Uninsured Unemployment Risk
and
Optimal Monetary Policy

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Low consumption → Low output → High unemployment → Strong precautionary motive → Bad aggregate shock

Basic questions

- how should the central bank respond to this feedback loop?
- how much does this response differ from that under full insurance?
- how well does the optimal policy stabilise welfare-relevant aggregates (relative to full-insurance benchmark)?
Framework and main results

- tractable HANK model with endogenous unemployment

- focus on (transitory, persistent) productivity & cost-push shocks

- monetary policy should be (much) more accommodative in recessions (and less in expansions) than under full insurance

- policy rate should typically be lowered after productivity- or cost-push driven recessions (opposite as in RANK)

- This is because monetary policy should counter the rise in desired savings due to the precautionary motive

- optimal policy almost fully neutralises feedback loop between aggregate demand and unemployment risk
**Model overview**

- 2 household types: workers, firm owners
- 3 firm types (final, wholesale, intermediate goods)
- government:
  - sets (lump sum, constant) taxes and transfers
  - balanced budget
- central bank: sets policy rate

<table>
<thead>
<tr>
<th>Firms</th>
<th>Frictions</th>
<th>Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>household labour ⇒ intermediate goods ↓ differentiated wholesale goods ↓</td>
<td>costly search</td>
<td>( \tau^l, T, \zeta_t )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( \tau^W )</td>
</tr>
<tr>
<td>consumption &amp; vacancy costs ⇐ final goods</td>
<td></td>
<td>((p_t^*, \pi_t, \Delta_t))</td>
</tr>
</tbody>
</table>
Households

- discount factor $\beta$, nonnegative asset wealth

- **workers**: period utility $u(c)$ ($u' > 0$, $u'' < 0$) and constraints:
  \[ a_{i,t} + c_{i,t} = e_{i,t}w_t + (1 - e_{i,t})\delta + R_t a_{i,t-1} \text{ and } a_{i,t} \geq 0 \]

- **firm owners**: period utility $\tilde{u}(c)$ ($\tilde{u}' > 0$, $\tilde{u}'' \leq 0$) and constraints:
  \[ a_{F,t}^F + c_{F,t}^F = \frac{D_t + \omega + \tau_t}{\nu} + R_t a_{F,t-1}^F \text{ and } a_{F,t}^F \geq 0 \]

- only workers have a precautionary motive

- $a = \text{real value of nominal bond holdings. Hence}$
  \[ R_t = \frac{1 + i_{t-1}}{1 + \pi_t} \]
Intermediate goods firms and labor market flows

- job creation/destruction a la DMP, with suitable timing assumptions

- matching technology \( M_t = m \left(1 - (1 - \rho) n_{t-1}\right)^\gamma v_t^{1-\gamma} \)

- vacancy posting satisfies free-entry: \( c = \lambda_t J_t \), where

\[
J_t = (1 - \tau^I) (z_t \varphi_t - w_t + T - \zeta_t) + (1 - \rho) \mathbb{E}_t M_{t+1}^F J_{t+1}
\]

flow profit from employ. relationship

- equivalently (using matching function):

\[
f_t^{\frac{\gamma}{1-\gamma}} = (1 - \tau^I) \frac{m^{\frac{1}{1-\gamma}}}{c} (z_t \varphi_t - w_t + T - \zeta_t) + (1 - \rho) \mathbb{E}_t M_{t+1}^F f_{t+1}^{\frac{\gamma}{1-\gamma}}
\]
Equilibrium

- optimal choice consistent with market-clearing + free entry

- zero debt limit ⇒ no-trade equilibrium:
  - employed workers precautionary-save, hence take down $R_t$
  - at that rate, the other households would like to borrow, but cannot
  - thus all households consume their current income

- preserves precautionary motive whilst maintaining tractability

- formally:
  
  $\mathbb{E}_t M_{t+1}^e R_{t+1} = 1$, where $M_{t+1}^e = \beta \frac{(1 - s_{t+1}) u'(w_{t+1}) + s_{t+1} u'(\delta)}{u'(w_t)}$;

  $\mathbb{E}_t M_{t+1}^u R_{t+1} < 1$, where $M_{t+1}^u = \beta \frac{(1 - f_{t+1}) u'(\delta) + f_{t+1} u'(w_{t+1})}{u'(\delta)}$;

  $\mathbb{E}_t M_{t+1}^F R_{t+1} < 1$, where $M_{t+1}^F = \beta \frac{\tilde{u}'(c_{t+1}^F)}{\tilde{u}'(c_{t}^F)}$. 
Constrained efficiency

