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International Investors, the U.S. Current Account, and the Dollar

TWO MAIN FORCES underlie the large U.S. current account deficits of the past decade. The first is an increase in U.S. demand for foreign goods, partly due to relatively faster U.S. growth and partly to shifts in demand away from U.S. goods toward foreign goods. The second is an increase in foreign demand for U.S. assets, starting with high foreign private demand for U.S. equities in the second half of the 1990s, and later shifting to foreign private and then central bank demand for U.S. bonds in the 2000s. Both forces have contributed to steadily increasing current account deficits since the mid-1990s, accompanied by a real dollar appreciation until late 2001 and a real depreciation since. The depreciation accelerated in late 2004, raising the issues of whether and how much more is to come and, if so, against which currencies: the euro, the yen, or the Chinese renminbi.

We address these issues by developing a simple model of exchange rate and current account determination, which we then use to interpret the recent behavior of the U.S. current account and the dollar and explore what might happen in alternative future scenarios. The model's central assumption is that there is imperfect substitutability not only between

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U.S. and foreign goods, but also between U.S. and foreign assets. This allows us to discuss the effects not only of shifts in the relative demand for goods, but also of shifts in the relative demand for assets. We show that increases in U.S. demand for foreign goods lead to an initial real dollar depreciation, followed by further, more gradual depreciation over time. Increases in foreign demand for U.S. assets lead instead to an initial appreciation, followed by depreciation over time, to a level lower than before the shift.

The model provides a natural interpretation of the recent behavior of the U.S. current account and the dollar exchange rate. The initial net effect of the shifts in U.S. demand for foreign goods and in foreign demand for U.S. assets was a dollar appreciation. Both shifts, however, imply an eventual depreciation. The United States appears to have entered this depreciation phase.

How much depreciation is to come, and at what rate, depends on how far the process has come and on future shifts in the demand for goods and the demand for assets. This raises two main issues. First, can one expect the deficit to largely reverse itself without changes in the exchange rate? If it does, the needed depreciation will obviously be smaller. Second, can one expect foreign demand for U.S. assets to continue to increase? If it does, the depreciation will be delayed, although it will still have to come eventually. Although there is substantial uncertainty about the answers, we conclude that neither scenario is likely. This leads us to anticipate, in the absence of surprises, more dollar depreciation to come at a slow but steady rate.

Surprises will, however, take place; only their sign is unknown. We again use the model as a guide to discuss a number of alternative scenarios, from the abandonment of the renminbi's peg against the dollar, to changes in the composition of reserves held by Asian central banks, to changes in U.S. interest rates.

This leads us to the last part of the paper, where we ask how much of the dollar's future depreciation is likely to take place against the euro, and how much against Asian currencies. We extend our model to allow for four "countries": the United States, the euro area, Japan, and China. We conclude that, again absent surprises, the path of adjustment is likely to be associated primarily with an appreciation of the Asian currencies, but also with a further appreciation of the euro against the dollar.

A Model of the Exchange Rate and the Current Account

Much of economists' intuition about joint movements in the exchange rate and the current account is based on the assumption of perfect substitutability between domestic and foreign assets. As we shall show, introducing imperfect substitutability changes the picture substantially. Obviously, it allows one to think about the dynamic effects of shifts in asset preferences. But it also modifies the dynamic effects of shifts in preferences with respect to goods.

We are not the first to insist on the potential importance of imperfect substitutability. Indeed, the model we present builds on an older (largely and unjustly forgotten) set of papers by Paul Masson, Dale Henderson and Kenneth Rogoff, and, especially, Pentti Kouri.[1] These papers relax the interest parity condition and instead assume imperfect substitutability of domestic and foreign assets. Masson and Henderson and Rogoff focus mainly on issues of stability; Kouri focuses on the effects of changes in portfolio preferences and the implications of imperfect substitutability between assets for shocks to the current account.

The value added of this paper is in allowing for a richer description of gross asset positions. By doing this, we are able to incorporate into the analysis the "valuation effects" that have been at the center of recent empirical research on gross financial flows,[2] and that play an important role in the context of U.S. current account deficits. Many of the themes we develop, including the roles of imperfect substitutability and valuation effects, have also been recently emphasized by Maurice Obstfeld.[3]

1. Masson (1981); Henderson and Rogoff (1982); Kouri (1983). The working paper version of the paper by Kouri dates from 1976. One could argue that there were two fundamental papers written that year, the first by Dornbusch (1976), who explored the implications of perfect substitutability, and the other by Kouri, who explored the implications of imperfect substitutability. The Dornbusch approach, with its powerful implications, has dominated research since then. But imperfect substitutability seems central to the issues we face today. Branson and Henderson (1985) provide a survey of this early literature.

2. See, in particular, Gourinchas and Rey (2005) and Lane and Milesi-Ferretti (2002, 2004).

3. Obstfeld (2004). We limit our analysis of valuation effects to those originating from exchange rate movements. Valuation effects can and do also arise from changes in asset prices, particularly stock prices. The empirical analysis of a much richer menu of possible valuation effects has recently become possible, thanks to the data on gross financial flows and gross asset positions assembled by Lane and Milesi-Ferretti.

The Case of Perfect Substitutability

To see how imperfect substitutability of assets matters, it is best to start from the well-understood case of perfect substitutability. Consider a world with two "countries": the United States and a single foreign country comprising the rest of the world. We can think of the U.S. current account and exchange rate as being determined by two relations. The first is the uncovered interest parity condition:

$$\left(1+r\right) = \left(1+r^*\right)\frac{E}{E^e_{+1}},$$

where r and r^* are U.S. and foreign real interest rates, respectively (asterisks denote foreign variables), E is the real exchange rate defined as the price of U.S. goods in terms of foreign goods (so that an increase in the exchange rate denotes an appreciation of the dollar), and E^e_{+1} is the expected real exchange rate in the next period. The condition states that expected returns on U.S. and foreign assets must be equal.

The second relation is the equation giving net debt accumulation:

$$F_{+1} = \left(1+r\right)F + D\left(E_{+1}, z_{+1}\right),$$

where $D(E, z)$ is the trade deficit. The trade deficit is an increasing function of the real exchange rate (so that $D_E > 0$). All other factors—changes in total U.S. or foreign spending, as well as changes in the composition of U.S. or foreign spending between foreign and domestic goods at a given exchange rate—are captured by the shift variable z. We define z such that an increase worsens the trade balance ($D_Z > 0$). F is the net debt of the United States, denominated in terms of U.S. goods. The condition states that net debt in the next period is equal to net debt in the current period times 1 plus the interest rate, plus the trade deficit in the next period.

Assume that the trade deficit is linear in E and z, so that $D(E, z) = \theta E + z$. Assume also, for convenience, that U.S. and foreign interest rates are equal ($r^* = r$) and constant. From the interest parity condition, it follows that the expected exchange rate is constant and equal to the current exchange rate. The value of the exchange rate is obtained in turn by solving out the net debt accumulation forward and imposing the condition that net debt does not grow at a rate above the interest rate. Doing this gives

$$E = -\frac{r}{\theta}\left[F_{-1} + \frac{1}{1+r}\sum_{0}^{\infty}(1+r)^{-i} z^{e}_{+i}\right].$$

That is, the exchange rate depends negatively on the initial net debt position and on the sequence of current and expected shifts in the trade balance.

Replacing the exchange rate in the net debt accumulation equation in turn gives

$$F - F_{-1} = \left[z - \frac{r}{1+r}\sum_{0}^{\infty}(1+r)^{-i} z^{e}_{+i}\right].$$

That is, the change in the net debt position depends on the difference between the current shift and the present value of future shifts in the trade balance.

For our purposes these two equations have one main implication. Consider an unexpected, permanent increase in z at time t—say, an increase in the U.S. demand for Chinese goods (at a given exchange rate)—by Δz. Then, from the two equations above,

$$E - E_{-1} = -\frac{\Delta z}{\theta}; \qquad F - F_{-1} = 0.$$

In words: permanent shifts lead to a depreciation large enough to maintain current account balance. By a similar argument, shifts that are expected to be long lasting lead to a large depreciation and only a small current account deficit. As we argue later, this is not what has happened in the United States over the last ten years. The shift in z appears to be, if not permanent, at least long lasting. Yet it has not been offset by a large depreciation but has been reflected instead in a large current account deficit. This, we shall argue, is the result of two factors, both closely linked to imperfect substitutability. The first is that, under imperfect substitutability, the initial depreciation in response to an increase in z is more limited, and, by implication, the current account deficit is larger and longer lasting. The second is that, under imperfect substitutability, asset preferences matter. An increase in foreign demand for U.S. assets, for example—an event that obviously cannot be analyzed in the model with perfect substitutability we have just presented—leads to an initial appreciation and a current account deficit. And such a shift has indeed played an important role since the mid-1990s.

Imperfect Substitutability and Portfolio Balance

We now introduce imperfect substitutability between assets. Let W denote the wealth of U.S. investors, measured in units of U.S. goods. W is equal to the stock of U.S. assets, X, minus the net debt position of the United States, F:

$$W = X - F.$$

Similarly, let W^* denote foreign wealth and X^* denote foreign assets, both in terms of foreign goods. Then the wealth of foreign investors, expressed in terms of U.S. goods, is given by

$$\frac{W^*}{E} = \frac{X^*}{E} + F.$$

Let R^e be the relative expected gross real rate of return on holding U.S. assets versus foreign assets:

$$R^e \equiv \frac{1+r}{1+r^*}\frac{E^e_{+1}}{E}. \tag{1}$$

Under perfect substitutability, the case studied above, R^e was always equal to 1; this need not be the case under imperfect substitutability.[4]

U.S. investors allocate their wealth W between U.S. and foreign assets. They allocate a share α to U.S. assets and, by implication, a share $(1 - \alpha)$ to foreign assets. Symmetrically, foreign investors invest a share α^* of their wealth W^* in foreign assets and a share $(1 - \alpha^*)$ in U.S. assets. Assume that these shares are functions of the relative rate of return, so that

$$\alpha = \alpha(R^e, s), \alpha_{Re} > 0, \alpha_s > 0 \qquad \alpha^* = \alpha^*(R^e, s), \alpha^*_{Re} < 0, \alpha^*_s < 0.$$

A higher relative rate of return on U.S. assets leads U.S. investors to increase the share they invest in U.S. assets, and foreign investors to decrease the share they invest in foreign assets. The variable s is a shift factor, standing for all the factors that shift portfolio shares for a given relative return. By convention, an increase in s leads both U.S. and foreign investors to increase the share of their portfolio in U.S. assets for a given relative rate of return.

4. One may wonder whether, even if many investors have strong asset preferences, the effects of these preferences on expected returns are not driven away by arbitrageurs, so that expected returns are equalized. The empirical work of Gourinchas and Rey (2005), which we discuss later, strongly suggests that this does not happen, and that financial assets denominated in different currencies are indeed imperfect substitutes.

An important parameter in the model is the degree of home bias in U.S. and foreign portfolios. We assume that there is indeed home bias, and we capture it by assuming that the sum of portfolio shares falling on own-country assets exceeds 1:

$$\alpha(R^e, s) + \alpha^*(R^e, s) > 1.$$

Equilibrium in the market for U.S. assets (and, by implication, in the market for foreign assets) implies

$$X = \alpha(R^e, s)W + [1 - \alpha^*(R^e, s)](W^*/E).$$

The supply of U.S. assets must be equal to U.S. demand plus foreign demand for those assets. Given the definition of F introduced earlier, this condition can be rewritten as

$$X = \alpha(R^e, s)(X - F) + (1 - \alpha^*(R^e, s))[(X^*/E) + F], \tag{2}$$

where R^e is given in turn by equation 1 and depends in particular on E and E^e_{+1}. This gives us the first relation, which we refer to as the *portfolio balance relation,* between net debt, F, and the exchange rate, E.

To see its implications most clearly, consider the limiting case where the degree of substitutability is zero, so that the shares α and α^* do not depend on the relative rate of return. In this case

—The portfolio balance condition fully determines the exchange rate as a function of the world distribution of wealth, $(X - F)$ and $[(X^*/E) + F)]$. In sharp contrast to the case of perfect substitutability, news about current or future current account balances, such as a permanent shift in z, has no effect on the current exchange rate.

—Over time, current account deficits lead to changes in F, and thus to changes in the exchange rate. The slope of the relation between the exchange rate and net debt is given by

$$\frac{\mathrm{d}E/E}{\mathrm{d}F} = -\frac{\alpha + \alpha^* - 1}{(1 - \alpha^*)X^*/E} < 0.$$

So, in the presence of home bias, an increase in net debt is associated with a lower exchange rate. The reason is that, as wealth is transferred from the United States to the rest of the world, home bias leads to a decrease in the demand for U.S. assets, which in turn requires a decrease in the exchange rate.

Outside this limiting case, the portfolio balance determines a relation between net debt and the exchange rate for a given expected rate of depreciation. The exchange rate is no longer determined myopically. But the two insights from the limiting case remain: On the one hand, the exchange rate will respond less to news about the current account than it does under perfect substitutability. On the other, it will respond to changes either in the world distribution of wealth or in portfolio preferences.

Imperfect Substitutability and Current Account Balance

Assume, as before, that U.S. and foreign goods are imperfect substitutes and that the U.S. trade deficit, in terms of U.S. goods, is given by

$$D = D(E, z),\ D_E > 0,\ D_z > 0.$$

Turn now to the equation expressing the dynamics of the U.S. net debt position. Given our assumptions, U.S. net debt is given by

$$F_{+1} = (1-\alpha^*(R^e, s))\frac{W^*}{E}(1+r) - (1-\alpha(R^e, s))W(1+r^*)\frac{E}{E_{+1}} + D(E_{+1}, z_{+1}).$$

In words, net debt in the next period is equal to the value of U.S. assets held by foreign investors next period, minus the value of foreign assets held by U.S. investors next period, plus the trade deficit next period:

—The value of U.S. assets held by foreign investors next period is equal to their wealth in terms of U.S. goods this period times the share they invest in U.S. assets this period times the gross rate of return on U.S. assets in terms of U.S. goods.

—The value of foreign assets held by U.S. investors next period is equal to U.S. wealth this period times the share they invest in foreign assets this period times the realized gross rate of return on foreign assets in terms of U.S. goods.

The previous equation can be rewritten as

$$(3)\quad F_{+1} = (1+r)F + (1-\alpha(R^e, s))(1+r)\left(1 - \frac{1+r^*}{1+r}\frac{E}{E_{+1}}\right)(X-F) + D(E_{+1}, z_{+1}).$$

We shall call this the *current account balance* relation.[5]

5. This appears to give a special role to α rather than α*, but in fact this is not the case. A symmetrical expression can be derived with α* appearing instead of α. Put another way, F, α*, and α are not independent. F_{+1} can be expressed in terms of any two of the three.

The first and last terms on the right-hand side of equation 3 are standard: next-period net debt is equal to this-period net debt times the gross rate of return, plus the trade deficit next period. The term in the middle reflects valuation effects, recently stressed by Pierre-Olivier Gourinchas and Hélène Rey and by Philip Lane and Gian Maria Milesi-Ferretti.[6] Consider, for example, an unexpected decrease in the price of U.S. goods—that is, an unexpected decrease in E_{+1} relative to E. This dollar depreciation increases the dollar value of U.S. holdings of foreign assets, decreasing the U.S. net debt position.

Putting things together, a depreciation improves the U.S. net debt position in two ways: the first, conventional way through the improvement in the trade balance, and a second way through asset revaluation. Note that

—The strength of the valuation effects depends on gross rather than net positions and so on the share of the U.S. portfolio in foreign assets $(1 - \alpha)$ and on U.S. wealth $(X - F)$. It is present even if $F = 0$.

—The strength of the valuation effects depends on our assumption that U.S. gross liabilities are denominated in dollars, so that their value in dollars is unaffected by a dollar depreciation. Valuation effects would obviously be very different when, as is typically the case for emerging market economies, gross positions are smaller and liabilities are denominated in foreign currency.

Steady State and Dynamics

Assume the stocks of assets X and X^* and the shift variables z and s to be constant. Assume also r and r^* to be constant and equal to each other. In this case the steady-state values of net debt F and E are characterized by two relations.

The first is the portfolio balance relation (equation 2). Given the equality of interest rates and the constant exchange rate, $R^e = 1$, the relation takes the form

$$X = \alpha(1,s)(X - F) + (1 - \alpha^*(1,s))[(X^*/E) + F].$$

6. Gourinchas and Rey (2005); Lane and Milesi-Ferretti (2004). As a matter of logic, one can have both perfect substitutability and valuation effects. (Following standard practice, we ignored valuation effects in the perfect substitutability model presented earlier by implicitly assuming that, if net debt was positive, U.S. investors did not hold foreign assets and net debt was therefore equal to the foreign holdings of dollar assets.) Under perfect substitutability, however, there is no guide as to what determines the shares, and therefore what determines the gross positions of U.S. and foreign investors.

