

# HOW SHOULD MONETARY POLICY RESPOND TO HOUSING INFLATION?

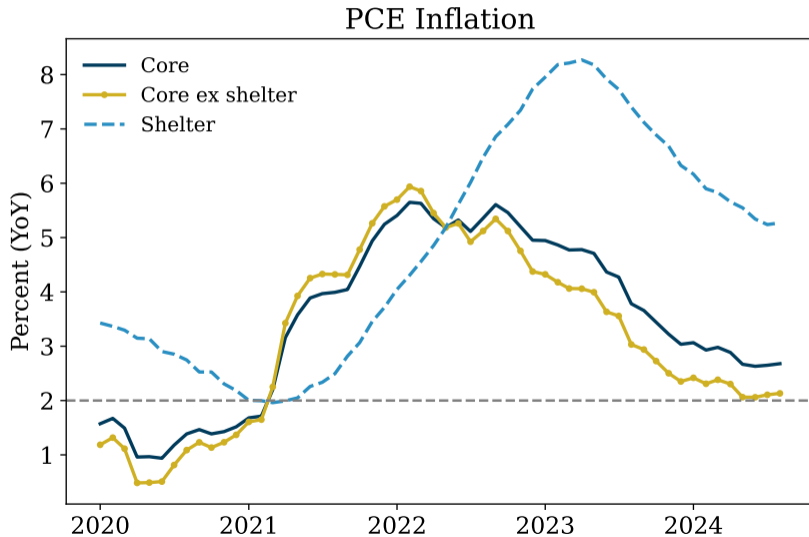
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Javier Bianchi, Alisdair McKay, Neil Mehrotra

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# Price of Shelter Driving Current Inflation



# New Keynesian Theory: Shelter Inflation is very Costly

- Larger welfare costs of  $\pi$  in sectors with more **sticky prices** and more **inelastic supply**  
Aoki (2001), Woodford (2003, ch. 6), Benigno (2004), Eusepi-Hobijn-Tambalotti (2011)
    - Equilibrium is demand determined: producers have to supply at posted price
      - Higher **stickiness**  $\Rightarrow$  larger response in demand
      - More **inelastic supply**  $\Rightarrow$  larger change in inputs to meet demand
  - Rents are highly sticky (e.g. 12-month contracts)
  - Housing supply essentially fixed in the short run
- $\rightarrow$  Monetary policy should respond aggressively to a rise in housing demand

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  - With search friction: **tradeoff** between congestion and output gap

Quantitatively: optimal to ignore housing inflation

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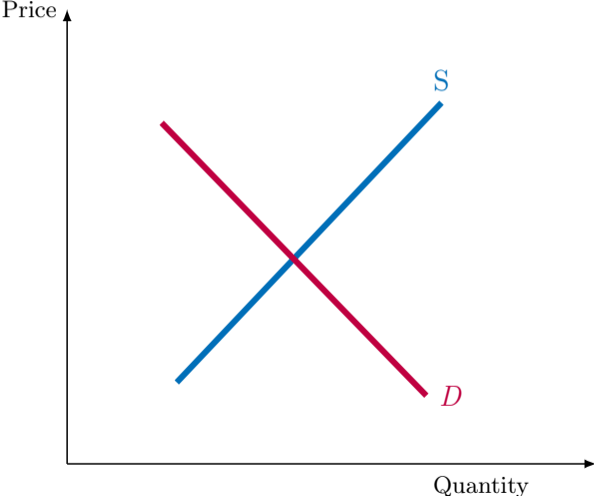
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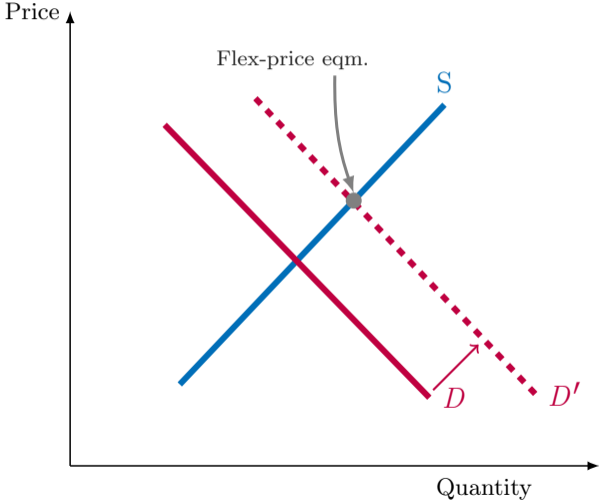
- Broader point— 3 considerations: (i) degree of stickiness; (ii) supply elasticity; (iii) **rationing mechanism**

