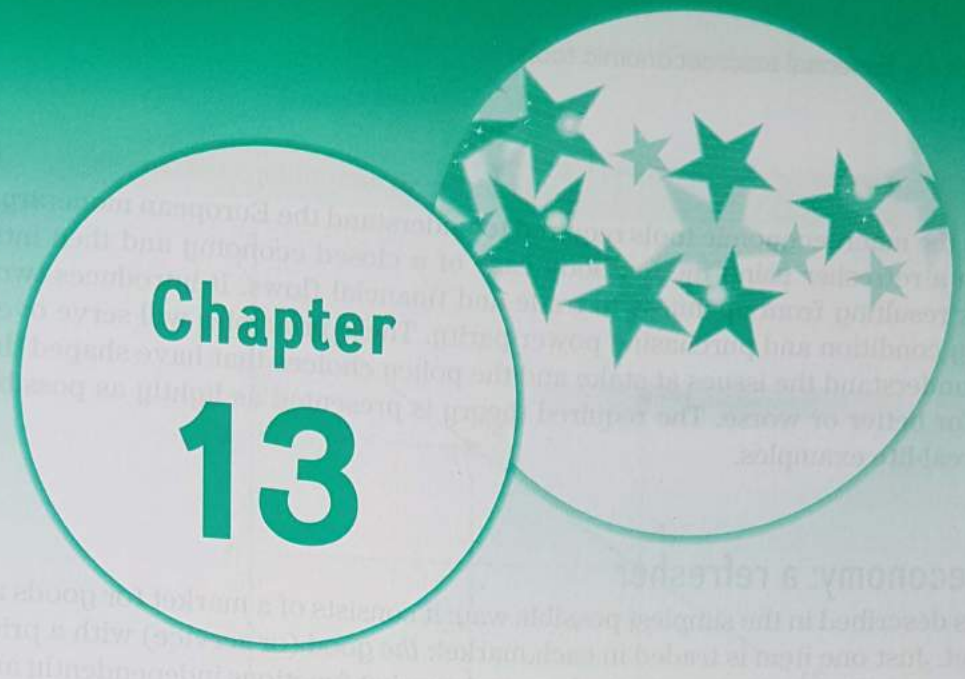
Part

IV

The Macroeconomics of Monetary Integration



Chapter

13

Essential macroeconomic tools

Chapter Contents

Introduction

This chapter provides the macroeconomic tools required to understand the European monetary integration process. It starts with a refresher using the textbook case of a closed economy and then introduces the all-important changes resulting from openness to trade and financial flows. It introduces two principles: the interest rate parity condition and purchasing power parity. These principles will serve over and again to help the reader to understand the issues at stake and the policy choices that have shaped the monetary integration process, for better or worse. The required theory is presented as lightly as possible and each step is illustrated by real-life examples.

13.1 The closed economy: a refresher

The macroeconomy is described in the simplest possible way: it consists of a market for goods and services and a financial market. Just one item is traded in each market: *the* good (or service) with a price P and *the* bond with an interest rate i. The goal is to examine how each market functions independently and how both markets interact. We thus study how each market achieves equilibrium on its own – this is called partial equilibrium – and then we ask how both markets simultaneously reach equilibrium – this is called general equilibrium. We start with the case of a closed economy, which does not trade in goods and services with the rest of the world and which is also financially isolated.

13.1.1 The goods market and the role of fiscal policy

All the country's firms produce a total quantity Y of *the* good. This is in contrast with previous chapters, which are about microeconomics and look at specific individual goods or industries (groups of similar goods). Here and in subsequent chapters, *the* good is the country's gross domestic product (GDP). We just group every thing that is produced (goods, services, both private and public) in one single good, disregarding the microeconomic details. Demand for this good originates from three categories of customers: households, which consume a quantity C; firms, which invest in a quantity I of the good for production purposes – think of the good being used as machinery; and the government, which purchases a quantity of G for its own needs. The good market equilibrium occurs when demand $C + I + G$ is equal to supply Y:

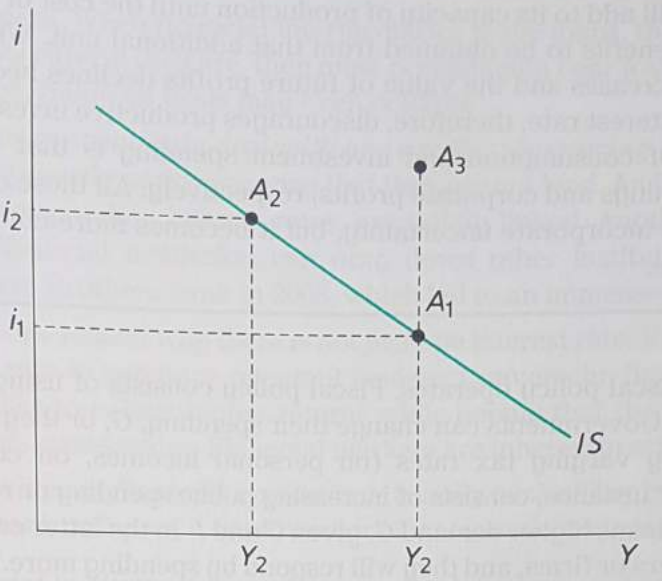
$$Y = C + I + G$$

This is a partial equilibrium as we ignore for the time being what is happening in the other market. Things become interesting when we note two things. First, consumers spend more when they earn more, and they earn more when the firms that employ them produce more and pay more salaries and dividends. Thus consumption C rises with income Y. Given firms' investment I and public spending G, there is one level of GDP such that consumption C is just right to achieve equilibrium in the goods market. This level is called, unsurprisingly, equilibrium GDP.[1] Second, in order to invest, firms usually borrow on the financial market, at the going interest rate i. When the interest rate rises, the cost of borrowing increases and firms invest less because they borrow less. An interest rate increase will also reduce consumption because some goods – mostly durable goods like cars, home equipment and houses – are often financed, partly at least, through borrowing. The result is that any change in the interest rate will affect demand that equilibrium GDP must decline. The negative effect of the interest on equilibrium GDP is represented graphically by the downward sloping IS curve in Figure 13.1.

Outside *IS*, the goods market is in disequilibrium. For example, consider point A_3, just above point A_1. Here, the interest rate is i_3 (not shown), higher than i_1. As we move from A_1 to A_3, the interest rate rises and firms spend less on investment, and demand declines. As we move vertically above $A1$, however, we keep output Y_1 unchanged: less demand, same supply – we are thus in a situation where firms do not sell everything that they produce. Above *IS*, we have a disequilibrium characterized by excess supply or

[1] Formally, equilibrium GDP Y is the solution of equation $Y = C(Y) + I + G$, where $C(Y)$ describes how consumption responds to GDP.

Figure 13.1 Goods market equilibrium: the *IS* curve



insufficient demand. This situation cannot last very long. If they can't sell, firms will cut production and we will move to the left of *A*3 until we hit the *IS* curve at a lower level of GDP. Similarly, below *IS*, we have a situation of excess demand and firms will respond by increasing production. As a first approximation, we will consider that the economy is always on its *IS* curve.

Box 13.1 The theory behind the *IS* curve

The *IS* curve rests on a description of how consumers and firms behave when they decide how much they want to spend on goods. A rational consumer is expected to want to consume as much as her resources allow. She earns income from work, she may have accumulated wealth through past savings, possibly to top up inherited wealth. She may want to save to accumulate wealth for future spending. She may also borrow in lean years to pay back in better years. The upshot is that consumption today – or this year – is related to the past (captured by wealth and debts) and to the future (planned income from work and from wealth). Noting that indebtedness is simply negative wealth, consumption today must be related to existing wealth and to expected future income. Expected future income is a form of wealth. It can be added to accumulated wealth to define total wealth. Total wealth can become negative at some points in life because of heavy borrowing but a key assumption is that no one can expect to leave the world with negative wealth: all debts must be reimbursed one day. This is called the wealth constraint. Consumption is therefore scaled by total wealth. Many people, however, cannot borrow, or not much. In that case, the most that they can consume today is their income today. For a country as a whole, therefore, total consumption is determined by the wealth of those who can borrow or do not need to borrow, and by income for the others. In the text, we overlook wealth for two reasons: (1) to keep things simple; (2) wealth, as defined as the sum of accumulated wealth and future expected income, is not really measurable.

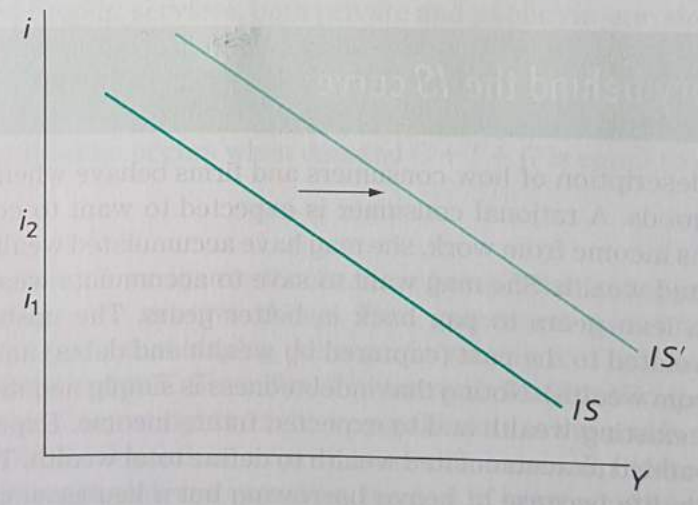
At any point in time, the consumer must choose between consuming and saving or borrowing. Saving is just postponing consumption. Similarly, borrowing is bringing consumption forward as future consumption will have to be reduced to pay back the debt. In both cases, the interest rate matters. A high interest rate means that saving today enhances future consumption because it is well rewarded. It also means that borrowing is expensive. In both cases, a high interest rate deters consumption today.

A similar reasoning can be applied to firms. They undertake productive investment to raise future profits. A rational firm will add to its capacity of production until the cost of one more unit reaches the value of the stream of benefits to be obtained from that additional unit. When the interest rate rises, the cost of borrowing increases and the value of future profits declines because they are discounted more heavily. A higher interest rate, therefore, discourages productive investment.

A common feature of consumption and investment spending is that both depend upon future outcomes – personal earnings and corporate profits, respectively. All these calculations are uncertain, however. The theory can incorporate uncertainty, but it becomes more complex without invalidating the results presented here.

We can now see how fiscal policy operates. Fiscal policy consists of using the government budget to affect the level of activity. Governments can change their spending, G, or they can change how much they collect in tax revenues by varying tax rates (on personal incomes, on corporations, on VAT, etc.). An expansionary policy, for instance, consists of increasing public spending or reducing tax revenues. In the first case, more spending means higher demand G, given C and I. In the latter case, reducing taxes provides higher incomes to consumers or firms, and they will respond by spending more. In both cases, total demand $C + I + G$ rises, for any given interest rate. This means that equilibrium GDP is now larger for any given interest rate. This is represented graphically in Figure 13.2 as a rightward shift of the *IS* schedule to *IS'*.[2] Naturally, a contractionary fiscal policy would do the opposite: move the *IS* schedule to the left.

Figure 13.2 An expansionary fiscal policy



13.1.2 The financial market and the role of monetary policy

We now look at the second market, where firms and households borrow or park their savings. As before, we simplify by assuming that there is just one way of saving and borrowing: issuing a bond to borrow or purchasing the bond to save. *The* bond carries an interest rate, *the* interest rate. This is a stark simplification. In reality, there are many other financial instruments than bonds and many interest rates, but they are all tightly linked, as we shall see. This means that there exist many financial markets, which involve a vast array of instruments like bonds, stocks, and more. Beyond the bewildering details, financial markets perform a relatively straightforward task. They consist of financial intermediaries (banks, investment firms, wealth managers, etc.) that collect savings from households and firms and then lend them to borrowers; again,

[2] Later on, we will worry that more public spending or fewer tax revenues hurt the government budget.

households and firms as well as public authorities. This activity has a few specific features that matter a lot in terms of understanding European integration:

- *Finance is a risky business.* When financial intermediaries make loans, they take risks. Will they be paid back? No matter how careful they are, they must occasionally bear losses on unpaid debts. When these debts are very large, financial firms may even collapse.
- *Financial intermediaries continuously deal with one another, borrowing and lending.* This is a way of spreading risks of temporarily parking money that they cannot lend. An implication is that all these instruments, and the corresponding interest rates, are tightly linked. Another implication is that the collapse of one large financial institution can drag down other institutions. A good example is the collapse of the Lehman Brothers bank in 2008, which led to an immense financial crisis.
- *Risk has a price.* This is one reason why there is not just one interest rate. Risky borrowers must offer to pay a higher interest rate to convince reluctant lenders. Conversely, financial intermediaries may be willing to take big risks to collect higher returns while hoping that the risks will not materialize. When they do materialize, crises occur. Financial markets are inherently crisis-prone.
- *Most people keep their savings in financial institutions, usually banks.* They generally ignore how fragile their banks are. When a bank collapses, a large number of innocent depositors stand to lose their savings.

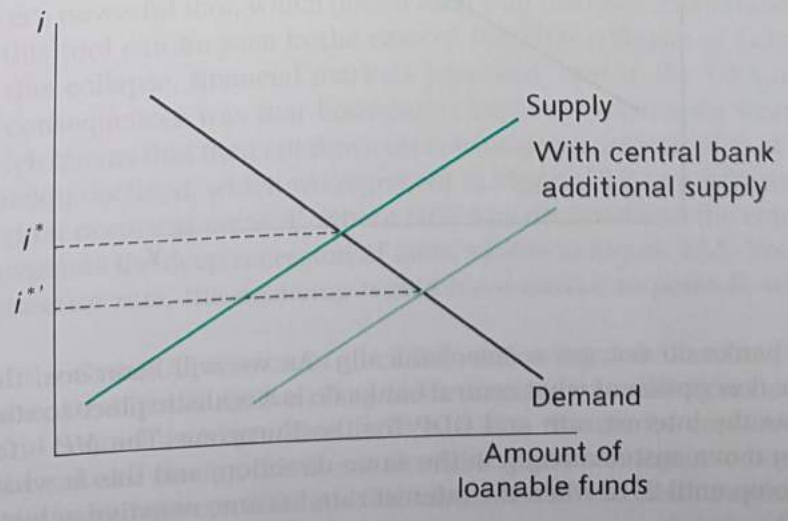
For these reasons, financial institutions are subject to regulations designed to reduce risk-taking, to make them better able to withstand large losses and to protect depositors. Of course, regulations are costly, so financial institutions develop ways of circumventing them. In turn, regulators add new regulations. This leads to an ever more complex process of new regulations and imaginative evasion strategies.

