4

US Fiscal Imbalance and the External Deficit

Understanding the Linkages

Correcting the large US external imbalance in a manner that avoids crisis will almost certainly require correcting the large US fiscal deficit. The reason is that the two deficits are closely linked. At the intuitive level, when a nation runs a current account deficit it is ''living beyond its means.'' If the country is a developing one that is building up productive capacity financed by capital from abroad, such a deficit can be quite appropriate, as long as the size of the current account deficit is not so large as to trigger a collapse in confidence in the capital market. However, if the country is a wealthy one that is using the resources from abroad to finance consumption and government spending rather than capital investment, the current account deficit is a manifestation of distortions in an economic policy that is dubious at best and dangerous at worst. The presence of a fiscal deficit in this case indicates that the public sector is living beyond its means, and therefore reducing the public sector deficit is a prime vehicle for achieving external adjustment.

The central message of this chapter is that both further real depreciation of the dollar and fiscal adjustment will be required to substantially reduce the US current account deficit. This is a mainstream diagnosis. One alternative extreme position is that no change in exchange rates is necessary or desirable, and that only fiscal adjustment can bring about the external adjustment (McKinnon 2005). Another alternative extreme is the ''Ricardian equivalence'' proposition that fiscal adjustment has no effect on the domestic use of resources (and hence the current account balance) because

any reduction (or increase) in the fiscal deficit is fully offset by a reduction (or increase) in private saving, on grounds that ''rational expectations'' lead households to expect future taxes to be lower (higher) as a consequence of the fiscal change (Barro 1974). The view that exchange rate change is not helpful contradicts past adjustment experience (Krugman 1991). The view that household saving changes to fully offset fiscal changes has always strained credulity, and has been flatly contradicted in recent years as private saving has continued to plunge even as government accounts have swung from surplus to large deficit.

This chapter develops a general equilibrium model to illustrate the importance of a combined contribution from both exchange rate change and fiscal adjustment in obtaining external adjustment. The discussion in chapter 5 returns to the question of the potential contribution of fiscal adjustment by assessing certain recent studies, especially Erceg, Guerrieri, and Gust (2005); Bernanke (2005); and Ferguson (2005).

Accounting Link

The national accounts provide a formal framework for thinking about how the excess claim on resources from abroad divides into excess use of resources by the respective public and private sectors. The national income accounts identity on the side of ''product demand'' is

$$Y = C + I + G + X - M \tag{4.1}$$

where Y is GDP, C is private consumption, I is private investment, G is government spending on consumption and investment (but not on interest payments or transfers), X is exports, and M is imports. Each of the elements on the right-hand side represents demand of a particular type. All of the demand components generate demand for domestic production except imports, which subtract from the amount that must be produced domestically to provide the product needed for the other components of demand.[1]

On the ''factor supply'' side of the national accounts, GDP is divided into the payments to the labor and capital that produce it. The household owners of labor and capital in turn use these payments for three possible purposes: consumption, saving, and tax payments. So on the factor payments side,

1. Government spending on interest and transfers, in contrast, does not generate a direct purchase of goods and services that enters into the national accounts estimates of production. The indirect effects of this spending, primarily induced consumption by recipients of transfers and interest, show up in the national accounts as consumption, not government activity.

$$Y = C + S_p + R \tag{4.2}$$

where S_p is private saving and R is government tax revenue. We can subtract equation 4.2 from equation 4.1 and then rearrange the result to obtain

$$\begin{aligned} &I + G + X - M - S_p - R = 0; \\ &I - S_p - [R - G] = M - X; \\ &I - S_p - S_g = M - X; \\ &I - S_p + D^F = M - X \end{aligned} \tag{4.3}$$

The third line of equation 4.3 provides the fundamental link between the external and fiscal deficits. It states that *the excess of investment over domestic private and public sector saving equals the excess of imports over exports.* Investment must equal domestic saving plus ''foreign saving,'' which is the excess of imports over exports. Domestic saving equals private saving (S_p) plus government saving (S_g, which is simply the excess of tax revenue over government spending, or [$R - G$]). The fourth line of equation 4.3 rewrites the same relationship using the definition of the fiscal deficit, D^F, which is the negative of government saving.

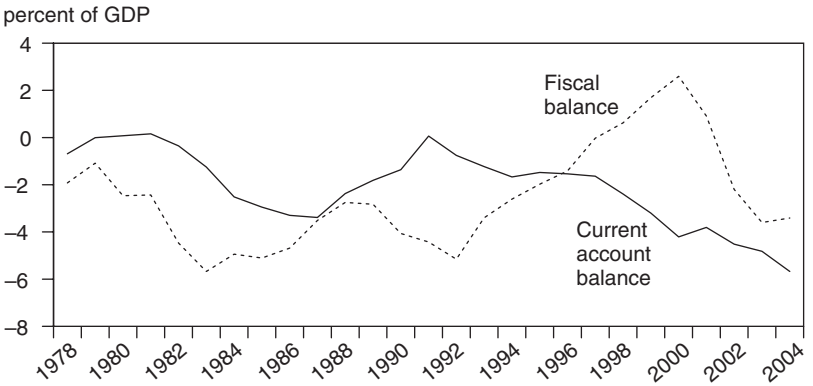
The excess of investment over saving amounts to a gap between the amount of resources used and the amount available domestically. This resource gap is made up by drawing on resources from abroad, in the form of imports in excess of exports. Because ''government saving'' is one source of domestic resources, a decline in government saving—i.e., a rise in the fiscal deficit—widens the resource gap and the external deficit. Thus, in the final line of equation 4.3, if the fiscal deficit rises and neither investment nor private saving changes, there must be an increase in the trade deficit.[2]

Because investment and private saving do not necessarily remain unchanged, however, what has sometimes been called the ''twin deficits'' relationship between the trade and fiscal deficits is by no means a lockstep (or Siamese-twin) relationship.[3] It is blindingly clear in figure 4.1 that, in fact, for the past quarter-century, the two deficits have moved in opposite

2. If the focus is on net foreign assets rather than the trade deficit, it is necessary to take net factor income on capital (NFI) into account as well as the above identities. Gross national income (GNI) equals GDP + NFI. The change in net foreign assets arises both from the trade balance and the balance on net factor income: $\Delta NFA = (X - M) + NFI$. At present, US NFI is still positive, although much smaller relative to GDP than in earlier decades. As the NFI turns negative and reaches large magnitudes, as in the baseline projections of net capital services income in chapter 3, the annual deterioration of net foreign assets will be considerably larger than just the trade deficit. Yet it will be only the trade deficit that provides real net resources to cover the gap between domestic investment and domestic saving.

3. For recent discussions of the twin deficits, see Gramlich (2004) and Truman (2004).

Figure 4.1 Fiscal balance and current account balance as a percent of GDP, 1978–2004



Sources: IMF (2005a); BEA (2005c).

directions much more frequently than in the same direction.[4] For 1979 through 2004, the change in the fiscal and current account balances from the prior year had the same sign in only 10 of the 26 years, or 38 percent of the time. The relationship has been even less evident for the past 21 years; the two balances moved in the same direction during only six of 21 years, or only 29 percent of the time. The two deficits moved in the same direction in 2002–03, but diverged again in 2004.

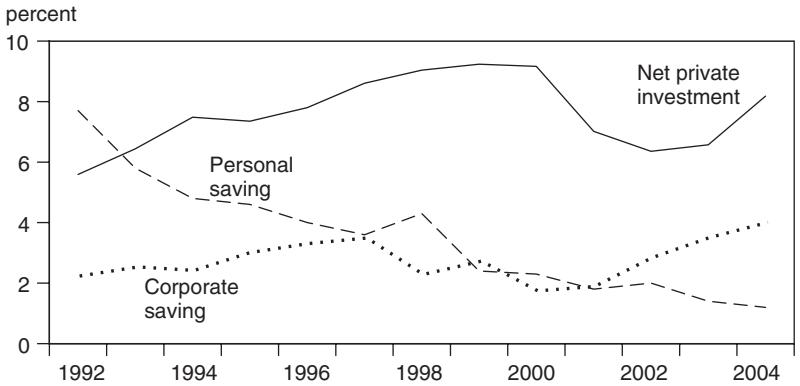
The most sustained and dramatic divergence between the external and fiscal deficits was from 1992 to 2000, when the current account swung from near balance to large deficit even though the fiscal accounts swung from large deficit to sizable surplus. The source of this paradox was the upsurge in private investment combined with a collapse in the private saving rate. As shown in figure 4.2, from 1992 to 2000, net private investment (i.e., gross investment less depreciation) rose from 5.6 to 9.2 percent of GDP. From national accounts equation 4.3 above, this would have been expected to drive a downswing in the current account balance by the difference, or 3.6 percent of GDP. Adding to the widening resources gap, personal saving fell from 7.7 percent of disposable income to 2.3 percent.[5] Corporate saving (undistributed profits) fluctuated but was basically unchanged from 1992 to 2000, and thus did not finance rising investment, let alone make up for falling household saving.

Any ''twin'' relationship between the external deficit and fiscal deficits thus vanished in the 1990s. Fiscal restraint and the booming economy eliminated the fiscal deficit and turned it into surplus. But for two related

4. Figure 4.1 shows the current account and consolidated (federal, state, and local) fiscal balances.

5. Personal disposable income averaged 73.4 percent over 1992–2003, with little variation.

Figure 4.2 Net private investment, personal saving, and corporate saving, 1992–2004 (percent of GDP and percent of disposable income)



Source: BEA (2005d).

reasons, that did not head off a wider external deficit. First, there was a boom in investment, partly associated with lower interest rates aided by the fiscal correction, but also spurred by ''the new economy'' and the information technology sectors in particular. Second, there was also a sharp decline in household saving as measured for national accounts purposes, probably in considerable part because households perceived their wealth to be rising from increased asset prices for their holdings of equities in the stock market boom and from rising valuations of their homes (as discussed below).[6] The result was the opening up of a large gap between personal saving and private investment that more than offset the reduction in the fiscal deficit. In terms of the national accounts relationship, from 1992 to 2000, we can write the following trends: $\Delta I > 0$; $\Delta S_p < 0$; $\Delta S_g > 0$; $[\Delta I - \Delta S_p > \Delta S_g] \rightarrow \uparrow[M{-}X]$.

Table 4.1 summarizes the relationships between the swings in investment, saving, and the external balance from 1992 to 2000 and then to 2004. All of the data are gross, so neither investment nor saving figures deduct depreciation. The bottom line for the external accounts was a widening of the deficit on goods and services, from net exports of -0.5 percent of GDP in 1992 to -3.9 percent in 2000 and -5.2 percent by 2004, using the national income and product accounts (NIPA) concept. The balance of payments concept of the current account balance, which differs slightly by the amount of net capital services and transfers (as well as statistical differences from NIPA data), closely followed this path. A

6. It could also be argued that falling rates of saving reflected a rational response to the falling interest rate incentive.

Table 4.1 National accounts investment, saving, and external balance, 1992, 2000, and 2004
(in billions of dollars and in percent of GDP)

		1992		2000		2004	
		Billions of dollars	Percent of GDP	Billions of dollars	Percent of GDP	Billions of dollars	Percent of GDP
GDP	Y	6,337.7	100.0	9,817.0	100.0	11,735.0	100.0
Personal consumption	C	4,235.3	66.8	6,739.4	68.7	8,229.9	70.1
Gross private investment	Ip	864.8	13.6	1,735.5	17.7	1,927.3	16.4
Government consumption and investment	G	1,271.0	20.1	1,721.6	17.5	2,186.8	18.6
Exports, goods and services	X	635.3	10.0	1,096.3	11.2	1,175.5	10.0
Imports, goods and services	M	668.6	10.5	1,475.8	15.0	1,781.6	15.2
Net exports	X–M	−33.3	−0.5	−379.5	−3.9	−606.1	−5.2
Current account	CA	−48.0	−0.8	−411.5	−4.2	−665.9	−5.7
Government investment	Ig	223.1	3.5	304.5	3.1	379.7	3.2
Private saving	Sp	1,100.4	17.4	1,334.1	13.6	1,749.0	14.9
Government saving	Sg	−152.1	−2.4	436.4	4.4	−129.0	−1.1
Resource gap: Ip + Ig − Sp − Sg	—	139.6	2.2	269.5	2.7	687.0	5.9
Trade deficit	M–X	33.3	0.5	379.5	3.9	606.1	5.2
Statistical discrepancy	—	106.3	1.7	−110.0	−1.1	80.9	0.7

Source: BEA (2005c, d).

rise in private investment by 4.1 percent of GDP from 1992 to 2000, combined with a decline in private saving by 3.8 percent of GDP over the same period, widened the domestic resource gap by more than it was narrowed by the upswing in government saving (by 6.8 percent of GDP) and the slight moderation in government investment (-0.4 percent of GDP). Surprisingly, however, the measured rise in the resource gap was much smaller (from 2.2 to 2.7 percent of GDP) than the rise in the NIPA net deficit on goods and services (from 0.5 to 3.9 percent of GDP). The result was a large swing in the statistical discrepancy of the resource gap, from 1.7 percent of GDP in 1992 to -1.1 percent of GDP in 2000.

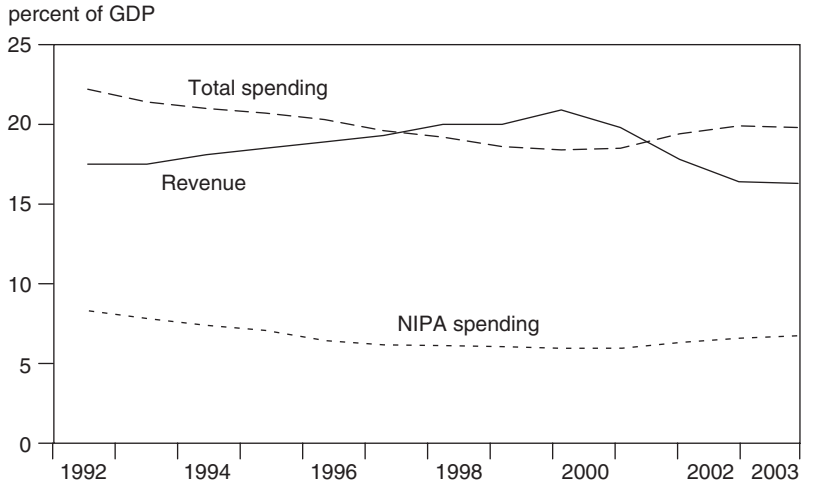
Table 4.1 also shows the further widening of the external deficit in association with the fiscal collapse over 2000–04. The downswing of government saving from 4.4 percent of GDP in 2000 to -1.1 percent of GDP in 2004 was only partially offset by a moderation in private investment by 1.3 percent of GDP (itself slightly offset by a rise in government investment by 0.1 percent of GDP) and by a modest recovery in private saving (from 13.6 to 14.9 percent of GDP). The result was a widening of the resource gap (investment minus saving) amounting to 3.2 percent of GDP, bringing the external deficit to about 6 percent of GDP.

It is fairly well known that the potential positive effect of fiscal adjustment in the 1990s on the external balance was more than offset by the even greater negative effect of rising investment and falling household saving. Perhaps less well known is that at least some part of the weak response of the external deficit to the fiscal adjustment was attributable to the difference between the budgetary fiscal deficit and the national accounts fiscal deficit. The traditional relationship of the fiscal deficit to the external balance weakens if the driving force in fiscal trends is changes in transfer and interest payments, which do not enter into the NIPA concept of government spending.

Consider a government that has been downsized to zero spending on defense, education, environment, and all other tangible goods and services demand. This government has only one function: to collect taxes and use them for transfers (e.g., Social Security and Medicare-Medicaid) and to pay interest on past debt. In the national accounts, this government's contribution to real product demand would be $G = 0$. Yet this government could be running a large fiscal deficit. For such a government, *reduction in the fiscal deficit would have no direct impact ex ante on the external balance*, because there would be no change in G in the national accounts relationships of equation 4.3. Reduction in the deficit would have to work strictly indirectly, by reducing the interest rate and thereby inducing downward pressure on the dollar (as discussed below); and by reducing disposable income to transfer-receiving households, thereby reducing their purchases of imports.

