Optimal Unemployment Insurance over the Business Cycle

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Unemployment insurance debate

1. UI provides a safety net
2. UI reduces job search and raises unemployment
3. UI raises wages and raises unemployment
4. job search is irrelevant if firms do not hire much

- public-finance approach: $1 + 2$
- our approach: $1 + 2 + 3 + 4$

Public-finance approach [Baily, 1978]

- workers are initially unemployed
- workers search for a job with some effort
- workers find a job at rate f per unit of effort
- workers are risk averse but no self-insurance
- job-search effort is unobservable
- **limitation:** f is a fixed parameter

Our approach

- matching model of unemployment with firms
- job-finding rate f depends on tightness θ
- $\theta =$ recruiting effort / job-search effort
- θ depends on UI + business cycle
- **contribution:** optimal UI formula in sufficient statistics when f responds to UI + business cycle

Outline

1. **General matching model**
2. Optimal UI formula
3. Specific matching models
4. Quantitative exploration

A static model

- measure 1 of identical workers, initially unemployed
- measure 1 of identical firms
- workers and firms meet on frictional labor market
- **tightness θ= recruiting effort/job-search effort**

Summary of matching frictions

- unobservable job-search effort: e
- job-finding rate per unit of effort : $f(\theta)$
- **job-finding probability: $e \cdot f(\theta)$ with $f' > 0$**
- employees $= [1 + \tau(\theta)] \cdot$ producers
- **recruiters $=$ $\tau(\theta)\cdot$ producers with $\tau' > 0$**
- workers like θ, firms dislike θ

Workers

- given θ and UI, choose e to maximize

$$\underbrace{v(c^u)}_{\text{consumption utility}} + \underbrace{e \cdot f(\theta) \cdot [v(c^e) - v(c^u)]}_{\text{utility gain from search}} - \underbrace{k(e)}_{\text{search cost}}$$

- effort supply $e^s(\theta, UI)$ determines optimal effort:

$$k'(e^s) = f(\theta) \cdot [v(c^e) - v(c^u)]$$

- labor supply $l^s(\theta, UI)$ determines employment rate:

$$l^s(\theta, UI) = e^s(\theta, UI) \cdot f(\theta)$$

Firms

- number of employees $l >$ number of producers n
- given θ and wage w, choose n to maximize

$$\underbrace{y(n)}_{\text{production}} \quad - \quad \underbrace{w \cdot [1+\tau(\theta)] \cdot n}_{\text{wage of producers + recruiters}}$$

- labor demand $l^d(\theta, w)$ gives optimal employment:

$$\underbrace{y'\left(\frac{l^d}{1+\tau(\theta)}\right)}_{\text{MPL}} = \underbrace{[1+\tau(\theta)]}_{\text{matching wedge}} \cdot \underbrace{w}_{\text{real wage}}$$

Government

- UI provides c^u to unemployed workers
- UI provides $c^e > c^u$ to employed workers
- generosity of UI is replacement rate:

$$R \equiv 1 - \frac{c^e - c^u}{w} = \text{labor tax rate} + \text{benefit rate}$$

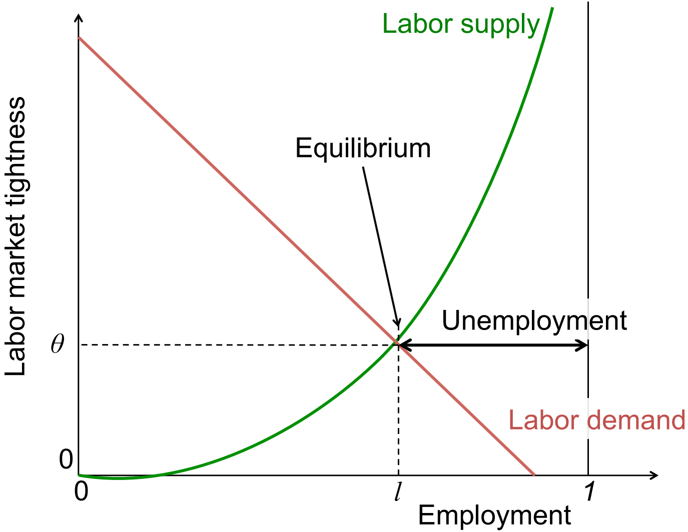
Equilibrium

- take UI policy as given
- equilibrium is (θ, w) such that supply $=$ demand:

$$l^s(\theta, UI) = l^d(\theta, w)$$

- 2 variables, 1 equation: wage w is indeterminate
- take general wage schedule: $w = w(\theta, UI)$
- **equilibrium tightness is $\theta(UI)$**

Equilibrium in (l, θ) plane



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Government's problem

- choose UI to maximize welfare

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

- subject to budget constraint

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

- subject to $e = e^s(\theta, UI)$, $l = l^s(\theta, UI)$, $\theta = \theta(UI)$

Social welfare maximization

- Lagrangian: $\mathscr{L} = \text{welfare} + \phi \cdot \text{budget}$
- first-order condition $d\mathscr{L}/dUI = 0$ implies

$$\left.\frac{\partial \mathscr{L}}{\partial UI}\right|_{\theta} + \left.\frac{\partial \mathscr{L}}{\partial \theta}\right|_{UI} \cdot \frac{d\theta}{dUI} = 0$$

- $\partial \mathscr{L}/\partial UI\big|_{\theta} = 0$ is Baily formula
- $\partial \mathscr{L}/\partial \theta\big|_{UI} = 0$ is generalized Hosios condition
- $d\theta/dUI$ can be expressed in sufficient statistics

