# Rent Inflation and Monetary Policy

Sergi Barcons[1] Gonzalo Paz-Pardo[2]

[1]Toulouse School of Economics

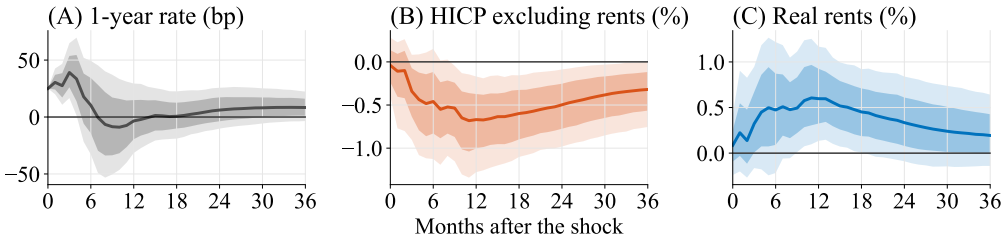
[2]European Central Bank

November 2, 2026

The views expressed here are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

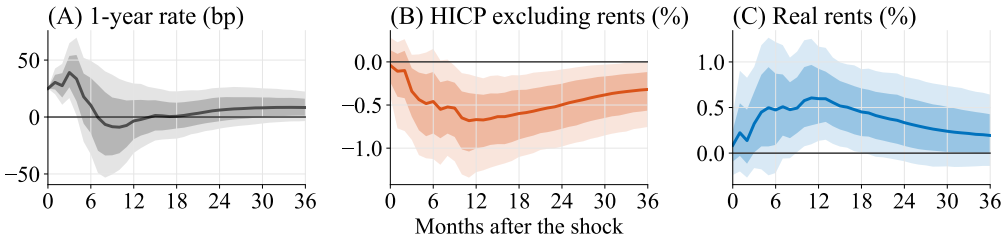
# Motivation

- Unlike other prices, rents do not fall when policy tightens: **real rents rise**



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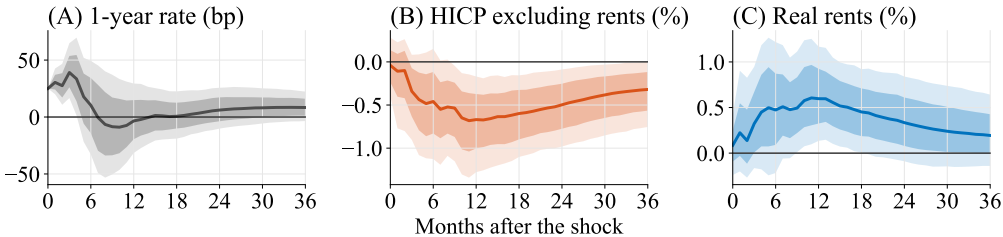
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- Rents are part of the **inflation target**

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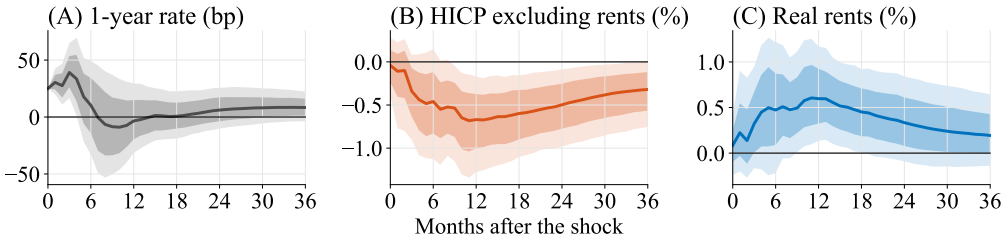



- Rents are part of the **inflation target**

  → *relevance*: **a third** of a renter's income, and renters earn **a quarter less**

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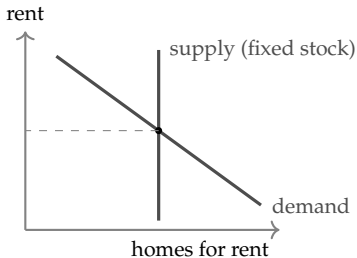

- Rents are part of the **inflation target**
  → *relevance*: **a third** of a renter's income, and renters earn **a quarter less**

**Q:** Why do **real rents rise** when monetary policy tightens?
What should **central banks** do about it?

▸ VAR details

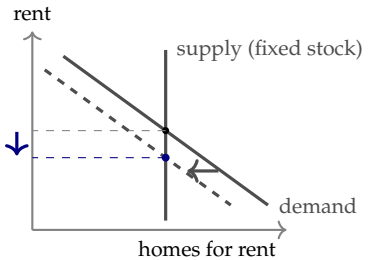
# Why Rents Rise

**Textbook *frictionless* economy**



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higher rates $\Rightarrow$ people spend less

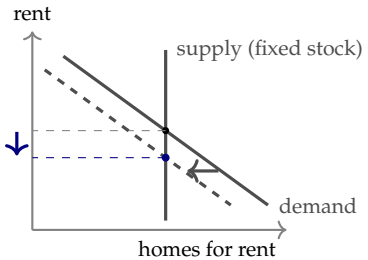
$\Rightarrow$ rental demand $\downarrow$ $\Rightarrow$ **rents fall**

▸ Textbook model

standard NK mechanism

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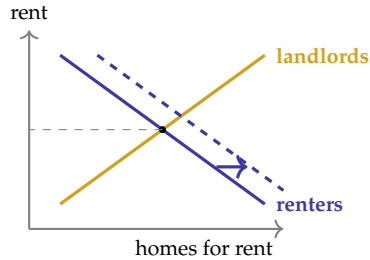



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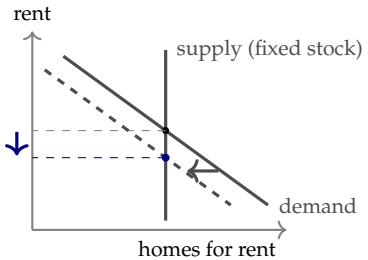
**Our economy**




**More renters**: buyers priced out of owning

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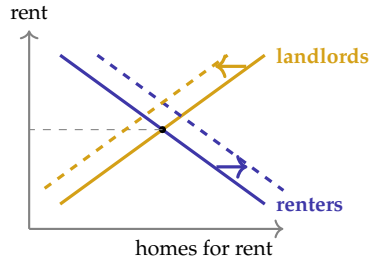



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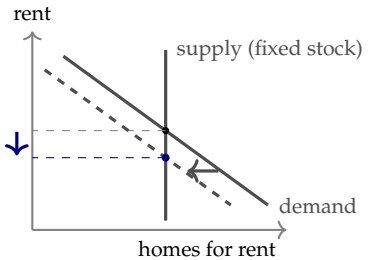



**More renters**: buyers priced out of owning
**Fewer homes for rent**: holding costs rise

▸ Who are the landlords?

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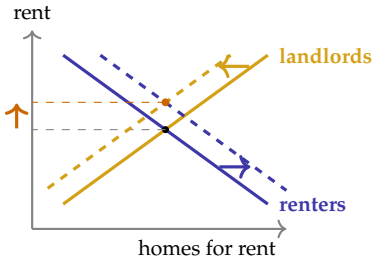



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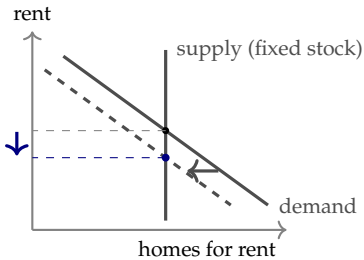

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**new here:** landlords weigh rents against interest rates

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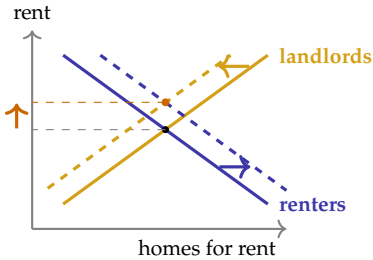



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**new here:** landlords weigh rents against interest rates

**This paper:** which force dominates, and what should policy do? ▸ Who are the landlords?

# This Paper

- A **HANK model** where households rent, own, or become landlords
  $\rightarrow$ landlords are households: rental supply is a portfolio choice

- Three steps:
  1. **Rent channel:** how monetary policy moves rents, via landlords or buyers
  2. **Rent in the target:** what happens when rents enter the target, as in the HICP
  3. **Optimal response:** how policy should respond to rent inflation

# Results

**Rent channel**

1. A tightening raises rents while house prices fall
2. **Landlords**, not **would-be buyers**, drive the rent rise
   → about 65% of the pressure from higher rates: returns on savings, mortgage costs

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**Rent in the target**

3. Putting rents in the target deepens the contraction
4. The rule fights rent inflation it created: **self-defeating**
   → rents paid lag, so it outlasts the shock → lowers welfare under all shocks considered

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**Optimal response**

5. Neither tighten against rent inflation nor look through it: **ease**
6. Why: mostly redistribution; under cost-push, efficiency too
   → rent relief redistributes, but also insurance benefits
7. **Full Ramsey plan**: most of the gain is a time-0 redistributive surprise

# Related Literature

**Housing and tenure choice in general equilibrium:** Sommer–Sullivan–Verbrugge (2013), Kaplan–Mitman–Violante (2020), Castellanos–Hannon–Paz-Pardo (2024), Greenwald–Guren (2025)

Contribution **1.** Monetary transmission via the rental market: why rents rise when policy tightens

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**HANK and optimal monetary policy:** Kaplan–Moll–Violante (2018), Bhandari et al. (2021), Acharya–Challe–Dogra (2023), Dávila–Schaab (2023, 2025)

Contribution **4.** Rental market as new source of efficiency + redistribution motives; Ramsey policy

# Outline

**Why do rents rise when policy tightens?**

1. Model
2. Calibration
3. Rent channel

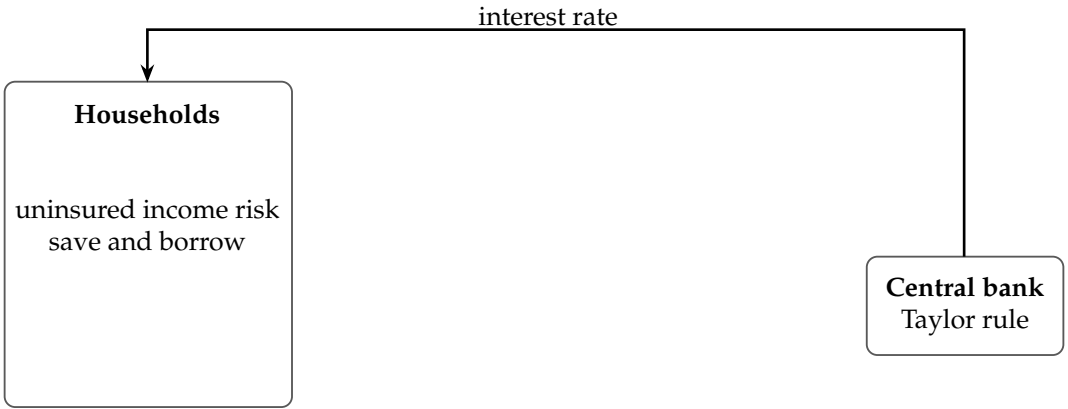
**What should central banks do?**

4. Rent in the target
5. Optimal response

# Model

# Model Overview

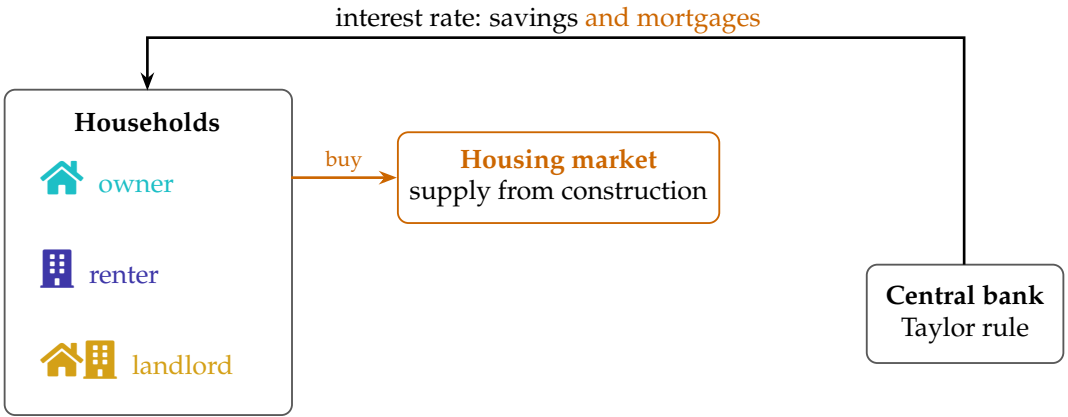
Standard HANK




Standard blocks: sticky wages, government debt

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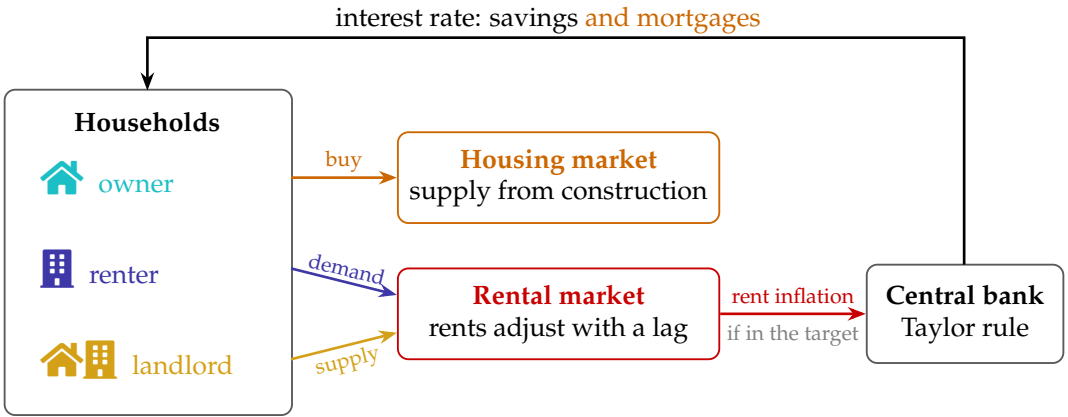
Standard HANK + housing market




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# Model Overview

Standard HANK + housing market + rental market




Standard blocks: sticky wages, government debt

# Households: Renters, Owners, Landlords

Recursive problem

**Preferences**

$$\mathcal{U}(c,h,n) = \frac{\left(c^{f(h)}\right)^{1-\gamma}}{1-\gamma} - \psi_n \frac{n^{1+\eta}}{1+\eta}$$



