VINCENT REINHART
Board of Governors of the Federal Reserve System

BRIAN SACK
Board of Governors of the Federal Reserve System

The Economic Consequences of Disappearing Government Debt

FEDERAL BUDGETARY DEVELOPMENTS in the United States of late have been fast moving and nothing short of outstanding: The latest projections of the Congressional Budget Office (CBO) peg the federal surplus for fiscal year 2000 in excess of $230 billion, around $50 billion more than its forecast of just six months earlier. For a generation accustomed to mounting government obligations and dire warnings of adverse macroeconomic consequences, a surplus in 2000 amounting to 2.4 percent of nominal GDP—the largest since 1948—would seem to imply a changed economic landscape.

Yet these developments are not limited to the United States. Several factors have combined to improve fiscal positions in a number of countries worldwide. Among these factors are cyclical recoveries that have boosted income tax revenue, increases in equity values that have produced capital gains tax windfalls, and spending restraint due in part to spending caps and, in many European countries, a desire to satisfy the fiscal criteria in the 1993 Maastricht treaty. In its latest *OECD Economic Outlook*, the Organization for Economic Cooperation and Development projects that fourteen of twenty-three countries covered will achieve fiscal balance or surplus over the immediate two-year projection period. Indeed, if one excludes Japan, whose fiscal position is moving in the opposite direction,

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the aggregate fiscal balance of the Group of Seven large industrial countries (the G-7) will have swung from a deficit of more than 3 percent of their combined GDP in 1996 to a projected surplus of about ¾ percent by 2001. These developments represent a general shrinkage of governments' claims on the world pool of saving, rather than a shift in the U.S. government's demands alone.

Will these worldwide shifts from deficits to surpluses, and the consequent declines in government debt, have important economic consequences? For some the self-evident answer is no. An influential body of opinion holds that government debt, because it implies a future stream of taxes to meet interest payments, should not be counted as part of household wealth. In that view the decline in government debt, by itself, has no implications for economic activity or financial market prices.[1] Instead, any effects that occur stem only from changes in fiscal policies that condition that path of declining debt. Our interpretation of recent events, however, is inconsistent with this view. After reviewing the recent fiscal experience of the industrial countries, we focus on three separate ways in which the disappearance of government debt has economic effects.

In our interpretation the U.S. budget surplus and its projected continuation and deepening represent a change in policy comparable in magnitude to the creation of massive deficits in the 1980s. At that time several prominent economists, including Olivier Blanchard, William Branson, Rudiger Dornbusch, and Martin Feldstein, stressed mechanisms through which a policy conventionally viewed as providing current fiscal stimulus could actually have contractionary effects.[2] The core of this insight was that fiscal policy in the 1980s was on a path that implied ever-widening deficits, which would require increasing real interest rates over time.[3] Investors in capital markets would bring forward to the present their expectations of higher short-term real interest rates, in the form of higher long-term interest rates, lower stock prices, and a stronger foreign exchange value of the dollar, *before* the direct stimulus of additional spending would be felt.

1. The classic reference is Barro (1974).

2. The main references include Blanchard (1981, 1984, 1985), Blanchard and Dornbusch (1984), Branson, Fraga, and Johnson (1985), Dornbusch (1986), and Feldstein (1984).

3. Blanchard and Summers (1984), however, argued that fiscal policy, by itself, was likely not the cause of the high real interest rates observed around the world at that time, as there was little evidence of a significant shift in structural saving across the OECD as a whole.

One channel for this "expectational crowding out" was thought to be the appreciation of the dollar on foreign exchange markets, as the prospect of a rise in real interest rates in the United States relative to those of its trading partners gave investors an incentive to increase their dollar holdings immediately. There is less reason, however, to bring that aspect of the argument to bear on the present situation. To a first approximation, if mounting surpluses are a generalized world phenomenon, rather than specific to the United States, there would seem to be no need for the dollar's exchange value to adjust to tilt spending into better balance worldwide. However, the other two mechanisms—those operating through changes in long-term rates and in wealth—should be at work. The second section of this paper discusses how a permanent move toward fiscal stringency, all else equal, should be associated with expectations of falling real interest rates. The testable implication of this association is that the emergence of budget surpluses should flatten the term structure of interest rates, both over time in one country and across countries in any one period. We find some support for this hypothesis in a panel data set of real-time OECD projections for budget prospects in nineteen countries over the past twenty years.

