EXCHANGE RATES AND

THE BALANCE OF PAYMENTS

When you pay for goods in the U.S. typically the payment is made in dollars. Usually you hand over some of your cash or write a check. But, if you were in England, Venezuela, South Korea, Zambia, or most any other country, you would not pay for your goods with dollars.15 Instead, you would pay with pounds in England, with bolivars in Venezuela, with won in South Korea, and with Kwacha in Zambia. In short, the majority of transactions within a country are carried out with the country's own currency.

However, you do not have to be a tourist in a foreign country to have a use for that country's currency. Importers and exporters buy and sell very large quantities of goods and services across their borders. The international sector is not only large, but a growing part of the U.S. economy. In 1990 U.S. exports and imports were each about 10% of the country's GDP. This compares with 6% for 1970, and about 5% for 1960. Even though the international sector in the U.S. is large, other countries are relatively more integrated. For example, in Peru imports and exports are roughly 16% of their GDP and the same figure for Spain is 26%.

Trade across countries occurs in many different types of goods. When a U.S. resident or firm buys a good or service from abroad it is called an import. When a U.S. resident or firm sells a good or service abroad it is called an export. Imports and exports may be final goods, such as coffee from Brazil, intermediate goods, such as tin from Thailand, or they may be services, like entertainment from the Vienna Boy's Choir or the movie Rambo. In summary, there are a vast array of imports and exports that make up an important and growing sector of world economies.

15 However, in some foreign countries the U.S. dollar circulates widely. Panama is an example.
In addition to trade in goods and services, people also buy and sell bonds and other assets across borders. For example, a saver in Germany may buy U.S. Treasury bonds or bonds sold by IBM. In this way the citizens of one country, Germany, are lending funds to the citizens or the government of another country, the U.S. Exchanges of bonds and other assets between the citizens of different countries are called capital flows, and the volume of these exchanges is a very large and very important feature of international transactions.

**Exchange Rates**

Let us now imagine that a U.S. household or firm wants to buy a Japanese good. The Japanese seller is likely to want payment in yen. After all, when the seller pays his bills, the Tokyo electric company does not want payment in dollars. This means that some party will eventually have to swap dollars for yen. It may be the U.S. importer who trades dollars for yen and then pays the Japanese seller, or the Japanese exporter may accept payment in dollars and then exchange the dollars for yen.

Whoever winds up making the exchange of dollars for yen must find out the price at which the currencies trade. Now, if someone asks you the price of a six pack of coke or a gallon of gas, you would know the answer, or at least where you could find it. But what if someone asked you for the price of a pound, bolivar, won, kwacha, or yen, how would you find the answer?

The Wall Street Journal and many local newspapers report the prices of foreign currencies each business day. For example, on May 15, 1994 the dollar price of a British pound was $1.50 and the Venezuelan bolivar cost $.0076. The dollar price of foreign currency is called the U.S. dollar equivalent exchange rate, or the dollar per pound exchange rate. We write in symbols

\[
e(\$/\text{pounds}) = 1.50
\]

\[
e(\$/\text{bolivars}) = .0076
\]

Rates are often quoted in the reciprocal form of foreign currency per U.S. dollar. This rate tells you how many units of the foreign currency one dollar buys. For example, the currency per U.S. dollar exchange rate between the pound and dollar was .67, which is just 1/1.50, and was 131.58 for the bolivar. In symbols
\( e(\text{pounds} / \$) = .67, \)

\( e(\text{bolivars} / \$) = 131.58 \text{ bolivars}, \)

and in general we have

\[ e(\$ / \text{foreign currency}) = \frac{1}{e(\text{foreign currency} / \$)} \]

There is yet more terminology. When the \( e(\$ / \text{pounds}) \) falls it means that it costs fewer dollars to buy a pound. The dollar has become more valuable relative to the pound and we say that the dollar appreciated relative to the pound. On the other hand, when \( e(\$ / \text{pounds}) \) increases, the dollar has depreciated. Of course, the opposite holds for the currency per U.S. dollar exchange rate. The two ways to quote exchange rates can lead to confusion because an increase in the U.S. dollar equivalent exchange rate means that the currency per U.S. dollar exchange rate is falling. To limit confusion, we use the U.S. dollar equivalent exchange rate, \( e(\$ / \text{pounds}) \), in our discussion.

