

CHAPTER 3

Introduction to the Open Economy: Exchange Rates and the Balance of Payments

This chapter provides an introduction to the concepts and determinants of the foreign exchange rates and the balance of payments. It lays the basis for the open economy macroeconomics and the determination of the exchange rates in later chapters.

This chapter also presents the theories important for open economy macroeconomics. These are the purchasing power parity (PPP) and interest rate parity (IRP) theories.

This chapter introduces the economic concepts related to the openness of the economy. Its focus is on the understanding of the exchange rate and the components of the balance of payments.

Every economy nowadays has considerable commodity and financial flows with other economies. These flows — mainly of commodities, currencies, and financial capital, though sometimes also of people — between economies affect their domestic national income, employment, prices, and other endogenous variables, as well as the scope and effectiveness of national monetary and fiscal policies.

The flows of factors of production other than physical capital¹ are minor and are generally ignored in macroeconomic analysis. Further, the short-run analysis of an open economy assumes that the physical capital stock is fixed so that any flows of such capital that occur are out of currently produced output and do not affect the productive capacity of any economy. In fact, there is a special use of the word ‘capital’ in the context of international trade. This is in its financial usage. Therefore, the international flows of ‘capital’ are to be understood as being only financial flows, that is, a flow of the currency and other financial assets of one country to another country in exchange for financial assets. These flows have become quite considerable in the last few decades with the global integration of financial markets, and on a daily basis, are very much larger than the values of commodity flows for many countries.

The open economy has one more good than the closed economy. This good is ‘*foreign exchange*’, which is the designation for the medium of payments between the domestic and foreign economies. This good consists of foreign currencies, gold, and *Special Drawing Rights* (SDRs) at the International Monetary Fund (IMF). SDRs act as a kind of demand deposits of individual countries with the IMF. The price of the domestic currency against a foreign one is the exchange rate between the currencies. Since macroeconomic theory usually treats the rest of the world as a single unit, our analysis will be set out in terms of the composite category labeled ‘foreign exchange’ — meaning by it the foreign currencies of the rest of the world — and ‘the exchange rate’ between this composite and the domestic currency.

Flows of commodities and financial instruments occur between the domestic economy and the rest of the world. The flows of commodities among countries take the form of exports and imports of commodities, with the difference between them designated as *net exports* (of commodities), which is also called the *balance of*

¹The remaining flows are of immigrants and transient migrants. While these are not very significant for most economies, there are a few countries, especially in the Middle East, for which such workers can be a significant proportion of the labor force.

trade. The flows of financial instruments — in the form of bonds and other ownership claims — are financial capital flows and are captured in the *balance of payments on capital account*. The flows of physical capital are counted in commodity imports or exports, rather than in international capital flows. They do not directly appear in the balance of payments on capital account.

3.1 Exchange Rates

3.1.1 Three concepts of exchange rates

Almost all countries have their own national currencies. The rate of exchange between a domestic currency and a foreign one is called the exchange rate between them. The exchange rates between currencies can be nominal, real or effective ones.

The (nominal) exchange rate

The *(nominal) exchange rate* is the rate at which a currency can be exchanged against another currency. This exchange rate between any two given currencies can be defined in two alternate ways. It can be defined as:

1. The price of the domestic currency (\$) in terms of a foreign currency (£s). An example of this occurs if we cite the exchange rate for the British £ in Canadian dollars as £0.4 per C\$. [News reports in Canada often use this definition of the exchange rate for the Canadian dollar in terms of the US dollar, as in ‘today, in foreign exchange markets, the Canadian dollar traded at 85 US cents’.]
2. The price (per unit) of a foreign currency in terms of the domestic currency. An example of this occurs if we cite the exchange rate for the British £ in Canadian dollars as C\$2.40 per £. This measure of the exchange rate is clearly the reciprocal of the former measure, so that the exchange rate as Canadian dollars per pound would be specified by £1 = C\$1/0.4 = C\$2.5. [News reports in Canada often use this definition of the exchange rate for the Canadian dollar in terms of the euro and the yen].

The definition of exchange rate that would be appropriate to use obviously depends upon convenience and preferences. There is no consensus on which definition is more useful. Both have certain advantages and disadvantages relative to the other. We prefer using the definition above. That is, *the (nominal) exchange rate will be defined as the amount (i.e., number of units) of a foreign currency required to purchase one unit of the domestic currency*. Taking the dollar as the unit of the domestic currency and the £ as the generic symbol for a unit of the foreign currency, the nominal exchange rate under our definition will be the amount of £s per \$ in the foreign exchange markets — *compactly expressed as £/\$*. We will use the Greek letter ρ (pronounced ‘rho’) for the nominal exchange rate. The dimension of ρ for our definition is £/\$.

The real exchange rate

The *real exchange rate*, designated as ρ^r , is the amount of foreign commodities that can be exchanged for one unit of domestic commodities.² Its relationship with the nominal exchange rate is specified by:

$$\rho^r = \rho P / P^F, \quad (1)$$

²To illustrate this point, assume that we are comparing the price of an identical car that costs £10,000 in Britain and \$24,000 in Canada, and the nominal exchange rate is £0.5 per \$. Hence, for this car,

$$\rho^r = \rho P / P^F = 0.5 \times 24,000 / 10,000 = 1.2$$

The units of measurement of ρ^r , from $\rho P / P^F$ are:

$$(\text{£ per \$})(\text{\$/per Canadian car}) / (\text{£ per British car}) = \text{British cars per Canadian car.}$$

where:

- ρ = nominal exchange rate (£/\$) (amount of foreign currencies per unit of the domestic one),
- ρ^r = real exchange rate (amount of foreign commodities per unit of the domestic one),
- P = domestic price level, and
- P^F = foreign price level.

Therefore, the real exchange rate is the nominal exchange rate adjusted for the relative price ratio between the countries. As mentioned above, *the real exchange rate specifies the amount of foreign commodities required to purchase a unit of the domestic commodity.*

The best way of intuitively grasping the concept of the real exchange rate is to focus on a single commodity, say X. Suppose we had one unit of commodity X and were to sell this unit at home, convert the dollars thus obtained into the British currency (£) and then attempt to buy units of the same commodity in Britain. Let the amount of the commodity obtained in Britain be z units. Then, assuming that there are no transport or other transactions costs, one unit of the commodity in the domestic market allows us to purchase z units of the same commodity in Britain. Therefore, the real exchange rate is z (units of the foreign commodity per unit of the domestic one). If the commodity is (a) a standardized one, (b) without transport and other transactions costs, and (c) traded on competitive world markets, we would expect z to equal unity but it is unlikely to do so if any of these conditions are not met.

At the level of the economy as a whole with a very diverse set of commodities, different economies have different mixes of commodities, so that each economy's mix is treated as if it was a 'composite commodity'. The proxy for the price of this composite commodity is the price level. Hence, the relative price ratio (P/P^F) is used to adjust the nominal exchange rate ρ to derive ρ^r .³

Since the standardised composite commodity on a world-wide basis does not exist, many economists intuitively estimate the real exchange rate on their travels by using the price of a standard commodity such as a Macdonald's hamburger as they move from one country to another. To illustrate, a price of \$1.20 in Canada and of £1 per hamburger in the UK, with a nominal exchange rate of £0.50 per \$, gives a real exchange rate of 0.60. The calculation is as follows:

$$\rho^r = \rho P / P^F = 0.5(1.20/1) = 0.6.$$

Intuitively, in this example, it takes only 60% of a British hamburger to buy a Canadian one: the Canadian hamburgers are relatively cheaper (by 40%).

The effective exchange rate

There is obviously a different exchange rate for each foreign currency, even though economic analysis is formulated in terms of a single exchange rate for simplification purposes. Such a rate can be envisaged as an average exchange rate for all currencies, just as the 'price level' is an average of the prices of commodities in the economy. This average exchange rate between the domestic currency and all foreign currencies is called the *effective exchange rate*. As an average, the effective exchange rate is obtained by weighting the exchange rate against each foreign currency by the proportion of the domestic economy's total trade (exports and imports) conducted with the foreign country. Changes in this effective exchange rate provide a measure of the average change in the value of a currency in terms of all other currencies.

³Since the dimensions of ρ are £/\$ and of P/P^F are \$/£, the dimension of ρ^r is $[(\text{£}/\$) \cdot (\$/\text{£})]$, where the £ and \$ signs cancel out, so that the dimension of the real exchange rate is foreign commodities per domestic ones.

There can obviously be both a nominal and a real effective exchange rate. The effective rate is preferable for converting GDP, exports, imports etc. from one currency to another one for international comparisons.⁴

3.2 Fixed, Flexible, and Managed Exchanged Rates

The market for foreign exchange may be allowed to determine the exchange rate. Alternatively, the exchange rate may be set by the central bank (or the government). The former is known as the *flexible/floating* exchange rate case and the latter as the *fixed/pegged*⁵ exchange rate case. In general, there are three *exchange rate regimes*: (i) fixed, (ii) flexible, and (iii) managed floating. The *managed floating exchange rate* regime covers the case where the central bank (and/or the government) buys or sells foreign currencies (from its reserves) in the foreign exchange market to limit the range of fluctuations in its foreign exchange rate. Most flexible exchange rate regimes tend to be managed ones to a greater or lesser extent.

