Monetary Policy without Redistributive Concerns

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Introduction

What is optimal monetary policy if Central Bank is concerned only with efficiency?

Efficiency Mandate in a general HANK model.

- Sticky wages, sticky prices, incomplete markets, cyclical income risk, multiple shocks.
- Policy **maximizes surplus** resources after winners compensate losers [Baqaee–Burstein, 2025]
  - No interpersonal comparisons of utility.
  - Invariant to monotone transformations of utility.
  - Like cost-benefit analysis but incorporates general-equilibrium feedbacks.
- Guarantees existence of Pareto improvements under new policy – potential consensus.

  [Similar spirit to: Kaldor (1939); Hicks (1939); Allais (1943); Debreu (1951); Schulz–Tsyvinski–Werquin (2023)]

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Preview – Incidence of aggregate demand fluctuations across households is key:

- ➢ Homogeneous incidence $\Rightarrow$ same policy as Woodford (2003)
- ➢ Heterogeneous incidence $\Rightarrow$ different policy (mostly due to dispersion in labor wedges)

Main results at a glance

Homogeneous incidence: HANK policy $=$ RANK policy [Woodford, 2003]

- Incomplete markets generate large efficiency losses, but MP cannot affect them locally
  Because MP cannot provide insurance

Heterogeneous incidence: HANK policy $\neq$ RANK policy

- Two departures from RANK policy:
  1. MP can **provide some insurance**: short-run force that depends on who bears agg. fluctuations
  2. **Dispersion in labor wedges**: output-gap fluctuations more costly [permanent difference]
- Long-run: Policy converges to dual-mandate with higher weight on output gap than RANK

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Labor-wedge dispersion is the key quantitative force

Baseline: **45% higher weight on output-gap stabilization** than in RANK.

Related Literature

1. Positive HANK, transmission and aggregate demand: Kaplan–Moll–Violante (2018); Auclert (2019); Werning (2015); Auclert–Rognlie–Straub (2024); Auclert et al. (2021); Bilbiie (2008, 2025)

Here: adopt the key HANK ingredients from this literature

2. SWF-Normative HANK: Bhandari et al. (2021); Bilbiie (2008, 2025); Bilbiie–Ragot (2021); Nuño–Thomas (2020); Smirnov (2022); Acharya–Challe–Dogra (2023); Dávila–Schaab (2023); La'O–Morrison (2024); Le Grand et al. (2022)

Here: change CB objective. Existing work uses SWF (e.g., utilitarian); we maximize aggregate surplus

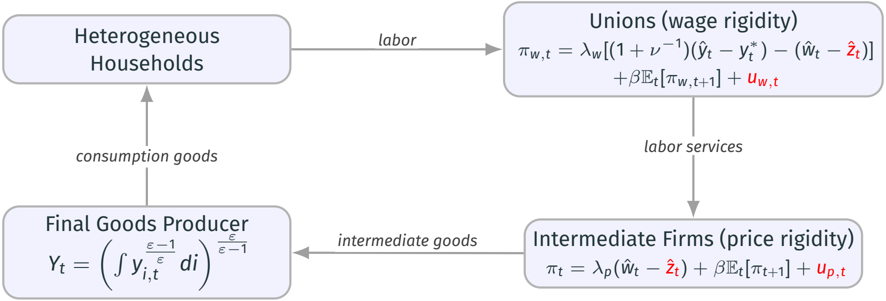
3. LQ Methods in Optimal Policy Analysis: Barro (1979); Clarida–Gali–Gertler (1999); Woodford (2003); Benigno–Woodford (2005); Gali (2008); Bilbiie (2008, 2025); Bilbiie–Ragot (2021); McKay–Wolf (2022)

Here: derive microfounded LQ problem for heterogeneous agents via maximum surplus
General approach in companian paper: Baqaee–Burstein–Guerreiro, 2026

Model and Efficiency Mandate

General Model: overview

General HANK environment with four building blocks:



Policy: Monetary policy sets time/state-contingent interest rate i_t.

Shocks: Technology, cost-push, wage-push, and demand/financial shocks.

Households: standard Aiyagari-type model with idiosyncratic labor productivity risk $z_{h,t}$ and borrowing constraints

- Preferences $\succeq$ over stoch. seq. $\boldsymbol{x}_h \equiv \{c_{h,t}, l_{h,t}\}$. Can be represented:

$$U(\mathbf{x}_h) \equiv (1-\beta)\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{1}{1+\chi} \log c_{h,t} + \frac{\chi}{1+\chi} \log(l_{h,t}) \right]$$

- Budget constraint:

$$P_t c_{h,t} + \frac{a_{h,t}}{(1+i_t)(1+\delta_t)} + \sum_k q_{k,t}\tilde{a}_{k,h,t} = y_{h,t} + a_{h,t-1} + \sum_k R_{k,t}\tilde{a}_{k,h,t-1} + \overbrace{\tilde{t}_{h,t}}^{\text{Offset savings wedge } \delta_t}$$

- Borrowing constraint:

$$\Omega(a_{h,t}, \{\tilde{a}_{k,h,t}\}_k) \geq 0$$

- At time 0, also compensatory transfers $T_{h,0}$ such that $\int T_{h,0} dh = 0$.

Households

Households: standard Aiyagari-type model with idiosyncratic labor productivity risk and borrowing constraints

➢ **Standard sticky-wage HANK**: Labor supply chosen by union with incidence rule

$$l_{h,t} + n_{h,t} = H, \qquad n_{h,t} = \Gamma(N_t; \mathbf{z}_h^t, a_{h,-1}, \tilde{\boldsymbol{a}}_{h,-1})N_t$$

[Heterogeneous incidence: Werning (2015), Auclert–Rognlie (2018), Alves–Kaplan–Moll–Violante (2020)]

- H is "productivity" of time endowment. [Baseline $H = 1$]

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- ➢ Incidence function $\Gamma(\cdot)$:
  - If $N_t = N^{ss}$, then labor supply is individually optimal
  - How relative employment of h responds to aggregate employment:

$$\gamma_h \equiv \frac{d\log(n_{h,t}/N_t)}{d\log N_t}$$

[Quantitative Assumption: $\gamma_h = \gamma(z_{h,t})$]

- ➢ **Income**: labor income + firm profits with same incidence

$$y_{h,t} = z_{h,t}\Gamma(N_t; z_{h,t}, a_{h,t})[\tilde{W}_t N_t + \underbrace{\Xi_t}_{\text{Firm Profits}}] = z_{h,t}\Gamma(N_t; z_{h,t}, a_{h,t})P_t Y_t.$$

The Efficiency Criterion

▸ More

Reform policy, send compensatory one-time checks, how much **can reduce factor endowments** *H*?

[Baqaee–Burstein, 2025]

1. DGP generates the status-quo allocation: $\mathbf{x}^0 = \{c^0_{h,t}, l^0_{h,t}\}$ under policy $\mathcal{P}^0 \equiv \{i^0_t\}$

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2. Consider new policy $\mathcal{P} \Rightarrow$ New set of equilibria $\mathcal{X}(H; \mathcal{P})$ given one-off time-zero transfers $\{T_{h,0}\}$

[Transfers do not insure]

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3. Calculate largest contraction in factor productivity, s.t. all households as well off as in status quo

$$A(\mathcal{P}) \equiv \max\{H : \text{ there exists } \mathbf{x} \in \mathcal{X}(1/H, \mathcal{P}), \text{ with } \mathbf{x}_h \succeq \mathbf{x}^0_h, \text{ for all } h\}$$

- By construction $A(\mathcal{P}^0) = 1.0$.
- If $A(\mathcal{P}) = 1.1$, can achieve same utility for all agents using $\sim 10\%$ less time.
  - There is surplus to generate Pareto improvement.
  - Measure of factor savings – call it “aggregate productivity gain” associated with policy $\mathcal{P}$
- Important: invariant to monotone transf. of util.

