Current Account Adjustment with High Financial Integration: A Scenario Analysis*

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A narrowing of the U.S. current account deficit through exchange rate movements is likely to entail a substantial depreciation of the dollar. We assess how the adjustment is affected by the high degree of international financial integration, with exchange rate movements having a direct valuation impact on international assets and liabilities. In particular, a dollar depreciation generates a capital gain for the United States by boosting the value of its assets that are denominated in foreign currencies. We consider an adjustment scenario in which the U.S. net external debt is held constant. One key finding is that while the current account moves into balance, the pace of adjustment is smooth. Intuitively, the valuation gains stemming from the depreciation of the dollar allow the United States to finance ongoing, albeit shrinking, current account deficits. We find that the smooth pattern of adjustment is robust to alternative scenarios, although the ultimate movements in exchange rates are affected.

1. Introduction

A central feature of the global economy is the extent of international imbalances, mainly the large and growing current account deficit of the United States. The sustainability of this situation as well as the pattern of an eventual adjustment are the subjects of substantial analysis and debate. Overall, however, a consensus has emerged that the international imbalances are likely to unwind eventually, requiring a substantial adjustment in the exchange rate of the dollar. In a widely cited contribution, Obstfeld and Rogoff (2005, 2006) estimate that the dollar would have to depreciate by 30 to 38 percent against the world's currencies to erase the U.S. current account deficit.

In this paper, we assess how the adjustment of the U.S. current account deficit interacts with the high degree of financial integration in the world economy. In addition to making U.S. goods more competitive in world markets, hence helping U.S. exports, a depreciation of the dollar leads to a capital gain for the United States by boosting the dollar value of a given amount of its foreign-currency assets. This valuation channel is playing an increasingly large role in driving the U.S. net investment position and, therefore, in affecting the dynamics of international adjustment.

The magnitude of exchange rate movements, however, is only one dimension of the adjustment. Whether the adjustment is likely to take place gradually or suddenly remains an object of debate. Our analysis focuses on this dimension by considering an alternative experiment. Rather than immediately bringing the current account to zero, as Obstfeld and Rogoff do, we consider a scenario where U.S. net external debt is kept constant. We regard such a scenario as realistic, since the current level of U.S. net external debt has so far proved manageable. We find that the presence of valuation effects allows for a "smooth landing," with the U.S. current account imbalance gradu-

*We thank Pierre-Olivier Gourinchas, Luca Guerrieri, Maurice Obstfeld, Alessandro Rebucci, Kenneth Rogoff, and Mark Spiegel for helpful feedback. Seminar participants at the Fall 2005 Federal Reserve SCIEA meeting, the Graduate Institute of International Studies, Geneva (HEI), the University of Geneva, the University of Tübingen, the Swiss National Bank, and the Bank for International Settlements provided valuable comments. We also thank Anita Todd for editorial assistance, and Thien Nguyen for excellent research assistance.

ally disappearing. Specifically, it takes three years for the current account deficit to halve under our scenario.

Intuitively, the smooth pattern of the adjustment in our scenario reflects the fact that the capital gains stemming from the depreciation of the dollar are used to finance ongoing, albeit shrinking, current account deficits during the adjustment. In the first year of the adjustment, the dollar depreciates, generating a capital gain through the valuation effect. This gain is used to finance net imports, so the current account does not have to fall to zero immediately. This reduces the pressure on the exchange rate in the first year, with the dollar depreciating by only 9 percent. In the second year of the adjustment, this pattern is repeated, with a further narrowing of the current account deficit, and a dollar depreciation reaching 15 percent from the initial situation. Our adjustment scenario does ultimately bring the current account into balance, as this is the only way to stabilize the U.S. net debt.

An important feature of our scenario is the leverage in international balance sheets. While net international asset positions are constant, the values of gross assets and liabilities increase substantially. To assess the sensitivity of our results to this aspect, we complement our baseline scenario by considering two alternatives. In the first one, we set financial flows to zero so leverage is kept constant. In the second one, we increase the rate of return on U.S. liabilities to match the rate on U.S. assets. The magnitude of exchange rate movements is larger under both alternative scenarios, and especially under the second alternative of interest rate convergence, where the dollar depreciation is boosted by one-third. Interestingly, the gradual nature of adjustment remains robust, with the U.S. current account deficit only halving in three to four years. The composition of adjustment is different from the baseline scenario, however. In particular the U.S. trade balance adjusts faster under the alternative scenarios, as the United States is no longer shielded from the interest burden on its liabilities.

The remainder of the paper is organized as follows. Section 2 provides background information and refers to the literature on the topic. Section 3 presents the key elements of our model. Section 4 describes our adjustment scenario, as well as a sensitivity analysis to alternative scenarios. Section 5 concludes.

2. Background and Literature Review

The large and growing current account deficit of the United States has become a central feature of the global economy, particularly in recent years. The U.S. external deficit increased gradually in the early 1990s, reaching a moderate level of 1.7 percent of GDP in 1997, and subsequently widened at a fast pace, hitting 5.7 percent of GDP in 2004. This substantial borrowing from the rest of the world has pushed the United States into a substantial net debt vis-à-vis foreign investors, with net liabilities amounting to 21.7 percent of GDP at the end of 2004.[1]

A volume by Clarida (2006) provides an overview of the substantial analysis and debate surrounding the sustainability of the U.S. external deficit and the path—whether smooth or sudden—an eventual adjustment might take. Several economists argue that the current situation is driven by policy choices that are likely to persist over several years, and that the United States is not condemned to face a disruptive adjustment in order to stabilize its borrowing.[2] The United States may also have better growth prospects than the rest of the world, leading it to account for a permanently higher share of world GDP. In this situation foreign investors could increase the share of U.S. assets in their portfolio, leading to sustained U.S. deficits, with a gradual adjustment once the portfolio reallocation has run its course.[3] Or, the U.S. financial sector may have an advantage in intermediating world savings. In this scenario, the transit of world savings through the United States to be converted into investment would lead to sustained current account imbalances.[4]

On the other side of the debate, many argue that the current situation is not sustainable and will lead to a substantial depreciation of the dollar vis-à-vis other currencies. This adjustment can be gradual and relatively benign.[5] Several contributions, however, point to the risk of a rapid adjustment, with disruptive consequences for the world economy.[6] A representative, and widely cited contribution of the latter view is the work by Obstfeld and Rogoff (2005, 2006). They show that the return of the U.S. current account deficit to balance entails a depreciation of the U.S. dollar of 30 to 35 percent against the main world currencies. In addition, they argue that such an adjustment could take place in a disruptive manner if it stemmed from foreign investors losing confidence in the U.S. economy.

Exchange rate movements play a central role in most scenarios of international adjustment. These movements

1. See Cavallo and Tille (2006) for data from the Bureau of Economic Analysis, International Economic Accounts.

2. See Dooley, Folkerts-Landau, and Garber (2005, 2006).

3. See Backus, Henriksen, Lambert, and Telmer (2005), and Engel and Rogers (2006).

4. See Caballero, Farhi, and Gourinchas (2006).

5. See Blanchard, Giavazzi, and Sa (2005), Helbling, Batini, and Cardarelli (2005), and Faruqee, Lexton, Muir, and Pesenti (2006).

