CHAPTER 5

Inflation and unemployment in the open economy

[This is a draft chapter of a new book - Carlin & Soskice (200x)[1]].

This chapter brings together the supply side of the economy with the demand side and the trade balance to provide a basic model for analyzing the open economy. It builds on the imperfect competition model of the supply side developed in Chapters 1 to 3 and on the Mundell–Fleming short-run model of the open economy developed in Chapter 4. The basic model can be used to answer the following questions:

- What determines the level of output and employment in the short run?
- What factors influence the rate of unemployment and output level that can be sustained in the medium run without problems of inflation?
- Why might a medium-run position of stable inflation but trade imbalance be unsustainable in the long run?

In this chapter, we explore a key difference between an open and a closed economy. In an open economy, there is a range of unemployment rates consistent with the absence of inflationary pressure. By contrast, in the closed economy, there is a unique unemployment rate consistent with constant inflation. The reason for this difference lies with the impact of changes in the real exchange rate on the supply side of the economy.

In the open economy it will generally be the case that the wage-setting real wage and the price-setting real wage are equal over a range of unemployment rates: this is what is required to deliver a range of constant inflation equilibrium unemployment rates. The wage-setting curve is just the same as in the closed economy: as employment rises, the wage-setting real wage rises. In the closed economy, the price-setting real wage is constant (or downward sloping). Hence there is just one level of employment at which the wage and price-setting real wages are equal: this fixes the unique equilibrium rate of unemployment (ERU), or $NAIRU$, as it is often called in empirical studies. But in the open economy, the price setting real wage is a function of the real exchange rate: it will shift up and down as the real exchange rate changes. The simplest way to think of this is that when the real exchange rate depreciates, the real cost of imports goes up and this reduces the price-setting real wage. The flexibility of the real exchange rate and hence of the real cost of imports means that the price-setting real wage can be equal to the wage-setting real wage over a range of unemployment rates. It is intuitively plausible that as the economy moves closer to being closed, the range of equilibrium unemployment rates narrows: in the closed economy there is a unique ERU.

Since there is a range of constant inflation unemployment rates in the open economy, can macroeconomic policy makers choose any desired unemployment rate by using fiscal policy to alter the level of aggregate demand? Policy makers in the open economy are likely to be constrained by the consequences of their actions for the external balance. If the economy is running either a persistent current account surplus or deficit, there are a number of mechanisms that are likely to come into play at some stage that push the economy toward current account balance. These pressures arise because the surplus or deficit represents a change in the economy's wealth position. A change in wealth can affect private sector expenditure and access to international capital markets. Equally, a persistent deficit or surplus may affect exchange rate expectations. In the long run it is likely that the current account position will place a constraint on the unemployment rate.

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This chapter begins by asking how wages and prices react in the open economy following the move to a new short run equilibrium. We then integrate the supply side more systematically into open economy analysis. A new core diagram that is used from this point onwards in the book is introduced. The diagram has the real exchange rate and output on the axes. Section 3 is short — it simply shows how to translate the demand side and trade balance analysis from Chapter 4 into the new diagram. In the third section, the demand and supply sides are put together to create the basic open economy model. The differences between the short-run, medium-run (i.e. constant inflation) and long-run (i.e. current account balance) equilibria are examined. The chapter concludes with a discussion of the reasons why in the longer run, the economy may be constrained to an unemployment rate close to current account balance.

1. Inflation and unemployment in the open economy

In what ways do we need to alter the analysis of the supply side in the closed economy to make it fit the open economy? First, let us recall the closed economy model. Medium run equilibrium in the closed economy is characterized by constant inflation: the rate of unemployment at which inflation is constant is referred to as the 'equilibrium' rate, the ERU (or $NAIRU$). For illustrative purposes it is simplest to assume constant labour productivity, LP, and a constant mark-up. Given the wage-setting curve and the price-setting curve, there is a single employment level (and associated unemployment rate) at which the expected real wage set by wage-setters is equal to the real wage that is implied by price-setting behaviour. Equilibrium employment, E_e, is shown in Fig. 5.1.

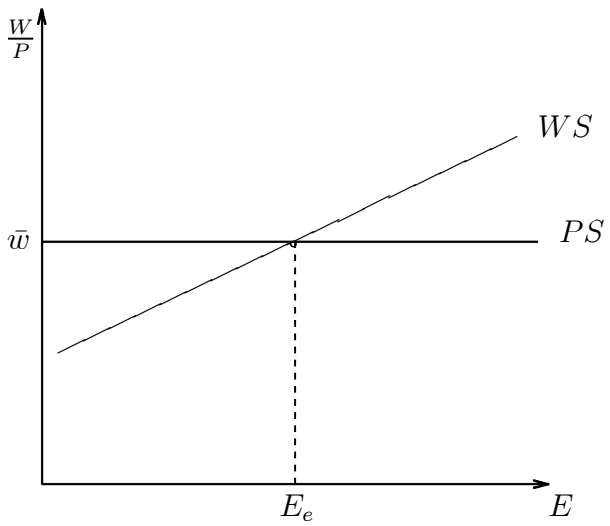


FIGURE 1. **Equilibrium employment in the closed economy**

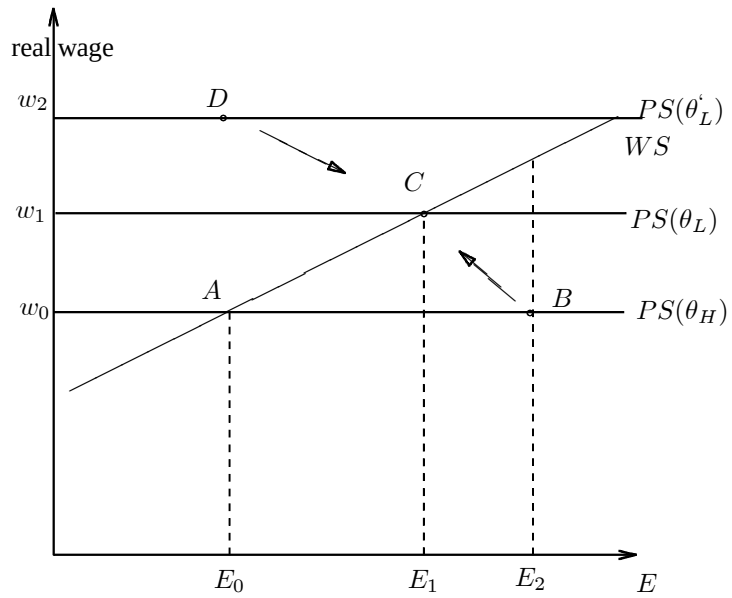
At E_e for a given expected inflation rate, money wages will rise in line with expected inflation to deliver the real wage $\overline{w}$ and prices will rise in line with money wages to keep the profit margin unchanged. Thus inflation will remain equal to its expected rate: there is constant inflation at E_e. At any other employment level, the wage-setting real wage will be either higher than the price-setting real wage (when employment is higher than E_e) or lower than the price-setting real wage (when employment is lower than E_e). There will be upward pressure on inflation in the first case and downward pressure in the second case. Inflation will be constant only when employment is at E_e because only here are the expectations of both wage and price-setters fulfilled. There is no pressure on inflation. This is the medium-run equilibrium. In a flexible exchange rate economy in a medium run equilibrium, inflation will be constant at the growth rate of the money supply set by the central bank or at the central bank's inflation target if it is using a monetary policy rule such as a Taylor rule. In a fixed exchange rate economy, inflation will be constant at the growth rate of the money supply

set by the central bank in the large economy to which its exchange rate is pegged or at that central bank's inflation target.

In an open economy with imperfect competition, the demand for the goods and services produced by home firms will depend on the level of demand in the home economy and in the world and on the relative price and non-price characteristics of the product. Similarly, the demand by home residents for goods and services produced abroad will depend on the level of demand in the home economy and on the price and non-price attributes of the foreign goods and services. These factors are reflected in the export and import functions (Chapter 4), where we saw how aggregate demand and the trade balance are affected by changes in the real exchange rate. But what is the significance of openness for the *supply side* of the economy?

One way to get a feel for this is to work through some examples, beginning with familiar situations that we have considered in Chapter 4. We shall begin with the economy in a medium-run equilibrium with constant inflation and then implement a change in fiscal or monetary policy. After noting the new short-run equilibrium, we ask how prices and wages will move once they are allowed to adjust. We shall see that wages and prices not only react to changes in the level of output (as in the closed economy) following changes to fiscal or monetary policy but also to any change in the real exchange rate that has occurred. This is because a change in the real exchange rate affects real wages and therefore disturbs the equilibrium in the labour market.

1.0.1. *Fixed exchange rates, fiscal expansion and inflation*
. Let us begin by assuming that the small open economy is at equilibrium employment at E_0 with a real wage of w_0 (see Fig. 5.2). We assume that inflation in the rest of the world is 3%. The home economy begins with 3% inflation as well and we assume that the exchange rate is fixed. The real exchange rate, $\theta = \frac{P^*e}{P}$, is therefore constant: e is fixed and P^* and P are growing at the same rate. Suppose there is a rise in aggregate demand as the result of a fiscal expansion. As usual, higher demand boosts output in the home economy and employment increases to E_2. This is the new *short-run* equilibrium in the Mundell-Fleming model (point B).



Mark-up pricing: profit margins are constant at
A and C ; real cost of imports lower at C than at A

FIGURE 2. **Equilibrium employment in the open economy at low and high employment**

The question is what will happen to wages and prices when we allow them to adjust. Money wages rise by more than 3% because the wage-setting curve is upward-sloping: wage-setters will

require a higher expected real wage. The unit costs of home firms therefore increase. According to our usual assumption about pricing behaviour, home firms raise their prices to reflect these higher costs (so home prices will rise in line with wages, i.e. at a rate above 3%). This in turn pushes up the consumer price index. This is an open economy so home consumers buy both imported goods and home produced goods. Since the price of imported goods has only risen by 3%, the consumer price index does not rise by as much as does the price index of home produced goods. This has a very important consequence. The rise in consumer prices wipes out some but not all of the rise in money wages: hence the real wage increases.

But there is something else going on as well: as home prices are pushed up relative to world prices, the home economy loses competitiveness (the real exchange rate appreciates) and output and employment fall below E_2. The economy moves north-west from B as shown by the arrow. Will employment shrink right back to its initial level of E_0? To find out the answer, remember that government spending is higher (due to the expansionary fiscal policy). That means that for the economy to return to point A so there is no change in output, the real exchange rate would have to appreciate in order to reduce net exports by the full amount of the increase in government spending (i.e. $\Delta g = -\Delta(x-m)$). But if the real exchange rate at point A has *appreciated* relative to its initial level, then the real cost of imports will be *lower* (since $P_m/P = P^*e/P = \theta$, which has fallen) and real wages will therefore be *higher* than they were initially. If so, the labour market will not be in equilibrium since the real wage will be above the wage-setting real wage (i.e. $w > w^{WS} = w_0$ at E_0).

