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American Fiscal Policy: Trends, Effects, and Implications

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Introduction

U.S. fiscal policy has been on a roller coaster over the past 15 years. The substantial deficits in the late 1980s and early 1990s turned into substantial, albeit short-lived, surpluses as the end of the decade, only to be followed by sharp increases in the deficit over the past several years. Tax revenues went from a half-century high as a share of GDP in 2000 to a half-century low just four years later.

At the same time, the long-term fiscal position of the United States has deteriorated as well. The approach of the baby boom generation to retirement would be enough to cause a deterioration even in the absence of policy changes. But policy-makers have also exacerbated existing long-term shortfalls by enacting an expensive prescription drug benefit under Medicare.

The result is that the federal government has backed itself into a fiscal corner, and the financial status of the federal government in the short- and long-term now dominates discussions of tax and spending initiatives. This paper reviews recent fiscal developments, discusses the economic effects of substantial and persistent budget deficits, and explores the implications for the United States over the medium- and longer-term horizons.

Recent Trends and Current Projections

1. Brookings Institution and Tax Policy Center. This paper is based on "Budget Deficits, National Saving, and Interest Rates," forthcoming, Brookings Papers on Economic Activity.

The federal budget deficit in any year can be measured in a variety of ways; the most appropriate measure is likely to depend on the particular model or application of interest. The most widely used measure, the unified budget balance, is fundamentally a cash-flow metric that includes both the Social Security and the non-Social Security components of the federal budget. To a first approximation, the unified balance shows the extent to which the federal government borrows or lends in credit markets during the year.[2] For some purposes it is more informative to examine the primary budget balance, which excludes interest payments on the public debt. Another measure, the standardized budget balance, adjusts the unified budget for the business cycle and certain special items.[3] We focus primarily on these traditional cash-flow measures. In particular, although we recognize the importance of the implicit debt created by promises of future government benefits, we do not incorporate these promises directly into our analysis, in part because historical time series of this accrued debt are not generally available, and in part because it is unclear how the market and households value this implicit debt relative to the government's explicit debt.[4]

Figure 1 shows the surplus or deficit in the federal unified budget and in the standardized budget, both since 1962, as reported by the Congressional Budget Office (CBO).[5] Both measures clearly show an increase in the deficit relative to GDP in the early and mid-1980s, a dramatic correction over the course of the 1990s, and an equally dramatic deterioration since 2000. In fiscal 2004 the unified deficit was 3.6 percent of potential GDP, and the standardized deficit about 2.5 percent. As the figure shows, deficits of this magnitude are large relative to historical norms. Even so, the current budget situation would not be a concern if future fiscal prospects were auspicious. Unfortunately, those prospects are in fact dismal.

The top line in figure 2 shows the CBO's baseline projections for the deficit in the unified budget as of September 2004.[6] The projections assume that the 2001 and 2003 tax cuts expire as scheduled. Summing the annual projections results in a ten-year baseline unified budget deficit of $2.3 trillion, or 1.5 percent of cumulative GDP over that period, for fiscal 2005 to 2014, with the deficits shrinking over time.

This baseline projection is intended to provide a benchmark for legislative

2. The unified budget is not recorded entirely on a cash-flow basis, and so the unified deficit does not precisely match the increase in debt held by the public. For example, only the subsidy cost of direct loan transactions is now recorded in the unified budget. The government must, however, finance the full value of the loan. This factor causes the unified budget deficit to be smaller than the increase in debt held by the public.

3. These include losses due to deposit insurance, receipts from auctions of licenses to use the electromagnetic spectrum, timing adjustments, and the contributions of the United States' allies for Operation Desert Storm (the 1991 Gulf war; Congressional Budget Office, 2004b).

4. Auerbach and others (2003) discuss the relationship among the cash-flow measures, accrual accounting, generational accounting, and other ways of measuring the fiscal status of the government.

5. CBO, "The Cyclically Adjusted and Standardized Budget Measures," September 2004.

6. CBO, "The Economic and Budget Outlook," January 2004.

purposes. It is explicitly *not* intended to be a projection of actual or likely budget outcomes or a measure of the financial status of the federal government.[7] Thus adjustments to the baseline are required to generate a more plausible budget scenario and to develop more meaningful measures of the government's financial situation.[8] One concern is that the baseline assumes that all temporary tax provisions expire as scheduled, even though most have been routinely extended in the past. Traditionally, this concern only applied to a small set of policies—such as tax credits for work opportunity or for research and experimentation—that have existed for years, are narrow in scope, and have relatively minor budget costs, and for which extensions occur as a matter of routine. In recent years, however, the distortion created by assuming that all temporary tax provisions will expire as scheduled has grown dramatically, because all of the provisions of the 2001, 2002, and 2003 tax cuts are scheduled to expire by the end of the decade. These "temporary" provisions are quite different in nature and scope than the other expiring provisions. Whether they will be extended is a major fiscal policy choice, not a matter of routine.[9]

A second concern is that revenue from the alternative minimum tax (AMT) grows exponentially under the baseline, a development that few observers regard as plausible.[10] Finally, the baseline uses cash-flow accounting, which is appropriate for many programs, but which can distort the financial status of programs whose liabilities increase substantially outside the projection period.[11]

Adjusting for these factors has an enormous impact on the ten-year budget projections. Figure 2 also shows that, if the 2001 and 2003 tax cuts are made permanent, if the other expiring tax provisions (except the 2002 tax cuts) are extended, and if the AMT problem is resolved (by indexing the AMT for inflation and allowing dependent exemptions, which would still leave 5 million households paying the AMT in 2014), then the adjusted unified budget deficit would remain at approximately 3.5 percent of GDP over the decade and would be 3.7 percent of GDP (almost $700 billion) in 2014.[12]

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7. CBO, "The Economic and Budget Outlook," January 2004.

8. See Auerbach and others (2003) for an extended discussion of these issues.

9. See Gale and Orszag (2003b) for further discussion of the expiring provisions, and Gale and Orszag (2004a) on the effects of making the tax cuts permanent.

10. See Burman, Gale, and Rohaly (2003) for discussion of AMT projections and trends.

11. Another concern is that the baseline holds real discretionary spending constant over time. In a growing economy with an expanding population and evolving security needs, this assumption is not credible. But the September 2004 projections contain offsetting biases for discretionary spending that roughly cancel out. In particular, the baseline includes the recent supplemental spending authority for military expenditures in Iraq, which is unlikely to persist for an entire decade. Removing the supplemental and adjusting the spending level for population results in a 10-year outlay total that is about the same as that in the baseline, so we simply adopt the official baseline figures for discretionary spending.

12. These figures include the cost of extending the bonus depreciation provision as specified in the 2003 tax law. Some ambiguity surrounds whether this temporary measure will be extended; it was not extended in the administration's fiscal 2005 budget. If this provision were not extended past its sunset at the end of 2004, the deficit over the decade would be about 3 percent of GDP.

One way to gauge the implications of the adjusted unified baseline is to examine the implied ratio of public debt to GDP, as is done in figure 3. Under the adjusted baseline, the debt-GDP ratio would rise steadily throughout the decade and by 2014 would equal 52 percent, well above the most recent high of 49 percent in 1992, and the highest level since 1956. The debt-GDP ratio would continue to rise thereafter.

The ratio of marketable public debt to GDP tells only part of the long-term budget story, however. Social Security, Medicare part A (the hospital insurance program), and government employee pension programs are projected to run surpluses over the next decade but face shortfalls in the long term. One way to control for these effects is to examine the ten-year horizon while separating the retirement trust funds from the rest of the budget. For example, the bottom line in figure 2 shows that, omitting the retirement trust funds, the rest of the budget would face deficits of 5.1 percent of GDP over the decade (and 5.3 percent of GDP in 2014) under the assumptions above.

An alternative way to incorporate the entitlement trust funds is to extend the time horizon of the analysis so that future shortfalls are included. To do this, we report estimates of the fiscal gap, defined as the immediate and permanent increase in taxes or reduction in noninterest expenditure that would be required to establish the same debt-GDP ratio in the long run as holds currently.[13] In an article co-written with Alan Auerbach, we estimate that, under adjustments similar to those made in figure 2, the nation faces a long-term fiscal gap in 2004 of 7.2 percent of GDP through 2080 and 10.5 percent of GDP on a permanent basis.[14] Jagadeesh Gokhale and Kent Smetters have made similar projections, as has the Bush administration.[15]

The main drivers of the fiscal gap, under the above assumptions, are the revenue losses from making the 2001 and 2003 tax cuts permanent and the growth in spending for Medicare, Medicaid, and Social Security. The recent tax cuts, if extended and not eroded over time by the AMT, would cost roughly 2 percent of GDP over the long term.[16] To help put these figures in context, over the next seventy-five years the actuarial deficit in Social Security is 0.7 percent of GDP under the Social Security trustees' assumptions, and 0.4 percent of GDP under new projections issued by the CBO.[17] The deficit in

13. See Auerbach (1994). Over an infinite planning horizon, the requirement is equivalent to assuming that the debt-GDP ratio does not explode. Alternatively, the adjustments set the present value of all future primary surpluses equal to the current value of the national debt, where the primary surplus is the difference between revenue and noninterest expenditure.

14. Auerbach, Gale, and Orszag (2004). In perhaps more familiar terms, the primary deficit would be 4.1 percent of GDP in 2030, 5.5 percent in 2060, and 5.8 percent by 2080; the unified deficit would rise much faster because of accruing interest payments: it would be 13 percent of GDP in 2030, 37 percent by 2060, and 64 percent by 2080. Public debt would be 139 percent of GDP in 2030, 505 percent in 2060, and 942 percent in 2080.

15. Gokhale and Smetters (2003); Office of Management and Budget, *Budget of the United States Government: Fiscal Year 2005 Budget.*

16. Gale and Orszag (2004a).

17. CBO, "The Outlook for Social Security," June 2004. The actuarial deficit in Social Security over an infinite horizon amounts to 1.2 percent of GDP over that horizon under the trustees' assumptions.

Medicare part A is 1.4 percent of GDP over the next seventy-five years under the trustees' assumptions.[18] Thus, extending the tax cuts would reduce revenue over the next seventy-five years by an amount about as large as the entire shortfall in the Social Security and Medicare part A trust funds over the same period.

