INTERMEDIATE MACROECONOMICS

LECTURE 3

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SEARCH AND UNEMPLOYMENT

IN THIS LECTURE

- Empirical facts about employment and unemployment
- The Diamond-Mortensen-Pissarides (DMP) model of search and unemployment
- What does theory predict about: (i) unemployment insurance, (ii) unemployment and productivity, and (iii) changes in the labor market
- Alternative models of unemployment

KEY LABOR MARKET VARIABLES

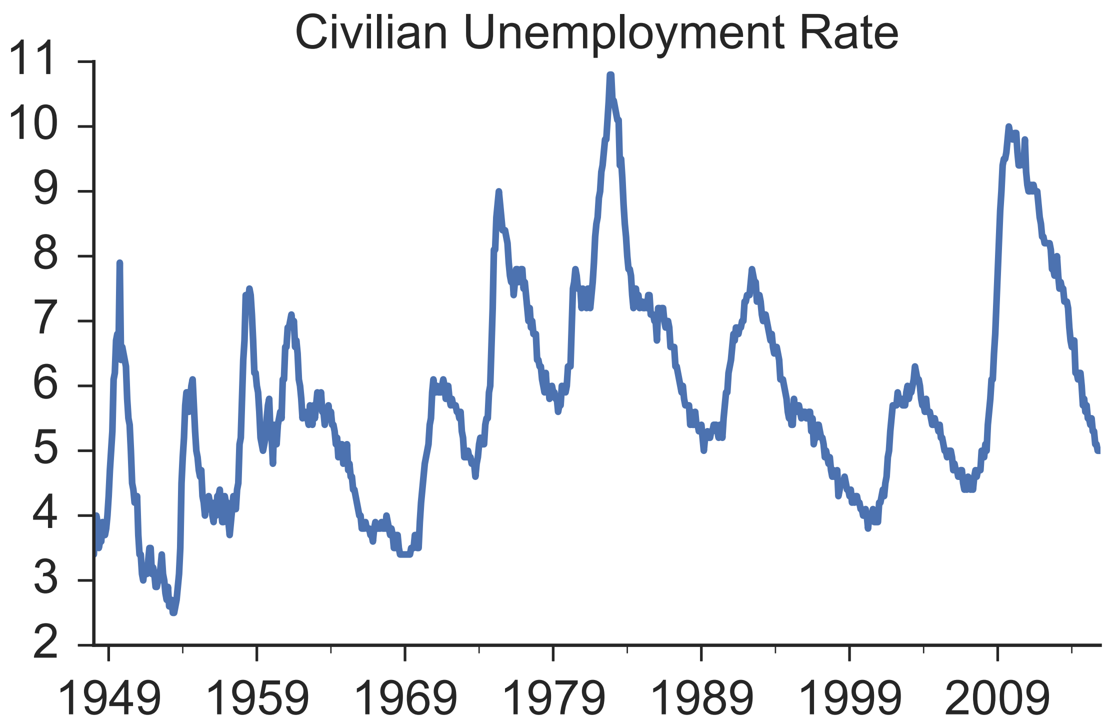
- N = Working age population
- Q = Labor force (employed + unemployed)
- U = Unemployed, E = Employed

$$Q = U + E$$

- Unemployment rate = $\frac{U}{Q}$ = $1 - \frac{E}{Q}$
- Participation rate = $\frac{Q}{N}$
- Employment/population ratio = $\frac{E}{N}$

