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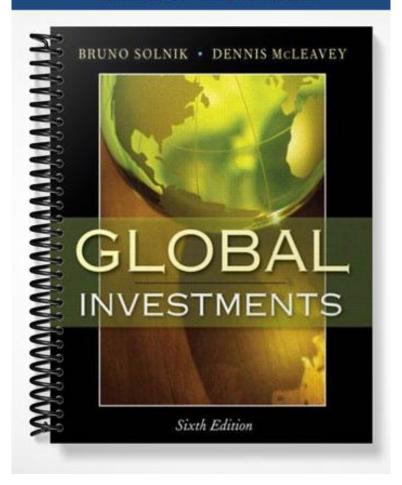
GLOBAL
INVESTMENTS

Sixth Edition

Chapter 2
Foreign Exchange Parity Relations

Note: In the sixth edition of *Global Investments*, the exchange rate quotation symbols differ from previous editions. We adopted the convention that the first currency is the quoted currency in terms of units of the second currency.

For example, €:$ = 1.4 indicates that one euro is priced at 1.4 dollars. In previous editions we used the reversed convention $/€ = 1.4, meaning 1.4 dollars per euro.

All problems in this test bank still use the old convention and have not been adapted to reflect the new quotation symbols used in the 6th edition.

■ Questions and Problems

1. The current Swiss franc/U.S. dollar spot exchange rate is 2 Swiss francs per dollar, or CHF/$ = 2. The expected inflation over the coming year is 2% in Switzerland and 5% in the United States. What is the expected value for the spot exchange rate a year from now, according to purchasing power parity?

    Solution

    According to the purchasing power parity relation, which states that spot exchange rate adjusts perfectly to inflation differential between two countries, the expected value for the exchange rate, a year from now, is given by:

    $$S_1 = 2\frac{1.02}{1.05} = 1.9429 \quad \text{CHF/\$}.$$

2. The spot exchange rate is CHF/$ = 2.00. The one-year interest rate is equal to 4% in Switzerland and 8% in the United States. What should the current value of the forward exchange rate be?

    Solution

    According to the interest rate parity relation, the forward discount (or premium) is equal to the interest rate differential. With F being the current value of the one-year forward exchange rate, we have:

    $$F = 2.\frac{1.04}{1.08} = 1.9259 \quad \text{CHF/\$}.$$

3. The ¥/€ spot exchange rate is 130 yen per euro. Inflation rates in Japan and Germany are similar. Over the past year the ¥/€ rate moved from 110 to 130. Is this good news or bad news for Japanese firms competing with German firms in the automobile market?

Solution

The weakening of the yen against the euro is good news for Japanese competitors in the automobile market. For the same amount of euros earned from their sales in Germany (for instance €1 billion), the Japanese companies will have the possibility to convert their earnings into a greater amount of yen (130 billion yen) than they used to (110 billion yen). Also, their relative cost structure improves compared to their German competitors.

4. Should nominal interest rates be equal across countries? Why or why not?

Solution

The nominal interest rate can be defined as the sum (or more precisely the compounding) of the real interest rate and the expected inflation rate over the term of the interest rate. Although the international Fisher relation claims that real interest rates are equal across the world, we know that expected inflation can be very different from one country to another. Therefore, there is no reason why nominal interest rates should be equal across countries.

5. Should real interest rates be equal across countries? Can a financial arbitrage take place in case of significant and persistent real interest rate differences? To answer this question:
    a. First assume that exchange rates are fully predictable and follow purchasing power parity (PPP).
    b. Then assume that they are uncertain but that PPP holds.
    c. Finally, assume that exchange rates are uncertain and that PPP does not hold.

Solution

Not necessarily. This can be shown by observing that no risk-free arbitrage can exploit differences in real interest rates. Let's start with a simple world and progressively add more complex realities. Assume that the real rates on euros and U.S. dollars are respectively 2% and 4%. Let's use the linear approximation:
a. Exchange rate is fully predictable and PPP holds.

