

CHAPTER 19

The Money Supply, the Price Level, and the Balance of Payments

In Chapter 16, we considered the impact of changes in the exchange rate alone on the balance of payments. In effect, income was held constant. In Chapter 17 we allowed income to vary. Similarly, the interest rate was held constant in Chapter 17; then it too was allowed to vary in Chapter 18. Chapter 19 will continue this pattern of letting additional macroeconomic variables vary by introducing the price level, which was assumed constant in the preceding chapters.

The determination of the price level, a monetary variable, had been relatively neglected until its central importance was pointed out by economists of the monetarist school of thought. This chapter considers not only changes in the price level but also changes in a second monetary variable: the central bank's holdings of international reserves. These two variables are fundamental to the monetary approach to the balance of payments. The monetary approach was originally developed in the 1960s, in large part at the University of Chicago but also at the International Monetary Fund. Its central point was that the balance of payments is a monetary phenomenon. The monetary approach to the balance of payments was and is often used by the IMF staff when they must figure out why a country is running a balance-of-payments deficit and what should be done about it.

19.1 The Nonsterilization Assumption

The monetary approach to the balance of payments is sometimes presented as an object of controversy, a model in conflict with the previously discussed elasticity and Keynesian approaches. The controversy is more apparent than real. This chapter will show that no necessary connection exists between the *monetary* approach to the balance of payments and *monetarism*. The debate between monetarists (or their successor, the new classical macroeconomists) and Keynesians *is* a proper object of controversy, but it is not directly at stake here. The beginning of this chapter will apply the monetary approach within the context of the Keynesian model of Chapter 17. The second half will show how the price level is determined in the monetarist model.

The Definition of Sterilization Operations

What *is* at stake here is “sterilization.” It is important to understand the difference between what happens when the central bank practices sterilization of international reserve flows and what happens when it does not. This distinction is relevant for understanding the difference between how major industrialized countries, especially the United States, conduct monetary policy today, and how it was conducted under the classical gold standard of the nineteenth century and is to an extent still conducted today in many small, open economies.

To begin, consider the definition of a country’s *monetary base* (sometimes called high-powered money to distinguish it from broader definitions of money such as M1). The monetary base consists of currency plus other liabilities issued by the central bank—particularly deposits that government agencies or commercial banks hold at the central bank. A checking account that an individual holds at his or her commercial bank is included in M1, but not in the monetary base.

When a country runs a balance-of-payments deficit, its central bank is necessarily buying the country’s own currency and selling international reserves.¹ If the bank takes no other action, then the monetary base is decreasing. One way of thinking of this is that there is less domestic currency in the hands of the public.

Another way of thinking of the effect is to recognize an alternate definition of the monetary base. Define it in terms of the assets held by the central bank: international reserves (claims against the rest of the world) plus net domestic assets (the central bank’s holdings of claims against its own government or citizens).

$$MB \equiv Res + NDA$$

where *MB* is the monetary base, *Res* is reserves, and *NDA* is net domestic assets, also known as domestic credit. This definition of the monetary base is identical to the first because the assets on the bank’s balance sheet must—by the rules of accounting—add up to the same sum as the liabilities. (As noted earlier, the equality sign is drawn with three lines for accounting identities.) As detailed in Chapter 15’s discussion of the balance-of-payments accounts, a country’s overall balance of payments is the same thing as the current period’s change in the central bank’s international reserves.²

$$BP \equiv \Delta Res$$

If reserves fall in a given year (because the balance-of-payments deficit, ΔRes , is negative), and net domestic assets, *NDA*, are unchanged, then the monetary base, *MB*, falls by the same amount.

¹The effect on the level of reserves is the same whether the balance-of-payments deficit arises in the trade balance or in the private-capital account. That is why we talk of the monetary approach to the balance of payments, rather than the monetary approach to the balance of trade. Nevertheless, this chapter will continue to omit capital flows and so will restrict the discussion to the determination of the trade balance. Chapter 22 will show how the monetary approach to the balance of payments changes in the presence of international capital movements.

²Assume here that the country’s currency is not held by other countries’ central banks, so their actions are not relevant.

The central bank *sterilizes* the reserve outflow if it prevents it from reducing the domestic money supply. The most standard way of doing this is to create money by expanding domestic credit at the same rate as the reserve outflow is contracting the money supply, so there is no net effect. If $\Delta NDA = -\Delta Res$, then $\Delta MB = 0$. In the United States, when the Federal Reserve wishes to expand domestic credit, it does so through open market operations in which it buys U.S. Treasury securities on the private market. In this way, any changes in the Federal Reserve's holdings of reserves are sterilized immediately.

When a country runs a balance-of-payments *surplus*, its central bank is necessarily selling its own currency in the foreign exchange market, thus adding to its stock of international reserves. Again, the central bank sterilizes the reserve inflow if it prevents the increase in reserves from increasing the domestic money supply. The most obvious way of doing this is to extinguish money by contracting domestic credit so that no net effect on the total monetary base results. In the United States, the Federal Reserve sells U.S. Treasury securities on the private market.

Most countries do not have as highly developed bond markets as does the United States, and open market operations are less feasible. For these countries, expanding domestic credit may be accomplished by buying securities directly from the treasury, and so monetizing the budget deficit, or else by extending credit to domestic commercial banks or other enterprises, especially any that may be owned by the government. In some developing countries, the central bank lends money directly to such enterprises as public utilities, industrial development banks, and agricultural cooperatives.

Contracting domestic credit means cutting back on loans to the government, state-owned enterprises, or the banking system. However, it is usually difficult to control the budget deficit of the government or state-owned enterprises on short notice. In developing countries and other countries where the central bank is obligated to finance these deficits, domestic credit is not a viable tool for sterilization, that is, for offsetting reserve flows on a short-run basis. An alternative possibility is to allow the high-powered money supply or monetary base—the liabilities of the central bank—to change, but to offset the effect on monetary aggregates such as M1. M1 represents the liabilities of the entire consolidated banking system, including not only claims on the central bank (such as currency) but also claims on commercial banks (such as checking accounts). Even on a relatively short-term basis, the central bank can regulate the amount of credit banks extend to the public—for example, by varying the reserve requirements to which banks are subject.

In many countries where the central bank has little short-run control over domestic credit, reserve flows simply are not sterilized. In the nineteenth century this was mostly true of countries that participated in the gold standard. If money is directly backed with gold, then balance-of-payments deficits are necessarily financed by gold sales that reduce the domestic money supply: They cannot be sterilized via offsetting changes in the liabilities of either the central bank or the private banking system.³ A handful of economies—Hong Kong, Estonia, Lithuania, and Bulgaria—have adopted a

³Appendix A to this chapter explains the gold standard at somewhat greater length.

monetary institution, called a currency board, which is a sort of modern equivalent of a strict gold standard. This arrangement requires 100 percent international reserve backing for domestic currency. Thus reserve flows, by legislation, cannot be sterilized.⁴

If reserve flows are not sterilized, then a balance-of-payments deficit or surplus implies that the money is, over time, decreasing or increasing. (If $\Delta NDA = 0$, then $\Delta MB = \Delta Res.$) This is bound to have effects on expenditure and the entire system, and it is the essence of the monetary approach. The monetary approach to the balance of payments is less applicable to the United States or other major industrialized countries under the current system than it is to many smaller countries, to which it is sometimes applied by the IMF.

Hume's Price Specie-Flow Mechanism

The monetary approach to the balance of payments can be traced back to eighteenth-century philosopher and economist David Hume. Hume attacked the mercantilists, who believed that a country's power depended on amassing gold and silver (specie), and who thus restricted trade to maximize the inflow of specie through the balance of payments. Hume, like Adam Smith and other writers of the Enlightenment, believed in maximizing the welfare of free, atomistic, rational individuals, not the power of an autocratic state. He believed further that the welfare of the individuals residing in a country depended on the economy's productive capabilities, not on the country's stock of gold or money. Money goes where it is demanded, which is where goods are being produced and sold. Assume that a country acquires a new stock of gold but is not especially productive. (Hume mentioned the example of tribute brought to Spain from the New World.) Then the country will spend the gold on the goods of countries that are productive. (Hume had in mind the England of the Industrial Revolution.) The gold flows out through the balance of payments and will continue to do so until the country's gold stock returns to what it was originally.

Hume attributed this process to the *price specie-flow* mechanism. If a country, previously in equilibrium, experiences an increase in its gold supply, then in the short run its price level will be driven up. However, the higher price level will discourage export demand and stimulate import demand, worsening the trade balance. The corresponding outflow of specie will continue until it, and thus the price level, returns to its original level and the trade balance returns to zero. The automatically equilibrating process is described by Hume in terms that evoke the tendency of physical systems toward equilibrium.

All water, wherever it communicates, remains at a level. Ask naturalists the reason; they tell you that, were it to be raised in any one place, the superior gravity of that part not being balanced must depress it, till it meet a counterpoise; and that the same cause, which redresses the inequality when it happens, must for ever prevent it, without some violent, external operation.

⁴For a balanced description, see John Williamson, "What Role for Currency Boards?" *Policy Analyses in International Economics*, 40 (Washington, DC: Institute for International Economics, 1995).

Can one imagine, that it had ever been possible, by any laws, or even by any art or industry, to have kept all the money in Spain, which the galleons have brought from the Indies? Or that all commodities could be sold in France for a tenth of the price which they would yield on the other side of the Pyrenees, without finding their way thither, and draining from that immense treasure? What other reason indeed is there why all nations, at present, gain in their trade with Spain and Portugal; but because it is impossible to heap up money, more than any fluid, beyond its proper level?

—David Hume: *On the Balance of Trade*

Mundell's Income Reserve-Flow Mechanism

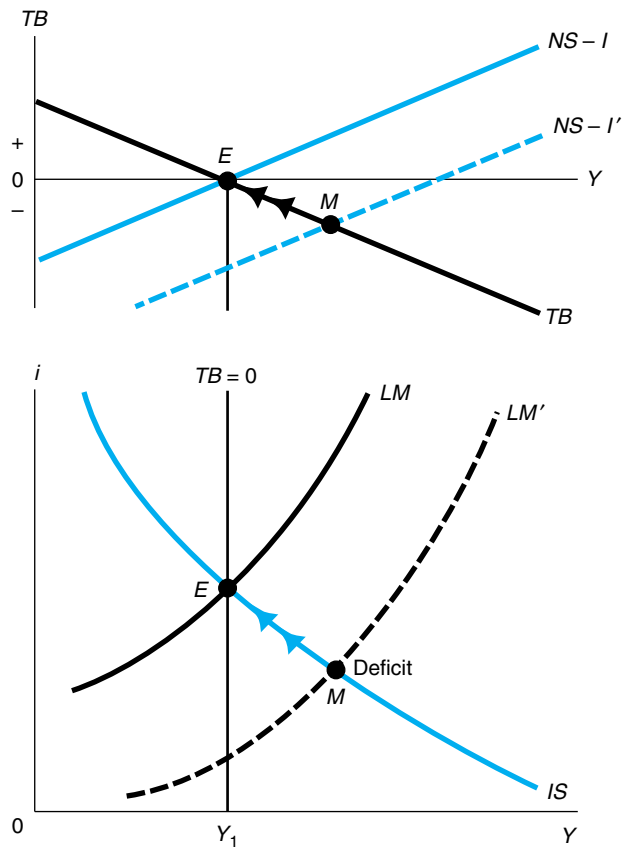
Harry Johnson and Robert Mundell revived Hume's view in the 1960s under the name, "the monetary approach to the balance of payments." They were more specific about price determination than Hume had been. First we consider Mundell's income flow mechanism, under which prices were assumed fixed for Keynesian reasons. This is simply the Keynesian model of Chapter 18, plus an analysis of the effects over time under the assumption of nonsterilization of reserve flows. One way to think of the Keynesian model is with a perfectly flat aggregate supply curve, so that outward shifts of demand are reflected entirely in output and not at all in price. As already mentioned, the assumption of a constant price level will be relaxed later in the chapter. At that point we will consider the opposite extreme—a perfectly vertical aggregate supply curve—in which increases in demand are reflected entirely in prices and not at all in output. Chapter 26 will examine more closely where the aggregate supply curve comes from and how its slope might be determined at some intermediate position between flat and vertical.

We consider the effects of a monetary expansion. Given the Keynesian assumption of fixed prices, the monetary expansion does not alter the price level. Instead, the expansion shifts out the LM curve and raises expenditure and income, thus raising imports and worsening the trade balance, as was detailed at the end of Chapter 18. Figure 19.1 is a reproduction of Figure 18.7. The monetary expansion moves the economy from point E to point M . The deficit at point M means that reserves are declining over time.