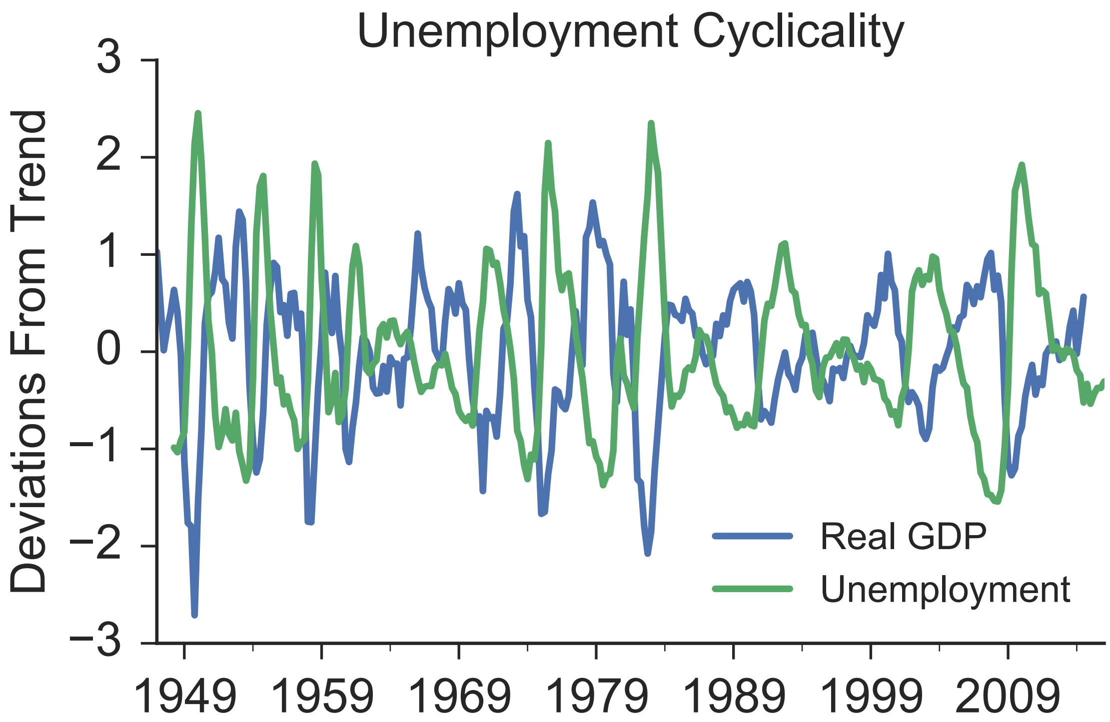
UNEMPLOYMENT RATE DATA

Characterized by large, persistent swings upward.
Cycle dominates trend.



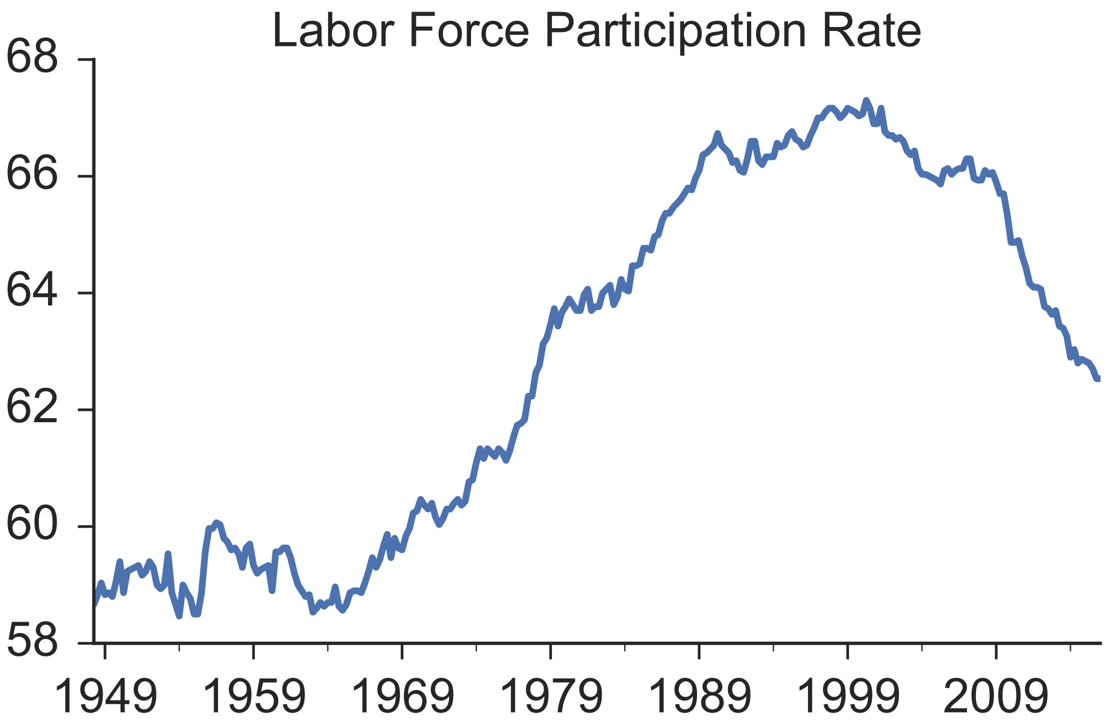
CYCLICALITY OF UNEMPLOYMENT

Clearly countercyclical (goes up when GDP goes down)