This first steady-state condition implies a negative relation between net debt and the exchange rate. As we showed earlier, in the presence of home bias, a larger U.S. net debt, which transfers wealth to foreign investors, shifts demand away from U.S. assets and thus lowers the exchange rate.

The second relation is the current account balance relation (equation 3). Given the equality of interest rates, and given the constant exchange rate and net debt, the relation takes the form

$$0 = rF + D(E, z).$$

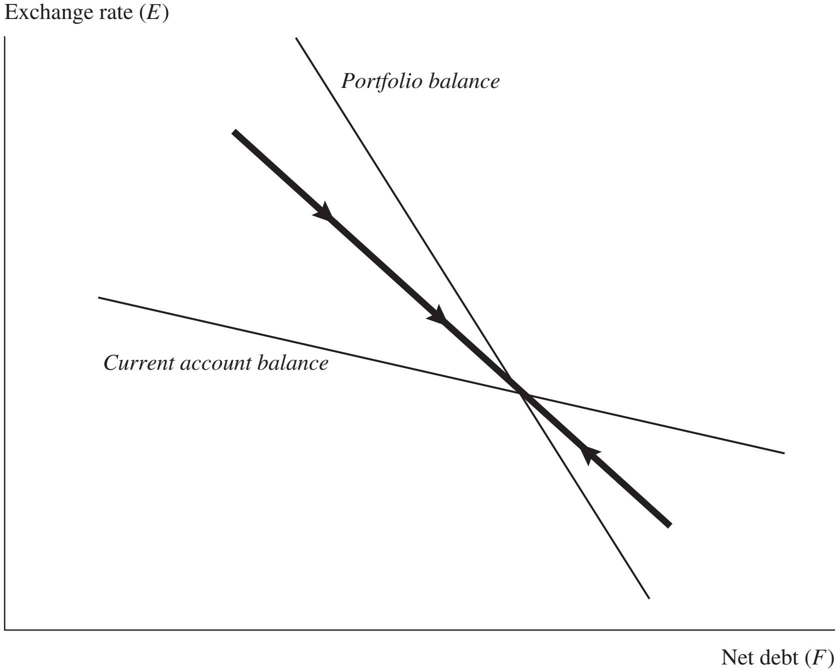
This second relation also implies a negative relation between net debt and the exchange rate. The larger the net debt, the larger the trade surplus required in steady state to finance interest payments on the debt, and thus the lower the exchange rate.[7] This raises the question of the stability of the system. The system is (locally saddle point) stable if, as drawn in figure 1, the portfolio balance locus is steeper than the current account balance locus. (Appendix A characterizes the dynamics.) To understand this condition, consider an increase in U.S. net debt. This increase has two effects on the current account deficit, and thus on the change in net debt: it increases interest payments, but it also leads, through the portfolio balance relation, to a lower exchange rate and thus a decrease in the trade deficit. For stability to prevail, the net effect must be that the increase in net debt reduces the current account deficit. This condition appears to be satisfied for plausible parameter values (the next section explores this issue further), and we assume that it is satisfied here. In this case the path of adjustment—the saddle path—is downward sloping, as drawn in figure 1.

The Effects of a Shift toward Foreign Goods

We can now characterize the effects of shifts in preferences for goods or assets. Figure 2 shows the effect of an unexpected and permanent increase in z. One can think of this increase as coming either from an increase in U.S. activity relative to foreign activity, or from a shift in exports or imports at a given level of activity and a given exchange rate; we defer until

7. If we had allowed r and r^* to differ, the relation would have an additional term and take the form $0 = rF + (1 - \alpha)(r - r^*)(X - F) + D(E, z)$. This additional term implies that if, for example, a country pays a lower rate of return on its liabilities than it receives on its assets, it may be able to combine positive net debt with positive net income payments from abroad—the situation in which the United States remains today.

Figure 1. Determination of Exchange Rate and Net Debt in Steady State



Source: Authors' model described in the text.

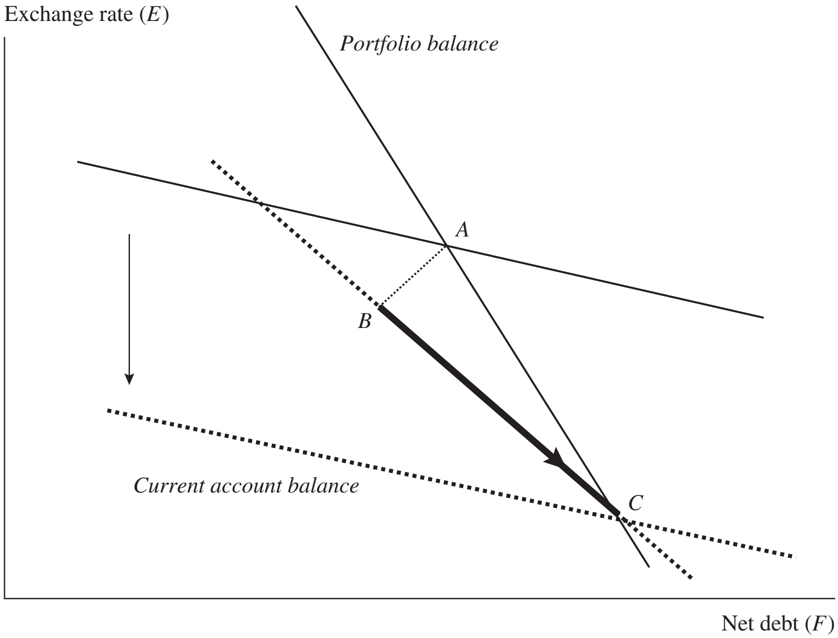
later a discussion of the sources of the actual shift in z over the past decade in the United States.

For any given level of net debt, current account balance requires a lower exchange rate: the current account balance locus shifts down. The new steady state is at point C, associated with a lower exchange rate and a larger net debt.

Valuation effects imply that any unexpected depreciation leads to an unexpected decrease in the net debt position. If we denote by ΔE the unexpected change in the exchange rate at the time of the shift, it follows from equation 3 that the change in net debt at the time of the shift is given by

$$\Delta F = (1 - \alpha)(1 + r^*)(X - F)\frac{\Delta E}{E}. \quad (4)$$

Figure 2. Adjustment of Exchange Rate and Net Debt to an Increase in *z*

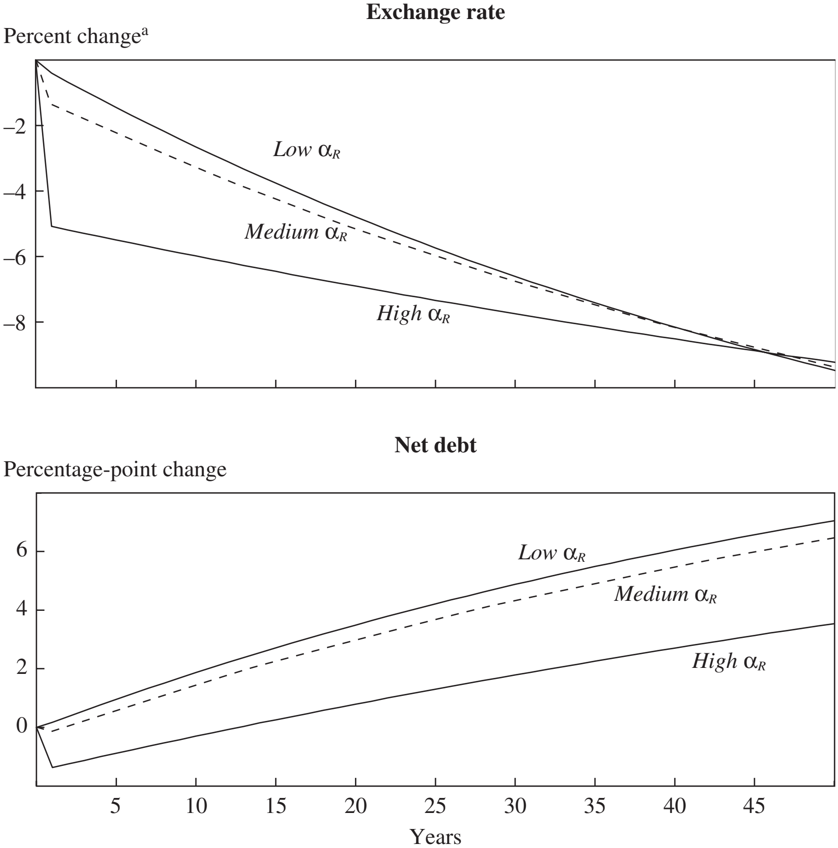


Source: Authors' model described in the text.

The economy jumps initially from point *A* to point *B* and then converges over time along the saddle path, from point *B* to point *C*. The shift in the trade deficit leads to an initial, unexpected depreciation, followed by further depreciation and net debt accumulation over time until the new steady state is reached.

Note that the degree of substitutability between assets does not affect the steady state; more formally, the steady state depends on $\alpha(1, s)$ and $\alpha^*(1, s)$, and so changes in α_R and α_R^* that leave $\alpha(1, s)$ and $\alpha^*(1, s)$ unchanged do not affect the steady state. In other words, the eventual depreciation is the same no matter how close substitutes U.S. and foreign assets are. But the degree of substitutability plays a central role in the dynamics of adjustment and in the relative roles of the initial unexpected depreciation and the anticipated depreciation thereafter. This is shown in figure 3, which shows the effects of three different values of α_R and α_R^* on the path of adjustment. (The three simulations are based on values for the parameters introduced in

Figure 3. Responses of the Exchange Rate and Net Debt to a Shift in *z*



Source: Authors' calculations.
a. All simulations are for a shift in *z* of 1 percent of U.S. GDP.

the next section. The purpose here is simply to show the qualitative properties of the paths. We return to the quantitative implications later.)

The less substitutable U.S. and foreign assets are—that is, the smaller are α_R and α_R^*—the smaller the initial depreciation and the higher the anticipated rate of depreciation thereafter. To understand why, consider the extreme case where the shares do not depend on rates of return: U.S. and foreign investors want to maintain constant shares, no matter what the relative rate of return is. In this case the portfolio balance relation (equation 2) implies that there will be no response of the exchange rate to the unexpected change in z at the time it happens: any movement in the exchange rate would be inconsistent with equilibrium in the market for U.S. assets. Only over time, as the deficit leads to an increase in net debt, will the exchange rate decline.

Conversely, the more substitutable U.S. and foreign assets are, the larger will be the initial depreciation, the lower the anticipated rate of depreciation thereafter, and the longer the time taken to reach the new steady state. The limit of perfect substitutability—corresponding to the model discussed at the start—is actually degenerate: the initial depreciation is such as to maintain current account balance, and the economy does not move from there on, never reaching the new steady state (and so the anticipated rate of depreciation is equal to zero).

To summarize: In contrast to the case of perfect substitutability between assets we saw earlier, an increase in U.S. demand for foreign goods leads to a limited depreciation initially, a potentially large and long-lasting current account deficit, and a steady depreciation over time.

The Effects of a Shift toward U.S. Assets

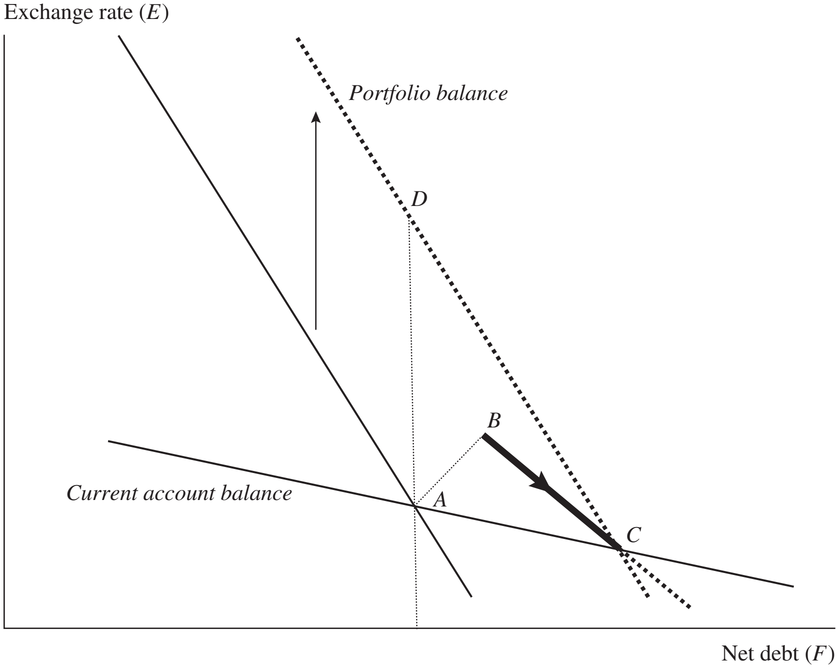
Figure 4 shows the effect of an unexpected and permanent increase in s, that is, an increase in the demand for U.S. assets. Again we defer to later a discussion of the potential factors behind such an increase.

By assumption, the increase in s leads to an increase in $\alpha(1, s)$ and a decrease in $\alpha^*(1, s)$. At a given level of net debt, portfolio balance requires an increase in the exchange rate. The portfolio balance locus shifts up. The new steady state is at point C, associated with a lower exchange rate and larger net debt.

The dynamics are given by the path ABC. The initial adjustment of E and F must again satisfy the condition in equation 4. So the economy jumps from point A to point B and then converges over time from point B to point C. The dollar initially appreciates, triggering an increase in the trade deficit and a deterioration in the net debt position. Over time, net debt continues to increase and the dollar depreciates. In the new equilibrium the exchange rate is necessarily lower than before the shift: this reflects the need for a larger trade surplus to offset the interest payments on the now-larger U.S. net debt. In the long run the favorable portfolio shift leads to a depreciation.

Again the degree of substitutability between assets plays an important role in the adjustment. This is shown in figure 5, which plots the path of

Figure 4. Adjustment of Exchange Rate and Net Debt to an Increase in *s*



Source: Authors' model described in the text.

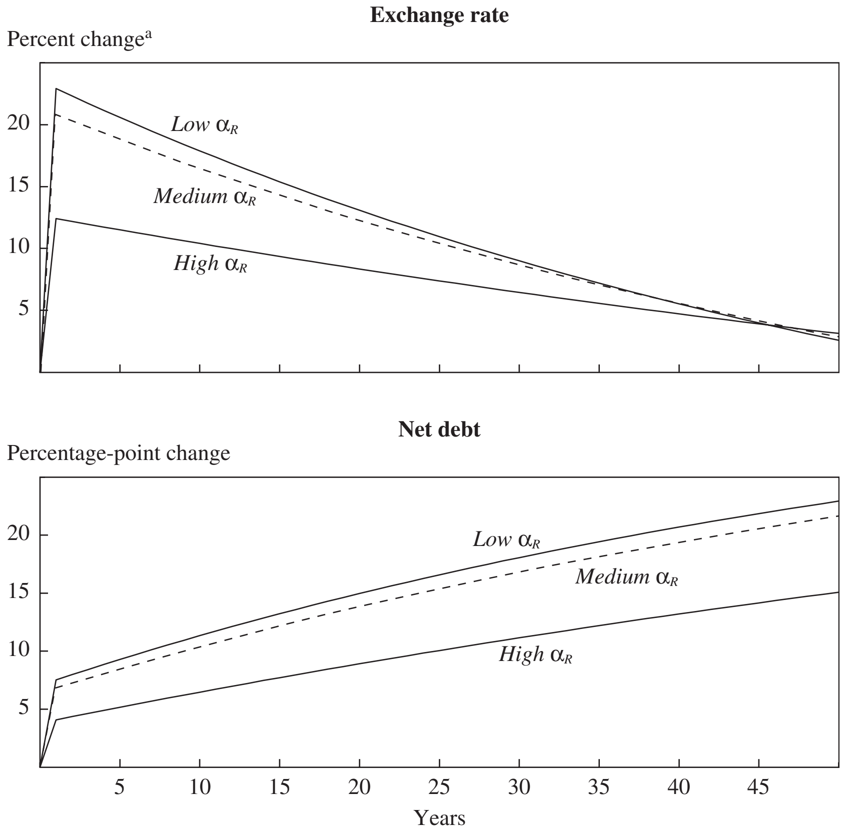
adjustment for three different values of α_R and α_R^*. The less substitutable are U.S. and foreign assets, the greater the initial appreciation and the higher the anticipated rate of depreciation thereafter. Although the depreciation is eventually the same in all cases (the steady state is invariant to the values of α_R and α_R^*), the effect of portfolio shifts is more muted but longer lasting when the degree of substitutability is high.

An Interpretation of the Past

Looking at the effects of shifts in preferences for goods and for assets under imperfect asset substitutability suggests three main conclusions:

—Shifts in preferences toward foreign goods lead to an initial depreciation, followed by a further anticipated depreciation. Shifts in preferences toward U.S. assets lead to an initial appreciation, followed by an anticipated depreciation.

