The Unemployment-Risk Channel in Business-Cycle Fluctuations

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Introduction

- **Unemployment-risk channel (URC):** *Reinforcing feedback loop*
  1. **Households:** Unemployment (risk) $\uparrow$
     $\Rightarrow$ (precautionary) savings $\uparrow$
     $\Rightarrow$ goods demand $\downarrow$
  2. **Firms:** Goods demand $\downarrow$
     $\Rightarrow$ labor demand $\downarrow$
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     share of hand-to-mouth households?
     tax- or debt-financing?

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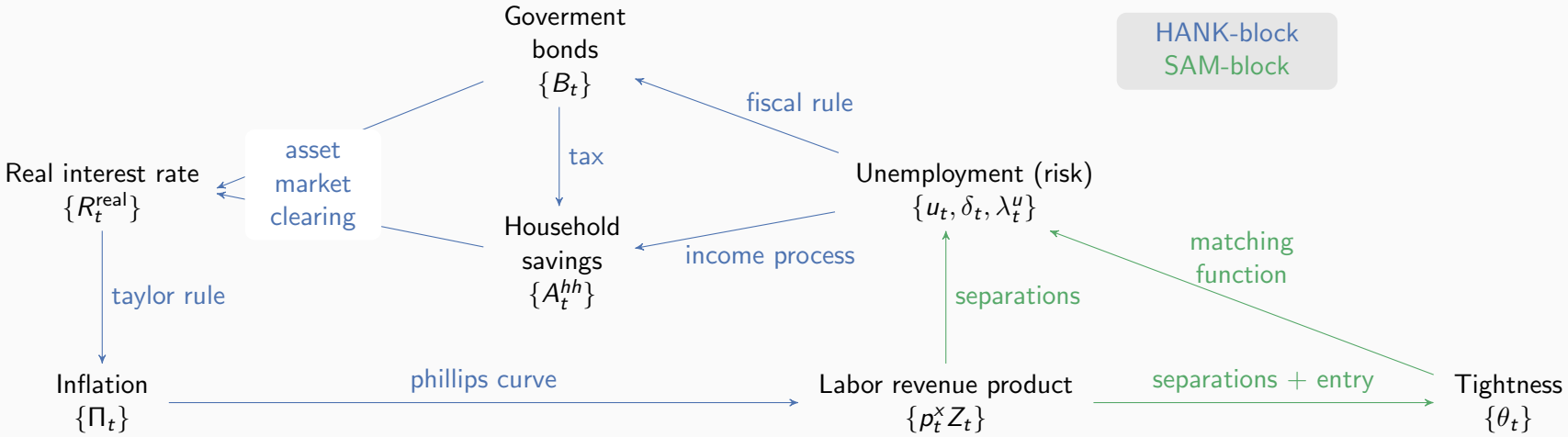
- **Questions:**
  1. ***What determines the strength of the URC?***
     separation vs. duration risk?
     share of hand-to-mouth households?
     tax- or debt-financing?
  2. ***Which fiscal stabilization policies are most cost-effective?***
     UI level or duration?
     public spending or transfers?
     wage or hiring subsidy?

Our model



1. **Search-and-matching** (endo. separations, ψ, sluggish entry, ξ)

2a. **Bond demand** (incomplete markets + income process with separation and duration risk + heterogeneous discount factors, β_i)

2b. **Bond supply** (fiscal rule, ω)

3. **Sticky prices** (phillips curve, ϕ, taylor rule)

Limitation: *Fixed supply of labor and capital*

Results (so far)

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3. Larger share of hand-to-mouth households is dampening, despite larger MPCs and larger drop of consumption in unemployment
4. More debt-financing is dampening due to a larger increase in the supply of government bonds
5. Fiscal stabilization policies can be almost self-financing

   Best: UI extensions (at the margin)
   Worst: Public transfers and UI level

Literature

Improve our understanding of existing HANK-SAM models

a) More general ($\psi \neq 0$, $\xi \neq \infty$, $\omega \neq 1$)

b) Clarify the propagation mechanism

c) Importance of calibration targets

d) Effectiveness of policy tools

Gorneman et al. (2016), Den Haan et. al. (2018), Challe (2020), McKay-Reis (2020), Ravn and Sterk (2021), Bilbiie (2021), Bibilie et. al. (2022), Cho (2022), Graves (2022), Kekre (2022)

SAM - sluggish entry: Coles-Kelishomi (2018), Fujita-Ramey (2007), Haefke-Reiter (2020), Leduc and Liu (2020), Mercan et. al. (2021), Engbom (2021)

SAM - endogenous separations: Mortesen-Pissarides (1994), Den Haan et. al. (2000), Shimer (2012), Fujita-Ramey (2012), Barnichon (2012), Trigari (2019)

RANK-SAM: Walsh (2005), Gertler et. al. (2008), Trigari (2009), Gali (2010), Ravenna and Walsh (2012), Christiano et al. (2016)

HANK - fiscal rules: Kaplan et. al. (2018), Hagedorn et. al. (2019), and Alves et. al. (2020)

Consumption effects wrt. unemployment: Gruber (1997), Aguiar and Hurst (2005), Eusepi and Preston (2015), Chodorow-Reich and Karabarbounis (2016), Kolsrud et. al. (2018), Harmenberg and Öberg (2021), Graves (2022), Ganong et al. (2019), Ganong et. al. (2022)

Plan

1. Model
2. Calibration
3. Propagation
4. Policy
5. Conclusion

Model

Model components

1. **Search-and-matching:**
   - Production with labor only
   - Sluggish vacancy posting due to idiosyncratic stochastic entry cost
   - Separations due to idiosyncratic stochastic continuation cost
   - Exogenous wage rule

2a. **Households:**
   - **Workers:** Receive wage or UI + self-insure by saving
   - **Capitalists:** Collect and consume all profits

2b. **Government:** Finances UI through taxes and debt

3. **Sticky prices:**
   - **Phillips curve:** Rotemberg price adjustment costs
   - **Central bank:** Taylor rule

1. Search-and-matching

- **Job value** and **separation rate**, δ_t, with elasticity ψ

$$V_t^j = p_t^x Z_t - (w_t - \text{wage subsidy}_t) + \beta^{\text{firm}} \mathbb{E}_t \left[(1 - \delta_{t+1})(V_{t+1}^j - \mu_{t+1}) \right]$$

$$\delta_t = \delta_{ss} \left(\frac{V_t^j}{V_{ss}^j} \right)^{-\psi}, \quad \mu_{t+1} \text{ is continuation cost}$$

- **Vacancy value** and **entry**, ι_t, with elasticity ξ

$$V_t^v = -\kappa + \lambda_t^v (V_t^j + \text{hiring subidy}_t) + (1 - \lambda_t^v)(1 - \delta_{ss}) \beta^{\text{firm}} \mathbb{E}_t \left[V_{t+1}^v \right]$$

$$\iota_t = \iota_{ss} \left(\frac{V_t^v}{V_{ss}^v} \right)^{\xi}$$

- **Tightness:** $\theta_t = \frac{(1-\delta_{ss}) v_{t-1} + \iota_t}{u_{t-1} + \delta_t (1 - u_{t-1})}$
- **Matching function:** $\lambda_t^v = A \theta_t^{-\alpha}$, $\lambda_t^u = A \theta_t^{1-\alpha}$
- **Wage rule:** $w_t = w_{ss} (u_t / u_{ss})^{\eta_u}$

2a. Household problem

$$V_t^w(\beta_i, u_{it}, a_{it-1}) = \max_{c_{it}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \beta_i \mathbb{E}_t \left[V_{t+1}^w (\beta_i, u_{it+1}, a_{it}) \right]$$

$$\text{s.t.} \quad a_{it} + c_{it} = R_t^{\text{real}} a_{it-1} + \text{transfer}_t + (1-\tau_t) y_t$$

$$y_t = \begin{cases} w_t & \text{if } u_{it} = 0 \\ \text{UI}_{it} \overline{\phi}_t w_t + (1 - \text{UI}_{it}) \underline{\phi} w_t & \text{else} \end{cases}$$

$$\text{UI}_{it} = \mathbb{1}_{\text{it}}^{\text{UI}} \cdot \begin{cases} 1 & \text{if } u_{it} \leq \overline{u}_t \\ u_{it} - \overline{u}_t & \text{if } u_{it} \in (\overline{u}_t, \overline{u}_t + 1) \\ 0 & \text{if } u_{it} \geq \overline{u}_t + 1 \end{cases}$$

$$a_{it} \geq 0$$

- **Months in unemployment counter:** u_{it}
  with separation rate $\delta_t(1 - \lambda_t^u)$ and job-finding rate λ_t^u
- **High UI,** $\overline{\phi}_t$**:** First $\overline{u}_t$ months and $\mathbb{1}_{\text{it}}^{\text{UI}} = 1$ with prob. π^{UI} at EU
- **Low UI,** $\underline{\phi}$**:** After $\overline{u}_t$ months or $\mathbb{1}_{\text{it}}^{\text{UI}} = 0$ with prob. $1 - \pi^{\text{UI}}$ at EU
- **Distribution:** $\boldsymbol{D}_t$ over β_i, u_{it} and a_{it-1}

2b. Government

- **Fiscal rule:**

$$\tau_t = \tau_{ss} + \omega q_{ss} \frac{B_{t-1} - B_{ss}}{Y_{ss}^{hh}}$$

where ω determines response of taxes to fluctuations in debt level

- **Government budget with long term bonds:**

$$\begin{aligned} q_t(B_t - \delta_q B_{t-1}) = & B_{t-1} \\ & + (1-\tau_t)\left(\overline{\phi}_t \mathrm{UI}_t^{hh} + \underline{\phi}\left(u_t - \mathrm{UI}_t^{hh}\right)\right) w_t \\ & - \tau_t(1-u_t)w_t \\ & + \text{wage subsidy}_t \cdot (1-u_t) \\ & + \text{hiring subsidy}_t \cdot \lambda_t^v((1-\delta_{ss})v_{t-1} + \iota_t) \\ & + \text{public spending}_t \\ & + \text{public transfer}_t \end{aligned}$$

where $\mathrm{UI}_t^{hh} = \int \mathbb{1}\{u_{it} > 0\} \mathrm{UI}_{it} d\boldsymbol{D}_t$

3. Sticky Prices

1. **Standard New Keynesian production structure** with Rotemburg adjustment costs

$$1-\epsilon_p+\epsilon_p p_t^x \quad = \quad \varphi(\Pi_t-1)\Pi_t-\varphi\beta\mathbb{E}_t\left[(\Pi_{t+1}-1)\Pi_{t+1}\frac{Z_{t+1}(1-u_{t+1})}{Z_t(1-u_t)}\right]$$

