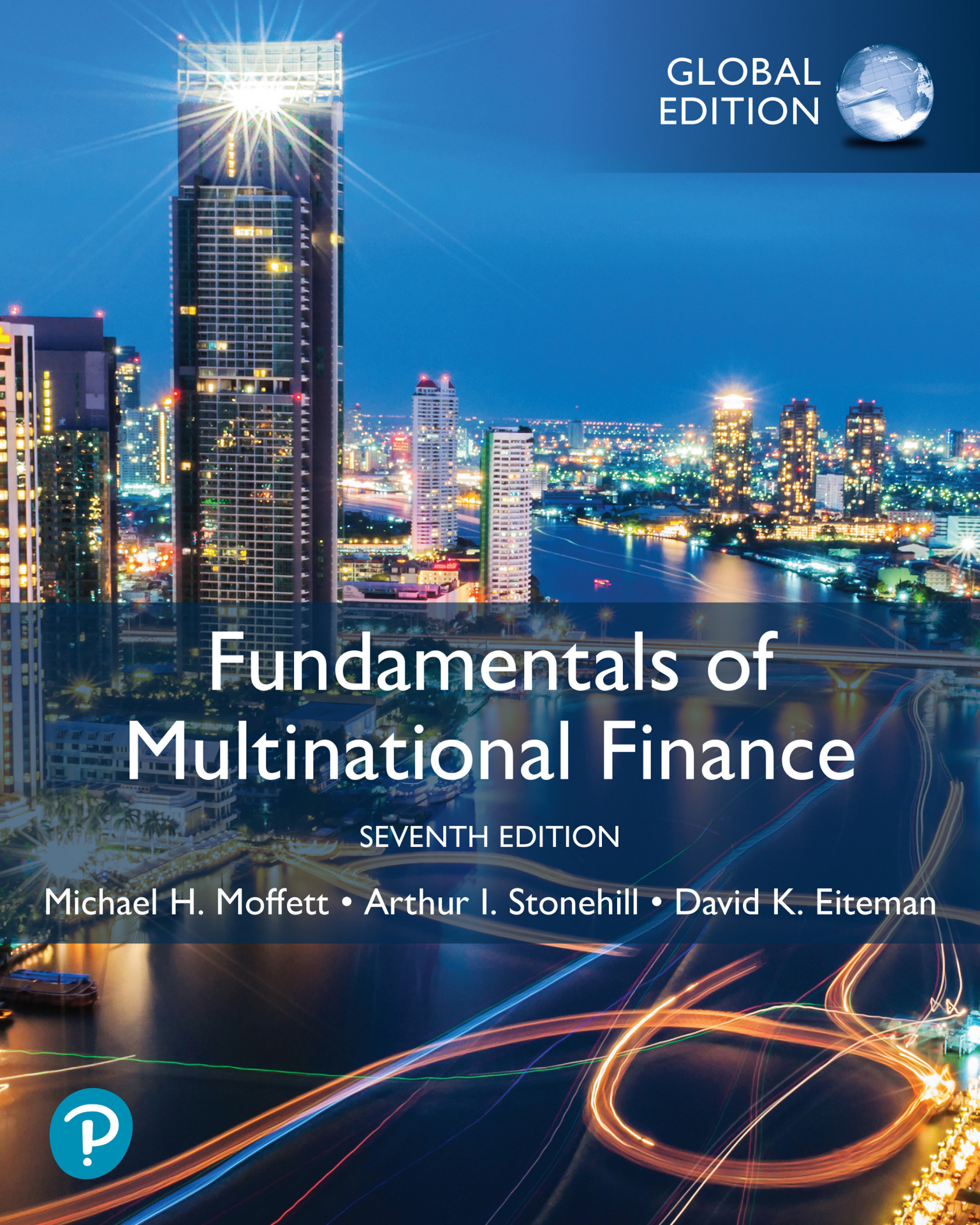
GLOBAL
EDITION
Fundamentals of
Multinational Finance
SEVENTH EDITION
Michael H. Moffett • Arthur I. Stonehill • David K. Eiteman

Fundamentals of Multinational Finance

Seventh Edition
Global Edition

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as real estate rental rates and taxes. That said, the prominence and weight the Big Mac Index has had globally is undeniable.