In the framework of traditional Keynesian income determination, the change in equilibrium income equals a ''multiplier'' times the initial

Figure 4.3 Federal revenue, total spending, and NIPA spending, 1992–2003 (percent of GDP)



NIPA = National Income and Product Accounts

Sources: BEA (2005d); CBO (2005d).

change in government purchases of goods and services. The first two rounds of the chain of spending in the multiplier are the change in government spending itself, ΔG, and the induced change in consumption by households selling the goods and services to the government, which is the marginal propensity to consume c times the amount purchased by the government. Aggregate demand thus rises by $\Delta G(1 + c)$ just in the first two rounds. In contrast, when the government increases transfer payments rather than real purchases for its own use, by amount ΔGT, there is no initial round of change in aggregate demand. The second, induced, round is the same as before, and amounts to $c\Delta GT$. On just the first two rounds in the spending chain, then, a change in government transfers has less than half as much impact on aggregate demand (assuming $c < 1$) as a change in government purchases of goods and services.

Figure 4.3 indicates that so far the distinction between budgetary and NIPA fiscal accounts has made only a modest difference in the extent of changes in resource pressure exerted by the federal government on aggregate demand. From 1992 to 2000, budgetary federal spending fell from 22.2 to 18.4 percent of GDP, or by 3.8 percent. Federal government purchases counted in the national accounts (NIPA in the figure) fell from 8.4 to 5.9 percent of GDP over the same period, or by 2.5 percent.[7] The

7. National accounts purchases by state and local governments hovered at a relatively steady 11.5 percent of GDP, placing total G at 20 percent of GDP in 1992, and falling to an average of about 17.5 percent in 1998–2000 before rebounding to 18.6 percent by 2004.

other 1.3 percent of GDP reduction in federal spending was mainly in lower interest payments (as discussed below). Even so, this divergence does suggest that *a modest part of the paradoxical divergence between falling fiscal deficits and rising external deficits from 1992 to 2000 was attributable to a smaller decline in real national accounts government purchases than in total government spending including interest and transfers.*

The difference between the NIPA and budgetary concepts of government spending could become much more important in the future. As discussed below, over a long-term horizon of several decades, transfer payments to recipients of Social Security and especially Medicare-Medicaid are projected to rise sharply. Fiscal adjustment programs involving cutbacks in these or other transfer payments would have no direct effect in reducing resource pressure from government spending. The ex ante effect of government spending cuts on the external balance would thus be absent in this area. The ex post effect would depend on induced exchange rate, investment demand, and consumer demand effects.

Induced Exchange Rate Effects

Whereas a focus on the national accounts identity tends to emphasize the role of government saving in aggregate demand for resources relative to supply as the transmission mechanism from fiscal to external deficits, the ''trade elasticities'' approach tends to emphasize the importance of the exchange rate in setting the relative price of tradables versus nontradables in the economy. There is a central linkage from fiscal balance to the exchange rate, which under normal times runs as follows. Fiscal adjustment to reduce the fiscal deficit takes pressure off of the domestic capital market, as there is less government ''crowding out'' of private borrowing. With a resulting fall in the interest rate, investment by foreigners in the US market is less attractive, so demand for the dollar will fall. As a consequence, fiscal adjustment prompts a decline in the value of the dollar. The resulting trade price ''signal'' working through trade response to price (''elasticities approach'') then becomes the transmission mechanism through which fiscal adjustment leads to external sector adjustment.[8]

As discussed below, the national accounts identity and the trade price elasticities equations are merely parts of a set of simultaneous equations that must all hold in a general equilibrium for the economy. It is useful to recognize at the outset, however, that the sign of the fiscal adjustment's impact on the exchange rate is potentially ambiguous. Even in benign times, there is also a relationship of the exchange rate to expected growth rates, because higher domestic growth relative to foreign growth will

8. This has been called the ''Massachusetts Avenue model'' after the addresses of economic research centers in Cambridge and Washington (Krugman 1991).

tend to attract foreign investors who are searching for more investment opportunities than are available in their home countries. If the fiscal adjustment sends the signal of slower domestic growth, discouragement of foreign investment inflows will reinforce the influence of lower interest rates in pushing down the exchange rate and making exports more attractive and imports less attractive. But if fiscal adjustment sends the signal that future growth instead will be higher because of lower domestic interest rates (broadly the ''Rubinomics'' of the mid-1990s, named after President Bill Clinton's Secretary of the Treasury, Robert Rubin), then the boost in demand for dollars in response to the more favorable growth outlook may exceed the cut in demand for dollars by interest-sensitive foreign investors. This appears to have occurred in the late 1990s, when large inflows of foreign investment influenced by the sustained economic boom boosted the dollar even though interest rates had fallen.[9]

These alternative potential expectations effects on the exchange rate are both within broadly benign environments. However, there can also be ''confidence shock'' expectational effects. The dollar began to fall relatively rapidly following the reelection of President George W. Bush.[10] One plausible interpretation is that foreign investors judged that the new administration was less likely than an administration of candidate John Kerry to carry out fiscal adjustment, and that this contributed to at least a temporary loss in confidence in the dollar.

The possibility of a confidence break suggests a potentially highly nonlinear relationship between the fiscal deficit and the exchange rate, such as that shown in figure 4.4. In a ''normal'' zone, such as a move in the fiscal balance from a moderate fiscal deficit at A to a modest fiscal surplus at B, the real exchange rate would depreciate from E_A to E_B in response to a moderation in the interest rate as the fiscal balances improve. If instead the fiscal deficit widens further, at some point there is a break in confidence and the exchange rate plunges to a level such as E_C at fiscal balance C. This occurs even though the interest rate is even higher at C than at A, because there is a sharply rising risk spread for exchange rate or (more typically for developing countries) debt default risk. Although the simple general equilibrium model developed later in this chapter assumes that, for any given growth rate, the exchange rate-fiscal balance relationship remains in the benign zone, the possibility of a confidence break must be kept in mind.

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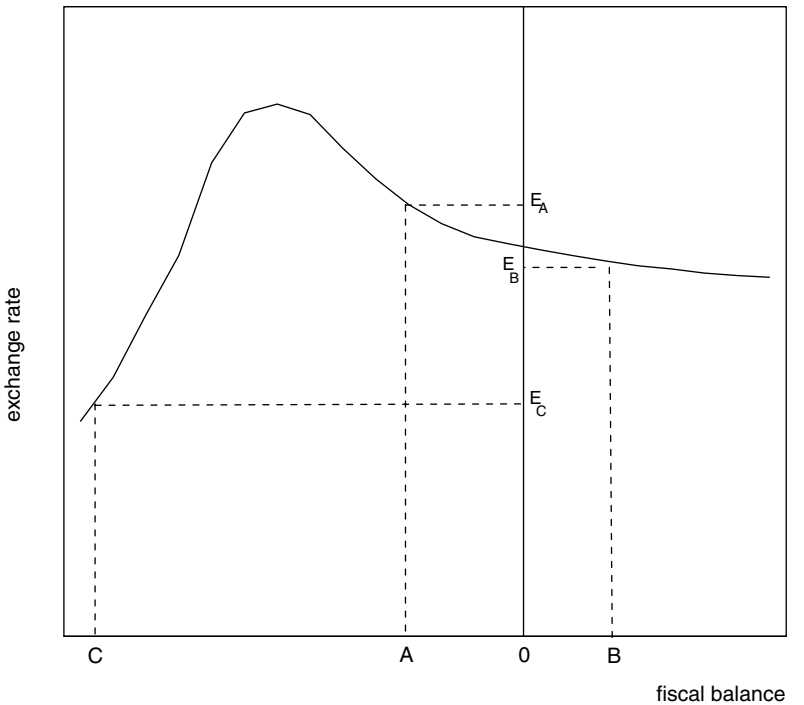
9. Thus, inflows of direct private investment into the United States soared from $58 billion in 1995 to $301 billion in 1999, even though the 10-year Treasury bond rate fell from 6.6 to 5.6 percent (IMF 2004b).

10. From November 2 to December 31, 2004, the dollar fell 6.2 percent against the euro and 3.4 percent against the yen.

Figure 4.4 Relationship of the exchange rate to the fiscal deficit



Note: Exchange rate = foreign currency/home currency.

Fiscal Adjustment and Consumption

Fiscal adjustment can influence the external balance working through induced reduction in consumption, as well as through the exchange rate mechanism. An increase in the tax rate will tend to reduce disposable income, which in turn will reduce consumption and imports of consumer goods. Similarly, a reduction in government spending (NIPA) will reduce payments to factors of production, hence income, hence consumption, and hence imports. In the case of transfer spending, a reduction will tend to reduce consumption in the same way as an increase in taxes, that is, by reducing disposable income.

From Fiscal Surplus to Deficit

The United States has experienced a stunning fiscal roller-coaster ride during the past decade. After a history of chronic fiscal deficits in the postwar period, and particularly large deficits in the 1980s, the federal

fiscal accounts by the late 1990s moved into surplus with help from the stock market bubble and the sustained economic boom. The projected future surpluses were so large that serious economists began to think about the implications of the eventual elimination of federal debt (Truman 2001). Then, during 2001–04, with the bursting of the bubble, a brief recession, increased military spending, and the tax reductions enacted by the first administration of George W. Bush, large fiscal deficits returned. The federal fiscal balance fell from a surplus of 2.4 percent of GDP in 2000 to a deficit of 3.6 percent of GDP in 2004. The long-term outlook suddenly shifted from potential elimination of federal debt to protracted deficits and debt buildup over a decade or so, and even worse prospects later when the rising Social Security and Medicare costs of the retiring baby boom generation would begin to take effect.

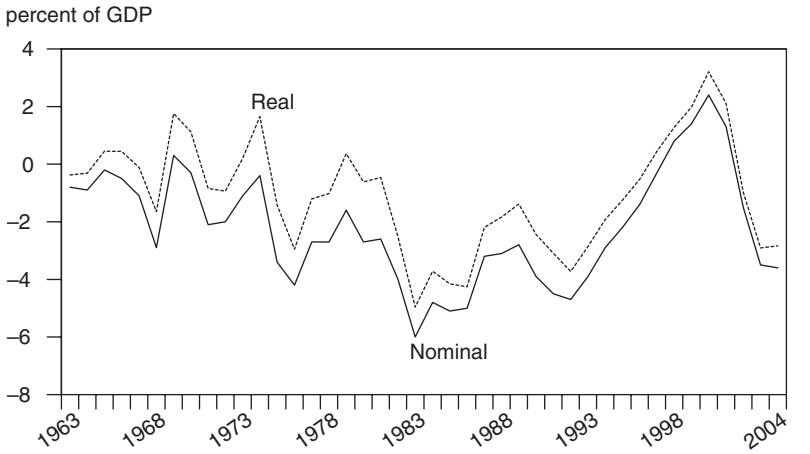
In the 2004 presidential campaign, both President George W. Bush and Senator John Kerry pledged to cut the fiscal deficit in half over four years. The actual outcome for fiscal 2004 (ending September) was a deficit of $412 billion, which amounted to 3.6 percent of GDP for October 2003 to September 2004 (OMB 2005b, BEA 2005d). The second Bush administration seeks to cut the deficit to 3.5 percent in fiscal year 2005, 3 percent in 2006, 2.3 percent in 2007, 1.7 percent in 2008, 1.5 percent in 2009, and 1.3 percent in 2010 (OMB 2005a). As discussed below, however, it seems much more likely that in the absence of forceful and even radical action, the deficit will amount to about 3 to 3½ percent of GDP during the full period 2007–12. This section first diagnoses how the US fiscal accounts collapsed so swiftly. It then turns to baseline fiscal prospects.

The Congressional Budget Office (CBO) successively revised downward its fiscal projections for the period 2001–11, from a prospective 10-year cumulative surplus of $5.6 trillion in its January 2001 estimates to a cumulative deficit of $3 trillion. The downswing amounted to 6 percent of average projected GDP. Of the total change in the baseline, and summing over the 11-year period, 40 percent was attributable to ''economic and technical changes,'' 33 percent to higher spending, and 27 percent to lower taxes. Much of the economic and technical change was for persistent rather than cyclical reasons. These include smaller than expected capital gains tax revenues, lower growth of incomes taxed at the highest marginal rates, and unexplained revenue weakness (OECD 2004b, 68–69, 94).

To provide historical perspective on the present imbalance, figure 4.5 shows the paths of the nominal and real federal fiscal deficits over the past 40 years. The real deficit is calculated as the nominal deficit less the inflationary erosion of outstanding federal debt in the hands of the public, estimated by applying the rise in the GDP deflator for the year in question to the debt at the end of the previous year.[11] It is the real deficit that

11. The series are from Council of Economic Advisers (2005). The federal fiscal deficits and federal debt held by the public are for fiscal years.

Figure 4.5 Nominal and real federal fiscal balances, 1963–2004 (percent of GDP)

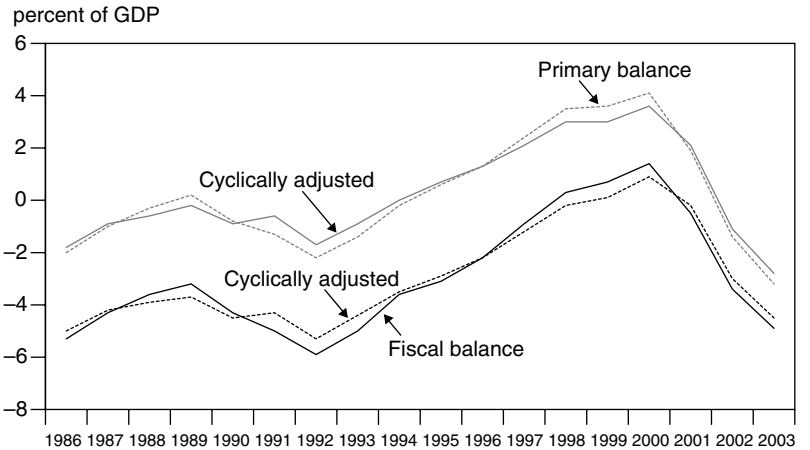


Sources: See text.

matters for the evolution of fiscal sustainability, because the inflationary component of rising debt will tend to be offset by corresponding inflation in the nominal GDP base. The nominal deficit was 3.5 percent of GDP in 2003 and 3.6 percent for 2004. These rates compare unfavorably with the average of 2.2 percent for the last four decades. The corresponding real deficits are 2.9 percent of GDP in 2003 and 2.8 percent in 2004. This outcome is even worse relative to experience over the past four decades: an average real deficit of only 1.1 percent of GDP. It is sometimes argued that today's deficits are not large by historical standards, but that impression is implicitly drawn against the period 1975–93, and in most of that period, the real deficit was considerably smaller than the nominal deficit because of relatively high inflation.

It is also natural to think that the recent deficits must be to a considerable extent transitory because they reflect in part the recession of 2001. Estimates by the Organization for Economic Cooperation and Development (OECD) of the cyclically-adjusted deficit suggest instead that the great bulk of the deterioration of the fiscal accounts has been for reasons other than the business cycle. Figure 4.6 reports OECD (2003) estimates of the US ''general government'' (federal, state, and local) fiscal balances for 1986–2003. The figure shows the actual deficit and the cyclically-adjusted deficit, for both the total and ''primary'' balances (the primary balance excludes net interest payments). The economic boom from 1999–2000 contributed a cyclical component of about +0.5 percent of GDP to the fiscal outcome for both the total and primary balances. Then by 2002–03, following the 2001 recession, the cyclical component had swung to about

Figure 4.6 General government fiscal balance and primary balance, actual and cyclically adjusted, 1986–2003
(percent of GDP)



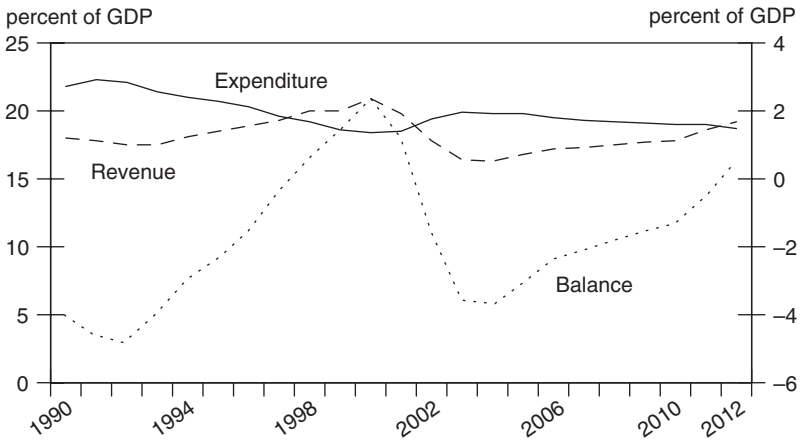
Source: OECD (2003).