6. See Roubini and Setser (2005).

affect the relative prices of various goods traded on the world market; for example a weaker dollar would make U.S. goods cheaper, hence boost U.S. exports. More importantly, exchange rate movements affect the price of nontraded goods (such as services) relative to traded goods (such as manufactured goods), inducing a reallocation of consumption between traded and nontraded goods. Obstfeld and Rogoff (2005, 2006) point out that this second channel plays a key role in the adjustment.

A growing body of research suggests that the degree of financial integration has dramatically increased since the early 1990s.[7] The world has moved from a situation where net positions were dominant, with some countries being creditors and others being debtors, to a situation where holdings of financial assets across countries have surged, with the values of gross assets and liabilities positions dwarfing the values of net positions. This development has opened a new channel through which exchange rate movements affect the world economies, the so-called valuation effect. If countries are leveraged in terms of currencies, with the currency composition of their assets differing from that of their liabilities, exchange rate fluctuations have a different effect on the two sides of the balance sheet, leading to sizable capital gains and losses in net terms.

This mechanism is illustrated by the case of the United States: while U.S. liabilities are nearly exclusively denominated in dollars, about two-thirds of U.S. assets are denominated in foreign currencies (Tille 2005). A depreciation of the dollar then improves the U.S. net investment position by increasing the dollar value of U.S. assets denominated in foreign currencies, while leaving the dollar value of U.S. liabilities essentially unchanged. This valuation channel has become an increasingly important factor in shaping the evolution of the U.S. net investment position. Indeed, over the last three years there developed an apparently puzzling pattern: the U.S. net international indebtedness remained steady at 20 to 25 percent of GDP despite a current account deficit in the order of 5 percent of GDP. This unusual pattern is a consequence of the valuation effect of exchange rate movements. While net financial inflows required to fund the increasingly large current account deficit consistently pushed the United States into debt, the valuation effects of exchange rate movements also substantially affected the U.S. position. In particular, the depreciation of the dollar since 2002 generated capital gains that amounted to about two-thirds of the current account deficit, thereby significantly cushioning the deterioration in the U.S. net investment position that arose from the need to finance the deficit.[8]

While some analyses of a narrowing of the U.S. current account deficit take financial integration into account, they do so in a way that limits its role.[9] In particular, Obstfeld and Rogoff (2005, 2006) argue that taking the valuation effect of exchange rate movements into account reduces the required depreciation of the dollar only modestly. This modest effect reflects the exact nature of their experiment. Abstracting from valuation effects, the stabilization of U.S. net external debt at its current level requires the current account to move into balance. When taking valuation effects into account, Obstfeld and Rogoff still require the current account to move immediately into balance. This generates a valuation effect that substantially improves the U.S. position, reducing the U.S. net external debt by a factor of three, but has a limited impact on the magnitude of the exchange rate movement.

Another dimension of adjustment that is an important focus of our study is the pace of these movements. The adjustment requires an eventual large depreciation of the dollar, and a contraction in U.S. consumption, as outlined by Obstfeld and Rogoff (2005, 2006). If the adjustment were gradual, the reduction of consumption would not have to occur immediately. In addition, a gradual adjustment would be less likely to be disruptive to financial markets. For instance, a 30 percent depreciation of the dollar would entail more adverse effects if concentrated over a year than if smoothed over a decade.

3. A Three-Country Model of Interdependence

The main elements of our analysis are based on the work by Obstfeld and Rogoff (2005). In this section, we summarize these elements informally, and then focus on how our setup departs from theirs. A more detailed presentation of the model is available in Cavallo and Tille (2006).

3.1. Consumption Allocation and Relative Prices

The model economy consists of three regions: the United States, Europe, and Asia, which are indexed by *U, E,* and *A,* respectively. The regions are linked by trade flows and by cross-holdings of financial instruments. Each region produces a traded good and a nontraded good, with the three traded goods being imperfect substitutes. Aggregate

7. See Gourinchas and Rey (2005, 2006), Lane and Milesi-Ferretti (2003, 2005, 2006), Obstfeld (2004), and Tille (2003, 2005).

8. See Cavallo and Tille (2006) for details.

9. The valuation effects are incorporated into the analyses of Blanchard et al. (2005) and Obstfeld and Rogoff (2005, 2006).

consumption is first allocated between domestically produced nontraded goods, C_N^i, and an index of the traded goods produced in all regions, C_T^i. The consumption index of traded goods, C_T^i, includes the consumption of goods produced in the United States, Europe, and Asia, denoted by C_U^i, C_E^i, and C_A^i, respectively. The consumption indexes of traded goods in all regions include a home bias, with consumers' preferences being tilted towards domestically produced goods

The costs of the various consumption baskets are captured by corresponding price indexes. These price indexes indicate the smallest amount of income required to purchase a unit quantity of the corresponding basket. P_C^i denotes the consumer price index in country *i*, while P_N^i is the price of nontraded goods and P_T^i is the price index of traded goods in region *i*. For simplicity we use the U.S. currency as a numeraire in which prices are expressed. P_T^U, P_T^E, and P_T^A are the price indexes of traded consumption in the three regions expressed in dollars. Throughout this article we assume that all prices are fully flexible and there are no impediments to trade, so that the price of a given traded good is the same across the world.

Demand for the various goods in a given region is driven by the aggregate consumption in the region, as well as the various relative prices. The bilateral terms-of-trade $\tau_{i,j}$, is the price of the traded good produced in region *j*, relative to the price of the traded good produced in region *i*. The three bilateral terms-of-trade in our setup are $\tau_{U,A}$, $\tau_{U,E}$, and $\tau_{E,A}$. An increase in $\tau_{U,E}$ indicates a deterioration of the U.S. terms-of-trade vis-à-vis Europe, because European-made goods are now more expensive in terms of U.S.-produced goods. It can also be interpreted as a competitiveness gain for the United States vis-à-vis Europe.

A key relative price in region *i* is the price of the domestic nontraded goods relative to the price of the traded basket in the region, x^i. An increase in x^i indicates that, in region *i*, nontraded goods are more expensive in terms of the composite traded consumption basket.

The bilateral nominal exchange rates represent the value of a currency in terms of another, with $E_{i,j}$ being the amount of region *i*'s currency that is required to purchase one unit of region *j*'s currency. We refer to the currencies of the United States, Europe, and Asia as the dollar, the euro, and the yen, respectively. The three bilateral nominal exchange rates in our setup are $E_{U,E}$, $E_{U,A}$, and $E_{E,A}$, with an increase in $E_{U,E}$ reflecting a nominal depreciation of the dollar against the euro. The nominal exchange rates are completed by the real exchange rates, which represent the ratios of consumer prices across countries. The three bilateral real exchange rates in our setup are $q_{U,E}$, $q_{U,A}$, and $q_{E,A}$. An increase in $q_{U,E}$ is an increase in the European consumer price index, relative to the United States. Such an increase represents a *real depreciation* of the dollar against the euro, that is a depreciation of the U.S. currency that is not offset by movements in the local currency price index. Bilateral real exchange rates are driven by both the terms-of-trade and the relative prices of nontraded goods.