# Rationing Mechanisms

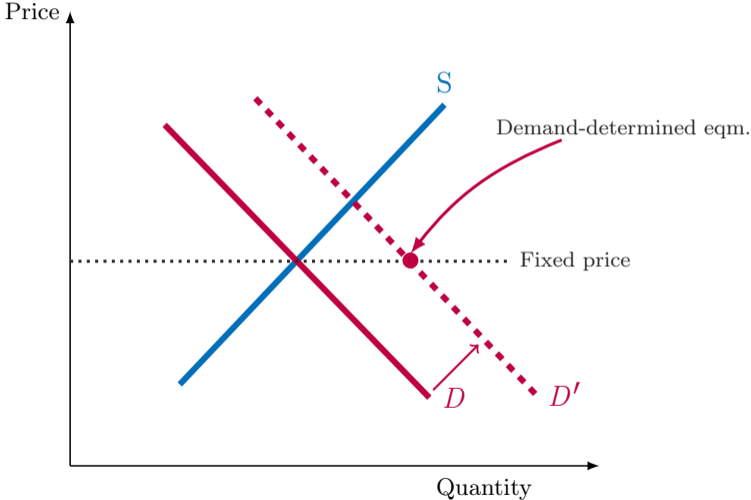
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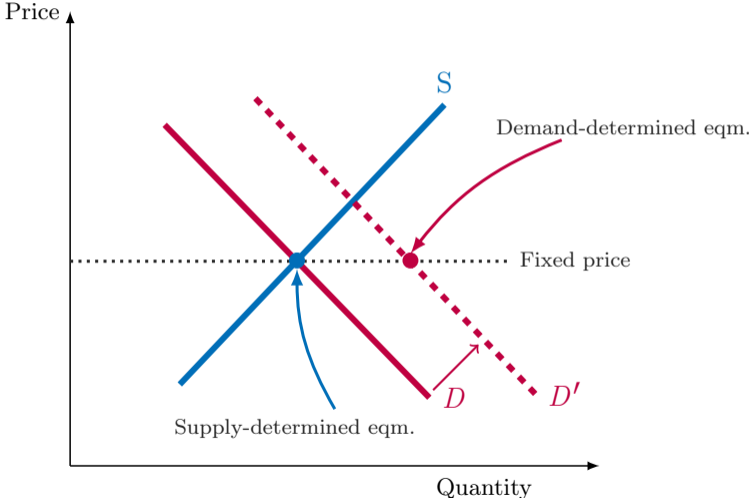
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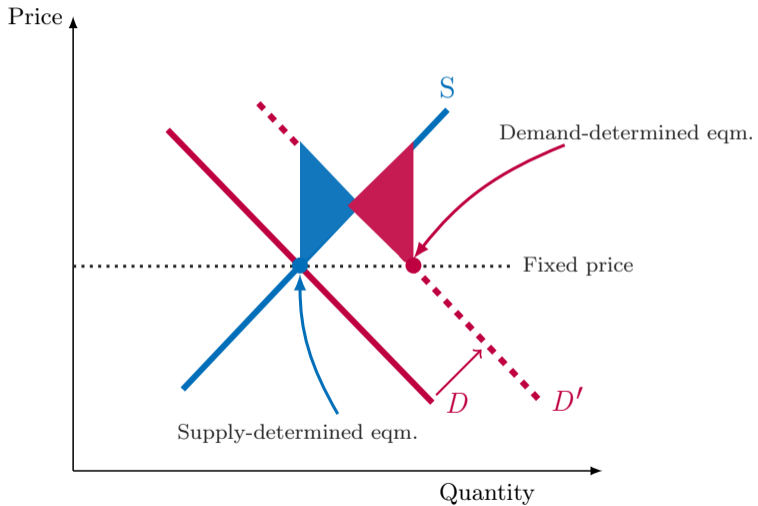
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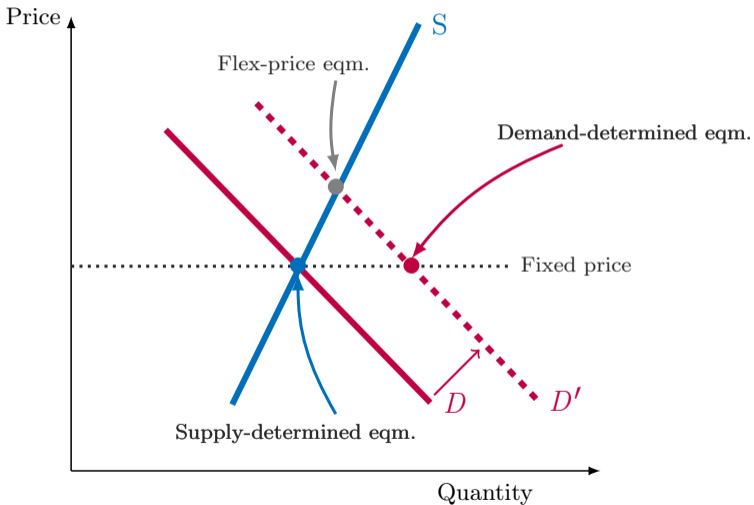
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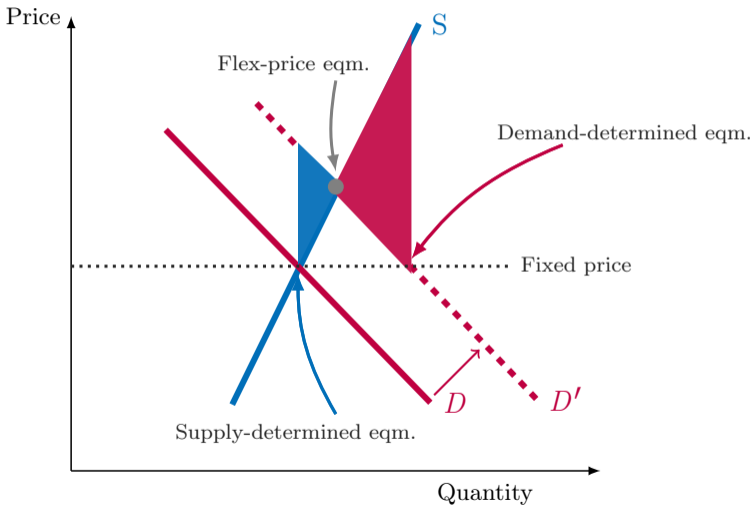
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# Roadmap

## 1. Static model:

– Prices of goods and rents fixed:

□ Goods: output is demand-determined

□ Housing: disequilibrium resolved via search

mimics supply-determined  
if excessive demand



## 2. Dynamic quantitative model:

– Staggered pricing for goods and rentals

– Compare optimal policy, CPI and goods-price targeting

# STATIC MODEL

## Households

$$\{\log(c) + \omega \log(h) + \varphi \log(m) - (\ell + \rho s)\}$$

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$$\max_{c, h, s, l, m} \{ \log(c) + \omega \log(h) + \varphi \log(m) - (\ell + \rho s) \}$$

$$\text{s.t. } Rh + Pc + Pm = W\ell + d + T$$

$$h = sf(\Theta) \quad (\text{search for housing})$$

Market tightness

finding probability  $f' < 0$

- Search split across HH members

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- Inelastically supply  $\bar{h}$

