Optimal Unemployment Insurance over the Business Cycle

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Framework

- Frictional labor market [Pissarides, 2000]
- Risk-averse workers, no self-insurance
- Unobservable job-search efforts [Baily, 1978]
- Recessions & job rationing [Michaillat, forthcoming]
  - wage rigidity [Hall, 2005]
  - downward-sloping labor demand
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Why Job Rationing in Recessions?
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Research Question

In recessions, unemployment insurance (UI) should be
- constant?
- more generous?
- less generous?
Research Question

In recessions, unemployment insurance (UI) should be

- constant
- more generous: $\frac{\text{Consumption of unemployed}}{\text{Consumption of employed}} \uparrow$
- less generous
What Happens in Recessions?

Unemployment rate

- Rationing unemp.
- Frictional unemp.


0.02 0.04 0.06 0.08 0.1

P. Michaillat (LSE)
Optimal Unemployment Insurance
What Happens in Recessions?

1. Constant insurance value of UI
2. Small effect of UI on aggregate employment
3. Correction for negative *rat-race externality*
Outline of Paper

1. Optimal UI Formula: \( \tau = \tau(\epsilon^m, \epsilon^M, \text{risk aversion}) \)

2. Optimal UI with Recessions and Job Rationing

3. Extensions in a Dynamic Setting
1 Optimal UI Formula: $\tau = \tau(\epsilon^m, \epsilon^M, \text{risk aversion})$

2 Optimal UI with Recessions and Job Rationing

3 Extensions in a Dynamic Setting
UI Program

- Government gives $c^e$ to $n$ employed workers
- Government gives $c^u$ to $1 - n$ unemployed workers
- Budget constraint: $n \cdot w = n \cdot c^e + (1 - n) \cdot c^u$

Implementation:

- tax rate: $t \equiv 1 - c^e/w$
- benefit rate: $b \equiv c^u/w$
- budget: $(t \cdot w) \cdot n = (b \cdot w) \cdot (1 - n)$
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One-Period Model with Matching Frictions

- Initial number of unemployed workers: $u$
- Job-search effort: $e$
- Job openings: $o$
- Number of matches: $h = m(e \cdot u, o)$
- Labor market tightness: $\theta \equiv o/(e \cdot u)$
- Vacancy-filling proba.: $q(\theta) = m(1/\theta, 1)$
- Job-finding proba.: $e \cdot f(\theta) = e \cdot m(1, \theta)$
Unemployed Worker’s Problem

- Given $\theta$, $\Delta v = v(c^e) - v(c^u)$, choose $e$ to maximize
  
  $$v(c^u) + e \cdot f(\theta) \cdot \Delta v - k(e)$$

- Optimal effort $e(\theta, \Delta v)$:
  
  $$k'(e) = f(\theta) \cdot \Delta v$$

- Aggregate labor supply:
  
  $$n^s(\theta, \Delta v) = (1 - u) + e(\theta, \Delta v) \cdot f(\theta) \cdot u$$
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Labor Supply: High UI

![Graph showing labor market tightness vs. employment with a curve indicating the relationship between the two variables.]
Labor Supply: Low UI

![Graph showing labor market tightness vs. employment, with a curve indicating the relationship between the two variables.](image)
Government’s Problem

Choose $\Delta v$ to maximize

$$n \cdot v(c^e) + (1 - n) \cdot v(c^u) - u \cdot k(e)$$

subject to:

- $\Delta v = v(c^e) - v(c^u)$
- Budget: $n \cdot c^e + (1 - n) \cdot c^u = n \cdot w$
- Labor market dynamics: $n = (1 - u) + u \cdot e \cdot f(\theta)$
- Optimal job search: $e = e(\theta, \Delta v)$
- Labor market clearing: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$
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Choose $\Delta \nu$ to maximize

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- budget: $n \cdot c^e + (1 - n) \cdot c^u = n \cdot w$
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Micro-Elasticity $\epsilon^m$

$$\epsilon^m = \frac{\Delta v}{1 - n} \cdot \frac{\partial n^s}{\partial \Delta v} \bigg|_{\theta}$$

