Monetary Transmission Through the Housing (Rental) Sector

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

Motivation

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.

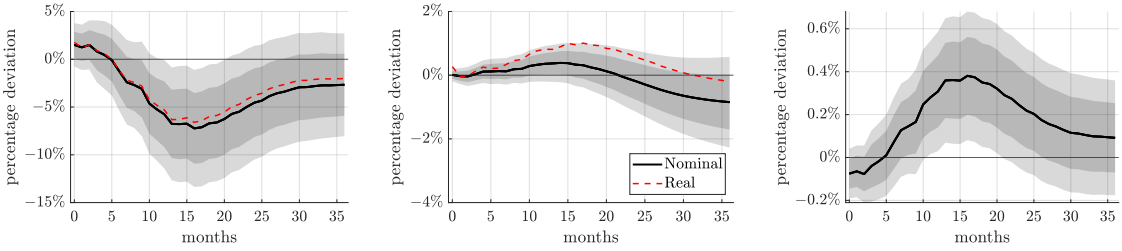
→ This paper: **HANK + housing + rental**

Contributions

1. Empirical results for monetary policy shock in the UK:
   - i **house prices are slow to fall** (hump-shaped), but magnitude is eventually large
   - ii **rents are stable** for 1-2 years, then fall
   - iii **sales fall is sluggish** (hump-shaped) for 1-2 years
2. Build upon canonical HANK model: housing tenure
   - renter / owner-occupier / **private landlord**
   - match to the data: house market targets + aggregate IRFs
   - i + ii + iii → **deviations from rational expectations**
3. Applications
   - Housing **market clearing**
   - **Frictions** (real v behavioural) & house price dynamics
   - Rental market structure: **private v commercial landlords**
   - Monetary policy response to **rental supply shock**

Empirical Evidence

House prices: hump-shaped decline; rents: stable for at least year



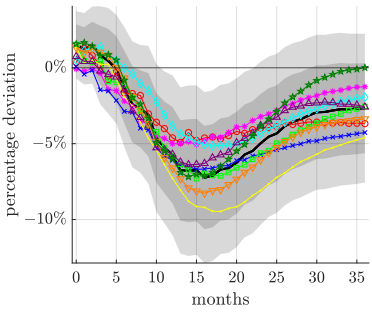
(A) House prices **(B)** Rents **(C)** Rent-to-price ratio

Figure IRFs to 1p.p. Bank Rate shock

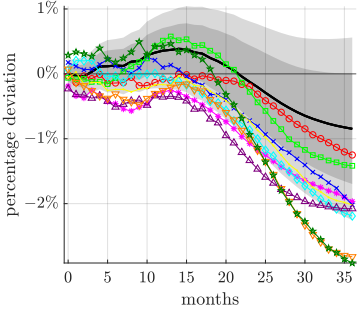
- Estimate a monthly VAR from 1997-2023, with dummies for the Covid period. ▸ IRFs
- VAR with 7 variables: GDP, CPI core ex-rent, bank rate, mortgage spread, FTSE, house prices and rents
- Use target factor from Braun et al. [2024] as instrument for bank rate