2. **Taylor rule:**

$$R_t \quad = \quad R_{ss}\Pi_t^{\delta_\pi}$$

3. **Fisher equation:**

$$R_t^{\text{real}} = R_{t-1}/\Pi_t$$

Equilibrium

1. **No arbitrage** requires

$$\frac{1+\delta_q q_{t+1}}{q_t} = R^{\text{real}}_{t+1}$$

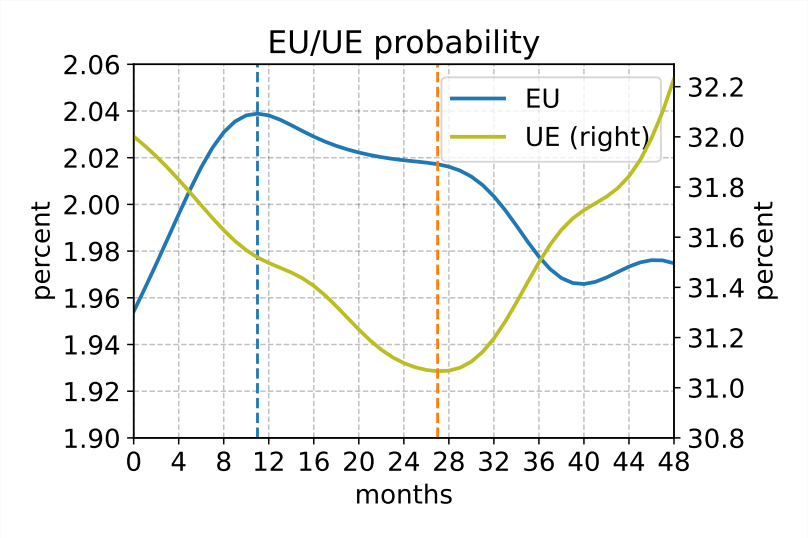
2. **Asset market clearing:**

$$q_t B_t = \int a^{\star}_t(\beta_i, u_{it}, a_{it-1}) d\boldsymbol{D}_t$$

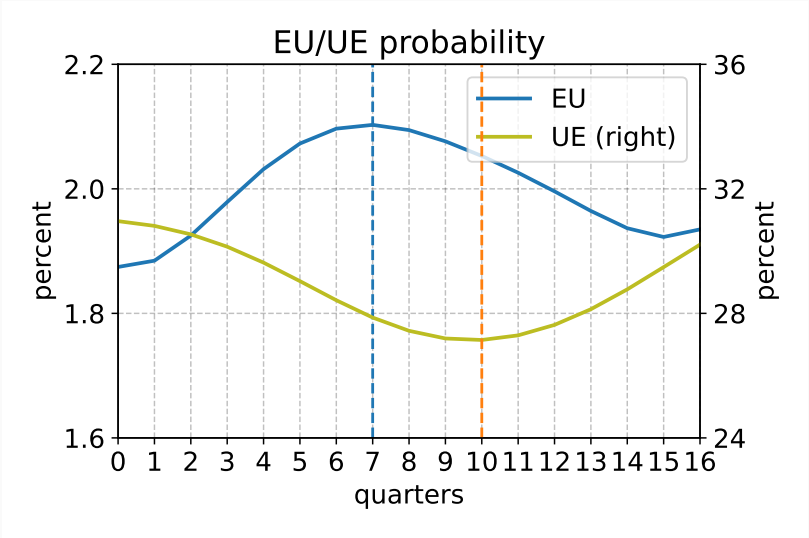
Calibration

Separations and job-finding in the U.S. I

Monetary policy shock



Technology shock



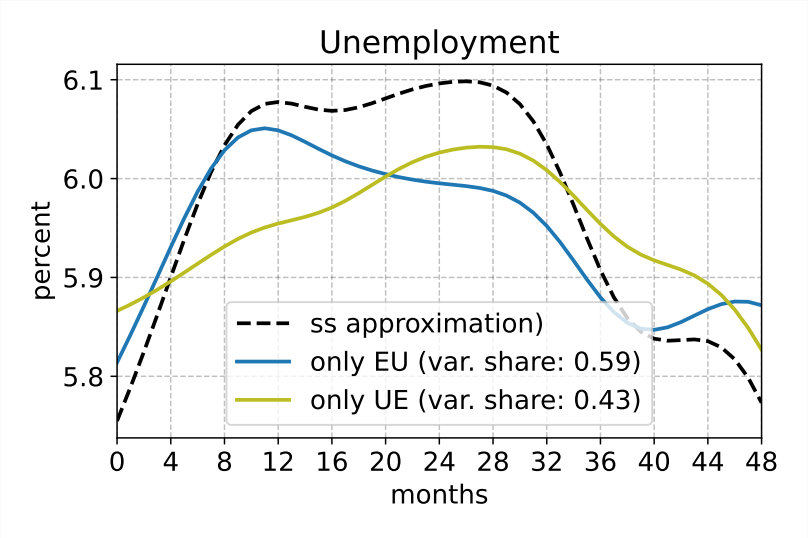
Source: CPS, 1967-2020

- **Stylized Fact #1:**
  Separation rate leads job-finding rate by 12-18 months
  Same pattern true in unconditional time-series data (see the paper)

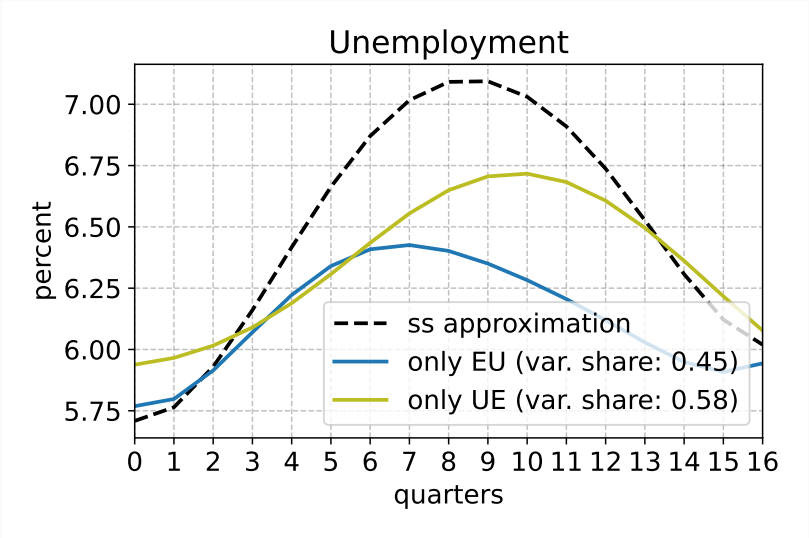
Note: See also Trigari (2009) and Oh and Picco (2020) for uncertainty shocks.

Separations and job-finding in the U.S. II

Monetary policy shock



TFP shock



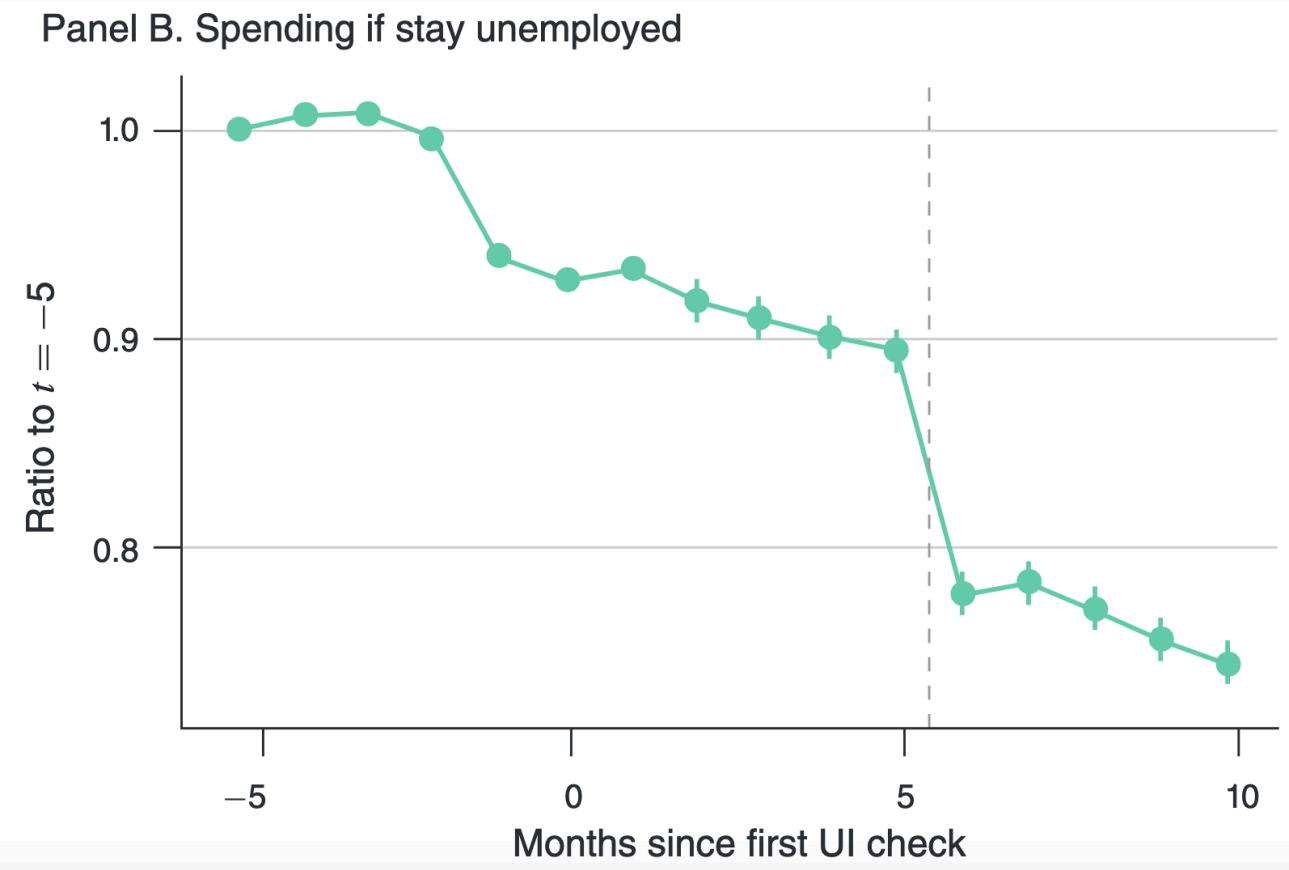
Source: CPS, 1967-2020

- **Stylized Fact #2:**
  Separations account for 40-60 percent of unemployment response
  Same pattern true in unconditional time-series data (see the paper)

Note: See also Trigari (2009) and Oh and Picco (2020) for uncertainty shocks.