**Renter** ($h = 0$)

$\rightarrow$ rents a small unit

$\rightarrow$ pays rent $\widehat{p}^r$

$\rightarrow$ cannot borrow

$\rightarrow$ saves in a risk-free deposit at $r$

**Budget constraint** Housing costs

$$c + a' + \psi_t(h,h') \leq \left(1 + r_t + \kappa \mathbb{1}_{a<0}\right) a + (1-\tau_y)\, w_t\, y\, n + T_t - \widehat{p}^r_t$$

**Borrowing limit**

$$a' \geq 0$$

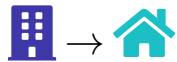
**State**: wealth $a$, housing $h$, AR(1) productivity $y$ + **taste shocks** $\Rightarrow$ logit tenure choice

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**A renter who buys**

→ buys a larger home: price + transaction tax

→ mortgage: up to a share $\lambda_{\text{LTV}}$ of the home's value and $\lambda_{\text{LTI}}$ times income

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$$c + a' + \psi_t(h,h') \;\leq\; \left(1 + r_t + \kappa\, \mathbb{1}_{a<0}\right) a + (1-\tau_y)\, w_t\, y\, n + T_t - \widehat{p}_t^{\,r}$$

**Borrowing limit** $p^h\, q(\cdot)$: value of the housing bought

$$a' \;\geq\; -\lambda_{\text{LTV}}\, p_t^h\, q(h,h') \;\;\&\;\; -\lambda_{\text{LTI}}\, w_t\, y\, n$$

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**Owner** ($h = 1$)

→ lives in a larger home: $f(h) > 1$

→ pays house depreciation

→ mortgage pays $r + \kappa$

→ amortizes at rate $m$

**Budget constraint** Housing costs

$$c + a' + \psi_t(h,h') \quad \leq \quad \left(1 + r_t + \kappa\, \mathbb{1}_{a<0}\right) a + (1-\tau_y)\, w_t\, y\, n + T_t - \widehat{p}_t^r$$

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$$a' \;\geq\; (1-m)\, a$$

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**Landlord** ($h = 2$) Rental supply

$\rightarrow$ owns two homes, lives in the larger one

$\rightarrow$ rents the small one out: receives rent $\widehat{p}^r$

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# Rental Market and Sticky Leases

**Leases**

→ contract: match between one **renter** & one **landlord**

→ rent set at signing: $p^r_{t-s}$ *(in real terms)*

→ new lease: *(exogenous)* renegotiation or tenure change

# Rental Market and Sticky Leases

## Leases

→ contract: match between one **renter** & one **landlord**

→ rent set at signing: $p^r_{t-s}$ *(in real terms)*

→ new lease: *(exogenous)* renegotiation or tenure change

## Rent paid

→ indexed to goods inflation $\pi^c$

→ after $J$ quarters: long-term tenants ➜ average of old signing rents

→ rent index = average rent paid ▸ Average rent

⇒ **Rents paid catch up as leases turn over**

# Remaining Model Details

**Wages and goods** sticky wages: unions ration hours, pay a Rotemberg adj. cost ▸ Details

goods: $Y_t^c = A^c N_t$, competitive firm $\Rightarrow$ $w_t = A^c$, $\pi_t^w = \pi_t^c$

**Construction** new homes from land permits and goods

**Central bank** $i_t = r_{ss} + \phi_\pi \, \pi_t^{\text{hicp}} + \varepsilon_t^m, \quad \pi_t^{\text{hicp}} = (1 - \omega_r) \, \pi_t^c + \omega_r \, \pi_t^{\text{rent}}$ ▸ Other rules ▸ Spain?

$\rightarrow \pi^{\text{rent}}$: inflation of the rent index $\rightarrow \omega_r = 0$: goods only $\rightarrow \omega_r > 0$: rents in the target

**Government** debt absorbs deficits; the lump-sum transfer responds to debt

**Equilibrium** prices clear housing, rental (**renters** = **landlords**), bonds and land

▸ Equilibrium

# Calibration

# Calibration to Spain

**Why Spain** → most outstanding mortgages are adjustable-rate, as in the model
→ landlords are households: they own 92% of private rentals
institutional investors: 34% in Germany, 23% in France

**Set externally** ▸ All parameters

Leases $\varphi = 0.99 \Rightarrow$ 17% signed a year
data $\in [14\%, 20\%]$

Mortgages $\lambda_{\text{LTV}}$: 80% $m$: 90% in 30 years
$\lambda_{\text{LTI}}$: 6× annual income
$\kappa$: 1.38 pp spread

Policy $\phi_\pi = 1.5$

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## Set internally, jointly

| | |
|---|---|
| house value / income | $A^h$ |
| construction / GDP | $\delta_h$ |
| renter share | $\theta$ |
| renter → owner flow | $\tau_h$ |
| landlord → owner flow | $\sigma_\varepsilon$ |
| 2% real rate | $\beta$ |
| public spending / GDP | $\tau_y$ |

# Model Fit

| Targeted | **Model** | **Spain** |
|---|---|---|
| house value / annual income | 5.25 | 5.25 |
| residential construction / GDP | 6.9% | 6.9% |
| renter share | 17.0% | 17.0% |
| public spending / GDP | 19.0% | 19.0% |

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| **Untargeted** | | |
| rent burden (renters) | 30.4% | 35.0% |
| owners + landlords | 83.0% | 82.9% |
| owner-occupiers | 66.0% | 72.9% |
| landlords | 17.0% | 10.0% |
| net worth / annual income | 6.58 | 7.33 |

$\rightarrow$ model: one home per landlord $\rightarrow$ data: several

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**Tenure transitions, quarterly** * targeted

| | next quarter: renter | owner | landlord |
|---|---|---|---|
| renter | 98.8<br>98.8 | 1.2*<br>1.2 | 0.0<br>0.0 |
| owner | 0.3<br>0.1 | 99.0<br>99.3 | 0.7<br>0.6 |
| landlord | 0.0<br>0.0 | 2.6*<br>2.6 | 97.4<br>97.4 |

model, %
data, %

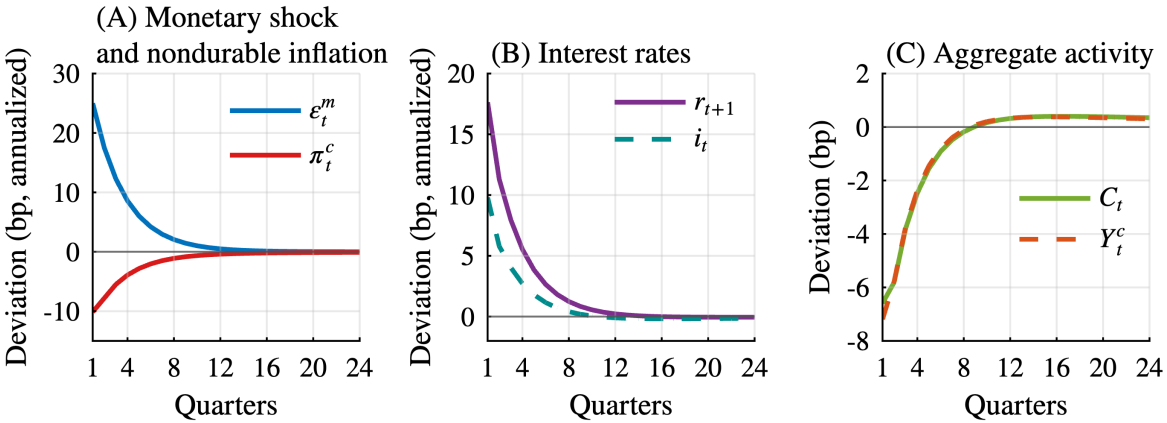
EFF panel 2014–2022, converted to quarterly

▸ More moments

# Rent Channel

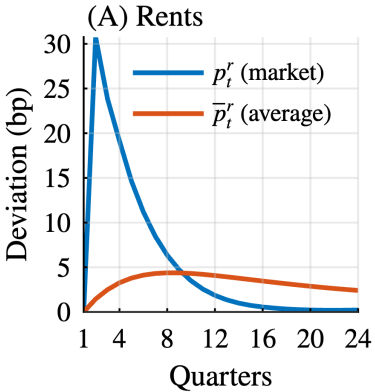
# Monetary Shock: Aggregates

**Shock** +25 bp to the Taylor rule (annualized), persistence 0.7

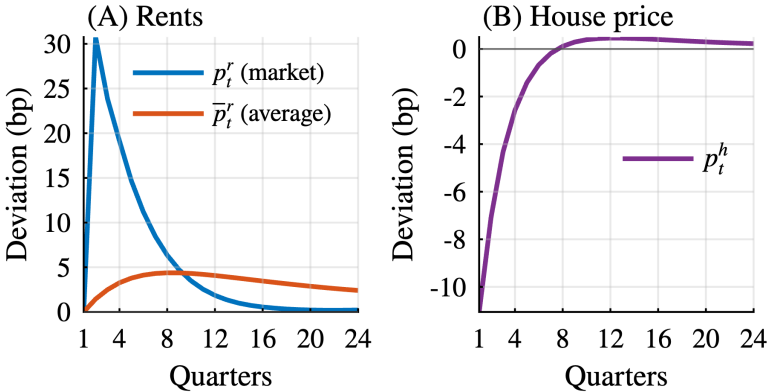



**A standard HANK response** real rate +71 bp per 100 bp shock (Kaplan et al. 2018: $\approx$ 60 bp)

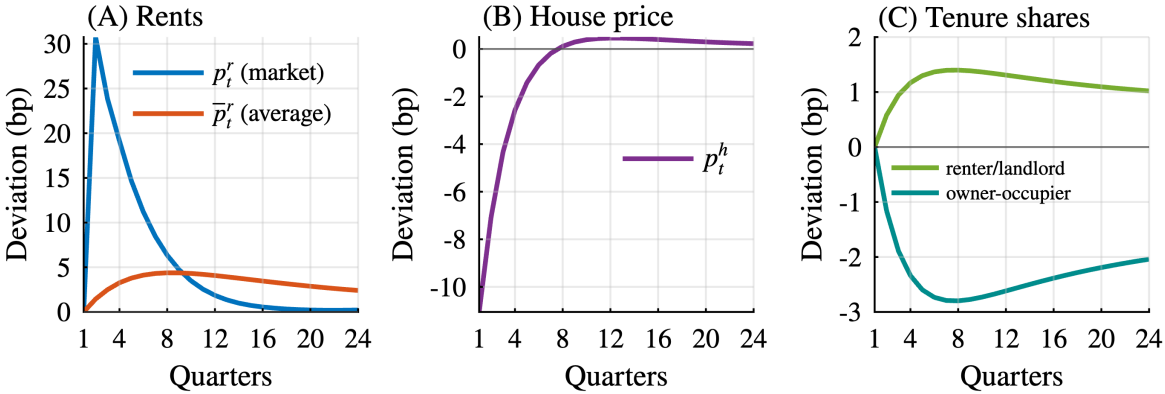
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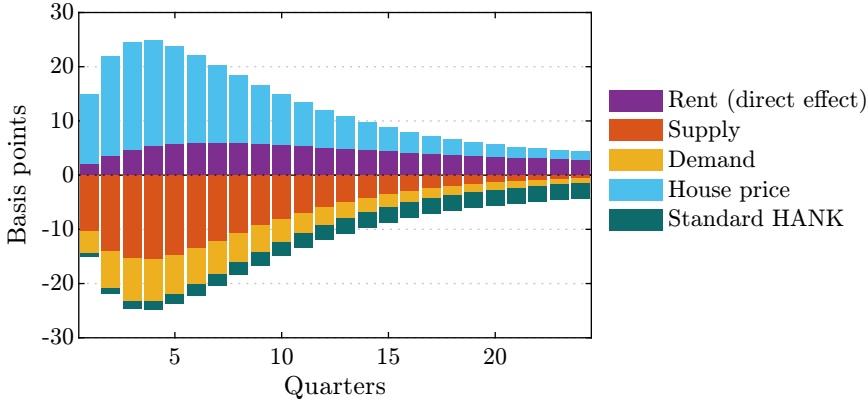



**As in the data: homeownership falls, rent-to-price ratio rises**

→ more renters ⇒ rents rise until enough households become landlords ▸ Model vs data

# Rent Decomposition

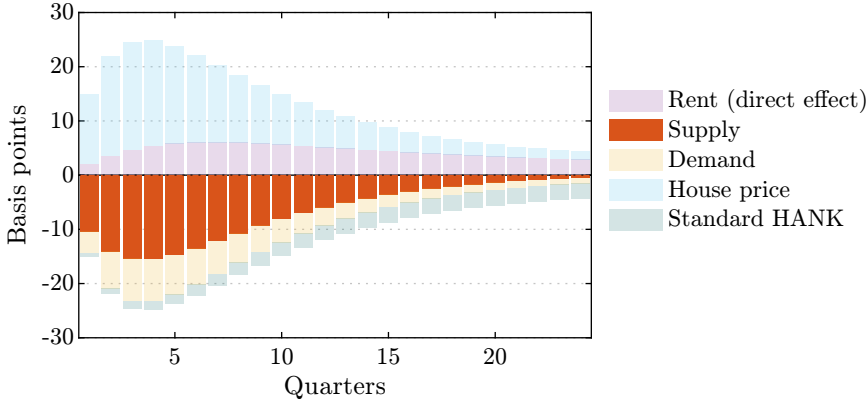
Bars: excess rental supply
below zero ⇒ pushes rents up




**Partial equilibrium**: each color moves one price alone, the others stay at SS
→ its contribution to the rent rise

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Bars: excess rental supply
below zero ⇒ pushes rents up

