A MACROECONOMIC APPROACH TO
OPTIMAL UNEMPLOYMENT INSURANCE

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BAILY-CHETTITY THEORY OF OPTIMAL UI

- insurance-incentive tradeoff:
  - UI provides consumption insurance
  - but UI reduces job search

- two aspects of the debate are missing:
  - sometimes jobs may be unavailable
  - UI may affect job creation

- because the Baily-Chetty model is a partial-equilibrium model:
  - endogenous labor supply
  - but fixed labor market tightness
THIS PAPER

• general-equilibrium model of optimal UI
  – endogenous labor supply
  – endogenous labor demand
  – equilibrium labor market tightness
• model captures 3 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:**

$$l = n + \rho \cdot \frac{l}{q(\theta)}$$

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

$\equiv 1 + \tau(\theta)$
• consumption utility $U(c)$, search disutility $\psi(e)$
• utility gain from work: $\Delta U \equiv U(c^e) - U(c^u)$
• solves $\max_e \left\{ U(c^u) + e \cdot f(\theta) \cdot \Delta U - \psi(e) \right\}$
• 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: $l^s(\theta, \Delta U)$
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

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

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

labor market tightness

employment

$0$

$1$
LABOR-MARKET EQUILIBRIUM

• as in any matching model, need a price mechanism
  – general wage schedule: \( w = w(\theta, \Delta U) \)
• tightness equilibrates 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
SUFFICIENT-STATISTIC 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 budget constraint:

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

• to workers’ response: $e = e^s(\theta, \Delta U)$ & $l = l^s(\theta, \Delta U)$

• and to equilibrium constraint: $\theta = \theta(\Delta U)$
• 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  \hspace{2cm}  correction
BAILY-CHETTY FORMULA

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

- \( \epsilon^m > 0 \): microelasticity of unemployment wrt UI
  - measures disincentive from search
  - \( R^* \) is decreasing in \( \epsilon^m \)
- \( \frac{U'(c^u)}{U'(c^e)} > 1 \): ratio of marginal utilities
  - measures need for insurance
  - \( R^* \) is increasing in \( \frac{U'(c^u)}{U'(c^e)} \)
MICROELASTICITY OF UNEMPLOYMENT

\[ \text{LS, low UI} \]

\[ \theta \]

labor market tightness

employment
MICROELASTICITY OF UNEMPLOYMENT

The diagram illustrates the relationship between labor market tightness ($\theta$) and employment, comparing LS (Low UI) and LS (High UI) scenarios.

- Low UI (LS, low UI)
- High UI (LS, high UI)

The variable $\varepsilon^m$ represents a parameter of interest in the model.

The graph shows how changes in labor market tightness affect employment levels under different UI conditions.
\[ \frac{\partial SW}{\partial \theta} \bigg|_{\Delta U} \] MEASURED BY EFFICIENCY TERM

- Efficiency term depends on several sufficient 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
EFFECTIVE TERM AND EFFICIENT TIGHTNESS

\[ \text{efficiency term} = 0 \]

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

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

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

\[ SW(\theta, \Delta U) \]

- Efficiency term > 0
- labor market tightness
- Social welfare \( SW(\theta, \Delta U) \)
- \( \theta < \theta^* \)
- \( \theta^*(\Delta U) \)
MACROELASTICITY OF UNEMPLOYMENT

![Graph showing the relationship between labor market tightness and employment with LD and LS labels.](image)
MACROELASTICITY OF UNEMPLOYMENT

![Graph showing labor market tightness and employment]

- LD
- LS
- $\theta$
- $\varepsilon^m$
MACROELASTICITY OF UNEMPLOYMENT

![Graph showing the relationship between labor market tightness and employment.](image)

- LD
- LS
- $\theta$
- $\varepsilon_M$
- $\varepsilon_m$
$1 - \epsilon^M/\epsilon^m$ GIVES EFFECT OF UI ON $\theta$

$d\theta > 0$

employment

labor market tightness
$1 - \varepsilon^M / \varepsilon^m$ GIVES EFFECT OF UI ON $\theta$
$1 - \frac{\epsilon^M}{\epsilon^m}$ GIVES EFFECT OF UI ON $\theta$