Figure 5. Responses of the Exchange Rates to a Shift in *s*



Source: Authors' calculations.
a. All specifications are for a 5-percentage-point shift in *s*.

—The empirical evidence suggests that both types of shifts have been at work in the United States in the recent past. The first shift, by itself, would have implied a steady depreciation in line with increased trade deficits, whereas instead an initial appreciation was observed. The second shift can explain why the initial appreciation has been followed by a depreciation. But it attributes the increase in the trade deficit fully to the initial appreciation, whereas the evidence is of a large adverse shift in the trade balance even after controlling for the effects of the exchange rate. (This does not do justice to an alternative, and more conventional, monetary policy explanation, in which high U.S. interest rates relative to foreign interest rates at the end of the 1990s led to an appreciation, followed since by a depreciation. The observed relative interest rate differentials seem too small, however, to explain the movement in exchange rates.)

—Both shifts lead eventually to a steady depreciation, to a lower exchange rate than before the shift. This follows from the simple condition that a larger net debt, no matter what its origin, requires larger interest payments in steady state and thus a larger trade surplus. The lower the degree of substitutability between U.S. and foreign assets, the higher the expected rate of depreciation along the path of adjustment. The United States appears to have indeed entered this depreciation phase.

How Large a Depreciation? A Look at the Numbers

The model is simple enough that one can insert some values for the parameters and draw the implications for the future. More generally, the model provides a way of looking at the data, and this is what we do in this section.

Parameter Values

Consider first what we know about portfolio shares: In 2003 U.S. financial wealth, W, was \$34.1 trillion, or about three times U.S. GDP of \$11 trillion.[8] Non-U.S. world financial wealth is harder to assess. For the euro area financial wealth was about €15.5 trillion in 2003, compared with GDP of €7.5 trillion; Japanese financial wealth was about ¥1 quadrillion in 2004, compared with GDP of ¥500 trillion.[9] If one extrapolates from a ratio of financial assets to GDP of about 2 for both Japan and Europe, and GDP for the non-U.S. world of approximately \$18 trillion in 2003, a reasonable estimate for W^*/E is \$36 trillion—roughly the same as for the United States.

The net U.S. debt position, F, measured at market value, was \$2.7 trillion in 2003, up from approximate balance in the early 1990s.[10] By implication,

8. Financial wealth data are from the Flow of Funds Accounts of the United States 1995–2003, table L100, Board of Governors of the Federal Reserve System, December 2004.

9. The figure for Europe is from *ECB Bulletin,* February 2005, table 3.1, and that for Japan from Bank of Japan, Flow of Funds (www.boj.or.jp/en/stat/stat_f.htm).

10. The source for the numbers in this and the next paragraph is Bureau of Economic Analysis, International Transactions, table 2, International Investment Position of the United States at Year End, 1976–2003, June 2004.

U.S. assets, X, were $W + F$ = \$36.8 trillion (\$34.1 trillion + \$2.7 trillion), and foreign assets, X^*/E, were $W^*/E - F$ = \$33.3 trillion (\$36.0 trillion – \$2.7 trillion). Put another way, the ratio of U.S. net debt to U.S. assets, F/X, was 7.3 percent (\$2.7 trillion ÷ \$36.8 trillion); the ratio of U.S. net debt to U.S. GDP was 24.5 percent (\$2.7 trillion ÷ \$11.0 trillion).

In 2003 gross U.S. holdings of foreign assets, at market value, were \$7.9 trillion. Together with the value for W, this implies that the share of U.S. wealth in U.S. assets, α, was 1 – (7.9/34.1), or 0.77. Gross foreign holdings of U.S. assets, at market value, were \$10.6 trillion. Together with the value of W^*/E, this implies that the share of foreign wealth in foreign assets, α^*, was equal to 1 – (10.6/36.0), or 0.71.

To get a sense of the implications of these values for α and α^*, note from equation 2 that a transfer of one dollar from U.S. wealth to foreign wealth implies a decrease in the demand for U.S. assets of $(\alpha + \alpha^* - 1)$ dollars, or 48 cents.[11]

To summarize:

W = \$34.1 trillion
W^*/E = \$36.0 trillion
X = \$36.8 trillion
X^*/E = \$33.3 trillion
F = \$2.7 trillion
α = 0.77
α^* = 0.71.

We would like to know not only the values of the shares, but also their dependence on the relative rate of return—the values of the derivatives α_R and α^*_R. Little is known about these values. Gourinchas and Rey provide indirect evidence of the relevance of imperfect substitutability by showing that a combination of the trade deficit and the net debt position helps predict a depreciation (we return to their results later);[12] this would not be the case under perfect substitutability. However, it is difficult to back out estimates of α_R and α^*_R from their results. Thus, when needed below, we derive results under alternative assumptions about these derivatives.

11. Note that this conclusion depends on the assumption we make in our model that marginal and average shares are equal. This may not be the case.

12. Gourinchas and Rey (2005).

The next important parameter in our model is θ, the effect of the exchange rate on the trade balance. The natural starting point here is the Marshall-Lerner relation:

$$\frac{\mathrm{d}D}{\text{Exports}} = \left[\eta_{\text{imp}} - \eta_{\text{exp}} - 1\right]\frac{\mathrm{d}E}{E},$$

where η_{imp} and η_{exp} are, respectively, the elasticities of imports and exports with respect to the real exchange rate.

Estimates of the ηs based on estimated U.S. import and export equations range quite widely.[13] In some cases the estimates imply that the Marshall-Lerner condition (the condition that the term in brackets be positive, so that a depreciation improves the trade balance) is barely satisfied. Estimates used in macroeconometric models imply a value for the term in brackets between 0.5 and 0.9. Put another way, together with the assumption that the ratio of U.S. exports to U.S. GDP is 10 percent, they imply that a reduction of the ratio of the trade deficit to GDP by 1 percentage point requires a depreciation of somewhere between 11 and 20 percent.

One may believe, however, that measurement error, complex lag structures, and misspecification all bias these estimates downward. An alternative approach is to derive the elasticities from plausible specifications of utility and the pass-through behavior of firms. Using such an approach in a model with nontradable goods, domestic tradable goods, and foreign tradable goods, Obstfeld and Rogoff find that a 1-percentage-point decrease in the ratio of the trade deficit to GDP requires a decrease in the real exchange rate of somewhere between 7 and 10 percent—a smaller depreciation than implied by the macroeconometric models.[14]

Which value to use is obviously crucial in assessing the scope of the required exchange rate adjustment. We choose an estimate for the term in brackets in the Marshall-Lerner equation of 0.7—toward the high range of empirical estimates but lower than the Obstfeld-Rogoff elasticities. This estimate, together with an exports-to-GDP ratio of 10 percent, implies that a reduction in the ratio of the trade deficit to GDP of 1 percentage point requires a depreciation of 15 percent.

13. See the survey by Chinn (2004).
14. Obstfeld and Rogoff (2004).

A Simple Exercise

We have argued that a depreciation of the dollar has two effects: a conventional one through the trade balance, and another through valuation effects. To get a sense of their relative magnitudes, consider the effects of an unexpected depreciation in our model. More specifically, consider the effects of an unexpected 15 percent decrease in E_{+1} relative to E on net debt, F_{+1}, in equation 3.

The first effect of the depreciation is to improve the trade balance. Given our earlier discussion and assumptions, such a depreciation reduces the trade deficit by 1 percent of GDP (which is why we chose to look at a depreciation of 15 percent).

The second effect is to increase the dollar value of U.S. holdings of foreign assets (and to reduce the foreign currency value of foreign holdings of U.S. assets) and thus reduce the U.S. net debt position. From equation 3 (with both sides divided by U.S. output, Y, to make the interpretation of the magnitudes easier), this effect is given by

$$\frac{\mathrm{d}F}{Y} = -(1-\alpha)(1+r^*)\frac{X-F}{Y}\frac{\mathrm{d}E}{E}.$$

From the earlier discussion, $(1 - \alpha)$ is equal to 0.23, and $(X - F)/Y$ to 3. Assume that r^* is equal to 4 percent. The effect of a 15 percent depreciation is then to reduce the ratio of net debt to GDP by 10 percentage points ($0.23 \times 1.04 \times 3 \times 0.15$). This implies that, after the unexpected depreciation, interest payments are lower by 4 percent times 10 percent, or 0.4 percent of GDP.[15] Putting things together, a 15 percent depreciation improves the current account balance by 1.4 percent of GDP, with roughly one-third of the improvement due to valuation effects.[16]

It is tempting here to ask how large an unexpected depreciation would have to occur to lead to a sustainable U.S. current account deficit *today?*[17]

15. This computation assumes that all foreign assets held by U.S. investors are denominated in foreign currency. In reality, some foreign bonds held by U.S. investors are denominated in dollars. This reduces the valuation effects.

16. Lane and Milesi-Ferretti (2004) give a similar computation for a number of countries, although not for the United States.

17. This is also the question taken up by Obstfeld and Rogoff in this volume. Their focus, relative to ours, is on the required adjustments in both the terms of trade and the real exchange rate, starting from a micro-founded model with nontraded goods, exportables, and importables.

Take the actual current account deficit of about 6 percent. What the "sustainable" current account deficit is depends on the ratio of net debt to GDP that the United States is willing to sustain, and on the growth rate of GDP: if g is the growth rate of U.S. GDP, the United States can sustain a current account deficit of $g(F/Y)$. Assuming, for example, a nominal GDP growth rate of 3 percent and a ratio of net debt to GDP of 25 percent (the ratio prevailing today, but one that has no particular claim to being the right one for this computation) implies that the United States can run a current account deficit of 0.75 percent while maintaining a constant ratio of net debt to GDP. In this case the depreciation required to shift from the actual to the sustainable current account deficit would be roughly 56 percent (6 percent – 0.75 percent) × (15 percent ÷ 1.4 percent).

This is a large number, and despite the uncertainty attached to the underlying values of many of the parameters, it is a useful number to keep in mind. But one should be clear about the limitations of the computation:

—The United States surely does not need to shift to sustainable current account balance right away. The rest of the world is still willing to lend to it, if perhaps not at the current rate. The longer the United States waits, however, the higher the ratio of net debt to GDP becomes, and thus the larger the eventual required depreciation. In this sense our computation gives a lower bound on the eventual depreciation.

—The computation is based on the assumption that, at the current exchange rate, the trade deficit will remain as large as it is today. If, for example, we believed that part of the current trade deficit reflects the combined effect of recent depreciations and J-curve effects, the computation above would clearly overestimate the required depreciation.

The rest of this section deals with these issues. First, by returning to dynamics, we try to get a sense of the eventual depreciation and of the rate at which it may be achieved. Second, we look at the evidence on the origins of the shifts in z and s.

Returning to Dynamics

How large is the effect of a given shift in z (or in s) on the accumulation of net debt and on the eventual exchange rate? And how long does it take to get there? The natural way to answer these questions is to simulate our model using the values of the parameters we derived earlier. This is indeed what the simulations presented in figures 3 and 5 did; we now look more closely at their quantitative implications.

Both sets of simulations are based on the values of the parameters given above. Recognizing the presence of output growth (which we did not allow for in the model), and rewriting the equation for net debt as an equation for the ratio of net debt to output, we take the term in front of F in the current account balance relation (equation 3) to stand for the interest rate minus the growth rate. We choose an interest rate of 4 percent and a nominal growth rate of 3 percent, so that their difference is 1 percent. We write the portfolio shares as

$$\alpha(R^e, s) = a + bR^e + s, \alpha^*(R^e, s) = a^* - bR^e - s.$$

The simulations show the results for three values (10, 1.0, and 0.1) of the parameter b. A value of 1 implies that an increase in the expected relative return on U.S. assets of 100 basis points increases the desired share in U.S. assets by 1 percentage point.

Figure 3 showed the effect of an increase in z of 1 percent of U.S. GDP. Figure 5 showed the effect of an increase in s of 5 percentage points, leading to an increase in α and a decrease in α^* of 5 percentage points at a given relative rate of return. Time is measured in years.

Figure 3 leads to two main conclusions. First, the effect of a permanent increase in z by 1 percent is to eventually increase the ratio of net debt to GDP by 17 percentage points and require an eventual depreciation of 12.5 percent. (Recall that the long-run effects are independent of the degree of substitutability between assets—that is, independent of the value of b.) Second, it takes a long time to get there: the figure is truncated at fifty years, by which time the adjustment is still not complete.

Figure 5 leads to similar conclusions. The initial effect of the increase in s is an appreciation of the dollar: by 23 percent if $b = 0.1$, and by 12 percent if $b = 10$. The long-run effect of the increase in s is an increase in the ratio of U.S. net debt to GDP of 35 percentage points and a depreciation of 15 percent. But even after fifty years the adjustment is far from complete, and the exchange rate is still above its initial level.

What should one conclude from these exercises? We conclude that, under the following assumptions—that there are no anticipated changes in z or in α or α^*, that investors have been and will be rational (the simulations are carried out under rational expectations), and that there are no surprises—the dollar will depreciate by a large amount, but at a steady and slow rate. There are good reasons to question each of these assumptions, and this we do next.

A Closer Look at the Trade Deficit

To think about the likely path of z, and thus of the path of the trade deficit at a given exchange rate, it is useful to write the trade deficit as the difference between the value of imports in terms of domestic goods, and exports:

$$D(E,z) \equiv E\ \mathrm{imp}(E,Z,\tilde{z}) - \exp(E,Z^*,\tilde{z}^*)$$

We have decomposed z into two components: total U.S. spending, Z, and $\tilde{z}$, which represents shifts in the relative U.S. demand for U.S. versus foreign goods, at a given level of spending and a given exchange rate. Similarly, z^* is decomposed into Z^* and $\tilde{z}^*$, the latter measuring shifts in the relative foreign demand for U.S. versus foreign goods.

Most of the large current account fluctuations in developed countries of the last few decades have come from relative fluctuations in activity, that is, in Z relative to Z^*.[18] It has indeed been argued that the deterioration of the U.S. trade balance has come mostly from faster growth in the United States than in its trade partners, leading imports by the United States to increase faster than U.S. exports to the rest of the world. This appears, however, to have played a limited role. Europe and Japan indeed have had slower growth than the United States (U.S. output grew a cumulative 45 percent from 1990 to 2004, compared with 29 percent for the euro area and 25 percent for Japan), but these countries account for only 35 percent of U.S. exports, and meanwhile other U.S. trade partners have grown as fast as or faster than the United States. Indeed, a study by the International Monetary Fund finds nearly identical output growth rates for the United States and its export-weighted partners since the early 1990s.[19]

Some have argued that the deterioration in the trade balance reflects instead a combination of rapid growth *both* in the United States and abroad and a U.S. import elasticity with respect to domestic spending that is higher (1.5 or above) than the elasticity of U.S. exports with respect to foreign spending. In this view rapid U.S. growth has led to a more than proportional increase in imports and an increasing trade deficit. The debate about

18. For a review of current account deficits and adjustments for twenty-one countries over the last thirty years, and references to the literature, see Debelle and Galati (2005).

19. International Monetary Fund, *Article IV United States Consultation—Staff Report,* 2004. As the case of the United States indeed reminds us, output is not the same as domestic spending, but the differences in growth rates between the two over a decade are small.

the correct value of the U.S. import elasticity is an old one, dating back to the estimates by Hendrik Houthakker and Stephen Magee; we tend to side with the recent conclusion by Jaime Marquez that the elasticity is close to 1.[20] For our purposes, however, this discussion is not relevant. Whether the growth in the U.S. trade deficit is the result of a high import elasticity or of shifts in the $\tilde{z}$s, there are no obvious reasons to expect either the shift to reverse or growth in the United States to drastically decrease in the future.

One way of assessing the relative roles of shifts in spending, the exchange rate, and other factors is to look at the performance of import and export equations in detailed macroeconometric models. The numbers obtained using the macroeconometric model of Global Insight (formerly the Data Resources, Inc., or DRI, model) are as follows:[21] The U.S. trade deficit in goods increased from $221 billion in the first quarter of 1998 (annualized) to $674 billion in the third quarter of 2004. Of this $453 billion increase, $126 billion was due to the increase in the value of oil imports, leaving $327 billion to be explained. When the export and import equations of the model are used, activity variables and exchange rates explain $202 billion, or about 60 percent of the increase. Unexplained time trends and residuals account for the remaining 40 percent, a substantial amount.[22]

Looking to the future, whether growth rate differentials, Houthakker-Magee effects, or unexplained shifts are behind the increase in the trade deficit is probably not essential. The slower growth in Europe and Japan reflects in large part structural factors, and neither Europe nor Japan is likely to make up much of the cumulative growth difference since 1995 over the next few years. One can still ask how much a given increase in growth in Europe and Japan would reduce the U.S. trade deficit. A simple computation is as follows. Suppose that Europe and Japan made up the roughly 20-percentage-point growth gap they have accumulated since 1990 vis-à-vis the United States—an unlikely scenario in the near future—so that U.S. exports to Europe and Japan increased by 20 percent. Given that U.S.