Definition 1 (The Efficiency Mandate)

The optimal policy solves

$$\max_{\mathcal{P}} A(\mathcal{P})$$

- Optimal policy problem: look for $\mathcal{P}$ that maximizes aggregate productivity gain
- New policy generates allocation set $\mathcal{X}(1; \mathcal{P})$, but no stance on which of these points to choose

  [No redistributive concerns]
- Potential consensus: if $A(\mathcal{P}) > 1$, there are Pareto improvements relative to status quo

▸ Key Properties of Efficiency Criterion

Illustration in RANK Economy

Illustrate in RANK model – no heterogeneity, complete markets

- ➢ No transfers: $T_{h,0} = 0 \Leftrightarrow \mathcal{X}(H, \mathcal{P})$ is a singleton [Only 1 agent]
- ➢ Easy to show that, in this model, allocations scale with H [Homothetic Preferences]

$$\mathcal{X}(H, \mathcal{P}) = \{\{H \cdot C_t(\mathcal{P}), H \cdot L_t(\mathcal{P})\}_{t \geq 0}\}$$

- $C_t(\mathcal{P}), L_t(\mathcal{P})$ are the equilibrium allocations under policy $\mathcal{P}$ when $H = 1$

$$A(\mathcal{P}) = \max \left\{ H > 0 : \{H^{-1} \cdot C_t(\mathcal{P}), H^{-1} \cdot L_t(\mathcal{P})\} \succeq \{C_t^0, L_t^0\} \right\}$$

Example: RANK Economy

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$$U\left(\left\{\frac{C_t(\mathcal{P})}{A(\mathcal{P})}, \frac{L_t(\mathcal{P})}{A(\mathcal{P})}\right\}\right) = U(\{C_t^0, L_t^0\})$$

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$$\log A(\mathcal{P}) = U\left(\{C_t(\mathcal{P}), L_t(\mathcal{P})\}\right) - U(\{C_t^0, L_t^0\})$$

- In this case, equivalent to Lucas' measure of welfare [Lucas, 1987]

$$U(\mathbf{x}^0) = U(\lambda^{-1} \cdot \mathbf{x}(\mathcal{P})) \Leftrightarrow \log(\lambda) = U(\mathbf{x}(\mathcal{P})) - U(\mathbf{x}^0)$$

- RANK optimal policy is equal to standard Ramsey

$$\max_{\mathcal{P}} A(\mathcal{P}) = \max_{\mathcal{P}} U(\{C_t(\mathcal{P}), L_t(\mathcal{P})\})$$

Approximate Optimal Policy Minimizes DWL Triangles

From a Global Criterion to a Tractable Policy Problem

In principle: choose policy to maximize aggregate productivity in the fully nonlinear economy

$$\max_{\mathcal{P}} \; A(\mathcal{P}).$$

- ➢ But hard to characterize analytically...

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Companion Paper: "An Approximate General Theory of Second Best"

- General results for approx. policy in distorted het-agents economies [in spirit Woodford (2003)]
- **Key result**: approximate optimal policy minimizes sum of DWL triangles [To 1^{st}-order in wedges]
- Paper characterizes DWL triangles in terms of expenditure shares, micro price elasticities, and elasticity of wedges to policy [Only observable statistics (e.g., no Pareto weights)]

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- Paper characterizes DWL triangles in terms of expenditure shares, micro price elasticities, and elasticity of wedges to policy [Only observable statistics (e.g., no Pareto weights)]
- Extension to distortionary compensating transfers.
- Analytical applications to labor taxes, fiscal unions, MP with workers and capitalists...

From a Global Criterion to a Tractable Policy Problem

How does the approximation work?

- For any allocation, implement it in an Arrow-Debreu economy with wedges μ_g
  - Wedges account for market failures (markups, incomplete markets, externalities,...)

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- **Key result**: To second-order in wedges, aggregate productivity is given by:

$$\log A \approx \underbrace{\log \mathcal{D}^0}_{\substack{\text{Status-quo}\\ \text{misallocation}}} - \sum_g \underbrace{\frac{p_g y_g}{\sum_{g'} p_{g'} y_{g'}}}_{\text{sales of market } g} \underbrace{\frac{d \log y_g^{\mathrm{comp}} \cdot d \log \mu_g}{2}}_{\text{DWL triangle}} + O(|| \log \mu_g ||^3),$$

$d \log y_g^{\mathrm{comp}}$ is response of quantity to wedges (formula in paper)

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  $d \log y_g^{\mathrm{comp}}$ is response of quantity to wedges (formula in paper)

- Figure out how each wedge responds to policy $d\mu_g(\mathcal{P})/d \log \mathcal{P}$

- Minimizing sum of DWL triangles by choosing $d \log \mathcal{P}$ yields first-order approx. of $\mathcal{P}^*$

$\Rightarrow$ Optimal policy problem reduced to linear-quadratic optimization

Example: Second-Order Approximation in RANK Economy

Example (Second-Order Approximation in RANK Economy)

What would it look like in RANK model?

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$$\log A(\mathcal{P}) \approx \underbrace{\log \mathcal{D}^0}_{\text{SQ Misallocation}} - \frac{(1-\beta)\omega_C}{2} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ (1+\nu^{-1})(\hat{y}_t - \hat{y}_t^*)^2 + \frac{\varepsilon}{\lambda_p}(\pi_t)^2 + \frac{\psi}{\lambda_w}(\pi_{w,t})^2 \right\}$$

- *SQ misallocation = how much aggregate productivity from closing all status-quo wedges*
- *Aggregate productivity = closing all wedges minus the losses from the wedges that remain open*
- *Losses are the standard quadratic RANK loss function in endowment-equivalent units*

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Next: map each HANK wedge into a deadweight-loss triangle.

Building Harberger Triangle Approximation

Generalize 2nd order approx. to HANK environment: Three step process

Step 1: Identify the wedges

Step 2: Construct Arrow-Debreu economy with wedges

Step 3: Construct DWL as before

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Step 1: Identify the wedges

- ➢ Four sources of inefficiency $\Rightarrow$ four wedges:
  - **Price markup:** $\log \mu^{p}_{i,t} \equiv \log p_{i,t} - \log(W_t/Z_t)$ *[Calvo prices]*
  - **Wage markup:** $\log \mu^{w}_{u,t} \equiv \log w_{u,t} - \log \tilde{W}_t$ *[Calvo wages]*
  - **Labor wedge:** $\log \mu^{L}_{h,t} \equiv \log\left(\frac{\chi\, c_{h,t}}{l_{h,t}}\right) - \log \frac{\tilde{W}_t}{P_t}$ *[Incidence rule]*
  - **IM wedge:** $\log \mu^{IM}_{h,t} \equiv -\left[\log\left(\frac{c_{h,t}}{C_t}\right) - \log\left(\frac{c_{h,0}}{C_0}\right)\right]$ *[incomplete mkts]*

Step 2: Construct Arrow-Debreu economy with wedges

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Generalize 2nd order approx. to HANK environment: Three step process

Step 1: Identify the wedges

Step 2: Construct Arrow-Debreu economy with wedges

- Use these wedges to construct AD economy that replicates original economy
- Households face budget constraint

$$\mathbb{E}_0\left[\sum_t q_t \mu_{h,t}^{IM}[c_{h,t} + \mu_{h,t}^{L}\tilde{W}_t l_{h,t}]\right] \leq I_h$$

- Firms price $p_{i,t} = \mu_{i,t}^{p} W_t / Z_t$ and pay wage $w_{u,t} = \mu_{u,t}^{w} \tilde{W}_t$.

