CHAPTER 6

Shocks and policy responses in the open economy

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

In this chapter, the open economy model developed in Chapters 4 and 5 is put to work to examine government policy instruments and to analyze shocks that may disturb the economy. The term ‘shocks’ is used to describe a disturbance to the economy that was unanticipated. Firms and households are likely to be forward-looking and, at least to some extent, are able to incorporate anticipated changes in their economic environment into their behaviour. It is the different kinds of unanticipated changes in the economic environment on which we focus in this chapter. We use the model to analyse

- aggregate demand shocks,
- supply shocks and
- external shocks.

In each case, it is necessary to diagnose the implications of the disturbance for the private sector and for policy-makers — does it shift the $AD$-curve, is it a shift along the $AD$-curve, does it shift the $BT$-curve or the $ERU$-curve? In order to assess the likely response of the private sector to the shock and to examine the appropriate policy response of the authorities, a diagnosis of the type of shock has to be made. Some shocks are relatively simple to analyze in the sense that they have an impact on only one of the three relationships in the model. Others are more complex — for example, shifting more than one relationship.

The importance of the correct diagnosis of the type of shock is demonstrated by the experience of the advanced countries in the 1970s. In 1973 and again in 1979, the world price of oil increased sharply. The consequence of the first oil shock was a fall in aggregate demand in the oil-importing OECD countries. Many countries adopted policies in response to the first oil shock based on the interpretation of it as an aggregate demand shock — one that shifted the aggregate demand curve to the left. Yet the attempt to offset the impact of the shock on employment through fiscal expansion was accompanied by rapid deterioration in the trade balance and rising inflation. A number of European countries experienced inflation rates rising well into double digits at a time of rising unemployment. The second oil shock in 1979 was met by quite a different policy response. By then it was clearer that the rise in the price of oil was an external supply shock, which had the effect of shifting the $AD$-, $BT$- and $ERU$-curves in an adverse direction.

Another example is the slowdown in productivity growth in the advanced countries from the early 1970s. Although the language of ‘shocks’ fits the case of a change in the productivity growth trend less well, it is still a useful way of conveying the idea of an unanticipated change in trend. Usually it is only with hindsight that it is possible to identify cyclical changes in aggregate demand, commodity prices or productivity growth from longer lasting movements. An interesting question in the early 21st century is whether the rise in productivity growth in the United States from the mid 1990s signals a new trend of higher productivity growth — due for example to the widespread introduction of new information technologies — or simply an unusually long cyclical upswing.

The analysis of different kinds of shocks, private sector responses and the efficacy of government policy measures also provides some of the tools that are needed in analyzing how a currency union

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operates and the advantages and disadvantages of membership. Chapter (Interdependent Economies) on the macroeconomics of European Monetary Union explores this further.

This chapter begins with an introductory section that looks at fiscal, monetary and supply-side policy in the open economy. This ties together the Mundell–Fleming analysis (from Chapter 4) with the medium- and long-run analysis in Chapter 5. This is followed by an examination of four different kinds of shocks: domestic aggregate demand shocks, domestic supply shocks, foreign trade shocks, and external supply shocks. In each case, we ask what the implication of such a shock is for the short-run, the medium-run and the long-run equilibrium. This helps us to analyse what would happen after each kind of shock if the government did not react to it at all. We can then ask whether there are appropriate tools available to the government with which to offset such a shock or to mitigate its effects on the economy.

There is then a summary section that draws together conclusions for the usefulness of the different policy instruments. The chapter ends with a short section that examines the implications of fluctuations in aggregate demand and of supply-side policy measures for the behaviour of real wages.

1. Fiscal, monetary, exchange rate and supply-side policies

The open economy model is very useful for analyzing the impact on the economy of policy changes at home and abroad as well as the impact of shifts in private sector behaviour. The key components of the model set out in Chapter 5 are:

- the $AD$-curve. This shows the combinations of the real exchange rate $\theta$ and level of output $y$ at which the goods market is in equilibrium and the real interest rate is equal to the world real interest rate.
- the $ERU$-curve. This 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, inflation is constant.
- the $BT$-curve. This shows the combinations of the real exchange rate $\theta$ and the level of output $y$ at which trade is balanced: $x = m$.

Timing assumptions. This is an appropriate point at which to spell out the assumptions that are being made about the speed of adjustment of different macroeconomic variables in the open economy.

: The short run. In the short run, the goods market equilibrium is established and arbitrage in financial markets ensures that the home real interest rate is equal to the world real interest rate. In the short run, we observe changes in the nominal interest rate, the nominal exchange rate, output and employment.\(^2\) The end of the short-run adjustment is marked by the attainment of the short-run equilibrium on the $AD$-curve. In the short run, it is assumed that wage and price-setters do not change wages or prices.

: The medium run. The medium run begins when wage and price-setters start to respond to two things:
- to any change in the level of activity (output, employment) in the economy that has occurred in the short run and
- to any change in the real wage that has been brought about by a change in the nominal (and hence the real) exchange rate in the short run.

: Wage-setting is assumed to happen periodically and price-setters are assumed to adjust their prices rapidly in the wake of wage changes. This means that the actual real wage in the economy is always equal to the price-setting real wage.\(^3\) The end of the medium run is

\(^2\)By virtue of any change in the exchange rate, the consumer price index changes. Although this will influence the short-run equilibrium in the money market, this effect is normally ignored.

\(^3\)This is obviously a simplification — if price-setting is sluggish in the wake of cost increases, then the real wage will lie between the wage-setting real wage and the price-setting real wage (i.e. between the $WS$-curve and the $PS$-curve).
marked by the attainment of the medium-run equilibrium with the economy at the intersection of the $AD$-curve and the $ERU$-curve, and hence with constant inflation.

**The long run.** In the long run, the presence of a current account surplus or deficit may produce shifts in the $AD$-curve (as consumers react to the changes in wealth implied, or the government adjusts fiscal policy in response to market or political pressures). The presence of a persistent surplus or deficit may lead to a change in the way exchange rate expectations are formed, with the consequence that there is constant inflation only at the intersection of the $ERU$ and $BT$ curves as discussed in Chapter 5. This in turn may lead the government to adjust fiscal policy to shift the economy to the long-run equilibrium.

In this section, we concentrate on three key results from the open economy model:

- a change in *fiscal policy* shifts the aggregate demand curve, which implies there is a new medium-run equilibrium for the economy at a different level of output and real exchange rate. In the absence of government intervention, the economy moves from the new short-run equilibrium to the new constant-inflation rate of unemployment. Since the short-run equilibrium differs under fixed and flexible exchange rates, the adjustment path to the new medium-run equilibrium differs under fixed and flexible exchange rates. In particular, the impact on inflation — whether there is a temporary rise or a temporary fall in inflation — depends on the exchange rate regime.

- a change in *monetary policy* under flexible exchange rates or a change in the exchange rate peg in a ‘fixed’ exchange rate system is a shift along the aggregate demand curve and therefore does not lead to a new medium-run equilibrium. The levels of output and unemployment change only in the short run. A temporary rise in inflation in the case of a devaluation/expansionary monetary policy or a temporary fall in inflation in the case of a revaluation/contractionary monetary policy leads the economy back to the original medium run equilibrium.

- a change in *supply-side* policy is a shift in the $ERU$-curve (under both fixed and flexible exchange rates). This changes both the medium and the long-run equilibrium.

We are not concerned here with why the government might want to use fiscal or monetary/exchange rate policy or supply-side policy — we come to that when we look at the different kinds of shocks that may affect the economy. For now, the aim is simply to pin down the effects of different policies. This is easiest to understand if we begin in full equilibrium at the intersection of the $AD$-, $BT$- and $ERU$-curves.

