DO MATCHING FRICTIONS EXPLAIN UNEMPLOYMENT? NOT IN BAD TIMES

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WORKERS QUEUE FOR JOBS IN BAD TIMES

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EXISTING MATCHING MODELS: NO QUEUES

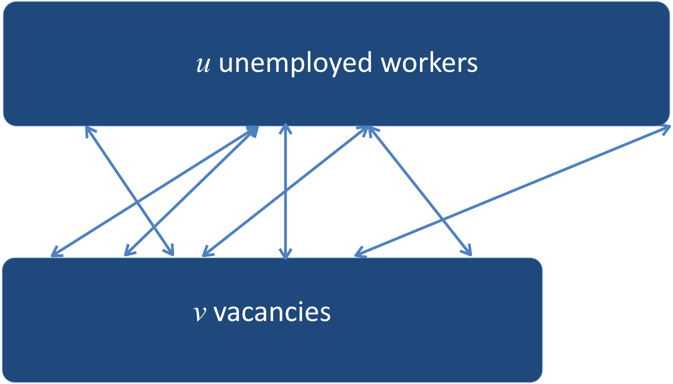
- a queue is a situation where workers desperately want a job but cannot find one
- in existing models, unemployment vanishes when workers desperately want a job $\rightsquigarrow$ queues cannot exist
  - formally: unemployment vanishes when workers' job-search effort becomes infinite
- problem with existing models: firms hire everybody when recruiting is costless

THIS PAPER: MATCHING MODEL WITH QUEUES

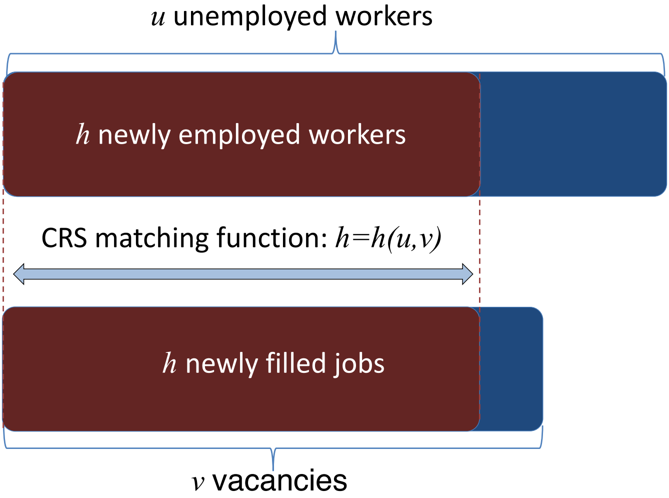
- firms may not hire everybody when recruiting is costless
- based on two assumptions:
  - diminishing marginal returns to labor
  - wage rigidity
- in bad times, jobs are rationed:
  - unemployment would not disappear if recruiting costs vanished
  - queues could appear

GENERIC MATCHING MODEL

MATCHING FUNCTION



MATCHING FUNCTION



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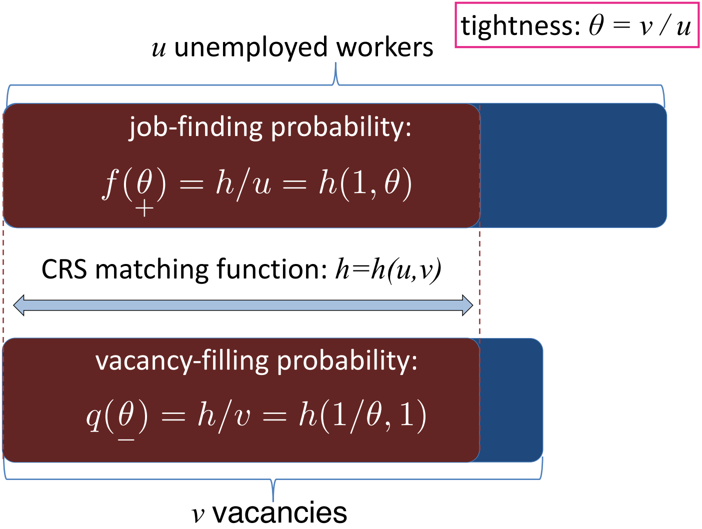
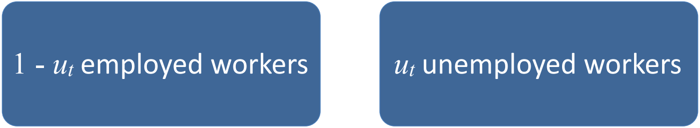


WORKER FLOWS: JOB CREATION & DESTRUCTION



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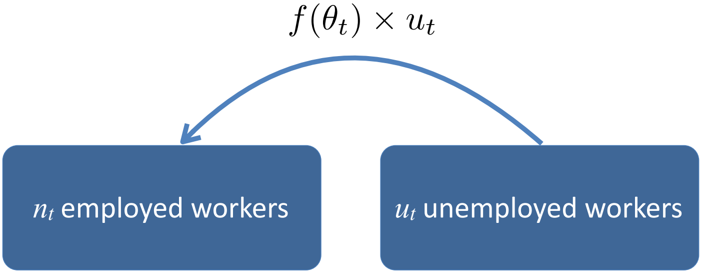

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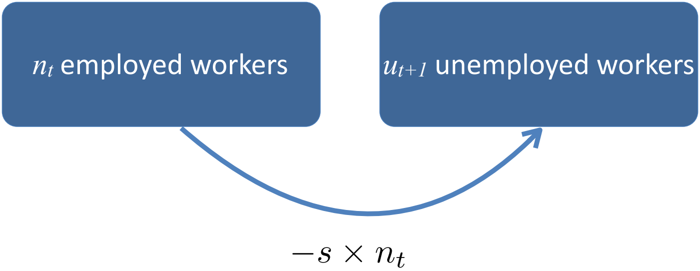