A less extreme form of this principle asserts that in relatively efficient markets, the price of a basket of goods—rather than a single product—would be the same in each market. Replacing the price of a single product with a price index allows the PPP exchange rate between two countries to be stated as

$$S = \frac{PI^{¥}}{PI^{\$}}$$

where $PI^{¥}$ and $PI^{\$}$ are price indices expressed in local currency for Japan and the United States, respectively. For example, if the identical basket of goods cost ¥1,000 in Japan and $10 in the United States, the PPP exchange rate would be

$$\frac{¥100}{\$10} \text{ or } ¥100 = \text{US}\$1.00$$

Relative Purchasing Power Parity

If the assumptions of the absolute version of PPP theory are relaxed a bit, we observe what is termed *relative purchasing power parity. Relative PPP* holds that PPP is not particularly helpful in determining what the spot rate is today, but that the relative change in prices between two countries over a period of time determines the change in the exchange rate over that period. More specifically:

> *If the spot exchange rate between two countries starts in equilibrium, any change in the differential rate of inflation between them tends to be offset over the long run by an equal but opposite change in the spot exchange rate.*

GLOBAL FINANCE IN PRACTICE 6.1

Lies, Damn Lies, and Statistics: Uber Fare as the Basis for Exchange Rate Parity

Tackling inflation has remained one of the top priorities for governments. Once inflation is embedded in the expectations of the society, and possibly becomes institutionalized through automatic price-index based price increases, it is very hard to control. One of the most common anti-inflation measures used by the government is the price-controls, where a government agency sets prices for given products to prevent prices from rising.

Let's see if such price controls distort the exchange rate parity among different currencies. We obtained taxi fare estimate for a very identical ride in the three South East Asian cities, Mumbai, Singapore, and Kuala Lumpur. If you hire an Uber for a 10 km ride, it will cost you INR 316.14 in Mumbai, SGD 14.30 in Singapore, and MYR 25 in Kuala Lumpur.

Assuming the exchange rate parity holds, the implied exchange rates were INR 22.10 per SGD, MYR 1.74 per SGD, and INR 12.64 per MYR. The actual spot rate among these currencies, at the same time were INR 58.41 per SGD, MYR 3.34 per SGD, and INR17.44 per MYR.

As you can see that the exchange rate parity does not hold in this case. This is because the taxi fare in a given city tend to be a very politically sensitive topic affected by local regulation. For example, taxi fares in Mumbai are authorized by the local municipal authority. Due to this regulatory regime, Uber in Mumbai is not allowed to increase taxi fares beyond a certain limit under surge pricing, no matter how big the demand for rides is.

You may also note from the table of taxi fares is that Singapore has the most expensive taxi rides for a given distance. As the taxi fares also include a component of wage for the taxi driver, the level of hourly wage rate also influences taxi price. As Singapore wages are highest among the three cities, the cost of taxi ride for similar distance is also highest, almost twice as much it is in Mumbai.

The logic behind the application of PPP to changes in the spot exchange rate is that if a country experiences inflation rates higher than those of its main trading partners, and its exchange rate does not change, its exports of goods and services become less competitive with comparable products produced elsewhere. Imports from abroad become more price-competitive with higher-priced domestic products. These price changes lead to a deficit on the current account in the balance of payments unless offset by capital and financial flows.

Empirical Tests of Purchasing Power Parity

There has been extensive testing of both the absolute and relative versions of purchasing power parity and the law of one price. These tests have, for the most part, not proved PPP to be accurate in predicting future exchange rates. Goods and services do not in reality move at zero cost between countries, and in fact many services are not "tradable," for example, for haircuts. Many goods and services are not of the same quality across countries, reflecting differences in the tastes and resources of the countries of their manufacture and consumption.

