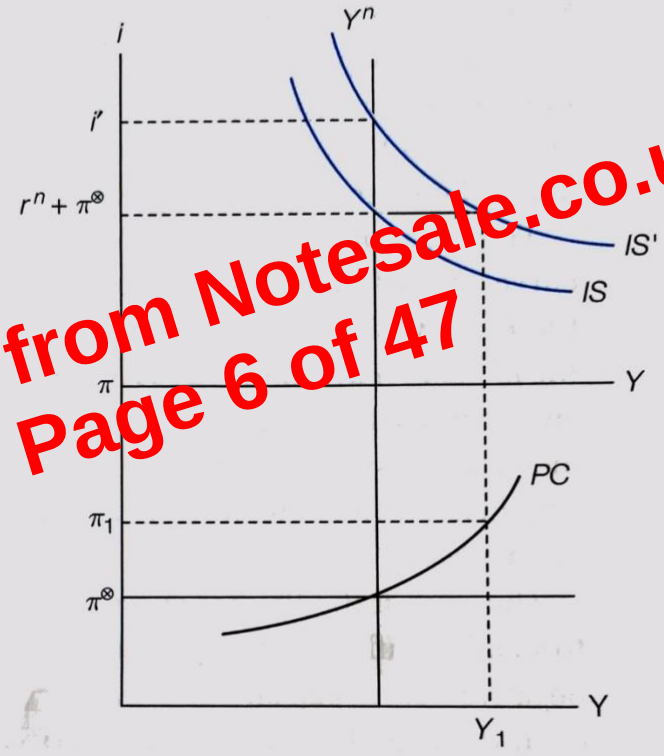
A demand shock:

Suppose that consumers become more optimistic about the future, so expected future income, Y^e, increases. We assume that expected inflation does not change but remains equal to the inflation target. When consumers become more optimistic, they consume more, so aggregate demand increases. The IS curve shifts out; if the interest rate is kept unchanged, production will increase and inflation will increase. In order to stabilize production and inflation, the central bank should counteract the aggregate demand shock by increasing the interest rate. In this way it prevents inflationary pressure from building up.

The nominal interest rate is higher in the new equilibrium, and so is the real interest rate for given inflation expectations. This is consistent with analysis in Chapter 4. There we found that an exogenous increase in consumption raises the natural rate of interest. In this case the central bank's action can be described as follows: *In order to stabilize inflation and production, the central bank should adjust the nominal interest rate so as to keep the real interest rate equal to the natural rate of interest.*

Fig. 10.2 *A real demand shock*



A cost-push shock:

Suppose, instead, that there is an unexpected cost-push shock in the form of an increase in the price of oil. Let us assume that this shock is perceived as a permanent, one-off occurrence. The cost-push shock shifts the Philips Curve upward so inflation will be higher for a given output gap. It is less clear how the IS curve may be affected; if oil is imported, the IS curve may shift inward because an increase in the world price of oil makes the oil-importing country poorer. If oil is produced in the country, the oil price increase redistributes income, so the effect on aggregate demand is less clear. For simplicity, we assume that the natural level of production and the IS curve remain unchanged.

production at an interest rate equal to the natural rate plus the inflation target, and the PC intersects the vertical line showing the natural level of production at the rate of inflation. In response to an increase in the expected level of inflation the central bank must raise rates but it faces a dilemma; increasing the interest rate to $r^n + \pi^e$ will bring production back to the natural level but leave inflation running at π^e which is above target however raising rates to i_1, the level required to return inflation to target, will create a large negative output gap. Although price stability is the primary objective it is still undesirable to create such a large negative output gap as production stability is also important. The likely result is that the central bank will adopt a rate somewhere inbetween these two levels in order to re-establish the credibility of its inflation target while at the same time preventing the creation of an excessively large negative output gap.

As we see here, the increase in the interest rate must be more than the nominal inflation rate if it is to be effective in returning inflation to target. This is because an increase in *real* interest rates is required to create the negative output gap. This principle is known as the Taylor Principle.