Social welfare function

- individual welfare aggregated into SWF

\[ W_t = U_t + \beta \mathbb{E}_t W_{t+1} \]

where

\[ U_t = n_t u(w_t) + (1 - n_t) u(\delta) + \Lambda \tilde{u} \left( \frac{1}{\nu} \left[ \omega + n_t \left( \frac{z_t}{\Delta_t} - w_t \right) - c v_t \right] \right) \]

- constrained-efficient allocation solves:

\[ W_t(n_{t-1}, \Delta_{t-1}, z_t) = \max_{p^*_t, w_t, n_t \geq 0} \left\{ U_t + \beta \mathbb{E}_t W_{t+1}(n_t, \Delta_t, z_{t+1}) \right\}, \]

s.t. \((n_{-1}, \Delta_{-1}) + \text{laws of motion for } (n_t, \Delta_t)\)

- inefficiencies:
  1. monopolistic competition
  2. relative price distortions
  3. congestion externalities
  4. imperfect insurance
Constrained efficiency
Constrained-efficient allocation

1. set \( \{ p_t^* \} = 1 \), so that \( \{ \pi_t \} = 0 \) & \( \{ \Delta_t \} = 1 \) (standard)

2. set \( \{ w_t \} \) to satisfy efficient sharing of aggregate risk:

\[
u' (w_t^*) = \Lambda \tilde{u}' \left( \nu^{-1} [n_t^* (z_t - w_t^*) - cv_t^* + \omega] \right)\]

3. set \( \{ n_t^* \} \) such that

\[
f_t^{\frac{\gamma}{1-\gamma}} = \frac{(1-\gamma) m^{\frac{1}{1-\gamma}}}{c} \left[ z_t - w^* + \frac{u(w_t^*) - u(\delta)}{u'(w_t^*)} \right]
+ (1 - \rho) \mathbb{E}_t M_{t+1}^{F} f_{t+1}^{\frac{\gamma}{1-\gamma}} (1 - \gamma f_{t+1})\]

with

\[
n_t^* = f_t (1 - n_{t-1}^*) + (1 - \rho (1 - f_t^*)) n_{t-1}^*\]
Constrained efficiency

Decentralisation through taxes

Compare constrained-efficient $f_t^*$ with decentralised-eq’m $f_t$:

\[
f_t^* \frac{\gamma}{1-\gamma} = \frac{(1 - \gamma) m^{1-\gamma}}{c} \left[ z_t - w^* + \frac{u(w_t^*) - u(\delta)}{u'(w_t^*)} \right]
+ (1 - \rho) \mathbb{E}_t M_{t+1}^{F} f_{t+1}^* \frac{\gamma}{1-\gamma} (1 - \gamma f_{t+1}^*)
\]

\[
f_t \frac{\gamma}{1-\gamma} = \frac{(1 - \tau^l) m^{1-\gamma}}{c} \left[ z_t \phi_t - w_t + T - \zeta_t \right] + (1 - \rho) \mathbb{E}_t M_{t+1}^{F} f_{t+1}^* \frac{\gamma}{1-\gamma}
\]

- \( \frac{u(w^*)-u(\delta)}{u'(w^*)} \) reflects insurance externality and calls for \( T > 0 \)
- \( 1 - \gamma \) & \( 1 - \gamma f_{t+1}^* \) reflect congestion externalities and call for \( \tau^l > 0 \)
- \( \phi_t \ (\leq 1) \) reflects monopolistic distortions and calls for \( \tau^W > 0 \)
- assume taxes decentralise constr.-efficient allocation in steady state
Optimal policy with full worker reallocation

- assume $\rho = 1 (\Rightarrow n_t = f_t)$ and $\bar{u}(c) = c (\Rightarrow w_t = w^*)$

- to 2nd order, $\max \mathcal{W}_t$ equivalent to:

$$\min L_t = \frac{1}{2} \mathbb{E}_t \sum_{k=0}^{\infty} \beta^k (\tilde{n}_{t+k}^2 + \Omega \pi_{t+k}^2), \quad \tilde{n}_t \equiv \hat{n}_t - \hat{n}_t^*$$

s.t.

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \frac{\kappa}{\Phi} \tilde{n}_t + \kappa \hat{\zeta}_t \quad \text{(Phillips curve)}$$

$$\Psi \mathbb{E}_t \tilde{n}_{t+1} = \hat{i}_t - \mathbb{E}_t \pi_{t+1} - r_t^* \quad \text{(Euler condition)}$$

where

$$r_t^* = \Psi \Phi \mu_z \hat{z}_t$$

- EC reflects precautionary motive with strength $\Psi \in (0, +\infty)$

- efficient rate $r_t^*$ is affected by precautionary motive
Optimal Ramsey policy

