Aggregate Demand and Aggregate Supply 13

13.1 Overview *315*

13.2 Aggregate Demand and Supply under Fixed Exchange Rates *316*
- 13.2.1 Aggregate Demand in the Long Run *316*
- 13.2.2 The Short-Run Aggregate Demand Curve *317*
- 13.2.3 Movements Along versus Shifts of the *AD* Curve *318*
- 13.2.4 The Complete System *319*
- 13.2.5 Fiscal Policy and Demand Disturbances *320*
- 13.2.6 Monetary Policy and Realignments *324*

13.3 Aggregate Demand and Supply under Flexible Exchange Rates *327*
- 13.3.1 Nominal versus Real Interest Rates: The Fisher Equation *327*
- 13.3.2 Aggregate Demand in the Long Run *329*
- 13.3.3 The Short-Run Aggregate Demand Curve *329*
- 13.3.4 Movements Along versus Shifts of the *AD* Curve *330*
- 13.3.5 The Complete System *331*
- 13.3.6 Monetary Policy *332*

13.4 How to Use the *AS–AD* Framework *333*
- 13.4.1 Lags and Time Horizon *333*
- 13.4.2 Supply Shocks *334*
- 13.4.3 Demand Shocks *336*
- 13.4.4 Disinflation *338*

Summary *341*

Money influences only monetary variables and not real variables in the long run. The problem is 'how long is long?' The 'Keynesian' answer embodied in the concept of the Phillips curve was 'too long to matter!': the 'monetarist' rejoinder was 'shorter than the Keynesians think!'; extreme rationalism provides the answer 'too short for anything else to matter!'—answers that no one concerned with either the history or the practice of stabilization policy is likely to accept.

Harry G. Johnson[1]

13.1 Overview

This chapter is the watershed of the textbook. It combines the demand side of the economy—the Mundell–Fleming model of Chapter 11—with the supply side—the response of output and inflation consistent with the plans of firms and workers developed in Chapter 12—into a single unified framework. This workhorse of modern macroeconomics is known as the '*AS–AD* model'. Until now, aggregate demand was analysed under the assumption that prices are sticky. The task ahead is to deal with inflation.[2] The result will be the downward-sloping curve *AD* displayed in Figure 13.1: the higher is the inflation rate, all other things equal, the lower is aggregate demand. The upward-sloping aggregate supply curve *AS* has already been derived in the previous chapter. In a market economy demand equals supply, so the position of the economy is described by the intersection of the *AD* and *AS* curves.

In this analysis of aggregate supply, we identified two *AS* curves: one for the short run and one for the long run. This distinction is fundamental. In the short run, there is a trade-off between output (or unemployment) and inflation. In the long run, the supply curve, shown in Figure 13.1 as *LAS*, is vertical and the trade-off has disappeared—monetary factors have no impact on real economic variables, e.g. real GDP, unemployment, or the real exchange rate. We will see that a similar conclusion applies to aggregate demand, but it is horizontal in the long run, as displayed in Figure 13.1 as *LAD*.

Ultimately, the inflation rate is set by exogenous forces: either by inflation in the rest of the world in the case of fixed exchange rates, or by the monetary authority in the case of flexible exchange rates. In the short run, inflation and demand are closely

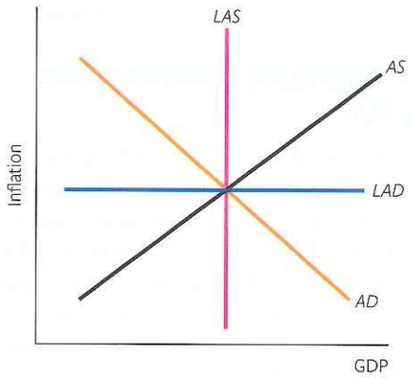

Fig. 13.1 Aggregate Demand and Aggregate Supply, Short Run and Long Run
The complete description of the macroeconomy comes in three steps. In the short run, the *AD* and *AS* curves allow us to understand the impact of changes in the exogenous variables. In the long run, the dichotomy principle produces the *LAD* and *LAS* curves. The medium run describes how we move from the short to the long run.

[1] Harry G. Johnson (1923–1979), a Canadian, was a professor of international trade and monetary economics at the University of Chicago and was known both for his dry wit and a wet whistle. Among his most important contributions to macroeconomics is the monetary approach to the balance of payments, which lies behind our understanding of the workings of monetary policy under fixed exchange rates.

[2] The book has been concerned until now with extremes: Chapter 6 dealt with the flexible price case, while Chapters 10 and 11 assumed constant prices. The real world must be somewhere in between, with price levels and inflation moving but much more slowly than the lightning speed of the neoclassical model.

related, and understanding these interactions and linking the economy's short run to the long run is a key function of the *AD–AS* framework. The chapter concludes with several examples of the *AS–AD* model's usefulness.

As in Chapters 11 and 12, we distinguish sharply between regimes of fixed versus flexible exchange rates under conditions of capital mobility. The reason is that the *AD* curve is derived from the *IS–TR–IFM* framework, which operates very differently according to the exchange rate regime. In particular, monetary policy operates through exchange rates, so that it is lost when the exchange rate is fixed, while fiscal policy is undermined by exchange rate movements when under a flexible rate arrangement. This framework also works differently in the case of a closed economy, without trade and capital movements. In that case, we can simply ignore the IFM line and both fiscal and monetary policies work, exactly as in Chapter 10.[3]

13.2 Aggregate Demand and Supply under Fixed Exchange Rates

We know from Chapter 11 that, when capital is mobile, a country that fixes its exchange rate to another currency loses its ability to pursue an independent monetary policy. The central bank has no choice but to set its own interest rate at the world level. The *TR* curve is irrelevant, so we will ignore it. This means that shifts in aggregate demand will only arise because of shifts in the *IS* or *IFM* curves.

13.2.1 Aggregate Demand in the Long Run

It is always a good idea to start with the long run. We showed in Chapter 6 that **relative purchasing power parity** (henceforth: **PPP**), meaning that the real exchange rate (σ) is constant, is a good rule of thumb for thinking about the long run.[4] With $\sigma = SP/P^*$, the fact that S is fixed and σ is constant in the long run means that the domestic inflation rate (π) must equal the foreign inflation rate (π^*):

$$\sigma = \frac{SP}{P^*} = \text{constant and } S \text{ fixed implies } \pi = \pi^*.$$

A very simple conclusion follows. *If the nominal exchange rate is constant, in the long run domestic inflation must be equal to foreign inflation.* Put differently, a fixed exchange rate regime rules out permanent differences between domestic and foreign inflation. If they could diverge permanently, the real exchange rate would appreciate or depreciate without limit. For example, if domestic inflation exceeded foreign inflation permanently despite a constant nominal exchange rate, the resulting real appreciation would make the economy increasingly uncompetitive and worsen the current account with no end in sight. This *cannot be a long-run equilibrium*.[5]

This restriction is represented in Figure 13.3(b) as the horizontal long-run aggregate demand **(LAD) line**. It is a demand-side restriction, because any permanent deviation would eventually lead to unsustainable current account deficits or surpluses.

Fixing the exchange rate means importing inflation from the country whose currency is used as a peg. The exchange rate becomes an anchor for

[3] This issue is discussed in Section 11.5.4.

[4] As stressed in Chapter 6, constancy of the real exchange rate implied by relative PPP should not be confused with absolute PPP or the law of one price. For countries of similar development, such as Germany, the UK, and France, relative PPP is fairly reliable. It tends to break down when comparing countries with significantly different levels of GDP per capita, especially when one is growing much faster than the other over a longer period. These issues are discussed in more detail in Chapter 15.

[5] Within the euro area, exchange rates are fixed in the most extreme way possible: a single currency. In part, the origins of the crisis can be found in persistently different inflation rates, e.g. higher in Greece and Spain than in Germany. In the long run, this is not sustainable.

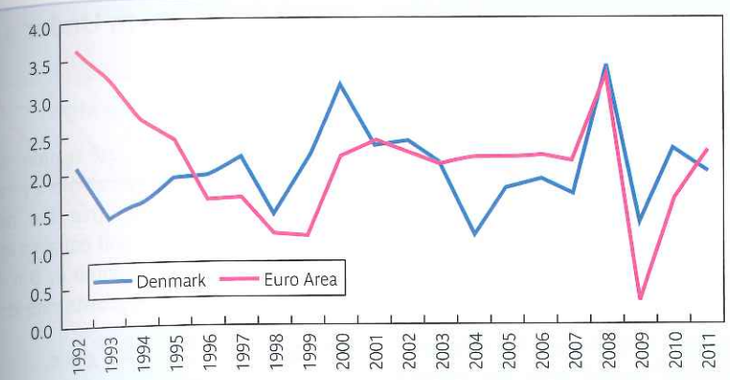

Fig. 13.2 Inflation in Denmark and the Euro Area, 1992 – 2010

Since the mid-1980s, the Danish central bank has committed to a fixed exchange rate regime. It first pegged the value of the currency, the krone, to the currencies of the European Monetary System (primarily the deutschemark). After 1999 it pegged the krone to the euro. The figure shows that Danish inflation has remained relatively close to inflation in the euro area. Because PPP does not hold in the short run, the relationship does not hold exactly every year. Yet over the period displayed in the figure, average inflation was 2.0% in Denmark, only slightly below the overall euro area rate of 2.1%.

Source: IMF, World Economic Outlook Database.

monetary policy, with a role pretty much like that of inflation in the inflation targeting strategy captured by the Taylor rule. Figure 13.2 shows how this anchor has worked for Denmark, which has fixed its exchange rate since the mid-1980s, first to the deutschmark, and then to the euro.

We know from Chapters 6 and 11 that, when the exchange rate is fixed, it is imported inflation that drives the money supply. Indeed, foreign inflation eventually determines inflation at home. Since economic agents are interested in the real value of money, as explained in Chapter 6, their demand for money grows proportionately to the inflation rate. Under fixed exchange rate, the central bank is committed to satisfy whatever demand for money is forthcoming, and will therefore let the money supply grow along with inflation. When the exchange rate is fixed, it is money growth that adjusts to (foreign) inflation, rather than inflation adjusting to money growth. Box 13.1 formally derives the endogenous growth rate of money under fixed exchange rates.

