Why HANK Matters for Stabilization Policy

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Introduction: Motivation

Since 2020, macroeconomic policy has entered uncharted territory:

- Large-scale fiscal interventions (pandemic support), followed by fast monetary tightening
- Inflation surge and concerns over wage-price spirals
- ▷ Renewed attention to the coordination of fiscal and monetary stabilization policy.

HANK models are a natural environment for these interactions:

- Realistic income/wealth distribution from credit constraints and incomplete markets.
- High MPCs, departure from Ricardian equivalence, demand amplification.

Does household heterogeneity matter for *optimal* stabilization and the fiscal-monetary policy mix?

What we do: Our questions

Two questions

(i) Do HANK models generate new mechanisms for the fiscal-monetary policy mix?
(ii) When and why optimal stabilization differ between HANK and RANK?

The framework of the question:

- Some elements are invariant:
  - **Positive side:** preferences, technology, market structure, and nominal frictions. HA: credit constraints + incomplete insurance market.
  - **Normative side:** Ramsey planner (with commitment) and social objective.
- However, the answer to our question is conditional on:
  - which (fiscal) instruments the planner can use;
  - which aggregate shocks affect the economy.

What we do: Approach and two setups

Common features: Compare how HA and RA responses differ under optimal policy (commitment), for various aggregate shocks: G, Z, β, or $\sigma(y)$

Simple model à la Woodford (1990) with flexible prices:

- Multiclass households with credit constraints.
- Fiscal menus that differ in how finely transfers can target households.
- ▷ Analytical results: which household wedges remain, and when HA and RA diverge

General HANK model with both sticky price and wage (120 economies simulated)

- Fiscal system: Capital tax, wage subsidy, labor tax, income tax, public debt.
- ▷ Simulation results using Lagrangian (Primal) approach
  $+$ refined truncation (Le Grand and Ragot, 2022a, 2022b, Le Grand, Martin-Baillon, Ragot 2022).

What we find

A new sufficient statistic – the Marginal Value of the Credit Constraint ($MVCC_t \geq 1$):

- It measures how tight the credit constraint is.
- Whether HA aggregate dynamics differ from RA is governed by whether the MVCC moves:
    - Constant MVCC $\rightarrow$ marginal-utility ratios constant ($\sim$ complete-market) $\rightarrow$ HA $\approx$ RA.
    - Moving MVCC $\rightarrow$ HA $\neq$ RA.
- ▷ Illustration: TFP shocks Z_t leave MVCC nearly flat; discount-factor shocks β_t move it.

When fiscal instruments are missing:

- Inflation becomes a costly second-best substitute for missing labor (and capital) taxes.
- Public debt is smoother in HA (it serves as a buffer stock).

Two margins: how much instruments close wedges $\times$ how much remaining wedges (MVCC) move

Selected literature

(i) Optimal policy in HA economies

- HANK: Kaplan et al. (2018), Auclert (2019), Bilbiie and Ragot (2021), Acharya, Challe, Dogra (2023).
- Methods: Bhandari et al. (2021), Açikgöz et al. (2022), McKay and Wolf (2022), Dávila and Schaab (2023), Nuño and Moll (2018), Nuño and Thomas (2022).
- Sufficient statistics / discount-factor wedge: Nakajima (2005), Werning (2015), Acharya and Dogra (2021), Berger et al. (2023).
- ▷ Tool: truncation, Le Grand and Ragot (2022a) – **first to solve *jointly* for optimal fiscal *and* monetary policy**.

(ii) Fiscal-monetary interaction (RANK and HANK)

- Equivalence: Correia et al. (2008), Seidl and Seyrich (2023), Wolf (2025).
- Fiscal roots of inflation: Leeper and Leith (2016), Cochrane (2023), Bianchi et al. (2023); TANK Bilbiie et al. (2024); Kaplan et al. (2023).

(iii) Price and wage stickiness / wage-price spirals

- Erceg et al. (2000), Chugh (2006), Lorenzoni and Werning (2023); Blanchard (1986), Blanchard and Galí (2007), Galí (2015, ch. 6).
- Inflation surge: Auclert et al. (2023) (energy), Comin et al. (2023) (supply chains), Barro and Bianchi (2023) (fiscal).

A tractable model

A tractable mechanism

The toy model asks a simple Ramsey question:

which household wedge remains when fiscal instruments disappear?

1. Multiclass Woodford-style economy with GHH preferences.
2. Classes differ in employed productivity y_h and borrowing limit $\underline{a}_h$.
3. Within each class, households alternate between employed and unemployed states.
4. Employed households produce; unemployed households have zero productivity.
5. Aggregate shocks move Z_t, β_t, G_t, or idiosyncratic-risk objects.

The two class profiles, y_h and $\underline{a}_h$, load differently on class budgets. This is why common instruments can generate class-specific resources $Q_{h,t}$.

Fiscal menus

We compare three nested fiscal systems.

Regime 1	State-and-class transfers $\{T_{e,h,t}, T_{u,h,t}\}$
Regime 2	Class transfers $\{T_{h,t}\}$, but no employment-state transfers
Regime 3	Common macro instruments only: taxes, interest rates, public debt

- The ranking is mechanical: Regime 1 has the largest feasible set.
- The economics is sharper: each menu leaves a different dimension of household wedge.

RA benchmark

Representative-agent allocation:

$$\max_{C_t, L_t} \sum_t \beta^t \log\left(C_t - \frac{L_t^{1+1/\varphi}}{1+1/\varphi}\right) \quad \text{s.t.} \quad C_t = Z_t L_t.$$

This is a static program:

$$C_t^{RA} = Z_t^{1+\varphi}.$$

- No household wedge.
- No distributional state.
- β_t has no direct effect on the allocation.

▷ This is the benchmark for reading HA responses.