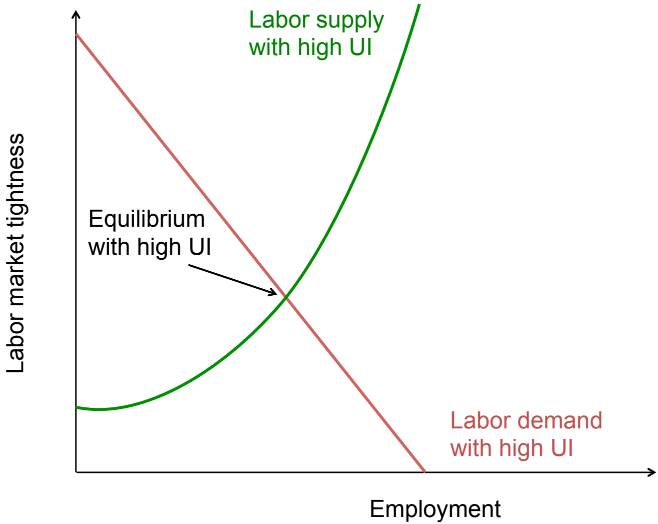
Baily formula

- optimal UI at constant θ satisfies

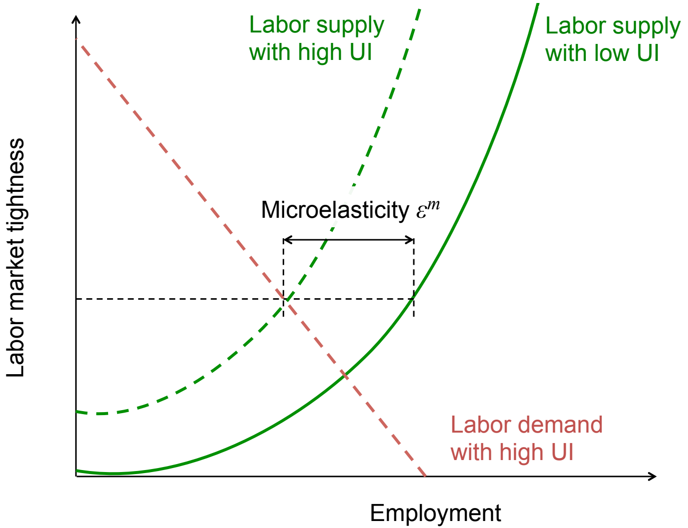
$$\underbrace{\frac{R}{1-R}}_{\text{UI generosity}} = \underbrace{\frac{l}{\varepsilon^m}}_{\text{moral hazard cost}} \cdot \underbrace{\left[\frac{v'(c^u)}{v'(c^e)} - 1\right]}_{\text{insurance value}}$$

- R: replacement rate of UI
- microelasticity ε^m: response of unemployment to UI at constant θ (only search effort responds)

Microelasticity in (l, θ) plane



Microelasticity in (l, θ) plane



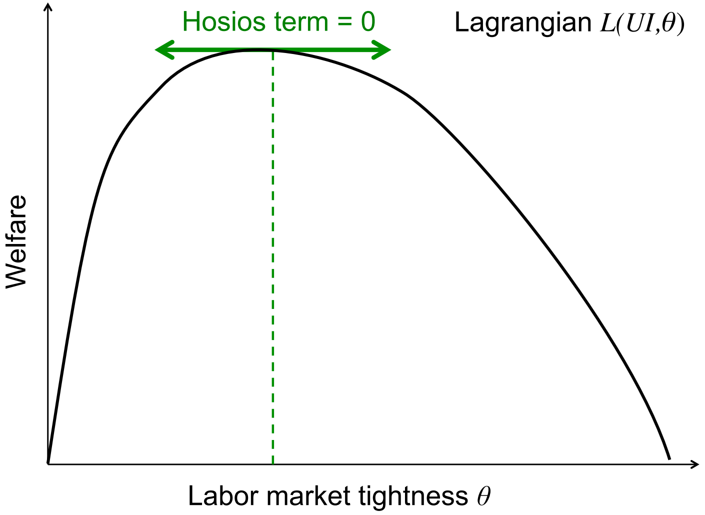
Generalized Hosios condition

- optimal θ at constant UI satisfies

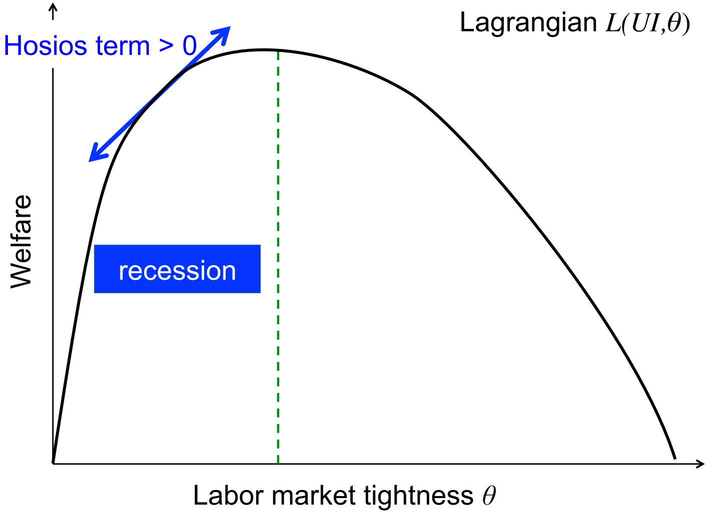
$$\frac{\Delta v}{\phi \cdot w} + R \cdot \left(1 + \varepsilon^d\right) - \frac{\eta}{1-\eta} \cdot \tau(\theta) = 0$$

