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What Are Equilibrium Real Exchange Rates?

This chapter does not provide a definitive or comprehensive definition of FEERs. Many discussions of the concept already exist (e.g., Williamson 1983, 1985, 1994; Wren-Lewis 1992; Clark et al. 1994). As the FEER concept is fairly generic, many different macroeconomic theories or open economy models will generate solutions for the equilibrium exchange rate. However, FEERs have two defining characteristics, which this chapter describes.

First, FEERs are a medium-term construct. The concept of medium-term equilibrium is important to understanding the FEER and its associated current account target, but it is often misunderstood. In addition, because the FEER is a medium-term equilibrium, it is vulnerable to the general criticism that the equilibrium cannot be studied independently of the path toward it. Therefore, this chapter ends with a short discussion of hysteresis.

The second defining characteristic of most work on FEERs is the assumption that aggregate trade flows depend on the real exchange rate through competitiveness effects. This is where FEERs differ from PPP, the other main concept of equilibrium exchange rates. If changes in the real exchange rate are to have a finite influence on aggregate trade, then the equilibrium exchange rate becomes a variable that can potentially be influenced by the equilibrium value of any other macroeconomic quantity. We illustrate this point in the section on PPP by outlining a small, general macroeconomic model that generates FEERs.

The Medium Term

John Williamson first coined the term fundamental equilibrium exchange rate in the mid-1980s (see Williamson 1983, 1985; Bergsten and Williamson 1982). Since then, the concept has been used, and possibly abused, in many academic and nonacademic publications. Occasionally, a similar concept has been employed under a slightly different name (e.g., the desired equilibrium exchange rate [DEER] in Artis and Taylor 1995 and Bayoumi et al. 1994).

Perhaps the most important point to make about the FEER is that the word equilibrium is not defined in the way an economist would normally define it. Normally, an economist would say that a macroeconomic relative price such as the exchange rate is in equilibrium when it shows no tendency to change. If this variable is influenced by the complete macroeconomic system, then it will only be in equilibrium when the complete macroeconomic system is in a state of rest or constant growth.

The FEER, however, applies to an economy that need not be in equilibrium in one specific sense: assets can still be accumulated or decumulated. In other words, the economy is not in stock equilibrium, but it is in flow equilibrium. Aggregate stocks wealth in relation to GDP, and their allocation among different foreign and domestic assets, may be changing. Therefore, the FEER will be associated with a medium-term current account (sometimes referred to as a target current account) that need not be zero.

While the FEER is consistent with the adjustment of asset stocks, it is not consistent with Keynesian disequilibrium. The FEER applies to an economy that has achieved internal balance or constant inflation and where there is no Keynesian disequilibrium. That is, the FEER is an exchange rate associated with the natural rate of unemployment.

The nature of medium-term equilibrium can be described as follows. If there is internal balance, domestic demand for goods equals domestic supply. In aggregate, there is no stock building and no tendency for inflation to change. Nevertheless, output may still differ from total domestic demand, either because the private sector is saving more or less than it is investing or because the government is spending more or less than its income. Thus, asset stocks will be changing.

Why does the FEER attempt to abstract from Keynesian disequilibrium and not asset disequilibrium? The time horizon is the important issue. Most advocates of the Keynesian assumption that nominal inertia is a key fact behind the business cycle believe that, in the absence of shocks, such disequilibrium would largely disappear within 5 to 10 years. The precise timing would depend on many factors, including the source of nominal inertia and the way expectations are formed, but economists normally de-

scribe such disequilibrium and the dynamic processes involved as short term.[1]

FEER analysis abstracts from these Keynesian dynamics by employing a familiar neutrality assumption. In the medium term, the real economy is independent of nominal magnitudes. Therefore, the FEER is a real exchange rate, and it is consistent with a range of nominal exchange rate and price combinations. In the medium term, monetary policy simply determines the price level, and it has no bearing on either the real economy or the FEER. In addition, a weak form of rational expectations suggests that expectations errors will not persist for more than a few years; therefore, the influence of these errors can be ignored in the medium term.