**1. Fiscal policy.** We focus on the implications for aggregate demand of a change in fiscal policy: we examine the supply-side aspects of some kinds of fiscal policy later on when we look at supply-side policy. Suppose the economy is at point $A$ at full equilibrium in Figure 6.1. The government undertakes an expansionary fiscal policy. The aggregate demand curve then shifts to the right. (A fiscal contraction will produce an exactly symmetrical set of results.) New medium-run equilibrium. A fiscal expansion implies a rightward shift of the $AD$-curve. This leads to a new medium-run equilibrium at point $B$. At the new medium-run equilibrium,

- output is higher and unemployment lower,
- $\theta$ is lower (i.e. a real appreciation), and the real wage is higher,
- there is a trade deficit, and
- inflation is constant.

This example was discussed at the beginning of Chapter 5, where we used the labour market diagram to discuss the implications of a fiscal expansion. The adjustment path from $A$ to $B$ depends on the exchange rate regime.

Under fixed exchange rates. As we saw in Chapter 5, under fixed exchange rates, output in the economy expands with the real exchange rate constant. In the Mundell–Fleming model expansionary fiscal policy has the full multiplier effect on output because in the new short-run equilibrium, the interest rate remains unchanged at the world rate. In Fig. 6.1, this is the move from $A$ to $C$. But
in the medium run, after output and employment in the economy have expanded, wages and prices will begin to respond. At a position above the ERU-curve (see Fig. 6.1), the existing real wage lies below the wage-setting real wage at the new higher level of activity (see Fig. 5.2). The reason is that the WS-curve is upward-sloping: as employment rises, so does the real wage that wage-setters can expect when money wages are set. As a consequence, at the next occasion on which wages are set, wages rise relative to expected inflation. From the pricing equation \( P = \frac{1}{1 - \phi} \cdot W \phi \cdot P^*e \), we know that when money wages rise, prices will be put up by home firms in proportion to the labour cost increase in order to keep the mark-up, \( \mu \), constant. Two things follow from this.

: First, from the definition of the consumer price index \( P_c = (1 - \phi) \cdot P + \phi \cdot P^*e \), it follows that consumer prices rise in the wake of the home price rise. However, the consumer price index will not rise by as much as does the price level of home-produced output because nothing has happened to the rate of inflation for imported goods. This implies that the real wage, \( W/P_c \), has increased.

: Second, because home inflation has risen and nothing has happened to world inflation, price competitiveness, \( \theta = \frac{P^*e}{P} \) has fallen. Another way of looking at this is that, in terms of the goods that the home economy exports, imports have become cheaper, i.e. the real cost of imports has declined.

The economy therefore moves in a south-westerly direction down the \( AD(y_0) \)-curve. This is the mirror-image of the north-westerly movement in the labour market diagram in Fig. 5.2. The home economy experiences a temporary rise in inflation relative to world inflation. Once the economy is at point \( B \), real wages, the real exchange rate and inflation are constant. An example is provided in the appendix to this chapter of how inflation changes as the economy moves from one medium-run equilibrium with constant inflation to another one — for example, following an expansionary fiscal policy.

Under flexible exchange rates. In the Mundell–Fleming model, the increase in output stimulated by a fiscal expansion is wiped out in the short run by the exchange rate appreciation induced by the
fact that the home nominal interest rate is temporarily higher than the world rate. In the medium run, however, there is higher output at the new equilibrium. As we saw in Chapter 5, the initial nominal exchange rate appreciation to point \(D\) (the Mundell–Fleming short-run equilibrium) in Fig. 6.1 implies that price competitiveness has fallen and real wages have risen. Real wages have risen because the nominal appreciation cuts the price (in domestic currency terms) of imported final goods in the consumption bundle (i.e. \(e \Rightarrow P_c \Rightarrow \left(\frac{w}{P}\right)\)). In the medium run, wage setters will react to this. With real wages at \(y_0\) above the level associated with wage-setting equilibrium, money wages will fall relative to the expected price level (refer back to Fig. 5.2). Since this reduces labour costs for firms, home prices are reduced by price-setters in line with the fall in nominal wages. Nothing has happened to world inflation so the consumer price index falls by less than the fall in the price level of home goods. The consequence is that real wages do fall. Since home inflation has fallen below world inflation, price competitiveness rises (the real exchange rate depreciates). The improvement in competitiveness boosts net exports and the economy moves in a north-easterly direction along the \(AD\)\((g_1)\)-curve toward the new medium run equilibrium at \(Z\) (this mirrors the south-easterly move from point \(D\) in Fig. 5.2). The home economy experiences a temporary fall in inflation relative to world inflation.

Summing up. Following an expansionary fiscal policy,

- under fixed exchange rates, adjustment to the new medium-run equilibrium is via rising output and a temporary increase in inflation (relative to world inflation), which weakens competitiveness and dampens the expansion.
- under flexible rates, adjustment is via an initial exchange rate appreciation that offsets the effect of the expansionary fiscal policy on output. This is followed by a temporary fall in inflation (relative to world inflation), which boosts competitiveness and raises output.

1.2. Monetary and exchange rate policy. In a flexible exchange rate economy with perfect capital mobility, monetary policy works through its effects on the nominal exchange rate. As we saw in Chapter 4, a change in monetary policy changes the home interest rate relative to the world interest rate and this leads to a change in the nominal exchange rate. In the new short-run equilibrium, the nominal interest rate is once more equal to the world interest rate and there is a different level of the nominal exchange rate.

We can recall from Chapter 4 that in a fixed exchange rate regime monetary policy is ineffectual even in the short run. The requirement to keep the nominal exchange rate fixed means that any change in domestic monetary policy is wiped out by offsetting changes in the monetary base before it gets off the ground. Therefore the analogue to monetary policy in a fixed exchange rate regime is the possibility that the exchange rate peg can be changed. A devaluation mimics an expansionary monetary policy: the rightward shift in the IS\(XM\) raises the domestic interest rate and induces a capital inflow, which shifts the \(LM\) to the right. Similarly, a revaluation mimics a contractionary monetary policy by inducing a capital outflow.

Let us now look more closely at the short and medium run consequences of changes in monetary policy (under flexible exchange rates) and a one-off change in the exchange rate peg under fixed exchange rates. Under flexible exchange rates, monetary policy is very effective in raising output in the Mundell–Fleming model. Monetary expansion has a strong impact because of the boost to aggregate demand due to the exchange rate depreciation induced by the temporary fall in the interest rate below the world rate. If we turn to the medium run, then we know that a change in monetary policy under flexible exchange rates cannot shift the medium-run equilibrium: in Figure 6.2 the \(AD\)-curve and the \(ERU\)-curve remain fixed so the medium run equilibrium remains at point \(A\). Exactly the same analysis applies in the case in which there is a discrete change in the exchange rate under a ‘fixed’ rate system (from \(e_0\) to \(e_1\) — see Fig. 6.2).

Following a loosening of domestic monetary policy or a nominal devaluation, net exports and output expand to \(y_1\): the short-run Mundell–Fleming equilibrium is at point \(B\). However, in the medium run, with the economy at point \(B\), we must consider the implications for the supply side of
the economy. The real depreciation of the exchange rate implies a lower real wage. This is because the rise in the price of imports, i.e. $P_m = P^*e$, due to the exchange rate depreciation from $e_0$ to $e_1$, implies a deterioration in the terms of trade for the home economy. Since the price of exports has not changed, a rise in the price of imports turns the terms of trade against the home economy. This cuts real wages because workers consume both imported and home-produced goods. The higher price of imports feeds directly into the consumer price index and cuts the real wage.

In the medium run, wage-setters will react to the *rise* in employment and the *fall* in the real wage. Since output has increased in the short run from $y_0$ to $y_1$, there are two sources of pressure pushing money wages up: the fall in unemployment means a higher wage-setting real wage and the depreciation means that the actual real wage has fallen. The result will be a rise in money wages relative to expected prices followed by an increase in the prices of home produced goods relative to world prices. After the initial depreciation, the nominal exchange rate remains fixed so that there are no further changes in import prices. As a consequence, the consumer price index rises by less than money wages: real wages rise and price competitiveness falls. This pattern is familiar: the economy is *above* the ERU-curve and as we have seen before, this results in a temporary burst of inflation (above world inflation) until the real wage has risen to a level equal to the wage-setting real wage. The rise in home relative to world inflation eats away at the initial rise in competitiveness due to the depreciation/devaluation and the economy moves back to point $A$ (see Fig. 6.2).

