h H_2$ | $\max(-\kappa_h p_h H_2, -\kappa_y y)$ |
| OOF - Rent | $p_h H_1 - F - p_r^*$ | 0 |
| Rent - OOF | $-p_h H_1 - F - \delta_h H_1$ | $\max(-\kappa_h p_h H_1, -\kappa_y y)$ |
| Rent - Rent | $-p_{r,i}$ | 0 |
| LL - OOH | $H_1 p_h - F - \delta_h H_2$ | $\min(a + p_h H_1 - F, \max(-\kappa_h p_h H_2, -\kappa_y y))$ |
| LL - LL | $p_{r,i} - \delta_h(H_2 + H_1)$ | $\min(a, \max(-\kappa_h p_h(H_1 + H_2), -\kappa_h p_h H_1 - \kappa_y y))$ |
| LL - LLx2 | $-H_1 p_h + 2p_{r,i} - F - \delta_h(H_2 + 2H_1)$ | $\min(a, \max(-\kappa_h p_h(2H_1 + H_2), -\kappa_h 2p_h H_1 - \kappa_y y))$ |
| LLx2 - LLx2 | $2p_{r,i} - \delta_h(H_2 + 2H_1)$ | $\min(a, \max(-\kappa_h p_h(2H_1 + H_2), -\kappa_h 2p_h H_1 - \kappa_y y))$ |
| LLx2 - LL | $H_1 p_h + p_{r,i} - F - \delta_h(H_2 + H_1)$ | $\min(a + H_1 p_h - F, \max(-\kappa_h p_h(H_1 + H_2), -\kappa_h p_h H_1 - \kappa_y y))$ |

Externally calibrated parameters

| Parameter | Value | Source |
|-----------------------------------|--|----------------------------------|
| Frisch | 0.5 | Auclert et al. (2021) |
| EIS | 0.5 | Auclert et al. (2021) |
| Steady state markup | 1.2 | Auclert et al. (2021) |
| Borrowing wedge $\bar{r}(ann)$ | 0.0126 | EHS (97-23) 2yr 75pct LTV |
| Transaction cost \bar{H} | $0.02p_{h,ss}$ $\frac{p_{h,ss}}{\bar{y}} = 6.3$ | Halifax EHS (97-23) |
| Loan to value max κ_h | 0.90 | PSD 90 th pctile; FTB |
| Loan to income max κ_y | 4.5 | PSD 90 th pctile; FTB |
| Rental price adj. prob θ_r | 0.25 | 1 year contract |

Parameters used for IRF matching

| Parameter | IRF matched value |
|---|-------------------|
| Price Philips Curve κ_p | 0.199 |
| Wage Philips Curve κ_w | 0.046 |
| Fiscal rules (debt stab.) | 0.034 |
| Taylor rule $(\phi_\pi, \phi_y, \rho_m)$ | 2.42, 0.028, 0.96 |
| Price forecast adj. prob θ_{SE} | 0.08 |
| House price forecast adj. prob θ_{SE, p_h} | 0.01 |