The dynamics associated with asset accumulation, however, do not appear to be short term. There may be many reasons for this. Firms are likely to face high adjustment costs for fixed capital. Intertemporal consumption optimization models emphasize the desire to smooth consumption paths over a lifetime. For the individual, any shock to wealth will dissipate gradually. Adjustment periods are likely to involve many decades rather than 5 to 10 years. (Most dynamic macroeconomic models have this property. See, for example, the simulations presented in chapter 2.)

Basic evidence that supports the proposition that assets do not reach equilibriums in the short term is shown in figures 1.1–1.6. These figures plot net external assets as a percentage of GDP for six of the Group of Seven countries (G7). They reveal no evidence of a tendency for net external assets to reach equilibriums within a 10-year period. (Italy's net external assets are not presented because only six data points are available.)

The FEER is not designed to forecast short-term exchange rates, and, as such, it is useful to abstract from short-term issues such as Keynesian dynamics and expectations errors. Macroeconomists often refer to the medium term as an equilibrium in which asset stocks are changing but other short-term disequilibriums have disappeared. The FEER belongs to this time domain.

The discussion so far has not mentioned external balance, although the FEER is generally defined as being consistent with both internal and external balance. While the meaning of internal balance is reasonably precise, the meaning of external balance is less so, and it could incorrectly be interpreted as an asset equilibrium. Definitions of external balance based on a sustainable current account are equally problematic. However, we argue in chapter 2 that the use of external balance to pin down the FEER is unnecessary. The use of internal balance allows us to abstract from short-term disequilibriums and places the analysis firmly in the medium term.

1. For example, see evidence for the United Kingdom presented in Joyce and Wren-Lewis (1991). Short-term fluctuations that can lead to permanent effects are an important exception. We refer to such hysteresis effects later in this chapter.