Depreciation and appreciation of the domestic currency

If the exchange rate (£/\$) decreases, say from £0.50 per dollar to £0.40 per dollar, the domestic currency decreases in value against foreign currencies and there is a *depreciation* (under floating exchange rates) or *devaluation* (under fixed exchange rates) of the domestic currency against other currencies. If the exchange rate depreciates, it costs more in the domestic currency to buy foreign goods and assets, while domestic goods and assets become cheaper in foreign currencies. Conversely, if the exchange rate increases, the domestic currency increases in value against foreign currencies and there is an *appreciation* (under floating exchange rates) or *reevaluation* (under fixed exchange rates) of the domestic currency against other currencies. In this case, foreign goods and assets will become cheaper in terms of the domestic currency, while the domestic goods and assets will become more expensive in foreign currencies.

3.3 Purchasing Power Parity (PPP) as a Theory of the Exchange Rate

3.3.1 PPP at the level of a single commodity

PPP for a single, standardized and internationally traded commodity is that it must cost the same in different countries, once its prices in the different countries are converted into the same currency by the nominal exchange rate. The assumptions required for this condition are that:

- The commodity is identical in different countries.
- There is perfect competition.
- There are no ‘transactions costs’ (such as from transport, insurance, tariffs, quotas, etc.) to its movement or information asymmetries among the countries.

Under these conditions, the internationally traded commodity will cost the same (after conversion into any one currency) in different countries. If its price was higher in one country, there would be an inflow of imports

⁴The PPP index of nominal exchange rates — which is an index over time of the nominal exchange rate which makes the real exchange rate equal to unity — would be an even better measure for certain purposes such as comparing standards of living across countries.

⁵The term ‘pegged’ is more appropriately used where the exchange rate by the policymaker is changed periodically.

from other countries in sufficient amounts to reduce the domestic price to the foreign one. If the price was lower, domestic firms will export enough of it to other countries to raise the domestic price to the foreign one.⁶

Absolute PPP among countries

In the limiting (but unrealistic) case where all the goods and services between the domestic and foreign economies are of the above type, we have *absolute PPP between the domestic economy and the world one*. At this aggregate level, PPP is the condition that:

$$\rho^r = \rho P / P^F = 1. \quad (2)$$

PPP is often called the ‘law of one price’ (for commodities in the international context). All of the commodities in the economy do not meet the assumptions for PPP. Among the reasons for this are that many goods — for example, buildings and land, most kinds of services, etc. — are not internationally tradable. Further, some of the inputs of even internationally tradable goods, such as the labor services in retailing or local transportation or the usage of immovables such as buildings and land, etc., have to be local ones. Therefore, even for the internationally traded goods, these transportation and local retailing costs drive a wedge between the domestic prices of goods and the prices in other countries. Hence, the conditions for PPP are not met for all or possibly most final goods (i.e., at the retail level) in the economy, so that the above absolute version of PPP does not apply in practice.

Extended Analysis Box 3.1: Does PPP Apply in the Real World? An Illustration

On the question of whether PPP applies in the real world, we turn to the prices of hamburgers across countries as an intuitively appealing test. *The Economist* annually publishes the prices of McDonalds’ Big Mac among countries.⁷ Its reports invariably show very significant deviations from PPP. The data reported is on the price in the local currency, the exchange rate between the local currency and the US dollar and the implied dollar price. The article on 27 April 2000, showed the following:

	In local currency	In US\$	Implied PPP* of the US\$ ⁸	Actual US\$ exchange rate ⁹	% Overvaluation (+) against US\$
USA	US\$2.51	US\$2.51	1.00	1.00	0
Australia	A\$2.59	1.54	1.03	1.68	–39
Britain	£1.90	3.00	0.76	0.63	+20
Canada	C\$2.85	1.94	1.14	1.47	–23
Mexico Peso	20.90	2.22	8.33	9.41	–12

The more detailed calculations for this table are given in the Appendix of this chapter. This evidence shows that, relative to the PPP implied values for the Big Mac as of 27 April 2000, the Canadian currency was undervalued by 23% and the Mexican one was undervalued by 11%, relative to the US dollar, even though these countries are neighbors of the USA. The British pound was overvalued by 20% relative to

⁶This activity is known as arbitrage, which consists of buying in cheaper countries and selling in more expensive ones so as to make a profit from the price differences.

⁷<http://economist.com/markets/bigmac/displayStory.cfm>.

⁸This is the domestic price of the Big Mac divided by its price in USA.

⁹Local currency per US dollar.

Extended Analysis Box 3.1: (Continued)

the USA. As a corollary, the British pound was overvalued relative to the Canadian dollar by about 50% ($=1.23/0.80 - 1$). There was also considerable under- or overvaluation even among the national currencies (in 2000) of the EU.

Over several years, *The Economist's* time series of Big Mac prices do not usually show a strong tendency toward PPP; in fact, they sometimes even show movements contrary to it. This can be seen by comparing the Big Mac index over several years. The issue of *The Economist* on 18 July 2009, showed the following for the countries in the preceding table.

	In US\$	Implied PPP* of the US\$ ¹⁰	% Undervaluation (–) or Overvaluation (+) against US\$
USA	US\$3.57	1.00	0
Australia	US\$3.37	1.22	–6
Britain	US\$3.69	1.56	+3
Canada	US\$3.35	1.09	–6
Mexico	US\$2.39	9.34	–33

Comparing the extent of undervaluation and overvaluation in the preceding data for 2000 and 2009, the extent of undervaluation of the currency decreased for Australia and Canada, whose nominal exchange rates against the US dollar shot up in July and August 2009; and the extent of overvaluation of the currency decreased for Britain, whose nominal exchange rate against the US dollar fell in 2009. But, for Mexico, the extent of undervaluation increased from 12% to 33%. Therefore, PPP does not hold as a reasonably realistic assumption over fairly long periods, and its assumption in macroeconomic theory is unjustified.

Although the Big Mac is a fairly standardized product, its local cost of production only partly depends upon internationally traded inputs, such as meat and flour, which should adhere to PPP. Its cost of production also depends on inputs such as local labor, land, and buildings, which are not internationally traded and for which there is unlikely to be PPP. The degree of local competition for hamburgers could also differ, so that McDonalds may vary its profit margin among countries. These factors cause differences in relative prices among countries.

At the economy's level, most final products are similarly combinations of internationally traded and non-traded goods, and there are different degrees of competition for each country's goods. Therefore, PPP rarely applies to individual goods or to commodities as a whole.

3.4 Relative PPP and Shifts in the Relative Efficiency of Economies

If we assume that the real exchange rate has a particular value k , we have:

$$\rho^r = \rho P / P^F = k. \quad (3)$$

¹⁰This is the domestic price of the Big Mac divided by its price in the USA.

For absolute PPP, $k = 1$, so that commodities would cost the same at home and abroad. However, travellers from a country with k less than unity find that the same commodities cost more abroad than at home — and vice versa. Appendix Box 3.1A derives the value of k for selected countries for 27 April 2000. k is less than 1 for Canada, Mexico, and Australia, so that the residents of these countries find a Big Mac more expensive in the USA than in their own countries. However, k exceeds 1 for Britain vis-à-vis the USA, so that Americans find a Big Mac more expensive in Britain than at home. One of the reasons for the divergence of k from unity for Big Macs is that some of the inputs — such as local labor and land — into their production and retailing are not internationally traded and the Big Mac is itself not internationally traded — i.e., cannot be exported or imported. Another reason arises from the impact of capital flows on exchange rates.

If a country's k exceeds unity, its exchange rate is said to be *overvalued* (relative to PPP). If k is less than unity, its exchange rate is said to be *undervalued*. The reasons why k can differ from unity, and, therefore, from absolute PPP, are:

- The price indices for P and P^F (such as the CPI) are based on the prices of a bundle of commodities, which include some internationally traded goods and others which are not internationally traded, e.g., services, buildings, etc.¹¹ The distinction between these types of commodities is relevant to the determination of the country's nominal exchange rate ρ , which is affected by its relative ability to produce and export internationally traded commodities more efficiently than other countries. The nominal exchange rate is not affected by the efficiency and costs of goods and services that are not internationally traded, even though they are included in the measurement of domestic and foreign price indices, which affect the derivation of the real exchange rate.
- The nominal exchange rate also reflects the ability to attract net inflows of capital. As explained later in this chapter and in Chapter 12, these flows are likely to be the dominant *short-term* determinant of exchange rates for countries with extensive capital flows. Countries that are attractive havens for capital attract large net capital inflows from abroad. These inflows push up the demand for their currencies, which increase their exchange rates, with the result that their value of k becomes greater than unity. The reasons for this attractiveness can be higher interest rates, better business opportunities, greater security of capital, etc. Countries that are relatively more attractive for capital inflows tend to have k greater than unity.
- Under fixed exchange rate regimes, another cause of the overvaluation (undervaluation) of the real exchange rate is if the government or the central bank sets the value of the country's exchange rate higher (lower) than P^F/P .

Empirical observation suggests that less developed countries often have values of k less than one relative to the developed ones. Even among the developed economies, countries that are attractive havens for capital have values of k higher than one relative to other developed economies.