Even if the tax cuts are not made permanent, however, the fiscal gap would be 5.1 percent of GDP through 2080 and 8.2 percent on a permanent basis. A primary reason is substantial projected increases in entitlement costs. Figure 4 shows the projected increases in Social Security, Medicare (this time including not only part A but also part B, supplementary Medicare insurance, and part D, the new prescription drug benefit), and federal Medicaid costs as a share of GDP over the long term.[19] The projected retirement of the baby-boomers, ongoing increases in life expectancy, and growth in health care costs per beneficiary in excess of growth in GDP per capita combine to drive federal expenditure on these three programs from 8.1 percent of GDP in 2004 to a projected 10.2 percent by 2015, 13.3 percent by 2025, and 22.7 percent by 2075.[20] Figure 4 also shows that the vast majority of the growth occurs in the health-related programs, not in Social Security. Indeed, after about 2030, Social Security costs are roughly stable relative to GDP. The health-related programs not only are projected to increase in cost much more dramatically than Social Security but are also much more difficult to reform.

To be sure, substantial uncertainty surrounds these short- and long-term budget projections. Much of the problem stems from the fact that the surplus or deficit is the difference between two large quantities, revenue and spending. Small percentage errors in either can cause large percentage changes in the difference between them. Furthermore, small differences in growth rates sustained for extended periods can have surprisingly large economic effects. Variations in assumed health care cost inflation, in particular, can have a substantial effect on the projections.[21] Nonetheless, almost all studies that have examined the issue suggest that, even if major sources of uncertainty are accounted for, serious long-term fiscal imbalances will remain.[22]

The Economic Effects of Budget Deficits

We categorize the effects of budget deficits into two types. What we here call the "traditional" effects are those described in terms of changes in the usual macroeconomic aggregates, such as consumption, saving, and investment, resulting from the linkages

18. Unlike with Social Security, the CBO has not issued its own fully independent actuarial analysis of Medicare's long-term finances.

19. Auerbach, Gale, and Orszag (2004). Medicaid is not wholly a federal liability but is financed in part by the states.

20. Although it is clear that entitlement spending is a major factor in generating long-term fiscal shortfalls, it is not straightforward to determine how much of the fiscal gap is due to these programs, because to a large extent they are supposed to be funded from general revenue. Auerbach, Gale, and Orszag (2004) examine different ways of decomposing the long-term fiscal gap.

21. CBO, "The Long-Term Budget Outlook," December 2003.

22. For example, see Lee and Edwards (2001) and Shoven (2002).

among them as described in any macroeconomics textbook. The "nontraditional" effects include the effects of weakened investor confidence in a country's economic leadership due to increased deficits, the possible threshold effect of a sudden change in investor perceptions of the sustainability of a country's deficits, and those effects that go beyond the strictly economic realm, such as the effect of a country's debtor or creditor status on its international power and influence.

Traditional Models

Figure 5 summarizes the three "traditional" views of deficits, at least as they apply to a deficit created by changes in the timing of a lump-sum tax, holding the path of government purchases constant, as described earlier. Under the Ricardian equivalence hypothesis proposed by Barro, such a deficit will be fully offset by an increase in private saving, as taxpayers recognize that the tax is merely postponed, not canceled. The offsetting increase in private saving means that the deficit will have no effect on national saving, interest rates, exchange rates, future domestic production, or future national income.[23]

If private saving rises by less than the full amount that public saving falls, then national saving falls, and further adjustments are required to bring national saving and the sum of domestic and net foreign investment back into balance.[24] If the flow of capital from overseas is infinitely elastic, the entire quantity adjustment occurs through increased capital inflows. In this case net foreign investment declines, but the domestic capital stock remains constant. With no change in the domestic capital stock, domestic output (GDP) is likewise constant. Americans' claims on that output, however, decline because the increased borrowing from abroad must be repaid in the future. In other words, the obligation to repay effectively creates a mortgage against future national income; as a result, future gross *national* product declines even though gross *domestic* product is constant.[25] Because the capital inflow in this example is assumed to be infinitely elastic, interest rates do not change. Even so, larger deficits reduce future national income (GNP). We refer to this scenario as the small open economy view.

A third possibility is that the supply of international capital is not infinitely elastic. In this case, if national saving falls in response to an increased budget deficit, the

23. Barro (1974).

24. The effects described in response to a change in the deficit would all occur simultaneously. Our ordering of the discussion is intended merely to provide a way of thinking about the channels through which deficits affect the economy. It does not imply or require that the effects occur in any particular order over time.

25. The distinction between domestic investment and net foreign investment is of secondary importance in determining national income (GNP), although it clearly affects domestic income (GDP). Elmendorf and Mankiw (1999, p. 1637) note that, "As long as the returns to wealth are the same at home and abroad, the location of the...[change in] wealth does not affect our income.… Tomorrow's national output and income depend on today's national saving, wherever this saving is ultimately invested." They also note several caveats to this statement, including differences in the tax implications of investment abroad relative to investment at home, and implications for income distribution.

relative price and quantity adjustments are different than under the small open economy model, but the end result—a decline in future national income—remains the same. In the absence of perfect capital mobility, the reduction in national saving implies a shortage of funds to finance investment, given existing interest rates and exchange rates. That imbalance puts upward pressure on interest rates, as firms compete for the limited pool of funds to finance investment. The increase in interest rates serves to reduce domestic investment. In a closed economy, the entire adjustment to the reduction in national saving would occur through reduced domestic investment. In an open economy with imperfect capital mobility, the decline in national saving and the resulting rise in interest rates induce some combination of a decline in domestic investment and a decline in net foreign investment (that is, an increase in capital inflows). These changes must be sufficient to ensure that the change in national investment equals the change in national saving. Following Douglas Elmendorf and Gregory Mankiw, we refer to this scenario as the conventional view.[26]

We emphasize throughout this paper that the relationship between deficits and national saving is central to the analysis of the economic effects of fiscal policy. National saving, which is the sum of private and government saving, finances national investment, which is the sum of domestic investment and net foreign investment.[27] The accumulation of assets, whether located in the United States or abroad, associated with national saving means that the capital stock owned by Americans rises. The returns to those additional assets raise the income of Americans in the future.

An increase in the budget deficit reduces national saving unless it is fully offset by an increase in private saving. If national saving falls, national investment and future national income must fall as well, all else equal. Therefore, to the extent that budget deficits reduce national saving, they reduce future national income. This reduction occurs even if there is no increase in domestic interest rates. In that case the reduction in national saving associated with budget deficits manifests itself solely in increased borrowing from abroad (the outcome under the small open economy view). This is the sense in which the effect of deficits on interest rates and exchange rates (which distinguishes the small open economy view from the conventional view) is subsidiary to the question of the effect on national saving (to which the Ricardian view gives a different answer than the other two).

Nontraditional Effects

Beyond their traditional effects on national saving, future national income, and interest rates, deficits can affect the economy in other ways. For example, increased deficits may cause investors to gradually lose confidence in U.S. economic leadership. As Edwin Truman emphasizes,[28] a substantial fiscal deterioration over the longer term may

26. Elmendorf and Mankiw (1999)

27. Domestic investment represents the accumulation of assets in a country by both its own residents and foreigners. Net foreign investment is the accumulation of assets abroad by residents less the accumulation of assets in the home country by foreigners. The sum of the two is just the accumulation of assets, by residents, in the home country and abroad. This sum must equal national saving.

28. Truman (2001).

cause "a loss of confidence in the orientation of US economic policies." Such a loss in confidence could then put upward pressure on domestic interest rates, as investors demand a higher risk premium on dollar-denominated assets. The costs of current account deficits—which are in part induced by large budget deficits—may even extend beyond the economic costs narrowly defined. Benjamin Friedman notes that, "World power and influence have historically accrued to creditor countries. It is not coincidental that America emerged as a world power simultaneously with our transition from a debtor nation…to a creditor supplying investment capital to the rest of the world."[29]

Both the traditional models and the analysis of nontraditional effects focus on gradual negative effects from reduced national saving. This focus may be too limited, however, in that it ignores the possibility of much more sudden and severe adverse consequences.[30] In particular, the traditional analysis of budget deficits in large advanced economies does not seriously entertain the possibility of explicit default, or of implicit default through high inflation. If market expectations regarding the avoidance of default were to change and investors had difficulty seeing how the policy process could avoid extreme measures, the consequences could be much more sudden and severe than traditional estimates suggest. The role of financial market expectations in this type of scenario is central. One of the principal ways in which such a "hard landing" could be triggered is if investors begin to doubt whether a country will maintain its strong historical commitment to avoiding high inflation in order to reduce the real value of the public debt. As Laurence Ball and Mankiw note,

> "We can only guess what level of debt will trigger a shift in investor confidence, and about the nature and severity of the effects. Despite the vagueness of fears about hard landings, these fears may be the most important reason for seeking to reduce budget deficits…as countries increase their debt, they wander into unfamiliar territory in which hard landings may lurk. If policymakers are prudent, they will not take the chance of learning what hard landings in G-7 countries are really like."[31]

Although we do not explicitly incorporate nontraditional effects in our analysis below, they serve as an important reminder of why budget deficits, especially chronic deficits, could exert large adverse effects on U.S. economic performance. Our focus on traditional effects is certainly justifiable in the context of a historical analysis of postwar data from the United States. That does not imply, however, that ignoring such issues is appropriate when examining the likely impacts of future deficits. The nation has never before faced the prospect of deficits that are large, sustained, and indeed likely to grow over many decades.

Benchmark calculations

29. Friedman (1988, p. 76).

30. Rubin, Orszag, and Sinai (2004).

31. Ball and Mankiw (1995, p. 117).

To generate some intuition about the potential effects of the projected growth in deficits shown above, we examine the impact of budget deficits in two simplified versions of the "conventional model." Before turning to these models, however, we must first address a key issue: If fiscal policy does influence interest rates, does it do so through changes in government deficits (what we call the "flow perspective") or through changes in the government debt (the "stock perspective")? According to Eric Engen and Glenn Hubbard,[32] government debt rather than deficits should affect the level of interest rates. However, since many models (including the IS-LM model widely taught to undergraduates) imply that budget deficits affect interest rates, we take a broader view. Throughout this paper we leave open the possibility that either the stock perspective or the flow perspective may be valid. In this section we therefore undertake two related calibration exercises. One focuses on the impact of the deficit in a Solow model of economic growth, and the other on the impact of debt in a highly stylized steady-state exercise.