If the central bank sterilizes the reserve outflow, the money supply remains at the new, higher level. The effect would be to keep income high and the trade balance in deficit. The central bank could keep the economy at point M indefinitely, or at least until it exhausts its international reserves. However, assume now that the central bank is either unable or unwilling to sterilize the reserve outflow. Over time, the reserve outflow reduces the money supply. The LM curve gradually shifts back. The effect is that expenditure and income fall, and the trade balance improves. The process continues as long as the trade balance is in deficit, which is until the economy returns to E . Once the trade balance is back at zero, no reason exists for reserves or any other variables to be changing. Notice that in the long-run equilibrium, income has not changed from what it was before the monetary expansion. Thus we have a central result under the monetary approach to the balance of payments: A monetary expansion, although it raises income and worsens the trade balance in the short run, has no effect on either in the long run.

FIGURE 19.1**Effects of a Monetary Expansion over Time**

In the short run, an increase in the money supply raises output and worsens the trade balance. If the loss of reserves is not sterilized, however, then the money supply falls over time and output returns to its original level at E .



Conversely, a monetary contraction reduces income and improves the trade balance in the short run but has no effect in the long run. Only continuing growth in the money supply (in excess of growth in money demand) could cause a continuing deficit.

19.2 The Purchasing Power Parity Assumption

The previous section defined the monetary approach to the balance of payments by the assumption of nonsterilization. There is a second proposition often associated with proponents of the monetary approach, however. It is called *purchasing power parity* (PPP) and requires the assumption that goods prices are perfectly flexible. Thus the time has come to consider the determination of the price level.

Unlike the nonsterilization assumption, which is simply appropriate or inappropriate depending on what the central bank does, the assumption of price flexibility is a bigger issue, one that generates ideological controversy. The issue is similar to the old Keynesian–monetarist debate in closed-economy macroeconomics. Some writers con-

tinue to confuse the monetary approach (nonsterilization) with monetarism (perfectly flexible prices). However, the difference is clear in a passage written by two of the central figures in the area:

The monetary approach to the balance of payments . . . can be readily applied to conditions of price and wage rigidity and consequent response of quantities—employment, output, consumption—rather than money wages.⁵

Indeed the application to price and wage rigidity constitutes Mundell's income mechanism, developed in the preceding section.

The alternative view, entailed by PPP, is that prices are perfectly flexible and so markets clear. This assumption is shared by the monetarists and their successors—those who believe in real business cycles and proponents of other branches of new classical macroeconomics. These believers in price flexibility adopt the nonsterilization assumption, but they have a slight quarrel with Hume's price specie-flow mechanism. Hume said that a monetary expansion will raise prices and worsen the trade balance, which will lead to an outflow that in the long run returns the prices to their original level. The alternative view asks how prices can be higher in one country than another even in the short run. Why would consumers buy any goods at all from the country with the higher prices? Would it not suffer an instantaneous trade deficit of unlimited size?

PPP: Definitions

Purchasing power parity, or PPP, is simply the name for the following equation:

$$P = EP^*$$

where E is the exchange rate, and P and P^* are the domestic and foreign price levels, respectively. It could also be written,

$$E = P/P^*$$

We are not ready to draw any conclusions about causality, about whether changes in E cause changes in P or the other way around. PPP is just a condition, not in itself a complete theory of determination of the price level or the exchange rate.

The equation has a long history. Many economists consider it discredited. Certainly it is inconsistent with the Keynesian model, in which price levels are not free to adjust whenever the exchange rate changes. However, some consider it a necessary and logical consequence of economic rationality. The right answer depends on how one defines P and P^* .⁶

⁵Jacob Frenkel and Harry Johnson, "The Monetary Approach to the Balance of Payments: Essential Concepts and Historical Origins," in Jacob Frenkel and Harry Johnson, eds., *The Monetary Approach to the Balance of Payments* (Toronto: University of Toronto Press, 1976), p. 25.

⁶For a survey of PPP, see Kenneth Rogoff, "The Purchasing Power Parity Puzzle," *Journal of Economic Literature*, 34, no. 2 (1996): 647–648.

Arbitrage and the Law of One Price

If P and P^* are defined to be the price, in domestic and foreign currency, respectively, of the identical good, and if tariffs and transportation costs are low, then the formula is indeed a logical consequence of economic rationality and competitive markets. Under this interpretation, the equation is called the *law of one price*. It is practically a definition of what it means to be a single good. The law of one price should hold because of international *arbitrage*.

When the price of the good in one country begins to rise above the price in another country (expressed in a common currency), it will become profitable for intermediaries to buy the good in the low-price country, sell it in the high-price country, and pocket the difference. Such activity is what is meant by arbitrage.

For example, in 1985, when the dollar had appreciated to roughly double its 1980 value against the mark, luxury German automobiles were selling for higher prices in the United States than in Germany. A so-called gray market developed rapidly, in which people bought BMWs, Mercedes, and Porsches in Germany and shipped them to the United States, either to use themselves or to resell. Another example of arbitrage arose in 1995, when the dollar had depreciated and it was the yen that was at its highest level in 40 years. Then arbitrage consisted of Japanese visitors to California loading up on consumer goods that were cheaper than the same goods back home.

Arbitrage will tend to drive the price up in the low-price country, by adding to demand there, and down in the high-price country, by adding to supply. The process should continue until the price is equalized in the two countries. Hence the law of one price.

An interesting question is why the arbitrage in 1985 was not powerful enough to force retailers of German autos in the United States to lower their prices to match the lower dollar prices of the autos sold in Germany. Evidently the costs involved in buying an auto in Germany and shipping it to the United States are large enough that most American customers preferred to continue buying from authorized dealers despite the higher price. Part of the explanation is that a BMW bought in Germany is not precisely the same commodity as a BMW bought from an authorized U.S. dealer. Even leaving aside the shipping costs, some changes must be made in pollution control equipment to satisfy U.S. regulations. Furthermore, when consumers buy automobiles from an authorized dealer, one thing they get is a warranty, the ability to have mechanical problems fixed at no cost. Needless to say, this is difficult to do if the dealer is in Munich.

Such frictions in the arbitrage process sometimes allow exporters to set different prices in different customer countries. This phenomenon of the firm “pricing to market”—setting prices with an eye more on prices of competing products in the customers’ market than on the price of the good in its country of origin—is especially a phenomenon of the U.S. market. In other countries, exchange rate changes tend to be somewhat more fully and rapidly passed through to the prices of imports. A possible reason is that foreign firms in U.S. markets tend to be heavily outnumbered by domestic firms.

Because the law of one price is so basic, we have been implicitly assuming all along that it holds. In the preceding two chapters even though we assumed that the price of BMWs produced in Germany was set rigidly in terms of euros (refer to the discussion

of Assumption 3 in Section 16.1), we took as given that the price of BMWs in the United States was simply the euro price times the dollar/euro exchange rate. In other words, we assumed that arbitrage enforced the law of one price for BMWs, and we will continue to do so, notwithstanding the anomaly just noted.

This is not as strong as the assumption that the price of *American-made* automobiles is equal to the euro price of German automobiles times the exchange rate. Buicks and BMWs are, after all, different products. Arbitrage between the two does not operate, given the reasonable assumption that consumers view American and German automobiles as different products. This fact allows U.S. manufacturers to set their prices in dollars with some degree of rigidity (at least in the short run), and at the same time allows German manufacturers to set theirs in euros.

Reasons for Failure of PPP

The term *purchasing power* connotes a basket of goods rather than a single good. If identical goods entered the domestic and foreign consumption baskets with identical weights, and the law of one price held for each good, then PPP would necessarily follow.

We will use P and P^* to refer to actual price indices in use, such as the producer price index (PPI) or consumer price index (CPI). Such indices inevitably refer to different baskets of goods in different countries, which immediately allows the possibility that the equation $P = EP^*$ will fail to hold. Note that aggregate price indices are expressed relative to a base year (e.g., 2000 = 100) rather than in absolute dollar or pound terms. Thus the concept here is known as “relative PPP,” rather than “absolute PPP.”⁷ Relative to the base year, the domestic price goes up by the same percentage as the foreign price level plus the percentage change in the exchange rate. If a bushel of wheat or a ton of steel is now—and in the past has always been—more expensive in France than China, this will not show up in the calculations of relative PPP. In other words, the equation $P = EP^*$ holds only up to a multiplicative constant. For convenience, the multiplicative constant usually is not shown explicitly. Another way of stating the proposition that relative PPP holds is to say that the *real exchange rate*, defined as EP^*/P , is constant over time.

There are four reasons why purchasing power parity can fail to hold. Each is associated with its own typical pattern of movement in the real exchange rate.

1. *Tariffs and transportation costs* create a band in which prices can fluctuate before arbitrage becomes profitable. Only if the price in one country exceeds the price in the other by more than the size of any tariffs, other trade barriers, and shipping costs, will arbitrage start to operate. We might rescue the law of one price by claiming that a

⁷It is difficult to get the data necessary for computing absolute PPP; we cannot use standard statistics on price indices that governments publish as we can when computing relative PPP. It means sending a team of researchers to different countries to sample the prices of a standardized set of goods. Absolute price indices are reported in the Penn World Tables. See Irving Kravis and Robert Lipsey, “Toward an Explanation of National Price Levels,” *Studies in International Finance*, 52 (1983).

bushel of wheat delivered in New York City at noon on a particular day is a different good than a bushel of wheat delivered in London, or delivered on a different day. (Contracts for spot or forward delivery of agricultural and mineral commodities do, in fact, specify time and place, and the price can vary accordingly, especially if there are substantial tariffs or transportation costs.) In any case, PPP is defined to apply to price indices that aggregate together, not only wheat, but all goods, so these geographical factors clearly allow deviations from PPP. Figure 19.2(a) represents these deviations as fluctuations of the real exchange rate within a band. The width of the band should be twice the magnitude of tariffs and transportation costs.

2. *Permanent shifts in the terms of trade* between traded goods take place, such as the upward shift that occurred between oil and manufactured goods in 1973 and 1979, the reverse shift that occurred in 1986 and 1998, or the return of high oil prices after 2004. Oil and manufactured goods can have very different weights in the price indices of the two countries, particularly if we consider producer price indices rather than CPIs. An oil-producing country, for example, will experience a real appreciation of its currency when the relative price of oil goes up, whether in the form of a nominal appreciation of the currency or in the form of an increase in the producer price index, P . If the oil price goes up by 50 percent and oil has a weight that is 20 percentage points higher in an oil-exporting country than in another country, then the effect on the real exchange rate will be 10 percent. To take another example, automobiles could have the same weight in two countries' price indices, but if Japan produces smaller, more fuel-efficient cars, then it is likely to experience a real appreciation in the event of an oil price increase that causes demand to shift toward its products.

In the case of tariffs and transportation costs, when the real exchange rate nears the top of the band it cannot go much farther. However, in the case of permanent shifts in the terms of trade, no natural limit exists on how far the real exchange rate can drift in one direction or the other. In the absence of any particular theory predicting changes in the terms of trade, the real exchange rate can move up from its current position as easily as down. Accordingly, in Figure 19.2(b), the shifts in the terms of trade are shown as "permanent": When a change in the real exchange rate is observed, there is no way to know whether it will in the future continue to move further in the same direction or will reverse itself. When changes in a variable such as the real exchange rate are not predictable, we say that the variable follows a "random walk," like a drunken reveler walking down an empty street. This description is just a statement of our ignorance of what the real exchange rate will do, however; it does not take the place of an economic theory.

