Global Current Account Imbalances and Exchange Rate Adjustments

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This is the third installment in a series of papers we have written over the past five years about the growing United States current account deficit, and the potentially sharp exchange rate movements any adjustment might imply (see Obstfeld and Rogoff 2000a, 2004).[1] The problem is hardly going away. Indeed, the U.S. current account today is running at around 6 percent of GDP, an all-time record. Incredibly, the United States current account deficit is currently soaking up about 75 percent of the combined current account surpluses of Germany, Japan, China and *all* the world's surplus countries.[2] To balance its current account simply through higher exports, the United States would have increase revenues by a staggering 70 percent over 2004 levels. And, as we shall argue in this paper, the speed at which the U.S. current account ultimately closes up, the triggers that drive it, and the way in which the burden of adjustment is allocated across Europe and Asia, all have enormous implications for the global exchange rates. Each scenario, in turn, poses its own risks to financial markets and to general economic stability.

Our overall assessment is that the risks of collateral damage -- beyond risks to exchange rate stability -- have grown substantially over the five years since our first research paper on the topic, partly because the U.S. current account deficit itself has grown, but mainly because of a mix of other factors. These include, first and foremost, the stunningly low United States personal saving rate (which, driven by unsustainable

[1] From an accounting perspective, a country's current account essentially adds net interest payments to its trade balance deficit. As we shall later discuss, the United States presently receives about the same amount of interest as it pays out. Hence, for the United States (and indeed many countries), the current account and trade balance are quantitatively very similar. As we shall later emphasize, however, the current account does not include capital gains and losses on existing wealth. Thus, the overall change in a country's net foreign asset position can, in principle, be less than or greater than its current account deficit or surplus.

[2] Calculated from World Economic Outlook data base (International Monetary Fund), using current account data from 2004.

rates of housing price appreciation and record low interest rates, fell to 1 percent in 2004). But additional major risks are posed by the sharp post-2000 deterioration in the United States federal government's fiscal trajectory, rising energy prices, and the fact that the United States has become increasingly dependent on Asian central banks and politically unstable oil producers for financing its deficits. Add to these vulnerabilities Europe's conspicuously inflexible economy, Japan's continuing dependence on export-driven growth, emerging markets' potential vulnerability to any kind of global financial volatility, and the fact bank counterparty risk increasingly corresponds to insurance companies, hedge funds and other non-bank entities. Perhaps above all, geopolitical and terror risks have risen markedly since September 2001, with the United States facing open ended long-term costs for financing wars and homeland security.

True, if some shock (such as a rise in foreign demand) were to close up the global imbalances absent any concomitant weaknesses, the damage might well be contained to exchange rates and to the collapse of a few large banks and financial firms – along with, perhaps, mild recession in Europe and Japan. But given the broader risks, it would seem prudent to try to find policies to start gradually reducing global imbalances now rather than later. Prudent policies would include finding ways to reverse the decline in United States saving, particularly by developing a more credible strategy for closing up the structural federal budget deficit and starting to tackle actuarially bankrupt old-age pension and medical benefit programs. Higher productivity growth in the rest of the world would be particularly helpful in achieving a benign outcome but only, as our model illustrates, if the growth in concentrated in nontraded (domestically produced and consumed) goods, rather than export-sector-driven productivity growth (which would be counterproductive).

It is also essential that Asia, which now accounts for more than one third of global output (on a purchasing power parity basis), take responsibility for bearing its share of the burden of adjustment. As our analysis illustrates, if demand shifts cause the United States current account to close even by half (from 6 percent to 3 percent), non-Asia exchange rates will have to depreciate by roughly 25 percent, even in a setting where the shift takes place over over a couple years rather than overnight. Not only will Europe and other non-Asian countries potentially suffer a severe decline in export demand, they will also incur huge losses on their net foreign asset positions (Europe will lose approximately 30 percent of GDP if the United States current account halves, and 60 percent of GDP is it goes to zero, under the Asia peg scenario.)

We do not regard our perspective as particularly alarmist. Roubini and Setser (2004) make a credible case that the situtation is far grimmer than we suggest, and Blanchard , Giavazzi, and Sa (2005) present an elegant and thoughtful analysis suggesting that prospective dollar exchange rate changes are plausibly even larger than those implied by our model. It would seem to us that any sober policymaker or financial market analyst ought to regard the United States current account as a potential Sword of Damocles hanging over the global economy.

There are however, many more Panglossian views. One leading benevolent interpretation is the Bretton Woods II model (or "Deutsche Bank view"), forcefully exposited in this volume by Dooley and Garber. This view maintains that the Chinese authorities' central problem is to maintain growth so they can soak up surplus labor, and that a dollar peg (or near peg) helps preserve international competitiveness for exports while protecting the country's fragile banking system. Let's set aside the fact that the Chinese maintained the peg even through the Asian financial crisis of 1997-98 and as the dollar soared at the end of the 1990s (presumably making Chinese exports much less competitive), or that China risks a classic exchange rate crisis if its fortunes ever turn, say, due to political upheaval in the transition to a more democratic system. The real weakness in the Bretton Woods II theory is that Chinese economy is still less than half the size of Germany's or Japan's at market exchange rates. So, while running surpluses of similar size to China's relative to GDP, Germany and Japan actually account for a much larger share of global surpluses in absolute terms. (After all, Germany, not China, is the world's leading exporter.) And surplus labor is hardly the problem in these countries.

United States Federal Reserve Chairman Alan Greenspan, in Greenspan (2004) and in many subsequent speeches, offers an intriguing argument. He agrees that the United States is unlikely to be able to continue borrowing such a massive percent of income indefinitely, and recognizes that the U.S. current account will likely close sharply some day. Greenspan argues, however, that increasing global financial integration is both what allows the United States to run such large deficits and the saving factor that will greatly cushion the process of unwinding those deficits. We completely agree that increasing global financial integration can explain larger current account deficits, particularly to the extent that greater trade integration helps underpin financial integration, as in our original analysis (Obstfeld and Rogoff 2000a,b). Indeed, this was precisely the point of our first approaches to this problem. A narrowing of the United States current account deficit must ultimately be the result, however, of more balanced trade – because the trade balance is overwhelmingly the main component of the current account. And, as seemingly open as the United States economy is to financial flows, international product markets remain quite imperfectly integrated. Thus, any correction to the trade balance is likely to entail a very large change in the dollar exchange rate: our baseline figure, with moderate adjustment speed, is over 30 percent. A much smaller dollar change is possible only if the adjustment is stretched over a very long period (say, a decade), in which case labor and capital mobility across sectors and economies can significantly reduce the need for relative price changes. On the other hand, should adjustment take place abruptly (say, because of a collapse in United States housing prices, or a dramatic reallocation of global central bank reserves toward the euro), the potential fall in the dollar is much larger even than our baseline 30 percent, primarily because sticky nominal prices and incomplete exchange rate pass-through hamper adjustment.

Enhanced global financial integration may well facilitate gradual current account and exchange rate adjustment, but it might also promote the development of large unbalanced financial positions that leave the world economy vulnerable to financial meltdown in the face of large exchange rate swings. True, in a recent Federal Reserve study, Croke, Kamin, and Leduc (2005) argue that sustained industrial country current account imbalances have typically terminated in a relative benign fashion. But their threshold for a current account "reversal" (the country must be running a deficit of at least 2 percent of GDP for three years, and improve its current account by at least 2 percent (or a third)) is a very low bar compared to where the United States stands today (at 6 percent of GDP). Croke et al. are forced to choose a low threshold, of course, because current account deficits of the size (relative to GDP) and duration of the recent United States experience are rare (see also Sebastian Edwards' contribution to this volume). Most importantly, the United States accounts for over 75 percent of global deficits today, so any comparison based on the experience of a small OECD country is of limited value.

In addition to Chairman Greenspan, a number of academic researchers have emphasized how important changes in the global financial system, particularly over the past ten years, have changed the nature of international financial adjustment. Lane and Milesi-Ferreti, in a series of papers (including especially 2005a,b), have documented the explosion of gross asset flows. Tille (2004) and Gourinchas and Rey (2005a) have shown that asset revaluation effects from dollar depreciation can have a significant impact on U.S. net financial obligations to foreigners. Gourinchas and Rey argue, in fact, that the growing importance of such revaluations implies that the United States need only adjust its trade balance two-thirds as much as in analyses such as Obstfeld and Rogoff (2000a); even this would still imply very large dollar movements, of course. We agree that the size and composition of gross asset positions is increasingly important, and our model simulations explicitly take account of the revaluation channel. We find it important, though it only mutes the requisite exchange rate changes modestly,

The growing financial globalization that these authors and Chairman Greenspan emphasize is, however, a double-edged sword. For example, because the United States borrows heavily in the form of bonds and lends heavily in the form of equities, it is peculiarly sensitive to even a modest rise in the interest rates it pays on its debt. Indeed, we show that, in terms of exchange rate adjustments, the adverse effect of a 1.25 percent rise in the interest rates the United States pays on its short term debt is similar in magnitude to the benefits gained via the valuation channel. More generally, whereas increased global financial integration can indeed help countries diversity risk, it also exposes the system to other vulnerabilities – such as counterparty risk – on a much larger scale than ever before. All in all, whereas we view growing financial globalization as largely a positive development, it is a thin reed on which to hang the case for a benign adjustment to a closing of global imbalances.

In the first section of the paper after the introduction, we try to put the recent U.S. experience in historical perspective, looking at the evolution of U.S. current account imbalances since the mid 1970s. We hope this section will provide a useful reference, though some readers may already be familiar with the essential elements. One piece that is important for our later analysis is that the United States (so far) has had the remarkable ability to consistently pay a lower rate of interest on its liabilities than it earns on its assets. Some component of this has been luck, some component is due to huge central bank holdings of U.S. Treasury bills, some may be due to the unique and central role of the dollar in international finance, and another piece is due to the fact Americans hold a much larger share of foreign assets in equities (and thus get the equity premium). An open question is whether this advantage can continue in the face of large and persistent U.S. deficits.

In the next section, we provide a nontechnical summary of our core three-region model (Asia, Europe and the United States). Readers who are interested in the technical details of our model can read the ensuing theoretical section and the most adventurous can venture into the technical appendix where we fully lay out the model. The final main section of the paper gives our core simulations, where we calibrate the requisite dollar decline against European and Asian currencies under various scenarios. Most of our analysis focuses on real exchange rates, but by assuming that the central banks target GDP or consumption deflators (or sometimes in the case of Asia, exchange rates against the dollar), we are able to extract nominal exchange rate predictions as well (relative to baseline).

In our baseline calibration (in which Asia, Europe's and the United States' current accounts all go to zero), we find that the real effective exchange rate of the United States needs to depreciate by 33 percent (35 percent for the nominal rate.). We view this change as relative to a baseline in which the dollar has already depreciated by roughly 10 percent; however, our calibration assumes flexible prices and does not allow for possible exchange rate overshooting that could significantly amplify the effect. A similarly shared halving of the U.S. deficit – arguably a more likely scenario over the short term –would lead to a depreciation of the real effective dollar of 17 percent . Within our baseline case, the real value of Asian currencies would need to rise 35 percent against the dollar and the real value of European currencies by 28 percent against the dollar.

If, however, Asia sticks to its dollar exchange rate peg as the U.S. current account closes up, the real value of the European currencies would have to rise by almost 50 percent relative to the baseline. Indeed, to maintain its dollar peg in the face of global demand shifts that close up the U.S. current account, Asia would actually have to increase its already massive currently account surplus by more than 70 percent. Even halving these numbers (corresponding, for example, to the case in which the U.S. current account deficit itself falls only by half), one can still appreciate the enormous protectionist pressures that are likely to emerge if Asia tries to stick to its dollar peg in the face of a significant pullback in the United States' voracious borrowing patterns.

Perhaps it is surprising that despite Asia's current account surplus being several times that of Europe (which we define broadly here to include the euro zone and the largest non-Asian economies), the required rise in the Asian currencies relative to the European currencies is not even larger. As we shall see, a couple factors drive this result, including the fact that Asia is relatively more open than Europe – so that a given exchange rate change has a bigger impact on trade – and the fact that a large unanticipated dollar depreciation inflicts brutal damage on Asia's net foreign asset position, a factor we explicitly incorporate in our calibrations.

Of course, our model, although considerably richer than those previously advanced in the literature (including our own), is still subject to a wide range of qualifications and interpretations; we try to emphasize the most important ones. Nevertheless, we view the calibrations as quite useful. A final section highlights the main conclusions that we draw from the technical analysis.

The U.S. Current Account and Foreign Wealth Position, 1970-2005 and Beyond

The main analytical contribution of the paper is to show how to model and numerically calibrate exchange rate and net foreign asset valuation adjustments under alternative scenarios for reducing the U.S. current account deficit. Our framework is intended as a tool for assessing risks and evaluating policy options. At some level, however, the exercise must entail an assessment of how unstable the current trajectory of external payments imbalances really is, along with the likelihood of that adjustment takes place in the medium term. In order to think about this overarching issue, it is helpful to understand the history and evolution of the problem.

Perspectives on the U.S. Deficit

Figure 1 shows the evolution of the United States current account, as a percent of GDP, between period 1970 and 2004. Having fluctuated between +1 and -1 percent of GDP during the 1970s, the United States current account balance first began to go into deep deficit during the mid-1980s, reaching a peak deficit level of 3.4 percent of GDP in 1987. After recovering temporarily at the end of the 1980s and actually attaining a slight surplus in 1991 (propped up by a special, approximately $100 billion one-time transfer from foreign governments to help pay for the Gulf War), the U.S. current account began a slow, steady deterioration throughout the 1990s. That deterioration has continued into the present. Today, of course, the U.S. current account deficit stands at around 6 percent of GDP. As we have already noted, U.S. international borrowing in 2004 accounted for about 75 percent of the excess of national savings over investment of all the world's current account surplus countries, from China to Germany to Japan.

What are the proximate causes of this profound deterioration in the U.S. external balance? That, of course, is the $600 billion (and rising) question. Since in principle, global current accounts should add up to zero, the United States current account deficit -- the excess of United States investment over national saving -- has to be viewed as the net result of the collective investment and saving decision of the entire world. German demographics, OPEC oil revenue investment decisions, depressed investment in Asia –

all these factors and many others impinge on global interest rates and exchange rates and, in turn, on U.S. investment and saving. We do not believe there is any simple answer.

Nevertheless, government fiscal policy clearly appears to have played a dominant role in some episodes. The current account equals, by definition, the sum of government saving less investment plus private saving less investment. Because the Ricardian equivalence of public debt and taxes does not seem to hold in practice, the big Reagan tax cuts of the 1980s almost certainly played a role in the current account deficits of that era. Similarly, the Bush II tax cuts of the 2000s have almost surely played a role over the past few years, preventing the current account from shrinking despite the post-2000 collapse in United States investment. Exchange rate over- and undervaluations also loomed large at the time, usually operating with a lag of one to two years. For example, the U.S. current account deficit peaked in 1987, lagging by two years the 1985 peak of the real trade-weighted dollar (see Figure 2). The weak dollar of the mid-1990s was matched by a pause in the U.S. current account's decline, and the dollar peak in early 2002 was followed again, with some lag, by a sharp decline in the current account. Admittedly, both correlations with the current account deficit -- of fiscal deficits and dollar appreciation --- are fairly loose. For example, Bush I lowered taxes in the late 1980s but the current account continued to improve, whereas Clinton raised taxes in the early 1990s even as the current account decline failed to reverse course. As Figure 3 illustrates, United States fiscal deficits have expanded massively in recent years compared to those of the rest of the world. But then, as the figure also illustrates, Japan has run even larger fiscal deficits than the United States has and yet, at the same time, it has consistently run the world's largest current account surplus in absolute terms.

Indeed, during the 1990s, the major proximate drivers of the U.S. current account were the country's declining rate of private saving and rising rate of investment (relative to those of the rest of the world). The U.S. personal savings rate, which had been stable at around 10 percent of GDP until 1985, has steadily declined since, reaching a mere 1 percent of GDP in 2004. The declining private saving rate has apparently been driven, first by the stock price boom of the 1990s, and then by the continuing housing price boom.[3] Were the U.S. personal saving rate simply to rise to 5 percent, or half way to its level of two decades ago, more than half of today's current account deficit could be eliminated. During much of the 1990s U.S. investment was booming, as shown in Figure 4, so that high external borrowing really was, in principle, financing future growth. Today, however, the picture has changed. As Figure 4 also shows, the main proximate driver of today's U.S. current account deficit is the low level of private and government savings, rather than high levels of investment. Another important factor that has contributed to the U.S. current account deficit since the late 1990s has been the persistently low level of investment in Asia since the region's 1997-98 financial crisis. Indeed today, low levels of investment outside the United States, particularly in Europe and Japan but also in many emerging markets, are a major factor holding global interest rates down. These low global interest rates, in turn, are a major driver in house price appreciation which, particularly in the United States – with its deep liquid home-equity loan markets –contributes to high consumption.

[3] Obviously, if one measures saving taking into account capital gains and losses on wealth, the trend decline in saving is much less, albeit housing wealth is largely not internationally tradable, and can evaporate overnight.