In this chapter, we ignore these aspects. We merely consider the financial market as a whole and imagine that all loans – which we call bonds – are riskless and identical. This means that there is just one interest rate, i, the one that applies to these bonds. It is the interest paid by borrowers and earned by lenders.

As the interest rate rises, lenders are naturally eager to lend more, increasing the supply of loanable funds, while borrowers are deterred by the rising costs and borrow less, as we have already seen in the previous section. It stands to reason that there must be an interest rate at which the supply of and the demand for loans are equal. This is the equilibrium interest rate, depicted as i^* in Figure 13.3 – the intersection of the supply of loans, which is upward sloping as explained above, and the demand, which is downward sloping.

What determines supply of and demand for loanable funds? Wealth is a first important parameter. The richer people are, the more they save, thus increasing supply. Optimism is another determinant. If households and firms are confident that their incomes will rise in the future, they are willing to borrow more, thus increasing demand. Another aspect is the role of governments. They can be large borrowers.

Figure 13.3 Financial market equilibrium



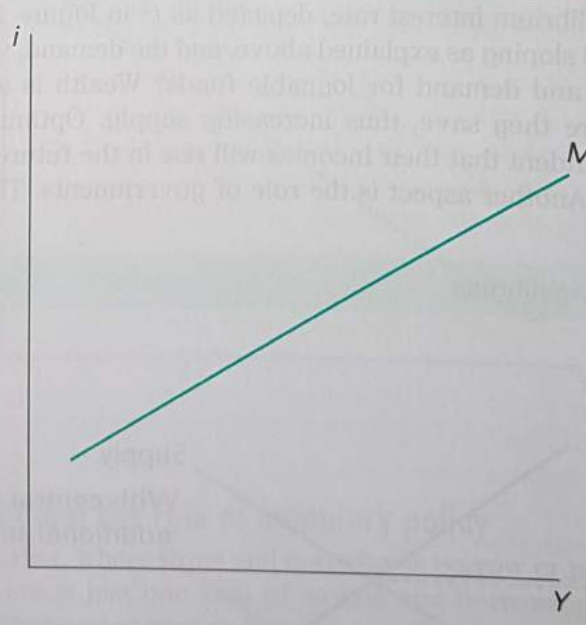
When they conduct expansionary fiscal policies, they spend more or tax less and they need to make up the difference by borrowing. All of this creates a link from the goods market to the financial market.

There is, however, another public institution that matters enormously: the central bank. Its unique characteristic is that it can create money at will. When it does, it lends to banks, which increases the amount of loanable funds as banks will seek to immediately re-lend what they borrowed from the central bank. Central banks can also withdraw money by simply not renewing loans to banks, or even by borrowing. The ability of central banks to create or reabsorb any amount of money means that they can control the interest rate. This is shown in Figure 13.3. An injection of money by the central bank shifts the entire supply curve to the right. This lowers the equilibrium interest rate, which is precisely what an expansionary monetary policy seeks to achieve. More generally, by shifting the overall supply curve, the central bank can achieve whatever interest rate it wishes to see.

The important lesson is that the central bank can decide on the interest rate that it wishes to see, at least in this very simple world in which there is just one interest rate and we do not worry about risk-taking and the threat of financial crises. In other words, once the central bank has an interest rate target, we do not need to worry about what happens to private demand and supply as described in Figure 13.3. The interest rate is the one chosen by the central bank and the financial market will find its equilibrium. Obviously, we will need to revisit the question at a later stage. For the time being, in order to understand the implication of this conclusion, we need to wonder what the central bank is trying to achieve when it sets the interest rate.

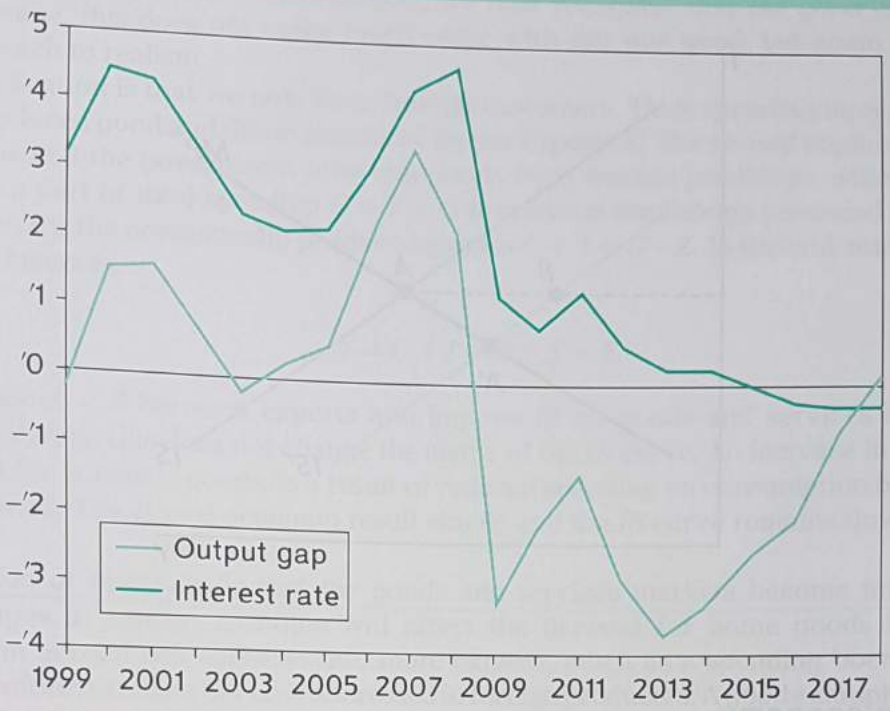
Any central bank has two main objectives: (1) to control inflation, of which more later; and (2) to stabilize the economy, that is, to avoid large fluctuations in economic activity. The second objective means that monetary policy must be counter-cyclical, meaning that the central bank raises the interest rate when the economy grows too fast and that it lowers the interest rate when the economy is stalling. This can be easily represented graphically, as in Figure 13.4, with an upward-sloping monetary policy schedule, *MP*. It says that, when the level of activity declines, the central bank systematically reduces the interest rate. Once again, the financial market simply adjusts in the background.

Figure 13.4 Monetary policy



Of course, central banks do not act so mechanically. As we will soon see, they also worry about inflation. Yet this simple description of what central banks do is a realistic place to start. This can be seen in Figure 13.5, which plots the interest rate and GDP for the Eurozone. The *MP* – for Monetary Policy – schedule says that they move systematically in the same direction, and this is what has happened since the creation of the euro up until 2012 when the interest rate became negative, a historical event to which we return in Chapter 19.

Figure 13.5 The interest rate and output in the Eurozone, 1999–2017



Note: GDP tends to rise continuously following a reasonably stable trend. The figure displays the deviation of actual from trend GDP, which reflects business cycles – precisely what a central bank worries about.

Source: Based on data from *Economic Outlook* Database, OECD, July 2018.

13.1.3 General equilibrium

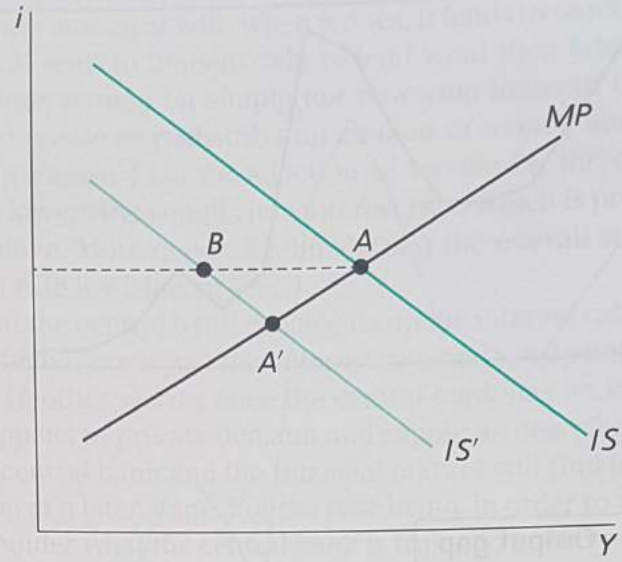
We have seen that financial considerations affect the goods market through the impact of the interest rate on firms' decisions about investment spending, and consumers' willingness to borrow and spend (the *IS* curve). We also noticed a link in the opposite direction because central banks react to the economic situation (the *MP* curve). This shows that the good and financial markets interact with each other. How does the dust settle? Quite simply, when both markets are simultaneously in partial equilibrium. This situation represents the general equilibrium of the economy.

We simply bring together the two schedules that describe the partial equilibria of the good and financial markets, which is done in Figure 13.6. The intersection point *A* between *IS* and *MP* represents the general equilibrium. This is a very powerful tool, which goes a long way towards understanding business cycles.

The usefulness of this tool can be seen in the case of the 2008 collapse of Lehman Brothers bank in New York. Following this collapse, financial markets panicked, first in the USA and then in the rest of the world. One of the consequences was that households became enormously worried. When people are worried, they save, which means that they cut down on consumption, irrespective of their current incomes. Total spending thus quickly declined, which we represent in Figure 13.6 as a leftward shift of the *IS* curve to *IS'*. The new equilibrium occurs at point *A'*, where GDP has declined and the central bank has reduced the interest rate. This explains the deep recession of 2009, visible in Figure 13.5. Note that, had the central bank not reduced the interest rate, the economy would have moved to point *B*, which corresponds to a deeper recession.

Avoiding a rerun of the Great Depression of the 1930s, following a similar crash on Wall Street, was a paramount objective of central banks. In fact, they have taken extraordinary actions, including lowering the interest rate over and beyond usual practice. In Figure 13.6, this can be captured as a downward shift of the *MP* curve. For the sake of clarity, this is not shown but you can imagine how the economy moves down along *IS'*, explaining why between 2009 and 2010 the interest rate declines while the level of activity recovers somewhat, as seen in Figure 13.5.

Figure 13.6 General equilibrium



13.2 The open economy

The next step is to recognize that countries are open to exchanges with the rest of the world. Trade in goods and services affect the *IS* curve while capital movements change the nature of financial market equilibrium.

13.2.1 The balance of payments

The balance of payments is an account that records all the transactions between a country and the rest of the world. It can be very detailed but can be simplified in three parts.

1. The first part is the current account. It records the commercial transactions, exports and imports of goods and services. Exports yield payments to the country, recorded as positive numbers, while imports are recorded as negative numbers because payments leave the country.
2. The second part is the financial account. It records the other international transactions, those that do not correspond to buying or selling goods or services. They concern borrowing and lending, the acquisition of shares of foreign firms or the setting up of foreign subsidiaries. Because lending amounts to acquiring foreign assets, it is recorded as a positive number. Borrowing leads to indebtedness and enters negatively.
3. The last part represents interventions by central banks as they buy or sell their foreign exchange reserves.

If the current account balance is positive, more money has been received than shipped abroad. What happens to this net acquisition? Either it is saved, which means that the financial account is positive, or the central bank buys it and its reserves increase. Conversely, a current account deficit means that, collectively, domestic residents (households, firms, the government) collectively spend more money abroad than they earn, and they must borrow, which shows up as a financial account deficit, unless the central bank draws on its foreign exchange reserves. Ignoring the change in reserves, the current account and the financial account must always be equal.

This is just an accounting exercise but it goes much further. Something must make this equality happen. We will see that prices and the exchange rate determine the current account, while interest rates and the exchange rate determine the financial account. These mechanisms lead to two key principles: purchasing power parity for the current account and the goods and services markets (the IS curve), and interest rate parity for the financial account.

13.2.2 Goods markets

Starting with the goods (and services) market, we now recognize that *the* good can be exported and imported. Of course, this does not make much sense with just one good, but again the simplification is worth another notch to realism.

The first implication is that we now have foreign customers. Their spending increases demand for our domestically produced good and this is measured by our exports X. The second implication is that domestic consumers, firms and the government now buy goods from foreign producers, which represent imports, denoted Z. Now a part of total spending $C + I + G$ is spent on the foreign-produced good. It follows that domestic demand for the domestically produced good is $C + I + G - Z$. In the end, total demand addressed to domestic producers is:

$$Y = C + I + G + X - Z$$

The difference $X - Z$ between exports and imports of all goods and services is called the current account.[3] Qualitatively, this does not change the shape of the *IS* curve. An increase in the interest rate still reduces demand for domestic goods as a result of reduced spending on consumption by households and on investment by firms. The closed economy result stands and the *IS* curve remains downward sloping as in Figure 13.1.

An implication of openness is that the goods and services markets become interdependent across countries. Changes in foreign spending will affect the demand for home goods through its exports. A spending boom abroad will translate into more exports, much as a spending boom at home will raise imports and therefore increases demand addressed to foreign producers. A good example of interdependence is the aftermath of the 2008 financial crisis. Financial institutions in the emerging market countries (e.g. the BRICS – Brazil, Russia, India, China and South Africa) were not directly hurt by the crisis because they had not been involved in the risky lending that turned sour in the USA and much of Europe. This led some observers to develop the 'decoupling theory', according to which the emerging market countries would not be affected by the crisis that was hurting the developed economies. This view overlooked the fact that part of the spending in the developed countries took the form of imports. The recession in the developed countries had to reduce imports from the rest of the world. Demand from buyers in the developed countries to producers in the rest of the world was bound to decline, and it did – as Figure 13.7 shows. Graphically, their *IS* curves shifted to the left.

13.2.3 Financial markets: the interest rate parity condition

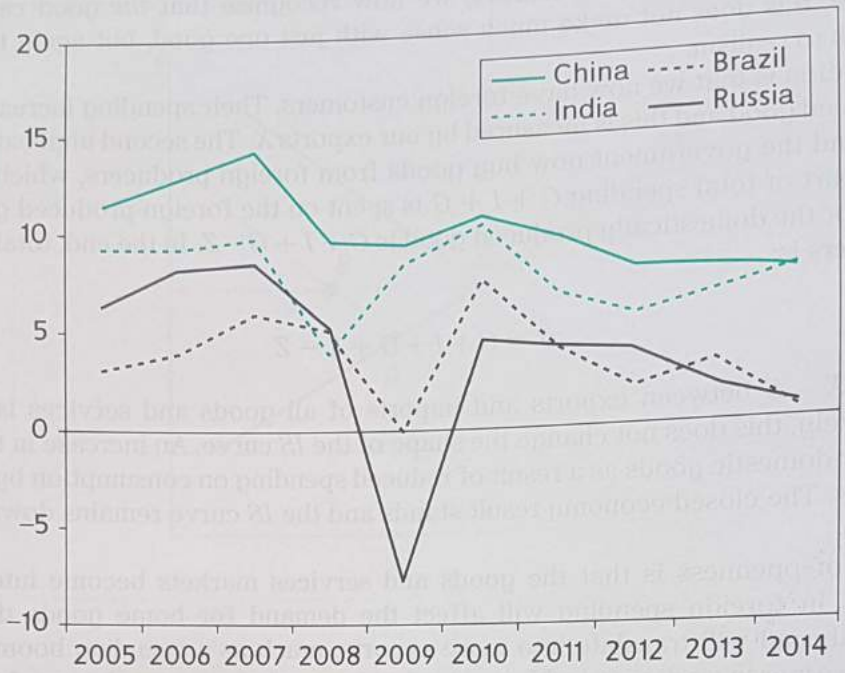
It is not just goods and services that travel across borders. Financial institutions daily move gigantic sums of money back and forth across borders. They do so routinely as they seek to improve their profits; borrowing here and borrowing there – buying and issuing bonds, for instance. These capital flows have a powerful effect on financial market equilibrium around the world.