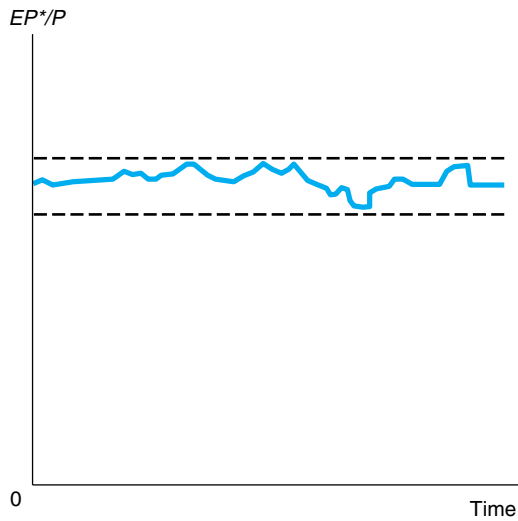
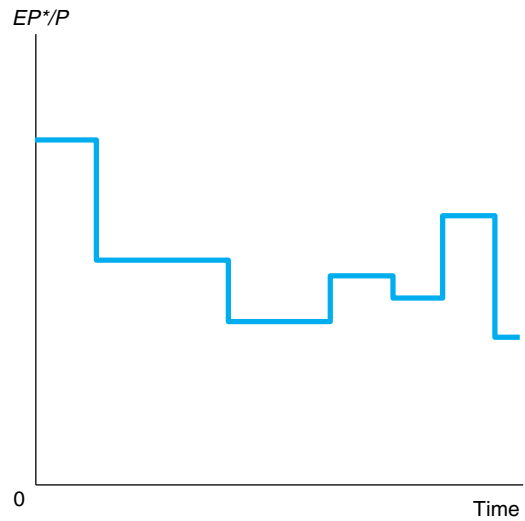
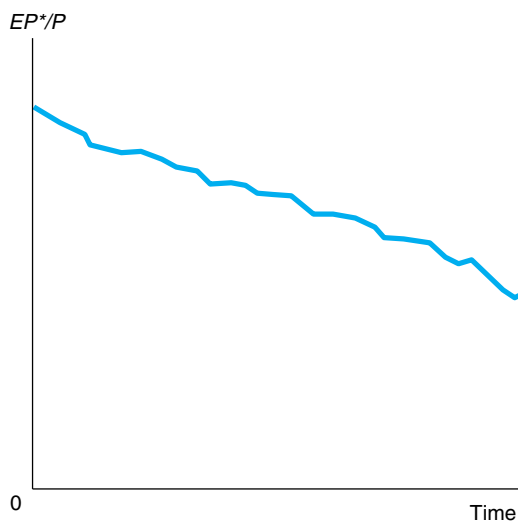
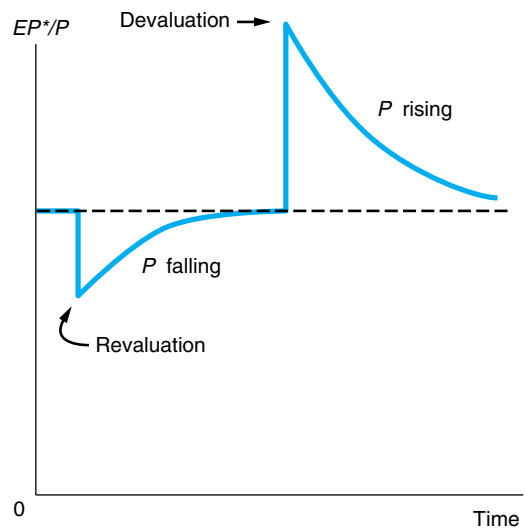
3. Even if the traded goods baskets are identical in both countries, if the indices include prices of *nontraded goods and services*, which cannot be arbitrated internationally, PPP may fail. If the prices of nontraded goods in each country happen to move proportionately to the prices of traded goods, then PPP will still hold. If there are shifts in the relative prices of traded goods and nontraded goods, PPP will fail. (Models with nontraded goods are discussed at greater length in Chapter 20.)

Consider the real exchange rate defined in terms of consumer price indices.

$$E_{\text{real}} = E(\text{CPI}^*/\text{CPI}) \quad (19.1)$$

FIGURE 19.2**Patterns of Deviation from Purchasing Power Parity**

(a) Tariffs and transportation costs create a band within which the real exchange rate can fluctuate. (b) Permanent shifts in the terms of trade move the real exchange rate unpredictably. (c) A long-term trend in the relative price of nontraded goods (e.g., upward in a rapidly growing country) will cause a trend in the real exchange rate. (d) The real exchange rate works its way back to equilibrium after a devaluation as goods prices adjust, but the process can be slow.

(a) Band Created by Tariffs and Transportation Costs**(b) Permanent Shifts in Terms of Trade****(c) Trend in Relative Price of Nontraded Goods****(d) Slow Adjustment of Goods Prices**

In each country, a weighted average of nontraded goods and traded goods constitutes the CPI. The real exchange rate will change if the *relative* price of non-traded goods (i.e., the price of nontraded goods in terms of traded goods) changes in either the foreign country or the domestic country.⁸ For example, the Japanese yen had come to appear highly overvalued in real terms by 1995. The long-term trend in the yen over the preceding half century had shown a strong real appreciation, in part because of an increase within the Japanese price index of the prices of housing and other nontraded goods and services (including golf-club memberships, a nontraded good particularly important in Japan!).

Bela Balassa and others have identified a pattern based on differential economic growth (the famous “Balassa-Samuelson effect”).⁹ Growth of a country’s income is associated with increased productivity in traded goods, which then fall in price relative to nontraded goods. In other words, the relative price of nontraded goods in terms of traded goods rises. Growth also may cause a rise in the relative price of nontraded goods and services if they are superior goods in consumers’ demand functions.¹⁰ Either way, because the prices of traded goods are tied to world prices, a rise in the relative price of nontraded goods can only mean an increase in the price of nontraded goods relative to world prices. Therefore, the CPI, which includes nontraded goods, rises relative to world prices. The domestic currency will appear to appreciate by PPP calculations. The real exchange rate, $E(\text{CPI}^*/\text{CPI})$, will appear to fall (i.e., either E will fall or CPI will rise). That is why countries with strong growth rates tend also to have upward trends in their relative prices and therefore in the real foreign exchange value of their currencies, as is shown in Figure 19.2(c). In other words, such countries often show downward trends in their real exchange rates.¹¹

4. In Chapter 16, lags caused by *imperfect information, contracts, inertia in consumer habits*, and so forth, rendered elasticities lower in the short run than in the long run. This implies that two goods that are highly substitutable in the long run may be very imperfect substitutes in the short run. This low degree of substitutability allows prices to be “sticky” and allows large deviations from PPP in the short run without inducing large-scale international arbitrage. For example, following a devaluation or revaluation, firms do not readjust their prices fully but absorb the (finite) increase or decrease in demand by varying the quantity sold. If the goods are close substitutes in the long run, then prices will adjust to PPP eventually; if they did not adjust, demand

⁸Refer to Problem 2c at the end of the chapter.

⁹Bela Balassa, “The Purchasing Power Parity Doctrine: A Reappraisal,” *Journal of Political Economy*, 72 (1964): 584–596; Paul Samuelson, “Theoretical Notes on Trade Problems,” *Review of Economics and Statistics* (May 1964): 145–154. This is the sort of “real trade theory” explanation for changes in the real exchange rate that we would like to have, as opposed to the agnostic position that is content with describing the real exchange rate as following a random walk.

¹⁰“Superior” goods are goods that experience a relative increase in demand when real income increases. Jeffrey Bergstrand, “Structural Determinants of Real Exchange Rates and National Price Levels: Some Empirical Evidence,” *American Economic Review*, 81, no. 1 (March 1991): 325–334.

¹¹Evidence in time-series data is found to support the Balassa hypothesis in Jose De Gregorio, Alberto Giovannini, and Holger Wolf, “International Evidence on Tradables and Nontradables Inflation,” *European Economic Review*, 38, no. 6 (June 1994): 1225–1244. Such studies look at relative PPP. Cross-country evidence on absolute PPP is summarized by Irving Kravis and Robert Lipsey, “National Price Levels and the Prices of Tradables and Nontradables,” *American Economic Review*, 78, no. 2 (May 1988): 474–478; it too shows that the price of non-traded goods relative to traded goods increases with the level of the country’s per capita income.

levels might rise or fall without limit. Figure 19.2(d) illustrates the process. If a sudden increase in the nominal exchange rate occurs, with prices fixed in the short run it translates fully into an increase in the real exchange rate. This real depreciation stimulates the demand for domestic goods, putting upward pressure on prices. As prices gradually rise, the real exchange rate comes back down toward its long-run equilibrium. However, it is always possible that before equilibrium is reached, another sudden exchange rate change will occur.

The precise nature of the microeconomics of sticky prices is not well understood, but the empirical evidence is clear, as we will see in the following section. Of these four ways in which PPP can fail, all contain some truth, but the last is the one with the most macroeconomic content. From now on, any reference to the possibility of short-run failure of PPP will usually be a reference to the macroeconomic, sticky-price interpretation. Although permanent changes in the real exchange rate because of productivity differences and other real factors do occur, they tend to be slow long-term trends. Short-run deviations from those trends are the sort of PPP failure that we will be examining at length.

Empirical Evidence on PPP

Any empirical study of PPP shows very large deviations, at least in the short run. Relative to the Bretton Woods period of fixed exchange rates, most countries' real exchange rates have been especially variable in the years since 1973, including Great Britain and the United States. This is reflected in Figure 19.3, which graphs the real pound sterling/dollar rate. A useful measure of variability is the standard deviation.¹² The standard deviation of the real pound/dollar rate was 22 percent over the period 1973 to 2005. In general, it takes a band of two standard deviations either way to encompass 95 percent of the fluctuations in a variable (assuming a normal distribution). These numbers imply that departures from PPP as large as 44 percent occur (2 times 22 percent = 44 percent). These are large swings to be occurring regularly in the relative prices of countries' goods. In comparison, the standard deviation of the real pound/dollar rate was only 9 percent over the fixed-rate period of 1945 to 1972. Some of the variation in the real exchange rate during the earlier period was caused by differences in inflation rates between the two countries, but much of the variation was accounted for by a few discrete devaluations of the pound. The exchange rate was not literally "fixed" permanently; it was "fixed, but adjustable."

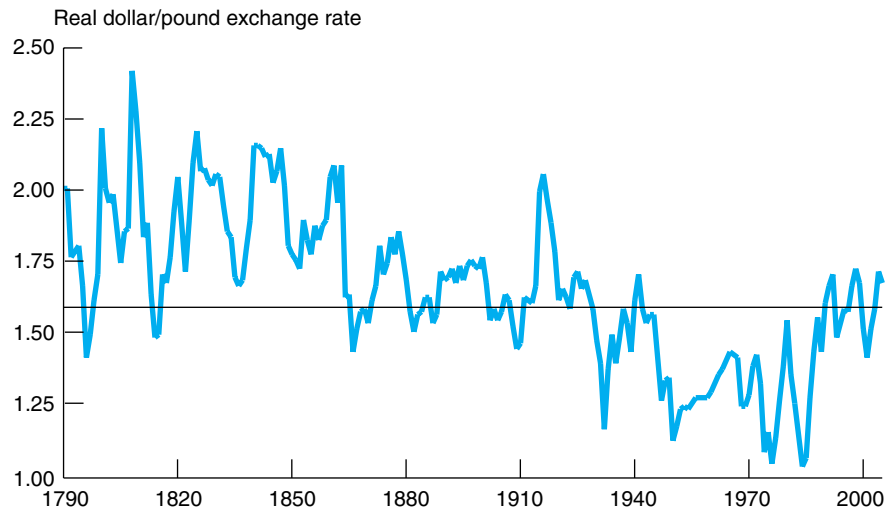
The 1973 increase in the variability of the real exchange rate against the United States was particularly great for Japan. This is clear in Figure 19.4, which shows monthly changes in the real yen/dollar rate.¹³ The pre-1973 versus post-1973 comparisons suggest strongly that fluctuations in the nominal exchange rate may be a cause of fluctuations in the real exchange rate.

¹²If you are familiar with the statistical concept of the *variance*, the standard deviation is simply the square root of it.

¹³Monthly variability in major exchange rates tripled after 1973. We have concentrated here on the U.K. case rather than the Japanese one, or others, because the time series of data extends unbroken much further back in history.

FIGURE 19.3**Two Hundred Years of Purchasing Power Parity Between the Dollar and the Pound**

Changes in the real exchange rate are not purely random. Rather, it tends to regress slowly toward its long-run equilibrium (until a new disturbance comes along). In the case of the United States and United Kingdom, the long-run equilibrium appears to have been constant.

