Optimal Unemployment Insurance over the Business Cycle

Camille Landais, Pascal Michaillat, Emmanuel Saez

SIEPR, LSE, UC Berkeley

Nuremberg – June 18, 2011

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

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

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

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

Why Job Rationing in Recessions?

Why Job Rationing in Recessions?

Why Job Rationing in Recessions?

Research Question

In recessions, unemployment insurance (UI) should be

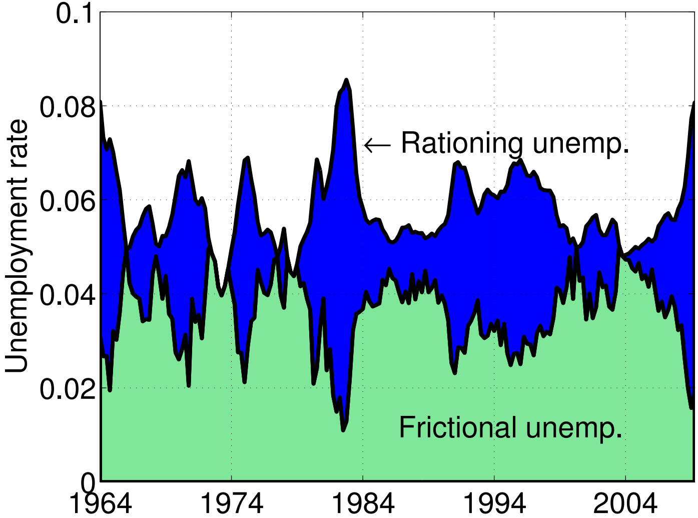
- constant?
- more generous?
- less generous?

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?



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: $(t \cdot w) \cdot n = (b \cdot w) \cdot (1 - n)$

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: $(t \cdot w) \cdot n = (b \cdot w) \cdot (1 - n)$

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.: $q(\theta) = m\left(1/\theta, 1\right)$
- 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:

$$n^s(\theta, \Delta v) = (1 - u) + e(\theta, \Delta v) \cdot f(\theta) \cdot u$$

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:

$$n^s(\theta, \Delta v) = (1 - u) + e(\theta, \Delta v) \cdot f(\theta) \cdot u$$

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:

$$n^s(\theta, \Delta v) = (1 - u) + e(\theta, \Delta v) \cdot f(\theta) \cdot u$$

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:

$$n^s(\theta, \Delta v) = (1 - u) + e(\theta, \Delta v) \cdot f(\theta) \cdot u$$

Unemployed Worker's Problem

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

$$v(c^u) + e \cdot f(\theta) \cdot \Delta v - k(e)$$

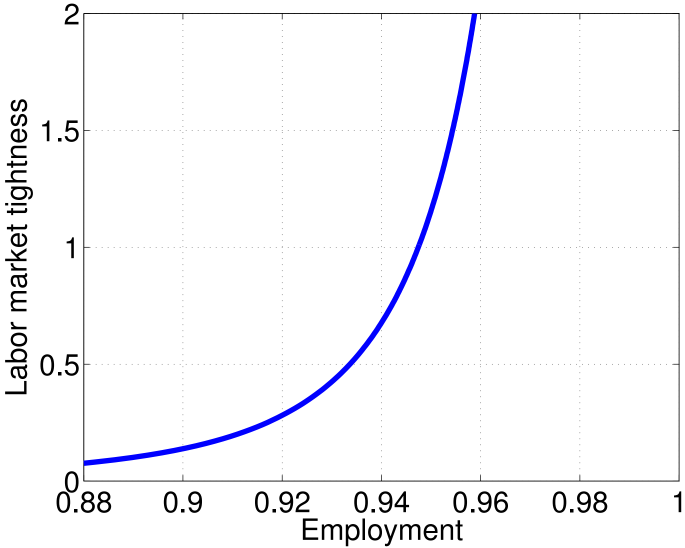
- Optimal effort $e(\theta, \Delta v)$:

$$k'(e) = f(\theta) \cdot \Delta v$$

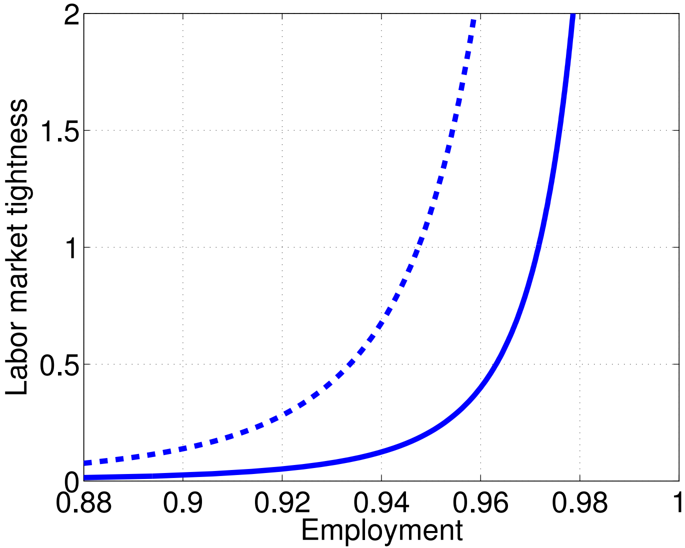
- Aggregate labor supply:

$$n^s(\theta, \Delta v) = (1-u) + e(\theta, \Delta v) \cdot f(\theta) \cdot u$$

Labor Supply: High UI



Labor Supply: Low UI



Government's Problem

Choose Δv 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: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$

Government's Problem

Choose Δv 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: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$

Government's Problem

Choose Δv 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: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$

Government's Problem

Choose Δv 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: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$

Government's Problem

Choose Δv 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: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$

Government's Problem

Choose Δv 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: $n^d(\theta) = n^s(e(\theta, \Delta v), \theta)$

Micro-Elasticity ϵ^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 ϵ^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

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

- τ: replacement rate c^u/c^e
- ρ: relative risk aversion
- κ: elasticity of k'
- ϵ^M: macro-elasticity of unemployment
- ϵ^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

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

Building on the Baily [1978] Formula

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

- Public economics: Baily [1978], Chetty [2006]
- Government's budget constraint in GE
- Correction for rat-race externality

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

2. Optimal UI with Recessions and Job Rationing

3. Extensions in a Dynamic Setting

Firm's Problem

- Given (θ, 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: $\alpha \in (0, 1)$

Firm's Problem

- Given (θ, 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: $\alpha \in (0, 1)$

Firm's Problem

- Given (θ, 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: $\alpha \in (0, 1)$

Firm's Problem

- Given (θ, 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: $\alpha \in (0, 1)$

Firm's Problem

- Given (θ, 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: $\alpha \in (0, 1)$

Firm's Problem

- Given (θ, 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: $\alpha \in (0, 1)$

Firm's Problem

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

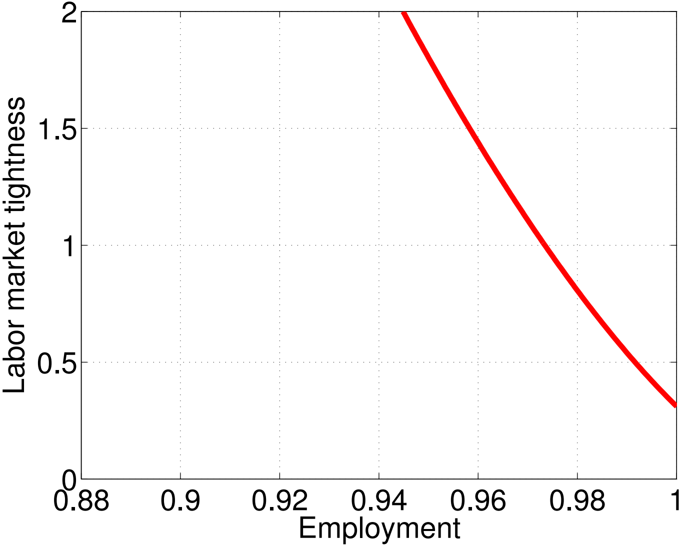
$$a \cdot n^{\alpha} - \omega \cdot a^{\gamma} \cdot n - \frac{r \cdot a}{q(\theta)} \cdot [n - (1 - u)]$$