To see how this works, imagine that you are a trader working for a large bank. You are in charge of a vast amount of money and your job is to achieve the best returns. The world is your playground and you are perfectly informed about all investment opportunities anywhere. Now suppose that the domestic interest rate is low relative to interest rates elsewhere in the world. Shouldn't you invest your money abroad rather than at home? Consider the two options. Investing at home for, say, one year gets you the principal and interest in the domestic currency after the year has elapsed. In order to invest the same amount abroad, you must first buy the foreign currency at the current exchange rate; then, after one year, you receive the principal and higher interest in foreign currency. To compare this situation with the first option, you will need to convert all of that back into domestic currency at the then-prevailing exchange rate.

If the exchange rate will not change, maybe because it is fixed, then the interest rates fully capture the difference between the two options and, indeed, you will want to invest abroad. If the foreign currency

[3] The trade balance is the difference between exports and imports of goods, excluding services. Although well known, it is not particularly interesting because there is no reason to exclude services like insurance, banking or tourism, which are widely traded internationally.

Figure 13.7 Growth rates of GDP in the BRICs (% per annum)



Source: Based on data from *Economic Outlook* Database, OECD, July 2018.

will appreciate, you will get more domestic currency from the foreign currency that you will receive in one year's time; by investing abroad you get both a higher interest rate and a capital gain (the additional domestic currency value of your holdings in the foreign currency). Now imagine that the foreign currency depreciates over the year. Then you will get less domestic currency for your foreign money when you convert it back at the end of the year, and the loss that you suffer may be even larger than what you gained from the higher interest rate. The conclusion is that you cannot just compare the domestic and foreign interest rates. You must also make a bet on the likely evolution of the exchange rate. Box 13.1 provides a formal derivation.

Box 13.1 The interest rate parity condition: a formal derivation

A trader wants to invest €1,000 for one year and considers the choice between euros where the interest rate is i, say, 5 per cent, and dollars where the interest rate is i^*, say, 2 per cent. After one year, the euro investment will have become €1,000$(1 + i)$, i.e. €1,050. The investment in dollars requires selling the euros to acquire dollars. The current exchange rate is E_t, defining how many dollars are obtained by selling one euro, for example 1.3. Selling €1,000 gives \$1,000·E_t – \$1,300 in our example – which will become \$1,000·E_t·$(1 + i^*)$ in one year's time, \$1,326 when $i^* = 2$ per cent. Then, the exchange rate is expected to be E_{t+1}, so that selling these dollars will yield €1,000·$E_t(1 + i^*)/E_{t+1}$, or €1,326/E_{t+1}.

The interest rate parity condition is achieved when both strategies yield the same revenue:

$$100(1 + i) = 100\, E_t(1 + i^*)\frac{1}{E_{t+1}}$$

This will be verified if the expected exchange rate one year ahead is 1.2629. Note that the initial investment, €1,000, appears on both sides of the equation and can therefore be eliminated, which simply means that the interest rate parity condition is independent of the amount involved:

$$(1 + i) = (1 + i^*)\frac{E_t}{E_{t+1}}$$

An approximation yields the condition presented in the text. It involves taking logs on both sides and noting that $\ln(1 + i) \approx i$, $\ln(1 + i^*) \approx i^*$, and $\ln(E_t/E_{t+1}) \approx -(E_{t+1} - E_t)/E_t$:

$$i = i^* - \frac{E_{t+1} - E_t}{E_t}$$

This approximation says that, if the euro interest rate is 5 per cent, the dollar interest rate is 2 per cent; the difference in favour of the euro (3 per cent) must be compensated by an expectation of euro depreciation of (about, because this is an approximation) 3 per cent.

The story becomes even more interesting when you realize that you are not the only trader in the world. Hundreds of colleagues look at the same screens and exchange views about what may happen in the future. If the consensus is that the exchange rate will not change much, they all conclude that investing abroad is the better deal. Then no trader will bring in money from abroad. Instead money will leave the country to benefit from the higher interest rate. Given the huge resources available to international investors, the resulting outflow of the domestic currency can be huge and lead to a depreciation of the current exchange rate. The story does not stop here. In one year's time, the maturing investments in foreign currency will be sold and the proceeds converted back into domestic currency. The resulting inflow will swell demand for the domestic currency and the exchange rate will appreciate. The combination of a weaker exchange rate today and a stronger exchange rate in one year's time means that the domestic currency is expected to appreciate or, equivalently, that the foreign exchange rate will depreciate. This undermines the attractiveness of investing abroad. In fact, if the expected foreign currency depreciation exactly undermines the higher foreign interest rate, traders become indifferent between the two options. This is when capital flows between the two countries will come to a halt.

International financial markets are in equilibrium when capital flows of this kind are unnecessary because the returns on domestic and foreign assets are equalized, taking into account likely capital gains or losses on currency conversion. This property of international financial markets is called the interest rate parity condition. It can be stated as:

$$\text{Domestic interest rate} = \underbrace{\text{Foreign interest rate} + \text{Expected exchange rate depreciation}}_{\text{Return on foreign assets}}$$

Written this way, it makes it clear that when our exchange rate is expected to depreciate, a higher domestic interest rate is required to prevent massive capital outflows. Conversely, an expected exchange rate appreciation – a negative depreciation – is accompanied by lower interest rates at home than abroad. For example, if the exchange rate is expected to depreciate by 3 per cent and the foreign rate is 2 per cent, the interest rate parity condition requires that the domestic interest rate be 5 per cent.

The smallest deviation from the interest rate parity condition instantly triggers huge capital flows among countries whose financial markets are deeply integrated. These flows promptly affect domestic and foreign interest rates as well as current and expected future exchange rates, and the interest rate parity is instantly re-established. In fact, deviations from the parity condition are fleeting, which is why traders try very hard to spot and act upon them, for they offer profit opportunities to the early birds.

Does the interest rate parity condition actually work? First, it can apply only when there are no restrictions to capital mobility (capital controls). Second, traders must be in a position to react fully, which may not be the case in crisis situations, as was the case in the aftermath of the Global Financial Crisis that started in 2007. Finally, the parity condition cannot be directly observed because we cannot measure the expected exchange rate. Anyway, whose expectation are we talking about? There are thousands of traders, each of whom has her own views. They all play the game of constantly shifting money around. The interest rate parity condition reveals the 'market sentiment', the average of what traders believe will be the exchange rate in the future. In other words, we can reinterpret the interest rate parity condition as revealing the 'market expectation':

$$\text{Expected exchange depreciation} = \text{Domestic interest rate} - \text{Foreign interest rate}$$

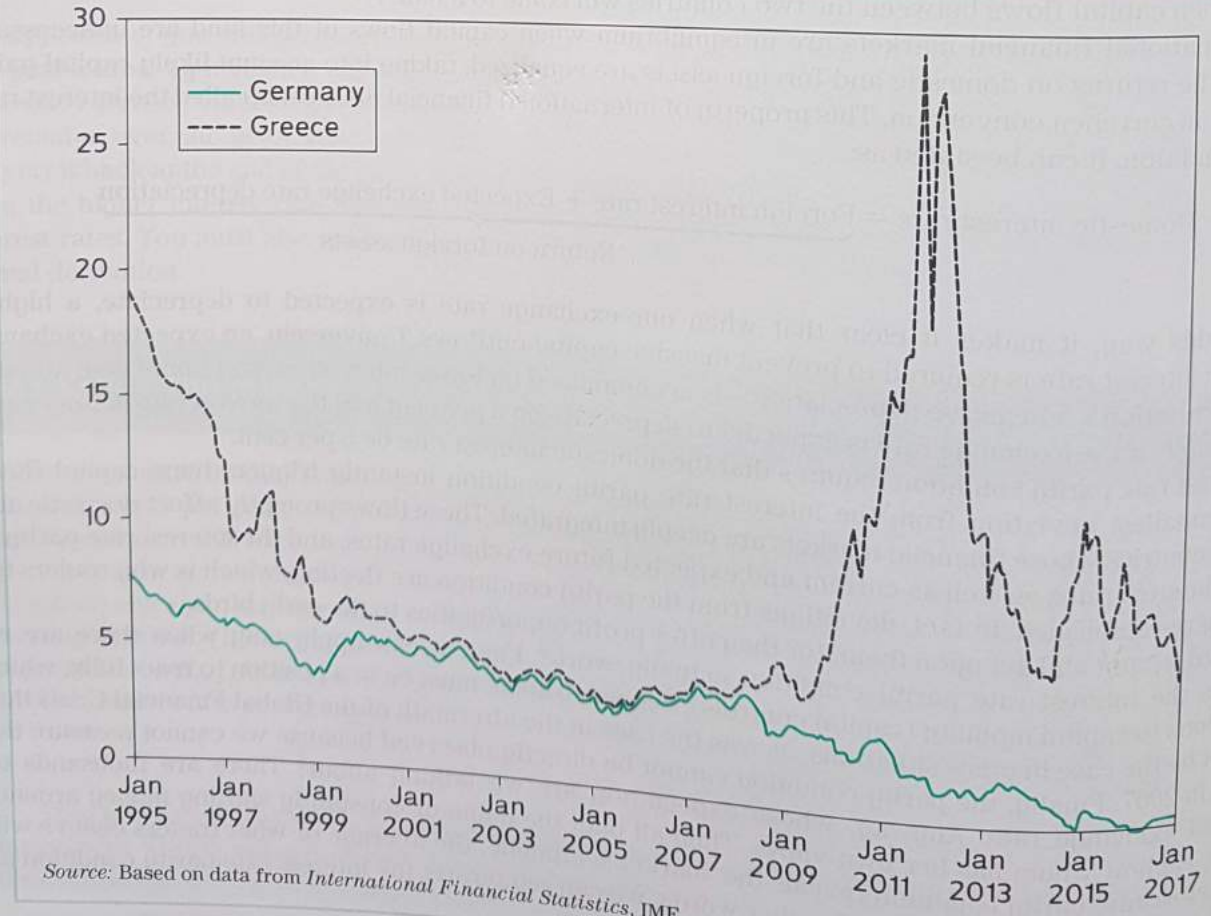
This reinterpretation of the interest rate parity condition offers a way of observing indirectly market expectations, under the assumption that the condition is indeed verified. Box 13.2 looks at the indirect evidence and provides a few refinements.

Box 13.2 The interest rate parity condition and risk: lessons from the Greek crisis

Figure 13.8 shows the interest rate on Greek and German public debts. Greece joined the Eurozone in January 2001. Before that, the Greek drachma was a weak currency that was perennially depreciating vis-à-vis the German mark. As the interest rate parity condition predicts, Greek interest rates were above German rates. Once Greece became a Eurozone member, the exchange rate between the drachma and the euro, Germany's new currency, was fixed. The interest rate parity condition predicts that the interest rates should become equal, which they dutifully did, with the Greek rate gradually converging to the German rate until D-day. This is not the end of the story, though, as Greek rates have again risen. This does not mean that the interest rate parity condition has failed; rather it requires going deeper into the issue.

One interpretation is that the markets expected Greece to leave the Eurozone; this possibility was dubbed 'Grexit'. Markets expected that, in this case, the new Greek currency would soon depreciate vis-à-vis the euro. As interest rate parity would predict, the Greek interest rate rose. Since summer

Figure 13.8 Government bond interest rates



Source: Based on data from *International Financial Statistics*, IMF.

2012, however, it has gone down, following the European Central Bank's statement that it would do 'whatever it takes' to keep Greece inside the Eurozone, an important event that is discussed in Chapter 19. When the risk of Grexit came again to the forefront in 2005, the interest rate steeply increased but concerns remain.

Another interpretation considers the risk factor. As noted above, any loan is risky, and holding bonds or other assets amounts to making a loan to whoever issued these assets because reimbursement is never – or rarely – fully guaranteed. This is why, within a country, rather than just one interest rate, a whole range of rates exists. Top-quality borrowers – rated AAA by rating agencies – pay much lower interest rates than risky borrowers. The difference, called the risk premium, is the price of risk, the compensation that not fully trustworthy borrowers must offer to lenders. This can be summarized as follows:

$$\text{Interest rate of risky asset} = \text{Interest rate of safe asset} + \text{Risk premium}$$

Moving capital across currencies adds another source of risk: the fact that we do not know what the exchange rate will be when the time comes to transfer back to the original currency. Within a monetary union, normally the exchange rate is expected not to change. In 2005, for instance, even though the Greek government was more indebted than the German government, its public debt was rated AA, just a notch below the AAA enjoyed by the German government. The risk premium was very small, hardly visible in Figure 13.8. The crisis changed all that. Highly indebted governments that went on running large deficits spooked the markets. The Greek debt came to be seen as increasingly risky and, quite naturally, commanded rising risk premia. This in turn fed fears of Grexit, further increasing the risk premium.

Summing up, when capital flows freely in and out of a country, the interest rate parity principle asserts that the domestic interest rate is tied to interest rates abroad and to market expectations of exchange rate movements. This is an equilibrium condition that applies to any country that is financially integrated with the rest of the world. Indeed, full integration means that there is no point defining financial market equilibrium at the national level, as in the closed country case. This conclusion seriously challenges the view that the central bank can decide the interest rate. This is the topic that we now consider.