This implies that when we allow prices and wages to adjust following a fiscal expansion under fixed exchange rates, the economy will end up in a medium-run equilibrium at a point such as C: with employment higher than initially and with inflation constant. Since home producers have protected their profit margins throughout, the wage-setting real wage and the price-setting real wage are equal at the new higher level of employment. We have therefore found a second equilibrium employment level at E_1.

The sequence of events is summarized as follows:

1st new short-run equilibrium is established (B) : $\uparrow g \rightarrow \uparrow y \rightarrow \uparrow E;\ \Delta E > 0$ and $\Delta w = 0$

2nd wages & prices adjust to change in E : $\uparrow E \rightarrow \uparrow W \rightarrow \uparrow P$ relative to $P^* \rightarrow \uparrow w$ and $\downarrow \theta \rightarrow \downarrow y \rightarrow \downarrow E$

3rd new medium-run equilibrium is established (C) : π constant, w higher, θ lower, E higher

If real wages are higher and real profits are the same, where have the extra resources come from at the new employment level to pay for the higher real wages? The answer is that the new resources have come from abroad. The terms of trade for the home economy ($\frac{P_x}{P_m} = \frac{1}{\theta}$) have improved because the price of goods exported ($P_x = P$) has risen relative to the price of goods imported ($P_m = P^*e$). The PS-curve that intersects the WS-curve at E_1 is associated with a lower value of θ and is labelled $PS(\theta_L)$. Since the home economy has raised the price of all home-produced goods including those exported by more than world inflation, the volume of imported goods that can be obtained by selling a given volume of exports has increased. It is these extra resources from abroad that mean that the open economy can operate at higher employment with constant inflation following a fiscal expansion.

The possibility that the terms of trade can change in an open economy provides an indication that the open and closed economies can work in somewhat different ways. In the closed economy, there is a unique equilibrium rate of unemployment (ERU). In an open economy, if the terms of trade can change, then the total amount of resources available to domestic wage and price setters is no longer fixed. This means that there is no longer a unique unemployment equilibrium: a range of unemployment rates is consistent with the absence of inflationary pressure.[2]

[2]Of course, not all countries can improve their terms of trade at the same time. We investigate the implications of this when we relax the 'small country' assumption in Chapter (Interdependence), which focuses on interdependent economies.

1.0.2. *Flexible exchange rates, fiscal expansion and inflation*

. We shall see that this feature of the open economy does not depend on the exchange rate regime in place. An insight into why this is so can be provided by sketching the implications of a fiscal expansion under a flexible exchange rate regime. As we have seen in Chapter 4, a fiscal expansion under flexible exchange rates has no effect on output since in the new short-run equilibrium, net exports are lower by exactly the increase in government expenditure i.e. there is complete crowding out of net exports by the higher government spending. This takes place because of the appreciation of the exchange rate in response to the higher domestic interest rate via the UIP condition. Now let us look at the consequences for prices and wages when the economy is at the new short-run equilibrium. Output is at its initial level (the composition has changed) and there has been an appreciation of the real exchange rate (e has fallen and P and P^* are unchanged; hence $\theta = P^*e/P$ has fallen).

Will inflation remain constant? To answer this, we must consider the labour market: are wage and price-setters in equilibrium? An appreciation of the real exchange rate means that the real cost of imports has gone down ($P_m/P = P^*e/P = \theta$, which has fallen) and therefore real wages have gone up. Looking at Fig. 5.2, with employment at E_0 in the new short-run equilibrium, the real wage is above w_0, for example, at w_2 (point D). Wage-setters are not on the WS curve. The result will be lower money wage settlements (i.e. below the going rate of inflation of 3%). Home producers will reduce their prices in line with their falling costs. But since the prices of imported goods continue to rise at 3%, whilst money wages have risen by less than 3%, real wages fall. The result will be an improvement in competitiveness, and output and employment will begin to rise. The economy moves south-west from point D and comes to rest at point C. We can summarize as follows:

1st new short-run equilibrium is established (D)	:	$\uparrow g \rightarrow \downarrow \theta \longrightarrow \downarrow (x-m)$; $\Delta E = 0$ and $\Delta w > 0$
2nd wages & prices adjust to change in θ	:	$\uparrow w \longrightarrow \downarrow W \rightarrow \downarrow P$ relative to $P^* \rightarrow \uparrow \theta \rightarrow \uparrow y \rightarrow \uparrow E$
3rd new medium-run equilibrium is established (C)	:	π constant, w higher, θ lower, E higher

We shall set out the details in the rest of the chapter. Here we note that although fiscal policy has a very different impact on the economy in the short run under fixed and flexible exchange rates, the medium-run impact is identical. Under *fixed* exchange rates, with an expansionary fiscal policy there is a phase of inflation *higher* than world inflation until point C is reached and under *flexible* exchange rates, there is a phase of inflation *lower* than world inflation until point C is reached. Hence, the immediate impact on inflation of a given policy depends on the exchange rate regime in place.

1.0.3. *Flexible exchange rates, monetary expansion and inflation*

. As a third example we take the case of a monetary expansion in a flexible exchange rate economy. As we have seen in Chapter 4, a loosening of monetary policy in a flexible exchange rate economy leads to a new short-run equilibrium with higher output. Output is boosted because the fall in the home interest rate below the world interest rate leads to a depreciation of the exchange rate (via the UIP condition). This in turn raises competitiveness and net exports: output and employment rise.

What happens to wages and prices once we allow them to respond? There are two relevant developments: first, employment in the economy is higher, which will boost wage claims. Second, the depreciation means that the real cost of the imported goods in the consumption bundle has gone up and that real wages have gone down. With higher employment and lower real wages, there will be two forces driving money wage claims up relative to expected inflation. As money wages rise, home firms will put up their prices to protect their profit margins. But the prices of imported goods will continue to rise by 3%. Thus, home's competitiveness will fall (θ will fall since P is rising by more than P^*e) and net exports will shrink. At the same time, real wages will rise (since W is rising relative to the price of imported goods, P^*e). Output and employment decline; real wages rise.

Will the economy end up back at its initial level of employment? The answer is yes. Monetary policy raised output because it caused a real depreciation of the exchange rate and raised net exports and therefore aggregate demand. But a real depreciation cuts real wages and we know that the

labour market is only equilibrium at the initial level of employment (E_0) when the real wage is w_0. Therefore a burst of domestic wage and price inflation above world inflation will drive the economy back to its initial position at A. Monetary policy has only a short-run impact on output and employment in the open economy. We summarize as follows:

1st new short-run equilibrium is established	:	$\downarrow i \longrightarrow \uparrow e \rightarrow \uparrow \theta \rightarrow \uparrow (x-m);\ \Delta E > 0$and $\Delta w < 0$
2nd wages & prices adjust to change in E& θ	:	$\uparrow E$ and $\downarrow w \longrightarrow \uparrow W \rightarrow \uparrow P$ relative to $P^* \rightarrow \downarrow \theta \rightarrow \downarrow y \rightarrow \downarrow E$
3rd new medium-run equilibrium is established	:	π constant, w unchanged, θ unchanged, E unchanged

1.0.4. *Summing up*

. We have seen that when we move from the short to the medium run, and allow wages and prices to adjust, the open economy behaves somewhat differently from the closed economy. Instead of wages and prices responding only to shifts in employment from the initial constant inflation equilibrium, they also respond to changes in the real wage that have occurred as a consequence of changes in the real exchange rate. Under fixed exchange rates, following a fiscal expansion, inflation rises above world inflation for a time before the economy settles at a new lower constant inflation rate of unemployment. Under flexible exchange rates, the fiscal expansion first leads to a real appreciation (and therefore a rise in real wages) and this is followed by a period of inflation below world inflation during which output rises and the economy settles at the same lower constant inflation unemployment rate as in the fixed rate case. We have also seen that although under flexible exchange rates, monetary policy is effective in changing the level of output and employment in the short run, this disappears in the medium run through the adjustment of wages and prices. The economy returns to its initial constant inflation equilibrium.

2. Supply side in the open economy

In this section, we provide a systematic treatment of why there is a range of medium-run equilibrium unemployment rates in the open economy. To define this range we need to set out the details of wage and price-setting in the open economy. We stick to the cost-plus pricing rule for home produced goods sold at home and exported:

$$P = P_x = \frac{1}{1-\mu} \cdot \text{unit cost} \qquad \text{(cost-plus pricing)}$$

where μ is the mark-up. (The central results are the same under the alternative imperfect competition hypothesis of world pricing (discussed in Chapter 4) but exposition is easier when we use the real exchange rate defined as price rather than cost competitiveness.)

In the open economy, it is necessary to be more careful about what is meant by real wages. The reason is that we can no longer talk about a single price level. The price level that is relevant in the assessment by workers of the real value of money wages is the money wage in terms of consumer prices (i.e. $\frac{W}{P_c}$, where P_c is the consumer price index). The consumer price index includes the prices of final consumer goods that are imported. By contrast, the real wage that is relevant as a cost to firms is the money wage in terms of the product price, P. The core open economy model can be best understood if we make a simplification: we assume that it is only final consumer goods that are imported into the economy. In Chapter 6, when we want to investigate external supply shocks such as oil shocks, we introduce the role of imported materials.

To define the consumer price index P_c it is assumed that consumers purchase a bundle of goods. Those which are imported have a price of P^*e and those which are home-produced have a price of P. The share of the consumption bundle that is imported we will call ϕ, ϕ (pronounced 'phi')for 'foreign'.[3] The consumer price index is:

[3] ϕ is equal to $\frac{m_y}{c_y}$.

$$P_c = (1-\phi)\cdot P + \phi \cdot P^* e. \qquad \text{(consumer price index)}$$

where we use the fact that $P_m = P^* e$. Whenever we use the term 'real wage' or w we mean the real wage in terms of consumer prices:

$$w = \frac{W}{P_c}. \qquad \text{(real wage)}$$

The next step is to set out wage and price setting behaviour in the open economy and then to look at the implications for the wage and price-setting curves.

Wage-setting

. Wage setting behaviour is the same as in the closed economy. The only modification is to make explicit the role of the consumer price index:

$$W = P_c \cdot b(E) \qquad \text{(wage equation)}$$

The wage-setting curve is defined by

$$\begin{aligned} \frac{W}{P_c} &= b(E) \\ w^{WS} &= b(E) \qquad \text{(wage setting real wage)} \end{aligned}$$

where a rise in employment is associated with a rise in the wage-setting real wage.

