

## Lecture 5

### Chapter 9

Today we are going to build the AS-AD model. This model reviews one equilibrium for which all markets are in equilibrium. We will derive the AS curve from the wage and price setting equations, and the AD curve from the (closed) economy IS-LM model.

#### From wage setting and price setting to aggregate supply

Combining the WS- and PS-curve gives  $P = Pe(1 + \mu)F(u, z)$ , which says that the price level is related to the natural rate of unemployment. The natural rate of unemployment is related to output  $u = 1 - \frac{Y}{L}$ . Hence, the price level is related to output  $P = Pe(1 + \mu)F(1 - \frac{Y}{L}, z)$ .

The AS relation has two important properties:

#### 1. An increase in output leads to an increase in the price level

This is the result of four steps

1. An increase in output leads to an increase in employment.
2. The increase in employment leads to a decrease in unemployment and therefore to a decrease in the unemployment rate.
3. The lower unemployment rate leads to an increase in the nominal wage.
4. The increase in the nominal wage leads to an increase in the prices set by firms and therefore to an increase in the price level.

We see that if output goes up, price goes up. This positive relation makes that the AS curve is upward sloping.

#### 2. An increase in the expected price level leads, one-for-one, to an increase in the actual price level

This effect works through wages

1. If wage setters expect the price level to be higher, they set a higher nominal wage.
2. The increase in the nominal wage leads to an increase in costs, which leads to an increase in the prices set by firms and a higher price level.

We see that any change in the expected price level will in the medium run lead to a change in the AS curve and prices. So a shock in the short run influences the medium run because of expectations.

We now know that the AS curve that for a given expected price level, the price level is an increasing function of the level of output, what gives an upward-sloping curve. Increases in the expected price level will shift the aggregate supply curve up and vice versa.

#### The aggregate demand function

The AD relation captures the effect of the price level on output. It is derived from the IS and LM relations.

IS relation:  $Y = C(Y - T) + I(Y, i) + G$

LM relation:  $\frac{M}{P} = YL(i)$

The IS-LM model is based on two curves, but the AD relation is based on one curve. If the price level is changing, the money supply is changing.

When the price level increases due to an exogenous shock,  $P$  will increase. The equation  $M/P$  will thus decrease. So in the IS-LM model, the LM curve will shift to the left. A decrease in price has the same effect as a contractionary monetary policy, i.e. a decrease in the real money supply. Now, the interest rate will go up so investments will go down. Output will decrease.

An increase in price will lead to a decrease in output, that's why the AD curve is downward sloping.

Expansionary fiscal policy has the same effect on the AD curve as expansionary monetary policy. When applying expansionary fiscal policy, government spending will increase or taxes will decrease. This leads to an increase in aggregate demand so consumption will increase. IS shifts to

the right so output will increase at each value of the price. This leads to a rightward shift of the AD curve.

When applying expansionary monetary policy, the central bank increases aggregate demand. The money supply will increase so LM shifts to the right. This leads to a decrease of the interest rate, an increase of investments and an increase in output at each price level. AD will shift to the right.

### **Equilibrium**

The short-run equilibrium can be found at the intersection of AS and AD. This short-run output level is not necessarily equal to the natural level of output. When we know that the medium run equilibrium is left of the short run equilibrium in the AD-AS model the adjustment to make in order to arrive in the medium run equilibrium is that AS shifts to the left, along AD.

We know that  $Y > Y_n$ , this means an excess in demand. Firms have to produce more than the capacity of the economy so prices will increase.  $P^e$  also increases and  $P$  increases over time. This leads to a leftward (upward) shift of the AS curve. The prices will adapt slowly.

There will be a shift along the AD curve and  $P^e$  increases. The actual prices change on the labour market. The supply of the real money balance changes and AS will shift to the left. This causes an increase of the interest rate, so there will be lower investment and less production until reaching the medium run equilibrium.

Because prices will adjust over time, the short run equilibrium will result in the medium run equilibrium.

### **Monetary policy in the AD-AS model**

Expansionary monetary policy will shift the AD-curve to the right so that output and prices increase. This has the following effect on the labour market: more producing will lead to lower unemployment so that the bargaining power of workers will increase. The wages will increase and so the prices increase. There will be a new short run equilibrium at the right of the former equilibrium. The prices are higher than the expected prices so the expected prices will adjust over time and go up. The AS curve will shift upward.

In the short run monetary policy is ineffective because prices will adjust. There has to be an increase in productivity to make the economy more efficient.