Estimated labour income parameters

Persistent $z_{1,i}$ and transitory $z_{2,i}$ components

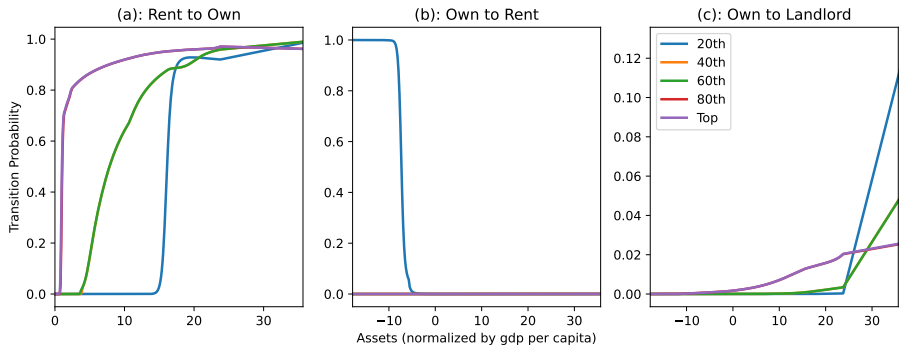
$$z'_i = z_{1,i} + z_{2,i}$$

where

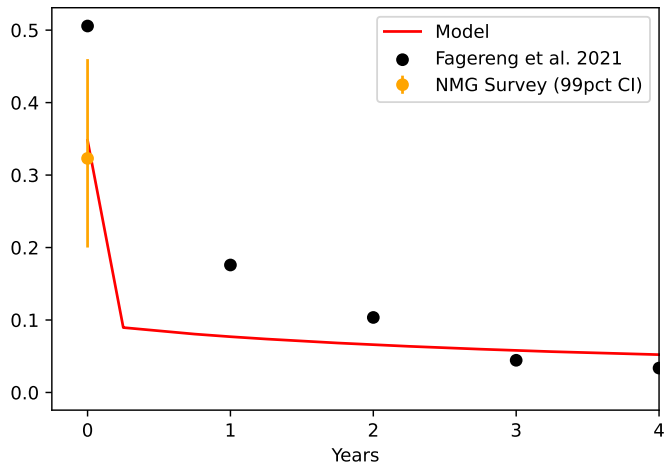
$$z'_{j,i} = \rho_{j,z} z_{j,i} + \epsilon_{j,z}, \quad \epsilon_{j,z} \sim N(0, \sigma_{j,z}^2)$$

| Moment | Value | Parameter | Source |
|--|-------|--|--------------------|
| Cross sectional labour income std. dev | 0.66 | $\rho_{z,1}, \rho_{z,2}, \sigma_{z,1}^2, \sigma_{z,2}^2$ | Bell et al. (2022) |
| One year earnings change std. dev | 0.19 | $\rho_{z,1}, \rho_{z,2}, \sigma_{z,1}^2, \sigma_{z,2}^2$ | Bell et al. (2022) |
| Five year earnings change std. dev | 0.38 | $\rho_{z,1}, \rho_{z,2}, \sigma_{z,1}^2, \sigma_{z,2}^2$ | Bell et al. (2022) |
| 90-10 ratio | 4.66 | $\rho_{z,1}, \rho_{z,2}, \sigma_{z,1}^2, \sigma_{z,2}^2$ | Bell et al. (2022) |

