Chapter 15
Price Levels and the Exchange Rate in the Long Run

■ Chapter Organization

■ Key Themes

Our focus shifts to a longer time horizon in this chapter with an analysis of the determinants of the long-run value of the exchange rate. As you learned in earlier chapters, the expected future value of the exchange rate affects today's spot exchange rate—therefore, an analysis of the determination of the long-run exchange rate is required for the completion of the short-run exchange rate model. In this chapter we divide the types of factors that affect the long-run exchange rate into two categories, monetary factors and real factors. Monetary factors include money supply and money demand, while real factors include the demand for and supply of goods and services. The ultimate goal of this chapter is to develop a general model of the determination of the exchange rate in the long run. In our path towards this goal, we touch on a number of related issues, including the effect of ongoing inflation on the exchange rate, the Fisher effect, and the role of tradable and nontradable goods. We also consider a number of empirical topics, such as the failure of purchasing power parity (PPP) to explain the movement of the real exchange rate during the past 20 years and why prices are low in less developed countries.

It makes sense to think that similar goods sell for the same price, as expressed in a common currency, in different countries when there are no transport costs or trade restrictions. If this did not hold, sellers would sell more in the high-price country and less in the low-price country, forcing the prices in each country to move towards one another. This concept is behind the law of one price which is represented algebraically as $P_i = E \cdot P_i^*$ where P_i represents the price of a particular good in the home country, P_i^* represents its price in the foreign country, and E is the exchange rate. If we extend the law of one price from holding for one good to holding for a wide set of goods, we have the absolute purchasing power parity relationship, $P = EP^*$, where P represents the aggregate price level at home, and P^* represents the aggregate price level in the foreign country. Relative purchasing power parity relates changes in exchange rates to changes in relative price levels and may be valid even when absolute PPP is not. Relative purchasing power parity is expressed algebraically as $\pi = d + \pi^*$ where π is domestic inflation, π^* is foreign inflation, and d is the rate of depreciation of the currency.

Purchasing power parity provides a cornerstone of the monetary approach to the exchange rate, which serves as the first model of the long-run exchange rate developed in this chapter. In this framework, the purchasing power parity relationship is used to express the exchange rate as the price level in the home country relative to the price level in the foreign country, that is $E = P/P^*$. The money market equilibrium relationship is used to substitute money supply divided by money demand for the price level [that is, $P = M/L(R,Y)$ for the domestic country and $P^* = M^*/L(R^*,Y^*)$ for the foreign country]. We then obtain

$$E = [M/M^*][L(R^*,Y^*)/L(R,Y)].$$

Combining these relationships we find that the long-run exchange rate depreciates (E rises) with an increase in the domestic money supply, a decrease in the foreign money supply, a decrease in domestic money demand (which can arise due to either an increase in the domestic interest rate or a decrease in domestic output) or an increase in foreign money demand (which can arise due to either a decrease in the foreign interest rate or an increase in foreign output). In the long-run model, interest rates are not changing due to changes in the money supply (in the long run, money is neutral), but instead, because of the Fisher effect. The Fisher effect establishes a connection between nominal interest rates and real interest rates: $i = r + \pi^e$, where "i" is the nominal interest rate, "r" is the real interest rate, and "π^e" is expected inflation. Thus, the nominal interest rate can rise when expected inflation rises or when the real interest rate rises. The Fisher effect is discussed in more detail in the appendix.