20. Houthakker and Magee (1969); Marquez (2000).

21. We thank Nigel Gault of Global Insight for communicating these results to us.

22. The model has a set of export and import equations disaggregated by product type. Most of the elasticities of the different components with respect to domestic or foreign spending are close to 1, indicating that Houthakker-Magee effects play a limited role (except for imports and exports of consumption goods, where the elasticity of imports with respect to consumption is 1.5 for the United States, but the elasticity of U.S. exports with respect to foreign GDP is an even higher 2.0).

exports to these countries are currently about $350 billion, the improvement would be 0.7 percent of U.S. GDP—not negligible, but not a major increase either.

One other factor, however, may hold more hope for a reduction in the trade deficit, namely, the working out of the J-curve. Nominal depreciations increase import prices, but these decrease the volume of imports only with a lag. Thus, for a while, a depreciation can increase the value of imports and worsen the trade balance, before improving it later.

One reason to think this may be important is the "dance of the dollar" and the movements of the dollar and the current account during the 1980s. From the first quarter of 1979 to the first quarter of 1985, the real exchange rate of the United States (measured by the trade-weighted major currencies index constructed by the Federal Reserve Board) increased by 41 percent (log percentage change). This appreciation was then followed by a sharp depreciation, with the dollar falling by 44 percent from the first quarter of 1985 to the first quarter of 1988. The appreciation was accompanied by a steady deterioration in the current account deficit, from rough balance in the early 1980s to a deficit of about 2.5 percent of GDP when the dollar reached its peak in early 1985. The current account continued to worsen, however, for more than two years, reaching a peak of 3.4 percent of GDP in 1987. The divergent paths of the exchange rate and the current account from 1985 to 1987 led a number of economists to explore the idea of hysteresis in trade:[23] the notion that, once appreciation has led to a loss of market share, an equal depreciation may not be sufficient to reestablish trade balance. Just as the idea was taking hold, however, the current account position rapidly improved, and trade was roughly in balance by the end of the decade.[24]

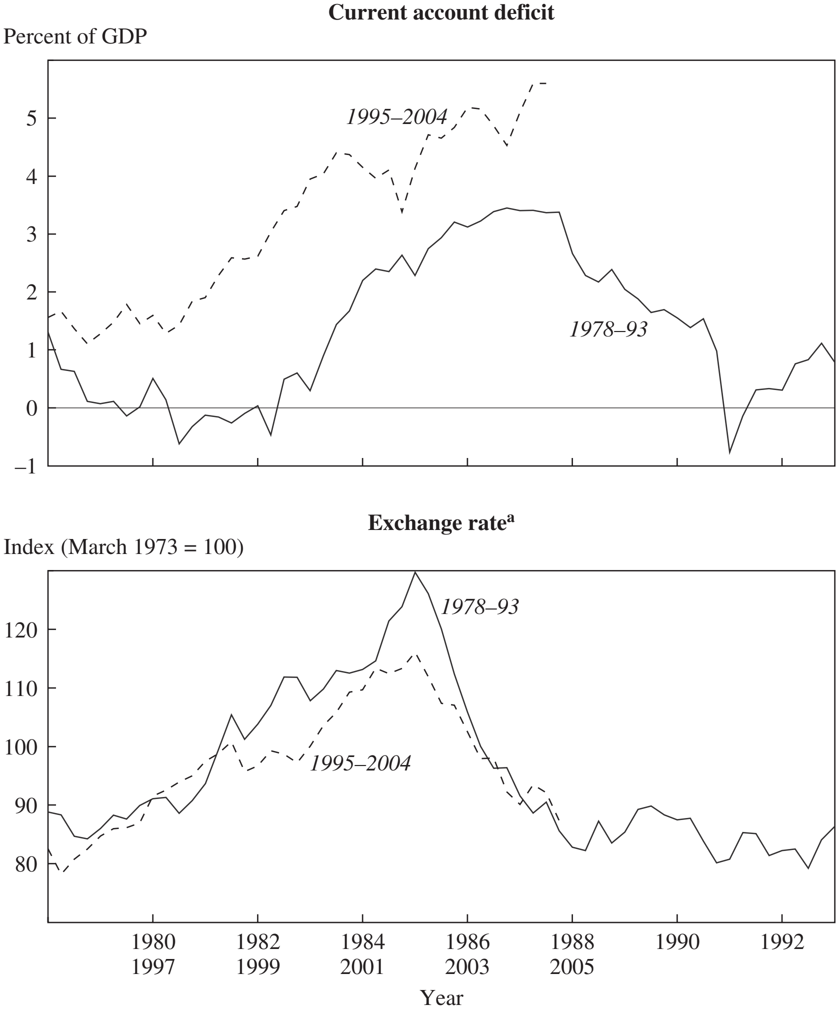
The parallels with more recent developments are clear from figure 6, which plots the dollar exchange rate and the U.S. current account during both episodes, aligned in the figure so that the dollar peak of 1985:1 coincides with the dollar peak of 2001:2. The figure suggests two conclusions:

—If the earlier episode is a reliable guide, and the lags today are similar to those that prevailed in the 1980s, the current account deficit may start

23. In particular, Baldwin and Krugman (1987).

24. These issues were discussed at length in the *Brookings Papers* at the time. Besides Baldwin and Krugman (1987), see, for example, Cooper (1986), Dornbusch (1987), and Sachs (1988), with post mortems by Lawrence (1990) and Krugman (1991). Another much-discussed issue, to which we return later, was the relative roles of fiscal deficit reduction and exchange rate adjustment in closing the deficit.

Figure 6. Current Account Deficit and Effective Real Exchange Rate, 1978–93 and 1995–2004



Source: Bureau of Economic Analysis, Table 1, U.S. International Transactions; Federal Reserve data.
a. Price-adjusted Major Currencies index.

to turn around soon. Today's deficit, however, is much larger than the earlier deficit was at its peak in 1987 (approaching 6 percent of GDP versus 3.5 percent), and the depreciation so far has been more limited (23 percent from 2001:2 to 2004:4, compared with 33 percent over the equivalent period from 1985:1 to 1988:3).[25]

—Hence one can surely not conclude that the depreciation so far is enough to restore the current account deficit to sustainable levels. But it may be that, in our computation, the appropriate place to start is from a J-curve-adjusted ratio of the current account deficit to GDP of 4 or 5 percent instead of 6 percent.[26] If we choose 4 percent—a very optimistic assumption—the remaining required depreciation is 34 percent (4 percent – 0.75 percent) × (15 percent ÷ 1.4 percent).[27]

A Closer Look at Portfolio Shares

One striking aspect of the simulations presented above is how slow the depreciation is along the adjustment path. This is in contrast with some predictions of much more abrupt falls in the dollar in the near future.[28] This raises two issues: Can the *anticipated* depreciation be greater than in these simulations? And are there possible surprises under which the depreciation might be much faster (or slower), and, if so, what are they?

To answer the first question, we go back to the model. We noted earlier that the lower the degree of substitutability between assets, the higher the anticipated rate of depreciation. So, by assuming zero substitutability—that is, constant asset shares except for changes coming from shifts in s—we can

25. On the other hand, the gross positions, and thus the scope for valuation effects from dollar depreciation, are much larger now than they were then. In 1985 gross U.S. holdings of foreign assets were $1.5 trillion, compared with $8 trillion today.

26. Forecasts by Macroeconomic Advisers, LLC, are for an improvement in the trade balance of $75 billion, or less than 1 percent of GDP, over the next two years. (The forecast is based on a depreciation of the dollar of 4 percent over that period.) The residuals of the import price equations of the model, however, suggest an unusually low pass-through of the dollar decline to import prices over the recent past, and the forecast assumes that the low pass-through continues. If the pass-through were to return to its historical average, the improvement in the trade balance would be larger.

27. This number is surprisingly close to the 33 percent obtained by Obstfeld and Rogoff in this volume.

28. For example, by Roubini and Setser (2005).

derive an upper bound on the anticipated rate of depreciation. Differentiating equation 2 gives

$$\frac{dE}{E} = -\frac{(\alpha + \alpha^* - 1)X}{(1 - \alpha^*)X^*/E}\,\frac{dF}{X} + \frac{(X - F)d\alpha - (X^*/E + F)d\alpha^*}{(1 - \alpha^*)X^*/E}.$$

In the absence of anticipated shifts in shares (so that the second term equals zero), the anticipated rate of depreciation depends on the change in the ratio of U.S. net debt to U.S. assets: the faster the increase in net debt, the faster the decrease in the relative demand for U.S. assets, and therefore the higher the rate of depreciation needed to maintain portfolio balance. Using the parameters we constructed earlier, this equation implies

$$\frac{dE}{E} = -1.8d\frac{F}{X} + (3.5\,d\alpha - 3.7\,d\alpha^*).$$

Suppose shares remain constant. If we take the annual increase in the ratio of net debt to U.S. GDP to be 5 percent and the ratio of U.S. GDP to U.S. assets to be one-third, this gives an anticipated annual rate of depreciation of 3 percent a year ($1.8 \times 0.05 \div 3$).[29]

If, however, shares of U.S. assets in the portfolios of either domestic or foreign investors are expected to decline, the anticipated depreciation can clearly be much larger. If, for example, we anticipate that the share of U.S. assets in foreign portfolios will decline by 2 percent over the coming year, the anticipated depreciation is 8.7 percent (2.7 percent as calculated above, plus 3.0 times 2 percent). This is obviously an upper bound on the size of the anticipated depreciation, derived by assuming that private investors are willing to keep a constant share of their wealth in U.S. assets despite a high negative expected rate of return between now and then. (If, instead, anticipating this high negative rate of return, private investors decide to decrease their share of dollar assets, then some of the depreciation will take place now, rather than when the shift in portfolio composition occurs, and so the anticipated depreciation will be smaller.) Still, it implies that, under imperfect substitutability, and under the assumption that desired shares in U.S.

29. Although comparison is difficult, this rate appears lower than that implied by the estimates of Gourinchas and Rey (2005). Their results imply that a combination of net debt and trade deficits 2 standard deviations from the mean—a situation that would appear to characterize well the United States today—implies an anticipated annual rate of depreciation of about 5 percent over the following two years.

assets will decrease, it is logically acceptable to predict a substantial depreciation of the dollar in the near future.

Are there good reasons to expect these desired shares to decrease in the near future? This is the subject of a contentious debate. Some argue that the United States can continue to finance its current account deficits at today's level for a long time to come at the same exchange rate. They argue that the poor development of financial markets in Asia and elsewhere, together with the need for Asian countries to accumulate international collateral, implies a steadily increasing relative demand for U.S. assets. They point to the latent demand for U.S. assets on the part of Chinese private investors, currently limited by capital controls. In short, they argue that foreign investors will be willing to further increase their holdings of U.S. assets for many years to come.[30]

Following this argument, we can ask what increase in shares—say, what increase in $(1 - \alpha^*)$, the share of U.S. assets in foreign portfolios—would be needed to absorb the current increase in net debt at a given exchange rate. From the relation derived above, setting dE/E and $d\alpha$ equal to zero gives

$$d\alpha^* = -\frac{(\alpha^* + \alpha - 1)X}{X^*/E + F}(Y/X)\,d\frac{F}{Y}.$$

For the parameters we have constructed, a change of 5 percentage points in F/Y requires an increase in the share of U.S. assets in foreign portfolios of about 0.8 percentage point a year (0.47×5 percent $\div 3$).[31]

We find more plausible the argument that the relative demand for U.S. assets may actually decrease rather than increase in the future. This argument is based, in particular, on the fact that much of the recent accumulation of U.S. assets has taken the form of accumulation of reserves by the Japanese and Chinese central banks. Many worry that this will not last,

30. See, for example, Dooley, Folkerts-Landau, and Garber (2004) and Caballero, Farhi, and Hammour (2004).

31. A related argument is that, to the extent that the rest of the world is growing faster than the United States, an increase in the ratio of net debt to GDP in the United States is consistent with a constant share of U.S. assets in foreign portfolios. This argument falls quantitatively short: although some Asian countries are growing rapidly, their weight and their financial wealth are still far too small to absorb the U.S. current account deficit while maintaining constant shares of U.S. assets in their portfolios.

that the pegging of the renminbi will come to an end, or that both central banks will want to change the composition of their reserves away from U.S. assets, leading to further depreciation of the dollar. Our model provides a simple way of discussing the issue and thinking about the numbers.

Consider pegging first: the foreign central bank buys or sells dollar assets so as to keep $E = \bar{E}$.[32] Let B denote the reserves (U.S. assets) held by the foreign central bank, so that

$$X = B + \alpha(1)(X - F) + (1 - \alpha^*(1))(X^*/E + F).$$

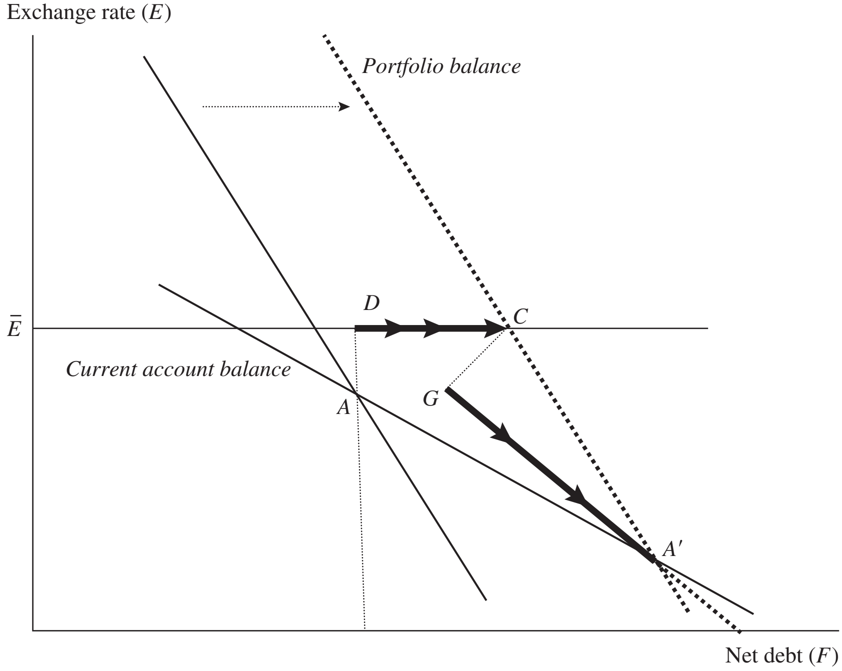
Figure 7 illustrates the resulting dynamics. Suppose that, in the absence of pegging, the steady state is given by point A and that the foreign central bank pegs the exchange rate at $\bar{E}$. At that level the U.S. current account is in deficit, and so F increases over time. Wealth gets steadily transferred to the foreign country, and so the private demand for U.S. assets steadily decreases. To keep E unchanged, B must increase further over time. Pegging by the foreign central bank is thus equivalent to a continuous outward shift in the portfolio balance schedule: in effect, the foreign central bank is keeping world demand for U.S. assets unchanged by offsetting the fall in private demand. Pegging leads to a steady increase in U.S. net debt and a steady increase in the foreign central bank's reserves, offsetting the steady decrease in private demand for U.S. assets (represented by the path DC in figure 7). What happens when the foreign central bank unexpectedly stops pegging? From point C just before the peg is abandoned, the economy jumps to point G (recall that valuation effects lead to a decrease in net debt, and therefore a capital loss for the foreign central bank, when there is an unexpected depreciation) and then adjusts along the saddle-point path GA'. The longer the peg lasts, the larger the initial and the eventual depreciation.

In other words, an early end to the Chinese peg would obviously lead to a depreciation of the dollar (an appreciation of the renminbi). But the sooner it takes place, the smaller the required depreciation, both initially and in the long run. Put another way, the longer the Chinese wait to abandon the peg, the larger the eventual appreciation of the renminbi.

The conclusions are very similar with respect to changes in the composition of reserves. We can think of such changes as changes in portfolio

32. Our two-country model has only one foreign central bank, and so we cannot discuss what happens if one foreign bank pegs its currency and the others do not. The issue is, however, relevant in thinking about the paths of the dollar-euro and the dollar-yen exchange rates. We discuss this further in the next section.

Figure 7. Adjustment of Exchange Rate and Net Debt to Abandonment of Foreign Peg



Source: Authors' model described in the text.

preferences, this time not by private investors but by central banks, and so we can apply our earlier analysis directly. A shift away from U.S. assets will lead to an initial depreciation, leading in turn to a lower current account deficit, a smaller increase in net debt, and thus to a smaller depreciation in the long run.