- Response of individual job-search effort
- Elasticity used in the literature [Baily, 1978]
- Estimation: increase in probability of unemployment when individual UI increases
Macro-Elasticity $\epsilon^M$

$$\epsilon^M = \frac{\Delta v}{1 - n} \cdot \frac{dn}{d\Delta v}$$

- Response of aggregate unemployment
- Estimation: increase in unemployment when aggregate UI increases
Optimal UI Formula in Sufficient Statistics

\[
\frac{\tau}{1 - \tau} \approx \frac{\rho}{\epsilon^M} \cdot (1 - \tau) + \frac{\kappa}{1 + \kappa} \cdot \left[ \frac{\epsilon^m}{\epsilon^M} - 1 \right] \cdot [1 + \rho \cdot (1 - \tau)]
\]

- \( \tau \): replacement rate \( c^u / c^e \)
- \( \rho \): relative risk aversion
- \( \kappa \): elasticity of \( k' \)
- \( \epsilon^M \): macro-elasticity of unemployment
- \( \epsilon^m \): micro-elasticity of unemployment
Building on the Baily [1978] Formula

\[ \frac{\tau}{1 - \tau} \approx \frac{\rho}{\epsilon^m} \cdot (1 - \tau) \]

- Public economics: Baily [1978], Chetty [2006]
- Government’s budget constraint in GE
- Correction for rat-race externality
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Optimal UI Formula: $\tau = \tau(\epsilon^m, \epsilon^M, \text{risk aversion})$

Optimal UI with Recessions and Job Rationing

Extensions in a Dynamic Setting
Firm’s Problem

- Given \((\theta, a)\), choose \(n \geq 1 - u\) to maximize

\[
a \cdot n^\alpha - \omega \cdot a^\gamma \cdot n - \frac{r \cdot a}{q(\theta)} \cdot [n - (1 - u)]
\]

- Optimal employment \(n^d(\theta, a)\):

\[
\alpha \cdot n^{\alpha - 1} = \omega \cdot a^{\gamma - 1} + \frac{r}{q(\theta)}
\]

- Wage rigidity: \(\gamma \in [0, 1)\)
- Diminishing marginal returns to labor: \(\alpha \in (0, 1)\)
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Labor Demand $n^d(\theta, a)$: Expansion
Labor Demand $n^d(\theta, a)$: Recession
Elasticities

- Micro-elasticity:

\[\epsilon^m = \frac{p}{1 - p} \cdot \frac{1}{\kappa}\]

- Positive wedge between micro- and macro-elasticity:

\[
\frac{\epsilon^m}{\epsilon^M} = 1 + (1 - \alpha) \cdot \frac{\alpha}{r \cdot \frac{\eta}{q(\theta)} \cdot \frac{\kappa}{1 - \eta} \cdot \frac{n^{1 - \alpha}}{s}}
\]
Expansion: High UI

![Graph showing Labor market tightness vs Employment]

- **Labor supply**
- **Labor demand**

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Optimal Unemployment Insurance
Expansion: Low UI

![Graph showing labor market tightness and employment](image)

- Labor supply
- Labor demand

P. Michaillat (LSE) Optimal Unemployment Insurance
Expansion: Measuring Elasticities

![Graph showing the relationship between employment and labor market tightness, with curves for labor supply and labor demand.](image)
Expansion: Micro-Elasticity

**Diagram:**
- **Y-axis:** Labor market tightness
- **X-axis:** Employment
- **Legend:**
  - Blue line: Labor supply
  - Red line: Labor demand

**Equation:**
\[ \varepsilon_m \]

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Optimal Unemployment Insurance

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Expansion: Macro-Elasticity

Employment
Labor market tightness

Labor supply
Labor demand

ε

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Expansion: Micro/Macro Elasticity Wedge

Labor market tightness

Labor demand

Labor supply

\[ \epsilon_m - \epsilon_M \]

Employment

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Optimal Unemployment Insurance
Recession: High UI

![Graph showing labor market tightness and employment](image)

- Blue line: Labor supply
- Red line: Labor demand
Recession: Micro-Elasticity

![Graph showing labor market tightness and employment relationship]