Differences in real interest rates can be arbitraged away. One can simply borrow in €, transfer the € in $ at the spot exchange rate and lend the $. It can easily be seen that this strategy yields exactly the real interest rate differential (2%) without any capital investment.

Since the exchange rate is fully predictable and follows PPP, we know for sure that its future depreciation is exactly equal to the (certain) expected inflation differential. The net result on the investment strategy is the real interest rate differential.

b. Exchange rate is uncertain but PPP holds.

We know that the future exchange rate will exactly reflect the observed future inflation differential (PPP) but we are not sure about future inflation rates. The interest rate differential is equal to the real interest rate differential plus the expected inflation differential, while the exchange rate depreciation will be equal to the ex-post realized inflation differential. The deviation between expected and realized inflation makes the above arbitrage uncertain. However, the deviation is likely to be small for short horizons, so arbitrage will insure that the short-term real interest rate differential is small.

c. PPP does not hold.

Real exchange rates can be very volatile in the short run. No riskless arbitrage can take place to take advantage of real interest rate differentials.

6. Here are some statistics:

	GBP(£)	CHF
Inflation (annual rate)	10%	4%
One-year interest rate	12%	?%
Spot exchange rate (CHF/£)		3%
Expected exchange rate (in one year)		?%
One-year forward exchange rate (CHF/£)		?%

Based on the linear approximation of international parity relations, replace the question marks with the appropriate answers.

Solution

Assuming that international parity relations hold, here are the appropriate answers (linear approximation):

	GBP(£)	CHF
Inflation (annual rate)	10%	4%
One-year interest rate	12%	6%
Spot exchange rate (CHF/£)		3%
Expected exchange rate (in one year)		2.84%
One-year forward exchange rate (CHF/£)		2.84%

Calculations can also be performed without the linear approximation.

7. Paf is a small country. Its currency is the pif and the exchange rate with the U.S. dollar was 2 pifs per dollar in 1980. The inflation indexes in 1980 were equal to 100 in the United States and in Paf. Twenty years later, the inflation indexes were equal to 400 in the United States and 200 in Paf. The current exchange rate is 0.9 pifs per dollar.
    a. What should the current exchange rate be if PPP prevailed?
    b. Is the Pif over/undervalued according to PPP?

Solution

a. According to the purchasing power parity relation, which states that the spot exchange rate adjusts perfectly to inflation differential between two countries, the expected value for the exchange rate, twenty years from now, is given by:

$$S_1 = 2 \times \frac{2}{4} = 1 \ \text{Pif/\$.}$$

b. According to PPP, the Pif is overvalued.

8. **Fundamental Value Based on Absolute PPP.** Ideally, one would like to compare directly the price of goods in two countries to see if an exchange rate conforms to *absolute PPP*, or whether it is overvalued or undervalued in real terms. As mentioned in Chapter 2, this can only be done for some individual goods that are clearly comparable ("law of one price"), and the estimation for different goods can lead to opposing conclusions. In Chapter 2, we provide an analysis based on the well-known Big Mac report of *The Economist.* Of course, the Big Mac is a very particular product and a fundamental PPP value can be computed on a wide range of products. The results are often conflicting. For example, one can look at production prices rather than consumption prices. Some studies are conducted by looking at labor costs. Rather than looking at unit labor costs for unskilled workers, as

is often done, the exhibit below reports the average annual remuneration of the chief executive officer (CEO) of industrial companies with annual revenues of $250 million to $500 million in ten selected areas of the world. The figures are also from April 1998. They include all forms of compensation, such as bonuses, perks, and stock options, but are not adjusted for different taxes or costs of living.

The first column gives the total CEO compensation measured in U.S. dollars using the actual exchange rate, which is indicated in the second column. The third column gives the fundamental PPP value of each currency, implied by the national CEO compensations. It is the exchange rate with the dollar that would make CEO compensation identical in all countries. The fourth column gives the actual overvaluation (if positive) or undervaluation (if negative) of the local currency relative to its fundamental value in terms of CEO compensation.

