A Macroeconomic Approach to Optimal Unemployment Insurance: Theory and Applications

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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:
  - $R \equiv 1 - (c^e - c^u)/w$
  - $R =$ tax rate $+$ 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: $l = m(\underset{+}{e}, \underset{+}{v})$
- **labor market tightness:** $\theta \equiv v/e$

Matching probabilities

- vacancy-filling probability:

$$q(\underset{-}{\theta}) \equiv \frac{l}{v} = m\left(\frac{1}{\theta}, 1\right)$$

- job-finding rate per unit of effort:

$$f(\underset{+}{\theta}) \equiv \frac{l}{e} = m(1, \theta)$$

- **job-finding probability:** $e \cdot f(\underset{+}{\theta}) < 1$

Matching cost: ρ recruiters per vacancy

- **employees =** $\left[1+\underset{+}{\tau(\theta)}\right]\cdot$ **producers**
- proof:

$$\underbrace{l}_{\text{employees}} = \underbrace{n}_{\text{producers}} + \underbrace{\rho \cdot v}_{\text{recruiters}}$$

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

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

Representative worker

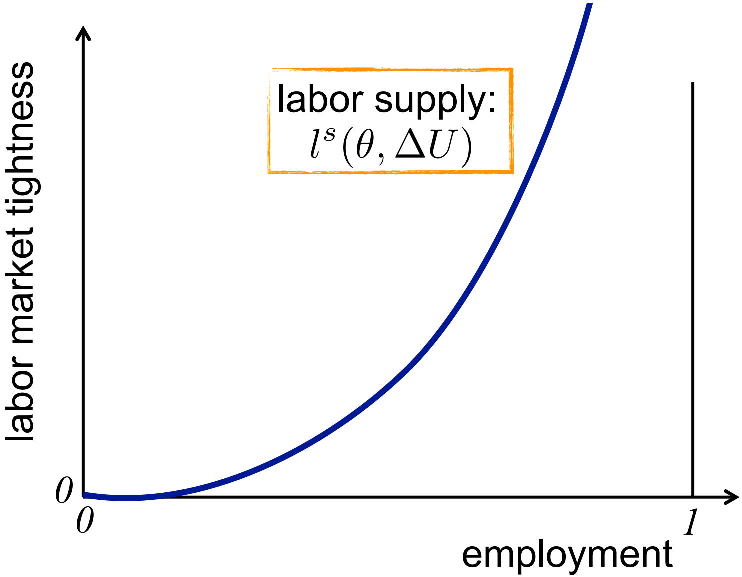
- consumption utility $U(c)$, search disutility $\psi(e)$
- **utility gain from work:** $\Delta U \equiv U(c^e) - U(c^u)$
- solves $\max_e \{U(c^u) + e \cdot f(\theta) \cdot \Delta U - \psi(e)\}$
- **effort supply** $e^s(\underset{+}{\theta}, \underset{+}{\Delta U})$ gives optimal effort:

$$\psi'(e^s(\theta, \Delta U)) = f(\theta) \cdot \Delta U$$

- **labor supply** $l^s(\underset{+}{\theta}, \underset{+}{\Delta U})$ gives employment rate:

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

Labor supply

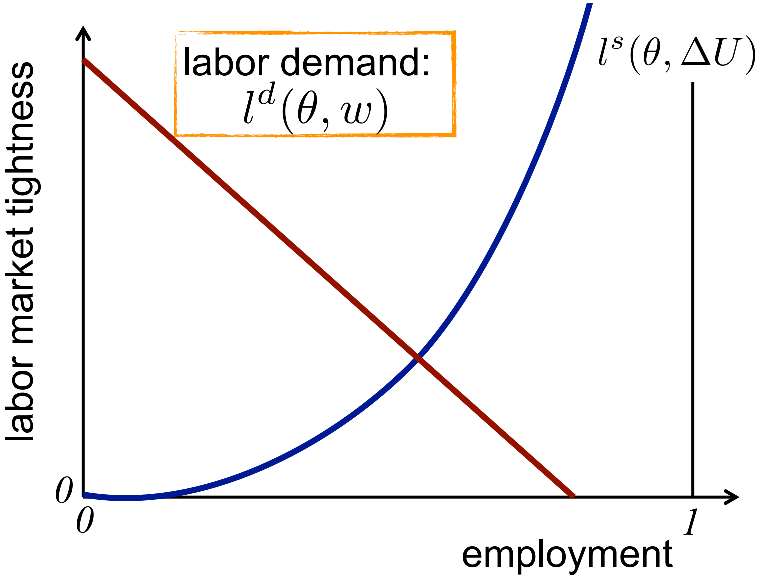


Representative firm

- 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** $l^d(\underline{\theta}, \underline{w})$ gives optimal employment:

$$y'\left(\frac{l^d}{1+\tau(\theta)}\right) = (1+\tau(\theta)) \cdot w$$

Labor demand



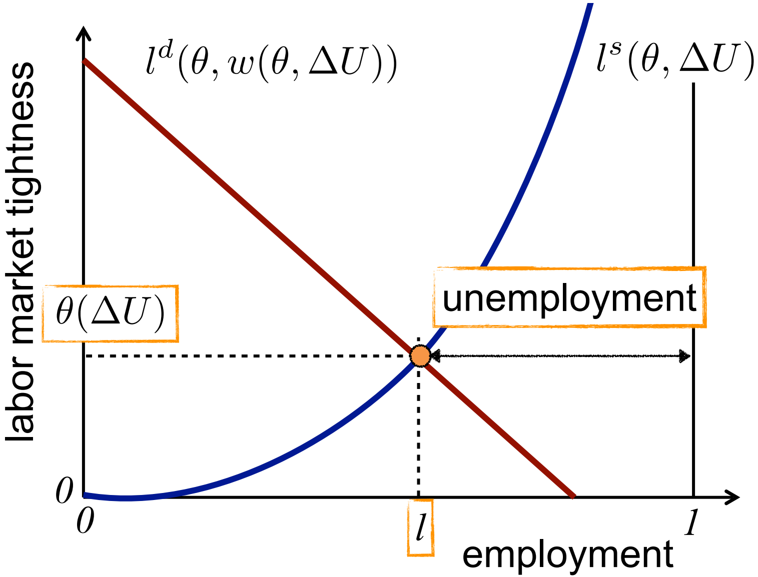
Labor-market equilibrium

- as in any matching model, need a price mechanism
  - **general wage schedule:** $w = w(\theta, \Delta U)$
- in equilibrium, θ 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



Sufficient-statistics formula for optimal UI

Government's problem

choose ΔU 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: $e = e^s(\theta, \Delta U)$, $l = l^s(\theta, \Delta U)$
- **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:

$$0 = \underbrace{\left.\frac{\partial SW}{\partial \Delta U}\right|_{\theta}}_{\text{Baily-Chetty formula}} + \underbrace{\left.\frac{\partial SW}{\partial \theta}\right|_{\Delta U} \cdot \frac{d\theta}{d\Delta U}}_{\text{correction term}}$$

Optimal UI versus Baily-Chetty

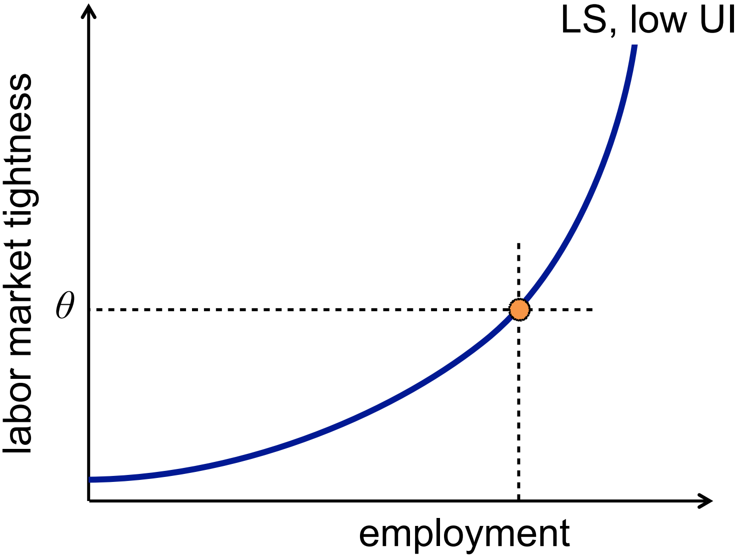
- Baily-Chetty formula is valid if UI has no effect on θ or θ is efficient (that is, $\partial SW/\partial\theta\big|_{\Delta U} = 0$)
- optimal UI departs from Baily-Chetty if UI affects θ and θ is inefficient (that is, $\partial SW/\partial\theta\big|_{\Delta U} \neq 0$)
  - **optimal UI $>$ Baily-Chetty iff UI brings θ closer to its efficient level**
- government UI beneficial when Baily-Chetty invalid