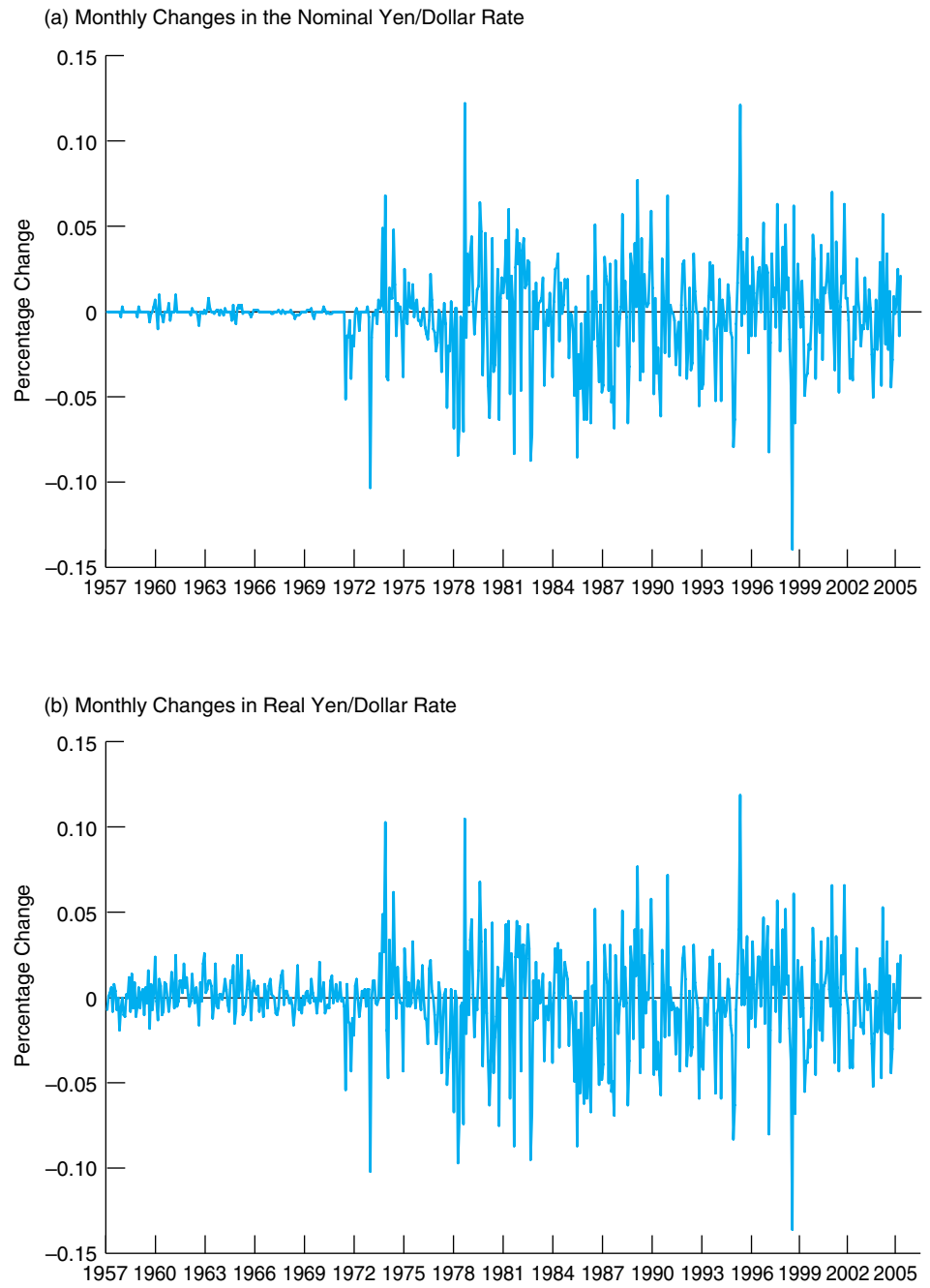


Sources: 1790–1990 James Lothian and Mark Taylor, “Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries,” *Journal of Political Economy* 104, 484–509 (1996); and for 1990–2005: IFS (International Financial Statistics) and Federal Reserve.

Another explanation is that the greater variability in real exchange rates after 1973 was related to the greater magnitude of real worldwide disturbances, such as oil shocks, and would have happened even under a regime of fixed exchange rates (in which case the variability would have shown up in the price levels). This alternative view holds that changes in the nominal exchange rate do not *cause* changes in the real exchange rate, but that both occur in response to exogenous real disturbances such as productivity changes.¹⁴ One problem with this view is that no one has identified these real shocks. It would seem if there were a change in productivity or consumer tastes that applied to hundreds of different industries in a country, such that all of them experience an increase in price when the currency appreciates (relative to their counterparts in foreign countries), then we should be able to identify what that change is. A few cases, in fact, do suggest explanations. The rapid fall in the value of the yen and the mark against the dollar when the price of oil quadrupled at the end of 1973 surely resulted because those two countries’ economies depended more on imported oil than the U.S. economy

¹⁴Such theories have been constructed, for example, by Alan Stockman, “The Equilibrium Approach to Exchange Rates,” *Economic Review*, Federal Reserve Bank of Richmond (March–April 1987): 12–31.

FIGURE 19.4
Nominal and Real Exchange Rates Both Became More Volatile After 1973



did. It is hard to see what changes in worker productivity or consumer tastes could possibly explain the 50-plus percent real appreciation of the dollar between 1980 and 1985, however, and its reversal over the following three years, or the similar 1990–1995 real appreciation of the yen and *its* reversal over the subsequent three years.

One way to check if the comparison of the fixed-rate and floating-rate periods might be contaminated by larger supply shocks after 1973 than before is to look at Canada, the one country to have a floating exchange rate in the 1950s. The real exchange rate in Canada was highly variable at the time, whereas those in fixed-rate countries were much less so. Evidently the floating-rate regime made the difference.

Another piece of evidence is offered by the case of Ireland. From 1957 to 1970 the Irish currency was pegged to the pound, and thereby to the dollar and mark as well, until the currencies began to float against each other. From 1973 to 1978 the Irish currency was again pegged to the pound, which meant it floated against the dollar and mark. Then from 1979 onward Ireland was in the European Exchange Rate Mechanism, and the currency—the punt—was thereby tied to the mark, which meant it floated against the dollar and pound. In each of the three periods, the choice of *nominal* exchange rate regime for the punt corresponds very well with the observed degree of *real* exchange rate variability vis-à-vis each of the three trading partners. Stickiness of prices explains the pattern. Otherwise it would be quite a coincidence that real variability vis-à-vis the mark, say, should fall and vis-à-vis the pound should rise at precisely the same moment that the nominal variabilities, respectively, fall and rise as well.¹⁵

A third way of evaluating whether real exchange rate variability is related to the exchange rate regime is to consider earlier historical experience. History demonstrates that the variability of real exchange rates was larger under floating-rate regimes than under fixed-rate regimes, not just during the period after World War II, but before the war as well.¹⁶

These findings would be difficult to explain with perfectly flexible goods prices. It seems more likely that prices are sticky and that nominal exchange rate variability is indeed a primary source of real exchange rate variability. Estimates on the yearly U.S.–U.K. data indicate that fluctuations in the nominal exchange rate are 84 percent reflected as fluctuations in the real exchange rate (1973–2005).

There have been some studies of PPP, or the law of one price, for disaggregated categories of goods matched across countries that are the smallest, most narrowly defined, SITC (Standardized International Trade Classification) categories. These studies find large deviations even on these disaggregated data. This need not be interpreted as a failure of economic rationality or the law of one price. One partial explanation is that most foreign trade takes place under 30- to 90-day contracts, so prices cannot be readjusted for 30 to 90 days after a disturbance. More fundamentally, manufactured goods of different firms are actually different goods, as was noted earlier.¹⁷

¹⁵Michael Mussa, *Exchange Rates in Theory and in Reality*, Essays in International Finance, 179 (Princeton: Princeton University Press, December 1990).

¹⁶Alan Taylor, “A Century of Purchasing Power Parity,” *Review of Economics and Statistics*, 84 (2002): 139–150.

¹⁷Charles Engel, “Real Exchange Rates and Relative Prices: An Empirical Investigation,” *Journal of Monetary Economics*, 32 (1993): 35–50.

Even goods that are marketed in the same location and differ in little more than brand name—for example, a Japanese television set and the identical item manufactured by the identical firm but under an American label—violate the law of one price. Different manufacturers vary with respect to reputation or warranty offered, and different retailers vary with respect to their sales and maintenance service. Long-term customer relationships are thought to be particularly important in Japan and give rise to what are sometimes called *implicit* contracts: A Japanese corporation will hesitate before raising prices when there is excess demand, in the anticipation that this will build loyalty among customers, who will continue to buy from it in other periods of excess supply.

This point recalls a distinction between homogeneous “auction goods”—for which the law of one price holds instantaneously and worldwide, and heterogeneous “customer goods”—for which the law of one price fails, at least in the short run. Auction goods are usually basic commodities such as agricultural and mineral products, whereas customer goods are usually heterogeneous manufactured goods that bear brand names. The rapidly evolving semiconductor industry provides an example of each kind of good. So-called commodity chips tend to be all the same regardless of the producer and are sold in perfectly competitive markets resembling those for agricultural or mineral commodities. Specialty chips are designed to fulfill more specific functions and tend to fit better the description of customer goods.

If PPP holds in the long run but not in the short run, the obvious empirical questions become: How long is the short run? How quickly do deviations from PPP disappear? The speed with which the real exchange rate adjusts back toward its long-run equilibrium has been estimated at about 15 percent a year: The best guess in a given year as to what will be the gap between the real exchange rate and its long-run equilibrium is 85 percent of what it was in the preceding year. After two years, 72 percent of the gap will remain ($.85^2 = .72$), and so forth. After four years, 52 percent of the gap will remain ($.85^4 = .52$). In other words, the half-life has been estimated at about four years. This speed of adjustment is not implausibly slow, but it is sufficiently slow as to be difficult to detect statistically in the data, given that large new disturbances come along frequently. This is especially true if only a few years of data are available. We must look at a long time period, such as the 200 years of data in Figure 19.3, for clear manifestation of the tendency of the real exchange rate to return to equilibrium.¹⁸

19.3 Purchasing Power Parity in a Hyperinflation

Hyperinflation was defined by Philip Cagan as a sustained inflation in which the price level goes up by more than 50 percent per month. Hyperinflations seem to attack like a mysterious disease. They afflicted Central Europe in the early 1920s, a smattering of countries at the end of World War II, Latin America in the 1980s, and several countries

¹⁸Hyperinflation is one context in which PPP in a sense works well empirically (because the long run in effect “telescopes” into a few years). This is explained in Section 19.3.

in the wake of the breakup of the Soviet Union in the early 1990s. The source is usually simple enough: a government that has control of a printing press but controls little else. Often it is a weak government printing money to fight a war.

In January 1994 the inflation rate in what remained of Yugoslavia (essentially Serbia) reached 313,563,558 percent per month, almost equaling the preceding record, which had been set by Hungary in 1945–1946. As with any hyperinflation, residents tried desperately to buy marks or dollars, anything to avoid holding the domestic currency. Reporting at the peak, a Belgrade newspaper described the situation: “Yesterday [morning] the price of the [Deutsche] mark on the black market was 2.0 million dinars, and around 3:00 P.M. it was 2.5 million dinars. Belgrade dealers were reluctant to sell marks, as they expected the exchange rate to reach 5 million dinars (per DM) by the evening.”¹⁹

As mentioned in footnote 18, hyperinflation is one context in which PPP in a sense works well empirically. Table 19.1 reports cumulative increases in the price level and in the exchange rate for some memorable hyperinflations of the twentieth century. They

TABLE 19.1
PPP in Great Hyperinflations of the Twentieth Century

Country	Period	$\frac{P \text{ final}}{P \text{ initial}}$	$\frac{E \text{ final}}{E \text{ initial}}$
Austria	10/1921–9/1922	93	29
Germany	7/1922–12/1923	179×10^8	141×10^8
Poland	1/1923–1/1924	699	491
Hungary	3/1923–2/1924 ^a	44	12
Hungary	8/1945–7/1946	381×10^{25}	304×10^{25}
Nat. China ^b	9/1945–5/1949	105×10^9	119×10^9
Bolivia	4/1984–9/1985	974	2,129
Peru	9/1988–8/1990	7,242	11,600
Argentina	4/1989–3/1990	204	294
Brazil	11/1989–3/1990	12	8
Ukraine	4/1991–12/1993	4,772	799
Belarus	4/1991–2/1992	8	6
The Congo	10/1991–9/1994	237,499	284,519
Tajikistan	1/1992–12/1993	1,088	743
Serbia	2/1992–1/1994	366×10^{20}	8.3×10^{20}
Armenia	9/1993–5/1994	139	99