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

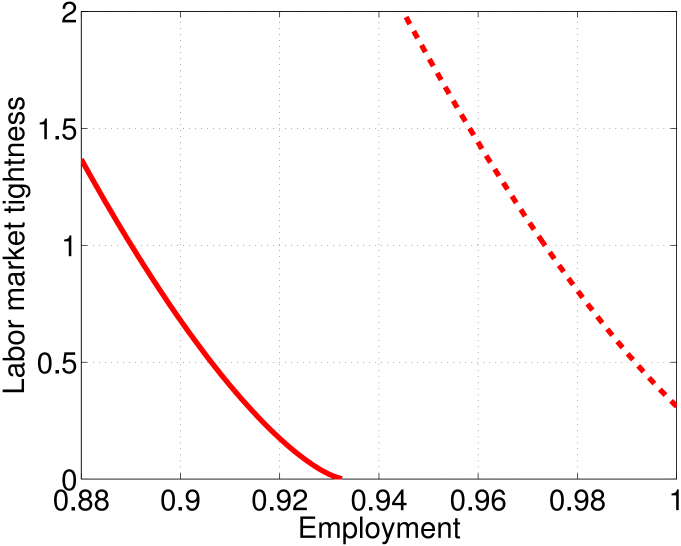
$$\alpha \cdot n^{\alpha - 1} = \omega \cdot a^{\gamma - 1} + \frac{r}{q(\theta)}$$

- Wage rigidity: $\gamma \in [0, 1)$
- Diminishing marginal returns to labor: $\alpha \in (0, 1)$

Labor Demand $n^d(\theta, a)$: Expansion



Labor Demand $n^d(\theta, a)$: Recession



Elasticities

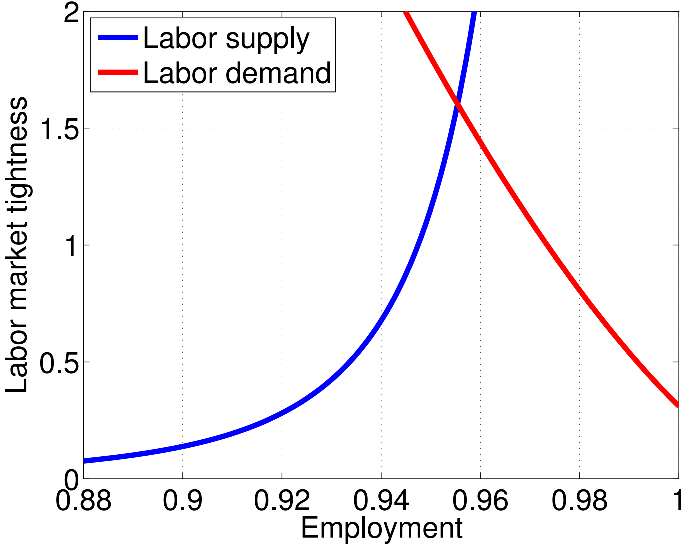
- Micro-elasticity:

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

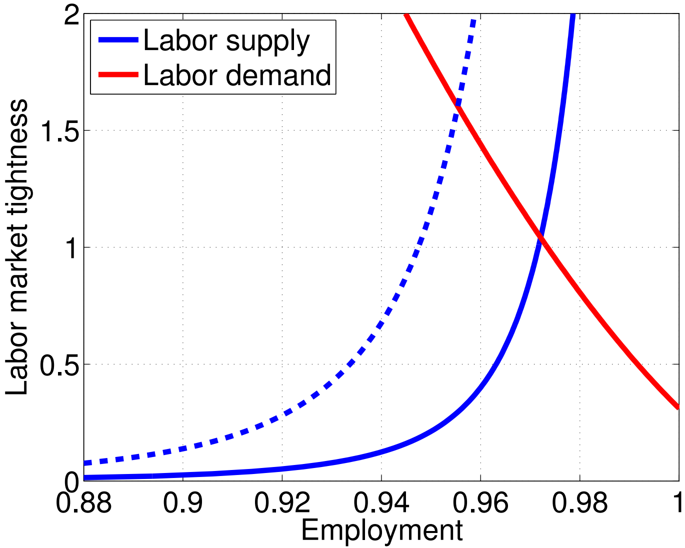
- Positive wedge between micro- and macro-elasticity:

$$\frac{\epsilon^m}{\epsilon^M} = 1 + (1-\alpha) \cdot \frac{\alpha}{\frac{r}{q(\theta)} \cdot \frac{\eta}{1-\eta} \cdot \frac{\kappa}{1+\kappa} \cdot \frac{n^{1-\alpha}}{s}}$$