$$\text{Total profits } d = z\ell - W\ell + Rg(\Theta)\bar{h}$$

$g$  prob. of landlord finding tenant

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## Government $M = T$

› Definition of fixed-price equilibrium

# Equilibrium Characterization

$$c = \frac{m}{\varphi}$$

$$\frac{\omega}{h} = \frac{1}{c} \left( \frac{\bar{R}}{\bar{P}} \right) + \frac{\rho}{f(\Theta)}.$$

$$\frac{W}{\bar{P}} = c,$$

## Equilibrium Characterization

$$c = \frac{m}{\varphi} = \frac{M}{\bar{P}\varphi}$$

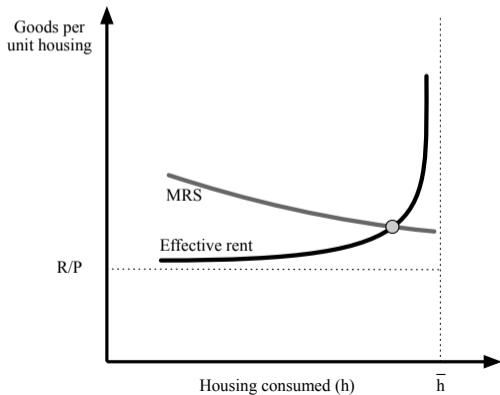
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$$sf(\Theta) = \bar{h}g(\Theta)$$

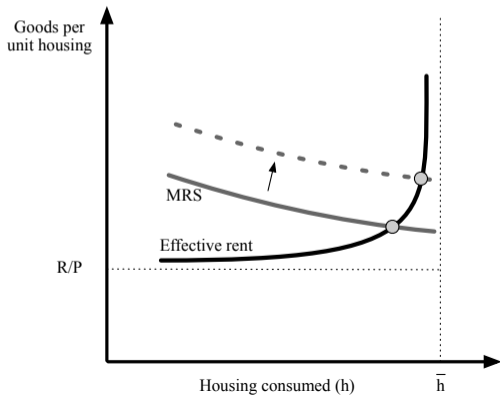
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$$\underbrace{\frac{\omega c}{h}}_{MRS} = \underbrace{\frac{\bar{R}}{\bar{P}} + \frac{c}{f\left(g^{-1}\left(\frac{h}{\bar{h}}\right)\right)}}_{\text{Effective rent}}$$



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## Constrained efficient allocation

- Planner directly chooses allocation subject to technology and search frictions

$$\max_{c,s} \left\{ \log(c) + \omega \log \left( sf \left( \frac{s}{\bar{h}} \right) \right) - \left( \frac{c}{z} + \rho s \right) \right\} \quad (\text{Ignoring money for welfare})$$

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- Optimality

$$c = z$$

$$\frac{\omega}{h} [f(\Theta) + f'(\Theta)\Theta] = \rho$$

- Flex-price outcome is not necessarily constrained efficient (Hosios, 1990)

- Excess search if  $\frac{\bar{R}}{\bar{P}} < -\frac{\omega c}{h} \frac{f'(\Theta)\Theta}{f(\Theta)}$

# Optimal monetary policy

$$\max_{c, s, M} \left\{ \log(c) + \omega \log(sf(s/\bar{h})) - \left( \frac{c}{z} + \rho s \right) \right\}$$

subject to

$$\frac{\omega}{sf(s/\bar{h})} = \left( \frac{1}{c} \right) \frac{\bar{R}}{\bar{P}} + \frac{\rho}{f(s/\bar{h})}$$

$$c = \left( \frac{1}{\varphi} \right) \frac{M}{\bar{P}}$$

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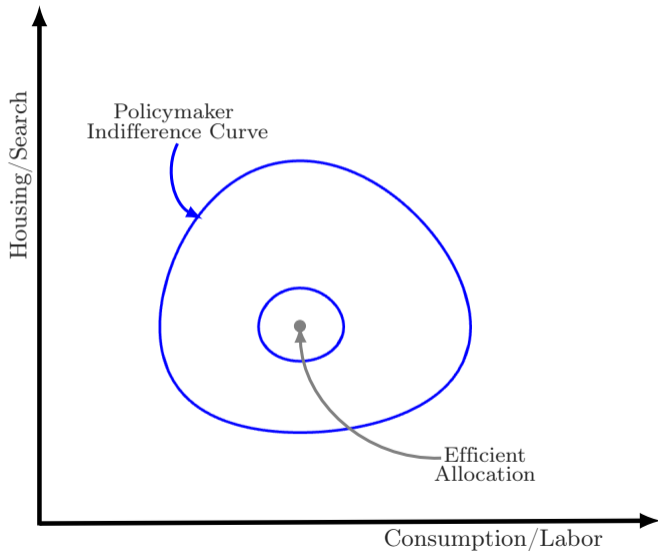
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## Targeting rule

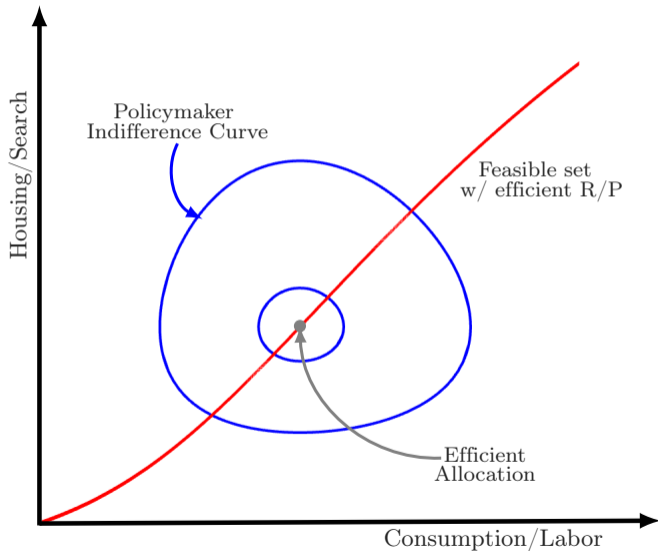
$$\underbrace{1 - \frac{\omega}{h} (f(\Theta) + f'(\Theta)\Theta)}_{\text{Housing congestion}} = [\text{term} < 0] \times \underbrace{(c - z)}_{\text{Output gap}}$$