International Assets, Liabilities, and Returns

Naturally, this sustained string of current accounts has led to a deterioration in the United States' net foreign asset position, as illustrated in Figure 5. In 1982, the United States held net foreign assets equal to just over 7 percent of GDP, whereas the U.S. now has a net foreign debt amounting to about 25 percent of GDP. Accompanying this growth in net debt has been a stunning increase in *gross* international asset and liability positions, as is also shown in Figure 5. From levels of 29.5 percent and 22.3 percent of GDP in 1982, U.S. gross foreign assets and liabilities, respectively, had risen to 71.5 and 95.6 percent of GDP by the end of 2003. This process of increasing international leverage -- borrowing abroad in order to invest abroad -- characterizes other industrial-country portfolios, and is in fact much further advanced for smaller countries such as the Netherlands and primary financial hubs such as the United Kingdom; see Table 1 for some illustrative comparative data.[4]

The implications of the reduction in U.S. net foreign wealth would be darker but for the fact that the United States has long enjoyed much better investment performance on its foreign assets than have foreign residents on their U.S. assets. This rate of return advantage, coupled with the expansion in foreign leverage documented in Figure 6, has allowed the U.S. to maintain a generally positive balance of net international investment income even as its *net* international position has become increasingly negative. Figure 6

[4] See also Lane and Milesi-Ferretti (2005a,b) and Obstfeld (2004). The BEA applies market valuation to FDI holdings starting only in 1982. Gourinchas and Rey (2005b) construct U.S. international position data going back to 1952. In 1976, with FDI valued at current cost rather than at market value, U.S. gross foreign assets amounted to 25 percent of GDP and gross foreign liabilities were 12.6 percent of GDP.

shows two measures of U.S. net international investment income.[5] The first (income receipts on U.S. assets owned abroad less income payments on foreign owned assets in the U.S.), is taken from the U.S. balance of payments accounts and comprises transactions data only, that is, actual cross-border remittances of interest and dividends. Interestingly, this balance has not yet entered negative territory, although it could do so soon. Over the period 1983-2003, the income return on U.S.-owned assets exceeded that on U.S. liabilities by 1.2 percent per year on average.

A more comprehensive investment income measure includes the nominal capital gains on foreign assets and liabilities, price changes that could be due to either asset-price movements (such as stock-price changes) or exchange-rate changes. The BEA incorporates estimates of these gains into its updates of the U.S. international investment position, although they do not appear in the international transactions or national income accounts. As expected, Figure 6 shows this net income measure to be much more volatile than the one based on investment income alone. Even though it is negative in some years, on average it is even more favorable for the U.S. than the smoother transactions measure. On average over 1983-2003, the U.S. return on foreign investment, inclusive of capital gains, exceeded the total payout on liabilities by a remarkable 3.1 percent per year.[6]

To understand better the implications of the U.S. rate of return advantage, r_H be

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[5] Gourinchas and Rey (2005b) present a similar graph covering a much longer historical period. The estimates in the text are consistent with those found by Obstfeld and Taylor (in progress) using a different methodology. For a complementary discussion of returns on foreign assets and liabilities, see Lane and Milesi-Ferretti (2005b).

[6] The broad rate of return measures for gross assets and liabilities are constructed by adding to the investment income flow the total capital gain on the previous end-of-period assets (or liabilities), and then dividing this total return by the previous value of assets (or liabilities). Thus in 2003, a year in which the dollar depreciated, the rate of return on U.S. foreign assets was 19 percent, that on liabilities 8.4 percent. Total capital gains are calculated by subtracting the change in U.S.-owned assets abroad (change in foreign-owned assets in the U.S.), as reported in the financial account, from the change in U.S. foreign assets

the rate of return on foreign assets, r_L the rate of return on liabilities, F the stock of net foreign assets, and L gross liabilities. Then the net total return on the international portfolio is $r_H F + (r_H - r_L)L$. This expression shows that when $F < 0$, as for the United States, total investment inflows can still easily be positive when $r_H > r_L$ and when the stock of gross liabilities (basically, the scale of the portfolio, given F) is sufficiently large. The expression also reveals, however, that the leveraging mechanism generating the U.S. surplus on investment returns also heightens the risk of reversal. An unresolved but critical question is whether the United States' favorable position in international markets will be sustained in the face of a high and growing external debt. Should the U.S. at some point be forced to pay a higher rate on its liabilities, the negative income effect will be proportional to the extent of leverage, L.

Part of the historical U.S. international investment advantage is chance and circumstance. The Japanese famously bought trophy properties like Pebble Beach golf club, Rockefeller Center, and Columbia Pictures at premium prices, only to lose large sums later. Europeans poured into the U.S. stock market only at the end of the 1990s, just as the tech bubble was about to burst. However, a deeper reason why the United States net debt position has only accumulated relatively slowly is that Americans hold a considerably larger fraction of their foreign assets in equities, both portfolio equity and direct foreign investment, than do foreigners in the United States. At the end of 2003, Americans held $7.864 trillion dollars in foreign assets, of which 60 percent were equities, either foreign stocks or foreign direct investment (here measured at market value). Foreigners, by contrast, held only 38 percent of their $10.515 trillion dollars in

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(liabilities) at market value, as reported in the BEA international position data.

U.S. assets in the form of equity. Given that equity has consistently paid a significant premium of 2 percent or more over bonds, it is not surprising that U.S. residents have, until very recently, been net recipients of investment returns despite having apparently crossed the line to being net debtor in the mid 1980s.

A major reason why foreigners hold relatively more U.S. bonds than vice-versa is that the U.S. dollar remains the world's main reserve currency. Indeed, out of the $3.8 trillion total international reserves held by central banks, a very large share is in dollars, and much of it is short term.[7] Figure 7 illustrates the burgeoning reserves of Asia, now in excess of $2 trillion. According to the BEA, over 45 percent of the United States' $680 billion dollar currency supply is held abroad, and this is probably an underestimate (see Porter and Judson 1996). This, together with the dollar's reserve currency role, goes far toward explaining why U.S. liabilities are so heavily weighted toward debt. Note that when one speaks of the United States enjoying rents or seigniorage from issuing a reserve currency, the main effects may come from foreigners' willingness to hold cash or liquid short-term Treasury debt, rather than from any substantial inherent interest-rate advantage. In other words, it is likely that composition effects explain why, even when capital gains are ignored, the balance of U.S. investment income has remained positive. In any event, our empirical analysis will take account of the systematically lower return on US liabilities than on assets elsewhere, and ask what might happen should that advantage suddenly disappear in the process of current account reversal.[8]

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[7] See the survey in *Central Banking*, "The Rise of Reserve Management," March 2005, p. 14.

[8] Of course, multinationals' practice of income shifting in response to differing national tax rates for profits distorts reported investment income flows, making an accurate picture of the true flows difficult to obtain. See, for example, Grubert, Goodspeed, and Swenson (1993) and Harris, Morck, Slemrod, and Yeung (1993). The expansion of gross international positions over the past decade has potentially worsened this

At present, the net U.S. foreign debt is about 25 percent of GDP. A simple back-of-the-envelope calculation shows that if United States nominal GDP grows at 5.5 percent per year and the current account deficit remains at 5.5 percent of nominal GDP, the ratio of U.S. net foreign debt to GDP will asymptote to 100 percent of GDP. Few countries have ever reached a level anywhere near this without having a crisis of some sort. The United States already has a net foreign debt to GDP ratio roughly equal to the previous peak of 26 percent reached in 1894 (see Obstfeld and Rogoff 2000a).

Is It Sustainable?

There is an intense and broad-ranging debate on the sustainability of the U.S. current account deficit, and the risks that its continuance poses. Though our main purpose here is to provide a new calibration framework for understanding what might happen to exchange rates when the current account does indeed close up, we cannot entirely avoid some discussion of sustainability. There are several schools of thought, in addition to those we described in the introduction. First, there are various versions of the view, prominently espoused by former U.S. Treasury Secretary Paul O'Neill, that the United States is the best investment opportunity around, so of course the world wants to send its money here.[9] If this view had some currency in the 1990s before O'Neill took office, it has become much more dubious since. When the tech bubble collapsed in 2001, U.S. investment collapsed with it. The growing United States current account of the past

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problem.

[9] To quote another proponent of this world view, "Whether you're an American or a foreigner the U.S. is the choice destination for capital. That's why we have such a large trade deficit." See Arthur B. Laffer,

few years has been fueled are more by a boom in consumption boom, both public and private, than by one in investment.

Cooper (2001) argues more plausibly that the U.S. current account deficit is a result of global portfolio diversification, and that the United States offers the world's richest and deepest capital market. Of course, the theory that foreign investors perceive high United States asset returns seems inconsistent with the fact that foreigners tend to invest in rather low-yielding U.S. instruments. In any case, an ongoing process of global portfolio diversification does not necessarily require any wealth transfer between countries. According to preliminary BEA estimates, in 2004 private foreign investors added $1.078 trillion in U.S. assets to their portfolios, far more than the U.S. current account deficit of $666 billion.

Ventura (2001) advances the related view that under optimal portfolio allocation, the United States will run perpetual current account deficits to maintain its desired leverage ratio. This view, while fascinating as a theoretical possibility, is not consistent with countries switching from being net creditors to net debtors, as the United States did in the mid-1980s. Nor is it consistent with the current account deficit rising without a rise in domestic investment.

Finally, we have already mentioned the Dooley, Folkerts-Landau, and Garber (2004a,b) perspective in our introduction. They argue provocatively that undervalued dollar pegs in Asia (notably in China), coupled with massive reserve accumulation by Asian central banks, are necessary if that region is to sustain its export-led growth and absorb excess labor into industrial employment. As we have already noted, China

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"Destination U.S.A.," *Wall Street Journal*, January 3, 2005.

certainly has an excess-labor problem, but it is hard to see how the model applies to Japan, the country that runs by far the largest current account surpluses in absolute terms, and that has accumulated the largest hoard of dollar reserves. Indeed, Japan's demographics put it on track to become a deficit country sometime over the next decade. If the United States is to continue borrowing at its current rate, the rest of world is going to have to run considerably larger surpluses once Japan switches over. Compared to China, however, the other countries of non-Japan Asia have much more sophisticated and open capital markets. Those countries will not easily be able to maintain artificially undervalued exchange rates for long even if China somehow manages to stick with its peg and delay its inevitable crisis into the far future. The less tightly controlled Asian economies will be forced to choose sooner between currency appreciation or much higher levels of inflation, just as Germany was toward the end of the Bretton Woods period.

Another school of thought holds that whereas the U.S. current account must ultimately adjust, the process will be relatively painless. Again, we have already mentioned the deceptively reassuring Greenspan (2004) view that as global financial markets deepen, it becomes easier for the United States to finance larger and more persistent deficits, a factor making a gradual rather than precipitous adjustment more likely. The problem is that goods market integration has not kept pace with finanical globalization, and ultimately it is goods markets that have to bear the burden of trade balance adjustment. Greenspan also argues that with its highly flexible markets, the United States can easily handle any needed adjustment in net exports. Whereas the United States economy may indeed be highly flexible, much of the rest of the world -- especially Europe -- is not. Exchange rate adjustments of the type our calibrated model predicts are likely to be quite painful abroad.

So much for the more sanguine views. A wide range of authors (including ourselves in our two earlier papers on this topic) take a much more alarmist view. We have already cited the views of Roubini and Setser (2004), who describe a particularly dire potential adjustment scenario, with the United States losing its reserve currency status and global interest rates skyrocketing. Cline (2005) takes a more centrist view, but still concludes that U.S. fiscal policy is so poorly anchored that a rocky finish to the current-account saga is inevitable. Mann (2005) also points to risks in the adjustment process. Krugman (1985, 1991) takes as dim a view as anyone on the unsustainability of long-term twin deficits, and his views on the 1980s experience would seem to apply with even greater force to the current scene.

It is hard to escape the conclusion that, in a world where the current account may adjust abruptly, bringing with it large changes in international relative prices, a persistently large U.S. deficit constitutes an overhanging systemic threat. A balanced view of the debate suggests the need for a quantitative analysis of how U.S. current account adjustment would affect exchange rates. We take this up next.

Summary of the Approach

In this section we summarize the main features and mechanisms in our analysis. After reading this section, readers who are primarily interested in our exchange rate predictions can skip the following section, in which we present the details of the model, and proceed directly to our discussion of numerical findings.

We work within a three-region model of a world economy consisting of the United States, Europe, and Asia. These regions are linked by trade, and also by a matrix of international asset and liability positions. A region produces a distinctive export good, which its residents consume along with imports from the other two regions. In addition, each region produces nontraded goods, which its residents alone consume.

A key, but realistic, assumption is that each country's residents have a relative preference for the traded good that is produced at home and exported -- that is, consumption of tradable goods is intensive in the home export, giving a home bias in tradable consumption. This feature builds in a "transfer effect" on the terms of trade that provides one of the key mechanisms through which changes in the international pattern of current accounts change real and nominal exchange rates. A reduction in the United States current account deficit, if driven by a fall in its spending and a rise in its saving, represents a shift in world demand toward foreign tradable goods that depresses the relative price of U.S. exports in terms of imports from both Asia and Europe. (The international terms of trade of the United States deteriorate.) Because U.S.-produced tradables play a large role in the U.S. CPI compared with foreign imports, while foreign export goods similarly play a larger role in foreign CPIs, the result is a real and nominal depreciation of the dollar.

This terms of trade effect of current account adjustment has been stressed in the literature, but it is potentially less important quantitatively than is a *second* real exchange rate effect contained in our model. That effect is the impact of current account adjustment on the prices of *nontradable* goods. The CPI can be viewed as made up of individual sub-CPIS for tradables and nontradables, with nontradables empirically having about three times the weight in the overall CPI (given the importance of nontradable service inputs into the delivery to consumers of even tradable products). The real exchange rate between two currencies is their overall CPI ratio, with both price indexes expressed in a common currency. Thus a fall in a country's prices for nontraded goods, relative to the same-currency price of nontradables abroad, will depress its relative price level just as a terms of trade setback does, causing real and nominal depreciation of its currency. Because nontradables are so important a component of the CPI, however, ignoring effects involving their prices would omit much of the effect of current account adjustment on exchange rates. So this additional mechanism, absent from much of the policy discussion, is critical to include.

When the U.S. external deficit falls due to a cut in domestic consumption, part of the demand reduction falls on tradable goods (exportables as well as imports), but part also falls on U.S. nontradables. The consequent fall in the nontraded goods' prices reinforces the effect of weaker terms of trade in depreciating the dollar against the currencies of Europe and Asia. As noted, in our calibration, this second effect receives three times the weight that terms of trade effects receive in explaining exchange rate movements.

Our discussion considers several scenarios for U.S. current account adjustment, involving different degrees of burden-sharing by Europe and Asia and the resulting effect on those regions' bilateral and effective exchange rates. For example, if Europe's deficit rises to offset a fall in America's, while Asia's surplus remains constant, the dollar appreciates more against Europe's currencies, and less against Asia's, than if Asia and Europe share in accommodating the U.S. return to balanced trade. The dollar's trade-weighted effective exchange rate depreciates by more under the second of the two preceding scenarios because Asia trades more with the U.S. than Europe does, giving the bilateral appreciation against Asia the dominant role in determining effective depreciation.

We also consider the effect of exchange rate changes in revaluing gross foreign asset positions, thus redistributing the burden of international indebtedness, as well as the possibility that the adjustment process, especially if disorderly, could entail higher interest payments abroad on U.S. short-term foreign obligations. Finally, key parameters in our model govern the substitutability in consumption between various tradable goods and between tradables and nontradables. In general, the lower are the substitution elasticities, the greater the relative price changes caused by current account adjustments and the greater, therefore, the resulting terms of trade and exchange rate responses. Because the values of these elasticities are quite uncertain and can differ as between the short and long runs, we quantitatively examine their role in generating our numerical estimates.

The Model

The three-country endowment model we develop here extends the earlier small-country framework used in Obstfeld and Rogoff (2000a) and the two-country framework of Obstfeld and Rogoff (2004).[10] The three countries (or regions), whose sizes can be

[10] Readers who wish to defer reading further technical details of the model may choose to skip to the next section on model predictions.

flexibly calibrated, will be labeled U (for United States), E (for Europe), and A (for Asia). The model distinguishes both between home and foreign produced tradables, and between tradable and nontradable goods (with the latter margin, largely ignored in many discussions of the U.S. current account deficit, turning out to be more important quantitatively in our simulations). Our focus here will be on articulating the new insights that can be gained by going from two countries to three, particularly in understanding different scenarios of real exchange rate adjustment across regions as the current account deficit of the United States falls to a sustainable level.

We draw the reader's attention to four features of our model. First, by assuming that endowments are given exogenously for the various types of outputs, we are implicitly assuming that capital and labor are not mobile between sectors in the short run. To the extent global imbalances close only slowly over long periods (admittedly not the most likely case based on experience), then factor mobility across sectors will mute any real exchange rate effects (Obstfeld and Rogoff 1996). Second, we do not allow for changes in the mix of tradable goods produced or for the endogenous determination of the range of non-tradable goods, two factors which would be operative over the longer run and could also mute the effects on real exchange rates of current account movements. Third, our main analysis assumes that nominal prices are completely flexible. That assumption—in contrast to our assumption on factor mobility—almost surely leads us to understate the likely real exchange rate effects of a current account reversal. As we discuss later, with nominal rigidities and imperfect pass-through from exchange rates to prices, the exchange rate will need to move more, and perhaps much more, than in our baseline case in order to maintain employment stability. Fourth, we do not explicitly model inter-temporal consumption allocation, but rather focus on the intra-temporal price consequences of alternative patterns of production/consumption imbalances.

The Core Model

Though notationally complex, our core three-region model is conceptually quite simple. We assume that consumers in each of the three regions allocate their endowment income between consumption of traded and non-traded goods. Within the category of traded goods, they choose between consumption of goods produced in each of the three regions. The equilibrium terms of trade and the relative price of traded and non-traded goods (and thus both cross-country and effective real exchange rates) are determined endogenously. Given assumptions on central bank policy (depending, for example, on whether the central bank aims to stabilize the CPI deflator, GDP deflator, or a bilateral exchange rate), the model can also generate nominal exchange rates.