Regional responses: some variation, mostly robust

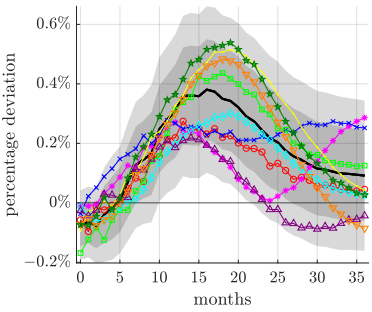
Dwellings



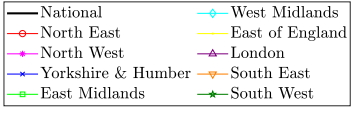
(A) Regional house prices



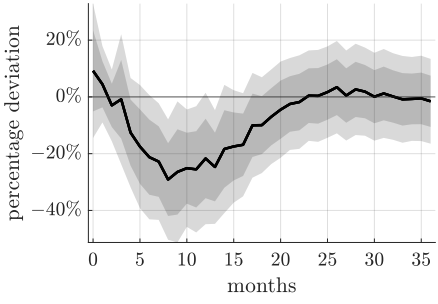
(B) Regional rents



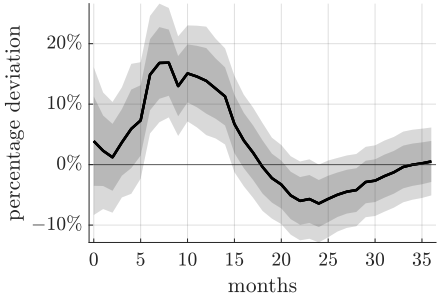
(C) Regional ratios



Sales and stocks: reduced activity for more than a year



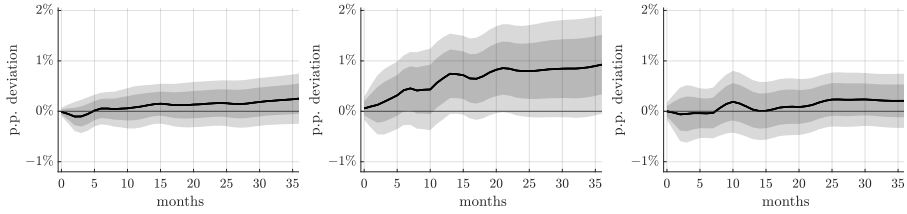
(A) Sales volume



(B) Stock of unsold houses

- p_h does not fall enough to maintain activity in housing market → not FIRE?

Renter Share



(A) Total **(B)** 20-35 **(C)** 36-50

(D) 51-65 **(E)** >65

Figure Share of renters - total and by age

Model: HANK + housing + rental

Model: HANK and Housing

- HANK model, with 2 assets: net 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
  - → sticky rental transitions with probability $\theta_r = 0.25$
  - → short-run analysis: fixed housing supply

- Housing market clearing conditions:
  - Housing: $\overline{H} = H_1(s_{r,t} + s_{ooF,t}) + H_2(s_{ooH,t} + s_{ll,t})$
  - Rental: $H_1 s_{r,t} = H_1 s_{ll1,t} + 2H_1 s_{ll2,t} + \overline{HA}$

Household's problem

- **Stage 1**: aggregate state χ; idiosyncratic labour productivity is $z = (z_1, z_2)$; and taste shock $\epsilon(h)$ are realised; housing transition h' is chosen

$$V^{(1)}(\chi, h', z, a) = \max_{\tilde{h}} \left[V^{(2)}(\chi, \tilde{h}, z, a) + \epsilon(\tilde{h}) - \eta(\tilde{h}) \right]$$

→ if we assume a Gumbel distribution for $\epsilon(h)$, then

$$Prob(\chi, h'|h, z, a) = \exp\left(\frac{V^{(2)}(\chi, h', z, a) - \eta(h')}{\alpha_z} \right) / \sum_{h'|h} \exp\left(\frac{V^{(2)}(\chi, h', z, a) - \eta(h')}{\alpha_z} \right)$$

- **Stage 2**: choice of consumption/savings

$$V^{(2)}(\chi, h', a, z) = \max_{a'} u(c, h', l) + \beta \mathbf{E}[V^{(1)}(\chi'|\chi, h', z'|z, a')]$$

subject to budget and borrowing constraints, with

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

Budget and borrowing constraints

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

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

Deviation from Rational Expectations to match empirical IRFs

Evidence

- We allow households to simultaneously **overreact to current economic conditions** and **under-react to news about the future** (Kohlhas and Walther [2021])

$$\bar{f}_t(x_{t+k} - x_{ss}) = \frac{1}{1+\delta_x}\left(\delta_x \bar{f}_{t-1}[x_{t+k} - x_{ss}] + E_t^*[x_{t+k} - x_{ss}] - \gamma_x(x_t - x_{ss})\right)$$

- $\gamma_x < 0$: over-reaction to current conditions; $\delta_x > 0$: under-reaction to news
  - $\gamma_x = 0, \delta_x = 0 \rightarrow RE$
  - $\gamma_x = 0, \delta_x > 0 \rightarrow$ sticky expectations
  - $\gamma_x < 0, \delta_x = 0 \approx$ extrapolative/diagnostic

- We allow for γ, δ to be different for house prices vs other macro aggregates
  - find **under-reaction to news** for both: $\delta_x, \delta_{ph} > 0$
  - but **no over-reaction to current conditions for house prices** ($\gamma_{ph} \approx 0, \gamma_x < 0$)

Rest of the Model

- Rest of the model is standard: Price/Wage PC, Fiscal rule, Taylor rule...
- Solved in sequence space with upper envelope EGM (Iskhakov et al. [2017])
- Generalised deviation from Rational Expectations follows Bardóczy and Guerreiro [2025] framework.
- Calibrate to hit key moments on wealth, income risk, tenure shares, iMPC's...