13.3 The impossible trinity principle

13.3.1 The exchange rate regime

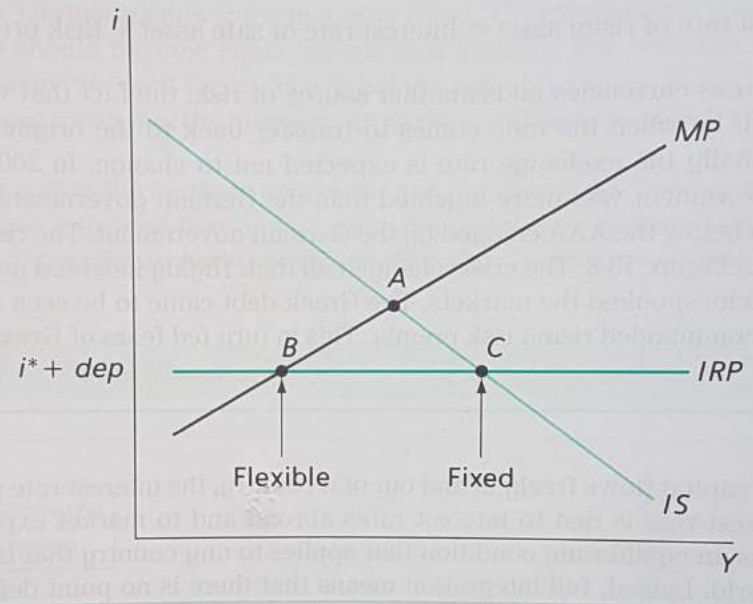
The exchange rate is the price of the domestic currency in terms of the foreign currency, for example \$1.2 for €1, or £0.9 for €1. Of course, there are many foreign currencies, and therefore many exchange rates, but we keep things simple by imagining just one foreign currency, say the dollar. This price can change as it freely responds to demand and supply movements on the foreign exchange market, a component of financial markets. Alternatively, the central bank can declare a fixed parity. In that case, the central bank commits to use its reserves of foreign currency to buy or sell any quantity of its own currency to ensure that demand and supply are equal at the chosen parity.

Each country decides which exchange rate regime it wants to adopt. The decision involves many trade-offs, and depends on local conditions such as inflation, the development of financial markets or the nature of national institutions. The Annex shows that there are many varieties of exchange rate regimes; they essentially differ by the degree of flexibility. Here, we consider two simple regimes: flexible, when the central bank does not intervene in the foreign exchange market; and fixed, when the central bank commits to uphold a particular parity relative to the foreign currency. This provides the tool for thinking about the choice of exchange rate regime, of which a monetary union is a special case of total fixity, to the point where mutual national exchange rates disappear since there is no national currency.

13.3.2 Properties of exchange rate regimes

Figure 13.9 brings together all the previous results. Like the closed economy analysis, we represent the goods market equilibrium with the *IS* curve – suitably reinterpreted to include exports and imports. We also continue to depict the central bank preferences with the *MP* curve. The horizontal line depicts the interest rate parity (*IRP*) condition as stated above: financial markets are in equilibrium when the domestic interest rate i is equal to the return from foreign currency bonds expressed in the domestic currency, that is, the foreign interest rate i^* plus the expected rate of depreciation (dep) of our currency. For the time being, to keep things simple, we ignore expected depreciation (so we assume $dep = 0$).

Figure 13.9 The role of the exchange rate regime



General equilibrium requires that both the goods and international financial markets be in equilibrium, which means the intersection of *IS* and *IRP*. The central bank chooses the interest rate according to *MP*. As all students of geometry know, however, three lines (or reasonably straight curves) normally intersect pair-wise at three different points. We are therefore stuck with too many possibilities represented by points *A*, *B* and *C*. This is, graphically, the impossible trinity principle, which is stated as follows:

- Only two of the three following features are compatible with each other:
  - Full capital mobility
  - Fixed exchange rates
  - Autonomous monetary policy.

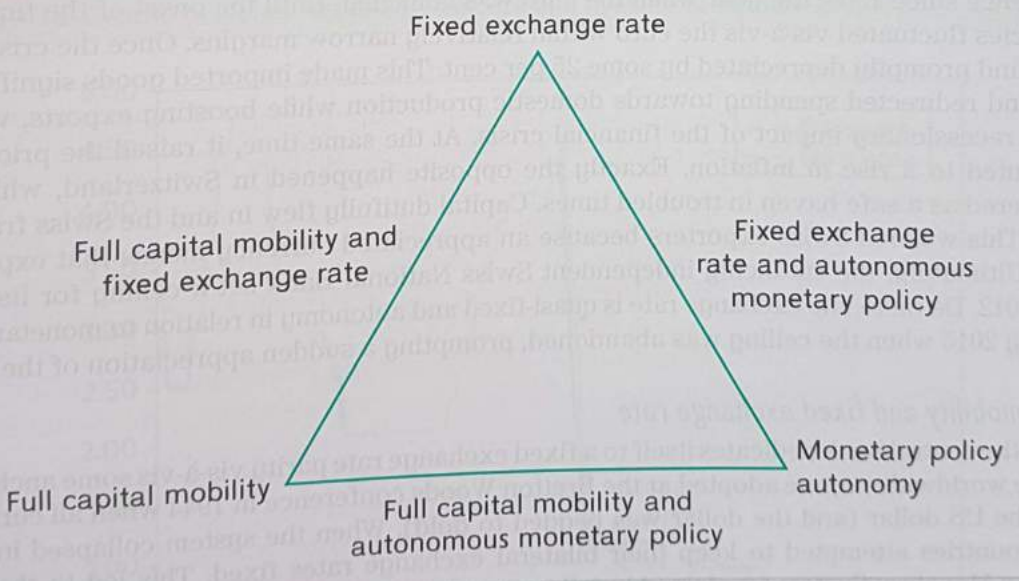
Consider first the case of a fixed exchange rate regime. When the goods market is in equilibrium and the central bank acts according to its preferences, we must be at *A*, at the intersection of *IS* and *MP*. As drawn, point *A* lies above the *IRP* line: the domestic interest rate is too high for the international financial markets to be in equilibrium. High returns on domestic currency assets attract capital inflows. Investors buy up the domestic currency, which tends to appreciate. But the central bank is committed to resist the appreciation. To do so, it intervenes on the foreign exchange market: it sells its currency – which it can produce in any amount – and accumulates the foreign currency. This will continue as long as the interest rate remains above the *IRP* line. Given how large the financial markets are, the amounts involved can be enormous and the central bank is filling a bottomless barrel. It will give up before long. Note that if the interest rate is below the *IRP* line, capital flows out and the exchange rate tends to depreciate. The central bank now buys

back its own currency, drawing upon its foreign exchange reserves. Evidently, this cannot go on for ever because the stock of reserves is bound to be depleted. Either way, monetary policy autonomy is lost and central bank preferences, represented by the *MP* schedule, become irrelevant. The only possible position is point *C*.

Consider now the case when the exchange rate is allowed to float freely. Consider again point *A*. We already know that in this position capital flows in and the exchange rate tends to appreciate, which the central bank no longer opposes. An appreciation means that the foreign currency becomes cheaper, which makes imported goods cheaper as well. Imports will rise. The opposite occurs abroad as our exports become more expensive because our currency costs more. Exports will decline. Less *X* and more *Z* means a diminishing demand $(C + I + G + X - Z)$ for our producers and the *IS* curve shifts to the left. It will continue to do so until it passes through point *B*, where international financial equilibrium is achieved while the central bank is pursuing its chosen policy *MP*. As the economy moves from *A* to *B*, the central bank lowers the interest rate to soften the decline in output. In this case, the central bank can remain on the *MP* schedule and the *IRP* condition is satisfied. It is now the *IS* curve that has to move until it meets the two other schedules. The exchange rate does what it has to do to achieve this outcome.

This analysis explains the impossible trinity principle, which is represented in Figure 13.10 by a triangle. Each angle corresponds to one of the three features listed above and each side represents a feasible combination. The bottom side of the triangle represents the case when the exchange rate floats freely, as just described. The triangle's left side corresponds to the fixed exchange rate case with capital mobility but no monetary policy autonomy. Consider now the right side of the triangle, when capital controls prevent capital mobility – more on controls below. Traders cannot (legally) move their monies freely and the interest parity condition no longer applies. Graphically, the *IRP* line does not exist, leaving the central bank free to choose the interest rate that best fits its objectives, irrespective of whether the exchange rate is fixed or not.[4]

Figure 13.10 The impossible trinity principle



[4] The reasoning is a little bit trickier than described so far as we assume that expected depreciation is nil ($dep = 0$). Under a fixed exchange rate regime, market expectation that the exchange rate will not change is a sign that the policy is credible, since it means that the financial markets accept the central bank commitment. When the exchange rate floats freely, the markets are likely to expect movements. This means that policy actions are likely to change market expectations, which means that the *IRP* line will shift. We do not pursue this (rather complicated) issue because it does not affect the conclusions reached so far.

The impossible trinity principle is central to the European integration process. It implies that, for a country that maintains full financial integration, the exchange rate policy – that is, the choice of an exchange rate regime – is simply the same thing as adopting a monetary policy strategy. Fixing the exchange rate means adopting the foreign interest rate; conversely, maintaining the ability to choose the domestic interest rate requires allowing the exchange rate to float freely. Ever since the EU adopted in 1992 the principle of open capital markets as part of the Single Market (see Chapter 1), the choice has been circumscribed to the left or bottom sides of the triangle in Figure 13.10.

One way of escaping the choice between exchange rate stability and monetary policy autonomy is to restrict capital movements. Indeed many European countries operated extensive capital controls until the early 1990s when full capital mobility was made compulsory as part of the Single Market. Likewise, many of the new EU members abandoned capital controls only upon accession.

13.3.3 Who does what?

Each side of the impossible trinity triangle has its real-life supporters. A few examples can illustrate the principle and serve as a warning that there is no universally better exchange rate regime. Governments often want to have all three features at the same time; refusing to choose invariably leads to a crisis.

Full capital mobility and autonomous monetary policy, flexible exchange rate

In this case, monetary policy is effective but the central bank must give up any pretence at steering the exchange rate. The Eurozone as a whole, the USA, Japan, the UK, Switzerland and Sweden, among many others, follow this approach. These countries, which gave up capital controls long ago and are committed to full financial openness, have decided to retain full control of monetary policy and therefore allowed their exchange rates to float freely.

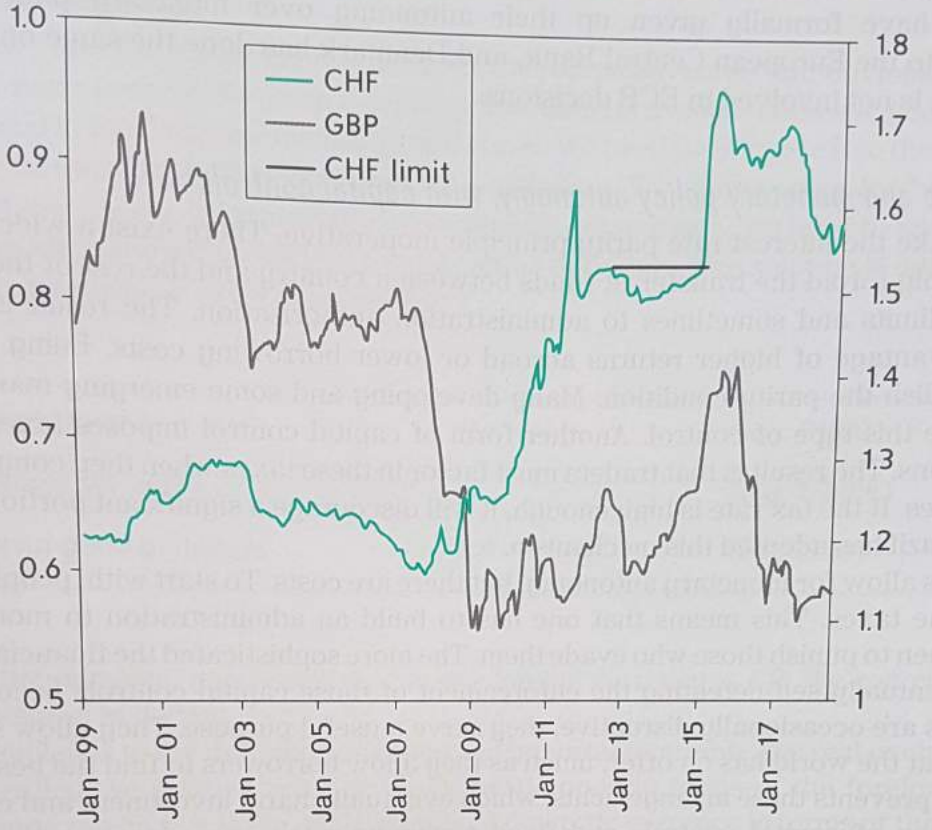
While retaining monetary autonomy sounds like a good idea, it also has drawbacks. The downside is that the exchange rate can be quite volatile, which affects external competitiveness. For example, the UK has very explicitly decided to retain monetary policy autonomy and negotiated an exemption from the EU obligation to eventually join the monetary union. Switzerland too has long decided that monetary policy autonomy is crucial to its standing as a financial centre with a stable currency. Figure 13.11 describes their experience since 1999, the year when the euro was launched. Until the onset of the financial crisis, both currencies fluctuated vis-à-vis the euro within relatively narrow margins. Once the crisis was under way, the pound promptly depreciated by some 25 per cent. This made imported goods significantly more expensive and redirected spending towards domestic production while boosting exports, which helped cushion the recessionary impact of the financial crisis. At the same time, it raised the price of imports and contributed to a rise in inflation. Exactly the opposite happened in Switzerland, which has long been considered as a safe haven in troubled times. Capital dutifully flew in and the Swiss franc began to appreciate. This worried Swiss exporters because an appreciated currency means that exports become expensive. Ultimately, the staunchly independent Swiss National Bank set a ceiling for its currency in September 2012. De facto, the exchange rate is quasi-fixed and autonomy in relation to monetary policy was until January 2015 when the ceiling was abandoned, prompting a sudden appreciation of the Swiss franc.

Full capital mobility and fixed exchange rate

In this case, the central bank dedicates itself to a fixed exchange rate parity vis-à-vis some anchor currency. This was the worldwide regime adopted at the Bretton Woods conference in 1944 when all currencies were pegged to the US dollar (and the dollar was pegged to gold). When the system collapsed in 1973, many European countries attempted to keep their bilateral exchange rates fixed. This led to the creation of the European Monetary System (explained in full in Chapter 14). A number of European countries now fix their exchange rate to the euro. One of them is Denmark.[5] Figure 13.12 shows that the Danish central bank

[5] In 1992, the Danish people rejected the Maastricht Treaty, against the wishes of the government, because they wanted to keep their currency. Since European treaties are valid only when ratified by all member countries, Denmark was offered an exemption from euro area membership. A second referendum in 1993 was, however, successful. The Danish authorities, which believe that exchange rate stability is crucial, are pegging the kroner to the euro.