Consumption effects of unemployment

- **Stylized fact #3:** Consumption ~20% lower for unemployed
- **Stylized fact #4:** Drop at UI exhaustion of ~45% of income drop



Source: Ganong et. al. (2019)

Calibration targets

- **Simplifications:**
  1. Only TFP shocks
  2. Fixed real wage ($\epsilon_u = 0$)
  3. Unit unemployment variance with flexible prices (w_{ss})
- **Targets:**
  1. Data on separation rate, unemployment duration and tightness
  2. EU share of unemployment volatility ~ 40 (ψ)
  3. UE lag relative to EU ~ 6 months (ξ)
  4. Unemployed have ~ 20 percent lower consumption ($q_{ss} B_{ss}$)
- **Baseline:**
  1. 15 percent with $\beta_i = 0.0$ *(more later)* [qtr. MPC of 25%]
  2. Tax-financing, $\omega = 0.90$ *(more debt-financing later)*

SAM parameters

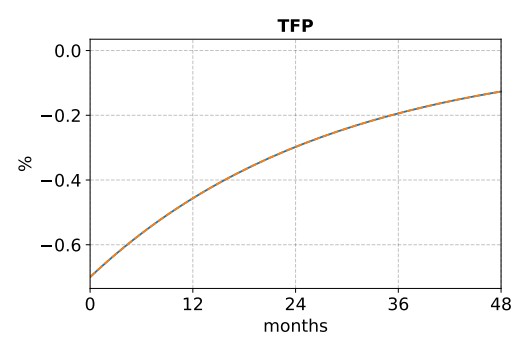
Parameter	Value	Source / Target
Firm discount factor, β^{firm}	$0.98^{\frac{1}{12}}$	Standard
Matching function elasticity, α	0.60	Petrongolo and Pissarides (2001)
Separation rate, δ_{ss}	0.027	Data
Job-finding rate, λ^u_{ss}	0.31	Data
Tightness, θ_{ss}	0.60	Hagedorn and Manovskii (2008)
Technology shock, persistence, ρ_Z	0.965	Coles and Kelishomi (2018)
Technology, standard deviation, σ_Z	0.007	Coles and Kelishomi (2018)
Separation elasticity, ψ	1.0	EU share of unemployment volatility
Entry elasticity, ξ	0.02	UE lag relative to EU
Wage level, w_{ss}	0.66	$var(u_t) = 1.0$ with flexible prices
Wage elasticity, η_u	0.00	Simplification

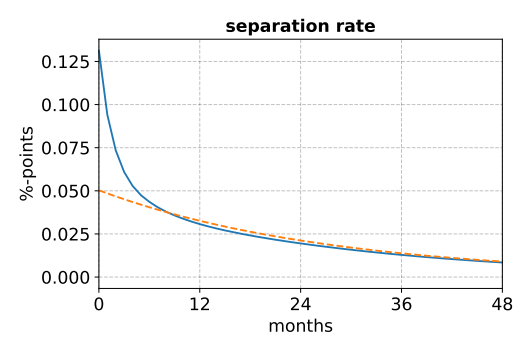
HANK parameters

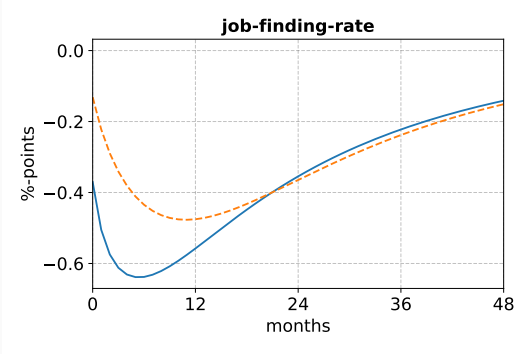
Parameter	Value	Source / Target
Discount factors, β_i^{12}	$\{0.00, 0.96, 0.98\}$	Baseline
... population shares	$\{0.15, 0.70, 0.15\}$	
CRRA coefficient, σ	2	Standard
High UI, $\overline{\phi}$	0.76	Kekre (2022)
Low UI, $\underline{\phi}$	0.55	Kekre (2022)
UI probability, π^{UI}	0.5	Kekre (2022)
UI duration, $\overline{u}$	6.0	Standard
Degree of tax financing, ω	0.90	Baseline
Bond maturity, δ_q	$1 - 1/60$	Standard
Value of bonds, $q_{ss} B_{ss}$	1.0	Consumption drop in unemployment
Substitution elasticity, ϵ_p	6	Standard
Rotemberg cost, φ	600.0	Standard
Taylor rule parameter, ϕ_π	1.5	Standard

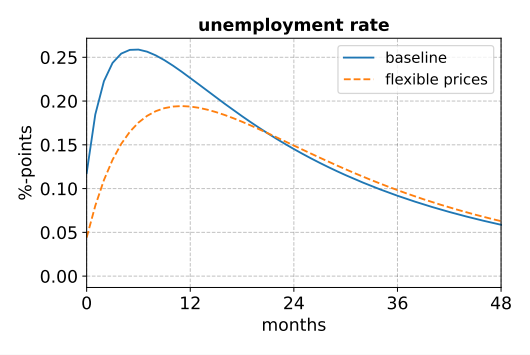
Propagation

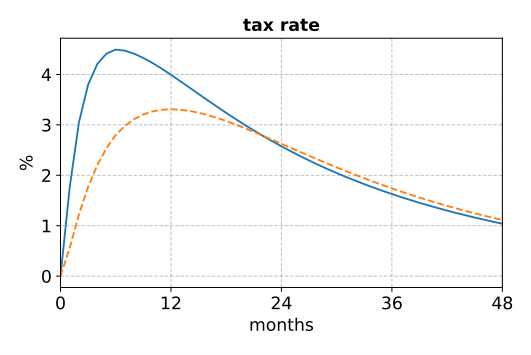
Equilibrium paths with baseline calibration

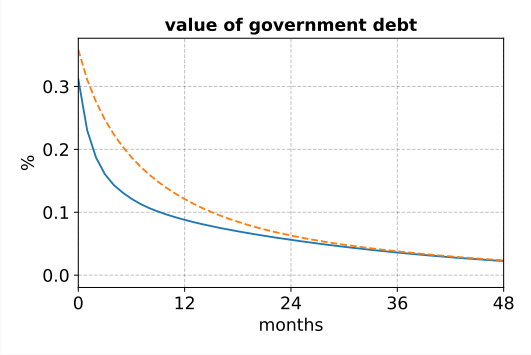


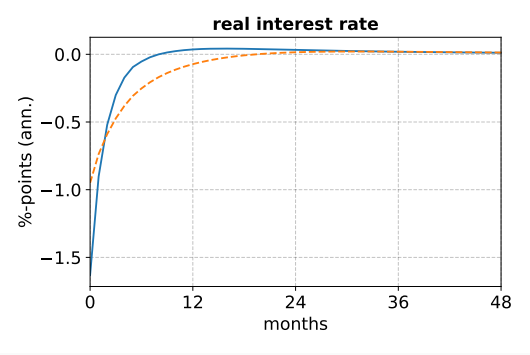


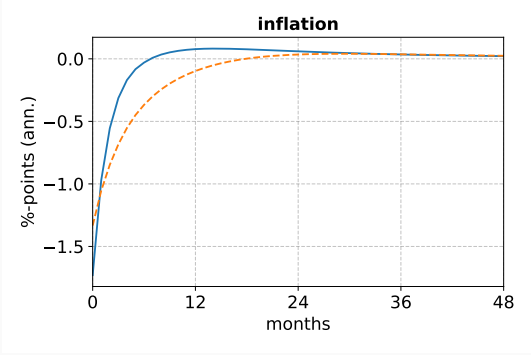






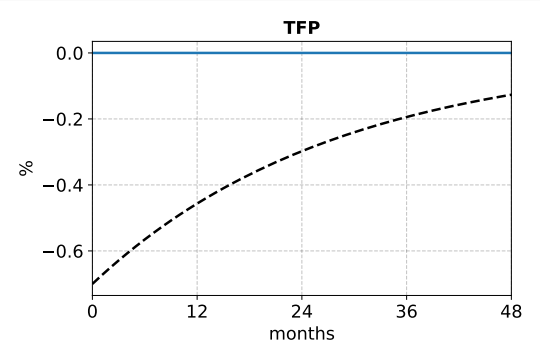


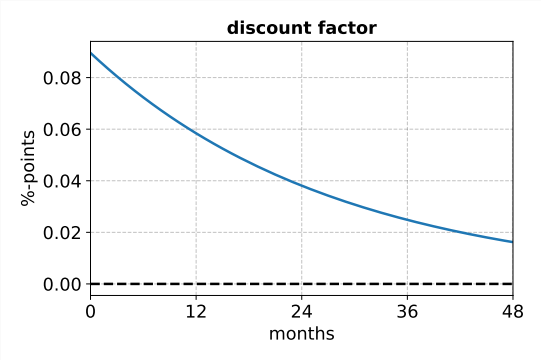


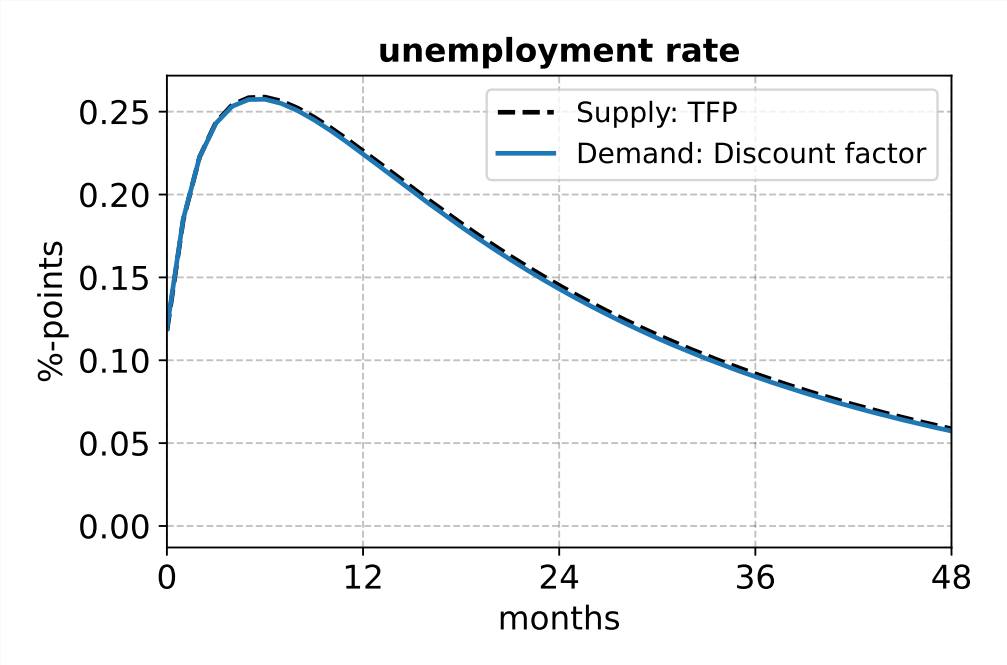


Equivalence: Demand vs. supply

- **Result:** The labor market dynamics are the same for demand and supply shocks (up to a scaling factor)



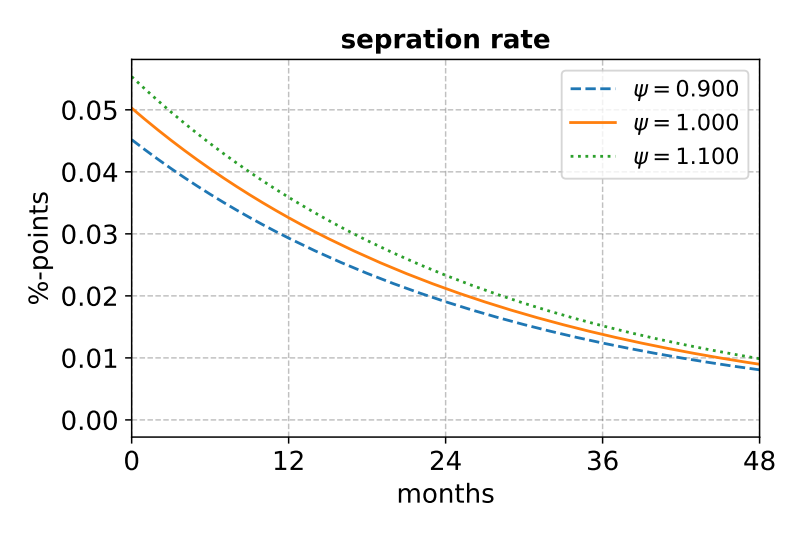


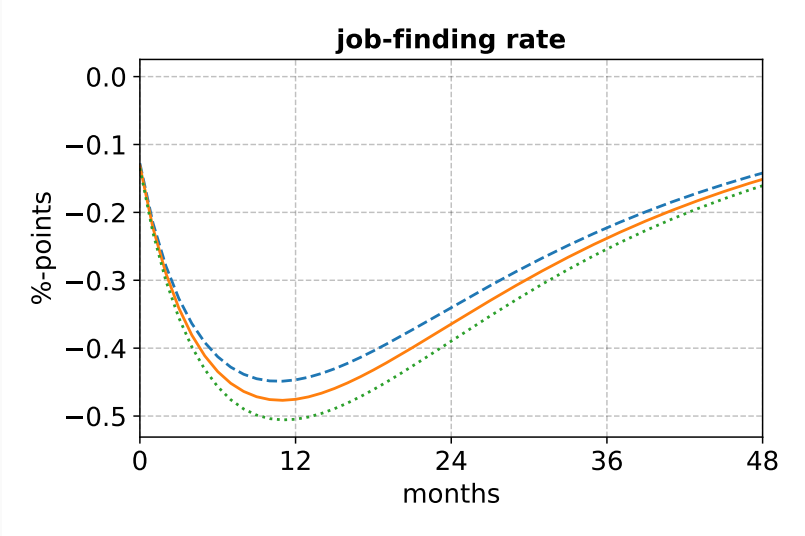


Propagation (of technology shock)