Reductions in government debt of the magnitude implied by many current forecasts will require substantial shifts in investor portfolios. These looming shifts are all the more considerable given the United States' large current account deficit. Projected by the OECD at around 4½ percent of GDP both this year and next, the ongoing current account deficit belies the notion of the "twin deficits" of the 1980s. If this international deficit persists, U.S. residents as a group will increase their net indebtedness to foreigners even as the federal government pays down its debt. Thus, over the next few years, foreign investors will have to be induced to hold more U.S. obligations on net, even as the composition of those obligations shifts away from government debt toward private debt.

The third section of the paper attempts to take some measure of the potential changes in the configuration of expected returns that will make investors indifferent to such a shift. For this task we rely on the workhorse of modern financial economic analysis, mean-variance optimization. In that framework, applied in similar contexts by Jeffrey Frankel and by Benjamin Friedman, the representative global investor is assumed to choose portfolio shares consistent with maximizing a welfare function that is quadratic in the expected returns on assets and the covariance of those

returns.[4] One advantage of the model is that it is parsimonious, in that the effect on expected returns of an assumed change in portfolio shares depends only on the covariance structure of returns and the specified risk tolerance of investors. We use data from a variety of sources on the returns on a set of global assets over the past decade to estimate the means and covariance of returns. We then consider several scenarios that vary according to which asset class crowds into investors' portfolios as government debt disappears, and according to the assumed risk tolerance of investors. The bottom line, familiar from Frankel's work, is that the effect on expected returns is quite small unless investors are assumed to be extraordinarily skittish toward taking on risk. This effect is particularly to be expected if U.S. agency and corporate debt securities are available to replace Treasury securities: investors should readily substitute these securities for their declining holdings of Treasury securities, given the high correlation between their returns.

This theoretical presumption that large changes in holdings of debt stocks can be accomplished through small changes in relative returns runs counter to the apparent preoccupation in financial markets of late over the shrinking supply of Treasury debt. We therefore consider the possibility that the model's characterization of the representative global investor does not fit all market participants. Some current holders of Treasury securities may especially prize the safety or the liquidity that these securities offer. These investors may be less responsive to changes in relative returns, allowing some scope for more sizable market consequences.

If it is the safety of Treasuries that these investors value, the scope for market innovation to fill that gap may be limited. If instead it is liquidity that now makes Treasuries unique, the situation may change precipitously. As we describe in the paper's fourth section, Treasury market liquidity has deteriorated recently as market participants have become increasingly concerned about large paydowns in Treasury debt. We offer a model that captures the self-reinforcing aspect of trading. Traders and some investors prefer to participate in that market segment in which they believe others will also participate. As a result, the determination of the depth of a market and the scale of trading can be highly nonlinear, and the market may

4. Frankel (1985); Friedman (1986).

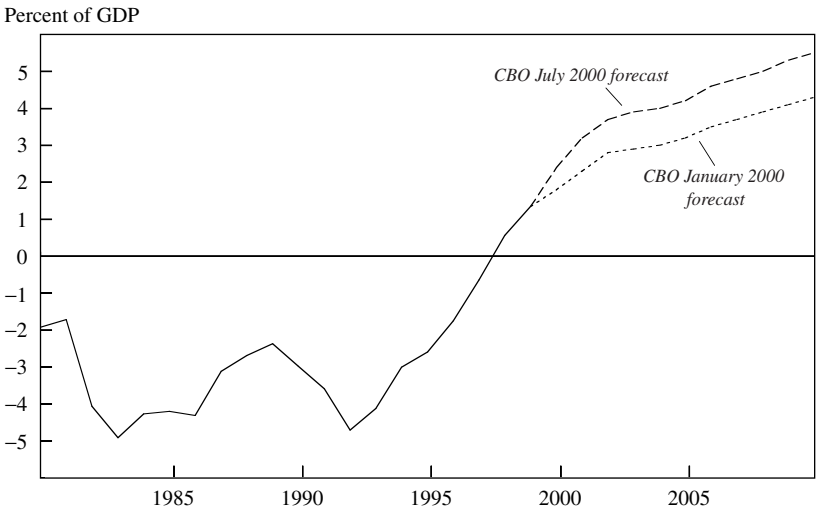
settle at any of multiple equilibria. The sheer volume of Treasury issues outstanding and their default-free status made it natural that, over the past couple of decades, participants would gravitate toward an outcome in which Treasury debt becomes the preferred trading vehicle and market benchmark. As Treasury debt disappears and this equilibrium breaks down, liquidity could erode in an abrupt and uneven manner. In that circumstance, investors preoccupied with holding the most liquid asset may shift their holdings into alternative assets, leading to the replacement of Treasuries as the benchmark asset. The stakes attached to becoming that new benchmark and capturing the associated liquidity premium could be high as new market conventions coalesce.