Price-setting

. As discussed above, we use a cost plus pricing rule for the open economy. In the absence of any imported materials, price-setting in the open economy is the same as in the closed economy:

$$P = P_x = \frac{1}{1-\mu}\cdot\frac{W}{LP}, \qquad \text{(price equation)}$$

where P is the price of home goods sold at home and in export markets. To work with the wage and price setting curves, both must use the same definition of the real wage. This means that we need to express the price setting real wage in terms of the consumer price index, i.e. $\frac{W}{P_c}$.

The first step is to substitute the price equation into the equation for the consumer price, P_c.

$$\begin{aligned} P_c &= (1-\phi)\cdot P + \phi \cdot P^* e \\ &= (1-\phi)\cdot\left[\frac{1}{1-\mu}\cdot\frac{W}{LP}\right] + \phi\cdot P^* e. \end{aligned}$$

In order to find the expression for the price-setting real wage, we now divide each side by $P = \frac{1}{1-\mu}\cdot\frac{W}{LP}$. This is shown in line (5.1). Then we use the definitions of the real wage, $w = \frac{W}{P_c}$ and of the real exchange rate, $\theta = \frac{P^* e}{P}$ to simplify the equation (5.2). In the third line, we rearrange the equation so that the real wage is in the numerator (5.3).

$$\frac{P_c\cdot(1-\mu)\cdot LP}{W} = (1-\phi) + \frac{\phi\cdot P^* e}{P} \tag{2.1}$$

$$\frac{(1-\mu)\cdot LP}{w} = (1-\phi) + \phi\cdot\theta \tag{2.2}$$

$$\frac{w}{(1-\mu)\cdot LP} = \frac{1}{(1-\phi)+\phi\cdot\theta}. \tag{2.3}$$

In the final step, we rearrange the equation so that the price-setting real wage is on the left hand side:

$$w^{PS} = \frac{LP\cdot(1-\mu)}{1+\phi\cdot(\theta-1)}. \qquad \text{(price-setting real wage, open)}$$

We can see from this that the price-setting real wage in the open economy is equal to the closed economy price setting real wage (i.e. $LP\cdot(1-\mu)$) modified by the real exchange rate, θ. If there

are no imported goods the weight of imports in the consumer price index is zero (i.e. $\phi = 0$) and so it is easy to see that the price-setting real wage is indeed equal to its closed economy value,

$$w^{PS} = LP \cdot (1 - \mu). \qquad \text{(price-setting real wage, closed)}$$

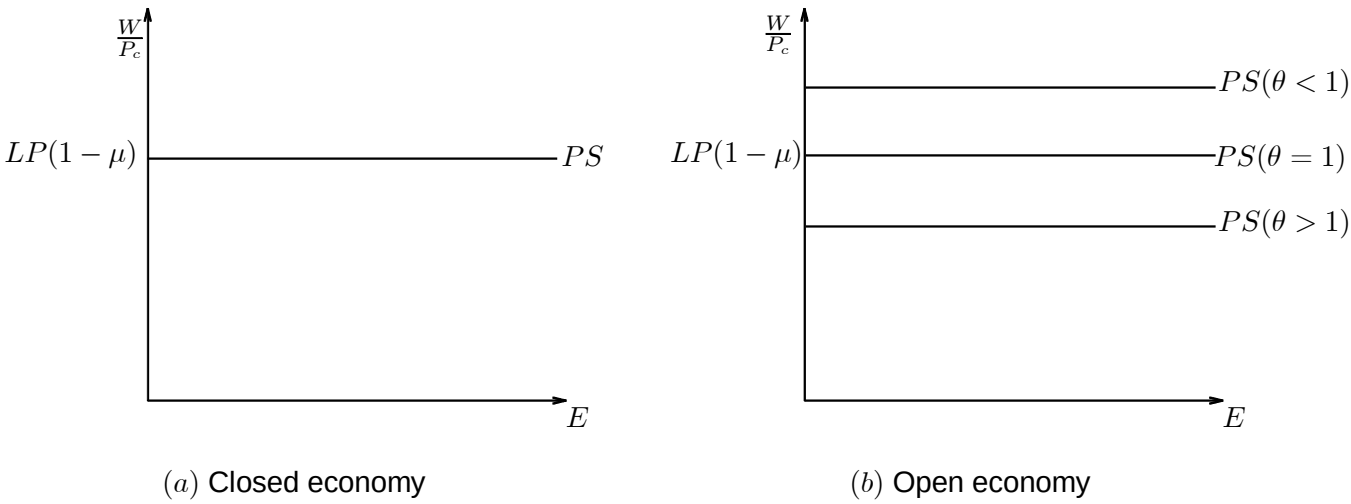


FIGURE 3. **Price-setting curves in closed and open economies**

The price-setting behaviour of firms means that the wage measured in terms of domestic output is fixed in exactly the same way and at the same level as in the closed economy. But workers choose to spend some of their wages on imported goods. The higher the price of imports, the fewer the bundles of domestic output plus imported goods (in proportions $(1 - \phi)$ and ϕ) they can afford. So the real wage is reduced. Given the world price of imports, P^*, the price to consumers varies with the exchange rate. See Fig. 5.3 for a comparison between the closed and open economy price-setting curves.

This highlights that the most important feature of the price setting real wage in the open economy is that it is inversely related to the real exchange rate, θ:

- a rise in θ raises the real cost of imported goods and therefore reduces the price-setting real wage.

2.0.5. *Medium-run equilibrium*

. If we now bring together the wage-setting and price-setting curves, we can see that since θ can vary, there is a range of unemployment rates at which wage and price-setters are in equilibrium in the sense that wage-setters are on the WS curve and price-setters are on the $PS(\theta)$ curve. Another way of putting this is to say that the claims on output per head of wage-earners and firms are consistent with the available output per head across a range of rates of unemployment. When wage and price setter are in equilibrium — i.e. their claims are consistent with the level of output per head available, then inflationary pressures are absent. Just as in the closed economy, we refer to any unemployment rate (and the associated level of output and employment) at which wage and price-setters are in equilibrium as an equilibrium rate of unemployment (ERU). It may also be referred to as a competing claims equilibrium.

In the closed economy, the claims for real wages per head and profits per head are equal to output per head only at a single unemployment rate: the WS-curve and the PS-curve intersect at a unique unemployment rate. In the open economy, there is a range of equilibrium rates of unemployment. In the top panel of Fig. 5.4, equilibrium rates of unemployment at A and at B are shown. At A, unemployment is relatively high and as a consequence, the labour market position of workers is rather weak. This means that the wage-setting real wage is relatively low. For an equilibrium rate of unemployment, the price-setting real wage must also be at this relatively low level. With a fixed

real profit margin per worker, the price-setting real wage will be relatively low when the real cost of imports in the basket of goods consumed is relatively high. The price-setting real wage associated with high import costs is shown by $PS(\theta_H)$.

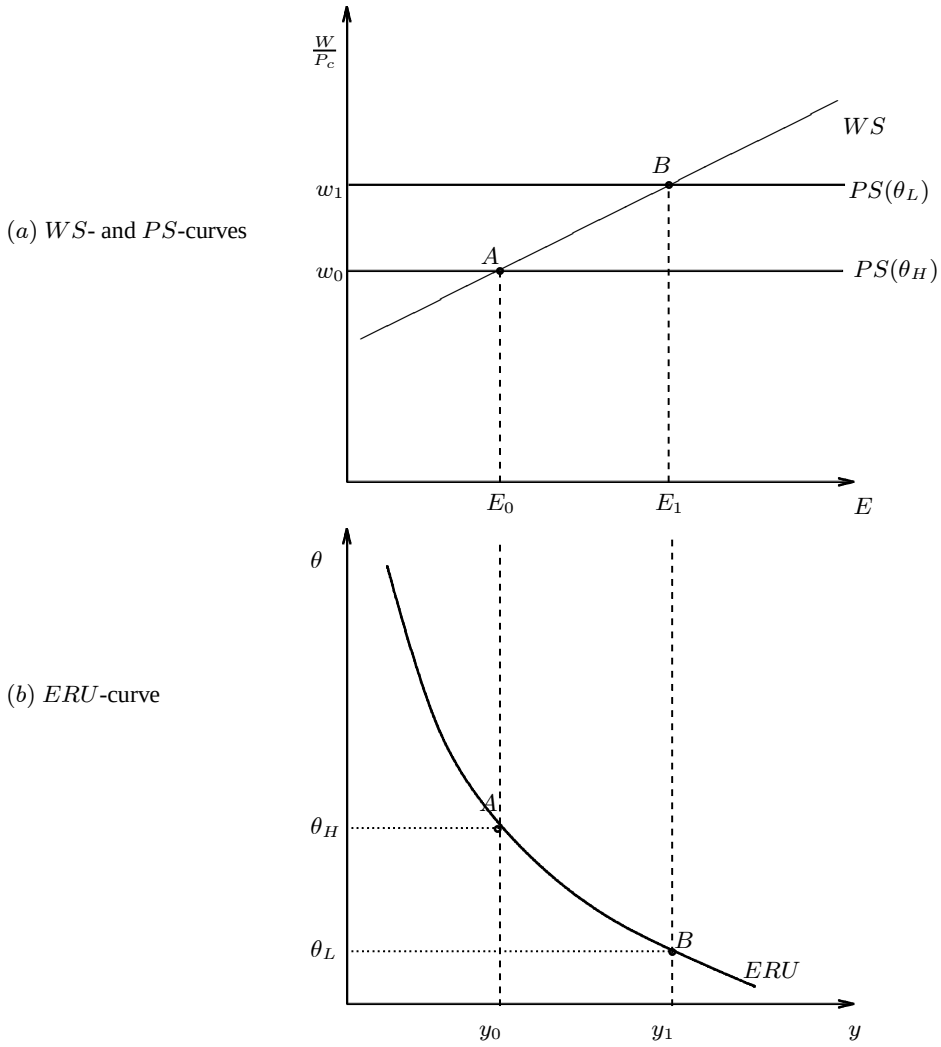


FIGURE 4. **Equilibrium rate of unemployment curve (ERU). Note: As θ increases, the real cost of imports increases**

When unemployment is much lower at point B, the tight labour market situation implies a higher wage-setting real wage. For an equilibrium rate of unemployment, the price-setting real wage must therefore also be higher. For this to be possible with the claim of real profits per worker unchanged, the real cost of imported goods in the basket of goods consumed must be relatively low. This is indicated by the price-setting real wage curve labelled $PS(\theta_L)$.

Equilibrium rate of unemployment (ERU) curve

. It turns out to be very useful when analyzing the open economy to work with a diagram with the real exchange rate and output on the axes. This is because changes in the nominal or real exchange rate are frequently the focus of attention. We can easily map the range of equilibrium unemployment rates from the wage and price setting diagram to the $\theta - y$ quadrant. We show the equation for the equilibrium rate of unemployment or ERU curve below.

