Intermediate Macroeconomics
Semester 2, 2017

<u>Week 1 – Introduction</u>

Aggregate output
Recorded in national income accounts, which is used to measure aggregate economic activity.

Key measures of aggregate output
- Gross domestic product (GDP)
- Gross domestic income (GDI)

GDP is the same as GDI.

There are three ways to measure aggregate output.
GDP is the
- Total value of the <u>final</u> goods and services produced
- Total *value-added*
- Total *income*

In the economy during a given period.

Nominal GDP and real GDP
<u>Nominal GDP</u>
Sum of quantities times current prices where prices are denominated in dollars.
<u>Real GDP</u>
Sum of quantities times constant prices.

Inflation
Inflation is a sustained increase in the general level of pries.
Two important measures of the price level:
- <u>The GDP deflator</u>

$$P_t = \frac{\$Y_t}{Y_t} \times 100$$

Where $\$Y_t$ = nominal GDP in period t
Y_t = real GDP in period t

  P_t is the GDP deflator, an implicit price index.
  P_t measures average price of aggregate output.
- <u>The consumer price index (CPI)</u>
  CPI measures average price of a consumption basket.
  CPI and GDP deflator usually move together over time.
  The inflation rate is:

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100\%$$

Unemployment
Unemployment rate in a given period:
N = employed
U = unemployed
L (labour force) = *N* + *U*

$$u = \frac{U}{L}$$

Participation rate in a given period:

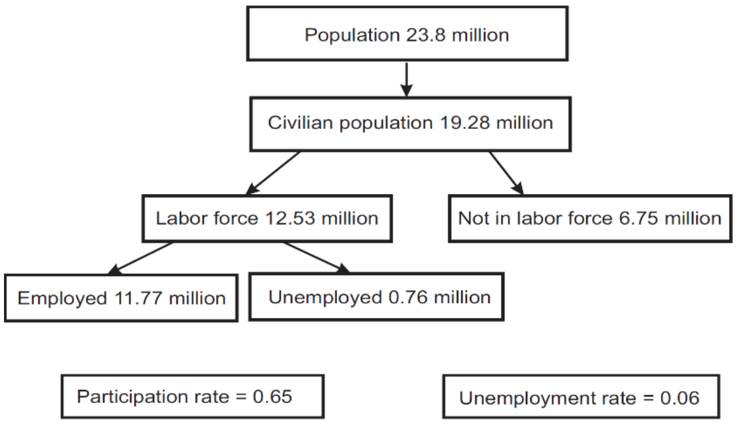
$$Participation\ rate = \frac{Labour\ force}{Population\ of\ working\ age}$$

Week 4 – The Labour Markets

Labour market concepts

- Civilian population – number of people aged 15+ available for civilian employment
- Labour force L – people who are either working or actively looking for work
- Participation rate – ratio of labour force to the civilian population
- Unemployment rate u – ratio of unemployed people to labour force $u = \frac{U}{L}$

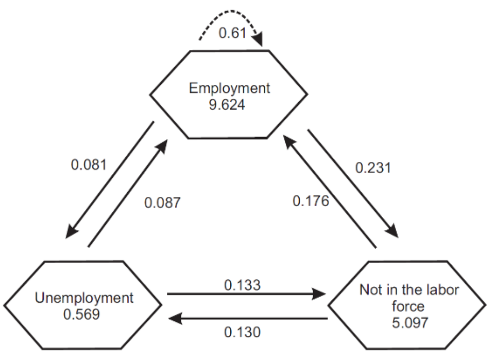
Australian labour market – June 2015



Labour market flows

A given overall unemployment rate may reflect two very different patterns of underlying labour market flows:

1. 'fluid' labour market – high turnover (many separations and many hires)
2. 'sclerotic' labour market – low turnover (few separations and few hires)



Notice large flows of workers in/out of employment. These separations are either due to:

- Quits – leaving a job for better alternative
- Layoffs – changes in employment levels across firms

Discouraged workers are classified as part out of the labour force.

Flows between employment, unemployment and non-participation from May to June 2015, in millions.

Simple model of flows

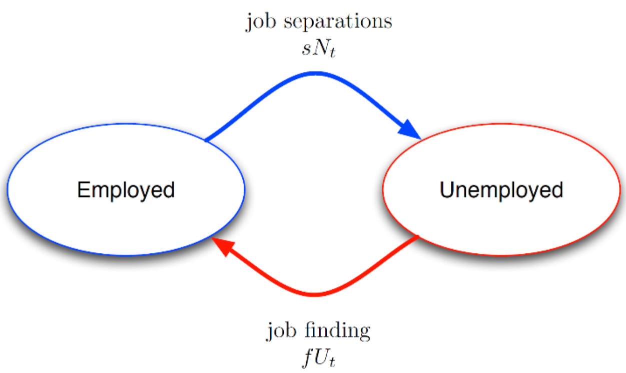
Consider a constant labour force $\bar{L}$. Workers are either employed N_t or unemployed U_t. Assume the labour force participation rate is 1.

$$N_t + U_t = \bar{L}$$

Change in unemployment given by difference between job finding and job separations:

$$U_{t+1} - U_t = sN_t - fU_t$$

Where $s > 0$ is the constant job separation rate and $f > 0$ is the constant job finding rate. Therefore, sN_t represents the flow into unemployment and fU_t represents flow out of unemployment



Steady state unemployment

The unemployment rate is $u_t = \frac{U_t}{L}$ and it follows

$$u_{t+1} - u_t = s(1 - u_t) - f_{u_t}$$

This is the flow condition of unemployment.