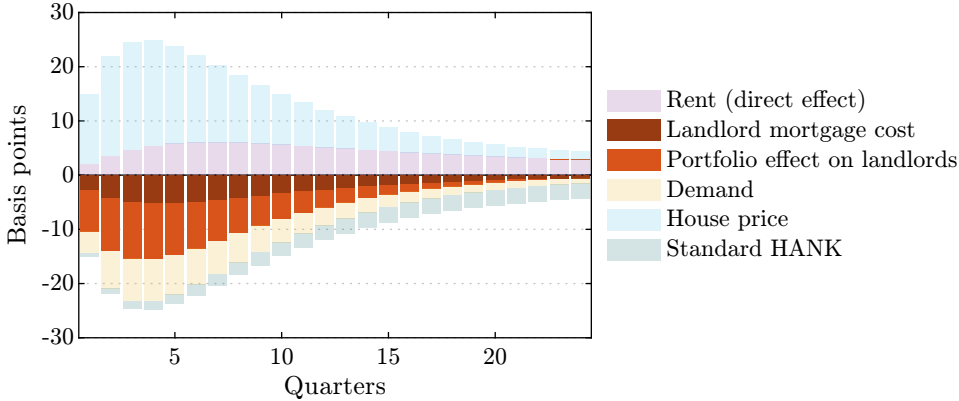



**Landlords, not would-be buyers, drive the rent rise**

→ ≈ 65% of the pressure from higher rates

# Rent Decomposition

Bars: excess rental supply
below zero ⇒ pushes rents up

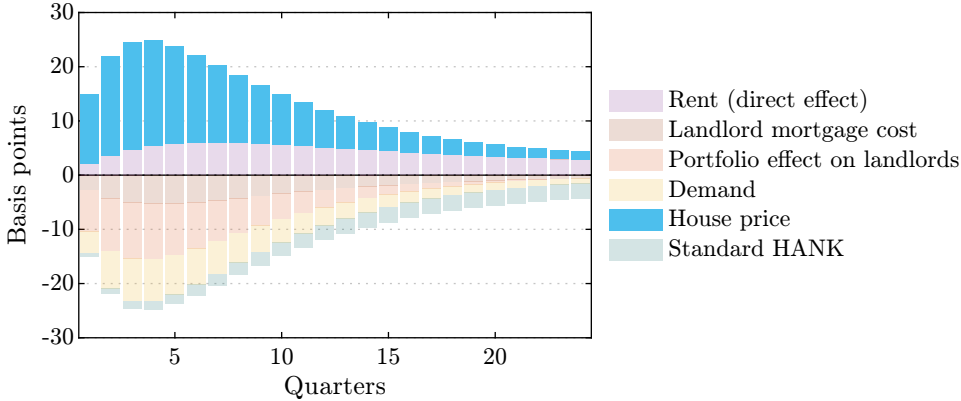



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# Rent Decomposition

Bars: excess rental supply
below zero ⇒ pushes rents up




**Landlords, not would-be buyers, drive the rent rise**

→ ≈ 65% of the pressure from higher rates: savings returns, landlord mortgage costs

→ falling house prices offset ≈ two-thirds

# Taking Stock

1. **HANK with rental supply**: households rent, own, or become landlords
2. Tightening $\rightarrow$ **real rents** $\uparrow$, house prices $\downarrow$, as in the data
3. **Mostly supply**: **landlords**, $\approx 65\%$ of the rate pressure

$\Rightarrow$ **What should central banks do about it?**

# What Should Central Banks Do?

# Central Bank Response

1. **Rent in the target**: HICP-style rule backfires — ▸ Rent in the target
2. **Optimal response**: **ease**, rent inflation lowers the rate — ▸ Optimal rule
3. **Ramsey**: gains mostly a time-0 redistributive surprise — ▸ Ramsey
4. Rent relief is progressive — ▸ Who gains
5. Mostly redistribution; cost-push: efficiency too — ▸ Efficiency *vs* redistribution
6. Not just a less hawkish rule — ▸ Less hawkish?

# Conclusion

1. **Rent channel:** a tightening raises rents while house prices fall
   → driven by landlords: better returns on savings, higher mortgage costs

2. **Rent in the target:** the HICP-style rule backfires
   → deeper contraction, and welfare losses under all shocks considered

3. **Optimal response:** rent inflation should lower the policy rate
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**Thank you for your attention!**

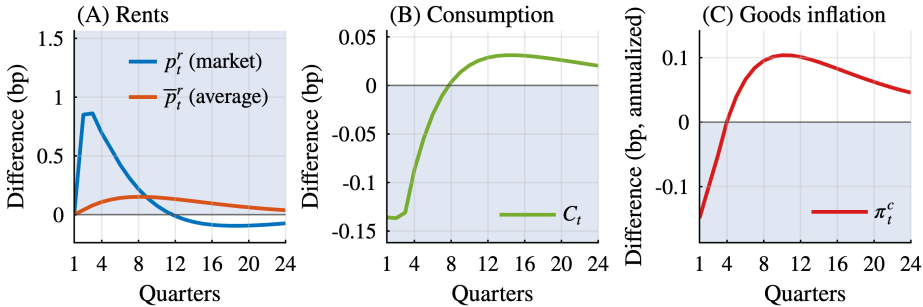
# Rent in the Target

# Rent in the Target: Policy Feedback

**Goods only** $i_t = r_{ss} + \phi_\pi \, \pi_t^c + \varepsilon_t^m$

**HICP-style** $i_t = r_{ss} + \phi_\pi \, \pi_t^{\text{hicp}} + \varepsilon_t^m, \quad \pi_t^{\text{hicp}} = (1 - \omega_r) \, \pi_t^c + \omega_r \, \pi_t^{\text{rent}}$

$\omega_r = 0.053$: model's rent share




HICP-style minus goods only  rule amplifies the tightening

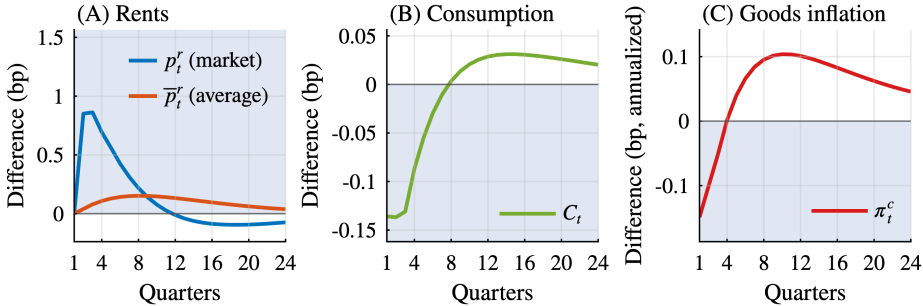
Back

# Rent in the Target: Policy Feedback

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HICP-style minus goods only  rule amplifies the tightening

## Rents in the target destabilize

**+2.7%** consumption loss | **+3.4%** rents paid | **+2.8%** $\pi^c$ volatility | **+2.8%** $\pi^{\text{rent}}$ volatility

for no extra disinflation (0% at two years, −2.7% by year five)

▸ All weights ▸ Owner-occupied housing ◂ Back

# Taking Stock

1. **HICP-style rule**: tightening $\rightarrow$ **rents** $\uparrow$ $\rightarrow$ rule tightens more
2. Rents paid lag $\rightarrow$ the loop **outlasts the shock**
3. **Deeper contraction**: the rule fights rent inflation it created

$\Rightarrow$ **How should policy respond to rent inflation?**

Back

# Optimal Response

# Optimal Simple Rule

**Rule** $i_t = r_{ss} + \phi_\pi \, \pi_t^c + \phi_r \, \pi_t^{\text{rent}}$ → main exercise: $\phi_\pi$ fixed, vary $\phi_r$

**Welfare**

$$\phi_r^* = \arg\max_{\phi_r} \sum_{t \geq 1} \tilde{\beta}_t \Big[ \underbrace{\int u(c_{it}, h_{it}) \, di}_{\substack{\text{all households,} \\ \text{equal weights}}} - \underbrace{\nu(N_t)}_{\text{hours}} - \underbrace{\frac{\theta_w}{2} (\pi_t^w)^2}_{\text{wage adjustment}} \Big]$$

**Four shocks that raise rents**

| | | |
|---|---|---|
| **Preferences** | ▸ IRFs | impatience, and the rule tightens → fewer buyers → rents rise |
| **Govt spend** | ▸ IRFs | spending ↑ → the rule tightens → fewer buyers → rents rise |
| **Rental supply** | ▸ IRFs | landlords' mortgage costs ↑ → fewer homes for rent → rents rise |
| **Cost-push** | ▸ IRFs | wage markups ↑ → $\pi^c$ ↑ → the rule tightens → rents rise |

**Should rent inflation raise ($\phi_r > 0$) or lower ($\phi_r < 0$) the policy rate?**

◂ Back

# Optimal Weight on Rent Inflation

| | demand | | supply | |
|---|---|---|---|---|
| | **Preferences** | **Govt spend** | **Rental supply** | **Cost-push** |
| Optimal weight, $\phi_r^*$ | $-0.50$ | $-0.50$ | $-0.18$ | $-0.48$ |
| Welfare gain at $\phi_r^*$ | $+1.24$ | $+0.37$ | $+0.11$ | $+0.09$ |

→ relative to goods only → CE in bp of permanent consumption → demand shocks: at the bound $\phi_\pi + \phi_r = 1$

**Ease: rent inflation should lower the policy rate**

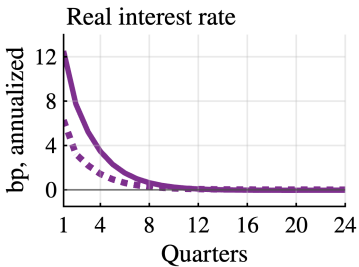
→ **any $\phi_r \in [-0.25, 0]$** raises welfare under all four shocks

→ HICP-style rule: welfare losses under all four ▸ Welfare across $\phi_r$ ▸ Other rules ▸ Reverse shock

◂ Back

# Mechanism: Cost-Push Shock

solid: goods only  dotted: $\phi_r^* = -0.48$

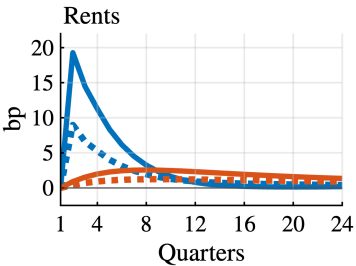



$\rightarrow$ lower landlord mortgage costs and savings returns

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# Mechanism: Cost-Push Shock

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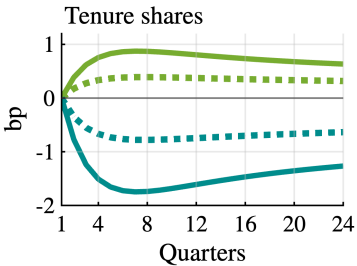

→ lower landlord mortgage costs and savings returns

→ rents rise less  market  average

Back

# Mechanism: Cost-Push Shock

solid: goods only  dotted: $\phi_r^* = -0.48$




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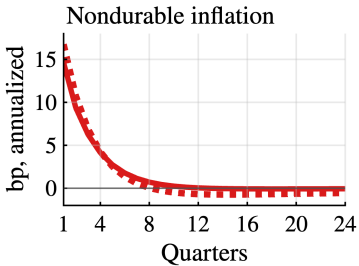
→ rents rise less

→ fewer renters  renters  owners

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# Mechanism: Cost-Push Shock

solid: goods only  dotted: $\phi_r^* = -0.48$




→ lower landlord mortgage costs and savings returns

→ rents rise less

→ fewer renters

→ some price destabilization

Back

# Taking Stock

1. **Ease**: rent inflation should *lower* the policy rate
2. **Robust**: any $\phi_r \in [-0.25, 0]$ raises welfare
3. Lower rates $\rightarrow$ **landlords'** costs $\downarrow$ $\rightarrow$ rents rise less & fewer **renters**

$\Rightarrow$ **Neither tighten nor look through: ease**

Back

# Ramsey Policy

# Standard Ramsey Policy

**policy chosen** at the date of the shock

**Problem** max $\mathcal{W}(\mathbf{i})$ s.t. competitive equilibrium given $\mathbf{i} = \{i_t\}_t$

**Computational method** automatic differentiation (Barcons, Ghassibe, Nakov & Thaler 2026)

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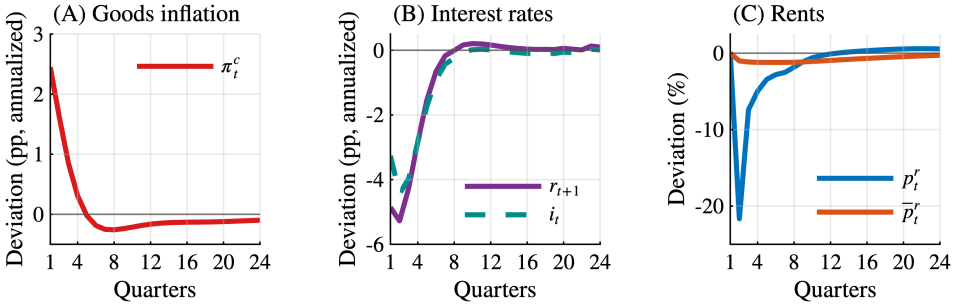
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- **No shock:** eases by surprise → redistribution to poor **renters** & **mortgagors**




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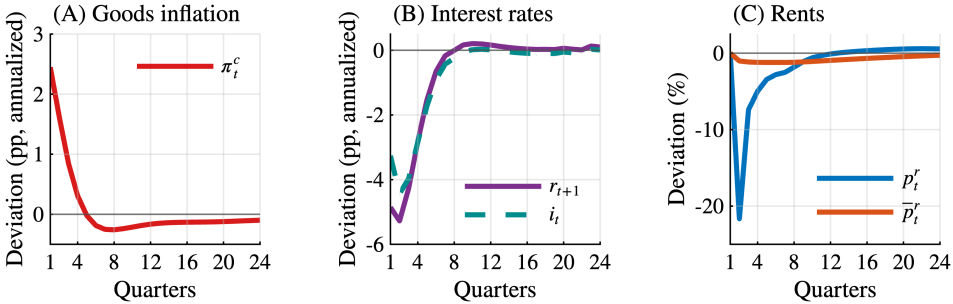
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- **No shock:** eases by surprise → redistribution to poor **renters** & **mortgagors**




- **Patience shock:** same surprise easing, about the same gain ▸ Results

◂ Back

# Timeless Ramsey Policy

Timeless problem

**What is optimal if the central bank cannot exploit the surprise?**

Back

# Timeless Ramsey Policy

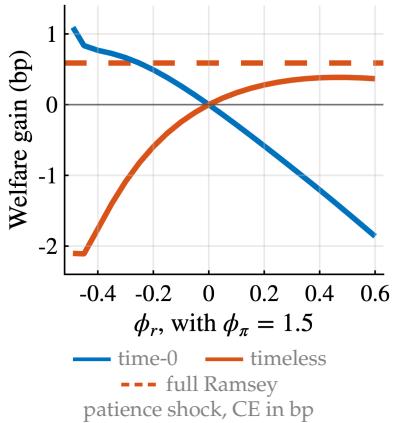
Timeless problem

**What is optimal if the central bank cannot exploit the surprise?**

**Result: timeless is mostly stabilization**

→ **no shock**: a surprise brings no gain

→ **patience**: best rule tightens, $\phi_\pi = 2.1$, $\phi_r = +0.2$




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# Timeless Ramsey Policy

Timeless problem

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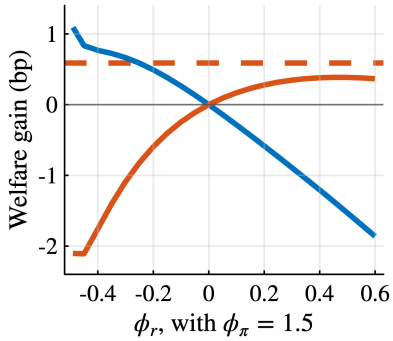
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## Why? The weights

