Monetary Transmission Through the Housing Sector

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RES Conference, June 2025

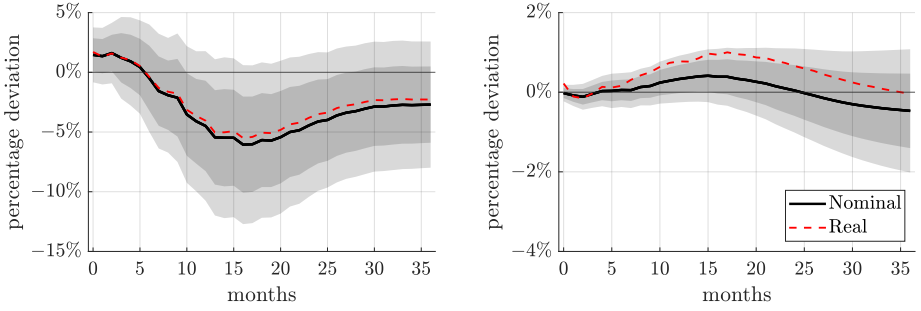
Recent period drew increased scrutiny to housing/rental market and effect of monetary policy.

- Limited empirical evidence base beyond house price and rent:price ratio.
- HANK literature not yet incorporated housing element.

Contributions

1. Empirical results for monetary policy shock in the UK:
   - i **house prices are slow to fall**, but magnitude is eventually large
   - ii **rents are stable** for 1-2 years, then fall
   - iii **Sales fall** for 1-2 years
2. Build upon canonical HANK model: housing tenure
   - renter / owner-occupier / **private landlord**
   - match the model to the data
   - **sticky and extrapolative house price expectations → i & ii**
3. Study Housing and monetary policy transmission
   - quantify the **housing channel of monetary policy** [quite large]
   - **private landlords vs commercial** rental housing [private landlords reduce trade off]
   - Policy response to rental market supply shock [Look through rental price] ▸ Fig.

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



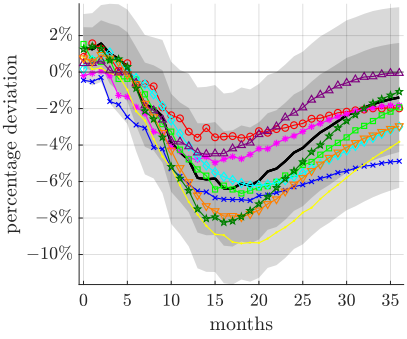
(A) House prices **(B)** Rents

Figure IRFs to 1p.p. Bank Rate shock

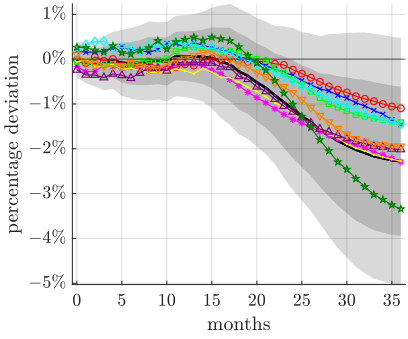
- Estimate a monthly VAR from 1997-2023, with dummies for the Covid period. ◂ IRFs
- Baseline VAR with 6 variables: GDP, CPI core ex-rent, bank rate, mortgage spread, FTSE and house prices
- Use target factor from Braun et al. [2024] as instrument for bank rate