Summing up. Following an expansionary monetary policy or a devaluation, output and employment expand due to the effect of the rise in competitiveness on net exports. But this is only a temporary effect: since the devaluation has its effect by raising the real cost of imports, once wages and prices respond to this, there will be a bout of domestic wage and price inflation in excess of world inflation. The higher inflation will reverse the boost to competitiveness and the cut in real wages and the economy will return to its original position.

### 1.3. Supply-side policy

To analyze supply-side policies, we have to focus our attention on the ERU-curve. Supply-side policies are those that shift the ERU-curve — either by shifting the wage-setting curve ($WS$) or by shifting the price-setting curve ($PS(\theta)$). In Chapter 2 the determinants of the wage and price setting curves were introduced. Here we apply that discussion to the open economy.

It is useful to separate out the factors that shift the $WS$-curve from those that shift the $PS(\theta)$-curve. We can recall from Chapter 2 that when we introduce taxes into the supply-side of the model,
it is necessary to be careful in defining both the money wage and the price level. We stick to the principle that the real wage shown on the vertical axis of the $WS - PS$-diagram is the real wage relevant to wage-setters. This is the real consumption wage defined as the “take home” wage deflated by the consumer price index:

$$w = \frac{W}{P_c} = \frac{\text{wage net of income tax and social security}}{\text{consumer price index including VAT}}$$  
(\text{real consumption wage})

Policies that shift the wage-setting curve. The wage setting curve shows the real take home wage at each level of employment that workers believe they have negotiated. As discussed in Chapter 2, the wage setting curve lies above the competitive labour supply curve either because of the presence of unions or because of efficiency wage considerations. At each level of employment, wage-setters set the money wage to secure this real wage, assuming that a specific price level will prevail over the course of the wage contract.

$$W = P_c^E \cdot b(E)$$  
(wage equation)

The wage-setting curve is therefore:

$$w^{WS} = \frac{W}{P_c^E} = b(E)$$  
(wage setting real wage)

Any policy that affects the wage-setting decision will shift the $WS$-curve. Policies discussed in Chapter 2 include changes in the worker’s outside option such as changes in unemployment benefit, labour legislation, or the negotiation by the government of a wages accord with unions and employers’ associations.

The $WS$-curve shifts down

- if there is a fall in unemployment benefits (or more precisely in the replacement ratio, which is the ratio of benefits to the average wage),
- if unions are given less legal protection,
- if unions agree to exercise bargaining restraint — in the context, for example, of a wages accord.

Policies that shift the price-setting curve for a given real exchange rate. We turn now to the policies that shift the $PS(\theta)$-curve. The price-setting curve shows the outcome for real consumption wages of the decisions of the price-setters in the economy. Price-setters set their prices in order to secure the mark-up $\mu$, given the unit labour costs that they face. We saw in the closed economy that the price-setting curve will shift if there is a change in

- taxes — either direct taxes or indirect taxes
- the mark-up, due, for example, to a change in competitive conditions
- efficiency, such as a change in the level or the trend of labour productivity growth.

The $PS(\theta)$-curve shifts up — showing that real take home wages in the economy consistent with price-setting behaviour are higher — if there is a fall in the mark-up, in tax rates or a rise in ‘efficiency’. We also know that in the open economy, the price-setting curve shifts as a consequence of changes in the real exchange rate. Since the $ERU$-curve is drawn in real exchange rate—output space, although a change in $\theta$ shifts the price-setting curve, it does not shift the $ERU$-curve. If the price-setting curve shifts for any other reason, this implies a shift in the $ERU$-curve.

Looking at each of these factors in turn, in the open economy, changes in the pressure of product market competition can arise from trade liberalization policies. A good example for European countries is the reduction of tariff barriers to trade between members of the European Economic Community, which began in 1957 with the Treaty of Rome. This was followed in the late 1980s with an initiative to remove non-tariff barriers to trade so as to increase product market competition in the internal market of the European Union. There is some evidence to suggest that monopoly
power has fallen in the EU following the so-called ‘1992’ Single Market measures.\textsuperscript{4} An increase in product market competition is likely not only to shift the $PS$-curve upwards but also shift the $WS$-curve downwards. More pressure in the product market has the effect of dampening union bargaining power. However, since both of these effects (an upward shift in the $PS(\theta)$-curve and a downward shift in the $WS$-curve) shift the $ERU$-curve in the same direction, we simplify here by considering competition effects under ‘price-setting’ only.

The analysis of taxes is very similar to that in the closed economy. The only extra consideration is the tax treatment of exports and imports. Exports are exempt from value-added tax. The logic of this arrangement is that indirect taxes should be ‘destination-based’ in order that cross-country differences in tax rates do not distort competition in the domestic market for final goods. This principle means that imports attract the VAT rate of the importing country. In the derivation of the price-setting real wage that is set out in detail in the appendix to this chapter, these factors are taken into account.

The impact of a change in productivity (or in the rate of productivity growth in a dynamic context) on equilibrium employment depends on its effects on the wage-setting and price-setting curves. If we abstract from productivity growth, and examine the impact of a policy that raises the level of productivity, the most obvious effect is to shift the price-setting real wage upward.\textsuperscript{5} More output per head is available for real wages at each level of employment. Education and training policies may have the effect of raising efficiency.

By recalling the derivation of the $ERU$-curve (Chapter 5.1), it is clear that any policy that shifts the wage setting curve or shifts the $PS(\theta)$-curve implies a shift in the $ERU$-curve. A downward shift in the $WS$-curve implies $ceteris paribus$ a rightward shift in the $ERU$-curve. An upward shift in the $PS(\theta)$-curve implies $ceteris paribus$ a rightward shift in the $ERU$-curve. We take an example of a supply-side policy that shifts the $WS$-curve and another that shifts the $PS(\theta)$-curve.

Example: wage accord. In Figure 6.3, the $WS$-curve shifts down. This could be for any of the reasons listed above. In this example, let us assume that it shifts because of the negotiation of a wages accord by the government. The conclusion of an agreement through which unions agree to exercise bargaining restraint implies a rightward shift in the $ERU$-curve, as explained above.

What are the implications for the economy? Consider an initial position of medium-run equilibrium. Then shift the $WS$-curve down. This reflects the fact that at the existing employment level, wage setters will set a lower nominal wage to secure the lower expected real wage. At an unchanged level of the real exchange rate (i.e. an unchanged real cost of imports) and with a given profit margin, this implies that lower unemployment will be compatible with medium run equilibrium. At lower unemployment the wage claims of wage setters will be boosted sufficiently so as to restore equality between the price setting real wage (given $\theta$ and $\mu$) and the wage setting real wage. The shift in the wage-setting curve from $WS$ to $WS'$ implies a shift in the $ERU$-curve to $ERU'$ (see Figure 6.3). To derive the new $ERU$-curve from the $WS/PS$ diagram, note that at point $A$ with $\theta = \theta_0$, $WS = PS(\theta_0)$ at an employment level of $E_0$. This is reflected in a point on $ERU$ of $(y_0, \theta_0)$. We can also see that $WS' = PS(\theta_0)$ at employment level $E_2$, i.e. at point $A'$. This is reflected in a point on $ERU'$ of $(y_2, \theta_0)$.

Nothing happens in the short run because wages and prices are assumed to be given. The new medium-run equilibrium for the economy is at point $B$ with lower unemployment and higher price competitiveness. The economy adjusts gradually from $A$ to $B$ in the following way: at $A$ following the shift in the $WS$-curve, the existing real wage, $w_0$, is above the new wage-setting real wage on the $WS'$-curve. Money wages fall, home prices fall in line — but because nothing has happened to the prices of imported goods, the consumer price index falls by less than does the price of home output.