The overall conclusion based on the models and results presented here is that the fiscal discipline that has recently emerged around the world could have significant macroeconomic benefits, but also some repercussions for global financial markets. The U.S. government's reduced claims on the limited pool of world saving have no doubt encouraged private uses of that saving, to the betterment of the capital stock and of output over time. But those same events will also require a considerable adjustment in financial markets—one that might involve rapid and unpredictable shifts in trading activity.

Some Pleasant Fiscal Arithmetic

For over a generation in the late twentieth century, the joint outcome in the United States of the political process and the state of the economy was a succession of federal budget deficits. From 1970 to 1997 the general government deficit averaged 2.7 percent of nominal GDP, and it reached 4.9 percent in 1983 (figure 1). Financing those cumulated deficits required issuing $3.5 trillion in U.S. Treasury securities, on net, pushing the total federal debt held by the public to 49 percent of GDP at its peak in 1993. In the past few years, inherited discipline from earlier budget reforms, political stalemate associated with a divided government, and the exceptional performance of the economy have combined to break that trend. Since 1998 the federal budget has been in the black, and about $450 billion of marketable Treasury debt will have been repaid over the three fiscal years ending in 2000. And the most recent CBO projections suggest that

Figure 1. Projected Federal Budget Balance, 1980–2010



Sources: Bureau of Economic Analysis, National Income and Product Accounts; CBO (2000a and b).

even more paydown of the debt is in train.[5] Under a CBO scenario in which spending is held at estimated statutory caps over the next two years and subsequently grows at the rate of inflation, the budget surplus is projected to mount to over $¾ trillion, or more than 5¼ percent of GDP, by 2009 (figure 1). By the following year, the total stock of Treasury debt in the hands of the public will have shrunk to $830 billion, one-quarter of its level ten years earlier and less than 5½ percent of GDP.[6]

Just as stunning as the magnitude of the improvement has been the extent to which it took budget analysts unaware. As late as January 1997 the CBO put its estimate of the budget *deficit* for 2000 at $171 billion, or more than $400 billion worse than what it now views as the most likely outcome. And the surprises have continued. As noted at the outset, the 2000 budget surplus projection announced in July of this year was $50 billion higher than the projection in January, and the situation going forward

5. CBO (2000b).

6. The Treasury actually begins to accumulate excess cash balances by 2006 under this scenario, as the CBO assumes that there is a limit on how quickly the Treasury can retire outstanding debt.

was viewed as sufficiently more favorable to yield another $1½ trillion in cumulative surpluses over the coming decade.

All budget projections, however, depend on a host of assumptions about public policy and the economy stretching well into the future. Alan Auerbach and William Gale, for instance, contend that more plausible policy assumptions would produce a cumulative surplus over the next decade that is one-tenth that projected by the CBO.[7] Indeed, it is easy to imagine political and economic outcomes that would make even the Auerbach-Gale projections fail to materialize. Nonetheless, the paydown of Treasury debt has considerable momentum in the near term. Moreover, not all the risks fall on one side of the distribution. If productivity increases continue to run at their recent rapid clip, growth of potential output would exceed that assumed by the CBO by a considerable margin, implying even more tax inflows and reductions in spending than in the agency's baseline scenario. Indeed, the impact of changes in the assumed growth rate of the economy is large. For example, familiar rules of thumb used by budget forecasters would suggest, given the CBO's assumptions about spending, taxes, and debt, that a sustained 0.1-percentage-point increase in economic growth would add over $200 billion to the cumulative surpluses projected over this decade.[8]

The good budget performance of late derives arithmetically from strong growth in receipts combined with modest growth in outlays, which apparently owes chiefly to three overlapping influences.[9] The single most important influence on both of these developments has been a strong economy, which has produced growth in activity of around 4 percent a year over the past few years while inflation has remained relatively subdued. In this period of growth, the automatic stabilizers in the budget have worked much as economic textbooks prescribe: the robust economy and low unemployment have boosted tax revenue and helped hold spending on some entitlements in check. Second, the strong economy has also produced large cumulative increases in equity and real estate prices, which have increased receipts from capital gains taxes, and especially large income gains for high-income households. Taken together, and given the

7. Auerbach and Gale (2000).
8. CBO (2000a).
9. These developments are surveyed in box 1-1 of CBO (2000b).

progressivity of the tax system, these windfalls have pushed up the effective tax rate. Third, national authorities must be given some credit for the budgetary outcome, whether because an emergent political consensus has become hostile to deficits, or because the end of the cold war made it easier to trim defense spending, or because a divided government has been unable to agree on steps that would erode the fiscal position.