In the **steady-state**, unemployment is constant, $u_{t+1} = u_t = \bar{u}$, so

$$0 = s(1 - \bar{u}) - f\bar{u}$$

Solving for the steady-state unemployment rate $\bar{u}$:

$$\bar{u} = \frac{s}{s + f}$$

Which implies:

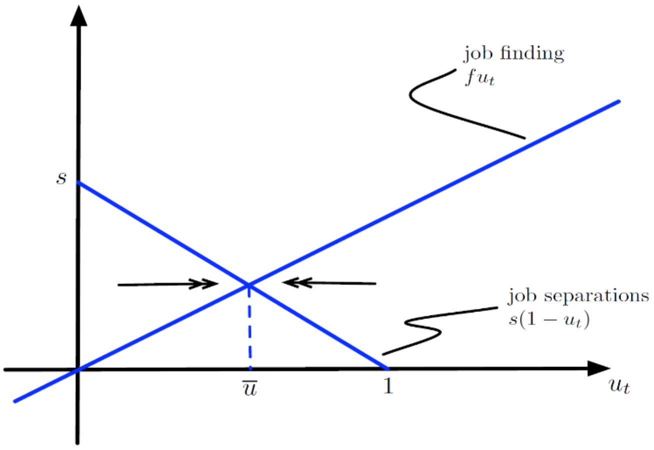
- Higher job separation rate *s*, higher unemployment
- Higher job finding rate *f*, lower unemployment

Determining steady-state unemployment

If job finding is less than separations, $f_{u_t} < s(1 - u_t)$, then unemployment rises towards $\bar{u}$.

If job finding is greater than separations, $f_{u_t} > s(1 - u_t)$, then unemployment falls towards $\bar{u}$.

If job finding equals separations, unemployment is constant at $u_t = \bar{u}$.



Scaling *s* and *f* by any common multiple *a* > 0 leaves the steady state unemployment unchanged.

$$\bar{u} = \frac{s}{s + f} = \frac{as}{as + af}, \quad \text{for any } a$$

For example, a 'fluid' labour market with *s* = 0.03 and *f* = 0.5. steady state unemployment is

$$\bar{u} = \frac{s}{s + f} = \frac{0.03}{0.03 + 0.50} = 0.057$$

A 'sclerotic' labour market with half as many separations and half as many flows, *s* = 0.015 and *f* = 0.25, steady state is:

$$\bar{u} = \frac{s}{s + f} = \frac{0.015}{0.015 + 0.25} = 0.057$$

Therefore, different underlying patterns of flows are consistent with the same overall unemployment rate.

Unemployment dynamics

Recall changes in the unemployment rate

$$u_{t+1} - u_t = s(1 - u_t) - f_{u_t}$$

In terms of deviation from the steady state $\bar{u}$:

$$u_{t+1} - \bar{u} = \lambda(u_t - \bar{u})$$

Where

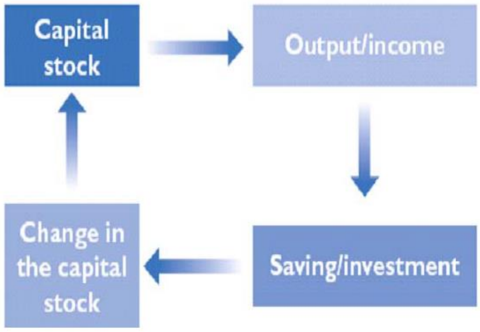
$$\lambda \equiv 1 - (s + f)$$

From some initial unemployment rate u_0, e.g., after a shock, unemployment rate at time *t* is

$$u_t - \bar{u} = \lambda^t(u_0 - \bar{u})$$

Return to steady rate is faster if λ is small i.e. if the total rate of turnover $(s + f)$ is high. Therefore, fluid labour markets may help the economy return to normal quickly following a shock.

Week 8 – Growth Theory



Solow neoclassical growth model
Based on two important long-run relationships
- amount of capital determines output produced (per period)
- amount of output determines saving and investment (per period)

Together, these relationships determine the amount of capital being accumulated <u>over time</u>.

To focus on capital accumulation, assume
- population, participation rate, unemployment rate all constant
- no technological progress

Then output per worker *y* is an increasing concave function of capital per worker *k*

$$y = \frac{Y}{N} = F\left(\frac{K}{N}, 1\right) = f(k)$$

Note that $F(\cdot)$ and thus $f(\cdot)$ has diminishing returns.

More capital per worker implies more output per worker.

<u>Effect of output on capital accumulation</u>
With constant saving rate *s*, total private savings are

$$S = sY, \quad 0 < s < 1$$

Closed economy with balanced budget ($G = T$). Investment equals savings.

$$I = S$$

Capital accumulation with constant depreciation rate δ. Between two periods *t* and *t*+1, the change in capital stock is

$$K_{t+1} - K_t = I_t - \delta K_t, \quad 0 < \delta < 1$$

Flow into K   Flow out of K

Or

$$K_{t+1} = (1 - \delta)K_t + I_t$$

Substitute $I_t = S_t = sY_t$ for investment and normalise everything by the number of workers *N*:

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = s\frac{Y_t}{N} - \delta\frac{K_t}{N}$$

Or in per worker terms:

$$k_{t+1} - k_t = sy_t - \delta k_t$$

Using the production function $y_t = f(k_t)$ to substitute for output per worker then gives the **fundamental equation of the Solow model**:

$$k_{t+1} - k_t = sf(k_t) - \delta k_t$$

Change in capital stock per worker is given by investment per worker $sf(k_t)$ less depreciation per worker δk_t.
- If investment > depreciation, capital stock rises, $k_{t+1} > k_t$
- If investment < depreciation, capital stock falls, $k_{t+1} < k_t$