$d\theta < 0$
\[ R = R^* \left( \epsilon^m, \frac{U'(c^u)}{U'(c^e)} \right) + \left( 1 - \frac{\epsilon^M}{\epsilon^m} \right) \cdot \text{efficiency term} \]

Baily-Chetty formula

Correction
OPTIMAL UI VERSUS BAILY-CHETTY LEVEL

- optimal UI = Baily-Chetty if
  - UI has no effect on tightness: $\epsilon^M = \epsilon^m$
  - or tightness is efficient: efficiency term = 0
- optimal UI ≠ Baily-Chetty if
  - UI affects tightness: $\epsilon^M \neq \epsilon^m$
  - and tightness is inefficient: efficiency term ≠ 0

$\implies$ optimal UI > Baily-Chetty if UI pushes tightness toward efficiency
OPTIMAL UI OVER THE BUSINESS CYCLE:

THEORY
## THREE MATCHING MODELS

<table>
<thead>
<tr>
<th>prod. function</th>
<th>standard</th>
<th>rigid-wage</th>
<th>job-rationing</th>
</tr>
</thead>
<tbody>
<tr>
<td>wage bargaining</td>
<td>linear</td>
<td>rigid</td>
<td>concave</td>
</tr>
</tbody>
</table>
BUSINESS CYCLES IN THE MODELS

- Baily-Chetty level is broadly constant
- \(1 - \frac{\varepsilon^M}{\varepsilon^m}\) 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: $1 - \varepsilon^M / \varepsilon^m < 0$
STANDARD MODEL: $1 - e^M/e^m < 0$

Diagram showing labor market tightness and employment with the following elements:
- LD and LS points
- Moral hazard indicated by an arrow and a dashed line
- $e^m$ as an arrow indicating a decrease in labor market tightness

Moral hazard is a phenomenon where an individual's behavior changes in response to changes in their environment, leading to a decrease in the equilibrium state.
STANDARD MODEL: $1 - \frac{\epsilon^M}{\epsilon^m} < 0$
RIGID-WAGE MODEL: \[ 1 - \frac{\epsilon^M}{\epsilon^m} = 0 \]
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RIGID-WAGE MODEL: $1 - \frac{\epsilon^M}{\epsilon^m} = 0$
JOB-RATIONING MODEL: $1 - \frac{\epsilon^M}{\epsilon^m} > 0$
JOB-RATIONING MODEL: $1 - \epsilon^M/\epsilon^m > 0$
JOB-RATIONING MODEL: $1 - \epsilon^M/\epsilon^m > 0$
Cyclicality of Optimal UI

- Tightness is too low in slumps & too high in booms
  - Standard model: procyclical UI
    - Moral hazard & job creation: $1 - \frac{\epsilon^M}{\epsilon^m} < 0$
    - UI should be reduced in slumps to stimulate tightness
  - Rigid-wage model: acyclical UI
    - Only moral hazard: $1 - \frac{\epsilon^M}{\epsilon^m} = 0$
    - UI has no effect on tightness
  - Job-rationing model: countercyclical UI
    - Moral hazard & rat race: $1 - \frac{\epsilon^M}{\epsilon^m} > 0$
    - UI should be raised in slumps to stimulate tightness
OPTIMAL UI OVER THE BUSINESS CYCLE:
APPLICATION TO THE US
MICROELASTICITY OF UNEMPLOYMENT WRT UI

- many estimates of the microelasticity
- obtained by comparing identical jobseekers receiving different UI benefits in the same market
- plausible range of estimates: $0.4 \leq \epsilon^m \leq 0.8$
  - estimates of the microelasticity of unemployment duration wrt potential duration of UI benefits
- key references:
  - Katz, Meyer [1990]
  - Landais [2015]
MACROELASTICITY OF UNEMPLOYMENT WRT UI