Baily-Chetty formula

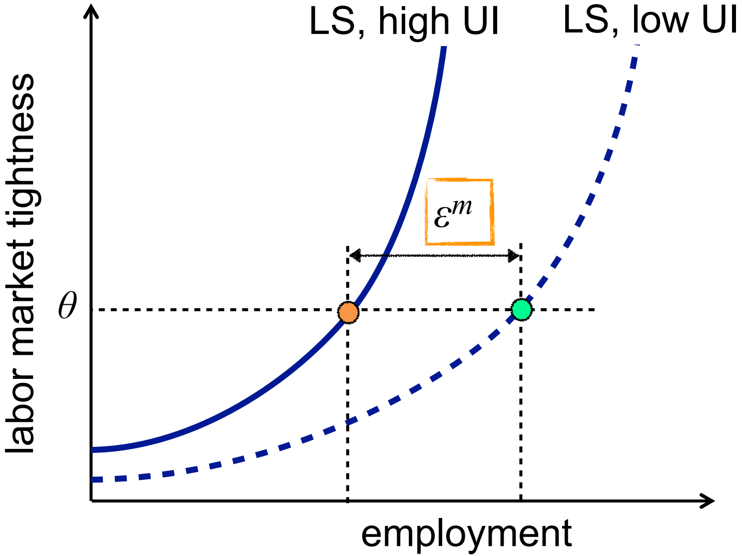
$$R = R^* \left(\varepsilon^m, \frac{U'(c^u)}{U'(c^e)} \right)$$

- $\varepsilon^m > 0$: microelasticity of unemployment wrt UI
  - measures disincentive from search
- $U'(c^u)/U'(c^e) > 1$: ratio of marginal utilities
  - measures need for insurance
- R^* is decreasing in ε^m
- R^* is increasing in $U'(c^u)/U'(c^e)$

Microelasticity of unemployment



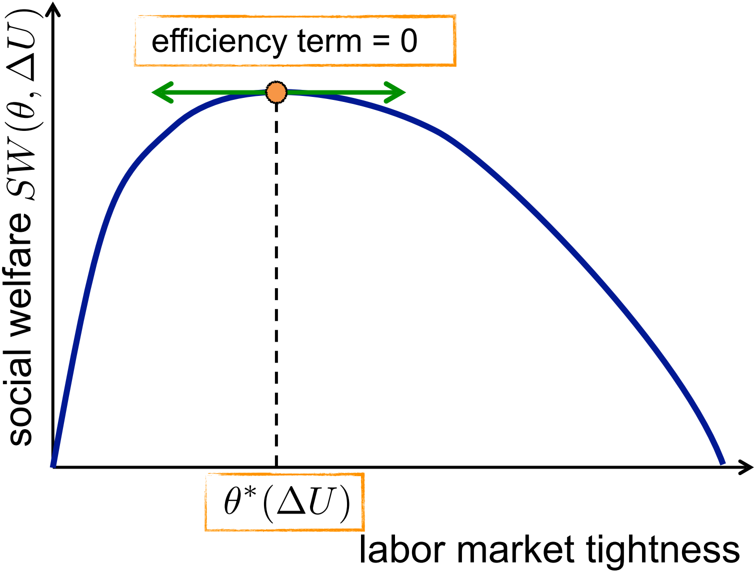
Microelasticity of unemployment



Efficiency term $\partial SW/\partial\theta\big|_{\Delta U}$

- depends on several estimable statistics
  - $\tau(\theta)$: recruiter-producer ratio
  - u: unemployment rate
  - $1-\eta$: elasticity of the job-finding rate $f(\theta)$
  - ΔU: the utility gain from work
- indicates the state of the labor market

Efficiency term and efficient tightness



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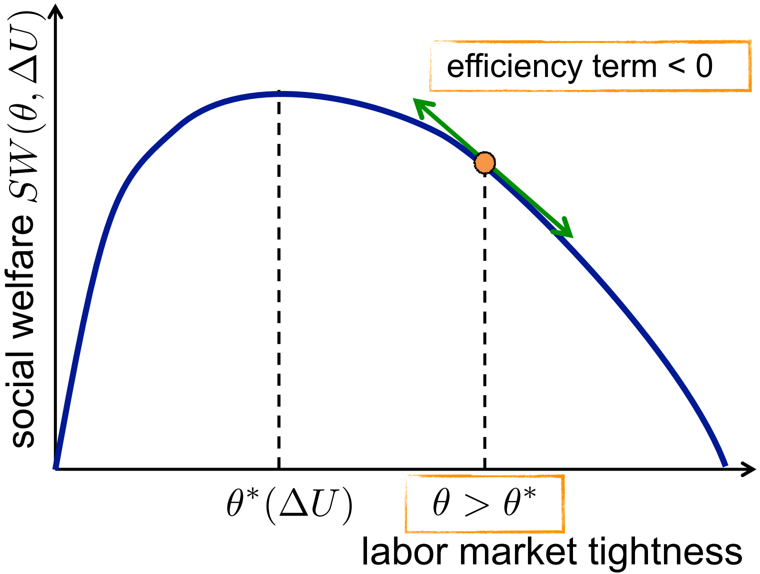

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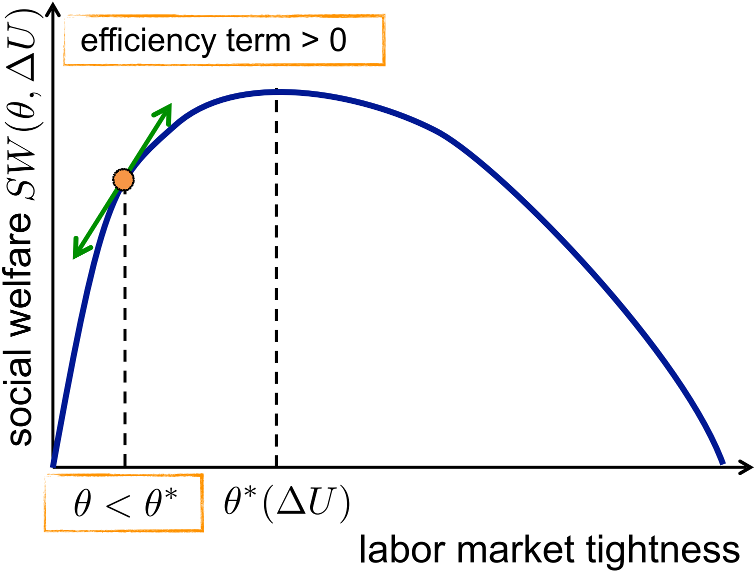
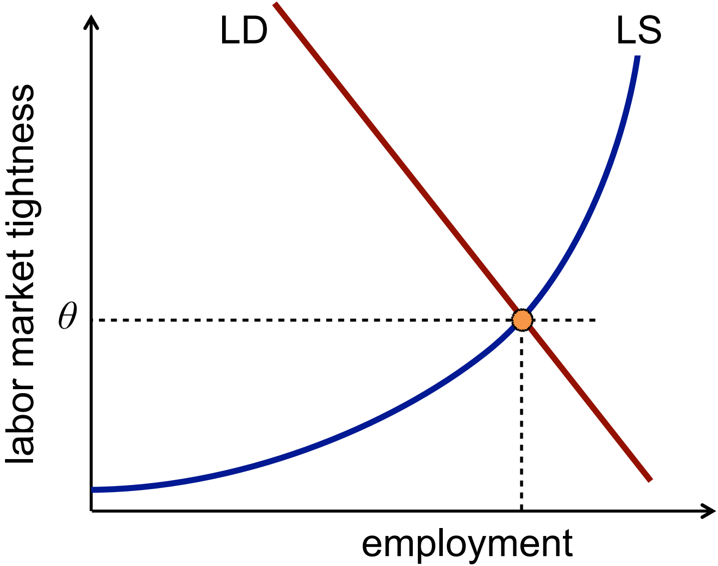