Regional responses: clear Macro Response

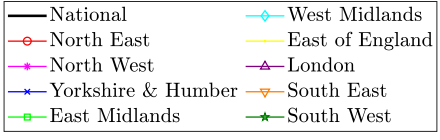
◂ Dwellings



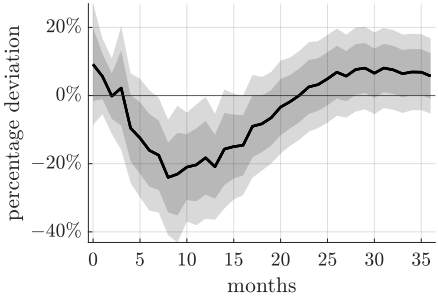
(A) Regional house prices



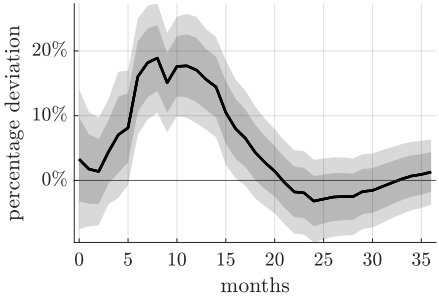
(B) Regional rents



Sales and stocks: reduced activity for at least one year



(A) Sales volume



(B) Stock of unsold houses

- p_h fall not enough to maintain activity in housing market

HANK Model with a 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 $\theta_r = 0.25$
- Novel Market Clearing Condition in Rental Market

$$\underbrace{s_{r,t}}_{\text{HH Rental Demand}} = \underbrace{\int is_{ll,i,t} di}_{\text{HH Rental Supply}}$$

- Household are inattentive and over-extrapolate as in Kohlhas and Walther [2021] (depart from RE) ▸ Empircal.
- Rest of Model standard: Price/Wage PC, Fiscal rule, Taylor rule...
  - Steady Sate of Model calibrated to relevant UK moments for housing, income. ▸ Calibration
  - Solved in sequence space (Auclert et al. [2021]) with upper envelope EGM method (Iskhakov et al. [2017].

HANK Model with a Housing Market

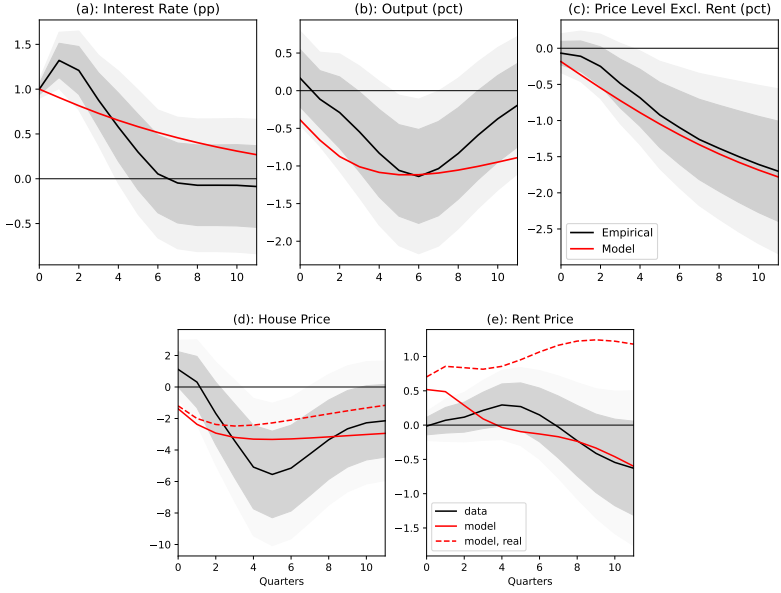
$$a' + c + C_h(p_h, p_r, p_r^*, h') = (1 + r + \mathbf{1}_{a<0}\bar{r})a + zwl(1-\tau) + \Pi(z),$$
$$a' \geqslant \bar{a}(h', p_h, z, w, l)$$