EXHIBIT: Determining a Fundamental PPP Value Based on CEOs' Remuneration

	Total Compensation in US $	Actual Exchange Rate (1 US $ =)	Fundamental PPP Value (1 US $ =)	Undervaluation in %
South Korea	150,711	1474	207	−86
Germany	398,430	1.84	0.68	−63
Japan	420,855	135	53	−61
Mexico	456,902	8.54	3.64	−57
Canada	498,118	1.42	0.66	−54
France	520,389	6.17	2.99	−51
U.K.	645,540	0.6024	0.3626	−40
Hong Kong	680,616	7.75	4.92	−37
Brazil	701,219	1.14	0.75	−35
U.S.A.	**1,072,400**	**1**	**1**	

Source: Total compensation data comes from *Towers Perrin*, 1998.

What conclusions can you draw from this exhibit?

Solution

There is a wide dispersion in the dollar remuneration of CEOs across the world. American CEOs are the best paid, followed by their Brazilian and Hong Kong counterparts. Korean and German CEOs have very low compensations relative to Americans. The implied PPP exchange rates suggest that all currencies are strongly undervalued relative to the U.S. dollar. They reflect a basic international difference in management culture across the world, rather than an enormous dollar overvaluation. Actually, recent international mergers (e.g., the acquisition of Amoco by British Petroleum, or the acquisition of Chrysler by Daimler Benz) highlight the problem, as German and British managers are envious of their U.S. counterparts, who themselves fear losing part of their remuneration. It is likely that the apparent overvaluation of the dollar as reflected in the exhibit will partly be corrected by a trend toward greater international harmonization of CEOs' remuneration. In the exhibit, the Brazilian real is overvalued relative to a majority of currencies, especially those of other emerging countries. It was not surprising to see the real devalue by some 40% in January 1999.

In practice, no one would estimate the fundamental value of a currency by applying absolute PPP to a single good, especially a nontraded one, and the above discussion is only anecdotal.

9. The exhibit below presents the 1997 balance of payments statistics for France, Germany, Japan, the United Kingdom, and the United States. The various balance of payments items have been aggregated using the presentation outlined in Chapter 2.

EXHIBIT: 1997 Balance of Payments of Five Major Countries

Billions of U.S. Dollars

	France	**Germany**	**Japan**	**U.K.**	**U.S.A.**
Current Account	**39**	**−1**	**94**	**7**	**−167**
Exports	284	510	409	279	680
Imports	−256	−436	−308	−300	−877
Trade Balance	28	74	101	−21	−197
Balance of Services	17	−41	−54	15	87
Net Income	3	−2	56	19	−18
Current Transfers	−9	−32	−9	−7	−39
Capital and Financial Account	**−33**	**−1**	**−88**	**−11**	**168**
Direct Investments	−12	−33	−23	−21	−11
Portfolio Investments	−24	−5	29	−22	308
Other Financial and Capital Flows	−2	36	−128	25	−32
Net Errors and Omissions	5	1	34	7	−97
Official Reserve Account	**−6**	**2**	**−6**	**4**	**−1**

Source: Adapted from International Monetary Fund, *International Financial Statistics*, 1998 Yearbook.

a. Provide an analysis of the U.S. balance of payments.
b. Provide an analysis of the British balance of payments.
c. Provide an analysis of the French balance of payments.
d. Provide a brief analysis of the Japanese balance of payments.
e. Provide a brief analysis of the German balance of payments.

Solution

a. The United States has been running a very large current account deficit for many years, and the 1997 deficit reached $167 billion. A positive balance for services and net income received from abroad are far from compensating a huge deficit in the U.S. merchandise trade balance ($197 billion). The U.S. capital and financial account is in surplus ($168 billion), despite the fact that Americans have been net direct investors abroad (–$11 billion). The 1997 surplus in the U.S. capital and financial account is explained by the fact that foreigners are happy to make portfolio investments and lend money to the United States (portfolio investments of $308 billion). The surplus in the capital and financial account is sufficient to cover the huge current account deficit. Two points are worth noting. First, the item "Net errors and omissions" (statistical discrepancy) is enormous, making the interpretation quite imprecise. Second, the International Monetary Fund (IMF) changed its definition of reserves in 1997: An item labeled "Liabilities constituting foreign authorities reserves" was deleted from official reserves and moved to the capital flows account. This figure traced the amount of dollar reserves invested by foreign central banks in the United States. For example, foreign monetary authorities invest some of their official reserves in U.S. Treasury securities, because of the special role of the dollar as a reserve currency.