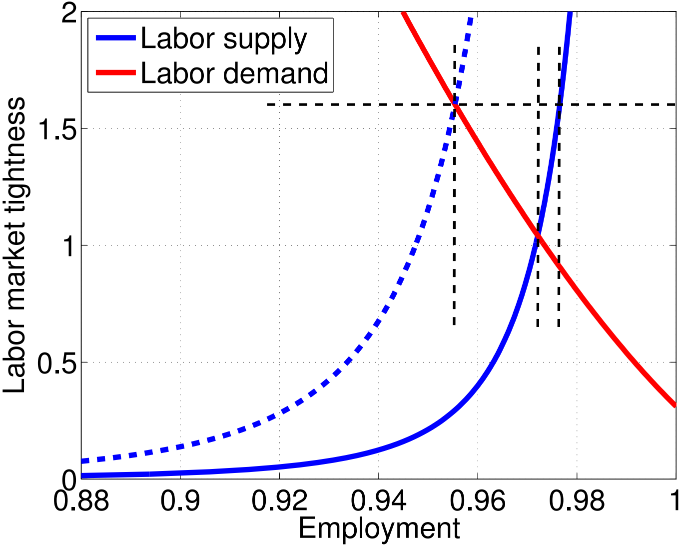
Expansion: High UI



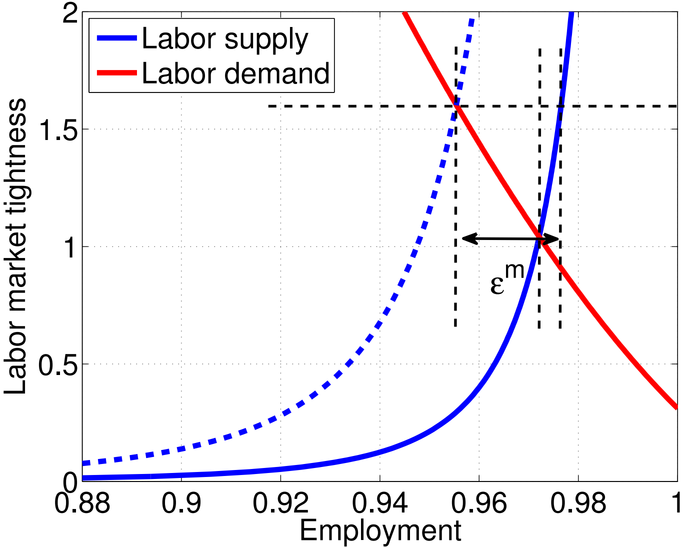
Expansion: Low UI



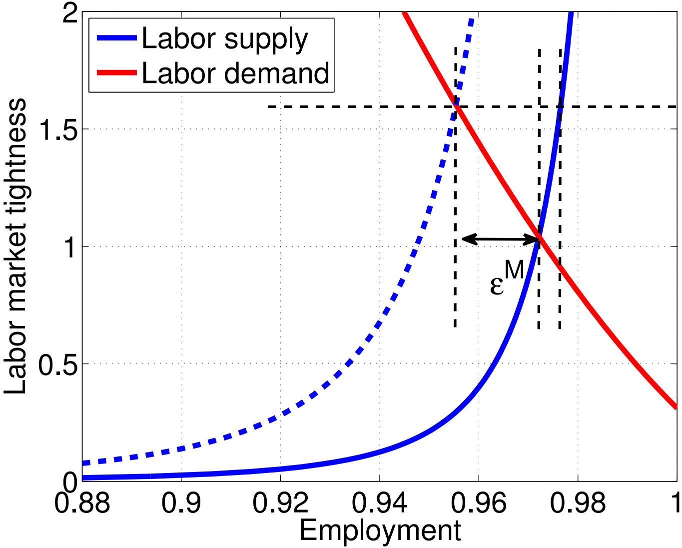
Expansion: Measuring Elasticities



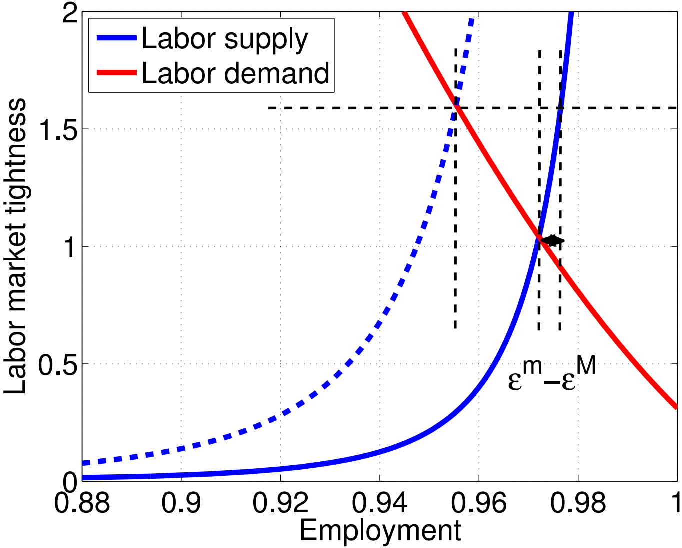
Expansion: Micro-Elasticity



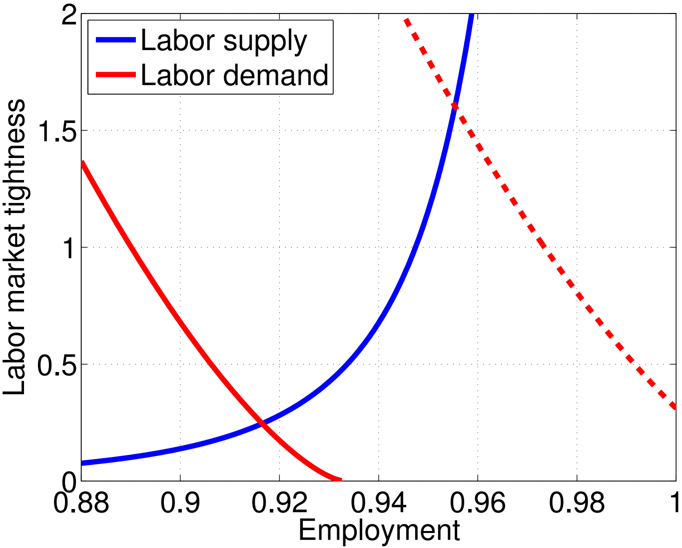
Expansion: Macro-Elasticity



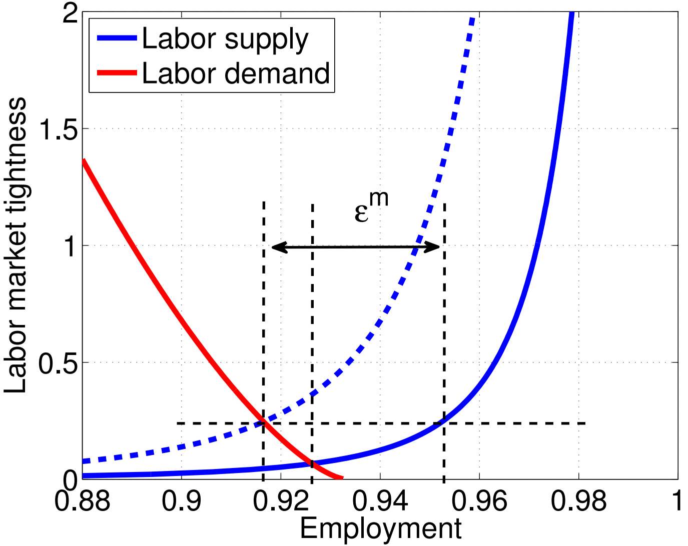
Expansion: Micro/Macro Elasticity Wedge



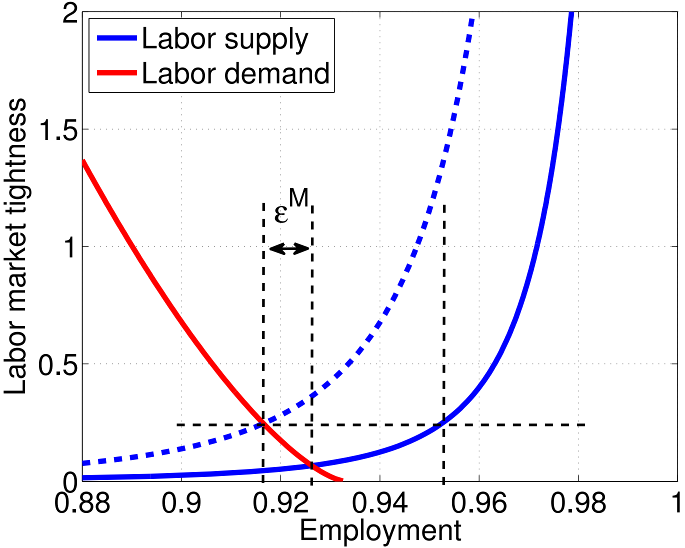
Recession: High UI



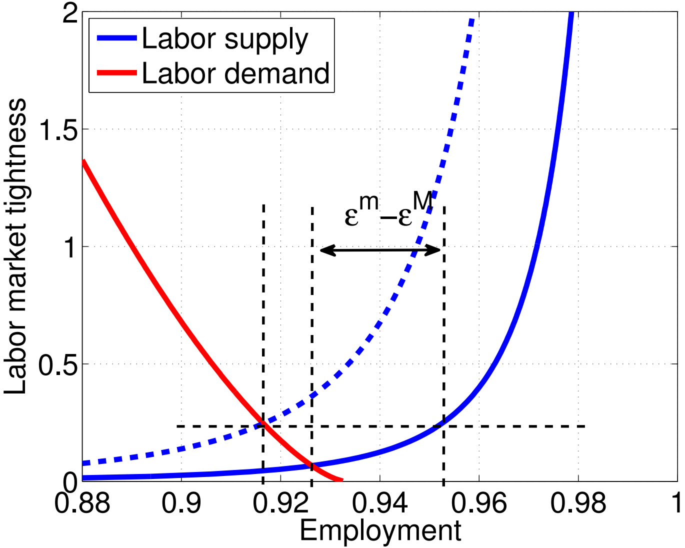
Recession: Micro-Elasticity