The household wedge

For class h, the reduced Ramsey objects are:

$$\tilde{C}_{h,t} := \tilde{c}_{e,h,t} + c_{u,h,t}, \qquad \Lambda_{h,t} := \frac{c_{u,h,t}}{\tilde{c}_{e,h,t}}.$$

$$\mathcal{W}_t = \sum_h n_h \left[2 \log \tilde{C}_{h,t} + \log \Lambda_{h,t} - 2 \log(1 + \Lambda_{h,t})\right].$$

$$\sum_h n_h \tilde{C}_{h,t} = Z_t L_t - \frac{\Xi^{-1/\varphi}}{1 + 1/\varphi} L_t^{1+1/\varphi}.$$

- $\tilde{C}_{h,t}$ is the class composite consumption.
- $\Lambda_{h,t}$ is the within-class credit-tightness wedge.
- Aggregate feasibility pins total resources.
- Missing fiscal instruments restrict *feasible paths* of $\Lambda_{h,t}$.
- ▷ **Ideally:** Push consumption to the max feasibility and close wedge ($\Lambda_{h,t} \to 1$)

What instruments do

	Wedge left by the menu	HA vs RA response
Regime 1	$\Lambda_{h,t} = 1$	HA $=$ RA
Regime 2	$\Lambda_{h,t} = \Lambda^{\star}_t$ for all h	$\widehat{\text{HA}} = \widehat{\text{RA}}$ if $\Lambda^{\star}_t$ is constant
Regime 3	$\Lambda_{h,t}$ varies across classes	HA $\neq$ RA generically

- **Instrument margin**: how much fiscal policy closes wedge dispersion.
- **Shock margin**: how much the remaining common wedge moves.

Regime 1: full insurance

State-and-class transfers can condition on both the permanent class and the employment state.

$$\Lambda_{h,t} = 1 \qquad \text{for all } h, t.$$

- The reduced welfare is maximized at the full-insurance split.
- The planner closes the within-class credit-tightness wedge.
- Aggregate feasibility collapses to the RA frontier.
- The credit-constraint wedge has zero shadow value at the Ramsey optimum.

Regime 1: $C_t = C_t^{RA}$ and $L_t = L_t^{RA}$.

Regime 2: Ramsey program

Class transfers can reallocate across permanent classes, but cannot condition on the employment state. They collapse the problem to one class composite and one common wedge:

$$\tilde{C}_{h,t} = \tilde{C}_t, \qquad \Lambda_{h,t} = \Lambda_t \qquad \text{for all } h.$$

$$\max_{\{\tilde{C}_t,\Lambda_t,L_t\}_{t\geq 0}} \quad \sum_{t\geq 0} \beta^t \left[2\log \tilde{C}_t + \log \Lambda_t - 2\log(1+\Lambda_t)\right]$$

$$\text{s.t.} \quad \tilde{C}_t = Z_t L_t - \frac{\Xi^{-1/\varphi}}{1+1/\varphi} L_t^{1+1/\varphi},$$

$$\Lambda_t \left(\frac{L_t}{\Xi Z_t^{\varphi}}\right)^{1/\varphi} = 1 + \beta_t.$$

- The first constraint is the aggregate GHH frontier.
- The second one is the remaining household implementability condition.
- It comes from the household budget and Euler equations once class transfers have equalized class resources but cannot insure the employment-state split.

Regime 2: solution unpacked

Solving the reduced Ramsey program gives the common wedge:

$$\Lambda_t^\star = \frac{1+\varphi(1+\beta_t)}{1+2\varphi} < 1.$$

The implementability condition then pins labor:

$$\Lambda_t^\star \left(\frac{L_t^{HA}}{\Xi Z_t^\varphi}\right)^{1/\varphi} = 1+\beta_t \qquad \Longrightarrow \qquad \frac{L_t^{HA}}{L_t^{RA}} = (1+\beta_t)^\varphi (\Lambda_t^\star)^{-\varphi}.$$

Because $C_t = Z_t L_t$,

$$\frac{C_t^{HA}}{C_t^{RA}} = \frac{L_t^{HA}}{L_t^{RA}} = (1+\beta_t)^\varphi (\Lambda_t^\star)^{-\varphi}.$$

- The FOC chooses the best common within-class insurance gap.
- The implementability condition translates that gap into aggregate labor and consumption.

Regime 2: interpretation

- **What class transfers do:** they remove cross-class dispersion.

$$\tilde{C}_{h,t} = \tilde{C}_{h',t}, \qquad \Lambda_{h,t} = \Lambda_{h',t}$$

- **What they do not do:** they do not remove the common employed/unemployed wedge.

$$\Lambda_{h,t} = \Lambda_t^\star < 1 \qquad \text{rather than} \qquad \Lambda_{h,t} = 1.$$

- **When HA looks like RA:** if the shock leaves $\Lambda_t^\star$ constant, HA and RA responses coincide.
- **When HA differs from RA:** if the shock moves $\Lambda_t^\star$, the common wedge moves aggregate labor and consumption.

Regime 2 removes class dispersion, but not the employed/unemployed wedge.

MVCC and credit tightness

The MVCC measures residual credit tightness in the common-wedge case.

$$MVCC_t := \left(1 - \frac{\nu_t}{U_c(c_{u,t}, 0)}\right)^{-1} \geq 1.$$

$$MVCC_t = \frac{1}{\Lambda_t^\star \Lambda_{t+1}^\star}.$$

- The MVCC and $\Lambda_t^\star$ read the same residual tightness in this case.
- We can therefore read $\Lambda_{h,t}$ as a class-level credit-tightness wedge.
- Lower $\Lambda_{h,t}$ means tighter credit for class h.
- In the toy benchmark, Z_t does not move $\Lambda_t^\star$, while β_t does.

Regime 3: dispersed wedges

With common instruments only, aggregate feasibility must also satisfy class implementability restrictions. Let $Q_{h,t}$ collect the class-specific resources left after common labor and return paths are fixed.

$$\tilde{C}_{h,t} = \frac{(1+\Lambda_{h,t})Q_{h,t}}{1+\beta_t}, \qquad \Lambda_{h,t} = \underbrace{\frac{\beta_{t-1}(1+r_t)(1+\beta_t)}{1+\beta_{t-1}}}_{\text{common factor}} \frac{Q_{h,t-1}}{Q_{h,t}}.$$

- The prefactor is common across classes.
- Cross-class dispersion comes from $Q_{h,t-1}/Q_{h,t}$.
- Since $Q_{h,t}$ differs across classes, wedges disperse generically.
- Regime 3 leaves both resource dispersion and wedge dispersion.