Transition	$-C_h$	$\bar{a}$
Own H - Own H	$-\delta_h H_2$	$\min(a, \max(-\kappa_h p_h H_2, -\kappa_y y(z)))$
Own H - Own F	$-p_h(H_1 - H_2) - 2F - \delta_h H_1$	$\max(-\kappa_h p_h H_1, -\kappa_y y(z))$
Own H - Rent	$p_h H_2 - F - p_r^*$	0
Own H - LL	$-p_h H_1 - F + p_r^* - \delta_h(H_1 + H_2)$	$\max(-\kappa_h p_h(H_1 + H_2), -\kappa_y y(z) - \kappa_h H_1 p_h)$
Own F - Own F	$-\delta_h H_1$	$\min(a, \max(-\kappa_h p_h H_1, -\kappa_y y(z)))$
Own F - Own H	$-p_h(H_2 - H_1) - 2F - \delta_h H_2$	$\max(-\kappa_h p_h H_2, -\kappa_y y(z))$
Own F - Rent	$p_h H_1 - F - p_r^*$	0
Rent - Own F	$-p_h H_1 - F - \delta_h H_1$	$\max(-\kappa_h p_h H_1, -\kappa_y y(z)))$
Rent - Rent	$-p_{r,i}$	0
LL - Own H	$H_1 p_h - F - \delta_h H_2$	$\min(a + p_h H_1 - F, \max(-\kappa_h p_h H_2, -\kappa_y y(z)))$
LL - LL	$p_{r,i} - \delta_h(H_2 + H_1)$	$\min(a, \max(-\kappa_h p_h(H_1 + H_2), -\kappa_h p_h H_1 - \kappa_y y(z))$
LL - LL x2	$-H_1 p_h + 2p_r^* - F - \delta_h(H_2 + 2H_1)$	$\max(-\kappa_h p_h(2H_1 + H_2), -\kappa_h 2 p_h H_1 - \kappa_y y(z))$
LL x2 - LL x2	$2p_{r,i} - \delta_h(H_2 + 2H_1)$	$\min(a, \max(-\kappa_h p_h(2H_1 + H_2), -\kappa_h 2 p_h H_1 - \kappa_y y(z)))$
LL x2 - LL	$H_1 p_h + p_r^* - F - \delta_h(H_2 + H_1)$	$\min(a + H_1 p_h - F, \max(-\kappa_h p_h(H_1 + H_2), -\kappa_h p_h H_1 - \kappa_y y(z)))$

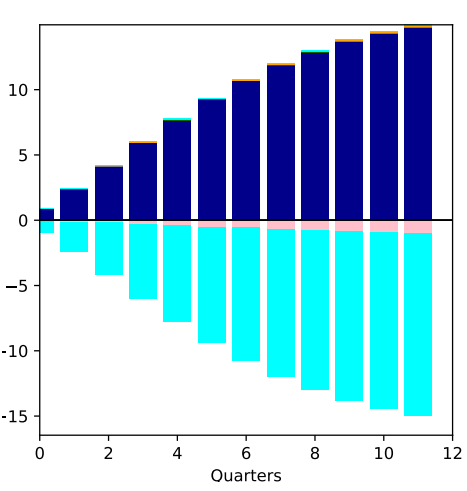
▸ Household Problem

IRF Matching

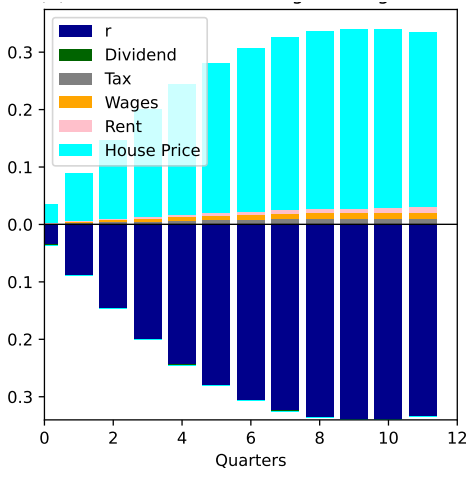
Params. Alt E



Application I: Housing and Monetary Policy



(A) Rental Market



(B) Housing Market

- House price dominant channel in closing housing markets after interest rate rise.