- few estimates of the macroelasticity
- obtained by comparing identical labor markets receiving different UI benefits
- plausible range of estimates: $0 \leq \epsilon^M \leq 0.3$
- key references:
  - Card, Levine [2000]
  - Hagedorn et al [2016]
  - Chodorow-Reich, Coglianese, Karabarbounis [2019]
  - Dieterle, Bartalotti, Brummet [2020]
  - Boone et al [2021]
estimates obtained separately suggest \( 1 - \epsilon^M / \epsilon^m > 0 \):

\[
0 < \epsilon^M < 0.3 < 0.4 < \epsilon^m < 0.8
\]

implied range for the elasticity wedge: 0.25–1

- lower bound: \( 1 - \epsilon^M / \epsilon^m = 1 - 0.3/0.4 = 0.25 \)
- upper bound: \( 1 - \epsilon^M / \epsilon^m = 1 - 0/0.8 = 1 \)

one exception: Johnston, Mas [2018] find \( 1 - \epsilon^M / \epsilon^m = 0 \) when they estimate \( \epsilon^m \) and \( \epsilon^M \) in MO data
RESPONSE OF TIGHTNESS TO UI

- Marinescu [2017] finds that an increase in UI raises tightness
  - corresponding elasticity wedge: $1 - \frac{\epsilon^M}{\epsilon^m} = 0.4$

- Levine [1993] & Farber, Valletta [2015] find that an increase in UI leads uninsured jobseekers to find jobs faster
  - an increase in UI raises tightness
  - $1 - \frac{\epsilon^M}{\epsilon^m} > 0$

- evidence from Austria: Lalive et al [2015] find that an increase in UI raises tightness
  - corresponding elasticity wedge: $1 - \frac{\epsilon^M}{\epsilon^m} = 0.2$
RCT evidence of rat-race mechanism:
- negative spillover of more intense job search
- Crepon et al [2013] in France
- Gautier et al [2012] in Denmark

no evidence of job-creation mechanism:
- re-employment wages unaffected by UI
- Krueger, Mueller [2016]
- Marinescu [2017]
- Johnston, Mas [2018]
- also true in Austria: Card et al [2007]
SUMMARY OF THE EVIDENCE: $1 - \frac{\epsilon^M}{\epsilon^m} \approx 0.4$

- the evidence shows that $1 - \frac{\epsilon^M}{\epsilon^m} \geq 0$
  - reasonable median estimate: $1 - \frac{\epsilon^M}{\epsilon^m} = 0.4$
- the evidence supports the rat-race mechanism but not the job-creation mechanism
  - further support for $1 - \frac{\epsilon^M}{\epsilon^m} > 0$
- additional evidence suggests that the elasticity wedge may be larger in bad times
  - Valletta [2014]
  - Toohey [2017]
ELASTICITY WEDGE IN GOOD TIMES

Labor market tightness

Employment

LS, high UI
LS, low UI

LD, boom

\( \varepsilon M \)
\( \varepsilon m \)
ELASTICITY WEDGE IN BAD TIMES

LD, slump  \( \varepsilon^M \)  LS, high UI  \( \varepsilon^m \)  LS, low UI

Labor market tightness

Employment
EFFICIENCY TERM IN THE US

1990
1995
2000
2005
2010
-0.3
0
0.3
0.6
0.9
EFFICIENCY TERM = 0 ⇒ UI = BAILY-CHETTY
EFFICIENCY TERM $< 0 \Rightarrow UI < \text{Baily-Chetty}$
EFFICIENCY TERM $> 0 \Rightarrow UI > BAILY-CHETTY$
EFFECTIVE REPLACEMENT RATE IN THE US
OPTIMAL REPLACEMENT RATE IN THE US

US replacement rate

Optimal replacement rate

20%
30%
40%
50%
60%

SENSITIVITY ANALYSIS: MICROELASTICITY

\[ \epsilon_b^m = 0.4 \]
\[ \epsilon_b^m = 0.6 \]
\[ \epsilon_b^m = 0.2 \]
SENSITIVITY ANALYSIS: COST OF UNEMPLOYMENT

\[ Z = 0.3 \times \phi \times w \]

\[ Z = 0 \]

\[ Z = 0.6 \times \phi \times w \]
SENSITIVITY ANALYSIS: MATCHING ELASTICITY

The graph shows the sensitivity analysis of matching elasticity with three different values: \( \eta = 0.6 \), \( \eta = 0.7 \), and \( \eta = 0.5 \). The data is plotted for years 1990 to 2010, with percentage values ranging from 20% to 60%.
SENSITIVITY ANALYSIS: RISK AVERSION
SENSITIVITY ANALYSIS: CONSUMPTION DROP