Regime 3: composition and one source

Aggregate class-composite consumption contains a composition term:

$$\bar{\tilde{C}}_t := \sum_h n_h \tilde{C}_{h,t} = \frac{1}{1+\beta_t} \sum_h n_h Q_{h,t}(1+\Lambda_{h,t})$$
$$= \frac{\bar{Q}_t(1+\bar{\Lambda}_t) + \mathrm{Cov}_{n,t}(Q,\Lambda)}{1+\beta_t}.$$

- A positive covariance means high-resource classes also have a looser employed/unemployed wedge.
- Holding $\bar{Q}_t$ and $\bar{\Lambda}_t$ fixed, this raises aggregate composite consumption.
- But it is not a free lunch: wedge dispersion still enters welfare through $\mathcal{J}_t^{\Lambda}$.

If only one fixed source of heterogeneity remains,

$$Q_{h,t} = A_t q_h \quad \Rightarrow \quad \Lambda_{h,t} = \Lambda_t \quad \text{and} \quad \mathrm{Cov}_{n,t}(Q,\Lambda) = 0.$$

Wedge block falls back to Regime 2, but resource dispersion can remain.

The toy lesson

We can decompose the period payoff:

$$\mathcal{W}_t = 2\log\left(\frac{\bar{Q}_t}{1+\beta_t}\right) + \log\bar{\Lambda}_t \quad -2 \underbrace{\mathcal{J}_t^Q}_{\text{Jensen dispersion of the } Q\text{s}} - \underbrace{\mathcal{J}_t^\Lambda}_{\text{Jensen dispersion of the } \Lambda\text{s}}$$

- **Regime 1**: full insurance closes the household wedge.
- **Regime 2**: class transfers kill wedge dispersion, so $\mathcal{J}_t^\Lambda = 0$, but the common wedge can still move.
- **Regime 3**: common instruments leave resource dispersion and wedge dispersion: $\mathcal{J}_t^Q$ and $\mathcal{J}_t^\Lambda$.

The toy lesson: two roles for instruments

Two roles for instruments:

1. Average-efficiency margin: instruments are more effective when they raise average implementability resources $\bar{Q}_t$ and the average wedge $\bar{\Lambda}_t$.
2. Dispersion margin: instruments are more effective when they prevent resources and wedges from being dispersed across classes, as measured by the Jensen gaps.

Toy model: summary (1/2)

Setup: multiclass Woodford (1990) economy: oscilation between employment w/ income y_h and unemployment with income $= 0$, log-GHH pref. + credit constraints.

Within-class wedge $\Lambda_{h,t} = c_{u,h,t}/\tilde{c}_{e,h,t}$ ($\Lambda = 1 \Leftrightarrow$ full insurance; lower $\Lambda \Leftrightarrow$ tighter credit)

Margin value of credit constraint $MVCC_t = \left(1 - \frac{\nu_t}{U_c(c_{u,t},0)}\right)^{-1} \geq 1$. Here: $MVCC_t = 1/(\Lambda_t^\star \Lambda_{t+1}^\star)$.

	Instruments	**Wedge left**	**HA vs RA**
Regime 1	State e,u & class h transfers	$\Lambda_{h,t} = 1$	$HA = RA$
Regime 2	Class transfers (across h)	$\Lambda_{h,t} = \Lambda_t^\star$ (common)	$\widehat{HA} = \widehat{RA}$ iff $\Lambda_t^\star$ constant
Regime 3	Common macro instruments	$\Lambda_{h,t}$ disperses	$HA \neq RA$ generically

Toy model: summary (2/2) — lessons

Two margins: instrument (how much policy closes wedge dispersion) $\times$ shock (how much the common wedge / MVCC moves). In toy benchmark, Z_t doesn't affect $\Lambda_t^\star$, β_t moves it.

Period welfare splits into average-efficiency terms minus dispersion (Jensen) terms:

$$\mathcal{W}_t = \log\left(\frac{\bar{Q}_t}{1+\beta_t}\right) + \log \bar{\Lambda}_t - \underbrace{\mathcal{J}_t^Q}_{\text{dispersion of resources}} - \underbrace{\mathcal{J}_t^\Lambda}_{\text{dispersion of wedges}}$$

Two roles for instruments:

1. Average-efficiency margin: raise average resources $\bar{Q}_t$ and the average wedge $\bar{\Lambda}_t$.
2. Dispersion margin: shrink the Jensen gaps $\mathcal{J}_t^Q, \mathcal{J}_t^\Lambda$ (keep resources and wedges from dispersing across classes).

Across the ladder: **Regime 1** closes the wedge; **Regime 2** kills wedge dispersion ($\mathcal{J}_t^\Lambda = 0$) but the common wedge can still move; **Regime 3** leaves both $\mathcal{J}_t^Q$ and $\mathcal{J}_t^\Lambda$.

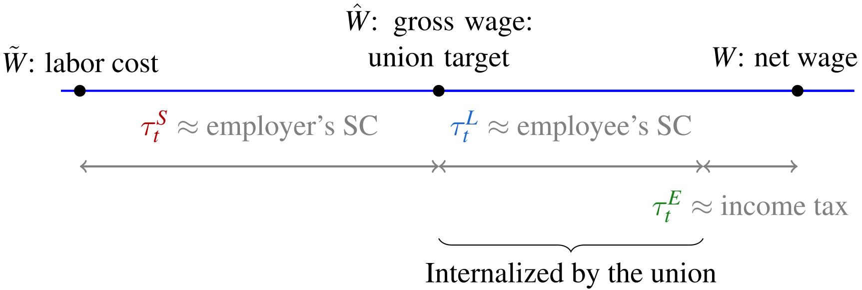
The general HANK model

The HANK model

1. Households face uninsurable productivity risk, credit-constraints, hold public debt to self-insure (no capital).
2. Both β_t and Z_t aggregate shocks.
3. Firms produce with labor, face sticky prices à la Rotemberg (Bhandari et al., 2022; Le Grand et al., 2022; Acharya, et al. 2022)
4. Unions bargain on behalf of households, choose the same wage-labor for all households, face sticky wages à la Rotemberg as in Auclert et al. (2023b); Alves and Violante (2023).
5. Government finances public spending with a rich fiscal structure.
6. We first present the *complete* fiscal structure.