Macroelasticity of unemployment



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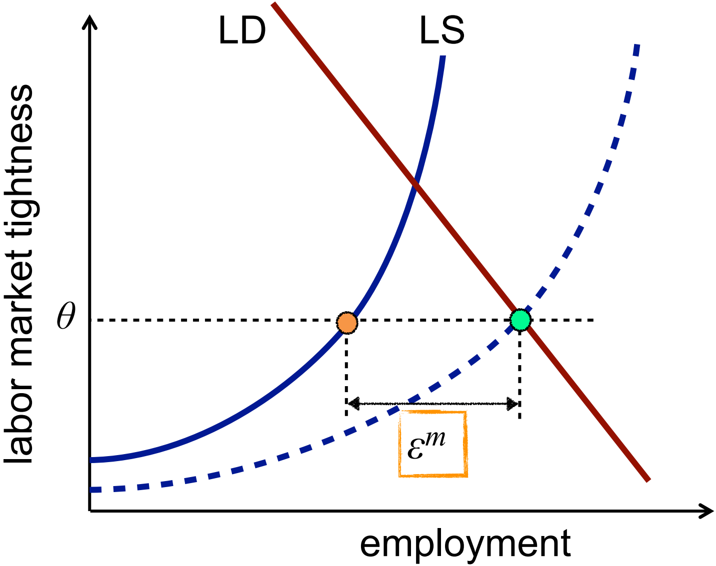

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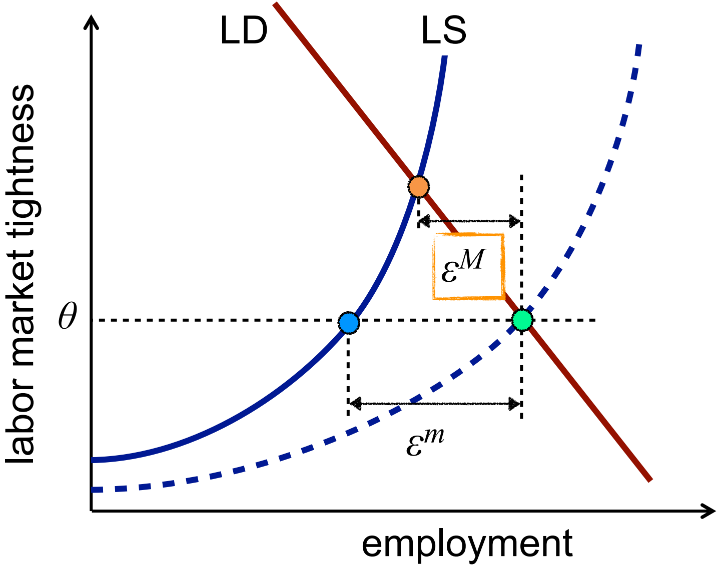
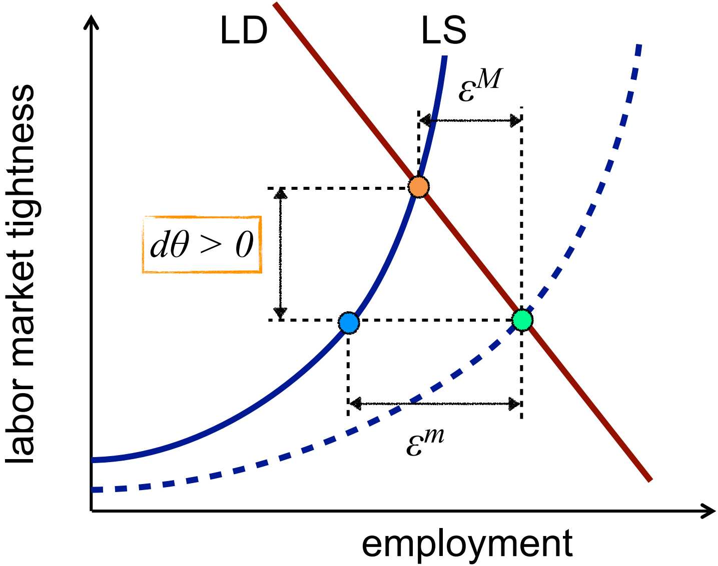


$1-\varepsilon^M/\varepsilon^m$ gives effect of UI on θ



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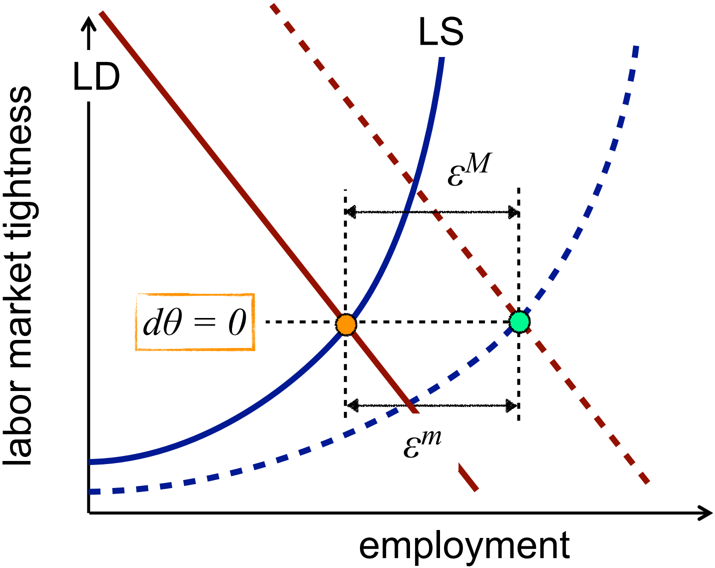
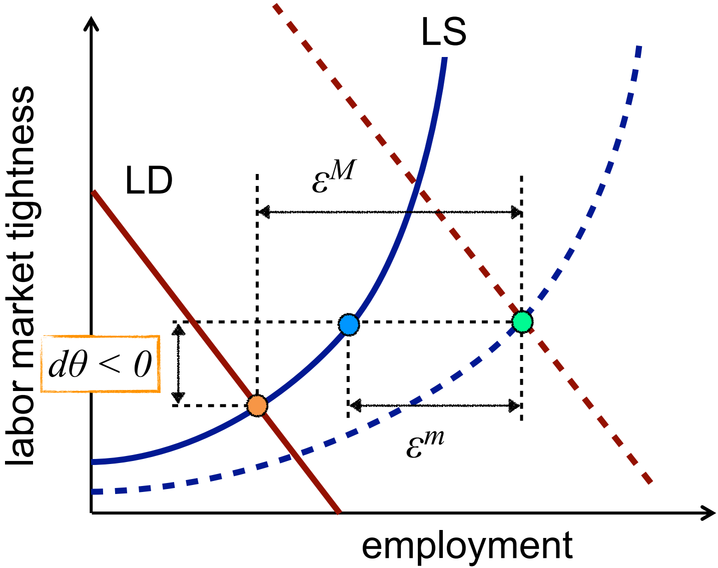