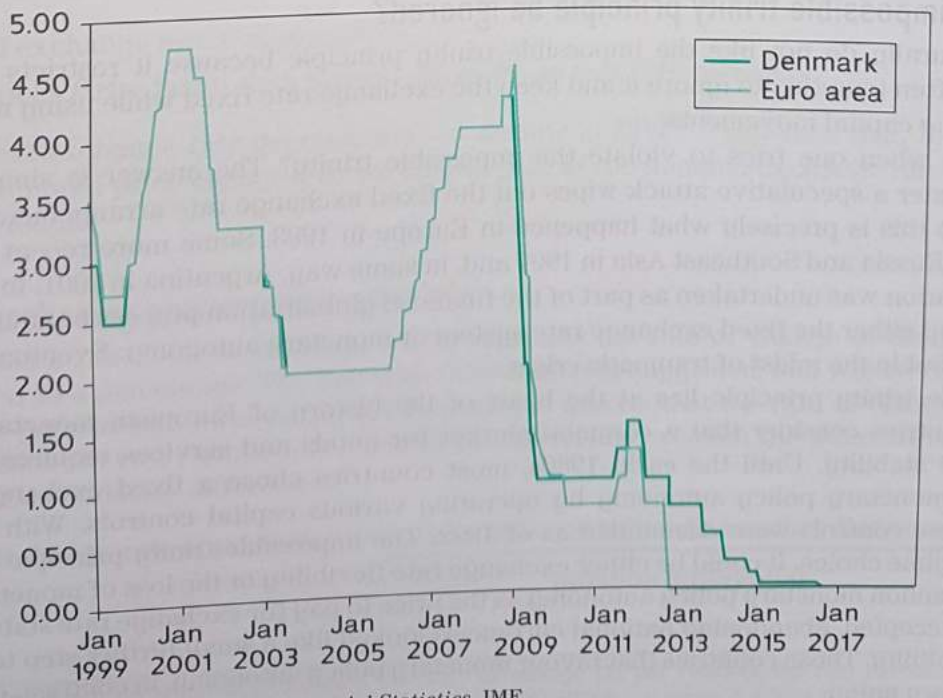
Figure 13.11 Flexible exchange rates: the British and Swiss experience



Note: Exchange rates for sterling and the Swiss franc vis-à-vis the euro (euros per pound or franc).

Source: Based on data from Swiss National Bank.

Figure 13.12 Central bank interest rates: Denmark and the euro area, 1999–2018



Source: Based on data from *International Financial Statistics*, IMF.

has essentially adopted all decisions taken by the European Central Bank, except (but only slightly) durin the crisis period. The distinction between such a policy and euro area membership is tenuous. Euro are member countries have formally given up their autonomy over monetary policy by transferrin responsibility for it to the European Central Bank, and Denmark has done the same on an informal basi Of course, Denmark is not involved in ECB decisions.

Fixed exchange rate and monetary policy autonomy, with capital controls

Capital controls make the interest rate parity principle inoperative. There exist a wide variety of capita controls. Some simply forbid the transfer of funds between a country and the rest of the world, or subjec these transfers to limits and sometimes to administration authorization. The result is that traders car no longer take advantage of higher returns abroad or lower borrowing costs. Being restricted, capital flows cannot establish the parity condition. Many developing and some emerging market countries, for instance China, use this type of control. Another form of capital control imposes taxes on international financial transactions. The result is that traders must factor in these taxes when they compare domestic and foreign interest rates. If the tax rate is high enough, it will discourage a significant portion of capital flows. In recent years, Brazil has adopted this mechanism.

Capital controls allow for monetary autonomy, but there are costs. To start with, people try to evade the restrictions and the taxes. This means that one has to build an administration to monitor and enforce the controls, and then to punish those who evade them. The more sophisticated the financial sector, the more expensive and eventually self-defeating the enforcement of those capital controls becomes. In addition, while capital flows are occasionally disruptive, they serve a useful purpose. They allow savers to achieve the best returns that the world has on offer, much as they allow borrowers to find the best available loans. Financial autarky prevents these arrangements, which eventually harm investment and economic growth.

The combination of capital controls and fixed exchange rates was widespread under the Bretton Woods system – although some countries such as Germany and Switzerland almost never enforced capital controls. It also characterized Europe's early monetary integration efforts, which led to the European Monetary System. As predicted by the impossible trinity principle, the removal of capital controls made this arrangement non-viable, which eventually led to the adoption of the euro by most EU countries, and to a free floating of the exchange rate in Sweden and the UK.

13.3.4 Can the impossible trinity principle be ignored?

Policymakers naturally do not like the impossible trinity principle because it restricts their room for manoeuvre. It is often tempting to ignore it and keep the exchange rate fixed while using monetary policy actively and freeing capital movements.

What happens when one tries to violate the impossible trinity? The answer is simple: a currency crisis. Sooner or later a speculative attack wipes out the fixed exchange rate arrangement. We will show in Chapter 14 that this is precisely what happened in Europe in 1993. Some more recent and prominent examples include Russia and Southeast Asia in 1997 and, in some way, Argentina in 2001. In all these cases, financial liberalization was undertaken as part of the financial globalization process but the authorities did not want to give up either the fixed exchange rate system or monetary autonomy. Eventually, they had to make this choice but in the midst of traumatic crises.

The impossible trinity principle lies at the heart of the history of European monetary integration. A number of countries consider that a common market for goods and services requires a high degree of exchange rate stability. Until the early 1980s, most countries chose a fixed exchange rate regime and maintained monetary policy autonomy by operating various capital controls. With the advent of globalization, these controls were dismantled as of 1992. The impossible trinity principle sharpened the exchange rate regime choice. It could be either exchange rate flexibility or the loss of monetary autonomy. They chose to abandon monetary policy autonomy as the price to pay for exchange rate stability. Once this conclusion was accepted, abandoning national currencies looked like a small further step to achieve total exchange rate stability. Those countries that favour monetary policy autonomy, in contrast, decided to stay out of the monetary union.

13.4 The real exchange rate and the purchasing power parity principle

13.4.1 The real exchange rate

We previously argued that the exchange rate matters for competitiveness but, obviously, prices must play a role too. Let us be more precise. We keep assuming that there is a single domestic good, whose price is P. This price is expressed in the domestic currency, say euros. We need to compare it to the price of the foreign good, P^*, which is expressed in the foreign currency, say dollars. We cannot compare them directly because they are in different currencies. To undertake a meaningful comparison, we need to use the exchange rate E to express both goods in the same currency, either euros or dollars. The solution is quite straightforward. Imagine a domestic good whose price is 100 euros:

Price of the European good in euros	P	(e.g. €100)
Exchange rate (dollars per euro)	E	(e.g. 1.2 \$/€)
Price of the European good in dollars	EP	(e.g. \$120)

Thus the price of the domestic good expressed in the foreign currency is EP. We can compare it with P^*, since both are measured in dollars.

This observation leads to the definition of a new and important variable, the real exchange rate. It is the ratio EP/P^*, also called the relative price of the domestic good in terms of the foreign good. Note that the nominal exchange rate is E; it is the relative price of domestic currency in terms of the foreign currency (\$1.2 for €1). Note that we could instead measure the price of the US good in euros as P^*/E and compare it to the domestic good price in euros as well. When we divide P by P^*/E, we obtain EP/P^* as before. Reassuringly, it does not matter which currency we use. Like price levels, the real exchange rate is an index number, computed to take a simple value (e.g. 1 or 100) in a specified period.

When the real exchange rate increases – we say that it appreciates – it means that domestic goods become more expensive relative to foreign goods: our competitiveness declines. The real exchange rate appreciates when:

- the nominal exchange rate E appreciates;
- domestic prices P rise faster than foreign prices P^*, so that P/P^* increases.

Conversely, a real exchange rate depreciation – a decline in EP/P^* – signals a gain in competitiveness. So far we have ignored price changes, so we looked only at the nominal exchange rate E; now we know that this is not enough.

13.4.2 The purchasing power parity principle

This section takes a first look at inflation, which measures the rate of change of the price level $\Delta P/P$, usually measured as a percentage. The link with GDP is merely suggested, and will be elaborated upon in Chapter 15. The purchasing power parity (PPP) principle asserts that the rate of change of the nominal exchange rate between two countries is equal to the difference between the inflation rates in these two countries, called the inflation differential:[6]

$$\text{Exchange rate appreciation} = \underbrace{\text{Foreign inflation rate} - \text{Domestic inflation rate}}_{\text{Inflation differential}}$$

[6] The formal proof of this assertion is as follows. The rate of change (in per cent) of the real exchange rate EP^*/P is $\Delta (EP/P^*)/EP/P^* = \Delta E/E + \Delta P/P - \Delta P^*/P$. It follows that $\Delta(EP/P^*)/EP/P^* = 0$ when $\Delta E/E = \Delta P^*/P^* - \Delta P/P$.

PPP asserts that the real exchange rate is constant, so that price competitiveness remains unchanged. It implies that our currency appreciates whenever inflation abroad exceeds inflation at home. Conversely, a country with higher inflation sees its exchange rate depreciate vis-à-vis the currency of a country with a lower inflation rate.

This principle is known to hold only in the long run – when it holds. The next section gives an important reason why it sometimes fails to hold. An example of PPP is provided in Table 13.1, which compares Italy and Germany over a very long period, from 1960 to 1998, the year before the adoption of the euro by these two countries. Inflation in Italy had been high, on average 8.0 per cent per year, far exceeding the German average rate of 3.2 per cent. The PPP prediction is that the Italian lira should have depreciated vis-à-vis the German mark by 4.8 per cent, on average. In fact, the lira depreciated a bit more, at an average rate of 5.3 per cent. This is a good example of how PPP works: it tells us the right story, not always very precisely, but close.

Table 13.1 PPP: Italy and Germany, 1960–98

	(%)
Average annual inflation rate in Italy	8.0
Average annual inflation rate in Germany	3.2
Average annual depreciation of the lira	5.3

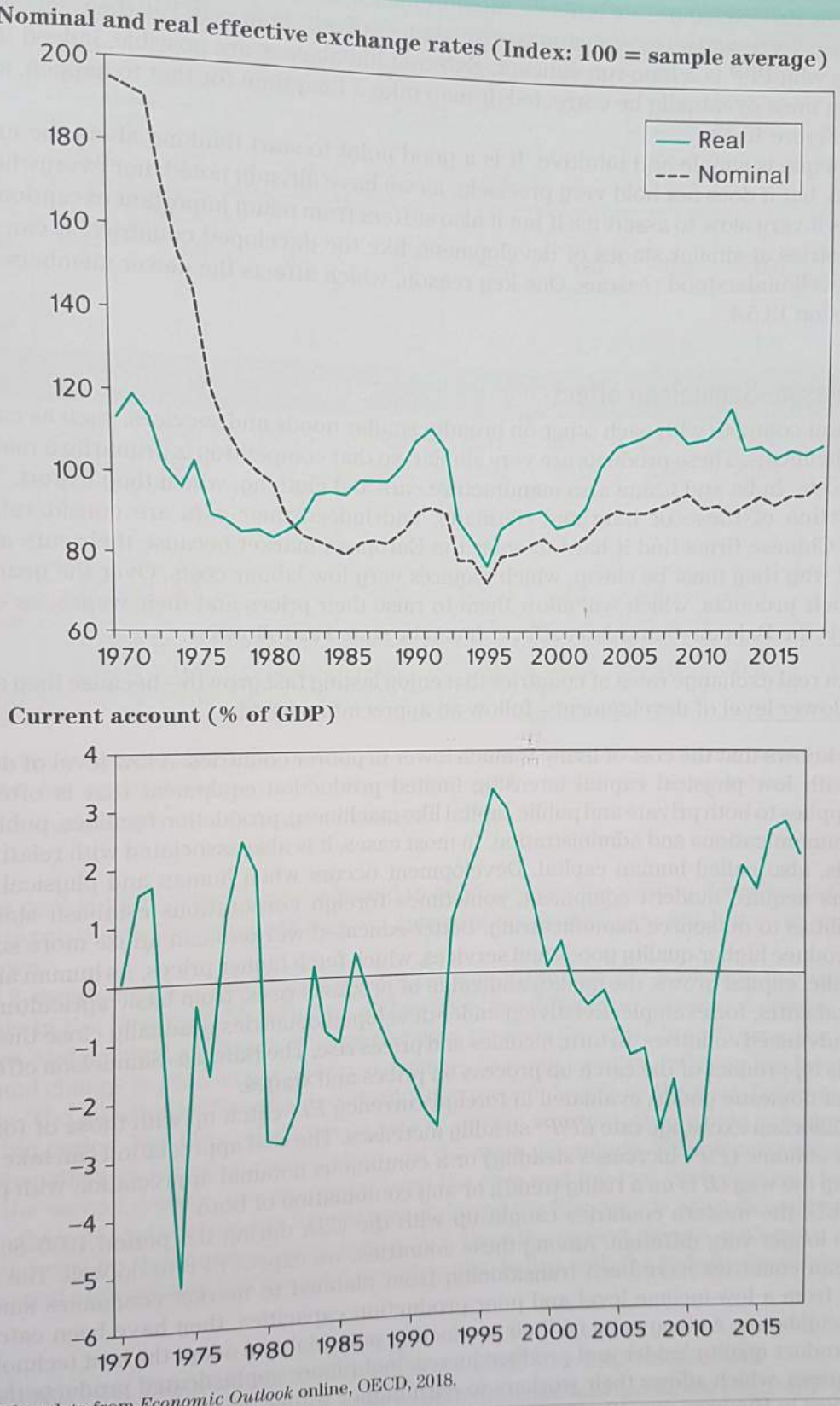
Source: Based on data from IMF.

13.4.3 The equilibrium real exchange rate

According to Table 13.1, on average over nearly 40 years, the real exchange rate of the Italian lira vis-à-vis the German mark depreciated by 0.5 per cent. This is not exactly zero and, in fact, the discrepancy can be explained. That the real exchange rate is a measure of price competitiveness implies that its evolution is somehow related to trade. Germany is an important trade partner of Italy, but not its only partner. This suggest that we also need to look at the evolution of the lira vis-à-vis the currencies of other partner countries. Could it be that the real depreciation of the lira vis-à-vis the mark is offset by a real appreciation vis-à-vis other currencies? In order to look at Italy vis-à-vis the rest of the world, we average the nominal exchange rates of the lira vis-à-vis all of Italy's partners – or its most important partners – and, accordingly, observe how prices elsewhere change, also on average. The result is the nominal effective exchange rate, still denoted E, and the price level in 'the rest of the world', still represented as P^*. Combining both, we measure the real effective exchange rate, EP/P^*. They are computed as indices, taking an arbitrary conventional value like 1 or 100 on a particular date or over a chosen period. The first chart of Figure 13.13 shows the evolution of Italy's nominal and real effective exchange rates over a long period (they are computed to be 100 on average during the whole period 1970–2018. The difference between the nominal and real rates stands out. During the 1970s, the nominal exchange rate depreciated hugely while the real exchange rate moved very little. This confirms that inflation in Italy was much higher than among its partners and that the exchange rate made up much of the inflation differential. The larger nominal fluctuations affect the real exchange rate in the short run but tend to leave no lasting influence. The real effective exchange rate is certainly not constant year after year, but roughly so over longer periods. The real effective exchange rate was 113.8 in 1970 and 108.0 in 2012 (and 107.7 in 2018). Over 48 years, this is close to constancy. It is PPP in the long run.

