MACROECONOMICS
73-240

Lecture 10

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Plan for this Lecture

- Unemployment
  - U.S. Labor Markets
  - Adding Unemployment to Our Model
  - The Concept of a "Steady State"

Unemployment

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Unemployment

- So far, we have only studied hours worked
- Consumers divided their time between work and leisure
- But in reality: there are people who are willing and able to supply labor, but are unable to find work.
- We want to consider how unemployment arises
- Key features of unemployment in the model:
  - Must search for work, find a job is not automatic.
  - Because people search for work, implies employment is better than unemployment
- Goal: understand determinants of the unemployment rate

Outline on Unemployment

- Some facts about U.S. labor markets (focus on workers vs. non-workers)
- Behavior of the unemployment rate
- Search model of unemployment.

Notations

- E: number of working age persons who are employed.
- U: number of unemployed.
- L: number of people in labor force $(E + U)$
- NL: number of working age persons who are not in the labor force
- Unemployment Rate: $u = \frac{U}{E+U}$
- Labor Force Participation Rate: $LP = \frac{E+U}{E+U+NL}$
- Employment to Population Ratio: $EP = \frac{E}{E+U+NL}$

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The U.S. Labor Market

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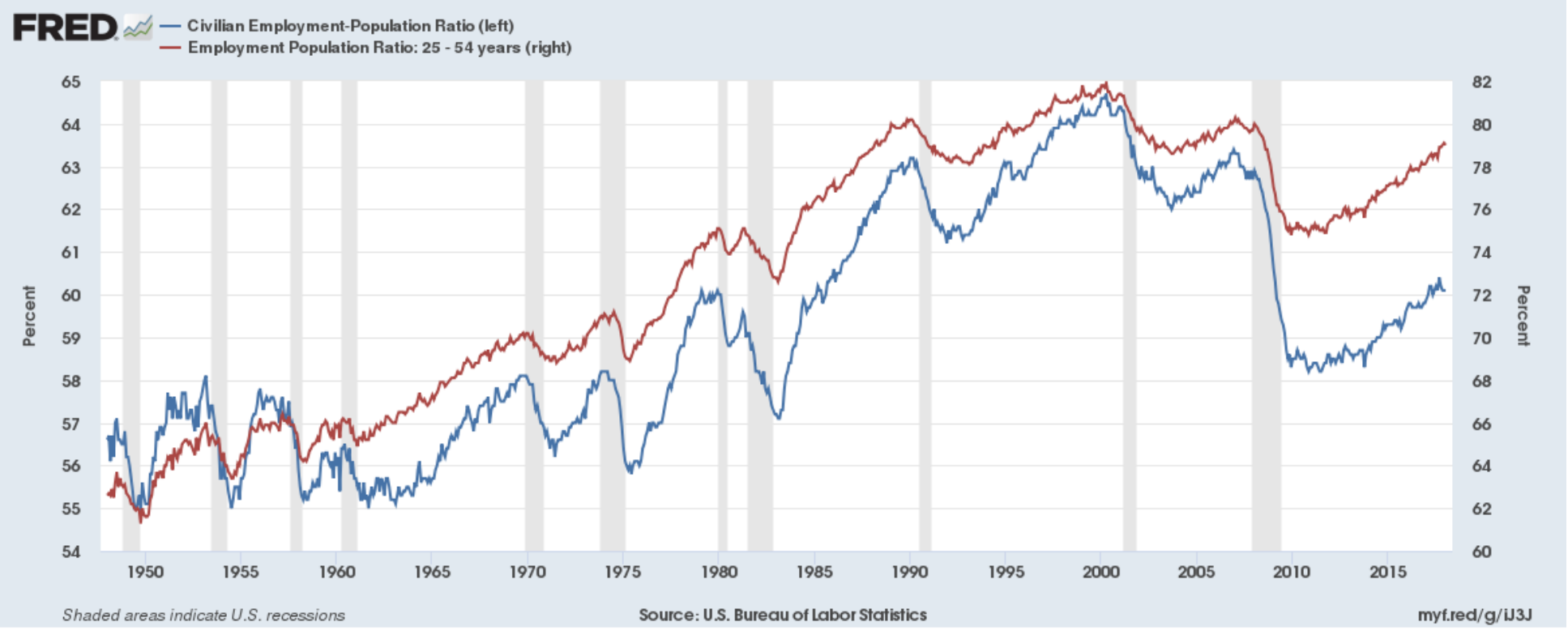
The employment-population ratio

- The fraction of the civilian population over the age of 16 that is working
- This ratio:
  - Has been increasing over time in large part due to the entry of women into the workforce.
  - Decreases in times of a recession.