Step 3: Construct DWL as before

The Second-Order Approximation of Aggregate Productivity

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \tfrac{1-\beta}{2}(\triangleright_{\mathrm{IM}} + \triangleright_P + \triangleright_W + \triangleright_L)$$

- $\triangleright_{\mathrm{IM}} = \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{IM}_{h,t} \cdot \partial \log x_{h,t} \, dh$ ($x_{h,t}$: effective consumption c and l)
- $\triangleright_P = \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{p}_{i,t} \cdot \partial \log y_{i,t} \, di$
- $\triangleright_W = \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{w}_{u,t} \cdot \partial \log n^{d}_{u,t} \, du$
- $\triangleright_L = (1-\omega_C) \, \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{L}_{h,t} \cdot \partial \log l_{h,t} \, dh$

Link Harberger Triangles to Aggregate Outcomes

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To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\left\{\sum_{t=0}^{\infty}\beta^t\left[\left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2+\frac{\varepsilon}{\lambda_p}(\pi_t)^2+\frac{\psi}{\lambda_w}(\pi_{w,t})^2\right]\right\}.$$

Term	Content	Source
RANK losses	$\{\hat{y}_t, \pi_t, \pi_{w,t}\}$	Aggregate labor wedge, price and wage markups

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$$+Var_{\chi_h}(\gamma_h)\left[\nu^{-1}\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2\right]$$

$$\Bigg\}.$$

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RANK losses	$\{\hat{y}_t, \pi_t, \pi_{w,t}\}$	Aggregate labor wedge, price and wage markups
het.-incidence losses	$\text{Var}_{\chi_h}(\gamma_h)\cdots$	Dispersion in labor wedges

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$$+Var_{\chi_h}(\gamma_h)\left[\nu^{-1}\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2\right]$$
$$\left.+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]-\sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)(\hat{y}_t-\hat{y}_t^*)\right\}.$$

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RANK losses	$\{\hat{y}_t, \pi_t, \pi_{w,t}\}$	Aggregate labor wedge, price and wage markups
het.-incidence losses	$\mathrm{Var}_{\chi_h}(\gamma_h)\cdots$	Dispersion in labor wedges
IM losses	$\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]$, $\mathrm{Cov}_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)$	Incomplete markets and their interaction with incidence

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$$+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right] - \sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right), \gamma_h\right)(\hat{y}_t - \hat{y}_t^*)\Bigg\}.$$

Proposition (Baqaee–Burstein–Guerreiro, 2026)

Let $\mathcal{P}^*$ be the policy that maximizes this approximation of $A(\mathcal{P})$, subject to the equilibrium conditions. Then, $\mathcal{P}^*$ is a ***first-order approximation of the optimal policy, around a no shocks and zero inflation.***

Two cases:

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\Bigg\{\sum_{t=0}^{\infty}\beta^t\Bigg[\left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2+\frac{\varepsilon}{\lambda_p}(\pi_t)^2+\frac{\psi}{\lambda_w}(\pi_{w,t})^2\Bigg]$$

$$+Var_{\chi_h}(\gamma_h)\left[\nu^{-1}\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2\right]$$

$$+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]-\sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)(\hat{y}_t-\hat{y}_t^*)\Bigg\}.$$

Two cases:

1. Homogeneous incidence of demand shocks $\Rightarrow Var_{\chi_h}(\gamma_h) = Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right) = 0$
2. Heterogeneous incidence of demand shocks $\Rightarrow Var_{\chi_h}(\gamma_h) > 0$ and $Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right) \neq 0$

Two cases

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\left\{\sum_{t=0}^{\infty}\beta^t\left\{\left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2+\frac{\varepsilon}{\lambda_p}(\pi_t)^2+\frac{\psi}{\lambda_w}(\pi_{w,t})^2\right\}\right.$$
$$\left.+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]\right\}.$$

Two cases:

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Proposition

*Suppose $\gamma_h = 0$ for all h. Then, IM losses are orthogonal to policy. So, optimal policy under the Efficiency Mandate is **identical to the corresponding RANK policy**.*

Heterogeneity does not change the efficient stabilization tradeoff.

Intuition: Monetary policy cannot offer insurance.

Examples:

- Sticky-price HANK – workers supply labor optimally given wage
- Canonical sticky-wage model – equal incidence rule

Where HANK Departs from RANK

Heterogeneous incidence: $\gamma_h \neq 0$

Some households are more exposed to aggregate fluctuations than others:

- Aggregate demand/labor fluctuations are borne disproportionately across household types
- Output gaps create dispersion in person-specific labor distortions

$$Var_{\chi_h}(\gamma_h) > 0$$

- By providing insurance, monetary policy can affect IM distortions

$$Cov_{\chi_h}(d \log c_{h,t},\ \gamma_h) \neq 0$$

Proposition

Suppose prices are flexible, $\lambda_p \to \infty$. The optimal policy implies the following inflation output-gap trade-off:

$$\pi_{w,t} + \hat{\psi}^{-1}(\tilde{y}_t - \tilde{y}_{t-1}) = \zeta_{\mathrm{IM}} \cdot \frac{\mathrm{Cov}_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{c_{h,t-1}}\right), \gamma_h\right)}{\mathrm{Var}_{\chi_h}(\gamma_h)}$$

where $\hat{\psi} < \psi$, $\zeta_{\mathrm{IM}} > 0$, and $\tilde{y}_t = \hat{y}_t - \hat{y}_t^*$ is the output gap.

Two differences relative to RANK:

- $\hat{\psi}^{-1} = \psi^{-1}\left(1 + \frac{\nu^{-1}}{1+\nu^{-1}} Var_{\chi_h}(\gamma_h)\right) > \psi^{-1}$ more weight on stabilizing output gap than RANK
- Covariance reflects whether exposed people have higher expected consumption growth

Asymptotically: A Dual Mandate

Proposition

The short-run IM correction vanishes asymptotically:

$$\lim_{t\to\infty} \frac{\mathrm{Cov}_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{c_{h,t-1}}\right),\,\gamma_h\right)}{\mathrm{Var}_{\chi_h}(\gamma_h)} = \lim_{t\to\infty} \frac{\mathrm{Cov}_{\chi_h}(d\log c_{h,t},\,\gamma_h) - \mathrm{Cov}_{\chi_h}(d\log c_{h,t-1},\,\gamma_h)}{\mathrm{Var}_{\chi_h}(\gamma_h)} = 0.$$

Hence optimal policy converges to:

$$\pi_{w,t} + \hat{\psi}^{-1}(\tilde{y}_t - \tilde{y}_{t-1}) = 0.$$

This is a dual mandate, with output weight

$$1 + \nu^{-1}\left[1 + \mathrm{Var}_{\chi_h}(\gamma_h)\right]$$

- Asymptotically, cannot provide insurance
- Long-run policy is RANK-like, but with a larger output weight
- The extra weight is determined by heterogeneous incidence across households