The long-run stability of the real exchange rate cannot be a fluke and, indeed, there is a good explanation. When its real exchange rate appreciates, that is when EP/P^* increases, a country becomes less competitive. Its current account deteriorates as exports decline – domestic goods become more expensive on foreign markets when EP increases – and/or imports rise – foreign goods are cheaper at home if P^*/E declines. The resulting external deficit – the country buys more abroad than it sells – cannot go on for ever, for two reasons. First, when the country spends more abroad than it sells, the shortfall must be compensated somehow; in effect, it means borrowing abroad, which cannot happen for ever. Second, total demand for the domestic good, $Y = C + I + G + X - Z$, declines and the IS curve moves to the left as firms cut down

Figure 13.13 Italy, 1970–2018



Source: Based on data from *Economic Outlook* online, OECD, 2018.

on production. Eventually, competitiveness must be restored. This can be achieved through a nominal depreciation, E goes down, though a reduction in prices P relative to foreign prices P^*, which is a likely response by domestic firms as they scale down production, or both. Either way, the real exchange rate

depreciates back to its 'normal' level, which is called the equilibrium rate: it is the rate at which trade is balanced. When the real exchange rate is above equilibrium, it is said to be overvalued, and it is undervalued in the opposite case. Over- and under-valuations are instances of misalignment. Yet, they cannot last for ever.

This explains why PPP is a long-run concept. External imbalances are possible, indeed they occur all the time, but they must eventually be corrected. It may take a long time for that to happen, as seen in the bottom chart of Figure 13.13.

The PPP principle is simple and intuitive. It is a good point to start thinking about the exchange rate over the long run, but it does not hold very precisely, as we have already noted, nor everywhere and at all times. Not only is it very slow to assert itself but it also suffers from many important exceptions. If it works well among countries at similar stages of development, like the developed countries, it can fail badly in other cases, for well-understood reasons. One key reason, which affects the newer members of the EU, is presented in Section 13.5.4.

13.4.4 The Balassa–Samuelson effect

Italy and Germany compete with each other on broadly similar goods and services, such as cars, clothing, insurance and chemicals. These products are very similar, so that competition is primarily a matter of costs, mostly labour costs. India and China also manufacture cars and clothing, which they export. Their labour costs are a fraction of those of Italy and Germany, and indeed their cars are considerably cheaper. Yet, Indian and Chinese firms find it hard to enter the European market because their cars are low-tech, which is indeed why they must be cheap, which requires very low labour costs. Over the years, however, they upgrade their products, which will allow them to raise their prices and their wages, as explained in Chapter 8. This is the Balassa–Samuelson effect.[7] It can be stated as follows:

- Equilibrium real exchange rates of countries that enjoy lasting fast growth – because they are catching up from a lower level of development – follow an appreciating trend.

Every traveller knows that the cost of living is much lower in poorer countries. A low level of development is associated with low physical capital intensity, limited production equipment that is often low-tech. This situation applies to both private and public capital like machinery, production facilities, public transport systems, telecommunications and administration. In most cases, it is also associated with relatively limited education levels, also called human capital. Development occurs when human and physical capital are upgraded. Firms acquire modern equipment, sometimes foreign corporations establish state-of-the-art production facilities to outsource manufacturing. Better-educated workers can utilize more sophisticated equipment to produce higher-quality goods and services, which fetch higher prices. As human and physical, private and public, capital grows, the quality and value of products rises, from basic agricultural products to elaborate foodstuffs, for example. Relatively under-developed countries gradually close the technology gap with more advanced countries. In turn, incomes and prices rise. The Balassa–Samuelson effect captures the effect of this by-product of the catch-up process on prices and wages.

The prices of domestic goods, evaluated in foreign currency EP, catch up with those of foreign goods P^*. The real equilibrium exchange rate EP/P^* steadily increases. The real appreciation can take the form of higher inflation at home (P/P^* increases steadily) or a continuous nominal appreciation with possible ups and downs along the way (E is on a rising trend), or any combination of both.

Within the EU, the western countries caught up with the USA during the period 1950–80. Standards of living are no longer very different. Among these countries, we expect PPP to do well. The central and eastern European countries have been transitioning from planned to market economies since the mid-1990s. Starting from a low-income level and poor production capacities, they have been catching up on their western neighbours. As they build up their production potential and adopt the best technologies, they climb up the product quality ladder and produce increasingly more sophisticated products that they can sell at higher prices, which allows their workers to earn higher wages. For instance, in 1997, the average hourly labour cost in Hungary was 10 per cent of that in Germany; by 2012, it had increased to 19 per cent

[7] It is named after Hungarian-born US economist Bela Balassa, who taught at Johns Hopkins University, and Paul Samuelson, Nobel Prize laureate, who taught at MIT; they discovered this effect independently.

Table 13.2 The Balassa–Samuelson effect: average annual changes (%), 1996–2008

	Bulgaria		Czech Republic		Estonia		Latvia		Lithuania	
	1998–2007	2008–2018	1997–2007	2008–2018	1997–2007	2008–2018	1997–2007	2008–2018	1997–2007	2008–2018
Inflation differential	5.4	0.7	1.5	0.5	2.9	1.7	3.0	1.4	1.0	1.5
Nominal appreciation	−0.3	0.0	1.9	0.7	−0.2	0.0	−0.2	0.0	3.3	0.0
Real appreciation	5.1	0.7	3.4	1.2	2.7	1.7	2.8	1.3	4.3	1.5
	Hungary		**Poland**		**Romania**		**Slovenia**		**Slovakia**	
	1997–2007	2008–2018	1997–2007	2008–2018	1997–2007	2008–2018	1997–2007	2008–2018	1997–2007	2008–2018
Inflation differential	6.6	1.4	3.6	0.5	35.3	2.3	4.0	0.2	4.5	0.2
Nominal appreciation	–2.5	–2.0	−1.2	–1.2	−25.1	–3.2	−3.1	0.0	1.2	1.0
Real appreciation	4.0	0.6	2.4	–0.7	10.3	–0.2	0.9	0.2	5.6	1.2

Notes: Real appreciation (last line) is the sum of inflation differential (first line) and nominal appreciation (second line) but rounding-up errors explain that numbers do not always add up. Negative appreciation is depreciation, both nominal and real.

Source: Based on data from *AMECO* online, European Commission.

and to 20 per cent in 2016. This process is bound to continue over the coming decades and Hungary's real exchange rate relative to Germany will keep on appreciating, year in, year out, but more slowly as the gap is closing down.

Table 13.2 shows how this has played out for several of the new EU members. For each country, the table displays in the first row the inflation differential, the difference between domestic and euro area inflation rates, and nominal exchange rate appreciation vis-à-vis the euro.[8] In each case, the table shows the average annual change in percentage over two decades. In every country, inflation has been higher than in the Eurozone. The inflation differential has declined from one decade to the next, following the turbulent early transition period. For the real exchange rate to remain constant, they would have had to undergo a nominal depreciation – a negative appreciation – of the same magnitude. With two exceptions, Poland and Romania in the second decade, this has never been the case and the real exchange rate has appreciated. Interestingly, the real appreciation has been stronger during the first decade when the catch-up process was fastest, as predicted by the Balassa–Samuelson effect. Over the second decade, with much of the catch-up achieved, the real appreciation has declined, which is also in line with the Balassa–Samuelson effect.

13.5 Applications: macroeconomic policies and the exchange rate

This section brings together the previous results to both illustrate how to use the IS-MP-IRP model and gain a solid insight in the role of macroeconomic policies and of the key drivers of exchange rate.

[8] Following the reasoning in footnote 6, we present $\Delta P/P - \Delta P^*/P^*$ in the first row, $\Delta E/E$ in the second row and the real exchange rate is calculated in the last row as $\Delta(EP/P^*)/(EP/P^*) = \Delta E/E + \Delta P/P - \Delta P^*/P^*$, i.e. the sum of the first two rows.

13.5.1 Fiscal policy

How does fiscal policy operate

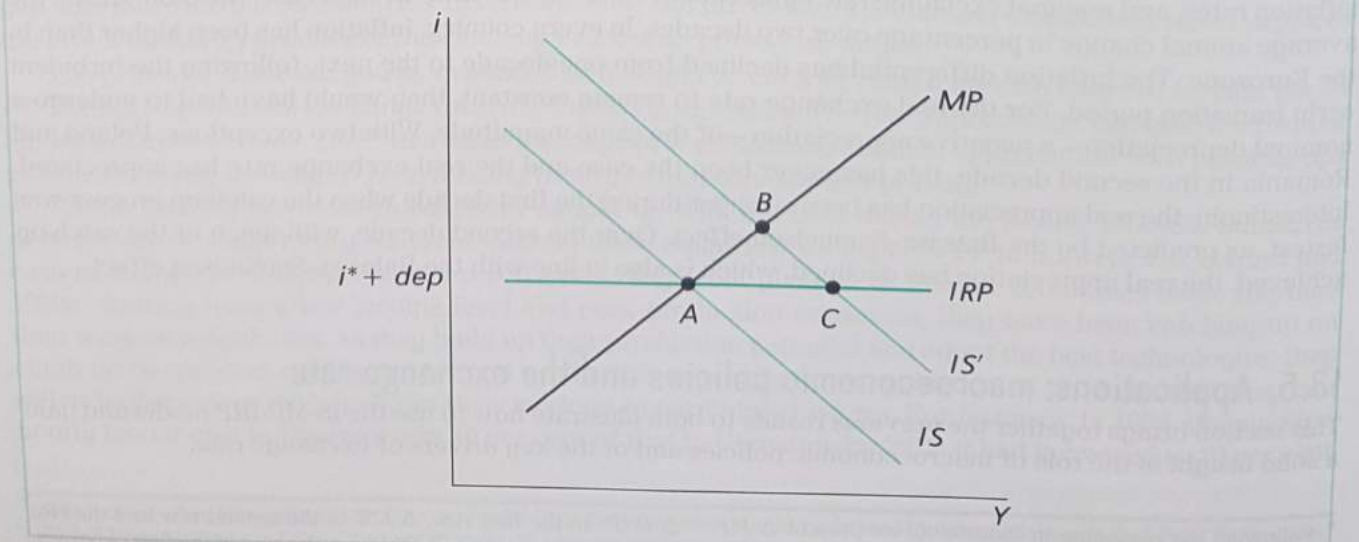
Fiscal policy is in the hands of the government, which decides on the level and composition of public spending and on the array of taxes that it levies. These decisions are made yearly when the government submits its proposal to the parliament, which can amend and must vote on the budget law. Much of the debate tends to focus on specific spendings (defence, education, health, etc.) and tax rates (income tax, VAT, corporate tax, etc.). We ignore these aspects, which matter a lot politically as they redistribute incomes – who gets what and who pays what – but have secondary macroeconomic effects. Note also that the budget law sets spending levels but not tax revenues. Instead, it decides on tax rates while the corresponding revenues will depend on how much there is to tax, which is not known *ex ante*. For example, setting a VAT rate of 20 per cent means that 20 per cent of all sales – roughly GDP – will be collected by the government, which depends on the eventual value of GDP during the upcoming fiscal year. Here again, we will make matters simple by assuming that the government decides on total tax revenues, ignoring that this is uncertain.

Public spending G directly affects total demand $Y = C + I + G + X - Z$. Taxes work indirectly. They affect personal incomes of households, which shape consumption C. They also affect the resources of firms that decide on how much they will spend on productive investment I. Imports Z are next determined by households, firms and the government, which decide what particular goods and services they wish to purchase. Finally, exports X depend on spending decisions by foreign customers. A common feature of exports and imports is that they also depend on the real exchange rate EP/P^*, which in turn is driven by the evolution of the nominal exchange rate E and of domestic and foreign prices P and P^*. For simplicity again, we assume that domestic and foreign prices remain unchanged from one year to the next. In fact, they respond to the level of activity, an important factor already mentioned in Section 13.4 that will be treated in more detail in Chapter 15.

Fiscal policy under a fixed exchange regime

We already saw the effects of fiscal policy in the closed economy case (Section 13.1.3). Here we draw the implication of the exchange rate regime on the effectiveness of fiscal policies. In Figure 13.14, we start with general equilibrium at point A and consider an expansionary fiscal policy, namely an increase in public spending, a reduction in some tax rates, or both. In either case, equilibrium GDP is increased as firms increase output to meet customers' demand. Graphically, the IS curve shifts to the right (a higher GDP, given the prevailing interest rate). Two possible outcomes emerge at point B and C, or maybe point A?

Figure 13.14 Fiscal policy



From Section 13.3, we already know the answer. Remember that we assume that the foreign interest rate i^* is a given, and so is the expected rate of depreciation *dep*. In other words, the *IRP* schedule stays put.

Under a fixed exchange regime, the outcome is at point *A*. As the fiscal expansion takes hold and the *IS* curve starts shifting towards *IS'*, we start moving from *A* to *B* along *MP*, which corresponds with the central bank strategy of raising the interest rate when GDP increases. However, as *i* rises, capital starts flowing in, with two effects: (1) international investors buy the domestic currency; (2) this means more abundant financial resources, which push the interest rate down. Both developments frustrate the central bank, which is committed to a fixed exchange rate and wants to raise the interest rate. In order to prevent the exchange rate appreciation, it sells its own currency and adds foreign currency to its reserves.

This conflict between the central bank and international investors can go on for ever, but in fact the central bank is in the weakest position. As long as it keeps its interest rate above the *IRP* level, foreign investors make profits from speculation. They borrow abroad at a cost (evaluated in domestic currency) of $i^* + dep$ and lend at home to receive the higher interest rate. Even if the difference is very small they make comfortable profits as they move huge amounts of money. They are delighted to go on with this so-called interest arbitrage strategy, the more the better. Eventually, the central bank must accept the impossible trinity result of Section 13.3: monetary policy cannot be autonomous in a fixed exchange rate regime when capital is totally mobile. Graphically, this means that the central bank must give up on the *MP* schedule. The economy is described by the *IS* and *IRP* schedules and the fiscal expansion results in a higher GDP, as represented by point *C*.

In practice, this all happens very fast because capital movements are highly responsive to financial conditions. A central bank that recognizes that it has no autonomy will not even attempt to raise the interest rate. A central bank that ignores the impossible trinity principle may try to act, but it will give up sooner or later. In the opposite case of a fiscal contraction, its efforts at reducing the interest rate will promptly cause a massive loss of foreign exchange reserves. No matter how stubborn the central bank may be, the day of reckoning will come rather sooner than later, unless the fixed exchange rate is abandoned.