BEVERIDGE CURVE

- the Beveridge curve relates employment n to tightness θ when labor market flows are balanced
  - $E \to U = U \to E$
  - $s \cdot n = f(\theta) \cdot u = f(\theta) \cdot [1 - n + s \cdot n]$
- equation of the Beveridge curve:

$$n = \frac{f(\theta)}{s + (1 - s) \cdot f(\theta)}$$

GENERIC WAGE SCHEDULE

- there are mutual gains from matching
- many wage schedules are consistent with equilibrium
- generic wage schedule: $w_t = w(n_t, \theta_t, x_t)$
  - n_t: level of employment in the firm
  - θ_t: aggregate level of tightness
  - x_t: state of the economy
- w nests various types of bargaining and wage rigidity

REPRESENTATIVE FIRM

- employs n_t workers paid w_t
- produces $y_t = g(n_t, a_t)$
  - g: production function
  - a_t: productivity (random variable)
- hires $n_t - (1 - s) \cdot n_{t-1}$ new workers
  - cost per vacancy: $c \cdot a_t$
  - probability to fill a vacancy: $q(\theta_t)$

FIRM PROBLEM

- given productivity $\{a_t\}$, tightness $\{\theta_t\}$, and the wage schedule w, the firm chooses employment $\{n_t\}$ to maximize expected profits

$$\mathbb{E}_0 \sum_{t=0}^{+\infty} \delta^t \left[\underbrace{g(n_t, a_t)}_{\text{production}} - \underbrace{w(n_t, \theta_t, x_t) \cdot n_t}_{\text{wage bill}} \right.$$
$$\left. - \underbrace{\frac{c \cdot a_t}{q(\theta_t)} \cdot (n_t - (1 - s) \cdot n_{t-1})}_{\text{recruiting expenses}} \right]$$

PROFIT MAXIMIZATION

$$\frac{\partial g(n,a)}{\partial n} - w - n \cdot \frac{\partial w(n,\theta,x)}{\partial n} - \left[1 - \delta \cdot (1-s)\right] \cdot \frac{c \cdot a}{q(\theta)} = 0$$

- the condition says that marginal profit = 0
- the marginal profit is the sum of
  - gross marginal profit: independent of c
  - marginal recruiting expenses: dependent on c
- (this is the steady-state expression of the condition)

ABSENCE OR PRESENCE OF JOB RATIONING IN SEVERAL MODELS

DEFINITION OF JOB RATIONING

- jobs are rationed if the employment rate remains strictly below 1 when recruiting is costless
- equivalently, jobs are rationed if the employment rate remains strictly below 1 when the recruiting cost $c \to 0$
- when jobs are rationed, queues could exist
  - employment is the same when job-search effort $\to \infty$ and when $c \to 0$

FOUR MATCHING MODELS

model	production function	wage setting
Pissarides [2000]	constant returns to labor	Nash bargaining
Cahuc & Wasmer [2001]	diminishing marginal returns to labor	Stole-Zwiebel bargaining
Hall [2005]	constant returns to labor	rigid wage
this paper	diminishing marginal returns to labor	rigid wage

THE MODEL OF PISSARIDES [2000]

- linear production function: $g(n, a) = a \cdot n$
- wage from Nash bargaining:

$$w = a \cdot c \cdot \frac{\beta}{1-\beta}\left[\frac{1-\delta \cdot (1-s)}{q(\theta)} + \delta \cdot (1-s) \cdot \theta\right]$$

  - $\beta \in (0, 1)$: workers' bargaining power
  - (this is the steady-state expression of the wage)

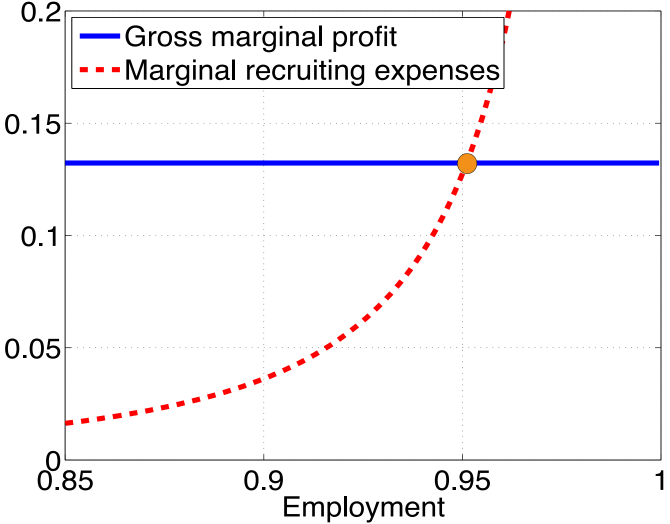
PISSARIDES [2000]: EQUILIBRIUM

- steady-state equilibrium: pair (n, θ) that satisfies
  - Beveridge curve
  - firm's profit-maximization condition
- equilibrium condition:

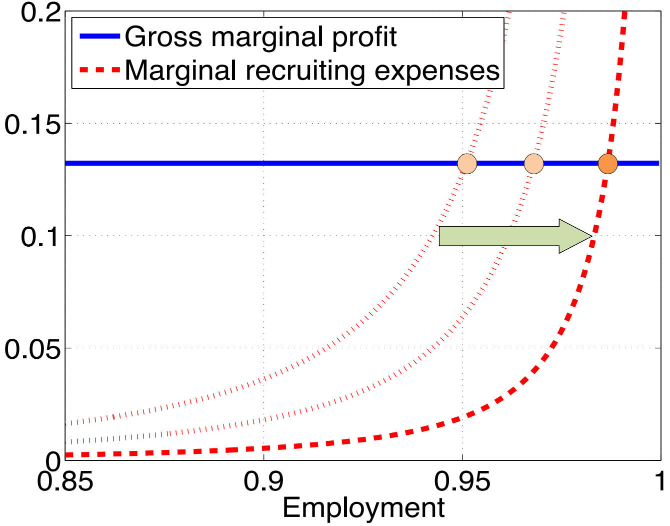
$$\underbrace{1-\beta}_{\text{gross marginal profit}} = \underbrace{c \cdot \left[\frac{1-\delta\cdot(1-s)}{q(\theta(n))} + \delta\cdot(1-s)\cdot\beta\cdot\theta(n)\right]}_{\text{marginal recruiting expenses}}$$

  - where $\theta(n)$ is implicitly defined by Beveridge curve

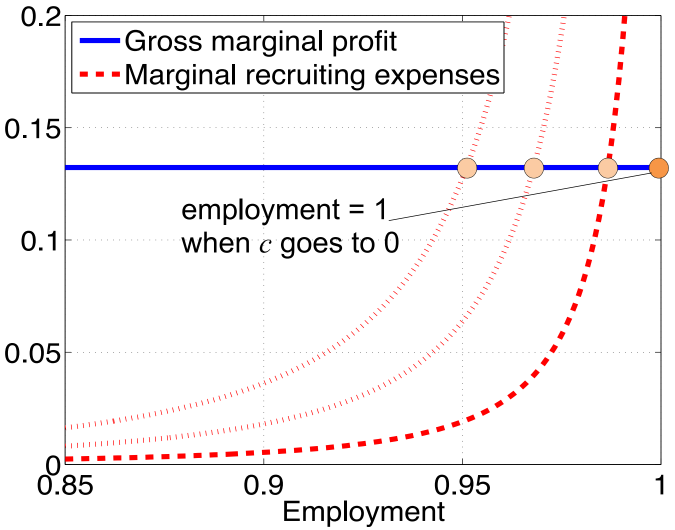
PISSARIDES [2000]: EQUILIBRIUM



PISSARIDES [2000]: EQUILIBRIUM AS $c \to 0$



PISSARIDES [2000]: NO JOB RATIONING



THE MODEL OF CAHUC & WASMER [2001]

- concave production function: $g(n, a) = a \cdot n^{\alpha}$
  - $\alpha < 1$: diminishing marginal returns to labor
- wage from Stole-Zwiebel bargaining:

$$w = a \cdot \left[\frac{\beta \cdot \alpha}{1 - \beta \cdot (1 - \alpha)} \cdot n^{\alpha - 1} + c \cdot (1 - s) \cdot \delta \cdot \beta \cdot \theta \right]$$

  - $\beta \in (0, 1)$: workers' bargaining power
  - (this is the steady-state expression of the wage)

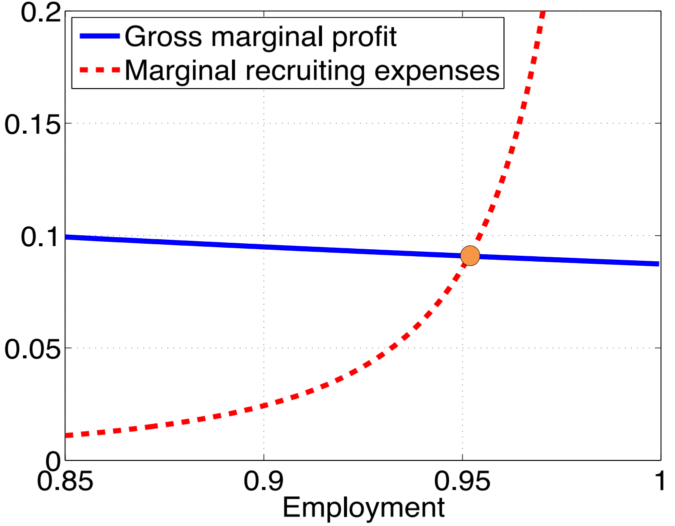
CAHUC & WASMER [2001]: EQUILIBRIUM

- steady-state equilibrium: pair (n, θ) that satisfies
  - Beveridge curve
  - firm's profit-maximization condition
- equilibrium condition:

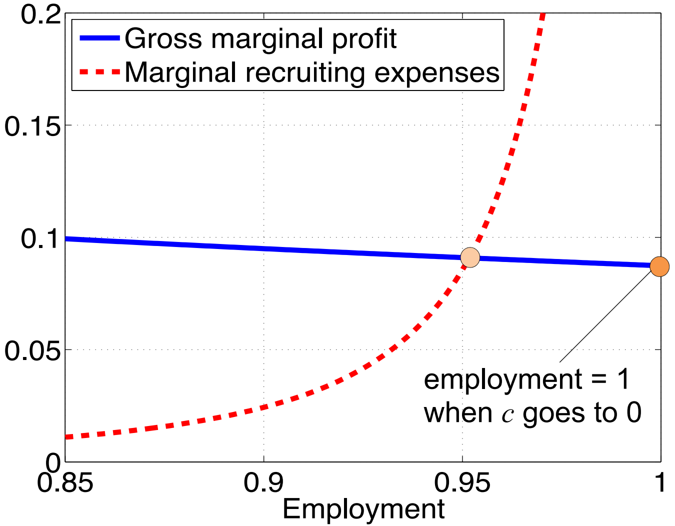
$$\underbrace{\frac{\alpha \cdot (1-\beta)}{1-\beta \cdot (1-\alpha)} \cdot n^{\alpha-1}}_{\text{gross marginal profit}} = \underbrace{c \cdot \left[\frac{1-\delta(1-s)}{q(\theta(n))} + \delta(1-s) \cdot \beta \cdot \theta(n)\right]}_{\text{marginal recruiting expenses}}$$