3.4.1 Long-run changes in relative PPP

Rewrite the preceding equation of the relative PPP as:

$$\rho = k \cdot (P^F/P). \quad (4)$$

In the long run, k will not be a constant since transactions costs, the relative competitiveness of the domestic economy in commodity production, the relative sizes of its internationally tradable and non-tradable sectors,

¹¹Note that the price indices do not take account of capital flows.

and its relative attractiveness for capital flows can change over time. With k potentially varying in the long run, the rate of change in ρ would be given by:

$$\rho'' = P^{F''} - P'' + k'' = (\pi^F - \pi) + k'' \quad (5)$$

Note that '' stands for the rate of change in the accompanying variable and π is the rate of inflation.

This is the *long-run version of relative PPP*. It asserts that the rate of change in the nominal exchange rate reflects the difference in the inflation rates and the rate of change in the real exchange rate. An increase in the value of k for our currency — i.e., $k'' > 0$ — appreciates it. A decrease in the value of k for our currency — i.e., $k'' < 0$ — depreciates it.

3.4.2 Short-run changes in relative PPP

For the short-run analysis, the factors that determine k are assumed to remain unchanged so that k is treated as a constant (i.e., its rate of change k'' equals zero), so that in the short run:

$$\rho'' = P^{F''} - P'' = \pi^F - \pi \quad (6)$$

This version of PPP is known as the *short-run version of relative PPP*.

Economists usually prefer using the relative version (either the long run or the short run one) of the PPP theory rather than its absolute version in explaining changes over time in exchange rates. However, PPP indices are often constructed and used for calculating the PPP-based GDP series for cross-country comparisons of output and output per capita. An example of these is given in Box 3.1.

3.4.3 Implications of short-run PPP for exchange rates and inflation rates

The short-run version of relative PPP is that $\rho'' = \pi^F - \pi$. This short-run version of relative PPP implies the following two theories, depending on whether the country is following a fixed or flexible exchange rate regime.

- (i) Fixed exchange rate regime case: In this case, $\rho'' = 0$, so that $\pi = \pi^e$. That is, in the short run, the domestic inflation rate for a small open economy is determined by the foreign one. Therefore, the domestic central bank through its monetary policies cannot achieve an inflation rate different from the world one. Hence, *under a fixed exchange rate regime, PPP becomes a theory for the determination of the domestic inflation rate for a small open economy.*
- (ii) Flexible exchange rate regime case: In this case, ρ'' can differ from zero. This assumes that the central bank through its monetary policies can bring about a domestic inflation rate different from the world one, so that the rate of appreciation/depreciation of the exchange rate will be given by: $\rho'' = \pi^F - \pi$. If the domestic inflation rate is maintained lower (higher) than the world one, the exchange rate will rise (fall) correspondingly. Therefore, *under a flexible exchange rate regime, PPP becomes a theory for determining the rate of change of the exchange rate for a small open economy.*

Box 3.1: International Comparisons of Standards of Living in Terms of PPP

The nominal GDP (or GNP) measure discussed in Chapter 1 was in domestic prices. The real GDP measure discussed in Chapter 1 was its nominal value divided by an index of the domestic price level (e.g., the CPI

Box 3.1: (Continued)

or the GDP deflator). The standard cross-country comparisons of GDP are made by converting its nominal value into a common currency, often the US dollar, at the nominal exchange rate between the domestic currencies and the US dollar. For example, Canadian GDP is converted to US dollars as:

$$\text{Canadian GDP in US\$} = (\text{Canadian GDP in C\$})(\text{US\$ per C\$})$$

or as,

$$\text{Canadian GDP in US\$} = \frac{\text{Canadian GDP in C\$}}{\text{C\$ per US\$}}.$$

This mode of conversion is quite useful for some purposes — e.g. comparing the relative sizes of economies in nominal terms for international trade purposes. However, the GDP per capita derived from it is not an appropriate measure of the relative standards of living among countries when the nominal exchange rate is not consistent with PPP.

Appropriate cross-country comparisons of real GDP and real GDP per capita require that each given commodity be given the same value among the different countries. For example, a cup of coffee, *ceteris paribus*, in one country should be properly counted as being equal to a cup of coffee in other countries, even though its domestic purchase price converted into the US dollars at the nominal exchange rate may be quite different from that in the USA. For this purpose, first, the exchange rates based on PPP have to be constructed.¹² These provide the values of the ‘PPP exchange rate’. Second, the PPP exchange rates are used to convert GDP in the national currency into the PPP GDP. This is done for selected countries in the following table.

Using PPP real exchange rates for cross-country conversions of GDP raises the GDP figures for countries whose real exchange rates (derived from the nominal ones) are less than unity and lowers those for countries whose real exchange rates (derived from the nominal ones) are greater than unity. The following table¹³ provides for a few selected countries the comparisons of GNP and GNP per capita based on the nominal exchange rate and those on PPP.

	GNP (1993)		PPP GNP (1993)	
	Total (US \$M)	Per capita (US \$)	Total (US \$M)	Per capita (US \$)
USA	6,378,873	24,070	5,925,080	23,220
Canada	574,786	19,970	596,557	20,970
UK	1,045,994	18,060	941,413	16,302
Mexico	324,997	3,610	692,795	7,867
Australia	307,967	17,500	321,126	18,500
India	269,460	300	1,437,124	1,633
Kenya	6,844	270	29,024	1,176

¹²The mode of construction of this index first requires finding for a common, pre-selected bundle of commodities the domestic price and the foreign price. Suppose this bundle is labeled as A and its domestic price is P^{PPP} while its foreign price is $P^{*\text{PPP}}$. Under PPP, $\rho^{\text{PPP}} \cdot (P^{\text{PPP}}/P^{*\text{PPP}})$ will equal unity, where ρ^{PPP} is the PPP exchange rate. Hence, $\rho^{\text{PPP}} = (P^{*\text{PPP}}/P^{\text{PPP}})$.

¹³Source: John L. Allen, *Student Atlas of Economic Development*. Dushkin/McGraw-Hill, 1997, pp. 69–72.

Box 3.1: (*Continued*)

The general pattern in this sample of countries is for the PPP calculations to be different from the ('standard') calculations based on the nominal exchange rates. Some of the differences are very large. In particular, the less developed economies have much higher PPP values than the standard ones. For India and Kenya, the PPP-based per capita values are about five times those based on the market exchange rate. For Mexico, they are twice as much. This reflects a commonly observed pattern of the relative — i.e., relative to PPP — under-valuation of the currencies of the developing economies. But, for the UK, the PPP figures are lower, reflecting its relatively over-valued exchange rate. This over-valuation pattern also holds for France, Germany, and most of the other West European countries.

3.5 Interest Rate Parity (IRP) and the Determination of the Exchange Rate

3.5.1 The benchmark IRP theory

Corresponding to the PPP for commodity flows, the interest rate parity IRP condition is derived with reference to capital flows. It is based on the assumption that investors seek the highest return on their investments. Therefore, if the risk of investing in different countries were identical, for capital to be shared among countries, the rate of return must be the same among countries — otherwise, the country with a higher rate of return will get all the capital flowing into it. This argument leads to the IRP condition. Its assumptions are: (a) perfect capital markets (including the absence of controls on capital flows), (b) zero transactions costs, and (c) risk indifference or zero risk. Under these assumptions, an investor will invest his capital in the country that offers him the highest return.

The nominal rate of return from investing in domestic bonds is their yield, designated by the interest rate R . Designating the nominal yield on foreign bonds as R^F , the net nominal return (in the domestic currency) on foreign investments is R^F less any expected appreciation ρ^{e} of the domestic currency — or alternatively, plus any expected depreciation of the exchange rate.

For this comparison, consider an investor who wants to invest \$100 for one year. If he/she invests it in domestic one-year bonds yielding 5% per year, he/she will get back \$105 at the end of the year. His/her alternative is to invest in British bonds at a current exchange rate of £0.50 per dollar, so that he/she will be investing £50. Let British bonds pay an interest rate of 6%, so that he/she will get back £53 after one year. Further, assume that he/she expects the exchange rate to become £0.51 at the end of the year, so that the £53 will give him/her \$103.92 (= £53/0.51) in dollars. He/She therefore benefits by investing in domestic bonds (which will pay \$105) — even though the domestic interest rate is only 5% against the 6% interest rate in Britain. The reason the British bonds provided a lower expected return in this calculation is that the exchange rate for the domestic currency was expected to appreciate (from £0.50 per dollar to £0.51 per dollar) and the effect of this appreciation had to be deducted from the British interest rate.

In general terms, investment of \$1 at home will yield $\$(1 + R)$. Investment of \$1 abroad will be worth $\pounds\rho$ in the foreign currency at the time of investment and therefore, would yield $\pounds(\rho + \rho R^F)$ in the foreign currency. The latter's expected value in the domestic currency will be $\$(\rho + \rho R^F)(1/\rho^e)$. This equals $\$(1 + R^F)(\rho/\rho^e)$. Therefore, the return from investments at home and abroad is the same if:

$$\begin{aligned}(1 + R) &= (1 + R^F)(\rho/\rho^e), \\ R &= R^F(\rho/\rho^e) + (\rho/\rho^e) - 1, \\ &= R^F(\rho/\rho^e) - [(\rho^e - \rho)/\rho^e].\end{aligned}$$

Note that the denominator on the right hand side is ρ^e and not ρ . Also note that R in the IRP equation stands for the return including the coupon payment and any expected capital gains or losses. This is especially important for capital flows into equities whose values fluctuate a great deal and have a strong speculative component. Note that for relatively small changes expected in the exchange rate, the error induced by the approximation can be ignored for the sake of simplifying the presentation. It cannot be ignored for large expected changes, as illustrated in Chapter 2.