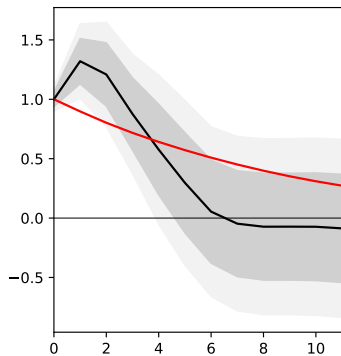
Transition Probabilities



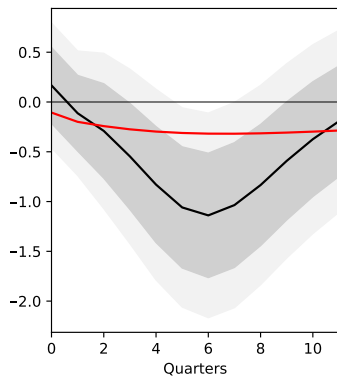
Average Household iMPCs



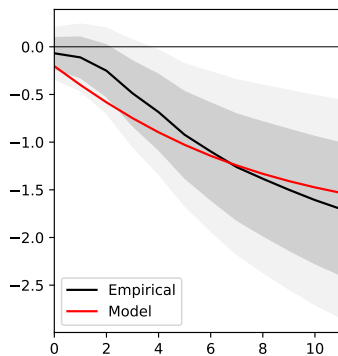
IRF Matching: macro variables



(A) Interest rate



(B) GDP



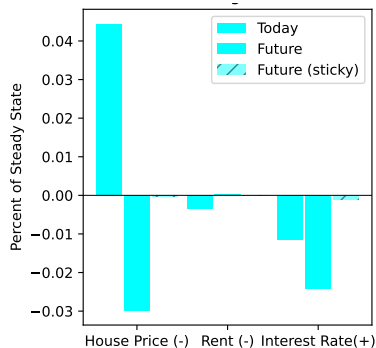
(C) CPI

Commercial Sector Pricing

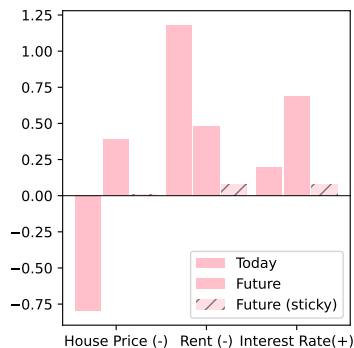
- ▶ Commercial sector can borrow from bank and purchase rental housing.
- ▶ Subject to fixed costs to make price same in steady state
- ▶ Same contract constraints as private landlords.
- ▶ Any profits (unexpected capital gains on housing) distributed with aggregate dividends
- ▶ Sets marginal price as follows.

$$\begin{aligned} Vr_{1,\tau,t} &= H_1 \delta_h + \frac{1}{1+r_{t+1}} (r_{t+1} p_{h,\tau} + (p_{h\tau} - p_{h,t+1}) \theta_r) H_1 + \frac{1-\theta_r}{1+r_{t+1}} Vr_{1,\tau,t+1} \\ Vr_{2,\tau,t} &= 1 + \frac{1-\theta_r}{1+r_{t+1}} Vr_{2,\tau,t+1} \\ p_{r,t} &= \frac{Vr_{1,\tau,t}}{Vr_{2,\tau,t}} + F_{cm} \end{aligned} \tag{1}$$

Sticky expectations mute the effects of future prices

[◀ back](#)

(A) Net rental demand

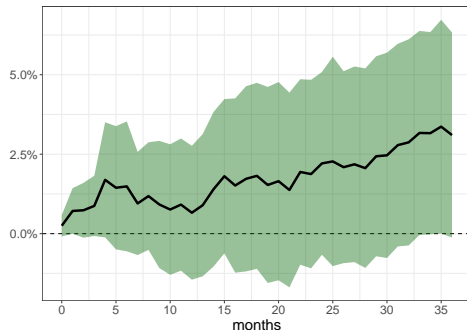


(B) Net housing demand

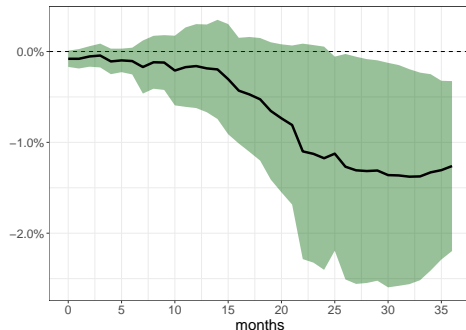
► need to add text

- However, higher p_h today $\rightarrow \uparrow$ rental demand, with a higher multiplier than that of future rents: $\rightarrow \uparrow$ rents for market clearing

Do expectations matter? [NOT USED ANYMORE]



(A) House prices



(B) Rents

- Panel Local Projection, interacting regional house price expectations ($x_{i,t}$) with monetary policy shock (s_t), for $y_{i,t}$ = house prices, rents.

$$y_{i,t+h} - y_{i,t} = \alpha_{i,h} + \alpha_{t,h} + \beta_h s_t x_{i,t} + \sum_{p=0}^{12} \delta_{p,h} x_{i,t-p} + \sum_{p=1}^{12} \phi_{p,h} y_{i,t-p} + u_{i,t,h}$$