−0.4 percent of GDP for both the total and primary balances. So the cyclical reversal contributed about 0.9 percent of GDP to the erosion of the fiscal balance between the two periods. Yet the total deterioration from the 1999–2000 average to the 2002–03 average amounted to about 5 percent of GDP for the actual deficit and 6 percent for the primary deficit. So the adverse cyclical effect can only account for about one-fifth to one-sixth of the erosion in fiscal performance.

Besides showing that the 2001 recession was not the main cause of fiscal deterioration, figure 4.6 illustrates another key development: The decline in interest rates has substantially shrunk the difference between the primary and total deficits. In part this reflects the decline in inflation, and hence the inflationary component of interest rates, since the late 1980s. In part, however, the unusually narrow gap by 2001–03 reflects unusually low real interest rates. This in turn suggests that the fiscal accounts are vulnerable to an increased interest burden as real rates return to more normal levels.

Figure 4.7 shows the evolution of actual federal revenue, expenditure, and fiscal balance as well as the CBO's baseline projections over the past 15 years and through 2012. It must be emphasized that the CBO is required by law to make projections based on current legislation, so its forecasts do not include the effect of the president's proposed extension of tax cuts and other changes that could make the outlook considerably worse. Focusing on the actual record to date, however, it is evident that the driving force in the fiscal collapse has been a decline in revenue. From

Figure 4.7 Actual and Congressional Budget Office baseline projection of federal revenues and expenditures and fiscal balance, 1990–2012 (percent of GDP)



Note: Revenue and expenditure on left scale; fiscal balance on right scale.

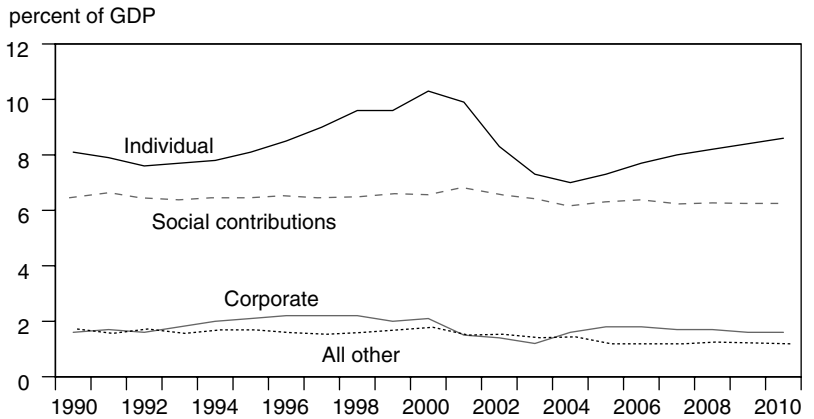
Source: CBO (2005a, b).

2000 to 2004, federal revenue fell from 20.9 to 16.3 percent of GDP, or by 4.6 percent of GDP. Spending also rose, but only by 1.5 percent of GDP, from 18.4 to 19.8 percent (CBO 2005a, b).

Figure 4.8 decomposes federal revenue into taxes on incomes of individuals, incomes of corporations, social contributions (Social Security and Medicare-Medicaid), and all other taxes (excise, estate, customs, and other). The figure shows clearly that the driving force in the fiscal turnaround was a swing in personal income tax revenue, from a strongly rising trend in 1997–2000 to a sharply falling trend in 2001–04. Taxes on individuals rose from an average of 8.3 percent of GDP in 1995–96 to an average of 10 percent in 2000–01, but then plunged to 7 percent by 2004. In contrast, corporate income taxes were virtually unchanged from 1995–96 to 2000 (at 2.1 percent of GDP) but then fell to a low of 1.2 percent of GDP in 2003 before partially reviving to 1.6 percent in 2004. The rise and then fall of personal income taxes also suggests that a major part of the problem was an unsustainably high pace of personal income tax revenue by the latter part of the financial market and economic boom of the late 1990s.

Capital gains tax revenues in particular appear to have played a key role in the rise and fall in personal income taxes. As indicated in figure 4.9, the total of net capital gains reported on personal income tax returns surged from about 2 percent of GDP in 1990 and 1995 to about 6 percent of GDP in 1999 and 2000 before plunging again (with the stock market) to 2 percent of GDP in 2002 (Internal Revenue Service 2004). The corres-

Figure 4.8 Actual and Congressional Budget Office baseline projection of revenue by source: Individual, corporate, social contributions, and all other, 1990–2010 (percent of GDP)



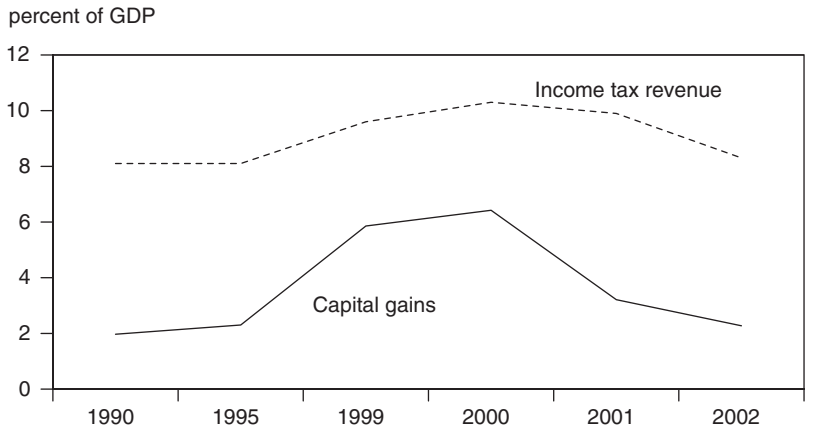
Source: CBO (2005a, b).

ponding magnitudes of tax revenues on capital gains would probably have been about 25 percent of the amount of capital gains (considering the 20 percent rate on long-term gains plus the normal marginal rate for short-term gains), so an upswing of 4 percent of GDP in capital gains might have contributed an additional 1 percent of GDP to revenues during the stock market bubble culminating in 1999–2000. This would have been about half of the increase in personal income tax revenue (from 8.1 percent before and just after the bubble to about 10 percent in 1999–2001).

Tax cuts were also a key part of the decline in revenue, however, especially by 2003–04 as the recovery was well under way. The OECD (2004b, 69) estimates that tax cuts enacted in 2001 (the Economic Growth and Tax Relief Reconciliation Act—EGTRRA) and 2003 (the Jobs and Growth Tax Relief Reconciliation Act—JGTRRA) reduced revenue by 1.9 percent of GDP in 2003 and by 2.6 percent of GDP in 2004 from levels otherwise obtained.[12] The OECD estimate implies that in the absence of the tax cuts, the 2004 fiscal deficit might have been only 1 percent rather than 3.6 percent of GDP.

12. The two tax bills cut the top marginal tax rate from 39.6 to 35 percent and the minimum rate from 15 to 10 percent; increased the standard deduction for married couples; increased the child tax credit; temporarily increased the exemption from the alternative minimum tax; and, for 2003–08, cut the long-term capital gains tax rate from 20 to 15 percent and made dividends taxable at 15 percent instead of the earned-income rate.

Figure 4.9 Capital gains and personal income tax revenue, 1990–2002 (percent of GDP)



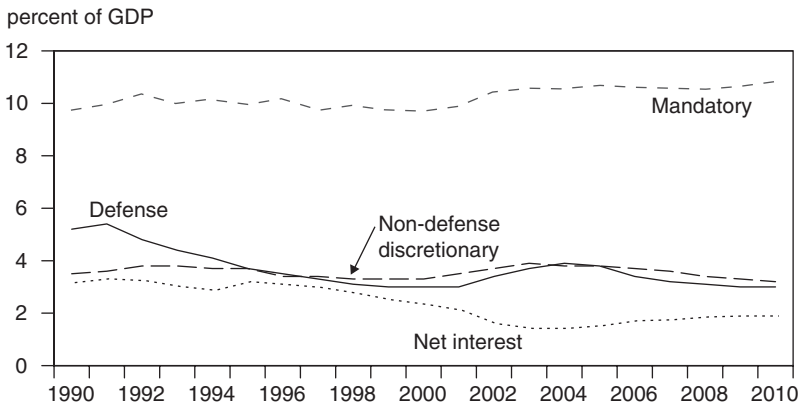
Source: IRS (2004).

Whether the economy would have recovered from the 2001 recession as well as it did without the tax cuts is, of course, a central issue. Boskin (2004) argues that the tax cuts were ideal for reviving the economy. Krugman (2003) argues persuasively, however, that they were part of a longer-term agenda to reduce taxation of capital and higher-income households, and that cuts oriented toward lower-income households on a more temporary basis would have been much less dangerous for long-term fiscal equilibrium. The main point for the present analysis is that the much longer-term nature of the cuts than would usually be adopted for fighting a recession poses a major challenge to restoring fiscal balance, especially if the Bush administration achieves the objective of making the cuts permanent despite their initial phase-out dates.

Figure 4.10 shows past trends in the main components of federal spending along with the CBO baseline projections. The future projections again tend to understate the deficit by accepting the administration's projection that non-defense discretionary domestic spending will fall relative to GDP.

An important long-term trend evident in figure 4.10 is the sharp decline in defense spending in the 1990s, from an average of 5.3 percent of GDP in 1990–91 to 3.6 percent by 1995–96 and 3 percent by 2000–01. This ''peace dividend'' of 1.7 percent of GDP following the end of the Cold War played a major role in the early phase of the reduction in the fiscal deficit, contributing about half of the deficit reduction from 5 percent of GDP in 1990–92 to 1.8 percent in 1995–96. Conversely, the military buildup as a result of the Afghanistan and Iraq wars following the September 11, 2001 attacks brought defense spending back up to 3.9 percent of GDP by 2004. The lack of any real prospect for a sharp decline in defense spending

Figure 4.10 Federal spending: Defense, non-defense discretionary, mandatory, and net interest, 1990–2010 (percent of GDP)



Source: CBO (2005a, b).

going forward is one of the main reasons that it is difficult to envision a repeat of the favorable swing into surplus in the 1990s.

Figure 4.10 also shows that the largest broad spending category has persistently been mandatory social spending, at about 10 percent of GDP, broken down as about 4.3 percent for Social Security, 2.3 percent for Medicare, 1.2 percent for Medicaid, 1.4 percent for income support, 1.2 percent for other retirement and disability programs, and 0.4 percent for other programs.[13] The mandatory category rose by about 1 percent of GDP from the 1997–2001 average to the 2002–04 average, mainly as a result of an increase in income support (reflecting in part unemployment after the 2001 recession) and higher Medicaid spending.

Once again, the spending relief from lower net interest is evident. Net interest fell from an average of about 3.2 percent of GDP in the early 1990s to only 1.4 percent of GDP in 2003–04. (The rebound to 1.9 percent of GDP by 2008 reflects not only accumulating debt but also the CBO assumption that 10-year Treasury bonds will be up to 5.4 percent by 2006 and 5.5 percent by 2007 and after, compared with 4.3 percent in 2004). Non-defense discretionary spending eased from an average of about 3.7 percent of GDP in the early 1990s to a low of 3.3 percent in 1999–2000, but jumped to an average of about 3.9 percent of GDP in 2003–04.

13. ''Income support'' includes unemployment compensation, supplemental security income, earned income tax credits, food stamps, family support, child nutrition, and foster care. Net total mandatory spending has typically been moderated by about 1 percent of GDP in ''offsetting receipts.''

De Rugy (2004) emphasizes that the first Bush administration sharply increased real discretionary spending. She estimates that the average annual real increase of 9.4 percent in the three fiscal years from 2002–04 was exceeded during the past 40 years only by the 13.6 percent average annual real increase in fiscal years 1967 and 1968. In contrast, the average annual increase for the past four decades was only 1.7 percent. She finds further that real non-defense spending will have risen almost as much as defense spending from fiscal year 2001 to fiscal year 2005, by 25 versus 36 percent respectively.

It is sometimes argued that non-defense spending on homeland security can explain the rise in discretionary non-defense spending. The budget for the Department of Homeland Security in fiscal year 2004 was $31 billion, or 0.26 percent of GDP, but much of this was supposed to replace spending in other agencies. In terms of budgetary impact, major increases in non-defense discretionary spending from fiscal year 2001 to fiscal year 2004 occurred in health, excluding Medicare (from 1.71 to 2.14 percent of GDP), education (0.57 to 0.77 percent), international affairs (0.16 to 0.3 percent), administration of justice (0.3 to 0.37 percent), transportation (0.54 to 0.6 percent), and regional development (0.12 to 0.16 percent) (OMB 2005b).[14]

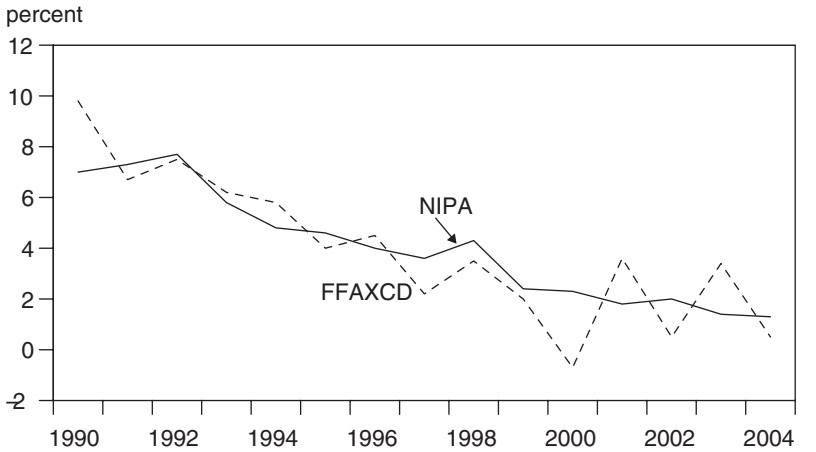
To summarize, the collapse of the US fiscal accounts from surplus to deficit was driven at first by recession and an end to high capital gains tax revenues as the stock market bubble burst, and then increasingly by a large reduction in tax liabilities through new legislation. A rise in defense and non-defense discretionary spending as well as mandatory social spending also contributed to the large reversal in the fiscal accounts, from a surplus of 2.4 percent of GDP in 2000 to a deficit of 3.6 percent of GDP in 2004.

The Decline in Personal Saving

The swing from fiscal surplus to deficit in recent years has not been the only source of falling domestic saving that has prompted the need for more saving from abroad, and hence a widening current account deficit. Personal saving also has fallen sharply. The principal alternative measures of personal saving reported in figure 4.11 show a large decline over the past 15 years. The US Commerce Department's measure of personal saving relative to disposable income fell from an average of 7.3 percent in 1990–92 to an average of 1.6 percent in 2002–04. The less familiar corresponding

14. Farm spending actually fell thanks to stronger international agricultural prices, but could also have widened given the generous subsidy framework of the 2002 farm bill, a reversal of the 1996 farm bill that had attempted to ''wean farmers from federal price supports and subsidies'' (de Rugy 2004).