$1 - \varepsilon^M / \varepsilon^m$ gives effect of UI on θ



Optimal UI formula in sufficient statistics

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

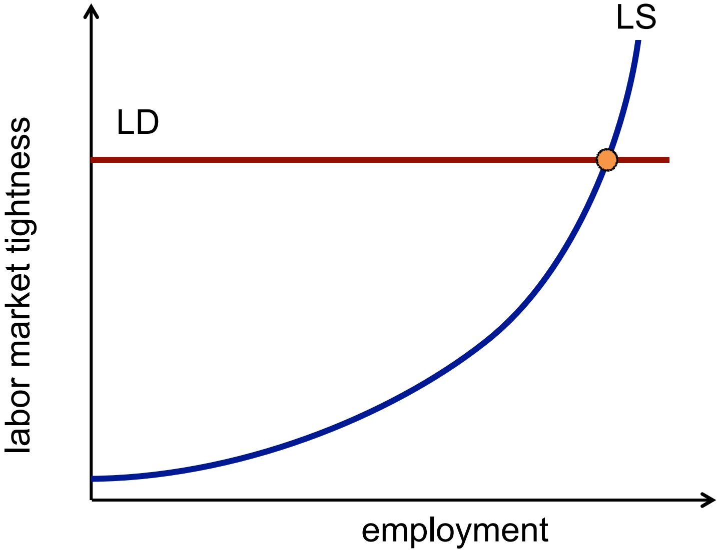
- $R \neq R^*\left(\varepsilon^M, U'(c^u)/U'(c^e)\right)$
- ε^M alone is not useful for optimal UI
- efficiency term fluctuates with θ
    - optimal UI over the business cycle
    - importance of $1 - \varepsilon^M/\varepsilon^m$

Optimal UI over the business cycle: theory

Three matching models

	model		
	standard	rigid-wage	job-rationing
prod. function	linear	linear	concave
wage	bargaining	rigid	rigid
reference	Pissarides [2000]	Hall [2005]	Michaillat [2012]

Standard model: $1-\varepsilon^M/\varepsilon^m<0$



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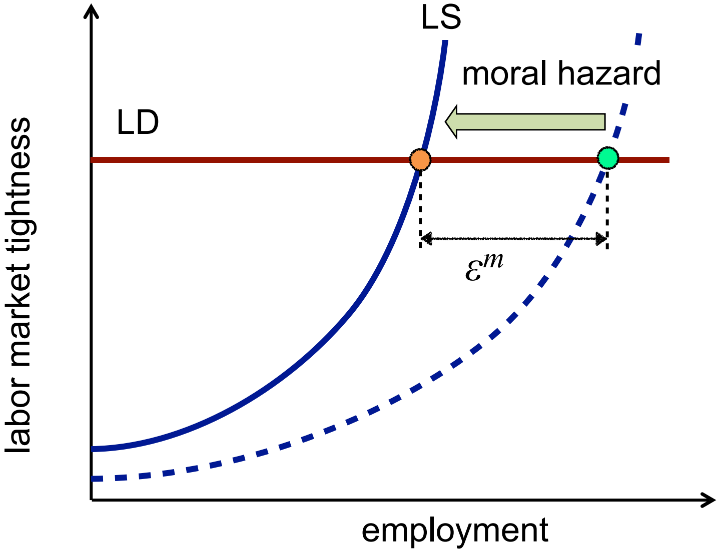

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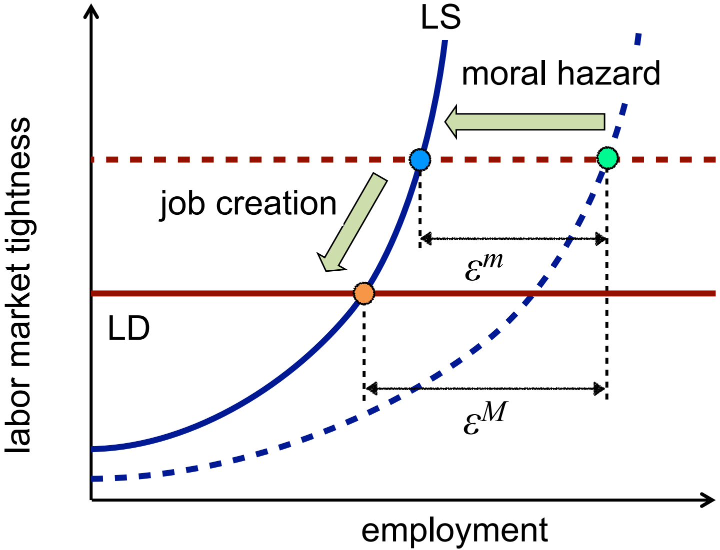
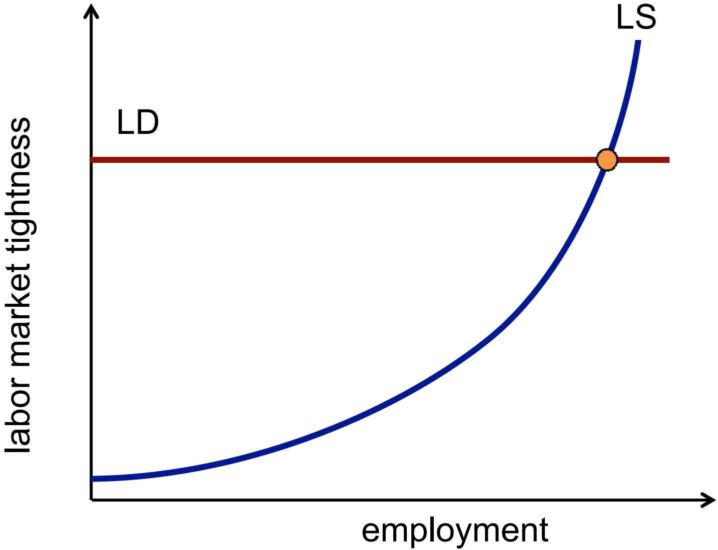


Rigid-wage model: $1 - \varepsilon^M / \varepsilon^m = 0$



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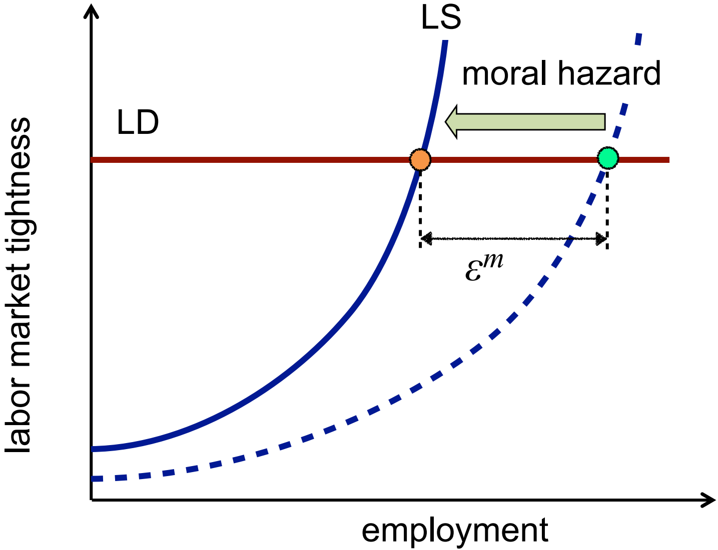