⇒ If housing market is tight, then goods market is slack

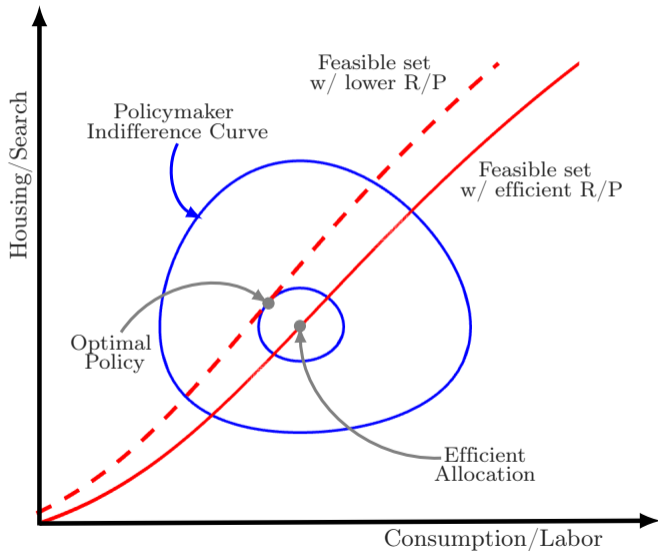
# Tradeoffs for Monetary Policy



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# Tradeoffs for Monetary Policy



# Taking Stock

- Two-sector model with two different rationing mechanisms
- Monetary policy faces a tradeoff between output gap and housing congestion
- In the paper, simple extension with housing production
  - Equilibrium with search mimics “short-side” rule:
    - If excess demand, quantity closer to supply-determined eqm. [▸ Details](#)

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- Next: dynamic model & quantitative analysis

# Dynamic Model

- Goods sector same as NK model
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- Goods sector same as NK model
  - Intermediate good producers with staggered pricing a la Calvo
- Long-term rental market for housing
  - Exogenous separations (prob.  $\delta$ ) and renegotiation (prob.  $\xi$ )
  - Law of motion for rental units

$$h_{t+1} = (1 - \delta)h_t + f(\Theta_t)s_t$$

- Rental rate is a weighted average of outstanding and Nash-bargained rents

$$R_t = \chi \bar{R}_t + (1 - \chi)R_t^{Nash}$$

# Nominal Rigidities and Policy Tradeoffs

## Result


The decentralized equilibrium coincides with the constrained efficient allocation if

1. Bargaining power  $\theta = \eta$  (Hosios)
2.  $\chi = 0$  (rents fully determined by Nash bargaining)
3. No price dispersion across intermediate goods
4. No output gap in goods

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$\Rightarrow \chi > 0$  is only reason to depart from  $\pi^{\text{goods}} = 0$

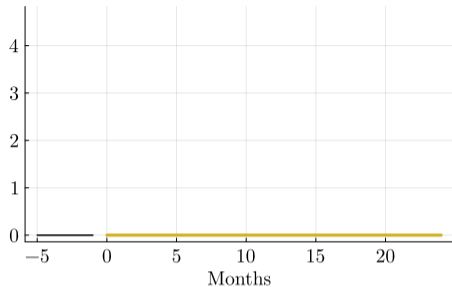
# Calibration and Main Experiment

- Monthly model, standard parameters for goods sector
- Calibrate steady-state to 2019
  - Match size of housing, renter mobility, vacancy rate, spending on real estate

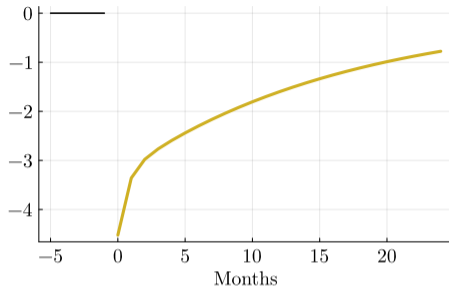
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  - Match size of housing, renter mobility, vacancy rate, spending on real estate
- Permanent increase in  $\omega_t$  to match rise in housing share from 15% to 18%
  - Change in demand for space, e.g., WFH (e.g., Mondragon-Wieland, 2022)
  - Rigidity ( $\chi$ ) to match pass-through from new rents (Zillow) to CPI shelter
- Three policies: (1)  $\pi^{\text{cpi}} = 0$ ; (2)  $\pi^{\text{goods}} = 0$ ; (3) Optimal policy
- Computation: non-linear perfect foresight