Weights

→ **time-0**: easing helps *renters* & *borrowers*, who count **most**

→ **timeless**: promises to past *savers* & *landlords* weaken it




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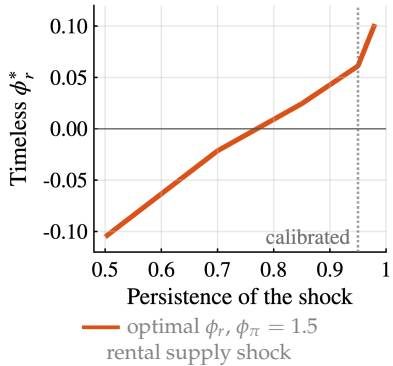
Weights

→ **time-0**: easing helps *renters* & *borrowers*, who count **most**
→ **timeless**: promises to past *savers* & *landlords* weaken it

## It depends on shock persistence

Persistence

→ persistent: stabilization ➜ $\phi_r^* > 0$
→ transitory: redistribution ➜ $\phi_r^* < 0$




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# Taking Stock

1. **Standard Ramsey**: **eases** by surprise, even with no shock $\rightarrow$ **redistribution**
2. **Timeless**: no surprise to exploit $\rightarrow$ mostly **stabilization**
3. **Timeless**, transitory shocks $\rightarrow$ redistribution supports **easing**

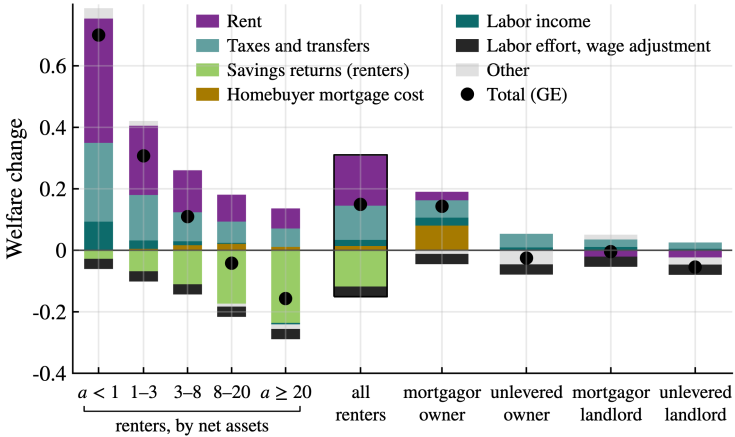
$\Rightarrow$ **Easing rests largely on redistribution**

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# Who Gains

Welfare change: $\phi_r^* = -0.50$ *vs* goods only (*in utils, per capita*)

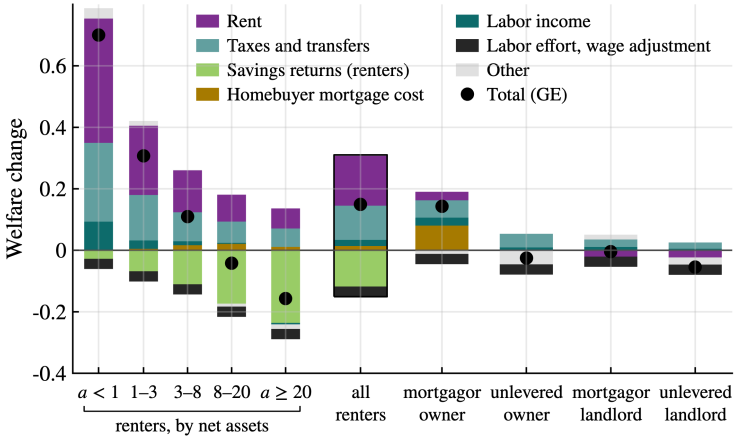
preferences shock, by household at the shock




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# Who Gains

Welfare change: $\phi_r^* = -0.50$ *vs* goods only (*in utils, per capita*)
preferences shock, by household at the shock




## Rent relief is progressive

→ lower rents: every renter gains, poorest most

→ wealthy renters lose: lower savings returns

→ mortgagor-owners gain: lower mortgage costs

→ lower interest bill: higher transfers

▸ Other shocks

◂ Back

# Just a Less Hawkish Rule?

$\pi_t^{\text{rent}} \approx \pi_t^c + \text{real rent growth}$

$$i_t = r_{ss} \quad + \quad \underbrace{(\phi_\pi + \phi_r)\,\pi_t^c}_{\text{less hawkish on } \pi^c} \quad + \quad \underbrace{\phi_r\left(\pi_t^{\text{rent}} - \pi_t^c\right)}_{\text{eases with real rent growth}}$$

**Is the gain just the first term?**

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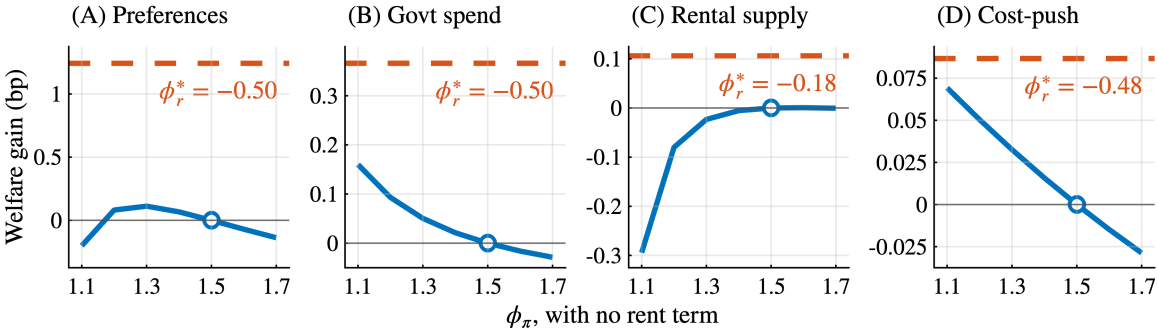
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## Lowering $\phi_\pi$ alone falls short: the rent term matters

▸ Fixed hawkishness ▸ One rule, all shocks




no $\phi_\pi$ comes close | $\phi_\pi = 1.1$: $\approx$ half short | no $\phi_\pi$ comes close | $\phi_\pi = 1.1$: $\approx 1/5$ short

no rent term, varying $\phi_\pi$ — optimized rent rule ($\phi_\pi = 1.5$) — goods only — CE in bp

◂ Back

# Appendix

# VAR Details

Other countries

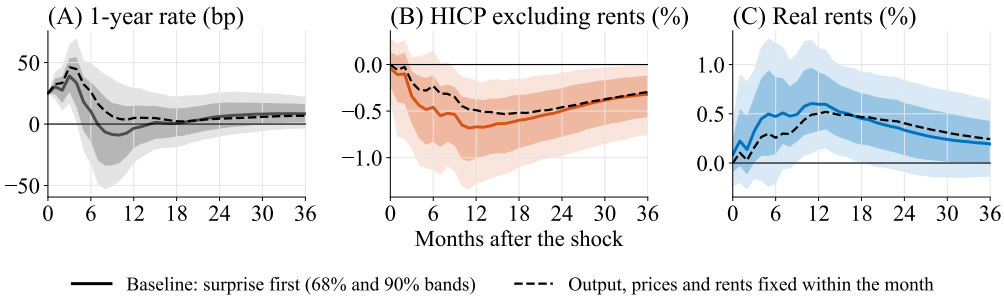
$$y_t = c + \sum_{\ell=1}^{6} A_\ell \, y_{t-\ell} + u_t, \qquad y_t = \left(z_t,\ i_t,\ ip_t,\ p_t,\ q_t,\ s_t\right)', \qquad u_t = B\,\varepsilon_t$$

| | Variable | Role | As in |
|---|---|---|---|
| $z_t$ | ECB surprise | instrument, ordered first | Altavilla et al. (2019); GK |
| $i_t$ | 1-year rate | policy indicator | Gertler and Karadi (2015) |
| $ip_t$ | Industrial production | activity | GK; Dias and Duarte (2019) |
| $p_t$ | HICP excluding rents | prices | GK; Dias and Duarte (2019) |
| $q_t$ | HICP rents | rents | Dias and Duarte (2019) |
| $s_t$ | ES–DE 10-year spread | credit conditions | GK's excess bond premium |

- **Shock**: innovation in $z_t$ (1-year OIS change around ECB announcements, monthly as in GK), ordered first, Cholesky (Plagborg-Møller and Wolf 2021); +25 bp on $i_t$; first-stage $F = 11.9$
- **Estimation**: Spain, monthly, 2005:3–2019:12; 6 lags; log levels; block bootstrap, 68% and 90% bands

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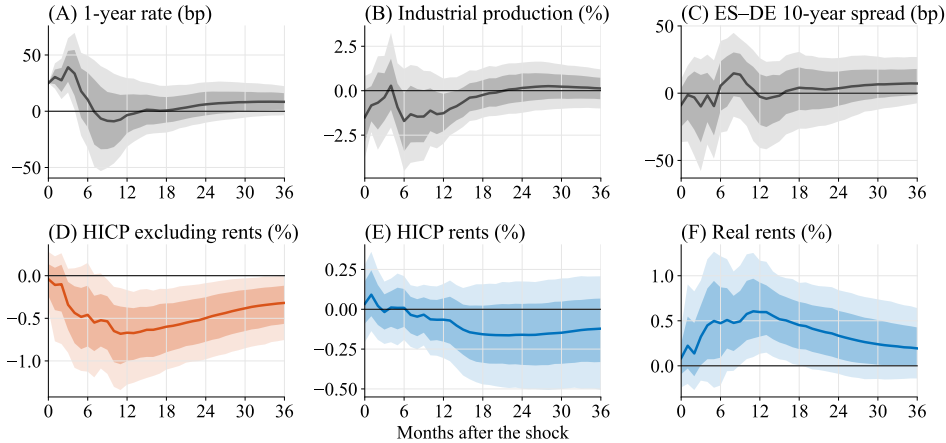
# VAR: Robustness




- **Ordering**: surprise placed after output, prices and rents (dashed): prices $-0.5\%$, real rents $+0.5\%$ after a year
- **INE rents** instead of HICP rents: real rents $+0.4\%$ after a year
- Real rents higher after a year in **all 24 specifications**: 6 or 12 lags, HICP or HICP excluding rents, two rent series, three sets of controls (none, spread, spread + oil)

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# VAR: All Responses




Baseline: surprise ordered first, Spain 2005:3–2019:12, per 25 bp on the 1-year rate; median, 68% and 90% bands.

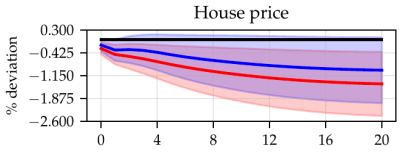
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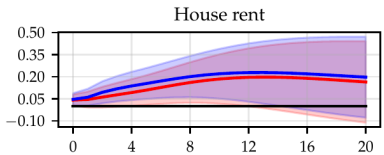
# Evidence: Rents after a Tightening

**United States**

house prices fall,

index rents rise




68% bands. US: Dias and Duarte (2022), 25bp, quarters; rents = CPI rent of primary residence (all tenants).

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Euro area

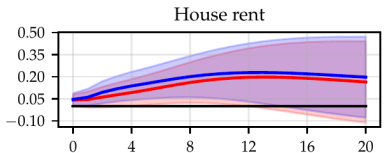
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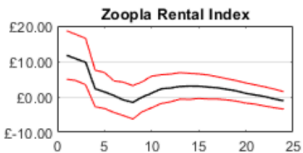


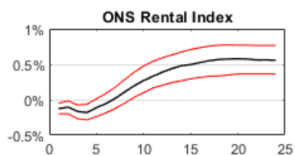




**United Kingdom**

new leases jump,

index rises later




68% bands. US: Dias and Duarte (2022), 25bp, quarters; rents = CPI rent of primary residence (all tenants). UK: Lazarowicz and Richard (2023), 100bp, months; Zoopla = new-lease listings (£/week, real), ONS = official private rents index.

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Euro area

# Evidence: Euro Area

*"Data on new rents in the euro area are **scarce**."*

*"[T]he rent basket mostly covers **existing rents**, which tend to catch up with market forces **with a lag**."*

— ECB Economic Bulletin, Issue 7/2023, box "Rent inflation in the euro area"

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**Euro area**

HICP actual rentals







→ house prices fall; index rents rise slowly, but the 68% band includes zero

→ as for the UK index: mostly existing leases, so it moves later and less than new leases

Corsetti et al. (2022): 25bp contractionary shock, quarters, 68% bands.