Figure 1.1 US net external assets, 1980–94

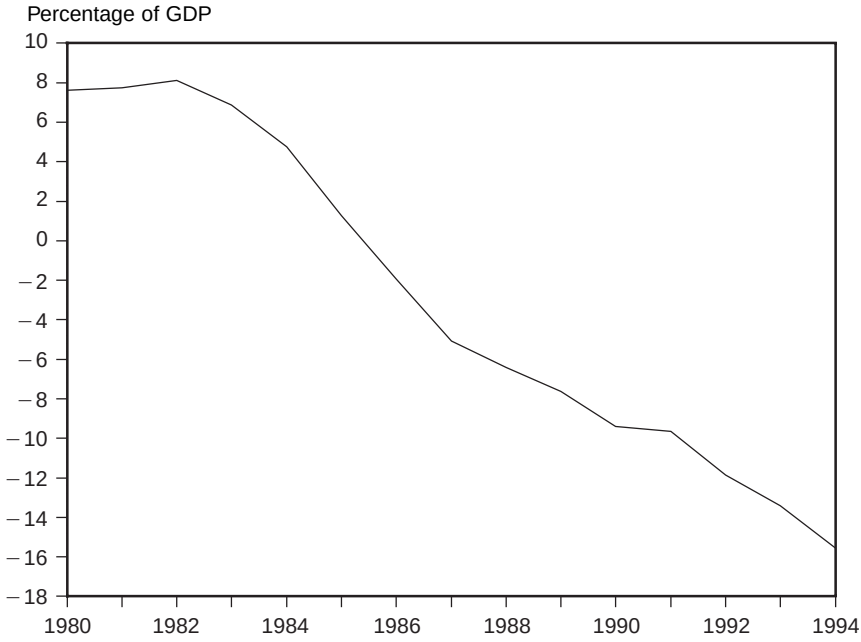

Figure 1.2 German net external assets, 1980–93

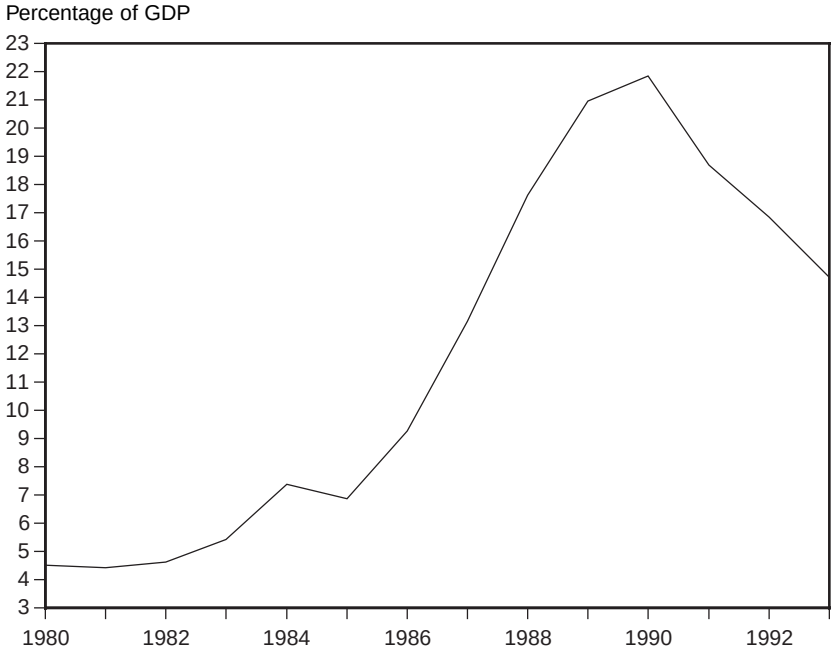

Figure 1.3 Japanese net external assets, 1983–94

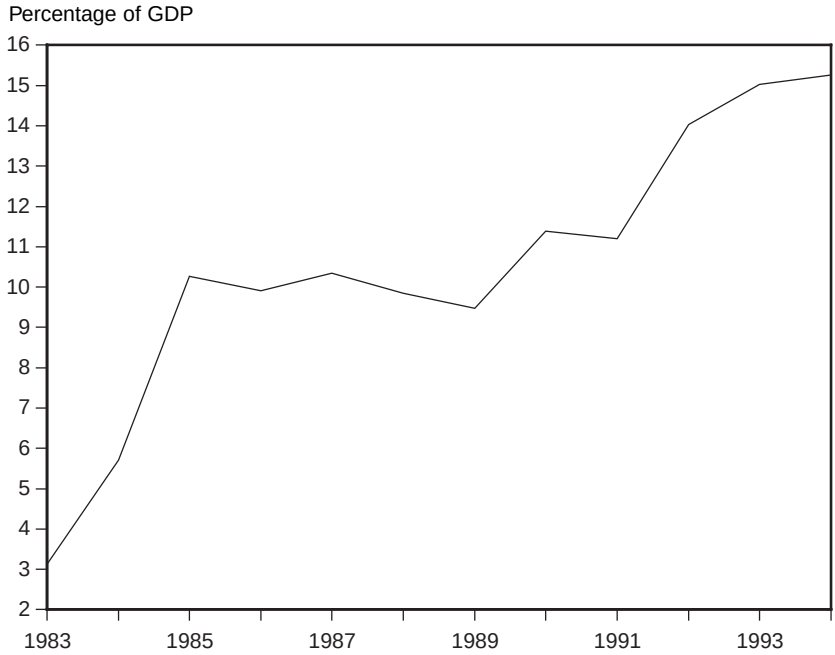

Figure 1.4 UK net external assets, 1973–94

Figure 1.5 French net external assets, 1980–95

Figure 1.6 Canadian net external assets, 1980–94

The idea that the real exchange rate tends toward some level is widely believed. When exchange rates are described as overvalued or undervalued, these real exchange rates are expected to depreciate or appreciate. The FEER, therefore, attempts to formalize and quantify such misalignments.

Purchasing Power Parity

The main competitor to the FEER is PPP. We will not provide a comprehensive survey of PPP (for more extensive discussions of PPP, see Breuer 1994; Froot and Rogoff 1995; MacDonald 1995). Instead, we compare PPP with FEERs.