The Taylor Rule

In 1993, the American economist John Taylor shows that US monetary policy in the period 1982-1991 could be described reasonably well by following the simple decision rule:

$$i = \bar{r} + \pi + 0.5(\pi - \pi^{\otimes}) + 0.5\hat{Y}$$

Here $\bar{r}$ is an estimate of the normal real rate of interest and $\pi^{\otimes}$ is the inflation target of the central bank. If we assume that expected inflation is equal to observed inflation, the implication is that the expected real rate is equal to:

$$r = i - \pi = \bar{r} + 0.5(\pi - \pi^{\otimes}) + 0.5\hat{Y}$$

The real interest rate is higher if inflation is above target. Taylor assumed that the normal real interest rate and the inflation target were both 2%, leading to the decision rule:

$$i = 0.02 + \pi + 0.5\,(\pi - 0.02) + 0.5\hat{Y} = 0.01 + 1.5\pi + 0.5\hat{Y}$$

The importance of the Taylor Rule is to show that a central bank must respond strongly to deviations in expected inflation if it is to achieve its goal of stabilising the price level. It also shows how nominal rates must rise a level greater than one to one with inflation in order to create the increase in real interest rates required to bring about a negative output gap and lower aggregate demand.

Rational Expectations

We argue that rational individuals should form expectations in a way that is consistent with how inflation is actually determined. This means that expectations will depend on how policy is actually conducted. Such *model-consistent expectations* were originally proposed by American economist John Muth in 1961 and he called them *rational expectations*.

The macroeconomic implications of rational expectations were formulated in the 1970s. The key policy conclusion that they derived was that, although monetary policy may be able to raise aggregate demand and employment in a particular period, any attempt to affect production by a systematic, and therefore predictable, monetary policy will be fruitless. The reason is that any predictable monetary policy will affect inflation expectations and hence it will be incorporated into wage and price setting. Only unpredictable monetary policy can affect the real economy. This may seem like bad news for

within the economy and where taxes and income are kept at a constant level relative to income. Furthermore, expected future changes should be taken into account when evaluating the sustainability of government finances and to evaluate the long-term sustainability of public finances projections must be made for what future expenditures will be on things such as health and pensions. Knowing that growth isn't constant we often consider the *cyclically adjusted budget balance* and the government's net financial liabilities when evaluating the long-term sustainability of public finances.

To stabilise the debt-to-GDP ratio in the long run, it must be that:

$$\frac{T}{Y} = \frac{G}{Y} + \frac{(r-g)D}{Y}$$

Fiscal policy in the short run:

When we include the government in our model of aggregate demand, production is given by:

$$Y = C + I + G$$

Where C represents private consumption, I represents private investment and G is government expenditure on goods and services - that is, government consumption and investment. We also have to modify our model; households pay taxes and receive interest payments from the government which will alter their disposable income. Real disposable income is:

$$Y^d = Y - T + rD$$

T represents the taxes that households pay to the government minus government transfers from the government to households. At the moment we will assume that there is no government debt to simplify the equation. We must also modify the consumption function derived in Chapter 4 to account for taxation:

$$C = C(Y - T,\ Y^e - T^e,\ i - \pi^e,\ A)$$

T^e is the expected future level of taxation. In line with our analysis of monetary policy in Chapter 10, we assume that the central bank sets the interest rate. In the short run, production is determined by aggregate demand:

$$Y = C(Y - T,\ Y^e - T^e,\ i - \pi^e,\ A) + I(i - \pi^e,\ Y^e,\ K) + G$$

To include a simple tax system in our model we assume that the government taxes all income at the rate τ and at the same time it hands out a lump sum transfer *Tr* to households. Then, real tax revenue minus transfers is determined by:

$$T = \tau Y - Tr$$

Now we can calculate the short-run effect on production of an increase in government expenditure on goods and services as:

$$\Delta Y = \frac{1}{(1 - a_1 + a_1\tau)}\Delta G$$

Increased government expenditure on goods and services raises aggregate demand and leads to higher production. As production increases, incomes increases, and this leads to further increases in