**Real Exchange Rates**

The nominal exchange rate tells you the rate at which national currencies swap and are expressed in terms of dollars, pounds, and so on. Because these rates are expressed in terms of currency, they are nominal exchange rates. A natural question is: at what rate do goods or bundles of goods trade across countries?

To find the answer to this question let's look at an example. Suppose the dollar per yen exchange rate is \( e(\$ / \text{yen}) = .05 \) and the price of a Japanese bundle is \( P(\text{yen} / \text{Japanese bun}) = 4,000 \text{ yen} \). The dollar cost of the Japanese bundle is just \( $.05 \times 4,000 = $200 \) since each yen costs five cents and you need 4,000 yen to buy a bundle of Japanese goods. In general, we can write
dollar cost of Japanese bundle = e($/yen) \cdot P_{(yen/Japanese bun)}.

Now suppose that the U.S. price level is $80. What is the cost of a Japanese bundle in terms of a U.S. bundle of goods? Or, to put it another way, how many U.S. bundles does it take to buy one Japanese bundle. Since a U.S. bundle costs $80 and the Japanese bundle costs $200, it takes 2.5 U.S. bundles to buy a Japanese bundle; 2.5 is called the real exchange rate, e^{real}.

The real exchange rate is just the ratio of the dollar cost of a Japanese bundle to the dollar cost of a U.S. bundle:

\[ e^{real} = \frac{\text{dollar cost of Japanese bundle}}{\text{dollar cost of U.S. bundle}} \]

In symbols we write

\[ e^{real} = \frac{e($/yen) \cdot P_{(yen/Japanese bun)}}{P($/U.S. bun)}, \]

or, more neatly,

\[ e^{real} = e \cdot \frac{P_f}{P}. \]

In our example

\[ e^{real} = (0.05)(4,000)/80 = 2.5 \text{ U.S. bun/Japanese bun.} \]

Interpretations of the Real Exchange Rate

a. the terms of trade
The real exchange rate can be given several interpretations. The interpretation depends on the goods included in the bundle that is used to calculate the price level. First, suppose that the only goods in the U.S. bundle are goods that the U.S. exports and in the Japanese bundle only goods that the U.S. imports. In this case $e^{\text{real}} = 2.5$ means that the U.S. must trade 2.5 units of exports to Japan to get one unit of imports. The real exchange rate with these bundles is called the terms of trade.

b. law of one price

The law of one price states that in the absence of transactions cost, identical goods sell for the same price. To see the reasoning behind this result, consider a standardized commodity, gold. Suppose the price of gold in London is $300/oz and the price in New York is $350/oz. This situation will not persist. People will rush to buy gold in London and then sell it in New York. Every ounce that is bought and sold earns the trader $50. The rush to buy in London will drive the price up there and the rush to sell in New York will drive prices down there. This process will bring the price of gold in the two cities to equality.

c. purchasing power parity

The law of one price applies in the aggregate as well. To see why suppose that the U.S. bundle of goods is identical to the Japanese bundle of goods and that it doesn't cost anything to buy goods in one country and ship them to another. Now reconsider our earlier example. The dollar cost of the U.S. bundle was $80 while the dollar cost of the Japanese bundle was $200. If these bundles are the same, a profit could be made by buying goods in the U.S., transporting them to Japan, and then selling them. Each bundle would bring $120 profit. There would be many entrepreneurs eager to take advantage of this opportunity. The process of buying goods in the U.S. and selling them in Japan drives the dollar cost of bundles up in the U.S. and down in Japan. The transporting of goods from the U.S. to Japan will continue until the dollar cost of bundles (and the yen cost also) is the same in both countries.
The above argument implies that if the bundles of goods are the same and there are no transportation or transactions costs, then the real exchange rate should equal one. This result is an example of the law of one price and in the present context is called 