Calibration

▸ More Cal.

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

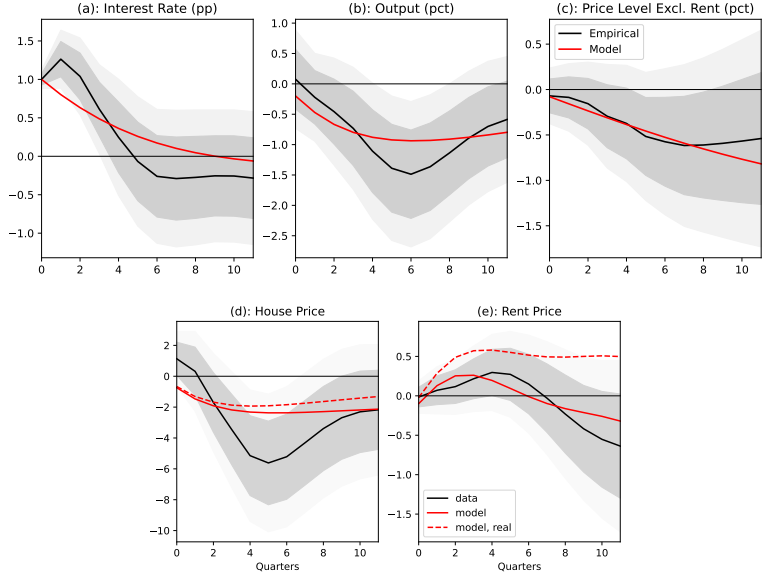
Targeted Moment	Model	Data	Parameter	Source
Ann. Debt to GDP	0.63	0.65	β	ONS
Share of Renters	0.33	0.33	$\phi_h, \omega_{oo}, p_{r,ss}$	EHS (97-23)
Share of Flat Owners	0.10	0.10	$\phi_h, \omega_{oo}, p_{r,ss}$	EHS (97-23)
Share of Landlords	0.06	0.06	$\phi_h, \omega_{oo}, p_{r,ss}$	WAS (08-20)
Annual rate $oo \rightarrow r$	0.01	0.01	η_m	EHS (97-23)

3. Untargeted Moments:

Moment	Model	Data	Source
Housing Wealth to Financial Net Worth	8.0	7.0	WAS (08-20)
Top 10 pct. Total Wealth Share	0.31	0.48	WAS (08-20)
Share of Homeowners with Mortgage	0.54	0.53	EHS (97-23)
Share of Landlords with Mortgage	0.49	0.57	WAS (07-20)
Avg Rent to Renter Disposable Income	0.28	0.33	EHS (97-23)