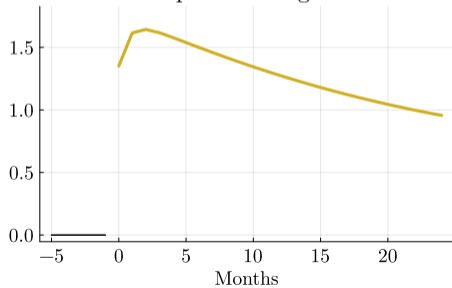
CPI inflation



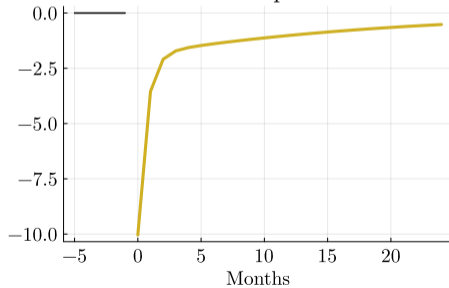
Goods inflation



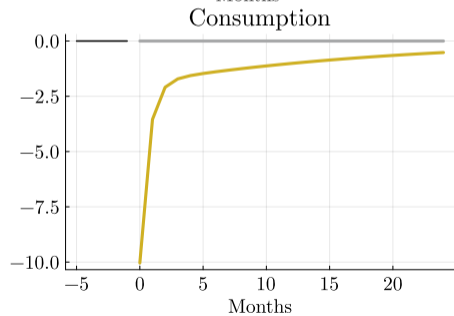
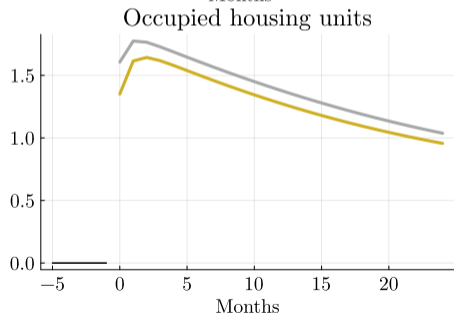
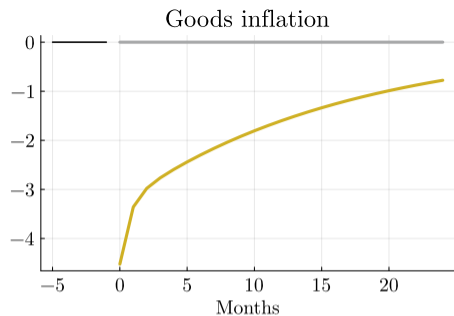
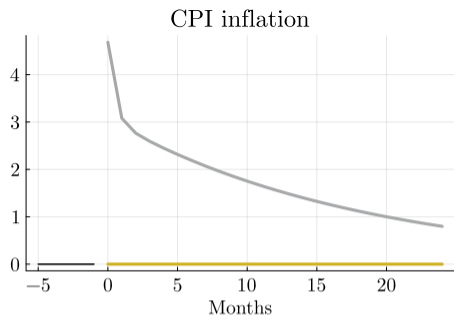
Occupied housing units



Consumption

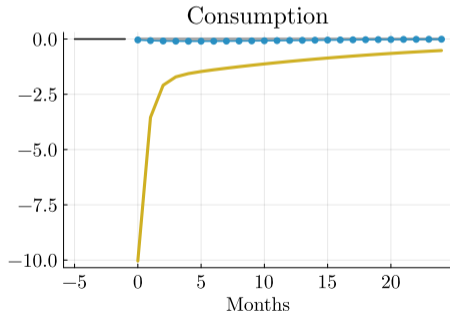
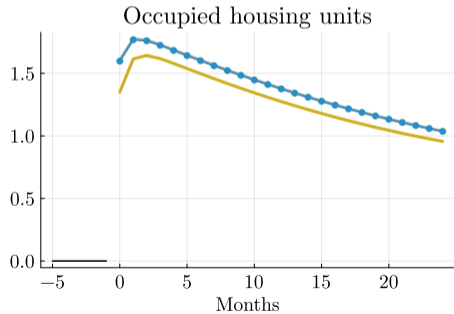
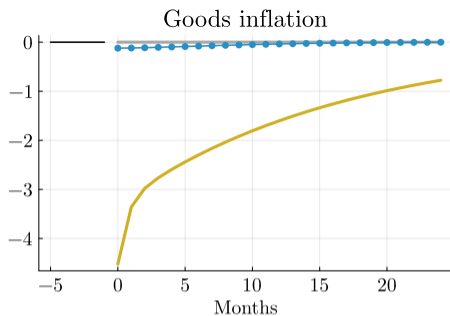
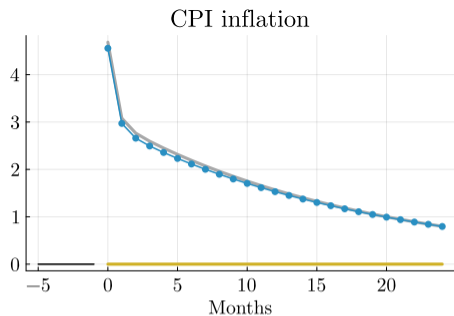


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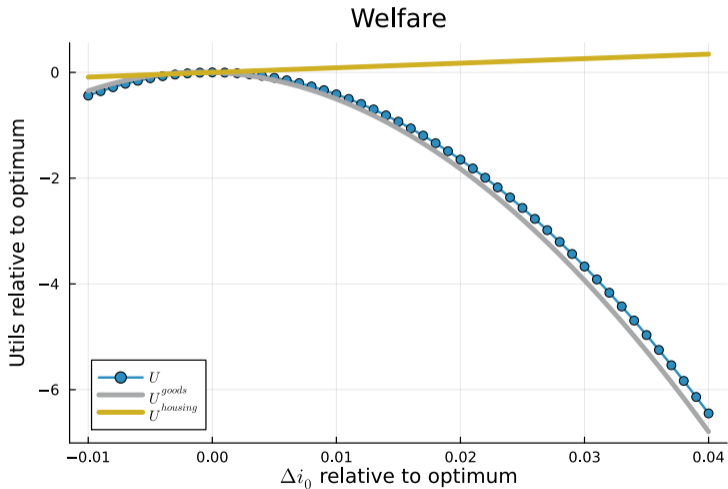


— CPI inflation target

— Goods inflation target

— Optimal

# Why ignoring housing inflation is optimal?



## Additional Results in the Paper

- Shelter inflation due to catch-up effects ▶ Figure
- Without price dispersion between goods ▶ Figure
- Without inelastic housing demand ( $h^o = 0$ ) ▶ Figure
- With equal stickiness in both sectors ▶ Figure
- With median price duration of 3.4 months ▶ Figure

# Conclusion

- Welfare costs of inflation depend on rationing mechanism
- Our model with demand rationing in housing: optimal policy is to ignore housing  $\pi$

EXTRA SLIDES

# Household Problem

$$H_t(h, X, B) = \max_{\substack{c, h', X', \\ s, \ell, B'}} \left\{ (1 - \omega_t) \log c + \omega_t \log (h^o + h') - \psi(1 - \omega_t) (\ell + s) + \beta H_{t+1} (h', X', B') \right\}$$

subject to

$$P_t c_t + \frac{B'}{1 + i_t} + X' = B + W_t \ell_t + P_t d_t,$$

$$h' = (1 - \delta)h + f(\Theta_t)s,$$

$$X' = (1 - \delta)(1 - \xi)X + R_t [\xi(1 - \delta)h + f(\Theta_t)s],$$

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- Use tenant bargaining power to target search effort

$$f(\Theta) \left( \frac{\omega}{h} - \frac{1}{c} \frac{R}{P} \right) = 1$$

- Given target for  $h$ ,  $R/P \uparrow \Rightarrow f(\Theta) \uparrow \Rightarrow \Theta \downarrow \Rightarrow s \downarrow$