\textsuperscript{5}Higher productivity may also have the effect of shifting the wage-setting curve upwards — in which case, there would be no effect on equilibrium unemployment. This certainly seems a sensible assumption for the long run. In the short to medium run, however, wage claims may not adjust rapidly to unexpected shifts in productivity.
Hence, the real wage falls and because domestic prices have risen relative to world prices, price competitiveness rises. The rise in \( \theta \) boosts net export demand and the economy moves along the \( AD \)-curve in a north-easterly direction from \( A \) toward \( B \). In the top panel of Figure 6.3, the \( PS(\theta) \)-curve shifts down as \( \theta \) rises: the economy moves from \( A \) to \( B \). We observe falling real wages and rising employment in the economy on the path to the new medium run equilibrium. There is a trade surplus at the new equilibrium.

The implication of the downward shift in the \( WS \)-curve for the long run is that the economy’s long-run equilibrium is at lower unemployment and a higher level of price competitiveness (see point \( Z \) in Fig. 6.3).

Example: supply-side fiscal policy — cut in income tax. What is the consequence of a supply-side policy that shifts the \( ERU \)-curve through its effects on the \( PS(\theta) \)-curve? In Figure 6.4, the \( ERU \)-curve shifts to the right as a consequence of a fall in tax rates. To show this, begin at point \( A \) in each panel. In the \( WS/PS \) diagram, at the initial equilibrium, we are on the \( PS(\theta_0,t_0) \). This is reflected in the point \( (y_0, \theta_0) \) on the \( ERU \)-curve. Now there is a fall in the tax rate to \( t_1 \). This has the effect of shifting the \( PS(\theta) \)-curve up to \( PS(\theta_0,t_1) \), which intersects the \( WS \)-curve at point \( A' \). This is in turn reflected in the point \( (y_2, \theta_0) \) which defines the new \( ERU' \)-curve (point \( A' \)).

In order to focus entirely on the supply-side implications of the tax fall, let us assume that the impact on aggregate demand of the tax cut is fully offset by an appropriate decrease in government spending. Hence, the \( AD \)-curve remains fixed. The new medium run equilibrium is at point \( B \) with
lower unemployment and higher price competitiveness. The new long-run equilibrium is at point $Z$ at lower unemployment. In the new medium run equilibrium, real profits are unchanged but both real wages and real import costs are higher — real taxes per worker are lower.

The economy adjusts to the new medium run equilibrium as follows. The economy begins at point $A$ on the $PS(\theta_0, t_0)$-curve. The cut in tax rates (e.g. income tax) raises the real consumption wage. This is shown by point $A''$ on the new $PS(\theta_0, t_1)$ curve. Note that nothing has happened to the real exchange rate — the upward shift in the $PS(\theta)$-curve is entirely due to the cut in the tax rate. The real wage is above the wage-setting real wage (compare $A''$ with $A$) and the economy is below the $ERU'$-curve. Given the expected price level, this leads to a fall in money wages when wages are next set. Lower money wages reduces unit labour costs and firms lower their prices in line. There is no change in import costs so the consumer price level falls by less than the price of home goods. Hence real wages begin to fall. Price competitiveness rises. The economy moves along the path from $A''$ to point $B$ in the $WS - PS$ diagram; and from point $A$ to point $B$ in the $\theta - y$ diagram.

The message from this example is that tax changes can be used as a supply-side measure. Moreover, when they are introduced into the economy for other reasons, the impact on the supply side should be taken into account.

**Figure 4.** Supply-side policy. Tax cut means $PS(\theta)$ shifts up. Step 1 Derive the new $CCE$-curve. Step 2 Examine adjustment to the new medium-run equilibrium at B.
2. Aggregate demand shocks

A shift in autonomous consumption or investment or a change in the world interest rate or in world trade leads to a shift of the $AD$-curve. In this section, we look at such pure shifts in the $AD$-curve. Changes in world trade also shift the $AD$-curve, but they shift the BT curve as well and such external trade shocks are analysed below. In the analysis of fiscal policy we have looked in some detail at how the economy adjusts in the short- and medium-run to a shift in the $AD$-curve. It is not necessary to repeat that analysis in full here. We can summarize the results as follows. We use the example of a negative aggregate demand shock, i.e. a fall in autonomous consumption or investment (see Fig. 6.5).

![Graph](image)

(a) Negative aggregate demand shock  (b) Positive aggregate demand shock

**Figure 5. Fiscal and monetary policy in the open economy**

Under **flexible exchange rates**, a negative aggregate demand shock

- leads in the *short run* to an exchange rate depreciation. Output stays unchanged in the short run (point $D$). This happens because the effect on output of the fall in aggregate demand is completely offset by the depreciation induced by the fall in the interest rate.
- Because the depreciation cuts real wages, this is followed by a phase of domestic inflation (relative to world inflation), which worsens competitiveness and leads to a fall in output (point $B$).

Under **fixed exchange rates**, a negative aggregate demand shock

- leads in the *short run* to a fall in output (point $C$).
- The fall in output is followed by a phase of domestic disinflation relative to world inflation (point $B$).

Under both flexible and fixed exchange rates, the new medium-run equilibrium is the same. Output and employment are lower, price competitiveness is higher and the real wage is lower, and there is an improvement in the trade balance. Inflation is constant.

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6Under flexible exchange rates, a change in the world interest rate also leads, in the short run, to a shift along the new $AD$-curve. The simplest way to see this is to run through the Mundell–Fleming analysis (as in Chapter 4) for this case.
If there is no policy intervention, then the economy will adjust first to the short-run equilibrium. If there is still no policy intervention, then over time, the economy will move to the new medium-run equilibrium. The question that arises is how the government should respond to a shock of this kind.

In the closed economy, the focus of attention in the wake of an aggregate demand shock, is the speed with which the automatic mechanisms will push the economy back to the unique equilibrium unemployment rate. In the event of a negative demand shock, the government may intervene with expansionary fiscal policy or it may loosen monetary policy by cutting the interest rate so as to speed up the return of the economy to the equilibrium unemployment rate. The rationale for intervention is to minimize the costs associated with unemployment above the equilibrium rate. Slow adjustment and therefore high costs would occur if the downward adjustment of wages and prices is very slow. This would be exacerbated if, for example, there is a weak interest rate response to the rise in real money balances or if the response of investment to a fall in the interest rate is weak.

In the open economy, the situation is different because an aggregate demand shock leads to a new medium run constant inflation equilibrium. Remember that in the open economy, the unique equilibrium unemployment rate has been replaced by the downward sloping ERU curve. Following a shift in the $AD$-curve, the economy can remain at point $B$ in the case of a negative demand shock (see the left panel of Fig. 6.5) and at point $B'$ in the case of a positive aggregate demand shock (right panel of in Figure 6.5). There are no automatic forces in the medium run leading to a shift back to the initial equilibrium.

If the government can identify the shock as an aggregate demand shock and can react to it in the short run, then the obvious policy tool to use is an offsetting fiscal policy. If there is a negative aggregate demand shock then the government should shift the $AD$-curve back to the right through an expansionary fiscal policy (from $AD'$ to $AD$) and the converse (from $AD''$ to $AD$) in the case of a positive aggregate demand shock. In the flexible exchange rate regime, the change in the exchange rate would just be reversed by such a policy and output would stay close to its original level. In the fixed exchange rate case, the decline in output in the case of a negative shock and the rise in output in the case of a positive shock would be reversed.

However, there are problems that arise with using fiscal policy to offset shocks in this way. In the case of a negative shock, the government needs to loosen fiscal policy. As we shall see in more detail in Chapter 13, if the government already has a high debt to GDP ratio, it may be reluctant to implement a deficit-financed increase in government spending to offset a negative shock. Cutting taxes to offset a temporary negative shock also increases the budget deficit. In addition, it may be difficult to reverse the policy when the shock has disappeared. The third option of a balanced budget expansion, i.e. an increase in government expenditure matched by higher taxation, is attractive because it does not increase the government’s deficit. But as we have seen, a change in direct or indirect taxation is likely to have supply-side effects: a rise in taxation would tend to shift the $ERU$-curve to the left. This may make the government cautious in using changes in taxes to stabilize the economy.