We begin by defining

$$C_j^i \equiv \text{country } i \text{ consumption of good (or good category) } j.$$

The country i consumption index depends on U.S., European, and Asian tradables, as well as domestic nontradables. It is written in the nested form

$$C^i = \left[\gamma^{\frac{1}{\theta}} \left(C_T^i \right)^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} \left(C_N^i \right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}, i = U, E, A,$$

with

$$C_T^U = \left[\alpha^{\frac{1}{\eta}} \left(C_U^U \right)^{\frac{\eta-1}{\eta}} + (\beta-\alpha)^{\frac{1}{\eta}} \left(C_E^U \right)^{\frac{\eta-1}{\eta}} + (1-\beta)^{\frac{1}{\eta}} \left(C_A^U \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}},$$

$$C_T^E = \left[\alpha^{\frac{1}{\eta}} \left(C_E^E \right)^{\frac{\eta-1}{\eta}} + (\beta - \alpha)^{\frac{1}{\eta}} \left(C_U^E \right)^{\frac{\eta-1}{\eta}} + (1-\beta)^{\frac{1}{\eta}} \left(C_A^E \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}},$$

$$C_T^A = \left[\delta^{\frac{1}{\eta}} \left(C_A^A \right)^{\frac{\eta-1}{\eta}} + \left(\frac{1-\delta}{2} \right)^{\frac{1}{\eta}} \left(C_E^A \right)^{\frac{\eta-1}{\eta}} + \left(\frac{1-\delta}{2} \right)^{\frac{1}{\eta}} \left(C_U^A \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}.$$

We do not assume identical preferences in the three countries. On the contrary, we wish to allow, both in defining real exchange rates and assessing the effects of shocks, for a home bias in tradables consumption, such that each country has a relative preference for tradables that it produces and exports abroad.[11] Home consumption bias gives rise to a "transfer effect," whereby an increase in national expenditure improves a country's terms of trade, that is, raises the relative price of its exports compared to its imports.

Above, the U.S. and Europe are "mirror symmetric" in their preferences for each other's goods, but attach the same weight to Asian goods. Asia weighs U.S. and European imports equally, but may differ in openness from the U.S. and Europe. Specifically, we will assume that $1 > \beta > \alpha > 1/2$. We will also assume that $\delta > \frac{1}{2}$. For example, if $\beta = 0.8$ and $\alpha = 0.7$, then the U.S. tradedables consumption basket has a weight of 0.7 on its own tradables, 0.1 on European tradables, and 0.2 on Asian tradables. (A very similar – and for many exercises isomorphic – model arises if one assumes that all countries have identical preferences, but that international trading costs are higher than domestic trading costs, see Obstfeld and Rogoff 2000b.)

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[11] Warnock (2003) also takes this approach.

The values of the two parameters θ and η are critical in our analysis. Parameter θ is the (constant) elasticity of substitution between tradable and nontradable goods. Parameter η is the (constant) elasticity of substitution between domestically-produced and imported tradables. The two parameters are important because they underlie the magnitudes of price responses to quantity adjustments. Lower substitution elasticities imply that sharper price changes are needed to accommodate a given change in quantities consumed.

Price Indexes and Real Exchange Rates

Using standard methods (see, for example, Obstfeld and Rogoff 1996), one can derived exact consumption based price indices. Define

$$P_j^i \equiv \text{country } i \text{ exact price index for consumption category } j.$$

The corresponding overall consumer price indexes are (say, in U.S. dollars; our main analysis is in terms of real prices and exchange rates, so all prices may be thought of in terms of the common numeraire),

$$P_C^i = \left[\gamma\left(P_T^i\right)^{1-\theta} + (1-\gamma)\left(P_N^i\right)^{1-\theta}\right]^{\frac{1}{1-\theta}}, i = U, E, A,$$

where subscript "C" denotes the overall consumption basket (so that this index is the broad CPI), and where

$$P_T^U = \left[\alpha P_U^{1-\eta} + (\beta-\alpha)P_E^{1-\eta} + (1-\beta)P_A^{1-\eta}\right]^{\frac{1}{1-\eta}},$$

$$P_T^E = \left[\alpha P_E^{1-\eta} + (\beta - \alpha) P_U^{1-\eta} + (1-\beta) P_A^{1-\eta}\right]^{\frac{1}{1-\eta}},$$

$$P_T^A = \left[\delta P_A^{1-\eta} + \left(\frac{1-\delta}{2}\right) P_U^{1-\eta} + \left(\frac{1-\delta}{2}\right) P_E^{1-\eta}\right]^{\frac{1}{1-\eta}}.$$

Above, P_i, $i = U, E, A$, is just the price of the differentiated tradable good produced by country i.

In our analysis we assume the law of one price for tradables, so that the price of any given country's tradable good is the same in all regions. (In practice, of course, the law of one price holds mainly in the breach, partly due to the difficulties in separating out the truly tradable component of "tradable" goods.) As a result of the home-export consumption bias we have assumed, the *tradables* price indexes P_T^i can differ across countries even when the law of one price holds, reflecting the asymmetric consumption weightings. As a result, changes in terms of trade, through their differential effects on countries' price levels for traded goods, affect real exchange rates.

There are three bilateral terms of trade, three bilateral real exchange rates, and three real effective exchange rates. The terms of trade are

$$\tau_{U,E} = \frac{P_E}{P_U}, \quad \tau_{U,A} = \frac{P_A}{P_U}, \quad \tau_{E,A} = \frac{P_A}{P_E} = \frac{\tau_{U,A}}{\tau_{U,E}}.$$

Here, for example, a rise in $\tau_{U,E}$ is a rise in the price of European tradables in terms of American tradables, a deterioration in the U.S. terms of trade. Bilateral real exchange rates are

$$q_{U,E} = \frac{P_C^E}{P_C^U}, q_{U,A} = \frac{P_C^A}{P_C^U}, q_{E,A} = \frac{P_C^A}{P_C^E} = \frac{q_{U,A}}{q_{U,E}}.$$

Here, for example, a rise in $q_{U,E}$ is a rise in the price of the European consumption basket in terms of American consumption baskets, or a real depreciation of the U.S. currency.

As we have noted, asymmetric preferences over traded goods allow terms of trade to affect traded goods price indexes. For example, the United States' price index places a comparatively high weight on U.S. exports, whereas Europe's does the same for its own exports, so the U.S. tradables price falls relative to Europe's when Europe's bilateral terms of trade against the U.S. improve. Denoting a percent change with a circumflex, we can logarithmically approximate the evolution of the relative European-to-American tradables price ratio as:

$$\hat{P}_T^E - \hat{P}_T^U = (2\alpha - \beta)\hat{\tau}_{U,E}.$$

(Exact expressions for price indexes, which we use to generate the numerical results reported below, are given in the Appendix.) The preceding expression equals the U.S. consumption weight on its own exports, α, less the European consumption weight on imports from the U.S., $\beta - \alpha$, times the percentage increase in Europe's terms of trade against the U.S. Observe that terms of trade against Asia do not enter this expression. Given the bilateral Europe-U.S. terms of trade, changes in terms of trade against Asia enter the European and U.S. tradables price indexes symmetrically (that is, with identical consumption weights of $1-\beta$), and therefore drop out in computing their log-difference change.

Similarly, the evolution of the Asian price level for tradables relative to that of the United States also reflects terms of trade movements. But because, under our assumptions, Asia trades more extensively with Europe than the United States does, prices of European exports have a relatively bigger impact on Asia's average import prices. This is shown by the logarithmic approximation:

$$\hat{P}_T^A - \hat{P}_T^U = [\delta - (1-\beta)]\hat{\tau}_{U,A} + \left[\left(\frac{1-\delta}{2} - (\beta - \alpha)\right)\right]\hat{\tau}_{U,E}.$$

The weights on the terms-of-trade changes above simply reflect relative consumption weights, as before. Now, however, given the bilateral Asia-U.S. terms of trade, an improvement in Europe's terms of trade vis-à-vis the U.S. raises Asia's price index for traded goods relative to that in the U.S. when, as we shall assume in our simulations, the Asian consumption weight on European imports, $(1-\delta)/2$, exceeds the weight attached by United States consumers, $\beta - \alpha$. Such third-country asymmetries cannot be captured, or course, in a two-country framework.

Bilateral real exchange rate movements follow immediately from the expressions above. For the rate between Europe and the U.S., for example, the log change in the bilateral real exchange rate is simply the consumption weight on tradables times the log change in relative tradables price indexes, plus the consumption weight on nontradables, times the log change in relative nontradables price indexes:

$$\hat{q}_{U,E} = \gamma(2\alpha - \beta)\hat{\tau}_{U,E} + (1-\gamma)(\hat{P}_N^E - \hat{P}_N^U).$$

Analogously, between the United States and Asia we have

$$\hat{q}_{U,A} = \gamma[\delta - (1-\beta)]\hat{\tau}_{U,A} + \gamma\left[\left(\frac{1-\delta}{2} - (\beta - \alpha)\right)\right]\hat{\tau}_{U,E} + (1-\gamma)(\hat{P}_N^A - \hat{P}_N^U).$$

We emphasize one key aspect of these expressions. The weight on nontraded goods is likely to be quite large due to the large component of nontradable services included in the consumer prices of goods generally classified as entirely tradable. In our simulations, we therefore take the weight on nontraded goods above to be 0.75. An implication is that, while the terms of trade certainly are a qualitatively important factor in real exchange-rate determination given home consumption bias, relative prices for nontraded goods potentially play an even larger role.

Solution Methodology

The methodology that we use to calculate the relative-price effects of current account shifts is essentially the same as that in our earlier papers (Obstfeld and Rogoff 2000, 2004), extended to a three-region setting. Given fixed output endowments, an assumed initial pattern of current account imbalances, an assumed initial pattern of international indebtedness, and a global interest rate, relative prices are determined by the equality of supply and demand in all goods markets. Changes in the international pattern of external imbalances, whether due to consumption shifts or other changes (including changes in productivity), shift the supply and demand curves in the various markets, giving a new set of equilibrium prices. These are the price changes we report below, under a variety of current-account adjustment scenarios. (Of course, the global sums of imbalances and of net international asset positions are both constrained to be zero.)

There are six market-clearing conditions, covering the three regional nontraded-goods markets and the three global markets for the tradable goods, although one of these is redundant by Walras' Law. The five independent equilibrium conditions allow solutions for:

1. The U.S. terms of trade against Europe, $\tau_{U,E}$.

2. The U.S. terms of trade against Asia, $\tau_{U,A}$.

3. The price of nontradables in terms of tradables in the U.S., $\frac{P_N^U}{P_T^U}$.

4. The price of nontradables in terms of tradables in Europe, $\frac{P_N^E}{P_T^E}$.

5. The price of nontradables in terms of tradables in Asia, $\frac{P_N^A}{P_T^A}$.

From the first two conditions above (U.S. bilateral terms of trade against Europe and Asia), one can, of course calculate the Europe-Asia bilateral terms of trade, $\tau_{E,A} = \frac{\tau_{U,A}}{\tau_{U,E}}$. One can also calculate the three bilateral real exchange rates, for which items $1-5$ above are the critical inputs. Because of the asymmetric preferences over tradables, there is, as we have noted, a transfer effect in the model (wealth transfers feed back into terms of trade and hence real exchange rates), although it is more complex than would be the case with only two countries in the world.

We will also want to define and analyze real *effective* (loosely speaking, trade-weighted) exchange rates. These are specified as

$$q^U = \frac{\left(P_C^E\right)^{\frac{\beta-\alpha}{1-\alpha}}\left(P_C^A\right)^{\frac{1-\beta}{1-\alpha}}}{P_C^U},$$

$$q^E = \frac{\left(P_C^U\right)^{\frac{\beta-\alpha}{1-\alpha}}\left(P_C^A\right)^{\frac{1-\beta}{1-\alpha}}}{P_C^E},$$

$$q^A = \frac{\left(P_C^U\right)^{\frac{1}{2}}\left(P_C^E\right)^{\frac{1}{2}}}{P_C^A}.$$

Three extensions of the analysis are helpful to add to its relevance and realism; details are included in the Appendix. First, we ask how real exchange rate changes translate into nominal exchange rate changes; this depends on central bank policy. In general, this turns out not to be a critical issue empirically. Two potentially far more important extensions are to take into account how exchange rate changes affect the net foreign asset positions of the different regions (due to a currency mismatch between gross assets and liabilities). This channel has recently been emphasized by Tille (2004), by Lane and Milesi-Ferretti (2005a, 2005b), and by Gourinchas and Rey (2005a, 2005b). The valuation channel turns out to be significant but of secondary importance compared to the main demand channels emphasized in our preceding analysis. Finally, we extend the analysis to take into account how a rise in relative U.S. interest rates (due, say, to concern about government deficits and/or erosion of the dollar's reserve-currency status). This effect, which works to exacerbate rather than ameliorate the adjustment problem, is also significant though again less important than the effects of a rebalancing of global demand.

With these analytical results in hand, we now proceed to study the model's quantitative implications.

Model Predictions

We are now ready to explore the model's predictions for global exchange rates and terms of trade under various scenarios for rebalancing the United States current account. We first need to think about parametrizing the model.

Choosing Parameters

As we have already observed, the critical parameters in the model are θ, the elasticity of substitution in consumption between traded and nontraded goods, and η, the elasticity of substitution in consumption between the traded goods produced by the three regions. The lower are these elasticities, the greater the exchange rate and price adjustments needed to accommodate any inter-regional shifts in aggregate demand. For θ, most of our simulations will be based on a value of $\theta = 1$. Relative to some estimates suggested in the literature, this is a relatively high number. Mendoza's (1991) point estimate is 0.74, Ostry and Reinhart (1992) report estimates in the range 0.66 to 1.3 for a sample of developing countries, and Stockman and Tesar (1995) use an estimate of 0.44. Using a different approach, Lane and Milesi-Ferretti (2004) derive estimates as low as 0.5. Indeed, for larger and relatively closed economies (such as the United States, Europe, and Japan), they suggest that the value should be even lower. We will also calculate results, however, for a higher elasticity of $\theta = 2$.

Our baseline choice of $\eta = 2$ as a representative aggregate trade elasticity is a compromise between two sets of evidence. Estimates based on trade flows within disaggregated product categories, for example those of Feenstra (1994) or the more recent figures of Broda and Weinstein (2004), cover a wide range but typically include many values much higher than $\eta = 2$. On the other hand, conventionally estimated aggregate trade equations, as well as the correlations between trade and terms of trade calibrated in dynamic general-equilibrium models, tend to indicate much smaller values for η, typically 1 or even lower.

A number of potential mechanisms explain this discrepancy, some echoing Orcutt's (1950) classic skepticism about the low elasticities seemingly implies by macro-level estimators. Aggregation bias lowers estimated macro-elasticities because the price movements of low-elasticity goods tend to dominate overall movements in import and export price indexes.[12] Another issue is that macro estimates of business-cycle frequency correlations tend to confound permanent and temporary price movements, in contrast to micro-level cross-sectional or panel studies centered on liberalization episodes.[13] In taking $\eta = 2$, we try, in a crude way, to address these biases while also recognizing the empirically-inspired rules of thumb that inform policymakers' forecasts. We also include a baseline simulation of the case $\eta = 100$ (all traded goods are essentially perfectly substitutes). That simulation shuts down terms of trade effects and thereby shows how large a role is being played by substitution between traded and nontraded goods, the

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[12] For an excellent example of this bias in action, see Hooper et al. (2000), who report that because oil and tourism demand are relatively price-inelastic, trade equations based on aggregates that include oil and services imply apparently much lower price elasticities than equations for nonoil manufactures only. Hooper et al. report short-run price elasticities for G-7 imports and exports (including oil and services) that in most cases do not satisfy the Marshall-Lerner condition. We view the elasticities implied even by aggregated estimates that exclude oil and services as unreasonably low; but if they are accurate, they imply larger terms of trade and real exchange rate effects of international spending shifts.

[13] See Ruhl (2003). In general, our model omits dynamics from the introduction of new product varieties, which would act over the longer run to dampen the extent to which a rise in a country's relative productivity lowers its terms of trade. See, for example, Krugman (1989) and Gagnon (2003).

channel emphasized in our 2000 paper.

We set both α and δ, the consumption weights of Americans/Europeans and Asians on home products within the traded-goods consumption baskets, equal to 0.7. That choice is plausible based on Obstfeld and Rogoff's (2000b) discussion. We set β = 0.8, implying that Europe and the U.S. alike place weights of β - α = 0.1 on each other's traded goods, and twice that weight (0.2) on Asian goods. Asia, by assumption, distributes its demand evenly across the two other regions (placing a weight of 0.15 on the exports of each). So in our model, Europe and the U.S. both trade more with Asia than with each other.

In the Appendix, we discuss in detail our calibration of gross liabilities and assets for each region, as well as their currencies of denomination. The point we stress here is that, to a first approximation, the United States is a net debtor (to the tune of about 25 percent of its total GDP or 100 percent of its exportable GDP) and greater Europe has approximately a zero net international position. Our model's third region, Asia, therefore is left therefore as a net international creditor in an amount equal to 100 percent of U.S. tradable GDP. United States gross foreign liabilities are almost all in dollars, but its gross foreign assets are only about 40 percent in dollars. We assume in our model that greater Asia has its gross liabilities equally divided between dollars, European, and Asian currencies (because Japan borrows in yen), whereas Asian gross foreign assets are 80 percent in dollars and 20 percent in European currencies. For Europe, we assume that gross foreign assets are 32 percent in dollars, 11 percent in Asian currencies and 57 percent in European currencies. In our model, 80 percent of European gross liabilities are denominated in European currencies, the balance being in U.S. dollars. These numbers are very rough approximation based in some cases on fragmentary or impressionistic data, but portfolio shares can shift sharply over time, so there is little point in trying too hard to refine the estimates. As we shall see, these shares do imply large potential international redistributions of wealth due to exchange rate changes, but those redistributions themselves have only a secondary impact on the exchange-rate implications of current account adjustment.

For nominal interest rates, we take a baseline value of 3.75 percent per year for U.S. liabilities but 5 percent per year for all other countries' liabilities. This assumption captures the "exorbitant privilege" the United States has enjoyed of borrowing from the world more cheaply than it lends.