First, we follow Matthew Shapiro and examine the effects of sustained budget deficits in the context of the Solow growth model.[33] Following Mankiw,[34] we assume that the economy's growth rate (the sum of the rate of population growth and that of output per worker *g*) is equal to 3 percent a year, the depreciation rate is 4 percent a year, and the capital share of output is 30 percent. We also assume that the initial national saving rate is 17.5 percent of output.[35] This level for the saving rate could, for example, reflect a private gross saving rate of 20 percent of output and a unified budget deficit of 2.5 percent, which are the values we assume for illustrative purposes. These assumptions generate an initial steady state with a capital-output ratio of 2.5 and a gross marginal product of capital of 12 percent, which are reasonable values for the United States (table 1).

Now assume that the unified budget deficit rises by 1 percent of output on a sustained basis.[36] Suppose that one-quarter of this decline in public saving is offset by an increase in private saving.[37] With this response, private saving rises to 20.25 percent of

32. Engen and Hubbard (2004).

33. Shapiro (2004).

34. Mankiw (2000a, p. 123).

35. Mankiw assumes a capital-output ratio of 2.5 and then solves for the saving rate. The implied saving rate is 17.5 percent.

36. Note that this simplified model does not impose a government budget constraint. As a result, we do not have to specify how the tax cut is paid for.

37. This private saving response is somewhat larger than might be expected based on the data patterns in figure 6, but it is within the range of the econometric estimates we report below. It is also roughly consistent with the calculations undertaken by the Council of Economic Advisers (*Economic Report of the President*, 2003) in the Bush administration, which reports that a one-dollar increase in the deficit reduces the domestic capital stock by about 60 cents. The Council's scenario could occur, for example, if a one-dollar increase in the deficit causes private saving to rise by 25 cents (the effect we assume) and international capital flows offset an additional 15 cents of the decline of the decline in national saving. Dennis and others (2004) make similar assumptions about private saving and capital flow offsets in

output, and the national saving rate declines to 16.75 percent. Given the reduction in national saving, output per capita in the new steady state is reduced by 1.9 percent. The marginal product of capital is 54 basis points higher. If we assume that the change in the interest rate at which government borrows is equal to the change in the marginal product of capital, the implication is that the increase in the unified budget deficit raises the interest rate by 54 basis points.

These results provide one way of calibrating the traditional effects of changes in the budget deficit. Under our base case assumptions, holding other factors constant, a sustained increase in the unified deficit of 1 percent of GDP reduces output by about 2 percent and raises interest rates by about 50 basis points. If half of the decline in public saving, rather than one-quarter, is offset by an increase in private saving, long-term output per capita would decline by 1.2 percent and interest rates would rise by 35 basis points. If there is no private saving response, output per capita would fall by 2.5 percent, and the marginal product of capital would rise by 73 basis points. (Table 1 summarizes these results.)

The Solow model exercise underscores the somewhat arbitrary nature of choosing between the stock and flow perspectives described above: In the steady state of the Solow model, deficits and debt are linked, making it difficult to assert that one variable rather than the other is the one that influences interest rates. Nonetheless, since our Solow analysis was presented in terms of the flow variable (the deficit), we also undertake a closely related exercise framed in terms of the stock variable (government debt). In steady state the debt-GDP ratio is equal to the unified deficit-GDP ratio divided by the GDP growth rate.[38] Assuming a 3 percent growth rate as in the Solow model exercise above, an increase in the unified deficit-GDP ratio of 1 percent of GDP would thus raise the steady-state debt-GDP ratio by approximately 33 percentage points.

To map this increase in the debt-GDP ratio into a change in income and interest rates, we follow the basic contours of the "debt fairy" calculation in Ball and Mankiw.[39] First, as in the Solow model above, we assume that the initial steady state for the economy involves a capital-output ratio of 2.5. The change in the ratio depends on how much of the debt increase is offset by increased private capital accumulation; we assume a 25 percent offset. (Because of depreciation, the 25 percent capital offset is a slightly different concept from the 25 percent saving offset assumed in the Solow model, and so the results presented here differ slightly from the Solow model results.) The reduction in capital is thus equal to 25 percent (= 33 * 0.75) of initial GDP. Assuming a marginal product of capital equal to 12 percent, the reduction in the capital stock causes income to

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modeling the macroeconomy. See Feldstein and Horioka (1980) and Dornbusch (1991) for analyses of the relationship between capital inflows and national saving.

38. If the unified deficit is a constant share k of GDP, then $(rD + p)/Y = k$, where r is the interest rate, D is government debt, p is the primary budget balance, and Y is GDP. A constant debt-GDP ratio requires that D grow at rate g, or that $(rD + p)/D = g$, where g is the growth rate of Y. Therefore, in a steady state with a constant debt-GDP ratio, $D/Y = k/g$.

39. Ball and Mankiw (1995).

decline by about 3 percent. Second, to map the change in the capital-output ratio into a change in the marginal product of capital, a specific form of the aggregate production function is necessary. With a Cobb-Douglas production function, the percentage increase in the marginal product of capital is equal to the percentage decline in the capital-output ratio. The capital-output ratio falls by 7 percent, from 2.50 to 2.32. The marginal product of capital would thus rise by 7 percent, from 12.0 to 12.8. Finally, we again assume that the change in the long-term government borrowing rate is equal to the change in the marginal product of capital. The result is that income declines by 3 percent, and steady-state long-term interest rates increase by about 80 basis points.

Since these two exercises are quite closely related despite their different framing in terms of deficits and debt, it is not surprising that the results are basically similar. A sustained increase in the unified deficit equal to 1 percent of GDP reduces income by 2 to 3 percent and raises long-term interest rates by roughly 50 to 80 basis points under the base case assumptions.[40]

To be sure, it is challenging to move from these simplified models to real-world results. For one thing, the models assume a closed economy, whereas the U.S. economy is large and open. One would therefore expect capital inflows to mitigate the interest rate and domestic production effects to some degree, even though the effect on national income should be largely unaffected by the assumption of a closed economy. In our view, however, these exercises not only help to calibrate the potential magnitude of the effects of deficits and debt on income and interest rates, but also underscore the shortcomings in ruling out the stock (debt) or the flow (deficit) perspective a priori.

Another key consideration is that the results above consider only the effects of increased budget deficits or debt per se. A full analysis of the effects of public policies on economic growth should take into account not only the effects of increased deficits and debt, but also the direct effects of the increases in spending programs or reductions in taxes that cause them. The effects of fiscal policies on both economic performance and interest rates depend not only on the deficit but also on the specific elements of the policies generating that deficit. For example, a dollar spent on public investment projects would increase the unified budget deficit by one dollar, but the net effect on future income would depend on whether the return on those investment projects exceeded the return on the private capital that would have instead been financed by the national saving crowded out by the deficit. Similarly, a deficit of 1 percent of GDP caused by reducing marginal tax rates will generally have different implications for both national income and interest rates than a deficit of 1 percent of GDP caused by increasing government purchases of goods and services. We return to this issue in the concluding section.

Preliminary Evidence

Figure 6 shows net national saving and net federal government saving as shares of

40. As noted in the text, the small differences reflect the treatment of depreciation.

net national product (NNP) since 1950.[41] Federal saving has fluctuated significantly over time, and this variation is visibly correlated with swings in national saving. The correlation is especially apparent in the last two decades. The two series both rise moderately in the mid-1980s, decline from the late 1980s to the early 1990s, rise significantly during the 1990s, and then decline again over the past few years. Over the whole period, each dollar of federal saving is associated with about $1 in national saving (each expressed as a share of NNP).[42]

Figure 7 shows net national saving and net domestic investment since 1950, again as shares of NNP.[43] The two series follow very similar patterns over time. Domestic investment has declined by less than national saving over the past twenty years and has exceeded national saving in every year since the early 1980s. The difference is reflected in chronic current account deficits (not shown) and a substantial decline in the nation's net international investment position.[44] Over the past few years, the decline in national saving has been much sharper than the decline in net domestic investment. Between 1998 and 2003, national saving declined by 6 percent of NNP, with about half of the decline made up by increased capital inflows, and half by reduced net domestic investment. A regression of the net domestic investment-NNP ratio on the net national saving-NNP ratio yields a coefficient of 0.57 (t = 15). When the regression is performed on first differences of the two measures, the coefficient is 0.83 (t = 10).[45]

Figure 8 plots annual observations of the projected five-year-ahead real ten-year interest rate on Treasury bonds against the CBO's projections of the unified federal deficit as a share of GDP five years ahead.[46] Figure 9 shows similar observations for real forward long-term rates and projections of the publicly held debt. Both figures show a clear association between projected fiscal policy outcomes and forward long-term real interest rates. A regression of the two series in figure 8 implies that an increase in the projected deficit by 1 percent of GDP is associated with an increase in the forward rate of about 27 basis points (t = 5).

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41. Net national saving is defined as gross saving minus depreciation of the capital stock and is taken from the National Income and Product Accounts, table 5.1, line 2. Net federal saving is defined as gross federal saving minus depreciation on the federal government's physical capital stock and is taken from the same table, line 11.

42. Both regressions include a constant term, as do those mentioned in the next two paragraphs.

43. Net domestic investment is equal to gross investment minus depreciation of the capital stock and is taken from the National Income and Product Accounts, table 5.1, line 31.

44. The current account, as defined by the "net lending" series published by the Bureau of Economic Analysis, ran a small surplus in 1991, in part because of capital account transactions related to the Gulf war and in part because of a large statistical discrepancy. On a current-cost basis, the United States has gone from being the world's largest creditor nation in 1980, with a net international investment position (NIIP) of 13 percent of GDP, to the world's largest debtor nation, with an NIIP of about -22 percent of GDP at the end of 2003. On a market-value basis, the NIIP was 7 percent of GDP in 1982, falling to -24 percent at the end of 2003 (Bureau of Economic Analysis, National Income and Product Accounts table 1.1.5, 2004).

45. The positive correlation between domestic saving and domestic investment mirrors the findings of a long line of research initiated by Feldstein and Horioka (1980).

46. The data in the figure are described in more detail later in the paper.

Figures 6 through 9 suggest a very simple story. Increases in current federal budget deficits significantly reduce net national saving. This reduction in national saving is reflected partly in increased borrowing from abroad and partly in reduced net domestic investment. Increases in projected future deficits raise long-term interest rates, which explains how reductions in national saving reduce domestic investment. These patterns are consistent with the conventional view, but not with the Ricardian or the small open economy view. A primary goal of our recent research has been to see how robust these simple relationships are to more formal analysis.