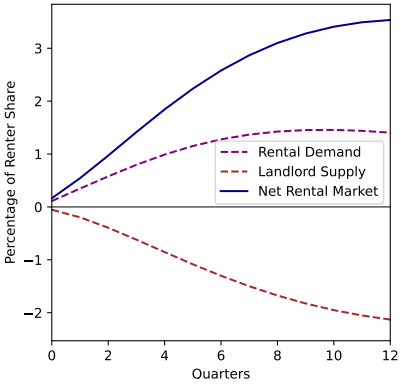
IRF Matching

Parameters | Alt. Expectations

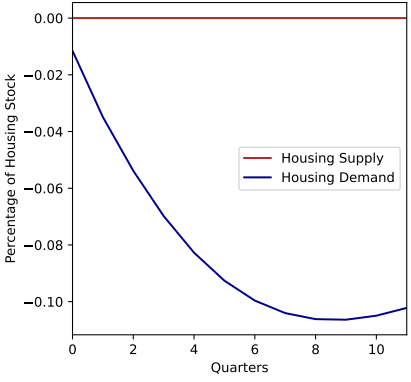


Model Applications

Housing Market Clearing: Partial Equilibrium



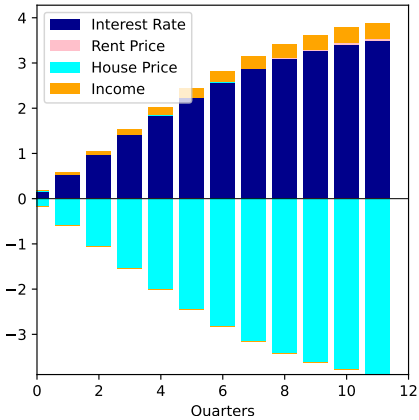
(A) Net demand: Rental Market



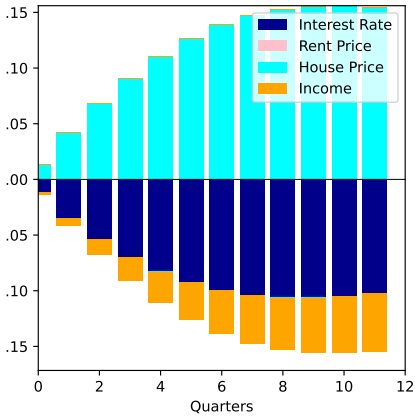
(B) Net demand: Housing Market

- Excess demand in the rental market and excess supply in the housing market.

Housing Market Clearing: General Equilibrium



(A) Net demand: Rental Market



(B) Net demand: Housing Market

- $\uparrow r \rightarrow$ house prices react to close housing and rental markets; rental prices do not have a big effect

Housing Market Clearing: Elasticities

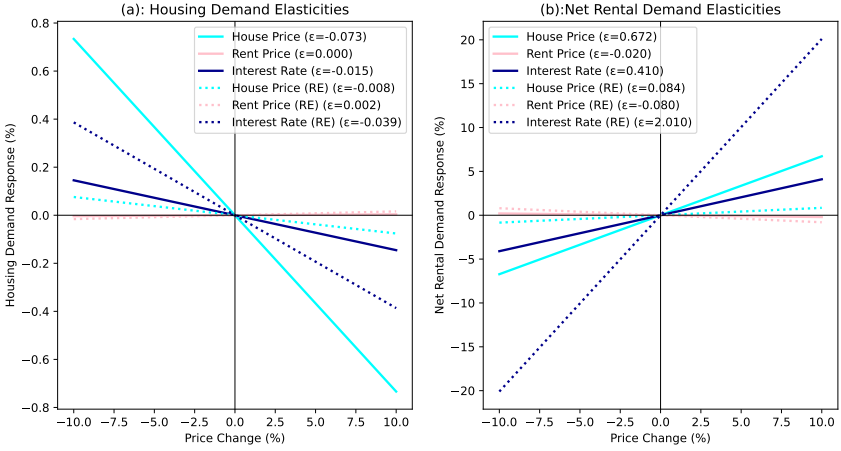
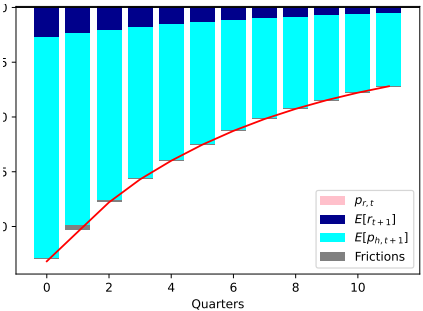


Figure Housing Market Elasticities

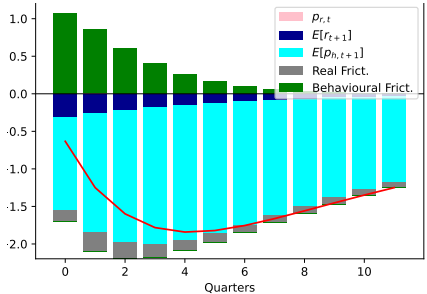
- Little spillovers from rental price to broader housing market
- Behavioural frictions sharpen house price elasticity

Frictions: House Price Path

Model Quants.



(A) Rational Expectations



(B) Deviation from FIRE

$$p_{h,t} = p_{r,t} + E_t\left[\frac{p_{h,t+1}}{1 + r_{t+1}}\right] + \text{frictions}$$

- Behavioural frictions are key
- Lumpiness and constraints pull down on house price, larger when elasticity is higher.