One result from this flexible price model that you may find confusing at first concerns the relationship between the long-run exchange rate and the nominal interest rate. The model in this chapter provides an example of an increase in the interest rate associated with exchange rate depreciation. In contrast, the short-run analysis in the previous chapter provides an example of an increase in the domestic interest rate associated with an appreciation of the currency. These different relationships between the exchange rate and the interest rate reflect different causes for the rise in the interest rate as well as different assumptions concerning price rigidity. In the analysis of the previous chapter, the interest rate rises due to a contraction in the level of the nominal money supply. With fixed prices, this contraction of nominal balances is matched by a contraction in real balances. Excess money demand is resolved through a rise in interest rates which is associated with an appreciation of the currency to satisfy interest parity. In this chapter, the discussion of the Fisher effect demonstrates that the interest rate will rise in response to an anticipated increase in expected inflation due to an anticipated increase in the rate of growth of the money supply. A rise in interest rates would cause money demand to fall short of money supply. When prices are perfectly flexible, this excess money supply (which is an excess supply of real balances) is eliminated by an increase in the price level. Through PPP, this price level increase implies a depreciation of the exchange rate. Thus, with perfectly flexible prices (and its corollary PPP), an increase in the interest rate due to an increase in expected inflation is associated with a depreciation of the currency.

Empirical evidence presented in the chapter suggests that both absolute and relative PPP perform poorly for the period since 1971. Even the law of one price fails to hold for specific groups of commodities. The empirical rejection of these theories is related to trade impediments (which help give rise to nontraded goods and services), to shifts in relative output prices, and to imperfectly competitive markets. Since PPP serves as a cornerstone for the monetary approach, its rejection suggests that a convincing explanation of the long-run behavior of exchange rates must go beyond the doctrine of purchasing power parity.

The chapter concludes by presenting a more general model of the long-run behavior of exchange rates. This model differs from the monetary model because the more general model allows shifts in the demand and supply of goods and services to play a role. The real exchange rate will respond to shifts in the demand and supply of a country's goods and services, and thus in this model we drop the assumption of a constant real exchange rate. The real exchange rate, q, is the ratio of the foreign price index, expressed in domestic currency, to the domestic price index (i.e., $q = EP^*/P$). If, for example, there is a balanced increase in domestic productivity, the real exchange rate depreciates due to falling production costs and hence falling prices. If tastes shift and there is an increase in the demand for a country's goods, then the country's real exchange rate appreciates.

■ Key Terms

Define the following key terms:

1. Law of One Price _____

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2. Purchasing Power Parity _____

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3.   Relative Purchasing Power Parity _____

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4.   Fisher Effect _____

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5.   Real Interest Rate _____

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6.   Monetary Approach to the Exchange Rate _____

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■   Review Problems

1.   In the next two questions you will use data to judge for yourself how well purchasing power parity performs in two different periods.

  a.   Calculate the dollar/pound real exchange rate for 1961–1967, for 1980–1987, and for 2000–2006, using the following data for the consumer price index in each country and for the dollar/pound exchange rate. Then answer the following questions:

  b.   What does absolute purchasing power parity predict for the value of the real exchange rate across time?

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c. Can you use the data below to assess whether absolute purchasing power parity holds in the 1960s? In the 1980s? In the 2000s?

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Year	U.S. CPI	British CPI	$/£ Nominal Exchange Rate	$/£ Real Exchange Rate
1961	17.37	7.58	2.80	_____
1962	17.57	7.89	2.81	_____
1963	17.78	8.06	2.80	_____
1964	18.01	8.31	2.79	_____
1965	18.31	8.71	2.80	_____
1966	18.86	9.05	2.79	_____
1967	19.38	9.27	2.75	_____
1980	47.85	39.27	2.33	_____
1981	52.79	43.93	2.03	_____
1982	56.04	47.70	1.75	_____
1983	57.84	49.90	1.52	_____
1984	60.34	52.37	1.34	_____
1985	62.49	55.55	1.30	_____
1986	63.65	57.45	1.47	_____
1987	66.03	59.84	1.64	_____
2000	100.00	100.00	1.52	_____
2001	102.83	101.82	1.44	_____
2002	104.46	103.49	1.50	_____
2003	106.83	106.50	1.63	_____
2004	109.69	109.66	1.83	_____
2005	113.41	112.76	1.82	_____
2006	117.07	116.36	1.84	_____

2. a. What does relative purchasing power parity predict for the behavior of real exchange rates?

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b. Does the data seem to support the theory of purchasing power parity in the 1960s, 1980s, or 2000s?