Fiscal Policy and National Saving

A key objective for researchers and policy makers is to understand the empirical effects of budget deficits on national saving. This helps distinguish among the three models described above and has important implications for public policy. Although there are many reasons to be believe that Ricardian Equivalence may not hold exactly in theory, such a finding leaves many important questions unanswered. As a result, empirical analysis is particularly important because virtually no one claims that Ricardian equivalence is literally true. Rather, the controversy is over the extent to which Ricardian equivalence is a good approximation of the aggregate impact of fiscal policies.

Previous work has obtained a wide variety of research findings from studies of aggregate consumption and fiscal policy. Authors of earlier literature reviews emphasize the daunting econometric problems inherent in such studies, but they come to different conclusions about what the literature shows. Robert Barro, and Elmendorf and Mankiw, conclude that the literature is inconclusive.[47] John Seater concludes that, once the studies are corrected for econometric problems, Ricardian equivalence is corroborated, or at least cannot be rejected.[48] Douglas Bernheim concludes that, once the studies are normalized appropriately, Ricardian equivalence should be rejected.[49]

Previous studies of the effects of fiscal policy on consumption have taken three general approaches. A variety of studies undertake reduced-form analysis of consumption and saving patterns in the United States and other countries.[50] Like figures 6 and 7 above, these studies generally appear to support non-Ricardian interpretations of the data.

A second, and by far the largest, strand of the literature specifies consumption functions and then tests for the effects of fiscal policy given the consumption function.[51]

47. Barro (1989); Elmendorf and Mankiw (1999).

48. Seater (1993).

49. Bernheim (1989).

50. See, for example, Summers (1985), Carroll and Summers (1987), Poterba and Summers (1986, 1987), and Serres and Pelgrin (2003).

51. Feldstein (1982); Seater and Mariano **(**1985); Kormendi (1983).

Perhaps the best-known study in this area is that by Roger Kormendi and Philip Meguire, who find no evidence of non-Ricardian effects.[52]

A third strand of the literature focuses on Euler equation tests. David Aschauer examines the effects of fiscal policy assuming utility maximization and rational expectations, but his model does not nest a non-Ricardian specification.[53] Fred Graham and Daniel Himarios nest Ricardian and non-Ricardian views in a model that builds off of work by Fumio Hayashi ; they find non-Ricardian results using a nonlinear instrumental variables estimation procedure.[54] Paul Evans and Iftekhar Hasan estimate an empirical version of a model due to Olivier Blanchard, which nests Ricardian and non-Ricardian alternatives, and obtain results consistent with Ricardian equivalence.[55] Graham and Himarios correct several data and econometric problems in Evans' work and find strong non-Ricardian effects.[56]

The relative value of the consumption function and Euler equation approaches is a recurring theme in the literature. The advantage of using the Euler equation approach is that Ricardian equivalence requires a combination of utility maximization and rational expectations that the Euler equation can explicitly incorporate. The disadvantage is that Euler equation models can (and do) fail for reasons unrelated to Ricardian equivalence,

52. Kormendi and Meguire (1986, 1990, 1995). A comprehensive review of the literature following Kormendi (1983) is beyond the scope of this paper, but some highlights include the following. Barth, Iden, and Russek (1986) update the data, correct some data problems, and obtain results broadly similar to those of Kormendi (1983). Modigliani and Sterling (1986) argue that Kormendi's results are flawed because of data problems, a failure to distinguish between temporary and permanent taxes, and inappropriate first-differencing of the data. They develop an aggregate consumption function derived from the life-cycle model that contains Ricardian equivalence as a special case. Their empirical results show strongly non-Ricardian results. Kormendi and Meguire (1986) note significant problems with how Modigliani and Sterling have defined temporary taxes. They show that imposing the condition that taxes and transfers have effects of equal magnitude and opposite sign (as Modigliani and Sterling do) is not supported by the data, and that when that restriction is relaxed, taxes and government debt continue to have Ricardian effects. Feldstein and Elmendorf (1990) work within the Kormendi framework and evaluate the effects of removing the war years, extending the sample, introducing other specification changes, and instrumenting for endogenous explanatory variables. After reproducing Kormendi's estimates, they find that their extensions fundamentally alter the findings, and they obtain very strong non-Ricardian results. Kormendi and Meguire (1990), however, show that Feldstein and Elmendorf's results obtain only as the joint consequence of using what Kormendi and Meguire view as the wrong deflators and failing to incorporate the improved definitions of variables that came out of the 1986 exchanges. Graham (1995) makes two adjustments to the Kormendi and Meguire framework, extended to 1991. He allows state and local variables to have different effects than federal variables. He also claims that theory suggests that labor and capital income should have distinct effects, and he proposes a decomposition of aggregate income and taxes into those due to labor and those due to capital. His reestimates suggest some non-Ricardian results, but not for tax revenue. Kormendi and Meguire (1995) challenge the decomposition of income into labor and capital and show that an alternative definition generates Ricardian results. Meguire (1998, 2003) continues research in this vein.

53. Aschauer (1985); see also Bernheim (1987) and Graham and Himarios (1991).

54. Graham and Himarios (1991); Hayashi (1982).

55. Evans (1988, 1993); Evans and Hasan (1994); Blanchard (1985).

56. Graham and Himarios (1996).

and Ricardian equivalence can fail in ways that do not affect the Euler equation.[57] Marjorie Flavin argues that the consumption function approach is fundamentally inconsistent with Ricardian equivalence and therefore cannot be used to test the theory.[58] On the other hand, the strongest evidence in favor of Ricardian equivalence comes from the consumption function studies by Kormendi and Meguire.[59] Rather than attempt to resolve this debate, we estimate both consumption function and Euler equation models. We also show that the two specifications are closely related, so that the differences between the resulting estimated equations may not be large, even though the conceptual frameworks are quite different.

A particular shortcoming of all of this literature is the lack of research exploiting data beyond the early 1990s. The past ten years, however, have witnessed dramatic shifts in fiscal policy in both directions (figures 1 and 6). These shifts have raised the prominence of policy concerns about budget deficits and should provide useful variation from an econometric perspective.

We have recently undertaken empirical research aggregate time-series data through 2002 to examine the impact of tax revenue on national saving, holding other factors constant. Our consumption function OLS regressions demonstrate robust non-Ricardian effects even within the basic specification that has previously suggested the strongest support for Ricardian equivalence. When the sample period is extended to cover the most recent years, federal and state tax variables are split, and a marginal tax rate variable is included, the results suggest that about 30 to 46 cents of every dollar in tax cuts is spent in the same year.

The OLS regressions likely suffer from severe simultaneity problems, however. When instrumental variables regressions are used in the Euler specification, with twice- and three-times-lagged variables as instruments, the results are generally more strongly non-Ricardian. The estimates from this specification, which is our preferred one, suggest that about 50 to 85 cents of every dollar in tax cuts is spent in the first year; most of the effects are measured precisely. This range is consistent with some previous assessments,[60] but it is inconsistent with the Ricardian prediction of a full offset from private saving, and the difference, as we will discuss further in the concluding section, is economically important.

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57. Bernheim (1987),

58. Flavin (1987).

59. Kormendi (1983); Kormendi and Meguire (1986, 1990).

60. For example, Bernheim (1987) and the CBO ("Description of Economic Models," November 1998) conclude that private saving would rise by between 20 and 50 percent of an increase in the deficit (hence consumption would rise by between 50 and 80 percent of the increase in the deficit). Elmendorf and Liebman (2000) conclude that private saving would offset 25 percent of the increase in the deficit. Gale and Potter (2002) estimate that private saving will offset 31 percent of the decline in public saving caused by the 2001 tax cut.

Our empirical consumption results, however, address only short-term Ricardian equivalence issues. In some models Ricardian equivalence fails in the short run but holds in the long run.[61] In others, small deviations from short-term Ricardian equivalence grow over time into very large deviations from long-term Ricardian equivalence.[62]

Fiscal policy and interest rates

Given the estimated impact of deficits on aggregate consumption and national saving described above, analysis of the effects of deficits on interest rates is useful in distinguishing the "small open economy" view, which predicts no effects, and the "conventional view," which predicts positive effects of deficits on interest rates. In addition, the evidence that deficits affect interest rates would provide further evidence rejecting Ricardian Equivalence.

For a number of well-known reasons, the effects of fiscal policy on interest rates have proved difficult to pin down statistically. The issues include the appropriate definitions of deficits and debt, whether deficits or debt should be the variable of interest, how to distinguish expected from unexpected changes in these variables, and the potential endogeneity of many of the key explanatory variables. We discuss several of these issues below.[63] In part because of these statistical issues, the evidence from the empirical literature as a whole is mixed.[64]

As we noted in our discussion of the stylized models above, we take no a priori view regarding whether interest rates should be affected by deficits or by debt. Below, however, we often refer to the relationship between interest rates and "deficits," in part for simplicity and in part because our results suggest that deficits contain more useful information than debt in explaining interest rate shifts.

Our previous contribution to interpreting the literature has been to highlight the key role of using expected deficits rather than current deficits.[65] As Feldstein has written,

61. Smetters (1999); Mankiw (2000b).

62. Auerbach and Kotlikoff (1987).

63. Bernheim (1987), Elmendorf and Mankiw (1999), and Seater (1993) provide comprehensive analyses.

64. Previous analyses reach widely varying conclusions about the effects of deficits on interest rates. For example, Barth and others (1991) survey forty-two studies through 1989, seventeen of which found a "predominately significant, positive" effect of deficits on interest rates (that is, larger deficits raised interest rates); six studies found mixed effects, and nineteen found "predominately insignificant or negative" effects. Barth and others (p. 72) conclude that "Since the available evidence on the effects of deficits is mixed, one cannot say with complete confidence that budget deficits raise interest rates. …But, equally important, one cannot say that they do not have these effects." Other reviewers of the literature have reached similar conclusions. Elmendorf and Mankiw (1999, p. 1658) note that "Our view is that this literature...is not very informative." Bernheim (1989, p. 56) writes that "it is easy to cite a large number of studies that support any conceivable position." Appendix table 2 updates the Barth and others (1991) survey and shows that, of more than sixty studies, roughly half found a predominantly significant, positive effect and the other half found either no effect or mixed effects.