An effective measure of the external value of a currency is obtained by taking weighted averages of the various bilateral exchange rates. The three effective real exchange rates in our setup are q^U, q^E, and q^A. An increase in q^U indicates that the dollar depreciates in real effective terms, reflecting a depreciation against the euro (an increase in $q_{U,E}$) or the yen (an increase in $q_{U,A}$).

While real exchange rates are driven entirely by *relative* prices, namely the terms-of-trade and the relative prices of nontraded goods, the nominal exchange rates are also affected by the *level* of prices in particular regions. Solving for nominal exchange rates then requires a specification of monetary policy to determine the price levels. We follow Obstfeld and Rogoff (2005) and assume that central banks keep the price of a basket of domestically produced goods constant in local currency. We focus our discussion on real exchange rates, as the movements in nominal exchange rates are very similar.

3.2. International Financial Positions

A central feature of our analysis is the integration of financial markets, with each region holding substantial asset positions in the other two regions.

3.2.1. Initial Asset and Liability Positions

Assets and liabilities on each region's balance sheet consists of assets denominated in different currencies. Exchange rate movements, then, affect asset values and lead to capital gains and losses across the three regions. Following Obstfeld and Rogoff (2005), we consider that positions are in a high-return bond paying an interest rate r^W, except for the liabilities of the United States, which are in a low-return dollar-denominated bond paying an interest rate $r^U < r^W$. This feature captures the "exorbitant privilege" the United States enjoys in its ability to borrow from the rest of the world at lower rates than it faces when lending (see Gourinchas and Rey 2006, and Lane and Milesi-Ferretti 2006).

Table 1 summarizes the initial currency composition of *international* balance sheets in the three regions derived from those used by Obstfeld and Rogoff (2005).[10] For the

10. For a more detailed illustration of the initial composition of assets and liabilities, see Cavallo and Tille (2006).

TABLE 1
INITIAL STRUCTURE OF ASSETS AND LIABILITIES
($ TRILLIONS)

	Assets (a)	Liabilities (b)	Net (c)
United States			
Total	8.3	11.0	–2.8
dollar	3.3	11.0	–7.7
euro and yen	4.9	—	4.9
Europe			
Total	11.0	11.0	0
dollar	3.5	2.2	1.3
euro and yen	7.5	8.8	–1.3
Asia			
Total	11.0	8.3	2.8
dollar	8.8	2.4	6.4
euro and yen	2.2	5.8	–3.6

United States, assets include positions in all currencies, and liabilities are in low-return dollar-denominated bonds. The United States is a net debtor, and a sizable share of U.S. assets (60 percent) is denominated in foreign currencies, while all U.S. liabilities are in dollars, in the low-return bond. This pattern is consistent with the U.S. numbers detailed in Tille (2005). The U.S. net position is then highly leveraged, with substantial asset positions in foreign currencies and large liabilities in dollars.

The European balance sheet includes assets and liabilities in all currencies. The position of Europe is balanced with equal amounts of assets and liabilities. European assets are mostly denominated in euros and dollars (57 and 37 percent of the total, respectively), with the latter consisting mostly of low-return bonds invested in the United States. Similarly, European liabilities are predominantly denominated in euros (80 percent), with the remainder in dollars.

The Asian balance sheet indicates that the region is a net creditor to the rest of the world, with the bulk (80 percent) of its assets consisting of dollar-denominated assets, essentially in low-return bonds invested in the United States. The liability side is relatively evenly split across the three currencies. In net terms, Asia is substantially leveraged, with large assets in dollars and substantial liabilities in yen and, to a lesser extent, in euros.

3.2.2. Dynamics of Balance Sheets

Tracking the dynamics of assets and liabilities is a central dimension of our model, with these values fluctuating for three reasons. First, gross trade flows lead to the accumulation of additional assets and liabilities. Second, the existing positions generate a stream of interest payments. Third, exchange rate fluctuations affect the value of positions in different currencies.

Trade flows. The first factor reflects gross trade flows. The mapping of trade flows into the dynamics of the balance sheet requires us to address two issues that are not present in simpler models, namely the relative magnitude of financial and trade flows and currency compositions.

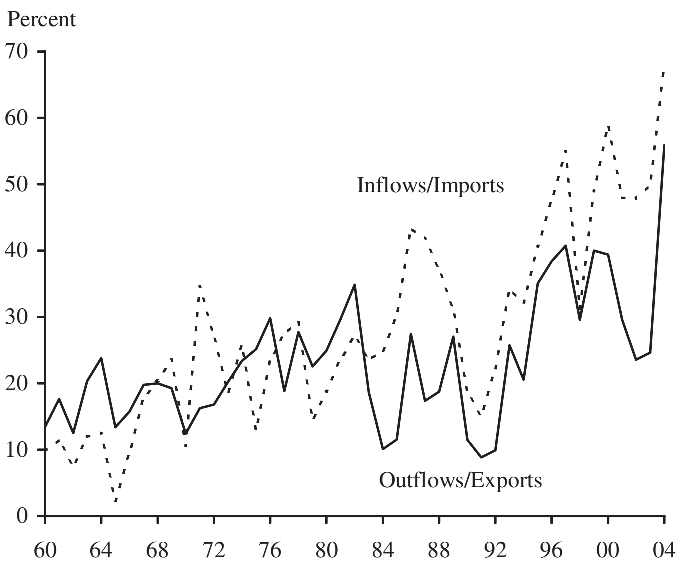
In net terms, the trade balance maps into an equal change in the net foreign asset position, ceteris paribus. The linkage is looser when we consider gross flows, however. Consider an example where a country *(A)* exports \$100 worth of goods to another country *(B)* and imports \$120 worth of goods. Country *A* clearly runs a trade deficit of \$20, with a corresponding deterioration in its net foreign asset position. The picture in terms of gross flows is not as straightforward. A first possibility is that all gross exports lead to an accumulation of gross foreign assets, whereas all gross imports lead to an accumulation of foreign liabilities. The gross assets and liabilities of country *A* then increase by \$100 and \$120, respectively. Another possibility is that the entire proceeds of exports are used to pay for imports, with an accumulation of liabilities amounting only to the trade deficit. The gross assets and liabilities of country *A* then increase by \$0 and \$20, respectively. This simple example shows how a given situation in net terms can correspond to vastly different situations in gross terms.

We rely on the empirical evidence for the relative magnitude of gross trade and financial flows, as economic theory does not provide us with an a priori guess. Data for the United States are presented in Figure 1, where the solid line is the ratio between gross financial outflows and gross exports, and the dotted line is the ratio between gross financial inflows and gross imports. Both lines show similar positive trends, with gross financial flows increasing from 10 to 15 percent of trade flows in the early 1960s to 40 to 50 percent in recent years, a pattern that reflects the increase in financial integration. Based on this evidence, we assume that a fraction $\pi = 0.5$ of trade flows maps into corresponding financial flows.

In addition to the magnitude of gross financial flows, their currency composition affects the dynamics of our model. If, for instance, the United States accumulates assets in foreign currencies, future exchange rate movements will lead to a larger valuation effect than if the additional U.S. assets are in dollars.