- Δv: utility gain from employment
- η: curvature of matching function
- ε^d: discouraged-worker elasticity
- $\tau(\theta)$: business-cycle statistic

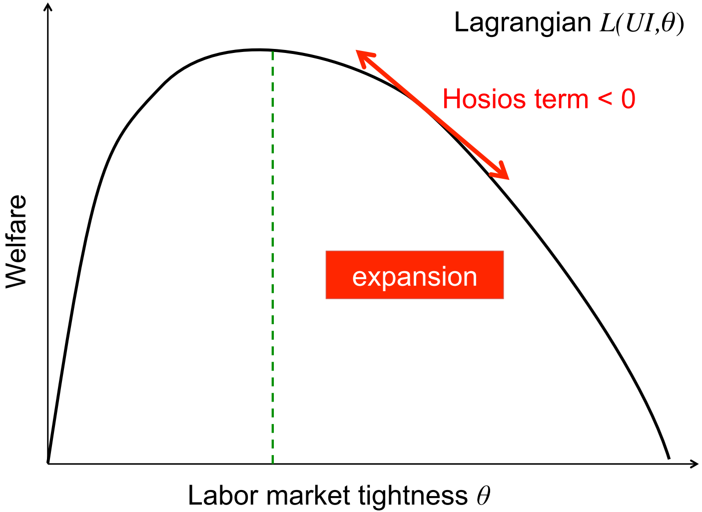
Hosios term over the business cycle



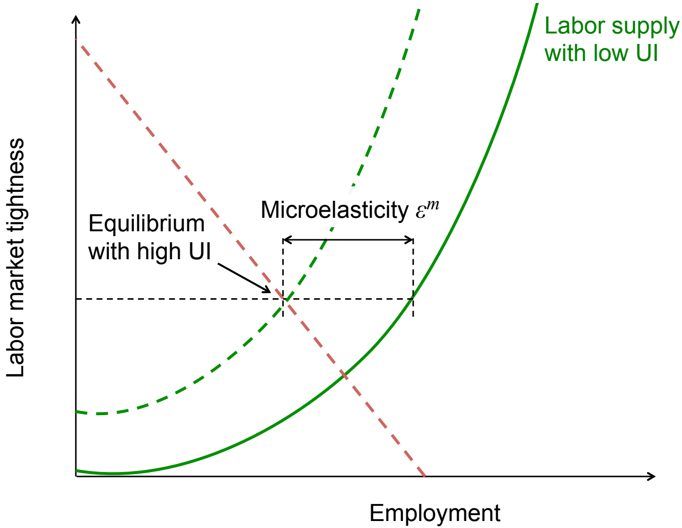
Hosios term over the business cycle



Hosios term over the business cycle



Microelasticity and macroelasticity



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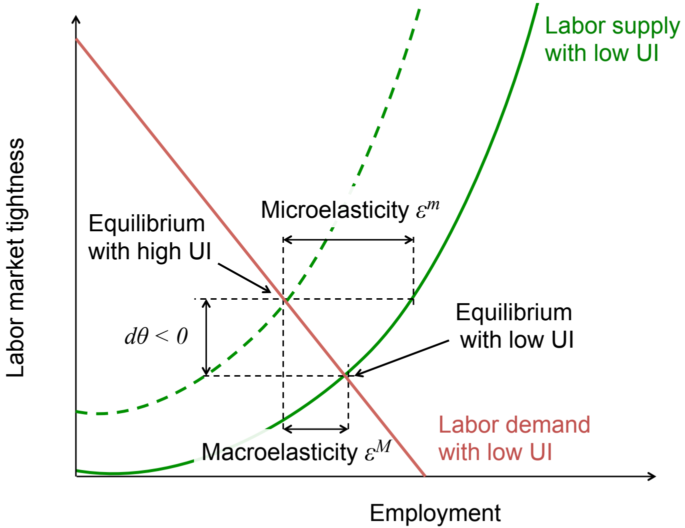

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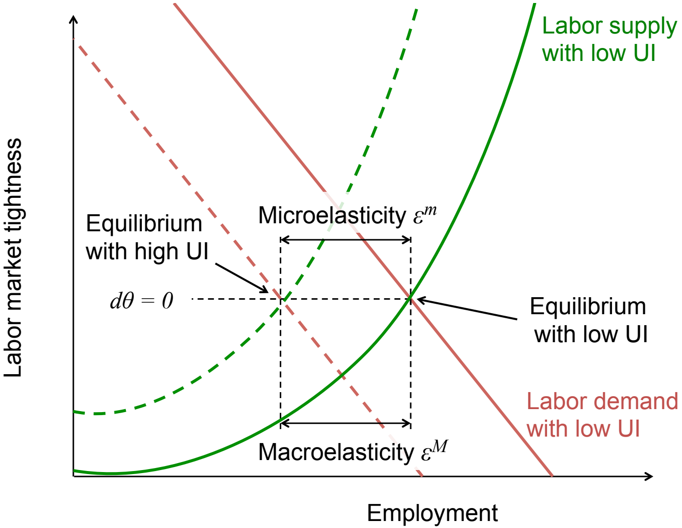