13.2.2 The Short-Run Aggregate Demand Curve

In the short run, PPP does not hold because prices are sticky. The real exchange rate σ can fluctuate and its movements directly affect aggregate demand. Our framework for thinking about the short run is the *IS–IFM* framework of Chapter 11, which assumed that the price level was constant. Now we must adapt it to allow for inflation.

To do this, let us ask what happens when the inflation rate changes, all other things being equal. In panel (*a*) of Figure 13.3, we start from general equilibrium at point *A*. We assume that this is a stable equilibrium, at least as long as domestic inflation π is equal to foreign inflation π^*. Now suppose that the domestic rate of inflation rises from π to π'—holding the foreign rate of inflation π^* constant, so $\pi > \pi^*$. In this situation, the real exchange rate will appreciate. Our competitiveness is eroded, the primary current account worsens, and demand for domestic output declines. Graphically, the *IS* curve shifts to the left, say to *IS'*. The new equilibrium occurs at point *A'*, the intersection of the new *IS* curve and the *IFM* line.[6]

Now suppose instead that inflation declines to π'', so $\pi'' < \pi^*$. Competitiveness would improve, the real

[6] Point *A'* is just a snapshot taken during a contractionary process that continues as long as inflation is higher at home than abroad. As long as domestic inflation exceeds the foreign rate, the real exchange rate will continue to appreciate. To keep things simple, we do not elaborate on this aspect.

Box 13.1 The Real Exchange Rate and Money Growth Under a Fixed Exchange Rate Regime

A regime of fixed exchange rates imposes restrictions on domestic inflation and monetary policy and the growth rate of money. This box formally explains these restrictions. It rests on three key concepts developed earlier. The first one is PPP, the second one is the money market equilibrium, both of which are presented in Chapter 6, and the last one is the interest parity condition introduced in Chapter 11.

As recalled in the text, PPP implies that inflation is the same at home and abroad when the nominal exchange rate is fixed. For a small economy, this means that the domestic inflation rate is equal to the foreign rate:

(B13.1) $$\pi = \pi^* .$$

Next, the demand for money is described as follows in Chapter 11:

$$M/P = k(i)Y$$

Finally, the interest parity condition when the exchange rate is fixed implies that $i = i^*$. Imposing this condition to the money demand equation, we have:

(B13.2) $$M/P = k(i^*)Y .$$

Under a fixed exchange rate regime, the central bank has no choice but to supply all money that is demanded. Equation (B13.2) implies that the money supply is determined by demand and equal to $k(i^*)PY$. Using the arithmetic principle presented in Box 6.3, this means that the nominal money growth rate is:

(B13.3) $$\frac{\Delta M}{M} = g + \pi,$$

where g is the growth rate of GDP.

Using (B13.1) and recognizing that the rest of world target inflation to achieve a long run rate of π^*, we finally see that the domestic central bank must allow money to expand at the growth rate:

(B13.4) $$\frac{\Delta M}{M} = g + \pi^*,$$

Students will recognize the similarities between this result and equation (B12.3) of Box 12.1. This is not a coincidence. Under fixed exchange rates, the role of the target inflation is replaced by the foreign rate of inflation, π^*.

exchange rate would depreciate, and the *IS* curve would shift outwards to *IS″*. The new equilibrium—after a period of one year, say—would be described by point *A″*. Connecting points like *A*, *A′*, and *A″* in panel (*b*) of Figure 13.3, we trace out the **aggregate demand curve** *AD*. The curve is downward-sloping because rising inflation weakens the country's external competitiveness, which reduces domestic and foreign demand for domestic goods. It represents aggregate demand because movements along the curve are induced by shifts of the *IS* curve, the goods market equilibrium condition under the Keynesian assumption that supply passively responds to, and therefore merely equals demand. It is a short-run curve because, as long as domestic inflation differs from foreign inflation, demand continues to change (so that a year later, say, output would have moved further away from *Y* in Figure 13.3, further reducing demand and flattening the demand curve). The long-run demand curve, instead, accepts the implication from PPP that domestic inflation is equal to foreign inflation. We will see shortly how we move to the long run.

13.2.3 Movements Along versus Shifts of the *AD* Curve

As in previous chapters, it is essential to distinguish between movement along the *AD* curve and shifts of the curve itself. The rule is always the same: the curve shifts when a relevant exogenous variable changes. Since the *AD* curve is nothing more than a summary of the *IS–IFM* framework, the list of endogenous and exogenous variables is similar to those already identified in Chapter 11. The difference, of course, is that the price level and the inflation rate are now endogenous.

This also means that any exogenous variable that shifts the *IS* curve also shifts the *AD* curve. For example, starting from initial inflation rate π, an increase in government spending *G* is represented in Figure 13.3(a)

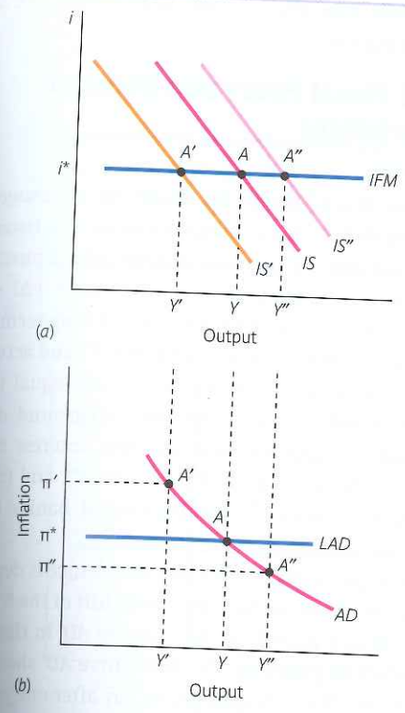

Fig. 13.3 The Aggregate Demand Curve Under Fixed Exchange Rates

Starting from inflation π^* at point *A*, an increase in the rate of inflation to π' reduces the country's external competitiveness. The *IS* curve shifts leftward in panel (*a*). The resulting decrease in demand is reported in panel (*b*). Conversely, a reduction in inflation to π'' improves competitiveness, shifts the *IS* curve rightward, and aggregate demand increases. The aggregate demand curve is downward sloping.

by a shift from *IS* to *IS″*. As long as inflation remains unchanged, in panel (*b*) the corresponding point is *B*. The new demand curve which passes through *B* must lie to the right of the initial curve, as shown in Figure 13.4. This reasoning applies to all exogenous variables studied in Chapter 10: government purchases *G*, net taxes *T*, household wealth Ω, Tobin's *q* ('animal spirits'), and foreign income *Y**. Missing in that list is the real exchange rate, which is now endogenous, because it depends on the evolution of domestic prices—which are no longer fixed—relative to foreign

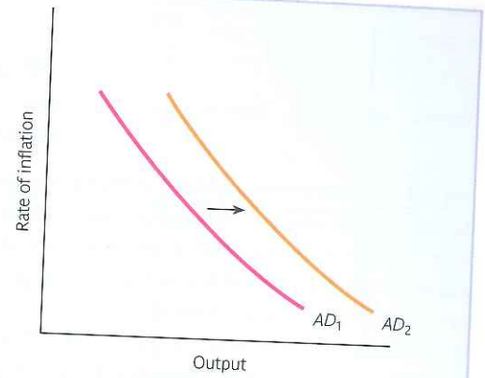

Fig. 13.4 Shifts in the Aggregate Demand Curve

Exogenous changes in demand which shift the *IS* curve also shift the short-run aggregate demand curve in the same direction. The outward shift shown here could be caused by an increase in government spending (*G*), reductions in taxes (*T*), rise in Tobin's *q*, an increase in foreign GDP (*Y**) or an increase in household wealth (Ω).

Changes in exogenous variables that affect aggregate demand shifts the *AD* curve, rightwards when aggregate demand rises, leftwards when it declines. Conversely, the *AD* curve stays in place when these variables remain constant. Any change in other variables implies that we move along the *AD* curve. Let us now examine how and when this happens.

13.2.4 The Complete System

In Figure 13.5 aggregate demand and supply are brought together. The demand side comes in two parts: (1) the downward-sloping short-run aggregate demand curve *AD*, and (2) the horizontal long-run *LAD* line, which reflects the endogeneity of money in fixed exchange rate regimes and the dependence of long-run domestic inflation on the foreign inflation rate. The supply side, derived in Chapter 12, also comes in two parts: (1) an upward-sloping short-run supply curve *AS*, and (2) the vertical long-run line *LAS*. The position of the *AS* curve depends on the underlying inflation rate $\tilde{\pi}$. The supply side in the long run dictates that actual and trend GDP are equal ($Y = \bar{Y}$), which requires that actual and underlying inflation be equal as well ($\pi = \tilde{\pi}$), at that point at which the *AS*

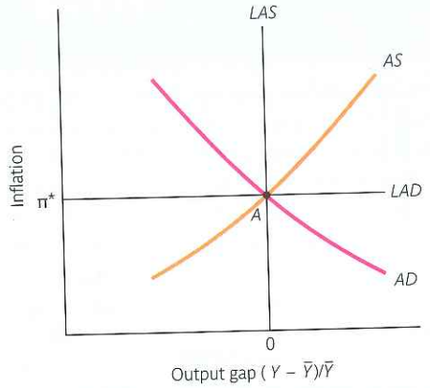

Fig. 13.5 Aggregate Demand and Supply Under Fixed Exchange Rates

In the long run, output is at its trend growth level, the output gap is zero, and the inflation rate is equal to the underlying rate, as well as the foreign inflation rate. The short run is determined by the *AD* and *AS* curves. The figure depicts a situation of long-run equilibrium in which all four curves intersect.

and *LAS* curves intersect. On the demand side, the long-run domestic inflation rate equals the foreign rate ($\pi = \pi^*$). In other words, in the long run, the economy stabilizes when GDP is on trend, inflation is the same as abroad, and the underlying inflation is in line with actual inflation. In Figure 13.5, the two long-run curves intersect at point *A*.