Figure 4.11 Measures of personal saving as a percent of disposable income, 1990–2004



FFAXCD = flow of funds accounts excluding consumer durables
NIPA = National Income and Product Accounts

Sources: BEA (2005d); Federal Reserve Board (2005c).

estimate in the Federal Reserve's Flow of Funds Accounts (FFA) fell similarly from 8 to 1.5 percent over the same period (Federal Reserve Board 2005c).[15] Averaging the two series, the decline over this period has thus amounted to 6.1 percent of disposable income. Considering that disposable income has averaged 73.5 percent of GDP over this period, this means that the decline in personal saving has amounted to about 4.5 percent of GDP. In comparison, the current account balance, and hence the excess of domestic investment over saving, declined by 4.3 percent from 1990–92 to 2002–04.

The saving concept that is relevant for the external imbalance is current saving out of the stream of domestic production. The external imbalance is the excess of the annual flow of domestically used resources over domestically available resources. When personal saving out of current income declines, this excess rises, because the increase in consumption is not accompanied by a rise in the flow of domestic resources. This saving concept is quite different from the individual household concept of saving defined as the change in total stock of assets. That concept includes not only saving as a set-aside in a stream of current income, but also appreciation on previously held assets (capital gains). Some would argue that

15. The FFA also reports personal saving measured to include consumer durables. This series also fell sharply, from an average of 9.2 percent of disposable personal income in 1990–92 to 4.1 percent in 2002–04.

concern about personal saving in the United States has been misplaced, because households' saving defined to include asset appreciation has held up much better than saving out of current income. The problem with including asset appreciation from the standpoint of evaluating external resource use is that it is a zero-sum game across households. Unrealized capital gains are just that—unrealized. The attempt of all households to sell off and realize them at the same time would drive prices back down. While it may well be true that households' individual saving rates have not fallen much if their capital gains are included, it would be a fallacy of composition to argue that as a result the decline in personal saving out of current income has not contributed to the rising current account deficit.

Yet rising capital gains are probably the main factor in the decline in saving out of current income. The reason is precisely that households judge that they need to do less current saving if their assets have appreciated. For most of the past decade, there has been a large run-up in the prices of two categories of assets that matter most to US households: residential real estate and equities. As a result, as shown in table 4.2, US households enjoyed total increases in net worth that far surpassed their cumulative saving out of current income. From end-1990 to end-1999, net worth of households (and nonprofit institutions) rose by $22 trillion. During the same period, cumulative personal saving amounted to only $2.7 trillion, or only 12 percent of the total net worth increase.

The bursting of the stock market bubble cut equity assets from $17.3 trillion at the end of 1999 to $10 trillion at the end of 2002, although those assets partially recovered to $14.3 trillion by the end of 2004. An acceleration in housing price increases softened the overall decline in net worth during 2000–01 and contributed to the return to large net worth gains in 2003–04. Residential housing is much more widely owned across the spectrum of US families than are stocks, so the shift in asset appreciation (asset inflation?) from stocks to housing may have sustained rising consumption (and continued slim saving) despite the stock market's decline.[16] The impact of housing values on consumption is also bolstered by the use of home equity loans that increase the consumption potential of credit-constrained households.

One way to gauge the impact of asset appreciation on the personal saving rate is to apply the conventional range for the marginal propensity to consume out of wealth. Most of the literature places this marginal rate at about 3 percent.[17] As indicated in table 4.2, in the period of the stock

16. In 1998, the top 5 percent of households accounted for 57.4 percent of net worth. They owned 74.9 percent of stocks, but a much lower 35.3 percent of housing equity. See Poterba (2000).

17. See Poterba (2000). Note, however, that Juster et al. (2004) arrive at empirical estimates indicating a marginal propensity to consume out of wealth increases as high as 19 percent for capital gains in equities, despite finding the usual range of 3 percent for aggregate capital gains.

Table 4.2 US household wealth and saving, 1990–2004 (in billions of dollars and in percent)

	Assets					Net worth		Personal saving		
Year	Real estate	Equities	Other	Total	Liabilities	Level	Change	Rate (percent)	Amount	As a percent of change in net worth
1990	6,576	3,124	14,366	24,066	3,719	20,347		7.0	300	
1991	6,810	4,347	14,729	25,886	3,934	21,952	1,605	7.3	326	20.30
1992	7,122	4,887	15,042	27,051	4,139	22,912	960	7.7	366	38.11
1993	7,358	5,684	15,557	28,599	4,407	24,192	1,280	5.8	285	22.26
1994	7,523	5,680	16,386	29,589	4,734	24,855	663	4.8	247	37.30
1995	7,991	7,606	17,194	32,791	5,071	27,720	2,865	4.6	249	8.68
1996	8,320	9,194	18,206	35,720	5,428	30,292	2,572	4.0	228	8.85
1997	8,779	11,829	19,186	39,794	5,785	34,009	3,717	3.6	216	5.80
1998	9,545	13,736	20,423	43,704	6,242	37,462	3,453	4.3	275	7.96
1999	10,395	17,257	21,498	49,150	6,818	42,332	4,870	2.4	161	3.30
2000	11,401	15,333	22,624	49,358	7,399	41,959	−373	2.3	165	n.a.
2001	12,492	13,076	23,525	49,093	7,978	41,115	−844	1.8	135	n.a.
2002	13,683	10,028	24,379	48,090	8,673	39,417	−1,698	2.0	157	n.a.
2003	15,099	13,037	25,812	53,948	9,583	44,365	4,948	1.4	114	2.31
2004	17,242	14,347	27,597	59,186	10,719	48,467	4,102	1.3	112	2.74

n.a. = not applicable

Notes: Figures include nonprofit organizations. Equities include directly and indirectly held. ‘‘Other’’ includes deposits, credit market instruments, and other assets.

Sources: Federal Reserve Board (2005c); BEA (2005d).

market boom, total net worth rose by $4.9 trillion in 1999 alone. Applying the rate of 3 percent, this could have been expected to boost consumption by $146 billion. As it turns out, there was a drop of personal saving by $114 billion from 1998 to 1999, in the right order of magnitude for consistency with a special impact of rising wealth. Similarly, the rise of net worth by $4.9 trillion in 2003 (as the stock market improved and housing price increases accelerated) would once again have been expected to boost consumption by about $150 billion. If instead saving had been $150 billion higher, the personal saving rate in 2003 would have been 3.2 percent of disposable income rather than the actual 1.4 percent.

Whether the decline in personal saving fueled by asset appreciation has been a serious distortion that has unduly bloated US borrowing from abroad, or rather a socially efficient response to real economic changes, depends largely on whether the increase in asset prices has been mainly due to bubble dynamics or to a rise in the future stream of output expected from the assets because of higher productivity growth. In the first case, borrowing from abroad to finance extra consumption will have been shortsighted. In the second case, doing so will arguably have been optimal, because the increase in future productive capacity will easily repay the extra external debt.

There is no doubt that some of the stock market price increases in the 1990s could be warranted by rising productivity growth and the ''new economy.'' By the late 1990s, however, the excesses of an equity bubble were the driving force, as most dramatically illustrated by the surge and then collapse of high-technology stocks.[18] As for real estate, there is no basis on which it can be argued that price increases reflect an increase in productivity and the future stream of output. Instead, rising housing prices seem likely to have been attributable mainly to historically low interest rates, and to the rotation of investor asset allocation from the stock market to housing once equities stumbled, especially as the specter of deflation was replaced by nascent signs of inflation and as real assets once again held attraction as a hedge against inflation.

The overall effect of the great asset appreciation of recent years, for the external accounts, seems likely to have been mainly that it contributed to a rise in current consumption beyond what was consistent with longer-term optimality for the economy as a whole. The implication is that, at some point, asset appreciation will slow down or reverse (as it did in 2001–02 for total net worth). As asset prices return to a path much closer to, and, possibly lower than, general inflation, households may increasingly return to saving out of current income, raising the personal saving rate

18. The NASDAQ index of high technology stocks rose from 752 in December 1994 to a monthly peak of 4,697 in February 2000 before falling to 1,321 in January 2003 (Bloomberg LP 2005).

back closer to its range of 7 percent of disposable income in the early 1990s from its recent level of about 1.5 percent. When and if that occurs, there will be much less pressure on the balance between domestic use and availability of the annual flow of goods and services, facilitating a correction in the external deficit.

Fiscal Outlook for 2005–10

The United States has two fiscal problems: a medium-term deficit similar to those of the past, and a long-term deficit involving more severe structural trends in Social Security and especially Medicare-Medicaid accounts. The medium-term problem is marked by the need to address the revenue already lost and the risk that it will not be regained if tax cuts initially enacted with expiration dates timed to the 10-year budget horizon are extended as the administration desires. The longer-term problem has so far been dominated by discussion of such measures as shifting part of Social Security rights to private accounts.

The baseline fiscal projections of the CBO (2005a) are shown in figures 4.7, 4.8, and 4.10. The baseline fiscal balance eases to 3 percent of GDP in 2005, then narrows by about 0.3 percent annually during 2006–08 and 0.2 percent annually in 2009–10, to reach a deficit of 1.2 percent of GDP in 2010. There is further improvement to a surplus of 0.4 percent of GDP by 2012, thanks mainly to expiration of the tax cuts of 2001 and 2003.

The CBO makes clear, however, that it is constrained by law about the assumptions it must make in the projections, and it illustrates what would happen to the projections if alternative assumptions were made. The projections must be made under the assumption that current tax law does not change. For discretionary spending, the projections must assume that the most recent year's spending holds constant in real terms, with no allowance for growth in real GDP.

For defense, moreover, the CBO states that its baseline projections omit supplemental appropriations for the wars in Iraq and Afghanistan, and for certain other expenses in the war against terrorism, amounting to about $30 billion in 2005 and rising to about $75 billion annually by 2006–08 (including extra interest costs) before easing. If allowance is made for these additional defense expenditures, the fiscal deficit reaches 3.3 percent of GDP in 2005 instead of the CBO baseline of 3 percent.

By July 2005, higher than expected revenues suggested instead that the fiscal year 2005 deficit could amount to about 2.7 to 2.9 percent of GDP ($325 billion to $350 billion; see CBO 2005c). The extra revenue was concentrated in corporate taxes, possibly reflecting expiration of 2002 corporate tax breaks, and income taxes not withheld, perhaps from capital gains in real estate. Reflecting the likely transitory nature of the higher

revenue, the director of the CBO indicated that the medium-term fiscal outlook had not changed.[19]

Over the medium term, there are considerably more important additional unfavorable factors. The baseline projection of discretionary spending is likely understated. The Deficit Control Act requires the CBO to project discretionary spending at the level of the most recent appropriations with adjustment only for inflation (based on the GDP deflator and the employment cost index for wages and salaries). If instead discretionary spending is projected to grow at the same rate as nominal GDP, the result is to boost spending from the baseline by about $75 billion by 2008 and $220 billion by 2012.

Similarly, the baseline projection using current law provides for termination of the tax cuts (EGTRRA and JGTRRA, discussed above). If instead the Bush administration is successful in extending these cuts, there would be revenue loss (and associated increased interest on additional debt) amounting to about $30 billion annually in 2008 and $50 billion in 2010, rising sharply to $205 billion in 2011 and $325 billion in 2012.

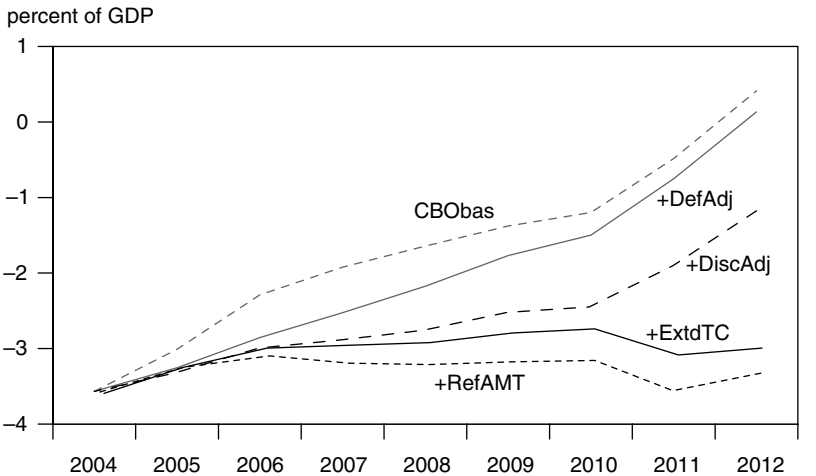
Finally, there is widespread expectation that the alternative minimum tax (AMT) will have to be reformed to avoid its extension to large numbers of middle-class households not originally intended to be covered as inflation boosts nominal income levels. The CBO calculates that if the AMT is instead indexed for inflation after 2005, the revenue (and interest) loss would amount to about $40 billion annually by 2008 and $70 billion by 2010, easing to about $40 billion by 2012. The magnitude of the correction amounts to a peak of 0.43 percent of GDP in 2010, somewhat smaller than might have been expected given the salient political profile of this issue.

Figure 4.12 shows the field of alternative baseline projections that would result from the changes in key assumptions just discussed. The official baseline is the top line. The next (lower) path adjusts for the extra expenses for Iraq, Afghanistan, and other costs of the war on terrorism. The next alternative additionally allows for discretionary spending to rise at the same rate as nominal GDP. The next alternative assumes that the administration successfully extends the tax cuts otherwise scheduled to expire. The final alternative assumes additionally that the AMT is indexed for inflation after 2004.

All four of the adjustments to the CBO baseline are reasonable assumptions. Their combined effect would be to freeze the fiscal deficit at about 3.2 percent over the next eight years, a sharp contrast to the (required) official CBO baseline showing gradual elimination of the deficit and achievement of a small surplus by 2012. Similar calculations under alternative assumptions have been made by the OECD (2004b) and by Gale and Orszag (2004, 3). The latter conclude that under the most plausible

19. Paul Krugman, ''Un-Spin the Budget,'' *New York Times*, July 11, 2005.

Figure 4.12 Congressional Budget Office baseline and alternative fiscal balance projections, 2004–12
(percent of GDP)



CBObas = Congressional Budget Office baseline
DefAdj = defense adjustment
DiscAdj = discretionary spending adjustment
ExtdTC = extension of tax cuts
RefAMT = alternative minimum tax indexed for inflation

Source: CBO (2005a).

assumptions, the baseline fiscal deficit will hover around 3.5 percent of GDP each year from 2005 through 2014. On the basis of the CBO alternative paths shown in figure 4.12 as well as these other recent studies, it seems likely that *the United States is on a path of continued fiscal deficits of about 3 to 3.5 percent of GDP rather than a path of gradually eliminating the deficit, especially if the tax cuts are made permanent*.

Some would argue that these deficit projections are too pessimistic because they do not include the dynamic effects of the tax cuts. Indeed, there has been ongoing debate on whether budget ''scoring'' of fiscal proposals should include dynamic macroeconomic effects. The implicit assumption is usually that tax cuts will spur incentives, increase growth, and hence cause less revenue loss than expected based solely on applying the change in rates to an unchanged GDP or income baseline. This issue is essentially a current incarnation of the ''supply side'' debate and the ''Laffer curve'' argument dating from the 1980s—that tax revenue could actually be higher if tax rates were lower because of incentive effects.

The dynamic effects of tax cuts can be ambiguous, however. Consider the important EGTRRA tax revisions of 2001. Gale and Potter (2002) estimate that even after taking account of improved incentives for labor,

private saving, and investment from the changes in this act, there would be a net loss in national saving and capital formation because of the dominant effect of lower fiscal revenue. They conclude that ''EGTRAA will slightly reduce the size of the economy by 2011'' (Gale and Potter 2002, 134). Orszag (2002, 1) argues more broadly that macroeconomic knowledge is insufficient to provide reliable estimates of dynamic macroeconomic effects of fiscal changes, and that to adopt dynamic scoring of fiscal proposals ''would exacerbate . . . the bias in the official baseline toward unrealistically favorable budget outcomes.'' In short, there would seem to be little firm basis for adopting more optimistic fiscal projections than those shown in figure 4.12 on grounds that dynamic macroeconomic effects of tax cuts should be added.

In the medium term, then, the challenge is to narrow the fiscal deficit sharply from a persistently high baseline. This will require some combination of spending cuts and tax increases. Many would argue that spending cuts are preferable on grounds, for example, that labor income taxes discourage effort and taxes on capital income discourage investment. However, the United States has already exhausted the easy defense spending cuts following the end of the Cold War, and parts of the social infrastructure (road systems, education) are arguably underfunded. Moreover, the tax cuts of recent years have reduced federal tax revenue to historically low levels gauged against the experience of the past half-century, suggesting at the least that some of the cuts should not be made permanent.