General HANK Model with Sticky Prices and Wages

With Sticky Prices and Sticky Wages

Proposition

In the general HANK model with both sticky prices and sticky wages, optimal policy under the Efficiency Mandate is asymptotically equivalent to a dual-mandate policy:

$$\min \frac{1}{2}\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ \omega_y \tilde{y}_t^2 + \frac{\varepsilon}{\lambda_p}\pi_t^2 + \frac{\psi}{\lambda_w}\pi_{w,t}^2 \right\}, \quad \omega_y = 1 + \nu^{-1}\left(1 + \mathrm{Var}_{\chi_h}(\gamma_h)\right).$$

With Sticky Prices and Sticky Wages

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- Price inflation now enters as an additional stabilization objective
- But the departures from RANK are the same as in the sticky-wage only case

Optimal policy is

$$S_t = D_t + S_t^*,$$

where D_t is deterministic short-run IM correction and S_t^* is the asymptotic dual mandate

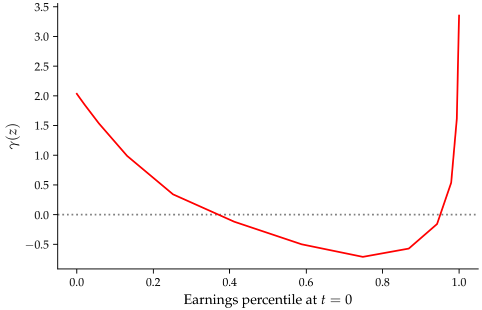
Quantitative Illustration

Baseline: sticky-wage HANK model (quarterly, U.S.)

Parameter	Description	Value
β	Discount factor	0.97
r	Yearly real interest rate	2%
χ	Labor disutility (Frisch $\nu = 0.75$)	0.75
$\underline{a}$	Borrowing limit (targets MPC $= 0.21$)	-4.82
λ_w	Wage Phillips curve slope	0.09
ψ	Elasticity across labor varieties	4

Incidence Elasticity

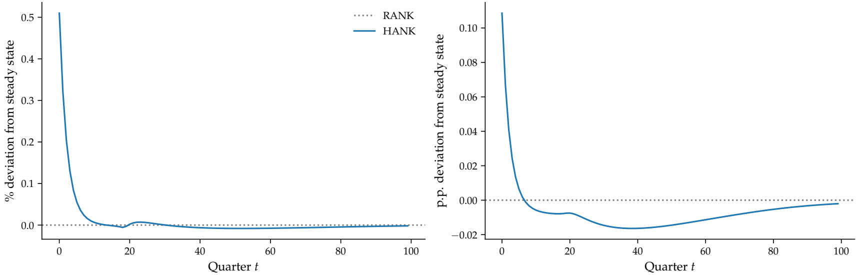
[Guvenen et al., 2017]



Calibration: Attribute worker betas entirely to movements in labor supply [Extreme upper bound]

- $\gamma(z)$ rises sharply at the top of the earnings distribution
- $\mathrm{Var}_{\chi_h}(\gamma_h) = 0.78 \;\Rightarrow\; \hat{\psi} = 2.76$, so output-stabilization weight rises by $\approx 45\%$ relative to RANK

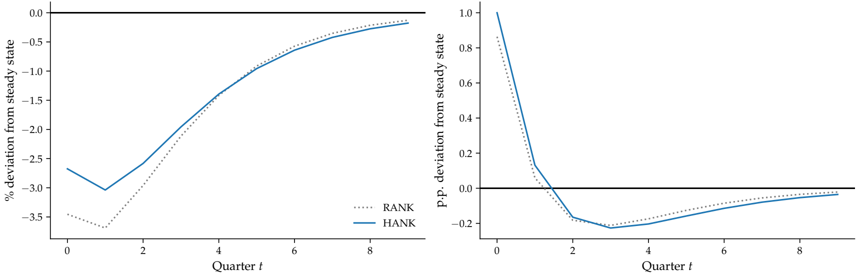
Deterministic Component of Optimal Policy



Main message: The short-run IM correction is a **small initial expansion**

Response to Cost-Push Shocks

Cost-push shock: AR(1), persistence $\rho_u = 0.5$; normalized to 1 p.p. impact on wage inflation in HANK



Main message: HANK tolerates more wage inflation and contracts output less

- **Present-value of output gaps is** 10.7% **higher in HANK than RANK**

Conclusions

Conclusion

Question: What is optimal MP in HANK for a CB with an efficiency mandate?

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Two main results:

1. Homogeneous incidence: **optimal policy = RANK** (IM losses orthogonal to MP)
2. Heterogeneous incidence ($\gamma_h \neq 0$): output-gap stabilization weight $\hat{\psi}^{-1}$ is larger than RANK

Conclusion

Question: What is optimal MP in HANK for a CB with an efficiency mandate?

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1. Homogeneous incidence: **optimal policy = RANK** (IM losses orthogonal to MP)
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Quantitatively: Cost-push IRF: 11% more cumulative output stabilization than RANK

Conclusion

Question: What is optimal MP in HANK for a CB with an efficiency mandate?

Two main results:

1. Homogeneous incidence: **optimal policy = RANK** (IM losses orthogonal to MP)
2. Heterogeneous incidence ($\gamma_h \neq 0$): output-gap stabilization weight $\hat{\psi}^{-1}$ is larger than RANK

Quantitatively: Cost-push IRF: 11% more cumulative output stabilization than RANK

Broader message: General theory of 2^{nd} best for policy design in a cost-benefit framework

[No cardinal utils, no SWF, no Pareto weights]

➢ Tools are broadly applicable, beyond monetary policy. E.g., fiscal unions in companion paper.

Thank you!

Appendix

Details: Building Harberger Triangle Approximation

Back

Step 1: Identify the wedges

Step 2: Construct Arrow-Debreu economy with wedges

Step 3: Construct Harberger Triangles

Step 4: Figure out how wedges are affected by policy

Details: Building Harberger Triangle Approximation

Back

Step 1: Identify the wedges

- Four sources of inefficiency $\Rightarrow$ four wedges:
  - **Price markup:** $\log \mu^{p}_{i,t} \equiv \log p_{i,t} - \log(W_t/Z_t)$ *[Calvo prices]*
  - **Wage markup:** $\log \mu^{w}_{u,t} \equiv \log w_{u,t} - \log \tilde{W}_t$ *[Calvo wages]*
  - **Labor wedge:** $\log \mu^{L}_{h,t} \equiv \log\left(\frac{\chi\, c_{h,t}}{l_{h,t}}\right) - \log \frac{\tilde{W}_t}{P_t}$ *[Incidence rule]*
  - **IM wedge:** $\log \mu^{IM}_{h,t} \equiv -\left[\log\left(\frac{c_{h,t}}{C_t}\right) - \log\left(\frac{c_{h,0}}{C_0}\right)\right]$ *[incomplete mkts]*

Step 2: Construct Arrow-Debreu economy with wedges

Step 3: Construct Harberger Triangles

Step 4: Figure out how wedges are affected by policy

Details: Building Harberger Triangle Approximation

Back

Step 1: Identify the wedges

Step 2: Construct Arrow-Debreu economy with wedges

- Can use these wedges to construct AD economy that replicates original economy
- Households face budget constraint

$$\mathbb{E}_0\left[\sum_t q_t \mu^{IM}_{h,t}[c_{h,t} + \mu^{L}_{h,t}\tilde{W}_t l_{h,t}]\right] \leq I_h$$

- Firms price $p_{i,t} = \mu^{p}_{i,t} W_t / Z_t$ and pay wage $w_{u,t} = \mu^{w}_{u,t}\tilde{W}_t$.