Application I: Housing and Monetary Policy

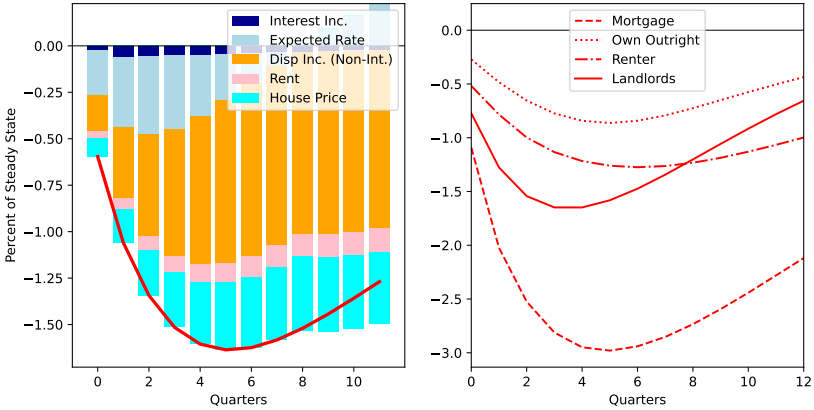
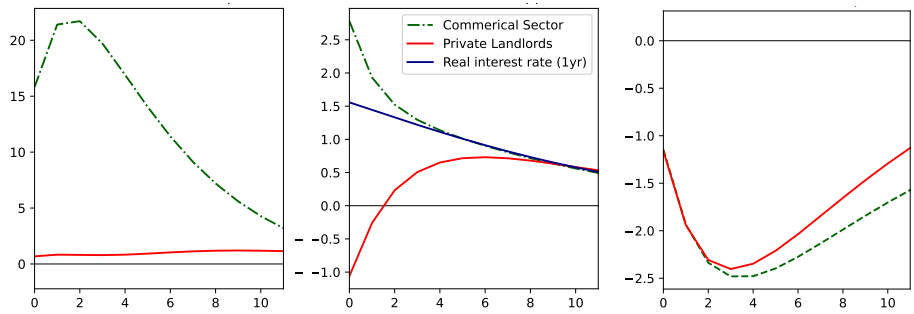


Figure Consumption Channels and by Housing Tenure

- Around quarter of transmission in the model at the peak through p_h and p_r.
- Mortgagors hit hardest but so are landlords.

Application II: Commercial vs private landlords



(A) Rents **(B)** Rental yield (1 yr) **(C)** House prices

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

Contributions

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Appendix

IRFs for baseline VAR

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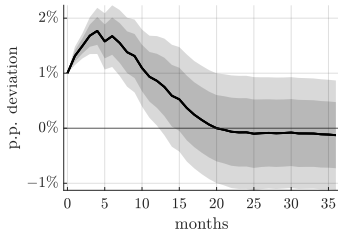
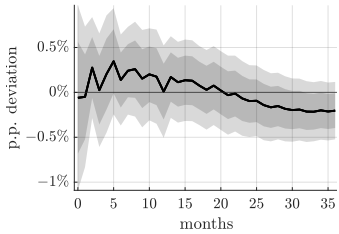
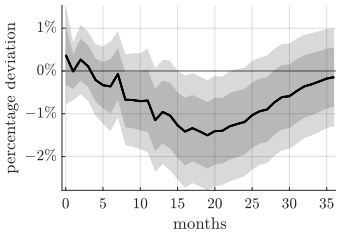


