Lecture 15: Unemployment: measurement and flows

ECON30009/90080 Macroeconomics

Semester 2, 2025

Unemployment

- So far, we have always assumed prices adjust to make markets clear
- which made the supply of labour $=$ demand for labour (everyone who wanted a job at that wage found a job).
- 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

Unemployment

- Key features of unemployment in the model:
  - Must search for work, finding a job is not automatic.
  - Because people search for work, implies employment is better than unemployment (and non-employment)
- Goal: understand determinants of the unemployment rate

Outline on Unemployment

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

Notations

- E: number of working age persons who are employed.
- U: number of unemployed.
- LF: number of people in the labour force $(E + U)$
- OLF: number of working age persons who are out of the labor force
- Unemployment Rate: $u = \frac{U}{E+U}$
- Labor Force Participation Rate: $LFPR = \frac{E+U}{E+U+OLF}$
- Employment to Population Ratio: $EPOP = \frac{E}{E+U+OLF}$

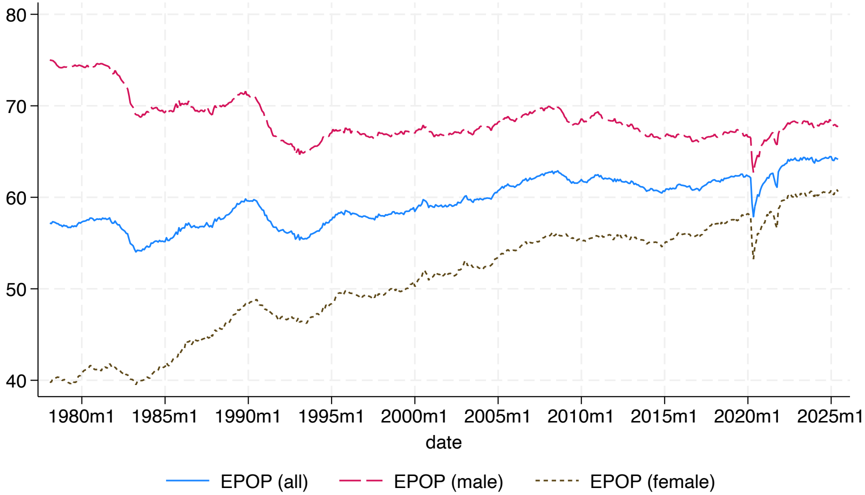
The employment-population ratio

- The number of people that are employed as a fraction of the civilian population aged 15 years and over
- This ratio:
  - Has been increasing over time (why?)
  - Decreases in times of a recession.

Employment to Population Ratio in Australia

Source: ABS

Employment to Population Ratio in Australia

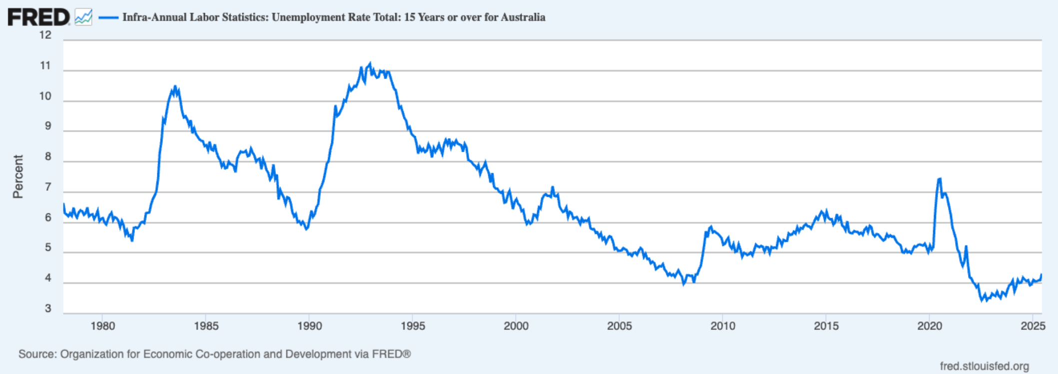


Source: ABS

The unemployment rate

- The fraction of the labour 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.

Australia unemployment rate



Looking at the unemployment rate

- The unemployment rate spikes at times during recessions
- And takes time to wind down to its mean rate
- Can we think of a way to characterize how the unemployment rate evolves?

Unemployment Dynamics

Thinking about why there exists unemployment

- Frictional unemployment: idea that workers do not automatically find jobs as there exists search frictions in the labour market
- Search frictions can take the form of:
    - Information frictions
    - Congestion effects

A matching function

Model matches via a matching function

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

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

  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)

Labour market tightness, θ

- 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 labour market tightness
- The labour market is tight when there are many vacancies to job-seekers, i.e. θ_t high
- The labour 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.