Two general conclusions can be made from these tests: (1) PPP holds up well over the very long run but poorly for shorter time periods, and (2) the theory holds better for countries with relatively high rates of inflation and underdeveloped capital markets.

Exchange Rate Indices: Real and Nominal

Because any single country trades with numerous partners, we need to track and evaluate its individual currency value against all other currency values in order to determine relative purchasing power. The objective is to discover whether a country's exchange rate is "overvalued" or "undervalued" in terms of PPP. One of the primary methods of dealing with this problem is the calculation of *exchange rate indices*. These indices are formed through trade—by weighting the bilateral exchange rates between the home country and its trading partners.

The *nominal effective exchange rate index* uses actual exchange rates to create an index, on a weighted average basis, of the value of the subject currency over time. It does not really indicate anything about the "true value" of the currency or anything related to PPP. The nominal index simply calculates how the currency value relates to some arbitrarily chosen base period, but it is used in the formation of the *real effective exchange rate index*. The *real effective exchange rate index* indicates how the weighted average purchasing power of the currency has changed relative to some arbitrarily selected base period. Exhibit 6.2 plots the real effective exchange rate indexes for Japan, the euro area, and the U.S. for the 1980–2021 period.

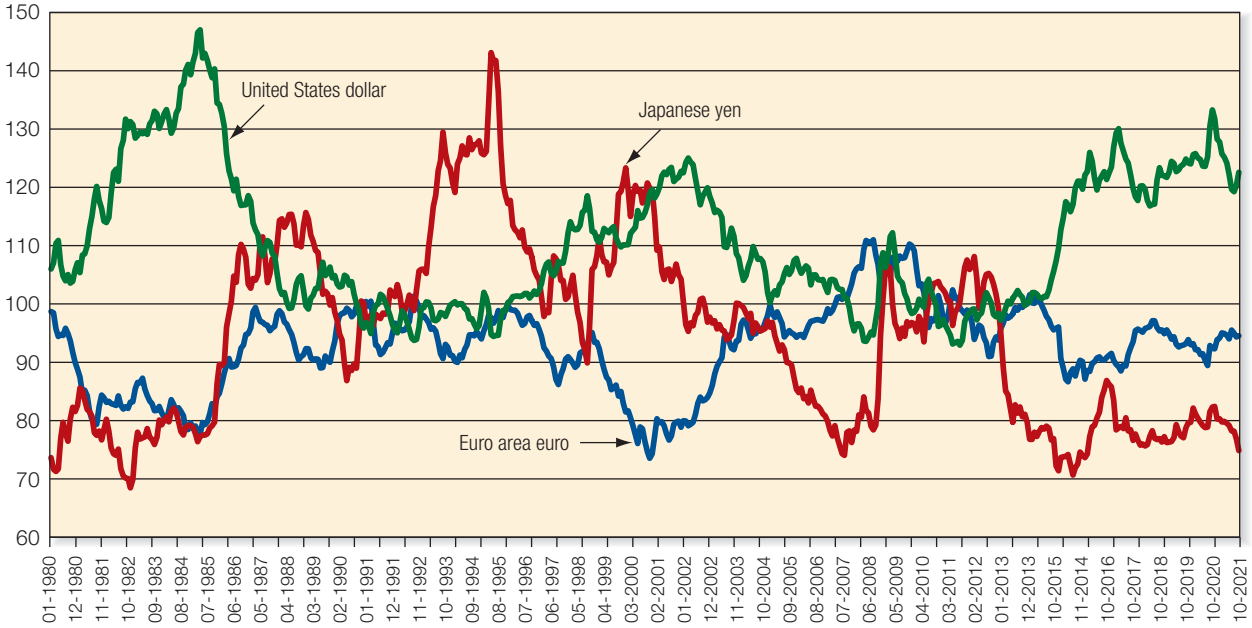
The real effective exchange rate index for the U.S. dollar, $E_R^{\$}$, is found by multiplying the nominal effective exchange rate index, $E_N^{\$}$, by the ratio of U.S. dollar costs, $C^{\$}$, over foreign currency costs, C^{FC}, both in index form:

$$E_R^{\$} = E_N^{\$} \times \frac{C^{\$}}{C^{FC}}$$

If changes in exchange rates just offset differential inflation rates—if purchasing power parity *holds*—all the real effective exchange rate indices would stay at 100. If an exchange rate strengthened more than was justified by differential inflation, its index would rise above 100. If the real effective exchange rate index were above 100, the currency would be considered "overvalued" from a competitive perspective, and vice versa.

