Introductory Macroeconomics

Lecture 23: review, part one

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GDP Measurement

- In fact, three ways to measure GDP per period

  1- market value of production of all final goods and services (*production approach*)   Revenue

  ⇒ allocate to worker and capital worker

  2- sum of all domestic expenditures (*expenditure approach*)

  income approach   labor income   capital income

  3- sum of all domestic income (*income approach*)

  expenditure approach $C. + I + G$

- By accounting construction, all three approaches give the same answer (up to a statistical discrepancy)

Nominal GDP vs. Real GDP

- **Goal:** separate nominal GDP into *quantity index* and *price index*

$$\text{nominal GDP} = \underbrace{(\text{real GDP})}_{\textit{quantity index}} \times \underbrace{(\text{GDP deflator})}_{\textit{price index}}$$

- We refer to the quantity index as *real GDP*: traditional approach and chain-weighing approach
- We often use *GDP deflator* or *CPI* as a price index
- Real GDP then gives measure of economic activity controlling for changing prices

Inflation

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

- Costs include

  borrower & lender
  if inflation↑. borrowers are better off

  – redistributes wealth, menu costs, shoe leather costs, etc.

- Measurement Issues of CPI

  – *Substitution bias* — consumers may substitute away from goods that are becoming relatively more expensive, if so this causes fixed-basket CPI to overstate the cost of purchasing a basket of goods and services that typical consumers actually consume

  – *Quality bias* — even if notional prices of goods unchanged, rising quality may mean consumers are getting more for their expenditure, again fixed-basket CPI may be misleading

  eg. phone

Nominal and Real Interest Rates

- Real interest rate is

$$(1 + r) = \frac{1 + i}{1 + \pi}$$

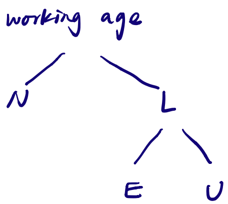
- When i and π are small, a good *approximation* to this is

$$r \approx i - \pi$$

- **Example:** if $i = 0.05$ and $\pi = 0.03$ then exact $r = (1.05)/(1.03) - 1 = 0.0194$ and approximation is $r \approx 0.02$.

Labour Market States

- *Working-age population* (aged between 15 and 64 in Australia) is divided into three labour market 'states' or outcomes



$$N = \text{population not in the labour force}$$

people who don't intend to find job

$$E = \text{population employed}$$

$N \neq U$.

$$U = \text{population unemployed}$$

willing to find job but can't

- The sum of the employed and the unemployed population is the population in the *labour force*

$$E + U = L = \text{labour force}$$

Participation and Unemployment Rates

- The *participation rate* is the fraction of the working-age population that is in the labour force

$$\text{participation rate} = \frac{L}{\underbrace{L+N}_{\text{working population}}} = \frac{E+U}{E+U+N}$$

- The *unemployment rate* is the fraction of the labour force that is not employed

$$\text{unemployment rate} = \frac{U}{L} = \frac{U}{E+U}$$

Model of Unemployment

- Number of unemployed in period $t+1$ comes from two states

$$U_{t+1} = sE_t + \underbrace{(1-f)}_{\text{can't find job}}U_t$$

$$U_{t+1} \Rightarrow \begin{cases} \text{employed} \xrightarrow{s} \text{unemployed} \\ \text{unemployed} \xrightarrow{1-f} \text{unemployed} \end{cases}$$

- Unemployment is stable ('in steady-state') when $U_{t+1} = U_t$

- That is, unemployment is stable when flows into unemployment equal flows out of unemployment

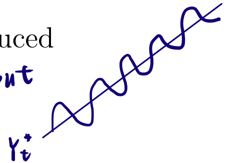
$$sE = fU$$

- Unemployment rate in steady state is

$$u = \frac{U}{L} = \frac{U}{U+E} = \frac{s}{s+f}$$

Potential Output Y_t^*

- *Potential output* or *natural output*: amount of output produced when using resources at 'normal rate' trend of actual output