Step 3: Construct Harberger Triangles

Step 4: Figure out how wedges are affected by policy

Details: Building Harberger Triangle Approximation

Back

Step 1: Identify the wedges

Step 2: Construct Arrow-Debreu economy with wedges

Step 3: Construct Harberger Triangles

- Generally, second-order approximation around eqbm. with no wedges is:

[Baqaee–Burstein–Guerreiro, 2026]

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 + \sum_g \underbrace{\frac{p_g y_g}{\sum_{g'} p_{g'} y_{g'}}}_{\text{Sales Share}} \overbrace{\frac{d \log y_g^{comp} \cdot d \log \mu_g}{2}}^{-\text{Harberger Triangle}}$$

  - Aggregate productivity approximated around efficient allocation (no wedges)
    - As in Woodford (2003) for RANK, can also incorporate steady-state/permanent distortions
  - Baqaee-Burstein (2026) show that second-order approximation of $\mathcal{D}^0$ is good in stationary Aiyagari model with idiosyncratic risk and borrowing constraints

Step 4: Figure out how wedges are affected by policy

Details: The Second-Order Approximation of Aggregate Productivity

Back

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 + \tfrac{1-\beta}{2}(\triangleright_{\mathrm{IM}} + \triangleright_P + \triangleright_W + \triangleright_L)$$

- $\triangleright_{\mathrm{IM}} = \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{IM}_{h,t} \cdot d\log x_{h,t} \, dh$ ($x_{h,t}$: effective consumption c and l)
- $\triangleright_P = \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{p}_{i,t} \cdot \partial \log y_{i,t} \, di$
- $\triangleright_W = \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{w}_{u,t} \cdot \partial \log n^{d}_{u,t} \, du$
- $\triangleright_L = (1-\omega_C) \, \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{L}_{h,t} \cdot \partial \log l_{h,t} \, dh$

Link Harberger Triangles to Aggregate Outcomes

Details: The Second-Order Approximation of Aggregate Productivity

Back

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\left\{ \sum_{t=0}^{\infty} \beta^t \left[\left(1+\nu^{-1}\right)(\hat{y}_t - \hat{y}_t^*)^2 + \frac{\varepsilon}{\lambda_p}(\pi_t)^2 + \frac{\psi}{\lambda_w}(\pi_{w,t})^2 \right] \right\}.$$

Term	Content	Source
Like RANK losses	$\{\hat{y}_t, \pi_t, \pi_{w,t}\}$	Aggregate labor wedge, price and wage markups

Details: The Second-Order Approximation of Aggregate Productivity

▸ Back

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\Bigg\{\sum_{t=0}^{\infty}\beta^t\left[\left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2+\frac{\varepsilon}{\lambda_p}(\pi_t)^2+\frac{\psi}{\lambda_w}(\pi_{w,t})^2\right]$$

$$+Var_{\chi_h}(\gamma_h)\left[\nu^{-1}\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2\right]\Bigg\}.$$

Term	Content	Source
RANK losses	$\{\hat{y}_t, \pi_t, \pi_{w,t}\}$	Aggregate labor wedge, price and wage markups
het.-incidence losses	$\mathrm{Var}_{\chi_h}(\gamma_h)\cdots$	Dispersion in labor wedges

Details: The Second-Order Approximation of Aggregate Productivity

▸ Back

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\Bigg\{\sum_{t=0}^{\infty}\beta^t\left[\left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2+\frac{\varepsilon}{\lambda_p}(\pi_t)^2+\frac{\psi}{\lambda_w}(\pi_{w,t})^2\right]$$

$$+Var_{\chi_h}(\gamma_h)\left[\nu^{-1}\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2\right]$$

$$+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]-\sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)(\hat{y}_t-\hat{y}_t^*)\Bigg\}.$$

Term	Content	Source
RANK losses	$\{\hat{y}_t, \pi_t, \pi_{w,t}\}$	Aggregate labor wedge, price and wage markups
het.-incidence losses	$Var_{\chi_h}(\gamma_h)\cdots$	Dispersion in labor wedges
IM losses	$\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]$, $Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)$	Incomplete markets and their interaction with incidence

Details: The Second-Order Approximation of Aggregate Productivity

Back

Proposition

To second order, aggregate productivity is given by

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$$+Var_{\chi_h}(\gamma_h)\left[\nu^{-1}\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2\right]$$

$$+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]-\sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\overline{c}_h}\right),\gamma_h\right)(\hat{y}_t-\hat{y}_t^*)\Bigg\}.$$

Proposition (Baqaee–Burstein–Guerreiro, 2026)

Let $\mathcal{P}^*$ be the policy that maximizes this approximation of $A(\mathcal{P})$, subject to the equilibrium conditions. Then, $\mathcal{P}^*$ is a ***first-order approximation of the optimal policy, around a no shocks and zero inflation.***

A1. Model: full household problem

Household h maximizes:

$$(1-\beta)\,\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{1}{1+\chi}\log c_{h,t} + \frac{\chi}{1+\chi}\log l_{h,t}\right]$$

Budget constraint:

$$P_t c_{h,t} + \frac{a_{h,t}}{(1+i_t)(1+\delta_t)} + \sum_k q_{k,t}\tilde{a}_{k,h,t} = y_{h,t} + z_{h,t}\Xi_t + a_{h,t-1} + \sum_k R_{k,t}\tilde{a}_{k,h,t-1} - \tilde{t}_{h,t}$$

Portfolio constraint: $\Omega(a_{h,t}, \{\tilde{a}_{k,h,t}\}_k) \geq 0$

Idiosyncratic risk: $z_{h,t}$ follows a Markov process with stationary distribution $\pi(z)$

Incidence rule: $n^s_{h,u,t} = \Gamma(1-L_t;\, \zeta_{h,t}) \int n_{i,u,t}\, di, \quad \gamma_h \equiv \frac{\partial \log \Gamma}{\partial \log(1-L_t)}$

Transfers: time-0 transfers $T_{h,0}$ are budget-neutral, $\int T_{h,0}\, dh = 0$, and are used to implement compensation under the Efficiency Mandate

A2. Aggregate productivity: formal definition

Definition [Baqaee-Burstein, 2025]

Given a status-quo equilibrium under policy $\mathcal{P}^0$, aggregate productivity under policy $\mathcal{P}$ is:

$$\mathcal{A}(\mathcal{P}) \;=\; \max\left\{H > 0 : \exists\, \mathbf{x} \in \mathcal{X}(1/H; \mathcal{P}) \text{ s.t. } U_h(\mathbf{x}_h) \geq U_h(\mathbf{x}_h^0)\ \forall\, h\right\}$$

where $\mathcal{X}(1/H; \mathcal{P})$ = feasible allocations under policy $\mathcal{P}$ with factor endowments scaled by $1/H$, and time-0 lump-sum transfers allowed

Properties:

- Invariant to lump-sum redistribution
- Pareto improvements are always $\mathcal{A}$-improvements
- Coincides with TFP in representative-agent models
- $\mathcal{A}(\mathcal{P}) = \mathcal{A}(\mathcal{P}')$ iff there is no Kaldor-Hicks improvement from $\mathcal{P}'$ to $\mathcal{P}$