Note that we have changed the horizontal axis from previous chapters. Before, we tracked real GDP (*Y*) along this axis. We now represent the output gap $Y_{gap} = (Y - \bar{Y})/\bar{Y}$. This rescaling is important. We learned in Chapters 3 and 4 that trend GDP $\bar{Y}$ grows over time in most countries. To study the level of GDP would require a continuous rightward shift of the *LAS* line, which would be quite cumbersome and, more importantly, would divert our attention from the focus of this chapter, which is the origin and propagation of business cycles.

Figure 13.5 characterizes a **long-run equilibrium** in which the two short-run curves—the *AS* and *AD* curves—also pass through the long-run equilibrium point *A*. In the following sections, we will study the **short-run equilibrium** as it evolves over time and distinguish it from the long-run position. In doing so, we explain how the economy moves from the short to the long run.

13.2.5 Fiscal Policy and Demand Disturbances

Short run

We now track down the effects of an exogenous **demand shock**. One common example is a fiscal policy expansion—an increase in government purchases ($\Delta\bar{G} > 0$) or a reduction in net taxes ($\Delta\bar{T} < 0$).[7] Initially, at point *A*, the economy is in long-term equilibrium: output *Y* is at its trend level $\bar{Y}$, and actual (π) and underlying ($\tilde{\pi}$) inflation are both equal to the world inflation rate π^*. In the background of the demand-side analysis, the domestic interest rate is equal to the world rate of return ($i = i^*$), and foreign inflation is equal to foreign central bank's target inflation rate, $\bar{\pi}^*$.

The expansionary demand disturbance is depicted in Figure 13.6(*a*) as the rightward shift of the *IS* curve to *IS′*, which moves the *AD* curve to *AD′* in the same direction in panel (*b*). The new curve *AD′* shows the short-run effect of fiscal policy, say after one year. At point *B* output has increased—as would be the case under the Mundell–Fleming framework—but inflation has also risen, which was previously ignored by assumption. The rise in inflation is due to the upward-sloping aggregate supply curve. The combination of a fixed nominal exchange rate ($S = \bar{S}$) and an inflation rate higher than abroad (*P* is increasing faster than P^*) implies that the real exchange rate $\sigma = \bar{S}P/P^*$ appreciates. External competitiveness is eroding and the primary current account is deteriorating. Thus rising inflation reduces the impact of the demand disturbance. This is precisely why the *AD* curve is downward-sloping. Had inflation remained unchanged, when working with the *IS–IFM* fixed-price assumption in Chapter 11, competitiveness would have remained unchanged, and the outcome would have been at point *B′* in both panels, along the *IS′* curve—constant inflation with a larger increase in output. The loss of competitiveness, however, has shifted the curve leftward to *IS″*. The horizontal distance between *B* and *B′* is a measure of the

[7] A contractionary fiscal shock would be a tax increase or a cut in government spending.

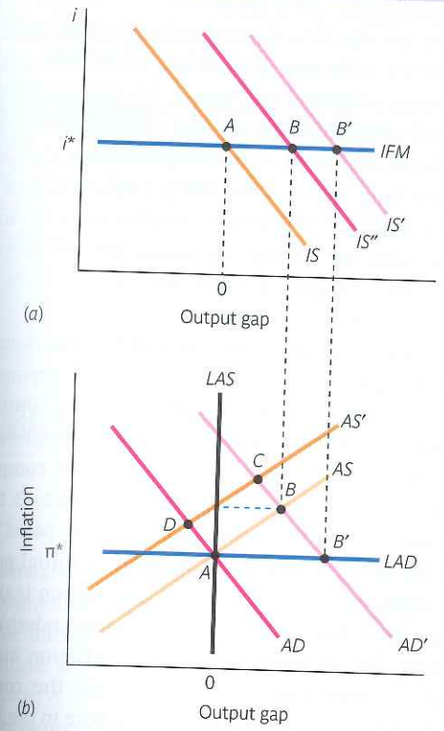

Fig. 13.6 Fiscal Policy Under Fixed Exchange Rates

A fiscal expansion shifts the *IS* and *AD* curves to the right, to *IS′* and *AD′*. However, domestic prices rise, so the short run outcome is point *B* instead of *B′*, implying an increase in real GDP which is accompanied by higher inflation. The resulting decline in competitiveness implies that the *IS* curve only shifts to *IS″*. As underlying inflation catches up with actual inflation, the *AS* curve shifts to *AS′*, which corresponds to a higher underlying inflation rate, equal to the inflation rate prevailing at point *B*. If the government does not change its fiscal policy stance, the new equilibrium occurs at point *C*, where inflation has again increased above the underlying rate, leading to further shifts of the *AS* curve. If the government cancels the fiscal expansion, the aggregate demand curve moves back to or even below *AD*, and the new short-run equilibrium is at point *D*, where actual inflation is now lower than underlying inflation. The *AS* curve starts shifting to the right and will do so until it returns to its initial position and the long-run equilibrium is restored at point *A*.

inflation-induced deterioration of the primary current account.

Long run

The long run is governed by three central restrictions:

- First, the *government budget constraint* rules out permanent fiscal expansions. For the initial shift in aggregate demand to be a long-run expansion, it must occur in *each period*. For fiscal policy to be sustainable and consistent with a steady state, on the other hand, the public debt must be stabilized, as explained in Chapter 7. The fiscal expansion implies that the public debt is rising, which is not sustainable. To reach a new long-run situation, the expansionary policy must eventually be reversed. When this is done, the aggregate demand curve will return to its initial position *AD*.[8]
- Second, output must return to its trend and the economy will stabilize along the *LAS* line. The logic here is that any non-zero output gap implies, by construction, that underlying and actual inflation differ, which is not sustainable indefinitely, either.
- Third, inflation cannot deviate from the foreign inflation rate for very long, if the exchange rate is to remain fixed. Thus, the economy must return to the *LAD* line.

The conclusion is that in the long run, the economy must return to point *A*, exactly where it started. The effect of a fiscal expansion is transitory because a fiscal expansion cannot be permanent if the government's budget constraint is to be satisfied.

The medium run

Summing up so far, in Figure 13.6 we start from point *A*, move to point *B*, and eventually move back to point *A*. The actual path taken by the economy from the

[8] In fact, the public debt will have risen in the meantime and must be paid for by a permanently higher primary budget *surplus*. This requires that the *AD* curve shifts back beyond its original position. We overlook this additional complexity. It is acceptable to do so if the fiscal expansion does not last long enough to seriously increase the debt–GDP ratio. In the course of the global financial crisis, this detail appears to have been neglected. We return to this important issue in Chapter 17.

immediate short run at point *B* to the long run at point *A* can be reconstructed using the observations just made. We already know that the budget constraint will force the government at some point to reverse gears and either cut spending or raise taxes. When this will happen is a political decision—it could depend on the timing of elections, for instance—and we cannot say much more about it. At any rate, the *AD* curve must eventually shift back to its initial position.

We can say more about the behaviour of the *AS* curve. Remember that its position is determined by underlying inflation ($\tilde{\pi}$), which is assumed initially—say, at time $t = 0$—to equal foreign inflation π^*. In Chapter 12, we saw that the underlying inflation has *backward-looking* and *forward-looking* components. The backward-looking component reacts to actual inflation conditions, 'catching up' with current inflation. Now note that at time $t = 1$ when the economy has moved to point *B*, actual inflation is higher than the initial underlying inflation rate at $t = 0$. Inevitably, wage negotiators—whose appraisal determines the underlying inflation rate when nominal pay increases are agreed—will recognize that the current (time $t = 1$) inflation rate is higher than it used to be assumed. They will naturally agree to push nominal wages faster, in effect raising underlying inflation. Without knowing more about the economy's structure, it is impossible to say where.

For the sake of the argument, suppose underlying inflation is simply equal to the inflation rate in the previous period. Then the *AS* curve would shift to *AS′*, which intersects the *LAS* curve at the inflation rate observed at point *B*. The new (time $t = 2$) short-run curve *AS′* cuts the *LAS* line ($Y = \bar{Y}$) at the underlying inflation rate corresponding to the height of point *B*. This means that at time $t = 2$, the economy moves from point *B* to point *C*, at the intersection of the *AD′* and *AS′* curves in panel (*b*). From *B* to *C*, inflation further rises, but now, GDP is lower: inflation higher than foreign inflation implies further erosion of external competitiveness and a deeper deterioration of aggregate demand. Behind this is a further leftward shift of the *IS* curve (not shown) as we move up along *AD′*. This is an instance of **stagflation**.[9] We are not yet back to the long-run equilibrium, however, if only because fiscal policy is not yet corrected. At point *C*, the output gap is still positive and the new current inflation rate exceeds underlying inflation (remember that along *AS′*, underlying inflation is equal to the inflation observed when the economy was at point *B*). It is just a matter of time until underlying inflation rises further, pushing the *AS* curve farther upwards and to the left above *AS′*. In that case, stagflation continues as the economy moves up along the *AD′* curve. Eventually, though, the government will have to reverse the fiscal expansion.

So let's now imagine that the government cancels its fiscal expansion at time $t = 2$ when the economy is at point *C*. The fiscal policy correction has a contractionary effect and the *AD* curve moves from *AD′* back to *AD* (assuming a complete policy reversal compatible with the long run). In that case, at time $t = 3$, the economy moves from point *C* to point *D* in panel (*b*). Even though the *AD* curve is back to its initial position, output is now below trend. The reason is that the *AS* curve has shifted to *AS′* because underlying inflation has increased. The higher inflation hurts external competitiveness. In panel (*a*), the corresponding *IS* curve (not shown) is therefore to the left of the initial one (*IS*) since fiscal policy is back to its initial stance but external competitiveness has been degraded by inflation.