In the preceding equation, setting $[(\rho^e - \rho)/\rho^e]$ as ρ''^e and approximating (ρ/ρ^e) by unity for small differences between ρ and ρ^e , the above equation reduces to the approximation:¹⁴

$$R = R^F - \rho''^e, \quad (7)$$

where ρ''^e is the expected rate of appreciation of the domestic currency and equals $(\rho^e - \rho)/\rho^e$. This simplified version of the IRP equation is called the *benchmark IRP equation*. Interpreting intuitively this benchmark IRP equation, to be used for low interest rates and 'small' changes in exchange rates, investors compare the nominal yield R on domestic bonds with the expected return on foreign bonds. The latter equals $(R^F - \rho''^e)$. If $R < (R^F - \rho''^e)$, investors will get a higher expected return from investing abroad, so that they will only invest abroad. But if $R > (R^F - \rho''^e)$, investors (including foreigners) will get a higher return from investing in our country and will only invest in it. In equilibrium, under the assumption that the investments in each country have the same risk level, if the bonds of both countries are to be sold simultaneously, the return must be the same from the two forms of investment, so that market equilibrium requires that $R = R^F - \rho''^e$.

To reiterate, the benchmark IRP equation is an approximation and holds only for very small changes in exchange rates. While it is in common usage and we will continue to use it for further analysis, it is an approximation to the actual relationship between these variables. However, the approximation is quite good for very small changes in exchange rates and for relatively low interest rates.

3.5.2 The benchmark IRP as a determinant of the domestic interest rate

If the country follows a fixed exchange rate regime or the exchange rate is expected to remain unchanged, $\rho''^e = 0$, so that the benchmark IRP theory implies that $R = R^F$. That is, the domestic interest rate will equal the world interest rate. Countries with a fixed exchange rate, which is expected by the investors to remain unchanged, would clearly have this determination of the interest rate. Countries with a flexible exchange rate that is not expected to change will also experience the same restriction on their interest rate.

If the investors expect the exchange rate to change, then the IRP condition implies that the domestic interest rate will diverge from R^F by ρ''^e .

3.5.3 The benchmark IRP as a theory of the exchange rate under flexible exchange rates

If the exchange rate is expected to change during the investment period, IRP turns into a theory for the determination of the exchange rate. For this theory, note that $\rho''^e = (\rho^e - \rho)/\rho^e$, so that IRP can be written as:

$$\rho''^e = (\rho^e - \rho)/\rho^e = R^F - R.$$

¹⁴This is an approximate formula that does fairly well at low values of the expected rate of change in the exchange rate but not very well at high values. It is only approximate since it does not, for foreign investments, take into account the conversion of the earned interest rate into the domestic currency.

Hence,

$$\begin{aligned} 1 - \rho/\rho^e &= R^F - R, \\ \rho/\rho^e &= R - R^F + 1, \\ \rho &= (R - R^F + 1)\rho^e. \end{aligned} \quad (8)$$

Given IRP, this equation determines the exchange rate for given values of the domestic and foreign interest rates and the given value of the expected future exchange rate. It implies that if the central bank raises the domestic interest rate relative to the foreign one, the country's current exchange rate will rise relative to the expected future exchange rate. Further, if the increases in the interest rate and exchange rate induce the financial markets to expect a further appreciation of the exchange rate (i.e., ρ^e rises), the exchange rate will appreciate even more.

A simple illustration of the above arguments is provided by the following example. Suppose that initially $\rho^e = \rho = 1$. The central bank now raises the interest rate by 5%. Keeping ρ^e unchanged at 1, IRP implies that the current value of the exchange rate ρ would rise by 5%. Therefore, the exchange rate is *expected to depreciate* to the lower future value, with this value equal to ρ^e , which remains at unity.

3.5.4 The role of speculative returns to stocks in capital flows and IRP

While the IRP theory is usually stated as if the capital flows were in and out of bonds, international capital flows arising from the purchase and sales of stocks have become increasingly important in recent decades, as evidenced by international mutual funds and stock index funds. These flows are dominated not by the present discounted value of a known stream of coupon payments on bonds, but by the unknown and highly speculative future stock prices (see Chapter 2). Consequently, the expected returns on stock prices tend to be speculative and very different from the returns on bonds. Further, the movements in bond and stock yields can follow very different patterns. In particular, bubbles in the stock prices (see Chapter 2) build up, often to different extents in different countries. These bubbles, rather than bond yields and movements in interest rates, can significantly influence capitals flows among countries and limit the straightforward application of the IRT theory as a determinant of capital flows and interest rates among countries.

3.5.5 Extending IRP to incorporate risk factors and risk aversion

The interest rate on an asset incorporates a premium to compensate investors for its riskiness. The extra risk ('exchange-rate risk') in investing in foreign countries includes the potential for future exchange rate appreciations and depreciations, which depend upon the possibility of different inflation rates in different countries and other factors. The latter in turn depend on the general health of the economy and the ability and willingness of governments and central banks to control inflation and promote growth. Further, the possibility of financial and exchange rate crises and that of the imposition of controls on the redemption of capital increase the risk for foreign investors and increase the required risk premium.

To compensate for the relevant risk premium α , the benchmark version of the IRP equation has to be modified to:

$$R = (R^F - \rho'^e) + \alpha.$$

Assuming a lower risk and/or a greater preference for investments at home than abroad, capital importing countries have to pay a premium to foreign investors as an inducement to send their capital, so that α would be positive. That is, capital importing countries have to maintain higher interest rates at home than

capital exporting countries because of the risk premium required by foreign investors to send capital to them. Conversely, capital-exporting countries would have a negative value of α and relatively lower interest rates at home than capital-importing countries. Hence, under the preceding assumptions,

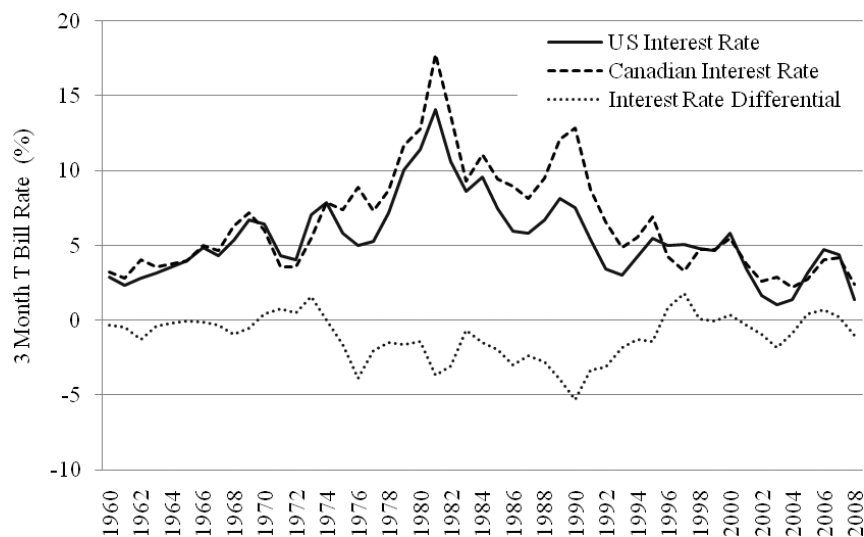
For capital importing countries: $\alpha > 0$, so that $R > R^F$.

For capital exporting countries: $\alpha < 0$, so that $R < R^F$.

In the general case, where countries are neither consistently capital importing nor exporting ones relative to each other, the sign and value of α will depend on many factors, which include the degree of risk aversion of investors, investor's perception of the degree of (country) risk involved in investing in at home versus abroad, etc. The latter depend on the likely future economic prospects of the economies. Therefore, as these factors shift, the sign and value of α can shift over time.

Fact Sheet 3.1: Interest Rate Differentials Between Countries

This Fact Sheet shows the interest rate differential (plotted as the USA Treasury bill rate minus the Canadian one) between USA and Canada, which have closely integrated financial markets, so that there should be perfect capital flows between these countries. The Interest Parity Theory implies that the interest rates should be identical between them. However, as the following graph shows, there is almost always a differential between them. The Canada T-bill rate was higher in Canada from the early 1970s to the mid-1990s; outside this period, the Canadian rate was sometimes higher and sometimes lower than in the USA. Therefore, the value of the interest rate premium/discount α is usually not zero, even for closely integrated economies, and also not constant over time.



