A Macroeconomic Approach to Optimal Unemployment Insurance: Theory and Applications

Landais (LSE), Michaillat (LSE), and Saez (Berkeley)

December 2015
Baily-Chetty theory of optimal UI

- insurance-incentive tradeoff: UI provides a safety net but UI reduces job search and raises unemployment

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

- problem: partial-equilibrium model
  - labor supply
  - fixed labor market tightness
In this paper:

- general-equilibrium model of optimal UI
  - labor supply and labor demand
  - equilibrium labor market tightness
- macroeconomic model captures three effects of UI:
  - UI may reduce job-search effort
  - UI may alleviate rat race for jobs in bad times
  - 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:
  
  - $R \equiv 1 - (c^e - c^u)/w$
  - $R = \text{tax rate} + \text{benefit rate}$
  - 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:

\[
\hat{l} = n + \rho \cdot \hat{v} \\
= n + \rho \cdot \frac{l}{q(\theta)} \\
= \left[ 1 + \frac{\rho}{q(\theta) - \rho} \right] \cdot n \\
\equiv 1 + \tau(\theta)
\]
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

Labor supply: $l^s(\theta, \Delta U)$

![Graph showing labor supply](image-url)
Representative firm

- hires $l$ employees
  - $n = \frac{l}{1 + \tau(\theta)}$ producers
  - $l - n$ recruiters
- production function: $y(n)$
- solves $\max_l \{y\left(\frac{l}{1 + \tau(\theta)}\right) - w \cdot l\}$
- **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

$\text{labor demand: } l^d(\theta, w)$

$l^s(\theta, \Delta U)$

labor market tightness

employment

0

0
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

0

0

\( l \)

employment

0
Sufficient-statistics formula for optimal UI
Government’s problem
choose $\Delta U$ to maximize welfare

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

subject to the following constraints:

- **budget constraint:**
  $$y\left(\frac{l}{1 + \tau(\theta)}\right) = l \cdot c^e + (1 - l) \cdot c^u$$

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

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

- express all the variables as a function of $(\theta, \Delta U)$
- express social welfare as $SW = SW(\theta, \Delta U)$
- 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 term
Optimal UI versus Baily-Chetty

- Baily-Chetty formula is valid if UI has no effect on $\theta$ or $\theta$ is efficient (that is, $\frac{\partial SW}{\partial \theta} \bigg|_{\Delta U} = 0$)
- optimal UI departs from Baily-Chetty if UI affects $\theta$ and $\theta$ is inefficient (that is, $\frac{\partial SW}{\partial \theta} \bigg|_{\Delta U} \neq 0$)

- **optimal UI > Baily-Chetty iff UI brings $\theta$ closer to its efficient level**

- government UI beneficial when Baily-Chetty invalid
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
- \( \frac{U'(c^u)}{U'(c^e)} > 1 \): ratio of marginal utilities
  - measures need for insurance
- \( R^* \) is decreasing in \( \varepsilon^m \)
- \( R^* \) is increasing in \( \frac{U'(c^u)}{U'(c^e)} \)
Microelasticity of unemployment

![Graph showing the relationship between labor market tightness and employment. The graph has a line that starts at a low point and increases sharply as it moves to the right, indicating an increase in employment. There is a specific point marked as LS, low UI, indicating a low unemployment rate.]
Microelasticity of unemployment

![Graph showing the relationship between labor market tightness and employment, with two curves representing high and low UI scenarios.]

\[ \varepsilon^m \]
Efficiency term $\frac{\partial SW}{\partial \theta} \bigg|_{\Delta U}$

- 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

- indicates the state of the labor market
Efficiency term and efficient tightness

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

Efficiency term $= 0$

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

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

$\theta^*(\Delta U)$

$\theta > \theta^*$

labor market tightness

efficiency term < 0
Efficiency term and efficient tightness

Efficiency term > 0

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

$\theta < \theta^*$ $\theta^*(\Delta U)$

labor market tightness
Macroelasticity of unemployment

[Diagram showing labor market tightness and employment with points LD and LS at intersection of curves]
Macroelasticity of unemployment

![Diagram showing labor market tightness and employment with points LD and LS marked.](image)
Macroelasticity of unemployment

Labor market tightness

Employment

LD

LS

$\theta$

$\varepsilon^M$

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

$d\theta > 0$
$1 - \frac{\varepsilon^M}{\varepsilon^m}$ gives effect of UI on $\theta$
$1 - \frac{\varepsilon^M}{\varepsilon^m}$ gives effect of UI on $\theta$

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

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

- \( R \neq R^* \left( \varepsilon^M, \frac{U'(c^u)}{U'(c^e)} \right) \)
- \( \varepsilon^M \) alone is not useful for optimal UI
- Efficiency term fluctuates with \( \theta \)
  - Optimal UI over the business cycle
  - Importance of \( 1 - \varepsilon^M / \varepsilon^m \)
Optimal UI over the business cycle: theory
Three matching models

<table>
<thead>
<tr>
<th>model</th>
<th>standard</th>
<th>rigid-wage</th>
<th>job-rationing</th>
</tr>
</thead>
<tbody>
<tr>
<td>prod. function</td>
<td>linear</td>
<td>linear</td>
<td>concave</td>
</tr>
<tr>
<td>wage</td>
<td>bargaining</td>
<td>rigid</td>
<td>rigid</td>
</tr>
</tbody>
</table>
Standard model: $1 - \varepsilon^M / \varepsilon^m < 0$
Standard model: $1 - \frac{\varepsilon^M}{\varepsilon^m} < 0$
Standard model: $1 - \frac{\varepsilon^M}{\varepsilon^m} < 0$
Rigid-wage model: $1 - \frac{\varepsilon^M}{\varepsilon^m} = 0$
Rigid-wage model: \(1 - \varepsilon^M / \varepsilon^m = 0\)
Rigid-wage model: \( 1 - \frac{\varepsilon^M}{\varepsilon^m} = 0 \)
Job-rationing model: \( 1 - \frac{\varepsilon^M}{\varepsilon^m} > 0 \)
Job-rationing model: \[ 1 - \varepsilon^M / \varepsilon^m > 0 \]
Job-rationing model: \( 1 - \frac{\varepsilon^M}{\varepsilon^m} > 0 \)
Cyclicality of optimal UI: theory