Point *D* is on the *AS′* curve, which corresponds to the underlying rate of inflation at time $t = 2$ at point *C*. But since point *D* is below point *B*, inflation is lower than the underlying rate. The next round of wage negotiations will recognize that inflation is ebbing and underlying inflation will also decline. The *AS* curve will shift down below *AS′* and the economy will move down along the *AD* curve from point *D* in the direction of point *A*. At the intersection of *AD* and the new *AS* curve (not shown), which corresponds to an underlying inflation rate equal to the actual rate observed at point D, inflation has again declined below underlying inflation. This prompts a new reappraisal of underlying inflation, a new downward shift of the *AS* curve, and a continuing movement along the *AD* curve. The process will continue until the *AS* curve has returned to its initial position and the long-run equilibrium is achieved at point *A*.[10]

To summarize, the acknowledgement of inflation requires that we reason in three steps:

(1) the immediate short run, described by the amended Mundell–Fleming (*IS–IFM*) framework subsumed in the *AD* curve and by the short-run *AS* curve;

(2) the long run, described by the long-run *AD* and *AS* curves;

(3) the medium run—the transition from the short to the long run—a drawn-out process driven by successive shifts of the short-run *AD* and *AS* curves.

The details of the curves and their movements with reference to Figure 13.6 are summarized in Table 13.1.

Until now, we have emphasized the role of the backward-looking component of underlying inflation. What is the role of the forward-looking component? Anticipating the future evolution of inflation, wage negotiators will reduce the lag between underlying and actual inflation and the *AS* curve will adjust faster, which will speed up the return to departure point *A*. We will see in Chapter 16 that this dimension depends strongly on the credibility of the anticipated policy measures which lie behind the anticipations of inflation.

The incorporation of inflation is a crucial amendment of the macroeconomic model. It modifies some of the conclusions that we reached in Chapters 11 and 12. In particular:

- First, a demand shock does not just move output, it also changes the inflation rate as we move along the *AS* curve. Along a given supply curve, an increase in demand raises the inflation rate, while a decline in demand lowers inflation.
- Second, bringing inflation into the picture naturally leads us to think beyond the current period. This was already apparent with the Phillips or *AS* curve because we need to think about the evolution of the underlying inflation rate. On the demand side, we were led to think about the government's budget constraint, which was ignored in Chapter 12 as we strictly focused on the short run. This led us to recognize that fiscal policy is inherently temporary.

[9] In Chapter 12 we saw that the instability of inflation was the downfall of the old-fashioned Phillips curve—or its mirror image, the *AS* curve. By understanding the dynamics of underlying inflation, it is possible to understand why the Phillips curve shifted so much.

[10] In fact, the economy will need to move temporarily below point *A* in panel (*b*), because a period when inflation is lower at home than abroad is required to bring the real exchange rate back to its original initial level. Only if inflation is below π^* for some period of time is it possible for a real depreciation to occur, competitiveness to be restored and the *IS* curve to return to its initial position.

Table 13.1 Tracking Movements in Figure 13.6

Time	Event	Movement	Equilibrium
0	Initial situation		Point *A*
1	Expansionary policy	*AD* shifts to *AD′*	Point *B*
2	Underlying inflation catches up with inflation at point *B*	*AS* shifts to *AS′*	Point *C*
3	Expansionary fiscal policy rescinded/loses impact	Back to initial *AD*	Point *D*
4	Underlying inflation catches up with inflation at point *D*	*AS′* shifts to the right	Point *E* (not shown)
5	Underlying inflation catches up with inflation at point *E*	*AS* shifts to the right	Point *F* (not shown)
6	Underlying inflation catches up with inflation at point *F*, etc.	*AS* shifts to the right	Point *G* (not shown)
Long run	Underlying inflation has caught up with actual inflation	Back to initial *AS*	Point *A*

- Third, a fiscal expansion is partly undermined by the increase in inflation that it generates. The resulting loss of competitiveness—when the nominal exchange rate is fixed—worsens the current account and thus reduces world demand for our goods.

This explains why the countercyclical use of fiscal policy is much less popular than it used to be in the heyday of Keynesianism, before the old Phillips curve was replaced by its rehabilitated version, augmented by forward- and backward-looking elements of expectations of inflation.

13.2.6 Monetary Policy and Realignments

A key lesson from Chapter 11 is that it is impossible to carry out an autonomous monetary policy when the exchange rate is fixed. But we indicated that exchange rate parities can be and are changed, at least on occasion, since most fixed exchange rate regimes are considered 'adjustable'. We now show how exchange rate realignments allow for some limited role of monetary policy.

A devaluation, for instance, means reducing the nominal exchange rate. How is this done in practice? Formally, the central bank simply announces the new parity and follows through with whatever is needed to make this happen. This means a monetary policy expansion—achieved either on the open market or through foreign exchange market interventions—will be necessary to increase the supply of domestic currency such that its price, the exchange rate, declines as intended. More precisely, more money implies a lower interest rate and capital outflows, which weaken the exchange rate. This in turn raises demand and the interest rate back up to the global return implied by the interest parity condition, the *IFM* line.

For simplicity, the initial situation at point *A* in panel (*a*) of Figure 13.7 is assumed to correspond to a long-run equilibrium, with domestic observed and underlying inflation both equal to foreign inflation. A nominal depreciation translates into a gain in external competitiveness, so that $\sigma = SP/P^*$ declines immediately when S is reduced. As a result, the *IS* curve shifts rightward to *IS′*. In the background, the target interest rate is usually cut as already mentioned. Recovering the monetary policy instrument is precisely the role (and some would say the goal) of exchange rate depreciations or appreciations. These are fleeting moments when the central bank can recover monetary room to manoeuvre.

The short run equilibrium is reached at point *B*. In panel (*b*), the demand expansion is shown as the shift of the aggregate demand curve from *AD* to *AD′*, and the corresponding outcome is represented by

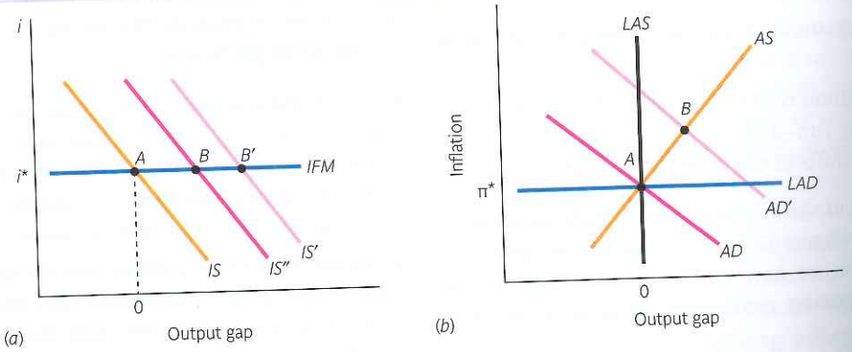

Fig. 13.7 Devaluation

Starting from a long-run equilibrium, a devaluation causes the *IS* curve to shift to *IS′*, but rising inflation undoes some of the real depreciation, so the net effect is a shift to *IS″*, corresponding to point *B* in both panels. Output expands, but not as much in the original Mundell–Fleming model. Ultimately, higher inflation will lead to increasing underlying inflation, which will eventually lead to pressure to devalue again, or a painful period of lower inflation and a negative output gap to restore competitiveness.

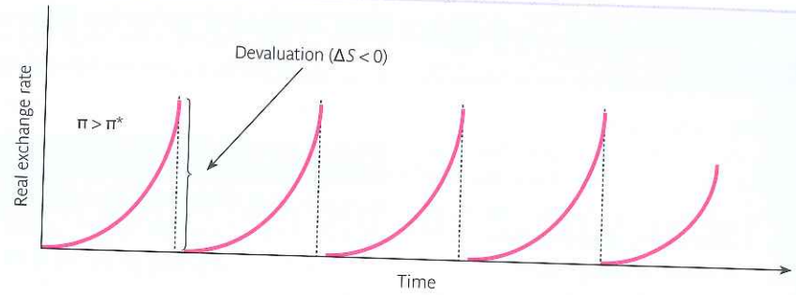

Fig. 13.8 Expansionary Monetary Policy Under a Fixed Exchange Rate Regime

A devaluation causes domestic inflation to rise above the foreign inflation rate. The real exchange rate, initially reduced by the devaluation, starts appreciating again until it returns to its pre-devaluation level. The central bank may devalue the nominal exchange rate again, which immediately depreciates the real exchange rate and triggers a new period of high inflation and real appreciation. In the end, monetary policy results in higher inflation and a chain of successive devaluations.

point *B*. As is now becoming customary, we find that an output expansion does not come for free, it is accompanied by rising inflation. This, in turn, reverses and undermines partly the expansionary effect of the devaluation, which is captured by the leftward shift of the *IS* curve from *IS′* to *IS″* in panel (*a*).

Point *B* does not represent a long-run equilibrium because it is neither on the *LAD* nor on the *LAS* curves. It lies on the short-run *AS* curve with position determined by initial underlying inflation (equal to the world rate of inflation at the outset), but now at point *B* inflation has risen. As a consequence, underlying inflation increases and the *AS* curve will shift up. On the other hand, rising inflation means that the domestic price level rises faster than the foreign price level. As a result, the real exchange rate keeps appreciating, the current account deteriorates, and the *IS* curve further shifts leftwards in panel (*a*). The economy will return to point *A*, after a period of inflation above the world level. During the transition back to point *A*, the inflation differential progressively undoes the real depreciation achieved through the initial devaluation.[11] At point *A*, this effect is complete: the competitiveness benefit from the initial depreciation has been entirely offset by the inflation differential with the country to whose currency the domestic currency is pegged.

This is yet another case of long-run monetary neutrality. We knew all along that the long-run equilibrium is at point *A*, so the question was what would take us there. In the end, if we start from long-run equilibrium, all real variables must return to their initial values, which applies to the output gap and to the real exchange rate. Inflation rate, too, must eventually return to the world level. In the end, devaluations or appreciations only have temporary effects.

Another possibility, however, is for the central bank to devalue again. If it does so, the temporary competitive advantage will again be gradually eroded by the inflation differential, leading to another devaluation, etc. In this limited sense, monetary policy independence is restored under a fixed but adjustable exchange rate regime. Through a succession of devaluations, the central bank can keep pushing temporarily real GDP above trend, but it will have to accept a permanently higher inflation rate. Figure 13.8 illustrates this path of the real exchange rate over time. It will depreciate abruptly at the time of each devaluation, only to appreciate again afterwards. In the end, this strategy merely allows a country to opt for a different inflation rate from the one that prevails in the country to which

[11] The careful reader will ask: what gets us back to point *A* in panel (*b*)? Here we would need to use the observation in footnote 8: during all the time when $\pi > \pi^*$, the curve *AD* becomes increasingly flatter, year after year. In the end it will coincide with *LAD*. In the intervening periods, it will be necessary for $\pi < \pi^*$ for a time, so the real exchange rate can depreciate to its original level.