Fiscal policy under a flexible exchange regime

We know that monetary policy is autonomous when the exchange rate is flexible, so the central bank can follow its strategy as described by the *MP* schedule. Now, as the economy moves from point *A* towards point *B* along the *MP* schedule, the exchange rate appreciates and the central bank just lets it happen. However, the continuing exchange rate appreciation increasingly hurts exporters and draws in imports to the detriment of local producers. The result is that the *IS* curve keeps shifting back to the left from its *IS'* position. In effect the exchange rate appreciation frustrates the fiscal expansion, and the government. Eventually, the appreciation entirely offsets the fiscal expansion – say a higher level of public spending *G* – through a deterioration of the current account $X - Z$ of equal size. Demand $Y = C + I + G + X - Z$. remains unchanged and the *IS* curve ends up back at its initial position. The outcome is described by point *A:* fiscal policy has failed to increase the GDP.

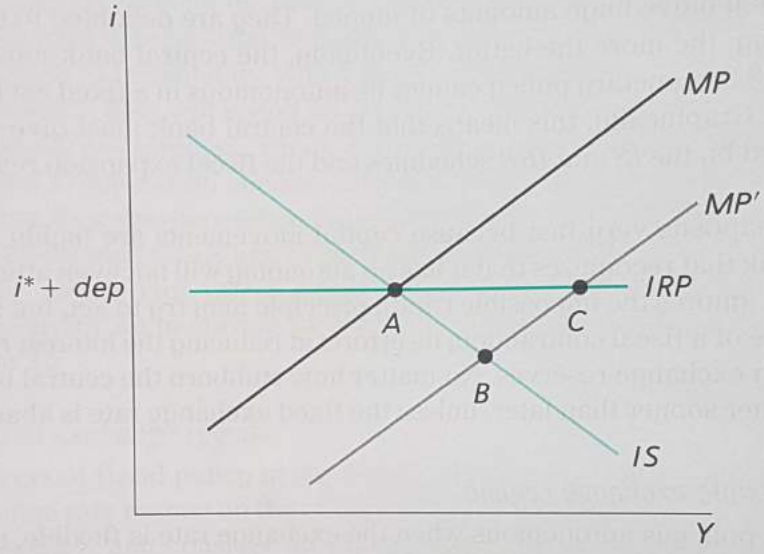
In the case of flexible exchange rates, therefore, the other side of the coin of monetary policy autonomy is the inability of the government to carry out an effective fiscal policy, in the sense that it affects the level of activity. A fiscal expansion will please the producers that sell goods and services to the governments, including civil servants, or those who see their taxes reduced, but the resulting appreciation will hurt domestic producers that compete with foreigners for exports and imports.

This is the theory. In real life, things are more nuanced. The IS schedule can be shifted, to the right in the case of an expansion and to the left in the case of a contraction. The exchange rate will respond fast, but its impact on exports and imports will take time to take hold because it is often the case that relationships between producers and their foreign customers tend to be stable, at least for a while. In the case of a fiscal expansion, the domestic producers may even cut prices to shield their competitiveness from a nominal exchange rate appreciation (*E* increases, *P* decreases and the real exchange rate EP/P^* remains unchanged). Similarly, foreign producers may do the same in the case of a fiscal contraction that results in a depreciation of the domestic exchange rate (*E* decreases, P^* decreases and EP/P^* remains unchanged). But cutting prices hurts profits and no producer can durably cut into profitability. The upshot is that the *IS* schedule will move, output will respond, but the effect will be gradually eroded. This can last a year or two, not much more.

13.5.2 Monetary policy

We now look at monetary policy. To recall, the central bank is presumed to set the interest rate so as to stabilize GDP. It raises the interest rate when GDP increases and lowers it when GDP declines, as represented by the *MP* schedule. In that sense, *MP* is representing monetary policy, and that is it. In this section we examine what happens when the central bank changes its preferences, for example by being more expansionary. This is represented in Figure 13.15. Starting from point A, the *MP* schedule shifts downward: along *MP'*, at any level of GDP, the central bank chooses a lower interest rate to boost consumption *C* and productive investment *I*. To do so, it makes money more abundant.

Figure 13.15 Monetary policy



Monetary policy under a fixed exchange regime

We already know the result: because the central bank is committed to the exchange rate peg, it is unable to carry out an autonomous monetary policy. As already noted, the MP schedule is irrelevant. The economy will remain at point *A*. To see why, imagine that the economy moves to point *B* on the new schedule *MP'*. The interest rate is below the IRP schedule, so capital flies out, which depreciates the exchange rate. The central bank must intervene on the foreign exchange market and buy its own currency to support its value. On the one hand, it creates money on the domestic financial market; on the other hand, it buys it back on the foreign exchange market. When the amounts of money created and bought back are the same, there is no change in the money supply and the interest rate remains at the *IRP* level. Put differently, the central bank tries to lower the interest rate but must bring it back up to stem capital outflows and support the exchange rate parity. Graphically, the *MP* schedule must always move to pass through the intersection of the *IS* and *IRP* schedules.

The question is why the central bank is trying to do so. It may want to escape the impossible trinity principle, which is impossible. All that it achieves is to spend some of its foreign exchange reserves when it faces the financial markets' reaction. The capital flight is instantaneous and massive, and so are the foreign exchange reserve losses.

A devaluation

There is one possibility, though. The exchange rate is fixed at some level, for example 0.134 € for 1 Danish kroner. The central bank of Denmark unexpectedly may decide to change this parity – which it has not done for 20 years! – and devalue the exchange rate to, say, 0.12€.[9] If the markets believe that this new parity will be kept for another 20 years, $dep = 0$, as before the devaluation. Since the foreign interest rate

i^* remains changed, the *IRP* line stays where it was. This is not the end of the story, though. The devaluation has made Danish products cheaper abroad and foreign products more expensive at home. Exports rise and imports decline. This increases the demand for domestic goods $Y = C + I + G + X - Z$. The situation is similar to a fiscal expansion, depicted in Figure 13.14 by the shift from *IS* to *IS'*, which takes the economy to point *C*. Monetary policy works, but not through the interest rate. The impossible trinity principle implies that monetary policy can only be an exchange rate policy.

Monetary policy under a flexible exchange rate regime

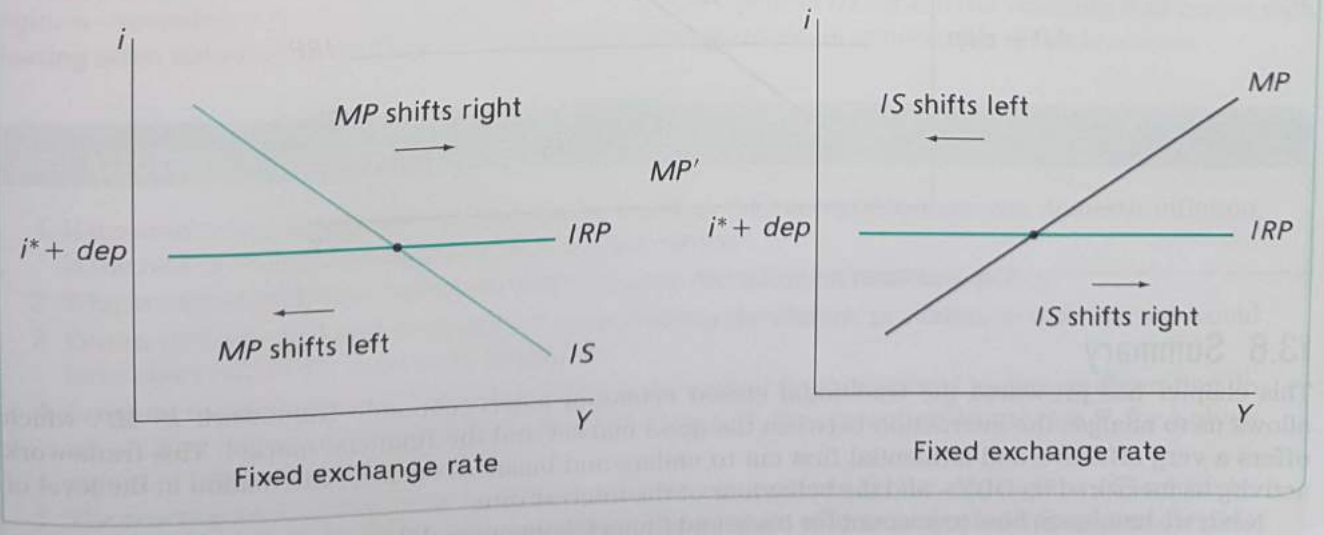
We now return to Figure 13.15. At point *B*, along the new *MP* schedule, the exchange rate is depreciating. The central bank does not resist the depreciation any more. The depreciation boosts exports and reduces imports, demand for domestic products increases and the *IS* curve shifts rightwards (not shown). As the economy moves from *B* to *C*, the central bank reacts according to *MP'* and raises the interest rate. This goes on until point *C* is reached. The expansionary monetary policy succeeds in increasing GDP as the *IS* schedule passively moves until it passes through the intersection of the *MP* and *IRP* schedules. The exchange rate depreciation occurs instantly as financial markets react to the central bank action. Exports and imports respond slowly for the reasons explained in Section 13.5.1. It may take up to two years for the *IS* curve to reach its new position.

Once again, the impossibility trinity principle is respected. Monetary policy autonomy is safeguarded under a flexible exchange rate regime. However, note the subtlety of the result: monetary policy does not operate through the interest rate, it works through the exchange rate. Exactly as in the case of a devaluation of a fixed exchange rate, monetary policy becomes exchange rate policy.

Graphical summary

Figure 13.16 provides a summary of how the *IS–MP–IRP* framework is adapted to the exchange rate regime. Under a fixed exchange rate regime, the loss of monetary policy autonomy means that the *MP* schedule is irrelevant. The economy is described by the *IS* and *IRP* schedules. Above the *IRP* line, capital flows in and the central bank defends its parity by buying foreign currency with domestic currency. The increase in domestic money supply amounts to an expansionary policy, and the implicit *MP* schedule moves until it meets the *IS* and *IRP* schedules. Below the *IRP* line, the central bank resists a depreciation by buying domestic currency with its reserves of foreign currency. This means that the domestic currency is becoming scarce and the implicit *MP* schedule shifts to the left.

Figure 13.16 Exchange rate regimes: a summary



[9] A devaluation or a revaluation is a change in the declared parity. A depreciation or an appreciation is a market-driven change of a flexible exchange rate.

Under a flexible exchange rate regime, exchange rate movements affect competitiveness and the *IS* schedule shifts accordingly. The economy is described by the *MP* and *IRP* schedules. Above the *IRP* line, the currency appreciates and the loss in competitiveness shifts the *IS* schedule to the left. Below the *IRP* line, the currency depreciates as capital flows out, which boosts competitiveness and shifts the *IS* schedule to the right.

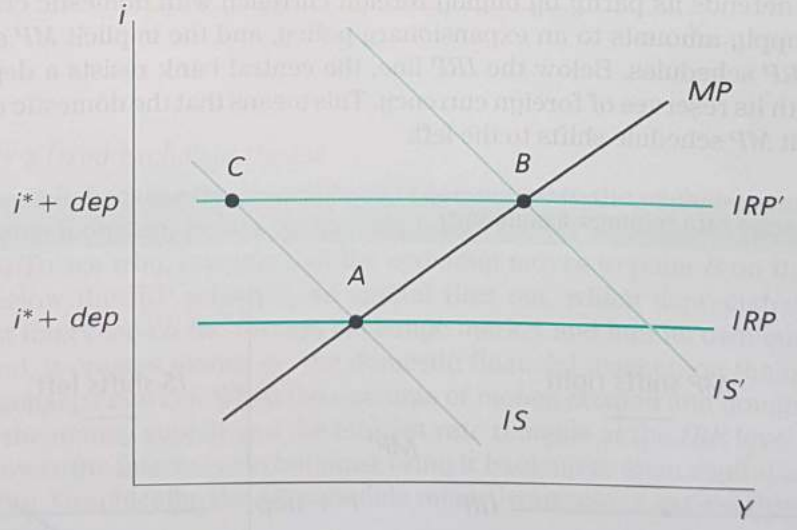
13.5.3 Exchange rate determination

The *IS–MP–IRP* framework can also be seen as a way of understanding exchange rate movements. The exchange rate appreciates when the *IS* and *MP* schedules intersect above the *IRP* line; it depreciates when the *IS* and *MP* schedules intersect below the *IRP* line.

One way to illustrate this observation is to ask what happens when the foreign central bank, for its own reasons, raises its interest rate from i^* to i'^*, assuming that *dep* remains zero. The result is the upward shift of the *IRP* line to *IRP′* in Figure 13.17, starting from point *A*. Note that we assume that the foreign country is 'the world' or a very large country that has the autonomy to carry out its monetary policy, an issue to which we return in subsequent chapters. Point *A* now lies below the new *IRP′* line. Capital flies out and the exchange rate depreciates under a flexible exchange rate regime. World demand for our goods increases and the *IS* curve starts shifting to the right. The depreciation will go on until the *IS* curve has moved to *IS′* and the economy has reached point *B*, which takes a year or two to happen, as explained above.

When the exchange rate is fixed, the central bank resists the depreciation pressure by intervening on the foreign exchange market. As it buys back its own currency, the money supply shrinks and the *MP* schedule moves up until it goes through point *B*. In effect, the domestic central bank is forced to adopt the restrictive stance of the foreign central bank, which results in a decline of GDP and a higher domestic interest rate.

Figure 13.17 Foreign monetary policy



13.6 Summary

This chapter has presented the traditional closed economy macroeconomic framework *IS–MP*, which allows us to analyse the interaction between the good market and the financial market. This framework offers a very effective and influential first cut to understand business cycles – fluctuation in the level of activity as measured by GDP – and the behaviour of the interest rate.

Next, we have seen how to account for trade and financial openness. When a country is fully integrated in global financial markets, the implications are drastic. The domestic interest rate is tightly linked to the 'world' interest rate, taking into account the expected change in exchange rate. This is captured by

the interest rate parity condition, graphically represented by the *IRP* line, which is added to the *IS* and *MP* schedules. An important aspect of the theoretical framework *IS–MP–IRP* is that it shows the importance of the exchange rate regime.

The interest rate parity condition is a feature of capital mobility and it is met permanently as financial markets reshuffle assets across countries and currencies. International investors are constantly on the watch for the best possible returns. As they shift capital around, they equalize expected returns across countries and currencies. Interest rate parity establishes a tight link between the exchange rate and domestic and foreign interest rates. Relying as it does on market expectations, it recognizes the importance of perceptions, whether or not they are correct, and irrespective of whether these expectations eventually materialize. Welcome to the world of finance!