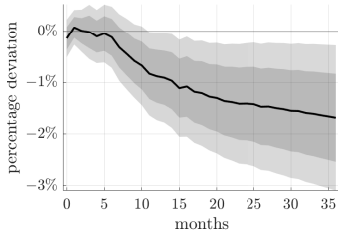
(A) Bank Rate



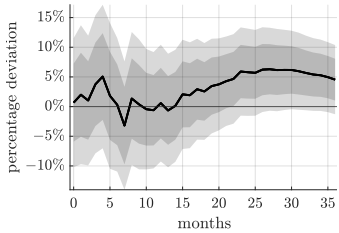
(B) Mortgage spread



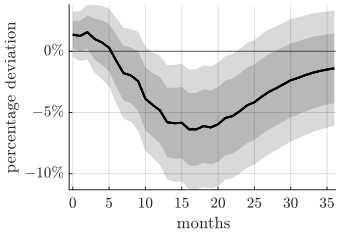
(C) GDP



(D) CPI core

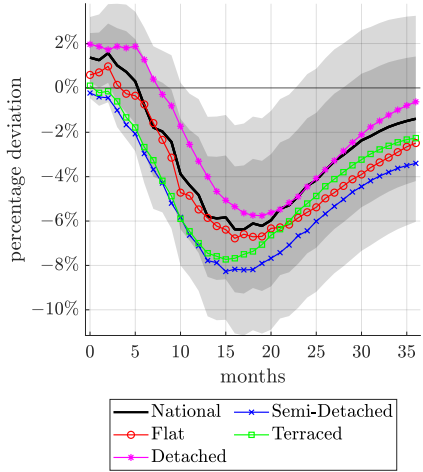


(E) FTSE



(F) House prices

Dwelling types: similar co-movement



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

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Household Problem

Back

$$z_i = z_{1,i} + z_{2,i}$$

$$z_{j,i} = \rho_{j,z} z_{j,i} + \epsilon_{j,z}, \qquad \epsilon_{j,z} \sim N(0, \sigma^2_{j,z}), j = 1, 2$$

$$\mathbf{E}\left[V^{(2)}(\chi, h, z, a)\right] = \sum_{h'} Prob(h'|h, \chi, z, a)\left(V^{(3)}(\chi, h', z, a) - \eta(h')\right)$$

$$Prob(h'|h, \chi, z, a) = \frac{\exp\left(\frac{V^{(3)}(\chi,h',z,a)-\eta(h')}{\alpha_z}\right)}{\sum_{h'} \exp\left(\frac{V^{(3)}(\chi,h',z,a)-\eta(h')}{\alpha_z}\right)}$$

$$V^{(3)}(\chi, h', a, z) = \max_{a'} u(c, h', l) + \beta \mathbf{E}[V^{(1)}(\chi'|\chi, h', z'|z, a')]$$

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

Expectations

Back

$$\bar{f}_t p_{t+k} = c + \frac{1}{1+\delta}(\delta \bar{f}_{t-1} p_{t+k} + E_t^{RE}[p_{t+k}] - \gamma p_t)$$

- Point estimates $\{\gamma = -0.11, \delta = 2.86, \gamma_{p_h} = 1.26, \delta_{p_h} = 0.05\}$
- δ much les than Auclert et al. [2020] (approx 11.5). Much less stickiness required.
- δ_{p_h} and γ_{p_h} close to estimates from Michigan data (1.55^{***},0.09)

Calibration

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

Targeted Moment	Model	Data	Parameter	Source
Ann. Debt to GDP	0.68	0.65	β	ONS
Share of Renters	0.35	0.33	$\phi_h, \omega_{oo}, p_{r,ss}$	EHS (97-23)
Share of Flat Owners	0.10	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 $oo \rightarrow r$	0.013	0.008	η_m	EHS (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	0.31	0.48	WAS (08-20)
Share of Homeowners with Mortgage	0.53	0.53	EHS (97-23)
Share of Landlords with Mortgage	0.37	0.57	WAS (07-20)
Avg Rent to Renter Disposable Income	0.31	0.33	EHS (97-23)

External Calibration

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Table Externally calibrated parameters

Parameter	Value	Source
Frisch	0.5	auclert2020micro
EIS	0.25	
Steady State Markup	1.06	auclert2020micro
Borrowing wedge $\bar{r}(ann)$	0.0126	(avg 97-19 of 2yr 75pct)
Transaction Cost	$0.02p_{h,ss}$	Halifax
$\frac{p_{h,ss}}{\bar{y}}$	6.3	Avg 97-23 ONS; $\bar{H}$
Loan to value max κ_h	0.90	PSD 90 pctile. FTB
Loan to income max κ_y	4.5	PSD 90 pctile. FTB
Rental price adj. prob θ_r	0.25	1 year contract
Housing Maintenance (ann) δ_h	0.015	Bureau of Economic Analysis
Taste shock scaler α_z	0.15	iskhakov2017endogenous

Income Process

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Table Internally estimated parameters