If the government does not stabilize, the economy moves to the medium-run equilibrium at point $B$ in the left panel of Fig. 6.5. The government may be reluctant to wait for the possible impact of wealth effects on consumption to kick in in the long run and push the economy back to the long-run equilibrium or for the aggregate demand shock to be reversed in another way. In the meantime, the economy suffers the costs of lower output and higher unemployment. Let us consider the options available to the government, looking first at fiscal and then at monetary policy. Expansionary fiscal policy can shift the economy from point $B$ to point $A$. If, in spite of the problems of using fiscal policy to stabilize, the government goes ahead, then the path of adjustment depends on whether there are fixed or floating exchange rates. With fixed exchange rates, adjustment occurs via point $F$ (output rises and there is a burst of inflation above world inflation). With flexible exchange rates, adjustment occurs via point $E$. Nominal appreciation is followed by falling inflation relative to world inflation and therefore output rises due to rising price competitiveness.
When we turn to a possible monetary policy response to the negative demand shock, we see that a loosening of monetary policy (or a devaluation in a fixed exchange rate economy) can raise the level of activity to $y_1$; this would mean a move from point $B$ to point $D$ (see Figure 6.5). Point $D$ is not a medium-run equilibrium, however, and eventually the economy will return to point $B$ as a consequence of domestic wage and price setting responses.

In the face of a positive aggregate demand shock, unless there is a view that a move into trade deficit will generate strong pressure on the exchange rate and thereby unleash inflation, there may be less of a tendency for the government to intervene in the short run than would be the case in a closed economy. However, the authorities in a fixed exchange rate economy may want to avoid the phase during which inflation in the home economy is above that in the rest of the world as the economy adjusts to the new medium-run equilibrium ($C'$ to $B'$) or they may be concerned about the impact of the fall in competitiveness on their ability in the longer run to maintain the exchange rate peg. In either case, the government would act to tighten fiscal policy and return the economy to $A$.

In a flexible rate system, adjustment to the positive demand shock takes the form of a nominal exchange rate appreciation followed by a phase of prices falling relative to the rest of the world. This may be viewed as a rather benign development by the authorities — although there may be some longer run concern about the consequences in terms of competitiveness and the balance of trade of the real appreciation. It is useful to consider the role of fiscal and monetary policy in a situation in which the government has not intervened and the economy has therefore adjusted to point $B'$. A fiscal tightening leads the economy back to the medium-run equilibrium at point $A$ (via a nominal depreciation to point $E'$). A monetary tightening leads only to a short-run dampening of activity (via nominal appreciation to point $D'$) and exacerbates the external imbalance. In order to shift the economy back to $A$ but to minimize the temporary increase in inflation that would accompany a purely fiscal tightening, coordinated tightening of fiscal and monetary policy is necessary. By keeping monetary policy tight, a modest depreciation is achieved so that the move from $B'$ to $A$ follows a path closer to the ERU-curve. The issues that this raises about the coordination of fiscal and monetary policy, the choice of policy rules and the institutional arrangements for such policies are investigated in Chapter 13.

### 3. Domestic supply shocks

Examples of domestic supply shocks are changes in union militancy, changes in product market competition, the emergence of coordinated wage-setting behaviour, or a change in ‘efficiency’, such as a change in the trend of productivity growth. The analysis is exactly the same as the analysis of the implementation of a supply-side policy discussed in Section 6.1.3. A domestic supply-side shock shifts the wage or price-setting curve and therefore shifts the ERU-curve.

To take an example, let us assume that a wages accord collapses unexpectedly. This is an example of a domestic cost shock. The collapse of the accord implies a leftward shift in the ERU-curve. The new medium-run equilibrium for the economy is at higher unemployment and lower price competitiveness. If there is no government intervention, the economy adjusts gradually to the new medium-run equilibrium through a bout of domestic wage and price inflation. It is the falling competitiveness that weakens net exports and depresses output. There is a trade deficit at the new medium-run equilibrium. The economy moves from point $A$ to point $B$ in Figure 6.6.

It is clear that only a supply-side improvement can offset the effects of this shock: a shift back of the ERU-curve, through policies that either shift the wage-setting curve down or price-setting curve (for a given level of the real exchange rate) up, is necessary to reestablish the medium and long-run equilibria at their initial levels. The use of fiscal or monetary/exchange rate policy under these circumstances can provide only a partial or temporary solution. For example, using expansionary fiscal policy to boost the level of employment would worsen the trade deficit (point $C$). Using a relaxation of monetary policy or a devaluation would lead in the short-run to a boost in employment and an improvement in the trade deficit. Suppose that the exchange rate depreciation/devaluation restored the initial level of output and real exchange rate (i.e. to point $A$). This provides a solution to
the domestic cost shock but it is only temporary. The depreciation cuts the real wage and leaves the economy above the new \( ERU \)-curve. Hence, in subsequent rounds of wage-setting, money wages will rise relative to expected prices and a gradual process of erosion of the impact on competitiveness of the devaluation will ensue from \( A \) back to \( B \).

4. External trade and supply shocks

4.1. External trade shocks. An external trade shock is defined as an unanticipated shift in the \( AD \)-curve and the \( BT \)-curve. For a given level of the real exchange rate, the volume of net exports changes. There are three main reasons why this can happen.

1. The level of world trade may change. This is a change in \( y^* \). This could arise from a boom or a slump in an important region of the world.

2. For a given level of world trade and at a given real exchange rate and level of home output, the home country’s share of world trade may change. This is a change in \( \sigma_x \) which reflects the home country’s share of world exports in the export function or a change in the marginal propensity to import, \( m_p \), in the import function. This could be because of a change in tastes in the world economy. Consumers may shift their preferences away from the style or type of goods produced in the home economy toward those produced elsewhere. In discussions of the economics of a single currency area, the example is often given of a two-country world in which tastes change in favour of the products of one of the countries. For example, preferences shift from beer to wine, benefiting French net exports to the detriment of German net exports. This is an example of an external trade shock. Another example is where there is a change in the non-price attributes of the products of one country. For example, suppose that at a given price, the quality of Italian-made cars suddenly increases. This represents a positive external trade shock for Italy and a negative shock for its competitors in the auto industry.

3. The world price of a key imported raw material may change. This is a change in the terms of trade at the world level between manufactures and raw materials, where \( \tau \) (tau) = \( P_{rm}^* / P_{manuf}^* \) where \( P_{rm}^* \) is the world price index of raw materials and \( P_{manuf}^* \) is the world price index of manufactures. An example of an increase in \( \tau \) is a rise in the world price of oil. A rise in the price of oil relative to manufactures means that for the home country, which is assumed to import raw materials and export manufactures, a higher volume of

\[ \text{FIGURE 6. A domestic supply-side shock} \]
exports must be sold to purchase a given volume of imports. This represents a negative external trade shock for the home country. As we will see in the next section, a raw materials price shock is not only an external trade shock but also a supply shock because it shifts the ERU-curve.

The analysis of the impact of an external trade shock is straightforward. It will shift the $AD$-curve and the $BT$-curve in the same direction. The horizontal shift of the $BT$-curve will be greater than that of the $AD$-curve for the same reason that the $AD$-curve is steeper than the $BT$-curve (refer back to Section 5.2). A simple way of seeing this is that if we look at the initial output level, $y_0$, at which the $AD$-curve and the $BT$-curve intersect (see point $A$ in Fig. 7) then the new $AD$-curve, $AD'$, and the new $BT$-curve, $BT'$, will intersect at $y_0$ (at point $A'$). This is because the exchange rate depreciation that would leave output unchanged in the face of the exogenous fall in net exports, must reverse the fall in net exports and hence it must leave the trade balance unchanged.