While we lack evidence on the currency composition of gross financial flows, we take an educated guess relying on the available evidence on the invoicing of international

FIGURE 1
RATIO OF GROSS FINANCIAL FLOWS TO GROSS TRADE FLOWS



Source: Bureau of Economic Analysis, International Economic Accounts.

trade flows, as reported by Goldberg and Tille (2005).[11] We assume that trade flows to and from the United States lead predominantly to an accumulation of dollar assets and liabilities.[12] Trade flows between Europe and Asia lead primarily to an accumulation of positions in euros, with a sizable secondary role for dollar positions.

Interest payments and valuation gains. The second driver of changes in assets and liabilities is the flow of interest income. For simplicity, we assume that a share π of the proceeds from interest payments are simply added to the principal of the corresponding position, with π being the same as the share of gross trade flows that map into financial flows. The *net* interest income for each region is the difference between the interest earned on its assets and that paid on its liabilities. See Box 1 for details.

The final driver of balance sheet dynamics is the valuation effect stemming from exchange rate movements. As we express all positions in dollars, there is no such effect for the positions in dollar-denominated assets. However, the dollar value of positions in euro- or yen-denominated assets is affected. We again assume that a share π of these valuation effects is added to the principal of the corresponding positions.

11. While a flow can be invoiced in one currency and transacted in another, we posit that the invoicing currency is a good indicator of the transaction currency.

12. Details are given in Cavallo and Tille (2006). The accumulation of U.S. liabilities takes place in the low-return dollar bond.

Overall dynamics and consistency. The dynamics of the various exchange rates are given by combining the three channels, as shown in Box 1.

While the assumption that trade flows, interest income, and valuation gains all map into gross positions up to a scaling π simplifies our model, one may worry that it could lead to inconsistencies across the various assets and liabilities. In Box 2 we show that this is not the case in the particular scenario we consider. As our scenario analysis focuses on constant net asset positions, our scaling of gross flows and valuations by π across the board is fine, though it would be problematic for other scenarios.

Aggregating the various components of balance sheet dynamics, the changes in the net foreign asset positions of the various countries are the sums of the current accounts and the valuation effects on assets and liabilities, as shown in Box 2.

3.3. Market-Clearing Conditions

In each region, the current account, in dollars, is the sum of net interest income and the trade balance, the latter being the difference between the value of tradable output and the value of consumption of tradable goods. For simplicity, the supply side of the world economy is modeled as an endowment economy.

We denote the endowments of tradable and nontraded goods in region *i* by Y_T^i and Y_N^i, respectively. Note that the valuation effects of exchange rate movements, *VH* and *VL,* do not enter the current account as they do not entail any financial flows across countries. Region *i*'s current account is then $CA^i = NI^i + P_i Y_T^i - P_T^i C_T^i$.

The clearing of goods markets requires that the endowments of the various goods are equal to the sum of domestic and foreign consumptions which depend on aggregate consumptions in the various regions and on relative prices. We define the following ratios between the various endowments of tradable and nontraded goods: $\sigma_{U/E} = Y_T^U / Y_T^E$, $\sigma_{U/A} = Y_T^U / Y_T^A$, and $\sigma_{N/i} = Y_N^i / Y_T^i$. We use lowercase variables to denote the ratio between a dollar value and the value of the endowment of U.S. tradable good, $P_U Y_T^U$. We scale the various trade flows in this way: $gh_j^i = GH_j^i / (P_U Y_T^U)$. Net interest incomes and current accounts are similarly scaled, with $ni^i = NI^i / P_U Y_T^U$ and $ca^i = CA^i / P_U Y_T^U$.

Using the allocation of consumption across the various goods, we write the various trade flows in terms of relative prices (the terms-of-trade and price between traded and nontraded goods) and the trade balance (current account net of interest income). The market-clearing condition for a particular traded good states that the endowment of the good is equal to the sum of domestic and foreign demands.

Box 1
What Drives Changes in Asset and Liability Positions?

We denote region *i*'s foreign assets by H^i, and its liabilities by L^i. The difference represents the net international position of the region, which we denote by $F^i = H^i - L^i$. H_j^i denotes region *i*'s assets that are denominated in region *j*'s currency. For instance, H_U^E is the value of dollar-denominated assets held by European investors. Similarly, L_j^i denotes region *i*'s liabilities that are denominated in region *j*'s currency. Positions are in a high-return bond paying an interest rate r^W, except for the liabilities of the United States which are in a low-return dollar-denominated bond paying an interest rate $r^U < r^W$. Positions in the low-return bond are denoted by a tilde.

The three factors we consider that drive changes in a region's assets and liabilities are trade flows, interest payments, and exchange rate changes.

Trade flows: We denote the value of trade flows, in dollars, of region *i*'s exports to region *j* by GH_j^i. For instance, GH_A^E is the value of European exports to Asia. In terms of region *i*'s exports to region *j*, GH_j^i, we assume that a share $\mu_{j,U}^i$ of these flows leads to the accumulation of assets denominated in dollars. Similarly, a share $\mu_{j,E}^i$ leads to the accumulation of assets denominated in euros, and a share $\mu_{j,A}^i = 1 - \mu_{j,U}^i - \mu_{j,E}^i$ leads to the accumulation of assets denominated in yen.

Interest payments: Based on the structure of the balance sheets, we write net interest income for the three regions as:

$$NI^U = r^W H^U - r^U L^U, \tag{1}$$

$$NI^E = r^U \tilde{H}_U^E + r^W \left(H_U^E + H_E^E + H_A^E\right) - r^W L^E, \tag{2}$$

$$NI^A = r^U \tilde{H}_U^A + r^W \left(H_U^A + H_E^A + H_A^A\right) - r^W L^A. \tag{3}$$

Exchange rate changes: We denote by VH_j^i the change in the value of region *i*'s gross assets denominated in region *j*'s currency due to exchange rate movements. VL_j^i is defined similarly for liabilities.

Valuation effects are driven by nominal exchange rates. Consider a period when the dollar-euro exchange rate changes from $E_{U,E0}$ to $E_{U,E}$, while the dollar-yen exchange rate changes from $E_{U,A0}$ to $E_{U,A}$. The valuation changes for U.S. assets denominated in euros and yen are:

$$VH_E^U = \left(\frac{E_{U,E}}{E_{U,E0}} - 1\right) H_E^U \quad \text{and} \quad VH_A^U = \left(\frac{E_{U,A}}{E_{U,A0}} - 1\right) H_A^U. \tag{4}$$

The valuation effects for Europe and Asia are computed along similar lines.

Overall adjustments: U.S. assets and liabilities at the end of a period are given as follows, with a prime indicating values at the end of the period:

$$H_U^{U\prime} = H_U^U + \pi\left[r^W H_U^U + \mu_{E,U}^U GH_E^U + \mu_{A,U}^U GH_A^U\right]$$

$$H_E^{U\prime} = H_E^U + \pi\left[r^W H_E^U + \mu_{E,E}^U GH_E^U + \mu_{A,E}^U GH_A^U + VH_E^U\right]$$

$$H_A^{U\prime} = H_A^U + \pi\left[r^W H_A^U + \left(1 - \mu_{E,U}^U - \mu_{E,E}^U\right) GH_E^U + \left(1 - \mu_{A,U}^U - \mu_{A,E}^U\right) GH_A^U + VH_A^U\right]$$

$$\tilde{L}^{U\prime} = \tilde{L}^U + \pi\left[r^U \tilde{L}^U + \left(GH_U^E + GH_U^A\right)\right].$$

The dynamics of the European and Asian balance sheets are computed along similar lines.