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- Given target for  $h$ ,  $R/P \uparrow \Rightarrow f(\Theta) \uparrow \Rightarrow \Theta \downarrow \Rightarrow s \downarrow$
- Empirical target: share of output devoted to brokers' commissions ( $1.2\% \times \text{PCE}$ )
- **Conservative:** nominal rigidities in rents can distort the whole real estate sector
- Resources used in real estate are small relative to housing budget share (15%)

## Calibrating $\delta$ and $\xi$

- $\delta$  and  $\xi$  play a role in that they affect estimation of  $\chi$ 
  - Lower values induce longer periods of fixed rents within a match
  - Average rents become more inertial even with  $\chi = 0$

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- $\xi$  set so leases turnover after one year (on average)
- $\delta$  estimated from American Community Survey  $\rightarrow$  “how long have you lived here?”
  - Assume two types: low- and high- $\delta$
  - Find 29% have high- $\delta = 0.035$ , remainder have low- $\delta = 0.005$

# Competitive equilibrium

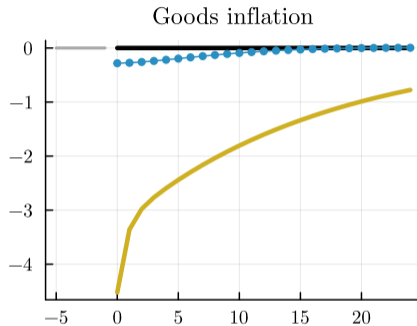
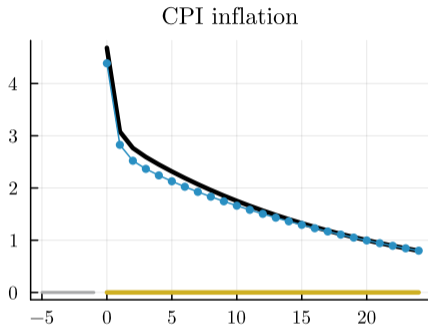
## Definition

Given fixed prices  $\{\bar{P}, \bar{R}\}$  and a government policy  $\{M, T\}$ , a **competitive equilibrium** in this economy is given by  $\{c, h, s, l, W, \Theta, d, m\}$  such that:

1. Household optimality conditions
2. Search process  $h = f(\Theta)s \Leftrightarrow h = g(\Theta)\bar{h}$
3. Goods and labor market clearing:  $\ell = c/z$
4. Definitions of  $m = M/P$ ,  $\Theta$ , and  $d$

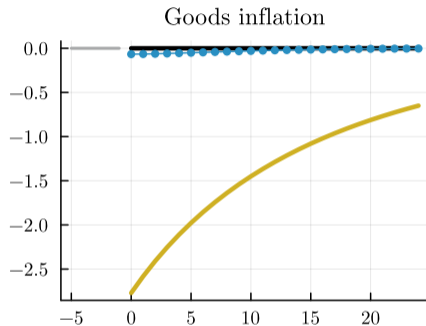
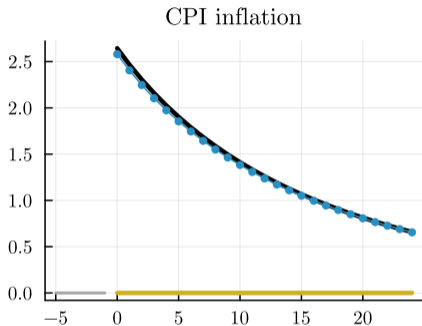
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# Without price dispersion within goods



- Goods inflation target
- CPI inflation target
- Optimal
- Initial steady state

## Without inelastic housing demand ( $h^o = 0$ )

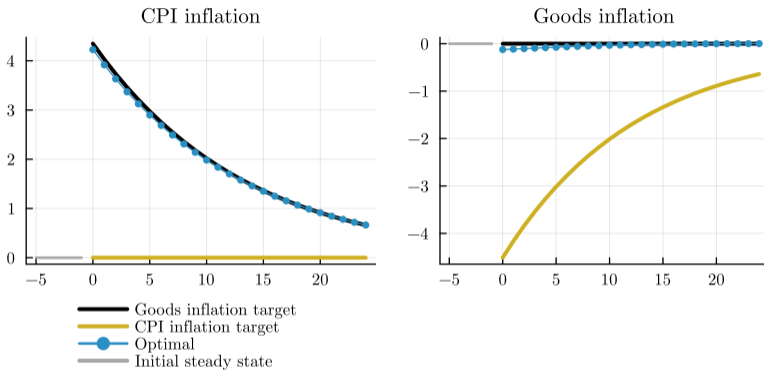


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Note: real estate sector is now 4.3% of PCE

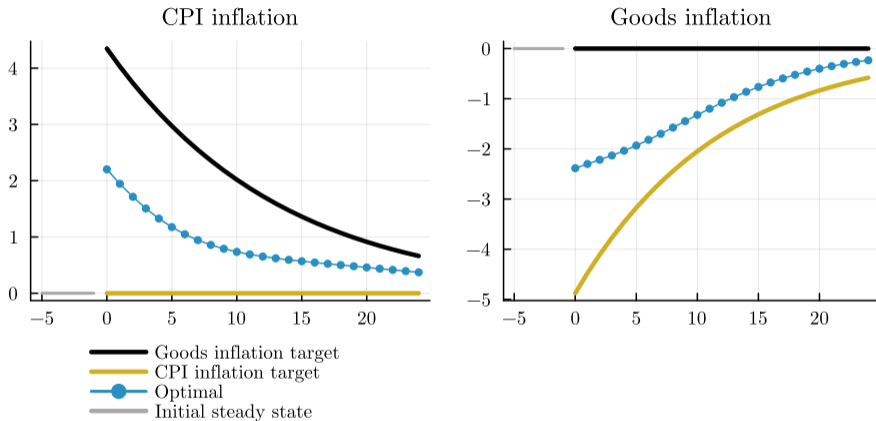
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# Using equal stickiness in both sectors