**purchasing power parity**. In symbols this means that

\[ eP^f = P. \]

The critical assumption in the above argument is the absence of transactions costs. In practice, there are a myriad of such costs. Transporting goods from one country to another may require the purchase of import licenses and the payment of shipping and insurance costs. Trade may be inhibited by quotas, which are legal restrictions on the quantity of a good that may be imported, or tariffs, which are taxes on imported goods. Therefore we shouldn't expect to see purchasing power parity holding in a strict sense. Instead, the message of the above argument is that over the long haul we should not expect to see "large" deviations from purchasing power parity where "large" is determined by the extent of transactions costs, including tariffs and quotas.

**The National Budget Constraint**

*a. a digression on the sources and uses of funds*

Simple counting requires that the total sources of funds available to an individual equal the total uses of the funds. We cannot use funds if we don't have them; and if we have them, the funds will be used in some manner. So long as we cover all of the possible sources and all of the possible uses, the total sources of funds must equal the total uses of funds.

For example, suppose there are only two possible sources of income, wage income and interest income. The total sources of funds for an individual is just

\[ \text{total sources of funds} = w_t + (1 + R_{t-1})b_{t-1}, \]
where \( w_t \) is the wage income in the current period, \( b_{t-1} \) is bond holdings in the previous period, and \( R_{t-1} \) is the interest rate on bonds over the last period. To keep things simple, suppose that the only things to do with the funds are to buy consumption goods or bonds. This means that the total uses of funds is

\[
\text{total uses of funds} = P_t c_t + b_t,
\]

where \( P_t c_t \) is total expenditures on consumption goods. It must be the case that

\[
w_t + (1+R_{t-1})b_{t-1} = P_t c_t + b_t.
\]

You may object and say that the household could lose the funds or hold cash. But, if you want to consider these possibilities, it is no problem. Just add any cash that you take into the period and any money you find onto the sources of funds; and add the cash that you carry at the end period and any money you misplace onto the uses side. Again, so long as our source and use lists exhaust the possibilities, the total sources of funds must equal the total uses of funds.

**b. the aggregate sources and uses of funds**

How does this handy fact help us understand the international accounts? Let's look at the aggregate sources and uses of funds for a nation. To make things manageable think of a country producing a single good, or perhaps a single bundle of goods. The residents of the country can either purchase the home good themselves or sell it to foreigners. The home residents can also buy goods from foreigners. We also allow gifts from one country to another. These gifts can be foreign aid from one government to another, or a pension check from, say, a U.S. firm to a resident of Acapulco. The official name for gifts is unilateral transfers. Finally, we let the residents of one country borrow from and lend to residents of another by buying and selling bonds.

With these simplifying assumptions the aggregate sources of funds for the home country is

\[
\text{aggregate sources of funds} = P_t Y_t + (1+R_{t-1})B_{t-1} + TRH_t,
\]
where $Y_t$ is the total output of the home country, $B_{t-1}$ the dollar value of bond holdings, $R_{t-1}$ is the interest rate, and $TRH_t$ stands for the gifts from foreigners to the home country. $B_{t-1}$ represents net claims by residents of one country on those of another. For example, if $B_{t-1}$ is $10$ million, it means that on the whole foreigners owed home residents $10$ million at time $t-1$. In this case we say that the home country is a **creditor nation**. On the other hand, if $B_{t-1}$ were negative, say - $10$ million, then on the whole home residents owe foreigners $10$ million; and in this case we say that the home country is a **debtor nation**.

The aggregate uses of funds in this setting is given by

$$\text{aggregate uses of funds} = P_tE_t + e_tP_t^fQ_t + TRF_t + B_t,$$

where $E_t$ is the amount of home output that is purchased by home residents, $Q_t$ is the amount of the foreign good purchased, $e_tP_t^f$ is the dollar price of the foreign good, $TRF_t$ is gifts to foreigners, and $B_t$ is the dollar value of bond holdings in period $t$.