3.5.6 The relative importance of PPP and IRP in determining exchange rates

International capital flows are nowadays potentially much larger than the value of commodity flows for developed economies with open capital markets, so that anticipated changes in interest rates can set up massive capital flows. These flows — entering on either the demand or supply side of the foreign exchange market of a country — dominate over other flows and determine the exchange rate — unless the governments have fixed

the exchange rate or try to manage it through offsetting sales or purchases of foreign exchange from their reserves.¹⁵

Further, since capital is extremely mobile and very large amounts can be transferred among countries with well-developed financial markets at a few minutes' notice, IRP determines exchange rate changes on a continuous basis in free exchange markets, while, as we have already argued, PPP holds at best in a long-run context. Hence, *in well-developed financial markets, IRP provides the short-term determination of the exchange rates while PPP or its relative version at best only provides a long-term tendency, so that exchange rates determined through IRP can deviate from PPP for considerable periods.*

3.6 The Balance of Payments

The balance of payments can be defined or presented in an economic or accounting form. Economic analysis focuses mainly on its economic form. *The (economic) balance of payments is a statement of the inflows and the outflows of funds from the domestic country and the difference between them.* If the economic balance of payments were arranged in the form of a table, it would specify each of the sources of the inflows and outflows of funds from a country, and the *difference* between them. This is illustrated in Table 3.1. The inflows of foreign exchange during a period are the sum of the payments we receive for commodities and financial assets sold to foreigners plus interest and dividends on our investments abroad and unilateral transfers (such as gifts) from foreigners. The outflows of foreign exchange are the sum of the payments we make for commodities and financial assets bought from foreigners plus interest and dividends on foreign investments in our country and unilateral transfers (such as gifts) to foreigners. Defining the (economic) balance of payments by B , we have:

$$B = \text{Inflows of foreign exchange} - \text{Outflows of foreign exchange} \quad (9)$$

$$= (X_c + Z_k + IR + IT) - (Z_c + X_k + OR + OT) \quad (10)$$

$$= (X_c - Z_c + IR + IT) - (X_k - Z_k + OR + OT),$$

where:

B = balance of payments,

X_c = value of exports of commodities (goods and services),

X_k = value of capital exports (against our purchases of stocks and bonds from foreigners),

Z_c = value of imports of commodities (goods and services),

Z_k = value of capital imports (against foreigners' purchases of stocks and bonds from us),

IR = inflows of interest and dividend payments,

IT = inflows of funds due to unilateral transfers (gifts and donations) from abroad,

OR = outflows of interest and dividend payments, and

OT = outflows of funds due to unilateral transfers (gifts and donations) to foreigners.

On the right side of the above equation, $(X_c + Z_k + IR + IT)$ are the inflows of foreign exchange, with X_c as the inflows against the exports of commodities and Z_k as the inflows against the outflows of bonds (including stocks and shares and other claims to ownership). $(Z_c + X_k + OR + OT)$ are the outflows of funds. Of these,

¹⁵The ability to do so depends upon the country's foreign exchange reserves (and other support it can arrange from other countries or the IMF) relative to the private capital flows. Since the latter can be potentially much larger than the former for most countries, countries now possess a very limited ability to manage exchange rates contrary to market forces.

Table 3.1 Stylized Balance of Payments Accounts

Credits (inflows of funds)		Debits (outflows of funds)	
The balance of payments on current account			
Merchandise exports	150	Merchandise imports	125
Rent	0	Rent	5
Interest	80	Interest	25
Dividends	100	Dividends	10
Wages and salaries	25	Wages and salaries	35
Transportation	5	Donations to foreign countries	
		Private	10
		Government aid (grants)	20
<i>Total for current account</i>	<i>360</i>		<i>230</i>
The balance of payments on capital account			
<i>A. Private</i>			
Sale of domestic shares to foreigners	15	Purchase of foreign shares	40
Sale of long-term bonds to foreigners	10	Purchase of foreign corporate bonds	20
Sale of short-term bonds to foreigners	20	Purchase of foreign government securities	10
Foreign demand deposits with local banks	5	Demand deposits with foreign banks	15
		Acquisition of foreign exchange by local banks	10
<i>B. Government</i>			
		Loans to foreign countries	100
<i>Total for capital account</i>	<i>50</i>		<i>195</i>
The balance of payments			
<i>Total flows for balance of payments</i>	<i>410</i>		<i>425</i>
Net balance of payments position	-15		
(= inflows – outflows = 410 – 425 (a deficit in the balance of payments of 15))			
Official settlements balance			
Official settlements balance	+15		
(= outflows from foreign exchange reserves, representing inflows into the foreign exchange markets)			
The accounting balance of payments			
Total inflows of funds	425	Total outflows of funds	425
(in/from the foreign exchange markets of the domestic economy)			

Z_c are the outflows of funds to pay for the imports of commodities and X_k are the outflows of funds to pay for our purchases of foreign bonds (including stocks and shares and other claims to ownership).

IR and IT represent inflows of funds without a corresponding reverse flow of currently produced commodities or bonds. IR captures the payments of interest and dividends on foreign bonds held by the domestic residents, with such bond holdings representing past investments rather than being a current cross-border flow of bonds. Similarly, OT captures the payments of interest and dividends on domestic bonds held by foreigners. IT and OT capture cross-border remittances or gifts, which do not involve explicit future debt obligations.

The preceding equations define the *balance of payments in an economic sense*. The balance of payments is thus a statement of the exports and imports of commodities and financial assets. Note that all of the magnitudes in this equation are in nominal form.

The balance of payments can be decomposed as:

$$\begin{aligned} \text{Balance of payments} &= \text{Balance of payments of current account} \\ &+ \text{Balance of payments on capital account.} \end{aligned}$$

3.6.1 The components of the balance of payments

The (economic) balance of payments has two components:

(i) *The balance of payments on current account* (B^c):

$$B^c = (X_c - Z_c + NR + NT), \quad (11)$$

where $(X_c - Z_c)$ specifies the *net exports of commodities* and is also called *the balance of trade*. $NR (= IR - OR)$ is the net inflow of interest and dividend payments and $NT (= IT - OT)$ is the net inflow of transfer payments.

The balance of payments on current account has three components: net exports of goods and services, net interest and dividend income from foreign investments, and net unilateral transfers. If the sum of the *net* interest and dividend payments and net unilateral transfers were zero, the balance of payments on current account becomes identical with net exports, which is also known as the balance of trade. The common assumption on $(NR + NT)$ in the macroeconomic analysis for most developed economies is that this sum is zero or that it can be taken as exogenously given in short-run analysis.¹⁶

(ii) *The balance of payments on capital account* (B^k):

$$B^k = Z_k - X_k. \quad (12)$$

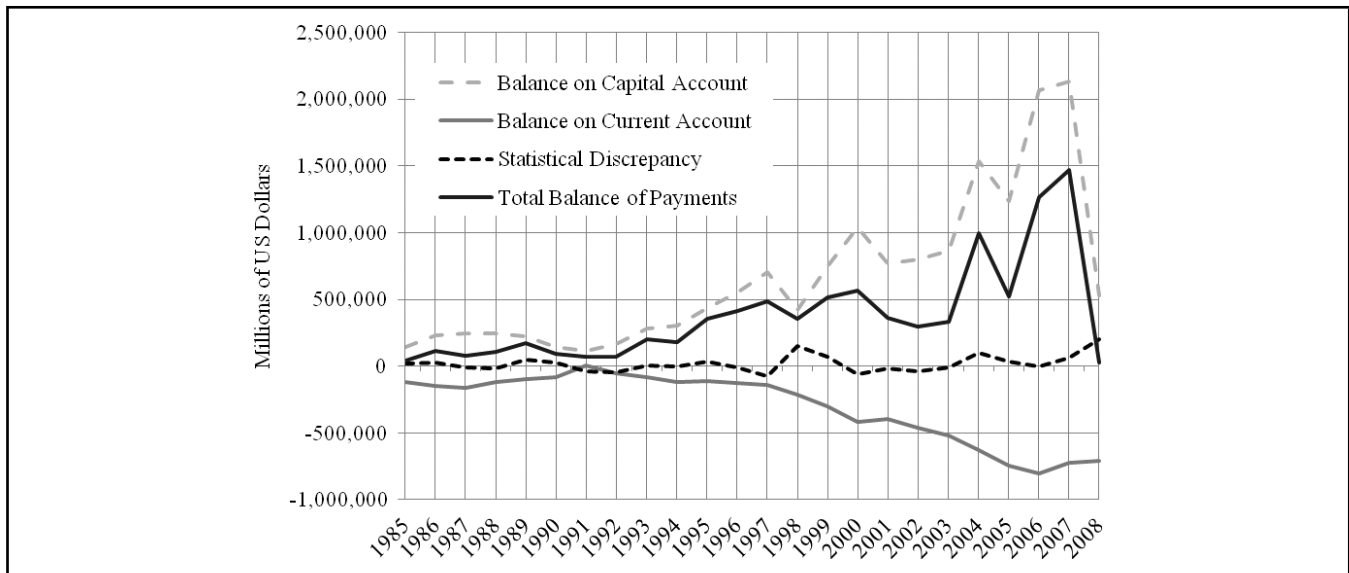
This balance specifies the *net* inflow/imports of funds resulting from (financial) capital flows. Z_k is the inflow of funds/capital resulting from the purchase by foreigners of financial assets from us while X_k is the outflow of funds/capital resulting from the purchases by domestic residents of financial assets from foreigners. Z_k is called capital imports and X_k is called capital exports.

Fact Sheet 3.2: United States Balance of Payments, 1976–2008

This Fact Sheet illustrates movements in the balance of payments and its components by examining these for the USA. As this sheet shows, none of these is ever in equilibrium, i.e., equal to zero. The USA has had a large and increasing trade and current account deficit since about 1984. Its capital account balance has tended to be positive since the USA attracts foreign capital flows because of its political stability and its economic performance.

¹⁶Such an assumption would be unrealistic for countries with large positive or negative values of either NR or NT . Among these are countries with a large externally held debt, as in the case of many developing economies, or large net remittances as in the case of some oil-rich countries on the Arabian Peninsula with a large number of foreign workers.