For current accounts, we place the U.S. external deficit at 20 percent of U.S. tradable GDP (which in Obstfeld and Rogoff, 2000a,b, we estimate to be at most 75 percent of total GDP). This is consistent with a U.S. current account deficit of 5 percent of total GDP, a reasonable baseline if part of the 2005 deficit is due to temporarily high oil prices. Because we find our simulation results to be approximately linear within the parameter space we are considering, it is easy to adjust the prediction to the case in which the current 6 percent of GDP deficit persists. In any event, what matters most for our calibration is the size of the adjustment of the current account (for example, from 6 to 3 percent of GDP). We assume an initial position with Europe's current account surplus at 5 percent of U.S. tradable GDP and Asia's at 15 percent.[14]

A final benchmark to establish is our initial reference value for measuring

[14] It would be interesting and useful to extend the model to include emerging markets and OPEC as a composite fourth region The four-country extension has been suggested to us by our discussant, T.N. Srinivasan.

subsequent exchange rate adjustments. This issue was less critical in our earlier two papers, because trade-weighted (effective) exchange rates move relatively slowly compared to the bilateral exchange rates that we look at below. In our basic model prices are flexible and economic responses to them are immediate. In practice, however, there are considerable lags: Mussa (2005), for example, posits the rule of thumb that the U.S. trade balance responds with a two-year lag to dollar exchange rate changes. In that case, if today's current accounts reflect averages of exchange rates over the past two years, it would be more accurate to think of our simulations as giving exchange rate changes relative to two-year average reference rates rather than current rates. The resulting reference exchange rates are given in Table 2. (The Chinese and Malaysian currencies have of course been pegged over, the past two years so the current and average rates are the same.)

Simulations

With the model and our parameter assumptions in hand, we are ready to consider alternative simulations of the model. Underlying our analysis is the assumption that demand shocks (such as a rise in U.S. saving) are driving the redistribution of global imbalances. This seems by far the most realistic scenario, given the magnitude of the external financing gaps.

In tables 3-6 below, we lay out three scenarios under which the U.S. current account might improve by 20 percent of tradable GDP, or, equivalently, 5 percent of total GDP. (All simulations include the effect of exchange rates in revaluing the regions' foreign assets and liabilities.) In the “global rebalancing” scenario (first column of the tables), all regions’ current accounts go to zero (with trade balances adjusting as needed to service interest flows on the endogenously determined stocks of net foreign assets). First looking at bilateral real exchange rates in Table 3, we see that Asia’s rate vis-à-vis the United States rises by 35.2 percent and Europe’s by 28.6 percent -- both changes being real depreciations of the dollar. Europe sees an improvement in its terms of trade against the U.S. (a rise in the price of Europe’s exports relative to its U.S. imports) of 14.0 percent, versus a 14.5 percent improvement for Asia.

What are the implications for *nominal* exchange rates? To answer the question we must specify monetary policies. We consider two possibilities. In the first, central banks stabilize the domestic consumer price index (CPI); in the second, they stabilize domestic GDP deflators. Table 4 reports the results. Under CPI targeting, overall price levels are held constant by monetary authorities, so the only source of real exchange rate change is nominal exchange rate change. As a result, nominal and real exchange rate changes are equal, as shown in table 4. The Appendix contains a detailed account of nominal exchange rate determination under GDP deflator targeting. Because none of the three regions is extremely open to trade, movements in CPIs and GDP deflators are fairly close, and as a result, nominal exchange rate changes when the GDP deflator is stabilized differ very little from their value under CPI stabilization.

Europe’s appreciation vis-à-vis the United States is smaller than Asia’s under the first scenario because Asia starts out in our simulation with a much larger external surplus than Europe does, so it has more adjusting to do.[15] But the Asian appreciation against the dollar is mitigated somewhat by the fact that Asia trades more with the U.S. than Europe does. We see in Table 5 that Europe's real *effective* currency appreciation -- denoted, as is traditional for such multilateral indexes, by a positive number -- is much smaller than Asia's, only a 5.1 percent real appreciation versus a 20.9 percent real effective appreciation for Asia. Again, this reflects the higher weight of the U.S. in Asia's trade-weighted real exchange rate than in Europe's. Notice that, as in our discussion of the preceding table, nominal (under GDP deflator targeting) and real effective exchange rate changes are again quite close numerically. Henceforth we report only real exchange rate changes.

Another factor underlying the equilibrium exchange rate responses is that dollar depreciation implies a much bigger reduction in Asia's net foreign asset position than in Europe's; see Table 6. Asia has 80 percent of its assets, but only 34 percent of its liabilities, in dollars. Thus, under the "global rebalancing" scenario, dollar depreciation raises Asia's gross liabilities relative to its gross assets, pushing its net foreign assets down from (as a fraction of U.S. tradable GDP) by 60 percent. Europe, but contrast, has only 32 percent of its assets and 20 percent of its liabilities in dollars. The fact that Asia is losing so much on the asset side implies that its trade balance shrinks by less than its current account surplus does. Because trade balance surpluses are what drive the constellation of real exchange rates, the extent of Asian real appreciation is mitigated. In

[15] Indeed, if one recalibrates the model so that $\beta = 0.85$ (in which case all countries' preferences are completely symmetric, so that Europeans and Americans no longer prefer Asian goods to each other's), then in the "global rebalancing scenario," Asia's real exchange rate appreciates against the dollar by 37.8 percent and against European currencies by 12.2 percent. These numbers exceed the 35.2 percent and 6.7 percent reported in table 3.

sum, thanks to Asia's greater openness and to fact it suffers particularly large capital losses on foreign assets when the dollar falls, Asian exchange rates do not need to change quite as much as a model-free back of the envelope calculation might suggest.

Recall that as of this writing, the euro stands about 8 percent above its two-year moving average, so that the further depreciation predicted for the euro versus most Asian currencies (except the Korean won, which itself has appreciated) is commensurately smaller. In addition, we have assumed in the tables that demand shocks drive the U.S. current account all the way to zero. If only half the current deficit were to be closed, then the euro would only need to appreciate against the dollar by (roughly) half as much, so that further appreciation above the current two-average would be relatively modest, only 6 to 7 percent.

The tables cover two other possible scenarios. The second column in Table 3 analyzes the "Bretton Woods II" scenario (following the interpretation of Dooley, Folkerts-Landau, and Garber 2004a,b), in which Asia clings to its dollar peg. We calibrate this case by setting the U.S. current account to zero, and endogenously varying Asia's and Europe's current accounts in a way that both maintains Asia's bilateral nominal exchange rate with the U.S. (assuming GDP deflator targeting) and absorbs the fall in U.S. borrowing. (Of course, nonmonetary policy instruments such as fiscal policy would have to be used to attain just the right constellation of current accounts.) In this case, the bilateral real exchange rate of the euro against the dollar must rise spectacularly, by 49.5 percent; the real euro would rise against Asian currencies by 50 percent. Indeed, this result also is approximately linear in the change in the U.S. current account. Thus, under "Bretton Woods II," eliminating only half the U.S. current account deficit would raise the real value of non-Asian currencies against the dollar by almost as much as in a global rebalancing scenario eliminating the U.S. current account deficit entirely.

For Asia to maintain its nominal exchange rate peg in the face of a balanced United States current account, it must drive its own current account significantly further into surplus, from 15 to 26 percent of U.S. tradable GDP. And Europe would have to move from a 5 percent of U.S. tradable GDP surplus to a 26 percent deficit! When Asia pegs its currency to a falling dollar, it will of course make its own traded goods more competitive, as well as making imports more expensive relative to domestic nontraded goods. Both factors shift world demand away from Europe, which, by assumption, is passively absorbing the blow, and toward Asia. These calibrations make patently clear why sustaining Asia's dollar peg is likely to be politically unpalatable for many of its trading partners if the U.S. current account deficit ever shrinks. Asia would be extremely vulnerable to a protectionist backlash.

As Table 5 shows, Europe's sharp appreciation also decimates its external asset position, which declines from balance to -60 percent of the value of U.S. tradable production! Asia suffers slightly, and the U.S., with assets concentrated in European currencies, is the major beneficiary. So Europe is hammered both by a sharp decline in its competitiveness, but also by the loss on its net foreign in excess of $1.5 trillion.

The third scenario in Table 3 (the third column) is a muted version of the Bretton Woods II adjustment scenario. Here, instead of maintaining its dollar currency peg, Asia maintains its current account surplus unchanged in the face of U.S. adjustment to a balanced position. That is, rather than increasing its current account surplus, it allows enough exchange rate adjustment to keep its external surplus constant. In this case, as

Table 4 shows, Europe's effective exchange rate rises by much less than in the Bretton Woods II scenario (31.7 percent versus 49.8 percent) and Asia's effective real exchange rate depreciates by only 2.9 percent versus 25.2 percent in the Bretton Woods II. Still, because the U.S. current account improves dramatically while Asia's holds steady, Asian currencies rise in real terms by 19.4 percent against the dollar. This exercise reveals a fallacy in the argument that Asia cannot allow its dollar peg to move without losing its ability to absorb regional surplus labor. To the extent that European demand increases, Asia can retain its surplus while releasing its dollar peg.

In Table 7, we vary the critical substitution elasticities in the model. In the first column, we revisit the "global rebalancing" scenario when the elasticity of substitution between tradables and nontradables, θ, equals 2.0 instead of 1.0. As we have already argued, this is very much a high-side estimate according to the limited evidence in the empirical macroeconomics literature, but we try it to incorporate a more conservative range of exchange rate adjustments alongside our baseline estimates. Comparing to column one of Table 3, we see that the real dollar/euro rate rises by only 19.3 percent instead of 28.6 percent, whereas the Asian currencies rise against the dollar by 22.5 percent instead of 35.2 percent. The real effective dollar (not shown in the table) falls by 21.5 percent rather than 33 percent. These results show that even with a relatively high value for θ, the required adjustment of exchange rates is quite significant even if, as here, we have flexible prices.

The second column in Table 7 looks at the case in which $\theta = 1$ but $\eta = 100$, so that the various countries' tradable outputs are almost perfect substitutes. This exercise, which essentially eliminates terms of trade adjustments as a factor in moving real exchange rates, allows us to see how much of the exchange rate action is due to intra-national substitution between traded and nontraded goods. This change mutes the exchange rate changes by an amount roughly similar those found in the previous exercise. The real effective dollar (again not shown) falls by 21 percent. According to this calibration, roughly two-thirds of the needed dollar adjustment is driven by substitution between traded and nontraded goods, and only one-third is driven by the terms of trade channel typically emphasized in the literature. This should not be surprising, given that (according to our previously cited calibrations), roughly 75 percent of GDP is nontraded. With more conservative assumptions about international trade, however -- greater home bias in consumption or $\eta = 1$ -- the terms of trade channel would become more important.

At present the U.S. is absorbing traded goods equivalent to roughly 30 percent of its GDP. This demand needs to adjust downward while not reducing the overall level of nontraded goods absorption, and that adjustment will require a significant relative-price change if full employment is to be maintained. Still, terms of trade shocks do account for about one-third of the overall adjustment, a proportion slightly larger than that found in the Obstfeld and Rogoff (2004a) two-country model, where we did not allow for trade or relative-price adjustments within the rest of the world.

Given the United States' leveraged international portfolio, with gross debts mostly in dollars and assets largely in foreign currencies, an unexpected dollar depreciation reduces the U.S. net foreign debt. The first two columns of Table 8 offer simulations intended to illustrate the quantitative importance of such asset-valuation effects. Most recently, Gourinchas and Rey (2005a) have estimated that nearly one-third of payments on the U.S. net foreign debt has historically been financed by valuation effects, with only the remaining two-thirds covered by higher trade balances. The first column in Table 8 shows the global rebalancing scenario with valuation effects taken into account; it is identical to the first column in Table 3. The second column shows the changes in bilateral exchange rates that would be required if there were no valuation effects (or, equivalently, if exchange rate changes were accurately anticipated and nominal returns adjusted fully to compensate). All relative price changes against the United States are larger in this case because the United States does not get the benefit of a haircut in its net dollar liabilities. Correspondingly, the U.S. trade balance needs to adjust more for any given adjustment in the current account deficit. The real dollar/euro rate needs to move by 33.7 rather than 28.6 percent when valuation effects are taken into account, and the real value of Asian currencies needs to rise by 40.7 instead of 35.2 percent. (The real effective dollar exchange rate falls by 37.8 instead of 33.0 percent. According to these numbers, asset revaluation effects will mute the required movement in exchange rates as the U.S. current account closes up, but the trade balance has to do the heavy lifting, since 87 percent (33.0/37.8) of the necessary real exchange rate adjustment remains. That valuation effects have only a secondary effect on equilibrium relative-price changes is not surprising: big valuation effects can only come from big exchange rate movements.

Our calculation does not take into account the likelihood of an accompanying rise in global interest rates, which would hurt the United States (a net debtor) and help Asia (a net creditor). There are a broad range of possible scenarios here; we incorporate only a single very simple one. (Details of the calculation are given in the Appendix.) In the third column of Table 8, we assume that annual interest rates on short-term U.S. debt rise from 3.75 percent to 5 pecent, the same level assumed for all other liabilities. Thus, the

U.S. simply loses its historical low borrowing rate and is put on a par with other debtors. This change wipes out much of the effect of the valuation changes (and it would wipe out even more if it applied to all U.S. external liabilities, not just the roughly 30 percent made up of short-maturity debt). As our introductory discussion suggested, the United States, as a big issuer of bonds relative to equity, is extremely vulnerable to increases in interest rates, even when all global bond rates rise together.

Until now, we have been concentrating on demand shocks. Productivity shocks may exacerbate or ameliorate the adjustment process, depending on their source. Higher productivity in foreign tradable goods production can actually be counterproductive, requiring an even greater depreciation of the dollar to bring about equilibrium in world markets. Otherwise, at constant relative prices, Europe and Asia would end up exporting some part of their increased tradable goods production capacity. If, on the other hand, there is a rise in nontraded goods productivity in Asia and Europe, the exchange rate effects of global rebalancing will be muted. As Table 9 illustrates, a 20 percent rise in nontradable goods productivity outside the United States implies significantly smaller real exchange rate changes, though terms of trade shifts are similar. A large rise in U.S. tradables productivity will also facilitate a softer landing. In this case (not reported), however, while the extent of real dollar depreciation is somewhat reduced, the U.S. terms of trade fall much more sharply.

Further Considerations

We believe our model offers many useful insights, but of course there are many caveats to its interpretation. Some of these suggest that we are understating the dollar's potential decline and some suggest that we are overstating it.

Intersectoral Factor Mobility

A critical implicit assumption of our model is that capital and labor cannot quickly migrate across sectors, so that prices rather than quantities must bear the burden of adjustment in response to any sudden change in relative demands for different goods. This assumption seems entirely reasonable if the global current account adjustment (full or partial) takes place moderately quickly (say, over one to two years). In the short run, workers cannot change location easily, worker retraining is expensive, and a great deal of capital is sector-specific. Over much longer periods, however (say, ten to twelve years), factor mobility is considerable. If, for example, prices rise dramatically in the United States traded goods sector, then new investment will be skewed towards tradables, as will new employment. Thus, in principle, a gradual closing of the United States current account deficit will facilitate much smoother adjustment with less exchange rate volatility. Unfortunately, our model is not explicitly dynamic (see however, the small country *q*-model analysis of Obstfeld and Rogoff 1996, chapter 4). One can, however, artificially approximate gradual current account adjustment by allowing for higher elasticities of substitution. We do this in Table 10, where we reconsider our central scenario (which assumed $\theta = 1$ and $\eta = 2$) by comparing it with two cases in which substitution elasticities are much higher. As one can see, in the case with "gradual" unwinding (proxied by $\theta = 2$ and $\eta = 4$), which we loosely take to capture a five to seven year adjustment horizon, bilateral exchange rate changes are only half as big as in our central global rebalancing scenario. For "very gradual" unwinding (which we take occur over ten to twelve years, with $\theta = 4$ and $\eta = 8$), the real exchange rate changes are less than a quarter as large.

Sticky Prices

Factor mobility kicks in if adjustment is slow and relatively anticipated. If, on the other hand, current account imbalances had to close up very quickly (say due to a collapse in U.S. housing prices), then the bias in our estimates would be in the other direction. In this case, nominal rigidities in prices would play a large role and, for reasons detailed in Obstfeld and Rogoff (2000b), actual exchange rate movements would likely be two or more times as large as in our central scenario.

Why? For one thing, our model assumes the law of one price for traded goods, whereas in fact, at most half of an exchange rate adjustment typically will pass through to traded goods prices even after one year (P. Goldberg and Knetter 1997; Campa and L. Goldberg 2002). Thus, in order to balance supply and demand for the different categories of goods, while maintaining full employment, central banks would have to allow much larger exchange rate movements -- possibly double those suggested by the model. These larger movements would be "overshoots" in the sense that they would unwind over time as domestic prices adjust.

The nominal prices of nontraded goods are typically even stickier than those of traded goods; this further amplifies the overshooting effect. In general, the presence of both sticky prices and slow factor mobility both point toward the likelihood that a slow unwinding of the United States current account will lead to smaller changes in real exchange rates than would a relatively abrupt correction.

Rising United States Interest Rates and the Dollar

As another qualification to our results, we must also add that the our model does not account for financial factors, and in particular does not account for how temporarily high real interest rates in the United States might tend to mute the dollar's decline. Using the FRB model, Reifschneider, Tetlow, and Williams (1999) estimate that a one percent rise in the Federal Funds rate (presumably unmatched by the rest of the world) leads to 2.2 percent appreciation of the dollar after one year, and 4.9 percent appreciation after two years. A back-of-the-envelope calculation based on the Dornbusch overshooting model yield a similar result. So the fact that over the past year, United States short-term interest rates have been rising relative to Europe's is a countervailing consideration to the ones we discuss below (though our calculations suggest it is likely to be far less important quantitatively). Add to this that Europe and Asia can always choose to lower their interest rates to further mute the dollar's decline. Of course, interest rate policy can only affect the dollar's real value temporarily, so long-term global rebalancing will still require a combination of real exchange rate adjustment and factor reallocation across sectors.

The Fundamental Unpredictability of Exchange Rates

Our model suggests that the gaping U.S. current account is a very large factor in the minus column for the United States dollar. It is well known, however (Meese and Rogoff 1983) that it is extremely difficult to explain major currency exchange rate swings, much less forecast them, at least at horizons up to eighteen months. Though there are a number of small qualifications to this result (see the survey in Frankel and Rose 1995, for example), it remains broadly true. How then, can one be concerned about a dollar decline if a rise is equally likely? There are two broad answers to this question. First, even the most cheery U.S. current account optimist would have to concede that an abrupt reversal is a potential risk, particularly as Federal government deficits remain less than fully tamed. Reversal need not result from what Calvo (1998) has called a "sudden stop" of capital inflows in the context of emerging markets; as we have noted, it could result, for example, from a rise in U.S. saving due to a purely domestic asset-price collapse. Our calibrations are useful in laying out the exchange rate consequences, and in illuminating how the burden of adjustment might be shared.