- This figure strips out the effect of automatic stabilisers.
- It is the deficit a country would have had, had its output gap been zero.
- Assume that GDP is 4% below the potential level and the deficit is 8% of GDP. Had GDP been 4% higher, the deficit would have been 2% smaller (0.5x4) that is, 6% of GDP.
- In practice it is hard to calculate the structural budget deficit when we do not know the natural production level.

Do governments stabilise the real economy? By running large deficits during recessions the government can help to stabilise the economy but by running small deficits during expansionary periods the government could also have a destabilising effect (it should be running a surplus to prevent the economy from overheating and also to pay off the debt from previous recessions). Provided that we do not have perfect Ricardian Equivalence, governments should have a stabilising effect on average. This is because the stabilising effect in a recession should be greater than the destabilising effects during the expansionary periods. The overall effect of fiscal policy on output depends largely on the response of monetary policy. If the Central Bank raises interest rates, crowding out is possible. However, during recessions, both expansionary fiscal and monetary policy can increase aggregate demand.

Economic policy and the ZLB

Suppose a very large negative demand shock hits the economy. The central bank decreases the nominal interest rate until it reaches the zero lower bound. However, this might still not stimulate demand sufficiently. Expansionary fiscal policy can fill the void and increase aggregate demand further and allow interest rates to escape from the ZLB.

If interest rates are at the ZLB and the central bank uses QE, this indicates that the central bank would like to cut rates even further - this means that rates will stay low for a long time and the chances of crowding out are greatly reduced. Thus, fiscal policy can close the gap in aggregate demand without the risk of a rise in the nominal interest rates. Moreover, new research shows that the spending multiplier is far higher during recessions, perhaps this is due to a higher marginal propensity to consume during these periods. Since Ricardian equivalence decreases multipliers, the further away we are from a Ricardian Equivalence the larger the multipliers. This suggests that during recessions Ricardian Equivalence is less likely to hold this is perhaps due to the assumptions we made about the availability of credit, the lack of liquidity during recessions limits the ability of the private sector to save. Also during recessions, the spread between borrowing costs for governments and for households are larger. This means that the government's spending will have a greater effect on the economy. The high levels of unemployment that accompany a recession also make recruiting new workers easier without significantly inflated wages.

Due to policy lags, conventional monetary policy is the preferable interest rate for stabilising the economy during normal times. Automatic stabilisers are by design less affected by policy lags and thus are also important instruments for stabilising the economy during economic downturns. If conventional monetary policy is constrained, i.e. approaching the ZLB, discretionary fiscal policy becomes very important - think about public work schemes. This applies not only when the interest rate is approaching the ZLB but also when interest rates cannot effect the real economy in the desired way. Where a common currency such as the Euro is used, one member may be in recession while the rest are growing strongly. In such a scenario lowering interest rates would not be in the bloc's interests so the member in recession would be forced to compensate through expansionary fiscal policy.

When interest rates are near the ZLB, fiscal austerity can prolong and deepen recessions and therefore a policy of gradual reduction by running no/small budget deficits may be preferable. However if

In the long run equilibrium we assume that the expected change in the exchange rate is equal to the actual change: $\frac{\Delta e^e}{e} = \frac{\Delta e}{e}$. So we can substitute this into the interest parity condition to give:

$$i + \pi^* - \pi = i^*$$

$$i - \pi = i^* - \pi^*$$

The LHS of this equation gives the real interest rate in the SOE and on the RHS we have the real interest rate in the ROW. We see that the real interest rate in the open economy must be the same as in the ROW:

$$r = r^*$$

Contrary to the situation in a closed economy, in an SOE the real interest rate is independent of savings and investment and is instead reliant upon world interest rate. If savings are less than investment then the residual is borrowed from abroad.