65. Gale and Orszag (2002, 2003a). One recent study expands the literature along a different dimension: Kiley (2003) examines the relationship between current government debt and the return to capital in the

"it is wrong to relate the rate of interest to the concurrent budget deficit without taking into account the anticipated future deficits. It is significant that almost none of the past empirical analyses of the effect of deficits on interest rates makes any attempt to include a measure of expected future deficits."[66] Since financial markets are forward-looking, excluding expectations could bias the analysis toward finding no relationship between interest rates and deficits.[67]

Studies that incorporate more accurate information on expectations of *future* sustained deficits tend to find economically and statistically significant connections between anticipated deficits and current interest rates. In a recent paper we summarize the findings of the studies on this topic reviewed by James Barth and others as well as several more recent papers.[68] Appendix table A1 shows that, of nineteen papers that incorporate timely information on projected deficits, thirteen find predominantly positive, significant effects between anticipated deficits and current interest rates, five find mixed effects, and only one finds no effects. The studies that find no significant effect are disproportionately those that do not take expectations into account at all or do so only indirectly through a vector autoregression. Thus, although the literature as a whole, taken at face value, generates mixed results, those analyses that focus on the effects of anticipated deficits tend to find a positive and significant impact on interest rates.

The challenge in incorporating market expectations about future deficits is that such expectations are not directly observable. An important caveat to the literature examining expected deficits, then, is that, to the extent that proxies for expected deficits are imperfect reflections of current expectations, the coefficient on the projected deficit will tend to be biased toward zero because of classical measurement error, and the tendency will be to *underestimate* the effects of deficits on interest rates.

Researchers have used different strategies in the face of this challenge. One approach is to use published forecasts of the deficit as a proxy for market expectations. For example, Elmendorf, using deficit forecasts from Data Resources, Inc., finds that an increase in the projected deficit of 1 percent of GNP raises five-year bond yields by 43 basis points. Matthew Canzoneri, Robert Cumby, and Behzad Diba, using CBO projections, find that "an increase in projected future deficits averaging 1 percent of current GDP is associated with an increase in the long-term interest rate relative to the short-term interest rate of 53 to 60 basis points."[69]

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nonfinancial corporate sector. Kiley finds that a 1-percentage-point increase in the debt-GDP ratio is associated with a 10-basis-point increase in the return to capital.

66. Feldstein (1986a).

67. Bernheim (1987) notes that, if households perfectly anticipate future deficits, one may well find no empirical relationship between current deficits and interest rates, even though the path of interest rates and economic activity would be substantially different in the absence of the deficits.

68. Gale and Orszag (2003a); Barth and others (1991).

69. Canzoneri, Cumby, and Diba (2002, p. 365).

One potential concern with these studies is that the business cycle could be affecting current yields.[70] Thomas Laubach suggests a novel way to resolve this issue:[71] he examines the relationship between projected deficits (or debt) and the level of real *forward* (five-year-ahead) long-term interest rates. The underlying notion is that current business cycle conditions should not influence the long-term rates expected to prevail beginning five years from now. Laubach uses CBO and Office of Management and Budget (OMB) deficit and debt projections and finds that a 1-percentage-point increase in the five-year-ahead projected deficit-GDP ratio raises the five-year-ahead interest rate on ten-year Treasury notes by between 24 and 39 basis points, and that a 1-percentage-point increase in the projected debt-GDP ratio raises the same long-term forward rate by between 3.5 and 5.6 basis points.

Following Laubach but controlling for additional variables, Engen and Hubbard use CBO projections and obtain somewhat smaller effects.[72] They find that an increase in the projected deficit equal to 1 percent of GDP raises the five-year-ahead ten-year rate (the same rate Laubach examines) by 18 basis points, and that an increase in the projected debt equal to 1 percent of GDP raises the forward long-term rate by between 2.8 and 3.3 basis points.

For Laubach and for Engen and Hubbard, the deficit-based results are not dissimilar from the debt-based results. Consider, for example, an increase in the budget deficit equal to 1 percent of GDP in each year over the next ten years. By the end of the ten years, such an increase will have raised government debt by roughly 10 percent of GDP. The deficit-based results found by Laubach would suggest about a 30-basis-point increase in interest rates in this scenario, whereas the debt-based results would suggest about a 45-basis-point increase. Likewise, the deficit-based results of Engen and Hubbard would suggest an increase in long-term rates of roughly 20 basis points, and their debt-based results suggest an increase of roughly 30 basis points (ten times the effect for an increase of 1 percent of GDP).

A second approach to incorporating expected deficits involves event analysis of news reports about deficit reduction legislation or budget projections. This approach examines the change in interest rates (or other variables) on the day on which deficit news is released. For example, Elmendorf examines financial market reactions to events surrounding passage of the Gramm-Rudman-Hollings legislation in 1985 and the Budget Enforcement Act of 1990;[73] he concludes that "higher expected government spending and budget deficits raised real interest rates…while lower expected spending and deficits

70. For example, in a recession the projected unified deficit could increase merely because of the lingering effects from the rise in debt during the downturn; at the same time, the yield curve could steepen as short-term interest rates are depressed by Federal Reserve policy. This could potentially introduce an artificial relationship, actually driven by the business cycle and monetary policy, between the yield spread and the projected unified deficit.

71. Laubach (2003).

72. Engen and Hubbard (2004).

73. Elmendorf (1996).

reduced real rates."[74] Unfortunately, given the inability to measure market expectations, this approach does not permit a mapping between the size of the unanticipated deficit and the interest rate effect.[75]

Notably, the results of most studies using either of the two approaches to incorporating anticipated deficits are consistent with the range of 20 to 60 basis points for an increase in projected deficits equal to 1 percent of GDP over ten years mentioned by us in a previous paper, and with the range of 30 to 60 basis points proposed by Robert Rubin, Orszag, and Allen Sinai.[76] This range is also consistent with the results of large macroeconometric models.[77] The simplified Solow model and debt calculation discussed above generate somewhat larger numbers, but those calculations assume a closed economy. In a large open economy like the United States, the effect of deficits on interest rates would be expected to be somewhat smaller, and this is consistent with the empirical evidence summarized above.

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74. The Council of Economic Advisers (*Economic Report of the President*, 1994, p. 78), studying the events surrounding passage of the Omnibus Budget Reconciliation Act of 1993, concluded that event analysis "linking the announcement and enactment of credible budget reduction to changes in the long-term interest rate…provides support for the view that the interest rate declines were largely due to budget policy."

75. Several other papers examine interest rate changes surrounding the release of new budget projections. Thorbecke (1993) uses OMB and CBO projections and finds that a $100 billion increase in the deficit (relative to the previously projected level) is associated with an immediate increase in ten-year interest rates of 14 to 26 basis points. Quigley and Porter-Hudak (1994) use CBO and OMB projections and find that a 1 percent increase in the deficit itself (not as a percentage of GDP) raises short-term interest rates by 0.37 to 0.87 basis point. Assuming a baseline deficit of 2 percent of GDP, their result implies that an increase in the deficit of 1 percent of GDP (a 50 percent increase in the deficit) would raise short-term interest rates by 18.5 to 43.5 basis points. Kitchen (1996) uses changes in OMB forecasts and finds a statistically significant but quite modest effect: an increase in the deficit projection of 1 percent of GDP raises ten-year bond yields by 3.4 basis points for one-year budget projections. He finds even smaller effects for multiyear budget projections on long-term interest rates. Calomiris and others (2004) examine announcement effects about previous deficits, rather than announcement effects about future deficits or future legislation. They find no effects on current interest rates of the announcement of the previous month's deficit. Their deficit measure, however, is based on the monthly budget updates provided by the CBO and the Department of the Treasury. These monthly updates are quite noisy and depend on factors such as the timing of defense contract payments. The variation in the monthly data is thus unlikely to provide significant information about the budget outlook.

76. Gale and Orszag (2003a); Rubin, Orszag, and Sinai (2004). Brook (2003) similarly concludes that "most empirical work conducted in the past ten years estimates the impact on US real long-term interest rates of a sustained 1 percentage point decrease in the US fiscal position to be in the range of 20-40 basis points, and the impact on the slope of the yield curve to be in the range of 10-60 basis points."

77. Almost all major macroeconometric models imply an economically significant connection between changes in budget deficits and changes in long-term interest rates. The precise effects depend on a wide variety of factors, including whether the change in the deficit is caused by a change in taxes or a change in spending, how monetary policy reacts, and how foreign governments react. The results vary widely, in part because different policies are simulated and standardization is difficult, but suggest that a sustained increase in the primary (noninterest) deficit of 1 percent of GDP would raise interest rates by 40 to 50 basis points after one year and 50 to 100 basis points after ten years (see Gale and Orszag, 2002).

Some of the most frequently cited papers that find no effect of deficits on interest rates, including those by Evans and by Charles Plosser, employ vector autoregressions (VARs).[78] The VARs in these studies are typically based on a very limited number of variables and only on past values of such variables; they ignore information on current and projected deficits that is not reflected in such variables but may be widely known to market participants. As a result, the VAR-based projections have been shown to be inferior to those produced by the OMB or Data Resources, Inc.[79] The implication is that VAR-based projections based on past values of variables are more likely to suffer from measurement error and thus to be biased toward showing no effect of deficits on interest rates.[80]

Despite these limitations, several recent papers have applied the VAR methodology to examining the connection between deficits and interest rates. For example, Canzoneri, Cumby, and Diba include both the federal funds rate and the ten-year bond rate in a structural VAR; they find that the ten-year yield rises by 45 basis points immediately, and by roughly 40 basis points in the long run, in response to an upward spending shock equal to 1 percent of GDP.[81] Engen and Hubbard use a VAR framework that includes *anticipated* deficits to estimate that an increase in the federal deficit equal to 1 percent of GDP causes the real interest rate to rise by 12 basis points.[82] Qiang Dai and Thomas Philippon estimate a structural VAR that uses information provided by no-arbitrage restrictions on the yield curve.[83] They conclude that a 1-percent-of-GDP increase in the unified deficit raises ten-year bond yields by 41 basis points. Silvia Ardagna, Francesco Caselli, and Timothy Lane, using data from a panel of sixteen advanced industrial countries over several decades, show in a VAR that a 1-percent-of-GDP increase in the primary deficit leads to a cumulative increase in interest rates of almost 150 basis points over ten years.[84] They also show that the initial, static effect of such an increase is in the neighborhood of 10 basis points.