- optimal policy rate (under AR(1) shocks):
  \[
i_0(\hat{z}_0, \hat{\zeta}_0) = \Upsilon(\alpha + \mu_\zeta - 1)\hat{\zeta}_0 - \Psi\Upsilon\theta n(\alpha + \mu_\zeta)\hat{\zeta}_0 + \Psi\Phi\mu_z\hat{z}_0,
  \]
  perfect-insurance response
  imperfect-insurance correction

and, for \( t \geq 1 \):

\[
i_t(\hat{z}_0, \hat{\zeta}_0) = \Upsilon[\mu^t_\zeta - (1 - \alpha)\sum_{k=0}^t \alpha^k \mu^{t-k}_z]\hat{\zeta}_0
  - \Psi\Upsilon\theta n[\sum_{k=0}^t \alpha^k \mu^{t-k}_z]\hat{\zeta}_0 + \Psi\Phi\mu^{t+1}_z\hat{z}_0.
\]
  perfect-insurance response
  imperfect-insurance correction

- imperfect insurance mutes down / reverts interest-rate response

- implied \( \{\tilde{n}_t, \pi_t\}_{t=0}^{\infty} \) is the same as under perfect insurance
Optimal discretionary policy

\[ \hat{t}(\hat{\zeta}_0, \hat{\zeta}_0) = \left( \frac{\kappa \Phi \mu_{t+1}^\zeta}{(1 - \beta \mu_{\zeta}) \Phi + \kappa \theta n} \right) \hat{\zeta}_0 \]

perfect-insurance response

\[ -\Psi \left( \frac{\kappa \Phi \theta n \mu_{t+1}^\zeta}{(1 - \beta \mu_{\zeta}) \Phi + \theta nk} \right) \hat{\zeta}_0 + \Psi \Phi \mu_{z+1}^t z_0 \]

imperfect-insurance correction

- similar features as in Ramsey: more accommodation + replication of perfect-insurance dynamics
Optimal policy with full worker reallocation

- solve Ramsey pb numerically for calibrated economy

- baseline: efficient wage with $\sigma = 1, \tilde{\sigma} = 1/3$
  \[ (\Rightarrow \frac{\text{dlog } w}{\text{dlog } z} = 0.32) \]

Calibration.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Value</th>
<th>Targets</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>Discount factor</td>
<td>0.989</td>
<td>$4i$</td>
<td>Annual interest rate</td>
<td>2%</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Elasticity of subst.</td>
<td>6.000</td>
<td>$\frac{1}{\theta-1}$</td>
<td>Markup rate</td>
<td>20%</td>
</tr>
<tr>
<td>$\omega$</td>
<td>% unchanged price</td>
<td>0.750</td>
<td>$\frac{1}{1-\omega}$</td>
<td>Mean price duration</td>
<td>1 year</td>
</tr>
<tr>
<td>$c$</td>
<td>Vacancy cost</td>
<td>0.044</td>
<td>$\frac{c}{w^*}$</td>
<td>Labor cost of vacancy</td>
<td>4.5%</td>
</tr>
<tr>
<td>$w^*$</td>
<td>Real wage</td>
<td>0.979</td>
<td>$f$</td>
<td>Job-finding rate</td>
<td>80%</td>
</tr>
<tr>
<td>$m$</td>
<td>matching efficiency</td>
<td>0.765</td>
<td>$\lambda$</td>
<td>Vacancy-filling rate</td>
<td>70%</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Job-destruction rate</td>
<td>0.250</td>
<td>$s$</td>
<td>Job-loss rate</td>
<td>5%</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Home production</td>
<td>0.882</td>
<td>$\frac{\delta}{w^*}$</td>
<td>Opp. cost of empl.</td>
<td>90%</td>
</tr>
</tbody>
</table>
Figure: Responses to a contractionary productivity shock (imperfect versus perfect insurance).
Figure: Responses to a contractionary cost-push shock (imperfect versus perfect insurance).
Figure: Responses to a contractionary productivity shock (alternative wage-setting mechanisms).
Figure: Responses to a contractionary cost-push shock (alternative wage-setting mechanisms).
Productivity shock / no production subsidy

![Graphs showing productivity shock, nominal interest rate, inflation, real wage, employment, and output with lines for imperfect and perfect insurance.](image-url)
Productivity shock / no wage subsidy

- Productivity shock
- Nominal interest rate
- Inflation
- Real wage
- Employment
- Output

- Imperfect insurance (baseline)
- Perfect insurance
Productivity shock / no subsidy at all
Summary

- optimal monetary policy in NK model with endogenous unemployment risk (⇒ amplification through feedback loop)

- replicates RANK predictions under perfect insurance

- but policy should be much more accommodating under imperfect insurance – hence RANK predictions may be overturned

- optimal policy (almost) replicates perfect-insurance dynamics

- incomplete markets “do not matter” when monetary policy is unconstrained and optimised