Probability of finding a job

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

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

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

Probability of finding a job

$$p(\theta_t) = \frac{M_t}{u_t} = \xi \mathcal{M}(\theta_t, 1)$$

- $p(\theta_t)$ is positively related to θ_t.
- When there are many job-seekers relative to vacancies (θ_t is low) $\Longrightarrow$ harder for an individual to find a job since there's more competition per vacancy
- θ_t, is informative of the amount of competition among job-seekers in the labour market.
- Also if ξ is low, then job-seekers can have a lower job-finding rate
- ξ can capture information frictions (it affects job-finding independently of congestion)

Outflows from unemployment

We want to think about how unemployment evolves

- Job-seekers leave unemployment when they find a job
- 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!

Inflows into unemployment

There are also inflows into unemployment.

- Employed individuals who separate from jobs flow into unemployment (s_t)
- Technically, those 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:

$$u + e = 1$$

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- An individual's labor market status can change:
  - Find job from unemployment; job-finding rate: $0 < p(\theta_t) < 1$
  - Lose job; separation rate: $0 < s_t < 1$

Unemployment Dynamics

Denote U_t and E_t as the total unemployed and employed, respectively, at the start of t

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

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

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- Rearranging:

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

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

Unemployment Dynamics (cont.)

- Recall $e_t = 1 - u_t$, so

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

can be written as

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

- Given some initial u_0, and path of job-finding rates and separation rates, we can trace how the unemployment rate evolves

Steady State Unemployment Rate

- Absent shocks in the economy, i.e. the economy is in steady state
- Job-finding and separation rates are constant in steady state: $p(\theta_t) = p$ and $s_t = s$
- In steady state, unemployment rate remains at a constant level, $\bar{u}$
- We call $\bar{u}$ the steady state unemployment rate
- Steady State Unemployment Rate: At steady state, $u_{t+1} = u_t \implies \Delta u_t = 0$, then

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

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 there is a measure 1 of individuals in the population and population= labour force.
    - Note that with this assumption: number unemployed equal to unemployment rate, $u_t = U_t/L_t = U_t$ since $L_t = 1$
- Suppose every period, only some unemployed find a job, $p(\theta_t) = p(\theta) = 0.38$.
- Suppose every period, 2% of all employed lose their job, $s_t = s = 0.02$
- 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

- Suppose the unemployment rate is initially at its steady state level. At date t, 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 0.02 to 0.10, and $p(\theta_t)$ remains constant at 0.38?

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

A quick exercise

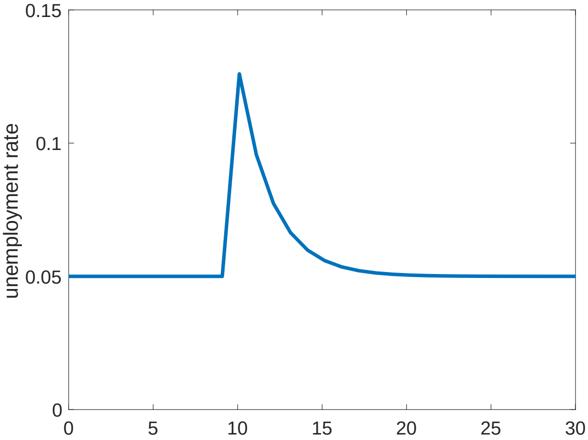
- Now let's go forward one period, suppose s_{t+1} in period $t+1$ goes back to $s = 0.02$, but now total u_{t+1} is higher

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

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

- Why?

Finding a job takes time



- Separation shocks cause unemployment rates to spike on impact
- Unemployment rates tend to gradually decline even if s goes back to normal after 1 period
- Gradual decline exists because of search frictions (it takes time to find a job!)

A quick exercise

- Again suppose the recessionary shock is over and s_t goes back to 0.02 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?

Following a recession, unemployment rates take time to recover

Whither Job?

- Where do jobs come from?

Vacancies and Unemployment

- When firms recruit new workers, they post *vacancies*, v

- The rate at which a vacancy is filled is called the job-filling rate, denoted by $q(\theta_t)$.

- The job-filling rate is also a function of labour market tightness because each vacancy competes with other vacancies for job-seekers.

- Using our matching function, if there are M matches and V vacancies, probability of filling a vacancy is:

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

Job-filling probability, $q(\theta_t)$, is negatively related to labour market tightness θ_t

An example of a matching function

- Suppose there is measure 1 of individuals in the population and population=labour force $\implies U_t = u_t$

- A common matching function we will use:

$$\xi \mathcal{M}(v_t, u_t) = \xi \frac{u_t v_t}{(u_t^{\alpha} + v_t^{\alpha})^{1/\alpha}}$$

- Try this on your own: write down $p(\theta_t) = M_t/u_t$ as a function of only θ_t, ξ and α. Show that the job-finding rate is increasing in θ_t

- Similarly, write down $q(\theta_t) = M_t/v_t$ as a function of only θ_t, ξ and α. Show that $q(\theta_t)$ is decreasing in θ_t.

Wrapping up

- Today: unemployment, measurement and flows
- Next class: a search model of unemployment