Distance to the frontier:

$$\mathcal{D} \equiv \max\left\{H > 0 : \exists\, \mathbf{x} \in \mathcal{X}^*(1/H) \text{ with } U(\mathbf{x}_h) \geq U(\mathbf{x}_h^0)\ \forall h\right\}$$

Frontier aggregates:

$$Y_t^* = C_t^* = \frac{Z_t}{1+\chi}, \qquad L_t^* = \frac{\chi}{1+\chi}$$

A3. Derivation of Harberger triangles

Lemma: aggregate productivity as Harberger triangles

$$\log \mathcal{A}(\mathcal{P}) \approx \log \mathcal{D} + \frac{1}{2}\left\{\Delta^{IM} + \Delta^{p} + \Delta^{w} + \Delta^{L}\right\}$$

with

$$\triangleright_{\mathrm{IM}} \equiv \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{IM}_{h,t} \cdot d\log x_{h,t} \, dh$$

$$\triangleright_{P} \equiv \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{p}_{i,t} \cdot \partial \log y_{i,t} \, di$$

$$\triangleright_{W} \equiv \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{w}_{u,t} \cdot \partial \log n^{d}_{u,t} \, du$$

$$\triangleright_{L} \equiv (1-\omega_C) \, \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{L}_{h,t} \cdot \partial \log l_{h,t} \, dh$$

Each term is a generalized Harberger triangle: a wedge times the associated general-equilibrium quantity distortion

A4. Proof sketch: IM losses orthogonal to MP (Prop. 4)

In sticky-price HANK:

The incomplete-market loss term is:

$$-\omega_C \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \operatorname{Cov}_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{c_{h,0}}\right), d\log\left(\frac{c_{h,t}}{\overline{c}_h}\right)\right)$$

Proposition 4: around the efficient allocation, this term is orthogonal to aggregate conditions

Implication:

- ➢ Incomplete markets still lower aggregate productivity
- ➢ But monetary policy cannot affect those losses at first order
- ➢ So the optimal sticky-price HANK policy coincides with sticky-price RANK

A5. Efficiency vs. SWF-based HANK analyses

Why do SWF-based analyses find larger departures from RANK?

SWF approach:

- Welfare $= \sum_h \omega_h U_h$, weights ω_h are *normative*
- Redistribution directly enters welfare
- Monetary policy can look attractive because it changes who bears fluctuations
- Result: optimal policy can depart materially from RANK

Efficiency Mandate:

- Aggregate productivity asks how much surplus a policy creates
- Redistribution is separated from the objective by time-0 lump-sum compensation
- The paper's departures from RANK come from efficiency effects, not redistributive motives

The gap between SWF and EM is precisely the redistributive component of optimal MP

We use sequence-space Jacobian (SSJ) methods [Auclert et al., 2021, 2024]

Key ingredients:

1. Solve for household decision rules in steady state
2. Compute fake-news matrices (heterogeneous impulse responses to news shocks)
3. Compose Jacobians across blocks to get general equilibrium responses

Application to Efficiency Mandate:

- ➢ Represent aggregate demand as a functional of expected fundamentals
- ➢ Compose block Jacobians to characterize equilibrium responses
- ➢ Use those linear responses inside the quadratic approximation of aggregate productivity

Advantage: Handles rich asset-market heterogeneity without curse of dimensionality

Three quantitative objects pin down the policy departure from RANK

Object	Value	Role
$\text{Var}_{\chi_h}(\gamma_h)$	0.78	Raises the output-stabilization weight
$\hat{\psi}$	2.76	Modified RANK tradeoff coefficient
ζ_{IM}	0.04	Short-run incomplete-markets correction

Expected consumption and covariance dynamics:

- $\mathbb{E}[d \log c_t \mid z_0]$ declines with initial productivity
- $Cov_{\chi_h}(d \log c_{h,t}, \gamma_h)$ is positive initially and converges to zero
- Hence the optimal HANK policy features a small initial expansion that vanishes over time

Takeaway: quantitatively, most of the HANK-RANK gap comes from the higher effective output weight, not from a large IM correction

Optimal Simple Rules

A8. Optimal Simple Rules

Simple rules: restrict policy to time-invariant linear functions of current shocks [Woodford, 1999]

$$\hat{y}_t = \phi_y + \phi_{y,\delta}\delta_t + \phi_{y,z}\hat{z}_t + \phi_{y,u}u_{w,t}, \qquad \pi_{w,t} = \phi_\pi + \phi_{\pi,\delta}\delta_t + \phi_{\pi,z}\hat{z}_t + \phi_{\pi,u}u_{w,t}$$

Result 1: Sticky-price HANK $=$ RANK

Result 2: Sticky-wage incomplete markets drop out

- In the sticky-wage HANK model, the IM covariance term does *not* affect the ex-ante optimal simple rule
- Simple rules are "as if RANK" but with a **modified elasticity** $\tilde{\psi} < \psi$

Bottom line: only *cyclical income risk* ($Var_{\chi_h}(\gamma_h) > 0$) shifts the rule relative to RANK

A9. Optimal Simple Rules: Cost-Push Shocks

Sticky-wage simple rules take the form:

$$\hat{y}_t = \phi_y + \phi_{y,\delta}\delta_t + \phi_{y,z}\hat{y}_t^* + \phi_{y,u}u_{w,t}, \qquad \pi_{w,t} = \phi_\pi + \phi_{\pi,\delta}\delta_t + \phi_{\pi,z}\hat{y}_t^* + \phi_{\pi,u}u_{w,t}$$

- Demand shock: zero inflation and output gap $=$ RANK
- Productivity shock: zero inflation and output gap $=$ RANK
- Cost-push shocks: HANK allows more inflation and less output volatility than RANK

Cost-push coefficients:

$$\phi_{y,u} = -\frac{\tilde{\psi}}{\kappa_w\tilde{\psi} + (1-\beta\rho_u)^2}, \qquad \phi_{\pi,u} = \frac{1-\beta\rho_u}{\kappa_w\tilde{\psi} + (1-\beta\rho_u)^2}$$

- with $\tilde{\psi} < \psi$, so the HANK simple rule is "RANK-like" but more weight output

A10. Optimal Simple Rules: Cost-Push Shocks

Cost-push coefficients:

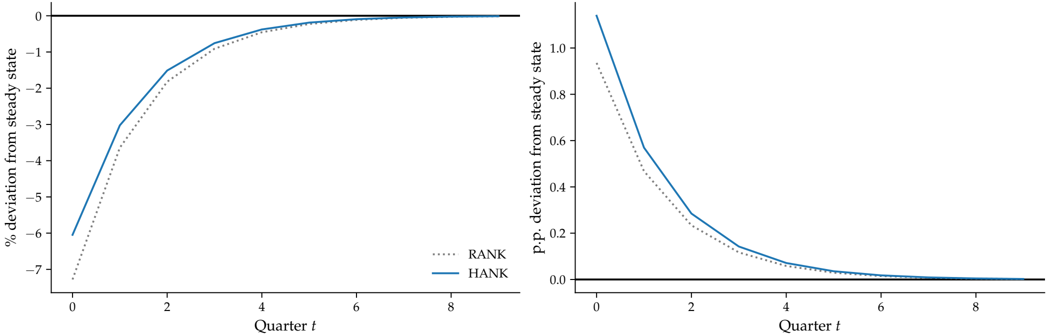
$$\phi_{y,u} = -\frac{\tilde{\psi}}{\kappa_w \tilde{\psi} + (1 - \beta \rho_u)^2}, \qquad \phi_{\pi,u} = \frac{1 - \beta \rho_u}{\kappa_w \tilde{\psi} + (1 - \beta \rho_u)^2}$$