Similarly the market clearing for a nontraded good is an equality between the endowment and the domestic demand.

A noteworthy feature of the various market-clearing conditions is that they do not involve the share π linking trade flows and financial flows. Given the current accounts and net interest incomes (ca^U, ca^E, ni^U, ni^E) we can compute the various terms-of-trade and traded-nontraded prices. Aggregate consumption in each region i can be computed from its endogenous endowment of the nontraded good, and the various relative prices, using the

Box 2
Net Financial Flows

Focusing on the United States for brevity, net financial flows consist of two main components. The first is the proceeds of trade flows and net interest payments that are added to net assets (which are a share π of these flows). The second is the share $(1-\pi)$ of valuation gains that is not added to the principal of the corresponding positions, bearing in mind that a valuation gain that is brought back into the United States is a financial inflow, that is, a negative financial flow. Net financial flows are then:

$$\begin{aligned} FF^U &= \pi\left[\left(GH_E^U + GH_A^U\right) - \left(GH_U^E + GH_U^A\right) + NI^U\right] - (1-\pi)\left(VH_E^U + VH_A^U\right) \\ &= \pi CA^U - (1-\pi)\left(VH_E^U + VH_A^U\right), \end{aligned}$$

where CA^U is the U.S. current account, that is the overall net trade and interest payments flow. Net financial flows and current accounts are equal, as they should be, only when:

$$FF^U = CA^U = \pi CA^U - (1-\pi)\left(VH_E^U + VH_A^U\right) \Rightarrow CA^U = -\left(VH_E^U + VH_A^U\right).$$

Therefore, our assumption that π is the same across the board is valid only when the current account is the inverse of the capital gains, that is when capital gains are associated with a current account deficit. A complementary way to establish this point is to look at the dynamics of the net foreign asset position. In our setup, the change in the net foreign asset position is the sum of the proceeds from trade flows and from net interest payments that are added to net assets, and the valuation gains that are added to the corresponding positions:

$$F^{U\prime} - F^U = \pi CA^U + \pi\left(VH_E^U + VH_A^U\right). \tag{5}$$

The changes in the net positions in the data, such as those published by the Bureau of Economic Analysis, combine the current account and the valuation effects:

$$\left(F^{U\prime} - F^U\right)_{\text{BEA}} = CA^U + \left(VH_E^U + VH_A^U\right). \tag{6}$$

Comparing (5) and (6) clearly shows that the dynamics of net foreign assets are inconsistent in general. The notable exception is the case where net foreign assets are constant: $\left(F^{U\prime} - F^U\right)_{\text{BEA}} = \left(F^{U\prime} - F^U\right) = 0$. In this case, the trade flows, interest income, and valuation effects sum to zero, whether or not they are all multiplied by π.

The changes in the net foreign asset positions for each region are

$$0 = CA^U + \left(VH_E^U + VH_A^U\right), \tag{7}$$

$$0 = CA^E + \left(VH_E^E + VH_A^E\right) - \left(VL_E^E + VL_A^E\right), \tag{8}$$

$$0 = CA^A + \left(VH_E^A + VH_A^A\right) - \left(VL_E^A + VL_A^A\right). \tag{9}$$

demand for nontraded goods. The share π matters only in mapping the ensuing results into the dynamics of the various components of the international balance sheets.

3.4. Solution Method

Our solution method computes the various prices in a period based on the initial international balance sheets and structural parameters. The results are then mapped into the dynamics of the balance sheet to compute a new set of international assets and liabilities that underpin the solution for the following period.

Given an initial structure of assets and liabilities and initial nominal exchange rates, we can easily compute the net interest incomes in Box 1, equations (1) to (3). We then pick values for the U.S. and European current accounts in dollars, CA^U and CA^E, and the endowment of U.S. tradable goods, Y_T^U. The values of the various current account balances are not freely picked. As we aim for constant net asset positions, we iterate our procedure so the current accounts lead to constant positions. Similarly, the endowment of U.S. tradable goods is computed based on the current allocation (as in Obstfeld and Rogoff 2005) and then held constant.

Armed with the values for the U.S. and European current accounts, the net interest income, and the endowment of U.S. tradable goods, we compute the terms-of-trade $\tau_{U,A}$ and $\tau_{U,E}$, the relative prices of nontraded goods, x^U, x^E, and x^A, and the price of the U.S. tradable good, P_U. This is done by numerically solving a system including the market-clearing conditions, and the expression for the price of the U.S. tradable good. Having solved the various relative prices, the real and nominal exchange rates easily follow. Combining the nominal exchange rates with the ones taken from the previous period, we compute the valuation effects on assets and liabilities. Combining the trade flows, interest income, and valuation effects, we compute the dynamics of the balance sheets, using the scaling factor π. These new asset and liability positions serve as the basis for the solution in the following period.

Note that the dynamic dimension of our analysis comes solely through the dynamics of the international balance sheets. For instance, consumption is not computed from an intertemporal optimization but is given by the exogenous endowments and the current account, the latter being set by our assumption of the dynamics of net foreign assets.

4. Global Adjustment under Various Scenarios

Our parameter values are as in Cavallo and Tille (2006), and we follow Obstfeld and Rogoff (2005) as much as possible. We assume that half the gross trade flows map into financial flows ($\pi = 0.5$) as is the case in the United States currently (Figure 1). We consider two extensions: one with no accumulation of assets and liabilities beyond the current positions ($\pi = 0$), and one where the interest rate on U.S. liabilities, r^U, increases from 3.75 percent to 5 percent to match the world interest rate, r^W.

4.1. Static Scenarios

We start by briefly reviewing the results of Obstfeld and Rogoff (2005). They consider static scenarios in the sense that the current accounts in all countries return to zero immediately.[13] The first column of Table 2 shows the main results for their analysis. The top section indicates the real depreciation of the dollar against the other currencies, while the bottom section shows the effective real depreciations of the various currencies (the movements in nominal exchange rates are very similar).[14]

Column (a) in Table 2 shows a scenario that entirely abstracts from any valuation effect, that is, a scenario where all assets and liabilities are denominated in dollars. The global rebalancing of the world economy requires a sharp depreciation of the dollar of 38 percent in effective terms, mirrored mainly by a substantial yen appreciation. Obstfeld and Rogoff (2005) also consider valuation effects, a case presented in column (b) of Table 2. Their exact scenario still requires all current accounts to move to zero. The adjustment entails a substantial depreciation of the dollar. This, in turn, generates a substantial capital gain for the United States, with its net debt falling by 70 percent, mostly at the expense of Asia. This improves the net interest income of the United States, and the trade balance does not have to narrow as much in order to bring the current account into balance. This, in turn, reduces the required movement in the exchange rate. Obstfeld and Rogoff (2005) argue that the benefits from the valuation effect are secondary, as the dollar still has to depreciate by 33 percent.