The current account and the real exchange rate:

In Chapter 4, we showed that the real interest rate adjusted in the long run so as to bring equality between aggregate demand and the natural level of production. As we have just seen, the long run level of the real interest rate is now determined by the world financial markets and is thus independent of domestic supply and demand.

In order to produce equity between supply and demand we must now look to another relative price that affects aggregate demand, the real exchange rate. The natural level of production is determined by the production function and available resources, in the same way as in the closed economy:

$$Y^n = F(K, L(1 - u^n))$$

Aggregate demand in the open economy is given by the IS eqaution derived in Chapter 12:

$$Y = C\left(Y^d,\ Y^e - T^e,\ r,\ A\right) + I\ (r,\ Y^e,\ K) + G + NX(\varepsilon,\ Y^*, Y)$$

Where $Y^d = Y^n - T + r^*(D + F)$

Since the real interest rate cannot adjust to keep production at the natural level, the real exchange rate must adjust instead. So what determines the real exchange rate?

Note that production that is not used for consumption and investment at home must be exported. For production to be at the natural level, $Y = Y^n$, we must have:

$$NX(\varepsilon,\ Y^*, Y) = Y^n - \ C\left(Y^d,\ Y^e - T^e,\ r,\ A\right) - I\ (r,\ Y^e,\ K)$$

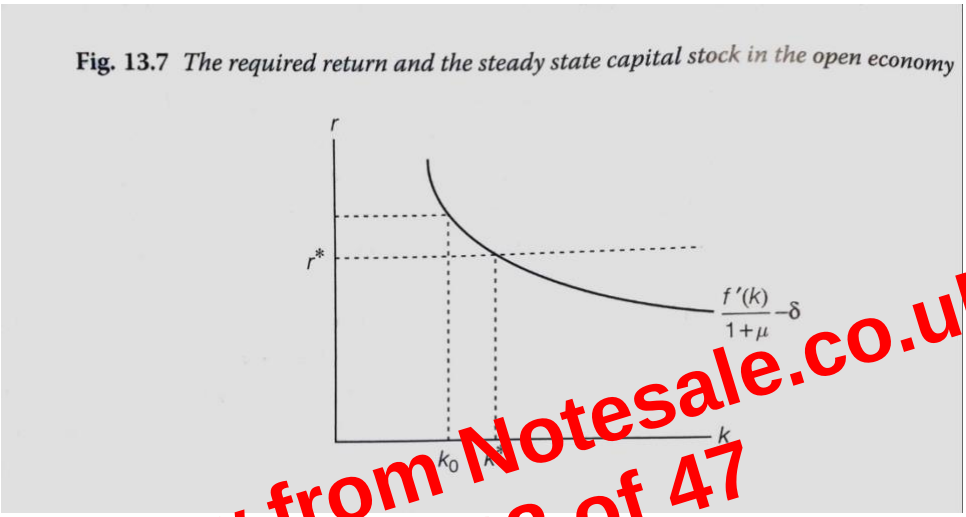
Fig. 13.2 illustrates the determination of net exports. In a closed economy, the real interest rate would be r^a, the *autarky* interest rate. If the world real interest rate is higher than this, production exceeds domestic demand and the residual must be exported.

When firms can finance their investments with foreign capital then the required return is determined by the international capital market. Hence firms will invest until the net MRP of capital, minus depreciation, equals the world real interest rate. Thus the steady state capital stock per effective worker is determined by:

$$\frac{f'(k^*)}{1+\mu} - \delta = r^*$$

Where $k = \frac{K}{EN}$. This condition determines the long run capital stock per effective worker. Given this capital stock per effective worker, production is determined by the production function:

$$Y = Y^n = F(K, EN^n) = F\left(\frac{K}{EN^n}, 1\right)EN^n = f(k^*)EN^n.$$



The long run adjustment of the capital stock is illustrated in Fig 13.7. If the capital stock is initially lower than k^*, the marginal return of capital is high, and firms will invest until the capital stock reaches this point. If domestic savings are not sufficient to finance the desired investment, firms will borrow from foreign households to finace the investment until the capital stock reaches the optimal level. During this period the country may run a current account deficit.