Long-Term Fiscal Problem

The longer-term problem is potentially much more severe. The CBO (2003) calculates that if spending growth is ''intermediate'' and if revenues recover by 2012 to their historical average of 18.4 percent of GDP (versus about 16.5 percent in 2004), then the fiscal deficit would be 6.1 percent of GDP in 2030 and 14.4 percent of GDP by 2050.[20] Federal debt in the hands of the public would rise from 37 percent of GDP in 2004 to 65 percent in 2030 and 185 percent by 2050.

The driving force behind this adverse long-term fiscal outlook is the prospective rise in Medicare-Medicaid spending, from 3.9 percent of GDP in 2004 to 8.4 percent in 2030 and 11.5 percent in 2050. Even this already high path assumes that the ''excess cost'' growth rate (excess of growth in Medicaid spending per enrollee above the annual GDP growth per capita) decelerates from 1.7 percent annually in 1990–2003 to only 1 percent annually in 2004–2050. In the high-spending scenario, this excess-

20. This scenario (intermediate spending, lower revenue) is one of six that the CBO calculates, comprising three spending cases (high, intermediate, low) combined with two revenue cases (higher, lower).

cost rate is 2.5 percent annually and Medicare-Medicaid spending would mushroom to 21.3 percent of GDP by 2050.[21]

Ironically, although most of the political discussion about radical fiscal reform has focused on Social Security (e.g., shifting from a public defined-benefit toward a private defined-contribution structure), spending on Social Security even without reform is only projected to rise from 4.2 percent of GDP today to 5.9 percent in 2030 and 6.2 percent in 2050. This increment of 2 percentage points of GDP not only pales in comparison to the 7.6 percent of GDP rise in Medicare-Medicaid spending (intermediate case), but is smaller than the 2.6 percent of GDP revenue lost by 2004 from the recent tax cuts. The 48 percent rise in projected Social Security spending as a share of GDP by 2050 is actually smaller than the 58 percent rise in the share of seniors in the total population.

Although the CBO (2003) projects that the ratio of workers to Social Security beneficiaries will fall from 3.3 today to 2.2 by 2030, various studies suggest that relatively modest changes in benefits and contributions could eliminate the prospective deficit in Social Security accounts. Remarkably, a single, arguably fair reform would seem capable of resolving the Social Security problem. At present, the initial benefit level of each cohort rises not only to offset inflation but also to accompany the growth of real average wages in the economy. Removing the increase for average real wages (projected by the CBO at 1.3 percent annually) but otherwise indexing for inflation would scale back Social Security spending from its projected 6.2 percent of GDP in 2050 to 4.1 percent, slightly below today's level (CBO 2003, 22).

It is a fair bet that a large majority of especially younger workers today do not expect the real level of their eventual Social Security benefits to be even as high as those paid to seniors today, let alone higher, and that most would favor stripping out the ''real wage growth'' component of current promised benefits if they could be assured in exchange that they

21. This much public spending on mandatory health programs would seem to border on the fanciful, however, because it implies (although the CBO does not state so explicitly) that more than half of GDP would be devoted to health care. Public and private health care together amount to 14.1 percent of GDP today. Medicare-Medicaid spending is thus about 28 percent of total health spending. The age group over 65 currently accounts for 12 percent of the population, and this will rise to 19 percent by 2030 and thereafter. The intensity of health spending is thus about 2.8 times as high for seniors as for the rest of the population (i.e., [28%/12%]/ [72%/88%] = 2.8). If Medicare-Medicaid spending expands to 21.3 percent of GDP (high case) when seniors reach 19 percent of the population, then maintenance of comparable health care for the rest of the population would imply [81/19]×[21.3/2.8] = 32.4 percent of GDP spent on nonsenior health. So 53.7 percent of GDP would be spent on health all together. This strains credulity. Even the ''intermediate'' Medicare-Medicaid excess cost growth rate of 1 percent per year, and Medicare-Medicaid spending at 11.5 percent of GDP in 2050, implies by the same calculus that total health spending would reach 29 percent of GDP, about double the share today.

would receive benefits no lower in real terms than those paid today.[22] Many might thus favor a reform that would assure maintenance of today's real benefits at the expense of delinking from further real wage growth. Nevertheless, removing the link between benefits and average real wages would make it much more explicit that Social Security is a ''redistribution program'' intended to assure a minimum income for the elderly, rather than a ''savings program'' in which workers get back at retirement what they themselves have saved and invested through the Social Security system. A true savings program instead would have a close link between the benefits and what the worker contributed (and thus, on average, a close link with average real wages). Of course, in reality the actual benefits received in the past have substantially exceeded the investment value of what the beneficiaries had contributed during their careers, a luxury made possible only by the pay-as-you-go structure of Social Security combined with the fact that in the first few decades, the ratio of active workers to retirees was very high.

In the CBO long-term scenarios, cutting the Medicare-Medicaid excess cost rate from 1 percent per annum to zero reduces that spending from 11.5 percent of GDP to 6.4 percent in 2050. Suppose instead that the excess cost growth rate were cut to 0.5 percent per annum. Call this ''plausible health reform.'' By implication, Medicare-Medicaid spending would be curbed halfway, to 9 percent of GDP in 2050. If real wage growth (but not inflation adjustment) were stripped from the future escalation of Social Security benefits, Social Security spending would fall from 6.2 percent to 4.1 percent of GDP in 2050. Call this ''real benefit maintenance Social Security reform.'' The CBO intermediate-spending scenario projects defense spending at 1.4 percent of GDP and all other primary (non-interest) spending at 4.2 percent of GDP in 2050. So if long-term fiscal adjustments included both ''plausible health reform'' and ''real benefit maintenance Social Security reform,'' total primary spending in 2050 would be only 18.7 percent instead of 23.4 percent of GDP. Even with just the ''lower'' CBO revenue assumption of 18.4 percent of GDP, the primary balance would be close to zero. A modest increase of taxes by 1 percent of GDP—smaller than that in almost all International Monetary Fund (IMF) adjustment programs for developing countries—would yield a primary surplus of 0.7 percent of GDP.[23] Federal debt held by the public

22. A 1998 survey on Social Security by Paine Webber found that only 12 percent of respondents under the age of 30 expected to receive ''all or most of the benefits to which they are entitled.'' The corresponding results for other age groups were 21 percent for those 31 to 49 years old and 57 percent for those near retirement (UBS 1998).

23. This could be accomplished through a ''corporate activity tax,'' which would be a type of value-added tax that could be set at a rate sufficient to replace all present corporate income tax plus a modest additional amount. This approach has been recommended by Hufbauer and Grieco (2005), who moreover suggest that the corporate activity tax could be the primary mechanism for raising far larger incremental amounts if needed because of less success in scaling back the prospective growth of Medicare-Medicaid and Social Security expenses.

could be maintained at about 50 percent of GDP or less, implying interest payments of 2.8 percent of GDP or less under the CBO's baseline interest rate assumption (5.5 percent on 10-year Treasury bonds). The overall deficit of 2.5 percent would be small enough to stabilize the debt-to-GDP ratio at about 50 percent if nominal growth were 5 percent annually (e.g., 2.5 percent real growth plus 2.5 percent inflation) or higher. The long-term fiscal problem would thus appear surmountable. But the longer the political effort needed is delayed, the larger and more dangerous the problem will become. The single most important part of the solution will be identifying an equitable and efficient means of limiting the pace of rising health care expenses.

This excursion into the United States' long-term fiscal problem has been necessary because that issue is the elephant in the room that can only be ignored by the uninformed or the disingenuous. In terms of correction of the external sector deficit and the sustainability of external debt, however, the next few years are the ones that will be crucial in determining whether the United States can carry out a smooth adjustment or instead will face a financial crisis. In particular, if global investors—and US citizens—begin to see progress in reducing the large recent fiscal deficits, as well as signs that the longer-term problem is beginning to be addressed, then the risks of a dollar crisis and hard landing will be substantially reduced. The rest of this chapter thus returns to the central question of the extent of fiscal adjustment needed, in combination with exchange rate adjustment, to carry out sufficient external adjustment to attain sustainability of external economic debt (or capitalized net capital income, CNCI, as discussed in chapter 3).

General Equilibrium Framework

The purpose of this chapter is to clarify the complementary roles of exchange rate and fiscal adjustments in achieving external adjustment. For this purpose, appendix 4A develops a simple general equilibrium model relating the external and fiscal accounts. This model contains seven underlying economic equations.[24] The first economic equation (4A.1) is the set of national income accounts identities (equations 4.1-4.3). The second is an equation relating imports to the real exchange rate (price variable) and the level of GDP (income variable). The third equation relates exports to the real exchange rate (price) and the level of foreign GDP (income). Thus, the first three equations in the appendix enforce a general equilibrium solution in which the conditions of both the ''absorption approach'' to

24. There are also five definitional equations: for disposable income; for the fiscal deficit; and for specifying the exogenous initial levels of government spending, the tax rate, and foreign income.

external correction and the ''elasticity approach'' are simultaneously met. The ''absorption approach'' emphasizes that reducing a trade deficit requires reducing the fiscal deficit or reducing private investment relative to private saving (national accounts identity). The ''elasticities approach'' emphasizes that reducing the external deficit requires real depreciation of the exchange rate and/or a slowdown in domestic growth or acceleration in foreign growth (price and income determination of trade). These three joint equations overcome the frequent critiques of each of these two schools against calculations made by the other, by forcing the system to take account of both approaches simultaneously.[25]

The remaining economic equations of the model state that (i) consumption is a function of disposable income and the interest rate; (ii) investment is a negative function of the interest rate and a positive function of the level of GDP; (iii) the real exchange rate varies positively with the interest rate and the level of domestic relative to foreign GDP; (iv) the interest rate rises in response to a larger fiscal deficit (''crowding out''), as GDP rises toward or above its potential (full employment) level, and in response to a rise in the general price level; and (v) prices respond to the level of GDP and the level of the exchange rate. To make the system highly transparent and to facilitate calculation of the solution, all equations are specified in linear terms. Finally, although the model is in real terms, for interpretation of the results it is necessary to convert the import estimates into nominal values. When the real exchange rate depreciates, there is an adverse terms of trade effect that raises the price of imports.

The parameters used in the model are similar to those in chapter 3 for the trade equations. The price elasticity is unity for both exports and imports; the pass-through ratio is 0.5 for imports and 1.0 for exports; and the import income elasticity is 1.8 and that for exports is 1.2, providing some ''Houthakker-Magee asymmetry'' (chapter 3). The marginal propensity to consume is set at 0.9.

The parameters for investment, the real exchange rate, and interest rate equations are plausible but less based on ''typical'' or ''stylized-fact'' magnitudes. It is postulated that a 1 percentage point rise in interest rates depresses investment by 0.6 percent of GDP and also curbs automobile consumption, and that a 1 percent rise in GDP induces a 1.1 percent rise in investment (accelerator effect). It is similarly assumed that a 1 percent rise in the interest rate induces a 5 percent rise in the real exchange rate, and that a rise of 1 percent in US GDP relative to rest-of-world GDP causes a 1.67 percent rise in the real exchange rate. Estimates by Gale and Orszag (2004) form the basis for a parameter stating that a rise in the fiscal deficit by 1 percent of GDP causes a 0.3 percentage point rise in

25. For example, in the US external adjustment episode of the 1980s, it was often argued by supporters of a ''strong dollar'' that real depreciation of the dollar would accomplish nothing because the external deficit was determined solely by the fiscal deficit.

the interest rate. The ''Taylor rule'' is invoked to obtain the parameter of an increase of 0.5 percentage points in the interest rate for an increase in GDP by 1 percent of its potential level (Taylor 1993). The same rule leads to a 0.5 percent rise in the interest rate in response to a 1 percent rise in the price level. The price equation states that a 1 percent depreciation of the exchange rate raises prices by 0.1 percent, and that a 1 percent rise in GDP boosts the price level by one-fourth of 1 percent (based on the nonaccelerating inflation rate of unemployment [NAIRU] formulation of the Phillips curve and on Okun's law; see appendix 4A).

The main overall result of the various simulations is that fiscal adjustment will be crucial to achieving external adjustment. An experiment with an exogenous initial depreciation of the dollar without fiscal adjustment generates very little external adjustment. Thus, a 20 percent ex ante decline in the dollar (for example, from a sharp fall in confidence) reduces the trade deficit by only 0.5 percent of GDP (from 5.2 to 4.7 percent) if it is unaccompanied by fiscal adjustment. The reason is partly that the ex ante depreciation of 20 percent turns into an ex post depreciation of only about 9 percent, because the dollar is bid back up by the rise in interest rates induced by the tendency of output to rise above the capacity-based potential level (as exports begin to expand in the absence of fiscal adjustment).[26]

In experiments with only a fiscal correction, the size of the trade balance adjustment is only about 40 percent as large as the fiscal adjustment.[27] In contrast, the most favorable external adjustment is achieved when there is a combination of ex ante exchange rate adjustment, fiscal adjustment, and some acceleration in foreign growth. In the most forceful and favorable example modeled, with an ex ante 25 percent real depreciation of the dollar, 2 percent of GDP reduction in government spending, 2 percent of GDP increase in taxes, and 1.5 percent rise in foreign GDP, the trade deficit is cut from 5.2 to 3.1 percent of GDP.

These relationships may be on the pessimistic side for judging the scope for external adjustment through fiscal and exchange rate adjustment. For example, as will be discussed in chapter 5, when there is a perceived need to accomplish a correction of fiscal and external deficits, monetary

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26. Note, however, that a special run of the Federal Reserve Board's Global Model (FRB/Global) shows that a considerably larger portion of the initial exchange rate shock persists after taking account of induced macroeconomic effects, including an increase in interest rates. An initial 10 percent decline in the dollar (modeled by a change in the risk premium required by foreign investors) results in a dollar that is 7 percent below the baseline by year 3. This simulation also shows a trade balance improvement from the baseline by 0.5 percent of GDP by year 3. (Christopher Erceg, personal communication, May 17, 2005.)

27. A much-cited recent study by Federal Reserve Board economists (Erceg, Guerrieri, and Gust 2005) places the ratio of the change in the current account to fiscal change at an even lower 20 percent. However, as argued in chapter 5, that model estimate and others like it may understate the potential for fiscal adjustment to contribute to external adjustment.

authorities could be much less likely to adhere to usual rules relating interest rates to output and inflation. Specifically, in the face of a reduction in the fiscal deficit, they might reduce the interest rate by less than a standard Taylor rule would suggest. If so, there would be less induced increase in investment and consumption to offset the reduction in government spending, leaving a larger rise in the domestic resource balance available to reduce the external deficit.[28] The relationship of the induced change in the trade balance to the change in the fiscal balance might thus be higher than 40 percent. If, in addition, there is an exogenous decline in the exchange rate, the overall external adjustment would be still larger.

Moreover, it should be kept in mind that the current account adjustment should be larger than the trade balance adjustment. Revaluation of foreign assets from exchange rate depreciation improves the base for capital service earnings, and an ease in interest rates associated with fiscal adjustment reduces interest payments on external debt.

The general equilibrium structure serves to underscore the importance of feedback effects. For exchange rate adjustment, these feedback effects tend to be negative (self-defeating) for external adjustment, whereas for fiscal adjustment, they tend to be positive (reinforcing). Exchange rate depreciation by itself causes an incipient rise in exports and a decline in real imports that boosts GDP by the national accounts equation. This raises disposable income and hence consumption, narrowing the potential reduction in the resource gap. The incipient rise in real GDP also boosts the interest rate (Taylor rule), which in turn curbs the extent of the exchange rate depreciation from its otherwise (ex ante) magnitude. In contrast, when a cut in government spending is the only ex ante change, the resulting incipient decline in GDP tends to reduce consumption and import demand, and reduces the exchange rate through the effect of domestic relative to foreign GDP level. The fiscal correction also tends to reduce the interest rate, both through the direct fiscal variable and the indirect effect of incipient decline in GDP relative to the full employment level, and the lower interest rate exerts further downward (and hence corrective) pressure on the exchange rate.