Although the evidence is mixed, it is also plausible that nonlinearities may be important, so that when exchange rates are particularly far out of line with one or more fundamentals, some predictability emerges. Obstfeld and Taylor (1997), for example, argue that convergence to purchasing power parity is much more important quantitatively when the real exchange rate is relatively heavily over- or undervalued. Gourinchas and Rey (2005a) argue that, contrary to the canonical Meese-Rogoff result, there is a forecastable component to trade weighted dollar exchange rate movements when net foreign assets are large relative to the United States' net export base. Their work supports much earlier work by Hooper and Morton (1992) suggesting that net foreign assets may be important in explaining dollar movements. As we have argued in the introduction, the U.S. current account deficit is so large and unprecedented that it is difficult to project its future evolution and consequences simply by extrapolating from past data.

Summary

We have developed a simple stylized model that can be used to calibrate exchange rate changes in response to various scenarios under which the United States current account deficit might be reduced from its unprecedented current level. Aside from the model's quantitative predictions (some of which are highlighted in the introduction), it yields a number of important qualitative insights.

First, Asia's greater openness to trade implies that the requisite exchange rate adjustments for that region are not all that much greater than Europe's despite the fact Asia starts from a much larger current account surplus.

Second, we find that if Asia tries to stick to its dollar peg in the face, say, of a rise in the U.S. saving rate that (even partially) closes up the U.S. current account gap, Asia will actually have to run significantly higher surpluses than now. Europe would bear the brunt of this policy, ending up with a current account deficit even larger than that of the United States today, while at the same time suffering a huge loss in net foreign assets.

Third, whereas it is true that dollar depreciation tends to improve the United

States net foreign asset position (because virtually all of its liabilities but not all of its assets are in dollars), this effect only slightly mitigates the requisite exchange rate change. Valuation effects will not rescue the United States from a huge trade balance adjustment. Indeed, if relative interest rates on U.S. short-term debt rise even modestly during the adjustment process, this adverse affect can easily cancel out any gain due to exchange rate valuation effects.

Fourth, we compare the importance of different components of real exchange rate adjustment. Our model suggests that the need for deficit countries to shift demand toward nontraded goods (and for surplus countries to shift demand away) is roughly twice as important quantitatively as the much more commonly stressed terms of trade channel (involving substitution between the traded goods produced by different countries). Of course, the importance of the terms of trade would be greater with lower international trade elasticities than we have assumed, or a greater degree of home-product consumption bias.

We have only scratched the surface of potential simulations that can be conducted in this framework. To that end, we have tried to make our approach as transparent as possible so that other researchers can easily investigate alternative scenarios. Clearly, it would be interesting to extend the model in many dimensions, in particular to allow for sticky prices and for dynamic adjustments, such as factor movement across sectors. It would also be interesting to extend the framework to allow for more regions of the world economy, for example, oil producers (who have recently emerging as a major surplus region), non-Asian emerging markets, and Asian sub-regions. Nonetheless, in a literature that is often long on polemics and short on analysis, we hope it is useful to have advanced a concrete model on which to base policy analysis.

Appendix: Equilibrium Prices, Model Normalization, Calculation of Nominal Exchange Rates, Revaluation Effects, and Interest Rate Effects

1. Equilibrium Prices

In this first appendix section we show how real exchange rates depend on equilibrium relative prices, and spell out the relevant equilibrium conditions for our three-region world economy. By definition, real exchange rates depend on relative international prices for both traded and non-traded goods. We take up relative traded goods prices first.

As was noted in the text, notwithstanding the law of one price, the assumed internationally asymmetric preferences over tradables permit relative regional price indexes for tradable consumption to vary over time. Instead of being fixed at unity, these ratios are given in our model by

$$\frac{P_T^E}{P_T^U} = \frac{\left[\alpha\tau_{U,E}^{1-\eta} + (\beta-\alpha) + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}}{\left[\alpha + (\beta-\alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}},$$

$$\frac{P_T^A}{P_T^U} = \frac{\left[\delta\tau_{U,A}^{1-\eta} + \left(\frac{1-\delta}{2}\right) + \left(\frac{1-\delta}{2}\right)\tau_{U,E}^{1-\eta}\right]^{\frac{1}{1-\eta}}}{\left[\alpha + (\beta-\alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}},$$

and

$$\frac{P_T^A}{P_T^E} = \frac{\left[\delta\tau_{U,A}^{1-\eta} + \left(\frac{1-\delta}{2}\right) + \left(\frac{1-\delta}{2}\right)\tau_{U,E}^{1-\eta}\right]^{\frac{1}{1-\eta}}}{\left[\alpha\tau_{U,E}^{1-\eta} + (\beta-\alpha) + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}}.$$

Thus, shifts in inter-regional real exchange rates q reflect both shifts in the relative price of traded and non-traded goods and shifts in the relative prices of exports and imports:

$$q_{U,E} = \frac{P_T^E}{P_T^U} \times \frac{\left[\gamma + (1-\gamma)(P_N^E / P_T^E)^{1-\theta}\right]^{\frac{1}{1-\theta}}}{\left[\gamma + (1-\gamma)(P_N^U / P_T^U)^{1-\theta}\right]^{\frac{1}{1-\theta}}}$$

$$= \frac{\left[\alpha\tau_{U,E}^{1-\eta} + (\beta-\alpha) + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}}{\left[\alpha + (\beta-\alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}} \times \frac{\left[\gamma + (1-\gamma)(P_N^E / P_T^E)^{1-\theta}\right]^{\frac{1}{1-\theta}}}{\left[\gamma + (1-\gamma)(P_N^U / P_T^U)^{1-\theta}\right]^{\frac{1}{1-\theta}}},$$

$$q_{U,A} = \frac{P_T^A}{P_T^U} \times \frac{\left[\gamma + (1-\gamma)(P_N^A / P_T^A)^{1-\theta}\right]^{\frac{1}{1-\theta}}}{\left[\gamma + (1-\gamma)(P_N^U / P_T^U)^{1-\theta}\right]^{\frac{1}{1-\theta}}}$$

$$= \frac{\left[\delta\tau_{U,A}^{1-\eta} + \left(\tfrac{1-\delta}{2}\right) + \left(\tfrac{1-\delta}{2}\right)\tau_{U,E}^{1-\eta}\right]^{\frac{1}{1-\eta}}}{\left[\alpha + (\beta-\alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{1}{1-\eta}}} \times \frac{\left[\gamma + (1-\gamma)(P_N^A / P_T^A)^{1-\theta}\right]^{\frac{1}{1-\theta}}}{\left[\gamma + (1-\gamma)(P_N^U / P_T^U)^{1-\theta}\right]^{\frac{1}{1-\theta}}},$$

and so on.

Having defined relative price indices, one can easily derive global market-clearing conditions for each region's tradable output, again using very standard techniques for constant elasticity of substitution models such as the one we have here (as illustrated, for example, in Obstfeld and Rogoff 1996). For U.S. tradable goods output, the market-clearing condition is given by

$$Y_T^U = \gamma\alpha\left(\frac{P_U}{P_T^U}\right)^{-\eta}\left(\frac{P_T^U}{P_C^U}\right)^{-\theta} C^U + \gamma(\beta-\alpha)\left(\frac{P_U}{P_T^E}\right)^{-\eta}\left(\frac{P_T^E}{P_C^E}\right)^{-\theta} C^E$$

$$+ \gamma\left(\frac{1-\delta}{2}\right)\left(\frac{P_U}{P_T^A}\right)^{-\eta}\left(\frac{P_T^A}{P_C^A}\right)^{-\theta} C^A,$$

and for European tradable output, it is given by

$$Y_T^E = \gamma\alpha\left(\frac{P_E}{P_T^E}\right)^{-\eta}\left(\frac{P_T^E}{P_C^E}\right)^{-\theta} C^E + \gamma(\beta-\alpha)\left(\frac{P_E}{P_T^U}\right)^{-\eta}\left(\frac{P_T^U}{P_C^U}\right)^{-\theta} C^U$$

$$+\gamma\left(\frac{1-\delta}{2}\right)\left(\frac{P_E}{P_T^A}\right)^{-\eta}\left(\frac{P_T^A}{P_C^A}\right)^{-\theta} C^A.$$

Walras' Law implies, of course, that the condition for Asian tradables equilibrium is superfluous, given the two others. One can similarly derive the market-clearing condition for U.S. nontradables as

$$Y_N^U = (1-\gamma)\left(\frac{P_N^U}{P_C^U}\right)^{-\theta} C^U,$$

(which depends, of course, only on U.S. demand), as well as the two corresponding conditions for European and Asian nontradables.

We take output endowments as given, and then use the preceding market-equilibrium conditions to solve for relative prices as functions of current account balances and initial net foreign asset positions. (In our simulations, we will allow for currency revaluation effects on foreign assets and liabilities, and the feedback to trade balances needed to sustain any given constellation of current accounts.)

To proceed, we first rewrite the equilibrium condition for the U.S. export's market as

$$Y_T^U = \alpha\left(\frac{P_U}{P_T^U}\right)^{-\eta} C_T^U + (\beta-\alpha)\left(\frac{P_U}{P_T^E}\right)^{-\eta} C_T^E + \left(\frac{1-\delta}{2}\right)\left(\frac{P_U}{P_T^A}\right)^{-\eta} C_T^A$$

or, in nominal terms, as

$$P_U Y_T^U = \alpha\left(\frac{P_U}{P_T^U}\right)^{1-\eta} P_T^U C_T^U + (\beta-\alpha)\left(\frac{P_U}{P_T^E}\right)^{1-\eta} P_T^E C_T^E + \left(\frac{1-\delta}{2}\right)\left(\frac{P_U}{P_T^A}\right)^{1-\eta} P_Y^A C_T^A. \qquad (1)$$

If trade were balanced and international debts zero, then of course, the total value of United States tradable goods consumption would have to equal the value of U.S. production of tradables. Here, of course, we want to allow for international debt as well as for trade and current account imbalances (which here are the same except for net factor payments). The United States current account surplus in U.S. dollars is given by

$$CA^U = P_U Y_T^U + rF^U - P_T^U C_T^U,$$

where F^U is the stock of U.S. net foreign assets (in dollars) and r is the "nominal" (dollar) rate of interest. Similarly, for Europe (and again measuring in dollars),

$$CA^E = P_E Y_T^E + rF^E - P_T^E C_T^E.$$

In the aggregate, of course,

$$CA^U + CA^E + CA^A = 0.$$

(Remember, we are defining theoretical quantities and not worrying about errors and omission in actual data!) Similarly,

$$F^U + F^E + F^A = 0.$$

Thus,

$$CA^A = -\left(CA^U + CA^E\right) = P_A Y_T^A - r\left(F^U + F^E\right) - P_T^A C_T^A.$$

In this framework, one can consider the effects of a variety of shocks that change the current nexus of global current account imbalances into one where, say, $CA^U = 0$. (Of course, other benchmark values can be analyzed as easily.)

To do so, we use the preceding current account equations (and the implied trade balances) to substitute for dollar values of consumptions of traded goods in the goods-market equilibrium conditions. The results are:

$$P_U Y_T^U = \alpha \left(\frac{P_U}{P_T^U} \right)^{1-\eta} \left(P_U Y_T^U + rF^U - CA^U \right) + (\beta - \alpha) \left(\frac{P_U}{P_T^E} \right)^{1-\eta} \left(P_E Y_T^E + rF^E - CA^E \right)$$

$$+ \left(\frac{1-\delta}{2} \right) \left(\frac{P_U}{P_T^A} \right)^{1-\eta} \left[P_A Y_T^A - r\left(F^U + F^E \right) + CA^U + CA^E \right], \tag{2}$$

$$P_E Y_T^E = \alpha \left(\frac{P_E}{P_T^E} \right)^{1-\eta} \left(P_E Y_T^E + rF^E - CA^E \right) + (\beta - \alpha) \left(\frac{P_E}{P_T^U} \right)^{1-\eta} \left(P_U Y_T^U + rF^U - CA^U \right)$$

$$+ \left(\frac{1-\delta}{2} \right) \left(\frac{P_E}{P_T^A} \right)^{1-\eta} \left[P_A Y_T^A - r\left(F^U + F^E \right) + CA^U + CA^E \right]. \tag{3}$$

Critically, current account imbalances also spill over into relative prices for nontradables, and to a degree depending on the elasticity of substitution between tradables and nontradables. For the three nontradables markets, one can show that

$$P_N^U Y_N^U = \frac{1-\gamma}{\gamma} \left(\frac{P_N^U}{P_T^U} \right)^{1-\theta} P_T^U C_T^U = \frac{1-\gamma}{\gamma} \left(\frac{P_N^U}{P_T^U} \right)^{1-\theta} \left(P_U Y_T^U + rF^U - CA^U \right), \tag{4}$$

$$P_N^E Y_N^E = \frac{1-\gamma}{\gamma} \left(\frac{P_N^E}{P_T^E} \right)^{1-\theta} \left(P_E Y_T^E + rF^E - CA^E \right), \tag{5}$$

$$P_N^A Y_N^A = \frac{1-\gamma}{\gamma} \left(\frac{P_N^A}{P_T^A} \right)^{1-\theta} \left[P_A Y_T^A - r\left(F^U + F^E \right) + CA^U + CA^E \right]. \tag{6}$$

2. Normalization for Simulation Analysis

To conduct our simulation analysis using the model of the text, it is helpful to normalize the model so that, for example we express all current accounts and net foreign asset positions in terms of ratios to the tradable component of U.S. GDP. In this Appendix section, we illustrate how to do this.

Let $ca^U = CA^U/\left(P_U Y_T^U\right)$, $f^U = F^U/\left(P_U Y_T^U\right)$, $ca^E = CA^E/\left(P_U Y_T^U\right)$, and $f^E = F^E/\left(P_U Y_T^U\right)$. Also, it is helpful to define $\sigma_{U/E} = Y_T^U/Y_T^E$, $\sigma_{U/A} = Y_T^U/Y_T^A$, $\sigma_{N/U} = Y_N^U/Y_T^U$, $\sigma_{N/E} = Y_N^E/Y_T^E$, and $\sigma_{N/A} = Y_N^A/Y_T^A$. Finally, let the relative price indices for traded and nontraded goods in each country be given as $x^U = P_N^U/P_T^U$, $x^E = P_N^E/P_T^E$, and $x^A = P_N^A/P_T^A$. With these normalizations, can write eqs. (2)-(6) as:

$$1 = \alpha \frac{1}{\left[\alpha + (\beta-\alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]}\left(1 + rf^U - ca^U\right)$$

$$+ (\beta-\alpha)\frac{1}{\left[\alpha\tau_{U,E}^{1-\eta} + (\beta-\alpha) + (1-\beta)\tau_{U,A}^{1-\eta}\right]}\left(\frac{\tau_{U,E}}{\sigma_{U/E}} + rf^E - ca^E\right)$$

$$+ \left(\frac{1-\delta}{2}\right)\frac{1}{\left[\delta\tau_{U,A}^{1-\eta} + \left(\frac{1-\delta}{2}\right) + \left(\frac{1-\delta}{2}\right)\tau_{U,E}^{1-\eta}\right]}\left[\frac{\tau_{U,A}}{\sigma_{U/A}} - r\left(f^U + f^E\right) + ca^U + ca^E\right],$$

$$1=(\beta-\alpha)\frac{\tau_{U,E}^{1-\eta}}{\left[\alpha+(\beta-\alpha)\tau_{U,E}^{1-\eta}+(1-\beta)\tau_{U,A}^{1-\eta}\right]}\left[\frac{\sigma_{U/E}}{\tau_{U,E}}\left(1+rf^{U}-ca^{U}\right)\right]$$

$$+\ \alpha\frac{\tau_{U,E}^{1-\eta}}{\left[\alpha\tau_{U,E}^{1-\eta}+(\beta-\alpha)+(1-\beta)\tau_{U,A}^{1-\eta}\right]}\left[1+\frac{\sigma_{U/E}}{\tau_{U,E}}\left(rf^{E}-ca^{E}\right)\right]$$

$$+\ \left(\frac{1-\delta}{2}\right)\frac{\tau_{U,E}^{1-\eta}}{\left[\delta\tau_{U,A}^{1-\eta}+\left(\frac{1-\delta}{2}\right)+\left(\frac{1-\delta}{2}\right)\tau_{U,E}^{1-\eta}\right]}\left\{\frac{\sigma_{U/E}}{\tau_{U,E}}\left[\frac{\tau_{U,A}}{\sigma_{U/A}}-r(f^{U}+f^{E})+ca^{U}+ca^{E}\right]\right\},$$

$$\sigma_{N/U}=\left(\frac{1-\gamma}{\gamma}\right)\left(x^{U}\right)^{-\theta}\left[\alpha+(\beta-\alpha)\tau_{U,E}^{1-\eta}+(1-\beta)\tau_{U,A}^{1-\eta}\right]^{-\frac{1}{1-\eta}}\left(1+rf^{U}-ca^{U}\right),$$

$$\sigma_{N/E}=\left(\frac{1-\gamma}{\gamma}\right)\left(x^{E}\right)^{-\theta}\left[\alpha+(\beta-\alpha)\tau_{U,E}^{-(1-\eta)}+(1-\beta)\tau_{E,A}^{1-\eta}\right]^{-\frac{1}{1-\eta}}\left[1+\frac{\sigma_{U/E}}{\tau_{U,E}}\left(rf^{E}-ca^{E}\right)\right],$$

$$\sigma_{N/A}=\left(\frac{1-\gamma}{\gamma}\right)\left(x^{A}\right)^{-\theta}\left[\delta+\left(\frac{1-\delta}{2}\right)\tau_{U,A}^{-(1-\eta)}+\left(\frac{1-\delta}{2}\right)\tau_{E,A}^{-(1-\eta)}\right]^{-\frac{1}{1-\eta}}$$

$$\times\left\{1-\frac{\sigma_{U/A}}{\tau_{U,A}}\left[r\left(f^{E}+f^{U}\right)-ca^{E}-ca^{U}\right]\right\}.$$

The preceding five equations are the core of the simulation model, though we also make use of the real exchange rate definitions above, the definitions of the x's (the relative price of traded and nontraded goods), and the relations $q_{E,A}=\frac{q_{U,A}}{q_{U,E}}$, $\tau_{E,A}=\frac{\tau_{U,A}}{\tau_{U,E}}$.