How large might these shifts be? Chinese reserves currently equal \$610 billion, and Japanese reserves are \$840 billion. Assuming that these reserves are now held mostly in dollars, if the People's Bank of China and the Bank of Japan reduced their dollar holdings to half of their portfolio, this would represent a decrease in the share of U.S. assets in total foreign (private and central bank) portfolios, $(1 - \alpha^*)$, from 30 percent to 28 percent. The computations we presented earlier suggest that this would be a substantial shift, leading to a decrease in the dollar exchange rate possibly as large as 8.7 percent.

To summarize: Avoiding a depreciation of the dollar would require a steady and substantial increase in shares of U.S. assets in U.S. or foreign portfolios at a given exchange rate. This seems unlikely to hold for very long. A more likely scenario is the opposite, a decrease in shares, due in particular to diversification of reserves by central banks. If and when this happens, the dollar will depreciate. Note, however, that the larger the adverse shift, the larger the initial depreciation but the smaller the accumulation of debt thereafter, and therefore the smaller the eventual depreciation. "Bad news" on the dollar now may well be good news in the long run (and vice versa).

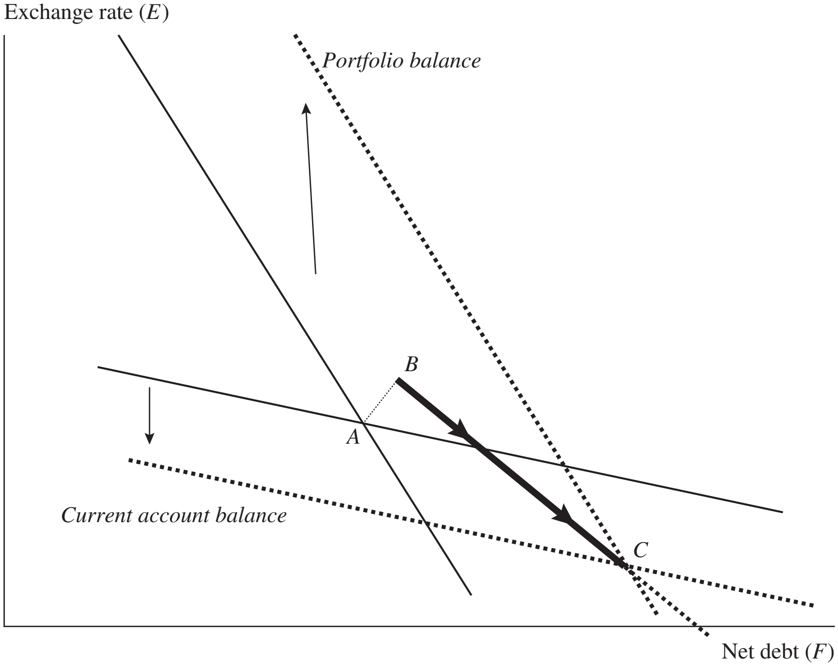
The Path of Interest Rates

Our model takes interest rates as given, and the discussion thus far has taken them as constant.[33] Yield curves in the United States, Europe, and Japan indeed indicate little expected change in interest rates over the near and the medium term. However, it is easy to think of scenarios where changes in interest rates play an important role, and this leads us to discuss the role of budget deficit reduction in the adjustment process.

First, however, we briefly show the effects of an increase in the U.S. interest rate in our model. Figure 8 shows the effects of an unexpected permanent increase in r over r^*. (In contrast to the case of perfect substitutability, it is possible for the two interest rates to differ even in the steady state.) The portfolio balance locus shifts upward: At a given level of net debt, U.S. assets are more attractive, and so the exchange rate increases. The current account balance locus shifts down: the higher interest rate implies larger payments on foreign holdings of U.S. assets and thus requires a larger trade surplus, and in turn a lower exchange rate. The adjustment path is given by *ABC*. In response to the increase in r, the economy jumps from point *A* to point *B* and then moves over time from point *B* to point *C*. As drawn, there is an appreciation initially, but, in general, the initial effect on the exchange rate is ambiguous. If gross liabili-

33. Remember that, when financial assets are imperfect substitutes, the interest rate differential no longer directly reflects expected exchange rate changes. It is thus perfectly rational for the level of long-term interest rates in the United States and in other countries to be very similar, even as the market anticipates a depreciation of the dollar. Therefore, if we consider that financial assets denominated in different currencies can be imperfect substitutes, there is no "interest rate puzzle," contrary to what is sometimes claimed in the financial press.

Figure 8. Adjustment of Exchange Rate and Net Debt to an Increase in the Domestic Interest Rate



Source: Authors' model described in the text.

ties are large, for example, the effect of higher interest payments on the current account balance may dominate the more conventional "overshooting" effects of increased attractiveness and lead to an initial depreciation rather than an appreciation. In either case the steady-state effect is greater net debt accumulation, and thus a larger depreciation than if *r* had not increased.

Thus, under the assumption that an increase in interest rates leads initially to an appreciation, an increase in U.S. interest rates beyond what is already implicit in the yield curve would delay the depreciation of the dollar, at the cost of greater net debt accumulation and a larger eventual depreciation.

Interest rate changes, however, do not take place in a vacuum. It is more interesting to think about what may happen to interest rates as the dollar depreciates, either slowly along the saddle path or more sharply, in response, for example, to adverse portfolio shifts. As the dollar depreciates, relative demand shifts toward U.S. goods, reducing the trade deficit but also increasing total demand for U.S. goods. Suppose also that output is initially at its natural level (the level associated with the natural rate of unemployment), which appears to be a good description of the United States today. Three outcomes are possible:

—Interest rates and fiscal policy remain unchanged. The increase in demand leads to an increase in output but also an increase in imports, which partly offsets the effect of the depreciation on the trade balance. (In terms of our model, it leads to an increase in domestic spending, Z, and thus to a shift in z.)

—Interest rates remain unchanged, but fiscal policy is adjusted to offset the increase in demand and leave output at its natural level; in other words, the budget deficit is reduced so as to maintain internal balance.

—Fiscal policy remains unchanged, but the Federal Reserve increases interest rates so as to maintain output at its natural level. In this case, higher U.S. interest rates limit the extent of the depreciation and mitigate the current account deficit reduction. In doing so, however, they lead to larger net debt accumulation and to a larger eventual depreciation.

In short, an orderly reduction of the current account deficit—that is, one that occurs while maintaining internal balance—requires both a decrease in the exchange rate *and* a reduction in the budget deficit.[34] The two are not substitutes: the depreciation is needed to achieve current account balance, and budget deficit reduction is needed to maintain internal balance at the natural level of output.[35] (The frequently heard statement that deficit reduction would reduce the need for dollar depreciation leaves us puzzled.) If the decrease in the budget deficit is not accompanied by a depreciation, the result is likely to be lower demand and a recession. Although the recession

34. Many of the discussions at Brookings in the late 1980s were about the relative roles of budget deficit reduction and exchange rate adjustment. For example, Sachs (1988) argued that "the budget deficit is the most important source of the trade deficit. Reducing the budget deficit would help reduce the trade deficit . . . [while] an attempt to reduce the trade deficit by a depreciating exchange rate induced by easier monetary policy would produce inflation with little benefit on the current account," a view consistent with the third scenario above. Cooper (1986), in a discussion of the policy package best suited to eliminate the U.S. imbalances, stated, "The drop in the dollar is an essential part of the policy package. The dollar's decline will help offset the fiscal contraction through expansion of net exports and help maintain overall U.S. economic activity at a satisfactory level," a view consistent with the second scenario.

35. Obstfeld and Rogoff (2004) emphasize a similar point.

would reduce the current account deficit, this is hardly a desirable outcome. If the depreciation is not accompanied by a reduction in the budget deficit, one of two things can happen: demand will increase, and with it the risk that the economy will overheat, or, more likely, interest rates will increase so as to maintain internal balance. This increase would either limit or delay the depreciation of the dollar, but, as we have made clear, this would be a mixed blessing. Such a delay implies less depreciation in the short run but more net debt accumulation and more depreciation in the long run.

The Euro, the Yen, and the Renminbi

The depreciation of the dollar since the peak of 2002 has been very unevenly distributed: as of April 2005 the dollar had fallen 45 percent against the euro, 25 percent against the yen, and not at all against the renminbi. In this section we return to the questions asked in the introduction: if substantially more depreciation is indeed to come, against which currencies will the dollar fall? If China abandons its peg, or if Asian central banks diversify their reserves, how will the euro and the yen be affected?

The basic answer is simple. Along the adjustment path, what matters—because of home bias in asset preferences—is the reallocation of wealth across countries, and thus the bilateral current account balances of the United States with its partners. Wealth transfers modify countries' relative demands for assets, thus requiring corresponding exchange rate movements. Other things equal, countries with larger trade surpluses with the United States will see a larger appreciation of their currency.

Other things may not be equal, however. Depending on portfolio preferences, a transfer of wealth from the United States to Japan, for example, may change the relative demand for euro assets and thus the euro exchange rate. In that context one can think of central banks as investors with different asset preferences. For example, a central bank that holds most of its reserves in dollars can be thought of as an investor with strong dollar preferences. Any increase in its reserves is likely to lead to an increase in the relative demand for dollar assets and thus an appreciation of the dollar. Any diversification of its reserves is likely to lead to a depreciation of the dollar.

It is beyond the scope of this paper to construct and simulate a realistic multicountry portfolio model. But we can make some progress in thinking about mechanisms and magnitudes. The first step is to extend our model to allow for more countries.

Extending the Portfolio Model to Four Regions

In 2004 the U.S. trade deficit in goods (the only component of the current account for which a decomposition of the deficit by country is available) was \$665 billion. Of this, \$162 billion was with China, \$77 billion with Japan, \$85 billion with the euro area, and the remainder, \$341 billion, with the rest of the world. We ignore the rest of the world here and think of the world as composed of four countries or regions: the United States, Europe, Japan, and China (indexed 1 through 4, respectively). We shall therefore think of China as accounting for roughly half the U.S. current account deficit, and Europe and Japan as accounting each for roughly one-fourth.

We extend our portfolio model as follows. We assume that the share of asset j in the portfolio of country i is given by

$$\alpha_{ij}(\cdot) = a_{ij} + \Sigma_k \beta_{ijk} R_k^e,$$

where R_k^e is the expected gross real rate of return, in dollars, from holding assets of country k (so that R_k^e denotes a rate of return, not a relative rate of return as in our two-country model).

We assume further that $\beta_{ijk} = \beta_{jk}$, so that the effect of the return on asset k on demand for asset j is the same for all investors, independent of the country of origin. This implies that differences in portfolio preferences across countries show up only as different constant terms, and derivatives with respect to rates of return are the same across countries.

The following restrictions apply: From the budget constraint (the condition that the shares sum to 1, for any set of expected rates of return), it follows that $\Sigma_j a_{ij} = 1$ for all i, and $\Sigma_j \beta_{jk} = 0$ for all k. The home bias assumption takes the form $\Sigma_i a_{ii} > 1$. The demand functions are assumed to be homogeneous of degree zero in expected gross rates of return, so that $\Sigma_k \beta_{jk} = 0$ for all j.

Domestic interest rates, in domestic currency, are assumed to be constant and all equal to r. Exchange rates, E_k, are defined as the price of U.S. goods in terms of foreign goods (so that $E_1 = 1$, and an increase in E_2, for example, indicates an appreciation of the dollar against the euro—or, equivalently, a depreciation of the euro against the dollar). It follows that the expected gross real rate of return, in dollars, from holding assets of country k is given by $R_k^e = (1 + r)E_k/E_{k+1}$. In steady state $R_k^e = (1 + r)$, so that

$\Sigma_k \beta_{jk} R_k^e = 0$, and we can concentrate on the a_{ij} elements. The portfolio balance conditions, absent central bank intervention, are given by

$$\frac{X_j}{E_j} = \Sigma_i a_{ij} \left(\frac{X_i}{E_i} - F_i \right),$$

where F_i denotes the net foreign debt position of country i, so that $\Sigma_i F_i = 0$.

So far we have treated all four countries symmetrically. China, however, is special in two respects: it enforces strict capital controls, and it pegs the renminbi to the dollar. We capture these two features as follows:

—We formalize capital controls as the assumption that $a_{4i} = a_{i4} = 0$ for all $i \neq 4$; that is, capital controls prevent Chinese residents from investing in foreign assets but also prevent investors outside China from acquiring Chinese assets.[36]

—We assume that, to peg the renminbi-dollar exchange rate ($E_4 = 1$), the People's Bank of China passively acquires all dollars flowing into China: the wealth transfer from the United States to the euro area and Japan is thus the U.S. current account minus the fraction that is financed by the Chinese central bank: $\mathrm{d}F_2 + \mathrm{d}F_3 = -\mathrm{d}F_1 - \mathrm{d}F_4$.

Some Simple Computations

Consider now an increase in U.S. net debt equal to $\mathrm{d}F_1$. Assume that a share γ of the U.S. net debt is held by China. Assume that a fraction x of the remaining portion is held by the euro area and a fraction $(1 - x)$ by Japan, so that the changes in net debt are given by

$$\mathrm{d}F_2 = -x(1-\gamma)\mathrm{d}F_1,\ \mathrm{d}F_3 = -(1-x)(1-\gamma)\mathrm{d}F_1,\ \mathrm{d}F_4 = -\gamma \mathrm{d}F_1.$$

Assume further that China imposes capital controls and pegs the renminbi, that the other three economies are all the same size, and that the matrix of a_{ij} elements is symmetric in the following way: $a_{ii} = a$ and $a_{ij} = c = (1 - a)/2 < a$ for $i \neq j$.[37] In other words, investors want to put more than one-third

36. This ignores inflows of foreign direct investment into China, but since we are considering the financing of the U.S. current account deficit, this assumption is inconsequential for our analysis.

37. The assumption of countries of equal size allows us to specify the matrix in a simple and transparent way. Allowing countries to differ in size, as they obviously do, would lead to a more complex, size-adjusted matrix; but the results would be unaffected.

of their portfolio into domestic assets (the conditions above imply $a > 1/3$) and allocate the rest of their portfolio equally among foreign assets.

Under these assumptions, $dE_4 = 0$ (because of pegging), and dE_2 and dE_3 are given by

$$\frac{dE_2}{dF_1} = -\frac{(a-c)(1-\gamma)[x(1-a)+c(1-x)]}{(1-a)^2 - c^2} + \frac{c\gamma}{1-a-c}$$

$$\frac{dE_3}{dF_1} = -\frac{(a-c)(1-\gamma)[xc+(1-a)(1-x)]}{(1-a)^2 - c^2} + \frac{c\gamma}{1-a-c}.$$

Consider first the effects of γ, the share of U.S. net debt held by China:

—For $\gamma = 0$, dE_2/dF_1 and dE_3/dF_1 are both negative. Not surprisingly, an increase in U.S. net debt leads to a depreciation of the dollar against both the euro and the yen.

—As γ increases, the depreciation of the dollar against the euro and the yen becomes smaller. This, too, is not surprising. What may be more surprising, however, is that, for high values of γ, the depreciation turns into an appreciation. For $\gamma = 1$, for example, the dollar appreciates against both the euro and the yen. The explanation is straightforward and is found in portfolio preferences: The transfer of wealth from the United States to China is a transfer of wealth from U.S. investors, who are willing to hold dollar, euro, and yen assets, to the People's Bank of China, which holds only dollars. This transfer to an investor with extreme dollar preferences leads to a relative increase in the demand for dollars and hence an appreciation of the dollar against both the euro and the yen.

Consider now the effects of x, the share of the U.S. net debt held by Europe, excluding the net debt held by China (for simplicity, we set γ equal to zero):

—Consider first the case where $x = 0$, so that the accumulation of net debt is entirely vis-à-vis Japan. In this case, it follows that $dE_3/dF_1 = 2\, dE_2/dF_1$. Both the yen and the euro appreciate against the dollar, with the yen appreciating twice as much as the euro. This result might again be surprising: why should a transfer of wealth from the United States to Japan lead to a change in the relative demand for euros? The answer is that it does not. The euro appreciates against the dollar but depreciates against the yen. The real effective exchange rate of the euro remains unchanged.

—If $x = \frac{1}{2}$ (which seems to correspond roughly to the ratio of trade deficits and thus to the relative accumulation of U.S. net debt today), then obviously the euro and the yen appreciate in the same proportion against the dollar.

This simple framework also allows us to think about what would happen if China stopped pegging, or diversified its reserves away from dollars, or relaxed capital controls on Chinese and foreign investors, or any combination of these. Suppose China stopped pegging but maintained capital controls. Because the end of the peg, together with the assumption of maintained capital controls, implies a zero Chinese surplus, the renminbi would have to appreciate against the dollar. From then on, reserves of the Chinese central bank would remain constant. So, as the United States continued to accumulate net debt vis-à-vis Japan and Europe, relative net debt vis-à-vis China would decrease. In terms of our model, γ, the proportion of U.S. net debt held by China, would decrease.[38] Building on our results, this would lead to a decrease in the role of an investor with extreme dollar preferences, the People's Bank of China, and would lead to an appreciation of the euro and the yen.