- **3-step propagation channel:**
  1. **Search-and-matching**
  2a. **Bond demand**
  2b. **Bond supply**
  3. **Sticky prices**
- **Now:** Quantitatively illustrate the propagation in each step

1. SAM: Separation elasticity, ψ

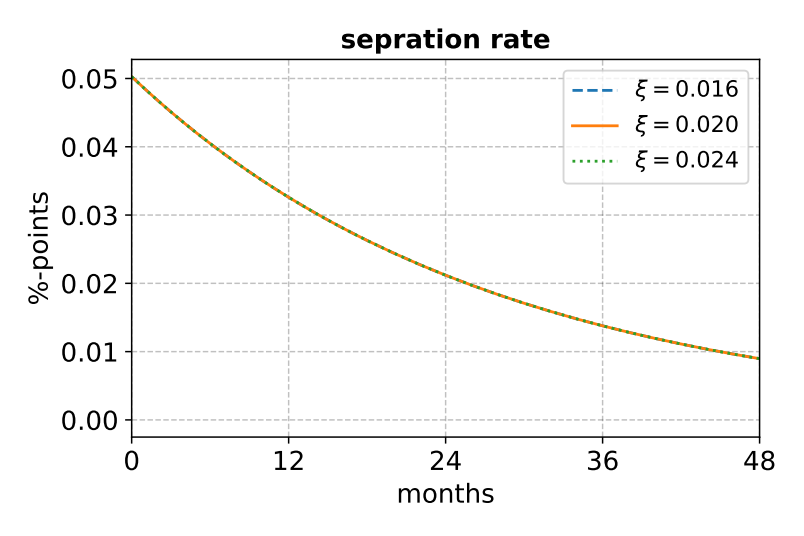


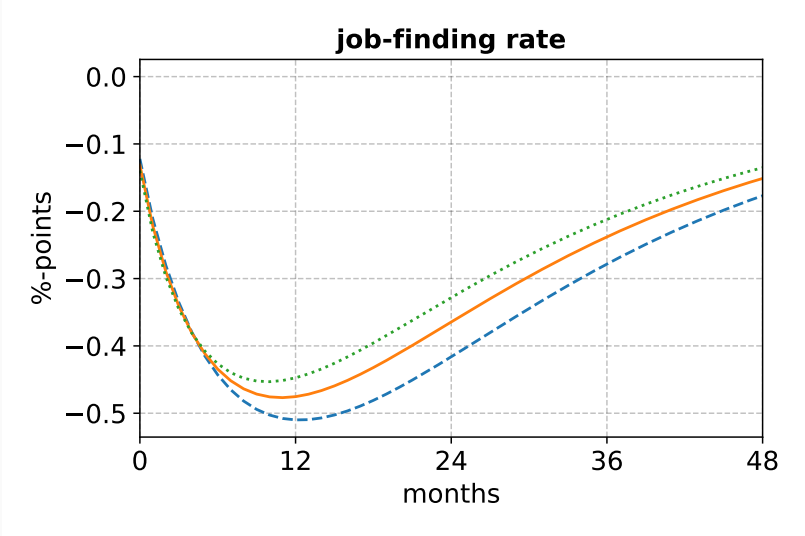


- **Result I:** Higher separation elasticity amplifies fluctuations
- **Result II:** Separations play relatively larger role

Note: Labor revenue product, $p_t^x Z_t$, is at the equilibrium path.

1. SAM: Entry elasticity, ξ





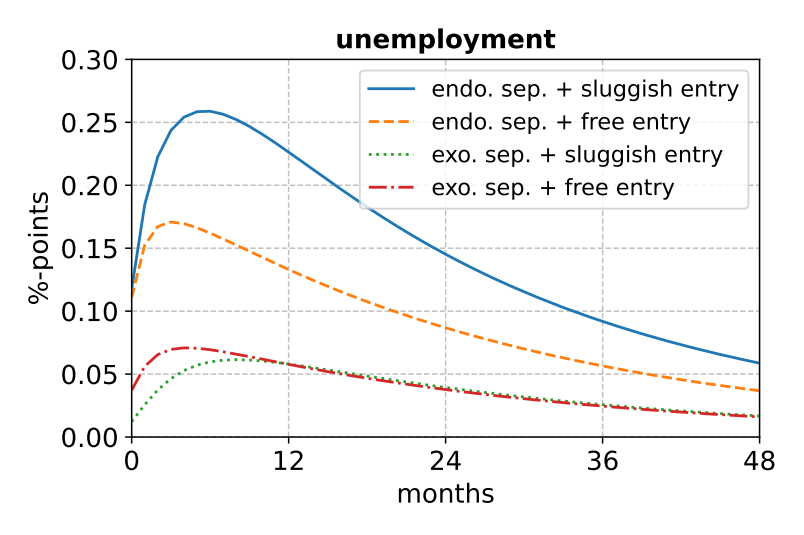
- **Result I:** Higher entry elasticity dampens fluctuations
- **Result II:** The lag of UE relative to EU is reduced

Note: Labor revenue product, $p_t^x Z_t$, is at the equilibrium path.

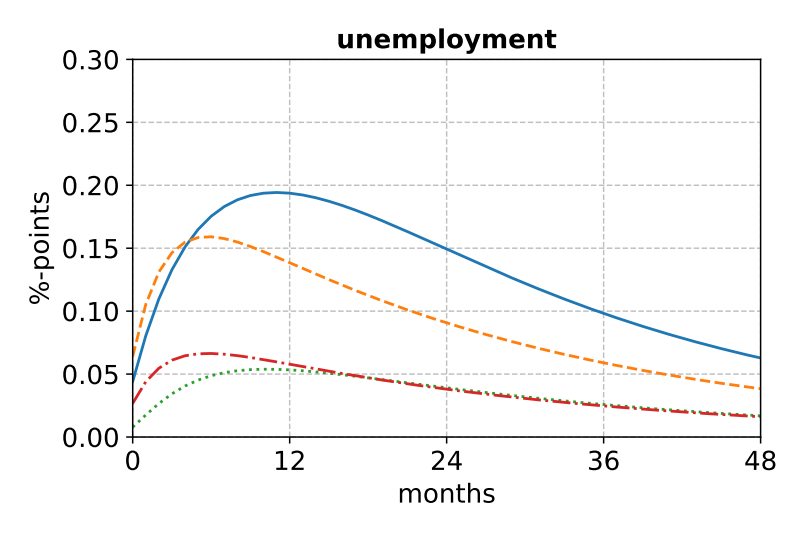
1. SAM: Exogenous separation and free entry

- **Result I:** Much lower volatility of unemployment with exogenous separations and free entry
- **Result II:** Smaller amplification from sticky prices with free entry

(a) baseline calibration

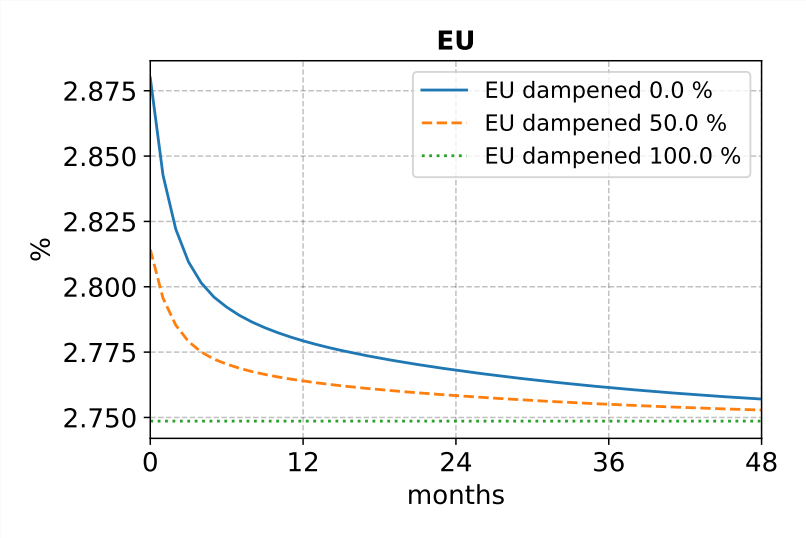


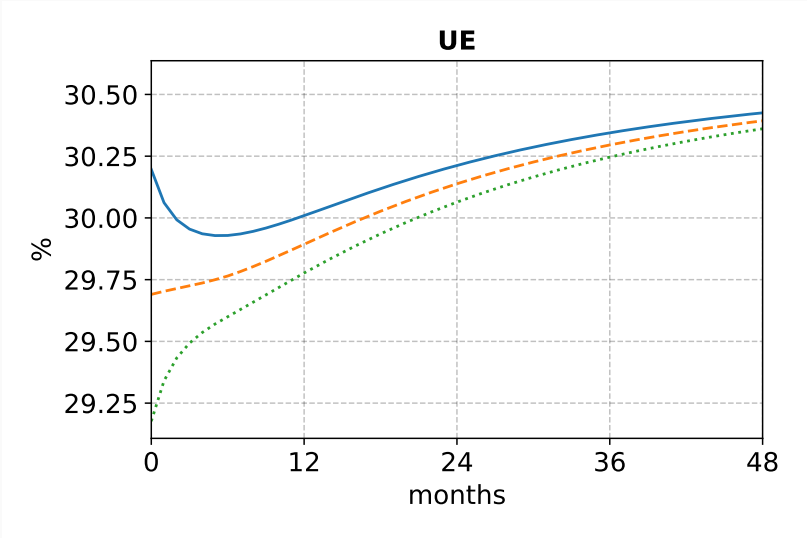
(c) Flexible prices ($\phi \to 0$)



2a. Bond demand: Separation vs. duration risk (1/3)

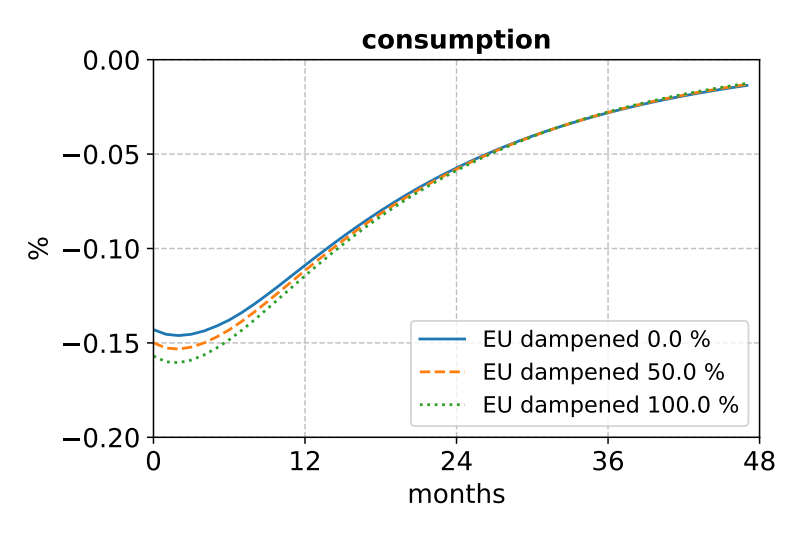
- **Experiment:** *Dampen equilibrium path of separation rate (EU) and adjust job-finding rate (UE) to keep unemployment fixed*