  - where $\theta(n)$ is implicitly defined by Beveridge curve

CAHUC & WASMER [2001]: EQUILIBRIUM



CAHUC & WASMER [2001]: NO JOB RATIONING



THE MODEL OF HALL [2005]

- linear production function: $g(n, a) = a \cdot n$
- rigid wage: $w = \omega \cdot a^{\gamma}$
  - $\omega > 0$: level of the real wage
  - $\gamma < 1$: partially rigid real wage
  - if $\gamma = 0$: fixed wage
  - specification from Blanchard & Gali [2010]

HALL [2005]: EQUILIBRIUM

- steady-state equilibrium: pair (n, θ) that satisfies
  - Beveridge curve
  - firm's profit-maximization condition
- equilibrium condition:

$$\underbrace{1 - \omega \cdot a^{\gamma-1}}_{\text{gross marginal profit}} = \underbrace{c \cdot \frac{1 - \delta \cdot (1 - s)}{q(\theta(n))}}_{\text{marginal recruiting expenses}}$$

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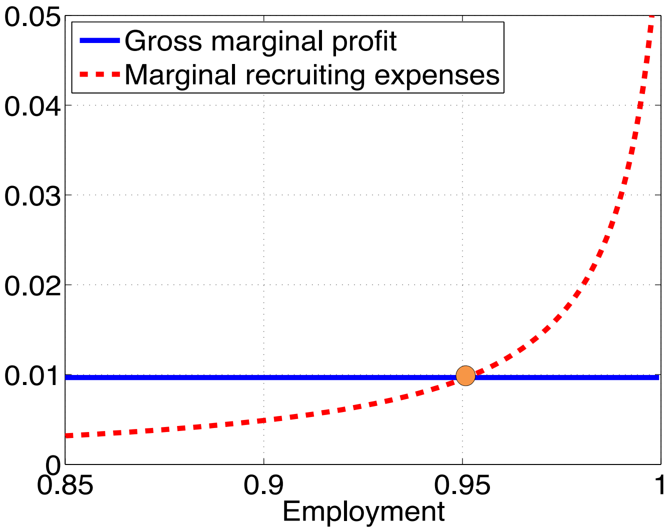
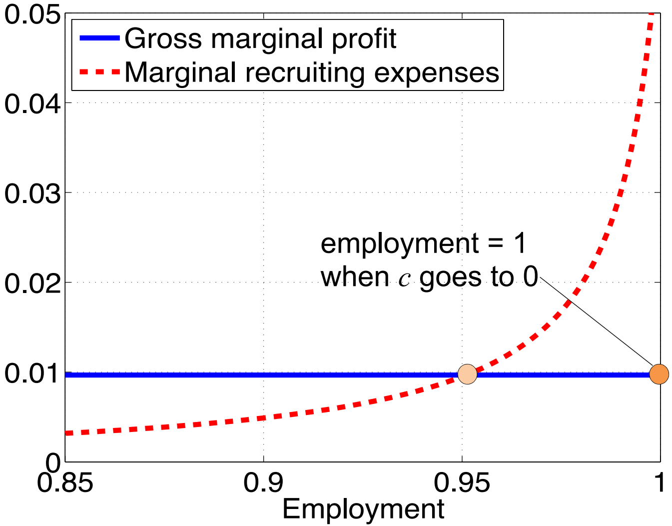
HALL [2005]: EQUILIBRIUM



HALL [2005]: NO JOB RATIONING



THIS PAPER'S MODEL

- concave production function: $g(n, a) = a \cdot n^{\alpha}$
  - $\alpha < 1$: diminishing marginal returns to labor
- rigid wage: $w = \omega \cdot a^{\gamma}$
  - $\omega > 0$: level of the real wage
  - $\gamma < 1$: partially rigid real wage
  - if $\gamma = 0$: fixed wage
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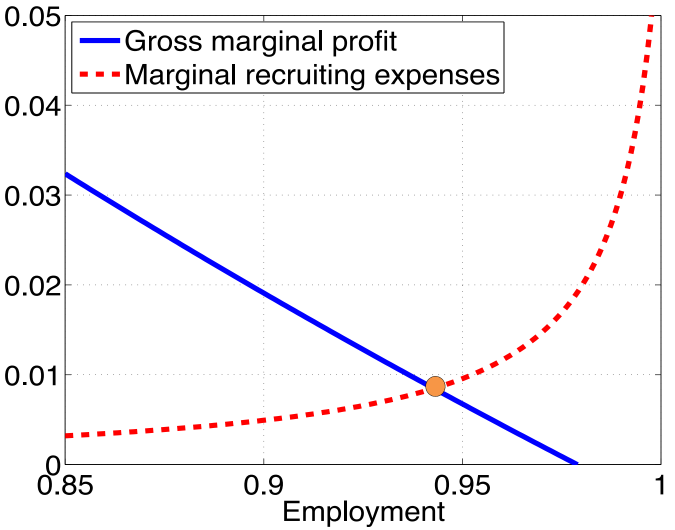
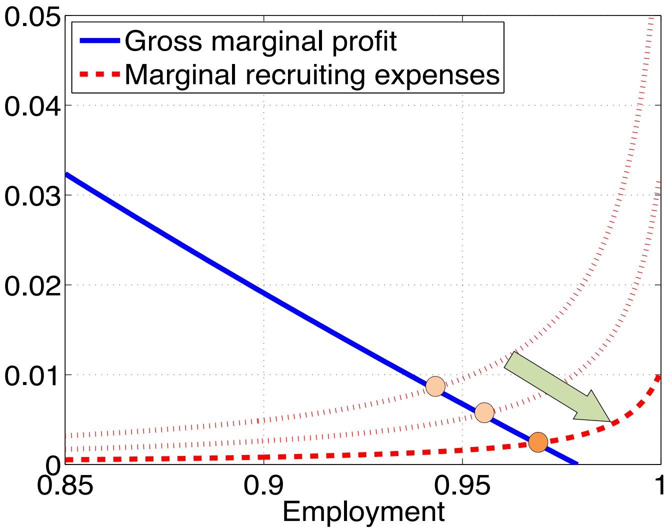
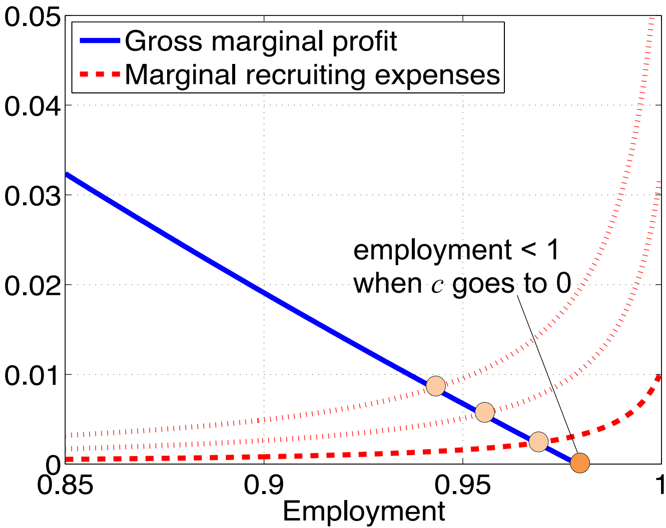