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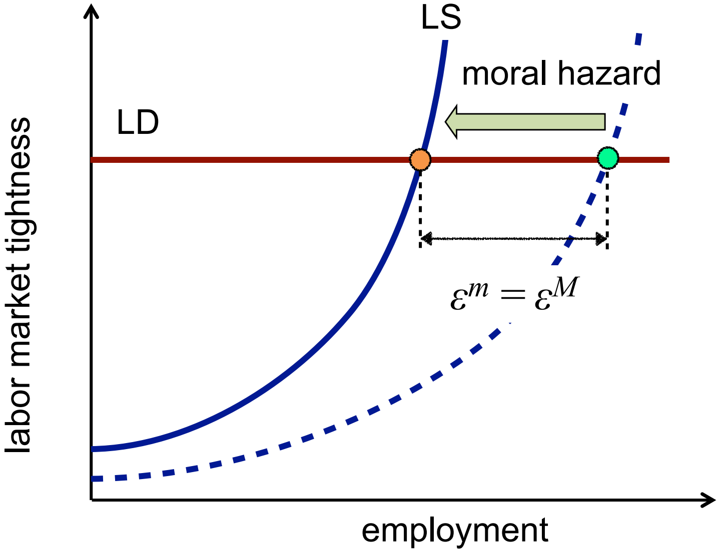
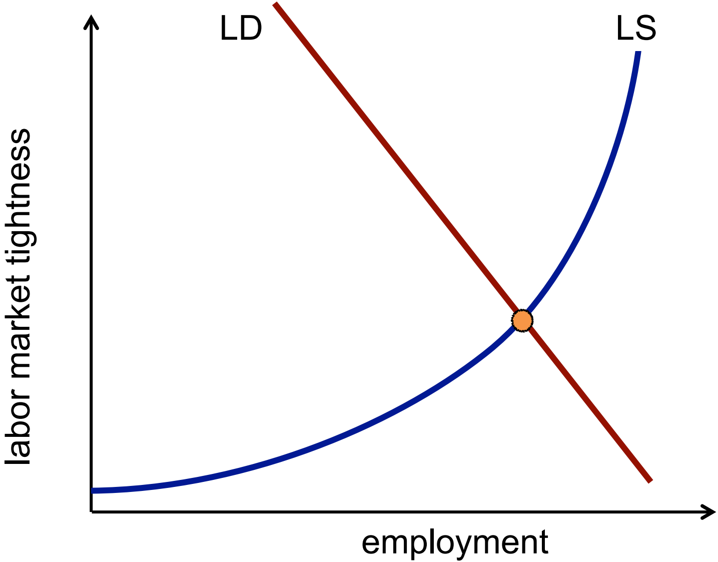
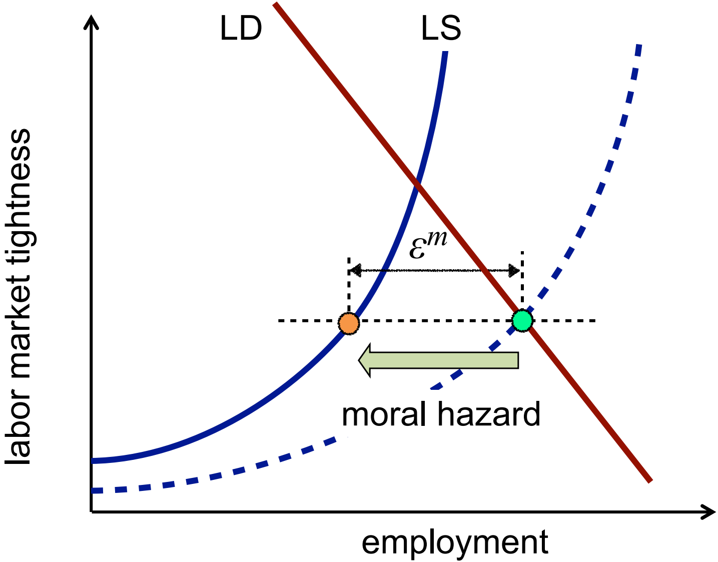


Job-rationing model: $1 - \varepsilon^M / \varepsilon^m > 0$



Job-rationing model: $1-\varepsilon^M/\varepsilon^m > 0$



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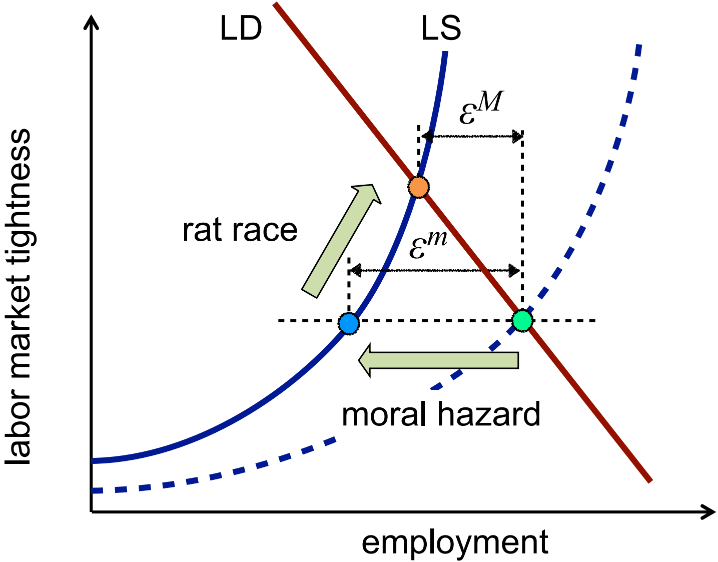


Cyclicality of optimal UI: theory

- **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

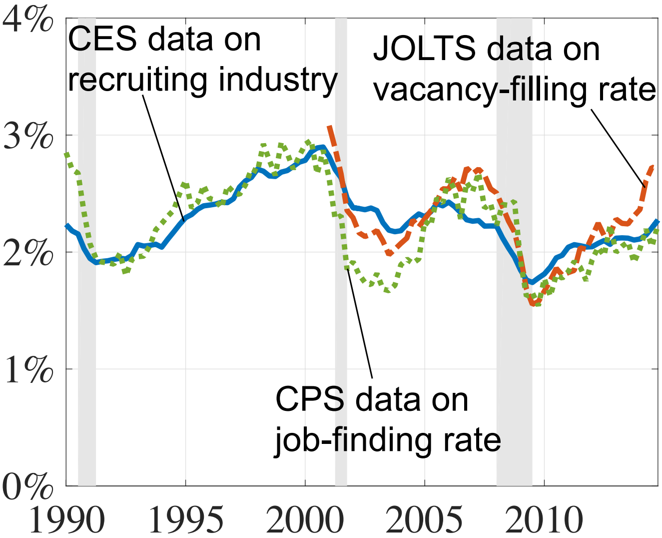
Direct evidence: $1-\varepsilon^M/\varepsilon^m>0$

- 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

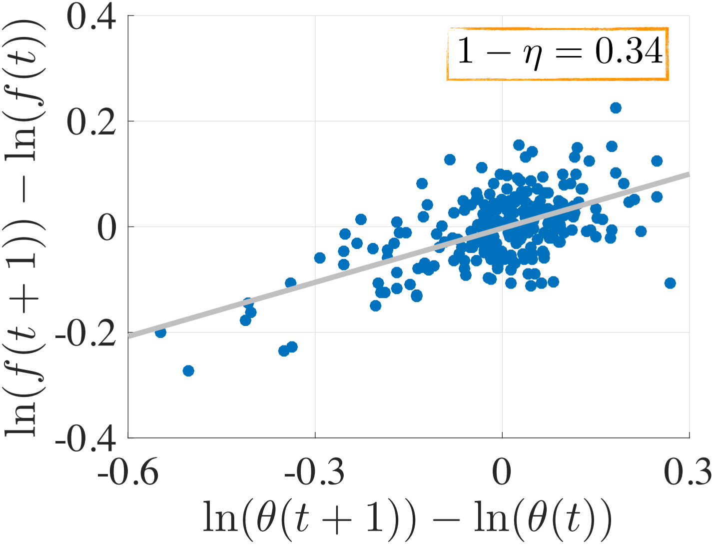
Indirect evidence: $1 - \varepsilon^M / \varepsilon^m > 0$