The U.S. Ratio of Employment to Population



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The unemployment rate

- The fraction of the labor force that is unemployed
- A person is "counted" as unemployed if the following conditions hold:
  - She does not have a job that pays a wage or salary.
  - She actively looked for a job during the four weeks before measuring the unemployment rate.
  - She is available to work.
- According to this definition a person that does not have job and is not looking for job is not "counted" as unemployed.

Looking at the US Unemployment Rate

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Looking at the US Unemployment Rate

- the unemployment rate spikes at times during recessions
- and takes time to wind down to its mean rate
- Can we think of how to model unemployment dynamics?

Unemployment Dynamics

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Thinking about why there exists unemployment

- We are going to do a bit of role-play to understand the role of search frictions and what they are.

- Experiment 1: 10 volunteers please
  - Each agent has an identity (Black or Red)
  - Without any communication, Black wants to match with Red (positive payoff: chocolate), if like-colors match, pair loses all chocolates.
  - An agent will select another agent from the group to form a match.
  - No communication allowed, so you cannot reveal your identity when you choose someone to form a match
  - If the other agent agrees, the two agents are matched, identities then revealed, game ends.

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Thinking about why there exists unemployment

- Why didn't we always have everyone matched up?

Thinking about why there exists unemployment

Thus far, we have seen information frictions can affect the probability that we find a match.

- Expt 2: 10 volunteers
- Exact same set-up as before.
- Now how many Reds found matches. How many Blacks found matches? What was total number of Reds vs. Blacks ?

Thinking about why there exists unemployment

Search frictions can take the form of:

- Information frictions
- Congestion effects

Thinking about why there exists unemployment

Let's try to capture search frictions with a matching function

- Notation: matches M, vacancies V, job-seekers U, match efficiency e

  $$M = e\mathcal{M}(V, U)$$

  where $\mathcal{M}(V, U)$ is a matching function that takes as inputs V and U.

- Matches are increasing in V and U: $\frac{d\mathcal{M}}{dV} > 0, \frac{d\mathcal{M}}{dU} > 0$

- There is diminishing marginal returns

- The function satisfies constant returns to scale (CRS):

  $$e\mathcal{M}(2V, 2U) = 2e\mathcal{M}(V, U) = 2M$$

Thinking about why there exists unemployment

- Let $p(\theta_t)$ captures the rate at which a job-seekers finds a job where θ_t is the ratio of vacancies to job-seekers, $\theta_t = \frac{V_t}{U_t}$
- We call $p(\theta_t)$ the job-finding rate, we call θ_t labor market tightness
- We say that the labor market is tight when there are many vacancies to job-seekers, i.e. θ_t high
- We say that labor market is slack when there are few vacancies to job-seekers, i.e. θ_t low
- Note that the term 'slack' refers to the case where workers are willing and able to be utilized in production, but there aren't many jobs available for them.

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Thinking about why there exists unemployment

- Notice that if there are M_t matches possible and U_t individuals searching, then the probability of finding a job is:

$$p(\theta_t) = \frac{M_t}{U_t} = \frac{e\mathcal{M}(V_t, U_t)}{U_t} = e\mathcal{M}(\theta_t, 1)$$

  where we arrived at the last equality by using the fact that the matching function exhibits CRS

Thinking about why there exists unemployment

$$p(\theta_t) = \frac{M_t}{U_t} = e\mathcal{M}(\theta_t, 1)$$

- $p(\theta_t) = e\mathcal{M}(\theta_t, 1)$ suggests that when there are many job-seekers relative to vacancies (θ_t is low)
  $\Longrightarrow$ its harder for an individual to find a job (i.e. be hired) since there's more competition for that job.

- θ_t, is informative of the amount of congestion in the market.

- Also if e is low, then job-seekers can have a lower job-finding rate

- e can capture information frictions (it affects job-finding independently of congestion)

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Thinking about why there exists unemployment

Suppose we want to think about how unemployment evolves

- If we want to think about how unemployment evolves, we want to consider the outflows from unemployment
- Clearly, $p(\theta_t)$ affects the outflows from unemployment.
- If $p(\theta_t)$ is very high, unemployed workers can find jobs very easily and leave unemployment!

Thinking about why there exists unemployment

There are also inflows into unemployment.

- Employed individuals who separate from jobs flow into unemployment (s_t)

- Technically, out of the labor force who decided to search for a job become unemployed. (We will ignore this margin today although it matters in reality!)