- When a rent is renegotiated, it is set to the Nash bargained rent.
  - We set  $\chi = 1$  so all new leases are set to the average outstanding rent.
  - We set the frequency of renegotiation to match the frequency of price changes in goods.
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## Using median price duration of 3.4 months

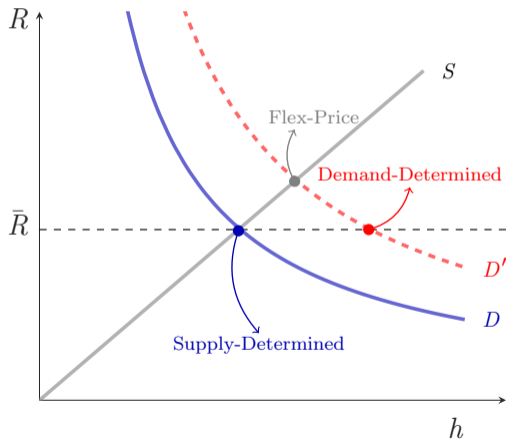


Note: 3.4 month median duration corresponds to all price changes including sales and product substitutions

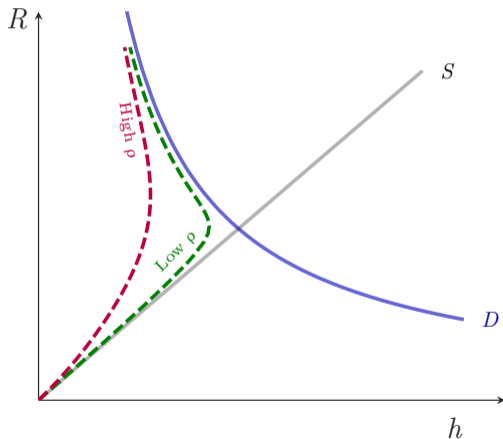
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# Short-Side Rule and Search Equilibrium

(a) Supply vs. Demand Determined Eqm.



(b) Search Equilibrium

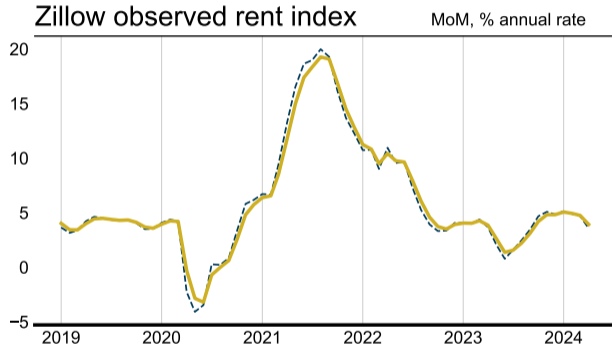


# Estimating $\chi$

State space model:

- CPI-shelter = average rent ( $\Delta$  6m)
- Zillow rent = Nash rent
- BLS NTR = typical new rent
  
- All series observed with measurement error
- Estimate by ML
- $\chi = 0.66$

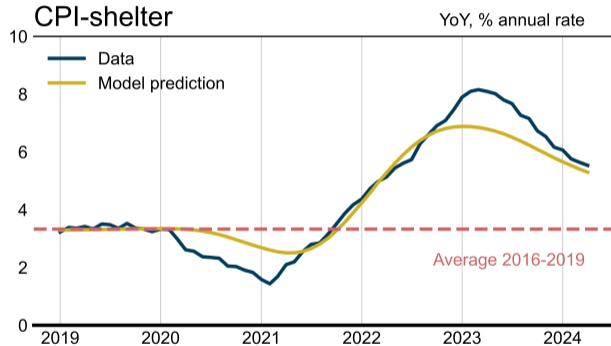
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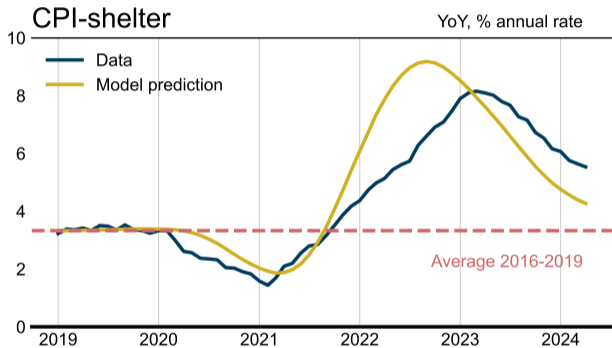
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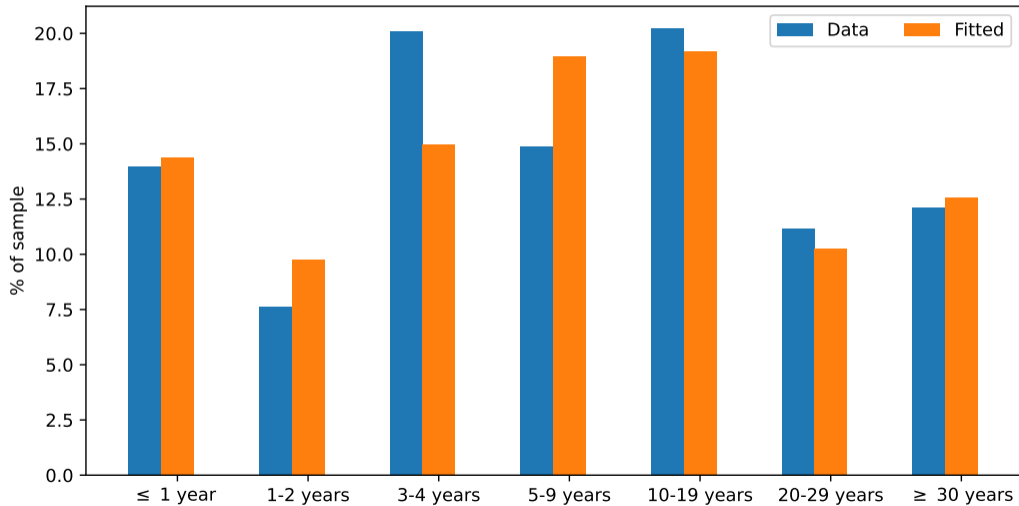
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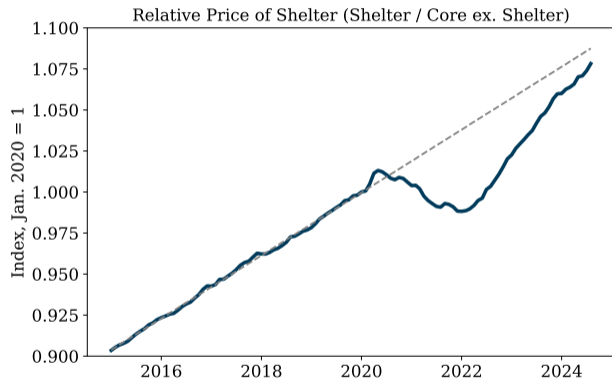