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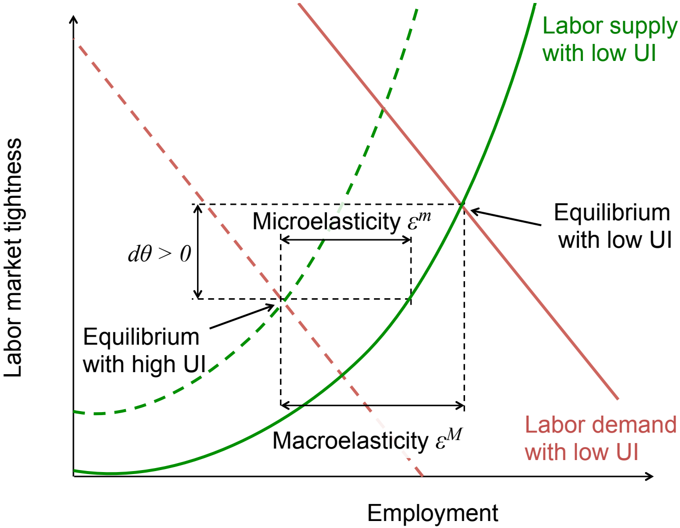
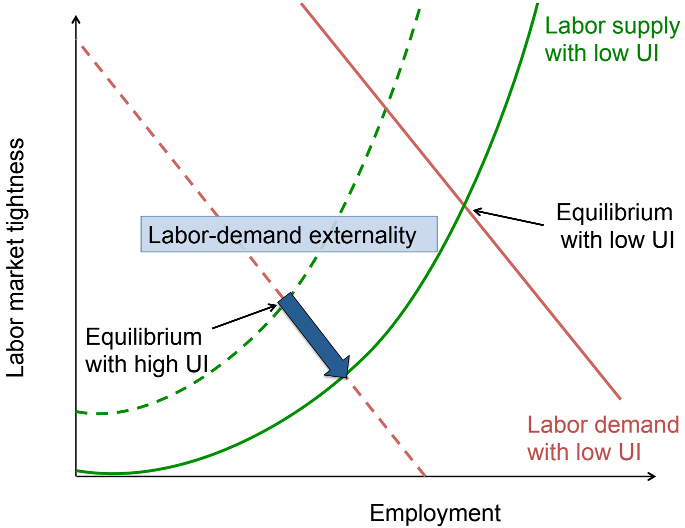


Externalities



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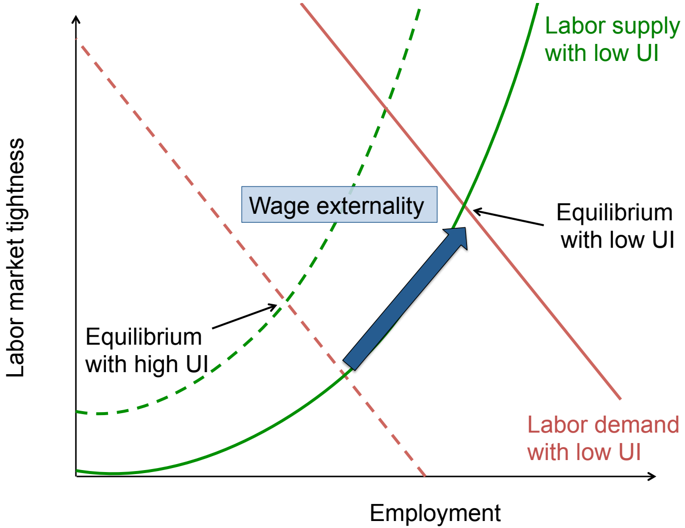

Elasticity wedge measures $d\theta/dUI$

- macroelasticity ε^M: response of employment to UI in general equilibrium (search effort + θ respond)
- $1-(\varepsilon^M/\varepsilon^m)>0$: lower UI $\Rightarrow$ lower θ
- $1-(\varepsilon^M/\varepsilon^m)=0$: UI does not influence θ
- $1-(\varepsilon^M/\varepsilon^m)<0$: lower UI $\Rightarrow$ higher θ

Optimal UI formula in general equilibrium

$$\underbrace{\frac{R}{1-R} = \text{Baily term}}_{0=\partial \mathscr{L}/\partial UI\big|_{\theta}} + \underbrace{P \cdot \left[1 - \frac{\varepsilon^M}{\varepsilon^m}\right]}_{d\theta/dUI} \cdot \underbrace{\text{Hosios term}}_{\partial \mathscr{L}/\partial \theta\big|_{UI}}$$

- R: replacement rate of UI
- $[d\theta/dUI] \cdot \left[\partial \mathscr{L}/\partial \theta\big|_{UI}\right]$: externality-correction term
- more UI than Baily if $[d\theta/dUI] \cdot \left[\partial \mathscr{L}/\partial \theta\big|_{UI}\right] > 0$
- more UI than Baily **if UI brings θ to optimum**

Optimal UI formula in general equilibrium

$$\frac{R}{1-R} = \text{Baily term} + \overbrace{P}^{+} \cdot \left[1 - \frac{\varepsilon^M}{\varepsilon^m}\right] \cdot \text{Hosios term}$$

- R: replacement rate of UI
- if $\left[1-(\varepsilon^M/\varepsilon^m)\right] \cdot \text{Hosios term} > 0$: UI above Baily
- if $\left[1-(\varepsilon^M/\varepsilon^m)\right] \cdot \text{Hosios term} = 0$: UI at Baily
- if $\left[1-(\varepsilon^M/\varepsilon^m)\right] \cdot \text{Hosios term} < 0$: UI below Baily