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# Textbook Economy: Setup

Reduced **Iacoviello (2005)**: one household, owned housing in fixed supply

## Household

$$\max \; E_0 \sum_t \beta^t \left[ \frac{c_t^{1-\sigma}}{1-\sigma} + j \ln h_t \right]$$

$$\text{s.t.} \;\; c_t + q_t \left( h_t - h_{t-1} \right) + b_t = y_t + \left( 1 + r_{t-1} \right) b_{t-1}, \qquad h_t = \overline{H}$$

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## First-order conditions

$$c_t^{-\sigma} = \beta \left( 1 + r_t \right) E_t \, c_{t+1}^{-\sigma} \qquad \text{(Euler)}$$

$$q_t \, c_t^{-\sigma} = \frac{j}{\overline{H}} + \beta \, E_t \left[ q_{t+1} \, c_{t+1}^{-\sigma} \right] \qquad \text{(Housing demand: buy, enjoy, resell)}$$

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## First-order conditions

$$c_t^{-\sigma} = \beta \left( 1 + r_t \right) E_t \, c_{t+1}^{-\sigma} \qquad \text{(Euler)}$$

$$q_t \, c_t^{-\sigma} = \frac{j}{\overline{H}} + \beta \, E_t \left[ q_{t+1} \, c_{t+1}^{-\sigma} \right] \qquad \text{(Housing demand: buy, enjoy, resell)}$$

**Rent** no rental market in Iacoviello: $R_t$ is the **shadow rent**, what one more period of housing services is worth (a frictionless rental market would charge exactly this; see Kaplan et al., 2020)

$$R_t \equiv \frac{j / \overline{H}}{c_t^{-\sigma}} \qquad \Rightarrow \qquad \underbrace{q_t}_{\text{buy today}} = \underbrace{R_t}_{\text{rent}} + \underbrace{\beta \, E_t \left[ \left( \frac{c_{t+1}}{c_t} \right)^{-\sigma} q_{t+1} \right]}_{\text{resale value, discounted}}$$

Back

# Textbook Economy: Response to a Tightening

**Rent** hats: log deviations from steady state

$$\hat{R}_t = \sigma\, \hat{c}_t, \qquad \hat{c}_t = E_t \hat{c}_{t+1} - \frac{1}{\sigma}\, \hat{r}_t \quad \Rightarrow \quad \hat{R}_t \;=\; E_t\, \hat{R}_{t+1} - \hat{r}_t \;=\; -\sum_{k\geq 0} E_t\, \hat{r}_{t+k}$$

**a tightening** raises the path of real rates $\Rightarrow$ **rents fall**, one-for-one

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**House price**

$$\text{Housing demand: } q_t\,c_t^{-\sigma} = \tfrac{j/\overline{H}}{1-\beta} \text{ (constant)} \quad \Rightarrow \quad q_t = \frac{R_t}{1-\beta} \quad \Rightarrow \quad \hat{q}_t = \hat{R}_t$$

rents and prices fall by the same %: **rent-to-price ratio unchanged** (data: it rises)

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rents and prices fall by the same %: **rent-to-price ratio unchanged** (data: it rises)

**Missing:** no rental market, so nobody is priced out of owning into renting, and no landlords whose mortgage costs rise with the policy rate

Back

# Who Are the Landlords?



| | **No landlord**<br>textbook | **A separate sector**<br>two-agent models:<br>Dias & Duarte 2022, de Llanos 2026 | **Households**<br>this paper |
|---|---|---|---|
| Rent equals | what households will pay for a fixed stock | landlord's user cost + conversion wedge | where renters who cannot buy meet landlords who could lend instead |
| Demand | falls: spending falls | **shifts out**: buyers priced out | **shifts out**: buyers priced out |
| Supply | fixed stock | **falls** with house prices; steep because converting homes is costly | **shifts in**: letting pays less than lending, mortgages cost more |
| Rents | **fall** | **rise** only if the demand shift beats the cheaper home<br>steepness = conversion cost, param. | **rise**; size of each shift = households at the buy/rent and own/let margins<br>disciplined by tenure flows |

**This paper:** both shifts; landlords supply about two thirds of the pressure from higher rates, and who switches (leverage, not tenure) drives incidence and welfare.

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# Recursive Household Problem

**State** $(a, h, y, s)$: wealth, tenure, productivity, lease state $s \in \{0, 1, \ldots, J\}$

housing services: $f(h) = \mathbb{1}_{h=0} + \mathbb{1}_{h>0} \left(\theta \tilde{h}_2 / \tilde{h}_1\right)^{\alpha_h}$

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## Bellman equation

$$V_t^{\varepsilon}(a, h, y, s) \;=\; \max_{c, a', h'} \;\; \mathcal{U}(c, h, n) \;+\; \sigma_{\varepsilon}\, \varepsilon(h') \;+\; \beta_t\, \mathbb{E}_t \left[ V_{t+1}(a', h', y', s') \,\middle|\, y, h, s, h' \right]$$

s.t. the budget and borrowing constraints

lease next period: keep rental tenure ($h' = h \in \{0, 2\}$) $\Rightarrow$ continues w.p. $\varphi\, \xi^s_{2-h,t}$, $s' = \min\{s+1, J\}$

otherwise $\Rightarrow$ new lease at the market rent ($s' = 0$) $\quad \xi$: partner's tenure retention

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**Logit tenure choice** $\widetilde{V}_t(h') \equiv \widetilde{V}_t(a, h, y, s; h')$: value of choosing $h'$, before taste shocks

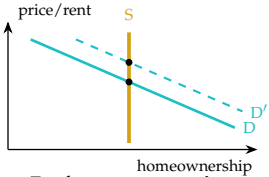
$$\mathbb{P}_t(h' \mid a, h, y, s) = \frac{\exp\left(\widetilde{V}_t(h') / \sigma_\varepsilon\right)}{\sum_j \exp\left(\widetilde{V}_t(j) / \sigma_\varepsilon\right)}, \qquad V_t(a, h, y, s) = \sigma_\varepsilon \log \sum_j \exp\left(\widetilde{V}_t(j) / \sigma_\varepsilon\right)$$

taste shocks $\varepsilon$ (type-I extreme value; Iskhakov et al. 2017) only smooth the tenure choice

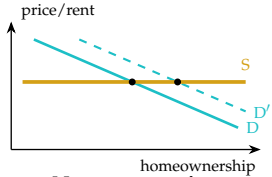
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# Rental Supply across Models

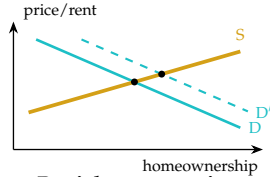
**Tenure supply** landlords' sales to owner-occupiers as price/rent rises (Greenwald & Guren 2025)




**Perfect segmentation**
Favilukis et al. (2017)
no rental market: credit moves only price/rent



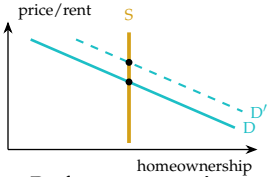

**No segmentation**
Kaplan et al. (2020)
deep-pocketed landlords: credit moves only homeownership



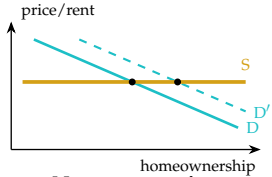

**Partial segmentation**
Greenwald & Guren (2025)
credit moves both; data closer to full segmentation

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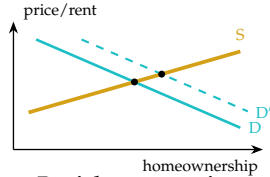
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**This paper:** upward-sloping, from the endogenous landlord margin (Castellanos et al. 2024)

| rental-supply elasticity | model | evidence |
|---|---|---|
| quarters 1–4 | 0.37 | 0.4–0.7 (short run) |
| quarters 5–8 | 1.06 | $\approx$ 1.4 (long run) |

Back

# Housing Costs and Collateral

**Housing units** sizes $\tilde{h}_1 < \tilde{h}_2$, freely convertible: a unit of size $\tilde{h}$ is worth $p_t^h \tilde{h}$

$\rightarrow$ renter holds nothing $\rightarrow$ owner holds $\tilde{h}_2$ $\rightarrow$ landlord holds $\tilde{h}_1 + \tilde{h}_2$

as in Castellanos et al. (2024)

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| from $h$ \ to $h'$ | renter (0) | owner (1) | landlord (2) |
|---|---|---|---|
| renter (0) | $0$ | $(1+\tau_h)\,\tilde{h}_2$ | $(1+\tau_h)(\tilde{h}_1+\tilde{h}_2)$ |
| owner (1) | $-(1-\tau_h-\delta_h)\,\tilde{h}_2$ | $\delta_h\,\tilde{h}_2$ | $(1+\tau_h)\,\tilde{h}_1+\delta_h\,\tilde{h}_2$ |
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$\rightarrow$ positive: net cost, negative: net receipt $\rightarrow$ $\tau_h$: transaction tax $\rightarrow$ $\delta_h$: depreciation

e.g. owner $\rightarrow$ renter: sells $\tilde{h}_2$ and receives $(1-\tau_h-\delta_h)\,p_t^h\,\tilde{h}_2$

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e.g. owner $\rightarrow$ renter: sells $\tilde{h}_2$ and receives $(1-\tau_h-\delta_h)\,p_t^h\,\tilde{h}_2$

**Housing bought** $q(h, h')$ (sets the LTV limit)

$\rightarrow q(0,1) = \tilde{h}_2$ $\rightarrow q(0,2) = \tilde{h}_1 + \tilde{h}_2$ $\rightarrow q(1,2) = \tilde{h}_1$ $\rightarrow q = 0$ otherwise

Back

# Average Rent and the Rent Index

**Average rent** paid by renters $\mu_t^{0,s}/\mu_t^0$: share of renters with lease state $s$

$$\overline{p}_t^r \;=\; \textstyle\sum_{s<J}(\mu_t^{0,s}/\mu_t^0)\,p_{t-s}^r \;+\; (\mu_t^{0,J}/\mu_t^0)\,\widetilde{p}_t^r \;\approx\; \textstyle\sum_{k\geq 0}\omega_k\,p_{t-k}^r$$

→ lease masses: $\mu_{t+1}^{0,s+1} = \varphi\,\xi_{0,t}^s\,\xi_{2,t}^s\,\mu_t^{0,s}$

→ long-term tenants: $\widetilde{p}_t^r = \lambda_{t-1}\,\widetilde{p}_{t-1}^r + (1-\lambda_{t-1})\,p_{t-J}^r$

→ weights $\omega_k$ on the market rent $k$ quarters ago: 59% on leases younger than $J$, 41% on long-term tenants

**Rent inflation** in the index: $1+\pi_t^{\text{rent}} = (1+\pi_t^c)\,\overline{p}_t^r/\overline{p}_{t-1}^r$

→ mean lag of 22 quarters: turnover delays the market rent, without shrinking it

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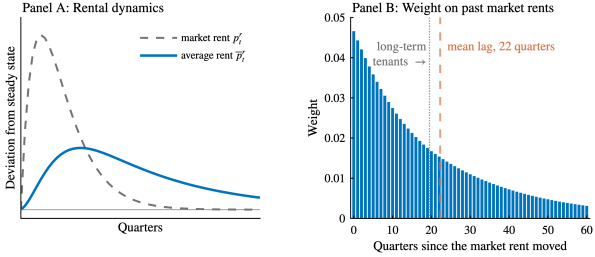
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# Alternative Taylor Rules

**Baseline** $i_t = r_{ss} + \phi_\pi \, \pi_t^{\text{hicp}} + \varepsilon_t^m$

**Inertia** $i_t - r_{ss} = \rho_i \, (i_{t-1} - r_{ss}) + (1 - \rho_i) \, \phi_\pi \, \pi_t^{\text{hicp}} + \varepsilon_t^m$

$\rho_i = 0.8$ (Burriel et al. 2010; Smets & Wouters 2007); one-time shock, same size as baseline

**Output gap** $i_t = r_{ss} + \phi_\pi \, \pi_t^{\text{hicp}} + \phi_y \left( Y_t^c / Y_{ss}^c - 1 \right) + \varepsilon_t^m$

$\phi_y = 0.125$, i.e. 0.5 annualized (Burriel et al. 2010)

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**Results hold; only magnitudes change** ▸ Inertia: IRFs ▸ Output gap: IRFs

→ rents still rise while house prices fall; landlords still drive about 65% of the rise

→ lower rent peak: −15% with inertia, −13% with the output gap

inertia: per unit of real rate, which moves 61% more; output gap: the real rate moves 14% less

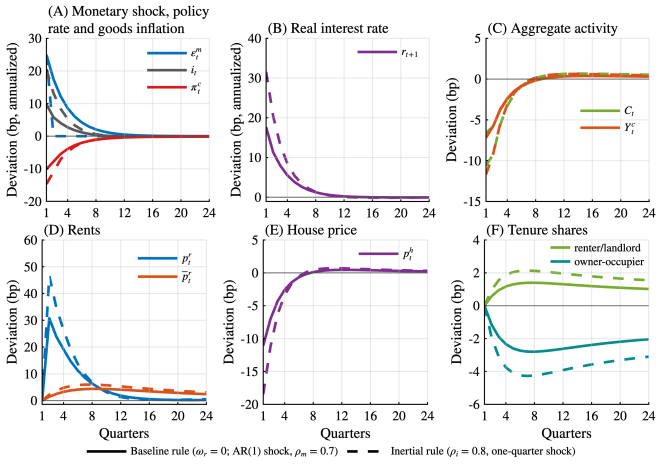
→ rents in the target still deepen the contraction, by less

→ optimal response: still ease, under all four shocks

◂ Back: model ◂ Back: optimal weight

# Inertial Rule: IRFs

Figure: inflation term goods only ($\omega_r = 0$)

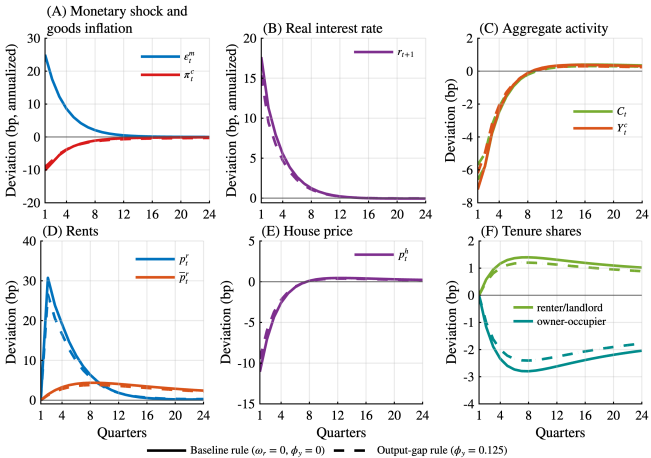



$\rightarrow$ one-time shock, same size as baseline

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# Output-Gap Rule: IRFs

Figure: inflation term goods only ($\omega_r = 0$)




→ same signs and shapes, but smaller → why? rule cuts rates as output falls

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# A Spanish Central Bank?