Exhibit 6.2 shows how the real effective exchange rate of the U.S. dollar, Japanese yen, and the European euro have changed over the past 40 years. The dollar's index value was substantially above 100 in the early 1980s (overvalued), falling below 100 during the 1988–1996 period (undervalued), then rising far above 100 since 2014. While the euro has not strayed far from "proper valuation" since 2009, the Japanese yen has bounced from undervalued to

EXHIBIT 6.2 Real Effective Exchange Rate Indexes (base year 2010 = 100)



Source: Bank International Settlements, www.bis.orgistatistics/eer/. BIS effective exchange rate (EER), real (CPI-based), narrow indices, monthly averages, January 1980–March 2021.

overvalued to undervalued again over the past decade. Apart from measuring deviations from PPP, a country's real effective exchange rate is an important tool for management when predicting upward or downward pressure on a country's balance of payments and exchange rate, as well as an indicator of whether producing for export in that country could be competitive.

Exchange Rate Pass-Through

Exchange rate pass-through is a measure of the response of imported and exported product prices to changes in exchange rates. When that pass-through is partial, meaning the full percentage change in the exchange rate is not reflected in prices, a country's real effective exchange rate index can deviate from its PPP equilibrium level of 100. Although PPP implies that all exchange rate changes are passed through by equivalent changes in prices to trading partners, empirical research in the years following the growth in floating-rate currencies questioned this long-held assumption.

Complete versus Partial Pass-Through. To illustrate exchange rate pass-through, assume that Volvo produces an automobile in Belgium and pays all production expenses in euros. The price of this specific model is €50,000. When the firm exports the auto to the United States, the price of the Volvo in the U.S. market should simply be the euro value converted to U.S. dollars at the spot exchange rate:

$$P^{\$}_{\text{Volvo}} = P^{€}_{\text{Volvo}} \times S^{\$=€1.00}$$

where $P_{\text{Volvo}^{\$}}$ is the Volvo price in dollars, $P_{\text{Volvo}^{€}}$ is the Volvo price in euros, and $S^{\$=€1.00}$ is the spot exchange rate in number of dollars per euro. If the euro were to appreciate 20% versus the U.S. dollar—from \$1.00 = €1.00 to \$1.20 = €1.00 the price of the Volvo in the U.S.

market should theoretically rise to $60,000. If the price in dollars increases by the same percentage change as the exchange rate, then there has been complete pass-through (or 100%) of changes in exchange rates.

$$\frac{P^{\$}_{\text{Volvo},2}}{P^{\$}_{\text{Volvo},1}} = \frac{\$60{,}000}{\$50{,}000} = 1.20 \text{ or a } 20\% \text{ increase}$$

However, if Volvo worried that a price increase of this magnitude in the U.S. market would severely decrease sales volumes, it might work to prevent the dollar price of this model from rising the full amount in the U.S. market. If the price of this same Volvo model rose to only $58,000 in the U.S. market, the percentage increase would be less than the 20% appreciation of the euro versus the dollar.

$$\frac{P^{\$}_{\text{Volvo},2}}{P^{\$}_{\text{Volvo},1}} = \frac{\$58{,}000}{\$50{,}000} = 1.16 \text{ or a } 16\% \text{ increase}$$

If the price in U.S. dollars rises by less than the percentage change in exchange rates (as is often the case in international trade), then there has been only *partial pass-through* of exchange rate changes.