Moment	Data	Model	Parameter
Cross sectional labour income std. dev	0.66	0.59	$\rho_{z,1}, \rho_{z,2}, \sigma^2_{z,1}, \sigma^2_{z,2}$
One year earnings change std. dev	0.19	0.19	$\rho_{z,1}, \rho_{z,2}, \sigma^2_{z,1}, \sigma^2_{z,2}$
Five year earnings change std. dev	0.78	0.37	$\rho_{z,1}, \rho_{z,2}, \sigma^2_{z,1}, \sigma^2_{z,2}$
90-10 income ratio	4.66	4.53	$\rho_{z,1}, \rho_{z,2}, \sigma^2_{z,1}, \sigma^2_{z,2}$

15 grids points

IRF Matching Parameters

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Table IRF Matched Parameters

Parameter	Symbol	IRF matched value
Slope of price Philips Curve	κ_p	0.06
Slope of wage Philips Curve	κ_w	0.005
Debt stab. in fiscal rule	γ_{tax}	0.34
Taylor rule coefficients	$\left(\phi_\pi, \phi_y, \rho_m\right)$	(1.06, 0.00, 0.95)
Price underreact	θ_{SE}	2.86
Price underreact p_h	θ_{SE,p_h}	1.26
Price extrapolation	γ_e	-0.10
House price extrapolation	γ_{e,p_h}	0.05

IRF Matching: Other Expectations

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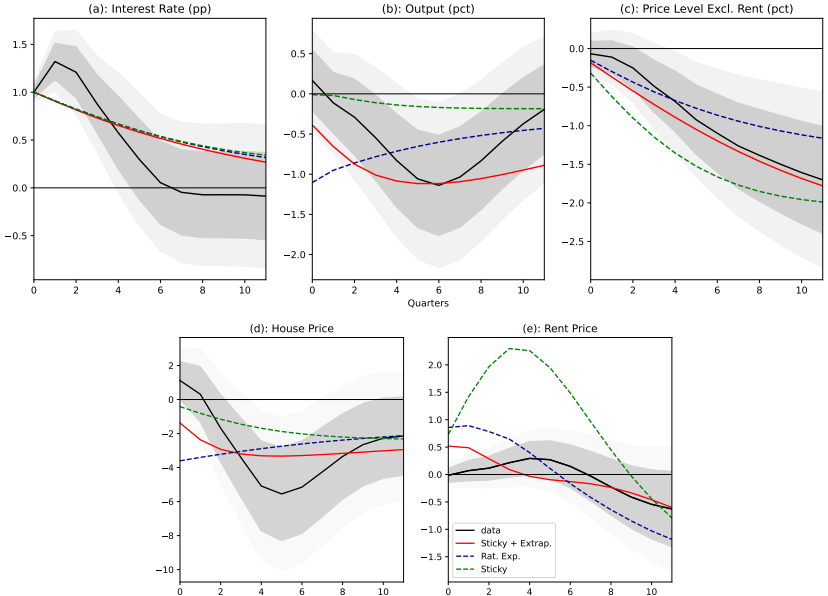
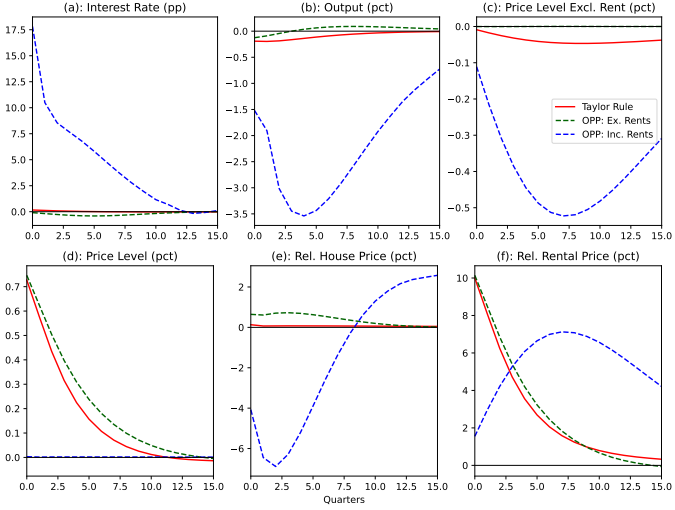