The model: Different wages

Nominal wages (e.g., W):



$+$ capital tax τ_t^K

The model: Households' program

Households' program is (Bewley-Aiyagari-Huggett type):

$$\max_{\{c_{i,t},a_{i,t}\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(u(c_{i,t}) - v(L_t)\right),$$

$$\text{s.t. } c_{i,t} + a_{i,t} = (1+r_t)a_{i,t-1} + w_t y_{i,t} L_t,$$

with $c_{i,t} > 0, \ a_{i,t} \geq 0$, and with post-tax rates:

$$\begin{aligned} w_t &= (1-\tau_t^L)(1-\tau_t^E)\hat{w}_t, \\ \hat{w}_t &= (1-\tau_t^S)\tilde{w}_t, \\ \tilde{r}_t &= \frac{1+i_{t-1}}{1+\pi_t^P}, \\ r_t &= (1-\tau_t^E)(1-\tau_t^K)\tilde{r}_t. \end{aligned}$$

Sticky wages

Differentiated labor, unions have market power, bargain for workers, same hours for all workers. Rotemberg adjustment cost for workers, based on Erceg et al. (2000) (e.g., as in Auclert et al., 2023b; Hagedorn et al. 2022; Alves and Violante, 2023).

Wage Phillips curve:

$$\pi_t^W(\pi_t^W+1) = \frac{\varepsilon_W}{\psi_W}\left(v'(L_t) - \frac{\varepsilon_W - 1}{\varepsilon_W}\frac{w_t}{1-\tau_t^E}\int_i y_{i,t}u'(c_{i,t})\ell(di)\right)L_t$$
$$+\beta\mathbb{E}_t\left[\pi_{t+1}^W(\pi_{t+1}^W+1)\right].$$

Sticky prices

Production: Firms produce with labor (CRS) with productivity Z. Rotemberg pricing.

Price Phillips curve:

$$\pi_t^P(1+\pi_t^P) = \frac{\varepsilon_P - 1}{\psi_P}\frac{1}{Z_t}\left(\frac{w_t}{(1-\tau_t^L)(1-\tau_t^S)(1-\tau_t^E)} - Z_t\right) + \beta\mathbb{E}_t\left[\pi_{t+1}^P(1+\pi_{t+1}^P)\frac{Y_{t+1}}{Y_t}\right]$$

Government

Real governmental budget constraint: financing of a public spending stream (G_t) with many taxes, and public debt.

$$G_t + \frac{1+i_t}{1+\pi_t^P}B_{t-1} \leq B_t + \tau_t^E(1-\tau_t^L)\hat{w}_t L_t + \tau_t^K \tilde{r}_t \int_i a_{i,t-1}\ell(di) + \tau_t^L \hat{w}_t L_t + \tau_t^S \tilde{w}_t L_t + \Omega_t.$$

which can also be written as:

$$G_t + (1+r_t)B_{t-1} + w_t L_t \leq \left(1 - \frac{\psi_P}{2}(\pi_t^P)^2\right) Z_t L_t + B_t.$$

Optimal Ramsey policy

The Ramsey problem

- Time-varying tools are subsets of $\mathcal{S} = (\tau_t^S, \tau_t^E, \tau_t^L, \tau_t^K, B_t, i_t)$.
- Aggregate shocks are $Z, G, \beta, \sigma(y)$
- Instruments outside the menu are fixed at their steady-state values.
- The planner chooses the optimal monetary-fiscal policy mix, which affects prices and allocations $(\pi_t^P, \pi_t^W, w_t, r_t, L_t, (c_{i,t}, a_{i,t}))_{t\geq 0}$,
- to maximize aggregate welfare.

Missing instruments replace Ramsey FOCs with restrictions, and the remaining FOCs determine the residual wedges.

Ramsey

The Ramsey problem: Formulation

max over $\{\tau_t^S, \tau_t^E, \tau_t^L, \pi_t^P, \pi_t^W, w_t, r_t, L_t, (c_{i,t}, a_{i,t})_{t\geq 0}\}$ of $\mathcal{W}_0$

$$\mathcal{W}_0 = \mathbb{E}_0\left[\sum_{t=0}^{\infty}\Theta_t\left[\int_i \omega(y_t^i)U(c_t^i, l_t^i)\ell(di) - \frac{\psi_W}{2}(\pi_t^W)^2\right]\right].$$

such that:

$$G_t + (1+r_t)\int_i a_{i,t-1}\ell(di) + w_t L_t \leq \left(1 - \frac{\psi_P}{2}(\pi_t^P)^2\right)Z_t L_t + \int_i a_{i,t}\ell(di),$$

for all i: $c_{i,t} + a_{i,t} = (1+r_t)a_{i,t-1} + w_t y_{i,t} L_t,$

$$u'(c_{i,t}) = \beta\mathbb{E}_t\left[(1+r_{t+1})u'(c_{i,t+1})\right] + \nu_{i,t},$$

$$\pi_t^W(\pi_t^W + 1) = \frac{\varepsilon_W}{\psi_W}\left(v'(L_t) - \frac{\varepsilon_W - 1}{\varepsilon_W}\frac{w_t}{1-\tau_t^E}\int_i y_{i,t}u'(c_{i,t})\ell(di)\right)L_t + \beta\mathbb{E}_t[\cdots],$$

$$\pi_t^P(1+\pi_t^P) = \frac{\varepsilon_P - 1}{\psi_P}\left(\frac{1}{Z_t}\frac{w_t}{(1-\tau_t^L)(1-\tau_t^S)(1-\tau_t^E)} - 1\right) + \beta\mathbb{E}_t[\cdots],$$

$$(1+\pi_t^W)\frac{w_{t-1}}{(1-\tau_{t-1}^E)(1-\tau_{t-1}^L)} = \frac{w_t}{(1-\tau_t^E)(1-\tau_t^L)}(1+\pi_t^P).$$

Equivalence result

Proposition (An equivalence result)

When all instruments are available, the government implements an allocation with zero inflation for prices and wages in all periods, in both HA and RA economies, and after all aggregate shocks.

- τ_t^S undoes the connection between mpl and wage $\rightarrow$ turns off price Phillips curve.
- τ_t^E undoes the connection between mrs and wage $\rightarrow$ turns off wage Phillips curve.
- τ_t^L makes both inflation rates independent.
- τ_t^K avoids rate pre-determination at $t = 0$.