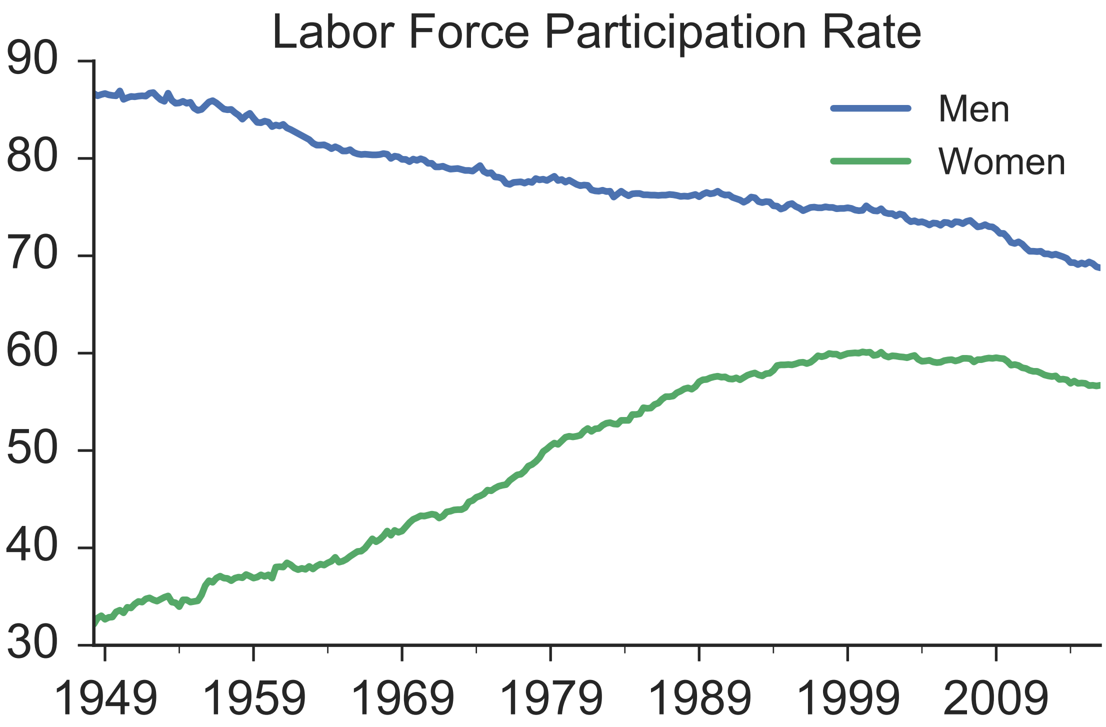
LABOR FORCE PARTICIPATION RATE

Grew by $\sim 10\%$ between 1960 and 2000, falling thereafter.