Recession: Macro-Elasticity



Recession: Micro-/Macro-Elasticity Wedge



Comparative Statics

- Micro-/macro-elasticity wedge (ϵ^m/ϵ^M) $\uparrow$
- Macro-elasticity of unemployment wrt. UI (ϵ^M) $\downarrow$

Optimal UI in Recession

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

- Matching frictions do not matter: ϵ^M decreases
- Strong rat-race externality: ϵ^m/ϵ^M increases
- τ increases: UI should be more generous

Optimal UI in Recession

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

- Matching frictions do not matter: ϵ^M decreases
- Strong rat-race externality: ϵ^m / ϵ^M increases
- τ increases: UI should be more generous

Optimal UI in Recession

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

- Matching frictions do not matter: ϵ^M decreases
- Strong rat-race externality: ϵ^m/ϵ^M increases
- τ increases: UI should be more generous

Optimal UI in Recession

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

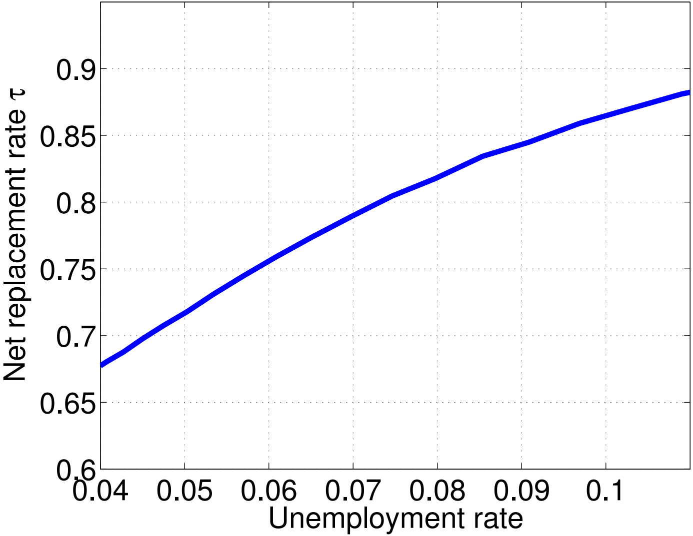
- Matching frictions do not matter: ϵ^M decreases
- Strong rat-race externality: ϵ^m/ϵ^M increases
- τ increases: UI should be more generous