The simple model is designed to be illustrative rather than a definitive quantification of results from alternative policies. Nonetheless, it serves broadly as a caveat that suggests that the direct exchange rate impact estimates of chapter 3 may tend to overstate rather than understate external adjustment effects. Most importantly, the general equilibrium model serves as a sharp reminder that fiscal adjustment will need to be a central part of the external adjustment process.

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28. Truman (2005) has argued implicitly that the Federal Reserve should be tightening monetary policy to curb demand and pave the way for external adjustment.

Toward Fiscal and External Adjustment

The partial equilibrium trade and factor services model developed in chapter 3 found that the US external accounts remain on a baseline path of widening external deficits, rising from 5.7 percent of GDP in 2004 to 7.3 percent of GDP by 2010 (preferred model). The simulations found that a further 21 percent real foreign appreciation against the dollar beyond the January–May 2005 level could trim the baseline path to about 4 percent of GDP by 2010, and the additional effect of plausible foreign growth acceleration might reduce it further to about 3 percent.

The principal purpose of the simulations in appendix table 4A.3 is to show that the exchange rate adjustment will likely need to be accomplished by sizable fiscal adjustment. The specific calibration of the parameters may overstate the amount of fiscal adjustment required. In chapter 3, the ratio of the current account adjustment to the trade balance adjustment is about 1.22 to 1 in the favorable scenario shown in table 3.4.[29] This scenario involves a 21 percent real foreign appreciation against the dollar and a cumulative 2.25 percentage-point-years in additional foreign growth (0.75 percent annually over three years). In comparison, in the most favorable scenario conducted in appendix 4A, the general equilibrium model shows a 2.1 percent of GDP reduction in the trade deficit for a 33 percent foreign real exchange rate appreciation (25 percent dollar depreciation), 1.5 percent cumulative increase in foreign GDP, and 4 percent of GDP fiscal adjustment. By implication, the current account adjustment would be $1.22 \times 2.1 = 2.6$ percent of GDP, reducing a 7.3 percent of GDP baseline deficit to 4.6 percent. The implied impact parameter would be only 0.79 percent of GDP for each 10 percent foreign appreciation, much lower than the impact estimate of chapter 3 of 1.4 percent by year 3 and 1.6 percent by year 5. One reason for a smaller impact is that the general equilibrium model does not capture exchange rate valuation effects on foreign assets, and with a larger dollar depreciation in the general equilibrium scenario (case G), the amount of current account adjustment for a given trade balance adjustment would be somewhat larger than in table 3.4.

After taking into account a possible bias toward understating the current account adjustment, the broad implication is that it will probably require *complete elimination* of the prospective fiscal deficit of about 3¼ percent of GDP as the necessary fiscal adjustment to accompany further real foreign appreciation of 20 percent or so to reduce the current account deficit in 2010 from its baseline value of about 7½ percent to the range of 3½ percent of GDP.

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29. Against the baseline, in the favorable scenario, the 2010 trade balance improves by 3.6, percent of GDP and the current account by 4.4 percent of GDP.

Neither the simulations of chapter 3 nor those here envision contractionary external adjustment premised on a serious slowdown in US investment and growth. However, if serious fiscal correction is not pursued, a loss in growth could well turn out to be the way in which external adjustment occurs. The present commitment of the administration to reduce the fiscal deficit from 3.6 percent of GDP in 2004 to 1.7 percent by 2008 does not seem sufficient to carry out the fiscal role needed to complement exchange rate adjustment and cut the external deficit to the range of 3 to 4 percent of GDP from a baseline level of 7½ percent of GDP in 2010. Moreover, at present, the most realistic fiscal outlook is for a deficit still at about 3¼ percent of GDP by 2008–10, rather than 1.7 percent, given the Bush administration's commitment to making the recent tax cuts permanent and in view of more plausible trends for discretionary spending.

If even the promised fiscal adjustment does not take place, the chances of a currency crisis would increase, as could the chances of a hard landing for the economy (recession). The calculations of the general equilibrium model suggest that exchange rate adjustment alone will accomplish only limited external adjustment. If one combines this judgment with the judgment that financial markets will become increasingly convinced that a baseline path of ever-widening current account deficits cannot be sustained, then the implication would seem to be ample potential for a large decline in the value of the dollar in the absence of perceived firm progress on reducing the fiscal deficit. Whether a hard landing for the dollar would translate into a hard landing for the economy would depend primarily on whether interest rates rose sharply. Although the Federal Reserve would likely be reluctant to significantly raise the policy interest rate (federal funds rate) solely to ''defend the dollar,'' it might raise the rate if higher import prices posed an increased risk of inflation; and the long-term interest rate determined in the private capital markets might surge because of reduced capital inflows. The next chapter considers the various sides in the debate about the risk of a hard landing and the sustainability of the external deficit.

The analysis of this chapter also suggests another important nuance about fiscal adjustment. Important as curbing transfer payments will be for addressing the long-term fiscal problem, limiting fiscal adjustment solely to reductions in transfer payments would tend to be less effective in curbing the external deficit than would cuts in direct government purchases of goods and services and increases in taxes. A dollar cut in transfer payments may have significantly less impact in reducing the external deficit than a dollar cut in government purchases or a dollar raised in additional taxes, as set forth above.

Correspondingly, if the baseline for the fiscal deficit by 2050 really is 14.4 percent of GDP, the only silver lining might be that the resulting

external deficit would be somewhat less than would be expected if the bulk of the projected spending were on goods and services rather than transfers (Social Security and Medicare-Medicaid) and interest. An analysis of the external sector implications of such large deficits would also have to take account of the fact that other industrial countries under similar baselines would show large fiscal deficits driven by transfers to the elderly population, with the implication that those countries at least would not be likely candidates for providing the external sector surpluses to match US external sector deficits.

Appendix 4A
A Simple General Equilibrium Model Relating the Trade and Fiscal Balances

To examine the relationship between the fiscal and trade deficits, it is necessary to consider multiple general equilibrium feedback effects. Depending on the principal causal force operating at any given time, these feedback effects will sometimes mean that the two deficits move closely together (the ''twin deficits'') and sometimes that they will not do so and may even move in opposite directions. This appendix constructs a simple general equilibrium model to analyze the relationship and consider the interaction between alternative adjustment policy instruments.

The Model

The national accounts identity is the first equation that must be met in general equilibrium determination of the external and fiscal balances. This identity leads to the familiar relationship that the trade deficit must equal the excess of investment over saving.[30] Thus:

$$Y = C + I + G + X - M \tag{4A.1}$$

where Y is GDP, C is consumption, I is investment, X is exports, and M is imports. This is the ''product demand'' side of the economy. On the factor payments side, output must equal income paid to workers and owners of capital, and this income must be used for consumption, saving, or tax payments. Thus, the basic national accounts identities also require that

$$Y = C + S_p + R \tag{4A.1a}$$

where S_p is private saving and R is government tax revenue. Subtracting equation 4A.1a from equation 4A.1 and rearranging yields the key external sector relationship in the national accounts identities:

$$\begin{aligned} &I - S_p + G - R = M - X; \\ &I - S_p - S_G = M - X \end{aligned} \tag{4A.1b}$$

where S_G is ''government saving'' or R–G. Equation 4A.1b confirms that the trade deficit (right-hand side) equals the excess of investment over saving, defined to include private saving (S_P) and government saving (S_G).

30. For the purposes of this appendix, ''trade'' refers to both goods and services.

The second building block of a general equilibrium framework is the partial equilibrium relationship between trade and the exchange rate and levels of activity. Abstracting from time lags, these traditional relationships show imports as a function of the real exchange rate and domestic GDP, and exports as a function of the real exchange rate and foreign GDP. In order to construct a simple model that can be solved by standard matrix methods, the relationships are specified here as being linear. Thus:

$$M = \alpha_M + \beta E + \mu Y \tag{4A.2}$$

$$X = \alpha_X - \gamma E + \varepsilon Y_F \tag{4A.3}$$

where E is the real exchange rate, defined as the amount of foreign currency per US dollar after deflating both sides by domestic prices (so that a rise in E means a stronger dollar), and Y_F is foreign GDP.

The addition of equations 4A.2 and 4A.3 already establishes a system in which the two traditional approaches to external balance must be met simultaneously: the ''absorption approach,'' concentrating on aggregate resource use compared to resource availability (the $I–S_p–S_g = M–X$ identity); and the ''elasticities approach,'' which determines changes in exports and imports by consideration of changes in the price and income variables as applied to the respective price and income elasticities.[31]

Simple specifications of the other components of a general equilibrium system relating the trade accounts to the fiscal accounts include the following. Consumption depends on disposable income, which in turn depends on the level of taxes. Consumption is also responsive to the interest rate, not so much because of the traditional theoretical effect of interest rates on the trade-off between consumption now and consumption in the future (and hence saving), but because of the influence of consumer finance on such durables as automobiles in particular (as discussed below). Thus:

$$C = \alpha_C + \delta Y^D - \eta r; \tag{4A.4}$$

$$Y^D \equiv Y - R = Y(1 - \tau) \tag{4A.5}$$

where r is the interest rate, Y^D is disposable income, and τ is the tax rate (assumed for simplicity to be both the average and marginal tax rate).[32]

For its part, investment may be specified as a negative function of the interest rate, which determines the cost of capital. An important part of this relationship is the influence of the interest rate on residential investment.

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31. The classic statement of the absorption approach is by Alexander (1952). The elasticities approach dates back much further, notably to 19th-century economist Alfred Marshall and 20th-century economist Abba Lerner.

32. That is: $R = \tau Y$.

Investment is also a positive function of the level of GDP, considering that rising GDP generates demand for increased productive capacity. Thus:

$$I = \alpha_I - \theta r + \psi Y \tag{4A.6}$$

The real exchange rate is also a function of the interest rate, and in addition, is influenced by the rate of domestic growth relative to foreign growth in response to greater capital inflows when relative growth appears likely to be stronger. In a simple linear formulation, the exchange rate is determined as

$$E = \alpha_E + \rho r + \Omega(Y - Y_F) \tag{4A.7}$$

The interest rate is influenced by the size of the fiscal deficit, as government ''crowding out'' exerts pressure on the capital market. Monetary authorities influence the interest rate, seeking to increase it when inflation increases. Monetary authorities are also likely to vary interest rates in response to the level of output relative to potential output. This means that the interest rate is likely to rise with GDP.[33] Thus:

$$r = \alpha_r + \phi D^F + \pi P + \lambda Y \tag{4A.8}$$

where P is the level of the domestic price index.

The level of prices depends on whether the economy is overheated or below potential output. It also depends on the exchange rate, because of the influence of the exchange rate on the price of tradables, especially imports. Thus:

$$P = \alpha_P + \omega Y + \Gamma E \tag{4A.9}$$

For its part, the fiscal deficit is the excess of total government spending over revenue. Total spending includes spending on real activity, G, which enters into the national accounts, as well as the interest paid on public debt, which is a transfer rather than a production concept and is thus not included in the national accounts activity concept of G. Because the model is ''comparative static'' in that it describes a single solution at a point in time once all of the variables settle to their equilibrium levels, rather than ''dynamic'' in the sense of tracing out a path over time, the level of public debt is a given constant, which may be designated Δ. Interest payments on the debt will then be $r\Delta$. There is another discrepancy between the national accounts concept of G and federal budgetary spending. The national accounts concept excludes other transfers as well, but it includes

33. A specification using $(Y-Y^*)$ where Y^* is potential GDP, rather than just Y, would simply shift the constant term downward by λY^*.

government activity at the state and local levels. These two differences largely offset each other, but there is a remaining difference between them, designated here as α_{DF}. The fiscal deficit is then

$$D^F = G + (0.01)r\Delta\gg\!\!+ \alpha_{DF} - R = G + (0.01)r\Delta\gg\!\!+ \alpha_{DF} - \tau Y \quad (4A.10)$$

Equations 4A.1 through 4A.10 constitute a system of 10 simultaneous equations for 10 endogenous variables (Y, C, I, X, M, E, Y^D, r, P, D^F) and three exogenous variables (G, τ, and Y_F). Fiscal policy is thus explicitly exogenous. In addition, monetary policy can be made exogenous by imposing a shift in the constant term α_r in equation 4A.8. Similarly, if it is believed that policymakers can affect the exchange rate by jawboning, coordinated intervention, special foreign withholding taxes, capital controls, or other direct measures (beyond monetary and fiscal policy), then there can also be an exogenous ''exchange rate policy,'' expressed through a shift in the constant term α_E.

The system in equations 4A.1 through 4A.10 can be expressed in matrix form, as follows:

$$\underset{10x10}{A}\ \underset{10x1}{Z} = \underset{10x1}{K} \quad (4A.11)$$

where A is a matrix of coefficients, Z is a vector of the ten endogenous variables, and K is a vector of constants. Table 4A.1 presents this matrix equation in the form of a table.

The set of equations can then be solved for the values of the variables in vector Z by applying Cramer's rule to each successive variable.[34]

Calibration

The base year for the macroeconomic aggregates in the general equilibrium model is 2004.[35] The calculation of parameters in the various equations applies the following approach. In each linear equation, there is a constant term and a series of coefficients applied to explanatory variables. For each of these relationships, there will typically be a ''stylized'' (or

34. Cramer's rule states that the solution to the vector of unknowns Z in a matrix equation AZ = K can be obtained as a ratio of two determinants: $z_i = |B_i|/|A|$, where z_i is the equilibrium value of unknown variable i, and B_i is a matrix constructed by replacing column i in matrix A with vector K.

35. Note that because the model was estimated before final data for 2004 were available, the values applied compared with final official data in parentheses were as follows: GDP, $11,715 billion ($11,735 billion); exports of goods and services, $1,152 billion ($1,151 billion); imports of goods and nonfactor services, $1,760 billion ($1,769 billion); consumption, $8,221 billion ($8,230 billion); gross private investment, $1,915 billion ($1,927 billion); and government consumption and investment, $2,187 billion ($2,184 billion).

Table 4A.1 General equilibrium matrix equation

	Z:														
	Y	C	I	X	M	E	Y^D	r	D^F	G	τ	Y^F	P		**K:**
Equation:	**A:**														
1	1	-1	-1	-1	1					-1				=	0
2	$-\mu$				1	$-\beta$								=	α_M
3				1		γ						$-\varepsilon$		=	α_X
4		1					$-\delta$	$-\eta$						=	α_C
5	$\tau-1$						1							=	0
6	$-\Psi$		1					θ						=	α_I
7	$-\Omega$					1		$-\rho$				Ω		=	α_E
8	$-\lambda$							1	$-\varphi$				$-\pi$	=	α_r
9	$-\omega$					$-\Gamma$							1	=	α_P
10	τ							$-.01\Delta$	1	-1				=	α_{DF}
11										1				=	G_o
12											1			=	τ_0
13												1		=	Y^F_0

''Bayesian'') value for the ''elasticity,'' which indicates the percentage change in the dependent variable for a 1 percent change in the independent variable. The equations seek instead the ''marginal'' relationship. There is a fundamental identity whereby for any relationship between a dependent variable y and an independent variable x, the elasticity = [marginal]/[average]. That is: $e = [\partial y/\partial x]/[y/x]$. Given a stylized estimate of e, it is possible to estimate the marginal coefficient $\partial y/\partial x$ as $e[y/x]$. The base values of x and y are known, so the equation parameter in question can be estimated. Then, when each of the estimated marginal coefficients is applied to each of the independent variables, and the sum is subtracted from the base level of the dependent variable, the residual is the constant for the equation in question.

For the import and export equations, the simplest formulation is to adopt the traditional Houthakker-Magee asymmetry structure. As it is found in chapter 3 that this structure can understate export growth relative to import growth, a relatively mild degree of asymmetry is adopted here, with the income elasticity set at 1.8 on the import side and 1.2 on the export side. The parameter $\mu = \partial M/\partial Y$ can then be estimated as follows: $\mu/[M/Y] = 1.8$. Applying base values of $M = 1760$ and $Y = 11{,}715$ the result is $\mu = 0.27$.