- *Output gap* is the (percentage deviation) between actual output Y_t and potential output Y_t^*, that is

$$\text{Output Gap}_t = \frac{Y_t - Y_t^*}{Y_t^*} \times 100$$

- During expansions, we observe $Y_t > Y_t^*$, i.e., output gap is positive

- During contractions, we observe $Y_t < Y_t^*$, i.e., output gap is negative

Natural Rate of Unemployment

- Similarly let u_t^* denote the *natural rate of unemployment*
- Rate of unemployment we would expect when the economy is operating at Y_t^*
- Okun's Law: Unemployment higher than normal when output less than normal

$$\frac{Y_t - Y_t^*}{Y_t^*} \times 100 = -\beta \left(u_t - u_t^* \right)$$

Keynesian Model

- *Keynesian equilibrium* Y is where planned aggregate expenditure (PAE) equals actual aggregate expenditure (AE)

$$C + I + G \quad = PAE \quad = \quad AE \qquad (= Y)$$

3 ways of measuring GDP are the same

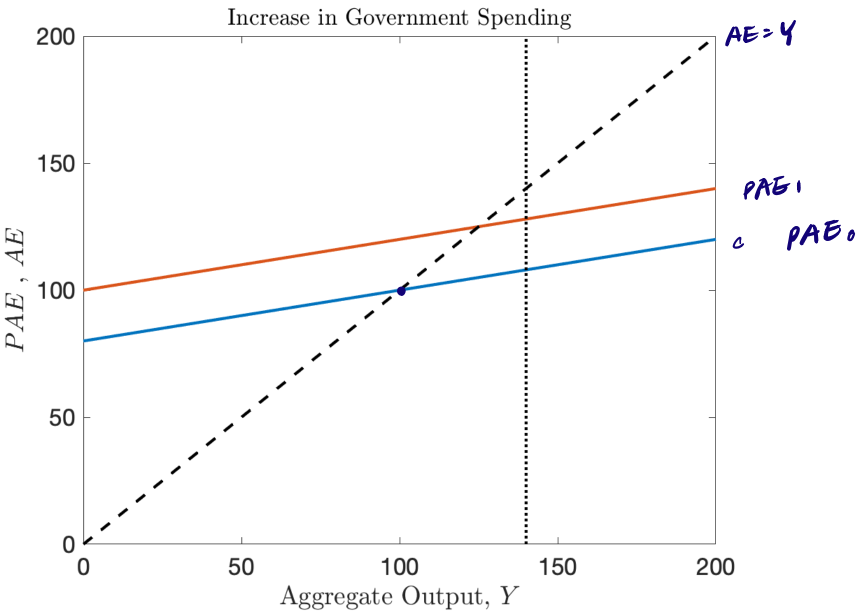
- To find this Keynesian equilibrium level of Y we use the $PAE = AE = Y$ condition to write

$$\boxed{\bar{C} + c(Y - \bar{T}) + \bar{I} + \bar{G} \quad = \quad Y} \qquad (*)$$

MPC

- This is one equation to be solved for one unknown, Y.

Increase in Government Spending



Fiscal Stimulus: Increase $\bar{G}$ or Decrease $\bar{T}$?

- Short-run output given by

$$Y = \frac{1}{1-c}\left(\bar{C} - c\bar{T} + \bar{I} + \bar{G}\right)$$

- Can stimulate output by *increase* in $\bar{G}$ or *decrease* in $\bar{T}$

- Which gives bigger effect on short-run output? Change in $\bar{G}$ gives

$$\frac{dY}{d\bar{G}} = \frac{1}{1-c}$$

$\frac{dY}{d\bar{G}} > \frac{dY}{d\bar{T}}$ government expenditure is more effective

Change in $\bar{T}$ gives

$$\frac{dY}{d\bar{T}} = -\frac{c}{1-c}$$

Keynesian Equilibrium Revisited

two ways to understand Keyesian models

① PAE = AE = Y

② planed investment = planned national saving

- Planned private savings

$$S = (1-c)(Y-T) - \bar{C}$$

- Investment and savings relationship in a closed economy

$$I = \underbrace{S}_{\text{private saving}} + \underbrace{(T-G)}_{\text{public saving}}$$

- Suppose $I = \bar{I}$, $T = \bar{T}$, $G = \bar{G}$ are given. Investment and savings relationship implies

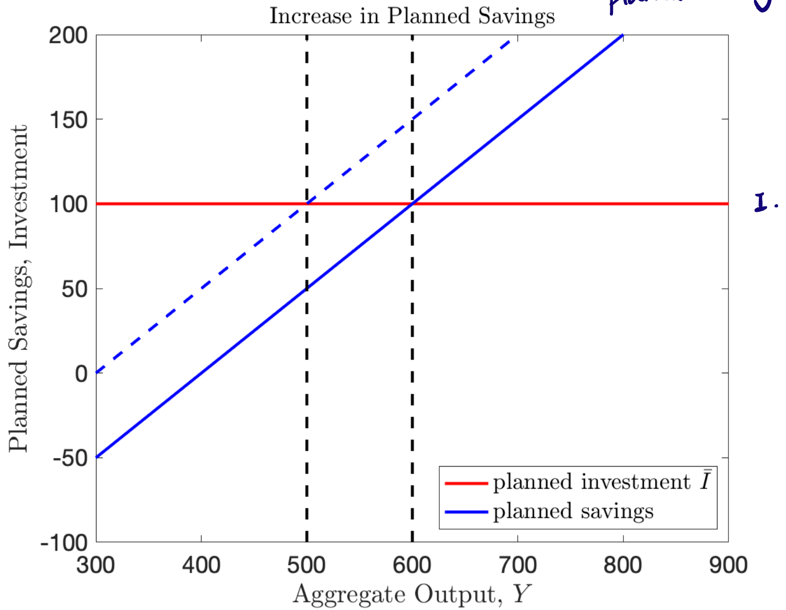
$$\boxed{\bar{I} = (1-c)(Y-\bar{T}) - \bar{C} + \bar{T} - \bar{G}} \qquad (*)$$