3. Nominal Exchange Rates

Most of our text discussion concerns real exchange rates, but of course many readers will be interested in nominal exchange rates. Here we show the assumptions underlying our calculations in the text's tables.

If we assume central banks stabilize CPIs (as in our earlier discussions in Obstfeld and Rogoff 2000a, 2004), then real and nominal exchange rate changes coincide in this model. Here, however, we show how to extend the analysis to the case in which central banks instead stabilize GDP deflators. (Because many readers will be interested in our results for nominal exchange rates, this is an important detail. However, we find in our text simulations that the differences between nominal and real exchange rate changes are uniformly small.) Unlike the case of CPIs, in which utility maximization dictated the appropriate weighting scheme, it is not clear *a priori* what the appropriate definition of the GDP deflator should be. A plausible case is one in which central banks stabilize geometric averages of the prices of tradable and nontradable domestic output. Thus, in the U.S., Europe, and Asia, respectively, we have

$$P_U^{\gamma}\left(P_N^U\right)^{1-\gamma}=1,$$

$$P_E^{*\gamma}\left(P_N^{E*}\right)^{1-\gamma}=1,$$

$$P_A^{*\gamma}\left(P_N^{A*}\right)^{1-\gamma}=1,$$

where the asterisk signifies that the nominal price is measured in the *local* currency. Notice that, for calculating log changes, setting these indexes equal to unity is a simple normalization that does not affect the answers. Also, the parameter γ above is the same one that enters the total consumption index.

To solve for nominal exchange rates, rewrite the above equations as

$$P_U^{\frac{\gamma}{\gamma-1}} = P_N^U,$$

$$\left(P_E^*\right)^{\frac{\gamma}{\gamma-1}} = P_N^{E*},$$

$$\left(P_A^*\right)^{\frac{\gamma}{\gamma-1}} = P_N^{A*},$$

and then make use of the five solutions, derived in the last subsection, for the terms of trade and relative prices of nontradables in terms of tradables.

By definition of the dollar/euro real exchange rate, the dollar price of the euro — the nominal dollar/euro exchange rate — is:

$$E_{U,E} = q_{U,E} \times \frac{P_C^U}{P_C^{E*}}$$

$$= q_{U,E} \times \frac{\left(P_T^U\right)^{\gamma}\left(P_N^U\right)^{1-\gamma}}{\left(P_T^{E*}\right)^{\gamma}\left(P_N^{E*}\right)^{1-\gamma}}$$

$$= q_{U,E} \times \frac{\left(P_T^U / P_U\right)^{\gamma}}{\left(P_T^{E*} / P_E^*\right)^{\gamma}}$$

$$= q_{U,E} \times \frac{\left[\alpha + (\beta - \alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{\gamma}{1-\eta}}}{\left[\alpha + (\beta - \alpha)\tau_{U,E}^{-(1-\eta)} + (1-\beta)\tau_{U,A}^{-(1-\eta)}\right]^{\frac{\gamma}{1-\eta}}}.$$

The equation makes it clear that in response to U.S. current account adjustment, the nominal exchange rate movement is greater than the real exchange rate movement. This result follows from the positive covariance between real exchange rates and terms of trade. Similarly

$$E_{U,A} = q_{U,A} \times \frac{\left[\alpha + (\beta - \alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{\gamma}{1-\eta}}}{\left[\delta + \left(\frac{1-\delta}{2}\right)\tau_{U,A}^{-(1-\eta)} + \left(\frac{1-\delta}{2}\right)\tau_{U,E}^{-(1-\eta)}\right]^{\frac{\gamma}{1-\eta}}}.$$

Of course,

$$E_{E,A} = E_{U,A}/E_{U,E}.$$

Using the preceding solutions, we define nominal effective exchange rates by:

$$E^U = \left(E_{U,E}\right)^{\frac{\beta-\alpha}{1-\alpha}}\left(E_{U,A}\right)^{\frac{1-\beta}{1-\alpha}},$$

$$E^E = \left(1/E_{U,E}\right)^{\frac{\beta-\alpha}{1-\alpha}}\left(E_{E,A}\right)^{\frac{1-\beta}{1-\alpha}},$$

$$E^A = \left(1/E_{E,A}\right)^{1/2}\left(1/E_{U,A}\right)^{1/2}.$$

These expressions use the same weightings as our measures of effective real exchange rates.

4. Revaluation of Gross Assets Stocks through Exchange Rate Changes

A key variable in the simulation analysis is f^i, the ratio of net foreign assets (in dollars), F^i, divided by dollar traded goods income, $P_U Y_T^U$. In reality, a country's gross assets and liabilities are often denominated in different currencies, so that focusing only on the net position will miss important revaluation effects that can occur as the exchange rate changes. Because gross assets and liabilities have now typically become quite large relative to their difference, taking into account revaluation effects can, in principle, have an important impact on the size of the exchange rate adjustment required when a country's current account balance changes. Here we show how we modified our simulation analysis to take these effects into account.

Let H^i equal the gross assets of country i and L^i its gross liabilities, measured in dollars. Then

$$F^i = H^i - L^i$$

and

$$f^i = \frac{H^i - L^i}{P_U Y_T^U}.$$

One can show that, under our assumptions on monetary policy conduct,

$$P_U = \left(x^U\right)^{\gamma-1}\left[\alpha + (\beta-\alpha)\tau_{U,E}^{1-\eta} + (1-\beta)\tau_{U,A}^{1-\eta}\right]^{\frac{\gamma-1}{1-\eta}}.$$

The first step is to plug this formula for P_U into the denominators of f^U, f^E, and f^A. Let ω_j^i be the share of region i gross foreign assets denominated in currency of region j, $j = U, E, A$, where we are thinking of composite currencies, particularly for the Asian zone. Similarly, define the portfolio currency shares λ_j^i on the liability side. Then after a change in exchange rates, the new dollar values of net foreign assets (with post-change values denoted by primes) are:

$$F^{U\,\prime} = F^U + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}} \right) \left(\omega_E^U H^U - \lambda_E^U L^U \right)$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}} \right) \left(\omega_A^U H^U - \lambda_A^U L^U \right),$$

$$F^{E\,\prime} = F^E + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}} \right) \left(\omega_E^E H^E - \lambda_E^E L^E \right)$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}} \right) \left(\omega_A^E H^E - \lambda_A^E L^E \right),$$

$$F^{A\,\prime} = F^A + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}} \right) \left(\omega_E^A H^A - \lambda_E^A L^A \right)$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}} \right) \left(\omega_A^A H^A - \lambda_A^A L^A \right).$$

Note that the following two constraints must hold in a closed system:

$$\omega_E^U H^U + \omega_E^E H^E + \omega_E^A H^A = \lambda_E^U L^U + \lambda_E^E L^E + \lambda_E^A L^A, \tag{7}$$

$$\omega_A^U H^U + \omega_A^E H^E + \omega_A^A H^A = \lambda_A^U L^U + \lambda_A^E L^E + \lambda_A^A L^A.$$

So we can eliminate the European asset shares by writing the preceding as post-change net asset values as:

$$F^{U\,\prime} = F^U + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}} \right) \left(\omega_E^U H^U - \lambda_E^U L^U \right)$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}} \right) \left(\omega_A^U H^U - \lambda_A^U L^U \right),$$

$$F^{E\,\prime} = F^E + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}} \right) \left(\lambda_E^U L^U + \lambda_E^A L^A - \omega_E^U H^U - \omega_E^A H^A \right)$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}} \right) \left(\lambda_A^U L^U + \lambda_A^A L^A - \omega_A^U H^U - \omega_A^A H^A \right),$$

$$F^{A\,\prime} = F^A + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}} \right) \left(\omega_E^A H^A - \lambda_E^A L^A \right)$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}} \right) \left(\omega_A^A H^A - \lambda_A^A L^A \right).$$

We also know that

$$H^U + H^E + H^A = L^U + L^E + L^A.$$

For our numerical findings we must posit estimated values for nominal assets and liabilities. Given the well-known measurement problems, any numbers are bound to be loose approximations at best. For the United States, the most recent numbers are for end-2003 (from the 2005 *Economic Report of the President*) and give foreign owned assets in the United States at \$10.5 trillion and US owned assets abroad at \$7.9 trillion. We take these to be \$11 trillion and \$8.25 trillion for purposes of our simulations. To a first approximation, essentially all of U.S. foreign liabilities are denominated in dollars, but only about 40 percent of its foreign assets are. (In principle, foreign assets such as stocks and land are real, but in practice, the dollar returns are highly correlated with dollar exchange rate movements.) Of the remaining 60 percent, we take 41 percent to be in European currencies and 19 percent in Asian currencies. Following Tille (2004), and including Canada, the United Kingdom and Switzerland in region *E*, the U.S. does have a very small share of liabilities in foreign currencies. The exact portfolio weights that we assume for the United States are

$$\omega_E^U = 0.405, \omega_A^U = 0.193,$$

$$\lambda_E^U = 0.03, \lambda_A^U = 0.006.$$

We base our portfolio estimates for the *E* zone in our model on the latest data from Lane and Milesi-Ferretti (in progress), which indicate that end-2004 assets and liabilities are both approximately \$11 trillion. Thus, we take $H^E = L^E = \$11$ trillion. Most of greater Europe's liabilities are in home currency; here we assume the home-currency share is 80 percent. We take the remaining 20 per cent to be entirely in U.S. dollars. On the asset side, however, we assume that 32 percent of Europe's holdings are in dollar assets, 11 percent in Asian currencies, with the remaining 57 percent in European currencies.

We turn next to Asia. Again drawing on the work of Lane and Milesi-Ferreti (but taking into account adding-up constraints that need to hold in our theoretical model), we take Asia's assets to be \$11 trillion and its liabilities to be \$8.25 trillion. As for portfolio shares, on the asset side, data from the International Monetary Fund's 2001 Coordinated Portfolio Investment Survey suggest that most Asian countries hold predominantly U.S.

dollars (and some yen), whereas Japan is about evenly balanced between dollar and euro holdings. If we take Japan as owning about 40 percent of the region's gross assets, then we would have the approximation:

$$\omega_E^A = 0.2, \omega_A^A = 0.$$

On the liabilities side, Japan borrows in yen but the other Asian economies have equity (including FDI) liabilities in local currencies, and extra-regional debt liabilities predominantly in dollars or euro (or sterling). We assume:

$$\lambda_E^A = 0.33, \lambda_A^A = 0.33.$$

Note that in our simulations, we take $P_U Y_T^U = \$(11/4)$ trillion based on Obstfeld and Rogoff (2000b), who argue that that roughly ¼ of US GDP may be regarded as traded.

Given our assumptions on each region's gross assets and liabilities and their currencies of denomination, our analysis will also tell us how net foreign assets change across various scenarios for the current account and the exchange rate, as well as allow for the feedback effect on interest payments. We will see that, given the large sizes of gross stocks, large changes in exchange rates can translate into large changes in net foreign asset positions. Indeed, for many short run and medium run issues, knowing the gross asset and liability positions is at least as important as understanding net positions. This conclusion is very much in line with the empirical findings of Gourinchas and Rey (2005a) for the United States.

5. Effects of Changing Interest Rates

It seems plausible that in the process of U.S. current account adjustment, global interest rates will shift. Such changes could come about simply as a result of the re-equilibration of the global capital market, or they could also reflect a shift in the portfolio preferences of foreign investors, such that, given the exchange rate of the dollar, higher dollar interest rates are necessary to persuade them to maintain their existing dollar-denominated portfolio shares. We adopt the latter perspective, allowing the interest rate on U.S. short-term debt liabilities as the dollar adjusts to rise without a corresponding increase in the earnings on U.S. foreign assets. Here we show the details. Capital-market shifts of this nature are likely to be quantitatively more important for the dollar than more generalized synchronized increases in world interest-rate levels (although the U.S., as a debtor, would naturally lose while its creditors would gain).

To illustrate this channel, we first, for simplicity, abstract from the effects of nominal exchange rate changes on asset stocks (for the purpose of our simulations, this case is only a computation check). We focus on the scenario under which, as the U.S. adjusts, it faces a sharp increase in borrowing rates. Thus there are two interest rates in the world economy—the rate r^U that the U.S. pays on its liabilities, and the rate $r^W > r^U$ that everyone else pays on liabilities and that everyone (including the U.S.) earns on assets outside the U.S. We focus on the implications of r^U rising when the U.S. adjusts; perhaps the increase in r^U has a causal effect on U.S. adjustment, although that possibility does not affect our calculation.

We look at scenarios in which TB (the trade balance) has to adjust enough to push CA to a specified level; that is, if r^U rises when TB^U rises, we will need a bigger fall in the real dollar exchange rate to hit a given target CA deficit. There is also a long-run, short-run distinction. In the short-run only U.S. short-run liabilities will pay higher interest (as these are rolled over). According to U.S. Treasury data for September 2004 (from http://www.treas.gov/tic/debta904.html), U.S. short-term liabilities were about 30 percent of total liabilities (and thus about 30 percent of US GDP). If the US needs to pay 200 basis points more on this liability, the result is an additional drain of about 0.02 × 0.3 = 0.6 percent of total GDP.

Let $\tilde{\omega}_j^i$ represent the share of country i gross foreign assets invested in *country* j. Then:

$$CA^U = TB^U + r^W H^U - r^U L^U,$$

$$CA^E = TB^E + \left[\tilde{\omega}_U^E r^U + \left(1-\tilde{\omega}_U^E\right) r^W\right] H^E - r^W L^E,$$

$$CA^A = TB^A + \left[\tilde{\omega}_U^A r^U + \left(1-\tilde{\omega}_U^A\right) r^W\right] H^A - r^W L^A.$$

To make the previous modeling consistent, we would also replace rF^i everywhere (for each of the three regions) by:

$$r^W H^U - r^U L^U,$$

$$\left[\tilde{\omega}_U^E r^U + \left(1-\tilde{\omega}_U^E\right) r^W\right] H^E - r^W L^E,$$

$$\left[\tilde{\omega}_U^A r^U + \left(1-\tilde{\omega}_U^A\right) r^W\right] H^A - r^W L^A.$$

From estimates described in the last subsection, we have the dollar values of H^i

and L^i. Asian currency shares probably exceed the Asian country shares, due to Asian claims on offshore Eurodollars, so we might assume that $\tilde{\omega}_U^A = 0.6$. Since total U.S. liabilities equal the claims on the U.S. of Europe and Asia,

$$\tilde{\omega}_U^E H^E + \tilde{\omega}_U^A H^A = L^U,$$

so with H^E, H^A, and L^U each equal to \$11 trillion, we must have $\tilde{\omega}_U^E = 0.4$.

We now turn to the calibration of interest rates (actually, nominal rates of return on asset and liability portfolios). We know that for the U.S. currently, $r^W H^U - r^U L^U \approx 0$. Since also, $H^U / L^U \approx 0.75, r^U / r^W \approx 0.75$. So we take $r^U = 3.75$ percent initially,[16] but maintain the earlier baseline assumption that $r^W = 5$ percent. We ultimately wish to consider alternative increases in r^U, e.g., of 125 basis points or more. These possibilities range from a scenario in which the U.S. simply loses its privilege, to some in which there is an element of confidence loss in U.S. solvency absent ongoing dollar depreciation. We will also assume that only the interest on short-term liabilities rises in the short run. Suppose the share of short-term foreign liabilities of the U.S. is 30 percent, or $\sigma = 0.3$. Then the service account of the U.S. and the other two regions would change as follows:

$$r^W H^U - r^U L^U \rightarrow r^W H^U - (r^U + \sigma \Delta r^U) L^U,$$

$$\left[\tilde{\omega}_U^E r^U + \left(1 - \tilde{\omega}_U^E\right) r^W\right] H^E - r^W L^E \rightarrow \left[\tilde{\omega}_U^E \left(r^U + \sigma \Delta r^U\right) + \left(1 - \tilde{\omega}_U^E\right) r^W\right] H^E - r^W L^E,$$

$$\left[\tilde{\omega}_U^A r^U + \left(1 - \tilde{\omega}_U^A\right) r^W\right] H^A - r^W L^A \rightarrow \left[\tilde{\omega}_U^A \left(r^U + \sigma \Delta r^U\right) + \left(1 - \tilde{\omega}_U^A\right) r^W\right] H^A - r^W L^A.$$

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[16] This number is very much in line with the estimate given above of the U.S. investment income excess return of foreign assets over foreign liabilities.

The last two changes assume that, empirically, $\tilde{\omega}_U^E + \tilde{\omega}_U^A \approx 1$ and that Europe and Asia hold equal proportions of short-term U.S. liabilities.

We next turn to trade-balance outcomes. If the interest rate on U.S. liabilities rises, and the value of net foreign assets does not change, then the trade balance must actually go to a larger *surplus* to give us $CA = 0$. To calculate the required trade balances we set current account as before but add the equations for the post-change current accounts:

$$CA^{U\prime} = TB^{U\prime} + r^W H^U - (r^U + \sigma\Delta r^U)L^U,$$

$$CA^{E\prime} = TB^{E\prime} + \left[\tilde{\omega}_U^E\left(r^U + \sigma\Delta r^U\right) + \left(1 - \tilde{\omega}_U^E\right)r^W\right]H^E - r^W L^E,$$

$$CA^{A\prime} = TB^{A\prime} + \left[\tilde{\omega}_U^A\left(r^U + \sigma\Delta r^U\right) + \left(1 - \tilde{\omega}_U^A\right)r^W\right]H^A - r^W L^A.$$

In this formulation the three trade balances become endogenous variables. One might also consider a formulation where $\Delta r^U = f(\Delta CA^U),\ f' > 0$. In this case adjustment could be unstable if the f function is too rapidly increasing, H^U is too big, and/or σ is too big. We leave possibility this for future research.