Model Components

- Suppose population size fixed $= L$
- Individuals are Employed (E) or Unemployed (U) (assumption: nobody is out of the labor force!)
  - Implies employment and unemployment *rates* sum to 1:

$$u + e = 1$$

- An individual's labor market status can change:
  - Find job from unemployment; job-finding rate: $0 < p(\theta_t) < 1$
  - Lose job; separation rate: $0 < s_t < 1$
- Let's call U_t the total unemployed at start of time t
- and E_t total employed at start of time t

Unemployment Dynamics

- Evolution of number of unemployed persons from t to $t+1$

$$U_{t+1} = \underbrace{[1 - p(\theta_t)]U_t}_{\text{Remain unemployed}} + \underbrace{s_t E_t}_{\text{newly separated}}$$

- Can write this in rates by dividing by L:

$$u_{t+1} = [1 - p(\theta_t)]u_t + s_t e_t$$

  implies

$$\boxed{u_{t+1} - u_t = s_t e_t - p(\theta_t)u_t}$$

- Unemployment rate rises if more employed people lose their jobs than employed people find new jobs

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Unemployment Dynamics (cont.)

- Recall $e_t = 1 - u_t$, so

$$u_{t+1} - u_t = s_t e_t - p(\theta_t) u_t$$

  can be written as

$$\boxed{u_{t+1} - u_t = s_t(1 - u_t) - p[\theta_t] u_t}$$

- Given some initial u_0, can find (predict?) subsequent unemployment rate

Steady State Unemployment Rate

- If there are no shocks in the economy, i.e. the economy does not go through booms or recessions
- Then, job-finding and separation rates are constant $p(\theta_t) = p$ and $s_t = s$
- In the absence of shocks, unemployment rate does not grow or decline (it remains at a constant level.)
- This implies that the unemployment rate "tends" to $\bar{u}$
- We call $\bar{u}$ the steady state unemployment rate
- Steady State Unemployment Rate: If $p(\theta_t), s_t$ are constant and $u_{t+1} = u_t$, then

$$\bar{u} = \frac{s}{s + p(\theta)}.$$

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Unemployment Dynamics (cont.)

- We want to understand the evolution of unemployment
- Why does unemployment spike (jump) rapidly at the start of a recession ?
- Why does it take so long for unemployment to recover ?
- Can we use our equation dictating how unemployment evolves to help us?

A quick exercise

- Suppose population $= 1$.
- Suppose every period, half of all unemployed find a job, $p(\theta_t) = p(\theta) = 0.5$.
- Suppose every period, 1% of all employed lose their job, $s_t = s = 0.01$
- Can you find steady state unemployment rate, i.e. the unemployment rate the economy will stay stable at if $p(\theta)$ and s are held constant?

A quick exercise

- Now suppose there is a recession. Recessions are typically marked by mass layoffs, this means $s_t \uparrow$.

- What happens to u_{t+1} if s_t increases from 0.01 to 0.10, and $p(\theta_t)$ remains constant at 0.5?

$$u_{t+1} = [1 - p(\theta)]u_t + s_t(1 - u_t)$$

A quick exercise

- Now let's go forward one period, suppose s_{t+1} in period $t+1$ goes back to s, but now total u_{t+1} is higher

$$u_{t+2} = [1 - p(\theta_{t+1})]u_{t+1} + s(1 - u_{t+1})$$

- Even if $p(\theta_{t+1}) = p(\theta)$, i.e. constant, unemployment rate doesn't go back down immediately in period $t+2$

- To see this, plug in $p(\theta) = 0.5$, $s = 0.01$, and your previous answer about u_{t+1}, what is u_{t+2} ?

- We can go forward one more period and calculate u_{t+3}, notice still not equal to u_t

A quick exercise

- Again suppose the recessionary shock is over and s_t goes back to 0.01 after 1 period.
- But now let's consider what's happening to the θ_{t+1}
- We found $u_{t+1} > u_t$, so for same amount of vacancies created, θ_{t+1}????
- Do you expect unemployment rates to drop back to its original rate immediately? What is happening to the rate of finding a job?

Key Takeaways

- Separation shocks can cause unemployment rates to jump
- Unemployment rates tend to gradually decline even if separation rates go back to normal after 1 period
- Gradual decline exists because of search frictions (it takes time to find a job!)

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Whither Job?

- Where do jobs come from?