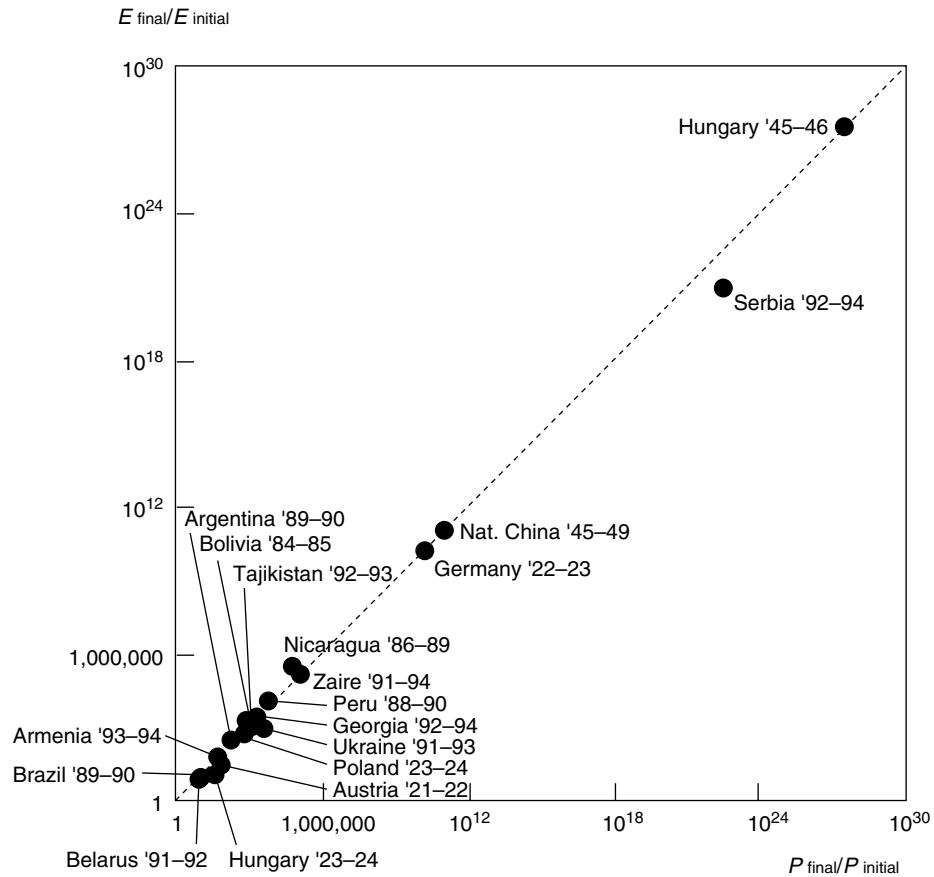
^aCumulative rise in exchange rate in Hungary is from average of March 1923 to average of March 1924.

^bChina's exchange rate change is the change in the price of gold rather than a direct exchange rate.

Sources: P. Cagan, “The Monetary Dynamics of Hyperinflation,” in Milton Friedman, *Studies in the Quantity Theory of Money* (Chicago: University of Chicago Press, 1956); Bogetic, Dragutinovic, and Petrovic, “Anatomy of Hyperinflation,” *Economic Review and International Financial Statistics*, IMF; T. Sargent, “The Ends of Four Big Inflations,” in Robert Hall, *Inflation: Causes and Effects* (Chicago: University of Chicago Press, 1982); D. Paarlberg, *An Analysis and History of Inflation* (New York: Praeger, 1993); T. Hu, “Hyperinflation and the Dynamics of the Demand for Money in China, 1945–1949,” *Journal of Political Economy* (January/February 1971); International Monetary Fund.

¹⁹The report was dated January 16, 1994, soon before a successful stabilization. As reported by Z. Bogetic, D. Dragutinovic, and P. Petrovic, “Anatomy of Hyperinflation and the Beginning of Stabilization in Yugoslavia, 1992–1994,” World Bank (September 1994).

FIGURE 19.5
PPP in Great Hyperinflations of the Twentieth Century



are expressed as multiples—that is, the level at the end of the period divided by the level at the beginning. In most of the hyperinflations reported, the increase in the exchange rate was roughly of the same order of magnitude as the increase in the price level. Figure 19.5 graphs the cumulative change in the price level and exchange rate for each of these hyperinflations. The points lie impressively close to the 45° line, supporting PPP.²⁰

Yet there is another sense in which PPP works poorly during a hyperinflation. We can see from Table 19.1 that the cumulative rise in the exchange rate never matches the

²⁰Similarly, Jacob Frenkel found that an OLS regression testing the time series relationship between the exchange rate E and the relative price level P/P^* in the German hyperinflation of 1920 to 1923 produced a coefficient close to one. “Purchasing Power Parity: Doctrinal Perspective and Evidence from the 1920’s,” *Journal of International Economics*, 8, no. 2 (May 1978): 169–191.

rise in the price level exactly. It is not uncommon for one variable to go up twice as much as the other—a movement in the real exchange rate of 100 percent—or by more.

The explanation for these seemingly conflicting findings is that PPP holds fairly well in the long run, but large short-run errors can push the exchange rate and the price level away from PPP. In a hyperinflation, the long run arrives quickly. In terms of Figure 19.5, the deviations from the 45° line are dwarfed by the magnitudes of the hyperinflations.²¹ In short, as an explanation of the level of the *nominal* exchange rate, PPP works well in hyperinflations. As a theory of the *real* exchange rate, it does not. We examine these hyperinflations further in Chapter 27.

19.4 PPP in the Model of the Balance of Payments

We now adopt the assumption that prices are perfectly flexible, so that PPP holds.

$$P = EP^* \quad (19.2)$$

Why is PPP assumed here, when the empirical evidence just reviewed does not support it? There are several reasons. First, just as assuming fixed prices allowed us to focus on the determination of output in the preceding chapter, assuming flexible prices and full employment is a simplification that allows us to focus on the determination of the price level. (We will relax the assumption of full employment in Chapter 26 to study the complete case, where increases in demand go partly into output and partly into prices.) Second, some economic analysts write as if PPP does hold. It helps to understand their viewpoint. Third, the flexible-price full-employment assumption is fairly realistic for thinking about the *long run*, just as the rigid-price assumption is fairly realistic for thinking about most countries in the short run.

Finally, PPP is more realistic, even in the relatively short run, for thinking about very small, very open economies. Hong Kong and Singapore are examples. Why is PPP a good assumption for some countries but not for others?

The Aggregation of Traded Goods for Small Open Economies

For most countries, even relatively large ones, prices of import goods can be taken as given exogenously in the short run, fixed in terms of foreign currency, as was assumed in the preceding three chapters. The reason is that a typical country constitutes a small fraction of the world demand for any given product and so has very little monopsony power. The situation is more varied when it comes to the country's export goods. Many countries have some monopoly power in their export goods. Even if the country is only one of many that produces, for example, automobiles, foreign consumers will not treat its autos as perfect substitutes for other countries' autos because they are customer goods. This makes it possible for producers to set a price for the product in domestic

²¹This is a standard "errors in variables" problem in econometrics. N. Davutyan and J. Pippenger, "Purchasing Power Parity Did Not Collapse During the 1970s," *American Economic Review*, 75, no. 5 (December 1985): 1151–1158.

currency without fearing an instantaneous large loss of demand when there are adverse changes in the exchange rate or in the prices charged by foreign competitors. This was the sort of country we considered in Chapters 16 through 18. But we now consider a different kind of country.

Many countries are so small in world markets that they have little monopoly power in their export goods and must take prices of export goods as exogenous, or fixed in terms of foreign currency. In the case of agricultural and mineral commodities and other auction goods, the output of different countries often can be considered perfect substitutes. Sugar or tin, for example, is basically the same regardless of where it is produced. In addition, if the country doesn't happen to produce a large proportion of the world output of the agricultural or mineral product, then it is safe to assume it accepts the world price. In other words, if it tried to charge more than the going price, it would quickly find itself without customers. In the case of manufactured goods, some labor-intensive products such as textiles are sufficiently similar among a wide range of countries that their prices too can be taken as essentially given on world markets. Then the analysis returns to the definition of a small country used in the first half of the book: a country that is too small in international markets to affect world prices.

As these examples show, developing countries are more likely to take export prices as given than are larger industrialized countries. (Note, however, that the assumption that the country can sell any quantity it wants on the world market at the going price can go wrong for another reason: Major customers may apply country-by-country quotas to purchases of the commodity. Industrialized countries maintain such quotas against sugar, for example.)

If a country is so small that it takes not only its import prices as given but its export prices as well, then it is possible to aggregate the two kinds of goods together at their (given) relative price. The composite commodity thereby created is referred to as *traded goods*. Under the assumption that the small open country can buy or sell all of the traded goods it wishes to, the trade balance becomes the quantity of traded goods it chooses to produce minus the quantity it chooses to buy. With this analysis, the question of how a given trade balance breaks down into imports and exports is left unanswered. The approach just tells us the overall trade balance, which is the variable we are usually interested in.

In reality, the relative prices of some of the goods within this composite commodity—the traded good—will sometimes change. When this happens, it will not be useful to talk in terms of traded goods in the aggregate. Worldwide changes in the relative price of oil, as occurred in 1973 and 1979 (upward), 1986 and 1998 (downward), and 2005 (again upward), are an important example. But such developments are usually taken to be exogenous. For purposes of studying changes that do not affect the terms of trade, such as changes that originate in macroeconomic policy, this aggregation will be useful. The next chapter will also continue to aggregate all traded goods.

The Real Balance Effect

In previous chapters, a devaluation raised the trade balance to the extent that it lowered the price of exports relative to imports. One might think that once we rule out such terms of trade, and indeed assume that purchasing power parity holds continuously,

that a devaluation can no longer affect the balance of payments. But this is not correct. Here we briefly consider the *real balance effect* resulting from a devaluation.

Consider a 10 percent devaluation. Not only do the prices of imports follow the price of foreign exchange E up by the same 10 percent, but under the assumption of PPP, *all* prices rapidly go up by the same amount. When the price level P rises 10 percent, if the nominal money supply is unchanged, then the real money supply M/P falls by 10 percent. This is called the real balance effect because M/P is sometimes called real money balances.

Nothing has happened to change money demand, so we now have excess demand for money. Individuals respond by cutting back purchases of internationally traded goods, thereby improving the trade balance. Thus is the improvement accomplished with no change in the terms of trade. (Individuals also cut back purchases of internationally traded assets, if capital flows are in the model. Recall from the opening of this chapter that its subject is the Monetary Approach to the Balance of Payments, not just the Balance of Trade.)

As with the Hume and Mundell flow mechanisms of Section 19.1, the balance of payments surplus sets in motion developments that are self-correcting. The surplus implies that reserves are flowing into the country. Under a system of nonsterilization, the money supply gradually rises. This endogenous monetary expansion, in turn, gradually reverses the fall in purchases of goods (and assets). The balance of payments declines, eventually returning to zero.

Appendix C to this chapter presents this model algebraically and graphically. It illustrates the effects not just of a devaluation, but of three other experiments as well: a monetary expansion, inflation in the rest of the world, and supply-led domestic growth. (The model is useful for thinking about how the global system operated under the gold standard and Bretton Woods systems, the subject of Appendix A.) The common denominator throughout the experiments, and throughout the chapter, is that effects on the balance of payments are temporary and self-equilibrating.

19.5 Summary

This chapter introduced two new concepts into our study of economies that operate under fixed exchange rates. The first concept was the flow of international reserves into or out of a country through the balance of payments. This reserve flow changes its monetary base endogenously over time if the central bank either cannot or does not choose to sterilize (offset or neutralize). Such changes in the monetary base then have further implications over time for the economy. The second concept was purchasing power parity (PPP). The first of the two concepts is the one that defines most the monetary approach to the balance of payments.

We studied the effects of two policy experiments: a change in the money supply and a devaluation. An increase in the money supply creates an excess supply of money, which leads to a higher level of private expenditure and a balance-of-payments deficit in the short run, the same as at the end of the preceding chapter. The difference is that under the nonsterilization assumption, the balance-of-payments deficit implies that the

level of the money stock falls over time, which in turn gradually undoes the increase in expenditure and the balance-of-payments deficit. A devaluation leads to a balance-of-payments surplus in the short run, again as in previous chapters. The level of the money stock rises over time, which in turn gradually undoes the balance-of-payments surplus. Whatever the policy experiment, in the long run the balance of payments must be zero under the monetary approach, so that the stock of reserves is no longer changing.