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c. What institutional factor might help explain the difference in the explanatory power of
    purchasing power parity across the two time periods?

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3. The chapter defines the real exchange rate, q, as the ratio EP^*/P where E is the exchange rate
    (domestic currency per unit of foreign currency), P^* is the foreign price level, and P is the domestic
    price level. An equivalent way to define the real exchange rate is the price of tradable goods divided
    by the price of nontradable goods.

    Defining the domestic price index as the weighted sum of tradable goods and nontradable goods in
    the domestic country, $P = aP_n + (1 - a)P_t$. Define the foreign price index as the sum of tradables and
    nontradables in the foreign country, $P^* = bP_n^* + (1 - b)P_t^*$. Assuming that purchasing power parity
    holds for traded goods, so $E = P_t/P_t^*$. Show how the definition $q = EP^*/P$ is related to the ratio of the
    price of traded to nontraded goods in the domestic economy, given the ratio of the price of traded to
    nontraded goods in the foreign economy.

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4. Consider the definition of the real exchange rate as the ratio of the prices of traded to nontraded
    goods, as discussed in Question 3. Discuss the real exchange rate effects of the following events.

    a. A large loan is made to Jamaica for the purpose of spending on health services in that country.

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    b. Chile, which is a major copper exporter, finds that there is a fall in the world demand for copper.

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    c. Colombia enjoys a particularly good coffee harvest.

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    d. Nigeria, a major oil exporter, feels the effects of a fall in the world price of oil.

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    e. The monetary authorities of Bolivia double the country's money supply.

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5. Productivity growth has slowed in the United States relative to other countries. This has implications for the real exchange rate as well as for the long-run nominal exchange rate.

a. What happens to the United States' real exchange rate if the United States has a one-time decrease in productivity relative to that of another country? What happens to its nominal exchange rate?

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b. How does the effect on the nominal exchange rate differ if, instead of a one-time drop in productivity, United States productivity relative to that of another country continues to decline for a very long time?

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6. What is the effect on the long-run nominal dollar/euro exchange rate of a rise in the expected future rate of real dollar/euro depreciation? Explain the result in terms of the effects on nominal interest rates. Assume that all other things, including the current level of the real exchange rate, stay the same.

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7. Use the real interest parity relationship to calculate the difference between the real interest rates in the United States and Japan in the late 1990s and 2000s. (Assume that the actual inflation rate equaled the expected inflation rate and that changes in the real exchange rate were anticipated.)

Year	U.S. CPI	Japanese CPI	$/¥	$/¥ Real Exchange Rate	Real Interest Rate Differential
1996	91.09	98.64	0.0092	_____	_____
1997	93.22	100.38	0.0083	_____	_____
1998	94.66	101.05	0.0077	_____	_____
1999	96.73	100.72	0.0088	_____	_____
2000	100.00	100.00	0.0093	_____	_____
2001	102.83	99.24	0.0082	_____	_____
2002	104.46	98.35	0.0080	_____	_____
2003	106.83	98.11	0.0086	_____	_____
2004	109.69	98.10	0.0092	_____	_____
2005	113.41	97.83	0.0091	_____	_____
2006	117.07	98.07	0.0086	_____	_____

■ Answers to Odd-Numbered Textbook Problems

1. Relative PPP predicts that inflation differentials are matched by changes in the exchange rate. Under relative PPP, the franc/ruble exchange rate would fall by 95 percent with inflation rates of 100 percent in Russia and 5 percent in Switzerland.

3. a. A tilt of spending towards nontraded products causes the real exchange rate to appreciate as the price of nontraded goods relative to traded goods rises (the real exchange rate can be expressed as the price of tradables to the price of nontradables).

   b. A shift in foreign demand towards domestic exports causes an excess demand for the domestic country's goods which causes the relative price of these goods to rise; that is, it causes the real exchange rate of the domestic country to appreciate.