Application III: Optimal Policy Response to Housing Market Shock



- Policy Maker targets a loss function of minimising $L_x = \sum_{t=0}^{20} (\pi_{t,x})^2 + \lambda (i_t - i_{t-1})^2$

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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.

$$p_{r,t} = E_t\left[\frac{\epsilon_r}{\epsilon_r - 1}\left(\delta_{hf} + \frac{p_{h,t}}{v_{1,t}} - \theta_r \frac{v_{2,t}}{v_{1,t}}\right)\right],$$

where $v_{1,t}$, $v_{2,t}$ are the usual forwarding looking terms in the solution of firms' problem subject to Calvo pricing.

$$H_1 s_{r,t} = H_1 s_{ll1,t} + 2H_1 s_{ll2,t} + \overline{HA} + \underbrace{H_{CR,t}}_{\text{Com. Supply}}$$

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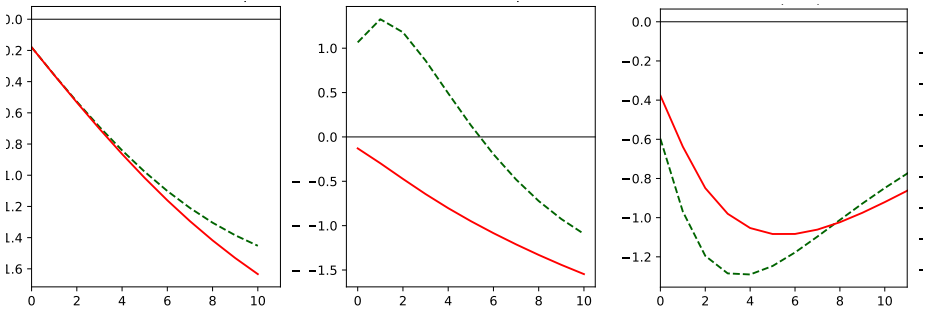
Application II: Commercial vs private landlords



(A) Price level (excl. rents) **(B)** Price level **(C)** Output

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

back

Application I: Housing and Monetary Policy

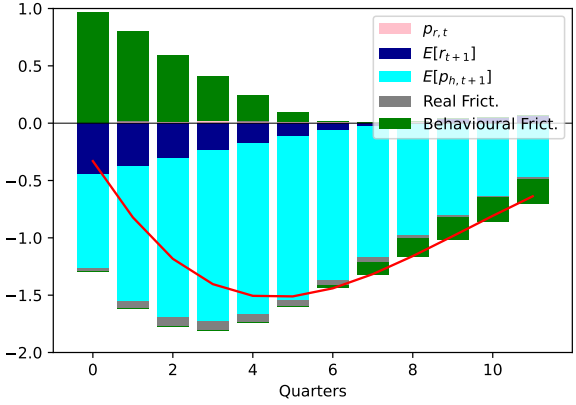


Figure House price decomposition: $p_{h,t} = p_{r,t} + \frac{1}{1+r_{t+1}} p_{h,t+1} + \omega_{frict} + \omega_{Behave}$

- Behavioural frictions push up on house price

Representative agent frictionless benchmark

Same macro structure but representative agent with no housing frictions. Still have nominal rigidities.

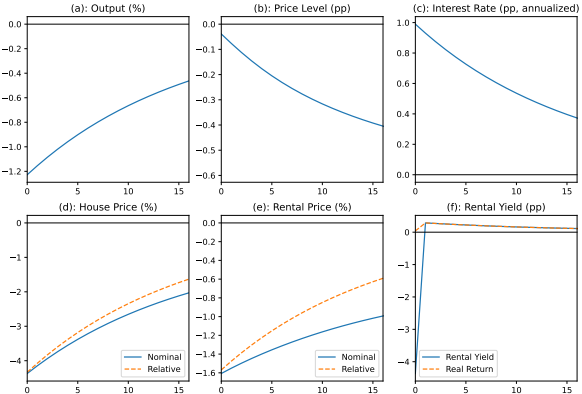


Figure Impulse response to a MP shock

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