For example, components and raw materials imported to Belgium cost less in euros when the euro appreciates versus the currency of foreign suppliers. It is also likely that some time may pass before all exchange rate changes are finally reflected in the prices of traded goods, including the period over which previously signed contracts are delivered upon. It is obviously in the interest of Volvo to do what it can to prevent appreciation of the euro from raising the price of its automobiles in major export markets.

Price Elasticity of Demand. The concept of price elasticity of demand is useful when determining the desired degree of pass-through. Recall that the *price elasticity of demand* for any good is the percentage change in quantity of the good demanded as a result of the percentage change in the good's price:

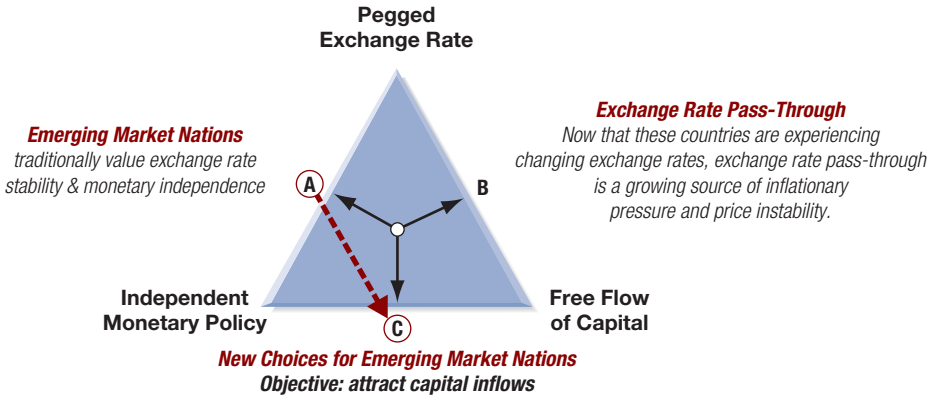
$$\text{Price elasticity of demand} = \varepsilon_p = \frac{\%\Delta Q_d}{\%\Delta P}$$

where Q_d is quantity demanded and P is product price. If the absolute value of ε_p is less than 1.0, then the good is relatively "inelastic." If ε_p is greater than 1.0, the good is relatively "elastic."

A Belgian product that is relatively *price-inelastic*—meaning that the quantity demanded is relatively unresponsive to price changes—may often demonstrate a high degree of passthrough. This is because a higher dollar price in the United States market would have little noticeable effect on the quantity of the product demanded by consumers. Dollar revenue would increase, but euro revenue would remain the same. However, products that are relatively price-elastic would respond in the opposite way. If the 20% euro appreciation resulted in 20% higher dollar prices, U.S. consumers would decrease the number of Volvos purchased. If the price elasticity of demand for Volvos in the United States were greater than one, total dollar sales revenue of Volvos would decline.

Pass-Through and Emerging Market Currencies. A number of emerging market countries have chosen in recent years to change their objectives and choices, as described in the impossible trinity (introduced and detailed previously in Chapter 2). These countries have shifted from choosing a pegged exchange rate and independent monetary policy over the free flow of capital (point A in Exhibit 6.3) to policies allowing more capital flows at the expense of a pegged or fixed exchange rate (toward point C in Exhibit 6.3).

EXHIBIT 6.3 Pass-Through, the Impossible Trinity, and Emerging Markets



Many emerging market countries have chosen to move from Point A to Point C, exchanging fixed exchange rates for the chance of attracting capital inflows. The result is that these countries are now the subject to varying levels of exchange rate pass-through.

This change in focus has also now introduced exchange rate pass-through as an issue in these same emerging markets. With changing exchange rates and increased trade and financial product movements in and out of these countries, prices are changing. Although price volatility alone is a source of growing concern, price changes contributing to inflationary pressure is even more unsettling. The root cause of these problems lies not with choices made by the emerging market nations but rather with the interest rate choices made by the major industrial countries with which they trade.