6. Synthesis of Interest Rate Changes and Asset Revaluations

We are now ready to illustrate the techniques used to calculate the third column in Table 8 of the text, in which asset revaluations and interest-rate changes occur simultaneously and interactively. Let us proceed as in the last section but add the equations

$$H^{U\,\prime} = H^U + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}}\right)\omega_E^U H^U$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}}\right)\omega_A^U H^U,$$

$$H^{E\,\prime} = H^E + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}}\right)\omega_E^E H^E$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}}\right)\omega_A^E H^E,$$

$$H^{A\,\prime} = H^A + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}}\right)\omega_E^A H^A$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}}\right)\omega_A^A H^A,$$

and

$$L^{U\,\prime} = L^U + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}}\right)\lambda_E^U L^U$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}}\right)\lambda_A^U L^U,$$

$$L^{E\,\prime} = L^E + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}}\right)\lambda_E^E L^E$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}}\right)\lambda_A^E L^A,$$

$$L^{A\,\prime} = L^A + \left(\frac{E'_{U,E} - E_{U,E}}{E_{U,E}}\right)\lambda_E^A L^A$$

$$+ \left(\frac{E'_{U,A} - E_{U,A}}{E_{U,A}}\right)\lambda_A^A L^A.$$

These equations are now necessary, rather than the equations for net positions used in the simpler revaluation exercise in which interest rates do not change, because here, assets and liabilities can pay different rates of interest. Therefore, they must be tracked separately.

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Table 1: International Investment Positions of Selected OECD Countries, 2003

(Percent of GDP)

	Assets	**Liabilities**	**Net Position**
Canada	80	99	-19
France	189	182	7
Germany	154	147	7
Italy	104	109	-6
Japan	82	45	37
United Kingdom	355	357	-2
United States	76	102	-26
Switzerland	519	379	140

Source: International Monetary Fund, Net International Investment Position data.

Table 2: Current versus Two-Year Average Exchange Rates

	GBP	CAD	EUR	KRW	TWD	SGD	JPY
Two-year average	1.75	1.32	1.21	1151.47	33.50	1.71	111
Rate on 03/30/05	1.88	1.21	1.30	1023.00	31.78	1.65	107

GBP is British pound, CAD is Canadian dollar, EUR is euro, KRW is Korean won, TWD is Taiwanese dollar, SGD is Singapore dollar, JPY is Japanese yen. All currencies except GBP and EUR are local currency units per U.S. dollar.

Table 3: External Adjustment Scenarios when US current account goes to balance:

CHANGES IN BILATERAL REAL EXCHANGE RATES

Log change (*x 100*) *in*:	**GLOBAL REBALANCING: All current accounts go to zero**	**BRETTON WOODS II: Asia raises CA surplus to keep dollar fix. Europe CA absorbs all change in US and Asia CAs**	**EUROPE TRADES PLACES: Europe absorbs entire US CA improvement, Asia CA constant**
Real exchange rate, $q_{U,E}$ (Europe/US)	28.6	49.5	44.6
Real exchange rate, $q_{U,A}$ (Asia/US)	35.2	–0.5	19.4
Real exchange rate, $q_{E,A}$ (Asia/Europe)	6.7	–50.0	–25.2
Nominal exchange rate, $E_{U,E}$ (Europe/US)	30.0	52.0	46.8
Nominal exchange rate, $E_{U,A}$ (Asia/US)	36.9	0.0	20.6
Nominal exchange rate, $E_{E,A}$ (Asia/Europe)	6.9	–52.0	–26.3
Terms of trade, $\tau_{U,E}$ (Europe/US)	14.0	21.5	22.0
Terms of trade, $\tau_{U,A}$ (Asia/US)	14.5	3.4	11.1
Terms of trade, $\tau_{E,A}$ (Asia/Europe)	0.5	–18.0	–10.8

Notes: An increase in $q_{i,j}$ is a real depreciation of country *i*'s currency against country *j*'s; an increase in $E_{i,j}$ is a nominal depreciation of country *i*'s currency against country *j*'s; and an increase in $\tau_{i,j}$ is a deterioration in country *i*'s terms of trade against country *j*, that is, a fall in the price of country *i*'s export good relative to that of country *j*'s.
Parameters: **(θ = 1, η = 2, α = 0.7, β = 0.8, δ = 0.7, γ =0.25)** (*See model in text;* θ is substitution elasticity between traded and nontraded goods, η is elasticity between different countries traded goods, γ is the share of traded goods in total consumption.)
Initial Current Accounts *(relative to US tradable GDP)*: US (–0.2), Asia (0.15), Europe (0.5)
NOTE: In Bretton Woods II simulation, Asia CA endogenously rises to 0.26, Europe falls to –0.26.
Initial Trade Balances *(relative to US tradable GDP)*: US (–0.2), Europe (0.07), Asia (0.13)
Gross Foreign Assets, Liabilities (dollar trillions): US (8.25, 11), Europe (11, 11), Asia (11, 8.25)
Interest rate on US liabilities (0.0375), Interest rate on non-US liabilities (0.05)

Share of Foreign Liabilities denominated in
- Dollars: US (0.964), Europe (0.2), Asia (0.34)
- European currencies: US (0.03), Europe (0.8), Asia (0.33)
- Asian currencies: US (0.006), Europe (0.0), Asia (0.33)

Share of Foreign assets denominated in
- Dollars: US (0.402), Europe (0.3175), Asia (0.8)
- European currencies: US (0.405), Europe (0.5737), Asia (0.2)
- Asian currencies: US (0.193), Europe (0.1088), Asia (0.0)

Table 4: External Adjustment Scenarios when US current account goes to balance: CHANGES IN BILATERAL REAL EXCHANGE RATES UNDER ALTERNATIVE INFLATION TARGETS

Log change (*x 100*) *in*:	**GLOBAL REBALANCING: All current accounts go to zero**	**BRETTON WOODS II: Asia raises CA surplus to keep dollar fix. Europe CA absorbs all change in US and Asia CAs**	**EUROPE TRADES PLACES: Europe absorbs entire US CA improvement, Asia CA constant**
	A. CPI inflation target		
Nominal exchange rate, $E_{U,E}$ (Europe/US)	28.6	49.5	44.6
Nominal exchange rate, $E_{U,A}$ (Asia/US)	35.2	–0.5	19.4
Nominal exchange rate, $E_{E,A}$ (Asia/Europe)	6.7	–50.0	–25.2
	B. GDP deflator target		
Nominal exchange rate, $E_{U,E}$ (Europe/US)	30.0	52.0	46.8
Nominal exchange rate, $E_{U,A}$ (Asia/US)	36.9	0.0	20.6
Nominal exchange rate, $E_{E,A}$ (Asia/Europe)	6.9	–52.0	–26.3

Table 5: External Adjustment Scenarios when US current account goes to balance: Changes in Effective (Trade-Weighted) Real and Nominal Exchange Rates

Log change (*x 100*) *in*:	**GLOBAL REBALANCING: All current accounts go to zero**	**BRETTON WOODS II: Asia raises CA surplus to keep dollar fix. Europe CA absorbs all change in US and Asia CAs**	**EUROPE TRADES PLACES: Europe absorbs entire US CA improvement, Asia CA constant**
U.S. effective real exchange rate	–33.0	–24.5	–27.8
U.S. effective nominal exchange rate	–34.6	–26.0	–29.3
Europe effective real exchange rate	5.1	49.8	31.7
Europe effective nominal exchange rate	5.4	52.0	33.1
Asia effective real exchange rate	20.9	–25.2	–2.9
Asia effective nominal exchange rate	21.9	–26.0	–2.85

Notes: See Table 3. Nominal exchange rate changes are calculated under the assumption of GDP deflator targeting; see the Appendix for a detailed description.

Table 6: Ratio of Net Foreign Assets to U.S. Tradable Output after Exchange Rate Revaluation Effects

Region:	**GLOBAL REBALANCING: All current accounts go to zero**	**BRETTON WOODS II: Asia raises CA surplus to keep dollar fix. Europe CA absorbs all change in US and Asia CAs**	**EUROPE TRADES PLACES: Europe absorbs entire US CA improvement, Asia CA constant**
United States	– 0.3	– 0.2	– 0.2
Europe	– 0.1	–0.6	– 0.4
Asia	0.4	0.8	0.6

Notes: For parameter details, see Table 3. The baseline net foreign assets positions in our simulations, with positions measured in dollars as a ratio to tradable U.S. output, are U.S., –1.0; Europe, 0.0; and Asia, 1.0. The entries in the Table give the positions after exchange rate valuation effects are taken into account.

Table 7: Alternative Calibrations under Global Rebalancing:
CHANGES IN BILATERAL REAL EXCHANGE RATES

Log change (*x 100*) *in*:	**GLOBAL REBALANCING with θ = 2 (larger elasticity of substitution between traded and nontraded goods)**	**GLOBAL REBALANCING with η = 100 (Different countries' tradable goods output almost perfect substitutes)**	**GLOBAL REBALANCING but US current account deficit only halves**
Real exchange rate, $q_{U,E}$ (Europe/US)	19.3	16.5	14.4
Real exchange rate, $q_{U,A}$ (Asia/US)	22.5	23.5	18.1
Real exchange rate, $q_{E,A}$ (Asia/Europe)	3.30	7.0	3.7
Terms of trade, $\tau_{U,E}$ (Europe/US)	14.6	0.0	7.2
Terms of trade, $\tau_{U,A}$ (Asia/US)	15.1	0.0	7.4
Terms of trade, $\tau_{E,A}$ (Asia/Europe)	0.5	0.0	0.2

Notes: See Table 3.

Table 8: Alternative Calibrations under Global Rebalancing (all regions' current accounts go to zero)
CHANGES IN BILATERAL REAL EXCHANGE RATES

Log change (*x 100*) *in*:	**GLOBAL REBALANCING With revaluation effects (same as Table 3)**	**GLOBAL REBALANCING (no asset and liability revaluation effects)**	**GLOBAL REBALANCING With revaluation and interest rate effects**
Real exchange rate, $q_{U,E}$ (Europe/US)	28.6	33.7	30.1
Real exchange rate, $q_{U,A}$ (Asia/US)	35.2	40.7	37.2
Real exchange rate, $q_{E,A}$ (Asia/Europe)	6.7	7.0	6.3
Terms of trade, $\tau_{U,E}$ (Europe/US)	14.0	16.5	15.1
Terms of trade, $\tau_{U,A}$ (Asia/US)	14.5	16.5	15.3
Terms of trade, $\tau_{E,A}$ (Asia/Europe)	0.5	0.0	0.2

Notes: See Table 3. Case with valuation and interest rate effects assumes that interest rates on U.S. short term liabilities held by foreigners rise 1.25 percent to same level as return earned by U.S. residents abroad.

Table 9: The effects of a 20 percent increase in productivity in the nontraded goods sector in both Europe and Japan:
CHANGES IN BILATERAL REAL EXCHANGE RATES

Log change (*x 100*) *in*:	**GLOBAL REBALANCING due to relative demand shifts (same as Table 3)**	**GLOBAL REBALANCING accompanied by a 20% increase in nontraded goods productivity in Europe and Asia**
Real exchange rate, $q_{U,E}$ (Europe/US)	28.6	17.0
Real exchange rate, $q_{U,A}$ (Asia/US)	35.2	23.6
Real exchange rate, $q_{E,A}$ (Asia/Europe)	6.7	6.61
Terms of trade, $\tau_{U,E}$ (Europe/US)	14.0	15.0
Terms of trade, $\tau_{U,A}$ (Asia/US)	14.5	15.3
Terms of trade, $\tau_{E,A}$ (Asia/Europe)	0.5	0.2

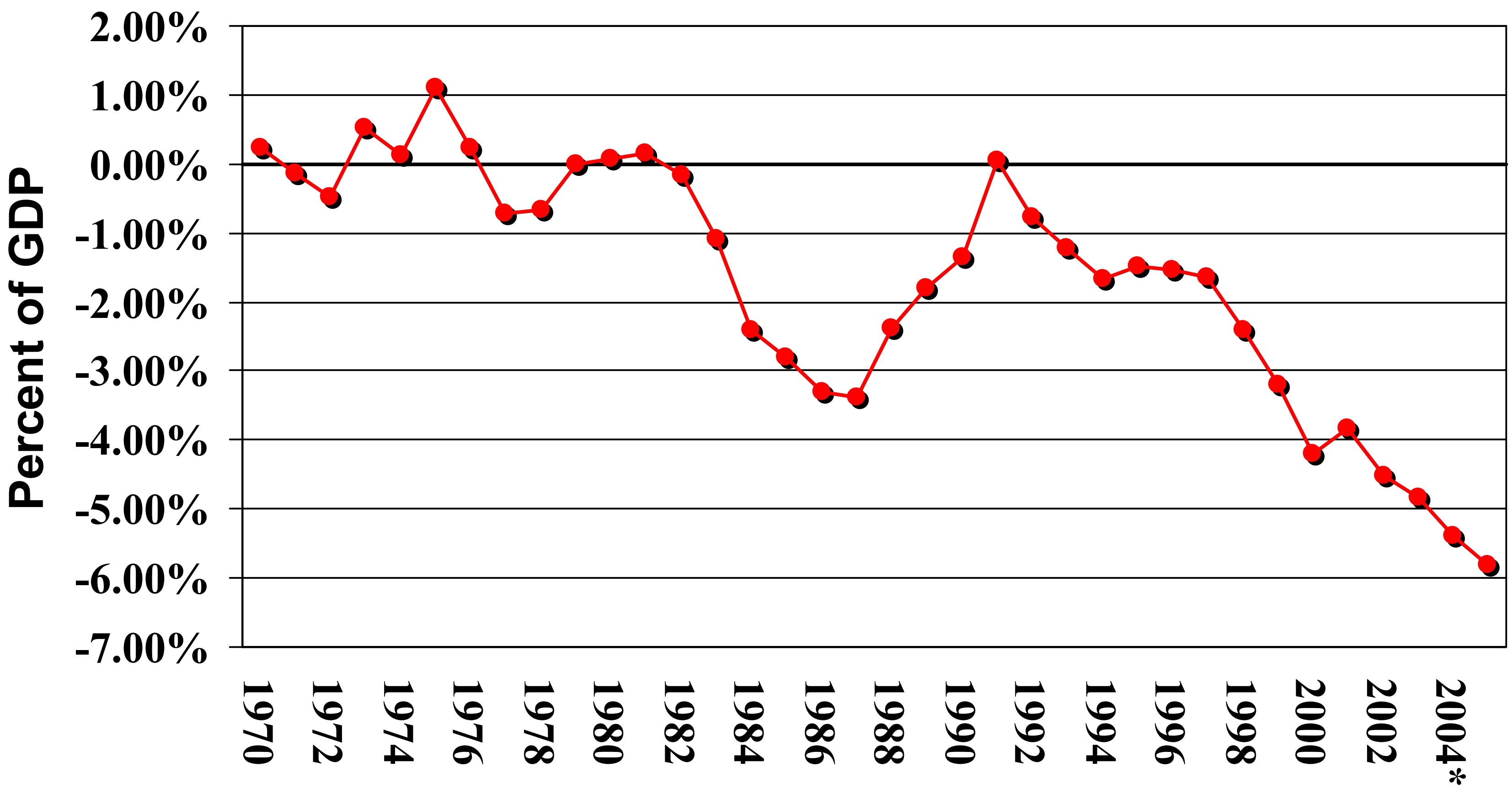
Notes: See Table 3.

Table 10 : Alternative Speeds of Global Rebalancing:
CHANGES IN BILATERAL REAL EXCHANGE RATES

Log change (*x 100*) *in*:	**Moderate speed (baseline) (two to three years)**	**Gradual unwinding (five to seven years)**	**Very gradual (10-12 years)**
$q_{U,E}$ (Europe/US)	28.6	13.4	6.5
$q_{U,A}$ (Asia/US)	35.2	17.3	8.5
$q_{E,A}$ (Asia/Europe)	6.7	3.9	2.0

Alternative speeds of adjustment are proxied by varying elasticities of substitution. Slow adjustment scenario has $\theta = 2$, $\eta = 4$. Very gradual unwinding is has $\theta = 4$, $\eta = 8$. Moderate adjustment has baseline parameters of has $\theta = 1$, $\eta = 2$.