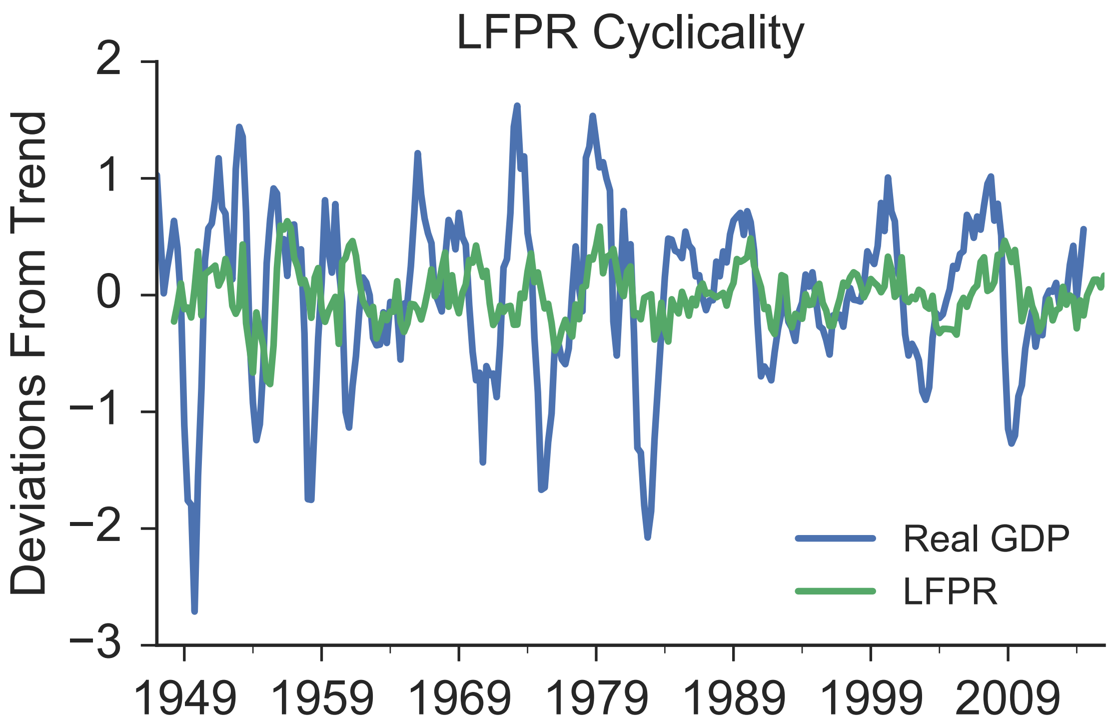
DEMOGRAPHIC CAUSES

Trends in age (baby boom) and gender (women entering work force)