Frictions: Frictionless Benchmark

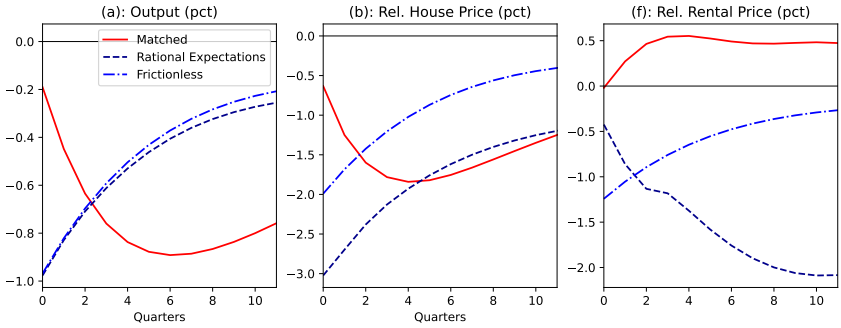


Figure IRFs with/without frictions

- Behavioural frictions push up on rental price
- Rat Exp. HANK model has similar dynamics to frictionless benchmark.
  - Frictionless benchmark: RANK, no sticky rental contracts, no transaction costs, no borrowing constraints, no lumpiness.

Housing → Monetary Policy

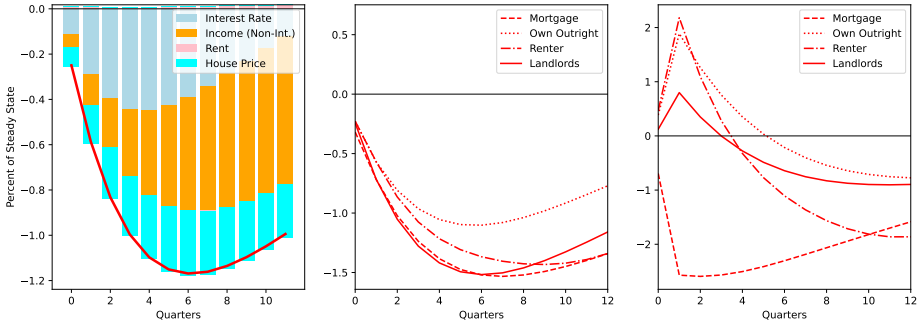
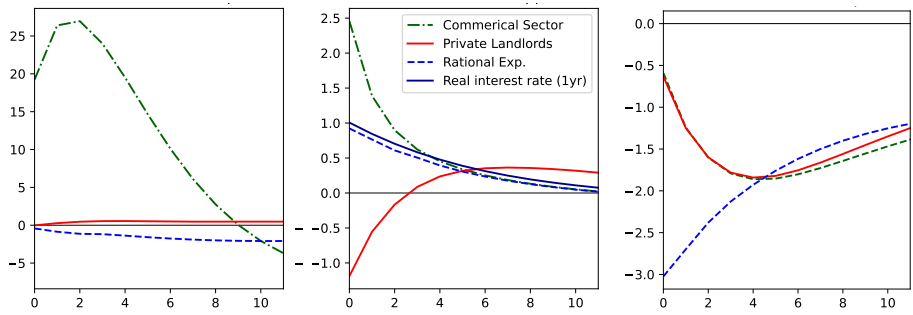


Figure Consumption Channels and by Housing Tenure

- Around 25% of transmission at the through of p_h.
- Winners and losers
- Landlords hit as hard(er) as renters, even though much wealthier (HTM)

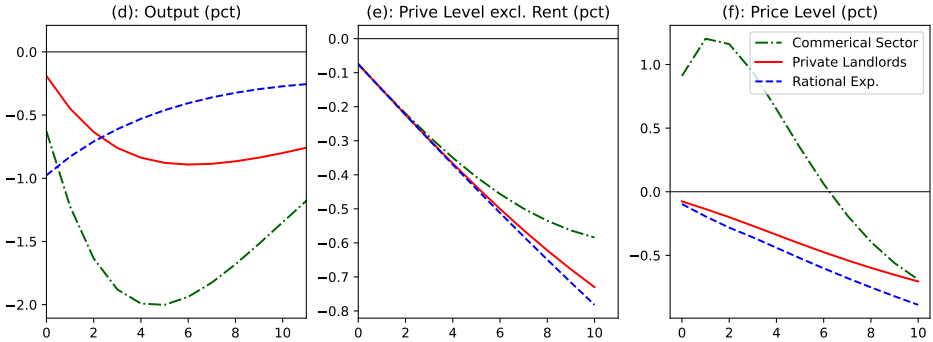
Rental Market Structure: Unconstrained vs private landlords