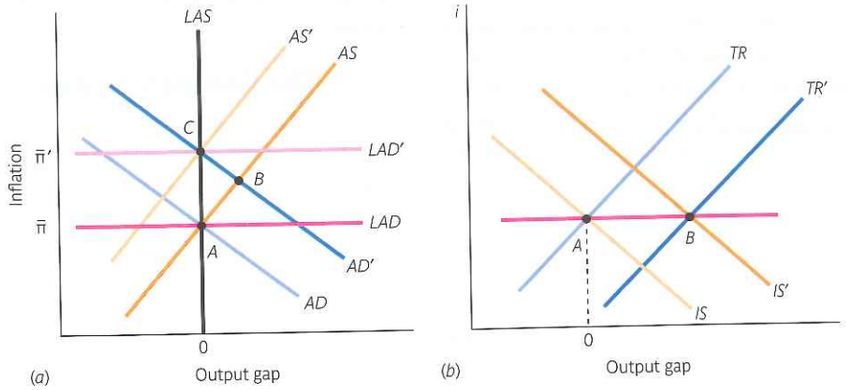

Fig. 13.13 Monetary Policy Under Flexible Exchange Rates

Starting at point *A* in panel (*a*), a monetary policy expansion—here shown as a permanent increase in the central bank's target inflation rate—shifts the *AD* curve rightwards to *AD′*. At the same time, the *LAD* curve also shifts to *LAD′*, reflecting the permanently higher target inflation rate and intersecting the *LAS* curve at point *C*. In the long run, the economy settles at point *C*, with GDP equal to trend output and the increase in inflation equal to the increase in the target inflation rate. Short-run equilibrium occurs at point *B*, where actual inflation exceeds underlying inflation. Thereafter underlying inflation increases to its long-run level and the economy moves from point *B* towards point *C*.

13.3.6 Monetary Policy

Central banks which follow a Taylor rule systematically set the interest rate relative to the natural or long-run target rate when inflation or output depart from their target and trend levels, respectively. In that sense, the rule-based monetary policy does not change, but the rule itself may be changed. It can be the adoption of a new target rate of inflation, or a changing view about the natural real interest rate or the equilibrium trend level of output, or a different sensitivity to the inflation or output gaps (parameters a and b). Here we consider the case when it raises its inflation target from $\bar{\pi}$ to $\bar{\pi}'$. This means that the neutral interest rate $\bar{i}$, which is the sum of an unchanged real interest rate and the new target rate of inflation $\bar{\pi}'$, will also rise permanently.

Long run

A permanently higher target rate of inflation means that the *LAD* line shifts up to *LAD′* in Figure 13.13(*a*). The dichotomy principle implies that the real side of the economy is left unaffected, so *LAS* is unchanged. In the long run, therefore, the economy will move from point *A* to point *C*. The vertical distance *AC* corresponds to the increase in the target inflation rate.

Short run

The increase in the inflation target implies that the central bank will attempt to reduce the nominal interest rate, producing an exchange rate depreciation and therefore an increase in aggregate demand. This is depicted in Figure 13.13(*a*) by the rightward shift from *AD* to *AD′*. In the background, the increase in $\bar{\pi}$ shifts the *TR* curve down and to the right in panel (*b*) of Figure 13.13. The economy moves from point *A* to point *B* in both panels. Overall, output rises (and unemployment declines) and inflation increases, but by less than the change intended by the central bank.[19]

The medium run

The transition takes the economy in steps from point *B* to point *C* in panel (*a*). At point *B*, where output is above its growth trend level, the actual rate of inflation exceeds the underlying rate. What happens during the transition—and therefore the details of the trajectory—depends on the behaviour

[19] We ignore an issue of further complexity. The Fisher principle implies that, eventually, the nominal interest rate must rise, which would shift the *IFM* curve up. Ignoring this aspect does not affect the reasoning.

of the underlying rate of inflation. To the extent that it is backward-looking, underlying inflation is sluggish. Initially, the *AS* curve does not move and the economy moves to point *B*. Over time, underlying inflation begins to track actual inflation, the short-run *AS* curve shifts upwards and the economy moves from *B* towards *C*, along the curve *AD′*. As in the case of a fixed exchange rate regime, along the path from *B* to *C*, actual inflation exceeds underlying inflation. As underlying inflation catches up, actual inflation rises, and output declines along *AD′*. Indeed, the rising inflation rate leads the central bank to tighten its stance according to the Taylor rule. In panel (*b*), this response to inflation is captured by an upward shift of the *TR* curve, as explained in Section 13.3.3. This will go on as long as inflation rises. The *TR* curve must continue to move up until it passes through point *C*, the new long-run equilibrium.

In summary, an expansionary monetary policy—described here as an increase of the inflation rate target—raises output and inflation in the short run. In the long run, the effect falls entirely on higher inflation with no effect on output—the neutrality result is confirmed under flexible exchange rates. In the short run, the backward-looking component of underlying inflation creates the non-neutrality needed for an output effect, while the forward-looking component tends to make neutrality more likely to hold in the shorter run. The role of underlying inflation receives closer scrutiny in Chapter 16.

13.4 How to Use the *AS–AD* Framework

The complete *AS–AD* framework provides macroeconomists with a key tool for studying real-life events and answering important macroeconomic questions. We proceed with three aims: (1) to illustrate the principles developed earlier, (2) to develop familiarity with the framework, and (3) to study and understand historical developments of general interest.

13.4.1 Lags and Time Horizon

We start by briefly providing indications on the duration of the short, medium, and long runs, an issue already discussed in Chapter 1. Here we link this discussion with the *AS–AD* and *IS–TR–IFM* apparatus. The question is: how long does an isolated shock need to work its way through the system? Naturally, the economy isn't served a single shock on a platter, but is constantly subjected to small and large shocks, which move it away from its long run. Despite this fact, an orderly discussion of the short, medium and long run is useful—it gives us a time horizon for understanding the effects of disturbances and more important, policy measures.

The short run corresponds to the Mundell–Fleming model, which is based on the Keynesian assumption of price stickiness. It lasts as long as the short-run *AS* curve remains roughly in place. It takes about one to two years for demand disturbances to affect output, and sometimes up to three years for inflation to react. At this point, inflation triggers changes in the underlying rate of inflation, the *AS* curve starts shifting and we move to the medium run.

The medium run—the transition from the short to the long run—lasts from two to five years. This is when the short-run *AS* curve begins to shift as the backward-looking component of underlying inflation starts catching up with actual inflation. The transition is shorter, the faster underlying inflation catches up. This depends therefore on the relative contributions of its backward- and forward-looking components. As previously noted, if the forward-looking component dominates, the short-run *AS* curve quickly reaches its final position—especially if prices and wages are not sticky. Wage and price **indexation** speeds up the transition. In countries where inflation is very high, formal or informal indexation schemes are usually in place and the long run occurs in the short run! We return to this important issue in the next section.

The long run is defined as the horizon over which the dichotomy asserts itself. This means that we look beyond the business cycle horizon. Although two business cycles are never exactly alike, experience shows that they generally last four to six years.

13.4.2 Supply Shocks

Supply shocks occur when conditions of production change suddenly, with an impact on production costs and the evolution of inflation. Supply shocks come in many different forms, but share the common feature that they invariably create difficulties for policy-makers, who are ill-equipped to face the consequences. This is because traditional demand-side policies are ineffective in dealing with supply shocks. In addition, supply-side policies are complex, slow in generating tangible results, and often politically unappealing.

The simplest example of an adverse supply shock is the sudden loss of human or physical factors of production resulting from natural disasters or wars. This leads immediately to medium- or long-run loss of production potential (think of the Fukushima disaster in Japan, Hurricane Katrina, or earthquakes in Turkey). Supply shocks can be favourable as well, e.g. an acceleration of technological advances. The often-cited information technology revolution (described in Chapter 3) that started in the mid-1990s is a recent example. Previous major episodes include the invention of electric generation and transmission, automobiles, and plastics. The discovery of natural resources or a sustained surge in capital investment (think of the Solow model) are other examples of favourable supply shocks—possibly very persistent ones.

Oil shocks are the most well-known supply shock, with the instances of 1973 and 1979 representing major turning-points in twentieth-century post-war economic history. They marked the end of the rapid growth performance of most European countries, and were followed by markedly higher inflation and unemployment rates. Japan and the USA were also badly affected. After a favourable counter-oil shock in the mid-1990s, oil prices started once again to rise sharply in 2000, again in 2003 in the wake of the Iraq war, quadrupled over the period 2005–2008, then fell again. The *AD–AS* model was developed largely in response to events of the 1970s, just as the *IS–LM* model was a response to the Great Depression.

A short-term policy dilemma

We saw in Chapter 12 that supply shocks shift the aggregate supply curve. The increase in production costs is passed on by firms in the form of price increases at any given level of output. This was represented by the exogenous shock s in the aggregate supply equation:

$$\pi = \tilde{\pi} + a(Y - \bar{Y}) + s. \quad \textbf{(13.11)}$$

When the shock is unfavourable, i.e. when $s > 0$, the short-run aggregate supply curve shifts upwards from *AS* to *AS′*, as shown in Figure 13.14. The move from point *A* to point *B* is the case of stagflation, i.e. declining real growth and rising inflation. If the relative price increase is a one-off event, the *AS* curve will

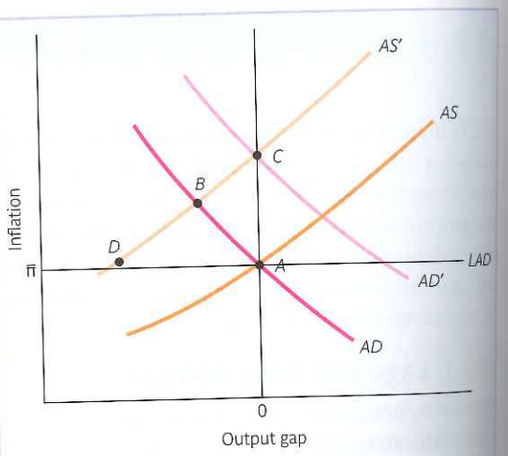

Fig. 13.14 An Adverse Supply Shock

An adverse supply shock shifts the *AS* curve up to *AS′*. The economy will suffer stagflation as it moves from point *A* to point *B*. If the authorities decide to avoid a fall in output and a rise in unemployment, they can adopt expansionary demand-side policies and move the economy towards a long-run equilibrium at point *C*. This would be achieved at the cost of a permanent increase in the central bank's target rate of inflation. If, in contrast, they choose to fight inflation, they can adopt contractionary demand-side policies—a lower target inflation rate—and aim at point *D*. Here the cost is a deep recession.

shift back to its initial position.[20] This is optimistic, however. While the economy is at point *B*, workers unexpectedly face higher prices. Quite likely, they will demand higher nominal wages and, if they succeed, the backward-looking component of underlying inflation rises. Such second-round effects are the reason why, even after the commodity price increase has been absorbed (when s goes back to zero), the *AS* curve is unlikely to shift back quickly or completely. The answer will depend on the behaviour of underlying inflation.