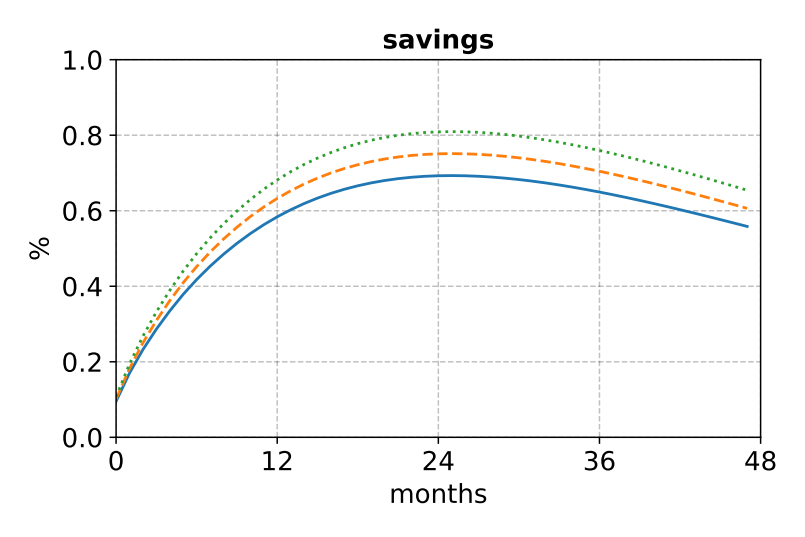




2a. Bond demand: Separation vs. duration risk (2/3)

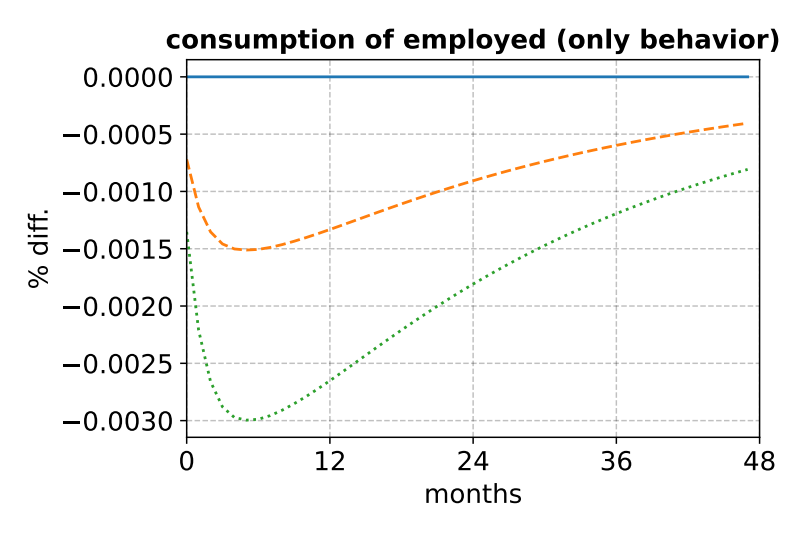
- **Result I:** Lower consumption and higher savings

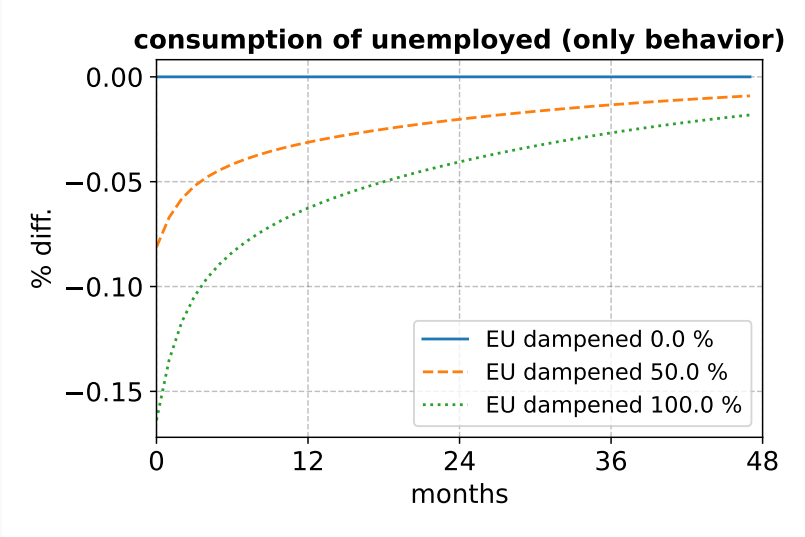




2a. Bond demand: Separation vs. duration risk (3/3)

- **Result II:** Both due to employed and unemployed

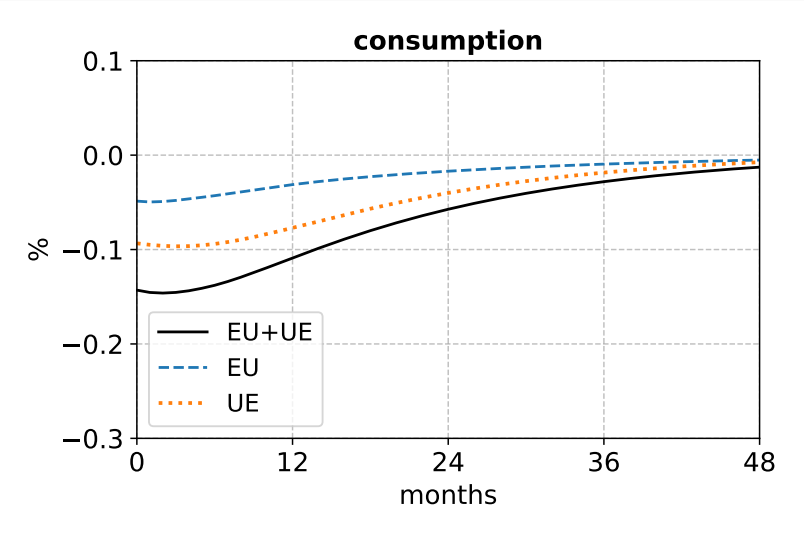


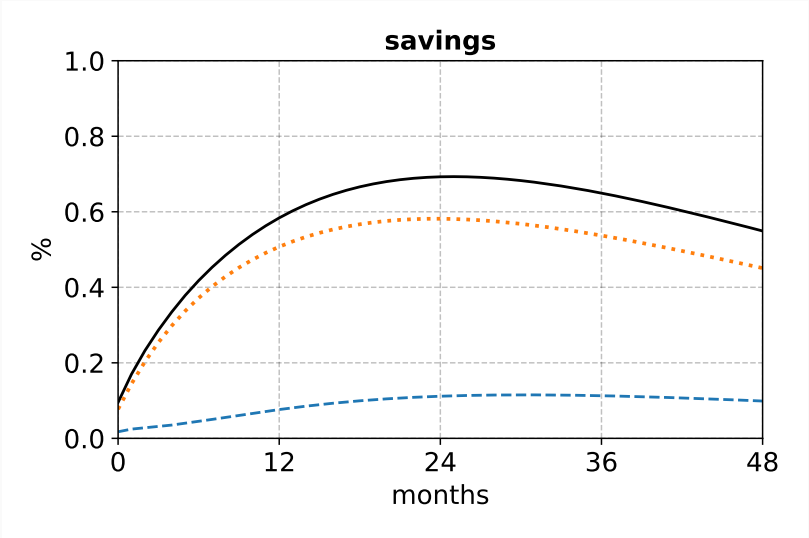


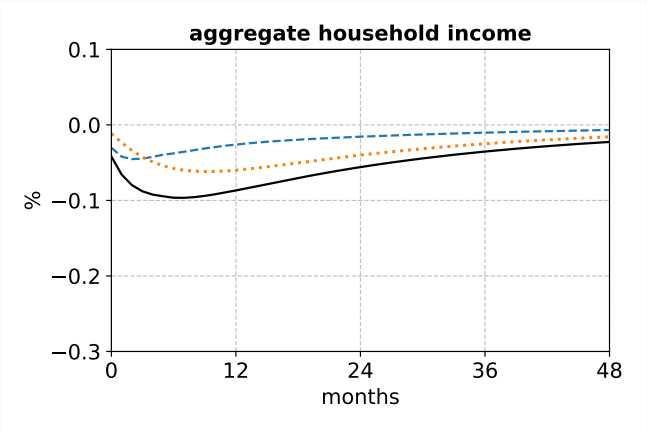
Note: »only behavior« = distribution fixed at steady state

2a. Bond demand: Job-finding rate matters most (1/3)

- **Result:** The job-finding rate (UE) matter more than the separation rate (EU) feeding in equilibrium paths of each or both

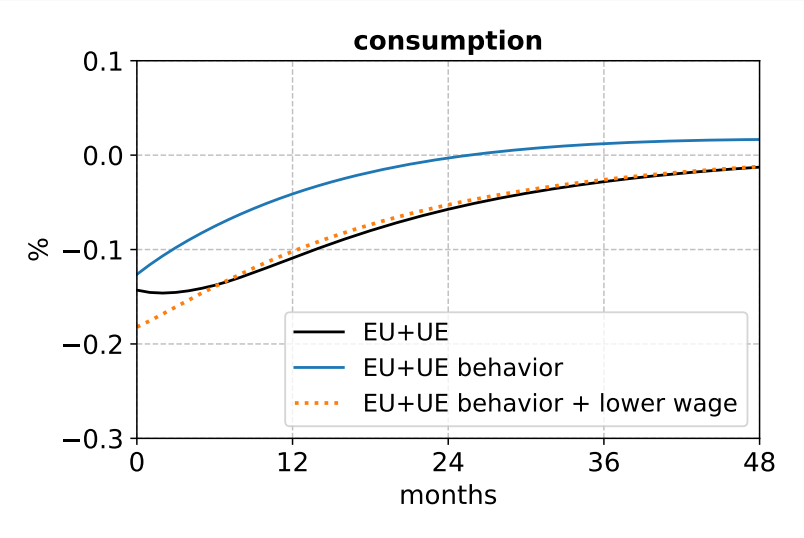


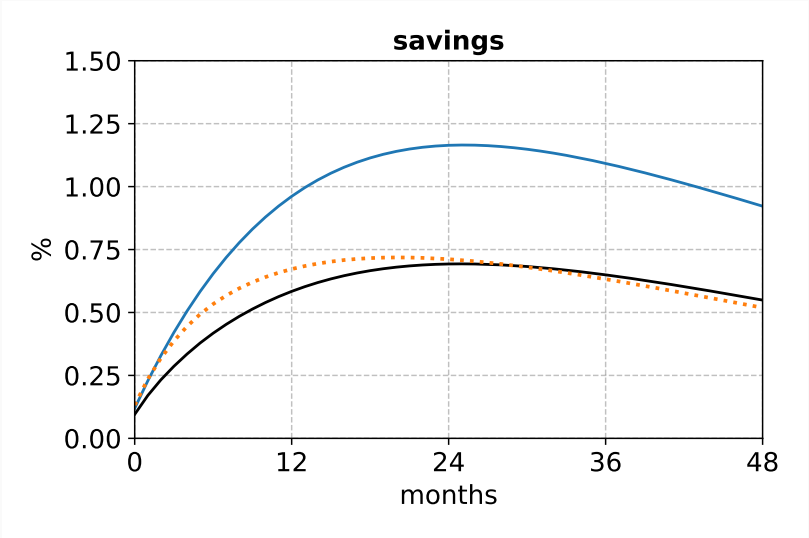


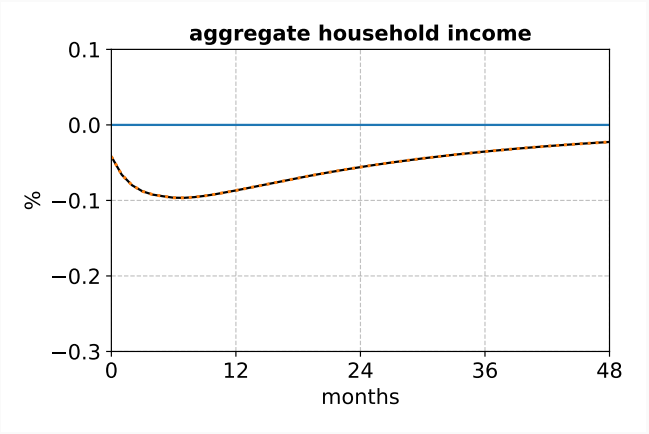


2a. Bond demand: Job-finding rate matters most (2/3)