To derive the equilibrium rate of unemployment curve in the $\theta - y$ diagram (bottom panel of Fig. 5.4), we start by asking the question: how can a low level of unemployment and the associated high level of output be sustained without inflationary pressure? As we have just seen, a low rate of unemployment implies that wage bargainers will only be satisfied by a high real wage. For this to be an equilibrium, the price-setting real wage must be at the same high level. This requires that

the real cost of imported goods is sufficiently low. At point B in the top panel of Fig.5.4 there is a high value of employment — and therefore a high level of output. This means that for equilibrium in the labour market, we have to have a low value of θ so that import costs are low (see point B in the bottom panel). A low value of $\theta = \frac{P^*e}{P}$ means that the world price level and hence the price of imported goods (P^*e) is low relative to the price of home goods and hence of exports (P). With low import costs, real wages can be high without affecting the real value of profits. Living standards are boosted because imports are cheap. This gives point B at the combination of a low value of θ and a high level of output.

Exactly the same logic lies behind the location of point A. When unemployment is high and output is depressed, workers are in a weak position in the labour market and there is a low wage-setting real wage. For the price-setting real wage to be at this low level as is required for competing claims equilibrium, the cost of imported goods must be high. At point B there will be a combination of low output and high import costs, i.e. high θ. Hence the equilibrium rate of unemployment (ERU) curve in the $\theta - y$ diagram is downward sloping (bottom panel of Fig. 5.4).

DEFINITION 1 (Equilibrium Rate of Unemployment curve). *The ERU-curve is defined as the combinations of the real exchange rate and output at which the wage-setting real wage is equal to the price-setting real wage. At any point on the ERU-curve, the real exchange rate, θ, is constant and inflation is constant.*

Off the ERU-curve

. Every point *on* the ERU-curve is a point at which the wage and price-setting curves intersect. It is also important to know what it means to be *off* the ERU-curve. We assume that prices adjust more rapidly than do wages so that the economy is always on the price-setting curve (i.e. $w = w^{PS}$) but not necessarily on the wage-setting curve. Let us consider a situation shown in Fig. 5.5 in which the employment level is E_1. Throughout this discussion, we hold the level of employment constant at E_1 so as to focus on wage and price adjustment.

Assume that the real wage is w_1. As is clear from the top panel, when the economy is on the PS-curve, $PS(\theta_H)$, the real wage is w_1 and is lower than the wage-setting real wage at this employment level. There will be upward pressure on inflation. The situation is also shown in the lower panel in the $\theta - y$ diagram (compare the two points labelled B' in the upper and lower panels). At point B' with low unemployment, we know that given the expected price level, P_c, wages will be set according to the wage-setting equation to deliver the higher expected real wage shown by the WS-curve (i.e. at point B). When producers set their prices immediately after wages, the price level rises since the rise in wages increases unit costs. Although nothing has happened to the prices of imported goods, the rise in home prices means that the consumer price level is above the price level expected when wages were set. This means that at points above the ERU-curve (like point B'), $w = w^{PS} < w^{WS}$ with the consequence that $P_c > P_c^E$.

According to the wage-setting equation, a higher than expected price level will result in higher money wages. Since by assumption, nothing has happened to the price of imported goods, the consumer price index will rise, but not by as much as money wages. As a result, the real wage rises and the real cost of imports falls: the PS-curve shifts up and θ falls.

At point B, the wage and price-setting real wages are equal and $P_c = P_c^E$. In the $\theta - y$ diagram, the real exchange rate appreciates as home prices rise relative to foreign prices and price competitiveness falls to θ_L. At B, the economy is once more on the ERU-curve. Inflationary pressures have disappeared.

A parallel argument tells us that at a point such as A' at which the real wage is above the wage setting real wage (i.e. $w = w^{PS} > w^{WS}$) and the economy is below the ERU-curve (point A' in the lower panel), then $P_c < P_c^E$. Falling inflation will occur, the real wage will fall, θ will rise (the real cost of imports will rise) and the economy will move back to the ERU-curve at point A with a real exchange rate of θ_H.

These results can be summarized as follows:

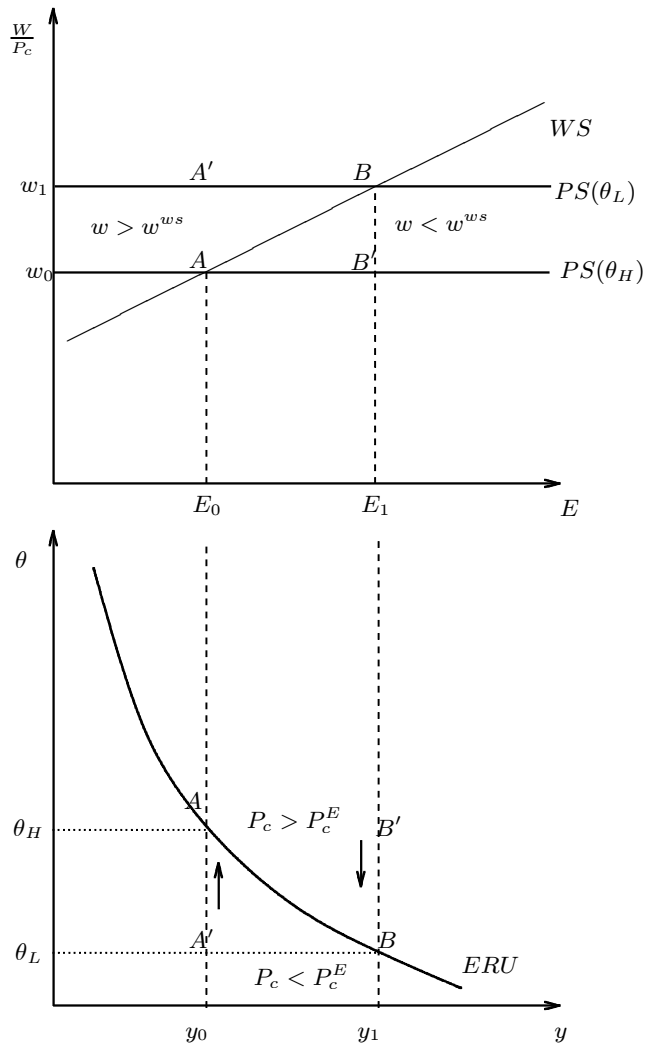


FIGURE 5. **Off the ERU-curve**

- On the ERU-curve, inflation is constant.
- At points above the ERU-curve, the real wage is *below* the WS-curve so that home wages and prices are rising relative to those abroad. Home inflation is rising relative to world inflation. Hence θ is falling.
- At points below the ERU-curve, the real wage is *above* the WS-curve so that home wages and prices are falling relative to those abroad. Home inflation is falling relative to world inflation. Hence θ is rising.

Slope of the ERU-curve

. A glance at Fig. 5.5 suggests that the steepness of the ERU-curve will be very important in fixing the range of output and employment levels consistent with stable inflation. If the ERU-curve was vertical, then there would be a unique equilibrium unemployment rate — a very steep ERU-curve would display only a narrow range of unemployment equilibria. A steep ERU-curve means that a very large change in the real exchange rate is required to bring about the change in the real cost of imports that is necessary to allow the wage and price setting real wage to be equal at a higher level of employment. This could be because the import propensity is very small so that a very big change in relative prices is needed to alter the real cost of imports in the consumption bundle.

It could also be because the wage-setting real wage is very steep, i.e. real wages are very sensitive to a change in unemployment. In such a case, a given fall in unemployment leads to a very big rise in the wage-setting real wage and hence for a given import propensity, requires a large cut in the real cost of imports (fall in θ) to allow the necessary rise in the price-setting real wage.

By contrast, a flat ERU-curve would indicate a wide range of medium-run equilibria. In this case, a high import share would mean that only a small fall in θ would be required for competing claims equilibrium at lower unemployment. Equally, if real wages are rather insensitive to employment, then a given fall in unemployment will be associated with only a modest rise in the wage-setting real wage along the WS-curve and therefore only a small fall in θ is needed to ensure competing claims equilibrium at lower unemployment. (Details for sketching the ERU curve are shown in the Appendix to this chapter.)

To summarize:

(1) If the economy is closed so that there are no imports (i.e. $\phi = 0$), there is a unique equilibrium level of output and hence a unique equilibrium unemployment rate. This will define a vertical ERU-curve.
(2) As the share of imports rises, the ERU-curve becomes flatter. More open economies have flatter ERU-curves.
(3) If the wage setting curve is flatter (i.e. real wages are less sensitive to employment), this will make the ERU-curve flatter. Economies in which labour market institutions make the wage-setting real wage more insensitive to changes in unemployment have flatter ERU-curves.

3. Demand side and trade balance

In Chapter 4, we introduced the impact on the macroeconomy of openness in goods and financial markets. The task now is to translate the key features of goods and financial market equilibrium and of trade balance into the new $\theta - y$ diagram. This step prepares the ground for Section 5.3 in which the supply side, the demand side and the trade balance are brought together to form the basic open economy model. We shall see that using the $\theta - y$ diagram greatly clarifies open economy analysis. As usual we assume that the Marshall–Lerner condition holds so that a rise in price competitiveness (a real exchange rate depreciation) boosts the trade balance (holding the level of output constant).

Goods market equilibrium is summarized by:

$$\begin{aligned} y &= y^D \\ &= c + I(r) + g + (x - m) \\ &= c + I(r) + g + \sigma(\theta) \cdot y^* - \theta m_y(\theta) \cdot y \end{aligned}$$

and

$$r = r^*.$$

Note that we assume that the home *real* interest rate is equal to the exogenous world *real* interest rate. In effect, we are assuming that the Mundell-Fleming adjustment process, discussed in detail in Chapter 4, has brought the economy to a short-run equilibrium. For now the focus is on the medium-run. Figure 6 shows the construction of the AD curve in the $\theta - y$ diagram.

DEFINITION 2 (AD-curve). *The AD-curve shows the combinations of the real exchange rate θ and level of output y at which the goods market is in equilibrium with the real interest rate equal to the world real interest rate.*

It is positively sloped because of the assumption that the Marshall–Lerner condition holds: high competitiveness (high θ) raises aggregate demand and output must therefore be high for goods market equilibrium.

We can also easily show the trade balance condition in the $\theta - y$ diagram.

DEFINITION 3 (BT-curve). *The BT-curve shows the combinations of the real exchange rate θ and the level of output y at which trade is balanced: $x = m$.*

An increased level of price competitiveness (higher θ) raises exports (assuming the Marshall–Lerner condition holds) and requires a higher level of output to drive up the demand for imports and deliver trade balance. Hence the BT-curve is positively sloped. To the left of the BT-curve there is a trade surplus and to the right there is a trade deficit.

