A Macroeconomic Approach to Optimal Unemployment Insurance: Theory and Applications

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Baily-Chetty theory of optimal UI

- insurance-incentive tradeoff:
  - UI reduces job search

- two aspects of the debate are missing:
  - sometimes jobs are unavailable
  - UI affects job creation

- problem: Baily-Chetty model is partial equilibrium
  - endogenous labor supply
  - but fixed labor market tightness
This paper

- general-equilibrium model of optimal UI
  - endogenous labor supply and demand
  - equilibrium labor market tightness
- model captures three effects of UI:
  - UI may reduce job search
  - UI may alleviate rat race for jobs
  - UI may raise wages and deter job creation
- application: optimal UI over the business cycle
A matching model of UI
UI program

- moral hazard: search effort is unobservable
- employed workers receive $c^e$
- unemployed workers receive $c^u$

**replacement rate** $R$ measures generosity of UI:
- $R \equiv 1 - (c^e - c^u)/w$
- $R =$ benefit rate + tax rate
- workers keep fraction $1 - R$ of earnings
Labor market

- measure 1 of identical workers, initially unemployed
  - search for jobs with effort $e$
- measure 1 of identical firms
  - post $v$ vacancies to hire workers
- CRS matching function: $l = m(e, v)$
- labor market tightness: $\theta \equiv v/e$
Matching probabilities

- vacancy-filling probability:
  \[ q(\theta) \equiv \frac{l}{v} = m \left( \frac{1}{\theta}, 1 \right) \]

- job-finding rate per unit of effort:
  \[ f(\theta) \equiv \frac{l}{e} = m (1, \theta) \]

- job-finding probability: \( e \cdot f(\theta) < 1 \)
Matching cost: $\rho$ recruiters per vacancy

- employees $= \left[ 1 + \tau(\theta) \right] \cdot$ producers

- proof:

$$
\begin{align*}
\text{employees} & = \underbrace{n + \rho \cdot \frac{l}{q(\theta)}}_{\text{producers} + \text{recruiters}} \\
\text{employees} & = \left[ 1 + \frac{\rho}{q(\theta) - \rho} \right] \cdot n \\
\equiv & 1 + \tau(\theta)
\end{align*}
$$
Representative worker

- consumption utility $U(c)$, search disutility $\psi(e)$
- **utility gain from work:** $\Delta U \equiv U(c^e) - U(c^u)$
- solves $\max_e \{U(c^u) + e \cdot f(\theta) \cdot \Delta U - \psi(e)\}$
- **effort supply** $e^s(\theta, \Delta U)$ gives optimal effort:
  \[
  \psi'(e^s(\theta, \Delta U)) = f(\theta) \cdot \Delta U
  \]
- **labor supply** $l^s(\theta, \Delta U)$ gives employment rate:
  \[
  l^s(\theta, \Delta U) = e^s(\theta, \Delta U) \cdot f(\theta)
  \]
Labor supply

\[ l^s(\theta, \Delta U) \]
Representative firm

- hires $l$ employees
  - $n = l/(1 + \tau(\theta))$ producers
  - $l - n$ recruiters
- production function: $y(n)$
- solves $\max_l \{y(l/(1 + \tau(\theta))) - w \cdot l\}$
- labor demand $l^d(\theta, w)$ gives optimal employment:

$$y' \left( \frac{l^d}{1 + \tau(\theta)} \right) = (1 + \tau(\theta)) \cdot w$$
Labor demand

\[ l^d(\theta, w) \]

\[ l^s(\theta, \Delta U) \]
Labor-market equilibrium

- as in any matching model, need a price mechanism
  - **general wage schedule:** \( w = w(\theta, \Delta U) \)
- in equilibrium, \( \theta \) is such that supply = demand:
  \[
  l^s(\theta, \Delta U) = l^d(\theta, w(\theta, \Delta U))
  \]
- **equilibrium tightness:** \( \theta(\Delta U) \)
Labor-market equilibrium

\[ l^d(\theta, w(\theta, \Delta U)) \]

\[ l^s(\theta, \Delta U) \]

\[ \theta(\Delta U) \]

unemployment

labor market tightness

employment

0

l

1
Formula for optimal UI
Government’s problem

choose \( \Delta U \) to maximize welfare

\[
SW = l \cdot U(c^e) + (1 - l) \cdot U(c^u) - \psi(e)
\]

- budget constraint:

\[
y \left( \frac{l}{1 + \tau(\theta)} \right) = l \cdot c^e + (1 - l) \cdot c^u
\]

- workers’ response: \( e = e^s(\theta, \Delta U), \ l = l^s(\theta, \Delta U) \)

- equilibrium constraint: \( \theta = \theta(\Delta U) \)
Condition for optimal UI

- express all the variables as a function of $(\theta, \Delta U)$
- government solves $\max_{\Delta U} SW(\theta(\Delta U), \Delta U)$
- first-order condition:

$$0 = \left. \frac{\partial SW}{\partial \Delta U} \right|_\theta + \left. \frac{\partial SW}{\partial \theta} \right|_{\Delta U} \cdot \frac{d\theta}{d\Delta U}$$

Baily-Chetty formula  

Correction
Baily-Chetty formula

\[ R = R^* \left( \varepsilon^m, \frac{U'(c^u)}{U'(c^e)} \right) \]

- \( \varepsilon^m > 0 \): microelasticity of unemployment wrt UI
  - measures disincentive from search
  - \( R^* \) is decreasing in \( \varepsilon^m \)

- \( \frac{U'(c^u)}{U'(c^e)} > 1 \): ratio of marginal utilities
  - measures need for insurance
  - \( R^* \) is increasing in \( \frac{U'(c^u)}{U'(c^e)} \)
Microelasticity of unemployment