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

- Commercial sector borrows from banks and purchases rental housing $H_{CR,t}$. ▸ Pricing
- Rents have limited impact on the (non-rental) housing market
- Higher pass-through of interest rates to rents → big trade-offs for monetary policy

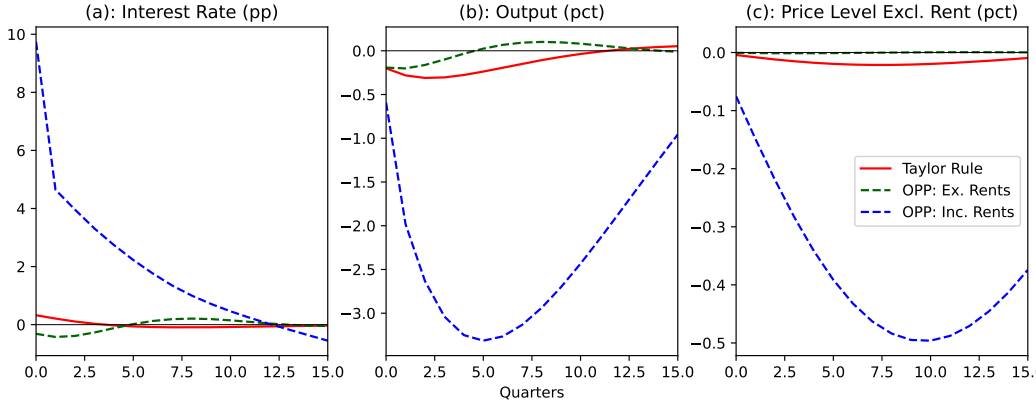
Rental Market Structure: Unconstrained vs private landlords



- Much higher Sacrifice ratio in commerical sector case (green dashed line).
  - Two to three times higher.
- Private landlords mititgate this but best is no behavioural frictions

Rental Market Shock: Targetting CPI with(out) rents

More IRFs



- Rental Housing supply shock that increases rents by 10% on impact
- Follow Barnichon and Mesters [2023] with policy makers minimising a loss function of $L_x = \sum_{t=0}^{20} (\pi_{t,x})^2$
- Targetting CPI with rents after housing shock leads to (too much) output volatility

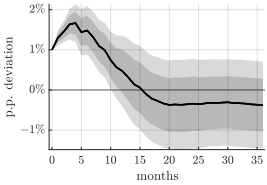
Conclusion

- We've added to the evidence base on monetary policy and housing markets
  - Large slow house price response, flat rental prices
  - Adjustment through volumes
- Housing a potentially big channel in HANK models, creating winners and losers
- Probed housing market clearing in rental market with private landlords
  - Behavioural frictions key and house price elasticity key
  - Private landlords losers in a monetary adjustment but beneficial to monetary policy
- Supply determined nature of housing might push policymakers to look past shocks to rental or housing sector.