- The equilibrium output

$$Y = \frac{1}{1-c}\left(\bar{C} - c\bar{T} + \bar{I} + \bar{G}\right)$$

Paradox of Thrift

household
incentive to save
⇓
lead to a recession



Monetary Policy

☆.

- *Conventional monetary policy* instruments such as
  - short-term nominal interest rates (cash rate)
  - narrow measures of the money supply
  - exchange rates (e.g., fixed vs. floating)
- As the cash rate approached this lower bound, much attention turned to *unconventional monetary policy* tools, including
  - negative interest rates (tax on saving, more willing to lend).
  - ?. extended liquidity programs (risky asset are taken by central bank and give loan).
  - ? asset purchases ('quantitative easing')
  - forward guidance (make promise to keep interest rate at 0)

    ⇒ firm can invest today and alleviate recession

AD Curve

- Output and real interest rate

$$Y - Y^* \;=\; -\gamma(r - r^*) + \varepsilon_D \tag{1}$$

where $\varepsilon_D = A - A^*$ represents *shocks to aggregate demand* and $\boxed{\gamma \;=\; \frac{1}{1-c}(\gamma_C + \gamma_I)}$.

- Monetary policy reaction function

$$r \;=\; r^* + \alpha(\pi - \pi^*) \tag{2}$$

α: aggresiveness of monetary policy

- Use the above two equations to get AD curve

$$\boxed{Y - Y^* \;=\; -\alpha\gamma(\pi - \pi^*) + \varepsilon_D} \tag{AD}$$

- Downward sloping relationship between π and Y, slope $\alpha\gamma$

AS Curve

- Short run trade-off between inflation and unemployment (Phillips curve)

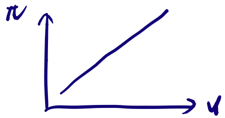
$$\pi = \pi^e - \phi(u - u^*) + \varepsilon_S \tag{3}$$

- Okun's law

$$u - u^* = -\beta(Y - Y^*) \tag{4}$$

- Use the above two equations to get the short-run AS cuve

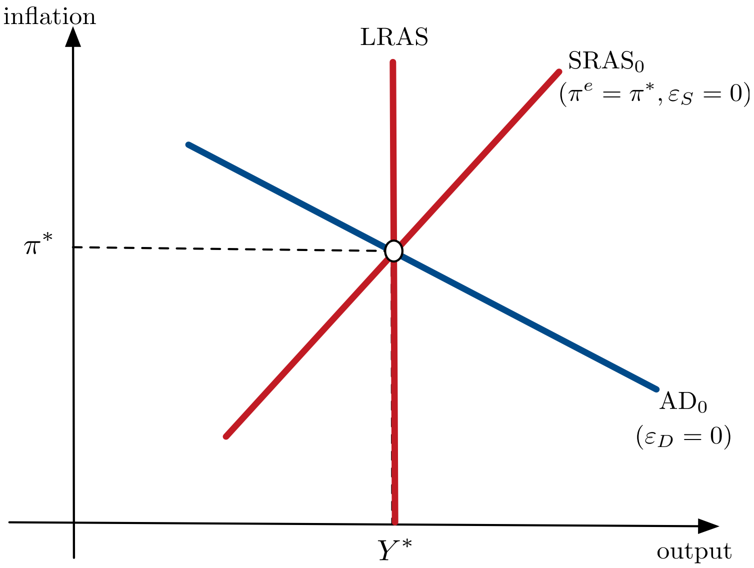
$$\boxed{\pi = \pi^e + \phi\beta(Y - Y^*) + \varepsilon_S} \tag{AS}$$