Fact Sheet 3.2: (Continued)



3.6.2 Equilibrium in the balance of payments

Clearly, the value of B need not equal zero. It could be positive, negative, or zero. If $B > 0$, there is said to be a surplus in the balance of payments, which is paid to us in foreign currencies so that our reserves of foreign currencies increase. If $B < 0$, there is said to be a deficit in the balance of payments, which we pay for through running down our country's reserves of foreign currencies. If $B = 0$, the balance of payments is said to be in *equilibrium*, so that there is no change in our foreign currency reserves. By comparison, if $B < 0$ or $B > 0$, the balance of payments is said to be in *disequilibrium*.

We have the following two implications of equilibrium in the balance of payments:

- a. If the balance of payments is in equilibrium, $B = 0$ so that,

$$(X_k - Z_k) = (X_c - Z_c) + (NR + NT). \quad (13)$$

That is, in the balance of payments equilibrium, net capital inflows (outflows) equal the balance of payments surplus (deficit) on the current account. Hence, if our country is exporting more than it imports of commodities, it must also be a net exporter of capital, so that it increases its investments abroad on a net basis.¹⁷

- b. Also, for $B = 0$, we have:

$$(Z_c - X_c) = (Z_k - X_k) + (NR + NT),$$

so that for the balance of payments equilibrium to exist, the net capital inflows (plus NR and NT) must be enough to cover the cost of net imports. Hence, countries with net imports of commodities must be importing capital or pay for them from their foreign exchange holdings.¹⁸

¹⁷A clear example is provided by the case of China in 2004 and 2006. It was both a net exporter of commodities and a net exporter of capital.

¹⁸A clear example is provided by the case of USA in 2004 and 2006. It was both a net importer of commodities and a net importer of capital.

3.6.3 The change in foreign exchange reserves

The difference between the inflows and outflows of funds equals the change in the nation's foreign exchange reserves. Evaluated in dollars, this amount is designated as ΔFR . Therefore,

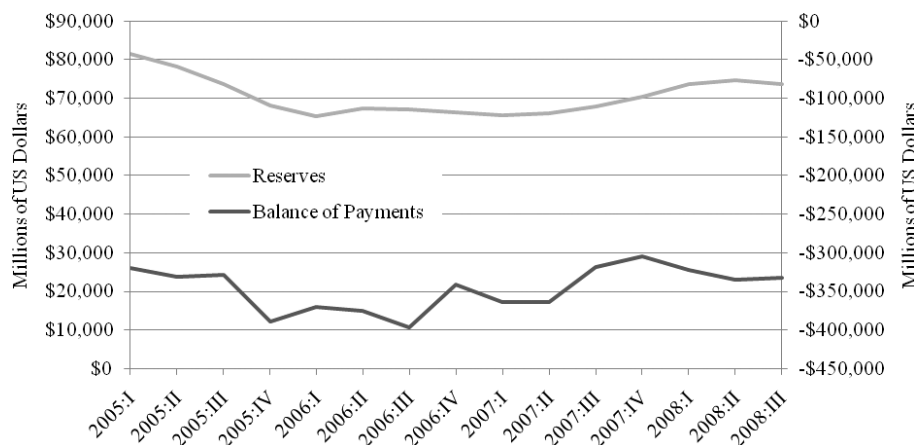
$$\begin{aligned} \$\Delta FR &= B \\ &= (X_c + Z_k) - (Z_c + X_k) + NR + NT \\ &= (X_c - Z_c) - (X_k - Z_k) + NR + NT, \end{aligned} \quad (14)$$

where \$FR stands for the foreign exchange reserves evaluated in the domestic currency (Canadian dollars).

Hence, the net change in our foreign exchange reserves is zero (i.e., $\Delta FR = 0$) if the balance of payments is in equilibrium (i.e., $B = 0$). There is a net inflow of foreign exchange to the home country ($\Delta FR > 0$) if the balance of payments is in surplus (i.e., $B > 0$) and a net outflow ($\Delta FR < 0$) if the balance of payments is in deficit (i.e., $B < 0$). B is thus a measure of the change in the country's foreign exchange reserves.

Fact Sheet 3.3: US Foreign Exchange Reserves and Balance of Payments, 2005–2008

As explained in the text, balance of payments surpluses and deficits produce corresponding changes in foreign exchange reserves, so that movements in the balance of payment and foreign exchange reserves are closely related. This Fact Sheet illustrates this relationship for the USA. For the USA, both balance of payments and foreign exchange reserves experienced a drop in 2005, followed by a steady increase up to the last quarter of 2008.



Equilibrium in the balance of payments

For pedagogical purposes, macroeconomic analysis assumes that the country in question desires equilibrium in its balance of payments.¹⁹ This corresponds to the assumption that the desired level of the balance of payments and of the change in foreign exchange reserves is zero. This is clearly a simplification, though it is commonly used in open economy macroeconomics. We will also do so. In this case, $\Delta FR = B = 0$, so that:

$$(Z_c - X_c) = (Z_k - X_k) + (NR + NT).$$

¹⁹However, note that in practice, central banks do often want to build up their foreign exchange reserves through $B > 0$. An example of this is provided by China in 2005 and 2010.

That is, the net capital inflows (plus NR and NT) must exactly cover the payments for the net imports of commodities, with the result that the change in foreign exchange reserves is zero.

Foreign exchange reserves and short-term bonds

Central banks often invest part of their inflows of foreign exchange in the short-term bonds, especially Treasury bills, of foreign governments, so that they can earn some income. These bonds are highly liquid and earn interest, while holdings of foreign currencies do not.

The country's official holdings of foreign exchange consist of its reserves of foreign currencies (including gold and SDRs) plus its holdings of short-term foreign bonds held by the government and the central bank.

3.7 The Balance of Payments in an Accounting Sense

Surpluses and deficits in the balance of payments have to be settled in foreign currencies. To capture the changes in the country's foreign exchange reserves, we define the *official settlements balance* B^s as the amount that has to be paid to 'settle' (or 'balance' for accounting purposes) the net indebtedness arising from the balance of payments deficits and surpluses. It is defined by the condition $B + B^s \equiv 0$, which makes B^s identical to $-B$.²⁰ To reiterate,

$$B^s \equiv -B. \quad (15)$$

That is, *the official settlements balance equals the negative of the balance of payments* B . Note that, with a balance of payments surplus, a positive value of B (but a negative value of B^s) represents an increase in our foreign exchange reserves.

The *accounting balance of payments* is given by $(B + B^s)$, which is identically equal to zero, since $(B + B^s) \equiv 0$. Hence,

$$[(X_c - Z_c + NR + NT) - (X_k - Z_k)] + B^s \equiv 0, \quad (16)$$

where \equiv indicates an identity.²¹ Hence, the *accounting* balance of payments is a statement of the receipts and payments to foreigners in a given period of time, in a form such that the total receipts *always* equal total payments.

The accounting balance of payments is related to the (economic) balance of payments by the identity $B + B^s \equiv 0$. The *accounting* balance of payments has three components:

1. The balance of payments on current account, B^c .
2. The balance of payments on capital account, B^k .
3. The official settlements balance, B^s , such that $B^s \equiv -B \equiv (-B^c - B^k)$.

Note that the balance of payments (in the macroeconomic sense of this concept) consists only of (1) and (2).

An illustrative form of the balance of payments accounts is shown in Table 3.1. For this tabular form, the inflows of funds are listed in one column and the outflows in another one, with the balancing item B^s being placed with an appropriate sign in one column or the other one. This table lists the flows by type of activity

²⁰Note that $B^s > 0$ indicates an outflow of foreign exchange from the central bank's official reserves to pay for a balance of payments deficit ($B < 0$). Conversely, if there is a balance of payments surplus ($B > 0$), $B^s < 0$ and there is a corresponding inflow of foreign exchange reserves, which become an addition to the official reserves.

²¹This is an identity since the left side will always equal zero.

or function. While the items in this table are self-explanatory, a few comments would be useful. The interest and dividend payment flows are the return to past flows of capital and appear in the current account (of the balance of payments), while the capital flows — through the purchases and sales of bonds (including loans, equities, and deposits in foreign banks) — during the same period are part of the capital account.²² Although there is a net surplus of 130 on the current account, the deficit on the capital account of 145 (because of net investments abroad) results in a net deficit of 15 on the overall balance of balance of payments. This deficit is settled by net sales of foreign exchange worth 15 by the country, so that the official foreign exchange reserves decrease by 15 — and the official settlements balance is +15.

To conclude, from the accounting perspective of Table 3.1, the inflows of funds from the exports of commodities, financial instruments, and foreign exchange equal 425. The outflows of funds from the imports of commodities, financial instruments, and foreign exchange reserves also equal 425. This is the essential aspect of an accounting balance of payments: both sides of the statement are always equal. The element in this balance sheet that ensures the identity of the two sides is the flows out/in of the country's foreign exchange reserves to settle the (economic) balance of payments deficit or surplus.

3.8 The Market for Foreign Exchange and the Changes in Foreign Exchange Reserves

3.8.1 The demand and supply of foreign exchange

As explained earlier, *foreign exchange* consists of all those assets that can act as media of exchange in international transactions. These include gold, currencies of foreign countries, and Special Drawing Rights (SDRs) at the International Monetary Fund (IMF). The SDRs are created by the IMF and held by individual countries as a form of demand deposits with the IMF itself, and are designated in a specified basket of the national currencies.