Optimal replacement rate vs. Baily rate

	$1-(\varepsilon^M/\varepsilon^m)$		
	$-$	0	$+$
recession	lower	same	higher
at Hosios	same	same	same
expansion	higher	same	lower

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3. **Specific matching models**
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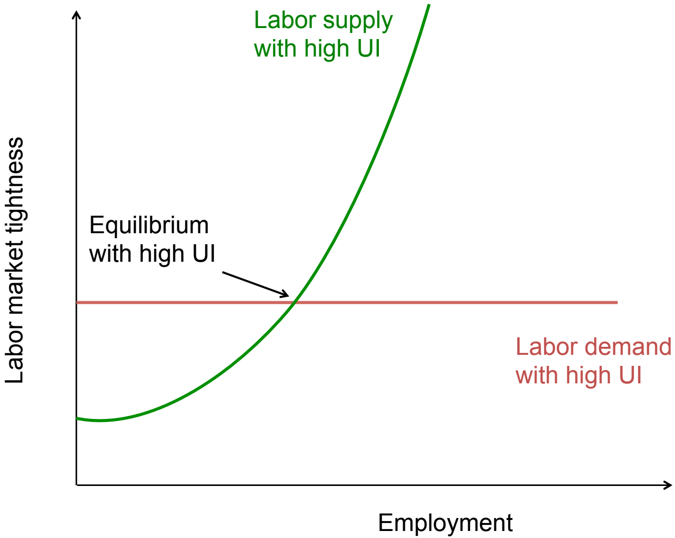
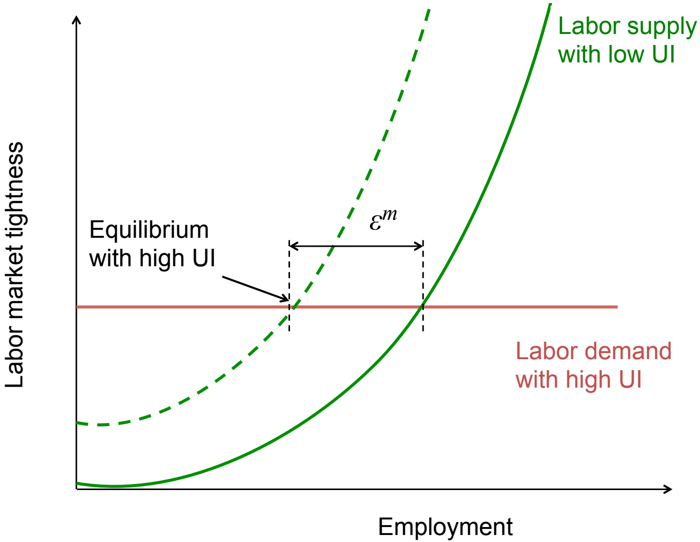
Three matching models

	Pissarides	**Hall**	**Michaillat**
production	linear	linear	concave
	$y(n) = n$	$y(n) = n$	$y(n) = n^{\alpha},\ \alpha < 1$
wage	Nash bargaining	rigid	rigid
	$w = w(\theta, UI)$	$w > 0$	$w > 0$
reference	Pissarides [1985]	Hall [2005]	Michaillat [2012]

Pissarides' model: $1-(\varepsilon^M/\varepsilon^m)<0$



Pissarides' model: $1 - (\varepsilon^M / \varepsilon^m) < 0$



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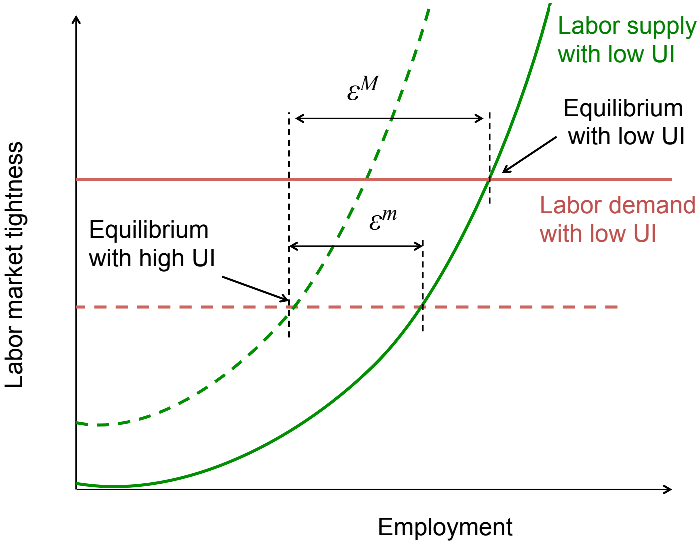
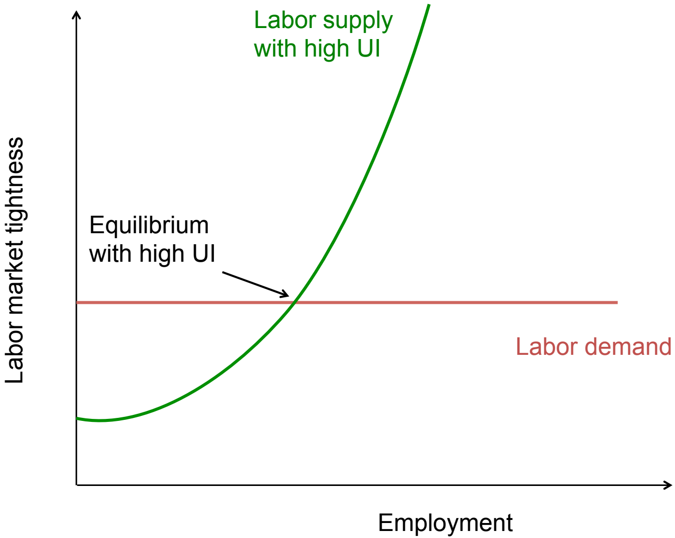