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

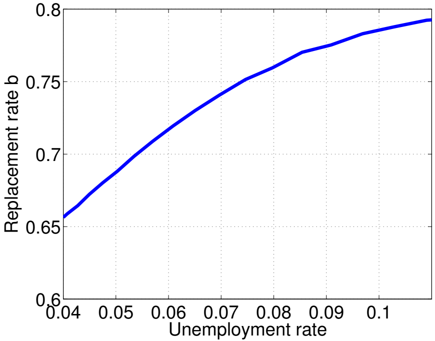
2. Optimal UI with Recessions and Job Rationing

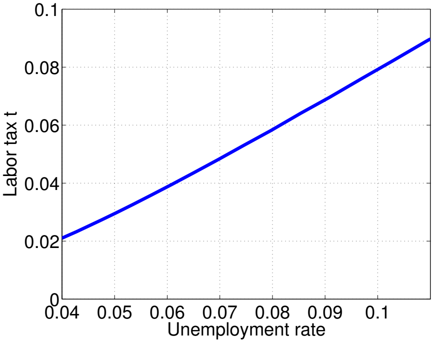
3. Extensions in a Dynamic Setting

Optimal UI: $\tau = c^u / c^e$

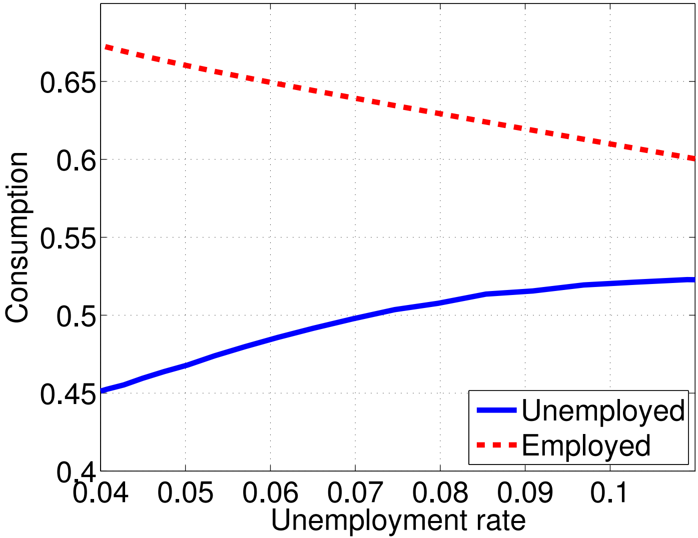


Optimal UI: b, t

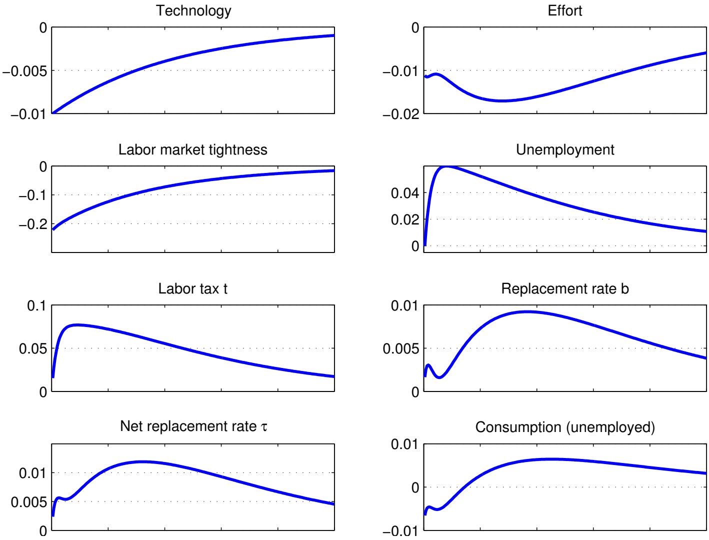




Optimal UI: c^e, c^u

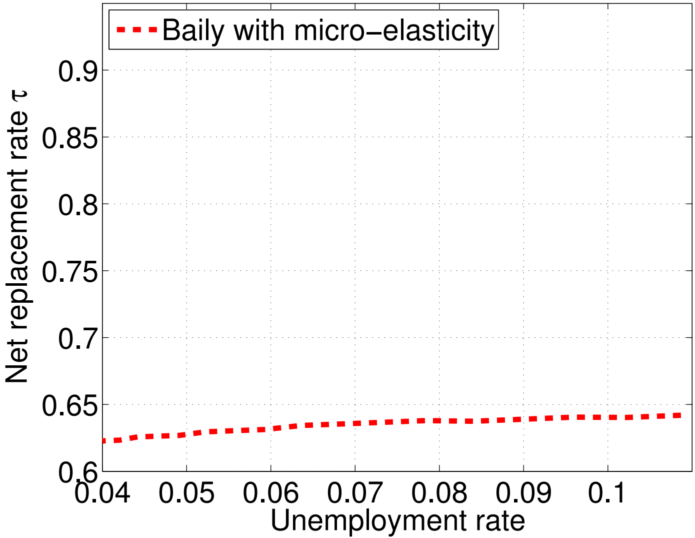


Response to Negative Technology Shock

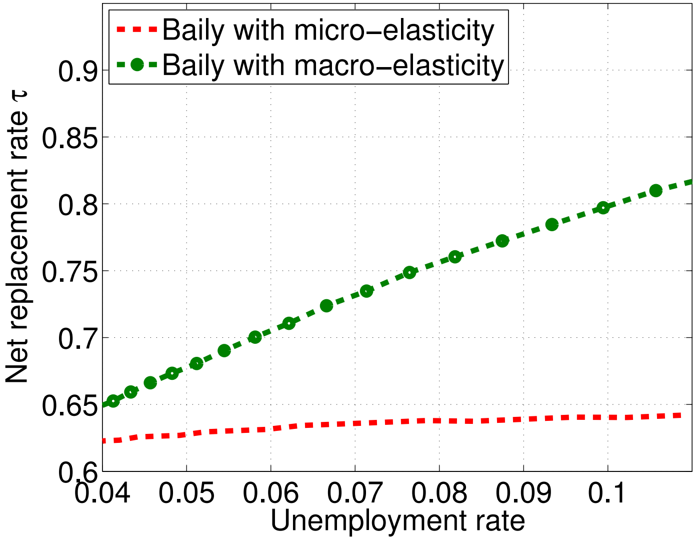


BACK-UP SLIDES

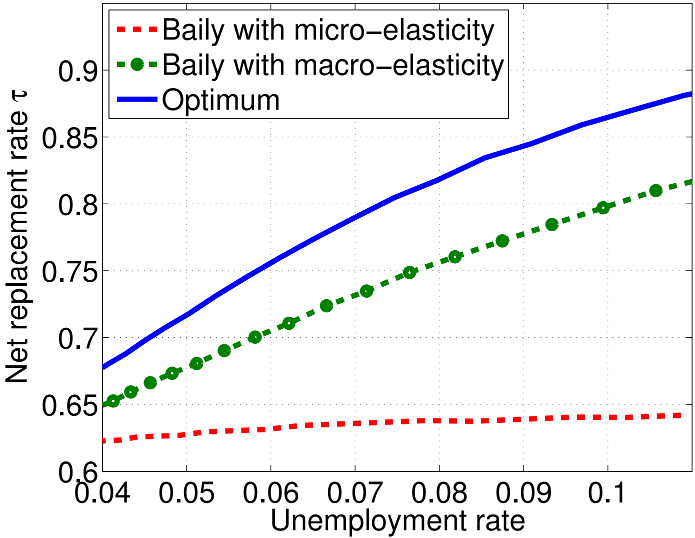
Decomposition of the Cyclicality of UI



Decomposition of the Cyclicality of UI



Decomposition of the Cyclicality of UI



Calibration: US, 1964–2010, Weekly

	Interpretation	Value	Source
η	U-elasticity of matching	0.7	Petrongolo and Pissarides (2001)
s	Separation rate	0.95%	JOLTS, 2000–2010
ω_m	Efficiency of matching	0.23	JOLTS, 2000–2010
ω_k	Cost of effort	0.87	Matches $\bar{e} = 1$
c	Recruiting costs	0.21	Microevidence: $0.32 \cdot \omega$
α	Returns to labor	0.67	Matches labor share$= 0.66$
γ	Real wage rigidity	0.5	Microevidence: $0.3 \leq \gamma \leq 0.7$
ω	Steady-state real wage	0.67	Matches unemployment$= 5.9\%$
σ	Risk aversion	1	Chetty (2006)
κ	Elasticity of cost of effort	1.8	Meyer (1990)