$\Rightarrow$ complete fiscal instruments close the nominal wedges.

This complements the HA-vs-RA household-wedge story: here, the issue is whether nominal rigidities constrain Ramsey allocations.

Solution method

Steps:

1. Writing the Ramsey problem Ramsey
2. Introducing Lagrange multipliers Multipliers
3. Factorization of the Lagrangian $\mathcal{L}$ to simply derive the FOC of the planner. Lagrangian
4. Relation with public finance: Saez and Santcheva (2016) Public
5. Truncation method to simulate the model (finite state space representation). Truncation
6. Refined Truncation method, to reduce the state space.

Wedges – Marginal Value of the Credit constraint

In the full HANK model, the toy wedge becomes a cross-history wedge vector.

$$MVCC_{i,t} = \left(1 - \frac{\nu_{i,t}}{u'(c_{i,t})}\right)^{-1} \geq 1,$$

$$u'(c_{i,t}) = \beta_t \, \mathbb{E}_t\big[MVCC_{i,t} \, R_{t+1} \, u'(c_{i,t+1})\big],$$

- $\mathcal{C}$: credit-constrained histories or "islands":
  $\mathcal{C}_t = \{i : \nu_{i,t} > 0\} \Leftrightarrow MVCC_{i,t} > 1$, measure $\pi_{\mathcal{C}} = \ell(\mathcal{C}_t)$
- $\mathcal{U}$: unconstrained histories / "islands":
  $\mathcal{U}_t = \{i : \nu_{i,t} = 0\} \Leftrightarrow MVCC_{i,t} = 1$, measure $\pi_{\mathcal{U}} = 1 - \pi_{\mathcal{C}}$.
- Average $MVCC_t$:

$$MVCC_t = \int_i MVCC_{i,t}, \ell(di)$$

General wedge accounting

In the full HANK model, the toy wedge becomes a cross-history wedge vector.

$$\mathcal{W}_t = \log C_t - \Bigg(\underbrace{\pi_{\mathcal{C}} \mathcal{J}^{\Lambda}_{\mathcal{C},t} + \pi_{\mathcal{U}} \mathcal{J}^{\Lambda}_{\mathcal{U},t}}_{\text{within islands}} + \underbrace{\mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t}}_{\text{between islands}} \Bigg) + \text{ other terms.}$$

- $\mathcal{C}$: credit-constrained histories, $\mathcal{U}$: unconstrained histories.
- $\mathcal{J}^{\Lambda}_{\mathcal{C},t}$ and $\mathcal{J}^{\Lambda}_{\mathcal{U},t}$: within-island dispersion.

$$\mathcal{J}^{\Lambda}_{\mathcal{C},t} = \log \bar{\Lambda}_{\mathcal{C},t} - \frac{1}{\pi_{\mathcal{C}}} \int_{\mathcal{C}_t} \log \Lambda_{i,t} \, \ell(di), \qquad \mathcal{J}^{\Lambda}_{\mathcal{U},t} = \log \bar{\Lambda}_{\mathcal{U},t} - \frac{1}{\pi_{\mathcal{U}}} \int_{\mathcal{U}_t} \log \Lambda_{i,t} \, \ell(di),$$

- $\mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t}$: between-island wedge.

$$\mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t} = \log \bar{\Lambda}_t - \left(\pi_{\mathcal{C}} \log \bar{\Lambda}_{\mathcal{C},t} + \pi_{\mathcal{U}} \log \bar{\Lambda}_{\mathcal{U},t} \right).$$

Fiscal instrument ladder in the general model

The general model keeps the toy fiscal hierarchy, but with histories instead of classes.

- **Full transfers**: close all household wedges.

$$\mathcal{J}^{\Lambda}_{\mathcal{C},t} = \mathcal{J}^{\Lambda}_{\mathcal{U},t} = \mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t} = 0$$

- **Within-island transfers**: close dispersion within $\mathcal{C}$ and within $\mathcal{U}$, leaving only between-island wedges.

$$\mathcal{J}^{\Lambda}_{\mathcal{C},t} = \mathcal{J}^{\Lambda}_{\mathcal{U},t} = 0 \qquad \mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t} > 0$$

- **Common macro instruments**: leave within-island and between-island dispersion.

$$\mathcal{J}^{\Lambda}_{\mathcal{C},t} > 0, \qquad \mathcal{J}^{\Lambda}_{\mathcal{U},t} > 0 \qquad \mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t} > 0$$

Quantitative results

Quantitative exercise

We read the IRFs through the **PC wedges** and **the welfare accounting**:

$$\mathcal{W}_t \simeq \log C_t - \left(\pi_{\mathcal{C}} \mathcal{J}^{\Lambda}_{\mathcal{C},t} + \pi_{\mathcal{U}} \mathcal{J}^{\Lambda}_{\mathcal{U},t} + \mathcal{J}^{\Lambda}_{\mathcal{C}/\mathcal{U},t}\right) - \text{labor/nominal wedge terms.}$$

- **Resource term**: does aggregate consumption/labor track the RA benchmark?
- **Household wedges**: does credit tightness move with the shock?
- **Labor and nominal PC wedges**: do missing fiscal instruments make inflation useful?

Quantitative ladder

The simulations ask which welfare terms remain when fiscal instruments disappear.

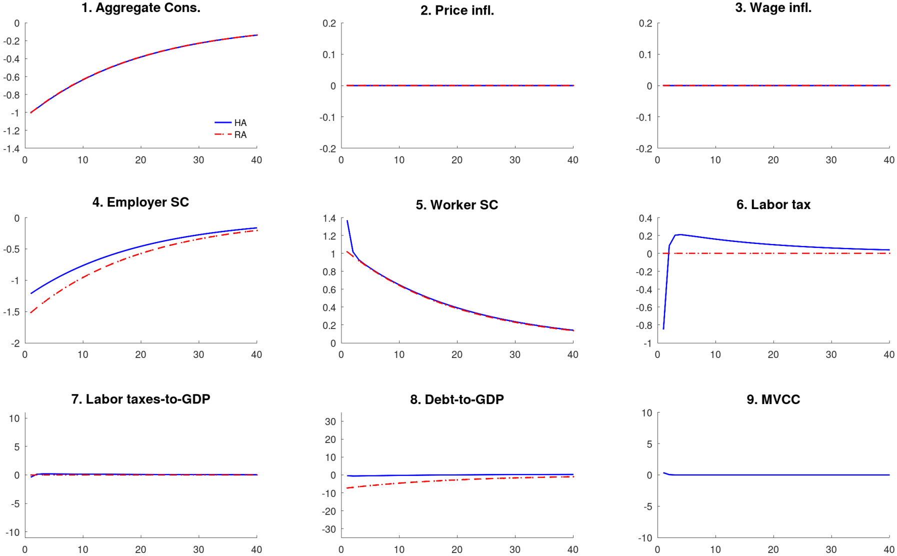
- We show two shocks: Z_t mostly moves agg. resources; β_t moves credit tightness.
- We compare complete instruments with restricted labor-tax instruments.