- \( \theta \): labor market tightness
- Employment

- LS, low UI

Graph showing the relationship between labor market tightness and employment.
Microelasticity of unemployment

\[ \varepsilon^m \]

\[ \theta \]

LS, high UI

LS, low UI

employment

labor market tightness
\[ \partial SW/\partial \theta \bigg|_{\Delta U} \] measured by efficiency term

efficiency term depends on several estimable statistics:

- \( \tau(\theta) \): recruiter-producer ratio
- \( u \): unemployment rate
- \( 1 - \eta \): elasticity of the job-finding rate \( f(\theta) \)
- \( \Delta U \): the utility gain from work
Efficiency term and efficient tightness

Efficiency term = 0

Social welfare $SW(\theta, \Delta U)$

Labor market tightness

$\theta^*(\Delta U)$
Efficiency term and efficient tightness

\[ \theta^*(\Delta U) \quad \theta > \theta^* \]

Social welfare \( SW(\theta, \Delta U) \)

Labor market tightness

Efficiency term < 0
Efficiency term and efficient tightness

Efficiency term > 0

$SW(\theta, \Delta U)$

{\theta < \theta^* \atop \theta^*(\Delta U)}

Social welfare

Labor market tightness
Macroelasticity of unemployment

\[ \text{labo market tightness} \]

\[ \theta \]

\[ \text{employment} \]

LD

LS

\[ \varepsilon^M \]

\[ \varepsilon^m \]
$1 - \varepsilon^M / \varepsilon^m$ gives effect of UI on $\theta$
$1 - \varepsilon^M / \varepsilon^m$ gives effect of UI on $\theta$

$d\theta = 0$
$1 - \varepsilon^M / \varepsilon^m$ gives effect of UI on $\theta$

$d\theta < 0$
Optimal UI formula in estimable statistics

\[ R = R^* \left( \epsilon^m, \frac{U'(c^u)}{U'(c^e)} \right) + \left( 1 - \frac{\epsilon^M}{\epsilon^m} \right) \cdot \text{efficiency term} \]

Baily-Chetty formula

Correction
Optimal UI versus Baily-Chetty level

- optimal UI = Baily-Chetty if
  - UI has no effect on $\theta$: $\varepsilon^M = \varepsilon^m$
  - or $\theta$ is efficient: efficiency term $= 0$

- optimal UI $\neq$ Baily-Chetty if
  - UI affects $\theta$: $\varepsilon^M \neq \varepsilon^m$
  - and $\theta$ is inefficient: efficiency term $\neq 0$

→ optimal UI $>$ Baily-Chetty if UI brings $\theta$ to efficiency
Optimal UI over the business cycle: theory
### Three matching models

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<th>rigid-wage</th>
<th>job-rationing</th>
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<tr>
<td>prod. function</td>
<td>linear</td>
<td>linear</td>
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<tr>
<td>wage</td>
<td>bargaining</td>
<td>rigid</td>
<td>rigid</td>
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</tbody>
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Business cycles in the models

- Baily-Chetty level is broadly constant
- $1 - \varepsilon^M/\varepsilon^m$ has constant sign
- Efficiency term changes sign over business cycle
  - under labor demand shocks
  - $> 0$ in slumps and $< 0$ in booms
  - Generates cyclicality of optimal UI
Standard model: \(1 - \frac{\varepsilon^M}{\varepsilon^m} < 0\)
Standard model: \(1 - \frac{\varepsilon^M}{\varepsilon^m} < 0\)
Standard model: $1 - \frac{\varepsilon^M}{\varepsilon^m} < 0$
Rigid-wage model: \( 1 - \varepsilon^M / \varepsilon^m = 0 \)
Rigid-wage model: $1 - \varepsilon^M / \varepsilon^m = 0$
Job-rationing model: $1 - \varepsilon^M / \varepsilon^m > 0$
Job-rationing model: \( 1 - \frac{\varepsilon^M}{\varepsilon^m} > 0 \)
Cyclicality of optimal UI

- $\theta$ is too low in slumps + too high in booms

- **standard model: procyclical UI**
  - moral hazard + job creation: $1 - \frac{\varepsilon^M}{\varepsilon^m} < 0$

- **rigid-wage model: acyclical UI**
  - only moral hazard: $1 - \frac{\varepsilon^M}{\varepsilon^m} = 0$

- **job-rationing model: countercyclical UI**
  - moral hazard + rat race: $1 - \frac{\varepsilon^M}{\varepsilon^m} > 0$
Optimal UI over the business cycle: empirics
Evidence on elasticities: $1 - \frac{\varepsilon^M}{\varepsilon^m} \geq 0$

- UI variations in the US since the 1980s
  - Levine [1993]: $1 - \frac{\varepsilon^M}{\varepsilon^m} = 1$
  - Marinescu [2014]: $1 - \frac{\varepsilon^M}{\varepsilon^m} = 0.3$
  - Johnston & Mas [2015]: $1 - \frac{\varepsilon^M}{\varepsilon^m} = 0$

- Reform of UI system in Austria in the 1990s
  - Lalive et al. [2015]: $1 - \frac{\varepsilon^M}{\varepsilon^m} = 0.2$

- (Evidence in favor of job-rationing model)
Recruiter-producer ratio $\tau(\theta)$

- CES data on recruiting industry
- JOLTS data on vacancy-filling rate
- CPS data on job-finding rate

Efficiency term $= 0$: UI $= \text{Baily-Chetty}$
Efficiency term < 0: UI < Baily-Chetty
Efficiency term $> 0$: UI $> \text{Baily-Chetty}$
UI >> Baily-Chetty in slumps

Simulation of job-rationing model:
$R^* = 50\%$ but $R = 70\%$ when $u = 10\%$