THIS PAPER'S MODEL: EQUILIBRIUM AS $c \to 0$



THIS PAPER'S MODEL: JOB RATIONING



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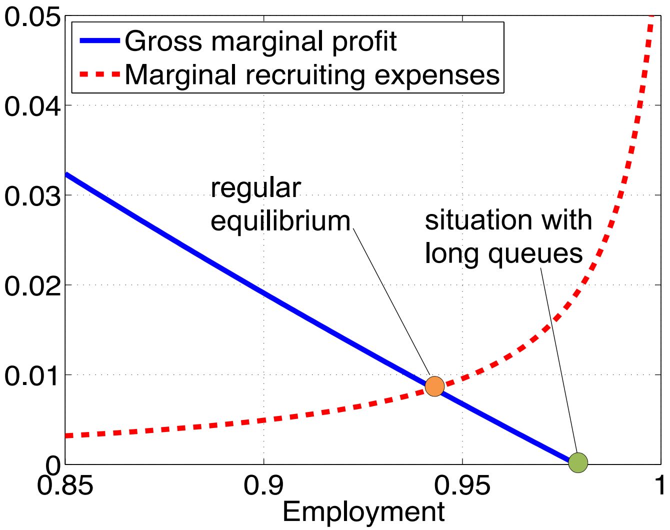
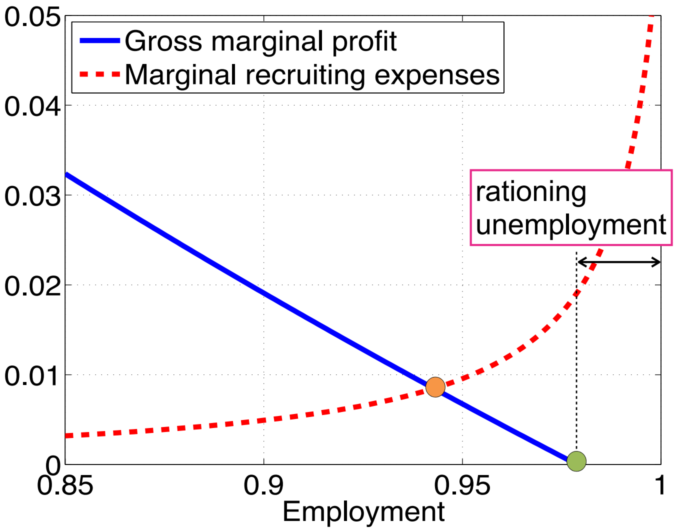
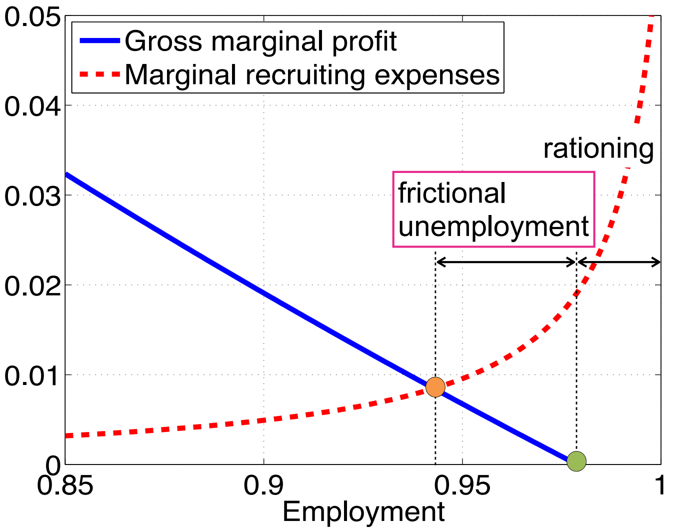