- **Result:** Response can be explained by *change in behavior* + *lower wage path implying same aggregate household income path*

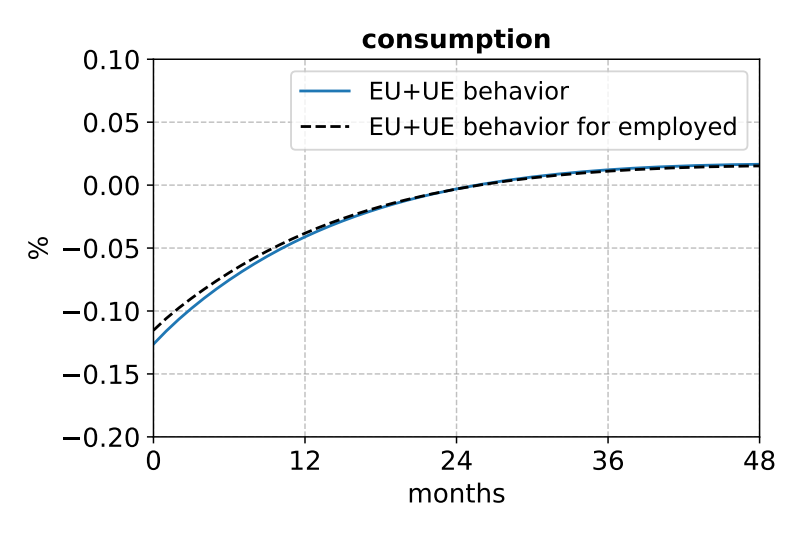


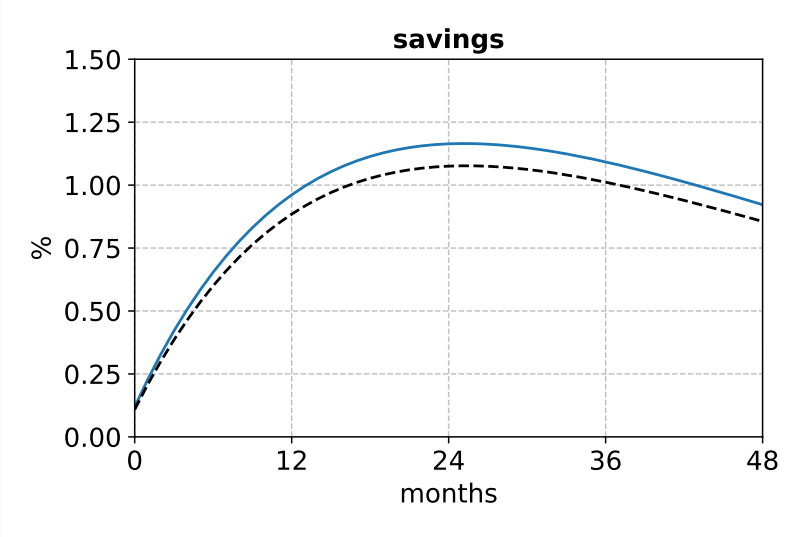




2a. Bond demand: Job-finding rate matters most (3/3)

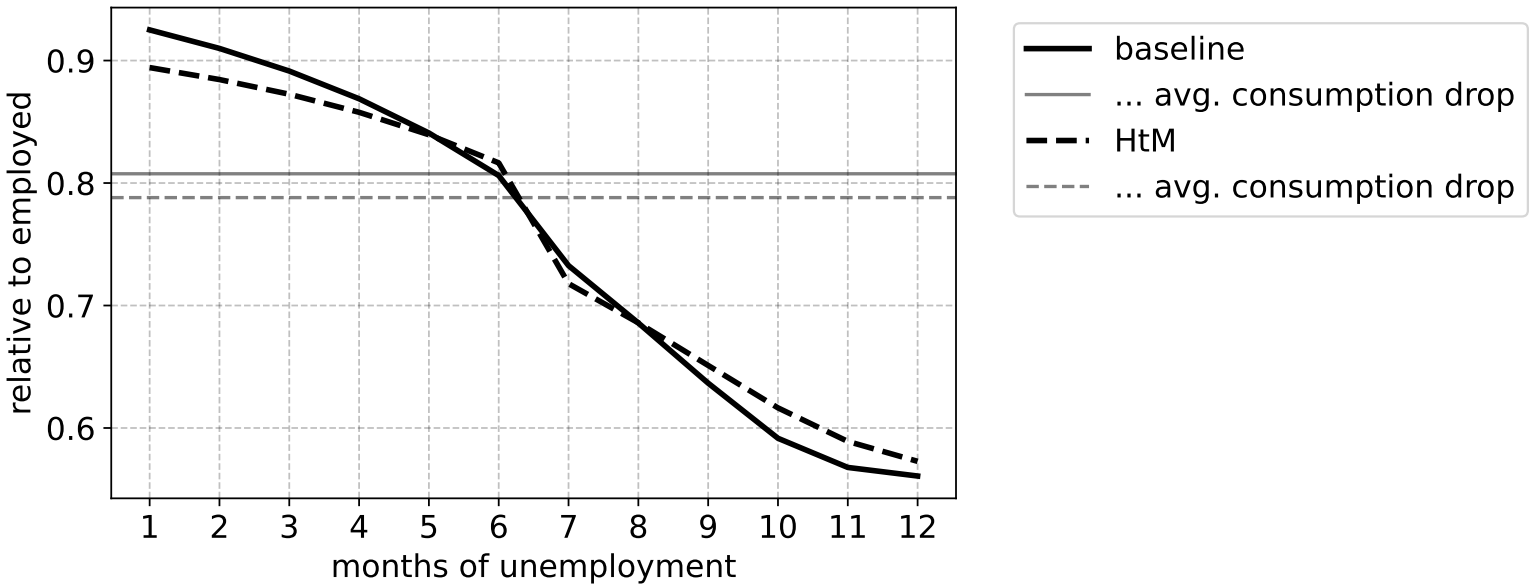
- **Result:** Behavioral response can be explained by *change in behavior of employed*





2a. Bond demand: Hand-to-mouth households (1/2)

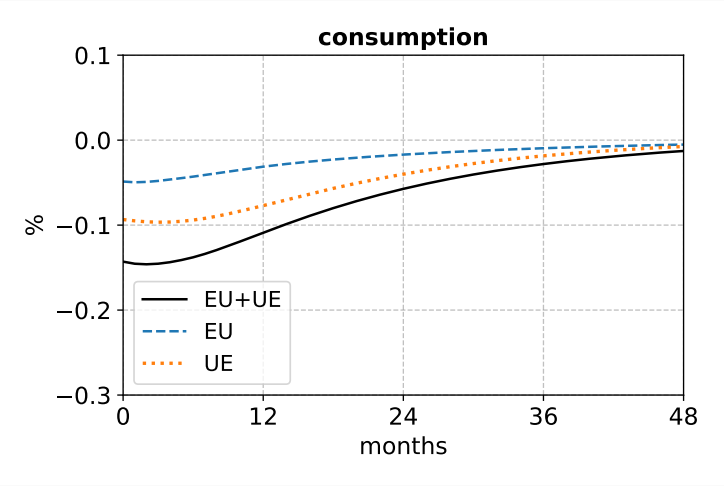
- **Alternative HtM calibration of discount factors:**
  1. Same discount factors, $\beta_i^{12} \in \{0.00, 0.96, 0.98\}$
  2. Equal population shares, $\{0.15, 0.70, 0.15\} \to \{1/3, 1/3, 1/3\}$
- **Implications:**
  1. Lower relative consumption of unemployed: $-19.2 \to -21.2$ %
  2. Larger drop at exhaustion: 34.7 $\to$ 46.5 % of income drop
  3. Quarterly MPC: 25.1 $\to$ 40.1 %

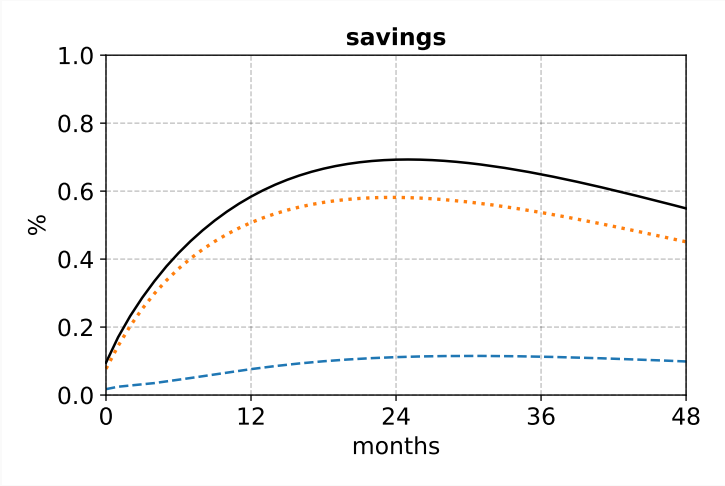


2a. Bond demand: Hand-to-mouth households (2/2)

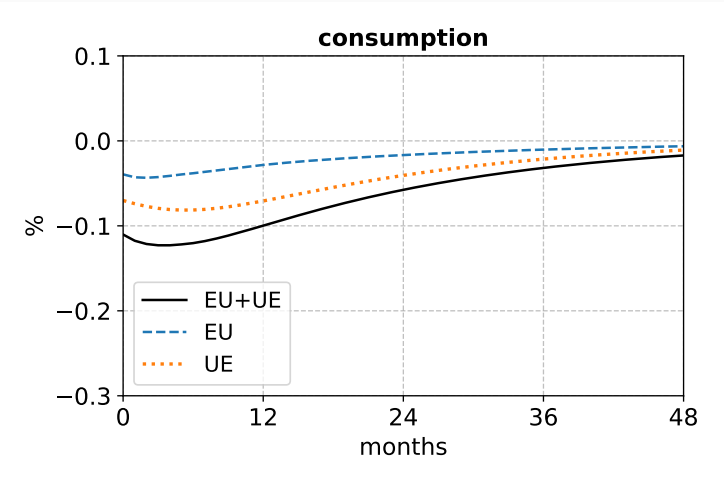
- **Result:** HtM households dampen the savings response a lot

