

## 14.02 REVIEW

Structure:

1. Basic Concepts
2. IS-LM + WS-PS = AD-AS
3. Inflation, disinflation, hyperinflation, interest rates, exchange rates, unemployment
4. Growth

### 1. Basic Concepts (Chapters 3 to 10)

- a. The equation to always remember, because it's a definition

$$Y = C + I + G + NX$$

Y: GDP, measures output, expenditure and income

C: Consumption, two theories, the keynesian (multiplier) equation, the permanent income or life cycle theory. We assume generally then that  $C = C(Y - T)$

I: Investment, a function of the real interest rate and output

NX: net exports =  $X - eQ$

X: exports a function of the real exchange rate  $e = EP^*/P$  and foreign GDP  $Y^*$

Q: imports a function of the real exchange rate  $e = EP^*/P$  and domestic GDP  $Y$

So therefore  $NX = NX(EP^*/P, Y^*, Y)$

- b. Two applications:

$$\begin{aligned} \text{Savings and investment} \quad I &= [(Y - T) - C] + [T - G] - NX \\ I &= S_p + S_g + S_x \end{aligned}$$

Long run and open economy

$$Y_n = C(Y_n - T) + I(r^*) + G + NX(EP^*/P, Y_n, Y^*)$$

This is a constraint that must hold in the long run.

Allows to see what changes in the LR if, for example,  $G$  increases.

- c. Money and Bonds

Why demand money? transactions

What is the alternative? Hold bonds

$$\text{Then, } M/P = L(r + \pi^e) \cdot Y$$

### 2. IS-LM + WS-PS = AD-AS

- a. The crucial issue is that the economy must always return to the long run equilibrium.

Aggregate supply Short run

Wage setting :  $W = P^e \cdot F(u, z)$ , wages depend on expected price, unemployment and other

Price setting:  $P = (1 + m)W$ , prices are a constant markup over wages

Aggregate supply curve in the short run:  $P = P_e \cdot (1 + m) \cdot F(u, z)$   
 So, increase in  $Y \rightarrow$  decrease in  $u \rightarrow$  increase in  $W \rightarrow$  increase in  $P$   
 AS is upward sloping in the short run

Aggregate supply Long run

Long-Run is  $WS + PS$  plus  $P_e = P$ . This leads to  $u = u_n \rightarrow Y = Y_n$

Aggregate demand is a product of IS+LM

What happens if  $P$  increases? Two effects

$M/P$  falls, this shifts the LM to the left

$EP^*/P$  falls, this appreciates the real exchange rate and contracts NX, shifts the IS to the left.

So AD is downward sloping, flatter in the open economy.

## b. Dynamics

In the end, AD-AS is useful to assess the dynamics of adjustment. Important to understand  
 Fiscal Policy, Monetary Policy under  
 Fixed exchange rates, Flexible exchange rates

Example 1: Monetary expansion under flexible exchange rates

In the long run we know that nothing will happen in real variables.

Short run: increase in  $M \rightarrow$  shifts AD, LM to the right, tends to lower interest rates  $\rightarrow$  expected devaluation.  $\rightarrow$  the economy must move to  $r = r^* \rightarrow$  IS shifts to the right. So this adds an extra punch to the shift in the AD  $\rightarrow$  Equilibrium is between AD and AS however  $\rightarrow$  higher  $Y$  leads to lower unemployment  $\rightarrow$  increase in  $W \rightarrow$  increase in  $P$

The adjustment continues, with AS shifting up, until a new equilibrium is reached. In the end  $E$ ,  $M, P$  increases by the same amount. How do we know? Remember  $Y = C + I + G + NX$

Example 2: Devaluation

Check that it is the same as above, and in the end  $M, P$  increase the same amount as  $E$ .

Do the same for fiscal expansion and fixed exchange rates.

A conclusion: monetary policy is neutral in the long run. Fiscal policy is not

## 3. Inflation, disinflation, hyperinflation, interest rates, exchange rates, unemployment

a. The Phillips curve is another way of looking at the short run AS

$$\pi = \pi_e + (\mu + z) - \alpha u$$

allows to find the natural rate of unemployment when inflation is as expected :  $u_n = (\mu + z) / \alpha$

The relation between inflation and unemployment has shifted over time, because expected inflation, the markup and other things, like wage indexation, have changed. If expected inflation is reflected by past inflation, then the unemployment rate is related to *changes* in inflation.

b. The Phillips curve, plus Okun's law and a simple AD equation allow to see the costs of disinflation.

Phillips curve :  $\pi = \pi_{-1} + (\mu + z) - \alpha u$

Okun's Law :  $u - u_{-1} = -0.4(g_y - 3\%)$

LM curve:  $g_y = g_m - \pi$

In the long run growth is equal to 3%, the unemployment rate is constant and equal to the natural rate, and inflation is equal to the growth of money. This is a simple extension of AS-AD to differences in variables, not levels.

Disinflation is possible only if unemployment is higher than the natural rate: sacrifice ratio measures this. Lucas critique says that the sacrifice ratio should be zero if people expect that disinflation will happen and the announcement is credible.

Overlapping contracts response: not every contract can be renegotiated and adjusted, even if there is full credibility

Application: the disinflation of the early 80's

c. Money growth and interest rates have different relationships in the short and long run

In the long run, higher money growth  $\rightarrow$  higher inflation rate  $\rightarrow$  higher nominal interest rate.

In the short run, higher money growth  $\rightarrow$  lower nominal interest rate.

d. Devaluations have pros and cons

Pros: allow adjustment without suffering unemployment

Cons: they are neutral in the Long run, and are equivalent to expansionary monetary policy.

So only effective if used little. Also might actually hurt in the long run

e. Inflation is a *tax* on money holdings, that's the reasons why governments might resort to it in the face of no other alternative. Why?

Seigniorage  $S = \Delta M / P = (\Delta M / M)(M / P) = (\Delta M / M)[L(r + \pi)Y]$

Therefore there is a tradeoff: higher inflation  $\rightarrow$  higher collection

higher inflation  $\rightarrow$  lower money demand

this is the Laffer curve, also a rationale for hyperinflations

#### 4. Growth

a. Very traditional ingredients

Aggregate Production Function:  $Y = F(K, N)$

Constant returns to scale  $\lambda Y = F(\lambda K, \lambda N)$

Simplified Production Function  $Y / N = F(K / N, 1) \Rightarrow y = f(k)$

Decreasing marginal product of capital  $f'(k) < 0$

Accumulation of capital through saving:  $I = S = sY$   
(implicit consumption function)

Depreciation of capital, constant fraction:  $\delta K$

Capital accumulation equation:  $K_{+1} - K = I - \delta K$

Putting things together, and dividing over by  $K/N$

$$(K_{+1} / N) - (K / N) = sf[(K / N)] - \delta(K / N)$$

steady state is defined when  $K/N$  is constant  $\rightarrow (K/N)^*$

### c. Conclusions

Steady state is stable

Output per person is determined by capital per person and technology

Savings only determine the level of output per person (through capital per person), not the growth

There is a rate of saving that maximizes consumption per capita in the steady state, golden rule.

Empirical fit: explains convergence between countries

Leaves open the issue of what determines the growth of technology (human capital, r&d)