- 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 $\tau(\theta)$



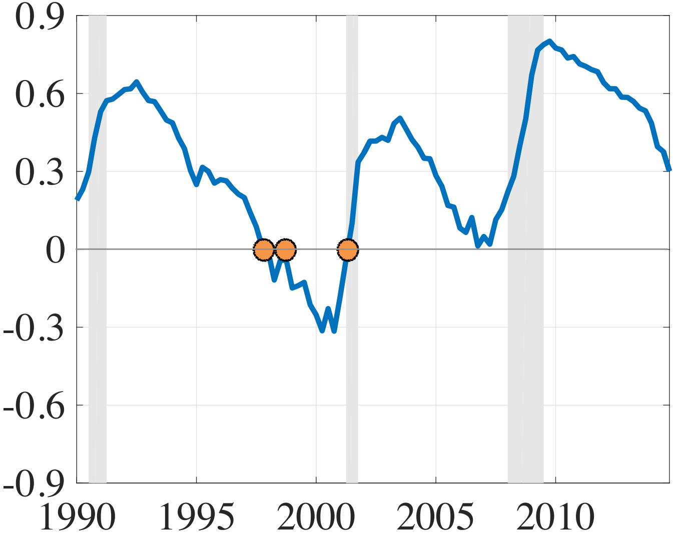
Elasticity of matching function η



Utility gain from work ΔU

- 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



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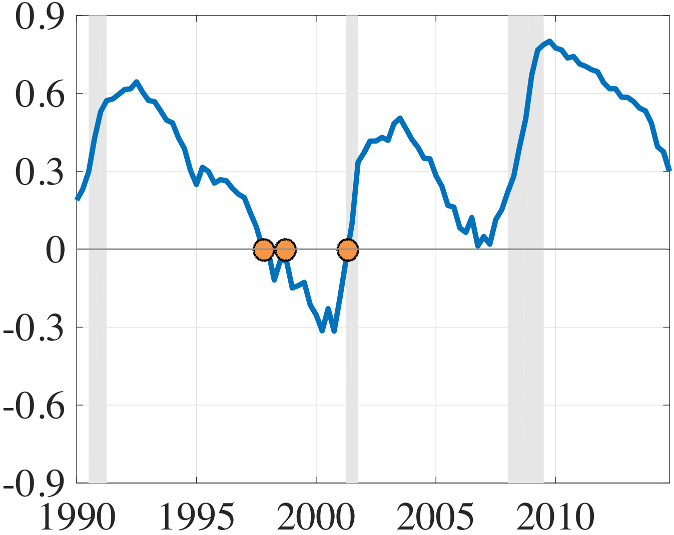
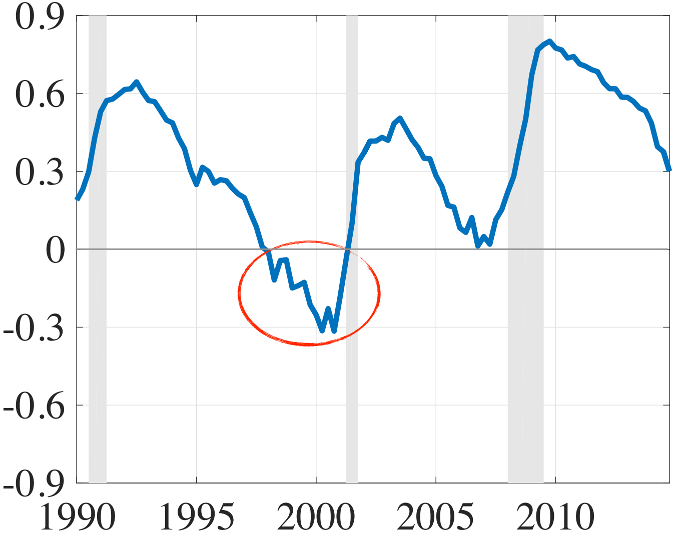
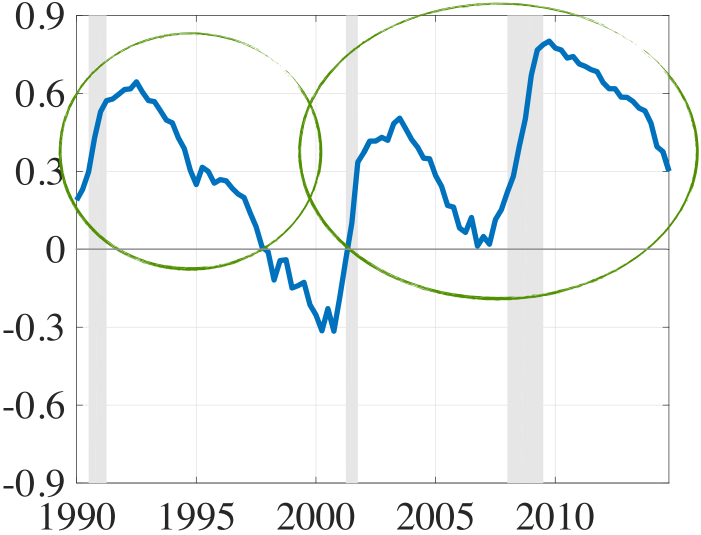


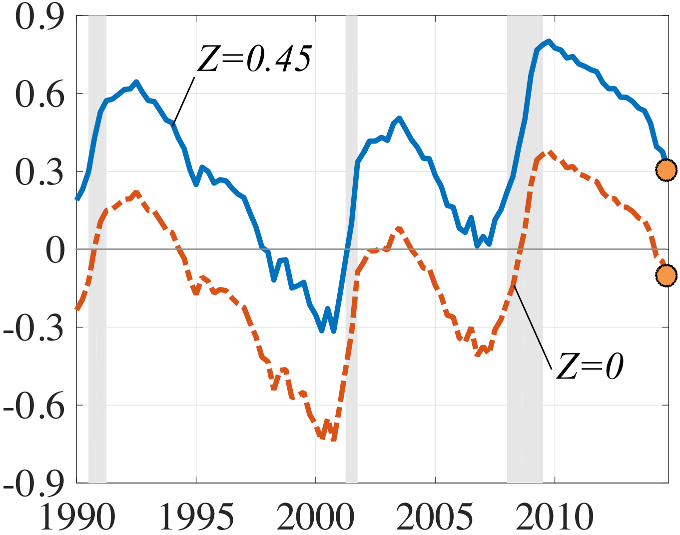
Efficiency term < 0: UI $<$ Baily-Chetty



Efficiency term > 0: UI $>$ Baily-Chetty

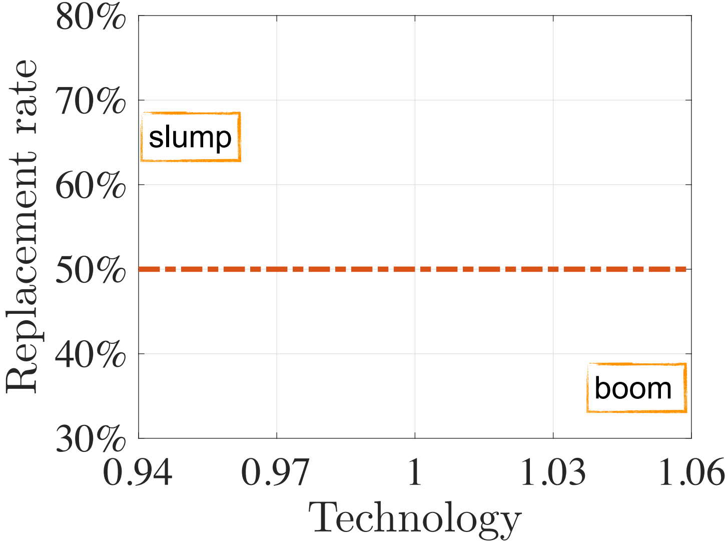


Nonpecuniary cost of unemployment Z is critical

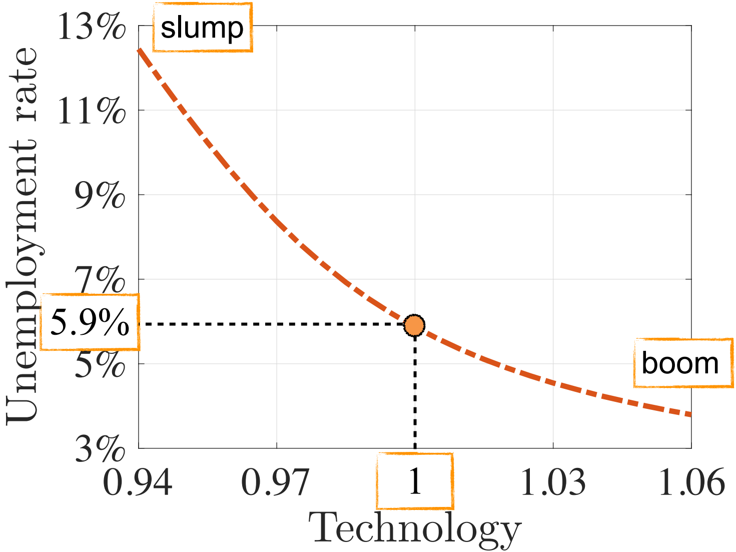


Optimal UI over the business cycle: simulations of the job-rationing model

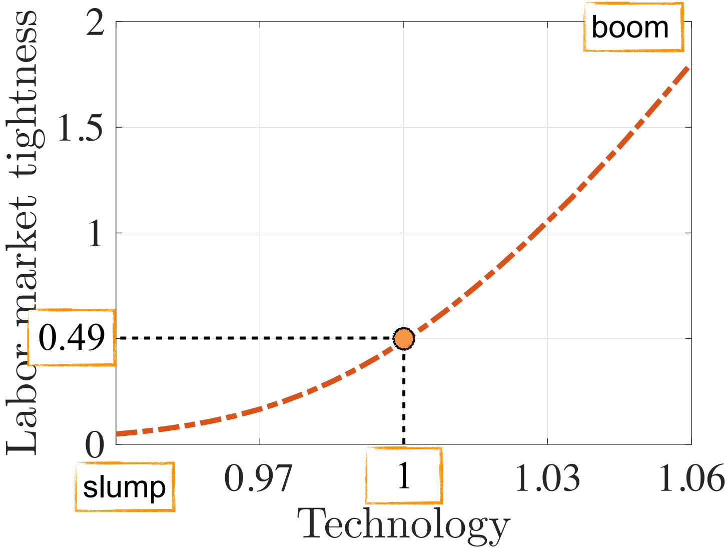
First simulation: constant UI, $R = 50\%$