Since 2009, all the major industrial country currency markets—the dollar, the euro, the yen—have been characterized by extremely low interest rates, as concerns over economic growth and employment have dominated. Select emerging market countries have then experienced appreciating currencies in some cases (because their interest rates are higher than industrial country currencies). Those exchange rate changes have led to exchange rate pass-through of imported products—rising prices—contributing to inflationary pressures.

6.2 Interest Rates and Exchange Rates

We have already seen how prices of goods in different countries should be related through exchange rates. We now consider how interest rates are linked to exchange rates.

The Fisher Effect

The *Fisher effect*, named after economist Irving Fisher, states that nominal interest rates in each country are equal to the required real rate of return plus compensation for expected inflation. More formally, this is derived from $(1 + r)(1 + \pi) - 1$ as

$$i = r + \pi + r\pi$$

where i is the nominal rate of interest, r is the real rate of interest, and π is the expected rate of inflation over the period of time for which funds are to be lent. The final compound term, $r\pi$ is frequently dropped from consideration due to its relatively minor value. The Fisher effect then reduces to (approximate form):

$$i = r + \pi$$

The Fisher effect applied to the United States and Japan would be as follows:

$$i^{\$} = r^{\$} + \pi^{\$}; i^{¥} = r^{¥} + \pi^{¥}$$

where the superscripts \$ and ¥ pertain to the respective nominal (i), real (r), and expected inflation (π) components of financial instruments denominated in dollars and yen, respectively.

We need to forecast the future rate of inflation, not what inflation has been. Predicting the future is, well, difficult. Empirical tests using ex post national inflation rates have shown that the Fisher effect usually exists for short-maturity government securities, such as Treasury bills and notes. Comparisons based on longer maturities suffer from the increased financial risk inherent in fluctuations of the market value of the bonds prior to maturity. Comparisons of private sector securities are influenced by unequal creditworthiness of the issuers. All the tests are inconclusive to the extent that recent past rates of inflation are not a correct measure of future expected inflation.

The International Fisher Effect

The relationship between the percentage change in the spot exchange rate over time and the differential between comparable interest rates in different national capital markets is known as the *international Fisher effect*. *Fisher-open*, as it is often termed, states that the spot exchange rate should change in an equal amount but in the opposite direction to the difference in interest rates between two countries. More formally,

$$\frac{S_1 - S_2}{S_2} \times 100 = i^{\$} - i^{¥}$$

where $i^{\$}$ and $i^{¥}$ are the respective national interest rates, and S is the spot exchange rate using indirect quotes (an indirect quote on the dollar is, for example, ¥ = \$1.00) at the beginning of the period (S_1) and the end of the period (S_2). This is the approximation form commonly used in industry. The precise formulation is as follows:

$$\frac{S_1 - S_2}{S_2} = \frac{i^{\$} - i^{¥}}{1 + i^{¥}}$$

Justification for the international Fisher effect is that investors must be rewarded or penalized to offset the expected change in exchange rates. For example, if a dollar-based investor buys a 10-year yen bond earning 4% interest, instead of a 10-year dollar bond earning 6% interest, the investor must be expecting the yen to appreciate vis-à-vis the dollar by at least 2% per year during the 10 years. If not, the dollar-based investor would be better off remaining in dollars. If the yen appreciates 3% during the 10-year period, the dollar-based investor would earn a bonus of 1% higher return. However, the international Fisher effect predicts that, with unrestricted capital flows, an investor should be indifferent to whether his bond is in dollars or yen, because investors worldwide would see the same opportunity and compete it away.

Empirical tests lend some support to the relationship postulated by the international Fisher effect, although considerable short-run deviations occur. A more serious criticism has been posed, however, by recent studies that suggest the existence of a foreign exchange risk premium for some major currencies. Also, speculation in uncovered interest arbitrage creates distortions in currency markets. Thus, the expected change in exchange rates might consistently be greater than the difference in interest rates. *Global Finance in Practice 6.2* explores a key dimension of international Fisher, the distinction between high inflation and high real rates of interest in attracting capital.