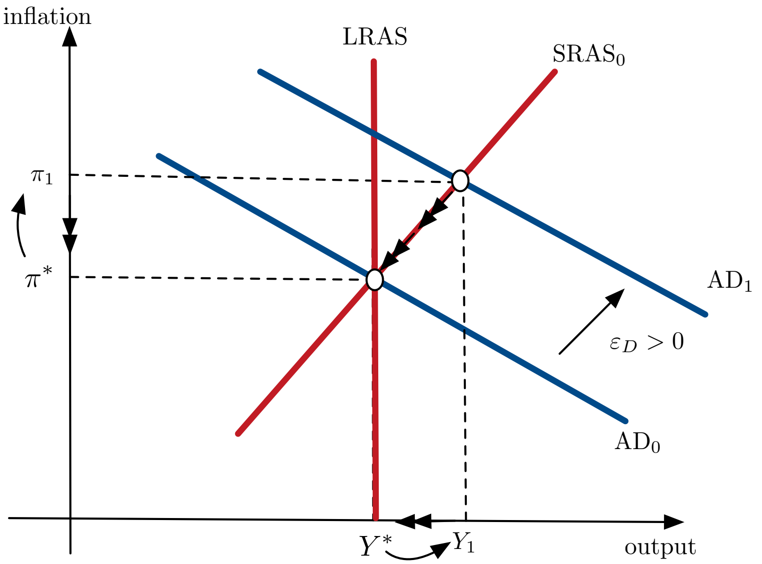
- Upward sloping relationship between Y and π, slope $\phi\beta$

- Long Run AS (LRAS) curve when $\pi = \pi^e$ and $\varepsilon_S = 0$

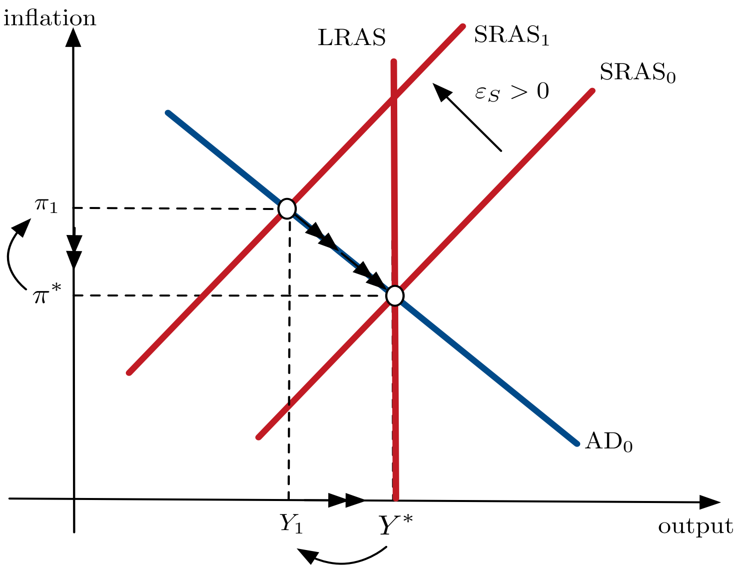
Initial Long Run Equilibrium



Investment or Consumption Boom



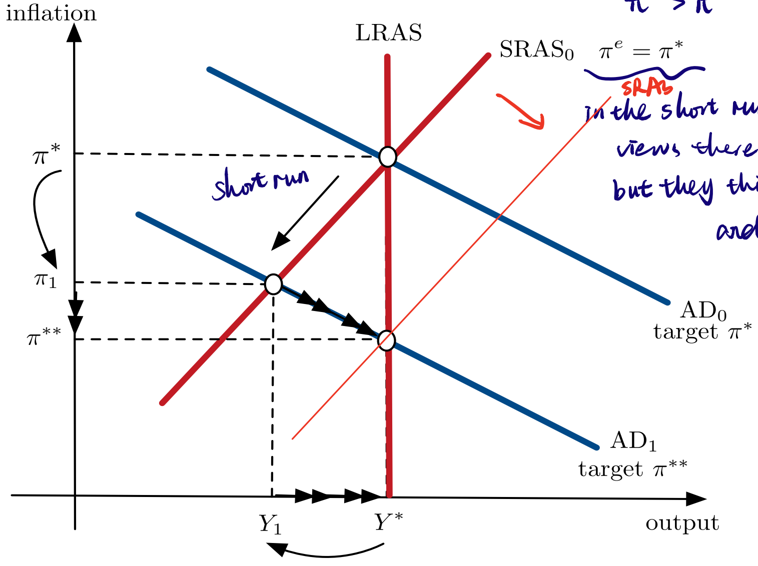
Energy Price Spike $\varepsilon S > 0$



Disinflation

$\pi^* \to \pi^{**}$

$\pi^* > \pi^{**}$



in the short run, all the agencies views there is a fall in π^*, but they think it's temporary, and π will go back to π^*.

in the long run, π^* fall is not temporary.

$\Rightarrow$ so they change π^e

Next Lecture

- Summary of the second part of the course