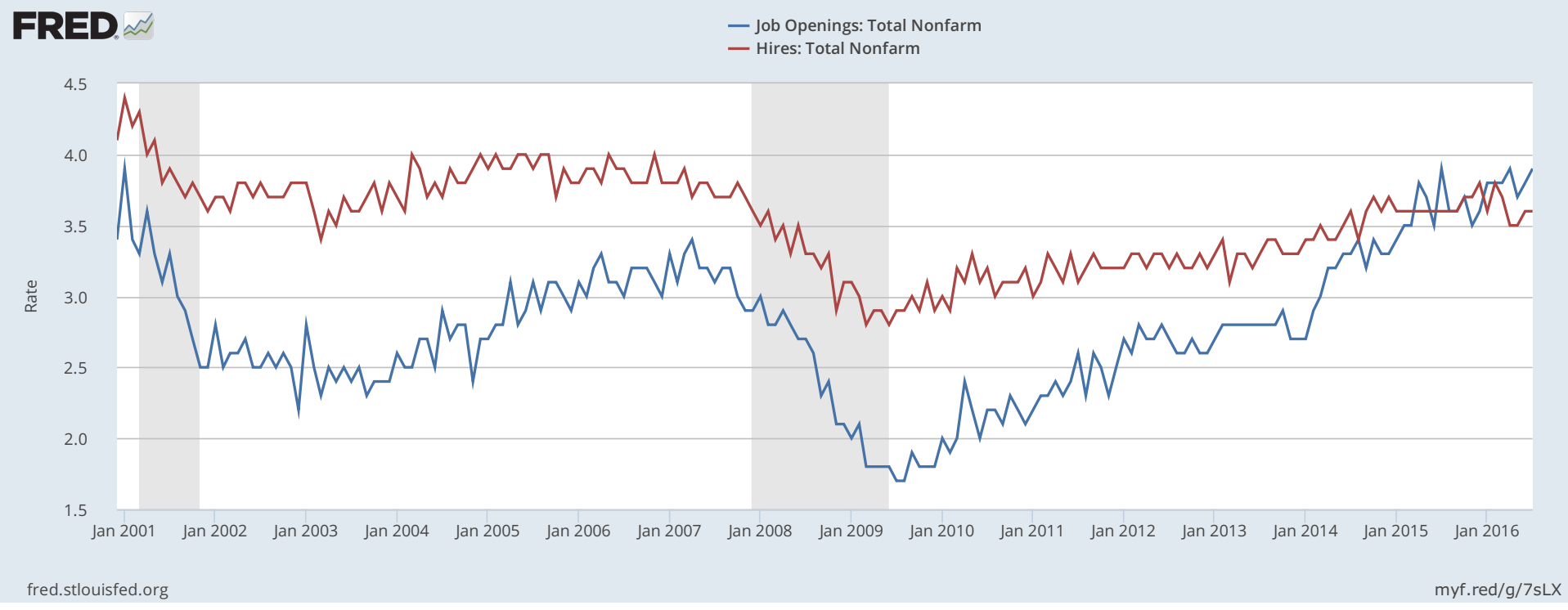
Vacancies and Unemployment

- When firms recruit new workers, they post *vacancies*
  Notation: V

- Vacancy Rate:

$$\text{Vacancy Rate } = \frac{V}{V+E}$$

Job Openings Rate



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The rate at which vacancies are filled

We call the rate at which a vacancy is filled the job-filling rate, denoted as $q(\theta_t)$

- Note that vacancies compete against other vacancies for job-seekers.
- So for M matches, and V vacancies, the job-filling rate is:

$$q(\theta_t) = \frac{M_t}{V_t} = \frac{e\mathcal{M}(V_t, U_t)}{V_t} = e\mathcal{M}\left(1, \frac{1}{\theta_t}\right)$$

- The vacancy job-filling rate is inversely (negatively) related to θ_t and positively related to e.

An example of the matching function

Consider the following matching function:

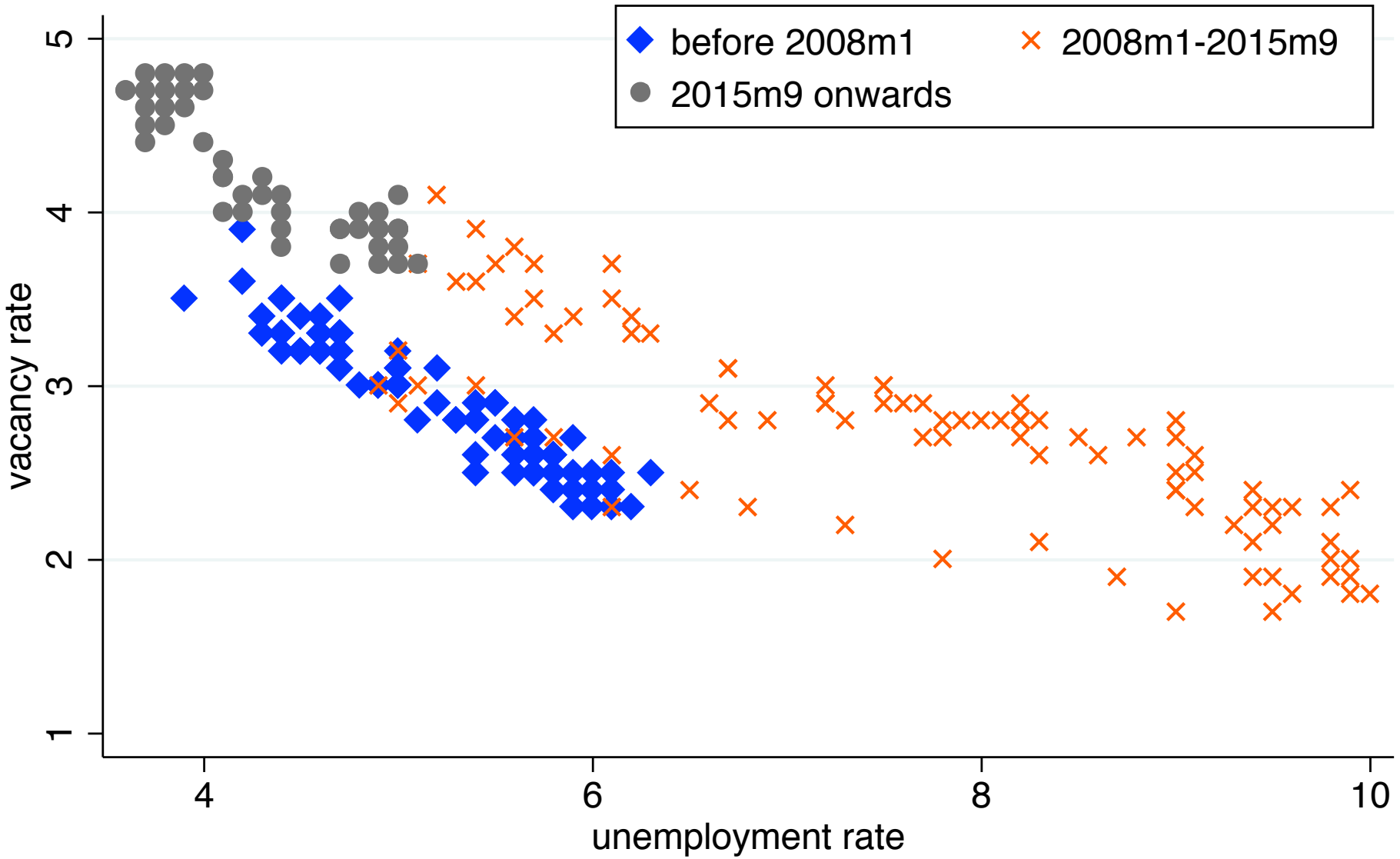
$$M = eV^{1-\gamma}U^{\gamma}$$

- Write down the form of $p(\theta)$ (job-seekers' job-finding rate) and $q(\theta)$ (vacancy filling rate) in terms of θ, e, γ, where $\theta = V/U$
- Show that job-seekers can find a job more easily when θ is high but vacancies actually have a harder time filling a job when θ is high.

The Beveridge Curve

- A Beveridge curve depicts the graphical relationship between the unemployment rate and vacancy (job openings) rate
- The Beveridge curve is downward sloping, reflecting the notion that if the job-openings rate is high (plenty of jobs available), then unemployment rate is low
- Shifts in the Beveridge curve suggest that matching efficiency (or the ability of the labor market to match workers to jobs) has declined as there are more unemployed per job opening.