To examine these issues we follow Laubach and Engen and Hubbard. Since it is conceivable that both stock and flow measures of fiscal policy matter, and that the effect of a change in one fiscal variable could depend on the level of the other, we include both

78. Evans (1987a, 1987b) and Plosser (1982, 1987).

79. Bernheim (1987); Cohen and Garnier (1991); Elmendorf (1993).

80. These studies have also been criticized on other grounds. For example, the tests appear to have very little power and in some cases are even unable to reject the hypothesis that expected inflation has no effect on nominal interest rates, and the results are not robust to changes in sample period or specification. For further discussion see Bernheim (1987) and Elmendorf and Mankiw (1999). A recent study by Kormendi and Protopapadakis (2004) shares the characteristic of estimating the effects on interest rates of a deficit measure that depends only on past values of the explanatory variables.

81. Canzoneri, Cumby, and Diba (2002).

82. Engen and Hubbard (2004).

83. Dai and Philippon (2004).

84. Ardagna, Caselli, and Lane (2004).

debt and deficits in some of the regressions.[85] The regressions that separate primary outlays and revenue provide insight to the extent that, as noted in the discussion of Ricardian equivalence above, changes in outlays could have different effects on national saving and thus on interest rates than changes in revenue.[86] We undertake several different versions of our generic regression, all of them using data from 1976 to 2004:

In our preferred specifications, which allow both debt and deficits to affect interest rates, the estimated effect on forward long-term rates from a 1-percent-of-GDP shift in projected primary budget variables ranges between 40 and 67 basis points, depending on the specification and on whether the fiscal variable is the primary deficit, or revenue and primary outlays separately. Our effects are larger than those found by Laubach and by Engen and Hubbard,[87] because we include both projected debt and projected deficits as variables, and because we include measures of whether the economy is currently in recession. The results show that the effects of projected deficits are *larger* when projected debt is included, and that the effect of a given future deficit tends to be larger if the economy is currently not in a recession than if it is.

In sharp contrast, the projected debt-GDP ratio never exerts a positive and significant effect on future interest rates when it is entered in a regression that also includes projected deficits. The projected deficit thus seems a more informative measure than projected debt. This is reflected in results from deficit-only equations, which had significantly higher R^2s than the debt-only equations, and most strikingly every regression where both debt and deficits were entered, deficits have large effects and the debt has virtually none.

Our estimates of the effect of an increase in the projected unified budget deficit are somewhat smaller——25 to 35 basis points for each 1-percent-of-GDP increase—than that of an increase in the primary deficit. This should be expected, since a shift of 1 percent of GDP in the primary deficit would represent a more dramatic change than a shift of 1 percent of GDP in the unified deficit. Finally, our results when debt is entered in the equation by itself suggest that an increase in the projected debt by 1 percent of GDP raises long-term rates by between 3 and 6 basis points.

All of the estimates above may understate the true effects for at least two reasons. First, as Rubin, Orszag, and Sinai note,[88] and as discussed earlier in the paper, the effects

85. Ardagna, Caselli, and Lane (2004, p. 4) include both debt and deficits in their model, for similar reasons: "...in theory, the relationship between fiscal policy and interest rates may be mediated by either variable....Furthermore, even if one were specifically interested in the effects of only one of these variables, it would still make sense to control for the other. For example, given the current stock of debt, including the deficit may help [control] for the expected future path of the debt itself."

86. Ricardian equivalence is a statement about the effects of variations in the timing of lump-sum tax payments, holding constant both the path of transfers and government purchases. Our regressions separate tax revenue from purchases and transfers.

87. Laubach (2003); Engen and Hubbard (2004).

88. Rubin, Orszag, and Sinai (2004).

would be larger if sustained deficits cause investors to lose confidence in the ability of policymakers to avoid a fiscal crisis. Second, because the projected fiscal policy variables are only approximations of investors' true expectations, the regressions may suffer from classical measurement error, which would bias the coefficient on projected deficits toward zero.

Implications

The empirical evidence we describe above indicates that federal budget deficits reduce national saving and raise long-term interest rates. Reasonable rules of thumb based on our estimates are that each 1-percent-of-GDP increase in current deficits reduces national saving by 0.5 to 0.8 percent of GDP, that each 1-percent-of-GDP increase in projected future unified deficits raises forward long-term interest rates by 25 to 35 basis points, and that each 1-percent-of-GDP increase in projected future primary deficits raises forward long-term interest rates by 40 to 70 basis points.

These findings carry substantial implications. First, both the consumption and the interest rate results reject the Ricardian view of the world. Second, the interest rate results reject the small open economy view, at least as it applies to the U.S. economy.

Third, the results suggest that the sustained deficits now facing the United States will impose significant economic costs. Under the assumptions we have described, the unified budget deficit over the next decade is projected to average about 3.5 percent of GDP. Our results suggest that these deficits will reduce annual national saving by 2 to 3 percent of GDP. As a result, by the end of the decade, the assets owned by Americans will be roughly 20 to 30 percent of GDP less than they would be if the unified budget were balanced over the next decade. With a rate of return on capital of 6 percent, those missing assets will reduce national income by 1 to 2 percent in 2015 and each year thereafter. Our results also suggest that the increase in unified deficits will raise interest rates by 80 to 120 basis points.

Fourth, our results suggest that making the 2001 and 2003 tax cuts permanent would raise the cost of capital for new investment, reduce long-term investment, and reduce long-term economic growth. Tax cuts have offsetting effects on the cost of new investment, with marginal tax rate cuts reducing, and higher interest rates from deficits increasing, the cost of capital. Gale and Samara Potter show that, if the 2001 tax cut were to raise interest rates by 50 basis points, the cost of capital would rise for corporate equipment and structures, noncorporate equipment and structures, and owner-occupied housing.[89] By 2014 the 2001 tax legislation, if extended past its official sunset, would increase the public debt by just over $3.4 trillion,[90] or about 19 percent of projected GDP in 2014. This implies an interest rate increase of 57 basis points using the Engen and

89. Gale and Potter (2002).

90. This estimate is based on Joint Committee on Taxation (2001, 2002, 2003) revenue figures for the original legislation, CBO estimates of the costs of extensions, and CBO interest rate matrix calculations for debt service costs.

Hubbard estimates,[91] and an even larger increase using our estimates. From an alternative perspective, making the 2001 tax cut permanent would reduce revenue by about 1.7 percent of GDP on a permanent basis (assuming the alternative minimum tax cuts are not effectively supplanted by the alternative minimum tax). Using our estimates for primary deficits, this implies that interest rates will rise by 70 and 120 basis points. Both sets of estimates imply that the 2001 tax cut will end up *reducing* long-term investment. It might be thought that the 2003 tax cut would have more beneficial effects on investment, since it focused on dividend and capital gains tax cuts. In recent work, however, we show that the net effect of making the 2001 *and* the 2003 tax cuts permanent would be to raise the cost of capital once the interest rate effects are taken into account—even under the Engen-Hubbard estimates.[92] These findings imply that making the tax cuts permanent would reduce the long-term level of investment, which is consistent with a negative effect on national saving and on future living standards.

Fifth, after 2014 the budget outlook grows steadily worse as costs associated with federal retirement and health programs mount. Under reasonable projections and in the absence of policy changes, the nation thus faces a long period of sustained large budget deficits. In this context the negative long-term effects of deficits presented in this paper, substantial though they are, may provide an unduly auspicious perspective on the adverse consequences of fiscal deficits.

Finally, there is the increasing prospect of non- traditional effects occurring, as outlined above. In particular, in the traditional view the exchange rate would stay constant or the currency would appreciate in response to the inflow of capital from abroad. The sign of the exchange rate change, however, is unclear in the presence of changes in a country-specific risk premium. If that premium increases as a country's net international indebtedness (or flow of new international borrowing) increases, the country's currency could depreciate. In other words, although nontraditional effects are likely to accentuate the impact of deficits on interest rates, they may alter even the sign of the exchange rate dynamics. The recent, substantial deterioration of the U.S. dollar against European currencies suggests the potential salience of such broader effects.

91. Engen and Hubbard (2004).

92. Gale and Orszag (2004b).

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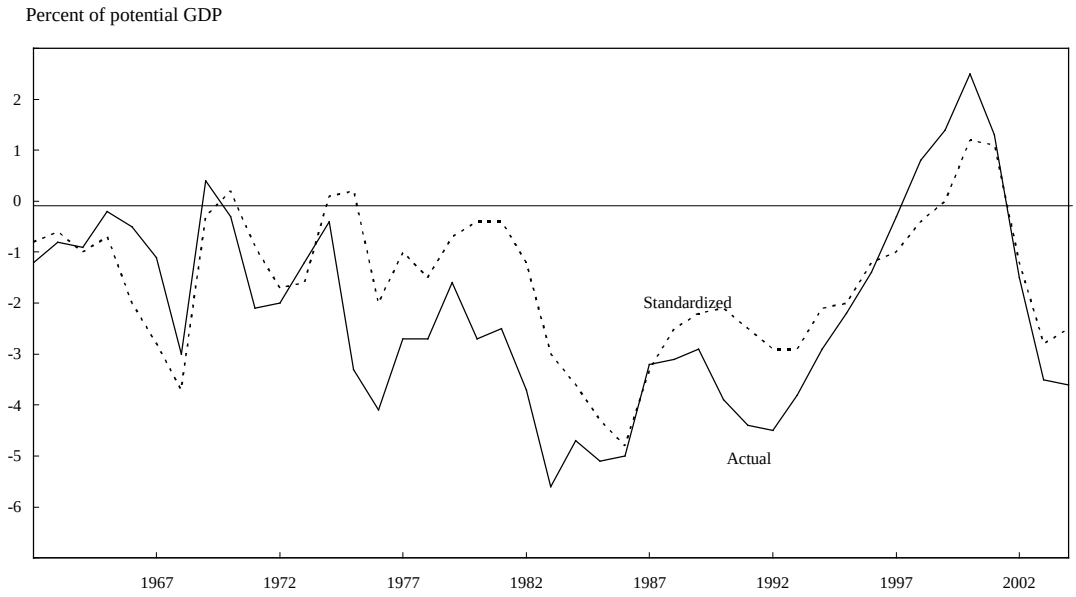
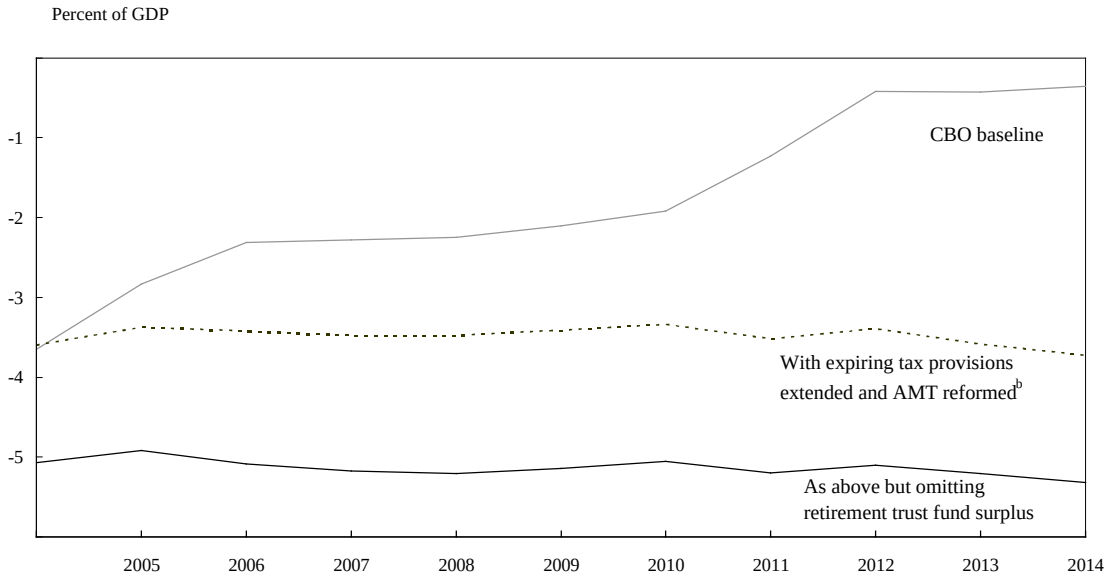
Figure 1. Actual and Standardized Federal Budget Balance, 1962-2004