Stagflation is a serious policy challenge for governments. One approach is to soften the blow to output and unemployment by adopting an expansionary demand policy (monetary or fiscal, depending on the exchange rate regime). Aiming at point *C*, and shifting the aggregate demand curve to *AD′* in Figure 13.14, hastens the return to trend growth but at the cost of higher inflation. Another approach is to prevent inflation from ever rising, so that underlying inflation remains under control. This calls for a prompt *contractionary* policy reaction, shifting the short-run aggregate demand curve back until it goes through a point like *D*. This reaction deepens the recession but, once the shock has worked itself through (and $s = 0$), the aggregate supply curve moves back to *AS* and the restrictive demand policy may be lifted to return to point *A*. The nature of the dilemma should be clear: the authorities can either aim at maintaining output and employment, but at the cost of higher inflation, or they can prevent a sharp inflationary impact, but at the cost of a low output and high unemployment. The reason behind this dilemma is also clear: macroeconomic management policies are demand-side policies and they are ill-adapted to deal with supply shocks.

The exchange rate regime

The reaction of underlying inflation is decisive for determining the outcome of the policy response to a supply shock. Underlying inflation tends to increase because of its backward-looking component, but what about the forward-looking component? The answer ultimately hinges on which long-run equilibrium is expected to be reached. If agents believe that policy-makers are aiming at point *D* in Figure 13.14, the forward-looking component is likely to support this policy. If wage negotiators are convinced that inflation will be kept under control, they see the jump to point *B* as strictly temporary and keep underlying inflation at the pre-shock level. Once the shock is over, the aggregate supply curve promptly returns to *AS* and the economy's trajectory will be from *A* to *B* and back to *A*. If, instead, wage negotiators expect an accommodating policy that aims at point *C*, underlying inflation will rise and shift the *AS* curve to *AS′*, even after the shock has passed. The trajectory will be from *A* to *B* and beyond, higher and to the left of *B* along the new *AD′* curve. However, since the output gap is negative, underlying inflation is above actual inflation, so the *AS* curve will eventually shift back towards *AS′*, even though the one-off supply shock is over. The economy winds up at point *C*.

Under flexible exchange rates, it is the central bank that determines the position of the *LAD* line. By their choice of an inflation target, the monetary authority can choose the long-run inflation rate and decide whether point *A* or point *C* will be eventually reached. This is not the case with a fixed exchange rate regime where the position of the *LAD* line depends on the 'foreign' inflation rate. In the presence of a severe supply shock, a fixed exchange rate regime can be maintained only among like-minded countries which have compatible views of how they will react. In Europe, for instance, the oil shocks of the 1970s and 1980s seriously strained the European Monetary System as different countries adopted different strategies. The adoption of a common currency, which floats freely, means that this decision is now in the hands of the European Central Bank (ECB). Even with a common currency, policy disagreements concerning the correct response to inflation remain. Following the rise of oil prices in 2003–2004, and again in 2007–2008, the ECB has been criticized by some governments as being too tight and by others as being too lax. Since the financial crisis, inflation has been subdued and other concerns have become dominant, but the issues regarding the

[20] A supply shock, such as a one-off increase in oil prices, directly affects the price level, not its rate of increase, unless these prices continue to rise. Normally, once they have reached a new higher level, the impact is passed on into higher goods prices. While the level of these prices remains higher, inflation is no longer directly affected by the shock.

management of expectations and credibility will always be waiting in the wings for the next supply shock to arrive.

Lessons from supply shocks

Three general lessons can be drawn. First, an adverse supply shock is bad news. It depresses growth while raising unemployment and inflation at the same time, contradicting the Phillips curve trade-off. Second, traditional demand management policies are not useful for dealing with an adverse supply shock. When the aggregate supply curve moves up and to the left, demand management cannot deal with both inflation and output. Policy-makers must choose between accepting the shock as an increase in inflation or as a drop in output with higher unemployment. The appropriate response should be supply-side policies, aiming at bringing back the aggregate supply curve as soon as possible to its initial position. This is not easy. The best hope is to manage the forward-looking component of underlying inflation and to try to 'disconnect' the backward-looking component. This requires a clear and credible signal from the authorities that they will not accommodate the shock. Third, the exchange rate regime becomes crucial. A fixed exchange rate can be maintained only among countries that adopt the same policy mix.

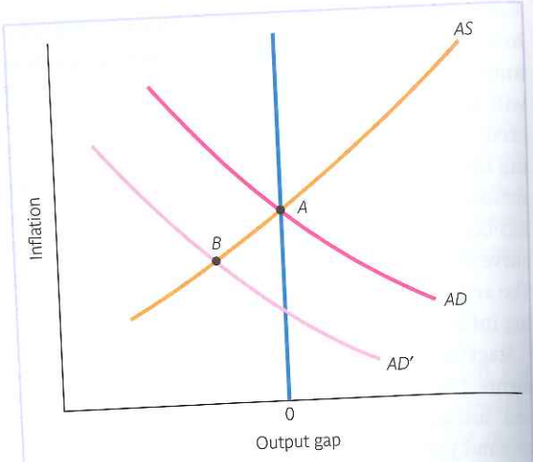

Fig. 13.15 An Adverse Demand Shock

An adverse demand shock is represented by a leftward exogenous shift of the short-run aggregate demand curve. The economy moves from point *A* to point *B*. In principle, the government has instruments at its disposal—monetary or fiscal policy, or both—which could restore the *AD* curve to its original position. This was the standard policy response of the 1960s. While European countries have relied less and less on such policy responses and sat out temporary declines in aggregate demand and output, pressure due to the financial crisis was simply too great, leading to a return to activist policy.

13.4.3 Demand Shocks

In principle, exogenous demand shifts are easier for policy-makers to contend with. Most of these shocks are the direct result of macroeconomic policy actions, fiscal or monetary policy depending on the exchange rate regime. Other examples are exogenous events, like the global financial crisis which began with the bankruptcy of the US investment bank Lehman Brothers, and was followed by a freezing-up of credit markets and a worldwide demand slowdown. Another, earlier example of a positive demand shock was German reunification, the source of an unexpected demand surge in central Europe during the first half of the 1990s.

Figure 13.15 shows the consequence of an adverse demand shock as a leftward exogenous shift of the short-run aggregate demand curve from *AD* to *AD'*. The economy moves from point *A* to point *B*: inflation declines and output falls below its trend level. In principle, the government has the required instruments at its disposal—monetary or fiscal policy, depending on the exchange rate regime—that could restore the *AD* curve to its original position. In the 1960s, this was the standard policy response. Until the global economic crisis (2008–2009), the use of demand policy was remarkably moderate. Many European countries had reacted to the initial oil shocks with accommodating policies—raising target inflation and allowing a temporary increase to become permanent. After a decade dedicated largely to erasing the scars from those oil shocks by bringing down underlying inflation, most countries were reluctant to give up those achievements again. This meant sticking to inflation targets and preventing monetary policy from becoming excessive again.

The global financial crisis and the ensuing recession—the deepest since the Great Depression of the 1930s—changed all that. A sharp, global reduction in aggregate demand prompted all countries to implement short-term stimulus packages. The idea was to replace or at least supplement aggregate demand lost through postponed or cancelled investment projects or reduced private consumption with government consumption. Even if the multiplier is low—as it is for small open economies—many policy-makers saw little alternative than to ramp up purchases of goods and services by governments to keep aggregate demand from collapsing. The benefits and the costs of fixed versus flexible exchange rates became evident as countries faced different and often difficult choices. Box 13.3 compares the situation of Ireland, a

Box 13.3 Ireland v. Iceland: Vulnerable Islands in a Global Financial Tsunami

Iceland and Ireland are small, wealthy, and very open economies which experienced strong real growth in the 1990s and pursued an aggressive course of international financial integration in the late 1990s and early 2000s. Previously backwater banks in the 1980s rose to become star international players in the early 2000s. In the ten years from 1995 to 2005, demand deposits in Iceland—a country of 320,000 people—grew from $6.8 billion to $65.8 billion! In Ireland growth was similar, from $33.1 billion to $163.5 billion. More frequently than not, these bank deposits belonged to foreign households, foreign firms, or foreign financial institutions. Icelandic banks went as far as to open subsidiaries in the UK and in the Netherlands, offering higher interest rates than the local competition; by all appearances, these banks were running Ponzi schemes (see Box 7.6). The banks eventually collapsed and defaulted on the foreign depositors. In the case of Ireland, the banks financed a housing boom, as in the USA. When housing prices started to decline, many borrowers defaulted because the loans now exceeded the value of their houses. The banks were distressed and some had to be taken over by the state.

The financial crisis was accompanied by a sharp decline in credit and plummeting stock prices (Tobin's *q* falling), which led to collapses of investment spending and aggregate demand in both countries. At the same time, the IFM curve shot up because the rest of the world sharply raised the interest rate i^* at which it would lend to these countries (Iceland was even shut off from foreign borrowing). In the *AS–AD* diagram, the *AD* curve shifted sharply to the left. Table 13.2 shows that both countries experienced similar cumulative declines in real GDP (in Iceland, about 10.4% over 2009–2010; in Ireland, 12.1% in the period 2008–2010). Unemployment skyrocketed and government budget deficits swelled to double-digit percentages of GDP as tax revenues fell in line with incomes.