5. The real effective exchange rate series for Britain shows an appreciation of the pound from 1977 to 1981, followed by a period of depreciation. Note that the appreciation is sharpest after the increase in oil prices starts in early 1979; the subsequent depreciation is steepest after oil prices soften in 1982. An increase in oil prices increases the incomes received by British oil exporters, raising their demand for goods. The supply response of labor moving into the oil sector is comparable to an increase in productivity which also causes the real exchange rate to appreciate. Of course, a fall in the price of oil has opposite effects. (Oil is not the only factor behind the behavior of the pound's real exchange rate. There was also the influence of Prime Minister Margaret Thatcher's stringent monetary policies.)

7. The mechanism would work through expenditure effects with a permanent transfer from Poland to the Czech Republic appreciating the koruna (Czech currency) in real terms against the zloty (Polish currency) if (as is reasonable to assume) the Czechs spent a higher proportion of their income on Czech goods relative to Polish goods than did the Poles.

9. Since the tariff shifts demand away from foreign exports and toward domestic goods, there is a long-run real appreciation of the home currency. Absent changes in monetary conditions, there is a long-run nominal appreciation as well.

11. A permanent increase in the expected rate of real depreciation of the dollar against the euro leads to a permanent increase in the expected rate of depreciation of the nominal dollar/euro exchange rate, given the differential in expected inflation rates across the United States and Europe. This increase in the expected depreciation of the dollar causes the spot rate today to depreciate.

13. International differences in expected real interest rates reflect expected changes in real exchange rates. If the expected real interest rate in the United States is 9 percent and the expected real interest rate in Europe is 3 percent then there is an expectation that the real dollar/euro exchange rate will depreciate by 6 percent (assuming that interest parity holds).

15. One answer to this question involves the comparison of a sticky-price with a flexible-price model. In a model with sticky prices, a reduction in the money supply causes the nominal interest rate to rise and, by the interest parity relationship, the nominal exchange rate to appreciate. The real interest rate, which equals the nominal interest rate minus expected inflation, increases both because of the increase in the nominal interest rate and because there is expected deflation. In a model with perfectly flexible prices, an increase in expected inflation causes the nominal interest rate to increase (while the real interest rate remains unchanged) and the currency to depreciate since excess money supply is resolved through an increase in the price level and thus, by PPP, a depreciation of the currency.

An alternative approach is to consider a model with perfectly flexible prices. As discussed in the preceding paragraph, an increase in expected inflation causes the nominal interest rate to increase and the currency to depreciate, leaving the expected real interest rate unchanged. If there is an increase in the expected real interest rate, however, this implies an expected depreciation of the real exchange rate. If this expected depreciation is due to a current, temporary appreciation, then the nominal exchange rate may appreciate if the effect of the current appreciation (which rotates the exchange rate schedule downward) dominates the effect due to the expected depreciation (which rotates the exchange rate schedule upwards).

17. If we assume that the real exchange rate is constant, then the expected percentage change in the exchange rate is simply the inflation differential. As the question notes, this relationship holds better over the long run. Starting from interest parity, we see that $R = R^* + \%\Delta^e E$. The change in the exchange rate is $\pi - \pi^*$ when PPP holds, so if PPP holds over a horizon, we can say that $R = R^* + \pi - \pi^*$. This means $r = r^*$. So, real interest rate differentials at long maturities should be smaller. On the other hand, if the real exchange rate changes or is expected to change, we would say that $\%\Delta^e E = \%\Delta^e q + \pi - \pi^*$. In that case, there can be a significant wedge between r and r^*. Thus, if PPP does hold over the long run and people predict this (and consequently are not expecting large changes in the real exchange rate) we would expect to see smaller real interest rate differentials at long maturities.

19. PPP for nontradables would arise if technologies were similar across countries and thus similar prices for goods in the long run would be consistent with competitive markets and similar labor costs. If the labor costs are similar, then (again assuming similar technologies) the costs of non-tradables should be similar also. Of course, as the chapter notes, differences in productivity that vary across sector could result in Balassa Samuelson style effects where despite tradables PPP holding, nontradables are still priced differently across countries.