Hall's model: $1 - (\varepsilon^M / \varepsilon^m) = 0$



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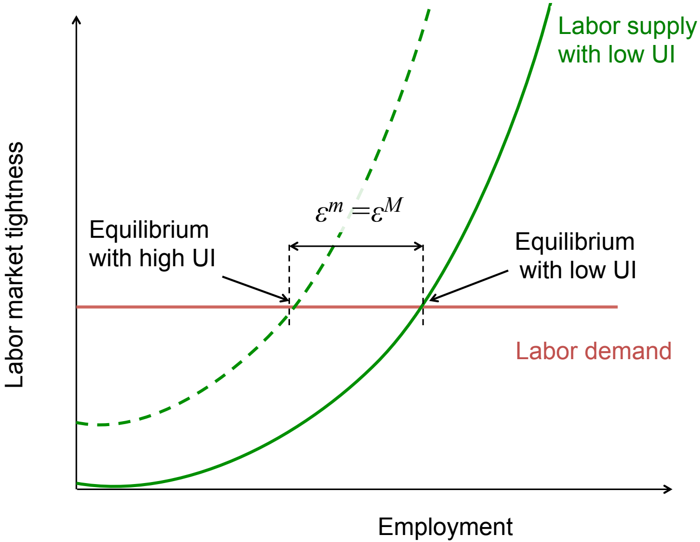
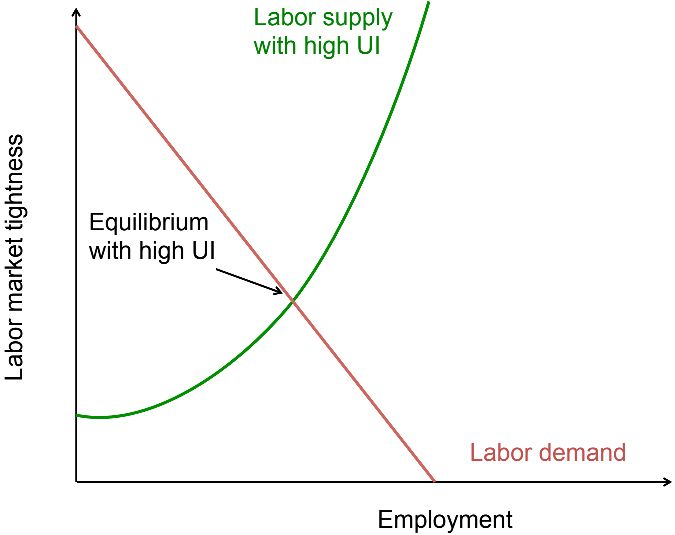


Michaillat's model: $1-(\varepsilon^M/\varepsilon^m)>0$



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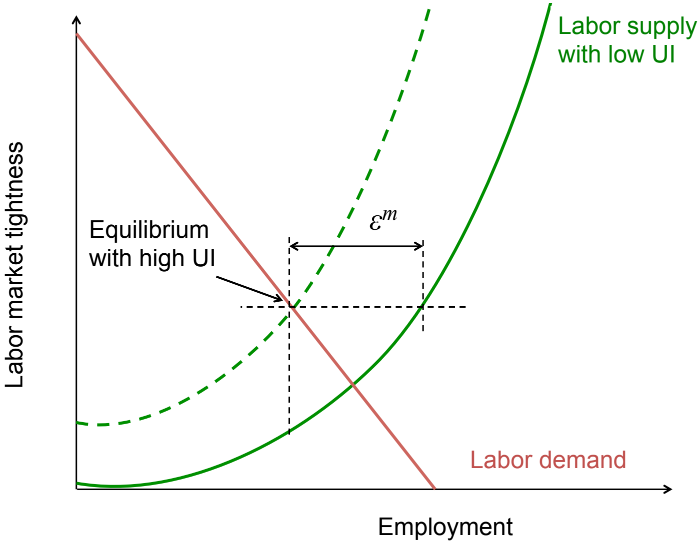
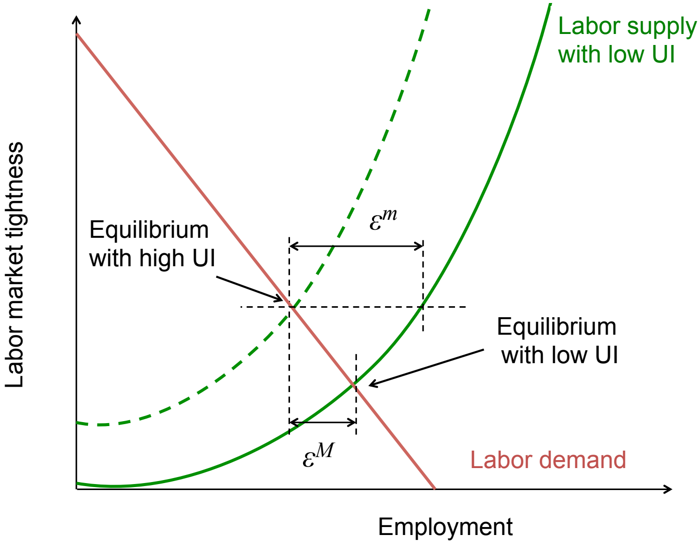