These results apply regardless of what is assumed about the second concept associated with the monetary approach to the balance of payments: purchasing power parity (PPP). PPP states that the domestic price level is given by the exchange rate times the foreign price level. There are a number of reasons why this relationship can fail in theory, why the *real* exchange rate is not constant. The most important, at least in the short run, is that prices are “sticky,” meaning that prices require time to adjust after a change in the nominal exchange rate. Thus the fixed-price assumption (which we made in Chapters 16 through 18 and will return to in Chapter 22) is realistic for the short run. Nevertheless, in the last part of the present chapter we explored the implications of the assumption of price flexibility and PPP. One motivation is to think about the long run. Another motivation is to think about very small, open economies.

In the small open economy model a devaluation translates directly into a proportionate increase in the domestic price level, so no change occurs in the real exchange rate. Nonetheless, there is an effect on the balance of payments, through what is called the *real-balance effect*. The increase in the price level reduces the real money balances held by the public. In response to the resulting excess demand for money, people cut back on expenditure, which in turn leads to the improvement in the balance of payments. The next chapter will include some additional effects that devaluations have for small, open countries, especially developing countries. In particular, it will introduce nontraded goods into the monetary model.

CHAPTER PROBLEMS

1. What effect does a revaluation of the currency upward have on income and the trade balance, in the short run and in the long run? Answer diagrammatically for each of the two monetary models.
 - a. The monetary model with fixed goods prices (Section 19.1).
 - b. The monetarist model with purchasing power parity (Section 19.4).
2. The real exchange rate is defined to be $E(CPI^*/CPI)$.
 - a. If PPP holds, what is the rate of change of the CPI when the foreign inflation rate is 3 percent per year and
 - i. the nominal exchange rate is fixed?
 - ii. the domestic currency is depreciating at 7 percent per year?
 - iii. the domestic currency is appreciating at 3 percent per year?
 - b. Assume that PPP holds, the foreign price level is fixed, the parameter K measures the sensitivity of desired money balances to nominal income, and the parameter δ measures the sensitivity of the balance of payments to the excess

demand for money, as in Equation 19.5 in Appendix C. In each of the following cases, what is the (short-run) effect on the balance of payments? Assume that nominal GDP is initially \$100 billion.

- i. The central bank decreases domestic credit by \$1 billion.
 - ii. Domestic output grows by 1 percent.
 - iii. The country devalues its currency by 1 percent.
- c. Let $CPI = P_n^a P_t^{(1-a)}$, where P_n is the price of nontraded goods, P_t the price of traded goods, and a the weight given to the former in the consumption basket. Define CPI^* analogously. Express the real exchange rate as a function of the relative price P_n/P_t in each country. (Assume the law of one price for traded goods.)
- d. If the domestic and foreign CPIs each give a weight of two thirds to nontraded goods and one third to traded goods, what is the rate of change of the real exchange rate if
- i. the relative price of nontraded goods is rising at 3 percent per year in the domestic country (and is constant in the foreign country)?
 - ii. the relative price of nontraded goods is rising at 3 percent per year in both countries?
 - iii. the relative price of nontraded goods is constant, but within traded goods there is an increase in EP_t^*/P_t —a shift in the terms of trade running against the home country—of 3 percent per year?
3. a. Assume that the gold standard is in effect and that huge new deposits of gold are discovered in California. What happens to the U.S. price level and trade balance, and the world price level?
- b. In *The Wizard of Oz*, Dorothy thinks that powerful men in the Emerald City have the answers to her problems, only to discover at the end of her journey that their power is based on sham and illusion and that she, the girl from Kansas, knew the answers all along. What city do you think this is? (See Appendix A, footnote 24.)

Extra Credit

Problems 4 and 5 deal with the monetary approach to the balance of payments. The rate of change of the money supply is given by the balance of payments.

$$H = TB$$

Problem 4 maintains the fixed-price assumption of the Keynesian model of Chapter 17. Problem 5 goes to the opposite extreme, fixed output.

4. a. Continuing Problem 5b, what is the initial, short-run effect of a fiscal expansion on the balance of payments: $\Delta TB_{SR}/\Delta \bar{G}$? What happens over time? What is the effect on income in the long run, defined as the time when the money supply is no longer changing ($H = 0$): ΔY_{LR} ?
- b. Continuing Problem 5d from Chapter 18, what is the initial effect of a monetary expansion on the balance of payments: $\Delta TB_{SR}/\Delta(\bar{M}/\bar{P})$? What is the effect on income in the long run: ΔY_{LR} ?

5. Think of the balance of payments, now equal to the desired rate of accumulation of money balances, as a function of the gap between the actual current money supply, M , and desired (long-run) money, M^d , where the latter is proportional to nominal GDP:

$$H = -\delta(M - M^d)$$

$$M^d = \frac{1}{v}PY$$

- Using BP to represent the balance of payments, which is equal to the nominal trade balance in the assumed absence of capital flows, express it as a function of M and PY . What is the effect of ΔM on ΔBP , and why?
- Is the effect of a monetary expansion on the trade balance in the Keynesian model of Problem 4b consistent with its effect in the monetarist model of 5a? (Note that the Keynesian model used TB to denote the real trade balance; the nominal trade balance is given by P times it. This made no difference when P was exogenous and normalized to 1.)
- For the first time, the assumption of a fixed price level is relaxed and replaced by the assumption of purchasing power parity:

$$P = E\bar{P}^*$$

where the small open economy assumption (that the world price level P^* is exogenous) is adopted, along with the assumption that income is exogenous because flexible prices guarantee full employment ($Y = \bar{Y}$).

Returning to the monetarist notation of Problem 5a, what is the effect of a devaluation, ΔE , on the balance of payments in the short run? In the long run?

SUGGESTIONS FOR FURTHER READING

- Dornbusch, Rudiger. "Purchasing Power Parity," in J. Eatwell, M. Milgate, and P. Newman, eds., *The New Palgrave*, Vol. 3 (New York: Macmillan, 1987). A good survey.
- Eichengreen, Barry. *The Gold Standard in Theory and History* (New York: Methuen, 1985). Important papers, including Barro, Cooper, Hume, and Triffin, on how the gold standard operated, and whether it did or did not correspond to the idealized version represented by the monetary approach to the balance of payments.
- Frenkel, Jacob, and Harry Johnson, eds. *The Monetary Approach to the Balance of Payments* (Toronto: University of Toronto Press, 1976). Includes, among other relevant papers, accounts of the overall monetary approach by the editors.
- Mundell, Robert. *International Economics* (New York: Macmillan, 1968). Includes "Barter Theory and the Mechanism of Adjustment" (Chapter 8), a classic reference on the monetary approach; "Growth and the Balance of Payments" (Chapter 9), which makes the argument that real growth leads to a surplus, not a deficit; and "The International Disequilibrium System" (Chapter 15), which develops the

model of the income-flow mechanism (although this paper, like much of the book, allows for capital mobility, and thus is most relevant for our Chapter 22).

Wanniski, Jude. “The Mundell-Laffer Hypothesis—A New View of the World Economy,” *The Public Interest*, 39 (Spring 1975): 31–52. The author, a former editorial writer for the *Wall Street Journal*, offered a heartfelt proclamation of the view that changes in the exchange rate have no effect on relative prices and therefore no effect on the trade balance.

APPENDIX A

The Gold Standard

The monetarist model is useful for thinking about the gold standard, the subject of this appendix. The two-country version of the model, which is developed formally in the supplement to Chapter 19, is particularly useful for thinking about international flows of money between Britain and the United States under the nineteenth-century gold standard—roughly the period 1880 to 1914.

The Idealized Gold Standard

There are many senses in which the world “lost its innocence” in World War I. The era before 1914 often is recalled with fond, and sometimes overly idealized, nostalgia as an era of unprecedented economic growth and stability under the gold standard. The definition of a gold standard is that central banks fix the value of their currencies in terms of gold. This means that they set a price of gold in terms of domestic currency and then stand ready to buy or sell gold to whatever extent is necessary to maintain that price. They must, of course, hold reserves of gold to meet any fluctuations in demand.

A gold standard is a special case of a system of fixed exchange rates. It is easy to show this: If the Federal Reserve has fixed the price of gold in terms of its currency (i.e., in dollars/ounce) and the Bank of England has fixed the price of gold in terms of its currency (in pounds/ounce), then they have in effect fixed their exchange rate (the ratio of the two, in dollars/pound).

The nineteenth-century gold standard, when visualized in its idealized form as a system of smooth and automatic adjustment to any disequilibrium, has two distinguishing characteristics. They correspond to the two assumptions of the monetary approach to the balance of payments laid out in the chapter.

First is the assumption that wages and goods prices are perfectly flexible and so adjust quickly to maintain equilibrium in the labor and goods markets. In the chapter, this cornerstone of the global monetarist view was discussed at length. Here it is worth noting that the assumption of flexible prices and wages was less unrealistic in the pre-1914 period than it is in the modern era of differentiated brand products, labor unions, and myriad forms of government intervention in the marketplace (such as minimum-wage laws).

The second aspect of the monetary approach to the balance of payments, the emphasis on international reserve flows, takes on an especially simplified form in the case of the idealized gold standard. The idealization leaves out reserves held in the form of foreign currency and thus treats gold as the only form of international reserve.²² Furthermore, it leaves out net domestic assets—purchases of domestic bonds by the central bank—and thus treats gold as the only component of the monetary base. Finally, it leaves out credit created by the commercial banking system, so that gold is treated as the only component of the money supply. This need not mean that gold literally circulates among the public; it is enough if the banking system always holds exactly the right amount of gold to back up one for one the domestic currency that it issues. (This is called “100 percent reserve backing,” as opposed to the modern system of “fractional-reserve backing,” under which the monetary base is only a fraction of the money supply in the hands of the public.) It follows that under this idealized version of the gold standard, the central bank could not sterilize international reserve flows even if it wanted to. The money supply necessarily varies one for one with the country’s holdings of gold, evaluated at the set price. This appendix will freely use the word *gold* interchangeably with reserves, or money.

In truth, domestic credit creation and fractional reserve backing began long before 1914. Central banks did not in fact always allow reserve outflows to translate fully into monetary contraction as they were supposed to under the *rules of the game*. It is probably true, however, that in the nineteenth century central banks made much less of a practice of sterilizing reserve flows so as to set monetary policy where they wanted it than they do today. It was only after World War I that central banks began to acquire responsibility for the deliberate setting of monetary policy to respond to problems such as unemployment. (One possible interpretation is that the motivation for them to do so stems from the greater degree of rigidity of wages and prices in the modern era.²³)

The Ups and Downs of the Gold Standard

When the world’s money was tied to gold, the world price level was determined by the world supply of gold, relative to world real income, precisely as in Equation 19.S.4 in the supplement. This relationship is the key both to arguments in favor of a gold standard and to arguments against it. The pro argument is that it prevents central banks from creating money at an excessive rate and thus generating sustained inflation. Excessive money creation and inflation have sometimes inspired proposals for a return to the gold standard, or some related form of commodity standard.

There are several con arguments. Tying the money supply to gold prevents central banks from responding to cyclical downturns with more expansionary monetary policy. (This is not considered a disadvantage by the gold-standard proponents; they would

²²This ignores the fact that under the gold standard, central banks held much of their reserves in the form of pounds sterling because they knew that the pound was convertible into gold.

²³See Robert Triffin, “Myths and Realities of the So-called Gold Standard”; and Donald McCloskey and J. Richard Zecher, “How the Gold Standard Worked, 1880–1913,” both reprinted in Eichengreen, *The Gold Standard in Theory and History*.

prefer that the government not have such discretionary power because they do not trust that it has the good faith and competence to use the power well.)