FRICTIONAL & RATIONING UNEMPLOYMENT



FRICTIONAL & RATIONING UNEMPLOYMENT

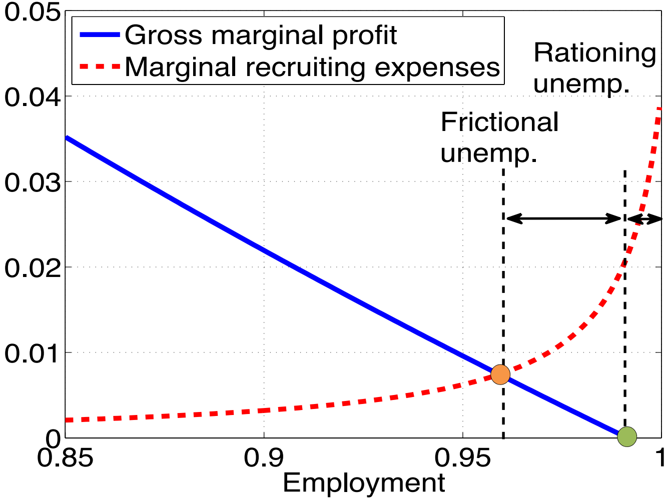


SUMMARY

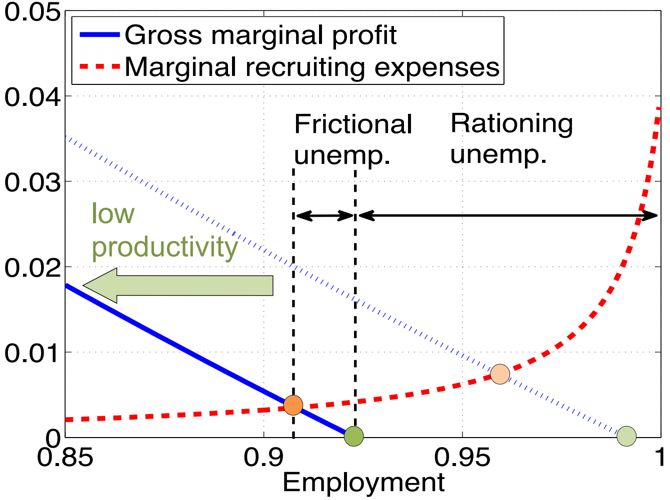
model	assumptions	job rationing?
Pissarides [2000]	bargaining linear production	no
Cahuc & Wasmer [2001]	bargaining concave production	no
Hall [2005]	rigid wage linear production	no
this paper	rigid wage concave production	yes

FRICTIONAL UNEMPLOYMENT OVER THE BUSINESS CYCLE: COMPARATIVE STATICS

FRICTIONAL UNEMPLOYMENT IS HIGH IN BOOMS



FRICTIONAL UNEMPLOYMENT IS LOW IN SLUMPS



SUMMARY

- with low productivity, gross marginal profits are low
  - because of wage rigidity

$\rightsquigarrow$ labor demand is depressed

$\rightsquigarrow$ total unemployment & rationing unemployment are high

- but it is easy for firms to recruit workers

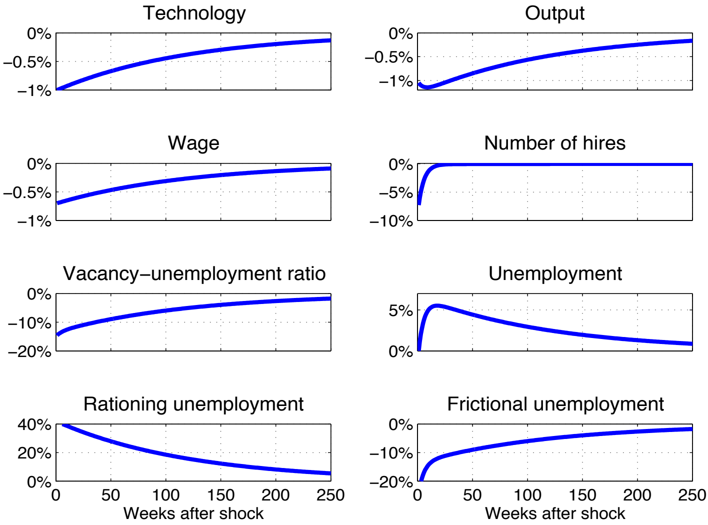
$\rightsquigarrow$ frictional unemployment is low

FRICTIONAL UNEMPLOYMENT OVER THE BUSINESS CYCLE: SIMULATIONS

CALIBRATION (WEEKLY FREQUENCY)

	interpretation	value	source
η	elasticity of matching	0.5	Petrongolo & Pissarides [2001]
γ	real wage flexibility	0.7	Haefke et al [2008]
c	recruiting cost	0.22	Barron et al [1997]
			Silva & Toledo [2009]
s	separation rate	0.95%	JOLTS, 2000–2009
μ	effectiveness of matching	0.23	JOLTS, 2000–2009
α	marginal returns to labor	0.67	matches labor share = 0.66
ω	steady-state real wage	0.67	matches unemployment = 5.8%
ρ	autocorrelation of productivity	0.992	MSPC, 1964–2009
ω	standard deviation of shocks	0.0027	MSPC, 1964–2009

IMPULSE RESPONSES TO NEGATIVE SHOCK



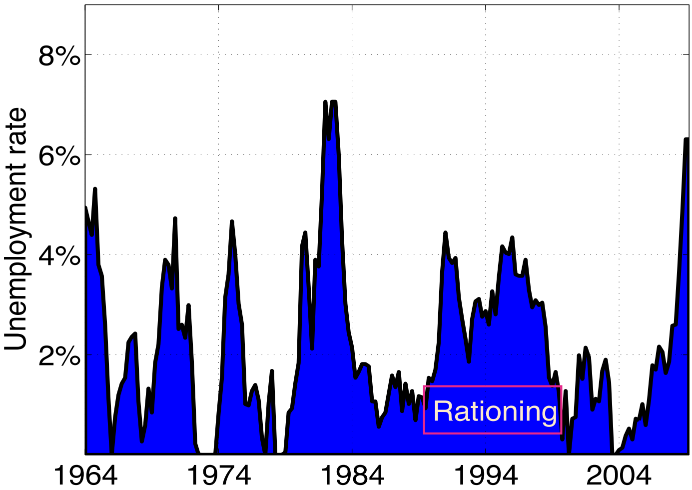
SIMULATED & EMPIRICAL MOMENTS

moment	model	US data
elasticity of u wrt a	5.9	4.2
elasticity of v wrt a	6.8	4.3
elasticity of w wrt a	0.7	0.7
autocorrelation(u)	0.90	0.91
autocorrelation(v)	0.76	0.93
correlation(u, v)	–0.89	–0.89