	Welfare lens	**Diagnostic in IRFs**
All instruments + TFP shocks	Household wedges and labor/nominal wedges are closed	Zero inflation; Z_t mainly shifts resources
Credit/β_t shocks	Household wedge term moves	$MVCC_t$ moves HA aggregate allocation differs from RA
Missing labor tools	Labor/nominal wedge terms remain	Inflation substitutes for unavailable taxes
Public debt	Liquidity relaxes credit tightness	Debt is less volatile in HA unless the RA shock is muted

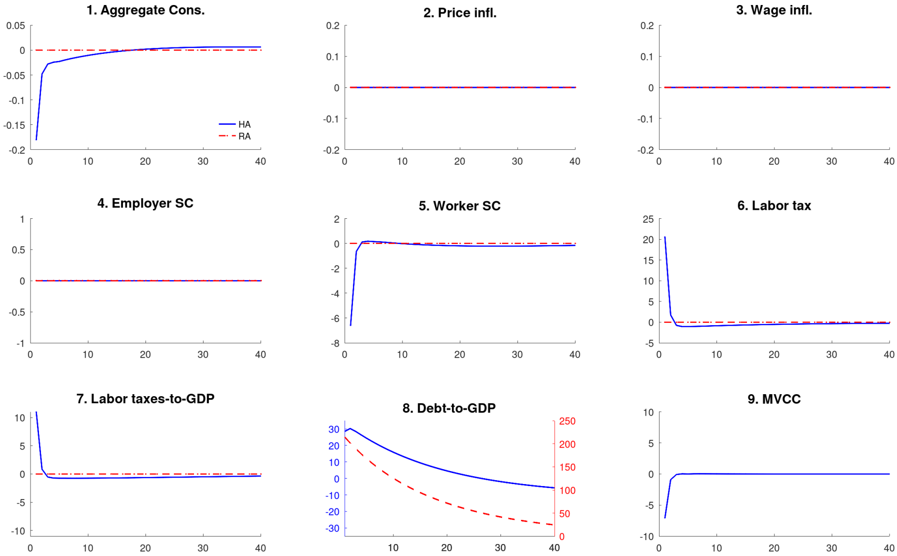
Calibration

	Preference and technology		
β	Discount factor	0.99	Quarterly calibration
σ	Curvature utility	2	
χ	Scaling param. labor supply	0.01	$L = 1/3$
φ	Frisch elasticity labor supply	0.5	Chetty, et al. 2011
	Shock process		
ρ_y	Autocorrelation idio. income	0.993	Krueger et al. 2018
σ_y	Standard dev. idio. income	6%	Gini= 0.78
ρ_z	Autocorrelation TFP shock	0.95	
	Tax system		
τ^L	Labor tax	16%	$G/Y = 15\%$
τ^S,τ^E,τ^K	Other tax	0%	
B/Y	Public debt over yearly GDP	128%	$MPC = 0.3$
G/Y	Public spending over yearly GDP	15%	Targeted
	Monetary parameters		
ε_p	Elasticity of sub. between goods	6	Schmitt-Grohe and Uribe, 2005
ψ_p	Price adjustment cost	100	Price PC 5%
ε_w	Elasticity of sub. labor inputs	21	Schmitt-Grohe and Uribe, 2005
ψ_w	Wage adjustment cost	2100	Wage PC 1%