**The ECB's rule** responds to euro-area inflation; Spain's share $\vartheta = 11.4\%$

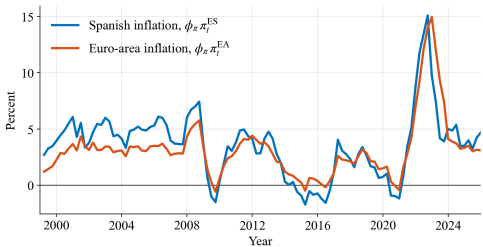
$$i_t = r_{ss} + \phi_\pi \left[ \vartheta \, \pi_t^{\text{ES}} + (1 - \vartheta) \, \pi_t^{\text{xES}} \right] + \varepsilon_t^m$$

**Seen from Spain**

$\rightarrow$ alone, the response to Spanish inflation is small: $\phi_\pi \vartheta \approx 0.17$

$\rightarrow$ but inflation in Spain and in the rest of the euro area shares one cycle: **correlation 0.82**, slope $b = 0.75$

$\rightarrow$ effective coefficient $\phi_\pi \left[ \vartheta + (1 - \vartheta) \, b \right] =$ **1.16**




$\phi_\pi \pi_t$, $\phi_\pi = 1.5$, y-o-y HICP 1999–2025; corr. 0.86

$\Rightarrow$ **to first order, a fictitious Spanish central bank acts as the ECB**

Back

# Wage Setting

**Unions** a continuum $k \in [0,1]$; union $k$ sets its nominal wage $W_{kt}$

**Labor demand** $N_{kt} = (W_{kt}/W_t)^{-\epsilon_t} N_t$ (a packer bundles the varieties)

**Rationing** every household works the same hours: $n_{it} = N_t$

**Objective** $\sum_{j \geq t} D_{t,j} \Big[ \int \left( u(c_{ij}, h_{ij}) - v(n_{ij}) \right) di - \frac{\theta_w}{2} \left( \pi^w_{kj} \right)^2 \Big]$ $D_{t,j}$: discount, $\theta_w$: Rotemberg cost

**Wage Phillips curve** symmetric equilibrium, $W_{kt} = W_t$

$$\pi^w_t = \frac{\epsilon_t}{\theta_w} N_t \Big( v'(N_t) - (1+\tau_L) \tfrac{\epsilon_t - 1}{\epsilon_t} (1-\tau_y) w_t \int y_{it} u_c(c_{it}, h_{it}) di \Big) + \beta_t \pi^w_{t+1}$$

$v'(N_t)$: what an extra hour **costs**

$(1-\tau_y) w_t \int y_{it} u_c di$: what an extra hour **pays**, after tax

$(1+\tau_L) \frac{\epsilon_t - 1}{\epsilon_t}$: unions' desired markup, offset by the subsidy in SS

$\rightarrow$ unions push wages up when an hour **costs** more than it **pays**

Back

# Competitive Equilibrium

Given the shock paths, an equilibrium is prices $(w_t, r_t, i_t, \pi_t^c, p_t^h, p_t^r, \widetilde{p}_t^r)$, quantities, transfers $T_t$, debt $B_t$, retention rates $\xi_t$ and a distribution $g_t(a, h, y, s)$ such that:

## Agents optimize

households: Bellman equation s.t. constraints

goods firm: $w_t = A^c$

construction firm: $Y_t^h = A^h L_t^{\alpha_L} S_t^{1-\alpha_L}$

maximizes profits given $p_t^h$

unions: $n_t = N_t$, wage Phillips curve

## Markets clear

housing: $H_{t+1} = (1 - \delta_h) H_t + Y_t^h$

rental: renters = landlords

bonds: $A_t \equiv \int a \, dg_t = B_t$

land: $L_t = \overline{L}$

goods: by Walras' law

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## Policy and aggregation

central bank: Taylor rule; Fisher: $1 + i_t = (1 + r_{t+1})(1 + \pi_{t+1}^c)$

government: debt absorbs deficits; the transfer responds to debt, $T_t = T_{ss} - \Gamma_B \left(B_t - \overline{B}\right)$

leases: expected retention $\xi_{h,t}^s$ = the one choices generate; long-term tenants' rent $\widetilde{p}_t^r$ follows its rule

$g_t$ evolves with household choices, income shocks and lease resets

no aggregate risk: one-time unexpected (MIT) shocks, then a deterministic transition back to steady state

Back

# Calibrated Parameters

## Set externally

### Housing and tenure

| | | |
|---|---|---|
| $\tilde{h}_1$, $\tilde{h}_2$ | 0.905, 1.095 | housing sizes |
| $\alpha_h$ | 0.5 | housing preference |
| $\varphi$ | 0.99 | lease continues, per quarter |
| $J$ | 20 | quarters until long-term tenant |

### Mortgages

| | | |
|---|---|---|
| $\lambda_{\text{LTV}}$ | 0.8 | 20% down payment (Bover et al. 2019) |
| $\lambda_{\text{LTI}}$ | 24 | 6× annual income (IMF 2026) |
| $\kappa$ | 0.00345 | 1.38 pp spread, as in the data |
| $m$ | 0.0190 | 90% repaid in 30 years |

### Preferences and income

| | | |
|---|---|---|
| $\gamma$ | 2 | risk aversion |
| $\eta$ | 2 | inverse Frisch elasticity |
| $\rho_y$ | 0.95 | income AR(1) (Flodén & Lindé 2001) |
| $\sigma_y$ | 0.104 | innovation s.d. (Arellano et al. 2022) |

$\tilde{h}_1$, $\tilde{h}_2$, $\alpha_h$, $\alpha_L$: Castellanos et al. (2024)

### Production and policy

| | | |
|---|---|---|
| $\alpha_L$ | 0.33 | land share |
| $\epsilon$ | 10 | elasticity across labor varieties |
| $\tau_L$ | 1/9 | employment subsidy: offsets the markup |
| $\theta_w$ | 777 | wage PC slope 0.02 (Auclert et al. 2024) |
| $\phi_\pi$ | 1.5 | Taylor rule (Auclert et al. 2025) |
| $\overline{B}$ | 4 | debt: 100% of annual GDP |
| $\Gamma_B$ | 0.051 | fiscal rule (Burriel et al. 2010) |

## Set internally, jointly

| | | |
|---|---|---|
| $A^h$ | 0.0294 | housing productivity |
| $\delta_h$ | 0.0046 | depreciation (1.8% a year) |
| $\theta$ | 1.197 | ownership preference |
| $\beta$ | 0.9881 | discount factor |
| $\sigma_\varepsilon$ | 0.122 | taste shocks |
| $\tau_h$ | 0.025 | transaction tax |
| $\tau_y$ | 0.150 | labor tax |

normalized: $A^c = \overline{L} = \mathbb{E}[y] = 1$; $\psi_n$ sets $N = 1$

Back

# Additional Moments

| | Model | Spain |
|---|---|---|
| **Renters** | | |
| renters' labor income / mean | 0.83 | 0.74 |
| rent burden, median | 30.7% | 24.1% |
| rent share of the consumption basket | 5.3% | 3.1% |
| **Wealth** | | |
| top-10% share of net worth | 18.1% | 53.2% |
| wealthy hand-to-mouth | 16.0% | 15.2% |
| poor hand-to-mouth | 1.7% | 4.4% |
| **Investment** | | |
| nonresidential investment / GDP | — | 15.6% |

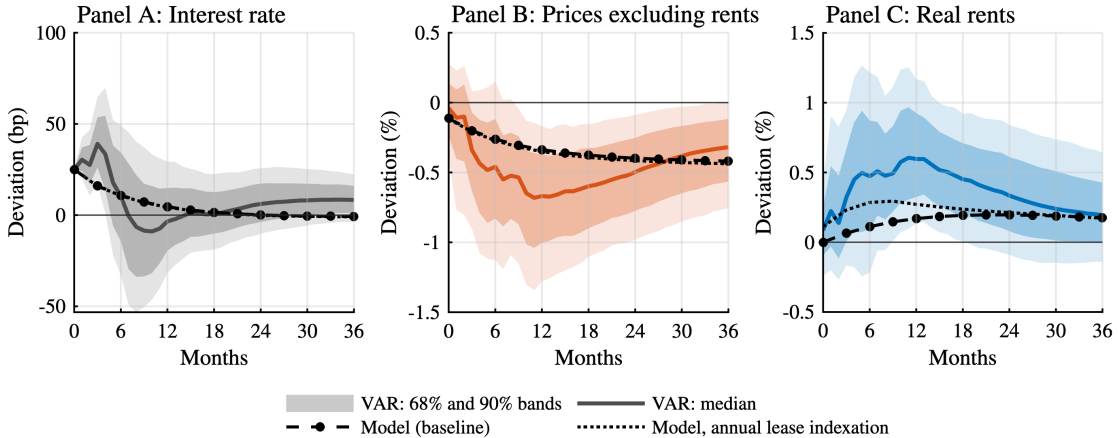
→ common discount factor: thin top tail (Auclert et al. 2025: heterogeneous patience)

→ renters cannot borrow: few poor hand-to-mouth; the ordering is right

→ adding productive capital: another saving vehicle

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# Monetary Tightening in Spain: Model and Evidence

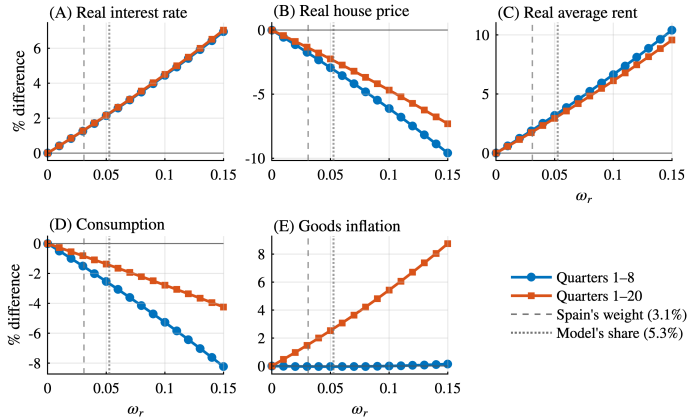



→ prices fall, real rents rise: same sign and timing as the VAR

Model scaled: 1-year nominal yield +25 bp on impact. Dotted: annual lease indexation.

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# Costs across Rent Weights




Cumulative, quarters 1–8 and 1–20: % difference from goods only ($\omega_r = 0$); negative: lower

→ costs grow almost in proportion to the weight; the disinflation does not

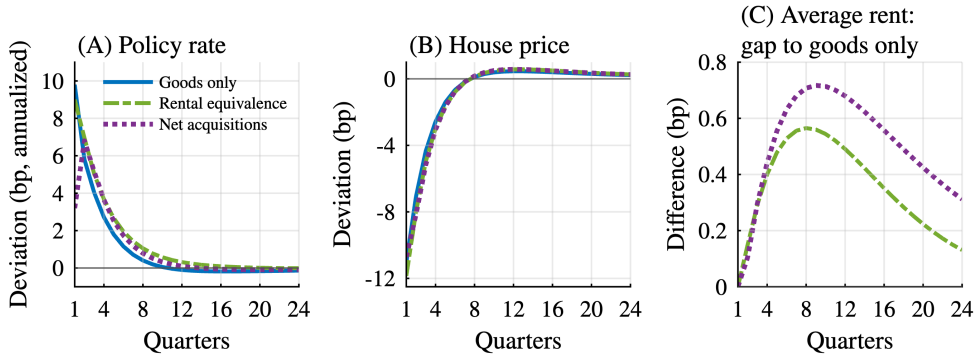
→ at Spain's 3.1%: about 60% of the effects at the model's 5.3%

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# Owner-Occupied Housing in the Target

**Index** $\pi_t^{\text{index}} = (1-\omega_r-\omega_o)\,\pi_t^c + \omega_r\,\pi_t^{\text{rent}} + \omega_o\,\pi_t^o$ $\quad \omega_r = 5.3\% \times (1-\omega_o)$

**Rental equivalence** $\pi_t^o = \pi_t^{\text{rent}}$ $(\omega_o = 13\%)$ $\quad$ **Net acquisitions** $1+\pi_t^o = (1+\pi_t^c)\,p_t^h/p_{t-1}^h$ $(\omega_o = 9\%)$




→ rental equivalence: imputed rents = average rent ⇒ the same lagged feedback, 3–4× stronger

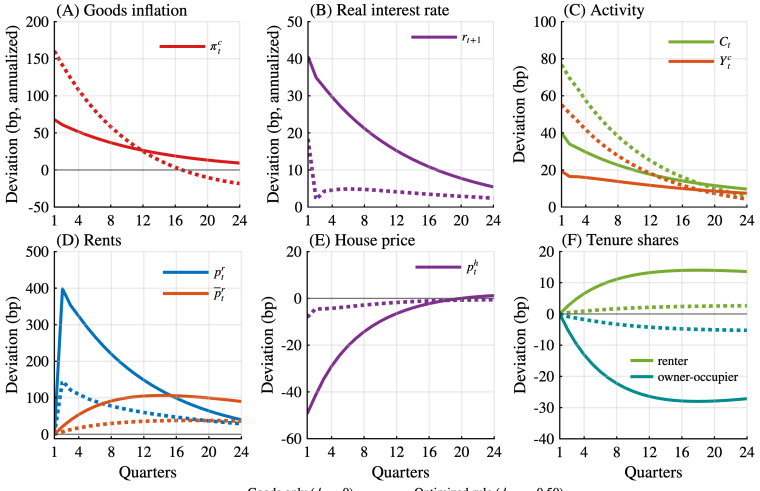
→ net acquisitions reads house-price *growth*: eases on impact, tightens as prices recover

the tightening comes in quarters 2–4, when new leases are signed at the peak market rent

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# Preferences Shock: IRFs

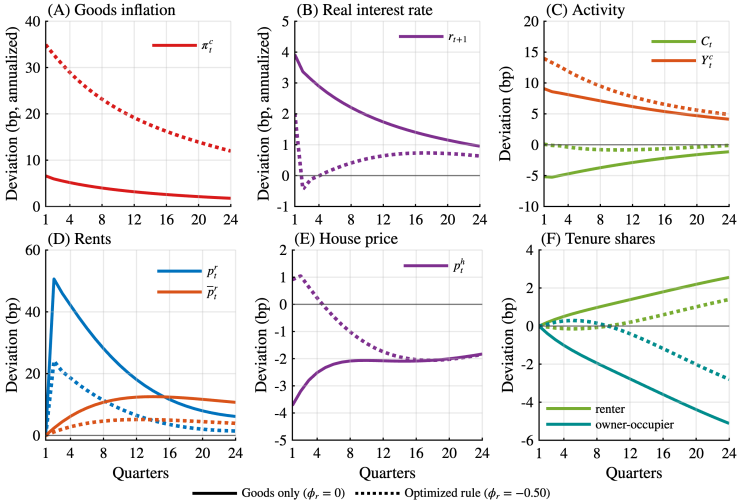
Figure: inflation term goods only ($\omega_r = 0$)




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# Government Spending Shock: IRFs

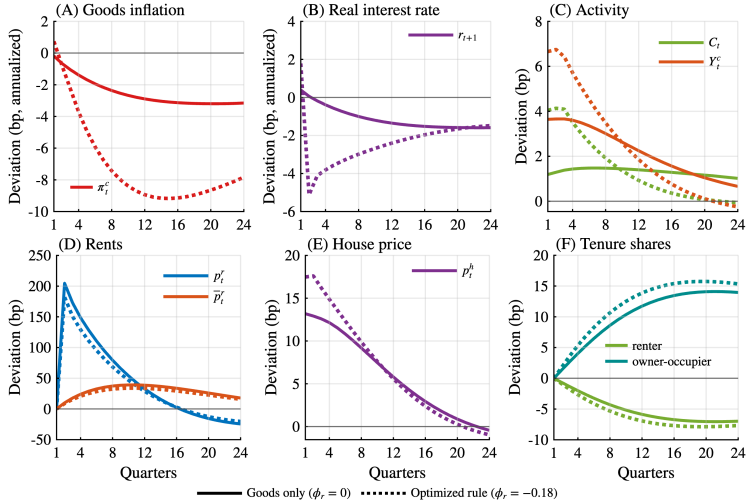
Figure: inflation term goods only ($\omega_r = 0$)