Calibrated values (baseline, $\rho_u = 0.5$):

	RANK	**HANK (Eff. Mandate)**
Output-gap coefficient $\lvert\phi_{y,u}\rvert$	baseline	-17%
Wage-inflation coefficient $\phi_{\pi,u}$	baseline	$+22\%$

- ➢ HANK rule contracts output 17% *less* and raises wage inflation 22% *more* than RANK
- ➢ Same qualitative lesson as the full Ramsey problem

A11. Optimal Simple Rules: Cost-Push Shocks



Main message: relative to full Ramsey, simple rules produce more inflation and a sharper output contraction in both models; but the **qualitative message is preserved**

A12. Related literature

Optimal monetary policy in HANK: [Bilbiie, 2008; Acharya-Dogra, 2020; Le Grand-Ragot, 2022; Challe, 2020; Debortoli-Galí, 2017]

Efficiency criteria and GE welfare: [Baqaee-Burstein, 2025a, 2025b; Harberger, 1964; Dixit-Norman, 1986]

HANK models: [Kaplan-Moll-Violante, 2018; Auclert, 2019; McKay-Nakamura-Steinsson, 2016; Bilbiie, 2019]

Sequence-space methods: [Auclert-Bardóczy-Rognlie-Straub, 2021; Auclert-Bardóczy-Rognlie-Straub, 2024]

Labor income risk and cyclicality: [Floden-Lindé, 2001; Storesletten-Telmer-Yaron, 2004; Guvenen-Ozkan-Song, 2014]

Separation of efficiency and redistribution: [Diamond-Mirrlees, 1971; Atkinson-Stiglitz, 1976; Werning, 2007]

The Second-Order Approximation of Aggregate Productivity

Back

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 + \tfrac{1-\beta}{2}\left(\triangleright_{\mathrm{IM}} + \triangleright_P + \triangleright_W + \triangleright_L\right)$$

- $\triangleright_{\mathrm{IM}} = \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{IM}_{h,t} \cdot d\log x_{h,t} \, dh$ ($x_{h,t}$: effective consumption c and l)
- $\triangleright_P = \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{p}_{i,t} \cdot \partial \log y_{i,t} \, di$
- $\triangleright_W = \omega_C \, \mathbb{E}_0 \sum_t \beta^t \int d\log \mu^{w}_{u,t} \cdot \partial \log n^{d}_{u,t} \, du$
- $\triangleright_L = (1-\omega_C) \, \mathbb{E}_0 \sum_t \beta^t \int \chi_h \, d\log \mu^{L}_{h,t} \cdot \partial \log l_{h,t} \, dh$

Link Harberger Triangles to Aggregate Outcomes

The Second-Order Approximation of Aggregate Productivity

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Proposition

To second order, aggregate productivity is given by

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Note that

$$\partial \log y_{i,t} = -\varepsilon \left(d \log \mu^p_{i,t} - \int d \log \mu^p_{i',t} di' \right) + (\hat{y}_t - \hat{y}^*_t)$$

$$\Rightarrow \int_0^1 d \log \mu^p_{i,t} \cdot \partial \log y_{i,t} di = -\varepsilon \underbrace{Var_i \left(d \log \mu^p_{i,t} \right)}_{\to \{\pi_s\}_{s=0}^t} + (\hat{y}_t - \hat{y}^*_t) \underbrace{E_i[d \log \mu^p_{i,t}]}_{\text{Avg. Labor Wedge}}$$

and similarly for wages.

$$\triangleright_P = -\omega_C \mathbb{E}_0 \sum_t \beta^t \frac{\varepsilon}{\lambda_p} \pi_t^2 + \omega_C \mathbb{E}_0 \sum_t \beta^t E_i[d \log \mu^p_{i,t}] (\hat{y}_t - \hat{y}^*_t)$$

$$\triangleright_W = -\omega_C \mathbb{E}_0 \sum_t \beta^t \frac{\psi}{\lambda_w} \pi_{w,t}^2 + \omega_C \mathbb{E}_0 \sum_t \beta^t E_u[d \log \mu^w_{u,t}] (\hat{y}_t - \hat{y}^*_t)$$

The Second-Order Approximation of Aggregate Productivity

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Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 + \tfrac{1-\beta}{2}(\triangleright_{\mathrm{IM}} + \triangleright_L)$$
$$-\frac{1-\beta}{2}\omega_C \mathbb{E}_0 \sum_t \beta^t \left[\tfrac{\varepsilon}{\lambda_p}\pi_t^2 + \tfrac{\psi}{\lambda_w}\pi_{w,t}^2 + \left(E_i[d\log \mu_{i,t}^p] + E_u[d\log \mu_{u,t}^w]\right)(\hat{y}_t - \hat{y}_t^*)\right]$$

Note that

$$\partial \log l_{h,t} = (1+\gamma_h)\partial \log L_t = -(1+\gamma_h)(\hat{y}_t - \hat{y}_t^*)$$

so that

$$\Delta^L = -\omega_C \mathbb{E}_0 \sum_t \beta^t \left\{E_{\chi_h}[d\log \mu_{h,t}^L] + Cov(d\log \mu_{h,t}^L, \gamma_h)\right\}(\hat{y}_t - \hat{y}_t^*)$$

Finally, replacing $\mu_{h,t}^L$ using its definition and the solution to the household problem, we obtain:

$$\Delta^L = -\omega_C \cdot \mathbb{E}_0 \sum_t \beta^t \Bigg[\left[\left(1+\nu^{-1}\right)\partial(\hat{y}_t - \hat{y}_t^*) + E_i\left[d\log \mu_{i,t}\right] + E_u\left[d\log \mu_{u,t}\right]\right] \cdot \partial(\hat{y}_t - \hat{y}_t^*)$$
$$+\nu^{-1} Var_{\chi_h}(\gamma_h)\left(\partial(\hat{y}_t - \hat{y}_t^*)\right)^2\Bigg] - \omega_C \cdot Var_{\chi_h}[\gamma_h] \cdot (1-\beta)\,\mathbb{E}_0\left(\sum_t \beta^t \partial(\hat{y}_t - \hat{y}_t^*)\right)^2.$$

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Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 + \tfrac{1-\beta}{2}\triangleright_{\mathrm{IM}} - \frac{1-\beta}{2}\omega_C \mathbb{E}_0 \sum_t \beta^t \left[\tfrac{\varepsilon}{\lambda_p}\pi_t^2 + \tfrac{\psi}{\lambda_w}\pi_{w,t}^2 + (1+\nu^{-1})\left(\hat{y}_t - \hat{y}_t^*\right)^2\right]$$

$$-\frac{1-\beta}{2}\omega_C \mathbb{E}_0 \sum_t \beta^t \left[\nu^{-1} Var_{\chi_h}(\gamma_h)(\hat{y}_t - \hat{y}_t^*)^2\right] - \frac{1-\beta}{2}\omega_C Var_{\chi_h}(\gamma_h)(1-\beta)\mathbb{E}_0 \left[\left(\sum_t \beta^t (\hat{y}_t - \hat{y}_t^*)\right)^2\right]$$