![Figure 7. A negative external trade shock](image)

Let us now examine the implications of the external trade shock. As an example, we consider a negative trade shock. As is clear from Figure 6.7, the new medium-run equilibrium is at point $B$ with higher unemployment, a lower real wage, higher real import costs and a trade deficit. The intuition behind this outcome is that the trade shock depresses activity through the usual goods market equilibrium channel. At higher unemployment, the wage-setting real wage is lower. For price and wage-setting equilibrium, the price-setting real wage must also be lower and this corresponds to a higher real cost of imports and hence a deficit.

The short-run impact of the trade shock depends on the exchange rate regime. Under fixed exchange rates, output and employment contract and the economy moves to point $C$ before the wage and price-setting process sets in train the adjustment from point $C$ to the medium-run equilibrium at $B$. In a floating rate system, a depreciation will occur in the short run and the economy will move to point $A'$ before the adjustment down the $AD'$ curve takes place. The possibility of changing the exchange rate can reduce the output cost of the adjustment to point $B$ but with the consequence that there is a bout of rising wages and prices in the home economy relative to the rest of the world.
The difference between the impact of an external trade shock and a pure aggregate demand shock is that the BT-curve moves in the case of an external trade shock. This has two consequences: first, points C and B are positions of trade surplus if there is a pure aggregate demand shock and of trade deficit if there is an external trade shock. Second, in the case of an external trade shock, the long-run equilibrium of the economy shifts (from A to Z).

4.2. External supply shocks. An external supply shock is defined as an unanticipated change in the world terms of trade between manufactures and raw materials: a change in the world price of oil is a good example. As noted in the previous section, this type of shock combines the effects of an external trade shock with a supply-side impact on the price-setting real wage curve. The consequence is that there is a shift in the AD-curve, in the BT-curve and in the ERU-curve: all curves shift in the same direction.

![Diagram showing the effects of an external supply shock](image)

**Figure 8. A negative external supply shock: increase in the oil price shifts ERU-curve left**

To see why the ERU-curve shifts, we need to look closely at what is meant by a change in the world price of oil. If we say that the world price of oil rises, this means that it rises relative to the
world price of manufactured goods, where \( \tau = \frac{P^*_{m}}{P^*_{manuf}} \). In other words, we are talking about a change in relative prices, or to put it another way, a change in the real price of oil. The price-setting curve is defined for a given real exchange rate, \( \theta \). Now suppose that the world price of oil rises. For a given \( \theta \), a rise in the price of an essential input like oil, raises costs for firms in the home economy so if firms are to protect their profit margins, then real wages must be lower. Hence the price-setting real wage curve shifts downward when the world price of oil rises (see Fig. 6.8). This implies a leftward shift in the \( \text{ERU} \)-curve as shown in Figure 6.8. The derivation of the price setting curve incorporating imported materials is presented in a footnote.\(^7\)

We can now analyze the full impact of an exogenous and permanent change in the world price of an essential commodity such as oil. We take the case of a rise in the price of oil. For simplicity, we assume that the home country only imports oil — it does not import final goods. This changes nothing essential and allows for a more direct examination of the issue at hand. We can investigate the three effects:

1. the impact on aggregate demand
2. the impact on the trade balance
3. the impact on price and wage setting and hence on the \( \text{ERU} \)-curve.

We have already examined the first two effects in the analysis of an external trade shock in Figure 6.7: there is a downward shock to net exports because the increase in the cost of the essential imported raw material absorbs a higher proportion of home income at a given real exchange rate. This shifts the \( AD \) curve and the \( BT \) curve to the left.\(^8\)

We turn to the consequences of the shift in the \( \text{ERU} \)-curve. The first observation is that the inflationary consequences of the commodity price rise are clear. Following the external supply shock, the initial equilibrium point \( A \) is above the new \( \text{ERU} \)-curve. This means that at \( E_1 \), the real wage is below the wage-setting real wage. The reason is that the costs of home firms have gone up and higher domestic prices cut the real consumption wage.

In terms of the assessment of the adjustment paths under fixed and flexible exchange rates, it is clear that as compared with a pure external trade shock, the costs of the adjustment via exchange rate depreciation (higher inflation via point \( A' \) in Fig. 6.9) go up relative to the costs of adjustment with a fixed exchange rate. This is clearly illustrated by reference to the two oil shocks in the 1970s. In response to the first oil shock in 1973, many countries focused on the aggregate demand consequences and sought to offset them via expansionary fiscal and monetary policies. If we look at the consequences of an accommodating monetary policy, this allowed the exchange rate to depreciate (to \( A' \)). The consequence was the onset of so-called stagflation: rising unemployment and rising inflation (as the economy eventually adjusted from \( A' \) to \( B' \) with unemployment rising and a burst of inflation).

When the second oil shock struck in 1979, the nature of the shock was better understood and many countries attempted to use tight monetary policy to prevent exchange depreciation and hence prevent a big upsurge in inflation. In terms of Figure 6.9, this allows adjustment from \( A \) to \( C \) to \( B' \).

\(^7\)It is simplest to assume that there is no mark-up on imported materials. Assume the only imports are of raw materials. Then

\[
P_e = P + v \cdot \tau \cdot P^* e
\]

where \( P = \frac{W}{(1-\mu) \cdot L} \) is the price of value added and \( v \) is unit materials requirement. This implies a price-setting real wage:

\[
w^{ps} = \frac{(1-\mu) \cdot LP}{1 + v \cdot \tau \cdot \theta}.
\]

Any rise in \( \tau \) reduces the price-setting real wage. Note that any fall in unit materials requirement through increased energy efficiency, for example, would tend to offset this.

\(^8\)Since the oil price shock is a ‘world’ phenomenon, there will be a fall in world aggregate demand and world output, \( y^* \), as all exporters of manufactures suffer from the supply shock. This assumes — realistically — that the exporters of raw materials, who have experienced an increase in their wealth, are unable to increase their expenditure sufficiently to compensate. This would reinforce the leftward shifts in the \( AD \) and \( BT \) curves.
Other countries were able to negotiate wages accords to shift the wage-setting curve downward and hence offset (at least partially) the leftward shift of the $ERU$-curve.

**Figure 9.** *External supply shock*

5. *Is devaluation useful?*

From our analysis of the different kinds of shocks that can affect an economy and of the role of different policies that can be used to respond to them, it is possible to draw together a set of circumstances in which the availability of devaluation can be a valuable tool. There are circumstances in which devaluation is attractive as a policy instrument. Three reasons why it can be useful are:

1. it can have a substantial impact on competitiveness and trade quickly.
2. if the new short-run equilibrium achieved by the devaluation is not a medium-run equilibrium (e.g. it is above the $ERU$-curve), the beneficial effects on employment and competitiveness can nevertheless last for several years.
3. if the new short-run equilibrium achieved by the devaluation is a medium-run equilibrium (i.e. on the $ERU$-curve) then devaluation allows the economy to get to the medium-run equilibrium faster and at lower cost than would be the case if domestic wage and price adjustments are relied on.

As we have seen, if there has been a negative aggregate demand shock in an economy, the appropriate policy response is a fiscal easing to ‘undo’ the effects of the shock. If, however, fiscal policy is not used to offset the shock, then the economy will adjust to the new medium-run equilibrium (point $B$ in Figure 6.10). As is clear from Figure 6.10, the cost of adjustment to $B$ is higher in terms of output loss under fixed exchange rates (adjustment occurs via point $C$) than it is under flexible rates (adjustment via point $C'$). This is especially clear if we assume that lags in wage and price setting are such that the economy adjusts all the way to point $C$ before wages and prices begin to adjust. In an economy with a very steep $ERU$-curve, the adjustment cost associated with a fixed rather than a flexible exchange rate is higher than it is when the $ERU$-curve is rather flat (see Fig. 6.10).