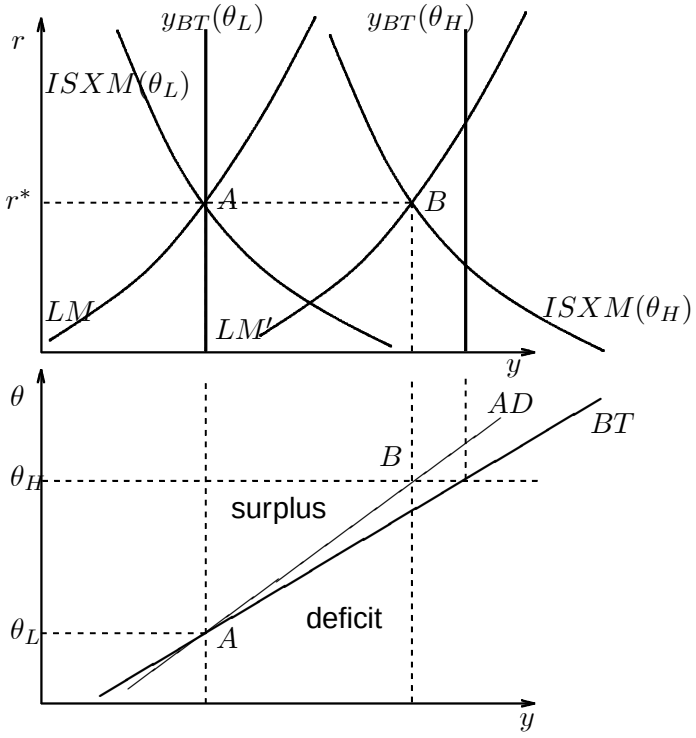


FIGURE 6. **Short-run equilibrium (goods & money market): AD-curve; and trade equilibrium: BT-curve**

The BT-curve is flatter than the AD-curve. The underlying reason for this result was explained in detail in Section 4.1, Fig. 4.3 when we asked what the outcome for the balance of trade would be if there was a depreciation of the real exchange rate. The answer was that there would be a trade surplus: this is shown by point B in Fig.5.6. The intuition is that from an initial equilibrium at point A at which trade is balanced, a given increase in θ implies a new goods market equilibrium at point B, where the level of output is lower than would be consistent with trade balance. This is because there are leakages in the form of savings and taxation (in addition to imports). This leaves the economy in goods market equilibrium at a level of output below the level that would generate imports equal to the new higher level of exports.

A sense of the usefulness of the new $\theta - y$ diagram is conveyed by the following exercise.[4] Think of a government that has two targets for economic policy — high output and external balance, as defined by trade balance. The government has two instruments of economic policy — the nominal exchange rate and fiscal policy (remember that $r = r^*$). There are two relationships linking the targets and the instruments: the $ISXM$ equilibrium (with $r = r^*$) summarized in the AD curve and the balance of trade curve, BT.

Suppose that the country suffers from high unemployment and a trade deficit: this is shown by point A in Fig. 7. What should be done by a government that seeks to attain a level of output of y_1 and trade balance?

If the government devalues the exchange rate from e_0 to e_1, then the economy moves from point A to point B. If we assume that all prices remain constant, θ rises from θ_0 to θ_1 in Fig. 5.10. The devaluation boosts aggregate demand and this is shown by a move along the AD curve. Output rises to y_2 because of the expansionary effect of the devaluation. But although output is higher and trade is balanced at point B, this level of output is higher than the government's target. It must therefore use its other policy instrument (fiscal policy) to adjust the level of output to y_1. This leaves the economy

[4]This analysis is very similar to the original 'Salter-Swan' diagram. In the next section, we integrate the supply side, which is ignored here and in the Salter-Swan analysis by virtue of the assumption of fixed wages and prices.

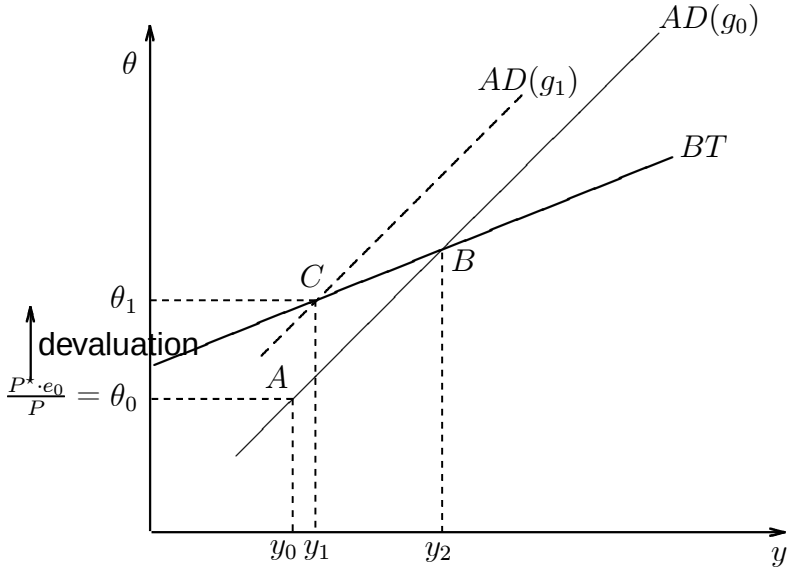


FIGURE 7. **Use of a devaluation and fiscal policy to achieve target output level, y_1, and trade balance**

at point C with the desired output level and with balanced trade. In this example, contractionary fiscal policy is combined with a devaluation.

In this example, we have seen how it will generally be necessary to use two instruments in order to achieve the government's two targets of "internal" and "external" balance. But is position C really a position of internal balance? What does the level of the real exchange rate at C imply for the real wage? Is this real wage compatible with wage-setting behaviour in the economy? These questions signal that we must bring the supply and the demand sides of the economy together with the trade balance condition in order to fully assess the characteristics of a point such as C with target unemployment and balanced trade. We do this in the next section by putting together the basic open economy model.

4. Basic open economy model

The basic model for analysis in the small open economy consists of

- the demand side represented by the AD-curve. On the AD-curve, the goods market is in equilibrium and $r = r^*$.
- the supply side represented by the ERU-curve. On the ERU-curve inflation is constant.
- the balance of trade equilibrium represented by the BT-curve.

In the short run, the economy will be on the AD-curve in goods market equilibrium. For a given nominal exchange rate and a given price level, the level of output is fixed by the AD-curve. But this is not necessarily a medium-run equilibrium.

For medium-run equilibrium, the economy must also be on the ERU-curve. Only on the ERU-curve are the wage and price setting real wages equal and inflationary or disinflationary pressures absent. In the medium run, therefore, the economy will be on an AD-curve and on the ERU-curve.

Only by chance will the medium-run equilibrium also be characterized by trade balance. Long-run equilibrium is at a position on the ERU-curve and at current account balance. As we have seen in Chapter 4, when the current account is balanced, the country's wealth is constant. To make the exposition as simple as possible, we ignore the difference between the trade balance and the current account. This allows us to define the long-run equilibrium as the intersection of the ERU-curve and the BT-curve. We are using long run in the macroeconomic sense — i.e. holding the economy's capital stock constant. As is usual in macroeconomics, we are abstracting from growth.

As discussed in Chapter 4, in the long run, there may be pressures that tend to ensure that there is trade balance in the economy. Such pressures can arise from private sector changes in aggregate demand through the wealth effects on consumption expenditure associated with a trade surplus (home wealth is rising) or a trade deficit (home wealth is falling). Equally, pressure may mount in the foreign exchange market and force the government to change its policy.

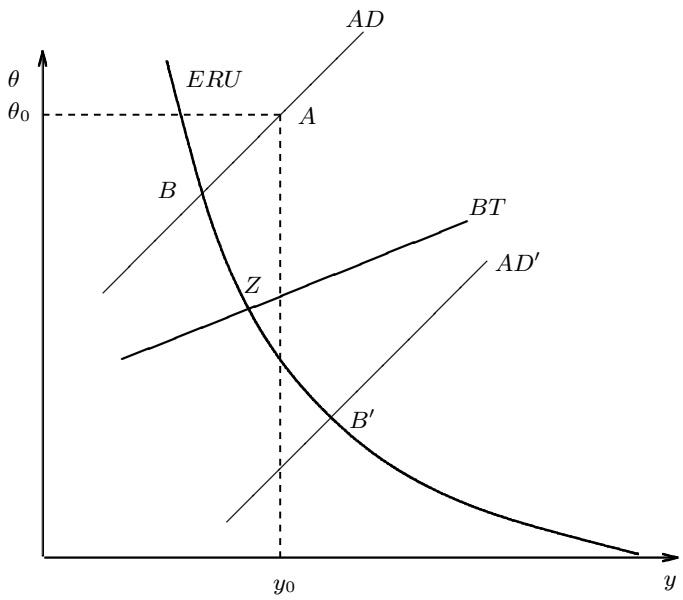


FIGURE 8. **Short-run, medium-run and long-run equilibria in the open economy**

The difference between short, medium and long-run equilibria in the basic model is illustrated by the example in Fig. 8. Let us compare the characteristics of points A, B, B' and Z.

: Short-run equilibrium at point A — on AD but not on ERU or BT. At point A, the economy is on the AD-curve and the level of output is y_0. The real exchange rate is equal to θ_0 and the economy is above the ERU-curve. This means that the prevailing real wage is below the real wage that wage-setters can expect at the relatively low unemployment rate associated with y_0. Workers are in a rather strong position in the labour market and the money wage that is set will rise relative to the expected price level. Home prices will rise relative to foreign prices. Inflation is rising relative to world inflation. This depresses price competitiveness and the economy moves along the AD-curve toward point B. Output falls because of the lower export demand generated by the fall in competitiveness.

: Medium-run equilibria at points B and B'— on ERU and AD and AD' respectively but not on BT. Inflation is constant at points B and B' because each is on the ERU-curve. There is a trade surplus at point B because it is to the left of the BT-curve and a trade deficit at point B' because it is to the right of the BT-curve. The economy can remain at points like B and B' with stable inflation. However, in the longer run, pressures may emerge as a consequence of the trade position that tend to push the economy away from B or B' toward point Z.

: Long-run equilibrium at point Z — on AD, ERU and BT. At point Z, the competing claims equilibrium coincides with the balanced trade level of output. This is likely to be a sustainable long run position for the economy.

Having put together the basic open economy model, we can now reexamine the situation described in Fig. 7 above: recall that the government used its two policy instruments of a change in the exchange rate and an adjustment of fiscal policy to achieve its two targets, the desired output level of y_1 and trade balance. We asked the following questions: Is position C really a position of internal balance? What does the level of the real exchange rate at C imply for the real wage? Is this

real wage compatible with wage-setting behaviour in the economy? These questions can be summarized by asking whether point C is on the ERU-curve. If so, then the economy can remain there without problems of inflation. Since trade is also balanced at C, it would also represent a long-run equilibrium. However, if the ERU-curve lies below point C as shown in Fig. 9, then C is not a medium-run equilibrium: the real wage is below the wage-setting real wage and the economy will experience rising wages and prices. ERU-curve represents a third constraint on the economy and the government will not be able to achieve its output target of y_1 with balanced trade through the use of just two instruments. It will have to use supply-side policy to shift the ERU-curve so that it intersects the BT-curve at point C. We investigate the use of supply-side policy more closely in Chapter 6. Failing this, the government will have to accept a more modest output target and trim aggregate demand accordingly (see point D in Figure 9).