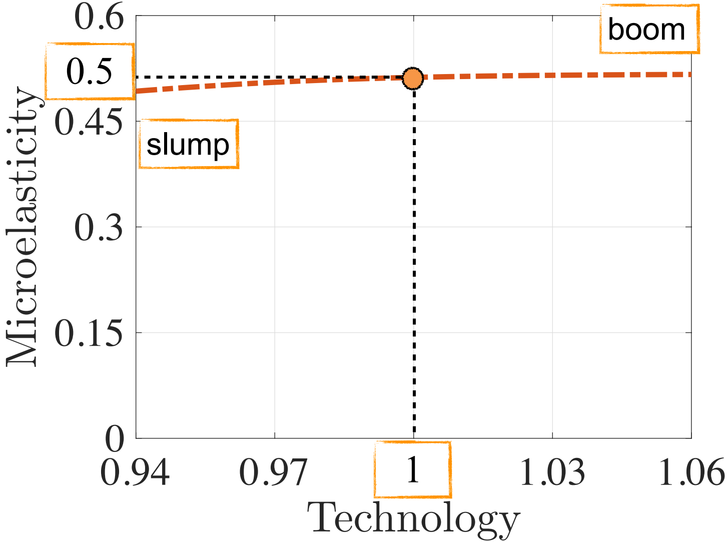
Large fluctuations in unemployment



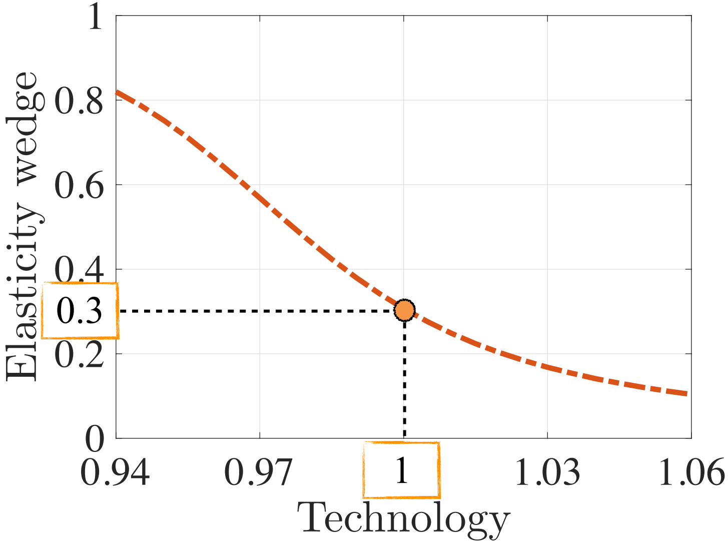
Large fluctuations in tightness



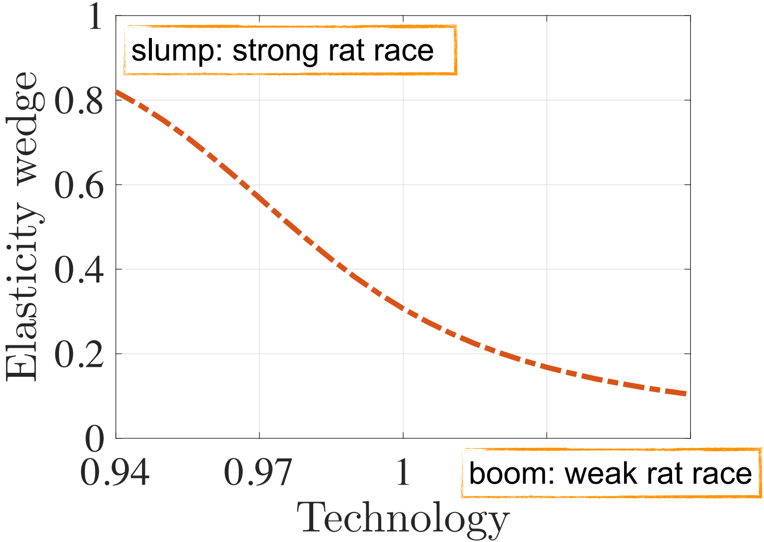
The microelasticity ε^m is stable



The elasticity wedge $1 - \varepsilon^M / \varepsilon^m$ is positive



The rat race is stronger in slumps



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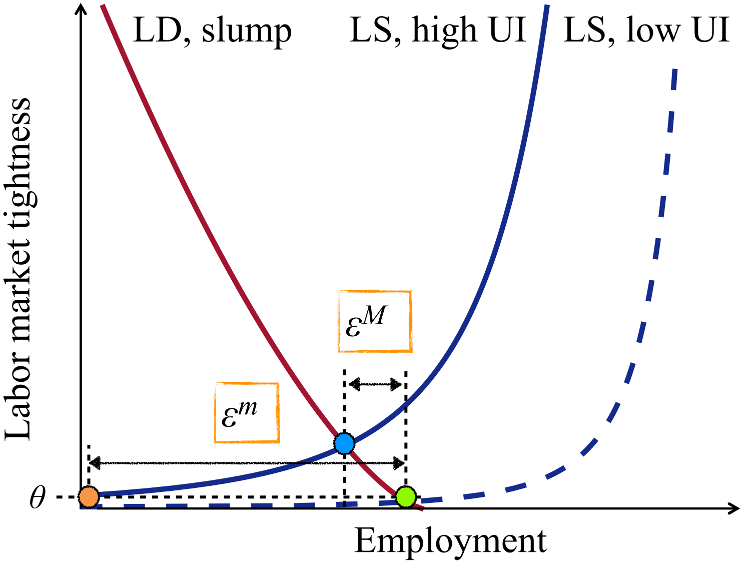