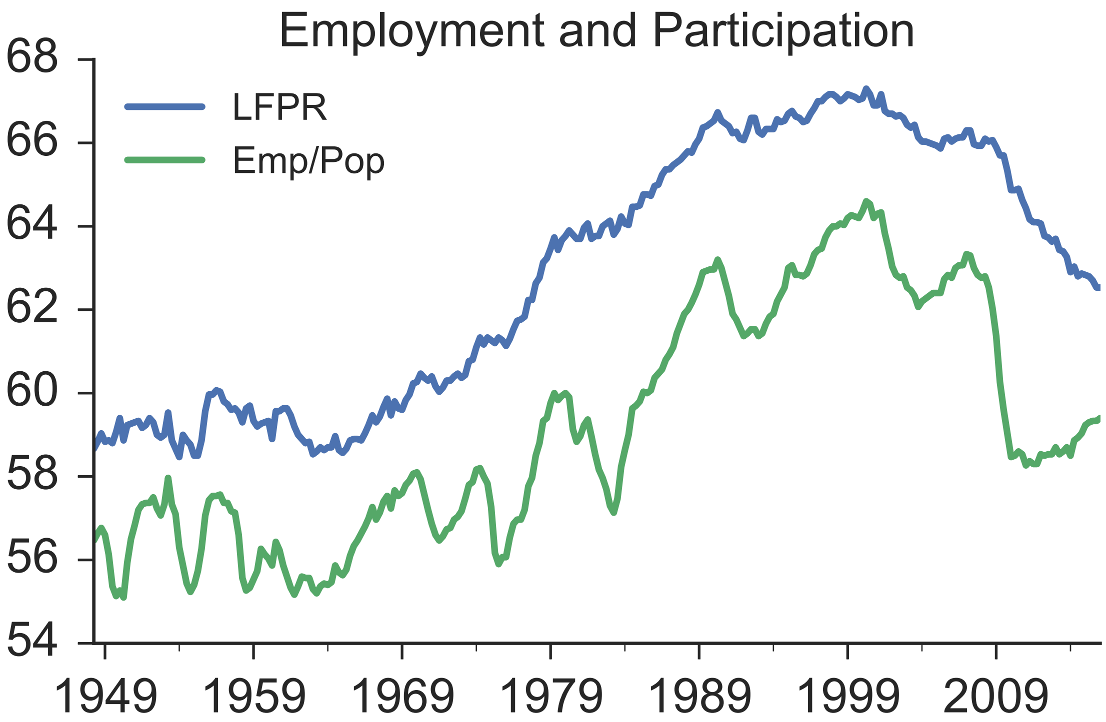
CYCLICALITY OF LFPR

Procyclical (goes up when GDP goes up) but less volatile and slightly lagging



LFPR VS. EMPL/POPULATION

Employment/population much less cyclically volatile



LABOR MARKET DYNAMICS

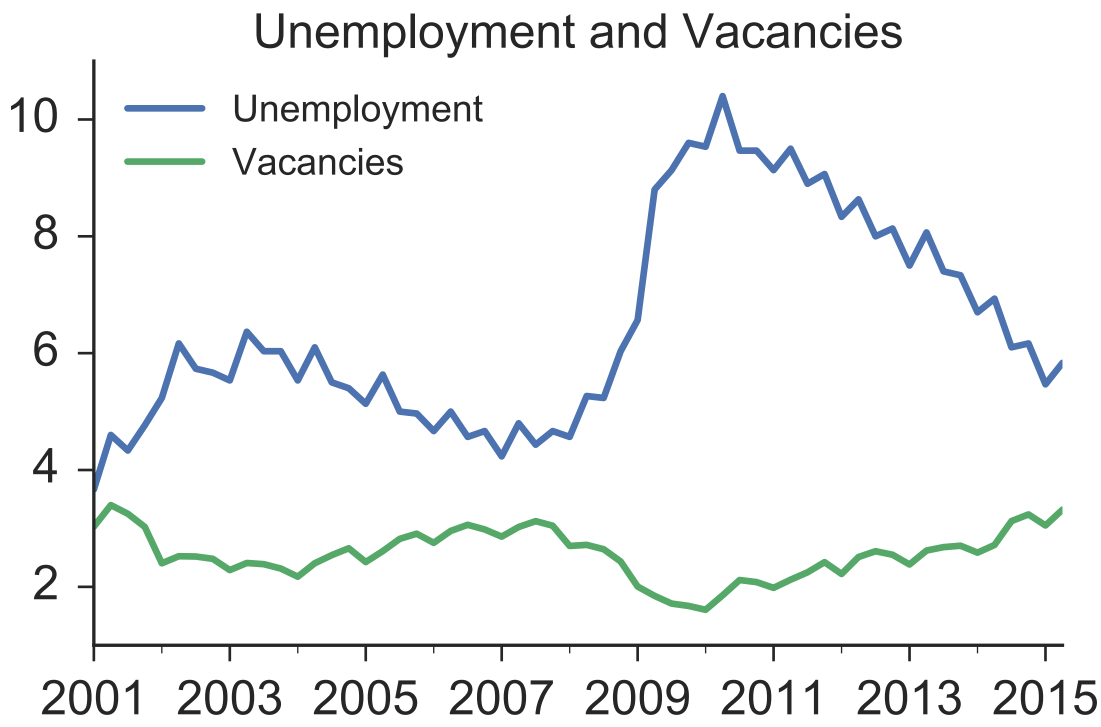
- Difference between level and "churn"
  - Lose your job every week, take one week to find another
  - Lose your job every month, take one month to find another
- Both have 50% unemployment (think about it), but first one has more movement/churn

FIRM SIDE PERSPECTIVE

- To hire workers firms post job openings or "vacancies" (A)
- Workers (potentially) reply to these and firms (potentially) hire someone
- Vacancy rate = $\frac{A}{A+E}$, fraction of vacancies that are filled, analogous to unemployment rate

VACANCIES IN THE DATA

Vacancies are negatively correlated with unemployment rate (hence procyclical)



WHAT IS UNEMPLOYMENT?