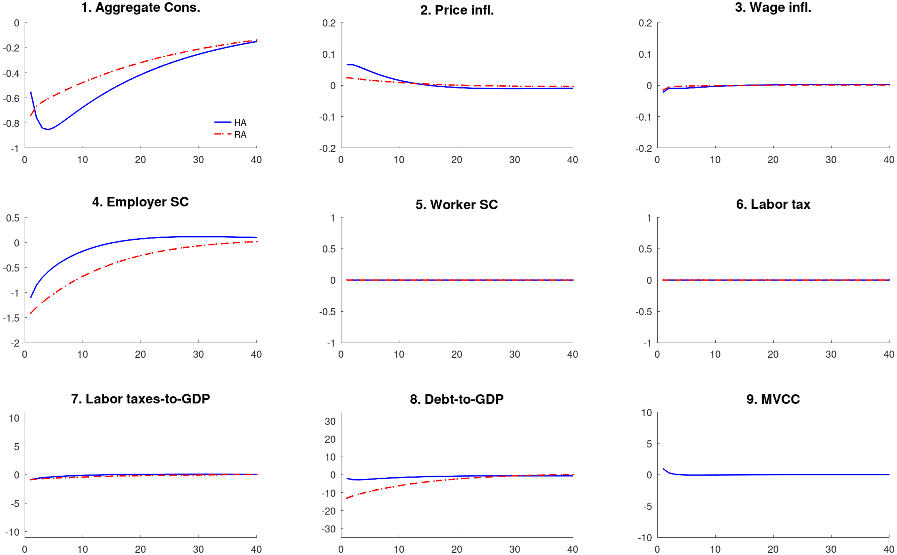
All instruments: Z shock



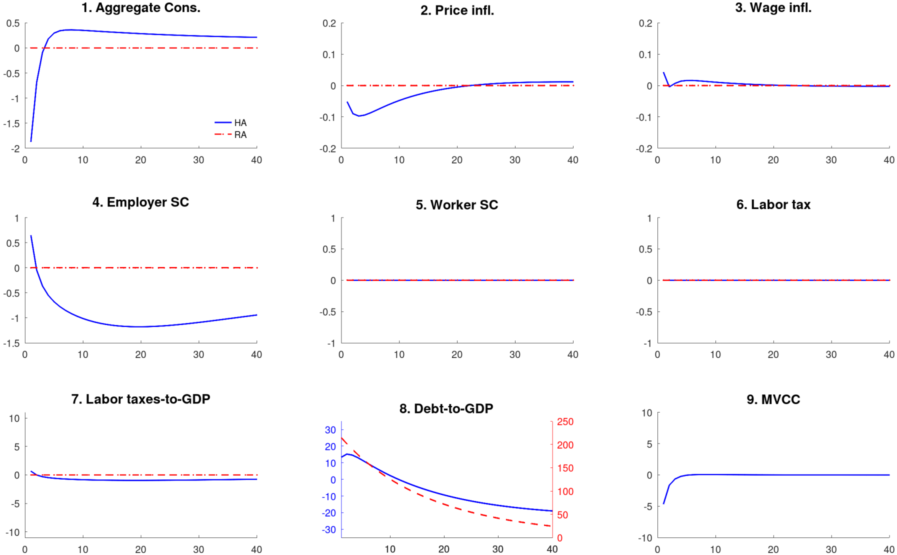
All instruments: β shock



Restricted labor instruments: Z shock



Restricted labor instruments: β shock



Quantitative lesson

- With all instruments, fiscal policy closes the nominal and labor-wedge terms. Price and wage inflation stay at zero.
- Z_t shocks mostly move the resource term. Credit tightness is nearly flat, so HA and RA responses are close
- β_t shocks move the household wedge. The credit tightness responds, so HA aggregate consumption and debt differ from RA
- When labor instruments are missing, inflation becomes a costly substitute for the missing fiscal wedge, especially in HA.

Conclusion

- HA vs RA depends on two margins: how much fiscal instruments close household wedge dispersion, and how much the remaining wedge moves with shocks.
- Fiscal ladder: full instruments close wedges. Intermediate instruments leave a common wedge. Common macro instruments leave dispersed wedges.
- Nominal complement: a complete fiscal system closes price and wage wedges, restoring price-wage stability.
- Quantitatively: the welfare-decomposition lens explains when MVCC/Credit tightness, labor wedges, inflation, and public debt matter.

Thank you!

Comments & questions welcome

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Appendix

The Ramsey problem Back

(Post-tax formulation, Chamley, 1986):

max over $(\tau_t^S, \tau_t^E, \tau_t^L, \pi_t^P, \pi_t^W, w_t, r_t, L_t, (c_{i,t}, a_{i,t})_{t\geq 0}$ of $\mathbb{E}_0\left[\sum_{t=0}^{\infty}\beta^t \int_i \omega(y_t^i)\left(u(c_t^i) - v(L_t)\right)\ell(di) - \frac{\psi_W}{2}(\pi_t^W)^2\right]$ with:

μ_t
$$G_t + (1+r_t)\int_i a_{i,t-1}\ell(di) + w_t L_t \leq \left(1 - \frac{\psi_P}{2}(\pi_t^P)^2\right)Z_t L_t + \int_i a_{i,t}\ell(di),$$

$$\text{for all } i \in \mathcal{I}\text{: } c_{i,t} + a_{i,t} = (1+r_t)a_{i,t-1} + w_t y_{i,t} L_t,$$

λ_t^i
$$u'(c_{i,t}) = \beta\mathbb{E}_t\left[(1+r_{t+1})u'(c_{i,t+1})\right] + \nu_{i,t},$$

γ_t^W
$$\pi_t^W(\pi_t^W+1) = \frac{\varepsilon_W}{\psi_W}\left(v'(L_t) - \frac{\varepsilon_W - 1}{\varepsilon_W}\frac{w_t}{1-\tau_t^E}\int_i y_{i,t}u'(c_{i,t})\ell(di)\right)L_t + \beta\mathbb{E}_t[\cdots],$$

γ_t^P
$$\pi_t^P(1+\pi_t^P) = \frac{\varepsilon_P - 1}{\psi_P}\left(\frac{1}{Z_t}\frac{w_t}{(1-\tau_t^L)(1-\tau_t^S)(1-\tau_t^E)} - 1\right) + \beta\mathbb{E}_t[\cdots],$$

Λ_t
$$(1+\pi_t^W)\frac{w_{t-1}}{(1-\tau_{t-1}^E)(1-\tau_{t-1}^L)} = \frac{w_t}{(1-\tau_t^E)(1-\tau_t^L)}(1+\pi_t^P)$$

Lagrangian Back

$$\mathcal{L} = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \int_i \omega_t^i (u(c_{i,t}) - v(L_t))\ell(di) - \frac{\psi_W}{2}(\pi_t^W)^2$$
$$- \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \int_i \left(\lambda_{i,c,t} - (1+r_t)\lambda_{i,c,t-1}\right) u'(c_{i,t})\ell(di)$$
$$- \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t (\gamma_{W,t} - \gamma_{W,t-1})\pi_t^W (1+\pi_t^W)$$
$$+ \frac{\varepsilon_W}{\psi_W} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \gamma_{W,t} \left(v'(L_t) - \frac{\varepsilon_W - 1}{\varepsilon_W} w_t \int_i y_{i,t} u'(c_{i,t})\ell(di) \right) L_t$$
$$- \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t (\gamma_{P,t} - \gamma_{P,t-1})\pi_t^P (1+\pi_t^P) Z_t L_t + \frac{\varepsilon_P - 1}{\psi_P} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \gamma_{P,t} \left(\frac{w_t}{(1-\tau_t^L)} - Z_t \right) L_t$$
$$+ \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \mu_t \left((1 - \frac{\psi_P}{2}(\pi_t^P)^2) Z_t L_t + \int_i a_{i,t}\ell(di) - G_t - (1+r_t)\int_i a_{i,t-1}\ell(di) - w_t L_t \right)$$
$$+ \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \Lambda_t \left((1+\pi_t^W)\frac{w_{t-1}}{1-\tau_{t-1}^L} - \frac{w_t}{1-\tau_t^L}(1+\pi_t^P) \right)$$