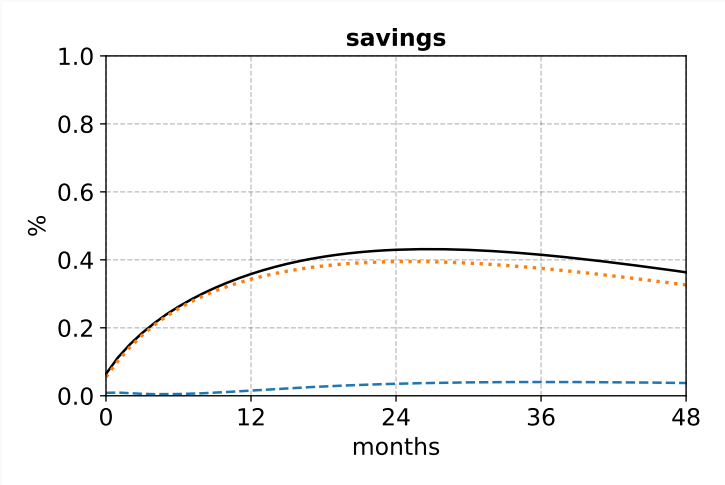
(a) baseline calibration





(b) hand-to-mouth calibration





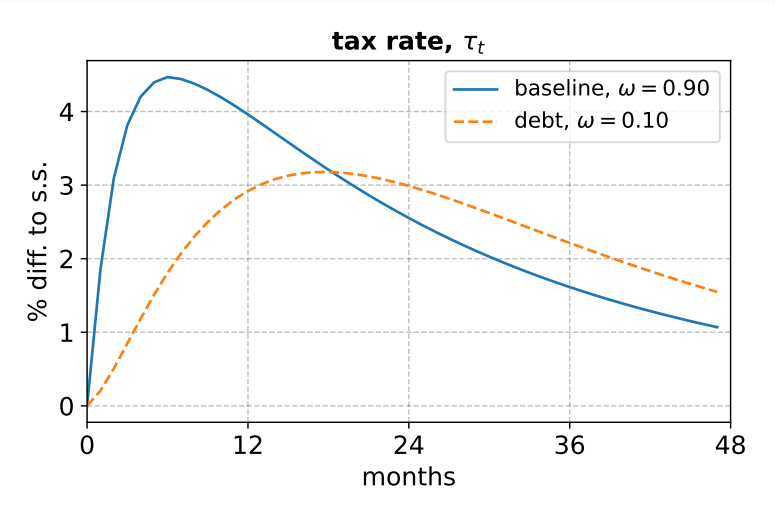
2b. Bond Supply: Tax vs. debt-financing

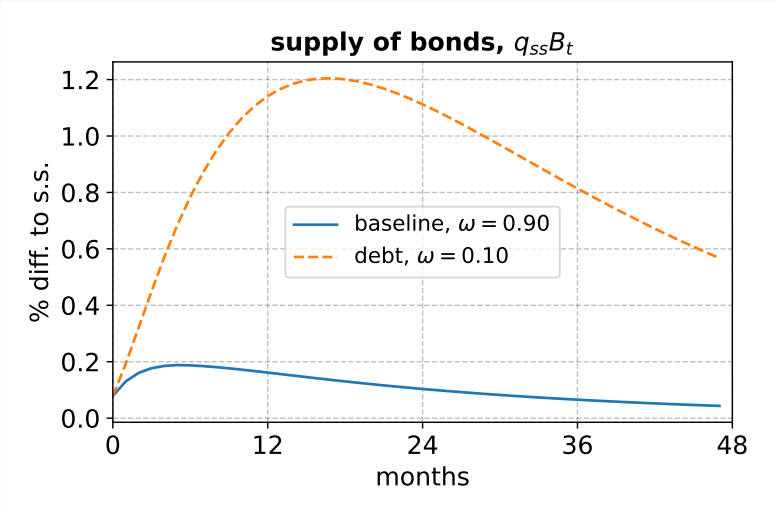
- **Experiment:** Feed in equilibrium path of unemployment for fixed real interest rate and forward accumulate from $B_{-1} = B_{ss}$,

$$\tau_t = \tau_{ss} + \omega q_{ss} \frac{B_{t-1} - B_{ss}}{w_{ss}(1 - u_t)}$$

$$B_t = \frac{(1 + \delta q_{ss})B_{t-1} + (1 - \tau_t)\left(\overline{\phi}_{ss}\mathrm{UI}_t^{hh} + \underline{\phi}\left(u_t - \mathrm{UI}_t^{hh}\right)\right) w_{ss})}{q_{ss}}$$

- **Result:** Large increase in bond supply

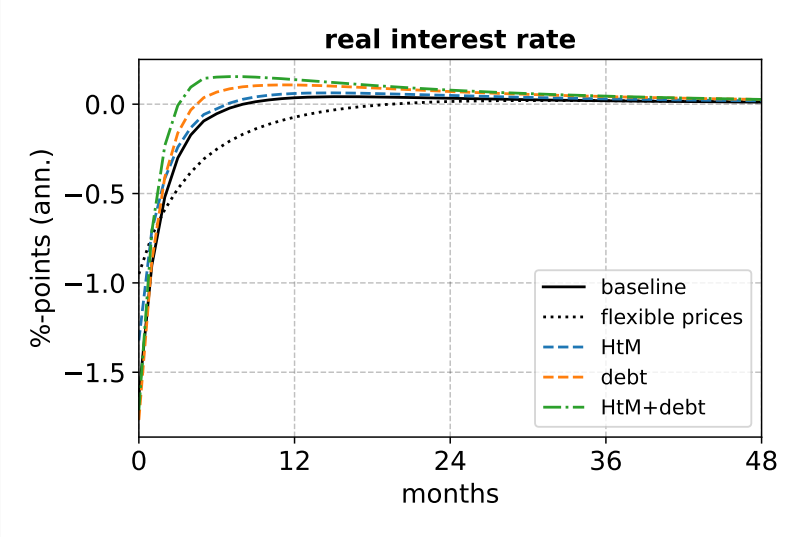


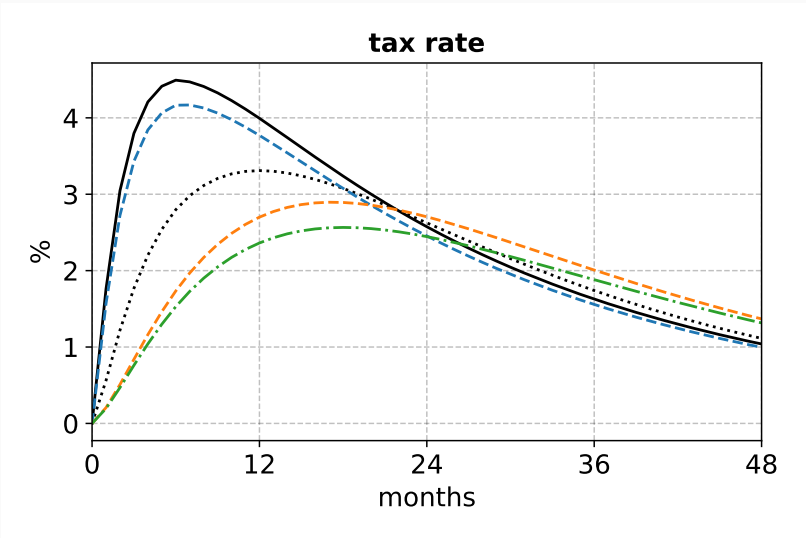


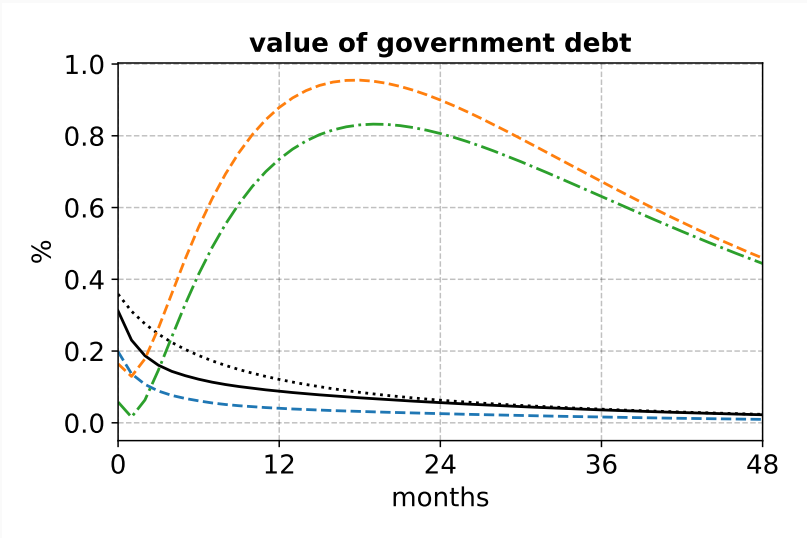
2. Bond market: Bringing it all together

- **Equilibrium path in alternative models:**
  1. **HtM:** Dampens fluctuations
  2. **Debt-financing:** Dampens fluctuations
  3. **Both:** *Less volatility than with flexible prices*

Underlying model dynamics







3. Sticky prices: Closing the loop

- **From real interest rate, R_t^{real}, intermediary goods prices, P_t^x:**

  Fisher: $R_t = R_t^{\text{real}} \Pi_{t+1}$

  Taylor: $\Pi_t = \left(\frac{R_t}{R_{ss}} \right)^{\frac{1}{\delta_\pi}}$

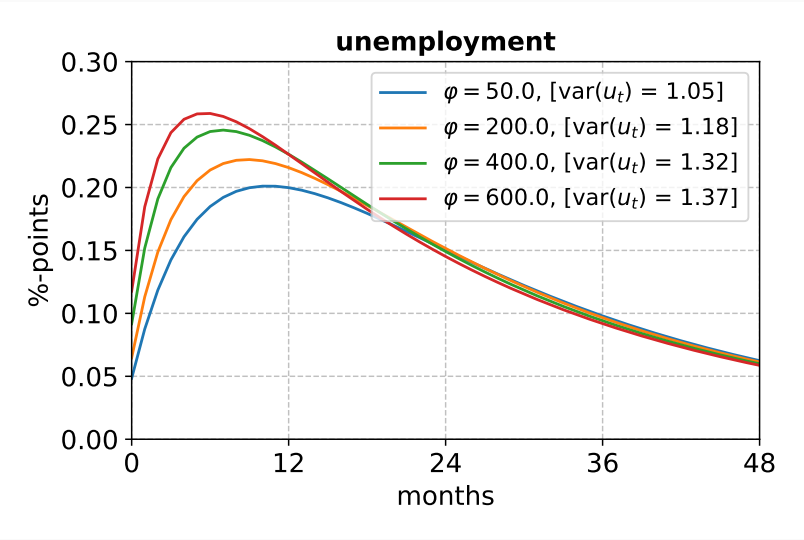
  NKPC: $p_t^x = \frac{\varphi \left((\Pi_t - 1)\Pi_t - \beta \left[(\Pi_{t+1} - 1)\Pi_{t+1} \frac{Z_{t+1}(1-u_{t+1})}{Z_t(1-u_t)} \right] \right) + \epsilon_p - 1}{\epsilon_p}$