4.2. A Dynamic Scenario

The limited impact of the valuation effect on the exchange rate in Obstfeld and Rogoff (2005) is a consequence of using the valuation gain to reduce the U.S. net debt while still requiring an immediate adjustment in the current account. This is only one of several possible uses of the valuation gains, and our analysis focuses on an alternative scenario where net international investment positions are held constant in all three regions. We regard this scenario as a reasonable alternative, as the U.S. net external debt has remained essentially unchanged in the last three years at a level that has so far proved manageable. In our scenario, the valuation effects stemming from exchange rate movements allow the various regions to run current account surpluses and deficits. These imbalances are financed by valuation gains and losses, keeping international investment positions constant, as shown by equations (7) to (9) in Box 2.

Our scenario highlights two dimensions of adjustment, namely the pace of adjustment and the ultimate movements in the various variables. Equation (4) in Box 1 shows that valuation effects require movements in nominal exchange rates. In the long run, once adjustment has run its course, the economy reaches a new steady state where all vari-

13. Obstfeld and Rogoff (2005) do not present their scenario as the adjustment taking place in one period, but rather in terms of comparing the current situation with a steady state where net positions are constant. However, as they abstract from any dynamics, their scenarios implicitly assume an immediate adjustment.

14. The numbers in Table 2 differ slightly from the ones presented in Obstfeld and Rogoff (2005), because we consider a structure of assets and liabilities in Table 2 that is slightly different from the one they use.

Table 2
Long-run Adjustment
(Percent, after Ten Periods)

	O&R global rebalancing		Dynamic	No gross	Convergence
	without valuation (a)	with valuation (b)	adjustment (c)	financial flows (d)	of interest rates (e)
Real depreciation of the dollar					
Against the euro	33.5	28.7	27.0	31.6	36.3
Against the yen	40.8	34.8	33.6	38.5	44.0
Effective real depreciations					
Dollar	38.4	32.7	31.4	36.2	41.4
Euro	–6.3	–5.5	–4.6	–6.0	–7.0
Yen	–24.1	–20.4	–20.1	–22.7	–25.8

Notes: O&R refers to Obstfeld and Rogoff (2005). O&R global rebalancing without valuation: all current accounts go to 0 in one period; initial positions are all in dollars. O&R global rebalancing with valuation: all current accounts go to 0 in one period; initial positions are listed in Table 1, Cavallo and Tille (2006). Dynamic adjustment: current accounts gradually go to zero, leaving the dollar value of net positions unchanged; initial positions are as in Table 1, Cavallo and Tille (2006). No gross financial flows: gross financial flows amount to 0, interest rate on U.S. liabilities remains at 3.75 percent. Convergence of interest rates: gross financial flows amount to 50 percent of corresponding gross trade flows, interest rate on U.S. liabilities increases to 5 percent from the first period.

ables, including nominal ones, are constant, since we assume that the central banks stabilize prices. Therefore there is no ongoing valuation in the long run, and equations (7) to (9) show that the current accounts are in balance. While our scenario still requires an ultimate balancing of current accounts, it can accommodate a gradual adjustment. This dimension is relevant in assessing whether the rebalancing of current account imbalances can be disruptive, as a sizable depreciation of the dollar is likely to be more benign if it is spread across several years than if it is concentrated in a short span.

4.2.1. Pace of Adjustment

The key feature of our alternative scenario is that the adjustment takes place at a much smoother pace than under the static scenarios. Figure 2 shows the paths of the various current accounts, expressed as percentages of the value of U.S. traded output. All current accounts eventually go to zero, as the economy reverts to a new steady state. The adjustment is quite gradual and spread over several periods (years). For instance, the U.S. current account deficit is only halved in the first three years.

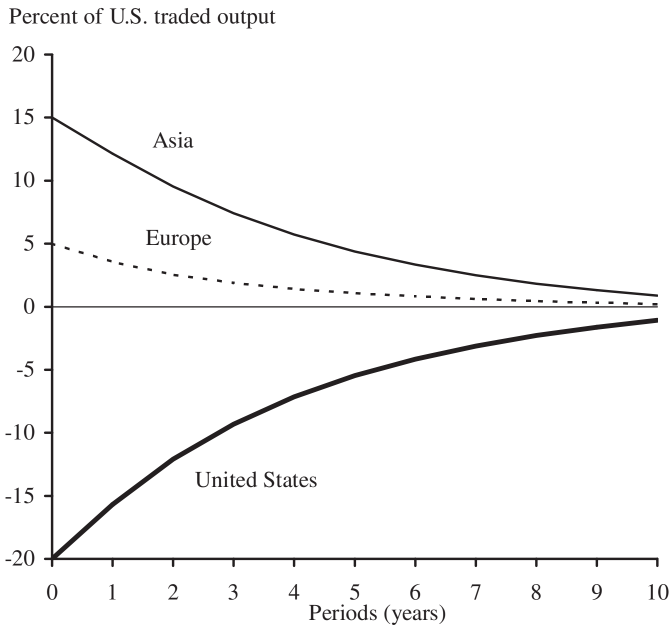
The smooth pattern of adjustment is also observed for exchange rates. Figure 3 shows the paths of bilateral and effective real exchange rates, expressed in percentage changes from initial levels. The dashed lines indicate the adjustment in the static scenario with valuation effect (column b of Table 2), while the solid lines show the adjustments under the dynamic scenario. The dynamic scenario's depreciation of the dollar clearly takes place at a gradual pace, against both the euro (panel A) and the yen (panel B) and in trade-weighted terms (panel D). For instance, the dollar depreciates by 8.6 percent in the first year (in trade-weighted terms), and 15 percent by the second year. A similar pattern of gradual adjustment is observed for the (moderate) appreciation of the euro (in trade-weighted terms, panel E) and the (substantial) appreciation of the yen (in trade-weighted terms, panel F).

Intuitively, the gradual nature of the adjustment reflects the use of valuation gains to finance international imbalances. The depreciation of the dollar leads to a sizable capital gain for the United States, which uses the proceeds to finance a trade deficit. While this mechanism can operate only temporarily because valuation gains eventually return to zero, it allows for a gradual decline in trade gaps. In the first year, the 8.6 percent depreciation of the dollar allows the United States to finance a current account deficit of 15.7 percent of its tradable output, which represents a narrowing by only 4.3 percentage points from the initial deficit. The 6.4 percent depreciation in the second year generates a smaller capital gain, with the current account deficit narrowing an additional 3.6 percentage points to 12.1 percent of U.S. tradable output. This pattern is repeated period after period, with the exchange rate ultimately stabilizing and the current account returning to balance.