PPP sometimes refers to the proposition that, other things being equal, inflation differentials between countries will eventually be reflected in equivalent changes in the nominal exchange rate between these countries. This basic neutrality proposition is quite consistent with the FEER approach. Indeed, the FEER would make little sense without it. In this limited sense, there is no contradiction between PPP and the FEER.

A stronger form of PPP asserts that, over some period, only inflation differentials influence the nominal exchange rate.[2] In other words, averaged over some period, the real exchange rate will be constant. Few would apply this argument to the short term, because the data show the opposite. When applied to the medium term, however, it is inconsistent with the FEER.

A simple medium-term open-economy model demonstrates this inconsistency. The model will also be helpful in later chapters. The first equation relates the supply of output to the demand for domestic output, where demand comes from various sources:

$$Y(K(i),N) = C(\bullet) + I(i,K) + G + X(YW,e) - M(Y,e). \tag{1.1}$$

Y is aggregate real output, which is a function of the capital stock, K, and employment, N. Capital is fully utilized, and its quantity depends on real interest rates, i. Employment may be less than the supply of labor because of labor market imperfections (i.e., there is involuntary unemployment in equilibrium). Thus, we define N as the level of employment that is consistent with the natural rate of unemployment. Demand for domestic output comes from consumption, C, investment, I, government spending, G, and exports, X—but some of the first three components of demand are met by imports, M. The determination of aggregate consumption is open,

2. The strongest form of PPP, absolute PPP, compares average prices in each country to derive an estimate of the equilibrium exchange rate. The validity of absolute PPP clearly depends on the extent of arbitrage, which we discuss later in this chapter.

but exports and imports depend on the real exchange rate, e (measured as domestic currency per unit of foreign), as well as the appropriate measure of total demand. In the case of exports, this is world output, YW. The functions $X(\bullet)$ and $M(\bullet)$ encapsulate export and import pricing behavior and the determination of trade volumes. Output includes the replacement of depreciated capital, so that investment is equal to the change in the capital stock.

The government's budget constraint is

$$G - T + iB = \Delta B, \tag{1.2}$$

where T is total taxes and B is government debt. We ignore high powered money for simplicity. The private sector's budget constraint is

$$Y - T - iK - C + i(K + B - D) + \left(i_w + \frac{\Delta e}{e}\right)Ae = \Delta(Ae - D + K + B). \tag{1.3}$$

The private sector holds three types of assets: government debt, capital, and foreign assets, A. It also issues debt to foreign residents, D. After-tax wage income less consumption plus the net return on assets is therefore equal to net saving. As foreign assets are defined in foreign currency, a change in the domestic currency value of A (i.e., Ae) can occur either through saving or through revaluations. World real interest rates are denoted by i_w.

The final equation is the uncovered interest parity (UIP) condition,

$$\frac{E(e_{+1}) - e}{e} - i + i_w = 0, \tag{1.4}$$

which states that the expected net return on foreign assets (allowing for revaluations) equals the domestic real interest rate, where $E(e_{+1})$ is the expected real exchange rate for period $t + 1$.

This model is consistent with the definition of the FEER discussed above, because it includes the dynamics of asset accumulation while abstracting from Keynesian issues. Output is given by a production function that fully utilizes capital (any spare capacity is at its long-term optimal level), and unemployment is at its natural rate. The model is specified entirely in real terms.

The model is deliberately general, to emphasize that the FEER is a generic concept applicable to a wide range of models. For example, the consumption function could be Keynesian, or it could be based on intertemporal optimization by consumers. The behavioral equations that are specified could also be augmented in various ways. For example, output supply could become a function of the real exchange rate (see chapter 3). However, FEER analysis needs one important ingredient to work: the net

trade balance must be a well defined function of the real exchange rate. The model applies most directly to a country that mostly trades in differentiated manufactured goods produced under imperfect competition, so that a change in the real exchange rate leads to a finite change in the demand firms face.