Source: Congressional Budget Office, "The Long-Term Budget Outlook" (January 2004), "The Cyclically Adjusted and Standardized Budget Measures" (September 2004), and "The Outlook for Social Security" (June 2004).

Figure 2. Federal Budget Balance, Projected 2004-14.[a]

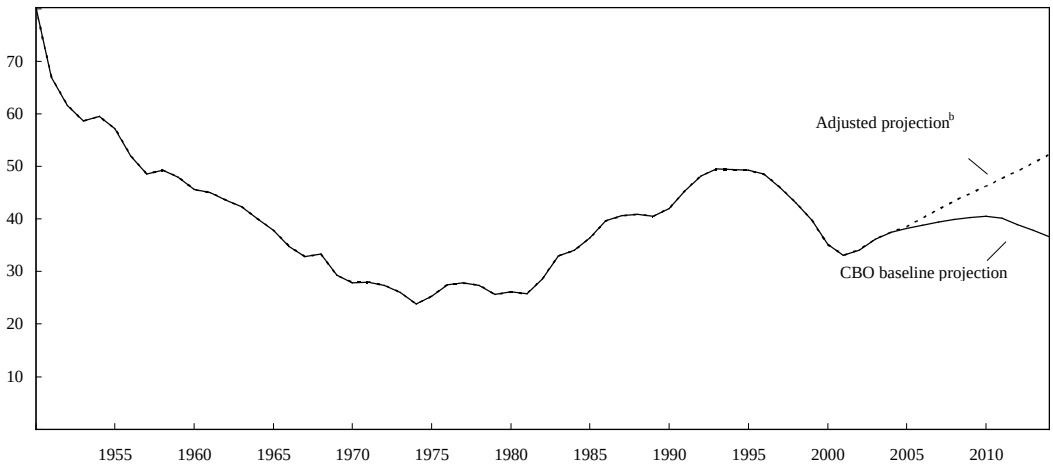


Source: Authors' calculations using Congressional Budget Office, "The Budget and Economic Outlook: An Update" (September 2004) and the TPC Microsimulation Model.

a. Debt service is imputed using the CBO interest matrix.
b. Assumes that the 2001 and 2003 tax cuts are made permanent and other expiring tax provisions (except the 2002 tax cuts) extended, and that the AMT is indexed for inflation and dependent exemptions are allowed under the AMT.

Figure 3. Public Debt, 1950-2014[a]

Percent of GDP



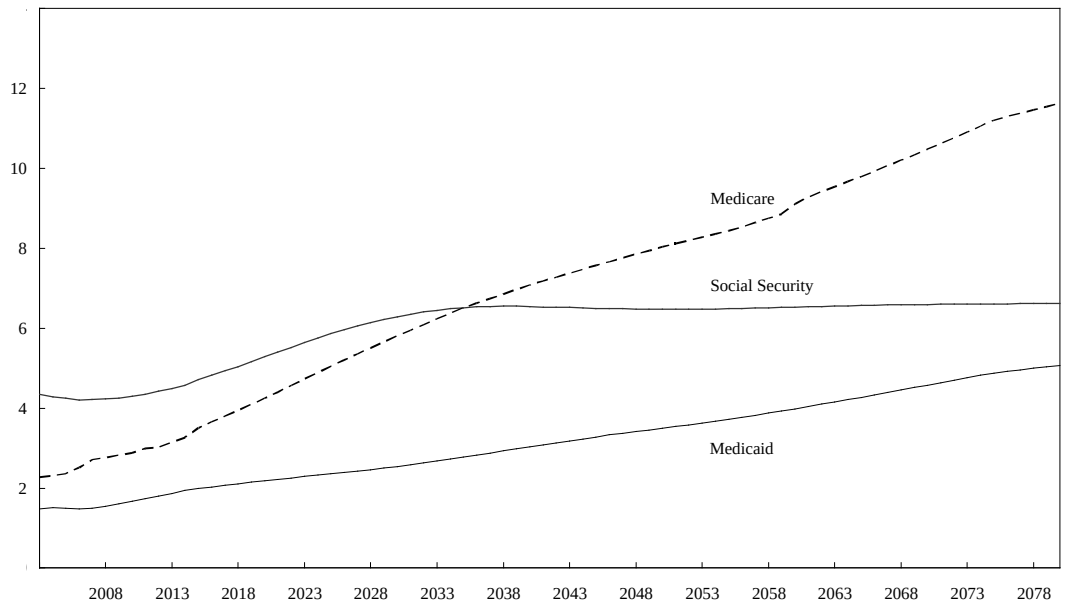
Source: Authors' calculations using Congressional Budget Office, "The Budget and Economic Outlook: An Update" (September 2004), OMB, and the TPC Microsimulation Model.

a. Debt service is imputed using the CBO interest matrix.

b. Assumes that the 2001 and 2003 tax cuts are made permanent and other expiring tax provisions (except the 2002 tax cuts) extended, and that the AMT is indexed for inflation and dependent exemptions are allowed under the AMT.

Figure 4. Entitlement Expenditure under Current Law, 2003 and Projected 2004-80

Percent of GDP



Source: Auerbach, Gale, and Orszag (2004).

Figure 5. Theoretical Responses to a Change in the Budget Deficit

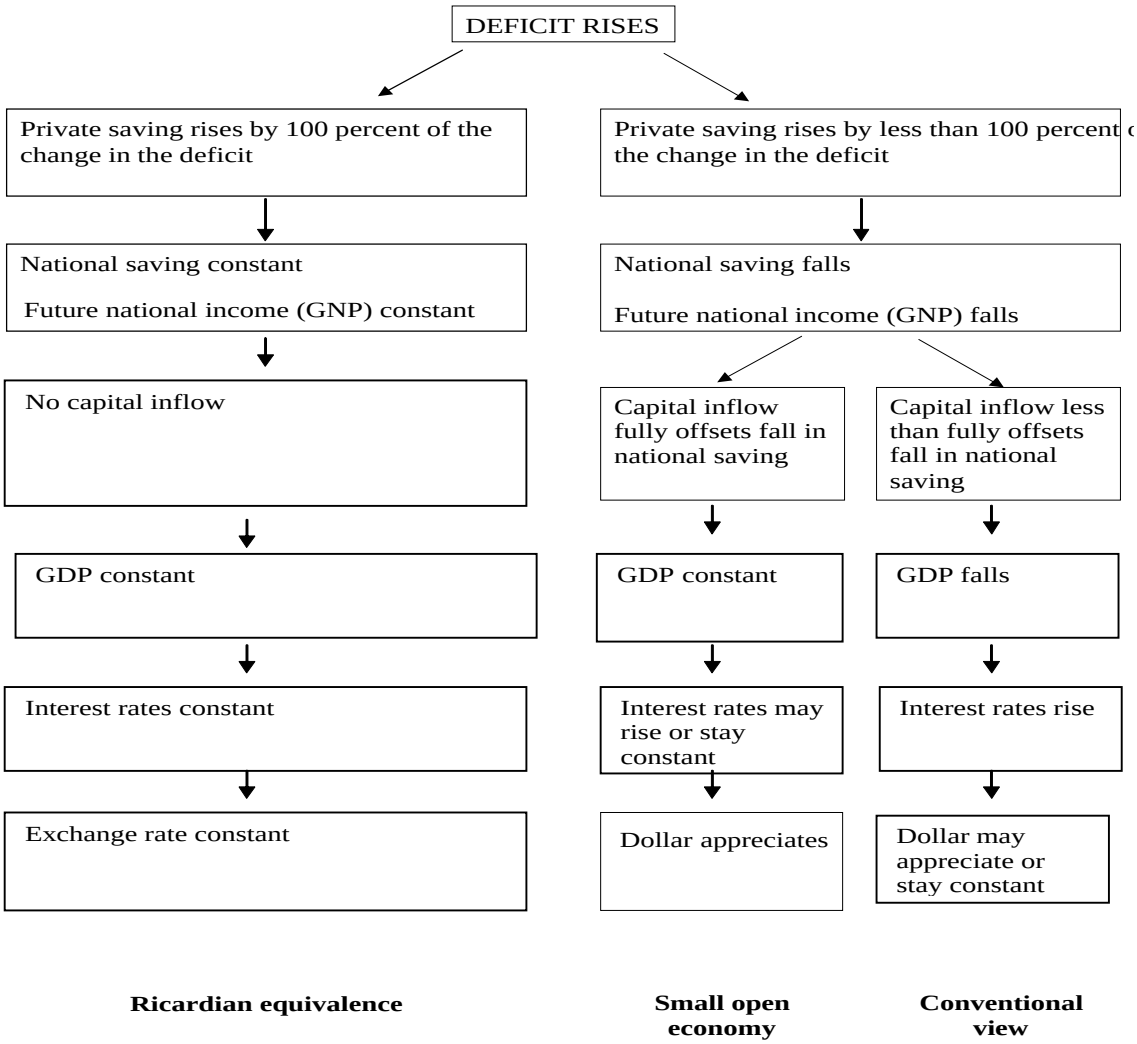
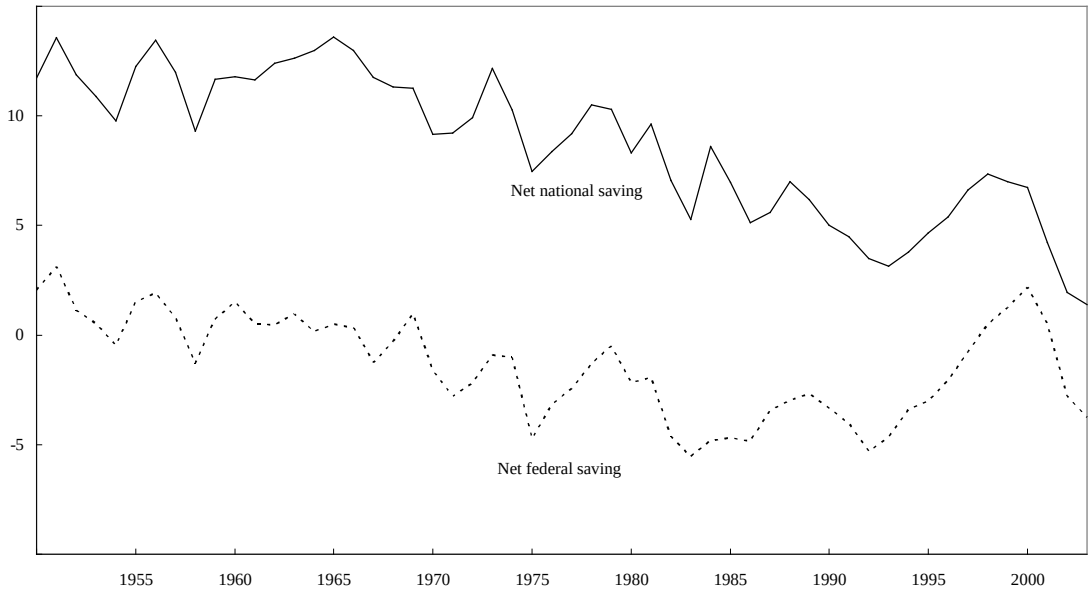