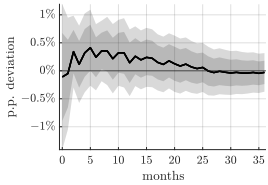
Appendix

IRFs for baseline VAR

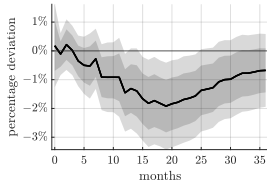
back



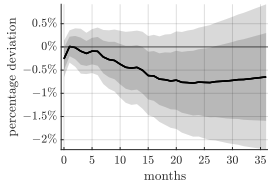
(A) Bank Rate



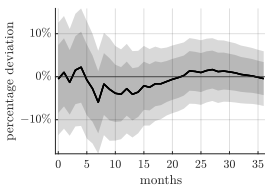
(B) Mortgage spread



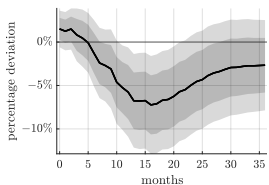
(C) GDP



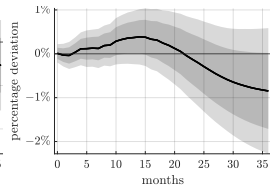
(D) CPI core



(E) FTSE

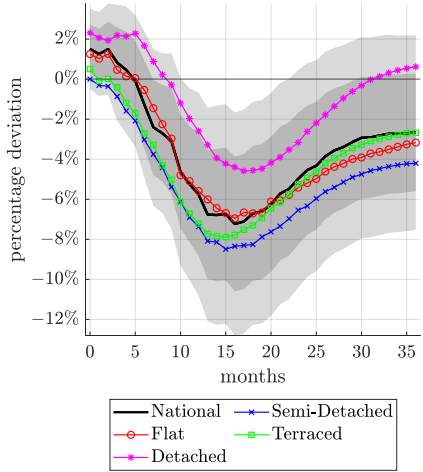


(F) House prices



(G) Rent prices

Dwelling types: similar co-movement



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

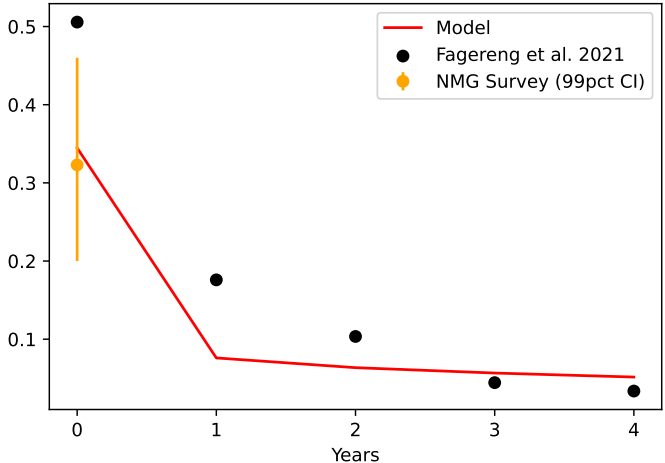
Back

External Calibration

Back

Table Externally calibrated parameters

Parameter	Value	Source
Frisch	0.5	Auclert et al. [2020]
EIS	0.5	
Steady State Markup	1.06	Auclert et al. [2020]
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	0.0009	ONS CPI-H
Taste shock scaler α_z	0.15	Iskhakov et al. [2017]


Model
Fagereng et al. 2021
NMG Survey (99pct CI)
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
Years

IRF Matching Parameters

Back

Table IRF Matched Parameters

Parameter	Rational Exp.	Sticky	Baseline
Price Philips Curve κ_p	0.003	0.5	0.01
Wage Philips Curve κ_w	0.28	0.5	0.004
Fiscal rules (debt stab.)	0.014	0.08	0.12
Taylor rule $\left(\phi_\pi, \phi_y, \rho_m\right)$	(2.5, 0.17, 0.93)	(2.5, 0.0, 0.92)	(1.01, 0.0, 0.87)
Price update prob. $\frac{1}{1+\delta_x}$	1.0	0.05	0.13
House price update prob. $\frac{1}{1+\delta_{ph}}$	1.0	0.09	0.36
Price extrapolation γ_x	0.0	0.0	-0.42
House price extrapolation γ_{ph}	0.0	0.0	0.02

IRF Matching (Comparison)

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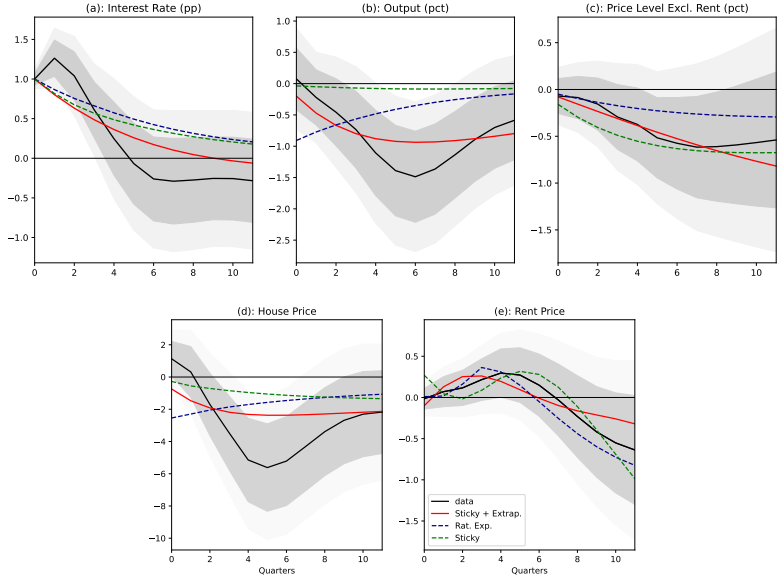