- **standard model: procyclical UI**
  - bargaining shocks $\rightarrow$ inefficient fluctuations
  - job-creation mechanism $\rightarrow 1 - \varepsilon^M / \varepsilon^m < 0$

- **rigid-wage model: acyclical UI**
  - no mechanism $\rightarrow 1 - \varepsilon^M / \varepsilon^m = 0$

- **job-rationing model: countercyclical UI**
  - productivity shocks $\rightarrow$ inefficient fluctuations
  - rat-race mechanism $\rightarrow 1 - \varepsilon^M / \varepsilon^m > 0$
Optimal UI over the business cycle: empirics
Direct evidence: $1 - \varepsilon^M / \varepsilon^m > 0$

- Levine [1993]: $1 - \varepsilon^M / \varepsilon^m = 1 > 0$
  - UI extensions in the US in 1980s
- Marinescu [2014]: $1 - \varepsilon^M / \varepsilon^m = 0.3 > 0$
  - UI extensions in the US during Great Recession
- Johnston & Mas [2015]: $1 - \varepsilon^M / \varepsilon^m = 0$
  - UI reduction in Missouri in 2011
- Lalive et al. [2015]: $1 - \varepsilon^M / \varepsilon^m = 0.2 > 0$
  - reform of UI system in Austria in the 1990s
Indirect evidence: $1 - \epsilon^M/\epsilon^m > 0$

- convincing evidence of rat-race mechanism
  - negative spillover of higher job search
  - Crepon et al. [2013], Burgess & Profit [2001]

- no evidence of job-creation mechanism
  - re-employment wages unaffected by UI
  - Card et al. [2007], Schmieder et al. [2015]
  - only exception is Hagedorn et al. [2013]
Recruiter-producer ratio $\tau(\theta)$

- CES data on recruiting industry
- JOLTS data on vacancy-filling rate
- CPS data on job-finding rate
Elasticity of matching function $\eta$

\[
\ln(f(t+1)) - \ln(f(t)) = \ln(\theta(t+1)) - \ln(\theta(t))
\]

$1 - \eta = 0.34$
Utility gain from work $\Delta U$

- extended empirical model: $\Delta U = \log(c^e/c^h) + Z$
- consumption drop upon unemployment: 19%
  - consumption drop for food: 7%
  - income elasticity of food consumption: 0.36
- nonpecuniary cost of unemployment: $Z = 45\%$
  - well-being surveys: 45\% of yearly income
  - career choices [Borgschulte & Martorell 2015]
  - standard macro assumption: $Z < 0$
Efficiency term = 0: UI = Baily-Chetty
Efficiency term = 0: \( UI = \) Baily-Chetty
Efficiency term $< 0$: UI $< \text{Baily-Chetty}$
**Efficiency term > 0: UI > Baily-Chetty**
Nonpecuniary cost of unemployment $Z$ is critical
Optimal UI over the business cycle: simulations of the job-rationing model
First simulation: constant UI, $R = 50\%$
Large fluctuations in unemployment

Unemployment rate

- 13%
- 11%
- 9%
- 7%
- 5.9%
- 5%
- 3%

Technology

- 0.94
- 0.97
- 1
- 1.03
- 1.06

slump

boom
Large fluctuations in tightness

Labor market tightness

Technology

slump
boom

0.49
1

0 0.97 1 1.03 1.06

45 / 55
The microelasticity $\varepsilon^m$ is stable.
The elasticity wedge $1 - \varepsilon^M / \varepsilon^m$ is positive.
The rat race is stronger in slumps
The rat race is stronger in slumps

Labor market tightness

Employment

LD, slump

LS, high UI

LS, low UI
The rat race is stronger in slumps
The efficiency term changes sign

Efficiency term

slump: inefficiently low tightness

boom: inefficiently high tightness

efficient tightness
The optimal UI is countercyclical

![Graph showing replacement rate vs technology with lines for optimal UI and constant UI. The graph indicates that the optimal UI rate decreases with technology, while the constant UI remains flat. The labels slump and boom are used to denote different economic conditions.]
The optimal UI is countercyclical
Despite large disincentive to search
Higher UI $\rightarrow$ slightly higher unemployment

[Graph showing the relationship between macroelasticity and technology, with two curves labeled 'Optimal UI' and 'Constant UI'.]
Higher UI → slightly higher unemployment
Conclusion
Theoretical approach is broadly applicable

- formula for optimal policy \( \tau \) is

\[
0 = \text{public-finance term} + \frac{d\theta}{d\tau} \cdot \text{efficiency term}
\]

- public-finance term = \( \partial SW / \partial \tau \big|_\theta \)

- efficiency term = \( \partial SW / \partial \theta \big|_\tau \)

- Michaillat & Saez [2014]: monetary and debt policy

- Michaillat & Saez [2015]: government purchases
Empirical applications would benefit from better estimates of many statistics
determinants of the efficiency term, and thus of the natural rate of unemployment
- nonpecuniary cost of unemployment \((z)\)
- recruiter-producer ratio \((\tau)\)
- matching elasticity with endogenous search \((\eta)\)
- elasticity wedge \((1 - \varepsilon^M/\varepsilon^m)\)