The Beveridge Curve



Source: BLS, JOLTS

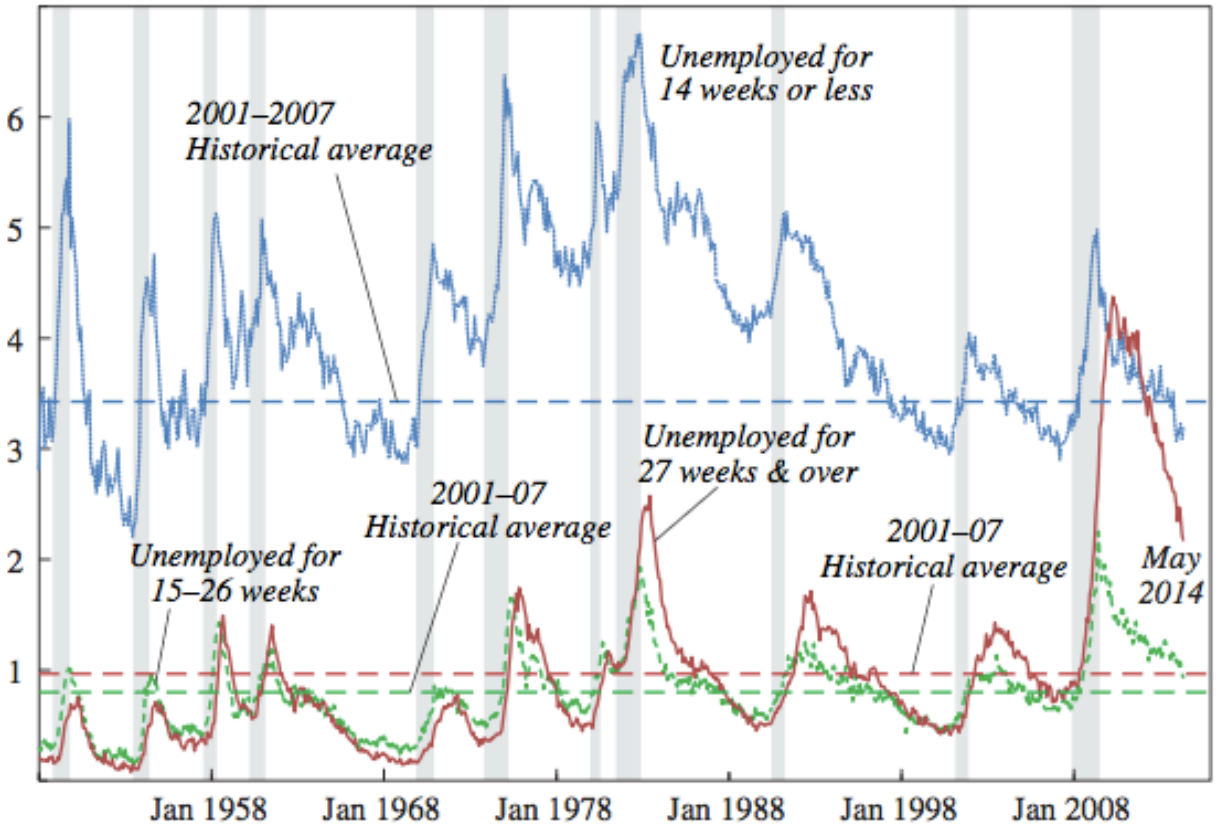
The Labor Market during the Great Recession

- Unemployment rate spiked during the Great Recession
- Vacancy rate declined
- Outward shift in Beveridge Curve, suggesting that the labor market was less able to match job-seekers to vacancies during the Great Recession
- Consequences?

The Long Term Unemployed

Figure 1. Unemployment Rates by Duration, 1948–2014

Percent of civilian labor force (seasonally adjusted)



Source: Bureau of Labor Statistics (Current Population Survey); National Bureau of Economic Research.
Note: Shading denotes recession.

Source: Krueger et al (2014)

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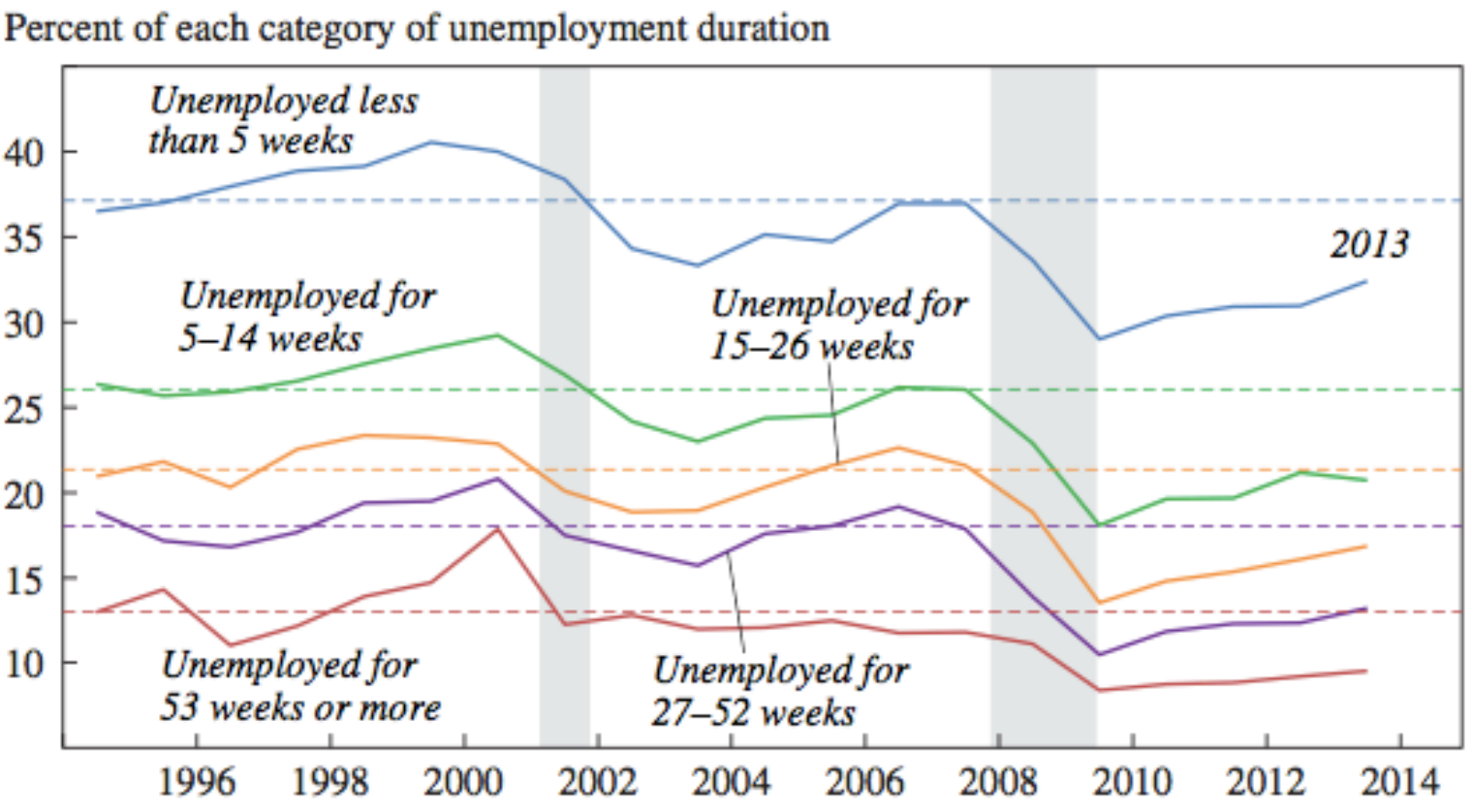
The Long Term Unemployed