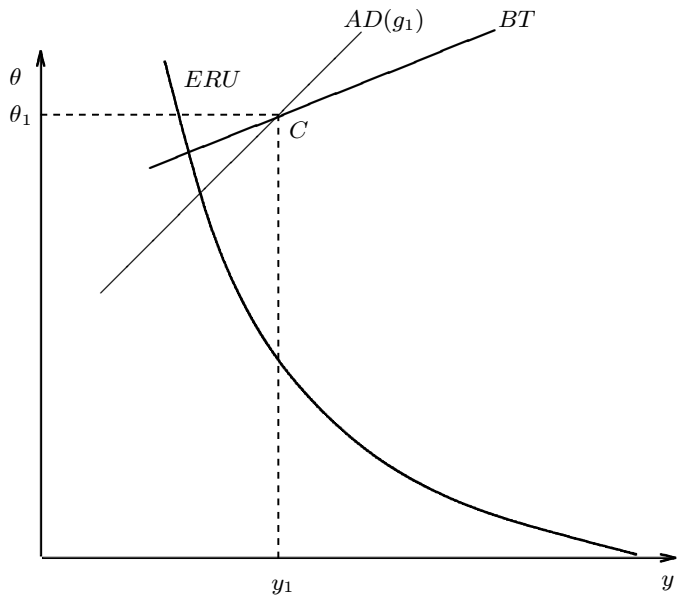


FIGURE 9. **Point C at target output and trade balance is not a medium-run equilibrium**

4.0.6. *Inflation in the medium run in the open economy*
. In the open economy, in medium run equilibrium, the economy is on the ERU-curve. This means that the real exchange rate is constant. If θ is constant, this implies

$$\frac{\dot{P}}{P} = \frac{\dot{P^*}}{P^*} + \frac{\dot{e}}{e}.$$

But what determines the rate of home inflation and the growth rate of the home money supply? It depends on whether exchange rates are fixed or floating.

- **Under fixed exchange rates**, there is no change in the nominal exchange rate (i.e. $\frac{\dot{e}}{e} = 0$) so for the real exchange rate to be fixed as in the equation above, home inflation must be equal to world inflation:

$$\frac{\dot{P}}{P} = \left[\frac{\dot{P^*}}{P^*}\right].$$

  Since home is a small country, its inflation rate is determined by world inflation. The square brackets are used to indicate an exogenous variable. We turn now to equilibrium in the home money market. The demand for money is a function of the level of output and the nominal interest rate. The nominal interest rate is equal to the real interest rate plus expected inflation ($i \approx r + \left(\frac{\dot{P}}{P}\right)^E$)[5]. In medium run equilibrium inflation is at its expected

[5]We assume in what follows that the approximation holds.

rate. With inflation at the world rate and with the home real interest rate equal to the world rate ($r = r^*$), equilibrium in the home money market is as follows:

$$\begin{aligned}\left(\frac{M}{P}\right)^S &= \left(\frac{M}{P}\right)^D \\ &= L(y,i) \\ &= L(y, r + \left(\frac{\dot{P}}{P}\right)^E) \\ &= L(y, r^* + \frac{\dot{P}^*}{P^*})\end{aligned}$$

In medium run, equilibrium in the home money market implies that the real money supply, $\frac{M}{P}$, is constant since all the determinants of the demand for money are fixed. Hence the home money supply is endogenous and must grow at the same rate as inflation:

$$\frac{\dot{M}}{M} = \frac{\dot{P}}{P} = \left[\frac{\dot{P^*}}{P^*}\right]. \qquad \text{(fixed exchange rates)}$$

Thus as long as foreign inflation remains constant and the exchange rate is fixed, home inflation is constant at the foreign rate in medium-run equilibrium. We assume constant world inflation.

- **Under flexible exchange rates**, in medium run equilibrium, it is also the case that the real exchange rate, θ, is constant. Hence

$$\frac{\dot{P}}{P} = \frac{\dot{P^*}}{P^*} + \frac{\dot{e}}{e}.$$

For equilibrium in the home money market and with the home real interest rate equal to the world rate ($r = r^*$),

$$\begin{aligned}\left(\frac{M}{P}\right)^S &= \left(\frac{M}{P}\right)^D \\ &= L(y,i) \\ &= L(y, r^* + \left(\frac{\dot{P}}{P}\right)^E).\end{aligned}$$

At the medium run output level, inflation is constant at its expected rate. This implies that the home money supply must grow at the rate of home inflation. We assume that the growth rate of the home money supply is exogenous, this determines the rate of home inflation.

$$\left[\frac{\dot{M}}{M}\right] = \frac{\dot{P}}{P}.$$

The change in the nominal exchange rate is endogenous: it is determined by the difference between the growth rate of the home money supply (and hence home inflation) and the rate of world inflation:

$$\begin{aligned}\frac{\dot{e}}{e} &= \frac{\dot{P}}{P} - \left[\frac{\dot{P^*}}{P^*}\right] \qquad \text{(flexible exchange rates)} \\ &= \left[\frac{\dot{M}}{M}\right] - \left[\frac{\dot{P^*}}{P^*}\right]\end{aligned}$$

In medium run equilibrium in the flexible exchange rate economy, the real exchange rate is constant, inflation is constant and the nominal exchange rate is changing unless home and world inflation are the same.

Summing up. In the open economy, there is a range of output and employment levels consistent with constant home inflation in the medium run. There is no unique ERU. The economy can be at any point on the ERU-curve with constant inflation equal to the growth rate of the home money supply — this is set by world inflation in the fixed exchange rate economy and by the home central bank in the flexible exchange rate economy.

5. Long-run equilibrium

In the open economy, the economy is on the AD-curve in the short run and on the ERU-curve in the medium run. Experience suggests that economies can remain for considerable periods at a medium-run equilibrium on the ERU-curve but with a current account imbalance. We look here at forces that might eventually lead the economy back to the long-run equilibrium on the BT-curve.

A country at a position such as A in Fig. 10 is in medium run equilibrium with constant inflation but has a current account surplus. As explained in Chapter 4, the counterpart to the current account surplus is a capital account deficit: country A is lending to the rest of the world at the world interest rate. It is acquiring foreign assets. The increase in the stock of foreign assets owned by the home country as it runs a trade surplus generates a stream of interest receipts to the home country that add to the current account surplus.

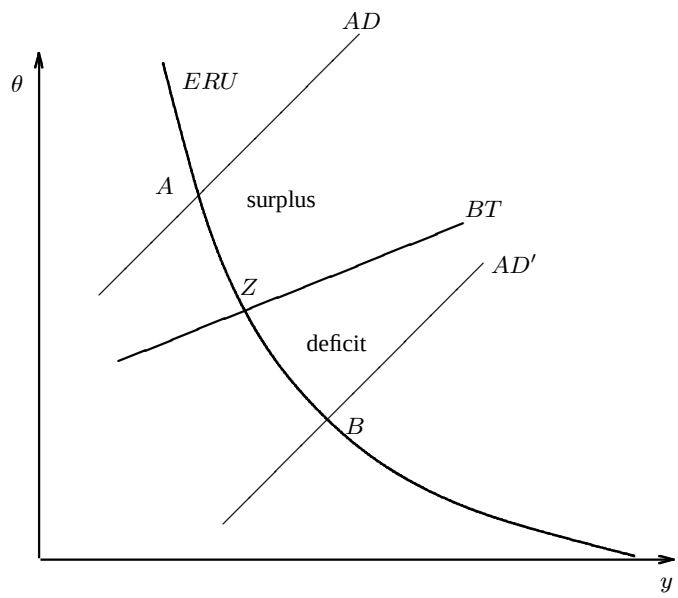


FIGURE 10. **Long-run equilibrium in the open economy: on BT- and ERU-curves**

By contrast, the country at B has a trade deficit and is borrowing from abroad to finance this. Country B is therefore acquiring foreign liabilities: its foreign debt is rising every year that it runs a trade deficit. It must pay interest on the accumulated debt. This means that even if the trade deficit remains constant, the current account deficit worsens as interest payments mount up.

A number of questions arise:

- are there automatic forces in the economy that tend to push the economy to the long run equilibrium at Z through the adjustment of aggregate demand?
- are there market forces that exert pressure on the government to adjust macroeconomic policy so as to shift the economy to the long run equilibrium?
- are there political pressures from home or abroad on the government to adjust policy?

We first examine these three mechanisms that might push the economy toward the long-run equilibrium (where the ERU and BT curves intersect). At this stage, we assume that exchange rate expectations are stable — i.e. that they are not affected by the trade position. In a second step, we look at how the economy may shift toward the long-run equilibrium as a consequence of the impact of the trade position on exchange rate expectations.

5.1. Mechanisms with stable exchange rate expectations.

Wealth effects

. One automatic mechanism that might produce a shift to long-run equilibrium is the operation of wealth effects. As noted in Chapter 4, home consumers may incorporate the changes in national wealth into their consumption decisions. It is obvious that a country cannot run down its wealth indefinitely: far-sighted consumers in the deficit country, B, may take the view that the deficit does not reflect a programme of investment in the home economy that will bear fruit in the longer term. They may believe that belt-tightening will eventually be required in the home economy to service and repay the foreign debt. As a result, they may adjust downward their estimate of permanent income and implement the associated cut in consumption spending. For a country such as country A with a trade surplus, the opposite considerations may lead to a rise in the assessment of permanent income and hence consumption may increase. To the extent that these reactions occur, the AD-curve will shift toward the long run equilibrium. These forces alone are unlikely to be powerful enough to guarantee long-run equilibrium.

Market pressure

. Throughout the analysis of the open economy in this chapter, we have made the assumption of perfect international capital mobility. Countries can borrow indefinitely at the international interest rate. But a country with a persistent trade deficit faces a build-up of its foreign debt. As noted above, it is possible that the deficit arises from the country taking advantage of especially favourable investment opportunities at home by borrowing from abroad. If so, then the investments will eventually bear fruit and directly or indirectly improve the country's export base allowing it to move from trade deficit to trade surplus and repay its debt. Norway provides an illustration of this pattern: there were substantial current account deficits averaging nearly 5% of GDP from the mid 1970s and into the 1980s as the domestic oil industry was developed, which were followed by surpluses in the 1990s.

If the sentiment in international financial markets is that the trade deficit reflects high home consumption or wasteful investment, then funds will cease to be available to country B at the world interest rate. Private expenditure will tend to be dampened by the change in credit conditions. In addition, the government may implement a tightening of aggregate demand policy to reduce the trade deficit.