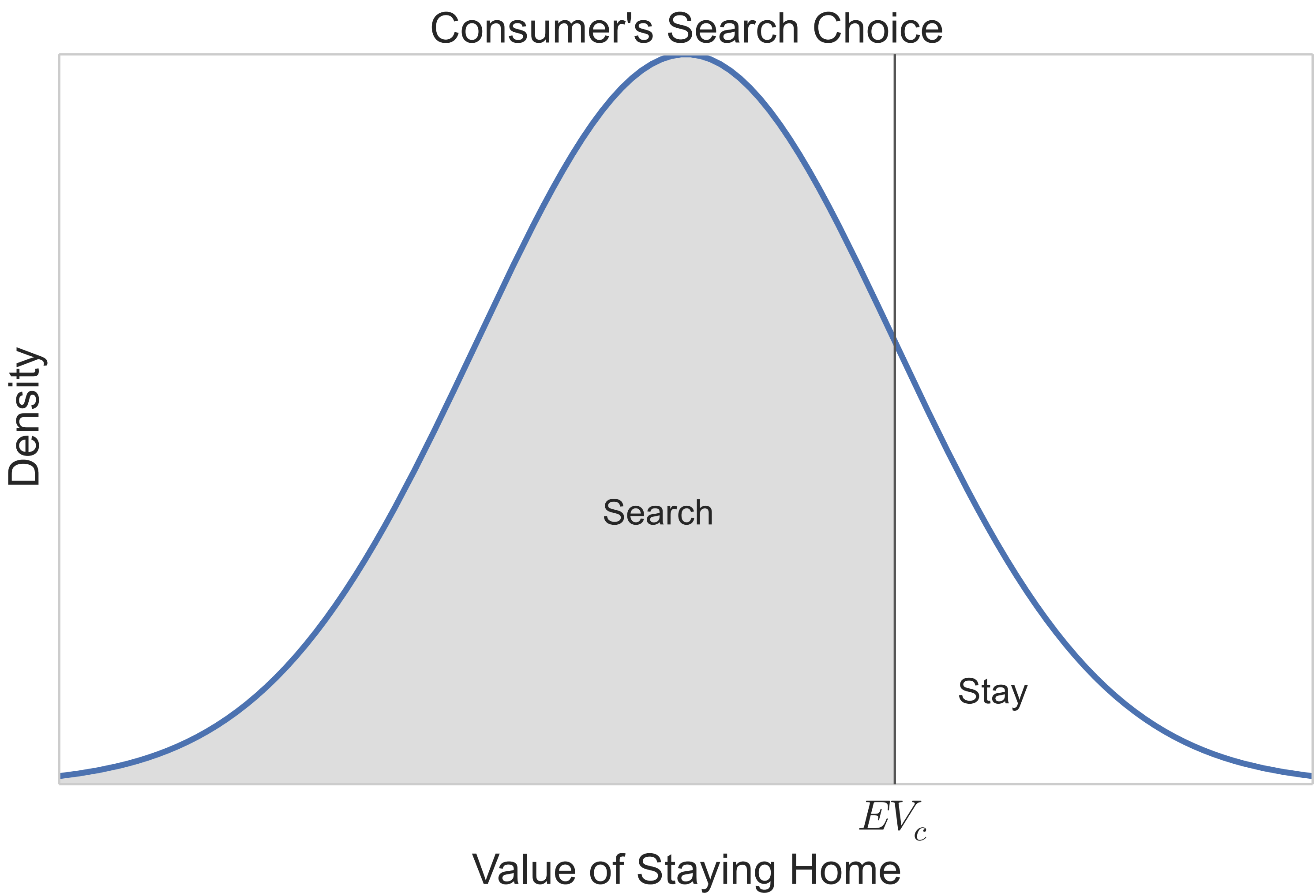
- People want to work, but they can't find anyone to hire them
- This means we can't use standard Walrasian model
- Supply $\neq$ Demand
  - Why can't people find jobs?
  - What happens to people who don't find jobs?
  - How does this affect wages and job postings?

A MODEL OF UNEMPLOYMENT

- Workers can either stay at home or search for work
- Staying at home gives some value s_i to worker i, unemployment benefits are b
- There are N workers in the economy, of which Q are out searching for jobs
- Supposing the distribution of s_i is $F(\cdot)$ and the expected value of searching is EV_c, then

$$Q = N \cdot F(EV_c)$$

HOW MANY PEOPLE SEARCH VS STAY?



JOB VACANCIES

- Many firms out there who post A vacancies in total
- **Matching function** tells us the number of jobs found

$$E = e \cdot m(Q, A)$$

- E is the total number of jobs found and e is the efficiency of matching, which may change over time

PROPERTIES OF THE MATCHING FUNCTION

- Constant returns to scale

$$m(xQ, xA) = x \cdot m(Q, A)$$

- Need both consumers and firms

$$m(0, A) = m(Q, 0) = 0$$

- Increasing in both arguments, $m_Q > 0$ and $m_A > 0$
- Decreasing individual returns $m_{QQ} < 0$ and $m_{AA} < 0$

THE WORKER'S PERSPECTIVE

- Probability of finding a job, with $j = A/Q$

$$p_c \equiv \frac{E}{Q} = \frac{e \cdot m(Q, A)}{Q} = e \cdot m(1, A/Q) \equiv e \cdot m(1, j)$$