4.2.2. Magnitude of Adjustment

In addition to the gradual nature of the adjustment, our dynamic scenario allows for a moderate reduction in its ulti-

Figure 2
Current Accounts, Baseline Scenario



mate magnitude. Column (c) of Table 2 shows the magnitude of depreciation in our dynamic scenario after ten periods. While the dollar still substantially depreciates, the magnitude is reduced to 31 percent. The depreciation of the dollar is therefore reduced by nearly one-fifth compared to the static scenario that ignores valuation effects (where the dollar depreciates by 38 percent). This magnitude is broadly consistent with the results in Gourinchas and Rey (2005), who find that valuation effects stemming from exchange rate movements account for one-third of the historical adjustment of U.S. external imbalances. Using a richer multi-country model, Helbling, Batini, and Cardarelli (2005) argue that higher financial integration facilitates the process of current account adjustment. Compared to the static case including valuation effects, our dynamic scenario shows a moderate dampening, with the depreciation of the dollar being reduced by 4 percent in effective terms.

4.2.3. The Impact on International Balance Sheets

Our adjustment scenario implies substantial valuation effects for international assets and liabilities. The substantial depreciation of the dollar results in a large capital gain for the United States, amounting to \$1.8 trillion for the first ten years after the adjustment started. This comes essentially at the expense of Asia, which suffers a loss of \$1.4 trillion, while Europe faces a moderate capital loss. The high exposure of Asia to capital loss is consistent with the findings of Higgins and Klitgaard (2004).

The combination of trade flows, interest income, and valuation effects leads to substantial movements in international balance sheets. While the net positions are unchanged by assumptions, the gross asset and liability positions essentially double over ten years.[15] This represents a sizable increase in leverage but is consistent with empirical evidence. Between 1994 and 2004, U.S. gross assets nearly doubled from 47 percent to 85 percent of GDP, while liabilities increased even more from 49 percent to 107 percent.

4.3. Sensitivity Analysis: Alternative Scenarios

We complete our baseline scenario by considering two extensions. In the first we assume that all gross financial flows are netted out ($\pi = 0$), so that gross assets and liabilities are held constant at their initial levels. This alternative with no gross financial flows illustrates the influence of the increase of gross positions on our results. In the second extension we assume that the U.S. exorbitant privilege disappears, with the interest rate on the low-return dollar bonds, r^U, immediately increasing to the world interest rate, r^W (this scenario holds π at 0.5). This second alternative with convergence of interest rates allows us to weight the gains from valuation effects against the interest burden of the U.S. net debt.

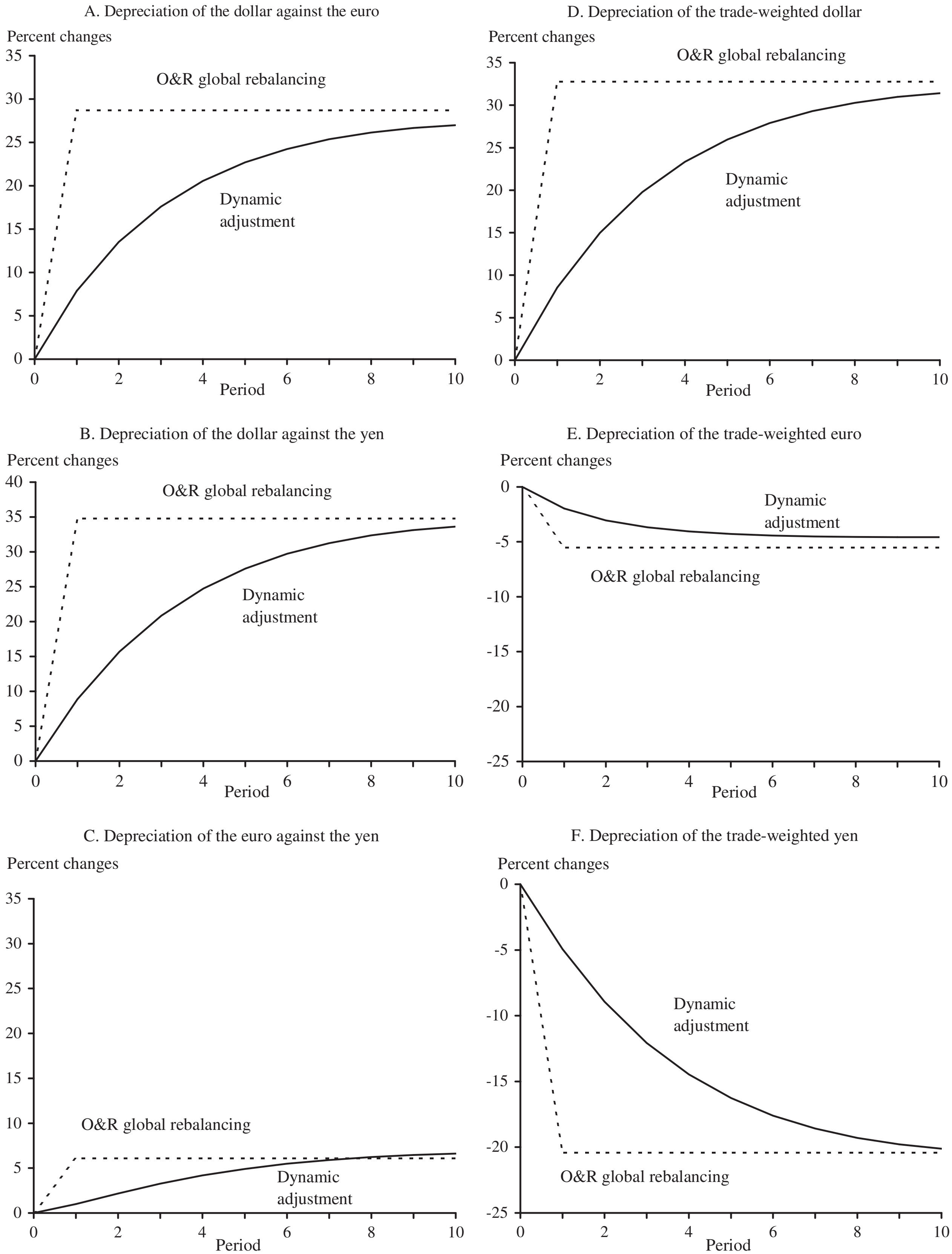
4.3.1. Pace and Magnitude of Adjustment

The gradual nature of the adjustment is observed across all scenarios, and, therefore, is robust to the alternatives. Adjustment is slower under interest rate convergence, but the gap is small and entirely reflects the jump in interest rate in the first period. The pace of exchange rate adjustment also remains gradual, although the ultimate magnitude of adjustment (after ten years) is sensitive to our alternatives. Column (d) of Table 2 shows the exchange rate movements under the alternative with no gross financial flows. The magnitude of adjustment is substantially increased, with the dollar depreciating by 36 percent in effective terms, an increase by one-sixth compared to the baseline scenario.

The magnitude of the ultimate adjustment is also sensitive to the path of interest rates, with exchange rate movements being larger under the alternative of convergence (column e). The dollar now depreciates by 41 percent in effective terms, a one-third increase compared to the baseline scenario. The sensitivity to interest rates goes beyond the

15. See Cavallo and Tille (2006) for details.

Figure 3
Real Exchange Rate Movements



Note: Percent change refers to percent change from current situation. Periods are in years. O&R refers to Obstfeld and Rogoff (2005).

impact computed by Obstfeld and Rogoff (2005), who find that a convergence moderately increases the depreciation of the dollar vis-à-vis the euro (from 28.6 to 30.1 percent). This difference in our results reflects two aspects. First, Obstfeld and Rogoff (2005) assume that the convergence applies only to U.S. debt in short-duration bonds, which represents only 30 percent of U.S. liabilities. Second, our assumption that gross positions increase ($\pi > 0$) implies an increasing and costly leverage for the United States. This dimension is substantial, as the gross positions double under the alternative scenario.