Political pressure

. The economic pressures on deficit countries to adjust are typically stronger than those on surplus countries. If wealth effects on consumption are weak, then a country is able to run a trade surplus for a lengthy period of time. This suggests there may be an asymmetry between deficit countries like B and surplus countries like A. Unless the investment opportunities abroad are particularly profitable, the wisdom of running a persistent surplus is questionable. This may lead to political pressure from within the country for the government to boost activity and operate at a lower unemployment rate. Surplus countries can also come under political pressure at the international level to adjust their policies (e.g. the US exerted pressure on the Japanese authorities during the 1980s).

5.2. Unstable exchange rate expectations. In the basic open economy model, we assume that the exchange rate remains at its expected level and that expectations are formed in a simple backward looking way. But even under fixed exchange rates, a country with a persistent trade deficit may find it difficult to defend the exchange rate peg indefinitely. As discussed in Chapter 4, if private counterparties are not willing to purchase the home currency and finance the deficit, then the home country's central bank will have to sell foreign exchange reserves. There is a limit to the extent to which this is possible because foreign exchange reserves are limited and borrowing to supplement them may be

difficult. Once exchange market operators begin to speculate on a devaluation, the central bank may be forced to combine interest rate rises to try to hold the exchange rate peg with intervention in the foreign exchange market. Eventually, the government may be forced to tighten fiscal policy to move the economy toward the long run equilibrium. Policy combinations are examined in more detail in Chapter 11.

Under flexible exchange rates, the stability of a medium run equilibrium is an open question. There is no consensus about the sustainability of a medium run equilibrium because the process by which exchange market expectations are formed is not well understood.

The aim of this section is to show that if we take a very different expectations hypothesis from the standard one in the basic model, then the results can change dramatically. For example, let us suppose that the exchange rate is expected to adjust immediately to deliver a real exchange rate consistent with trade balance i.e.

$$e_t = e_t^E \text{ if and only if } BT = 0.$$

If there is a trade deficit, the exchange rate is expected to depreciate and if there is a trade surplus, the exchange rate is expected to appreciate.

In Figure 11, the economy is at the medium run equilibrium at point B with a trade deficit and constant inflation. The stability of this position depends on the assumption in the basic model that the expected exchange rate remains unchanged. Under the new balanced trade expectations hypothesis, this expected exchange rate is not sustainable in the long run. A depreciation of the exchange rate will be expected and lead to a movement along the AD-curve toward the north-east as price competitiveness improves.[6] But we know that when the economy is above the ERU-curve, domestic inflationary pressures will emerge.

The two sources of inflationary pressure are easy to see: on the one hand, output and employment have increased, so the wage-setting real wage is higher and money wage increases will follow; on the other hand, the exchange rate depreciation has increased the real cost of imports and cut real wages. Money wages will increase in response to this too. Hence there will be a 'tug-of-war' going on as the economy is pulled toward the BT-line by nominal exchange rate depreciation ($\theta \uparrow$) and pulled back toward the ERU-curve ($\theta \downarrow$) by domestic wage and price inflation. The consequence will be rising inflation.

Figure 12 shows two panels. In the first one, the pressures emanating from the foreign exchange market that drive the economy toward balanced trade via nominal exchange rate depreciation or appreciation are shown. In the second one, the pressures emanating from the supply side through wage and price setting that drive the economy toward competing claims equilibrium via wage and price inflation or disinflation are shown.

Under the 'balanced trade exchange rate expectations' hypothesis, the BT-curve becomes the *full exchange market equilibrium condition*.

[6]To be precise, the economy will move in a north-easterly direction but to the left of the AD-curve. The reason is that the expected real depreciation of the exchange rate implies that home's real interest rate must be above the world real interest rate. A higher real interest rate implies lower output than shown by the AD-curve since the AD-curve is drawn assuming $r = r^*$. The financial arbitrage condition with perfect capital mobility (UIP-condition) is translated into real terms by substituting the definitions for the home and world real interest rates into the UIP-condition and using the fact that

$$\left(\frac{\Delta\theta}{\theta}\right)^E = \left(\frac{\Delta P^*}{P^*}\right)^E + \left(\frac{\Delta e}{e}\right)^E - \left(\frac{\Delta P}{P}\right)^E.$$

This implies:

$$r - r^* = \left(\frac{\Delta\theta}{\theta}\right)^E$$

i.e. an expected depreciation of the exchange rate implies that the home real interest rate is above the world real interest rate.

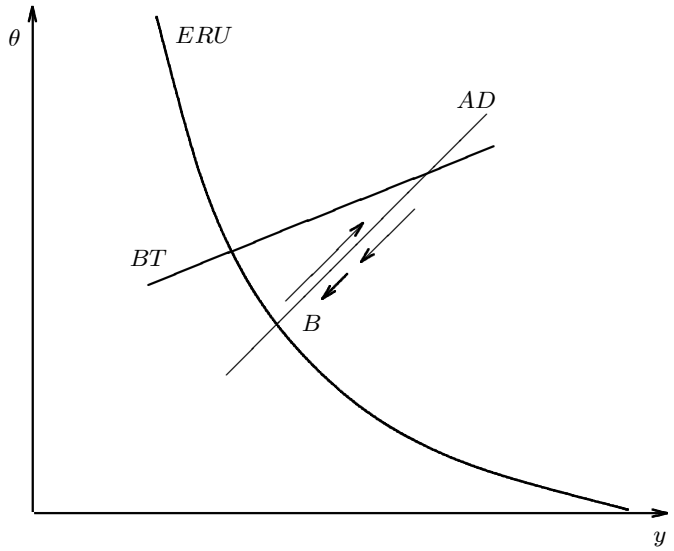
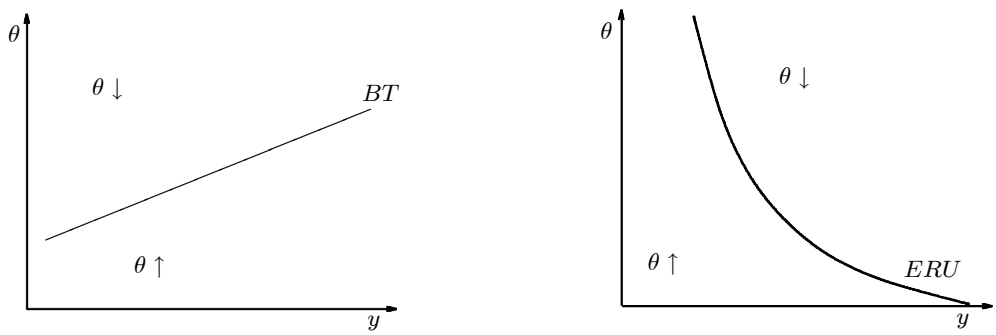


FIGURE 11. **Medium-run equilibrium at B (trade deficit) is disturbed by an exchange rate depreciation**



(a) Pressure on e and hence on θ. (b) Pressure on inflation and hence on θ.

FIGURE 12. **Interaction of foreign exchange market and labour market: Unique constant inflation equilibrium if exchange rate expectations are oriented to trade balance**

Under this condition, and assuming, that inflation expectations are formed adaptively (i.e. $\left(\frac{\Delta P}{P}\right)^E = \left(\frac{\Delta P}{P}\right)_{-1}$) then on the BT-curve, the nominal exchange rate will be changing to maintain the real exchange rate consistent with trade balance, given lagged inflation:

$$\frac{\Delta e}{e} = \left(\frac{\Delta P}{P}\right)_{-1} - \frac{\Delta P^*}{P^*}.$$

On the ERU-curve, home inflation will be such that the real exchange rate is consistent with wage and price-setting equilibrium, given the lagged change in the exchange rate:

$$\frac{\Delta P}{P} = \left(\frac{\Delta e}{e}\right)_{-1} + \frac{\Delta P^*}{P^*}$$

The consequence is that between the BT- and ERU-curves there will be rising inflation (in zone III) and falling inflation (in zone IV) as shown in Figure 13. By contrast, in zone II pressures from the foreign exchange market and from the labour market are both pushing the real exchange rate in the same direction (falling price competitiveness) and in zone I, (rising competitiveness). We can therefore conclude that the only stable position is where the BT-curve intersects the ERU-curve. Only at point Z in Fig. 13 are (i) exchange rate expectations consistent with balanced trade

fulfilled and (ii) the inflation expectations of wage and price setters fulfilled. There is a unique long-run equilibrium rate of unemployment. The attempt by the authorities to maintain a level of activity higher than y_N will require an ever-increasing growth of the money supply to fuel the rising inflation. Ever-increasing inflation will eventually lead the government to implement a restrictive fiscal policy and shift the economy to the lower level of employment that is consistent with exchange rate expectations and with price and wage setting behaviour in the long run.

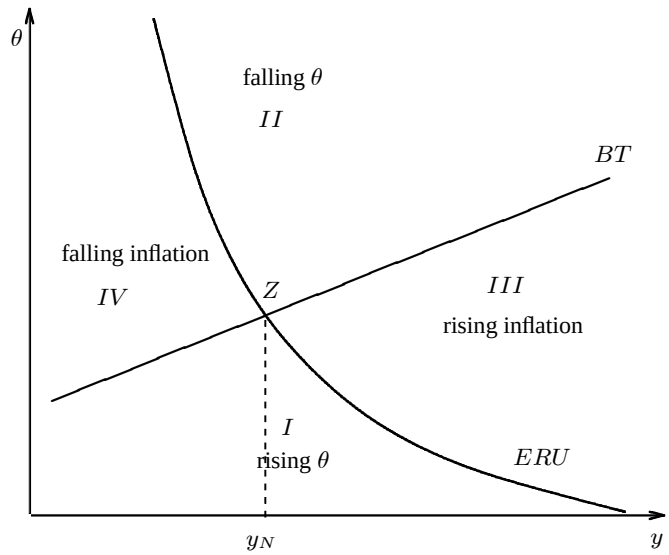


FIGURE 13. **Unique constant inflation equilibrium if exchange rate expectations are oriented to trade balance**

6. Conclusions

The basic open economy model set out in this chapter provides the tools for analyzing a rich variety of disturbances to the economy from the demand and supply sides and coming from home and abroad. It enables us to diagnose the nature of the disturbances and to identify the role of economic policy in responding to them.

The key results of the basic open economy model are the following:

- there is a range of unemployment rates at which inflation is constant and at which the economy can remain in the medium run
- there is an inverse relationship between the real exchange rate and the medium-run level of output and employment
- the range of medium-run equilibria is wider in a more open economy; in a completely closed economy, there is a unique constant inflation equilibrium
- the range of medium-run equilibria is wider, the less responsive is the wage-setting real wage to changes in unemployment
- changes in fiscal policy shift the medium-run equilibrium
- changes in monetary policy or in the nominal exchange rate shift the economy only temporarily away from its medium-run equilibrium
- in the long run, wealth effects or market pressures, including exchange rate instability, may push the economy toward the long-run equilibrium with current account balance
- any external or supply-side change that shifts the BT-curve or the ERU-curve leads to a change in the long-run sustainable unemployment rate.