Despite the remarkable similarity in the nature of the demand shock hitting the two economies, the reaction could not have been more different, highlighting fundamental differences between fixed and flexible exchange rate regimes. Ireland, a member of the Eurozone, had no monetary policy option and had little choice but to bite the bullet. Just as the *IS–TR–IFM* model predicts, the demand shock hit GDP hard. Second, Ireland had to experience a deflation (falling prices) to adjust to the shock. Initially, fiscal policy was active; the government nationalized and recapitalized one bank after the next, and managed to increase government purchases as well, before engaging in massive budget cuts in 2009–2010 in order to stabilize the public debt. The overall adjustment process was considerably quicker in Iceland, which had freedom to depreciate the currency—from 2007 to 2009 the dollar value of the krona dropped by 50%. Predictably, the recession was over more quickly in Iceland, and its current account, while swinging more wildly than in Ireland, contributed more decisively to the Icelandic recovery. The dark cloud hanging over Iceland is not the ash cloud of it infamous volcanic eruptions, but rather the burst of inflation, which was a necessary side-effect of the devaluation—increasing to over 12% for two years before returning to the 2–3% range. Some economists claim this is a small price to pay for escaping a greater recession. Others see the episode as a blemish on the credibility of the Icelandic economy for years to come.

Table 13.2 Iceland and Ireland: Key Economic Indicators, 2004–2011

		2004	2005	2006	2007	2008	2009	2010	2011
Real growth	*Iceland*	7.7	7.5	4.6	6.0	1.4	–6.9	–3.5	2.3
	Ireland	4.6	6.0	5.3	5.6	–3.5	–7.6	–1.0	0.5
Unemployment rate (% of l.f.)	*Iceland*	3.1	2.1	1.3	1.0	1.6	8.0	8.1	7.5
	Ireland	4.5	4.4	4.4	4.6	6.3	11.8	13.6	14.5
Inflation (CPI)	*Iceland*	3.2	4.0	6.8	5.0	12.4	12.0	5.4	2.6
	Ireland	2.3	2.2	2.7	2.9	3.1	–1.7	–1.6	0.5
Dollar exchange rate (2007 = 100)	*Iceland*	91.3	101.7	91.3	100.0	72.8	51.8	52.4	54.5
	Ireland	90.7	90.9	91.6	100.0	107.4	101.6	96.8	99.9
Investment (% of GDP)	*Iceland*	23.4	28.3	35.2	29.0	24.8	14.2	12.7	14.6
	Ireland	24.7	27.2	28.0	27.3	22.3	14.1	10.8	11.0
Current account (% of GDP)	*Iceland*	–9.8	–16.1	–25.7	–15.7	–28.3	–10.4	–8.0	1.1
	Ireland	–0.6	–3.5	–3.6	–5.3	–5.7	–3.0	–0.7	0.2

member of the Eurozone, with Iceland, which had its own currency and floating exchange rates during the crisis.

13.4.4 Disinflation

An important policy question faced by many developing countries is how to deal with a high rate of inflation already long in place. We know that high and persistent inflation is the consequence of excessive monetary growth that the central bank has chosen or been forced to choose. The cure must be to slow down money growth, meaning to aggressively implement a lower target inflation rate. Again, how a policy of **disinflation**—a successful reduction in the rate of inflation—is ultimately implemented depends on the exchange rate regime.

Under flexible exchange rates, the central bank can choose its inflation rate target, so the solution to high inflation is technically simple, but often very painful. Figure 13.16 shows why. We start from point *A*, which we take to be a long-run equilibrium. Thus we assume that the high inflation rate is indeed the central bank's target—we are on some original *LAD* line which is not drawn—and that actual and underlying inflation are equal—we are on the *LAS* line. If the central bank exogenously reduces the target inflation rate well below the current rate of inflation, the *LAD* curve shifts downward by the reduction of target inflation to *LAD′*. As a consequence it must drastically raise nominal interest rates in the short run.[21] In the *TR–IFM* model (not shown), the *TR* curve shifts to the left, the nominal and real exchange rates appreciate, the current account worsens, and demand declines. This is captured by the leftward shift of the short-run aggregate demand curve from *AD* to *AD′*. The short-run effect of this disinflationary policy corresponds to point *B*: inflation declines but so does output, and unemployment rises. At point *B* actual inflation is below underlying inflation so the latter will be revised downwards and, over time, the short-run aggregate supply curve will shift downwards until it reaches the position *AS′*. At point *C* a new long-run equilibrium is reached and the disinflation is complete. The cost has been a period of negative output gap and high unemployment, which may extend over several years as noted in Section 13.4.1.

[21] To see this, consider the Taylor rule again and observe that a decrease in $\bar{\pi}$, holding all other things constant, implies an *increase* in the nominal interest rate.

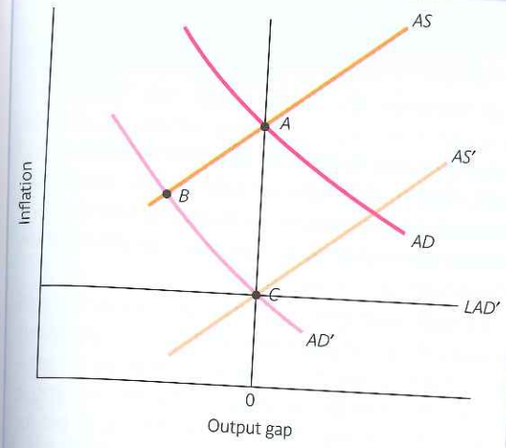

Fig. 13.16 Disinflation

Disinflation moves the economy from point *A* to point *C*. Using demand-side policies implies the use of contractionary monetary or fiscal policies which move the aggregate demand curve from *AD* to *AD′* and the *LAD* curve to *LAD′*. The short-run equilibrium at point *B* explains why disinflation is usually painful: it requires a period of low output and high unemployment. Long-run equilibrium is achieved at point *C* when the short-run aggregate supply curve has shifted to *AS′*. The speed of this shift depends on the time required by underlying inflation to catch up with lower actual inflation.

Under a fixed and adjustable exchange rate regime, high and lasting inflation is only possible if the exchange rate is regularly depreciated, as explained in Section 13.2. Bringing inflation down requires a change in monetary policy. If the fixed exchange rate regime is to be retained, this means doing away with chronic depreciations. In that case, we know that the *LAD* line is set by the foreign inflation rate, so it is essential to peg the exchange rate to the currency of a country where inflation is suitably low. The peg becomes the anchor that will deliver disinflation. Initially, inflation is higher at home than abroad. If inflation moves slowly, fixing the nominal exchange rate means that the real exchange rate appreciates as long as domestic exceeds foreign inflation. In the *IS–IMF* model (not shown), the *IS* curve shifts to the left. The resulting decline in aggregate demand is represented by the leftward shift of the short-run aggregate demand curve from *AD* to *AD′* in Figure 13.16. Then the logic is the same as under the flexible exchange rate regime. Underlying inflation must decline in light of lower realized inflation rates and the economy will eventually settle at point *C* on the long-run aggregate demand *LAD′*, which corresponds to the lower foreign inflation rate. Here disinflation also requires a period of negative output gap and high unemployment.

The interesting questions are: how long does it take to move from point *B* to point *C* in Figure 13.16? And how much output is lost along the way? The **output cost of disinflation** is lower the faster the *AS* curve comes down. That, in turn, depends on the speed at which underlying inflation adapts to a declining inflation rate. The backward component slows down the speed at which the *AS* curve shifts, while the forward-looking component accelerates the adjustment. In periods of disinflation, therefore, it would be helpful to give more weight to the forward-looking component, possibly even shutting down the backward-looking component. The backward-looking component depends on wage- and price-setting institutions, an issue examined in Box 13.4. The forward-looking component is often referred to as the 'psychological' nature of price- and wage-setting, but it can be influenced by policy institutions.

Wage negotiators may have different incentives when formulating their expectations. It is good bargaining tactics for workers to argue that inflation is high, while employers tend to predict declines in the rate of inflation. Jointly, however, employers and employees have an incentive to be as close as possible to target, for errors may be costly in terms of competitiveness and profitability. As they aim at disinflation, policy-makers have a strong interest in convincing wage negotiators that inflation will surely decline, since this will accelerate the downward movement of the *AS* curve. One solution is to credibly use the exchange rate as an anchor. To do so, the authorities must demonstrate that they will not let the exchange rate depreciate again. This is why a number of countries have adopted **hard pegs**, a variety of fixed exchange rate arrangements that

Box 13.4 Wage Negotiations: The Time Dimension

In most European countries and in the USA, wage negotiations are *staggered* over a year or more. One wage negotiation takes the previous one into account, and may even anticipate the next one. Employees do not want to be out-done by their colleagues, and employers do not want the competition to undercut their labour costs. In contrast, in Japan wage negotiations are *synchronized*. They take place every year at roughly the same time, the so-called 'spring offensive' (*shunto*). Each industry opens up bargaining, but closely monitors the state of play elsewhere. When one bargain is struck, it sets the trend and all the others follow quickly. For a time, wage negotiations in Northern Europe were centralized and therefore highly synchronized. Even when they are staggered, some negotiations are *trend-setting*: they result in similar agreements later on and sometimes even trigger readjustments to previously reached ones, thus injecting a dose of synchronization. With wage staggering, aggregate nominal wages (the average of all nominal wages) move slowly, which retards the return to equilibrium unemployment. The *AS* curve will appear flatter. With full synchronization, average nominal wages are stable between negotiations, and then jump. This implies a steeper *AS* curve. The implications for the economy are profound. Either a quick return to the equilibrium unemployment rate if the real wages are set right, or a prolonged departure if they are set incorrectly.

The situation is different in economies where inflation is high and has been so for a long time. There it is common to have mandatory or mutually agreed indexation schemes for wages. Brazil was particularly advanced in this regard, indexing virtually *all* nominal prices, including house rents, corporate balance sheets, taxes, and public utilities rates. Such indexation schemes can often reduce the staggering considerably, with the same effect as an increase in synchronization of wage-setting.