Michaillat's model: $1 - (\varepsilon^M / \varepsilon^m) > 0$



Optimal UI in various matching models

	Pissarides	**Hall**	**Michaillat**
wage ext.	yes	no	no
labor-demand ext.	no	no	yes
$1-(\varepsilon^M/\varepsilon^m)$	$-$	0	$+$
optimal UI	procyclical	acyclical	countercyclical

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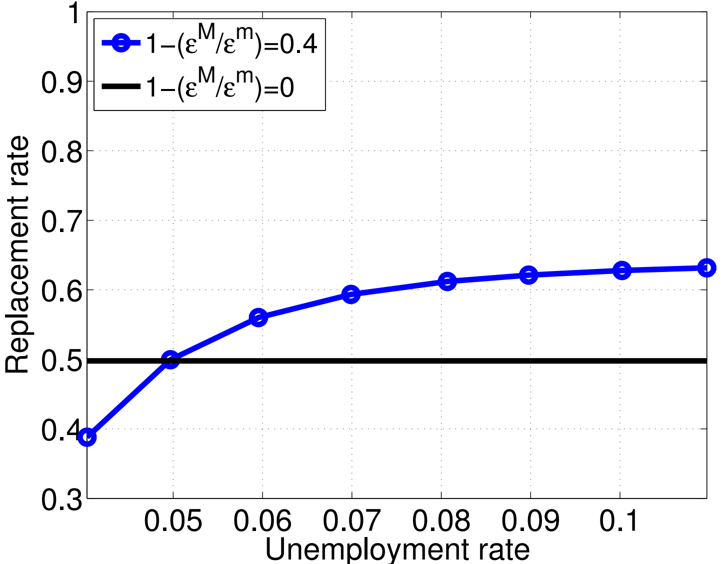
Empirical strategy

- microelasticity: increase in probability of unemployment when **individual UI** increases
- macroelasticity: increase in aggregate unemployment when **aggregate UI** increases

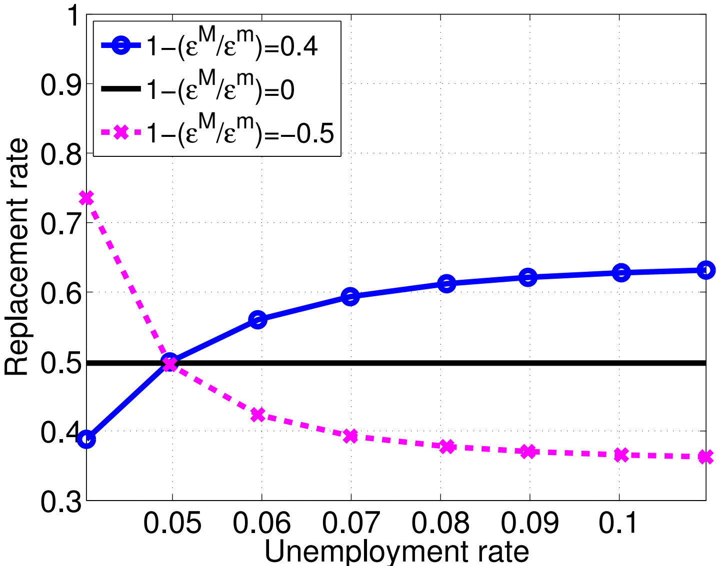
Elasticity wedge estimates

- Crepon, Duflo, Gurgand, Rathelot, and Zamora [QJE, 2013] for France
  - treatment: job-search assistance
  - labor-demand externality only
  - $\mathbf{1 - (\varepsilon^M / \varepsilon^m) = 0.37 > 0}$
- Lalive, Landais, and Zweimüller for Austria
  - treatment: increase UI duration from 52 to 209 weeks
  - labor-demand and wage externality
  - $\mathbf{1 - (\varepsilon^M / \varepsilon^m) = 0.35 > 0}$

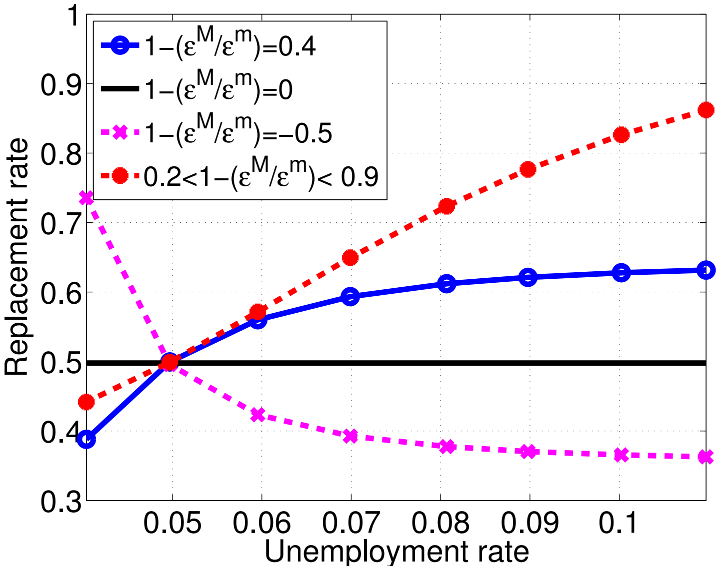
Optimal UI over the business cycle



Optimal UI over the business cycle



Optimal UI over the business cycle



Future research

1. empirical estimates of elasticity wedge $1-(\varepsilon^{M}/\varepsilon^{m})$
2. optimal macro policies over the business cycle
    - fiscal policy, insurance programs, monetary policy
    - formula for policy τ takes form

$$0 = \text{PF term} + \frac{d\theta}{d\tau} \cdot \text{Hosios term}$$

    - PF term $= \partial SW/\partial\tau\big|_{\theta}$ and Hosios term $= \partial SW/\partial\theta\big|_{\tau}$
    - see Michaillat and Saez [2013]