In Chapter 6, we shall put the basic open economy model to work. We look at aggregate demand shocks and at the use of aggregate demand and exchange rate policies to respond to them. Demand shocks can be caused by changes in private sector behaviour in the home economy or they can come from abroad. We shall look at supply side shocks (e.g. changes in the exercise of bargaining power

by unions or changes in the product market competition) and at supply side policies (e.g. supply-side fiscal measures, labour and product market regulation). Foreign trade shocks and external supply shocks, such as oil or commodity price shocks, are also examined. In each case, the implications for the AD-curve, the ERU-curve and the BT-curve and hence for output, inflation and the external balance are investigated.

7. APPENDIX: Sketching the ERU-curve (optional)

If we express the wage-setting real wage equation in terms of output rather than unemployment and use a simple linear form, then

$$w^{WS} = \lambda \cdot y$$

where λ is a positive constant. The price-setting real wage is

$$w^{PS} = \frac{LP \cdot (1-\mu)}{1+\phi \cdot (\theta - 1)}.$$

In competing claims equilibrium, $w^{WS} = w^{PS}$. Hence if we substitute the equations for the wage and price-setting real wage and rearrange to get the level of output on the left hand side, we have:

$$\begin{aligned} w^{WS} &= w^{PS} \\ \lambda \cdot y &= \frac{LP \cdot (1-\mu)}{1+\phi \cdot (\theta - 1)} \\ y &= \frac{1}{\lambda} \cdot \frac{LP \cdot (1-\mu)}{1+\phi \cdot (\theta - 1)}, \end{aligned} \tag{CCE-curve}$$

which is an equation for competing claims equilibrium in terms of y and θ.

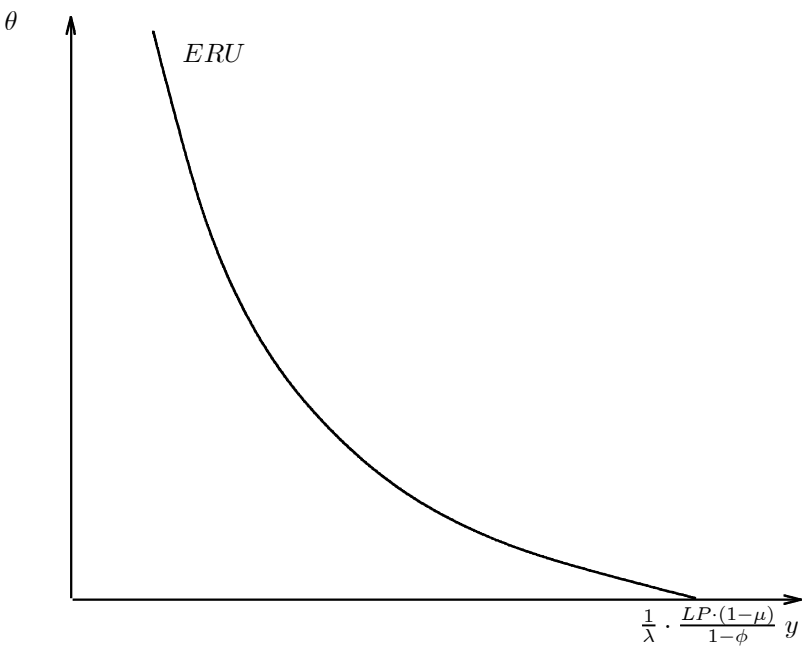


FIGURE 14. **The ERU-curve:** $\frac{1}{\lambda} \cdot \frac{LP \cdot (1-\mu)}{1-\phi}$

The negative relation between θ and y in competing claims equilibrium that we have discussed in developing the ERU-curve is clearly reflected in the equation. We can also see the role of the share of imports (ϕ) and of the sensitivity of real wages to output (or employment) in wage-setting (λ) in determining the shape of the ERU-curve.

The easiest way to see these characteristics is to sketch the ERU-curve. First, assume that $\theta = 0$. This gives an intercept on the $y-$axis of

$$y = \frac{1}{\lambda} \cdot \frac{LP \cdot (1-\mu)}{1-\phi}.$$

Now consider what happens when θ becomes very large. As $\theta \to \infty$, the denominator of the equation for the ERU becomes very large and $y \to 0$. Hence the ERU-curve is asymptotic to the vertical axis. Figure 14 shows the ERU-curve.

Openness. Now consider what happens to the ERU-curve as the import share changes. As we have already noted, if $\phi = 0$, $y = \frac{1}{\lambda} \cdot LP \cdot (1 - \mu)$ and this is simply the closed economy unique equilibrium output level (Fig. 15). We have also seen before that in the open economy if $\theta = 1$, the output level on the ERU-curve will be at the closed economy equilibrium level: i.e. if $\theta = 1$,

$$y = \frac{1}{\lambda} \cdot LP \cdot (1 - \mu).$$

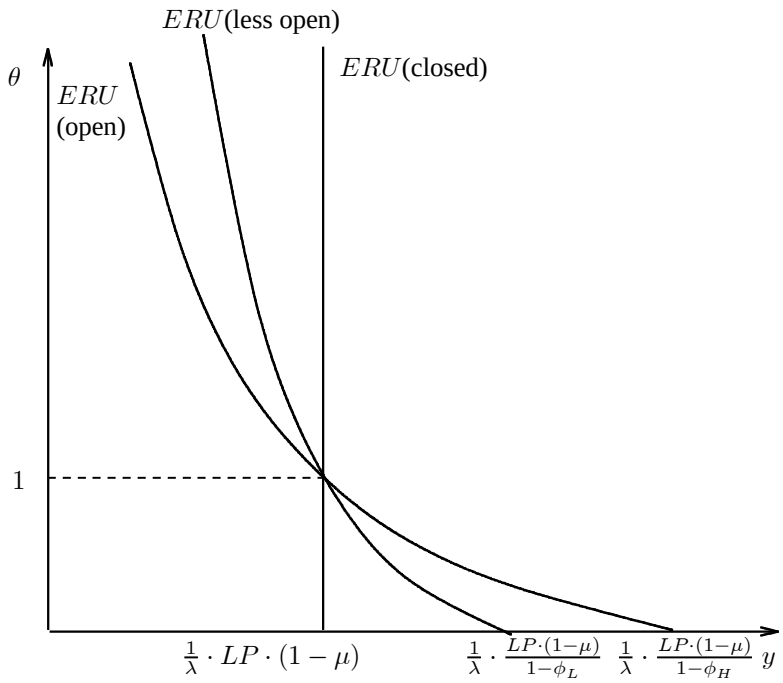


FIGURE 15. ERU**-curves in open, less open and closed economies**

This gives us a point on the open economy ERU-curve. To find a second point, we look for the intercept with the $y-$axis, i.e. when $\theta = 0$. If there is a low share of imports, ϕ, then at $\theta = 0$, $y = \frac{1}{\lambda} \cdot \frac{LP \cdot (1-\mu)}{1-\phi}$ which will be to the right of but quite close to $y = \frac{1}{\lambda} \cdot LP \cdot (1 - \mu)$ (see Fig. 15). Hence the ERU-curve for an open economy that has only a small share of imports is steep.

If we now take the case of a very open economy with a high share of imports, ϕ, the point at which the ERU-curve intersects the y-axis will be much further to the right than in the previous case (see Fig. 10.7). And we know that at $\theta = 1$, the ERU-curve will go through the same point as in the previous case: $y = \lambda \cdot LP \cdot (1 - \mu)$. The three contrasting cases are shown in Fig. 15

Sensitivity of wage-setting real wage to employment. We have already discussed the intuition behind the effect of an increased sensitivity of the wage-setting real wage to employment in steepening the ERU-curve. To see this diagramatically, it is easy to see that an increase in λ from λ_L to λ_H shifts to the left the intercept with the y-axis: $y = \frac{1}{\lambda} \cdot \frac{LP \cdot (1-\mu)}{1-\phi}$. We now look at what happens when $\theta = 1$. With λ_L, the output level on the ERU-curve is $y = \frac{1}{\lambda_L} \cdot LP \cdot (1 - \mu)$. With a highly employment-sensitive WS-curve, $y = \frac{1}{\lambda_H} \cdot LP \cdot (1 - \mu)$. Because $\frac{1}{1-\phi} > 1$, the leftward shift of the ERU-curve in the case of the high level of λ is greater when $\theta = 0$ than when $\theta = 1$. Hence, a higher level of λ means a steeper ERU-curve (see Fig. 16).

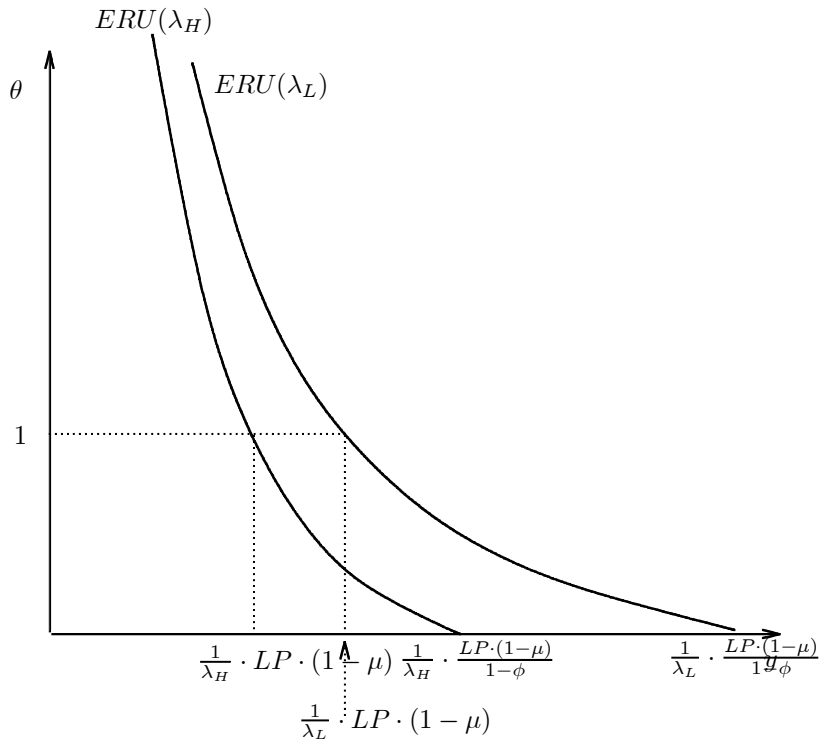


FIGURE 16. ERU**-curves reflect the sensitivity of real wages to employment in the wage-setting curve**