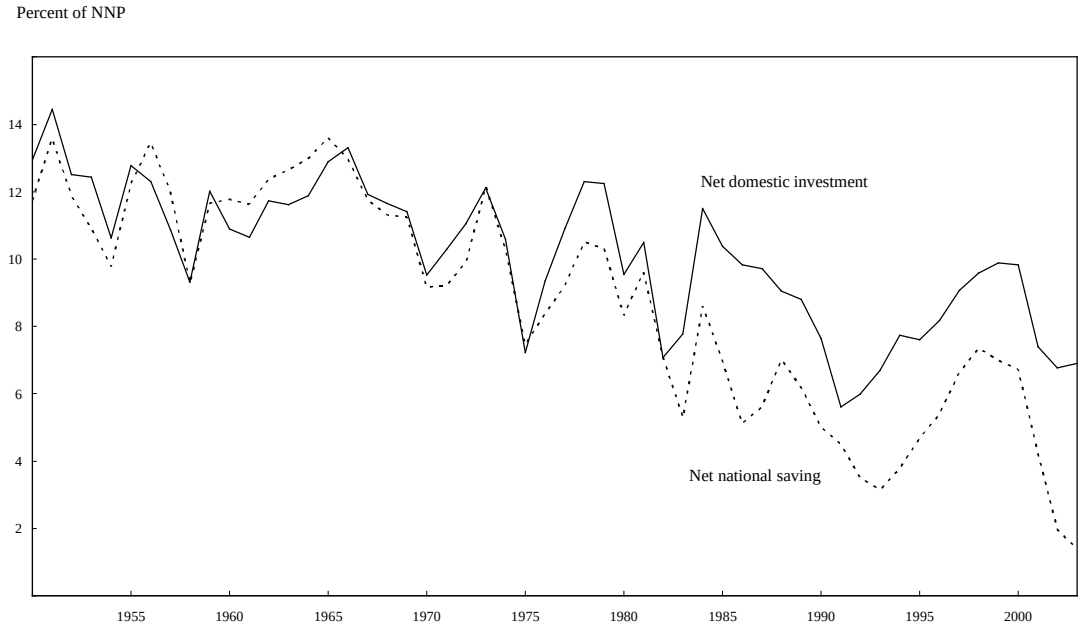
Figure 6. Net National Saving and Net Federal Saving, 1950-2003

Percent of NNP



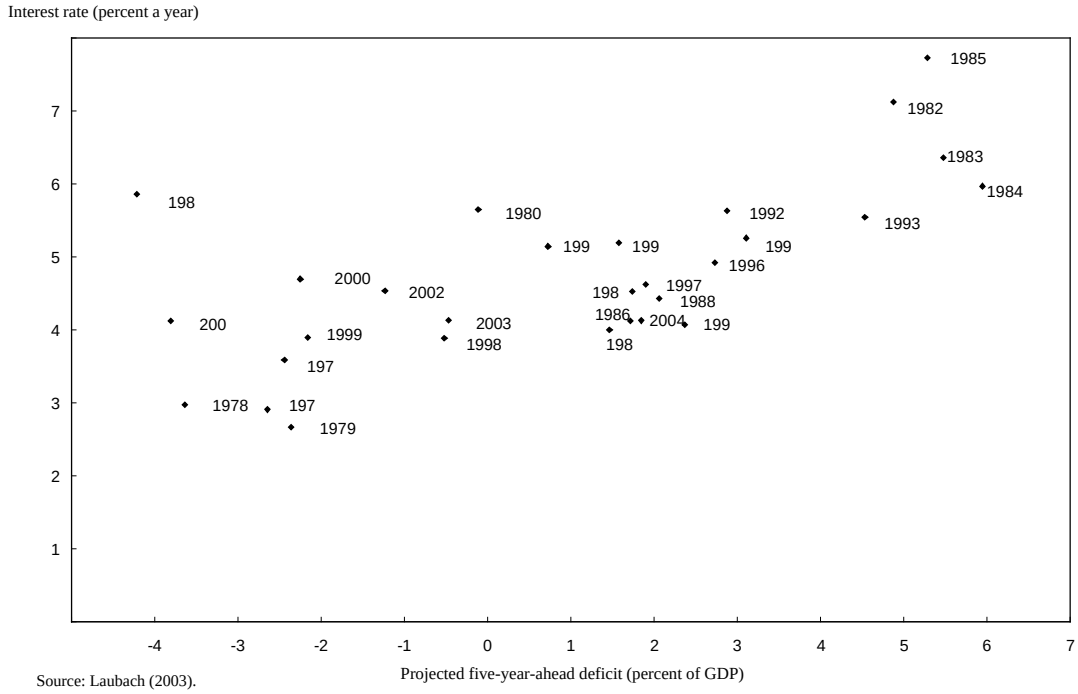
Source: Bureau of Economic Analysis, National Income and Product Accounts.

Figure 7. Net Domestic Investment and Net National Saving, 1950-2003



Source: Bureau of Economic Analysis, National Income and Product Accounts

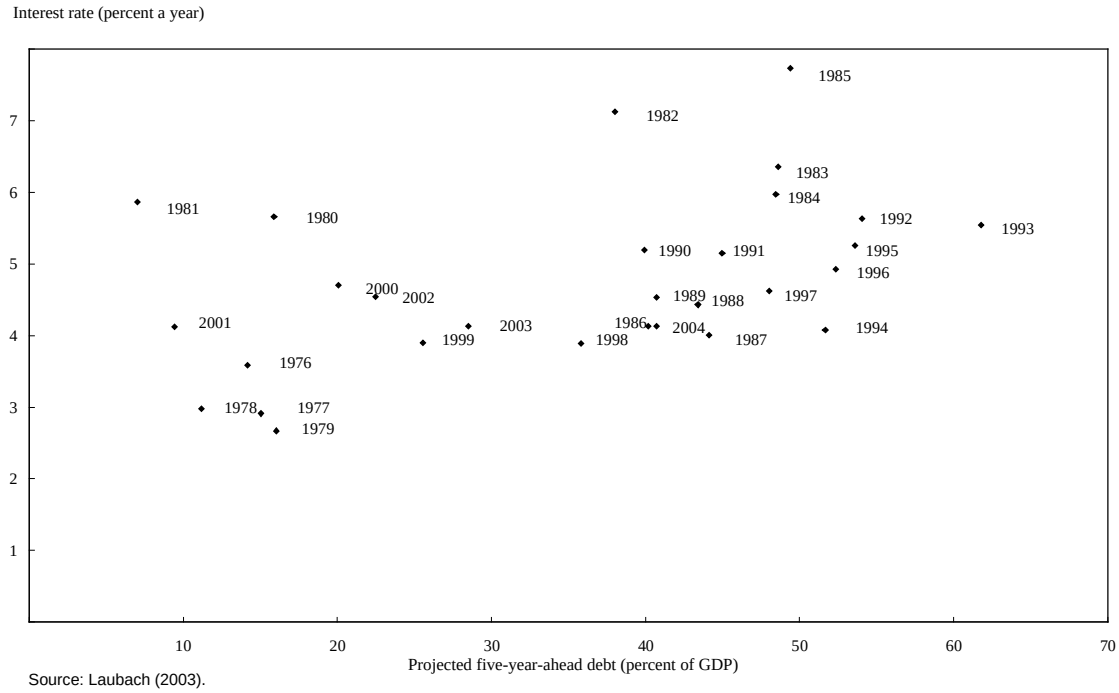
Figure 8. Forward Ten-Year Real Treasury Rates and Projected Deficits, 1976-2004[a]



Source: Laubach (2003).

a. Projected deficits as constructed by Laubach (2003).

Figure 9. Forward Ten-Year Real Treasury Rates and Projected Debt, 1976-2004[a]



Source: Laubach (2003).

a. Projected debt as constructed by Laubach (2003).