The *supply of our currency (\$)* in foreign exchange markets arises during the payments process when we buy from foreigners their commodities (which are our imports of commodities) or financial assets (which lead to our export of capital), pay interest and dividends or transfer funds as gifts to them. Conversely, *foreigners' demand for our currency* arises because they buy our commodities (which constitute our exports of commodities) or our assets (which constitute our imports of capital), pay interest and dividends or send gifts of currency to us.²³ Hence,

$$S^{\$} = Z_c + X_k + OR + OT \quad (17)$$

$$D^{\$} = X_c + Z_k + IR + IT, \quad (18)$$

where:

- $S^{\$}$ = supply of our dollars in the foreign exchange markets,
- $D^{\$}$ = demand for our dollars in the foreign exchange markets,
- OR (IR) = outflows (inflows) of funds for interest and dividend payments, and
- OT (IT) = outflows (inflows) of funds occurring due to unilateral transfers.

²²High levels of net inflows (outflows) of capital over some years will imply increased outflows (inflows) for interest and dividends in subsequent years, creating a dynamic relationship between the present capital account and the future current account. The donations to foreign countries are unilateral flows and enter in the current account.

²³Note that our exports (imports) of capital X_k would be equal to our imports (exports) of bonds (including equities) Z_b .

Note that $(IR - OR) = NR$ and $(IT - OT) = NT$, where NR is net inflows of interest and dividends and NT is net inflows of transfers.

3.8.2 Equilibrium in the foreign exchange market

Equilibrium requires the equality of demand and supply, so that, in equilibrium,

$$\$S^{\$} = \$D^{\$}.$$

Since $\$S^{\$}$ corresponds to the inflow of foreign funds in the balance of payments and $\$D^{\$}$ corresponds to the outflow of funds, equilibrium in the balance of payments requires that $B = 0$.

Extended Analysis Box 3.2: The Demand and Supply of Foreign Exchange Stated in Foreign Currencies

In terms of foreign currencies, the *demand for foreign exchange* (£s) is the demand for an international mode of payment (other than one's own currency). This demand arises because the residents of the domestic economy wish to purchase, i.e., import either commodities or financial assets from other countries, pay interest and dividends and make transfer payments.²⁴ This demand corresponds to the outflow of funds in the balance of payments. The *supply of foreign exchange* (£s) to our economy arises because foreigners wish to purchase our commodities or financial assets, as well as pay interest and dividends to us, and send us gifts. This supply of foreign exchange to our economy corresponds to the inflow of funds in the balance of payments. The difference between the supply of and demand for foreign currencies becomes the inflow of foreign exchange funds into our economy. A net inflow (outflow) in the form of foreign currencies, gold and SDRs increases (decreases) the country's foreign exchange reserves.

The demand for *foreign currencies* (£ D^F) by the domestic economy is the sum of our imports of commodities (£ Z_c) and our imports of financial assets corresponding to our capital exports or outflows (£ X_k). Similarly, the supply of foreign currencies (£ S^F) to the domestic economy is the sum of our exports of commodities (£ X_c) and our exports of financial assets (corresponding to our capital imports) (£ Z_k), plus net transfers of interest and dividends (£ NR) and net unilateral transfers (£ NT). Therefore,

$$\pounds D^F = \pounds Z_c + \pounds X_k + \pounds OR + \pounds OT \quad (19)$$

$$\pounds S^F = \pounds X_c + \pounds Z_k + \pounds IR + \pounds IT, \quad (20)$$

where:

D^F = demand for foreign currencies,

S^F = supply of foreign currencies,

£ $OR(IR)$ = outflows (inflows) of funds for interest and dividend payments, and

£ $OT(IT)$ = outflows (inflows) of funds for unilateral transfer payments.

²⁴Note that capital equipment and services such as shipping and tourism are already included in the definition of commodities (goods and services) and are part of imports and exports.

Extended Analysis Box 3.2: (Continued)

The *demand for foreign currencies* by a country ($\text{£}D^F$) has its converse in *the supply of dollars* ($\text{\$}S^{\text{\$}}$) by us to foreigners to act as an element of their foreign exchange balances. The *supply of foreign currencies* by foreigners ($\text{£}S^F$) is correspondingly the converse of the *demand for dollars* ($\text{\$}D^{\text{\$}}$) by foreigners from us. The market for foreign exchange, therefore, can be looked at from two different viewpoints: as the demand and supply of *dollars in the foreign exchange market* or as the demand and supply of foreign exchange/currencies. We will often find it convenient to switch from one to the other in the intuitive explanations of our analysis.

3.9 The Market Determination of the Nominal Exchange Rate

For the flexible exchange rate regime with efficient exchange markets, Figure 3.1 illustrates the market for foreign exchange and the market determination of the equilibrium exchange rate. The horizontal axis measures the quantity of dollars in the foreign exchange market, while the vertical axis specifies the exchange rate (in £ s per $\text{\$}$). This figure assumes that the curve for $\text{\$}D^{\text{\$}}$ follows the usual shape of demand curves and is downward sloping, while that for $\text{\$}S^{\text{\$}}$ follows the usual shape of supply curves and is upward sloping. Equilibrium between $\text{\$}D^{\text{\$}}$ and $\text{\$}S^{\text{\$}}$ is shown at the nominal exchange rate ρ^* . Exchange rates above this equilibrium rate would have $(\text{\$}D^{\text{\$}} - \text{\$}S^{\text{\$}}) < 0$, so that there would be a deficit in the balance of payments. Exchange rates below this equilibrium rate would have $(\text{\$}D^{\text{\$}} - \text{\$}S^{\text{\$}}) > 0$, so that there would be a surplus in the balance of payments.

Since the exchange markets for financially developed economies tend to be efficient (i.e., go to equilibrium rapidly), the market exchange rate for our economies would tend to be the equilibrium one. However, if the exchange rate has been fixed by the government or the central bank, it might be at the equilibrium level, or above or below the equilibrium level. If it was set above the equilibrium level, the economy would have a balance of payments deficit; if it was set below the equilibrium level, the economy would have a balance of payments surplus.

Since both commodity and capital flows are components of the demand and supply of foreign exchange, changes in the net exports of commodities and net capital flows both produce changes in the market exchange rate. In the short term, capital flows are usually more volatile, so that short-term fluctuations in the exchange rate are usually due more to fluctuations in capital flows than in commodity flows.

Chapter 12 will further expand on this analysis of the foreign exchange market.

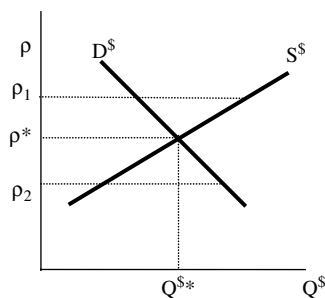
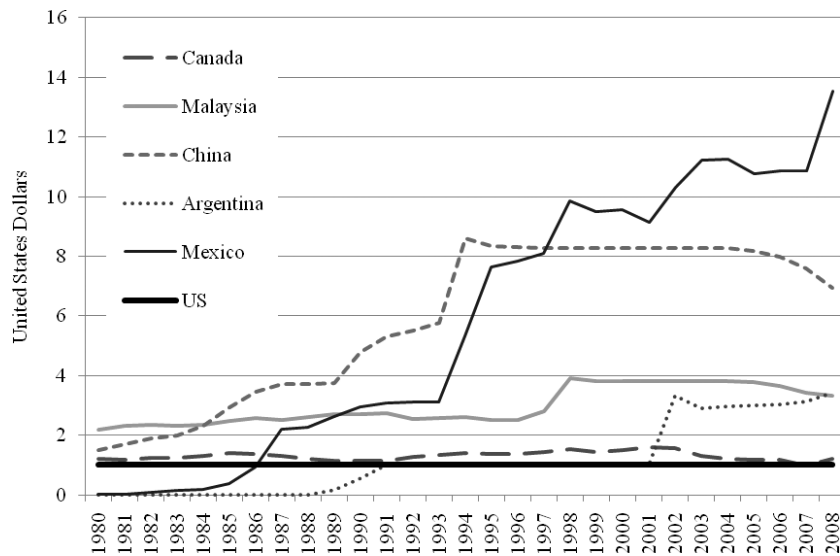


Figure 3.1

Fact Sheet 3.4: Exchange Rates against the US Dollar, 1980–2008

This Fact Sheet illustrates movements in the exchange rates in terms of the US dollar of the currencies of several countries. Some of these countries had pegged exchange rates for part of the selected period. For example, the decision to peg the national currency to the US dollar was taken by Argentina from 1980 to 1988 and from 1991 to 2001, by Mexico in the early 1990s, by Malaysia after 1997, and by China in 1993. When this peg became unsustainable, they switched to a floating exchange rate. The depreciation experienced after such a switch is evident for Argentina in 1988 and 2001 as well as for Mexico in 1991.

**3.9.1 Hot money**

Some of the capital flows among countries are extremely sensitive to expected interest and exchange rate changes, as well as to the political and economic insecurity in the country. Speculation about a possible devaluation/depreciation of the domestic currency can cause sudden, heavy outflows of short-term funds seeking protection from it, or trying to make a profit out of it. Funds whose flows among countries are very sensitive to expected exchange rate changes, interest rate fluctuations or security and convertibility (i.e., unhindered exchanges among currencies) considerations are known as *hot money*.

Investments in short-term bonds can move easily among countries, so that changes in them are part of hot money movements. Such investments can be a major part of financial capital flows among countries.