4.3.2. The Composition of Adjustment

While the adjustment of the current account shows little difference across our baseline scenario and the two alternatives we consider, the components of the current account are more contrasted. Table 3 summarizes the overall adjustment over the ten periods we consider. The top section indicates the cumulative valuation gains for the three regions. Under the baseline adjustment (column a), the depreciation of the dollar leads to a $1.8 trillion capital gain for the United States, allowing it to finance a gradual rebalancing of the current account. The U.S. gain is mirrored primarily by a loss in Asia. The valuation effect is essentially unchanged in the absence of gross flows (column b). In the alternative with a convergence of interest rates, the valuation effects are magnified, amounting to $2.5 trillion, i.e., $0.7 trillion more than in the baseline scenario.

The valuation gains and losses exactly correspond to the cumulative current account under our assumption that net asset positions are constant. The cumulative current accounts are in turn the sum of net interest income and the trade balance, which are presented in the middle and bottom sections of Table 3. Under the baseline scenario, the United States benefits from net interest income, despite being a net debtor, because it earns a larger return on its assets than it pays on its liabilities. This interest transfer comes essentially at the expense of Europe, while the net assets of Asia are large enough to offset its earning a lower rate on its assets than it pays on its liabilities. As a result of this "exorbitant privilege," the United States can run a cumulative trade deficit ($2.2 trillion) that exceeds its cumulative current account deficit ($1.8 trillion). This limits the pressure on the exchange rate, which is driven primarily by the required adjustment in the trade balance.

The cumulative current accounts are essentially the same in the alternative with no financial flows: they are driven more by trade balances. The United States earns no net interest income, so the rebalancing requires a smaller trade deficit ($1.8 trillion) than under the baseline scenario ($2.2 trillion). In the absence of gross flows, the United States cannot increase its leverage between high-return assets and low-return liabilities, which limits its interest income. As more of the adjustment comes through the trade balance, the dollar depreciates more under this alternative.

TABLE 3
CUMULATIVE FLOWS AND VALUATION GAINS
($ TRILLIONS)

	Baseline dynamic adjustment (a)	No gross financial flows (b)	Convergence of interest rates (c)
Cumulative valuation gain			
U.S.	1.82	1.80	2.52
Europe	–0.38	–0.36	–0.56
Asia	–1.44	–1.44	–1.96
Cumulative net interest income			
U.S.	0.41	0.00	–1.38
Europe	–0.52	–0.38	0
Asia	0.11	0.38	1.38
Cumulative trade balance			
U.S.	–2.23	–1.80	–1.15
Europe	0.89	0.74	0.56
Asia	1.33	1.06	0.59

Notes: All amounts represent total amounts between the initial period and period ten. Valuation gain: total amounts transferred through the valuation effect of exchange rate movements. Net interest income: total amounts transferred through interest receipts net of payments. Trade balance: total amounts transferred through exports net of imports.

While the United States runs a larger cumulative current account deficit in the alternative with interest rate convergence ($2.5 trillion) than in the baseline ($1.8 trillion), this is merely a reflection of the large movement of the exchange rate due to the interest burden of U.S. liabilities. The increase in the interest rate that the United States pays on these liabilities removes its "exorbitant privilege," and the net debt translates into substantial net interest payments. Compared to the baseline scenario, the United States pays $1.4 trillion in net interest. This represents a $1.8 trillion shift from the baseline scenario, where the United States was receiving a net interest income of $0.4 trillion. While the country benefits from a larger valuation gain ($2.5 trillion, compared to $1.8 trillion in the baseline), the extra gain is too small to offset the surge in the interest burden. The burden then requires a faster narrowing of the trade deficit, with the cumulative trade deficit amounting to $1.2 trillion, i.e., half of its value under the baseline case. The faster narrowing in the trade deficit requires a larger depreciation of the dollar. Note that the presence of valuation effects still smooths the adjustment. With the valuation effect, the difference in the trade balance from the baseline scenario ($1.0 trillion) amounts to 60 percent of the additional interest payments ($1.8 trillion), while in the absence of these effects the trade balance would have to match the additional interest payments exactly. The sensitivity of U.S. external accounts to alternative scenarios for the returns on assets and liabilities is in line with the results of Higgins, Klitgaard, and Tille (2005).

5. Concluding Remarks

The rapidly widening U.S. current account deficit has received a lot of attention, with several economists pointing out that bringing the current account down to a more sustainable level could require a substantial, and possibly disruptive, depreciation of the dollar. This paper assesses how such an adjustment would be affected by the high degree of financial integration across countries. The main consequence of financial integration is the growing relevance of valuation effects, where exchange rate movements lead to sizable changes in the value of a country's assets and liabilities. We consider an adjustment scenario where current account imbalances are resorbed, and the net asset positions of the various countries are kept constant.

Our main finding is that high financial integration can potentially generate a "smooth landing" pattern, with a very gradual movement of the current accounts into balance. Focusing on the United States in our model, the depreciation of the dollar generates capital gains, which can be used to finance a narrowing current account deficit while keeping the net debt vis-à-vis the rest of the world unchanged. The pace of adjustment is an important feature of the rebalancing scenario. One of the main concerns in unwinding the current account imbalance is that the adjustment may prove sudden and disorderly, with foreign investors losing confidence in the United States, for instance. Obstfeld and Rogoff (2005) focus on the risk of a "hard landing," where the depreciation of the dollar that they calculate would take place in a fast and disruptive manner. While a 30 percent depreciation of the dollar in a single year could be disruptive for world markets, a similar movement spread over several years would be more manageable. Our scenario explores a situation in which the largest one-year depreciation of the dollar is less than 10 percent, a magnitude that can be absorbed by markets: in 2003 and 2004 the dollar depreciated by 12.2 and 8.2 percent (as measured by the major currency index published by the Federal Reserve Board of Governors),[16] a movement that proved manageable.

A sensitivity analysis shows that the gradual pace of adjustment, which is the central result of our analysis, remains robust to alternative scenarios. However, the magnitude of the exchange rate movements is larger if we limit gross financial flows, thereby limiting the leverage between assets and liabilities with different rates of return. The United States also benefits from earning a larger return on its assets than it pays on its liabilities, and removing this spread leads to a larger adjustment in the exchange rate.

A caveat to our setup is that the dynamic linkages remain quite simple, as we do not consider any intertemporal optimization by agents. Nevertheless, several studies, such as Blanchard et al. (2005), Helbling et al. (2005), and Faruqee et al. (2006), use richer models of the world economy and find a gradual adjustment to be a manageable alternative.

16. The values of the index are 105.98 (2002), 93.04 (2003), and 85.42 (2004). See http://www.federalreserve.gov/releases/g5a/current/.

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