It is therefore clear that a fixed exchange rate economy that is hit by a negative demand shock and is unable to use fiscal policy to offset the shock, could benefit substantially from a devaluation. A devaluation would produce a speedy move from point $C$ to the new medium-run equilibrium. The key point here is that at $C$, the economy is below the $ERU$-curve. Therefore real wages are above
the level consistent with wage-setting equilibrium. Devaluation provides a quick way of cutting real wages: once the economy is on the \( ERU \)-curve, inflation will remain constant at the world rate. It is true that left to its own devices, the economy would move from point \( C \) to the medium run equilibrium \((B \text{ or } B')\). But the process of disinflation through successive rounds of wage and price setting could be extremely slow. Meanwhile, the economy suffers from unemployment higher than consistent with the medium run equilibrium.

We can draw a second lesson by combining the analysis of shifts in the \( ERU \)-curve with the analysis of the role of exchange rate changes. A supply-side policy that shifts the \( ERU \)-curve to the right allows the economy to move to a medium run position with lower unemployment. However as noted above, the adjustment process may be very slow as wages and prices fall relative to world prices over successive rounds of wage-setting. If the government has the possibility of devaluing the exchange rate, a rapid shift to the new medium-run equilibrium is possible. The possibility of delivering quick results for employment may make it easier to gain approval for the supply-side policy (e.g. a wages accord). The combination of wage accord and devaluation to accompany policies of fiscal consolidation was implemented by a number of European countries in the 1980s (see Chapter 16 for further details).

In the case of a negative external trade shock, we have argued that the correct policy response is not to use fiscal policy to offset the shock since this widens the external imbalance. Under these circumstances, devaluation has something to commend it as an interim measure. Devaluation helps to mitigate the impact of the external trade shock on output and on the trade balance. Of course, it only provides a temporary solution since the devaluation takes the economy above the \( ERU \)-curve by cutting real wages. The benefits to competitiveness will be eroded in subsequent wage and price-setting rounds. However, in the face of a temporary external trade shock devaluation could prove useful. If the external trade shock signifies a more serious underlying problem for the economy such as a shift in tastes away from the goods that the home economy specializes in, then devaluation may divert the attention of both private and public sector actors from the source of the problem in the supply-side of the economy.

**Figure 10. Assessing the role of devaluation**
6. Real wages in open and closed economies

There are two different questions to address here:

(1) what happens to real wages over the business cycle - i.e. in response to changes in the level of aggregate demand?
(2) what happens to real wages when there is a supply-side change such as a shift in the wage-setting curve?

The contrast between the open and the closed economy is interesting here. In the closed economy if the price-setting curve is flat as we normally assume and if prices are adjusted immediately to any change in costs, then the economy would always be on the price-setting curve and real wages would not vary over the cycle. Real wages would be acyclical. A rise in aggregate demand from an initial equilibrium would boost money wages: if the rise in costs is fully incorporated in prices, the real wage will revert to its initial level (on the $PS$-curve). However, if it takes time for firms to mark their prices up in response to the higher costs, real wages will rise temporarily. The real wage will be above the $PS$-curve until full adjustment had occurred and there would be some evidence of pro-cyclical real wages. The key result is that in equilibrium real wages are determined by the price-setting real wage. Thus if the $PS$-curve happened to be downward-sloping, then real wages would countercyclical. Inertia in the adjustment of prices to changes in wages would be needed to overturn this prediction.

![Diagram showing real wages in the open economy](image)

**Figure 11.** Procyclical real wages in the open economy
By contrast in the open economy, what happens to real wages in response to different shocks depends on the exchange rate regime and on the nature of the shock, as well as on the lags in wage and price-setting and the slope of the $PS$-curve. As we have already seen, in the open economy procyclical real wages in the medium-run are likely to be observed following an $IS$ shock (e.g. consumption, investment, government spending, taxation) as the economy settles at a new medium-run equilibrium on the $ERU$-curve. The economy moves up the $WS$-curve in the event of a positive shock and down in the event of a negative shock. Fig. 6.11 illustrates: the rise in employment from $E_0$ to $E_1$ to $E_2$ is associated with a rise in real wages from $w_0$ to $w_1$ to $w_2$.

Of course, if activity fluctuates because of changes in monetary policy then the economy will move along the $AD$ curve. A loosening of monetary policy (associated with a depreciation) will lead to a rise in output and a rise in competitiveness ($\theta$). This entails a fall in the real wage. Thus with fluctuations coming from $LM$ shifts, real wages will move countercyclically. Unlike the fluctuations associated with $IS$ shifts, movements along the $AD$ curve will only be observed in the short run.

In the closed economy supply side policies that shift only the wage-setting curve have no effect on the medium run real wage. Figure 6.12 illustrates this by taking the case of a downward shift in the $WS$-curve. This could have been the result of a labour market reform that weakened union bargaining power or it could have been due to the negotiation of a social pact. Either way if the $WS$-curve shifts down, the equilibrium unemployment rate falls but real wages remain unchanged at the new $ERU$ at point $B$. Equilibrium employment rises because of the reduction in wage pressure and not because of a reduction in real wages.

![Figure 12](image-url)

**Figure 12.** Supply-side policy and real wages: comparing the closed and open economies.

How does a downward shift in the $WS$ curve affect real wages in the open economy? The $AD$-curve and the $BT$-curve are shown in the real wage/employment diagram and labelled as "$AD$" and "$BT$" respectively. In an open economy, a similar result can be achieved to that in the closed economy if the downward shift in the $WS$-curve is accompanied by an expansionary fiscal policy so that the $AD$ curve moves to the right to $AD'$. Higher employment would be achieved without any fall in actual real wages. But unlike the closed economy, this is not sustainable in the long run in the open economy. At $B$, there is a trade deficit. The real wage has to fall to $w_1$ to eliminate the deficit, and this requires a trimming back of the employment gain (point $C$). Exchange rate depreciation plus a tightening of fiscal policy will achieve this. The fundamental point is that in an open economy, a rise in employment can only be sustained in the long run by a fall in real wages,
even if such a fall is not required to make production profitable (i.e. even when the PS-curve is flat). The fall in real wages is necessary to raise competitiveness (from $\theta_0$ to $\theta_1$) and secure a satisfactory external account.

7. Conclusions

In this chapter the basic model has been used to examine the impact on the economy of a series of different kinds of policies and shocks. Fiscal policy, monetary/exchange rate policy and supply-side policy have been investigated.

- Aggregate demand shocks that shift the $AD$-curve and therefore the medium run equilibrium are changes in autonomous consumption and investment. The short-run effects of an aggregate demand shock can be best offset by using fiscal policy.
- Changes in monetary policy in a flexible exchange rate regime or discrete changes in the exchange rate peg in a fixed rate system lead to a shift along the $AD$-curve and therefore do not change the medium run equilibrium
- Supply shocks and supply-side policies are defined as those that shift either the wage-setting curve, the price-setting curve (for a given real exchange rate) or both. In the open economy, a supply shock or policy is one that shifts the $ERU$-curve and hence shifts the medium and long run equilibrium rate of unemployment.
- External trade shocks are defined as those that change the level of net exports for a given real exchange rate. Such shocks shift the $AD$ and the $BT$-curves and therefore change the short, medium and long run equilibria.
- External supply shocks such as a change in the world price of an essential commodity shift the $AD$, $BT$ and $ERU$ curves.
- The usefulness of devaluation as a policy instrument depends on the nature of the shock, the starting position of the economy (e.g. on or off the $ERU$-curve), the structural characteristics of the economy (e.g. the lags in wage and price setting and the responsiveness of the wage-setting real wage to changes in unemployment) and the availability of complementary policies (e.g. fiscal policy, supply-side policies).
- The model predicts that there will not be a fixed relationship between real wages and employment e.g. pro-cyclical or counter-cyclical real wages in the open economy. The pattern will depend on the nature of the shock (e.g. IS-shock, LM-shock or supply-side shock).
1. Appendix: Open economy inflation and short-run Phillips curves: an example

It may be useful to work through an example to show in detail how inflation changes as the economy moves from one medium-run equilibrium to another — for example, in the aftermath of an aggregate demand shock. This illustrates how the expectations augmented Phillips curve analysis operates in the open economy. As an example, let us take the case under fixed exchange rates in which the government decides to use a fiscal expansion to push the economy to lower unemployment. The diagrammatic analysis is less messy if we assume that expected inflation in the economy is equal to world inflation throughout. An assumption of adaptive expectations could just as easily be used but this diverts attention from the shifts in the expectations-augmented Phillips curve caused by changes in the real exchange rate.