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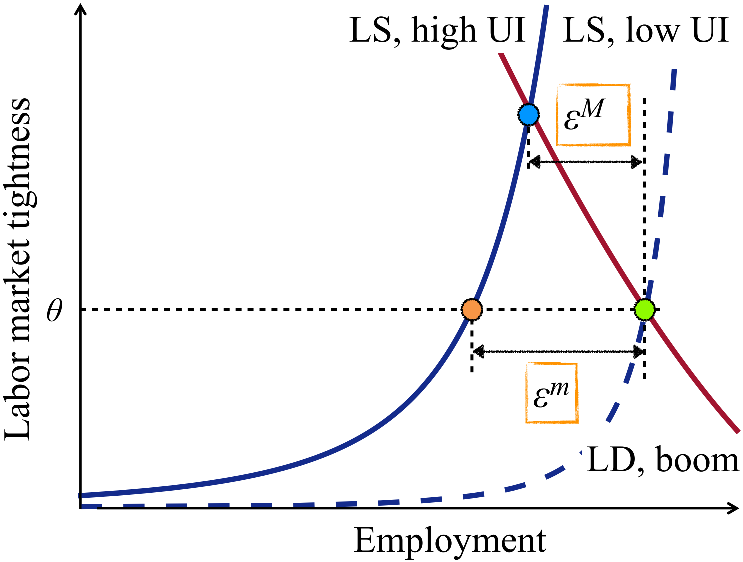
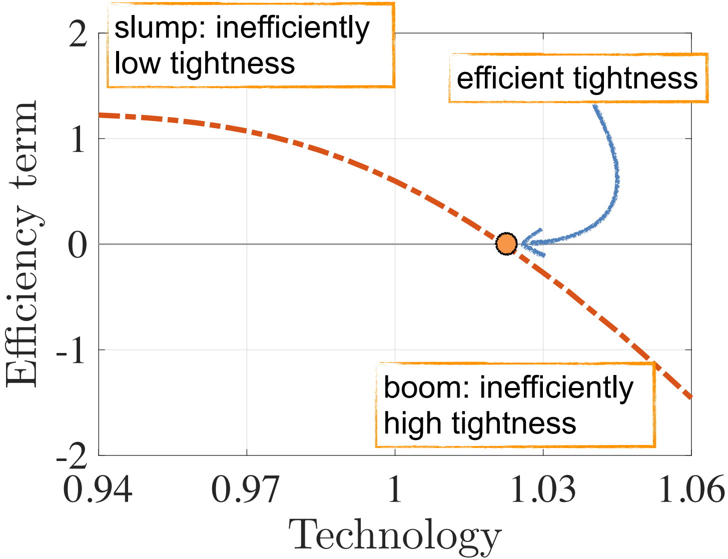
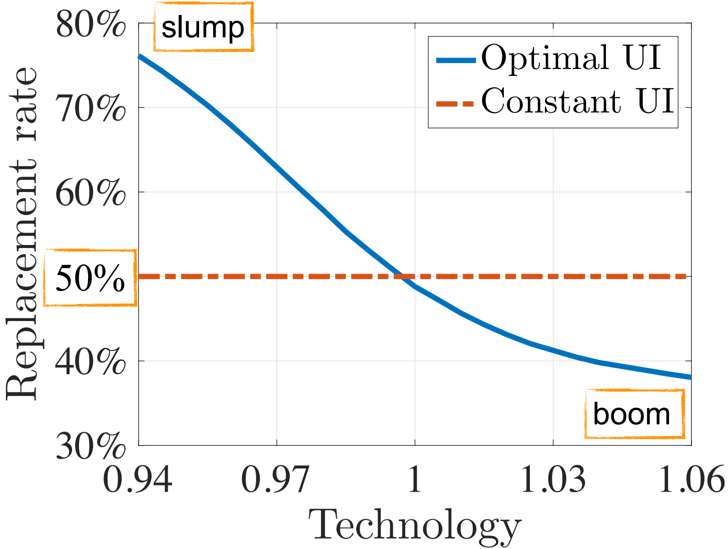


The efficiency term changes sign



The optimal UI is countercyclical



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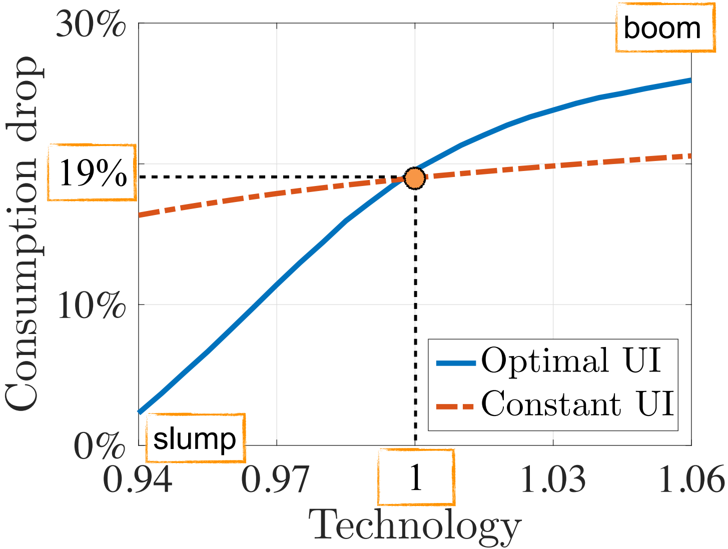
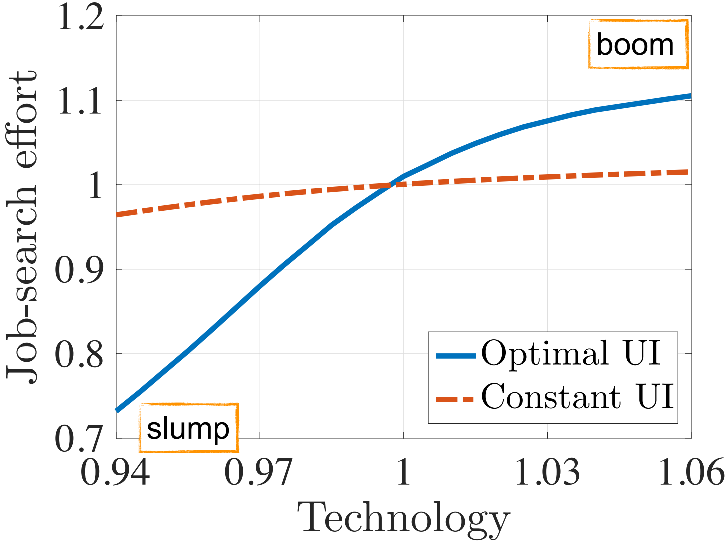
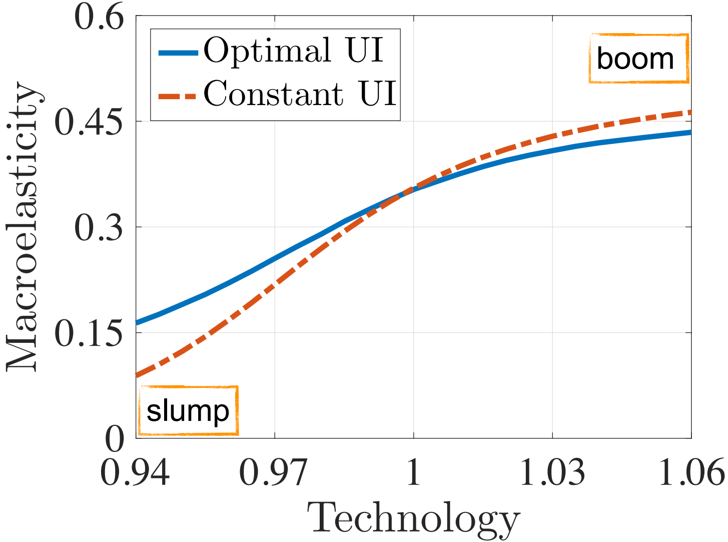


Despite large disincentive to search



Higher UI → slightly higher unemployment



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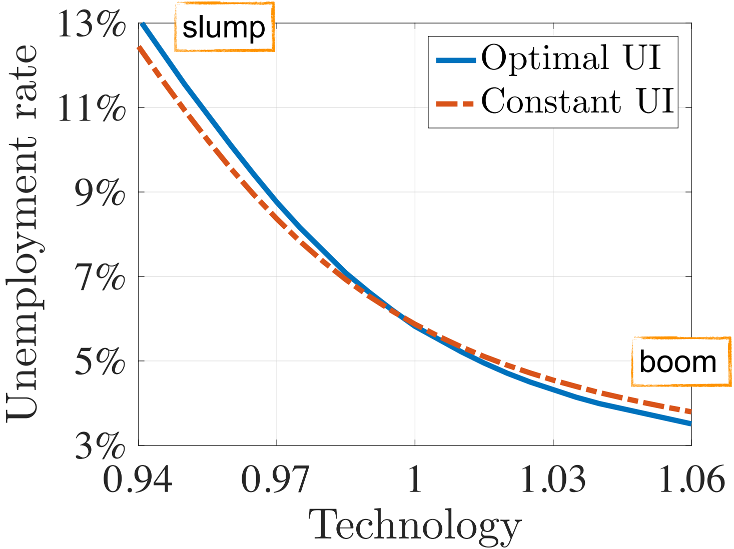

Conclusion

Theoretical approach is broadly applicable

- formula for optimal policy τ 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 (τ)
  - matching elasticity with endogenous search (η)
- elasticity wedge ($1 - \varepsilon^M / \varepsilon^m$)