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# Rental Supply Shock: IRFs

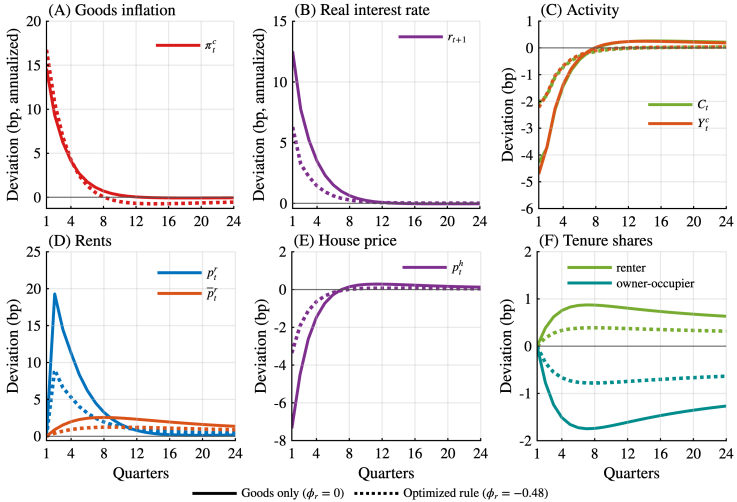
Figure: inflation term goods only ($\omega_r = 0$)




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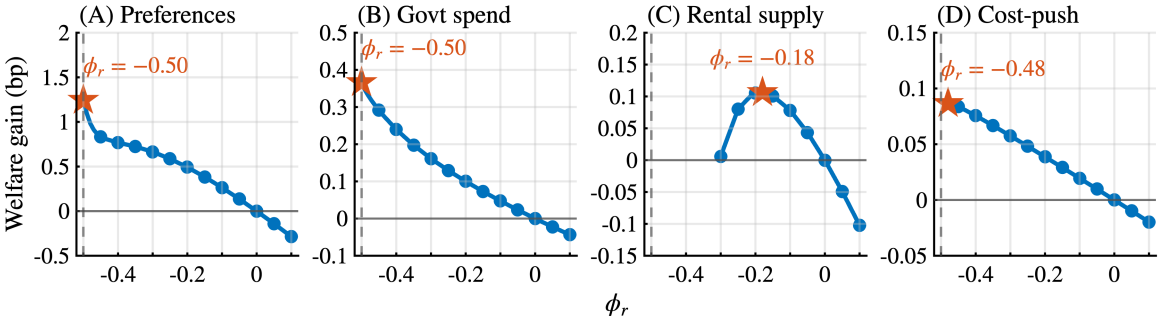
# Cost-Push Shock: IRFs

Figure: inflation term goods only ($\omega_r = 0$)




Back

# Welfare across $\phi_r$




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# Reverse Sign Shock

each shock with the opposite sign of the baseline
$\Rightarrow$ rents fall under all four

$\rightarrow$ **optimal $\phi_r > 0$ under all four shocks** ▸ IRFs ▸ Who gains
at the cap $\phi_r = +0.65$ under all four; gains $\geq +2.40, +0.24, +0.65, +0.14$ bp

$\rightarrow$ **why?** mostly redistribution, also efficiency *(smaller)*

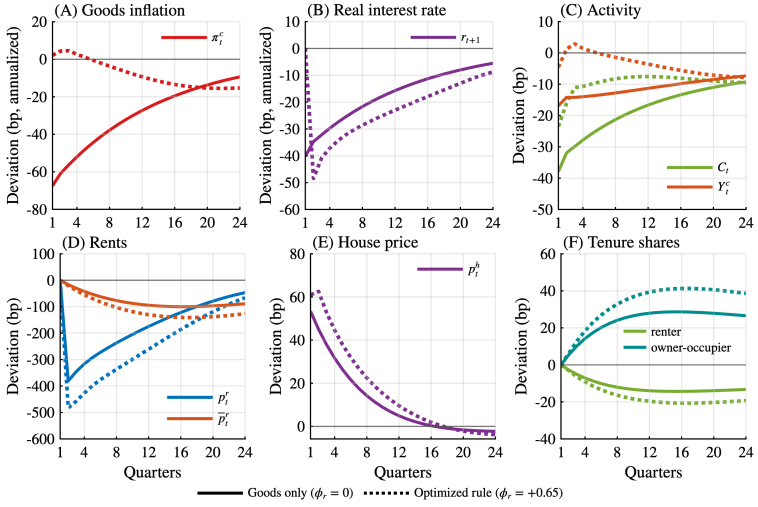
$\rightarrow$ rent term **loosens policy**: lower real rate, higher inflation, both signs

$\rightarrow$ redistribution always gains; efficiency gains only when the shock is deflationary

◂ Back

# Reverse Sign Shock: IRFs

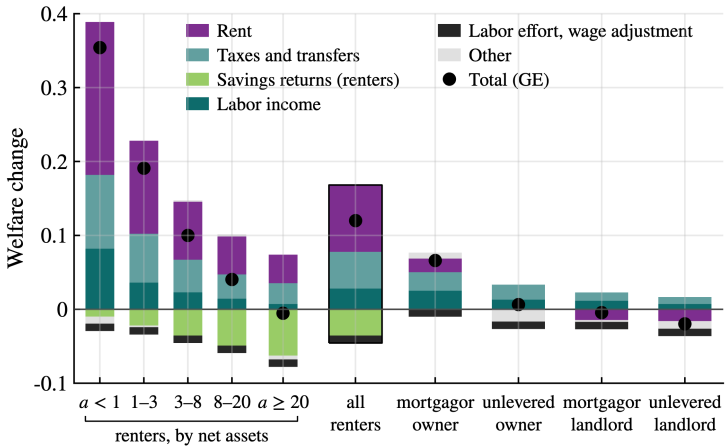
Preferences shock; inflation term goods only ($\omega_r = 0$)




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# Reverse Sign: Who Gains

Welfare change: $\phi_r = +0.65$ *vs* goods only (*in utils, per capita*)
preferences shock, reverse sign, by household at the shock




## Rent relief leads

→ lower rents: every renter gains, poorest most

→ then higher transfers and labor income

→ wealthy renters lose: lower savings returns

Back

# Holding Hawkishness Fixed

welfare gain over $(\phi_\pi, \phi_r) = (1.5, 0)$, bp

$$i_t = r_{ss} + \underbrace{(\phi_\pi + \phi_r)}_{\widetilde{\phi}_\pi} \pi_t^c + \phi_r \left(\pi_t^{\text{rent}} - \pi_t^c\right)$$

$\widetilde{\phi}_\pi$: hawkishness on $\pi^c$

| | **Less hawkish only** best $\widetilde{\phi}_\pi$, $\phi_r = 0$ | **Rent term only** $\widetilde{\phi}_\pi = 1.5$, $\phi_r = -0.4$ | **Both** best on the grid, $(\phi_\pi, \phi_r)$ |
|---|---|---|---|
| Preferences | $+0.11$ ($\widetilde{\phi}_\pi = 1.3$) | $+\mathbf{0.58}$ | $+0.78$ (1.6, $-0.4$) |
| Govt spend | $+\mathbf{0.16}$ ($\widetilde{\phi}_\pi = 1.1$) | $+0.09$ | $+0.24$ (1.5, $-0.4$) |
| Rental supply | $0.00$ ($\widetilde{\phi}_\pi = 1.5$) | $+\mathbf{0.28}$ | $+0.28$ (1.9, $-0.4$) |
| Cost-push | $+\mathbf{0.07}$ ($\widetilde{\phi}_\pi = 1.1$) | $+0.02$ | $+0.08$ (1.5, $-0.4$) |

→ at a fixed $\widetilde{\phi}_\pi$ ($\geq 1.2$), easing with real rent growth helps under all four shocks

→ rent term matters most: preferences, rental supply; lower $\widetilde{\phi}_\pi$: govt, cost-push

→ rental supply: lowering $\widetilde{\phi}_\pi$ alone *hurts* ($-0.29$ at $\widetilde{\phi}_\pi = 1.1$)

grid: $\widetilde{\phi}_\pi \in \{1.1, 1.2, 1.3, 1.5\}$, $\phi_r \in [-0.4, 0]$; best points at $\phi_r = -0.4$

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# One Rule for All Shocks

$\pi_t^{\text{rent}} \approx \pi_t^c + \text{real rent growth}$

$$i_t = r_{ss} + \underbrace{(\phi_\pi + \phi_r)\,\pi_t^c}_{\text{response to } \pi^c\text{: 1.3 in both}} + \underbrace{\phi_r\left(\pi_t^{\text{rent}} - \pi_t^c\right)}_{\text{eases with real rent growth}}$$

**Is the gain just the first term?**

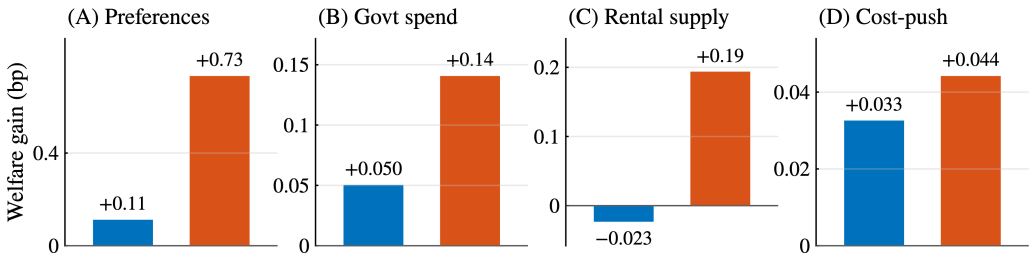
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# One Rule for All Shocks

$\pi_t^{\text{rent}} \approx \pi_t^c +$ real rent growth

$$i_t = r_{ss} + \underbrace{(\phi_\pi + \phi_r)\,\pi_t^c}_{\text{response to } \pi^c\text{: 1.3 in both}} + \underbrace{\phi_r\left(\pi_t^{\text{rent}} - \pi_t^c\right)}_{\text{eases with real rent growth}}$$

**Same response to $\pi^c$: higher welfare under every shock** ▸ Fixed hawkishness




$(\phi_\pi, \phi_r) = (1.3, 0)$: best rule without rents  $(1.7, -0.40)$: best rule with rents  best: summed over shocks · CE in bp

→ rent term **eases when rents rise**; no single $\phi_\pi$ does ▸ Same rates?

◂ Back

# Same Rates without a Rent Term?

cumulative real rate $r_{t+1}$, quarters 1–20

Each shock: rule without rents, same total rate cut as the rent rule → welfare?

| | **No rent term, same rates** | | **Rent term** |
|---|---|---|---|
| | $\phi_\pi$ that matches | its gain | $(1.7, -0.40)$ |
| Preferences | 1.11 | $-0.18$ | $+\mathbf{0.73}$ |
| Govt spend | below 1.1 | — | $+0.14$ |
| Rental supply | none: rates fall | — | $+\mathbf{0.19}$ |
| Cost-push | 1.23 | $+0.046$ | $+0.044$ |

→ same rate path: a **different $\phi_\pi$ for every shock**

→ rental supply: the rent rule cuts rates; no $\phi_\pi$ does

→ cost-push: same rates, same gain → the gain is the lower rate path

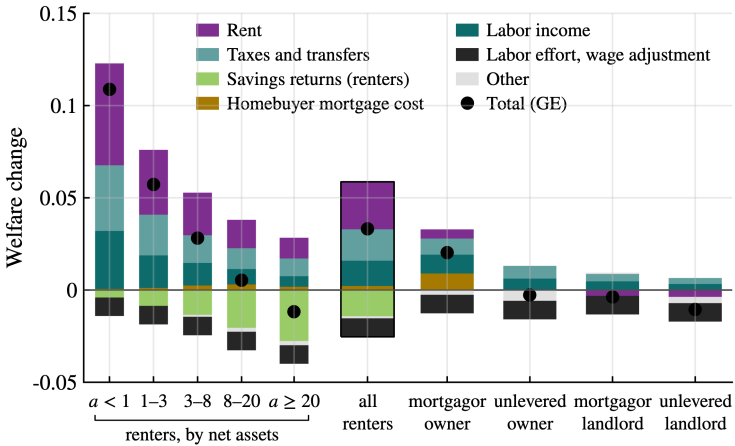
CE in bp over $(1.5, 0)$

Back

# Who Gains: Other Shocks

Welfare change: $\phi_r^* = -0.50$ *vs* goods only (*in utils, per capita*)

govt spending shock, by household at the shock




## Rent relief leads

→ lower rents: every renter gains, poorest most

→ more work: higher labor income, at an effort cost to all

→ lower interest bill: higher transfers

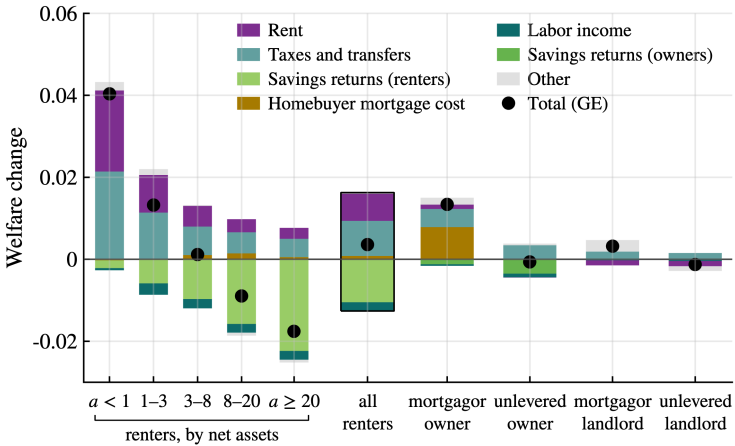
→ wealthy renters lose: lower savings returns

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# Who Gains: Other Shocks

Welfare change: $\phi_r^* = -0.18$ *vs* goods only (*in utils, per capita*)

rental supply shock, by household at the shock




## Transfers and rent relief

→ poorest renters: transfers and lower rents, about equally

→ wealthy renters lose: lower savings returns

→ renters as a group: about break even

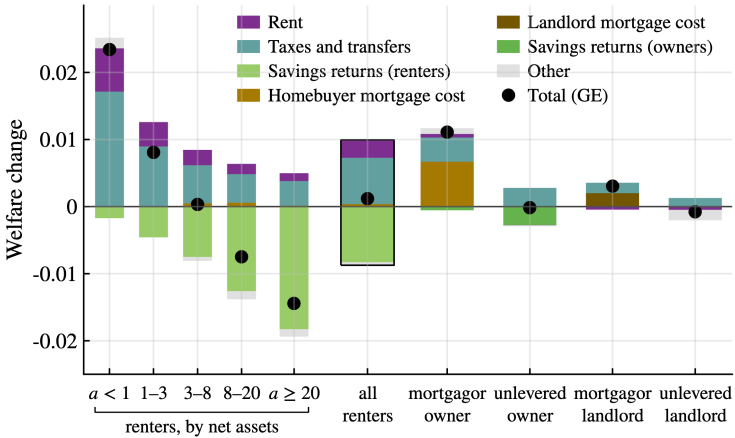
→ mortgagor-owners gain: lower mortgage costs