b.   Since imports are greater than exports, the United Kingdom suffers from a negative trade balance at −$21 billion. This figure is somewhat offset by a $15 billion excess of exported services over imported services. Nonetheless, the balance of goods and services is negative at −$6 billion. Net income received is positive and it overshadows a negative amount of unrequited transfers (current transfers). The balance of all current transactions with foreigners is therefore positive at $7 billion.

Both direct investments and portfolio investments are negative. Investments represent a financial outflow for the United Kingdom since its residents invest more actively abroad than foreigners invest in the country. The balance for portfolio investments is negative at −$22 billion, reflecting the United Kingdom's traditional involvement in international banking. Other capital flows, which include short-term capital deposited in domestic banks, do not compensate for this financial outflow at $25 billion. Adjusted for net errors and omissions, the capital and financial account remains negative at −$11 billion.

The balance of the current account and the capital and financial account causes a decrease in official reserves by −$4 billion, which shows as a positive official reserve account.

c.   At $284 billion, French exports of goods exceed imports by $28 billion. Exports of services also exceed imports, by $17 billion. Altogether, exports of goods and services exceed imports by $45 billion. This positive figure is strengthened by positive net income received, but partly offset by negative unrequited transfers, leading to a $39 billion positive current account. $39 billion is the amount of money that France has received from all current transactions with foreigners in 1997.

Direct investment is −$12 billion, showing that the amount of direct purchases of companies or real estate made by foreigners in France is inferior to the amount of direct purchases made by residents abroad. The same conclusion can be drawn for portfolio investments at −$24 billion. Other capital flows, which include short-term deposits made by foreigners in France and by residents abroad, is negative at −$2 billion. This corresponds to a financial outflow. Adjusted for net errors and omissions, the capital and financial account remains negative at −$33 billion, reflecting the fact that French residents have invested more capital abroad than have been invested by foreigners in France.

The balance of the current account and the capital and financial account causes an increase in official reserves by $6 billion, which shows as a negative official reserve account.

d.   Japan has a very different balance of payments structure. Japan runs a huge trade surplus, with a current account surplus of $94 billion. This allows Japan to invest heavily abroad while retaining a balanced reserve account. Actually, its reserves increased by $6 billion.

e.   Germany has a surplus in its trade balance but a deficit in its balance of services, plus large unrequited transfers (current transfers). With a slight capital and financial account deficit (−$1 billion), the German central bank has to use its reserve assets to cover the deficit of the overall balance ($2 billion).

10.   Because of the relative rise in local production costs brought about by the appreciation of the yen, many Japanese corporations have decided to transfer production abroad. What should be the immediate and future impact on the Japanese balance of payments?

Solution

Transferring production abroad means that Japanese capital is invested abroad. It will *immediately* result in a deterioration of the capital and financial account in the balance of payments. This deterioration will have to be balanced by the official reserve account, that is, a decrease in official reserves. This is not a problem in Japan because of its current account surplus.

In the longer run, exports will drop because the production of goods that used to be exported is transferred abroad. Imports should also drop, as goods needed in the production process need not be imported anymore. Overall, one can expect a drop in the trade balance, which will eventually show as a drop in the current account of the balance of payments. On the other hand, income received from these additional foreign investments will contribute positively to the Japanese current account.

11. The Japanese balance of payments from 1987 to 1993 is as follows. All numbers are reported in billions of U.S. dollars. The last line gives the real effective exchange rate index of the yen relative to other currencies. An increase in the index means a real appreciation of the yen.