Box 3.2: National Policies on the Balance of Payments and Accumulation of Foreign Exchange Reserves

Countries hold reserves of foreign exchange with their central banks to meet the possibility of deficits in the balance of payments. Deficits draw down the country's foreign exchange reserves by the amount of the deficit and surpluses increase these reserves by the size of the surplus.

The size of the country's foreign exchange reserves, or changes in it, is a matter of national policy, so that ΔR^F may be positive or negative for long periods. For example, by the end of World War II in 1945, the USA had accumulated massive foreign exchange reserves that were really not needed for financing

Box 3.2: (*Continued*)

its international transactions and could have been reduced. It ran very significant deficits in its balance of payments virtually throughout the 1950s and the 1960s. Germany and Japan had hardly any foreign exchange reserves until the early 1950s and needed to build them up. As their economies recovered and exports increased, they maintained surpluses in their balances of payments for several decades as a way of building up their reserves. Neither the US nor Germany or Japan was especially concerned about their deficit or surplus for much of the 1950s and 1960s. This example illustrates that countries often deliberately accept continuing deficits or surpluses in their balance of payments for fairly long periods. In 2005 and 2006, China provided a clear example of continuing surpluses and the USA provided a clear example of continuing deficits.

3.10 The Persistence of Balance of Payments Deficits and Surpluses

A country may continue to have a balance of payments surplus even with flexible exchange rates if its central bank is willing to accumulate the resulting inflow of foreign exchange. Alternatively, if there is a deficit, it may be willing to sell the required foreign exchange from its reserves. As explained earlier, such a system is known as a managed exchange rate system. Under a managed exchange rate, the exchange rate is manipulated by the central bank through sales or purchases of foreign exchange from its reserves or changes in domestic interest rates. This provides one reason for the persistence over time of balance of payments surpluses and deficits. There are several additional reasons for the persistence over time of balance of payments disequilibrium. These have to do with the elasticities of the exports and imports of commodities and lags in the adjustment of foreign exchange markets from a disequilibrium position to equilibrium. These reasons will be discussed in Chapters 12 and 13 on the open economy.

Conclusions

- While some countries in the world have floating/flexible exchange rates, others have fixed/pegged ones. Many countries with flexible exchange rates try to control/manage the movements in their exchange rates.
- PPP and IRP provide the main theories for explaining the differentials between inflation rates, exchange rates, and interest rates across countries. These theories are especially likely to apply to countries with high ratios of exports and imports to GDP and with large inflows and outflows of capital.
- The weight of empirical evidence is that PPP does not strictly hold among countries even over several years. The empirical failure of PPP occurs mainly because of the existence of goods that cannot be traded across borders and because of capital flows.
- The weight of empirical evidence is that most currencies do not strictly possess interest rate parity with others. The empirical failure of IRP occurs because of imperfect capital markets and differences in the riskiness of domestic versus foreign assets, especially the ‘exchange-rate risk’ in investing abroad.
- Foreign exchange consists of foreign currencies, gold, and SDRs issued by the IMF. These serve as the media of exchange in international payments. A decrease in the demand for the domestic currency in the foreign exchange markets induces a depreciation of its exchange rate, while a decrease in the supply of the domestic currency in the foreign exchange markets induces an appreciation of its exchange rate.

KEY CONCEPTS

<i>Exchange rates: nominal real, and effective</i>	<i>Balance of payments on current account</i>	<i>Foreign exchange reserves</i>
<i>Purchasing power parity</i>	<i>Balance of payments on capital account</i>	<i>The demand and supply of foreign exchange, and</i>
<i>Interest rate parity</i>	<i>The balance of payments</i>	<i>Fixed, flexible, and managed</i>
<i>Balance of trade</i>	<i>The accounting balance of payments</i>	<i>exchange rates.</i>
	<i>Official settlements balance</i>	

SUMMARY OF CRITICAL CONCLUSIONS

- The nominal exchange rate defines the value of a currency in terms of another currency.
- The real exchange rate defines the conversion rate between the commodities in one country and the commodities in other countries.
- The real exchange rate rather than the nominal one indicates the relative prices of commodities in different countries.
- Relative PPP rather than absolute PPP is more likely to apply among countries.
- IRP is an important determinant of interest rates across countries with perfect capital flows.
- While the accounting concept of the balance of payments is that the balance of payments will always be in balance, this is not so for the (economic) balance of payments, which can have a positive or negative value. The latter is said to be in equilibrium when its value is zero.
- Countries can have fixed, flexible, or managed exchange rates.
- Most countries with floating exchange rates usually try to manage the movements in the exchange rate.

Appendix

Extended Analysis Box 3.1A: Comparison of the Actual and PPP Costs of the Big Mac in Different Countries, 27 April 2000

	Big Mac price in local currency	Big Mac's implied PPP exchange rate	PPP check	Exchange rate = US\$ per unit of local currency	Big Mac price in US\$	% Overvaluation of local currency (+) against US\$	<i>k</i>
USA	2.51	1.00	1	1.00	2.51	0.00	1.00
Australia	2.59	0.97	1	0.60	1.54	-38.58	0.61
Britain	1.90	1.32	1	1.59	3.00	20.15	1.20
Canada	2.85	0.88	1	0.68	1.94	-22.76	0.77
Mexico	20.90	0.12	1	0.11	2.22	-11.51	0.88

Notes:

Nominal exchange rate = US\$ per unit of local currency.

Implied PPP exchange rate = foreign (US\$) price of the Big Mac divided by the local price of the Big Mac.

PPP check is done by multiplying PPP-implied exchange rate by local price and dividing by foreign price.

This should equal 1.

US\$ per unit of local currency is the actual nominal exchange rate.

Big Mac price in US\$ = Big Mac price in local currency times the nominal exchange rate.

% Overvaluation (+) against US\$ = (actual exchange rate – PPP exchange rate)/PPP exchange rate.

k equals the nominal exchange rate times the domestic price of the Big Mac divided by its US price.

Findings:

With k less than 1 for Australia, Canada, and Mexico, the Big Mac is relatively cheaper in these countries than in the USA.

With k more than 1 for Britain, the Big Mac is relatively more expensive in Britain than in the USA.

Source of original data: <http://economist.com/markets/bigmac/displayStory.cfm>.

REVIEW AND DISCUSSION QUESTIONS

1. What are the two ways of defining the nominal exchange rate? Which one is used in this book?
2. What is purchasing power parity? Explain its relationship to the real exchange rate.
3. What does relative purchasing power parity imply for changes in the nominal exchange rate?
4. Does PPP apply to different shops in the same city? Same country? Across countries? Illustrate with some examples. Give reasons for the deviations from PPP.
5. What is the relative importance over time of IRP and PPP in determining movements of the exchange rates?
6. Define equilibrium, surplus, and deficit in the balance of payments? What does each imply for changes in the country's foreign exchange reserves?
7. Is the accounting balance of payments always in balance? Give reasons for your answer.
8. Is the (economic) balance of payments always in balance? Give reasons for your answer.
9. Distinguish between fixed, flexible (floating), and managed exchange rates? Which does your country have at present?
10. Show diagrammatically the demand and supply of the domestic currency in the foreign exchange markets. For the figure as you have drawn it, is the equilibrium exchange rate stable or unstable? Explain your answer.
11. How is the payment of interest to foreigners treated in the country's balance of payments?
12. Why do countries with flexible exchange rates continue to have deficits or surpluses on their (a) current account, (b) capital account, and (c) balance of payments?

ADVANCED AND TECHNICAL QUESTIONS

- T1. Suppose that a given bundle of commodities costs C\$50 in Canada and £20 in Britain, and the exchange rate (£ per C\$) is 0.5. What is the real exchange rate between these countries? Is this different from the real exchange rate that PPP requires?
- T2. Why do underdeveloped economies tend to have real exchange rates less than unity? What difference does it make in comparing standards of living across countries?

T3. A simplified form of Canada's balance of payments on current account is presented below.

	1999 (\$b)	2000 (\$b)	2001 (\$b)
Goods and services receipts	417	478	468
Investment income receipts	33	42	37
Transfer receipts	6	6	7
Goods and services payments	385	425	413
Investment income payments	65	69	65
Transfer payments	5	5	5

Calculate the values of (a) net exports of commodities, (b) net interest and dividend flows, (c) net transfers, and (d) balance of payments on current account.

T4. A simplified form of Canada's net inflows on capital account is presented below.

	1999 (\$b)	2000 (\$b)	2001 (\$b)
Net flow of Canadian assets ²⁵			
Canadian direct investment abroad	-27	-65	-57
Canadian portfolio investment abroad ²⁶	-23	-62	-35
Other Canadian investment abroad ²⁷	5	-7	-16
Net flow of Canadian liabilities			
Foreign direct investment in Canada	37	94	43
Foreign portfolio investment in Canada	4	20	30
Other foreign investment in Canada ²⁸	-13	8	8
Statistical discrepancy	15	-7	-3

Calculate the balance of payments on capital account (including the statistical discrepancy)?

T5. Given the information in the preceding two questions, what was Canada's balance of payments in the three years? Was it in equilibrium, deficit or surplus?

²⁵A minus sign indicates an outflow of capital due to an increase in our claims on nonresidents or a decrease in liabilities to them.

²⁶This item includes bonds and stocks.

²⁷This item consists of loans, deposits, official international reserves, etc.

²⁸This item consists of loans, deposits, official international reserves, etc.