For the import coefficient on the exchange rate, we have $\beta = \partial M/\partial E$. Following chapter 3, the underlying price elasticity is set at unity. However, the formulation here treats the import price pass-through and elasticity jointly. With pass-through at 0.5 and the underlying elasticity at 1, the effective elasticity is 0.5. So we have: $\beta/[M/E] = 0.5$. The base value of E is index level 100. So $\beta = 0.5\ [1760/100] = \$8.8$ billion change in import volume per percentage point change in the real exchange rate. As the national accounts are in real terms, change in volume equals change in value. However, a subsequent adjustment must be made in price to examine the corresponding change in import value. In effect, with an underlying import price elasticity of unity, there is no change in the nominal value of imports from an exchange rate change, because the reduction in volume from a 1 percent price increase (or 0.5 percent price increase after pass-through dampening) is just offset by the 1 percent (or 0.5 percent) increase in terms of dollar prices. For the constant term, given the estimates of μ and β, from equation 4A.2 we have: $\alpha_M = 1760 - (0.27 \times 11715) - 8.8 \times 100 = -\$2{,}283$.

For exports, the price elasticity is also set at unity. For simplicity, full pass-through is assumed (close to the 0.8 pass-through suggested in chapter 3). The exchange rate coefficient is thus: $\gamma = 1 \times [X/E] = [1152/100] = \$11.52$ billion per percentage point change in the real exchange rate index. Foreign GDP is estimated as follows. In 2002, global output at market exchange rates was $32.3 trillion, of which the United States accounted for $10.38 trillion (World Bank 2004a, 188). Applying the same

relationship for 2004, rest-of-world output is set at a base of $24,740 billion. With an export income elasticity of 1.2, we have for the export income coefficient: $\varepsilon = 1.2 \times [1152/24740] = 0.0559$. Applying the price and income coefficients and subtracting from the base export level, we obtain the constant term as: $\alpha_X = 1152 + 11.52 \times 100 - 0.0559 \times 24740 =$ $921 billion.

For consumption, national accounts data for 1982–2003 show that, as a simple average of the change in consumption from the prior year relative to change in GDP, the marginal propensity to consume is: $\delta = 0.90$ (BEA 2004e). As indicated in the main text, tax revenue in 2004 is set at 16 percent of GDP ($\tau = 0.16$), so disposable income is $0.84 \times $11,715 billon.

In recent years it has also become evident that consumption responds to the interest rate. The classical argument for such a response is that the interest rate is the relative price between current and future consumption, and households will consume less and save more if the reward for delaying consumption increases. Against this price effect, however, there is an income effect working in the opposite direction, because higher interest rates raise the income of households owning interest-bearing assets.

In contrast to the ambiguous classical relationship resulting from opposing price and income effects, the influence working through the availability of consumer finance, and in particular financing ''incentives'' from producers, appears to have been clear and significant at least in the case of automobiles. In the 2001 recession especially, real consumption of automobiles rose by a surprising 5 percent, up from 3.8 percent in 2000 (BEA 2004e). Over 1991–2004, the income elasticity for real automobile consumption was approximately unity.[36] In 2001, real GDP growth dropped to 0.8 percent from 3.7 percent the year before. Based on the income elasticity, auto consumption growth should have fallen commensurately. However, the prime interest rate eased as well, from 9.23 percent in 2000 to 6.92 percent in 2001 (IMF 2004b). If all of the unexplained strength of auto consumption growth in 2001 is attributed to the decline in the interest rate, the parameter obtained is that a 1 percentage point decline in the interest rate boosts auto consumption by 1.8 percent.[37] Automobile consumption stood at 4 percent of GDP in 2003 (BEA 2004e). So we can estimate that a 1 percentage point decline in interest rates boosts automobile consumption by an amount equivalent to 1.8 percent of 4 percent of GDP, or by $8.4 billion. This amount is used as the coefficient of consumption on the interest rate (η) in equation 4A.4.

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36. Based on a simple regression of percent changes with statistics too non-robust to bother reporting.

37. That is, instead of falling to 0.8 percent growth in 2001, auto consumption rose to 5 percent growth. The 4.2 percent unexplained growth divided by the 2.31 percentage point drop in the prime rate yields a coefficient of a 1.8 percentage point change in auto consumption for a 1 percentage point decline in the interest rate.

Consumption in 2004 was $8,221 billion. The constant term in the consumption equation is thus: $\alpha_C = 8221 - 0.90 \times 0.84 \times 11715 + 8.4 \times 4.1 = -\$601.1$ billion.

The coefficient relating investment to the interest rate is perhaps one of the weakest areas for identifying a ''stylized-fact'' value. However, suppose the real interest rate were to rise by 10 percentage points, and suppose that the consequence would be to suppress real gross investment down to a level where it would just cover depreciation (leaving zero net investment). Real investment for 2004 is estimated at 16.3 percent of GDP. On the basis of national accounts for 2002–03 (BEA 2004e), private capital consumption (depreciation) amounted to 10.3 percent of GDP. So if a rise in the real interest rate by 10 percent cut net private investment to zero, this would amount to a reduction in gross investment by 6 percent of GDP. A rise in the interest rate by 1 percentage point would then reduce investment by 0.6 percent of GDP, so in equation 4A.6 the coefficient $\theta = 0.006 \times 11715 = \$70.3$ billion.

Once again a closer look at financing helps firm up this estimate. Falling mortgage rates in recent years, as interest rates generally have fallen, have contributed to a boom in residential construction. (The bursting of the stock market bubble may also have spurred portfolio shifts toward housing and hence construction.) Residential investment amounts to about one-third of total gross fixed investment (BEA 2004e). Real residential investment growth averaged only 0.6 percent in 2000–01, but surged to an average of 8.25 percent in 2003–04 (BEA 2004e). Allowing a one-year lag, the corresponding change in the 10-year bond rate (which influences mortgage rates) was from 5.84 percent (1999–2000) to 4.32 percent (2002–03). So a decline in the interest rate by 1.52 percentage points was associated with a rise in residential investment by 7.65 percentage points, giving a relationship of about 5 to 1 between the change in residential investment growth and the change in the interest rate. Residential investment in 2003 was 5.2 percent of GDP. This implies that a decline in the interest rate by 1 percentage point induces a rise in residential investment equivalent to about $30 billion.[38] This amount is in the correct order of magnitude to be consistent with an overall decline in investment by $70 billion for a 1 percent rise in the interest rate, considering that residential investment is about one-third of the total.

The relationship of investment to GDP is also set to incorporate some ''accelerator'' influence, with an elasticity of 1.1 (i.e., a 1 percent rise in GDP induces a 1.1 percent rise in investment). On this basis, the coefficient ψ in equation 4A.6 is: $\psi = 1.1 \times [1915/11715] = 0.180$. The base year value for the interest rate is estimated at 4.1 percent (10-year bond). Applying the interest rate and GDP coefficients to equation 4A.6, the

38. That is, $0.052 \times \$11{,}715$ billion $\times 5 \times .01 \cong \$30$ billion.

constant term then becomes: $\alpha_I = 1915 + 70.3 \times 4.1 - 0.18 \times 11715 =$ \$94.5 billion.

The base year value of 100 for the real exchange rate index (E) conveniently is approximately the actual level of the Federal Reserve's broad real index for 2004 (see chapter 3). How much should we expect the real exchange rate to rise in response to a rise in US interest rates? All else being equal, it is assumed here that a 3 percentage point rise in the interest rate will induce sufficient additional capital inflow to cause the real exchange rate to rise by 15 percent. This implicitly assumes that interest rates remain unchanged abroad. In equation 4A.7, the coefficient ρ is thus set at 5 percentage points on index E for each percentage point rise in interest rate r. For the response of the exchange rate to differential growth, the calculations assume that a 3 percent rise in the level of US GDP relative to rest-of-world GDP induces a 5 percent rise in the real exchange rate. On this basis, an increase in US GDP by \$351 billion induces a 5 percent rise in the real exchange rate, or coefficient $\Omega = 5/351 = 0.0142$. The constant term for the exchange rate equation is then estimated as: $\alpha_E = 100 - 5 \times 4.1 - 0.0142(11715–24740) = 264.5$.

For the relationship of the real interest rate to the fiscal deficit, Gale and Orszag (2004) estimate that an additional 1 percent of GDP in the fiscal deficit increases the long-term interest rate by 25 to 35 basis points. On this basis, an additional deficit of \$117.15 billion translates into a 0.3 percentage point increase in the interest rate, so in equation 4A.8 the corresponding coefficient is $\varphi = 0.3/117.15 = 0.00256$ percentage point per billion dollars of additional fiscal deficit.

It is important to note that the experience of the 1990s tended to support a strong influence of fiscal deficit reduction on the interest rate and, in turn, on investment and consumption. This virtuous circle of fiscal adjustment rewarded by expansion of the economy became known as ''Rubinomics,'' after US Treasury Secretary Robert Rubin (see Krugman 2003, xxi). At the extreme, this influence implies that an increase in the fiscal deficit (usually called ''fiscal expansion'') is contractionary for the economy, and a reduction in the deficit (usually called ''fiscal contraction'') is expansionary. That is, in an extreme formulation, the indirect effects on investment and consumption demand, working through the interest rate effect, would swamp the direct effects of changes in government spending (or taxes). The parameters used in the model of this chapter are not this extreme, however, and fiscal expansion (contraction) remains expansionary (contractionary) for the economy.

With respect to the impact of GDP expansion on the interest rate, the ''Taylor rule'' describing monetary policy provides a basis for determining the needed parameter (Taylor 1993). This rule states that the change in the real policy interest rate (federal funds rate) is determined half on the basis of the deviation of inflation from the target inflation rate and half

on the basis of the deviation of actual from potential output.[39] Backcasts applying this rule for 1987–2003 and using a target inflation rate of 2 percent obtain a very close fit with actual federal funds interest rates (Carlstrom and Fuerst 2003).

The CBO (2004b) has estimated that the ''output gap,'' or shortfall of actual from potential GDP, stood at 3.1 percent at the beginning of 2003 and 1.3 percent at the beginning of 2004. If we use a 1 percent output gap for base year 2004, then potential output will have been $11,832 billion for this year. Each increment of 1 percent of this base, or $118.32 billion, generates a Taylor-rule tightening of monetary policy by 0.5 percentage points. So in equation 4A.8, the corresponding coefficient $\lambda = 0.5/118.3 = 0.00423$ percentage point change in the interest rate for each additional $1 billion in GDP.

The other half of the Taylor rule concerns inflation. For this component the coefficient is simply 0.5. That is, if inflation rises by 1 percent, the Federal Reserve raises interest rates by 0.5 percent. As discussed below, the model applies the change in the price *level* as this change in the inflation rate. Given the parameters φ, λ, and π, and using 4.1 percent as the base level of the nominal interest rate and $422 billion as the base fiscal deficit (CBO 2004b), the constant in the interest rate equation can be estimated as: $\alpha_r = 4.1 - .00256 \times 422 - .00423 \times 11715 - 0.5 \times 100 = -96.53$ percent.

For prices (equation 4A.9), the specification requires translation of annual rates of inflation into a price level. As a model of comparative static equilibrium, the model is best suited to identifying an equilibrium *level* of prices (price index level), not an equilibrium rate of change for prices (rate of inflation). In equation 4A.9, use of the price level fits naturally with inclusion of the level of the exchange rate as an explanatory variable (E). The coefficient on the exchange rate, Γ, is obtained as follows. The import pass-through ratio is 0.5, so a 1 percent rise in the real exchange rate E reduces the price of imports by 0.5 percent. (Export pass-through is complete, so dollar export prices do not change when the exchange rate changes.) Imports of goods and services amount to 15 percent of GDP. Allowing for spillover into tradables more generally, we can place ''importables'' at, say, 20 percent of GDP. So if a 1 percent decline in the exchange rate boosts import prices by 0.5 percent, then applying a weight of one-fifth for importables in the overall price index will result in an increase of one-tenth of 1 percent for prices overall. With the price index at 100, this means that a 1 percent depreciation in the real exchange rate

39. Taylor assumed target inflation of 2 percent and a long-term average real federal funds rate of 2 percent, giving a nominal interest rate of 4 percent under target conditions warranting ''neutral'' monetary policy. For other conditions, the rule implies: $r^* \equiv r - \pi = 2 + 0.5(\pi - 2) + 0.5\,(100 \times [Y/Y_p - 1])$ where r^* is the real interest rate, π is the inflation rate, and Y_p is potential output.

causes a 0.1 percent rise in the price index, giving a parameter value of: $\Gamma = -0.1$.

The parameter relating prices to GDP is more difficult to assess. The approach here is to use the modern formulation of the Phillips curve to arrive at this parameter. Gordon (1996) judges that a decline of the unemployment rate by 1 percentage point below the nonaccelerating inflation rate of unemployment (NAIRU) will generate a 0.5 percent increase in the rate of inflation, if sustained for one year. He also indicates that, from Okun's law, a 1 percentage point change in unemployment is associated with a 2 percent change in GDP.[40] This means that a 4 percent rise in GDP will be associated with a 1 percent rise in prices (i.e., [2%∂Q/∂u] / [0.5%∂P/∂u] = 4%∂Q/1%∂P). Four percent of GDP for 2004 amounts to $469 billion. If an increase in the price level by 1 percent is associated with this amount of additional GDP, then the coefficient ω in equation 4A.9 is: $\omega = 1/469 = 0.00213$ percentage point increase in the price index for a $1 billion increment in GDP. The constant term is then: $\alpha_P = 100 + 0.1 \times 100 - 0.00213 \times 11715 = 85$.

Deriving this coefficient further requires mapping the percent price change (inflation rate) to price levels. The Phillips curve and Okun's law are stated as annual percentage rates. The treatment here assumes that the impacts in question are sustained only one year, so changes in the inflation rate also equal the change in the price level. It could alternately be assumed, for example, that the cumulative comparative static impact should be based on, say, three years or more of annual inflation. However, the central role of the price variable in the model is as an influence on the interest rate, and the specification in the interest rate equation applies the change in the price level for one year only. For consistency, the price equation cumulates inflation for only one year as well.

Finally, in the fiscal deficit (equation 4A.10), the contribution of interest on the debt is simply the interest rate as applied to debt at the end of the previous year. The CBO estimate of net interest for 2004 is $159 billion, and end-2003 federal debt in the hands of the public was $3.9 trillion. This is consistent with the 4.1 percent interest rate used here as the base year rate.[41] The term α_{DF} is set at $-$$50 billion to adjust for the difference between the national accounts concept of government activity (federal,

40. The idea is that firms tend to hold on to workers during recessions but are slow to hire additional workers during expansion, so that employment varies less than proportionately with swings in output over the business cycle.

41. Note that this is the 10-year rate. Although the Taylor rule cited above applies to the short-term federal funds rate, the incremental coefficient λ discussed above will apply to both the 10-year rate and the short-term policy rate if the yield curve remains unchanged. In practice, the yield curve is likely to flatten as the economy strengthens.