Suppose instead that China diversified its reserves away from dollars. Then, again, the demand for euros and for yen would increase, leading to an appreciation of both currencies against the dollar.

To summarize: The trade deficits of the United States with Japan and the euro area imply an appreciation of both the yen and the euro against the dollar. For the time being, this effect is partly offset by the Chinese policies of pegging and keeping most of its reserves in dollars. If China were to give up its peg or to diversify its reserves, the euro and the yen would appreciate further against the dollar. This last argument is at odds with the often-heard statement that the Chinese peg has "increased the pressure on the euro-dollar exchange rate," and that therefore the abandonment of the peg would remove some of the pressure, leading to a depreciation of the euro against the dollar. We do not understand the logic behind that statement.

Two Simulations and a Look at Portfolios

We have looked so far at equilibrium for a given distribution of Fs. This distribution is endogenous, however, in our model, determined by

38. Marginal γ, the proportion of the increase in U.S. net debt absorbed by China, would equal zero.

trade deficits and portfolio preferences. We now report the results of two simulations of our extended model.

In the first simulation we keep the symmetric portfolio assumptions introduced above. We take the three economies to be of the same size, and we use the values for the portfolio parameters introduced above of 0.70 for a and 0.15 for c. We consider a shift in the U.S. trade deficit, with half of the change in the deficit falling on China, one-fourth on Japan, and one-fourth on the euro area. We assume that each country trades only with the United States, so that we can focus on the bilateral balances with the United States.

We perform this simulation under two alternative assumptions about Chinese policy. In both we assume capital controls, but in the first case we assume that China continues to peg the renminbi, and in the second we assume that the renminbi floats; together with the assumption of capital controls, this implies, as indicated above, a zero Chinese trade surplus.

The top panel of figure 9 presents the results. Because of symmetry, the responses of the euro and the yen are identical and thus represented by the same line. The lower line shows the depreciation of the dollar against the euro and the yen when the renminbi floats. The higher locus shows the more limited depreciation of the dollar (and more limited appreciation of the euro and the yen) when the renminbi is pegged and the Chinese central bank accumulates dollars.

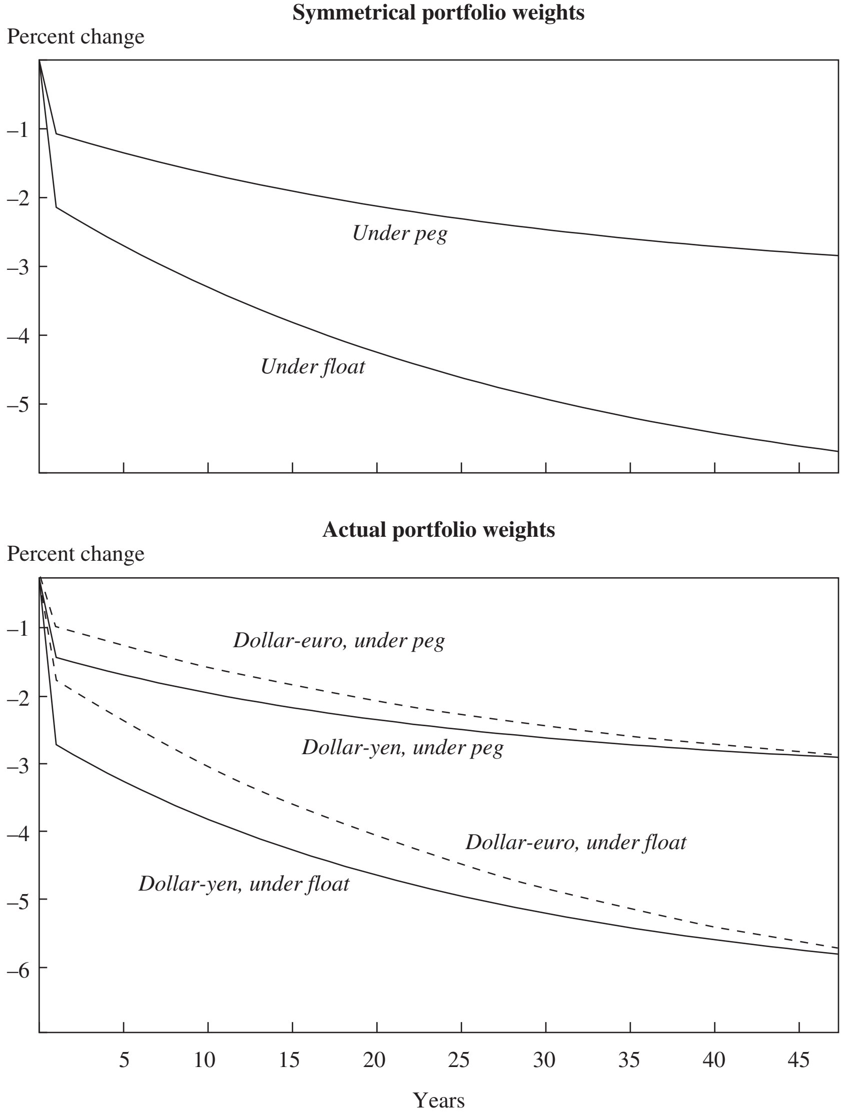
One may wonder whether the preferences of private investors are really symmetric, however. Constructing portfolio shares for Japanese, European, and U.S. investors requires rather heroic assumptions. We have nevertheless given it a try, and the results are reported in table 1. Appendix B presents details of the construction.

Note in table 1 the much larger share of dollar assets in European than in Japanese portfolios. Note also the small share of Japanese assets held by euro-area investors relative to the share of euro-area assets held by Japanese investors (the difference is much larger than the difference in relative size of the two economies). Portfolio preferences appear indeed to be asymmetric.

To show what difference this asymmetry makes, the bottom panel of figure 9 presents results of a second simulation. This simulation is identical to that in the top panel but now takes into account the relative size of the three economies (the Xs) and uses the shares reported in table 1.

The main conclusion we draw from the bottom panel is that it looks very similar to the top, except that the dollar depreciates initially a bit

Figure 9. Effects of a Shift in the U.S. Trade Deficit on Euro-Dollar and Yen-Dollar Exchange Rates, with and without Chinese Peg[a]



Source: Authors' calculations.

a. All simulations assume that China maintains capital controls.

Table 1. Calculated Portfolio Shares by Investment Destination[a]

	Investing country		
Destination	*United States*	*Euro area*	*Japan*
United States	0.77	0.42	0.22
Euro area	0.15	0.53	0.15
Japan	0.08	0.05	0.63

Source: Authors' calculations using data in appendix table B-1.
a. Investment includes both portfolio investment and foreign direct investment.

more against the yen than against the euro. This difference is due to the larger share of dollar assets in European than in Japanese portfolios: a dollar transferred from the United States to Europe leads to a smaller decrease in the demand for U.S. assets than does a dollar transferred from the United States to Japan.

Summary and Conclusions

We have argued that there have been two main forces behind the large U.S. current account deficits of the past ten years: an increase in the U.S. demand for foreign goods, and an increase in the foreign demand for U.S. assets. The path of the dollar since the late 1990s can be explained as the reaction to these forces.

The shift in portfolio preferences toward U.S. assets manifested itself first, in the late 1990s, in the form of high private demand for U.S. equities, and more recently in the form of high central bank demand for U.S. bonds. The shift in demand away from U.S. goods is often attributed to more rapid growth in the United States than in its trading partners. This appears, however, to have played only a limited role: the performance of import and export equations in macroeconometric models shows that activity variables and exchange rates explain only about 60 percent of the increase in the U.S. trade deficit, with unexplained time trends and residuals accounting for the rest. We interpret this as evidence of a shift in the U.S. trade balance relation.

Either shift could have induced the observed paths of the dollar and the U.S. current account only in a world where financial assets are imperfect substitutes. A shift in asset preferences could not account for these paths, because it would be meaningless in a world where assets are perfect substitutes. Nor can the shift in preferences for goods explain these paths, because with perfect substitutability such a shift—provided it were perceived as long lasting—would have induced a quicker and sharper depreciation of the exchange rate and a smaller increase in the current account than we have observed.

As a way of organizing our thoughts about the U.S. current account deficit and the dollar, we have studied a simple model characterized by imperfect substitutability both among goods and among assets. The model allows for valuation effects, whose relevance has recently been emphasized in a number of papers. The explicit integration of valuation effects in a model of imperfect substitutability is, we believe, novel.

We find that the degree of substitutability between assets does not affect the steady state. In other words, the eventual dollar depreciation induced by either shift is the same no matter how closely U.S. and foreign assets substitute for each other. But the degree of substitutability does play a central role in the dynamics of adjustment.

In contrast to the case of perfect substitutability between assets, an increase in U.S. demand for foreign goods leads to a limited depreciation initially, a potentially large and long-lasting current account deficit, and a slow and steady depreciation over time. An increase in foreign demand for U.S. assets leads to an initial appreciation, followed by a slow and steady depreciation.

The slow rate of dollar depreciation implied by imperfect substitutability contrasts with predictions by others of much more abrupt falls in the dollar in the near future. We show that, in the absence of anticipated portfolio shifts, the anticipated rate of depreciation depends on the change in the ratio of U.S. net debt to U.S. assets: the faster the increase in net debt, the faster the decrease in the relative demand for U.S. assets, and therefore the higher the rate of depreciation needed to maintain portfolio balance. If we take the annual increase in the ratio of net debt to U.S. GDP to be 5 percent, we derive an upper bound on the anticipated annual rate of depreciation of 2.7 percent a year.

If, however, shares in U.S. assets in the portfolios of either U.S. or foreign investors are expected to decline, the anticipated depreciation can be much larger. If, for example, we anticipate that central banks will diversify their reserves away from dollars and, as a result, that the share of U.S. assets in foreign portfolios will decline by 2 percent over the coming year, then the anticipated depreciation may be as large as 8.7 percent. This is obviously an upper bound on the size of the depreciation, derived by assuming that private investors are willing to keep a constant share of their wealth in U.S. assets despite a high expected negative rate of return between now and then. (If, in anticipation of this high negative rate of return, private investors decide to decrease their share of dollar assets, then some of the depreciation will take place now, rather than at the time of the shift in composition of reserves, and so the anticipated depreciation will be smaller.)

On the other hand, a further shift in investors' preferences *toward* dollar assets would slow down, or even reverse, the path of dollar depreciation. The relief, however, would only be temporary. It would lead to an initial appreciation, but the accompanying loss of competitiveness would speed up the accumulation of foreign debt. The long-run value of the dollar would be even lower. The argument that the United States, thanks to the attractiveness of its assets, can keep running large current account deficits with no effect on the dollar appears to overlook the long-run consequences of a large accumulation of external liabilities.

For basically the same reason, an increase in interest rates would be self-defeating. It might temporarily strengthen the dollar, but the depreciation eventually needed to restore equilibrium in the current account would be even larger—because (as in the case of a shift in portfolio preferences) the accumulation of foreign liabilities would accelerate, and eventually the United States would need to finance a larger flow of interest payments abroad. A better mix would be a decrease in interest rates and a reduction in budget deficits to avoid overheating. (To state the obvious: tighter fiscal policy is needed to reduce the current account deficit, but it is not a substitute for the dollar depreciation. Both are needed.)

The same will happen so long as China keeps pegging the exchange rate. One should think of the People's Bank of China as a special investor whose presence has the effect of raising the portfolio share of the world outside the United States invested in dollar assets. The longer the Chinese central bank intervenes, the larger this share. Sooner or later, however—as in the case of Korea in the late 1980s—the People's Bank of China will find it increasingly difficult to sterilize the accumulation of reserves. Eventually, when the peg is abandoned, the depreciation of the dollar will be larger, the longer the peg will have lasted, because in the process the United States will have accumulated larger quantities of foreign liabilities. Thus, if China is worried about a loss of competitiveness, pegging may be a myopic choice.

What would abandonment of the Chinese peg imply for the euro and the yen? Contrary to a commonly heard argument, if the renminbi were allowed to float, both currencies would be likely to appreciate further against the dollar. The reason is that, when the People's Bank of China stops intervening, the market effectively loses an investor with extreme dollar preferences, to be replaced by private investors with less extreme preferences. A similar argument holds if the People's Bank of China diversifies its reserves away from dollar assets. For Europe and Japan, however, what matter are effective exchange rates, and their currencies may well depreciate in effective terms even if they appreciate relative to the dollar in bilateral terms.

We end with one more general remark. A large fall in the dollar would not by itself be a catastrophe for the United States. It would lead to higher demand for U.S. goods and higher output, and it would offer the opportunity to reduce budget deficits without triggering a recession. The danger is more serious for Japan and Europe, which suffer from slow growth already and have little room to use expansionary fiscal or monetary policy at this stage.

APPENDIX A

Dynamics of the Model

THE DYNAMICS OF the system composed of equations 2 and 3 are more easily characterized by taking the continuous time limit. In continuous time the portfolio and current account balance equations become, respectively,

$$X = \alpha\left(1+r-r^*+\frac{\dot{E}^e}{E},s\right)(X-F)+\left(1-\alpha^*\left(1+r-r^*+\frac{\dot{E}^e}{E},s\right)\right)\left(\frac{X^*}{E}+F\right).$$

$$\dot{F} = rF+\left(1-\alpha\left(1+r-r^*+\frac{\dot{E}^e}{E},s\right)\right)\frac{\dot{E}^e}{E}(X-F)+D(E,z).$$

Note the presence of both expected and actual appreciation in the current account balance equation. Expected appreciation determines the share of the U.S. portfolio invested in foreign assets; actual appreciation determines the change in the value of that portfolio, and in turn the change in the U.S. net debt position.

We limit ourselves to a characterization of the equilibrium and local dynamics, using a phase diagram. (The global dynamics are more complex. The nonlinearities imbedded in the equations imply that the economy is likely to have two equilibriums, only one of which is potentially saddle-point stable. This is the equilibrium we focus on.) We do so here under the additional assumption that $r = r^*$. The extension to differences in interest rates, which we used to construct figure 8, is straightforward.

The locus ($\dot{E} = \dot{E}^e = 0$) is obtained from the portfolio balance equation and is downward sloping. In the presence of home bias, an increase in net debt shifts wealth abroad, decreasing the demand for U.S. assets and requiring a depreciation.

The locus ($\dot{F} = 0$) is obtained by assuming ($\dot{E}^e = \dot{E}$) in the current account balance equation and replacing ($\dot{E}^e$) with its implied value from the portfolio balance equation. This locus is also downward sloping: a depreciation leads to a smaller trade deficit and thus allows for a larger net debt position consistent with current account balance.

Note that the locus ($\dot{F} = 0$) is not the same as the current account balance locus in figure 1; that locus is derived under the assumption that both $\dot{F}$ and $\dot{E}$ are zero. Using that locus makes for a simple graphical characterization of the equilibrium but is not appropriate for studying stability or dynamics.

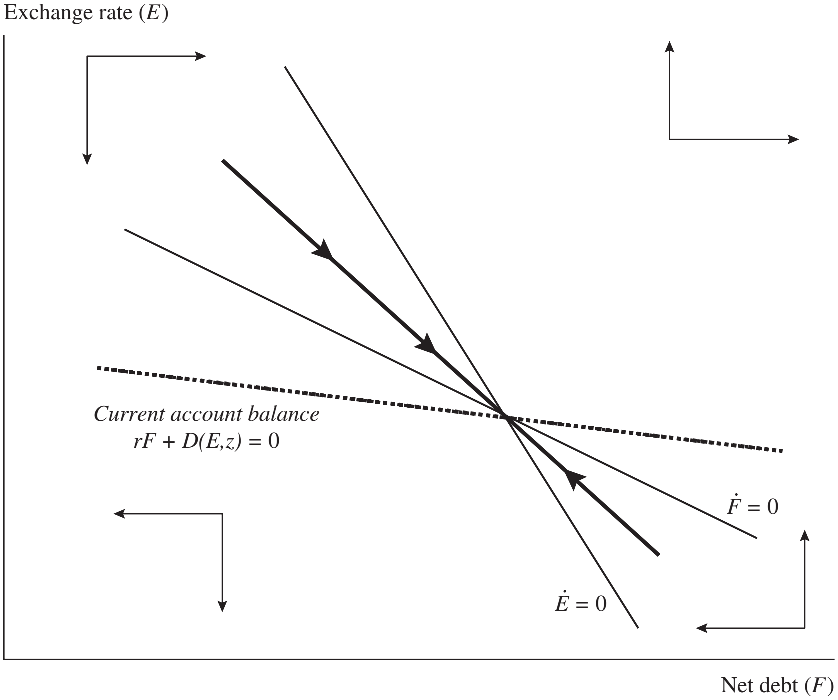
The derivatives α_R and α^*_R do not affect the slope of the locus ($\dot{E} = 0$) but do affect that of the locus ($\dot{F} = 0$). The smaller these derivatives are (that is, the lower the degree of substitutability between assets), the closer the locus ($\dot{F} = 0$) is to the locus ($\dot{E} = 0$). In the limit, if the degree of substitutability between U.S. and foreign assets is zero, the two loci coincide. The larger these derivatives are (that is, the higher the degree of substitutability between assets), the closer the ($\dot{F} = 0$) locus is to the current account balance locus, $0 = rF + D(E,z)$.