	1987	1988	1989	1990	1991	1992	1993
Merchandise: Exports	224	260	270	280	307	331	351
Merchandise: Imports	−128	−165	−193	−217	−203	−198	−210
Services: Credit	29	35	40	41	45	48	52
Services: Debit	−48	−64	−75	−82	−85	−90	−93
Income: Credit	51	77	104	125	144	146	152
Income: Debit	−37	−60	−85	−106	−121	−114	−115
Current Transfers	−4	−4	−4	−6	−12	−5	−6
Direct Investments	−18	−35	−45	−45	−29	−15	−14
Portfolio Investments	−91	−53	−33	−14	35	−28	−66
Other Financial and Capital Flows	64	21	30	39	−78	−64	−24
Net Errors and Omissions	−4	3	−22	−21	−8	−10	0
Reserve Account							
Real Effective Yen Rate	128	135	128	114	122	127	160

a. Calculate the trade balance, current account, capital and financial account, and official reserve account for each year.

b. Use these numbers to describe what has happened in terms of Japanese financial transactions with the rest of the world.

Solution

a. The various accounts are given below:

	1987	1988	1989	1990	1991	1992	1993
Trade Balance	96	95	77	63	104	133	141
Current Account	87	79	57	35	75	118	131
Capital and Financial Account	−49	−64	−70	−41	−80	−117	−104
Official Reserves	−38	−15	13	6	5	−1	−27

b. The Japanese trade balance, which has been constantly positive over the time period, worsened from 1987 to 1990 and improved from then on. The current account tracked the trade balance. This surplus was mostly used to invest abroad (negative capital and financial account).

The decrease in the current account from 1988 to 1990 led to a drop in official reserves (positive reserve account) and a weakening of the yen. Its real effective exchange rate depreciated from 135 to 114. This improvement in the terms of trade led to an increase of the Japanese trade balance in the early 1990s. In 1991 and 1992, the increased current account surplus was used to

increase foreign investments by the Japanese (the capital and financial account deficit increased from 41 billion in 1990 to 117 billion in 1992). In 1993, the current account increased to 131 billion but net foreign investments accounted to only 104 billion. Hence, Japanese reserves increased by 27 billion (a negative official reserve account). This led to a strong appreciation of the yen.

12. The Japanese balance of payments from 1994 to 1997 is as follows. All numbers are reported in billions of U.S. dollars. The last line gives the real effective exchange rate index of the yen relative to other currencies. An increase in the index means a real appreciation of the yen.

	1994	1995	1996	1997
Merchandise: Exports	386	429	400	409
Merchandise: Imports	2241	2297	2317	2308
Services: Credit	58	65	68	69
Services: Debit	2106	2123	2130	2123
Income: Credit	155	192	225	222
Income: Debit	2115	2148	2172	2166
Current Transfers	26	28	29	29
Direct Investments	217	222	223	223
Portfolio Investments	228	236	242	29
Other Capital Flows	241	25	36	2128
Net Errors and Omissions	218	14	1	34
Reserve Account				
Real Effective Yen Rate	169	175	146	137

a. Calculate the trade balance, current account, capital and financial account, and official reserve account for each year.

b. Use these numbers to describe what has happened in terms of Japanese financial transactions with the rest of the world.

Solution

a. The various accounts are given below:

	1994	1995	1996	1997
Trade Balance	145	132	83	101
Current Account	131	110	65	94
Capital and Financial Account	−104	−49	−28	−88
Official Reserves	−27	−61	−37	−6

b. The Japanese trade balance, which has been constantly positive over the time period, decreased dramatically from 1994 to 1996. The current account tracked the trade balance. This surplus was mostly used to invest abroad (negative capital and financial account). In each year, the current account surplus exceeded the capital and financial account deficit and official reserves increased.

In 1994 and 1995, the yen kept appreciating in real terms (its real effective exchange rate was 127 in 1992 and moved up to 175 in 1995). The strong yen hurt the international competitiveness of Japan and its trade balance strongly deteriorated until 1996.

13. Under a system of fixed exchange rates, a nation experiencing an excess of imports over exports can try to remedy this situation by:
    a. Adopting tariffs and quotas.
    b. Reducing its income from investments abroad.
    c. Applying an expansionary macroeconomic policy to drive prices up and interest rates down.
    d. Building up its reserves of foreign currencies and reserve balances with the International Monetary Fund.