A second objection is that tying the money supply to gold also prevents the steady long-term growth in the world supply of money and reserves necessary to satisfy the transactions demand that comes with growing output and trade. If there is no increase in the supply of available gold, then money will get tighter and tighter, creating a drag on world growth. The absence of major discoveries of gold between 1873 and 1896 helps explain why price levels fell dramatically over this period (53 percent in the United States and 45 percent in the United Kingdom).²⁴ Conversely, the gold rushes in California in 1849 and in South Africa and Alaska in the late 1890s were each followed by upswings in the price level of similar magnitude. Clearly, the system did not in fact guarantee price stability. Opponents of the gold standard ask why one would want to make the world economy hostage to chance gold discoveries and the other arbitrary vicissitudes of supply and demand in the world gold market. They also question the efficiency of a system that requires the use of resources to dig gold out of the ground laboriously, only to bury it back in the ground at Fort Knox.²⁵

After World War I, it was considered very important to Britain to restore convertibility of the pound into gold. But at what exchange rate? This is the context in which the idea of purchasing power parity was first debated. A misplaced faith in the ability of wages and prices to adjust downward easily led the treasury minister, Winston Churchill, to peg the pound at too high a value, that is, to set too low a price for gold in terms of pounds. The result was a balance-of-payments deficit and severe contraction that ended in collapse of the system, rather than in smooth adjustment to the disequilibrium.²⁶

Officially, gold was also the reserve asset of the Bretton Woods system founded in 1944. World growth would have soon run into the constraint of a basically fixed supply of gold, were it not for the fact that the dollar immediately became the de facto reserve asset. Central banks held much of their reserves in the form of dollars because the dollar was convertible into gold, in the same way that central banks had earlier held much

²⁴The deflation of these years inflicted economic hardship, in particular, on American farmers, who had debts that were set in dollar terms but who produced commodities and owned land whose prices were falling in dollar terms. This was the era of Snidely Whiplash threatening to foreclose on poor Nell's farm and of the rise of populism in the American Midwest. The populists wanted the United States to abandon the gold standard so as to expand the money supply and get prices up. William Jennings Bryan, their candidate for president in 1896, warned that the farmers would not be "crucified on a cross of gold." Incidentally, the book *The Wizard of Oz* was really an allegory about populism. Oz stands for "ounces" (gold). Dorothy is the "innocent" from Kansas, the Scarecrow represents the farmer, the Tinman is the downtrodden urban worker (with whom the populists might have hoped to make a political alliance), and the Lion is William Jennings Bryan. Their enemies are the Wicked Witch of the East, representing the East Coast bankers (who were suspected of conspiring to keep money tight) and the Wicked Witch of the West, representing drought (only water can kill her).

²⁵A good introduction to the topic is provided by Richard Cooper, "The Gold Standard: Historical Facts and Future Prospects," *Brookings Papers on Economic Activity*, 1 (1982): 1–45. It includes the latter-day controversy over proposals to return to the gold standard to restore price stability, and the statistics on the price level swings that in fact characterized the nineteenth century.

²⁶John Maynard Keynes accurately predicted this outcome of the return to gold in 1925: "The Economic Consequences of Mr. Churchill," reprinted in his *Essays in Persuasion* (New York: Norton, 1963), pp. 244–270. Much has been written on this interwar period. See Barry Eichengreen, *Golden Fetters: The Gold Standard and the Great Depression, 1919–1939* (New York: Oxford University Press, 1992).

of their reserves in the form of pounds. This is why the Bretton Woods system was sometimes called a gold-exchange standard.

Before long, however, the new system came under increasing strain. The reason was that, beginning in 1958, the United States ran balance-of-payments deficits. Foreign central banks' holdings of dollars rose relative to the gold in Fort Knox, and foreigners (particularly Charles de Gaulle, the gold-conscious leader of France) began to doubt the ability of the U.S. government to redeem its dollar liabilities in gold. This was the beginning of the long, drawn-out breakdown of the Bretton Woods system.

The monetarist model can be used to illustrate the emergence of U.S. balance-of-payments deficits in 1958. Let the countries in the two-country model of the chapter supplement be the United States and Europe. In the 1950s the European economies grew more rapidly than the U.S. economy as they recovered from the devastation of the 1940s. Their rapidly growing levels of income led to rapidly growing demand for money. To acquire international reserves, they had to run balance-of-payments surpluses against the United States. The model was used in the 1960s to show why the emergence of U.S. deficits was a natural consequence of the system that had been set up in 1944.

The world monetary system was faced with the "Triffin dilemma."²⁷ If the United States was allowed to continue running balance-of-payments deficits, eventually there would be a crisis of confidence as foreigners all tried to cash in their dollars for gold before it was too late, and thereby exhausted the U.S. gold reserves. Conversely, if steps were taken to end the U.S. deficit, then the rest of the world would be deprived of sufficient liquidity in the form of a steadily growing stock of reserves.

Economists and policy makers debated the problem throughout the 1960s. There were two solutions proposed to increase the world supply of reserves, both of them radical departures from the system agreed on at Bretton Woods. The first was to increase the price of gold—that is, to devalue the dollar in terms of gold—thereby raising the nominal value of the world supply of reserves. The second was to create an artificial reserve asset, a sort of "paper gold."

Eventually, both changes were made, although it had not been planned that way. The artificial asset was the Special Drawing Right, which the members of the International Monetary Fund agreed to create in 1968. By the time three batches of SDRs were phased into use (1970–1972), other events had intervened. In August 1971, in response to the worsening U.S. balance of payments,²⁸ President Nixon unilaterally suspended convertibility of the dollar into gold, not just for private residents, but for foreign central banks as well. When the leading countries met at the Smithsonian Institution in December 1971 to agree on a new set of exchange rates, the realignments included a 10 percent devaluation of the dollar against gold. This attempt to shore up

²⁷Robert Triffin, *Gold and the Dollar Crisis* (New Haven: Yale University Press, 1960).

²⁸The year 1971 was the first time since World War II that the United States ran a deficit, not just on the private capital account, but on the trade account as well. The U.S. trade surplus had been diminishing steadily since 1964. The cause was overly expansionary macroeconomic policies, as the Johnson administration—followed by the Nixon administration—increased military spending on the war in Vietnam and domestic spending at the same time, and were reluctant to raise taxes to pay for it. Some have pointed out parallels between that period and U.S. macro policy from 2001 to 2005.

the system of fixed exchange rates did not last long, and in March 1973 the system was abandoned completely. The market price of gold increased twentyfold (in dollars) over the remainder of the decade.

APPENDIX B

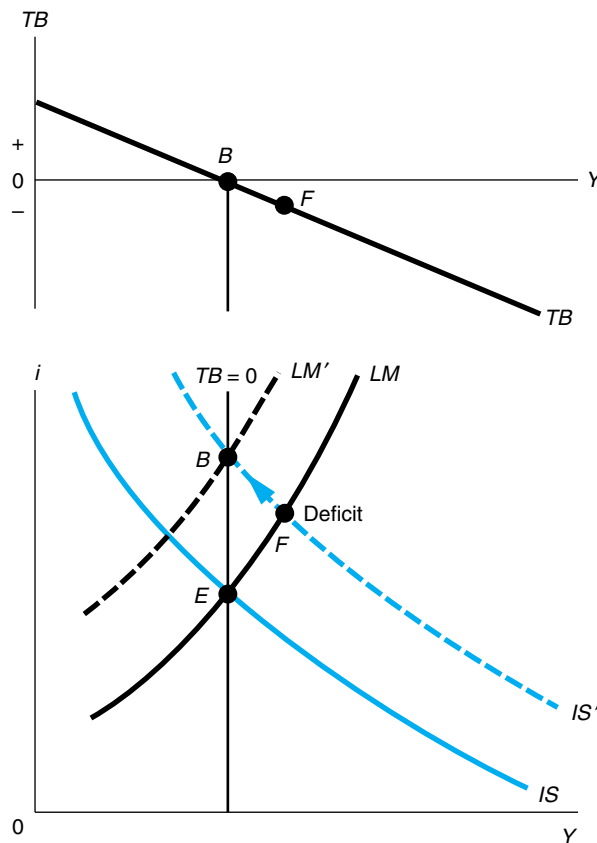
Reserve Flows After Spending Increase and Devaluation

Section 19.1 looked at the implications of reserve flow by focusing on the effects of a monetary expansion. Now consider the effects of a fiscal expansion in the same model (Mundell's "income reserve-flow mechanism"). Figure 19.B.1 is a reproduction of Figure 18.8. The fiscal expansion shifts out the IS curve, raising income. The higher income at point F causes a trade deficit. The deficit means that reserves are declining over time.

FIGURE 19.B.1

Effects of a Fiscal Expansion over Time

In the short run an increase in spending raises output and worsens the trade balance. If the loss of reserves is not sterilized, then the money supply falls over time and output returns to its original level at B .



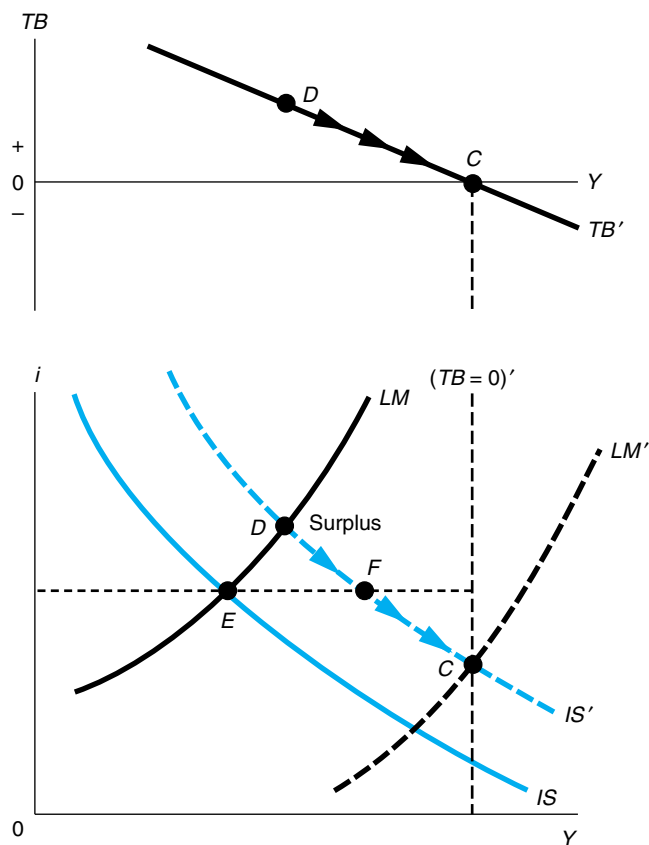
As in the case of a monetary expansion, the central bank could sterilize the reserve outflow to keep the money supply constant and remain at F . Under the assumption of nonsterilization, however, the money supply falls over time. The LM curve shifts back, income falls, and the trade balance improves. Eventually, income and the trade balance return to B , where they were before expansion. There is one difference between the new equilibrium at B and the old equilibrium at E . The interest rate is higher, meaning that a reallocation of output between sectors has taken place: The government sector has expanded at the expense of private investment. We thus have another result under the monetary approach: A fiscal expansion, although raising income and worsening the trade balance in the short run, has no effect on either in the long run.

Finally, consider the effects of a devaluation. Figure 19.B.2 is a reproduction of Figure 18.9. The devaluation shifts out the IS curve. At point D income has increased. The devaluation shifts the vertical $TB = 0$ line farther out than the IS curve, so the trade balance improves at point D . As a consequence of the trade surplus, reserves are increasing over time. The central bank could sterilize the reserve inflow to keep the

FIGURE 19.B.2

Effect of a Devaluation over Time

In the short run a devaluation improves the trade balance and raises output. If the inflow of reserves is not sterilized, then the money supply rises over time and output rises further to C .



money supply constant and remain at point D , but under the assumption of nonsterilization the money supply rises over time and the LM curve shifts out. Income rises and the trade balance worsens. Eventually, the trade balance returns to zero, at point C . In this case, however, income ends up at a permanently higher level. The TB line in the upper panel of Figure 19.B.2 shows the magnitude of the long-run increase in income. The line's slope is $-m$, so

$$\Delta Y_{LR} = \frac{1}{m} \Delta \bar{X}.$$

Intuitively, we can see that money keeps flowing in through the trade surplus until income has risen enough for increased imports, ΔM , to cancel out the initial stimulus of the devaluation, $\Delta \bar{X}$. This returns the trade balance to where it was before the expansion.²⁹ It is interesting to compare the effect of the devaluation to what it would be in the simpler Keynesian multiplier model (at point F), that is, in the absence of crowding-out:

$$\frac{1}{s + m} \Delta \bar{X}.$$

The former is larger. Under the monetary approach to the balance of payments, the long-run effect is not only greater than the short-run effect, but it is even greater than the short-run effect without crowding-out. The conclusion that a devaluation is an effective means of raising income even in the long run is a very “unmonetarist” conclusion; it stems from the Keynesian assumption that prices are fixed. This assumption is not realistic for the truly long run and is relaxed in Section 19.4.

APPENDIX C

The Determination of the Balance of Payments in the Monetarist Model

This chapter considers only pegged exchange rates. This is probably just as well because most very small, very open economies (such as Hong Kong) do in fact seek to maintain a fixed exchange rate. The monetary approach under floating rates will be taken up in Chapter 27. The goal here is to analyze the effect of monetary policy and devaluation on the two target variables, income and the trade balance. Furthermore, this section considers the small-country version of the monetarist model, which means that the world price level is taken as exogenous.³⁰ Because both the exchange rate and

²⁹The way Figure 19.B.2 is drawn, the long-run interest rate is lower, and therefore I is higher, after the devaluation than before. We know that this must be right. Otherwise, with $X - M$ unchanged, $Y = C + I + G + X - M$ could not be higher after the devaluation.