BACKUP

Matching frictions

- measure 1 of workers, initially unemployed
- job-search effort (unobservable): e
- number of vacancies: o
- constant-returns matching function: $m(\cdot,\cdot)$
- number of matches: $l = m(e,o) \leq 1$
- labor market tightness: $\theta \equiv o/e$
- vacancy-filling proba.: $q(\theta) = l/o = m(1/\theta, 1)$
- job-finding rate: $f(\theta) = l/e = m(1, \theta)$
- job-finding proba.: $e \cdot f(\theta)$

Matching cost

posting each vacancy requires r workers:

$$\underbrace{l}_{\text{employees}} = \underbrace{n}_{\text{producers}} + \underbrace{r \cdot o}_{\text{recruiters}} = n + r \cdot \frac{l}{q(\theta)}$$

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

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

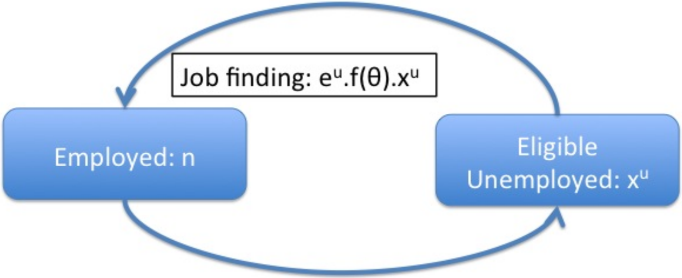
$$\Rightarrow \text{employees} = [1 + \tau(\theta)] \cdot \text{producers}$$

Formula in dynamic model

$$\frac{w}{\Delta c} - 1 \approx \frac{1}{\varepsilon^m}\left(\frac{c^e}{c^u} - 1\right) + \frac{1}{1+\varepsilon^d}\left(1 - \frac{\varepsilon^M}{\varepsilon^m}\right) \times \left[\frac{\ln(c^e/c^u)}{1 - c^u/c^e} + \left(1+\varepsilon^d\right)\left(\frac{w}{\Delta c} - 1\right) - \frac{\eta}{1-\eta}\frac{w}{\Delta c}\frac{\tau(\theta)}{u}\right]$$

- solve for replacement rate $1 - (\Delta c/w)$
- exogenous sufficient statistics: ε^d, ε^M, ε^m, η, $\tau(\theta)/u$
- $1 - (\varepsilon^M/\varepsilon^m)$ **measures labor-demand & wage externality**
- $\tau(\theta)/u$ **measures business cycle**

Flows in finite-duration model



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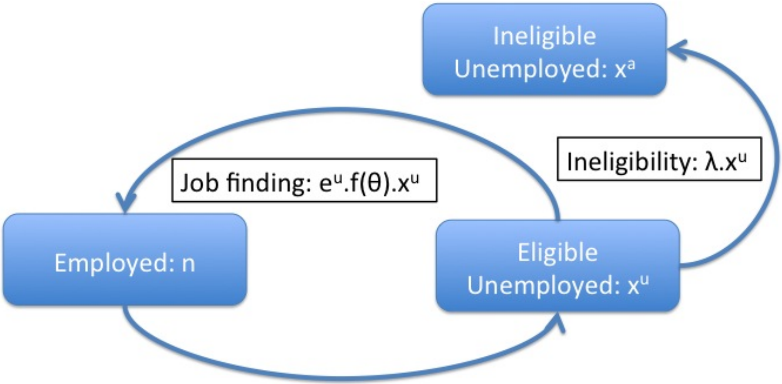

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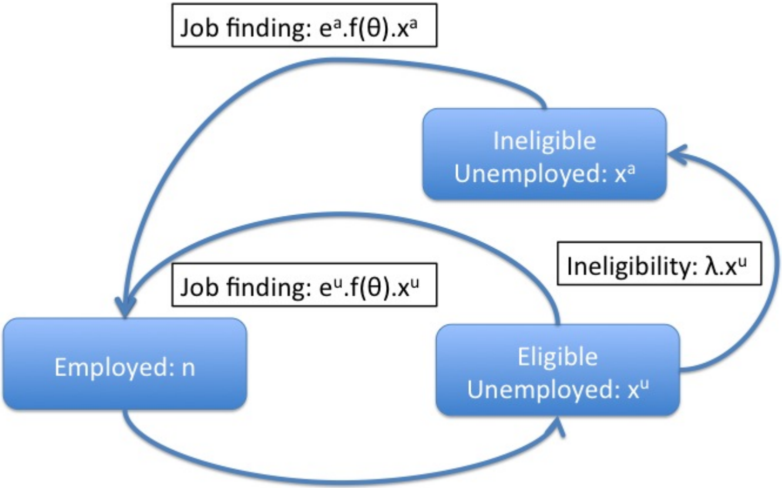

Countercyclical arrival rate of ineligibility