Since the aggregate sources of funds must equal the aggregate uses of funds, we have

$$P_tY_t + (1+R_{t-1})B_{t-1} + TRH_t = P_tE_t + e_tP_t^fQ_t + TRF_t + B_t.$$

This rendition of the relationship hides more than it reveals, but we can rearrange things to give us a more useful interpretation. Simple subtraction gets us

$$(P_tY_t - P_tE_t) - e_tP_t^fQ_t + R_{t-1}B_{t-1} + (TRH_t - TRF_t) - (B_t - B_{t-1}) = 0. \quad (1)$$

The first term in parentheses is the dollar value of output produced at home less the dollar value of home sales. Where did the home output go that was not bought at home? It was exported to foreigners so that $(P_tY_t - P_tE_t)$ is the home exports of goods and services. The term $e_tP_t^fQ_t$ is just the dollar value of imports. The term $TRH_t - TRF_t$ is called **net unilateral transfers**. It can be positive or negative. For example, if the home country gives more gifts to foreigners than foreigners give to the home country, net unilateral transfers will be negative. $R_{t-1}B_{t-1}$ is called **net investment income**.
Net investment income requires a bit of discussion. It is positive for a creditor nation and negative for a debtor nation. If $B_{t-1}$ is positive, $R_{t-1}B_{t-1}$ is interpreted as an export of capital services. To see why this interpretation makes sense, suppose that $B_{t-1}$ is $5$ million and $R_{t-1}$ is .08 or 8%. The $5$ million represents $5$ million worth of resources that the home country has lent to foreigners. These resources can be thought of as a form of capital, for example, foreigners may have used the loan to buy $5$ million worth of machines. These resources provide services to foreigners in much the same way that the export of legal, medical, or entertainment services does. For providing these productive "capital" services to foreigners the home country receives $(.08)(5$ million) or $400,000$ in interest payments, and we can think of this income as arising from "rent" on a capital export. If $R_{t-1}B_{t-1}$ happens to be negative, it's treated as an import of capital services; and reflects payment for the use of resources lent to the home country.

We can now recognize the first three terms in equation (1) as net exports. We met this concept earlier in our discussion of national income accounting. In discussions of the international accounts, this balance is often called the balance on goods, services, and income.¹⁶ When we add net unilateral transfers to net exports we get the home country's current account balance. When the current account balance is positive we say there is a surplus. A deficit means that the current account balance is negative. In symbols

\[
\text{current account balance} = \text{net exports} + \text{net unilateral transfers} = (P_Y Y_t - P_E E_t) - e_i P_i Q_i + R_{t-1}B_{t-1} + (TRH_t - TRF_t)
\]

¹⁶ GDP does not include income of home residents earned abroad nor does it subtract the income earned by foreigners in the U.S. For this reason net exports according to GDP do not equal the balance on goods, services, and income. Net exports according to GNP does equal the balance on goods, services, and income.
The last term in equation (1), \(-(B_t - B_{t-1})\), is just the negative of the home country's change in bond holding and it is called the home country's capital account balance:

\[
\text{capital account balance} = -(B_t - B_{t-1}).
\]

To interpret the capital account balance, suppose that \(B_{t-1} = $3\) million, and \(B_t = $4.6\) million. This makes the capital account balance \(-$1.6\) million, and it means that in period \(t\) residents of the home country lent an additional \$1.6 million to foreigners. In this case, a negative capital account balance means that the home country increases its lending to foreigners and we say that the home country experiences a capital outflow as some of its capital goes out to other countries.

The capital account balance will also be negative if home residents are repaying a previously accumulated debt. For example, suppose that the home country is a debtor nation and \(B_{t-1}\) is \(-$5\) million. If home residents use a portion of their funds to repay some of the debt, \(B_t\) will be lower than \(B_{t-1}\), say, \(-$4\) million. The capital account balance is

\[
-(B_t - B_{t-1}) = -(-$4 \text{ million} - (-$5 \text{ million})) = -$1 \text{ million}.
\]

The capital balance is again negative and we still say that the home country experiences a capital outflow. When the capital account balance is positive the home country is either increasing its borrowing from foreigners or reducing its claims on them. In either case, we say the home country experiences a capital inflow. Finally, the two balances sum to zero:

\[
\text{current account balance} + \text{capital account balance} = 0.
\]

The relationship between the current and capital account will help us to understand the effect of shocks, such as changes in oil prices and investment booms, on the current account. The key is to remember that if one country increases its lending to another, it means that its capital account balance will be negative. But, from the above relationship this implies that the country runs a surplus in its current account. So, shocks that induce the residents of one country to lend to the residents of another will tend to move the current account towards surplus. On the
other hand, shocks that encourage home residents to borrow from foreigners tend to move the current account toward deficit.