The impossible trinity principle reveals crucially important implications for monetary and exchange rate policy strategies. It asserts that governments must make coherent choices regarding the exchange rate regime, the use of monetary policy and the capital mobility regime. An important implication is that, when capital is free to move, a central bank cannot control simultaneously the interest and the exchange rates.

The *IS–LM–IRP* framework is a powerful instrument. It allows us to understand how monetary and fiscal policies operate under different exchange regimes. In line with the impossible trinity principle, it shows that fiscal policy is effective when the exchange rate is fixed but its effects are entirely offset by exchange rate changes in the flexible regime. Conversely, monetary policy is ineffective under a fixed exchange regime and operative under a flexible exchange regime.

Under a fixed exchange rate regime, the situation is always explained by the intersection of the *IS* and *IRP* schedules; the loss of monetary policy autonomy means that the *MP* schedule shifts passively. Under a flexible exchange rate regime, the situation is always explained by the intersection of the *MP* and *IRP* schedules; the exchange rate movements shift the *IS* schedule until it goes through the intersection of the two other schedules.

The real exchange rate is a measure of a country's external competitiveness. It combines the nominal exchange rate and the prices of domestic and foreign goods. Its equilibrium level corresponds to a situation when exports and imports are lastingly balanced. Thus the actual real exchange rate eventually converges to its equilibrium level. Among countries at a similar development stage, the equilibrium real exchange rate is unlikely to change much. This explains the purchasing power parity (PPP) principle: the long-term constancy of the real exchange rate implies that the nominal exchange rate is equal to the inflation differential. Developing countries that successfully catch up with the advanced countries are likely to see their equilibrium real exchange rate appreciate over time. This is the Balassa–Samuelson principle.

In practice, genuinely fixed exchange rates and complete free floating are just the two corners of a wide range of intermediate arrangements. These 'soft peg' arrangements either set limits to exchange rate fluctuations – betraying a fear of floating – or seek to introduce some degree of flexibility in fixed rate regimes – revealing a fear of fixing. Attempts to avoid the rigour of fixing and the volatility that comes with floating often amount to violating the impossible trinity principle. In general, the result is a crisis.

Self-assessment questions

1 If the nominal exchange rate appreciates by less than the excess of foreign over domestic inflation, is the real exchange rate appreciating or depreciating?
2 Why are fixed exchange rates believed to impose discipline on monetary policy?
3 Return to Table 13.2 and compute for each country the change in exchange rate that we would have observed if PPP were to be satisfied.
4 Consider the case where $i > i^* + dep$. Explain the capital flows triggered by this configuration. In which direction are the capital flows likely to push i, i^*, the current exchange rate E, for a given expected future exchange rate?
5 The reaction of a central bank to GDP fluctuations is captured by the slope of the *MP* schedule. Interpret the meaning of a steeper schedule. Examine its effects under both fixed and flexible exchange regimes.

6 Using the *IS–MP–IRP* framework, examine the case when fiscal and monetary policies are jointly made expansionary.
7 Drawing on your results in the previous question, characterize the differences between the fixed and flexible exchange rate regimes: which policies work and which do not?
8 A standard speculation strategy consists of borrowing in the home country, investing abroad and selling the proceeds from the foreign investment to pay back the original loan. Determine when this strategy is profitable. Explain why it helps to re-establish the interest rate parity condition.
9 Use the *IS–MP–IRP* framework to examine the effects when the markets expect the exchange rate to appreciate, so that *dep*, which was zero, becomes negative. Study the situation under both exchange rate regimes.
10 Does PPP imply that the inflation rate must be the same in every country under fixed exchange rate arrangements?

Essay questions

1 The real, not the nominal, exchange rate is what matters for the real side of the economy. Why don't central banks attempt to control the real rather the nominal exchange rate?
2 It is often believed that a peg encourages residents (households, firms, banks) to borrow in a foreign currency. Then, if the exchange rate is devalued, many residents face the risk of bankruptcy. Explain and comment.
3 The Eurozone crisis has resulted in very different interest rates being applied in different countries, as exemplified by the case in Greece (Figure 13.9). Explain how this has reduced the ECB's ability to conduct monetary policy.
4 Argue why it may be preferable to adopt a fixed exchange rate regime. Now make the argument in defence of a floating exchange rate.
5 In the aftermath of the financial crisis, the exchange rates of Poland, Sweden and the UK have depreciated sharply (by some 20 per cent or more) relative to the euro. These countries are members of the Single Market but not of the monetary union. Discuss the likely effects on these countries and on the Eurozone countries.

References and further reading

Further reading: the aficionado's corner

Purchasing power parity is one of the oldest regularities detected by economists, traced back to the sixteenth century and much studied ever since. A classic review of its various incarnations (absolute PPP, relative PPP) and of the evidence is:

Rogoff, K. (1996) 'The purchasing power parity puzzle', *Journal of Economic Literature*, 34(2): 647–68.

The interest rate parity condition also has a long history. While its logic is strong, 'proving' this condition is much more difficult because it deals with expectations and everyone is entitled to their own views. There is no such thing as the 'expectation of the markets'. A large empirical literature has been and still is grappling with the issue. It has become increasingly technical. A good update is:

Lothian, J.R. and L. Wu (2011) 'Uncovered interest-rate parity over the past two centuries', *Journal of International Money and Finance*, 30(3): 448–73.

The impossible trinity comes under a variety of names such as the unholy trinity, the policy trilemma or the triangle of impossibility. It was made clear by Robert Mundell in his classic development of what has come to be called the Mundell–Fleming model. This link is described in detail in:

Burda, M. and C. Wyplosz (2013) *Macroeconomics: A European Text*, 6th edition, Oxford University Press, Oxford.

A critical view of the impossible trinity asserts that even countries with a flexible exchange rate lose their monetary policy autonomy; see:

Rey, H. (2013) 'Dilemma not trilemma: the global financial cycle and monetary policy independence', VoxEU, 31 August.

The Bank for International Settlements (BIS) surveys the size and functioning of foreign exchange markets every three years. The latest survey is described in:

BIS (2016) *Triennial Survey*, December. Download from www.bis.org.

A description of existing capital controls and an evaluation of their effectiveness can be found in:

Ostry, J.D., A.R. Ghosh, K. Habermeier, L. Laeven, M. Chamon, M. S. Qureshi and A. Kokenyne (2011) 'Managing capital inflows: what tools to use?', IMF Staff Discussion Note, 5 April. Download from imf.org /external/pubs/ft/sdn/2011/sdn1106.pdf.

Useful websites

The IMF presents up-to-date evaluations of exchange rate policies: www.imf.org.

To find out about the exchange rate regime of a particular country, visit the website of its central bank.

Annex: Various exchange rate regimes

So far we have mentioned just two exchange rate regimes: fixed and flexible. In practice, exchange rate regimes come in all sorts of shapes and forms. Except when the exchange rate is freely floating, all other regimes require choosing a foreign currency to peg. The main anchors have traditionally been the US dollar and the Deutschmark, the latter now replaced by the euro. This section reviews the various possible arrangements, ranging from full flexibility to full rigidity.

Free floating

The simplest regime is when the monetary authorities decline any responsibility for the exchange rate. The rate is then freely determined by the markets and can fluctuate by any amount at any moment. We have already noted (Section 13.3.3) that most developed countries let their exchange rate float freely because they want to conduct autonomous monetary policies and to put their central bank in charge of inflation.

Managed floating

In small and open economies, the authorities are often concerned that a free float results in excessive exchange rate volatility, a pattern sometimes called 'fear of floating'. At the same time, for reasons that will become clear below, they may not want to commit themselves to a particular exchange rate; this is 'fear of fixing'. What they desire is to intervene on the exchange markets from time to time, as they see fit. They operate a managed float, sometimes called a dirty float, which is a halfway house between a free float and a peg. Central banks buy their own currency when they consider it too weak, and sell it when they see it as too strong, but they refrain from pursuing any particular exchange rate target. They are not making any explicit commitment but they are occasionally present on foreign exchange markets with the aim of smoothing short-term movements. This strategy cannot always be distinguished from a free float. European countries that manage their exchange rates to some degree include the Czech Republic, Hungary, Poland and Romania.

Fixed exchange rates or target zones

In a fixed exchange rate regime, the authorities declare an official parity vis-à-vis another currency, chiefly the US dollar or the euro, sometimes vis-à-vis a basket of several currencies. The arrangement normally specifies margins of fluctuation around the central parity, hence the qualification as a target zone. The wider is the band of fluctuation, the closer is the regime to a free float or a managed float. Practically, the central bank must intervene – and lose policy autonomy – when the exchange rate moves towards the edges of the target zone, but it can also intervene at any time it wishes, even if the exchange rate is well within its band of fluctuation. The main advantage is that the knowledge that the central bank will intervene for sure as the exchange rate moves towards the margins leads traders to become prudent when this is the case, which has a stabilizing effect – unless they believe that the central bank will not be willing to intervene strongly enough, in which case a speculative attack may occur.

It is understood that the central parity may be infrequently changed, a procedure called realignment. The realignment option is useful when dealing with serious disturbances. It is also needed when domestic inflation durably exceeds that of the anchor currency, which erodes external competitiveness.[10]

[10] If inflation is higher than abroad, P rises faster than P^* and P/P^* increases. When the nominal exchange rate E is fixed, the real exchange rate EP/P^* appreciates. In order to restore competitiveness and lower the real exchange rate, the country must depreciate the nominal rate, i.e. reduce E.

The realignment option provides some monetary policy autonomy, mainly the ability for the inflation rate to differ from that in the anchor currency country.

From 1945 to 1973, under the Bretton Woods agreement, fixed and adjustable exchange rates were the rule worldwide. The margins were initially set at ±1 per cent until 1971, and then widened to ±2.25 per cent. This widening reflected a desire to maintain autonomy over monetary policy as capital movements, strictly limited since the end of the Second World War, were gradually liberalized. Fundamentally, it reflected attempts to avoid the implication of the impossible trinity. The Bretton Woods system eventually collapsed because it was built around the US dollar, whose value was fixed in terms of gold. The collapse was the last step in removing links between currencies and gold.

Between 1979 and 1993, Europe's Exchange Rate Mechanism (ERM) also operated as a system of fixed and adjustable exchange rates, a situation studied in the next chapter. Here, we merely note that attempts to retain monetary policy autonomy led to a serious crisis in 1993 and to the end of the ERM as originally designed.

Crawling pegs

In a crawling peg regime the authorities declare a central parity and a band of fluctuation around it. The characteristic of this regime is that the central parity and the associated maximum and lower levels are allowed to slide regularly: they crawl. The rate of crawl is sometimes pre-announced, sometimes not. The difference between a crawling peg and a target zone is not clear cut, since both involve an acceptable range – margins considered narrow enough to qualify as a pegged arrangement are typically less than ±5 per cent around the official parity. Many Latin American countries operated crawling pegs in the 1980s, as did Poland and Russia in the mid-1990s. These arrangements did not last for very long, however, because they really are attempts to escape the logic of the impossible trinity.

Currency boards

Currency boards are a tight version of fixed exchange rate regimes. Under a pegged regime, monetary policy has to be wholly dedicated to the exchange rate target but, as we saw, the possibility to devalue or revalue and the existence of margins of fluctuation introduce some degree of flexibility. Currency boards are designed to remove this flexibility. In order to ensure that monetary policy is entirely dedicated to supporting the declared parity, with no margin of fluctuation, the central bank may issue domestic money only when it acquires foreign exchange reserves. If it spends its foreign exchange reserves, the central bank must retire its own currency from circulation and the money supply shrinks.[11]

Currency boards used to exist in the British Empire, and disappeared with it. They were revived by a number of Caribbean islands as they became independent and by Hong Kong in 1983. They became more widespread in the 1990s when countries with weak political institutions, such as Argentina, Bosnia-Herzegovina and Bulgaria, chose this rigorous arrangement to put an end to monetary indiscipline and its corollary, raging inflation. Freshly independent from the Soviet Union, with no history of central banking, Estonia and Lithuania also adopted a currency board. Argentina's system collapsed in 2002, illustrating the dangers of an inflexible arrangement.

Dollarization/euroization and currency unions

A yet stricter regime is to fix the exchange rate irrevocably, which means adopting a foreign currency, hence the term '*dollarization*' (as in Ecuador, El Salvador, Panama, Zimbabwe and Liberia) or '*euroization*' (as in Kosovo and Montenegro). Without a domestic currency, there obviously can be no monetary policy whatsoever. This regime is typically adopted by small countries with very weak political institutions as they simply rely on a foreign central bank to carry out what is de facto their own monetary policy.

[11] The study of the gold standard in Section 14.1.1 provides the logic of this rule.

A monetary union is very similar since countries that decide to share the same currency give up national monetary policy. The difference between a currency board and a monetary union is that, in the former, monetary policy is carried out by a foreign central bank, which only cares about its own country, while the common central bank of the latter cares about all member countries. In addition to Europe, francophone Africa and some Caribbean islands have formed monetary unions, as described in Box A13.1.

Box A13.1 Existing monetary unions

In Africa, the CFA zone was created when the former French colonies gained independence in the 1960s.[12] It includes two unions: the West African Economic and Monetary Union (Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal, Togo) and the Central African Economic and Monetary Union (Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Equatorial Guinea, Gabon). These countries never created their own currencies (Mali and Equatorial Guinea did, until they joined the CFA zone in 1985). The two monetary unions are formally independent of each other and each has its own central bank, yet both pegged their currency to the French franc at the same rate, and both devalued just once, by 50 per cent in 1994. They have been pegged to the euro since 1999. The arrangement is special, a legacy of colonial times and based on a guarantee by France, but it is a true, modern monetary union. Belgium and Luxembourg formed a monetary union until they joined the euro area.

The East Caribbean Common Market (Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, St Lucia, and St Vincent-and the Grenadines) forms a monetary union. These are small islands that can hardly be compared to the European monetary union.

Brunei and Singapore also form a currency union.

Other countries have unilaterally adopted a foreign currency. This is the case of Kiribati, Nauru and Tuvalu, which use the Australian dollar; Lesotho, Namibia and Swaziland, which use the South African rand; and the Bahamas, Liberia, the Marshall Islands, Micronesia, Palau and Panama, which have adopted the US dollar. Since 2001, Ecuador, San Salvador and Zimbabwe have also adopted the US dollar. In Europe, Monaco uses the French franc (now the euro), Liechtenstein the Swiss franc, and San Marino the Italian lira (now the euro). These are not true monetary unions, since the centre country is not committed to taking into account the interests and viewpoints of its 'satellites', and actually never does.

[12] The term CFA comes from the old colonial French designation 'Comptoir Français d'Afrique'. The western Africa CFA means *Communauté financière d'Afrique* (Financial Community of Africa), while the central Africa version means *Coopération financière en Afrique centrale* (Financial Cooperation in Central Africa).