The model includes nine endogenous variables (Y, e, A, i, X, M, C, K, and one of G, T, or B) and six exogenous variables (YW, i_w, D, N, and two of G, T, or B). In this model, a permanent change in an exogenous variable or permanent shock to one of the behavioral equations will influence the solution for the real exchange rate (the FEER) in some way. For example, a permanent increase in domestic supply relative to foreign output (due, for example, to a local sustained productivity shock or population increase), would lead to increases in the demand for and supply of domestic output that would not in general be equal. Therefore, a change in the real exchange rate would be required to ensure that equation 1.1 held. (This particular shock is discussed in detail in chapter 3.)

Equation 1.1 illustrates how the real exchange rate can equate the supply and demand for domestic output. However, it is also true that the real exchange rate moves to achieve the current account consistent with domestic saving and investment. To see this, rearrange the equations above to derive the balance of payments identity:

$$X - M - iD + \left(i_w + \frac{\Delta e}{e}\right)Ae = \Delta(Ae - D). \tag{1.5}$$

Within the model, the impact of a permanent shock on the real exchange rate will change over time even if the shock is constant, because in general private-sector net savings or government debt will change. (We give an example using an estimated model in chapter 2.) The only way that permanent shocks could be (approximately) consistent with a constant and unchanged real exchange rate (and, hence, PPP in that form) is if the model's parameters always implied that shocks had a small influence on the exchange rate. This could only be true if the trade balance were extremely sensitive to movements in the real exchange rate. If this were the case, then in the example above only a very small change in the real exchange rate would be required to equate demand to the new level of supply. This is the only way that PPP could be consistent with the general model that we present. Unfortunately for PPP, the evidence of econometric trade equations is that the trade balance is not highly sensitive to movements in the real exchange rate, because competitiveness elasticities (the sensitivity of trade flows to relative prices) are low (a finding confirmed in chapter 4).

Arbitrage is the theoretical rationale behind PPP. The simple idea is that if similar goods are priced differently in different countries, then demand for the cheaper good will increase and prices will equalize. Deviations of the real exchange rate from PPP will lead to changes in supply and de-

mand that will move the real exchange rate back to PPP. However, the evidence from econometric trade equations that competitiveness elasticities are low suggests that there are important limitations to arbitrage in goods.

One limitation comes from the nature of trade among countries of the Organization for Economic Cooperation and Development (OECD), which tends to be in differentiated manufactured goods. The characteristics of a car produced in one OECD country may differ in important respects from a car produced in another OECD country, so significant price differences between the two can exist without demand for the more expensive car going to zero.

Another critical limitation to arbitrage in goods is transport costs. Transport costs prevent many goods and services from being traded at all. If we measure the real exchange rate using a price index that covers all goods in the economy, then a key component of that index is excluded from the forces of arbitrage. In particular, nontraded goods are often services with a high labor content, and productivity improvements for services are relatively slow compared to those in traded manufactures. As Balassa (1964) first pointed out, the real exchange rate in fast-growing countries, where the productivity differential between traded and nontraded goods is relatively large, will tend to appreciate.

While differentiated products and transport costs imply strong limitations to arbitrage in goods, those limitations apply with less force to arbitrage in capital. While cheaper labor costs in, for example, the United Kingdom relative to Japan may make cars produced in the United Kingdom more attractive to consumers in Japan, other factors may make Japanese produced cars more desirable (e.g., reliability). However, if labor costs in the United Kingdom are likely to remain lower than in Japan for many years, Japanese companies might shift production to the United Kingdom from Japan. There will be a movement in production from the overvalued to the undervalued economy, not because of consumer arbitrage, but because of a relocation of production. In chapter 3, we discuss the extent to which such processes might move the exchange rate toward PPP. We conclude that, although such a mechanism may exist, it is likely to be long term rather than medium term in duration and, hence, unlikely to rejuvenate PPP as a medium-term tool.

The data for G7 real exchange rates also suggest that PPP is not a very useful concept over the medium term (see figures 5.1–5.7 in chapter 5). In statistical terms, a test for PPP would be that these real exchange rate series are stationary, I(0) (integrated of order 0) series, implying that they revert to some constant mean, PPP. Econometric studies of the real exchange rate typically confirm the visual impression from the data—that real exchange rate series are not I(0).