Factorization of the Lagrangian Back

$$
\begin{aligned}
\mathcal{L} = & \ \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \int_i \omega_t^i (u(c_{i,t}) - v(L_t))\ell(di) - \frac{\psi_W}{2}(\pi_t^W)^2 \\
& - \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \int_i (\lambda_{i,c,t} - (1+r_t)\lambda_{i,c,t-1}) \, u'(c_{i,t})\ell(di) \\
& - \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t (\gamma_{W,t} - \gamma_{W,t-1})\pi_t^W (1+\pi_t^W) \\
& + \frac{\varepsilon_W}{\psi_W} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \gamma_{W,t} \left(v'(L_t) - \frac{\varepsilon_W - 1}{\varepsilon_W} w_t \int_i y_{i,t} u'(c_{i,t})\ell(di) \right) L_t \\
& - \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t (\gamma_{P,t} - \gamma_{P,t-1})\pi_t^P (1+\pi_t^P) Z_t L_t + \frac{\varepsilon_P - 1}{\psi_P} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \gamma_{P,t} \left(\frac{w_t}{(1-\tau_t^L)} - Z_t \right) L_t \\
& + \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \mu_t \left((1 - \frac{\psi_P}{2}(\pi_t^P)^2) Z_t L_t + \int_i a_{i,t}\ell(di) - G_t - (1+r_t) \int_i a_{i,t-1}\ell(di) - w_t L_t \right) \\
& + \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \Lambda_t \left((1+\pi_t^W) \frac{w_{t-1}}{1-\tau_{t-1}^L} - \frac{w_t}{1-\tau_t^L}(1+\pi_t^P) \right)
\end{aligned}
$$

Relationship with public finance Back

Define $\psi_{i,t} := \frac{\partial \mathcal{L}}{\partial c_{i,t}}$. It is the Social value of liquidity (equivalent to GSMWW, of Saez and Stantcheva, 2016).

$$\psi_{i,t} := \underbrace{\omega_t^i u'(c_{i,t})}_{\text{direct effet}} - \underbrace{(\lambda_{i,t} - (1+r_t)\lambda_{i,t-1})\, u''(c_{i,t})}_{\text{effect on savings}}$$
$$- \underbrace{\frac{\varepsilon_W - 1}{\psi_W} \gamma_{W,t} w_t L_t y_{i,t} u''(c_{i,t})}_{\text{effect on wage inflation}}.$$

Define $\hat{\psi}_{i,t} := \psi_{i,t} - \mu_t$, then

$$\hat{\psi}_{i,t} = \beta \mathbb{E}_t \left[(1+r_{t+1}) \hat{\psi}_{i,t+1} \right]$$

$\rightarrow$ the FOCs of the planner can be expressed as a function of $\hat{\psi}_{i,t}$ and of the available instruments.

Social value of aggregate liquidity: $\mu_{t+1} - (1+r_t)\mu_t$

Simulating the Model: The truncation back

Problem: Equilibrium = joint distribution over (a, λ_c). Hard to solve.
Main ideas:

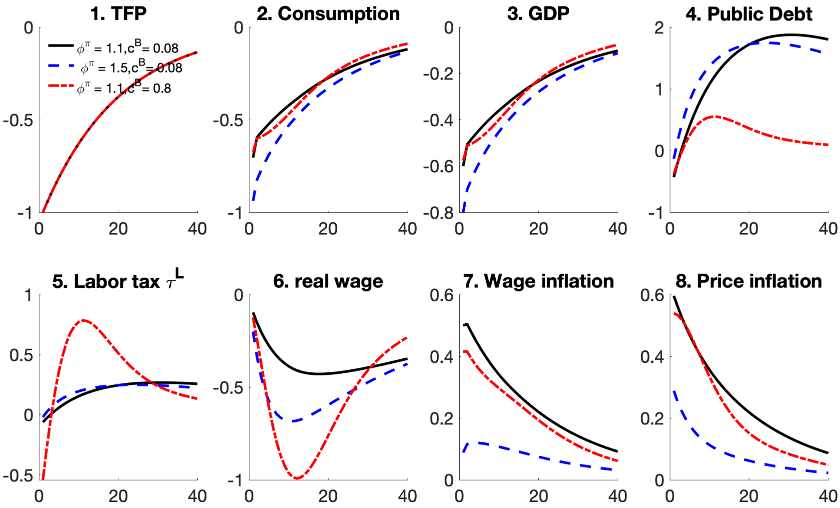
- Construct a finite-dimensional state-space representation.
- Go back in the sequential representation (space of idiosyncratic histories).
- Truncate consistently the histories for the N previous periods, to produce a recursive representation: as if there were a Representative Agent for each history.
- "Exact" truncation: Same prices and same aggregate quantities (L, K, C) as in the true model.
- Can prove convergence to the true allocation when the truncation length increases (Le Grand and Ragot, 2022a).
- Problem of the curse of dimensionality: Number of histories k^N, now solved by a **refined truncation**.

Simulating the Model: The truncation back

$$\{\underbrace{y_{-\infty}, \ldots, y_{-N}}_{\sim\xi_h}, \underbrace{y_{-N+1}, .., y_{-1}, y_0}_{h}\} = y^i$$

$$\begin{aligned}
\pi_{\hat{h}h} &= 1_{h \succeq \hat{h}} \pi_{y_0^{\hat{h}} y_0^h} \\
S_h &= \sum_{\hat{h} \in \mathcal{H}} S_{\hat{h}} \pi_{\hat{h}h} \\
\tilde{a}_{t,h} &= \sum_{\hat{h} \in \mathcal{H}} \frac{S_{t-1,\hat{h}}}{S_{t,h}} \pi_{\hat{h}h} a_{t-1,\hat{h}}. \\
a_{t,h} + c_{t,h} &= w_t y_0^h l_{t,h} + (1 + r_t)\tilde{a}_{t,h} + T_t, \\
\xi_h u'(c_{t,h}) &= \beta \mathbb{E}_t \left[(1 + r_{t+1}) \sum_{\tilde{h} \succeq h} \pi_{h\tilde{h}} \xi_{\tilde{h}} u'(c_{t+1,\tilde{h}}) \right] + \nu_{t,h}.
\end{aligned}$$

The sensitivity of the economy to rules back



Simulating the model with rules: The inflation "spiral" Back

Taylor Rule $\phi^{\pi} = 1.1$ and $c^B = 0.08$.