³⁰The supplement to this chapter relaxes the small-country assumption to look at the two-country version of the monetary approach to the balance of payments, which is relevant when the country is large enough to affect the world price level. (As long as world prices are perfectly flexible and PPP holds, it continues to be a “monetarist” or “new classical” model, as opposed to the Keynesian model previously examined.)

the foreign price level are determined, by Equation 19.2 the domestic price level is also determined. This method of determining the domestic price level is very different from the Keynesian way in which it was exogenously set. The difference becomes obvious when we consider devaluation as in Section 19.4. PPP states that the devaluation is instantly reflected as a proportionate increase in the domestic price level, whereas in the Keynesian model the domestic price level did not change.

Desired money balances are proportional to nominal income.³¹

$$M^d = KPY \quad (19.C.1)$$

Individuals adapt actual money balances to desired money balances through saving (in excess of investment), represented by H . This part of the book ignores assets other than money, such as bonds. (They will enter in Part V.) For this reason, saving can only take the form of additions to holdings of money balances. H is thus equal to the change in the money stock over time: It tells us how much the money supply is going up per year. H is assumed proportional to the current gap between the desired money stock and the actual money stock, M :

$$H = \delta(M^d - M)$$

where δ is the speed with which money balances are adjusted. This equation simply says that individuals act to add to their money balances when money demand minus money supply is positive. Now we use Equation 19.C.1 to substitute for long-run desired money balances, M^d .

$$H = \delta(KPY - M) \quad (19.C.2)$$

Under the key nonsterilization assumption of the monetary approach, the rate of change of the money supply, M , is the same as the rate of accumulation of reserves, the balance-of-payments surplus, BP . The equation becomes

$$BP = H = \delta KPY - \delta M \quad (19.C.3)$$

Equation 19.C.3 looks unlike any balance-of-payments expression seen before. An increase in the money supply has a negative effect on the surplus, as in the last chapter. Although the Keynesian model was quite specific about the channel through which the increase in the money supply raises spending (it lowers the interest rate and thus stimulates investment), the monetarist explanation is more general. A monetary expansion worsens the balance of payments because individuals, when faced with an excess supply of money, increase spending to adjust their excessive money holdings back down to the level of their money demand. (These two explanations can be made entirely consistent if investment depends linearly on the interest rate.³²)

Another difference between the two models is that the monetary approach says the outflow occurs through the overall balance of payments, without differentiating

³¹ M here represents the money stock, not imports as in previous chapters. Desired money balances, M^d , refers to a long-run notion of money demand; it differs somewhat from the short-run notion of money demand in $IS - LM$, where the interest rate adjusts so that money demand is always equal to money supply, even in the short run.

³²The reduced form of the linear $IS - LM$ system (i.e., with the interest rate substituted out) is the same as the monetarist formulation. This is chapter Problem 5b.

between the current account or capital account, whereas the Keynesian approach specifies that it occurs through the trade balance. However, because we have not yet introduced capital flows, it is difficult to tell the difference.

These differences are not especially important. The crucial difference between the monetarist and Keynesian models, remember, is price flexibility.

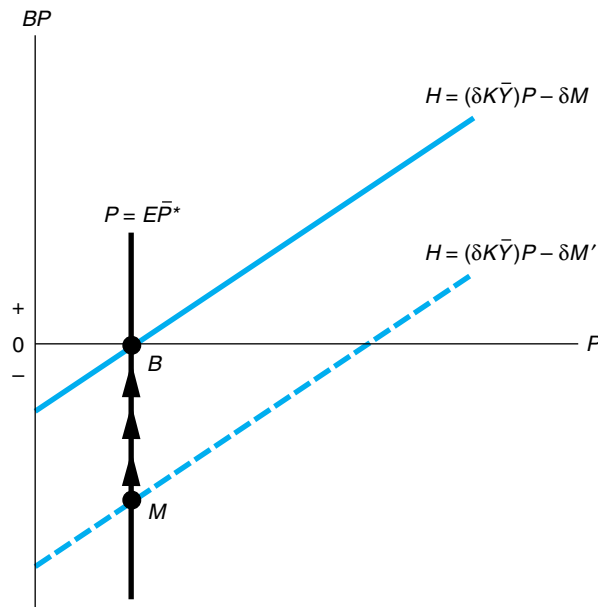
The assumption of perfect wage and price flexibility in the global monetarist model implies completely inelastic aggregate supply. Because income is always at the full-employment level, $Y = \bar{Y}$, the balance of payments in Equation 19.C.3 varies only with the price level, P , and the money supply, M . Figure 19.C.1 graphs the relationship between the balance of payments and the price level for a given M , with the balance of payments measured on the vertical axis, and refers to it as the H schedule.³³ As the equation says, the vertical intercept is $-\delta M$ and the slope is $\delta K \bar{Y}$. Again, the reason the schedule slopes upward is that a higher price level means a higher demand for money, which causes residents to cut back on spending so they can earn the desired money balances through a balance-of-payments surplus.

The exogenous foreign price level, P^* , and the given fixed exchange rate, E , together determine the domestic price level, $P = E\bar{P}^*$, by Equation 19.2. This price level, P , is represented in Figure 19.C.1 by a vertical line. Point B in the figure is the starting point, a position of balance-of-payments equilibrium. Two policy changes will be considered: monetary policy and devaluation.

FIGURE 19.C.1

Monetary Expansion in the Monetarist Small-Country Model

An increase in the money supply shifts the H schedule. With the price level, P , tied down by PPP, this leads to an excess supply of money and a balance of payments deficit ($BP < 0$ at M). Over time, money flows out of the country and balance is restored ($BP = 0$ at B).



³³The symbol H stands for “hoarding,” defined as the accumulation of money through saving.

The Effect of a Monetary Expansion in the Monetarist Model

A monetary expansion shifts the H schedule down. The size of the downward shift is determined by the size of the change in the vertical intercept ($\delta\Delta M$). The economy moves to point M . Any given P implies a certain level of money demand. At the level implied by the exogenously given $P = E\bar{P}^*$, an excess supply of money is now evident because money supply is greater than money demand. (Any point below the horizontal axis is a point of excess money supply.) People will increase spending or decrease saving. In fact *dissaving*, a balance-of-payments deficit, can be read off the vertical axis at point M .

Recall again the essence of the monetary approach—the identification of the balance-of-payments deficit with the rate of decumulation of the money supply. The H schedule shifts whenever the money supply changes. As time passes and money flows out through the balance-of-payments deficit, the H schedule shifts upward. The intersection with the price level line gradually moves upward from M . As the excess supply of money is worked off, the deficit falls, as can be read off the vertical axis. This process continues until (in the long run) the economy returns to point B , where money supply again equals money demand and there is no further need for dissaving: The balance of payments has returned to zero. Only then, when the reserve stock is no longer changing, has it reached long-run equilibrium.

Conversely, a monetary contraction initially shifts the H schedule upward, improving the balance of payments. However, the payments surplus itself leads to an increasing money supply, which over time shifts the H schedule back down until, again, in the long run it returns to balance-of-payments equilibrium.

In the case of either expansion or contraction, there is no long-run effect on the level of the money supply, but there may be an effect on its composition. Expansion or contraction of domestic credit is permanent. It is the foreign component of the monetary base—international reserves—that changes to offset the change in domestic credit.

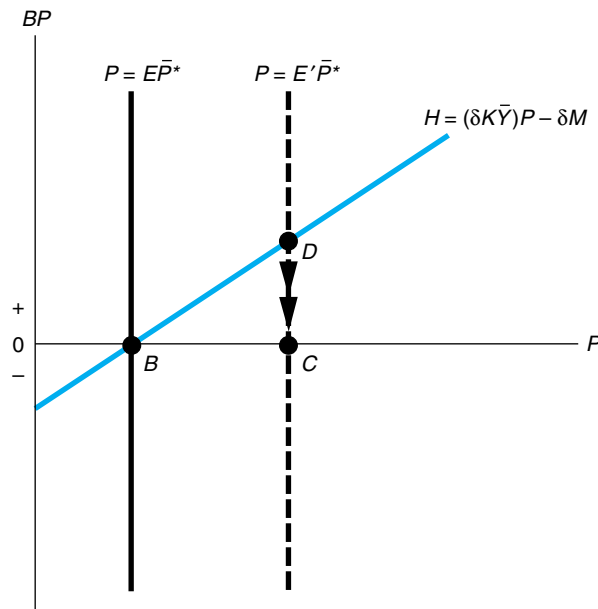
The “Real Balance” Effect of a Devaluation

Now consider the effect of a devaluation. An increase in the exchange rate from E to E' means that the exogenous world price level, \bar{P}^* , translates into a higher domestic price level, $E'\bar{P}^*$, represented by a vertical domestic price line that is farther to the right in Figure 19.C.2. The higher value of P implies a higher level of domestic money demand. With an unchanged level of money supply, there is an excess demand for money at point D . (Any point above the horizontal axis is a point of excess money demand.) People reduce their spending or increase their saving. A balance-of-payments surplus results. That devaluation leads to a surplus is a common observation, but in this case the cause is not a change in relative prices stimulating exports. There can be no change in relative prices in this model. Rather, the higher price level raises the demand for nominal money balances. This is the *real balance* effect.

The balance-of-payments surplus at D means that the money supply is increasing. Over time, the H schedule shifts down, as the excess demand for money is alleviated by the increasing supply. In the long run it moves to point C , where money supply again

FIGURE 19.C.2**Devaluation in the Monetarist Small-Country Model**

An increase in the exchange rate from E to E' raises the price level, P , proportionately, leading to an excess demand for money and a balance of payments surplus ($BP > 0$ at D). Over time, money flows into the country and balance is restored ($BP = 0$ at C).



equals money demand and the balance of payments is back at zero. The new equilibrium after the devaluation features not only a higher price level but a higher money supply, with both nominal variables having increased in the same proportion as the exchange rate.

Let us now consider an exogenous increase in the world price level, \bar{P}^* , as might result, for example, from an expansion in the world money supply. It is instantly transmitted as a proportionately higher domestic price level, $P = E\bar{P}^*$. It acts just like the devaluation pictured in Figure 19.C.2 so far as the small country is concerned. The excess demand for money shows up as a temporary balance-of-payments surplus. Notice again that the favorable effect of the foreign price increase on the balance of payments does not take place through *relative* prices, as in the elasticities or Keynesian approaches, but rather through the effect of the *price level* on money demand.

Finally, consider an exogenous increase in domestic money demand. Such an increase in money demand might result, for example, from an exogenous increase in domestic output, \bar{Y} . Because this section assumes full employment, the increase in output must come from the supply side: an increase in the capital stock, labor force, or productivity. In any case, the increase in money demand causes people to cut back spending so that they can acquire the desired money balances. It acts like the decrease in money supply previously considered, in that it creates an excess demand for money and shifts the H schedule up. (More precisely, if the increase in M^d comes from an increase in \bar{Y} , then it rotates the H schedule in the counterclockwise direction: Refer to the slope, $\delta K\bar{Y}$. The point remains: A higher BP now corresponds to a given P .) The cutback in spending thus leads to a balance-of-payments surplus. Over time money

flows in through the payments surplus, until equilibrium returns with a higher money supply and a zero balance of payments, as always.

Notice the sharp contrast to the Keynesian model, in which an increase in income caused an immediate trade deficit, rather than a surplus. The Keynesian model should be thought of as correct for income growth induced by increases in spending because it is a model in which the economy can be below full employment. The present result—growth causing a payments *surplus* because of higher money demand—is appropriate for exogenous supply-induced growth. A prime motivation for the development of the monetary approach in the 1960s was the observed fact that the fastest growing countries, such as Japan, Germany, and other European countries, ran balance-of-payments surpluses while the United States ran a deficit. That the monetary approach could explain this situation accounted in part for its popularity.³⁴

³⁴The argument was made by Robert Mundell, “Growth and the Balance of Payments,” in his *International Economics* (New York: Macmillan, 1968), Chapter 9. For examples from the current era (in which Japan and euroland have floating rather than fixed exchange rates and are growing more slowly than before), consider the cases of China and some other newly industrialized economies of East Asia. They have tended to experience rapid supply-side growth with surpluses in their balances of payments.