- **Result:** Response converges to the response under flexible prices for $\varphi \to 0$ or $\delta_\pi \to 0$

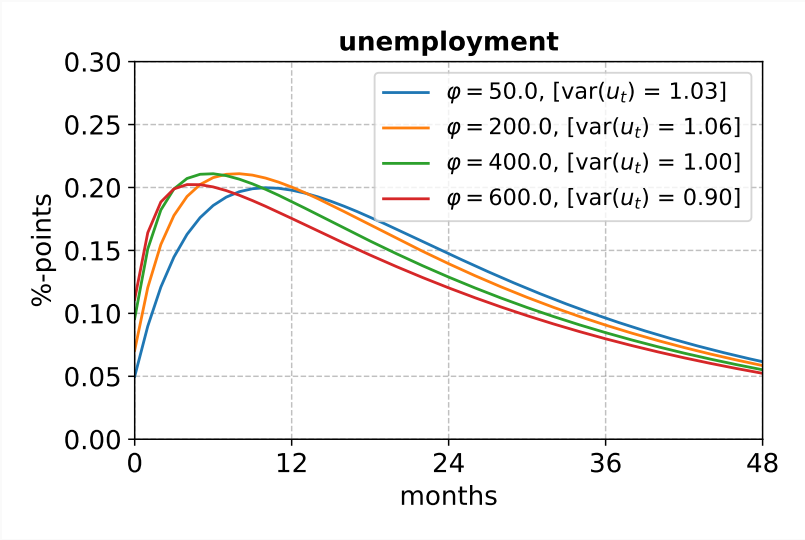
Varying price stickiness, φ

- **Baseline:** More price stickiness is *amplifying*
- **HtM+debt:** More price stickiness is (eventually) *dampening*

(a) baseline calibration



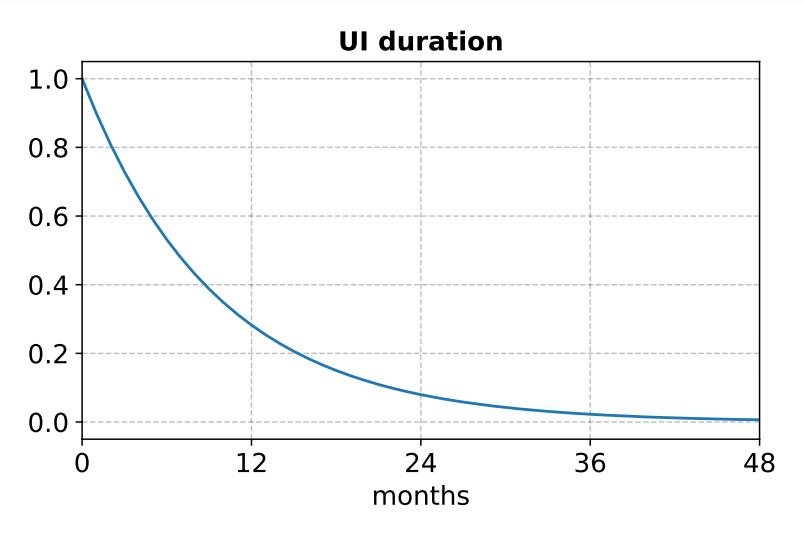
(a) HtM+debt calibration

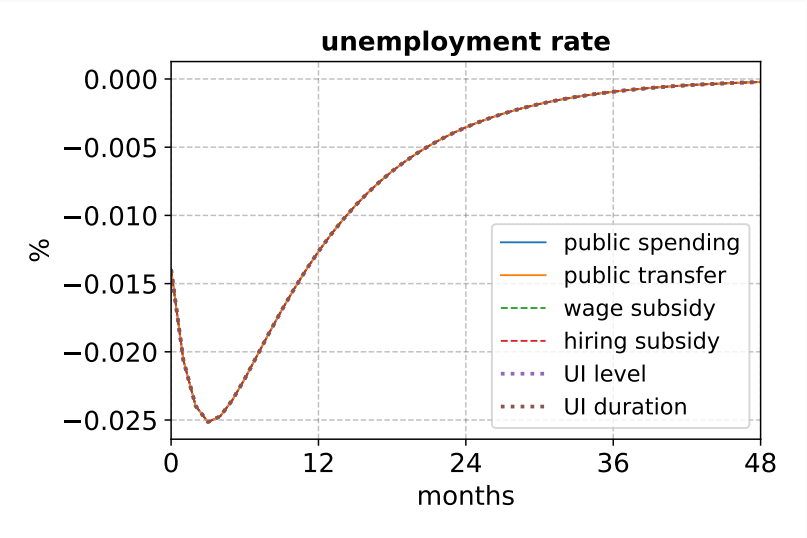


Policy

Policy experiment

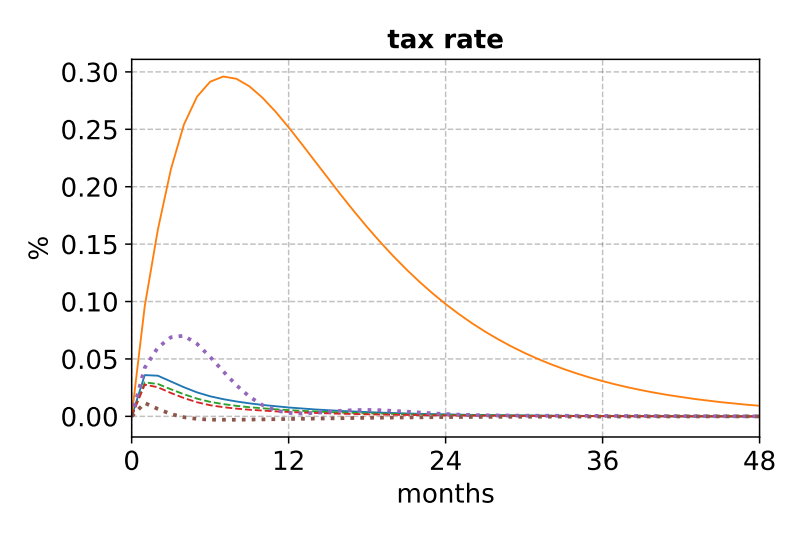
1. Consider the extension of UI duration below
2. Adjust other policy paths to get same unemployment path

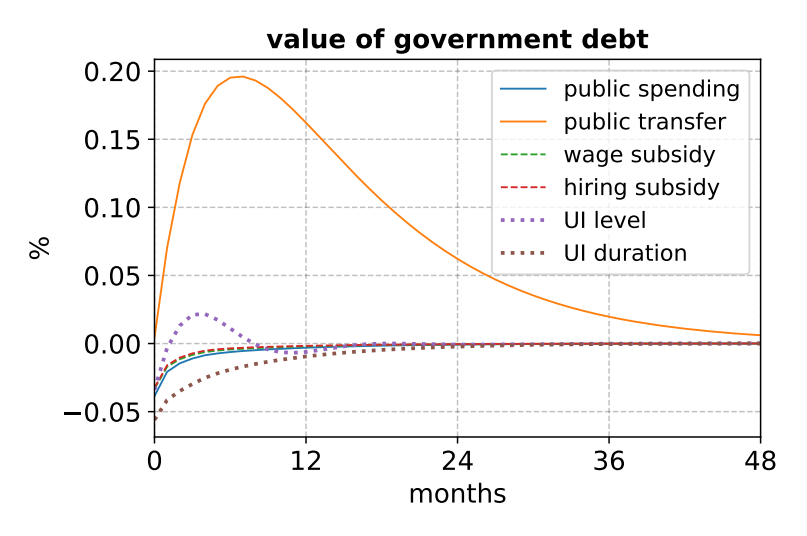




Baseline calibration

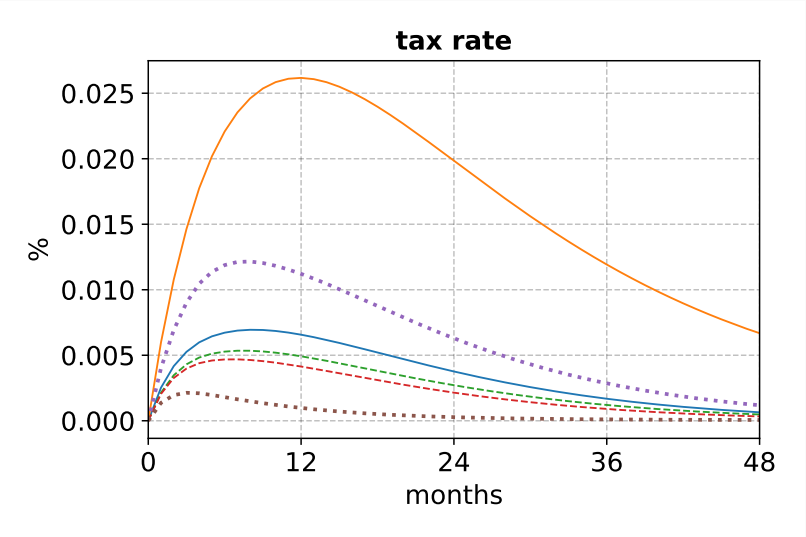
- **Result I:** Some fiscal policies are almost self-financing
- **Result II:** Public transfer and UI level is *worst*
- **Result III:** UI duration is *best*

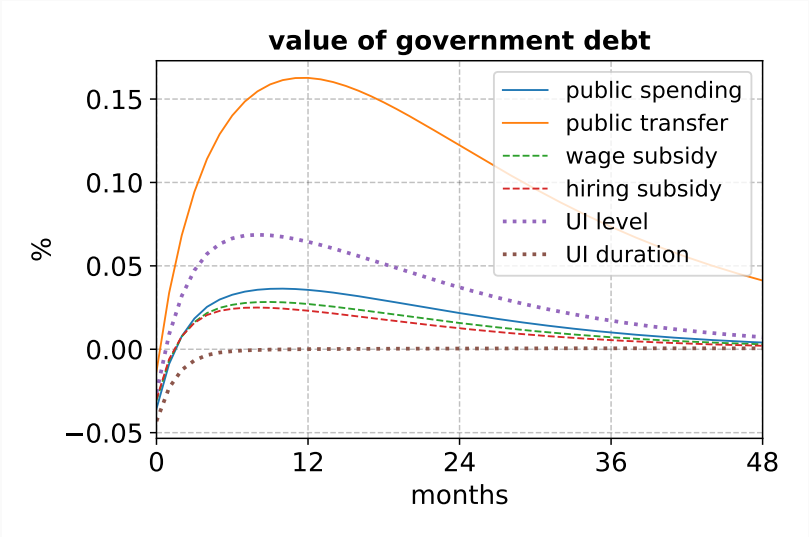




HtM+debt calibration

- **Result I:** Further away from self-financing
- **Result II:** Same order of policy tools





Conclusion

Conclusion

1. **Endogenous separations and sluggish entry:** Amplify unemployment fluctuations and shape unemployment risk
2. **HtM households:** Dampening due to *weaker bond demand*, despite larger MPCs and larger consumption drop in unemployment
3. **Debt-financing:** Dampening due to *stronger bond supply*

   2.+3.: We can have less volatility than with flexible prices

Fiscal policy: Can be close to self-financing. UI extensions is most cost-effective at the margin across range of calibrations

On the agenda:

1. Supply of labor and capital
2. Detailed calibration / estimation (incl. capitalists behavior)
3. Welfare considerations