The condition for the equilibrium to be saddle-point stable is that the locus ($\dot{E} = 0$) be steeper than the locus ($\dot{F} = 0$); this turns out to be the same as the condition given in the text, that the portfolio balance locus be steeper than the current account balance locus. For this to hold, the following condition must be satisfied:

$$\frac{r}{ED_E} < \frac{\alpha + \alpha^* - 1}{(1 - \alpha^*) X^*/E}.$$

The interpretation of this condition was given in the text. It is more likely to be satisfied the lower the interest rate, the larger the home bias, and the larger the response of the trade balance to the exchange rate. If the condition is satisfied, the dynamics are as shown in figure A-1. The saddle path is downward sloping, implying that the adjustment to the steady state

Figure A-1. Adjustment of Exchange Rate and Net Debt in Continuous Time



Source: Authors' model described in the text.

from below (in terms of F) is associated with an expected depreciation, and the adjustment from above with an expected appreciation. Valuation effects imply that unexpected shifts in z or s are associated with initial changes in F, according to

$$\Delta F = (1-\alpha)(1+r^*)(X-F)\frac{\Delta E}{E}.$$

The effect of the degree of substitutability on the dynamics is as follows. The smaller are α_R and α_R^*, the closer the locus ($\dot{F}=0$) is to the locus ($\dot{E}=0$), and so the closer the saddle-point path is to the locus ($\dot{E}=0$). In the limit, if the degree of substitutability between U.S. and foreign assets is zero, the two loci and the saddle-point path coincide, and the economy remains on and adjusts along the ($\dot{E}=0$) locus, the portfolio balance relation.

The larger α_R and α_R^*, the closer the ($\dot{F} = 0$) locus is to the locus given by $0 = rF + D(E,z)$, and the closer the saddle-point path is to that locus as well. Also, the larger are α_R and α_R^*, the slower is the adjustment of F and E over time. The slow adjustment of F comes from the fact that the current account is close to balance. The slow adjustment of E comes from the fact that, the larger the elasticities, the smaller is $\dot{E}$ for a given distance from the $\dot{E} = 0$ locus.

The limiting case of perfect substitutability is degenerate. The rate of adjustment to an unexpected, permanent shift in z goes to zero. The economy is then always on the locus $0 = rF + D(E,z)$. For any level of net debt, the exchange rate adjusts so that net debt remains constant, and, in the absence of shocks, the economy stays at that point. There is no unique steady state, and where the economy is depends on history.

APPENDIX B

Construction of Portfolio Shares

DATA ON THE country allocation of gross portfolio investment are from the International Monetary Fund's Coordinated Portfolio Survey for 2002. Data for the country allocation of direct investment are from the Organization for Economic Cooperation and Development and likewise refer to 2002. Financial wealth for the United States, the euro area, and Japan, which we need to compute the home bias of portfolios, are from official flow of funds data.[39]

From these data we construct the a_{ij} elements in two steps. First, we compute the geographical allocation of net foreign investment positions by weighting the shares of portfolio assets and foreign direct investment allocated to country j by the relative importance of portfolio (pf) and direct investment (fdi) in country i's total investment abroad. We then scale these shares by the share of total foreign investment $(1 - a_{ii})$, so that

$$a_{ij} = \{[pf_i/(pf_i + fdi_i)]a_{ij,p} + [fdi_i/(pf_i + fdi_i)]a_{ij,fdi}\} \times (1 - a_{ii}).$$

Table B-1 presents the results.

39. For the United States, see footnote 8. The source for Japan is the Bank of Japan flow of funds data (www.boj.or.jp/en/stat/sj/stat_f.htm), and that for the euro area is the *ECB Economic Bulletin* (released February, 2005 and available at www.ecb.int/pub/html/index.en.html).

Table B-1. Calculated Portfolio Shares by Investment Destination[a]

	Investing country		
Destination	*United States*	*Euro area*	*Japan*
United States	0.77	0.19	0.17
Euro area	0.08	0.53	0.12
Japan	0.04	0.02	0.63
Rest of the world	0.11	0.27	0.08

Sources: Authors' calculations using data from the International Monetary Fund, the Organization for Economic Cooperation and Development, and national central banks.

a. Investment includes both portfolio investment and foreign direct investment. Shares may not sum to 1.00 because of rounding.

To perform the simulation described in the text, we then allocate the shares invested in the "rest of the world" to foreign holdings so as to keep the relative shares in the remaining foreign assets the same. For the United States, for example, we increase the foreign shares in euro and yen assets to approximately 0.15 and 0.08, respectively. This gives us the numbers reported in table 1.

The simulation presented in figure 9 uses these values, together with asset levels of $36.8 trillion for the United States, $23.0 trillion for the euro area, and $8.0 trillion for Japan. Trade is assumed to be bilateral between the United States and each of the other regions, with elasticities of the trade balance all being equal to the elasticity used in our earlier two-country model.

Comments and Discussion

Ben S. Bernanke: Olivier Blanchard, Francesco Giavazzi, and Filipa Sa have produced a gem of a paper. They introduce a disarmingly simple model, which nevertheless provides a number of crucial insights about the joint dynamics of the current account and the exchange rate, in both the short and the long run. Their analysis will undoubtedly become a staple of graduate textbooks.

The authors' model has two features that deserve special emphasis. First, following an older and unjustly neglected literature, the model dispenses with the usual interest rate parity condition in favor of the assumption that financial assets may be imperfect substitutes in investors' portfolios; that is, the model allows for the possibility that the demand for an asset may depend on features other than its rate of return, such as its liquidity or its usability as a component of international reserves. In focusing on imperfect asset substitutability and its implications, the authors identify an issue that has taken on great practical significance for policymakers in recent years. At least two contemporary policy debates turn in large part on the extent (or the existence) of imperfect asset substitutability. One is whether so-called nonstandard monetary policies—such as large purchases of government bonds or other assets by central banks—can stimulate the economy even when the policy interest rate has hit the zero lower bound. The other is whether sterilized foreign exchange interventions, like those recently undertaken on a massive scale by Japan and China, can persistently alter exchange rates and interest rates.[1] The authors' analysis explores yet another important implication of imperfect substitutability: that, if assets denominated in different currencies are imperfect substitutes, then agents may rationally anticipate the sustained depreciation of a currency even in the absence

1. Bernanke, Reinhart, and Sack (2004) present empirical evidence relevant to both of these debates.

of cross-currency interest rate differentials. Thus, by invoking imperfect substitutability, the authors are able to show that expected dollar depreciation is not necessarily inconsistent with the currently low level of U.S. long-term nominal interest rates and the evident willingness of foreigners to hold large quantities of U.S. assets.

The assumption that financial assets of varying characteristics are imperfectly substitutable in investor portfolios seems quite reasonable. (Almost as I write these words, an announcement by the U.S. Treasury that it is contemplating the reinstatement of the thirty-year bond seems to have triggered a jump in long-term bond yields, suggestive of a supply effect on returns.) However, both the theoretical and the empirical literatures on asset substitutability are exceedingly thin, which is a problem for assessing the quantitative implications of the authors' analysis. In particular, as they themselves note, in their model the speed of adjustment of the exchange rate and the current account depends importantly on the elasticities of foreign and domestic asset demands with respect to expected return differentials, numbers that are difficult to pin down with any confidence. Further complications arise if, as is plausibly the case, the degree of asset substitutability is not a constant but varies over time or across investors. For example, if private investors view assets denominated in different currencies as more substitutable than central banks do, which seems likely, then changes in the share of assets held by each type of investor will have implications for exchange rate dynamics. Finding satisfying microfoundations for the phenomenon of imperfect asset substitutability, and obtaining persuasive estimates of the degree of substitutability among various assets and for different types of investors, should be high on the profession's research agenda.

The second feature of the authors' analysis worth special note is its attention to the long-run steady state. By integrating short-run and long-run analyses, the authors obtain some useful insights that a purely short-run approach does not deliver. Notably, they demonstrate that factors affecting the value of the dollar or the size of the U.S. current account deficit may have opposite effects in the short and in the long run. For example, an increased appetite for dollars on the part of foreign central banks is typically perceived by market participants as positive for the dollar in the short run, and the model supports this intuition. However, the authors show that, because the short-term appreciation of the dollar may delay necessary adjustment, in the long run the result of an increased preference for dollars may be more rather than less dollar depreciation. Thus developments that are "good news" for the currency in the short run may be "bad news" at a longer horizon.

One point that I take from the paper's analysis, however, is that the particular assumptions one makes about the nature of the steady state may significantly affect one's predictions about short-run dynamics and the speed of adjustment. For example, the authors assume in most of their analysis that, in the long run, the U.S. current account must return to balance. One might reasonably assume instead that, in the long run, the current account will remain in deficit at levels consistent with long-run stability in the ratio of external debt to GDP. This apparently innocuous change in the steady-state assumption may have quantitatively important implications for the medium-term pace of adjustment. In particular, to the extent that foreigners are willing to accept a long-run U.S. debt-to-GDP ratio that is somewhat higher than the current level of about 25 percent, the authors' model predicts that the period of current account adjustment could be extended for a number of years. Because we know little about the quantity of U.S. assets that foreigners may be willing to hold in the long run, the model suggests that one cannot forecast the speed of the adjustment process with any confidence.

Although the authors' model is extraordinarily useful, like any simple model it leaves out important factors. From my perspective, the model's most important omissions are related to its treatment of asset values and interest rates. Except for the exchange rate itself, the model takes asset values and interest rates as exogenous, thereby excluding what surely must be an important source of current account dynamics, namely, the endogenous evolution of wealth and expected returns. For example, I doubt that the recent decline in U.S. household saving, a major factor (arithmetically at least) in the rise in the U.S. current account deficit, can reasonably be treated as exogenous, as is done in the paper. Instead, at least some part of the decline in saving likely reflects the substantial capital gains that U.S. households have enjoyed in the stock market (until 2000, and to some extent since 2003) and in the values of their homes. Capital gains have allowed Americans to feel wealthier without saving out of current income.

Where did these capital gains come from? In my view an important driver of the rise in U.S. wealth is the rapid increase over the past decade or so in the global supply of saving, which in turn is the product of both the strong motivation to save on the part of other aging industrial societies and a reluctance of emerging economies to import capital since the financial crises of the 1990s. Increased global saving has produced a striking decline in real interest rates around the world, a decline that has contributed to the increased valuation of stocks, housing, land, and other assets.[2] Because of its openness to foreign capital, its financial sophistication, and its relatively strong economic performance, the United States has absorbed the lion's share of this increment to global saving; however, other industrial countries (including France, Italy, Spain, and the United Kingdom) have also experienced increased asset values (house prices, for the most part), increased consumption, and corresponding movements in their current account balances toward deficit. An implication of this story is that an endogenous moderation of the U.S. current account deficit may be in store, even without major changes in exchange rates and interest rates, as a diminishing pace of capital gains slows U.S. consumption growth.[3] This story, or any explanation that relies heavily on endogenous changes in asset prices and the ensuing wealth and spending dynamics, cannot be fully captured by the current version of the authors' model.

How might endogenous wealth dynamics change the authors' conclusions? One way of developing an intuition about the effects of wealth dynamics in the context of their model is to use that model to consider the implications for the current account and the dollar of an exogenous change in the value of U.S. assets, *X*. Although this approach yields at best a simple approximation of the effect of making wealth endogenous, examining model outcomes when one drops the authors' assumption of unchanging wealth should provide some insight.

To carry out this exercise, I write the key equations of the model as follows:

$$(1) \qquad F_{+1} = [1 - \alpha^*(R,s)]\left(\frac{X^*}{E} + F\right)(1+r) - \frac{[1 - \alpha(R,s)(X - F)]}{R_{\text{realized}}}(1+r) + D(E, X - F)$$

where $R = \dfrac{(1+r)E^e_{+1}}{(1+r^*)E}$ and $R_{\text{realized}} = \dfrac{(1+r)E_{+1}}{(1+r^*)E}$

2. Bernanke (2005).

3. Recent experience in the United Kingdom shows that a stabilization of house prices after a period of rapid increases may damp consumer spending and increase saving rates.

$$(2) \qquad X = [\alpha(R,s)](X - F) + [1 - \alpha^*(R,s)]\left(\frac{X^*}{E} + F\right).$$

I use the authors' notation, except that I find it useful to distinguish between the anticipated relative return on U.S. assets, R, and the realized relative return on U.S. assets, R_{realized}. I also suppress the shock terms z and s, which I will not use here.

Equation 1 is the current account equation, which describes the evolution of U.S. net foreign debt, F. The first term on the right-hand side of equation 1 captures the idea that, all else equal, foreign debt grows at the U.S. real rate of interest. The second term, which I have chosen to write in a slightly different form than the authors do, is the valuation effect associated with unanticipated changes in the exchange rate. In particular, when the value of the dollar is less than expected, $R_{\text{realized}} < R$, and the dollar value of U.S. gross foreign assets rises. This valuation effect serves to reduce U.S. net dollar liabilities. The third term in equation 1 is the trade deficit, which adds directly to net foreign liabilities. I extend the authors' model here by including U.S. domestic wealth, $X - F$, as a determinant of the trade deficit. I assume that the derivative of the trade deficit with respect to U.S. wealth is positive; higher wealth induces U.S. households to spend more, increasing the trade deficit.

Equation 2, the portfolio balance equation, is the same as in the paper. This equation requires that the supply of U.S. assets X equal the sum of U.S. and foreign demands for those assets.

The steady-state equations corresponding to equations 1 and 2 are

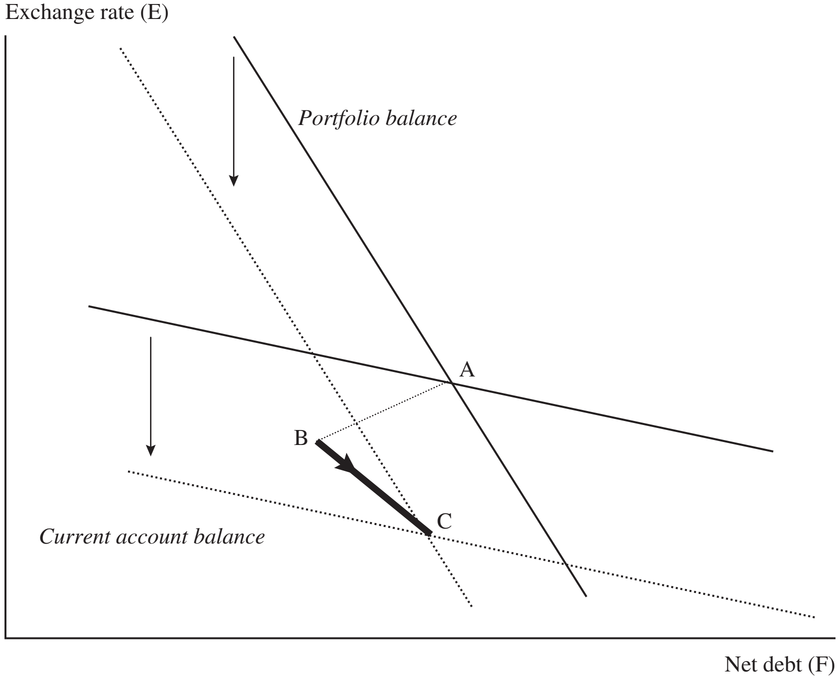
$$(3) \qquad rF = -D(E, X - F)$$

$$(4) \qquad X = [\alpha(1,s)](X - F) + [1 - \alpha^*(1,s)](X^*/E + F).$$

Equation 3 is the steady-state version of the current account equation, modified to allow U.S. wealth to affect the trade balance. Here I retain the authors' assumption that the current account must be in balance in the long run (as opposed to assuming a constant ratio of external debt to GDP in the long run). Equation 4 is the steady-state version of the portfolio balance, exactly as in the paper. Like the authors, I assume that the foreign real interest rate equals the domestic rate, so that $R = R_{\text{realized}} = 1$ in the steady state.

My figure 1, which is analogous to the figures in the paper, graphs the steady-state equations 3 and 4. Because foreign debt F is included as a

Figure 1. Adjustment of the Exchange Rate and the Net Debt Position to an Increase in U.S. Assets



Source: Authors' model described in the text.

determinant of the trade deficit (more foreign debt reduces U.S. wealth and thus the trade deficit), the current account line in my figure is flatter than its analogue in the authors' model, all else equal; under reasonable assumptions, however, it is still downward sloping. The portfolio balance line is the same as in the authors' analysis.