Fig. 1: U.S Current Account: 1970-2005



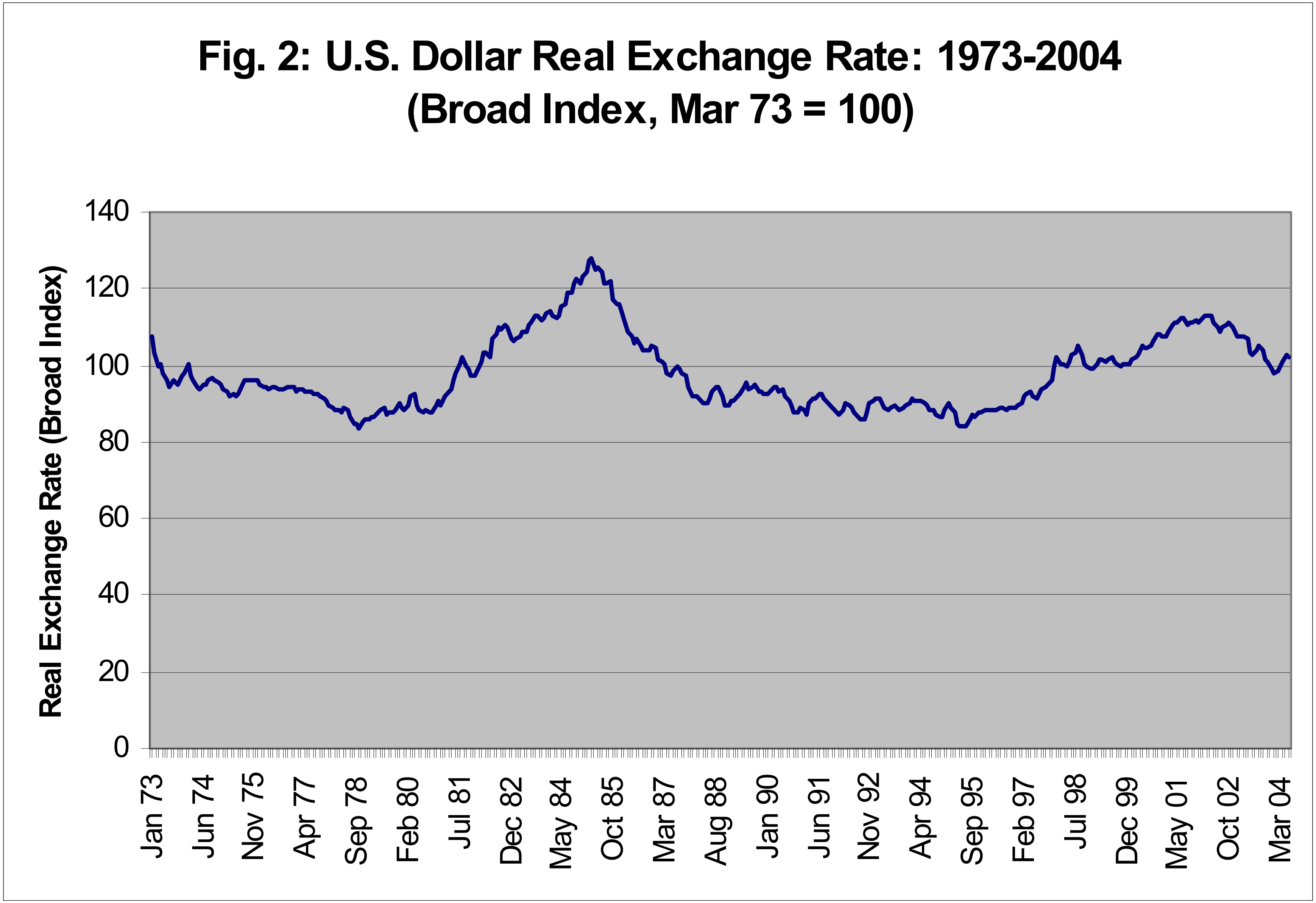


Fig. 2: U.S. Dollar Real Exchange Rate: 1973-2004
(Broad Index, Mar 73 = 100)
Real Exchange Rate (Broad Index)
0
20
40
60
80
100
120
140
Jan 73
Jun 74
Nov 75
Apr 77
Sep 78
Feb 80
Jul 81
Dec 82
May 84
Oct 85
Mar 87
Aug 88
Jan 90
Jun 91
Nov 92
Apr 94
Sep 95
Feb 97
Jul 98
Dec 99
May 01
Oct 02
Mar 04

Fig. 3: Fiscal Balances in Major Economies (% GDP)

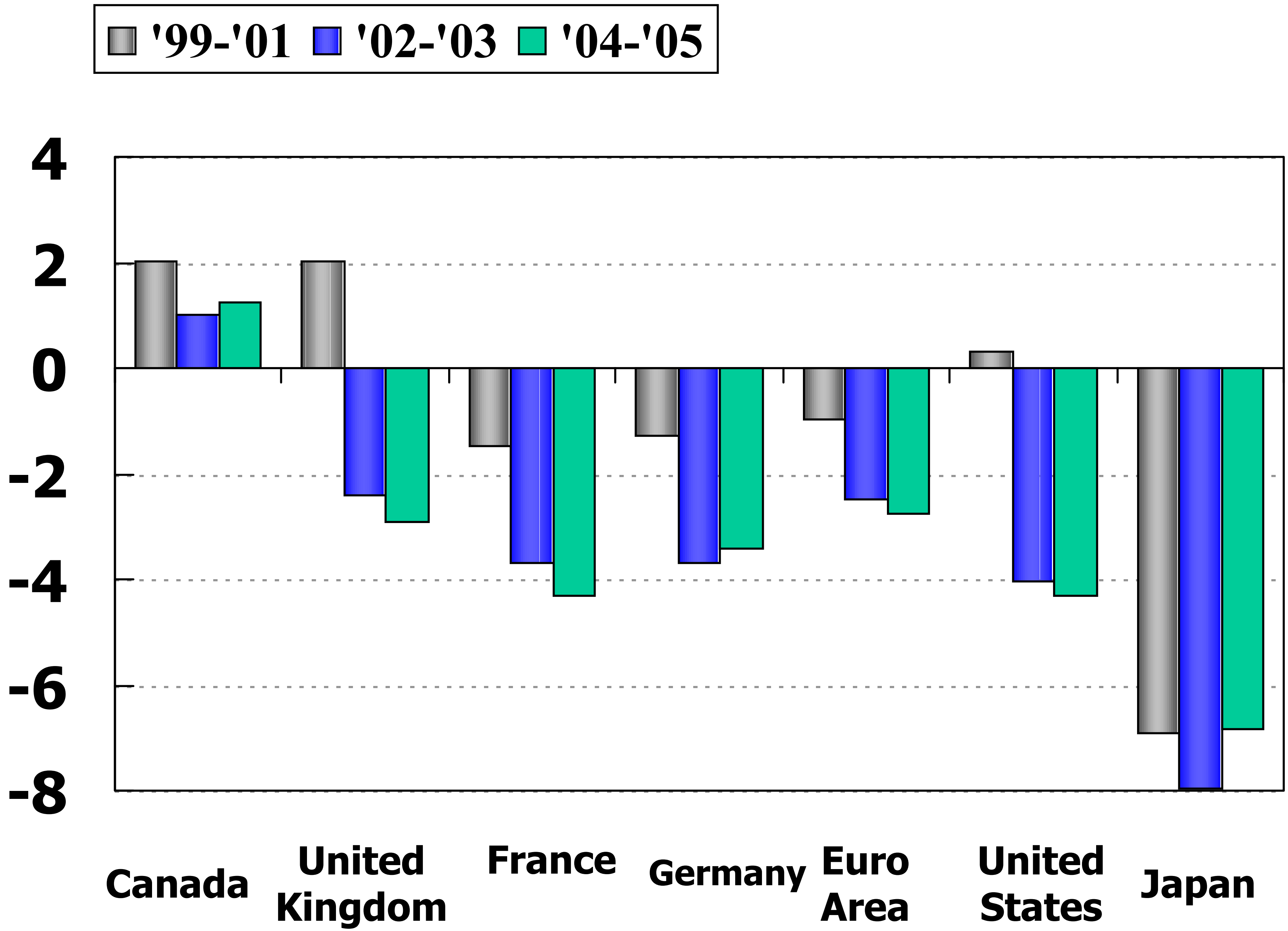


Fig 4: U.S. Current Account and Saving-Investment

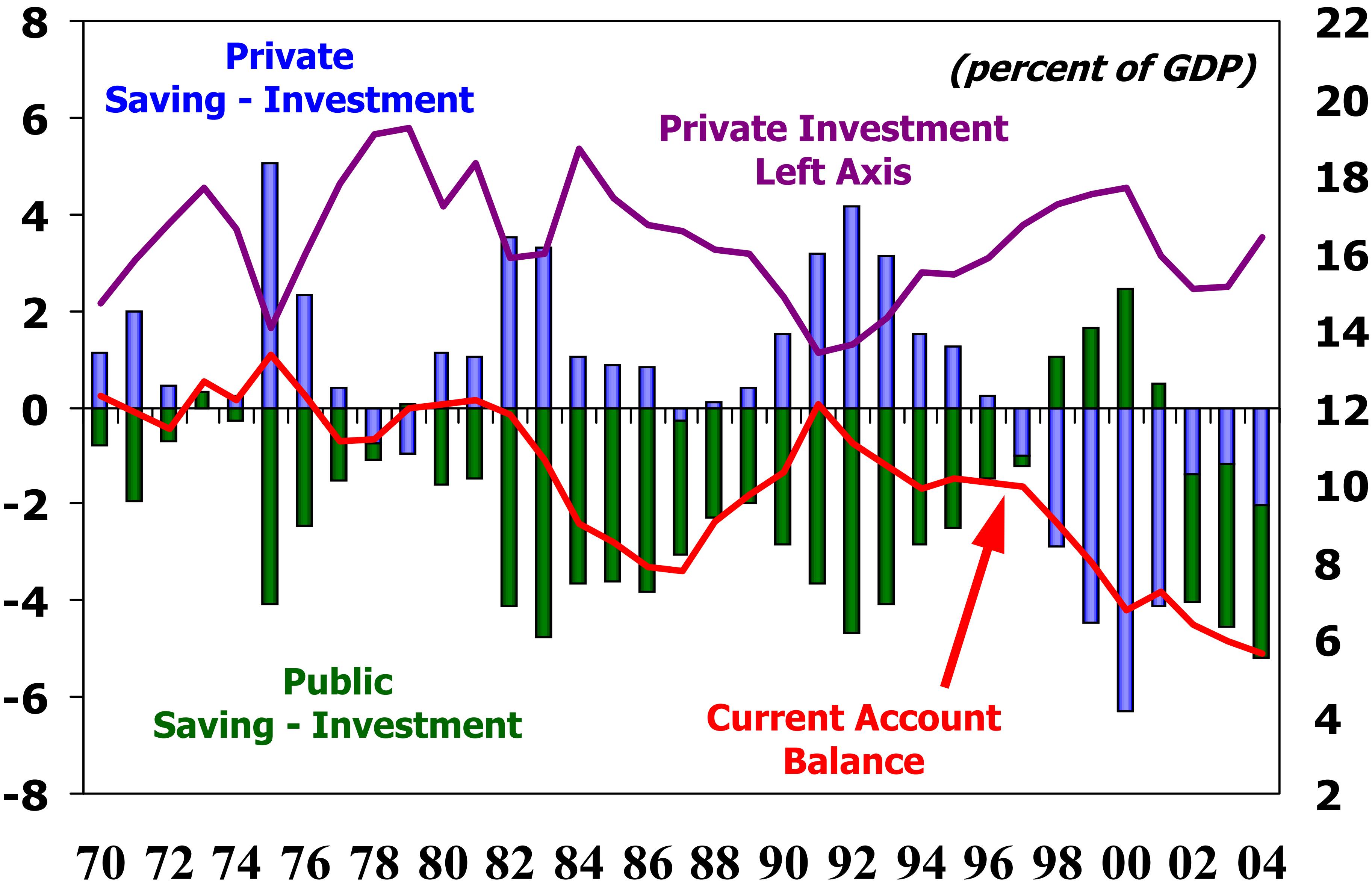
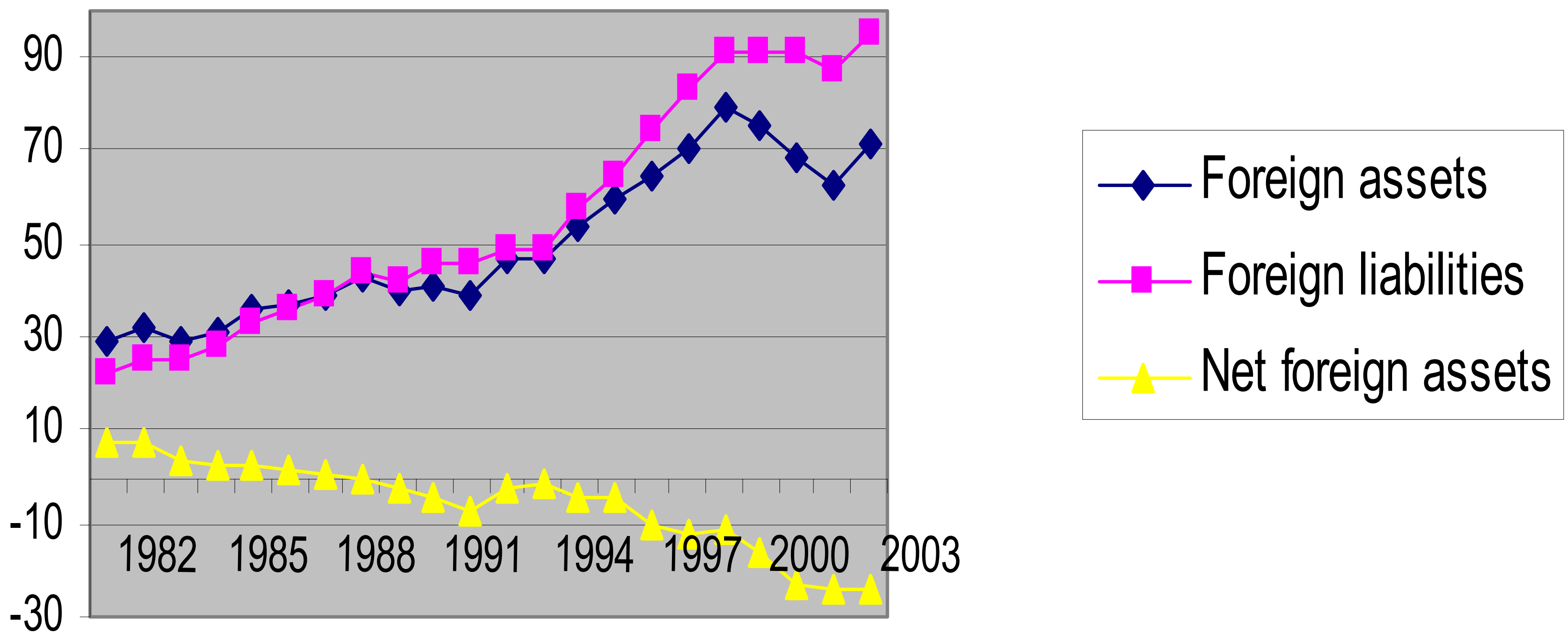


Figure 5: United States Foreign Assets, Liabilities, and Net Foreign Assets, 1982-2003 (percent of GDP)



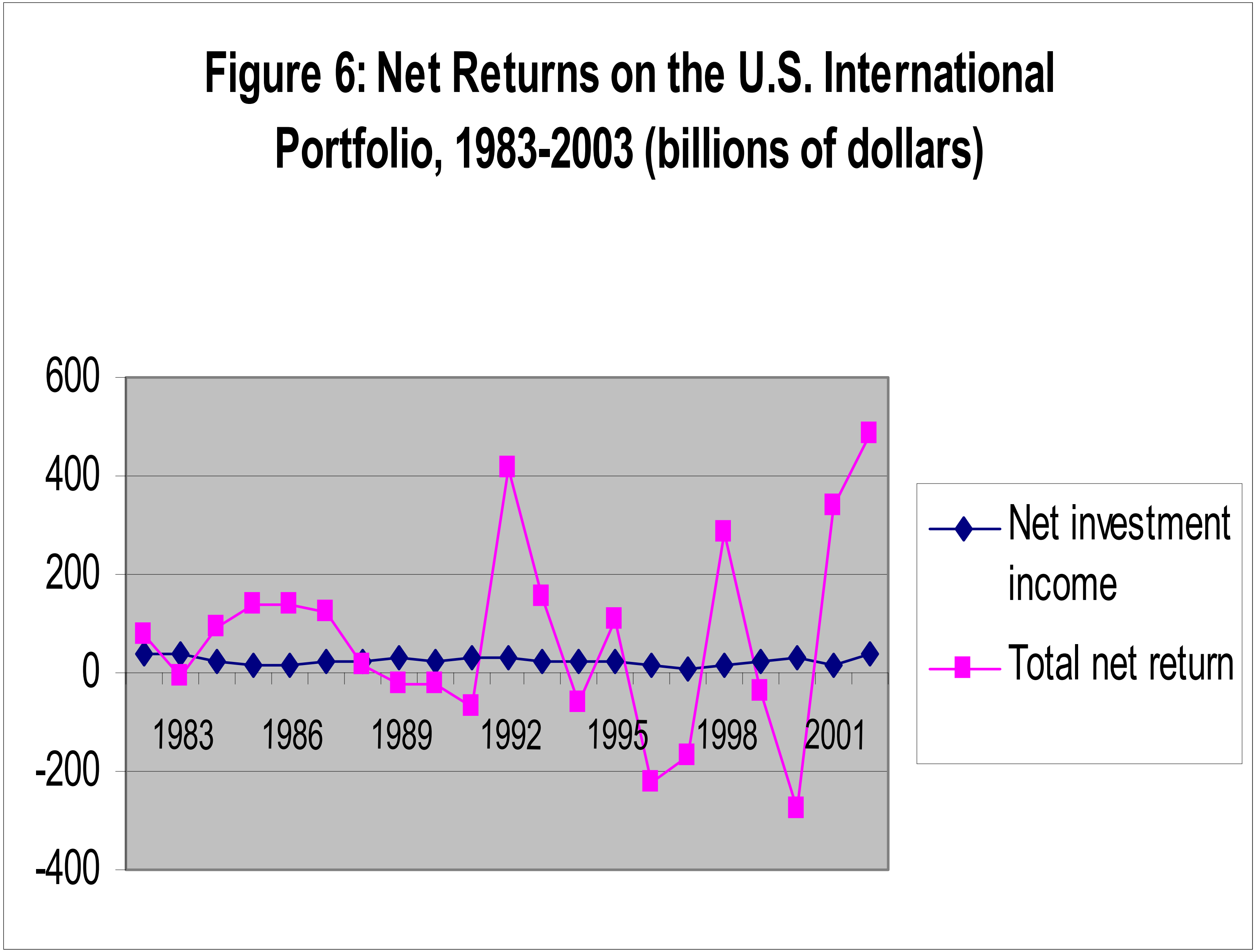


Figure 6: Net Returns on the U.S. International Portfolio, 1983-2003 (billions of dollars)
600
400
200
0
-200
-400
1983
1986
1989
1992
1995
1998
2001
Net investment income
Total net return

Fig 7: Foreign Exchange Reserves