Commercial Sector Pricing

- Commercial sector can borrow from bank and purchase rental housing.
- Subject to fixed costs to make price same in steady state and indifferent too entry.
- 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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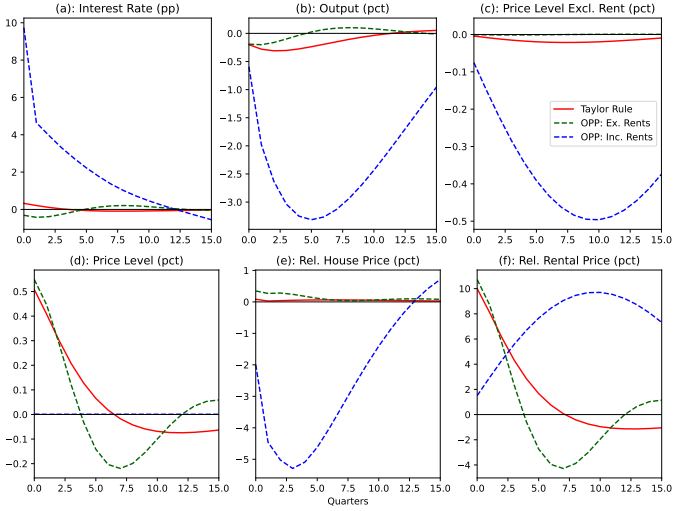
Policy Response to Rental Market Shock



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

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Empircal evidence on expectations

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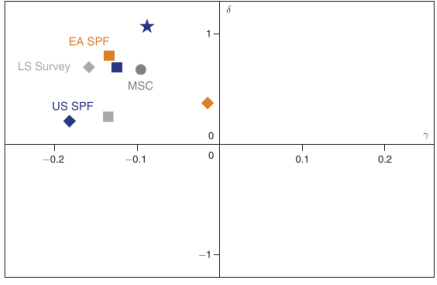
Table Michigan Survey

	Forecast Error		
	No extrap.	Extrap	IV
γ_{p_h}	-	-0.02	-0.03
	-	(0.05)	(0.04)
δ_{p_h}	1.45	1.46	1.94
	(0.26)	(0.32)	(1.39)
Observations	68	68	68
R^2	0.46	0.46	0.41

Notes: Tables presents for regressions of the form of Kohlhas and Walther [2021] for real log house price expectations in the Michigan Survey:

$$p_{t+4} - f_{t+1,t+4} = \gamma_{p_h} p_t + \delta_{p_h}(f_{t+1,t+4} - f_{t,t+3}) + \epsilon_t.$$

Figure Kohlhas and Walther [2021]



Sales Volumes (model) Back

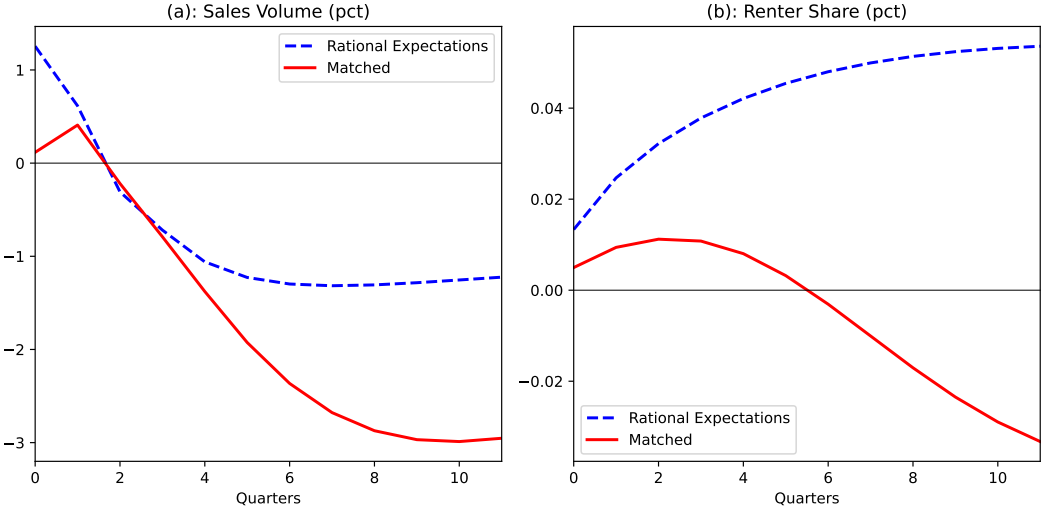


Figure Further IRFs

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