Table 4A.2 Parameter values

Parameter	Concept	Value	Units
α_M	Import (M) equation constant	−2,283.0	Billions of dollars
μ	Marginal impact of GDP on imports	0.27	Pure number
β	Marginal impact of exchange rate on M	8.8	Billions of dollars/index
α_X	Export (X) equation constant	921.0	Billions of dollars
γ	Marginal impact of exchange rate on X	11.52	Billions of dollars/index
ε	Marginal impact of foreign income on X	0.0559	Pure number
α_C	Consumption equation constant	−636.0	Billion of dollars
δ	Marginal propensity to consume	0.90	Pure number
η	Marginal impact of interest rate on consumption	−8.4	Billions of dollars
α_I	Investment (I) equation constant	94.5	Billions of dollars
θ	Marginal impact of interest rate on I	70.3	Billions of dollars/percent
Ψ	Marginal impact of GDP on investment	0.180	Pure number
α_E	Exchange rate (E) equation constant	264.5	Index
ρ	Marginal impact of interest rate on E	5.0	Index/percent
Ω	Marginal impact of $Y\text{-}Y^F$ on E	0.0142	Index/billions of dollars
α_r	Interest rate (r) equation constant	−96.53	Percentage points
φ	Marginal impact of fiscal deficit on r	0.00256	Percent/billions of dollars
λ	Marginal impact of GDP on r	0.00423	Percent/billions of dollars
π	Marginal impact of price level on r	0.5	Pure number
α_P	Price level constant	85.0	Index
ω	Marginal impact of GDP on price level	0.00213	Index/billions of dollars
Γ	Marginal impact of exchange rate on prices	−0.1	Pure number
α_{DF}	Budget vs. national accounts adjustment	−50.0	Billions of dollars
Δ	Government debt held by public	3,914.0	Billions of dollars
G_0	Base case government spending	2,187.0	Billions of dollars
τ_0	Base case tax rate	0.16	Pure number
Y^F_0	Foreign GDP	24,740.0	Billions of dollars

state, and local spending excluding transfers) and the corresponding budgetary concept for the federal deficit, as discussed above.[42]

The full set of parameter estimates is reported in table 4A.2.

Because the model so far is stated solely in real terms, and because the dollar price of imports changes with the exchange rate, it is necessary to consider further the translation of the equilibrium outcome into consequences for the nominal trade balance. When the real exchange rate depreciates (e.g., from $E_0 = 100$ to $E_1 = 90$), and if the pass-through ratio is σ, then the dollar price of imports rises from $P^M{}_0 = 1$ to $P^M{}_1$, and the nominal value of imports becomes M^{nom}, where:

42. Thus, the federal fiscal deficit is estimated at $422 billion (CBO 2004b). With $G = \$2{,}187$ billion, interest at $160 billion, and revenue at $0.16 \times$ GDP or $1,874 billion, the adjustment constant is $\alpha_{DF} = 422 - 2187 - 159 + 1{,}874 = -\$50$ billion.

$$P_1^M = 1 + \sigma\left(\frac{E_0}{E_1} - 1\right); \quad M^{nom} = MP_1^M \tag{4A.12}$$

This relationship of the nominal to the real equilibrium import level is needed to evaluate the equilibrium trade balance, but it does not constitute a direct part of the general equilibrium system of equations 4A.1 through 4A.11 and table 4A.2.

Simulation Results

Table 4A.3 reports the results of alternative simulations of the model. The first column of the table reports estimated ''actual'' values for 2004, the base year. The second column reports the corresponding estimates of the model applying Cramer's rule to the matrix shown in table 4A.1 with the parameter values indicated in table 4A.2. The only divergences of the model's base values from ''actual'' values are small rounding errors. The base value of the trade deficit (goods and nonfactor services) is 5.2 percent of GDP; the base fiscal deficit is 3.6 percent of GDP.

The first policy simulation, case A, applies a fiscal adjustment reducing government spending (NIPA concept) by 3 percent of GDP. The fiscal deficit falls to 0.4 percent of GDP. It is worth noting that the reduction in the fiscal deficit outcome by 3.2 percent of GDP exceeds the initial cut in government spending, because of favorable induced effects from lower interest payments on government debt. The easing of pressure on the domestic capital market allows the interest rate to fall from 4.1 to 2.7 percent. A lower interest rate exerts downward pressure on the real exchange rate, which falls by about 9 percent. The lower interest rate also boosts investment by about 3.5 percent. GDP falls by 1.4 percent, however, because the rise in investment is not enough to offset the reduction in government demand and induced reduction in consumption as disposable income falls. The more competitive exchange rate boosts exports by about 9 percent and, together with weaker domestic output, curbs imports by about 7 percent in real terms (but only about 2 percent in nominal terms). The trade deficit falls from 5.2 to 4 percent of GDP.

The second simulation, case B, also imposes a 3 percent of GDP ex ante fiscal adjustment by raising the tax rate from 16 to 19 percent. The results for GDP and for the trade balance are similar but slightly weaker than those from the cut in government spending. The principal difference is that personal consumption is lower and government spending remains higher than in the first case, where the adjustment is through lower government spending. Once again the interest rate falls and so does the real exchange rate. The fiscal adjustment is the same as in the first case—a cut in the deficit by 3.2 percent of GDP. The external adjustment is slightly smaller—a reduction in the trade deficit by 1.1 percent of GDP. On the basis of simulations A and B, it would appear that *a reasonable*

Table 4A.3 General equilibrium model simulations (in billions of dollars, in ratios, and in percent)

	Base		Simulation						
Variable	**Actual**	**Model**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
GDP	11,715	11,714	11,549	11,578	11,909	12,129	11,758	11,825	11,823
Consumption	8,221	8,220	8,107	7,815	8,354	8,506	8,093	8,139	8,085
Investment	1,915	1,915	1,982	1,979	1,839	1,754	1,905	1,884	1,888
Exports	1,152	1,152	1,258	1,247	1,259	1,380	1,361	1,404	1,465
Imports, real	1,760	1,760	1,634	1,651	1,731	1,698	1,613	1,614	1,567
Real exchange rate	100.00	100.02	90.78	91.77	90.69	80.20	81.88	79.92	74.65
Disposable income	9,841	9,839	9,701	9,378	10,003	10,188	9,700	9,756	9,695
Interest rate percent	4.1	4.1	2.7	2.8	5.7	7.5	4.3	4.8	4.8
Price level	100.0	100.0	100.6	100.5	101.3	102.9	101.9	102.2	102.8
Fiscal deficit	422	423	44	48	454	488	74	80	−39
Government spending (NIPA)	2,187.0	2,187.0	1,835.6	2,187.0	2,187.0	2,187.0	2,011.3	2,011.3	1,952.7
Tax rate	0.16	0.16	0.16	0.19	0.16	0.16	0.175	0.175	0.18
Foreign GDP	24,740	24,740	24,740	24,740	24,740	24,740	24,740	25,111	25,111
Import price	100.0	100.0	105.1	104.5	105.1	112.4	111.1	112.6	117.0
Imports, nominal	1,760	1,760	1,718	1,725	1,820	1,908	1,791	1,816	1,833
Trade balance percent of GDP	−5.2	−5.2	−4.0	−4.1	−4.7	−4.4	−3.7	−3.5	−3.1
Fiscal balance percent of GDP	−3.6	−3.6	−0.4	−0.4	−3.8	−4.0	−0.6	−0.7	0.3
GDP percent change from base	0	0	−1.4	−1.2	1.7	3.5	0.4	0.9	0.9

A. 3 percent of GDP cut in government spending.
B. 3 percent of GDP increase in taxes.
C. 20 percent ex ante fall in dollar.
D. 20 percent ex post fall in dollar.
E. 1.5 percent of GDP cut in government spending, 1.5 percent of GDP rise in taxes, 20 percent ex ante decline in dollar.
F. E plus 1.5 percent rise in foreign GDP.
G. 2 percent of GDP for both lower spending and higher taxes, 25 percent ex ante decline in dollar, 1.5 percent rise in foreign GDP.

NIPA = National Income and Product Account

expectation for the external adjustment solely from fiscal correction is only about 40 percent as large as the initial fiscal adjustment.[43]

In simulation C, in contrast, it is assumed that by some means there is an ex ante exogenous reduction in the real exchange rate by 20 percent.[44] This is implemented in the model by reducing the constant in the exchange rate (from α_E = 264.5 to 244.5, or by 20 index points against an index base of 100). The results of this case show that there are strong general equilibrium influences tending to offset the ex ante weakening of the exchange rate. Most importantly, because of the incipient upward pressure on GDP as exports expand and imports contract, the interest rate rises briskly (driven by the Taylor rule response). The rise in the interest rate substantially diminishes the size of the exchange rate reduction as foreign capital responds to higher interest rates, leaving the net exchange rate decrease at only about half of the ex ante potential reduction. The rise in GDP also boosts demand for imports by enough to leave the real import volume approximately unchanged from the base case, and the nominal import bill increases as a result, considering that the dollar price of imports is now higher. The overall extent of adjustment is surprisingly modest given the depth of the ex ante exchange rate reduction; the trade deficit eases by only 0.5 percent of GDP (from 5.2 to 4.7 percent).

A more extreme case of ''exchange rate only'' adjustment is shown in simulation D. In this case, the constant term in the exchange rate equation is successively reduced until the general equilibrium solution shows approximately a 20 percent reduction in the ex post exchange rate.[45] This time the upward pressure on interest rates is even more severe, as GDP rises by an outsized 3.5 percent (to well above potential). Once again the external adjustment in nominal terms is modest (from 5.2 to 4.4 percent of the GDP nominal trade deficit) in view of the major reduction in the real exchange rate. Interestingly, the sharp depreciation scenario also boosts the federal deficit. The reason is that the large rise in the interest rate increases the interest burden in fiscal accounts.

Simulation E, in contrast, assumes a more balanced set of adjustment influences. Government spending is cut by 1.5 percent of GDP; taxes are raised by 1.5 percent of GDP; and the ex ante real exchange rate is cut by 20 percent (α_E falls from 264.5 to 244.5). This case achieves a somewhat greater external correction than under the ''fiscal only'' scenarios (A and

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43. That is, in scenario A, the trade deficit falls from 5.2 to 4 percent of GDP or by 1.2 percent of GDP, which is 40 percent of the initial 3 percent of GDP reduction in government spending. Note, however, the discussion of possible downward bias in the relationship of the current account adjustment to fiscal adjustment in the main text of this chapter and also in chapter 5 and appendix 5A.

44. From 100 to 80. This represents a 25 percent rise in the dollar price of foreign currencies.

45. This requires cutting the ex ante real exchange rate by 29 percent, as the constant α_E is cut from 664.5 to 635.5, or by 29 index points.

B), as the trade deficit is cut from 5.2 to 3.7 percent of GDP. Moreover, this adjustment occurs with a GDP increase of 0.4 percent rather than a GDP decline of about 1.3 percent in the fiscal-only cases. Considering that US GDP in 2004 was about 1 percent below potential, this ''balanced'' case of fiscal and exchange rate adjustment with some expansionary effect is relatively favorable.

Simulation F adds foreign GDP expansion to the ''balanced'' package of simulation E. Foreign GDP is assumed to rise exogenously by 1.5 percent. This scenario gives the largest increase in real exports (by 21.9 percent from the base level). It also gives the largest reduction in the real exchange rate, considering the additional downward pressure from a larger foreign GDP relative to US GDP (the ''relative growth'' influence in the exchange market). Under the more favorable conditions of simulation F, the trade deficit eases to 3.5 percent of GDP. One reason the external adjustment is not larger is that, with a 20 percent decline in the ex post real exchange rate, the dollar price of imports rises by 12.6 percent, and after taking account of the increase in GDP on import demand, the nominal value of imports is 3 percent higher than in the base case, even though the import volume is 8.3 percent lower.

Simulation G applies a more forceful package of adjustment, involving a 2 percent of GDP cut in government spending, a 2 percent of GDP rise in taxes, an ex ante 25 percent reduction in the real exchange rate, and once again the favorable assumption of a 1.5 percent rise in foreign income. This time the fiscal adjustment is strong enough to swing the fiscal balance to a surplus of 0.3 percent of GDP. The nominal trade deficit falls to 3.1 percent of GDP.

Implications

The principal implication of the general equilibrium experiments is that fiscal adjustment will be an indispensable part of external adjustment. Without substantial fiscal adjustment, much of the potential trade correction from even a large decline in the dollar will tend to be thwarted by a partial dollar rebound in response to rising interest rates and offsetting increases in import volume in response to the rise in aggregate demand. The particular quantitative estimates obtained here should be interpreted as primarily illustrative rather than definitive. They probably err on the side of pessimism in finding that, under plausible scenarios, the size of the nominal external adjustment is considerably smaller than the size of the fiscal adjustment, even when there is help from an exogenously falling dollar. At the same time, as discussed in the main text of this chapter, it should not come as a surprise that fiscal adjustment by a given percent of GDP will not necessarily be accompanied by an ''identical twin'' reduction in the trade deficit by the same percent of GDP.

In chapter 3, it was estimated that, using an elasticities model approach, a 10 percent real depreciation of the dollar can be expected to reduce the current account deficit by 1.4 percent of GDP after two years (although in the first year there is a perverse J-curve effect). In contrast, in the general equilibrium model presented in this appendix, even in the most favorable and strongest adjustment package considered (simulation G), a 25 percent real depreciation, accompanied by a fiscal adjustment of about 4 percent of GDP, only reduces the trade deficit by 2.1 percent of GDP (from 5.2 to 3.1 percent). The adjustment impact of 0.084 percent of GDP for each percentage point of real depreciation is considerably smaller than in the partial equilibrium estimate of 0.14 percent of GDP per percentage point depreciation. Moreover, if the exchange rate moves alone with no help from fiscal adjustment (simulation D), the impact shrinks to an even smaller 0.067 percent of GDP for 1 percentage point depreciation.

It is important to recognize, however, that the size of the real external adjustment is larger than the size of the nominal adjustment, because of the adverse terms of trade effect from the rise in the price of imports. Thus, in the most favorable case (G), whereas the nominal trade deficit falls by 2.1 percent of GDP, the real trade deficit at base period import prices falls from $608 billion to $102 billion, or by 4.3 percent of GDP. The fiscal adjustment is 3.9 percent of GDP, so the size of the two deficit corrections is approximately the same in real terms. The underlying economics is that enough room must be made in aggregate demand for the shift of real resources away from domestic use to foreign use as the real trade deficit declines. A key implication, however, is that whereas the required fiscal adjustment will be approximately the same size as the real trade balance adjustment obtained, the observed reduction in the dollar value of the trade deficit will be considerably smaller than both of the real adjustments because of the rising unit price of imports. More generally, the various simulations involving at least some fiscal adjustment find that the size of the adjustment in the real trade deficit is approximately 60 percent as large as the fiscal adjustment (in cases A-B of fiscal-only adjustment) to 100 to 115 percent (in the fiscal *cum* ex ante exchange rate adjustment cases E-G) as large as the fiscal adjustment, but that the corresponding nominal external adjustment in these cases tends to be in the range of one-third to one-half the size of the fiscal adjustment respectively.[46]

The difference between the real and nominal adjustment also means that the larger nominal external adjustment impact parameters estimated

46. In contrast, when there is no ex ante fiscal adjustment but only ex ante exchange rate reduction, the real external adjustment is far larger than the ex post fiscal adjustment. However, in these cases (C and D), the magnitude of the external adjustment is very limited, and even so there is strong upward pressure on GDP and hence potential inflationary pressure.

in chapter 3 than in this appendix also imply larger real adjustment impacts. Thus, in the model of chapter 3, given the pass-through parameters and trade elasticities, the ratio of the real to nominal external adjustment is approximately 1.5 to 1 (Cline 1989, 360). On this basis, the results in chapter 3 imply that a 10 percent real decline of the dollar generates a real external adjustment of about 2 percent of GDP after two years.

It is normal for general equilibrium estimates to damp down the size of policy impact parameters. General equilibrium systems tend to generate negative (damping) rather than positive (amplifying) feedback. The large difference between the estimated partial and general equilibrium impacts of a decline in the dollar on the trade balance suggests relatively strong negative feedback in this system. One of these is the induced increase in GDP when exports begin to rise, which in turn induces increased imports through the income demand effect. Another is the induced rise in the interest rate as GDP rises relative to potential output, which in turn tends to arrest the decline in the dollar. At the same time, however, the results here suggest that when fiscal adjustment is the initial policy measure, the feedback effects tend to be positive (reinforcing) for external adjustment. As one example, the smaller fiscal deficit exerts downward pressure on the interest rate, which induces a real depreciation of the exchange rate, which in turn contributes to external adjustment through the price effect.

Overall, the simulations here suggest that it will be essential for sizable fiscal adjustment to accompany dollar adjustment if US external adjustment is to make much progress. Moreover, although primarily illustrative, the estimates tend to suggest that the size of the external adjustment, in terms of the change in the ratio of the nominal deficit to GDP, will tend to be moderate, even for what can only be regarded as large changes in the value of the dollar and the size of the fiscal deficit.