SIMULATED & EMPIRICAL MOMENTS

- the volatility of unemployment and vacancies is as large in the model as in US data
  - ⇝ no Shimer [2005] puzzle
  - – although wages are as flexible as in newly created US jobs
- the correlation between unemployment and vacancies is the same in the model as in the data
  - ⇝ realistic Beveridge curve

HISTORICAL DECOMPOSITION OF UNEMPLOYMENT



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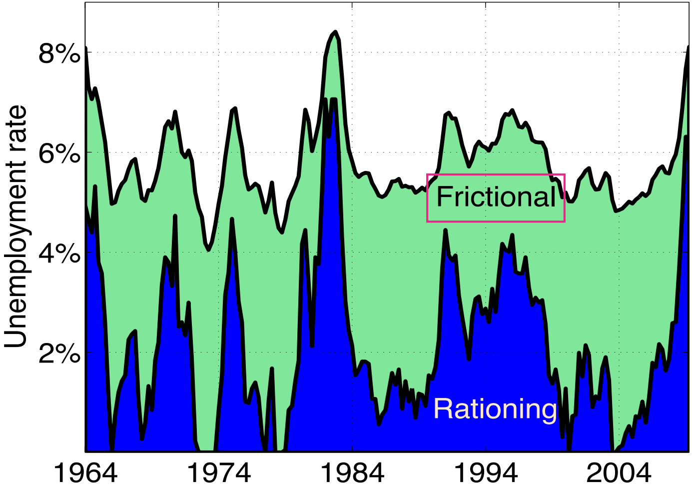

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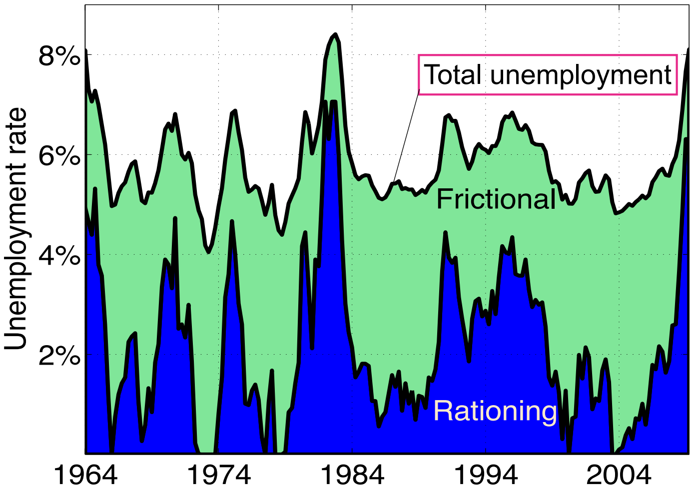
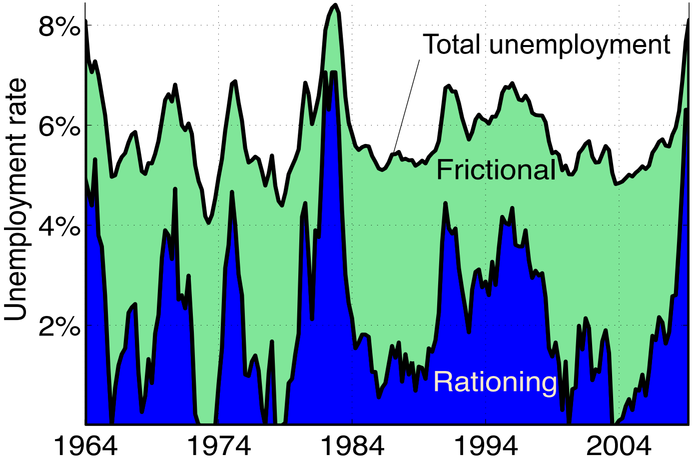


HISTORICAL DECOMPOSITION OF UNEMPLOYMENT

The model is simulated using measured productivity from US data and a shooting algorithm.



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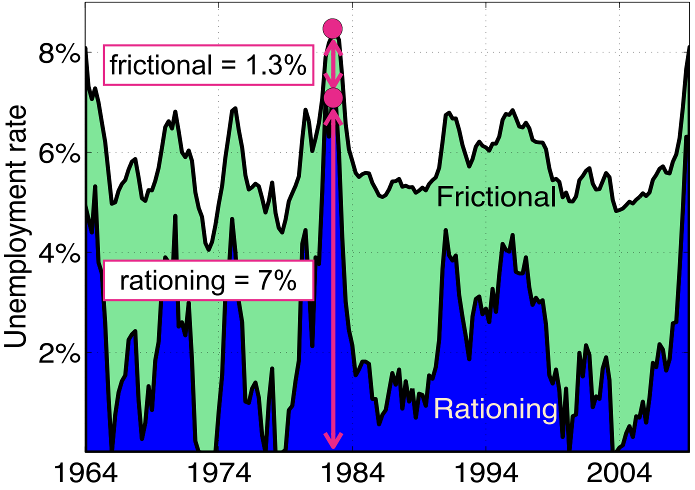