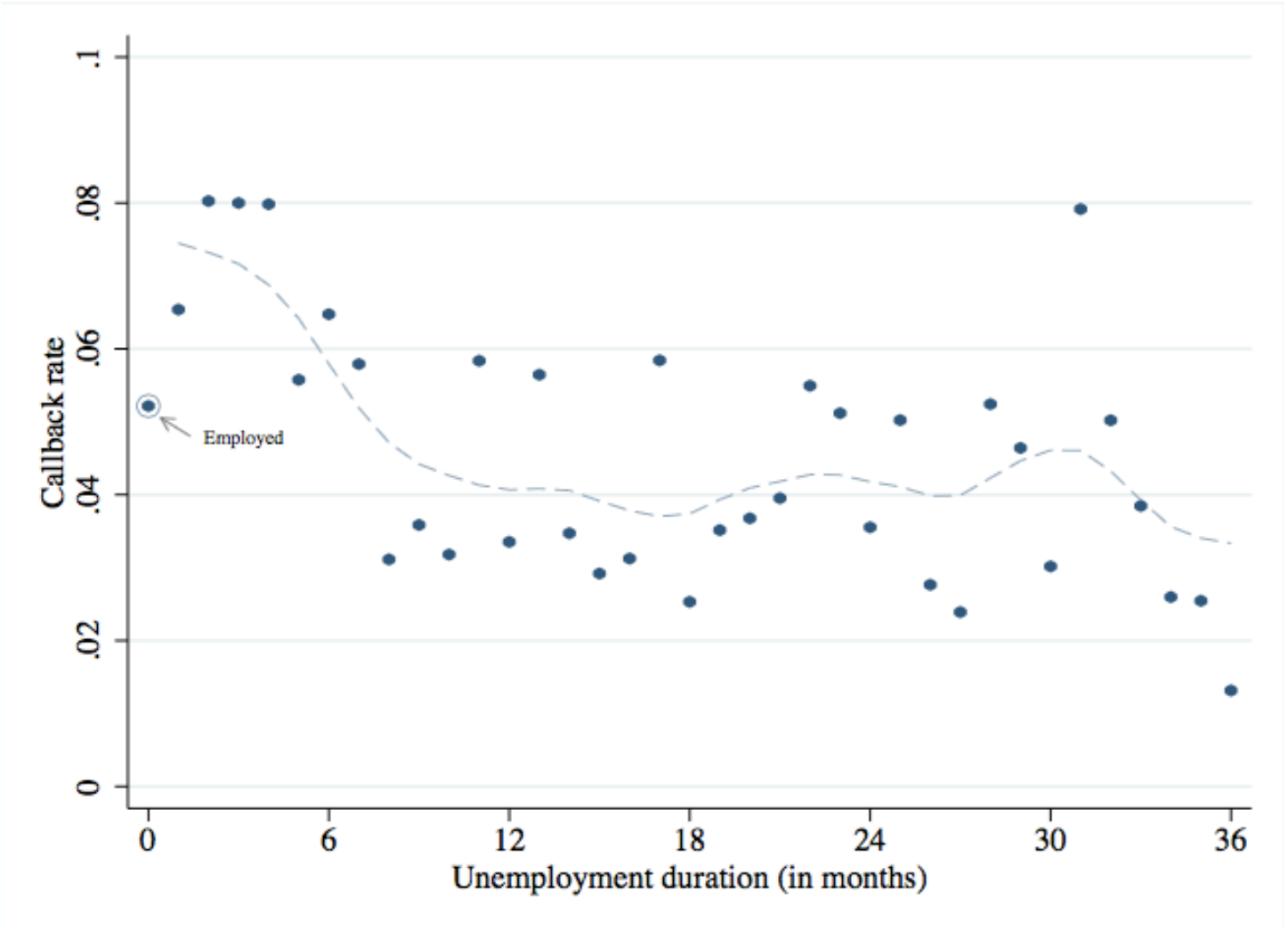
Figure 3. Monthly Probability of Transitioning from Unemployment to Employment by Duration of Unemployment, 1994–2013[a]