The example is developed using the \( \theta - y \) diagram, the wage-setting and price-setting diagram and the Phillips Curve diagram (Figure 6.13). The economy begins at point \( A \) with output of \( y_0 \) and unemployment of \( U_0 \). The government undertakes a fiscal expansion to take the economy to point \( Z \) at lower unemployment. From our analysis of the medium run model, we know that there is a new medium run equilibrium at \( Z \) at which inflation will be constant. Since this is a fixed exchange rate economy, the inflation rate at \( Z \) is equal to world inflation - just as it was at \( A \). But what happens to inflation along the path from \( A \) to \( Z \)?

In this example, we assume:

\[
\left( \frac{\Delta P}{P} \right) ^E = \frac{\Delta P^*}{P^*} \quad \text{and} \quad \frac{\Delta e}{e} = 0.
\]

At point \( A \), home wage and price inflation are equal to world inflation. The government increases spending from \( y_0 \) to \( y_1 \). The AD-curve shifts to the right. In the short run, the rise in aggregate demand drives up output and employment through the usual multiplier process (point \( B \) in the top panel).

We now turn to the medium run. The key equations are the following:

\[
W = P^E_e \cdot b(E) \quad \text{(wage equation)}
\]

\[
P = P_x = \frac{1}{1 - \mu} \cdot \frac{W}{LP} \quad \text{(price equation)}
\]

\[
P_e = (1 - \phi) \cdot P + \phi \cdot P^*e \quad \text{(consumer price index)}
\]

\[
w = \frac{W}{P_e} \quad \text{(real wage)}
\]

\[
\theta = \frac{P^*e}{P} \quad \text{(real exchange rate)}
\]

With a higher level of employment, \( E_1 \), we can see from the wage and price setting diagram that the wage-setting real wage at \( E_1 \) is well above the existing real wage of \( w_0 \) (in the middle panel, compare point \( B \) on the price-setting curve \( PS(\theta_0) \) with point \( Z \). The increase in money wages that this gives rise to can be read off from the Phillips curve diagram: the expectations-augmented Phillips curve that is relevant to point \( B \) is the short run Phillips curve defined by expected inflation of \( \left( \frac{\Delta P}{P} \right) ^E = \frac{\Delta P^*}{P^*} \) and the equilibrium unemployment rate of \( U_0 \) (where the \( WS \)-curve intersects the \( PS(\theta_0) \)-curve). Money wage inflation goes up to the level shown by point \( B' \) in the Phillips curve diagram (bottom panel). Home firms will immediately mark up their prices by the same percentage. From the price-setting equation, we know that price inflation of home-produced goods and services will equal the rate at which unit labour costs have increased.

As we have seen before, the crucial point is that consumer prices do not rise by as much as domestic producer prices. The reason is that consumer price inflation depends on world inflation (the rate at which the prices of imported final goods rise), domestic price inflation and on \( \phi \), the weight of foreign goods in the consumption bundle. Nothing has happened to world inflation and \( \phi \) is constant. Hence, consumer prices rise by less than the prices of home-produced goods (i.e. \( \frac{\Delta W}{W} = \frac{\Delta P^*}{P^*} \) and \( \frac{\Delta e}{e} = 0 \).
Figure 13. Expectations augmented Phillips curves in the open economy: temporary rise in inflation following a loosening of fiscal policy under fixed exchange rates.

\[ \frac{\Delta p}{p} > \frac{\Delta p_0}{p_0} > \frac{\Delta p^*}{p^*} \] which implies that the real wage \( \left( \frac{w}{p} \right) \) increases and price competitiveness (\( \theta \)) decreases. In Figure 13, the real wage rises from \( w_0 \) to \( w_1 \) and \( \theta \) falls from \( \theta_0 \) to \( \theta_1 \). The economy now at point \( C \) in Figure 6.13 (see the upper two panels). The upward shift of the price-setting curve is shown in the central panel: this means that the equilibrium rate of unemployment has decreased to \( \hat{U} \). A new expectations-augmented Phillips curve must therefore be drawn: it is indexed by the level of \( \theta \) (i.e. \( EAPC(\theta_1) \)) and shows that in the following period, money wages will rise by less than in the previous period. The reason is straightforward: the real wage has risen closer to the value of the wage-setting real wage at \( U_1 \). Thus there is less discrepancy between the real wage that workers anticipate and the wage they actually receive, which in turn means that wage inflation has to exceed expected inflation by a smaller percentage.

In subsequent periods, wages and prices increase according to the above pattern (i.e. \( \frac{\Delta w}{w} = \frac{\Delta p}{p} > \frac{\Delta p_0}{p_0} > \frac{\Delta p^*}{p^*} \Rightarrow \downarrow \theta \) and \( \uparrow w \)) until the real wage is equal to \( w_z \) and the real exchange rate is equal to \( \hat{\theta}_z \). The economy will then be at the new medium run equilibrium at point \( Z \). At point \( Z \),
\[ \frac{\Delta W}{W} = \frac{\Delta P}{P} = \frac{\Delta P_x}{P_x} = \frac{\Delta P^*}{P^*} \text{ and there is constant inflation at the lower unemployment rate, } U_1. \text{ The real wage and the real exchange rate remain constant at the values } w_z, \theta_z. \]

2. Appendix: The price-setting curve in the open economy with taxes

The wage element of costs for firms is the full cost of labour to firms - i.e. the gross wage paid to the worker (which includes the income tax and social security payments that have to be made by the worker) plus the employer’s social security contributions. All of these direct taxes are summarized in the tax rate, \( t_d \). This is shown in the pricing equation:

\[
P = P_x = \frac{1}{1 - \mu} \cdot \frac{W^{gross}}{L_P} \quad \text{(price equation)}
\]

\[
= \frac{1}{1 - \mu} \cdot \frac{W(1 + t_d)}{L_P}
\]

In order to derive the price-setting real wage, it is necessary to note that we must express the price-setting real wage in terms of the real consumption wage, \( \frac{W}{P} \). We use the definition of the consumer price index as before, but include value added tax at the rate \( t_v \). The home country’s VAT is levied on imported final goods.

\[
P_c = \left[ (1 - \phi) \cdot P + \phi \cdot P^*e \right] \cdot (1 + t_v).
\]

After some tedious algebraic manipulation, which is shown in the footnote, we derive the expression for the price-setting real wage in the open economy including tax variables:

\[
w^{PS} = \frac{LP \cdot (1 - \mu)}{(1 + t_d)(1 + t_v) \cdot [1 + \phi(\theta - 1)]}.
\]

(\text{price-setting real wage, open})

Although this expression looks frightening, it is very easy to interpret. It is simply the usual open economy price-setting real wage adjusted for the so-called tax wedge. Any increase in either direct or indirect taxation reduces the price-setting real wage and therefore shifts the \( PS(\theta) \)-curve downwards.

---

9Divide \( P \) by \( P \)

\[
\begin{align*}
\frac{P_c \cdot (1 - \mu) \cdot LP}{W \cdot (1 + t_d)} &= \left[ (1 - \phi) + \phi \cdot \frac{P^*e}{P} \right] (1 + t_v) \\
\frac{W \cdot (1 + t_d)}{P_c \cdot (1 - \mu) \cdot LP} &= \frac{1}{\left[ (1 - \phi) + \phi \cdot \frac{P^*e}{P} \right] (1 + t_v)} \\
\frac{W}{P_c} &= \frac{LP \cdot (1 - \mu)}{(1 + t_d)(1 + t_v) \cdot [1 + \phi(\theta - 1)]}
\end{align*}
\]