Consider now the effects of an exogenous increase in *X*. A first issue is whether this increase is expected to be temporary or permanent. If consumers have a target wealth-to-income ratio, which is not an unreasonable supposition, the increase in *X* might be thought of as largely transitory. In this case it is straightforward to show that the steady state will be unaffected by the increase in U.S. assets, so that the current account and the exchange rate will return to their original values in the long run; that is, although it would imply a short-run depreciation, a temporary increase in the value of U.S. assets would have no lasting effect on the dollar or the U.S. net international position. Since this case, although possibly relevant, is not very interesting, I consider instead the case in which the increase in the value of U.S. assets is expected to be permanent.

Figure 1 shows the graphical analysis of a permanent increase in U.S. assets. I assume that the economy is initially in the steady state defined by point *A*. Inspection of equation 3 shows that an increase in *X* shifts the current account line down, as greater U.S. wealth worsens the steady-state trade balance at any given exchange rate. Conceptually, this downward shift is analogous to the effect of an exogenous increase in the U.S. demand for foreign goods, as analyzed by the authors. Absent any change in the portfolio balance condition, this shift would imply both dollar depreciation and increased foreign debt in the long run, exactly as in the paper's analysis of an exogenous shift in demand.

However, the portfolio balance line is not unchanged in my scenario but instead is shifted downward by the increase in *X,* as foreigners are willing to hold their share of the increase in U.S. assets only if the dollar depreciates. (The depreciation implies an unanticipated reduction in the dollar share of foreigners' portfolios, for which they are assumed to compensate by buying additional dollar assets.) With the shifts in both the current account and the portfolio balance relations taken into account, the new steady-state position is shown as point *C* in figure 1. As indicated, and under plausible assumptions, the economy adjusts by jumping immediately from point A to point *B*, as the dollar depreciates and U.S. net foreign debt declines. Over time the economy moves from point *B* to point *C*, as the dollar depreciates further and foreign debt accumulates.

A key point is that, all else equal, the steady-state outcome described by point *C* involves less dollar depreciation and less accumulation of foreign debt than the scenario (analyzed by the authors) in which U.S. demand for foreign goods increases exogenously (that is, a scenario in which only the current account line shifts down). Economically, the unexpected depreciation induced by the requirement of portfolio balance assists the U.S. current account adjustment process in two ways: First, the depreciation reduces the initial dollar value of U.S. net foreign debt directly, by means of the valuation effect. Second, the early depreciation of the dollar associated with the portfolio balance requirement mitigates the trade impact of the rise in wealth. Note also that U.S. domestic wealth (that is, net of foreign liabilities) is very likely to be higher in the long run than initially, reflecting the capital gains enjoyed at the beginning of the process. This analysis is overly simple, as already noted, but it suggests to me that inclusion of endogenous wealth dynamics might give different and possibly less worrisome predictions about U.S. current account adjustment than those presented in the paper.

My final observations bear on the authors' analysis of the case with more than two currencies. I found this part of the paper quite enlightening, particularly the discussion of the likely effects of a revaluation of the Chinese currency on the value of the euro. One occasionally hears the view expressed that yuan revaluation would "take the pressure off" the euro (that is, allow it to depreciate); the underlying intuition appears to be that the effective dollar exchange rate must fall by a certain amount, and so, if it cannot fall against the yuan, it will fall against the euro. The authors show that this intuition is likely misguided, in that a stronger yuan probably implies a stronger euro as well. Their argument can be understood either in terms of portfolio balance or in terms of trade balance. From a portfolio perspective, a yuan revaluation presumably would shift Chinese demand away from dollar assets and toward euro assets, strengthening the exchange value of the euro. From a trade perspective, if Chinese goods become more expensive for Americans, U.S. demand may shift toward euro-zone goods, again implying euro appreciation.

I see much merit in this analysis but would note that these results may not generalize to cases with many countries and variable patterns of substitution and complementarity among goods and among currencies. To illustrate, suppose that Chinese goods and European goods are viewed as complements by potential buyers in other nations. Then, in the same way that a rise in the price of teacups lowers the price of saucers, a Chinese revaluation might reduce the global demand for European exports to an extent sufficient to cause the euro to depreciate. This example is probably not realistic (others could be given), but it shows that drawing general conclusions about how changes in the value of one currency affect that of another may be difficult.

Even if a revaluation of the yuan did lead to an appreciation of the euro, however, one should not conclude that yuan revaluation is against the European interest. A yuan revaluation might well lead to both an increase in the demand for European exports (as U.S. demand is diverted from China) and a reduction in European interest rates (reflecting increased Chinese demand for euro assets). Yuan revaluation might therefore stimulate the European economy even though the euro appreciates.

Hélène Rey: Olivier Blanchard, Francesco Giavazzi, and Filipa Sa have given us a very clear and elegant framework within which to discuss some complex and important questions. The U.S. current account deficit has been at the center of the economic policy debate for some time. The deficit stood at more than 6 percent of GDP in 2004, and in dollar terms it has reached historically unprecedented levels.

A country can eliminate an external imbalance either by running trade surpluses, or by earning favorable returns on its net foreign asset portfolio, or both. The first of these, the *trade channel* of adjustment, has been traditionally emphasized in studies of current account sustainability. The *valuation channel* has received attention only lately, but with the recent upsurge in cross-border asset holdings, its quantitative significance has greatly increased. When the securities in which external assets and liabilities are held are imperfectly substitutable, any change in asset prices and, in particular, any change in the exchange rate create international wealth transfers, which can be sizable. These transfers significantly alter the dynamics of net foreign assets.

The following example illustrates the power of the valuation channel to smooth the U.S. adjustment process. Following Cédric Tille,[1] assume that U.S. external liabilities, which amounted to about $10.5 trillion in December 2003, are all denominated in dollars, whereas 70 percent of the $7.9 trillion in U.S. external assets are in foreign currency. Then a mere 10 percent depreciation of the dollar, by increasing the dollar value of the foreign-currency assets while leaving the dollar value of the liabilities constant, would create a wealth transfer from the rest of the world to the United States equal to $0.1 \times 0.7 \times 7$ trillion, or about $553 billion, which is approximately 5 percent of U.S. GDP and on the order of the U.S. current account deficit in 2003. The exchange rate thus has a dual stabilizing role for the United States. A dollar depreciation helps improve the trade balance *and* increases the net foreign asset position, and this has to be taken into account when assessing the prospects of the U.S. external deficit and the future path of the dollar.

The authors have set out to do just that. They use a portfolio balance model (drawing on the work of Pentti Kouri, Stanley Black, Dale Henderson and Kenneth Rogoff, and William Branson in the 1980s) to model jointly the dynamics of the current account and of the exchange rate, allowing for

1. Tille (2003).

imperfect substitutability between assets and for (some) valuation effects. In such a framework, a negative shock to preferences for U.S. goods, say, leads immediately to a depreciation of the dollar. This immediate, unexpected depreciation does not, however, fully offset the shock. If it did, there would be excess demand for U.S. assets, as the supply of those assets is taken to be fixed and the dollar value of the rest of the world's wealth rises. Instead there is a less than fully offsetting drop in the dollar, and foreigners' demand for U.S. assets is kept in check by a further, *expected depreciation* of the dollar toward its long-run steady-state value. Along the path of this depreciation, the United States accumulates more debt, so that the long-run level of the dollar will be below that which would have been needed to offset the entire negative shock immediately. The dollar is expected to depreciate at a decelerating rate in order for foreigners to keep accumulating U.S. assets. A remarkable prediction thus emerges from this simple model: foreigners continue to purchase U.S. assets and finance the U.S. current account deficit even though they expect a further dollar depreciation, which implies capital losses on their portfolio.

This result stems entirely from the imperfect degree of substitutability between U.S. and foreign assets. If assets were perfect substitutes, the exchange rate would jump immediately to the steady-state level that would be compatible with the change in preferences for goods. Pierre-Olivier Gourinchas and I present strong evidence that assets are imperfect substitutes.[2] We find that current external imbalances have substantial predictive power on net asset portfolio returns and, in particular, on exchange rates. Using a newly constructed database on U.S. external imbalances since 1952, we show that negative external imbalances imply future expected depreciations of the dollar. We find that a 1-standard-deviation increase in the imbalance leads to an expected annualized depreciation of around 4 percent over the next quarter. These empirical results are fully supportive of the portfolio balance approach and of Blanchard, Giavazzi, and Sa's model. We also find, however, that the trade channel of adjustment kicks in at longer horizons, so that the valuation effects operate in the short to medium run whereas the trade balance effects operate in the longer run. In the authors' model, in contrast, valuation and trade channels operate contemporaneously. There is no lag in the adjustment dynamics of the trade flows. If there were, the dynamics of the debt accumulation would be different. But I think

2. Gourinchas and Rey (2005).

it is reasonable to conjecture that this would not change any of the qualitative results of the paper.

A more important point is that the authors model rates of return using (exogenous) interest rates only. In reality, U.S. assets and liabilities include both equity and debt and indeed have a very asymmetric composition. The external assets of the United States consist mainly of foreign direct investment and equities, whereas U.S. external liabilities contain a larger share of bank loans and other debt. As a consequence, the returns on U.S. external assets and liabilities differ substantially. The United States, as the world's banker, has traditionally enjoyed higher returns on its assets, which are dominated by long-term risky investments, than it has had to pay on its mostly liquid liabilities. (This explains in part why the income on U.S. net foreign assets is still positive even though the United States' liabilities exceed its assets by about 30 percent.) Hence the net foreign asset dynamic is highly dependent on differences in relative returns on portfolio equity, FDI, and so forth, and is mischaracterized if one considers only the risk-free interest rate.

The authors' framework also ignores the joint determination of exchange rates, bond prices, and equity returns on asset markets. A more complete model would feature endogenous valuation effects on the stock of assets and liabilities, both in the current account equation and in the portfolio balance equation. This also means that the steady-state condition of the authors' model, which equates the interest to be paid on the U.S. net foreign debt to the trade balance, may be significantly altered when one takes into account the composition of the net debt. If it is dominated by contingent claims such as equities, the equilibrium steady-state exchange rate necessary to generate the required trade balance may differ considerably from what their model assumes. The exogeneity of the rate of return (the interest rate) is a clear limitation. In principle, the interest rate should be determined by the reaction of the Federal Reserve and by endogenous changes in world supply and demand for capital. Proponents of the "global savings glut" theory see no mystery in persistently low long-term U.S. interest rates. As it stands, the model has nothing to say on these issues.

The authors make a very natural extension of their model to a three-country setting, and they demonstrate that putting pressure on China to introduce more flexibility in its exchange rate regime would be counterproductive if the objective is a less depreciated dollar against the euro. Indeed, by forcing China out of the business of buying dollars, one effectively bans from the market the agent with the stronger bias for dollars. Since the currency demand of the other agents is more diversified, this decreases the demand for dollars and increases the pressure on the euro to appreciate. Hence, at least in the short run, the dynamic is perverse. I think this is an excellent insight that should be discussed in policy circles.

One of the messages of this very rich paper is that, as then-U.S. Treasury secretary John Connolly put it in the 1970s, “the dollar is our currency but your problem.” Indeed, the paper makes a very strong case that, to return to the steady state after a negative shock to the U.S. current account, one needs the dollar to depreciate in a predictable way at a moderate speed for a long period. Along the adjustment path, foreign investors incur capital losses as wealth is transferred to the United States. The adjustment is smooth and relatively painless for the U.S. economy, but the rest of the world suffers not only the capital loss but also a loss in competitiveness for the export sector (but increased purchasing power). I have two comments on this point. The first is that, within the model, the speed of the predicted depreciation of the dollar can be computed only with considerable uncertainty. It depends on several difficult-to-measure quantities such as world wealth, the degree of home bias in U.S. and foreign portfolios, and the future change in that bias. So it would not be surprising if the speed of depreciation turned out to be quicker than the upper bound of 2.7 percent a year (or even 8.4 percent a year) predicted by the authors. We just do not know.

My second comment is that the assumptions implicit in these results are that bond prices are exogenous and that no run on dollar assets occurs. In the authors’ model, whatever happens to the exchange rate does not affect the U.S. interest rate. That is surely too extreme an assumption. Without making any predictions, I would like to suggest that a less rosy scenario be put on the table as well, in which turmoil occurs in both the bond and the foreign exchange markets simultaneously. One can imagine that some Asian central banks that are at least partly accountable to the citizens of their countries (such as the Korean central bank) might start diversifying out of dollar assets in order to decrease their exposure to exchange rate risk. To the extent that such a move creates jitters in financial markets and private investors follow suit, the U.S. interest rate could go up at the same time that the dollar is going down, which could lead to a further unwinding of positions. We had a small taste of such an event in early 2005, when the Korean central bank announced that it would diversify its future accumulations of reserves (that is, its flows, not even its stocks) out of the dollar, and U.S. interest rates rose sharply for a short period. This scenario could be particularly damaging if

Asian central banks were to dump ten-year U.S. Treasuries, which constitute the backbone of the U.S. mortgage market. Since we do not have precise information on the maturity structure of the debt held by the Asian central banks, or precise estimates of the degree of substitutability between the ten-year bond and bonds at the short end of the yield curve, such a scenario would be sure to be full of surprises. In the end much would depend on the willingness of the Federal Reserve to tighten monetary policy aggressively. If U.S. interest rates jumped sharply, the whole world economy could be in for a hard landing.

To conclude, this paper is a remarkable achievement, and I am sure it will prove to be an invaluable pedagogical tool. After almost three decades during which the portfolio balance approach was largely neglected, this paper and some other recent work point toward its renewed relevance. The authors provide a perfect example of how powerful it can be to gain clear insights on the very complex questions posed by the dynamics of the U.S. current account deficit and the dollar. The next, very important step in this line of research is to develop a more convincing model of asset prices and wealth dynamics. Until we endogenize international portfolio flows in different assets, the wealth dynamics, and the joint determination of the exchange rate, equity prices, and interest rates, we will not be able to fully comprehend the nature of the international adjustment process and will have to shy away from specific policy recommendations.

General discussion: Gian Maria Milesi-Ferretti observed that foreigners own relatively little of U.S. housing wealth. As a consequence, any fall in home prices due to rising interest rates would have a relatively small valuation effect on foreign wealth, and therefore little effect on foreign demand for U.S. assets. By the same token, it would have a relatively large effect on U.S. wealth, saving, and the current account. He also pointed out that the large increase in world saving over the past decade has come mainly from China, where both saving and investment have risen spectacularly. Outside of China saving rates have mostly declined. Indeed, the rise in current account surpluses in other East Asian economies reflects a sharp decline in domestic investment rather than an increase in saving. Sebastian Edwards added that every region in the world outside North America, including Africa, has a current account surplus, and most emerging economies are purchasing U.S. assets. He reasoned that it will be difficult for these countries to grow rapidly if their saving continues to go abroad rather than into domestic investment.

Richard Cooper suggested that alternative assumptions about the character of financial markets and the distribution of world saving could alter some of the authors' model results, quantitatively and possibly qualitatively. For example: Saving in the rest of the world is roughly three times U.S. saving, but more than half of the world's easily marketable assets are located in the United States, making it the preferred destination for foreign investment. Even with home bias, as long as rest-of-world wealth is growing faster than U.S. wealth, net investment flows into U.S. assets are likely to continue, and with them U.S. current account deficits. William Nordhaus remarked that the situation Cooper described is changing: as Europe opens its capital markets, the large U.S. share of the world's marketable assets should gradually fall.

Michael Dooley argued that Cooper's analysis, and the imperfect substitutability in the authors' portfolio model, did not capture the growing risk that private agents would perceive as U.S. net indebtedness continues to grow. A counter to this constraint on private asset demand is provided when foreign official sectors invest in U.S. assets the way several Asian central banks are doing today. Peter Garber added that central banks of emerging economies are readily buying these assets because they provide the collateral that encourages outside investors to undertake gross investment flows into these economies. He believed the exchange rate movements of the past few years were mainly due to these official interventions, which underwrite the U.S. capital market at low interest rates. At these low rates, private sector investors have shifted their demand toward European securities, causing the euro to strengthen and reducing Europe's current account surplus.

Edmund Phelps explained that his own model projected a much lower dollar and a shift to U.S. current account surpluses, and he addressed the macroeconomic implications for the United States of such a move. He disagreed with the more optimistic experts who see such a transition as not affecting aggregate output and employment in any important way. On that scenario, the investment decline that accompanies lower business asset values in his model would be smoothly offset by rising exports and a move toward current account surpluses. Phelps, however, believed that the needed shift in resources would be incomplete to the extent that the investment-type activities are relatively labor intensive in production. He thus expected the needed adjustment to have a significant macroeconomic impact, and he saw the U.S. economy heading into a decade or more of slower growth and weakening employment.

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