- Workers get wage w if employed, so their expected value of searching is

$$EV_c(j) = p_c w + (1 - p_c)b = b + e \cdot m(1, j)(w - b)$$

- Consistency requires that $Q = N \cdot F(EV_c(j))$

THE FIRM'S PERSPECTIVE

- Probability of finding a worker to hire
$$p_f \equiv \frac{E}{A} = \frac{e \cdot m(Q, A)}{A} = e \cdot m(Q/A, 1) = e \cdot m(1/j, 1)$$
- Workers generate z profits to the firm, so their expected value of posting a vacancy is
$$EV_f(j) = e \cdot m(1/j, 1)(z - w)$$
- A vacancy costs k, so we need $k = EV_f(j)$

WAGE DETERMINATION

- What happens when you actually find a job? No market wage, need to negotiate
- The productivity of the worker z and their available outside benefits b will be important here
- Worker would never accept $w < b$ and firm would never pay $w > z$, so it will always be between the two

$$b \leq w \leq z$$

- So then we'll say that wage is some linear combination a

$$w = az + (1 - a)b$$

PUTTING IT ALL TOGETHER

- The two equations characterizing the equilibrium are then

$$\begin{aligned} \text{Firm:} \quad & k = e \cdot m(1/j, 1)(1-a)(z-b) \\ \text{Worker:} \quad & Q = N \cdot F(b + e \cdot m(1, j)a(z-b)) \end{aligned}$$

- First equation gives us j, higher $j = A/Q$ leads to more competition for workers, and lower firm profits
- Using this j^* second equation gives us Q, higher j means more jobs per worker, so more job seekers

MAPPING TO THE DATA

- We can express everything of interest using j, so unemployment

$$u = \frac{Q - E}{Q} = 1 - e \cdot m(1, j)$$
$$v = \frac{A}{A + E} = \frac{1}{1 + e \cdot m(1/j, 1)}$$

- Total output (GDP) = output/worker X number of matches

$$Y = z \cdot E = z \cdot e \cdot m(Q, A) = z \cdot e \cdot Q(j)m(1, j)$$

- Movements in j will generate negative correlation between output Y and unemployment u

A SPECIFIC MATCHING FUNCTION

- Those properties look familiar, we can actually just use Cobb-Douglas

$$m(Q, A) = Q^{\beta} A^{1-\beta}$$

- We're interested in

$$m(1, j) = j^{1-\beta} \qquad \text{and} \qquad m(1/j, 1) = j^{-\beta}$$

A SPECIFIC MATCHING FUNCTION

- Plugging this into our equilibrium equations

$$j^* = \left[\frac{e(1-a)(z-b)}{k} \right]^{1/\beta}$$

- And the economic outcomes

$$u = 1 - e\left[\frac{e(1-a)(z-b)}{k} \right]^{\frac{1-\beta}{\beta}}$$

A CHANGE IN BENEFITS

- In creasing b leads to an increase in wage $w = az + (1 - a)b$
- Now there are too many vacancies being posted, firms scale back vacancies per worker j
- When j falls and b rises, Q can either rise or fall
- So lower probability of finding a job, but higher value of unemployment

WELFARE EFFECTS

- What are true effects of unemployment benefits changes?
- Difficult to test because unemployment benefits generally go up in bad times, when unemployment goes up for other reasons (like z falling)
- Workers are also insured against job loss, which as we learn in micro is a good thing
- Optimal policy should balance unemployment effects with insurance gains

A CHANGE IN PRODUCTIVITY

- We only ever see $z - b$, so we know the story for decreasing z is the same as increasing b
- z falls $\rightarrow$ $(z - w)$ falls $\rightarrow$ j falls $\rightarrow$ u rises
- There is no countervailing force here, clearly a fall in productivity is bad for welfare

A CHANGE IN MATCH EFFICIENCY

- Fall in match efficiency e has a similar effect: unemployment goes up and output goes down
- We can observe this in the relationship between the unemployment rate u and the vacancy rate v

$$j = \left(\frac{1-u}{e}\right)^{\frac{1}{1-\beta}} \rightarrow v = \frac{1}{1 + \left[\frac{e}{(1-u)^{\beta}}\right]^{\frac{1}{1-\beta}}}$$

- Negative relationship between u and v called **Beveridge curve**

BEVERIDGE CURVE SHIFTS OUT

This can be rationalized by a decrease in match efficiency e