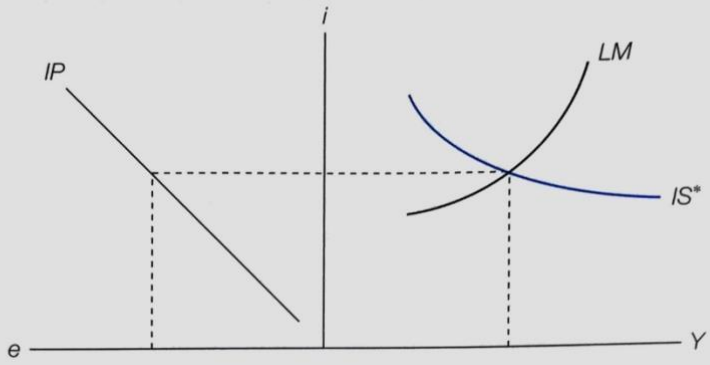
In theory this means that any country should be able to develop quickly and immediately obtain the necessary capital to be as productive as a developed nation. However other factors such as human capital that complement the physical capital may be missing and this slows down the process. If the national institutions of the country are poor then the this will slow the process as well as the marginal returns on capital are not as high. It is also important to remember that global financial markets are not totally integrated and that small firms cannot simply borrow from foreign banks.

The current account and the long run level of foreign debt:

National income is affected by primary income from abroad, which is for now defined as net interest payments from foreign households. This income will therefore depend on the relative size of the stock of foreign loans that are held and those which are owed. Therefore to understand how the long run level of national income is determined we need to determine the long run level of net foreign debt.

Consider an economy that is in equilibrium, the current account is balanced and the nation has some claim on foreign households', F. Let us assume that the consuemr's subjective rate of discount is equal

Fig. 14.2 *The Mundell–Fleming model*

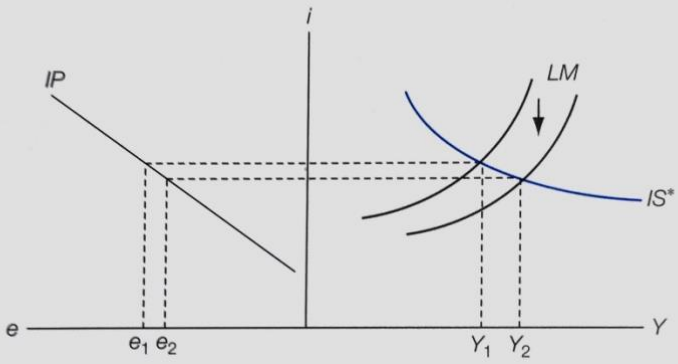


Monetary policy with a floating exchange rate:

Consider an increase in the money supply.

1. LM shifts down because the interest rate will be lower in the money market for a given level of production.
2. As we see in Fig. 14.3, the interest rate falls, production increases, and the currency depreciates.
3. The central bank buys bonds, or lends to banks, so as to increase the money supply and reduce the interest rate. This stimulates consumption and investment and the reduction in the interest rate also makes it less attractive to hold domestic currency. The depreciating currency stimulates exports and therefore aggregate demand and production increase and a multiplier effect is generated.
4. The effect on net exports is ambiguous because the increase in aggregate demand will stimulate demand for imports and reduce the impact of the multiplier.

Fig. 14.3 *The effect of an increase in the money supply in the Mundell–Fleming model*



Fiscal policy with a constant money supply:

Consider an increase in government expenditure.

1. The IS^* curve shifts to the right because higher government expenditure increases demand for a given interest rate.