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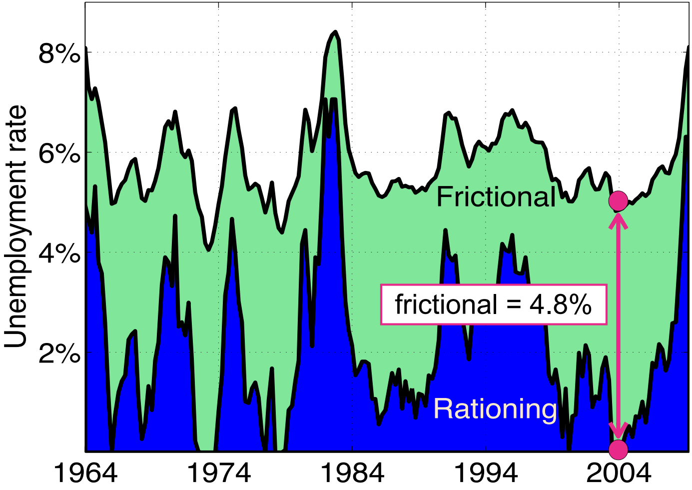

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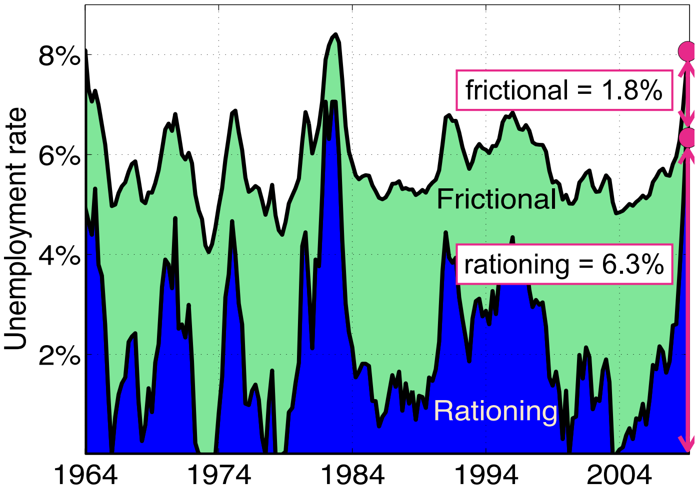
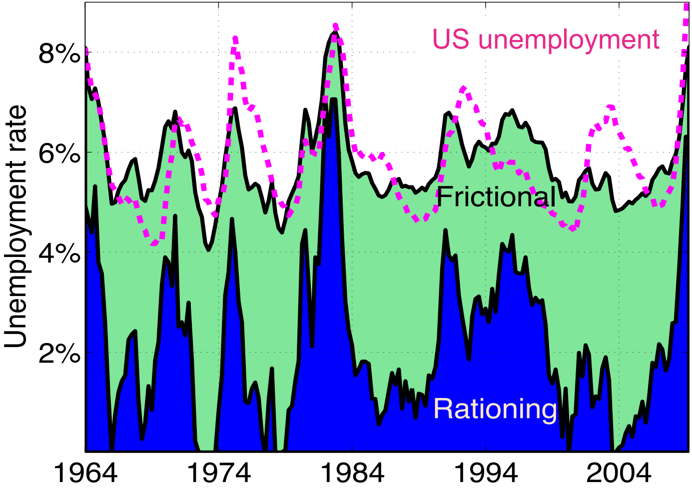


UNEMPLOYMENT IN MODEL & DATA



CONCLUSION

SUMMARY

- this paper develops a matching model with job rationing
  - unemployment does not disappear when recruiting costs vanish
- in booms: most of unemployment is frictional
  - there are enough jobs
  - but the matching process and recruiting costs create unemployment

SUMMARY

- in slumps: frictional unemployment is lower and unemployment mostly comes from job rationing
  - there are not enough jobs
  - the matching process and recruiting costs create little additional unemployment
- simulations:
  - as unemployment ↑ from 4.8% to 8.3%
  - rationing unemployment ↑ from 0% to 7%
  - frictional unemployment ↓ from 4.8% to 1.3%

IMPLICATIONS FOR MODELING UNEMPLOYMENT

- the result that frictional unemployment is low in slumps does not mean that the matching framework is inappropriate to describe slumps
- but it means that in slumps, the matching process and recruiting costs create little unemployment
- instead, most unemployment arises from a shortage of jobs—a weak labor demand

IMPLICATIONS FOR POLICY

- in slumps: unemployment comes from job rationing

⇝ to reduce unemployment in slumps, it is necessary to stimulate labor demand

⇝ policies reducing frictional unemployment have limited scope in slumps

  - example #1: creating a placement agency to improve matching
  - example #2: reducing unemployment insurance to stimulate job search

APPLICATION #1: UNEMPLOYMENT INSURANCE

- the model can be combined with a Baily-Chetty model of optimal unemployment insurance (UI)
- this model explains the rat-race effect: higher UI alleviates the rat race for jobs and raises tightness
- policy implication: optimal UI is more generous in slumps than in booms
- see Landais, Michaillat, & Saez [2018]

APPLICATION #2: COUNTERCYCLICAL MULTIPLIERS

- the labor market model can be embedded into a New Keynesian model
- this model explains the countercyclicality of the government multiplier
- the result relies not on the zero lower bound but on the nonlinearity of the labor market
- see Michaillat [2014]

APPLICATION #3: UNEMPLOYMENT FLUCTUATIONS

- the labor market model can be combined to a product market model with a similar structure
- this general-equilibrium model describes how unemployment fluctuations may arise from
  - aggregate demand shocks
  - technology shocks
  - labor supply shocks
- in the US: most unemployment fluctuations come from aggregate demand shocks
- see Michaillat & Saez [2015]