Although wage indexation removes some of the costs of high inflation to households and firms, it has serious adverse side-effects. First, indexation generally perpetuates any real wage gain achieved. This gives an incentive to any group of wage-earners to be the first to bid for higher wages. The result is that all groups rush to be first, as much to protect themselves as to achieve a head start. Second, indexation reduces both public and government support for anti-inflation policies. This is why Germany, after its famous hyperinflation in the 1920s, made indexation illegal. Third, indexation makes disinflation costlier in terms of unemployment. When inflation is on the way up, nominal wages trail behind prices: real wages are reduced and labour demand is robust. When inflation is on the way down, wages indexed on past inflation trail actual inflation: real wages rise, firms' profits are squeezed, and unemployment rises. This is why most European countries with legal or simply widespread indexation clauses eliminated them in the 1980s, much against the will of trade unions. Fourth, indexation eliminates downward real wage flexibility as real wages are at least constant unless there is a sharp burst of inflation. The lack of flexibility is a source of unemployment when an adverse supply shock occurs.

makes it politically costly or even illegal to devalue.[22] If the exchange rate is not fixed, it is the credibility of the central bank as an inflation-fighter that becomes crucial. This is why a number of countries have given formal independence to their central banks, instructing them to aim at price stability. Many independent central banks have adopted the **inflation-targeting strategy** as already described, publicly announcing the inflation rate they intend to achieve and explicitly and publicly linking their actions to the target, and staking their credibility on their success in achieving the target.

[22] This is the strategy adopted, for example, by Argentina in 2001 and by Bulgaria in 1997. In both cases, it worked, although Argentina's arrangement collapsed in 2001, for other reasons. By then, however, inflation had turned negative!

Summary

1 The macroeconomy is analysed as the interplay of aggregate demand and aggregate supply. This framework emphasizes the distinction between the short run and the long run, when output returns to its trend growth path.

2 Under fixed exchange rates, inflation is restricted to be equal to foreign inflation in the long run. Under flexible rates, long-run inflation is determined by the target inflation rate.

3 The short-run aggregate demand curve is downward-sloping. Under fixed exchange rates, an increase in inflation above the foreign rate erodes external competitiveness and reduces demand for domestic goods. Under flexible exchange rates, an increase in the inflation rate relative to the central bank's inflation target prompts an increase in the interest rate. This in turn results in a nominal and real exchange appreciation with a contractionary effect on aggregate demand.

4 Only in the flexible rate regime can the monetary authority determine the long-run inflation rate. Under fixed exchange rates, some monetary independence is possible, but only by repeated devaluations or revaluations.

5 Under fixed exchange rates, fiscal policy can affect aggregate demand and output. The effects of a fiscal policy action are temporary, however. The change in spending or cut in taxes which leads to the shift in the *AD* curve cannot be sustained indefinitely. In the long run, the government's budget constraint prevents a permanently expansionary fiscal policy.

6 A fiscal expansion initially raises the output level at the cost of a higher rate of inflation. Over time, as underlying inflation rises and the unavoidable retrenchment of fiscal policy occurs, demand returns to trend output.

7 Under fixed exchange rates monetary policy is ineffective. This is also the case for fiscal policy under flexible exchange rates.

8 Under flexible exchange rates, a monetary policy expansion—the consequence of an increase in the central bank's target inflation—initially raises output and inflation. Over time, inflation continues to increase, ultimately sowing the seeds of the next recession, as the central bank is forced to raise interest rates and return output back to its trend growth path.

9 An adverse supply shock simultaneously lowers output and raises inflation. Demand management policies are ill-equipped to deal with a supply shock. They may cushion the fall in income at the cost of more inflation, or reduce the inflationary impact at the cost of a deeper fall in output and more unemployment.

10 Disinflation requires a permanent reduction in the target inflation rate when the exchange rate is floating or sticking to the peg under a fixed exchange rate regime. It can be costly in terms of lost output and above-equilibrium unemployment.

11 The faster underlying inflation adjusts, the lower the costs of disinflation. This calls for adopting credible institutions that can convince wage negotiators that the disinflation policy is 'serious'.

Key Concepts

- purchasing power parity (PPP)
- LAD line
- short-run versus long-run equilibrium
- aggregate demand curve
- demand shock, demand disturbance
- stagflation

Box 13.4 Wage Negotiations: The Time Dimension

In most European countries and in the USA, wage negotiations are *staggered* over a year or more. One wage negotiation takes the previous one into account, and may even anticipate the next one. Employees do not want to be out-done by their colleagues, and employers do not want the competition to undercut their labour costs. In contrast, in Japan wage negotiations are *synchronized*. They take place every year at roughly the same time, the so-called 'spring offensive' (*shunto*). Each industry opens up bargaining, but closely monitors the state of play elsewhere. When one bargain is struck, it sets the trend and all the others follow quickly. For a time, wage negotiations in Northern Europe were centralized and therefore highly synchronized. Even when they are staggered, some negotiations are *trend-setting*: they result in similar agreements later on and sometimes even trigger readjustments to previously reached ones, thus injecting a dose of synchronization. With wage staggering, aggregate nominal wages (the average of all nominal wages) move slowly, which retards the return to equilibrium unemployment. The *AS* curve will appear flatter. With full synchronization, average nominal wages are stable between negotiations, and then jump. This implies a steeper *AS* curve. The implications for the economy are profound. Either a quick return to the equilibrium unemployment rate if the real wages are set right, or a prolonged departure if they are set incorrectly.

The situation is different in economies where inflation is high and has been so for a long time. There it is common to have mandatory or mutually agreed indexation schemes for wages. Brazil was particularly advanced in this regard, indexing virtually *all* nominal prices, including house rents, corporate balance sheets, taxes, and public utilities rates. Such indexation schemes can often reduce the staggering considerably, with the same effect as an increase in synchronization of wage-setting.

Although wage indexation removes some of the costs of high inflation to households and firms, it has serious adverse side-effects. First, indexation generally perpetuates any real wage gain achieved. This gives an incentive to any group of wage-earners to be the first to bid for higher wages. The result is that all groups rush to be first, as much to protect themselves as to achieve a head start. Second, indexation reduces both public and government support for anti-inflation policies. This is why Germany, after its famous hyperinflation in the 1920s, made indexation illegal. Third, indexation makes disinflation costlier in terms of unemployment. When inflation is on the way up, nominal wages trail behind prices: real wages are reduced and labour demand is robust. When inflation is on the way down, wages indexed on past inflation trail actual inflation: real wages rise, firms' profits are squeezed, and unemployment rises. This is why most European countries with legal or simply widespread indexation clauses eliminated them in the 1980s, much against the will of trade unions. Fourth, indexation eliminates downward real wage flexibility as real wages are at least constant unless there is a sharp burst of inflation. The lack of flexibility is a source of unemployment when an adverse supply shock occurs.

makes it politically costly or even illegal to devalue.[22] If the exchange rate is not fixed, it is the credibility of the central bank as an inflation-fighter that becomes crucial. This is why a number of countries have given formal independence to their central banks, instructing them to aim at price stability. Many independent central banks have adopted the **inflation-targeting strategy** as already described, publicly announcing the inflation rate they intend to achieve and explicitly and publicly linking their actions to the target, and staking their credibility on their success in achieving the target.

[22] This is the strategy adopted, for example, by Argentina in 2001 and by Bulgaria in 1997. In both cases, it worked, although Argentina's arrangement collapsed in 2001, for other reasons. By then, however, inflation had turned negative!

Summary

1 The macroeconomy is analysed as the interplay of aggregate demand and aggregate supply. This framework emphasizes the distinction between the short run and the long run, when output returns to its trend growth path.

2 Under fixed exchange rates, inflation is restricted to be equal to foreign inflation in the long run. Under flexible rates, long-run inflation is determined by the target inflation rate.

3 The short-run aggregate demand curve is downward-sloping. Under fixed exchange rates, an increase in inflation above the foreign rate erodes external competitiveness and reduces demand for domestic goods. Under flexible exchange rates, an increase in the inflation rate relative to the central bank's inflation target prompts an increase in the interest rate. This in turn results in a nominal and real exchange appreciation with a contractionary effect on aggregate demand.

4 Only in the flexible rate regime can the monetary authority determine the long-run inflation rate. Under fixed exchange rates, some monetary independence is possible, but only by repeated devaluations or revaluations.

5 Under fixed exchange rates, fiscal policy can affect aggregate demand and output. The effects of a fiscal policy action are temporary, however. The change in spending or cut in taxes which leads to the shift in the *AD* curve cannot be sustained indefinitely. In the long run, the government's budget constraint prevents a permanently expansionary fiscal policy.

6 A fiscal expansion initially raises the output level at the cost of a higher rate of inflation. Over time, as underlying inflation rises and the unavoidable retrenchment of fiscal policy occurs, demand returns to trend output.

7 Under fixed exchange rates monetary policy is ineffective. This is also the case for fiscal policy under flexible exchange rates.

8 Under flexible exchange rates, a monetary policy expansion—the consequence of an increase in the central bank's target inflation—initially raises output and inflation. Over time, inflation continues to increase, ultimately sowing the seeds of the next recession, as the central bank is forced to raise interest rates and return output back to its trend growth path.

9 An adverse supply shock simultaneously lowers output and raises inflation. Demand management policies are ill-equipped to deal with a supply shock. They may cushion the fall in income at the cost of more inflation, or reduce the inflationary impact at the cost of a deeper fall in output and more unemployment.

10 Disinflation requires a permanent reduction in the target inflation rate when the exchange rate is floating or sticking to the peg under a fixed exchange rate regime. It can be costly in terms of lost output and above-equilibrium unemployment.

11 The faster underlying inflation adjusts, the lower the costs of disinflation. This calls for adopting credible institutions that can convince wage negotiators that the disinflation policy is 'serious'.

Key Concepts

- purchasing power parity (PPP)
- LAD line
- short-run versus long-run equilibrium
- aggregate demand curve
- demand shock, demand disturbance
- stagflation