**The Merchandise Trade Balance**

Until recently, the most publicized international balance was the **merchandise trade balance**. The trade balance is the value of exported goods minus the value of imported goods. This balance does not take the international trade of services or net investment income into account, and in this sense it provides only a partial picture of the international balance. For example, in 1990 the merchandise trade balance for the U.S. was about -$108 billion. For services the U.S. ran a surplus of about $32 billion and net investment income \((R_{t-1}B_{t-1})\) was about $18 billion. This means that net exports for the U.S. were about -$58 billion, more than 40% smaller than the trade deficit. Net unilateral transfers were about -$33 billion, our "gifts" to
foreigners were larger than their "gifts" to us, so the current account balance for 1990 was roughly -$91 billion, still a smaller deficit than the trade balance.

U.S. International Balances Over Time

Figure 6.1 traces net investment income for the U.S. from 1790 to 1957. Recall that when net investment income is negative, \( B_{t-1} \) is negative, and the country is a debtor nation. The figure reveals that in our early history we were a debtor nation. To judge from net investment income, we accumulated debt over our first century as a nation and began to pay it off during the 1890s. By the middle of the second decade of the twentieth century we had repaid the debt and become a creditor nation.

This is a typical story for a young and growing nation. As agriculture spread, the railroads were laid, and manufacturing grew there were many profitable investment opportunities and the U.S. attracted capital from abroad. That is to say, we borrowed from foreigners to take advantage of the available opportunities. We know that when foreigners are lending to home residents, the home country runs current account deficits; and Figure 6.2 shows that this was true for the U.S. Although from the mid 1870s to the early 1880s the U.S. ran current account surpluses, most of the years from 1790 to 1890 were years of current account deficits. By the end of the 19th century, we began to run surpluses to pay off these debts, and by the 1920s we were a creditor nation running current account surpluses.

Is it good to be a creditor nation and bad to be a debtor nation? In general, the answer is no. Many readers of this page borrowed money to pay for college. Was it a bad idea for them to go into debt? Obviously they didn't think so because they did. Presumably they expect the payoff of a college education to exceed the cost of the debt. In a similar way it was very likely a wise thing for the U.S. to be a debtor nation for its first 120 years or so. Had we not been able to borrow from foreigners, many opportunities would have been forgone, and the growth in living standards would have been slower. In general, to judge the desirability of borrowing and lending requires information on the purpose of the loans.
Extensions

a. arbitrage

There are many countries and many currencies, but the various exchange rates are connected to each other through arbitrage. To see how let's consider two ways that you could acquire Venezuelan bolivars for dollars. First, you take your dollars and buy bolivars directly. The number of bolivars that one dollar will buy is just $1/e(\$/bolivars)$. But, you could also buy your bolivars indirectly. The first step would be to take a dollar and buy pounds. One dollar will bring $1/e(\$/pounds)$ pounds. Then, take these pounds and use them to buy bolivars. The number of bolivars that you will acquire is

\[
\text{# of bolivars acquired for one dollar through indirect trade} = \left(\frac{1}{e(\$/pounds)}\right) e(\text{bolivars/pounds}).
\]

The two ways must give the same amount of bolivars otherwise there will be an opportunity for arbitrage. Arbitrage is the simultaneous purchase and sale of assets for a certain profit.