    Solution
    a. Adopting tariffs and quotas.

14. Under a system of fixed exchange rates, a nation can try to remedy its balance of payments deficit by:
    a. Applying expansionary macroeconomic policy to drive prices up and interest rates down.
    b. Applying restrictive macroeconomic policy to keep prices down and interest rates up.
    c. Reducing its income from investments abroad.
    d. Building up its reserves of foreign currencies and reserve balances with the International Monetary Fund.

    Solution
    b. Applying restrictive macroeconomic policy to keep prices down and interest rates up.

15. In 1994, the United States was experiencing a fairly strong economic recovery, ahead of other nations. Fears of an overheating economy led to sudden inflationary fears for the next few years.
    a. Would you expect U.S. interest rates to rise or drop?
    b. Would you expect the dollar to depreciate or appreciate?
    c. Would you expect a foreign bond portfolio to be a good investment compared to a U.S. dollar portfolio under this scenario?

    Solution
    a. Inflationary fears will cause interest rates to rise. Economic growth could also lead to higher real interest rates.
    b. The dollar is likely to depreciate because of higher expected inflation. This could be offset by higher real interest rates, which could attract foreign capital flows.
    c. The rise of U.S. interest rates will cause the market price of U.S. bonds to fall. It is therefore appropriate to invest in foreign bonds rather than U.S. bonds. The likely depreciation of the dollar makes such an investment even more interesting (the foreign currency in which the bonds are denominated will appreciate against the dollar during the investment period and the investor will make a foreign exchange profit when reselling his bonds).

16. **Exchange Rate Dynamics.** Britain and Europe have no inflation, a constant money supply and (annualized) interest rates equal to 2% for all maturities. The exchange rate is equal to one pound per euro; this is its PPP value and the price indexes can be assumed to be equal to one in both countries.

    Suddenly and unexpectedly, Britain increases its money supply by 5%. This is a one-time but permanent shock. Immediately upon the announcement, the British interest rate drops from 2% to 1% for all maturities (excess liquidity induces a drop in the real interest rate). It is expected that it will take three years for the shock in money supply to translate fully into a price increase. There is no effect on the real sector, nor any effect on Europe. Assume that the Eurozone is the domestic country. What will be the exchange rate dynamics?

Solution

First determine the long-run exchange rate. After three years, the British price level will rise by 5% to 1.05. The exchange rate expected to prevail at that time, *E(S)*, is the new fundamental PPP value of the exchange rate, which is:

$$S^* = 1 \times \frac{1.05}{1.00} = 1.05 \text{ pound per euro.}$$

After three years, the British interest rate will be back to 2%. In the short run (immediately after the announcement), the exchange rate will move to:

$$S_0 = E(S) \times (1 + r_{DC})/(1 + r_{FC}) = 1.05 \times \frac{(1+2\%)^3}{(1+1\%)^3} = 1.0815 \text{ pounds per euro.}$$

Following the money supply shock, the short-run effect on the pound is a depreciation of 8.15%. This is caused by two phenomena:

—The fundamental PPP value depreciates by 5% because of the 5% long-run increase in the British price level.

—The drop in British interest rates leads to an additional 3.15% dollar depreciation (a total of 8.15%).

This second phenomenon is caused by the drop in British interest rates. If the exchange rate S_0 had settled at its long-run value of $S^* = 1.05$ £/€, an arbitrage could be constructed. Rather than investing pounds at a 1% interest rate, it is much more attractive to exchange pounds for euros spot at 1/1.05 euros per pound, to invest those euros at 2%, and to repatriate the euros into pounds three years from now at the exchange rate of $S^* = 1.05$ £/€. This would enable a speculator to "pocket" the interest rate differential and put pressure on the spot exchange rate until it reaches $S_0 = 1.0815$ £/€. Of course, such reasoning relies on the assumption that the future exchange rate S^* is known with certainty.