\[
1 - \frac{c^h}{c^e} = 12\% \\
1 - \frac{c^h}{c^e} = 5\% \\
1 - \frac{c^h}{c^e} = 20\%
\]
OPTIMAL UI OVER THE BUSINESS CYCLE:
SIMULATIONS OF JOB-RATIONING MODEL
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha = 0.73$</td>
<td>Production function: concavity</td>
<td>$1 - \frac{e^M}{e^m} = 0.4$</td>
</tr>
<tr>
<td>$\gamma = 1$</td>
<td>Relative risk aversion</td>
<td>Chetty [2006]</td>
</tr>
<tr>
<td>$s = 2.8%$</td>
<td>Monthly job-separation rate</td>
<td>CPS, 1990–2014</td>
</tr>
<tr>
<td>$\eta = 0.6$</td>
<td>Matching elasticity</td>
<td>Petrongolo, Pissarides [2001]</td>
</tr>
<tr>
<td>$\mu = 0.60$</td>
<td>Matching efficacy</td>
<td>$\theta = 0.43$</td>
</tr>
<tr>
<td>$\rho = 0.80$</td>
<td>Matching cost</td>
<td>$\tau = 2.3%$</td>
</tr>
<tr>
<td>$\zeta = 0.5$</td>
<td>Real wage: rigidity</td>
<td>Michaillat [2014]</td>
</tr>
<tr>
<td>$\omega = 0.73$</td>
<td>Real wage: level</td>
<td>$u = 6.1%$</td>
</tr>
<tr>
<td>$\sigma = 0.17$</td>
<td>Disutility from home production: convexity</td>
<td>$\frac{d \ln(c^h)}{d \ln(c^u)} = 0.2$</td>
</tr>
<tr>
<td>$\xi = 1.43$</td>
<td>Disutility from home production: level</td>
<td>$1 - \frac{c^h}{c^e} = 12%$</td>
</tr>
<tr>
<td>$\kappa = 0.22$</td>
<td>Disutility from job search: convexity</td>
<td>$e^m = 0.4$</td>
</tr>
<tr>
<td>$\delta = 0.33$</td>
<td>Disutility from job search: level</td>
<td>$e = 1$</td>
</tr>
<tr>
<td>$z = -0.14$</td>
<td>Disutility from unemployment</td>
<td>$Z = 0.3 \times \phi \times w$</td>
</tr>
</tbody>
</table>
REPLACEMENT RATE OVER THE CYCLE

Low labor productivity  →  High labor productivity

- **$R = 42\%$**
- Baily-Chetty
- Optimal UI
RECRUITERS/PRODUCERS OVER THE CYCLE

Recruiter-producer ratio

Low labor productivity  →  High labor productivity

- $R = 42\%$
- Baily-Chetty
- Optimal UI
EFFICIENCY TERM OVER THE CYCLE

![Graph showing efficiency term over the cycle with different productivity levels and lines representing different models: R = 42%, Baily-Chetty, and Optimal UI. The x-axis represents low labor productivity to high labor productivity, and the y-axis represents efficiency term.](image)
MICROELASTICITY OVER THE CYCLE

- Low labor productivity
- High labor productivity

- R = 42%
- Baily-Chetty
- Optimal UI
MACROELASTICITY OVER THE CYCLE

![Graph showing macroelasticity over the cycle with different productivity levels and UI optimal lines.](image-url)
ELASTICITY WEDGE OVER THE CYCLE

$R = 42\%$

Baily-Chetty

Optimal UI

Elasticity wedge

Low labor productivity  →  High labor productivity
CONSUMPTION DROP OVER THE CYCLE

- Consumption drop
- Low labor productivity
- High labor productivity
- $R = 42\%$
- Baily-Chetty
- Optimal UI

Graph showing consumption drop over the cycle with different productivity levels and various lines representing different scenarios.
JOB SEARCH OVER THE CYCLE

- Low labor productivity
- High labor productivity

Graph showing job-search effort over the cycle with different productivity levels.
HOME PRODUCTION OVER THE CYCLE

- \( R = 42\% \)
- Baily-Chetty
- Optimal UI

Low labor productivity \( \rightarrow \) High labor productivity