- Labor supply
- Labor demand

Symbols:
- $\varepsilon^m$
Recession: Macro-Elasticity

**Diagram:**

- **Labor supply**
- **Labor demand**

**Axes:**
- **Y-axis:** Labor market tightness (0.5 to 2)
- **X-axis:** Employment (0.88 to 1)

**Notation:**
- \( \varepsilon \)
- \( M \)
Recession: Micro-/Macro-Elasticity Wedge

Employment

Labor market tightness

Labor supply
Labor demand

\( \varepsilon_m - \varepsilon_M \)

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Optimal Unemployment Insurance

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Comparative Statics

- Micro-/macro-elasticity wedge \((\epsilon^m / \epsilon^M) \uparrow\)
- Macro-elasticity of unemployment wrt. UI \((\epsilon^M) \downarrow\)
Optimal UI in Recession

\[
\frac{\tau}{1 - \tau} \approx \frac{\rho}{\epsilon^M} \cdot (1 - \tau) + \left[ \frac{\epsilon^m}{\epsilon^M} - 1 \right] \cdot \left[ \frac{\kappa}{1 + \kappa} \right] \cdot \left[ 1 + \rho \cdot (1 - \tau) \right]
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- Matching frictions do not matter: \( \epsilon^M \) decreases
- Strong rat-race externality: \( \epsilon^m / \epsilon^M \) increases
- \( \tau \) increases: UI should be more generous
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2 Optimal UI with Recessions and Job Rationing

3 Extensions in a Dynamic Setting
Optimal UI: $\tau = \frac{c^u}{c^e}$
Optimal UI: $b, t$
Optimal UI: $c^e, c^u$
Response to Negative Technology Shock

- Technology
- Effort
- Labor market tightness
- Unemployment
- Labor tax $t$
- Replacement rate $b$
- Net replacement rate $\tau$
- Consumption (unemployed)

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BACK-UP SLIDES
Decomposition of the Cyclicality of UI

\[
\text{Baily with micro-elasticity}
\]

Unemployment rate vs. Net replacement rate $\tau$

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Decomposition of the Cyclicality of UI

![Graph showing the relationship between Unemployment rate and Net replacement rate with Baily with micro-elasticity and Baily with macro-elasticity.]
Decomposition of the Cyclicality of UI

Unemployment rate
Net replacement rate $\tau$

Baily with micro-elasticity
Baily with macro-elasticity
Optimum

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<table>
<thead>
<tr>
<th>Interpretation</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\eta$ U-elasticity of matching</td>
<td>0.7</td>
<td>Petrongolo and Pissarides (2001)</td>
</tr>
<tr>
<td>$s$ Separation rate</td>
<td>0.95%</td>
<td>JOLTS, 2000–2010</td>
</tr>
<tr>
<td>$\omega_m$ Efficiency of matching</td>
<td>0.23</td>
<td>JOLTS, 2000–2010</td>
</tr>
<tr>
<td>$\omega_k$ Cost of effort</td>
<td>0.87</td>
<td>Matches $\bar{e} = 1$</td>
</tr>
<tr>
<td>$c$ Recruiting costs</td>
<td>0.21</td>
<td>Microevidence: $0.32 \cdot \omega$</td>
</tr>
<tr>
<td>$\alpha$ Returns to labor</td>
<td>0.67</td>
<td>Matches labor share $= 0.66$</td>
</tr>
<tr>
<td>$\gamma$ Real wage rigidity</td>
<td>0.5</td>
<td>Microevidence: $0.3 \leq \gamma \leq 0.7$</td>
</tr>
<tr>
<td>$\omega$ Steady-state real wage</td>
<td>0.67</td>
<td>Matches unemployment $= 5.9%$</td>
</tr>
<tr>
<td>$\sigma$ Risk aversion</td>
<td>1</td>
<td>Chetty (2006)</td>
</tr>
<tr>
<td>$\kappa$ Elasticity of cost of effort</td>
<td>1.8</td>
<td>Meyer (1990)</td>
</tr>
</tbody>
</table>