To see how arbitrage would work let's take some simple numbers:

\[
e(\$/pounds) = 2, \quad e(\$/bolivars) = 0.05 \quad e(\text{bolivars/pounds}) = 100
\]

In this case one dollar will buy 20 bolivars directly, but an indirect trade for bolivars through pounds will buy 50 bolivars. Obviously there is an advantage in buying bolivars indirectly. Indeed, you can make a certain profit if you trade indirectly for bolivars and then swap them directly back for dollars. Your dollar will buy you 1/2 pound, and your 1/2 pound will then fetch 50 bolivars. You could then trade your 50 bolivars directly for $2.50. You start with $1 and end with $2.50 with no uncertainty. Surely, if you could find such an opportunity, you would exploit it as much and as rapidly as possible.

The exploitation of the arbitrage opportunity will cause the profit opportunity to disappear. As you and others rush to buy pounds, the pound will appreciate against the dollar. The effort to then swap the pounds for bolivars will cause the bolivar to appreciate against the pound, and
finally the effort to swap the bolivars for dollars will lead to an appreciation of the dollar against the bolivar. All these changes work to eliminate the arbitrage opportunity.

The concept of arbitrage is important because it ensures that exchange rates are consistent. In particular, arbitrage ensures that

\[ e(\text{bolivars/pound}) = e(\$\text{/pound}) \cdot (\$1/e(\$\text{/bolivars})). \]

So, we can safely say that the bolivar per pound exchange rate was \((1.50) \cdot (1/0.0076) = 197.37\) bolivars/pounds.

\[ \text{b. the official reserves settlements balance} \]

To simplify matters, we left governments out of our discussion of international balances, but governments have claims on each other. For example, the U.S. holds foreign asset and foreign governments hold dollar assets. These claims are called official reserve assets and we represent them by \(ORA_t\). Official reserve assets from the previous period are a new source of funds for a nation and official reserve assets for the current period are a new use of funds. Just like bonds, if \(ORA\) is positive, then foreign governments on net owe the U.S. government. If \(ORA\) is negative, the U.S. government owes foreign governments.

So we can take government actions into account by adding \(ORA_{t-1}\) to the left-hand side of equation (1) and \(ORA_t\) to the right-hand side of equation (1). If we are careful to follow all of the algebra, we find that now

\[ \text{current account balance + capital account balance} - (ORA_t - ORA_{t-1}) = 0. \]

The new term, \(-(ORA_t - ORA_{t-1})\), is called the \textbf{official reserves settlement balance}.

Why would this balance ever change? It may change because governments purchase goods from each other, military hardware for example. It may also change if governments intervene in foreign exchange markets. For example, suppose there is a fear of a revolution in Mexico. Given this uncertainty, people who hold pesos may try to sell them for dollars. This makes the dollar more valuable, and the dollar appreciates relative to the peso. It will cost more pesos to
buy a dollar now. If the U.S. government believes these fears are unwarranted, it may want to offset the appreciation of the dollar because, other things the same, the appreciated dollar makes U.S. exports more expensive, and therefore harder to sell in Mexico. To offset the pressure on the dollar the U.S. may enter foreign exchange markets to buy pesos at the existing exchange rate. This will keep the dollar from appreciating, but it will also cause the U.S. government to accumulate pesos. This accumulation of pesos increases official reserve assets and the official reserve settlements balance will be negative.

Summary

This chapter went into detail about the international accounts. We discussed the meaning of the nominal exchange rate and differentiated it from the real exchange rate. We also introduced the notion of purchasing power parity. We will use this idea later to develop some basic ideas about what determines movements in the nominal exchange rate.

We also discussed the various international balances. The connection between the current account and the capital account balances is very important. Later this connection will help us understand why countries run current account deficits and surpluses.

REVIEW QUESTIONS

1) What is the difference between the nominal and real exchange rate?

2) Suppose the e($/pounds) = $3/pound, and the price of a British bundle is 200 pounds per bundle. If there are no transactions costs, what must the U.S. price level be for purchasing power parity to hold?

3) Suppose that net exports = -$50 billion and the capital account balance is -$74 billion. What are net unilateral transfers and the current account balance?

4) "This current account deficit is shameful. It is a symptom of our country's weakness. We just must do something about it." Comment.