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# Who Gains: Other Shocks

Welfare change: $\phi_r^* = -0.48$ *vs* goods only (*in utils, per capita*)

cost-push shock, by household at the shock




## Transfers lead

→ poorest renters: mostly transfers, then lower rents

→ wealthy renters lose: lower savings returns

→ renters as a group: about break even

→ mortgagor-owners gain: lower mortgage costs

Back

# Efficiency *vs* Redistribution

$dV_i^\lambda / d\phi_r$: household $i$'s willingness to pay for a higher $\phi_r$ (*in* $\lambda$ *units*)

$$d\mathcal{W}^\lambda / d\phi_r \quad = \quad \underbrace{\mathbb{E}_i\left[dV_i^\lambda / d\phi_r\right]}_{\textbf{efficiency}} \quad + \quad \underbrace{\mathbb{C}\text{ov}_i\left(\omega_i,\, dV_i^\lambda / d\phi_r\right)}_{\textbf{redistribution}}$$

**efficiency**: total willingness to pay — **redistribution**: toward high-$\omega_i$ households

$\omega_i$: $i$'s value of extra consumption, relative to the average household (Dávila & Schaab 2025) Decomposition

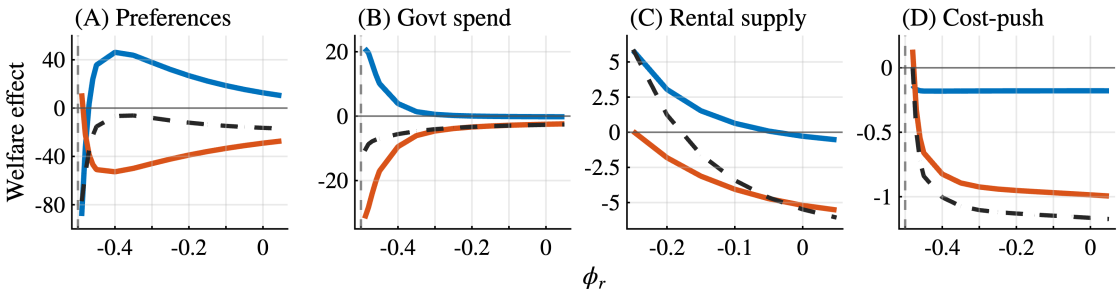
**Why does easing raise welfare?**

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# Efficiency *vs* Redistribution

$$d\mathcal{W}^{\lambda}/d\phi_r \quad = \quad \underset{\text{total willingness to pay}}{\textbf{efficiency}} \quad + \quad \underset{\text{toward high-}\omega_i\text{ households}}{\textbf{redistribution}}$$

**Mostly redistribution; under cost-push, efficiency too**



# Efficiency *vs* Redistribution: Decomposition

**Welfare** $\mathcal{W} = \sum_t \tilde{\beta}_t \big[ \int u(c_{it}, h_{it})\, di - \nu(N_t) - \frac{\theta_w}{2} (\pi_t^w)^2 \big] = \sum_i \mu_i V_i$

$V_i = \mathbb{E}\big[ \sum_t \tilde{\beta}_t \big( u(c_{it}, h_{it}) - \nu(N_t) - \frac{\theta_w}{2} (\pi_t^w)^2 \big) \big]$

$i$: household type at the shock (wealth, income, tenure), with share $\mu_i$

**Unit** $\lambda_i = \mathbb{E}\big[ \sum_t \tilde{\beta}_t\, u_c(c_{it}, h_{it}) \big]$: value of one unit of consumption forever

$\bar{\lambda} = \sum_i \mu_i \lambda_i, \qquad \omega_i = \lambda_i / \bar{\lambda}, \qquad dV_i^\lambda / d\phi_r = \lambda_i^{-1}\, dV_i / d\phi_r$

**Split** $d\mathcal{W}^\lambda / d\phi_r \equiv \bar{\lambda}^{-1}\, d\mathcal{W} / d\phi_r = \sum_i \mu_i\, \omega_i\, dV_i^\lambda / d\phi_r$

$$= \underbrace{\mathbb{E}_i \big[ dV_i^\lambda / d\phi_r \big]}_{\textbf{efficiency}} + \underbrace{\mathbb{C}\text{ov}_i \big( \omega_i,\, dV_i^\lambda / d\phi_r \big)}_{\textbf{redistribution}}$$

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→ **efficiency** $> 0$: on average, households would pay for a higher $\phi_r$

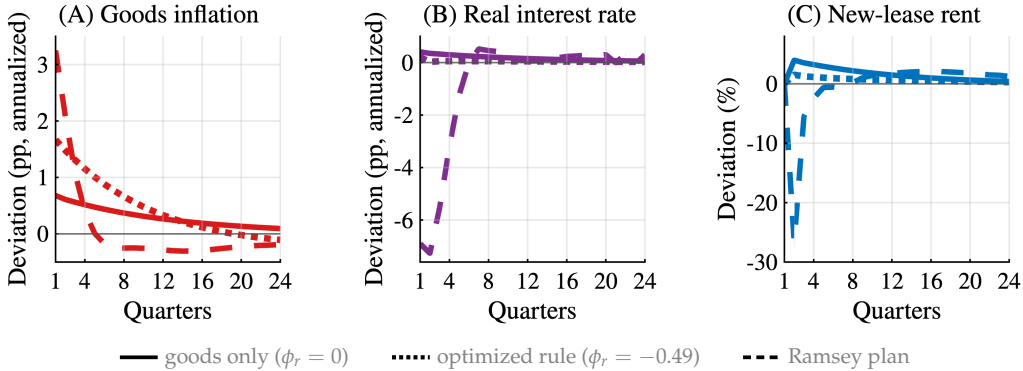
→ **redistribution** $> 0$: a higher $\phi_r$ favors the households with high $\omega_i$

→ $\omega_i$, high to low: renters, then owners, then landlords; within each, mortgagors first

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# Standard Ramsey: Patience Shock

deviations from steady state




→ the rule eases the same way, less than a tenth as far: it moves only with inflation

→ it captures **19%** of the Ramsey gain, **23%** when $\phi_\pi$ is also chosen

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# Timeless Problem

time inconsistency: Kydland & Prescott (1977)
timeless: Woodford (2003); in HA: Dávila & Schaab (2023)

**How do we take the surprise away?** charge the central bank for broken promises

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# Timeless Problem

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**How do we take the surprise away?** charge the central bank for broken promises

**Penalty for broken promises**

$$\mathcal{T}_1 = \underbrace{\sum \int\int \left[ \bar{\Psi}_V V_1 + \bar{\Psi}_{V^a} \partial_a V_1 \right]}_{\text{distributional penalty}} - \underbrace{\bar{\Psi}_\pi \pi_1^w (1 + \pi_1^w)}_{\text{inflation penalty}}$$

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**Timeless problem** $\max \mathcal{W}(\mathbf{i}) + \mathcal{T}_1$ each $\bar{\Psi}$: its value in the stationary Ramsey plan

| | promise on | protects |
|---|---|---|
| $\bar{\Psi}_V$ | value $V_1$ | the *tenure* choice: rent, own, let |
| $\bar{\Psi}_{V^a}$ | marginal value $\partial_a V_1$ | the *saving* and borrowing choice |
| $\bar{\Psi}_\pi$ | wage inflation $\pi_1^w$ | the *unions'* wage setting |

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| $\bar{\Psi}_\pi$ | wage inflation $\pi_1^w$ | the *unions'* wage setting |

**Intuition** the central bank acts as if it had always been in charge

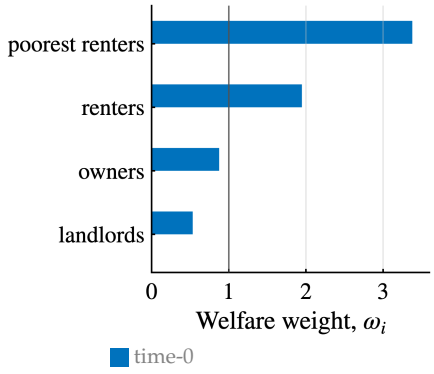
$\rightarrow$ no shock $\Rightarrow$ a surprise brings no gain: the steady state stays optimal

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# Welfare Weights

patience shock; nearly identical under the other shocks

**Weight** $\omega_i$: $i$'s value of an extra euro (average = 1)



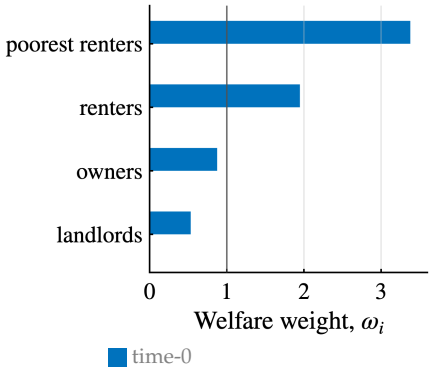

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# Welfare Weights

patience shock; nearly identical under the other shocks

**Weight** $\omega_i$: $i$'s value of an extra euro (average = 1)

**Time-0**: the planner weighs *poor renters* most
$\rightarrow$ poorest renters **3.4**, landlords **0.5** $\Rightarrow$ easing pays




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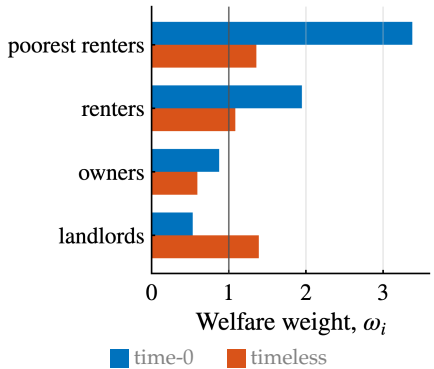
# Welfare Weights

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**Time-0**: the planner weighs *poor renters* most
→ poorest renters **3.4**, landlords **0.5** ⇒ easing pays

**Timeless**: weight moves to *savers* & *landlords*
→ renters *vs* landlords: **3.7**× ⇒ **0.8**×




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# Welfare Weights

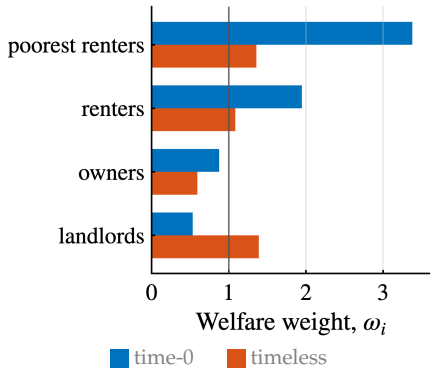
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**Timeless**: weight moves to *savers* & *landlords*
$\rightarrow$ renters *vs* landlords: **3.7**$\times$ $\Rightarrow$ **0.8**$\times$

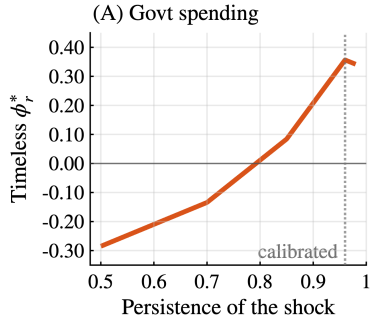
**Why penalize high-MU households?**
to offset the time-0 temptation to redistribute

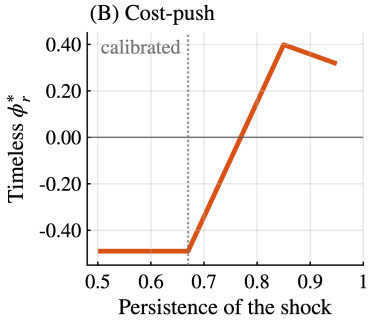



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# Persistence of the Shock

timeless-optimal $\phi_r$, $\phi_\pi = 1.5$

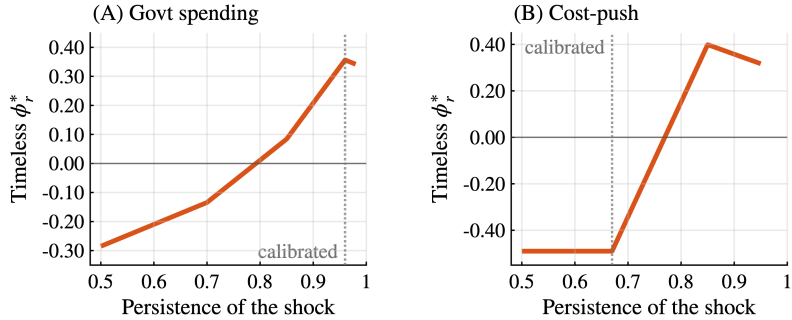



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# Persistence of the Shock

timeless-optimal $\phi_r$, $\phi_\pi = 1.5$




## Why? Efficiency *vs* redistribution

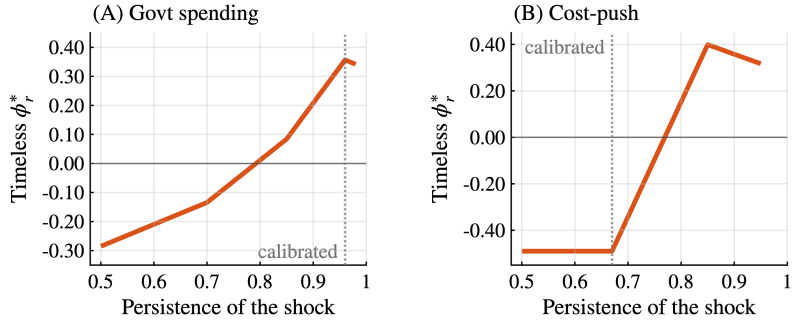
→ **persistent**: easing's efficiency cost is **4–5**× its redistributive gain ➜ $\phi_r^* > 0$

→ **transitory**: the efficiency cost falls much faster ➜ redistribution prevails, $\phi_r^* < 0$

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# Persistence of the Shock

timeless-optimal $\phi_r$, $\phi_\pi = 1.5$




## Why? Efficiency *vs* redistribution

→ **persistent**: easing's efficiency cost is **4–5**× its redistributive gain ➜ $\phi_r^* > 0$

→ **transitory**: the efficiency cost falls much faster ➜ redistribution prevails, $\phi_r^* < 0$

shorter leases: a smaller response, same sign

patience shock: positive down to $\rho = 0.7$

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