The incomplete markets triangles are more complex, but can be written as

$$\Delta^{IM} = -\omega_C \mathbb{E}_0 (1-\beta)^{-1} \mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]$$

$$+\,\omega_C \cdot \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right), \gamma_h\right) \partial(\hat{y}_t - \hat{y}_t^*).$$

The Second-Order Approximation of Aggregate Productivity

Back

Proposition

To second order, aggregate productivity is given by

$$
\begin{aligned}
\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\Bigg\{ \sum_{t=0}^{\infty}\beta^t\Bigg\{ \left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2 + \frac{\varepsilon}{\lambda_p}(\pi_t)^2 + \frac{\psi}{\lambda_w}(\pi_{w,t})^2 \Bigg\} \\
+ \nu^{-1} Var_{\chi_h}(\gamma_h)\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2 + (1-\beta)\,Var_{\chi_h}[\gamma_h]\left[\sum_t \beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2 \\
+ (1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right] - \sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\overline{c}_h}\right),\gamma_h\right)(\hat{y}_t-\hat{y}_t^*)\Bigg\}.
\end{aligned}
$$

Term	**Content**	**Source**
RANK losses	$(1+\nu^{-1})\tilde{y}_t^2 + \frac{\varepsilon}{\lambda_p}\pi_t^2 + \frac{\psi}{\lambda_w}\pi_{w,t}^2$	Aggregate labor wedge, price and wage markups
heterogeneous-incidence losses	$\nu^{-1}\,\mathrm{Var}_{\chi_h}(\gamma_h)\sum_t \beta^t\tilde{y}_t^2 + (1-\beta)\,\mathrm{Var}_{\chi_h}(\gamma_h)\left[\sum_t \beta^t\tilde{y}_t\right]^2$	Dispersion in labor wedges
IM losses	$\sum_t \beta^t\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right] - \sum_t \beta^t\,\mathrm{Cov}_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)\tilde{y}_t$	Incomplete markets and their interaction with incidence

The Second-Order Approximation of Aggregate Productivity

Back

Proposition

To second order, aggregate productivity is given by

$$\log A(\mathcal{P}) \approx \log \mathcal{D}^0 - \frac{(1-\beta)\omega_C}{2}\mathbb{E}_0\left\{\sum_{t=0}^{\infty}\beta^t\left\{\left(1+\nu^{-1}\right)(\hat{y}_t-\hat{y}_t^*)^2+\frac{\varepsilon}{\lambda_p}(\pi_t)^2+\frac{\psi}{\lambda_w}(\pi_{w,t})^2\right\}\right.$$
$$+\nu^{-1}Var_{\chi_h}(\gamma_h)\sum_{t=0}^{\infty}\beta^t(\hat{y}_t-\hat{y}_t^*)^2+(1-\beta)\,Var_{\chi_h}[\gamma_h]\left[\sum_t\beta^t(\hat{y}_t-\hat{y}_t^*)\right]^2$$
$$\left.+(1-\beta)^{-1}\mathbb{E}_{\chi_h}\left[Var_{\beta,\pi}\left(d\log\left(\frac{c_{h,t}}{Y_t}\right)\right)\right]-\sum_{t=0}^{\infty}\beta^t Cov_{\chi_h}\left(d\log\left(\frac{c_{h,t}}{\bar{c}_h}\right),\gamma_h\right)(\hat{y}_t-\hat{y}_t^*)\right\}.$$

Proposition (Baqaee–Burstein–Guerreiro, 2026)

Let $\mathcal{P}^*$ be the policy that maximizes the quadratic-approximation of aggregate productivity, subject to the equilibrium conditions. Then, $\mathcal{P}^*$ is a first-order approximation of the optimal policy in the non-linear problem.

The Efficiency Criterion - A Visual Illustration

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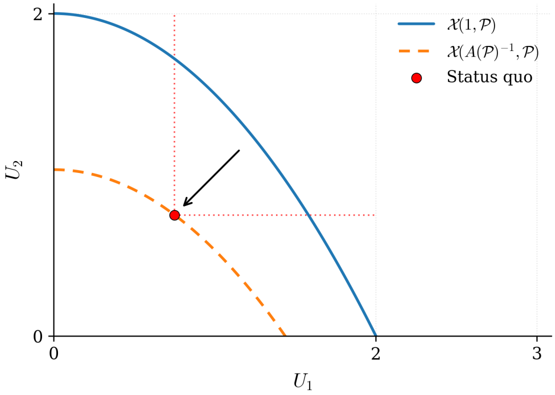


$\mathcal{X}(1; \mathcal{P})$ generates a new frontier – given compensatory transfers

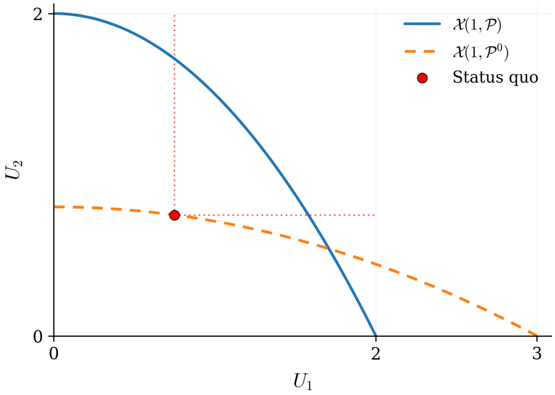
Agg Productivity = how much can contract factor productivity (and so frontier), while keeping everyone at least as well off as under status quo

Status quo is part of the theory and is disciplined by data

Policy problem: look for a policy that generates consensus – feasible Pareto improvements

Theory does not take a stance on what point on new frontier to choose

The Efficiency Criterion and the Scitovsky Paradox



Scitovsky paradox: Kaldor-Hicks criterion can generate reversals

This does not happen here for two reasons:

- Status quo is part of the theory (the data) and we do not change it – changing status quo is like changing preferences
- We compare status quo to new frontier, not a point. There are points on that frontier that Pareto dominate the status quo – if ultimately those were chosen, then no reversal. . .

The Efficiency Criterion: Key Features

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1. **Surplus/Cost-benefit focus**: separates "is there surplus?" from "who gets surplus?" [~~redistributive concerns~~]
2. **Potential-consensus property**: can generate Pareto improvements, process/status-quo matters
   - New allocations reached by consensus, not by coercion [Lockean Pareto principle]
   - Not subject to Scitovsky paradox

   More
3. **Ordinal invariance**: no interpersonal utility comparisons, not dependent on cardinal utility
   - No explicit aggregation of utils (SWF), no Pareto weights, no representative-agent fiction required
4. **TFP Equivalent**: measured in factor productivity (interpretable units), preserves Hulten
   - Measures misallocation as resource waste, not as a change in spending
5. **GE consistency**: accounts for GE feedbacks from policy and transfers
6. **Global criterion**: also applies to large changes, not just marginal ones
7. **Empirical implementation**: characterized using only observables (supply and demand curves)
8. **Generalizations**: (1) can incorporate altruism/people's equity concerns in preferences, (2) can allow for costly redistribution
9. **Nesting and fixes**: nests familiar measures when "well defined", but also avoids pathologies
   - (1) No Boadway/Kaldor-Hicks paradox, (2) avoids real GDP pathologies with heterogeneous preferences, (3) robust to including general market distortions unlike real GDP/KH
10. **Tractable**: Baqaee-Burstein (2025) develop tools to analyze this criterion in general distorted economies with heterogeneous agents