More recent studies that use cointegration techniques have suggested that nominal exchange rates may be cointegrated with domestic and foreign price indices, leaving an I(0) residual. This would not be consistent

with the model outlined above, unless the processes for all the exogenous variables in the model are mean reverting or trend stationary. However, the estimated coefficients on prices in these cointegrating vectors are often not unity. One interpretation of these results is that published price series are poor measures of true prices. Thus, allowing nonunity coefficients allows the regressions to reveal true PPP. However, as Breuer (1994) points out, it is difficult to interpret these results as supporting PPP, particularly if the coefficients on the price series in the cointegrating vector are noticeably different from unity. They imply, of course, an absence of measured long-term neutrality. Breuer also notes two other factors associated with many of the studies that find evidence of PPP: substantial variation in prices (e.g., in hyperinflations) and long runs of data. The first factor could reflect the difficulty in distinguishing between an I(0) and I(1) process when nonstationarity in the real exchange rate is dominated by nonstationarity in prices. The second provides support for long-term, as opposed to medium-term, PPP—a theoretical possibility that we note in chapter 3.

Therefore, the evidence supports the proposition that PPP in its strong form is not a useful concept for the medium term. It is not a realistic alternative to calculating the FEER. Many economists now accept this proposition, but PPP estimates still play a powerful role in policy discussions.[3] Therefore, we make no apology for reiterating the deficiencies of PPP estimates here. This conclusion is of critical policy importance, because the two estimates can differ significantly. In particular, for some countries (e.g., the United Kingdom and United States) estimates of the FEER appear to be persistently undervalued (i.e., imply a depreciation) compared to PPP calculations. While there are strong theoretical arguments for preferring the FEER concept, it is fair to say that far more empirical testing of time series for FEER estimates is required.

Hysteresis

The model we set out above abstracts from all dynamic behavior except asset accumulation. It is a condensed version of a more complex macroeconomic model, which abstracts from other dynamic processes. If we are only interested in a time frame under which, in the absence of shocks, these dynamics will have worked themselves out, then this abstraction is valid under one key assumption: the medium-term equilibrium is independent of the short-term dynamic path that the economy takes to get to it.

3. For example, PPP estimates played an important role when the United Kingdom entered the European Exchange Rate Mechanism (ERM) of the European Monetary System (EMS), and the pound's entry rate was much closer to PPP estimates than FEER calculations.

When this assumption does not hold, hysteresis or pure hysteresis is said to occur.[4] The assumption that macroeconomic systems do not suffer from hysteresis is conventional. However, some influential models of hysteresis behavior have been put forward, and what is conventional in macroeconomic theory is not necessarily true in the real world.

Two points need to be made about hysteresis and the FEER. First, the assumption of no quantitatively important hysteresis is critical. If hysteresis is important, then we would need to know about the short-term dynamics before looking at the medium term. How we achieve internal balance would influence the nature of that balance. For example, we could not calculate trend output without knowing how that trend level would be achieved, that is, the dynamic path toward equilibrium.

Second, because the FEER is a medium-term equilibrium, it is arguably more vulnerable to hysteresis effects than a conventional long-term equilibrium would be. As the model we set out shows, the solution for the real exchange rate at any particular point in time is conditional on the stock of assets. Those stocks may not be independent of the transition path to internal balance.

To see why, consider first the long-term equilibrium position, which combines the level of output consistent with internal balance with some long-term vector of asset stocks. Suppose this long term is conventional, that is, without hysteresis. There will be an infinite number of transition paths toward this long term, each associated with a different starting point for asset stocks and, therefore, different levels of asset accumulation. The level of asset stocks associated with internal balance is critical in setting the level of asset accumulation in the medium term, and, therefore, in defining the FEER. The level of asset stocks in the medium term will depend mainly on the current level, but it may also depend on the transition path to internal balance, giving rise to medium-term hysteresis. This point is discussed at length in the section in chapter 3 that deals with debt interest.

4. Briefly, hysteresis is the notion that an equilibrium may not be independent of the dynamic adjustment paths toward it. For a thorough discussion of the term as used in economics and other disciplines, see Cross (1993).