Source: Bureau of Labor Statistics (Current Population Survey); National Bureau of Economic Research.
a. Dashed lines represent 1994–2007 averages. Shading denotes recessions.

Source: Krueger et al (2014)

Call-back rates decline with duration



Source: Kroft et al (2013)

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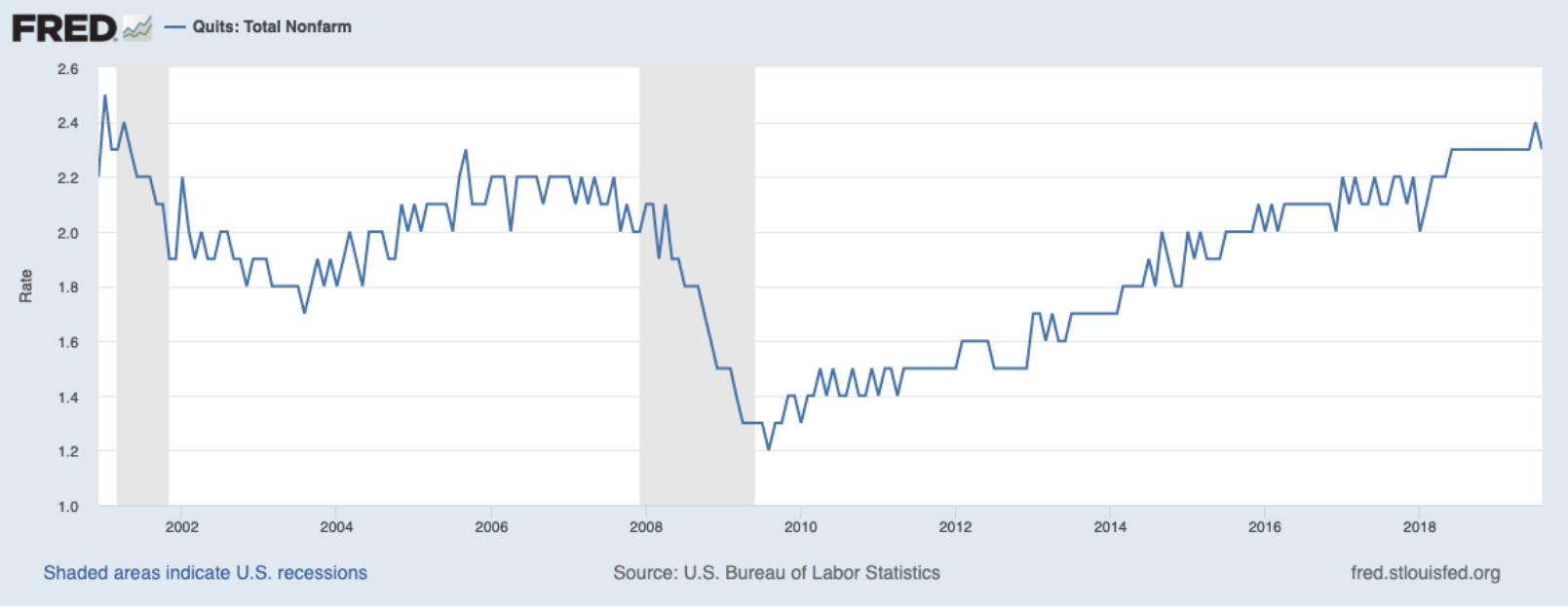
Quits rate



- The quits rate is: countercyclical? procyclical? acyclical?
- Former Fed Chairwoman Janet Yellen identified the quits rate as one her favored labor market indicators. Why?

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Mid-Semester Evaluations

- Mid-semester evaluations administered electronically
- Please go to the following link:
  http://cmu.ca1.qualtrics.com/jfe/form/SV_4NM9KuIv3xJA8IZ
- Surveys are anonymous. Please take the time to fill them out. It helps your faculty members improve their teaching!

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