Counterfactual with  $\chi = 0$

# How long have you lived here? (ACS)



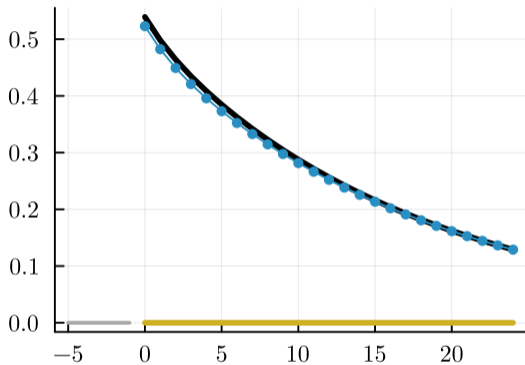
# Rents need to catchup



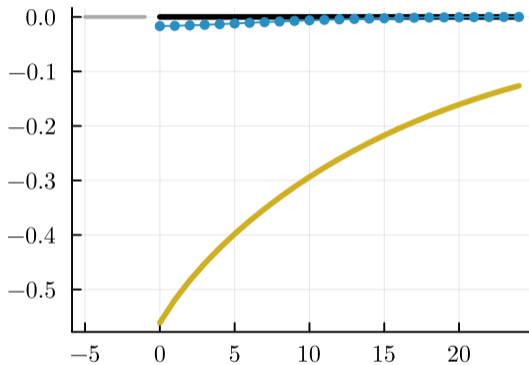
- Relative price of shelter fell below trend in '21 & '22
- A period of "catchup" ensues
- Simulate a 5% deflation of real outstanding rents
- Affects allocation due to  $\chi > 0$

# Rents need to catchup

## CPI inflation



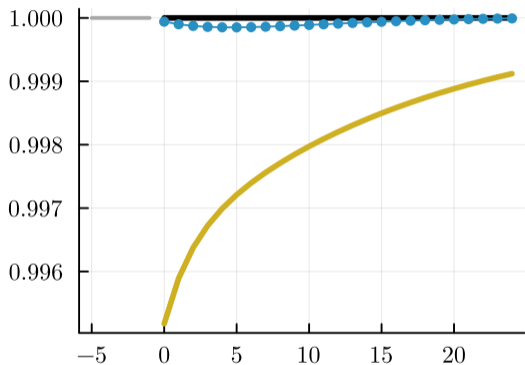
## Goods inflation



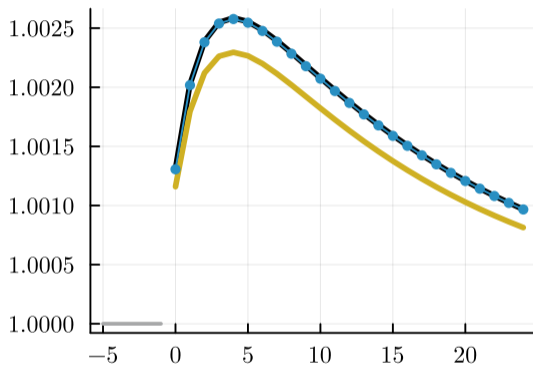
- Goods inflation target
- CPI inflation target
- Optimal
- Initial steady state

# Rents need to catchup

## Consumption



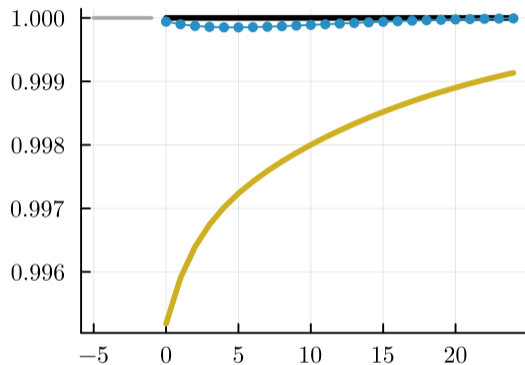
## Occupied housing units



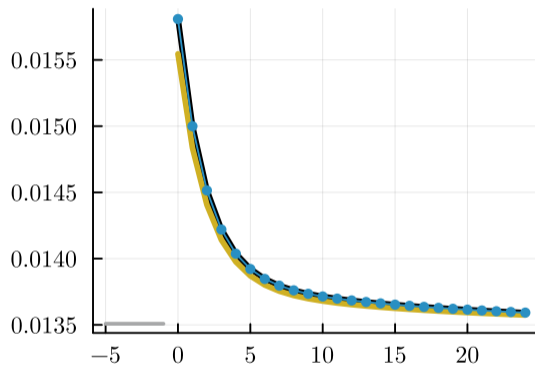
- Goods inflation target
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# Rents need to catchup

## Labor effort



## Search effort



- Goods inflation target
- CPI inflation target
- Optimal
- Initial steady state