That fiscal surpluses may have been more a matter of commission (a political preference for smaller budgets) than of omission (the failure of a divided government to agree on how to raise spending or cut taxes) receives some credence from the fact that other industrial countries with different political arrangements and economic performances are also running surpluses. As table 1 shows, the United Kingdom and Canada also have fiscal surpluses that are large relative to the size of their economies. And the EU countries shown in the table will have shrunk their aggregate deficit, which averaged nearly 5 percent of their combined GDP in 1995, to near 1 percent this year and next.

Figure 2 provides some sense of the worldwide character of this move toward fiscal restraint. Virtually all of the OECD countries have posted budgetary improvement since the 1996–98 period, as reflected in the tendency for points to cluster above the 45-degree line, which denotes outcomes that leave the budget unchanged. In most cases these improvements have come about through increases in receipts combined with relatively modest changes in spending. (The lonely point in the lower right portion of the figure denotes the change in Japan's fiscal position, which, unlike that of the rest of the industrial world, has deteriorated as a result of a large relative increase in outlays.)

This rise in the effective tax rate in the OECD countries as a group is likely to be attributable to developments similar to those in the United States: capital gains windfalls associated with generally buoyant equity and property markets, and disproportionate income gains in upper-income brackets. But some of the improvement also must trace back to fiscal discipline. This reflects changes in the political climate in countries such as Canada and Sweden, as well as strictures associated with the adoption of a single currency by the eleven countries in the European Monetary Union (and other countries hoping to enter at a later date). It is this generalized move toward restraint that shapes our first description of the worldwide consequences of fiscal surpluses.

Table 1. Central Government Fiscal Balances in the Group of Seven Industrial Countries, 1980–2001

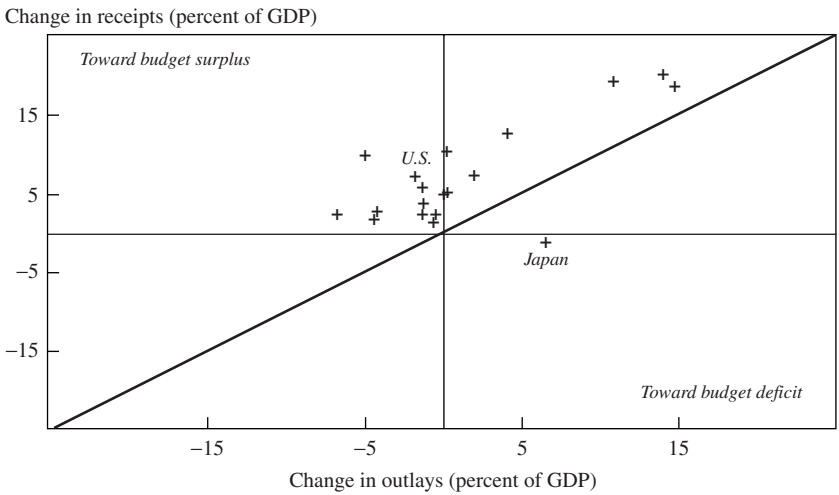
Percent of GDP

Country	*1980*	*1985*	*1990*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*[a]	*2001*[a]
Canada	–3.1	–7.3	–4.5	–4.3	–1.8	0.8	0.9	2.8	2.5	2.2
France	–0.3	–3.1	–2.1	–5.5	–4.1	–3.0	–2.7	–1.8	–1.4	–1.2
Germany	–2.8	–1.1	–2.0	–3.2	–3.4	–2.6	–1.7	–1.1	–1.2	–1.7
Italy	–8.3	–12.2	–11.0	–7.6	–7.1	–2.7	–2.8	–1.9	–1.5	–1.1
Japan	–4.4	–0.8	2.8	–3.6	–4.2	–3.3	–5.0	–7.0	–6.7	–6.4
United Kingdom	–3.3	–2.9	–1.5	–5.8	–4.4	–2.0	0.2	1.1	1.1	0.9
United States	–1.9	–4.2	–3.0	–2.6	–1.8	–0.6	0.6	1.3	2.4	3.2

Sources: Bureau of Economic Analysis, National Income and Product Accounts; CBO (2000b); *OECD Economic Outlook*, various issues.

a. Projected.

Figure 2. Changes in Government Receipts and Outlays in Selected OECD Countries, 1996–98 to 1999–2001[a]



Sources: *OECD Economic Outlook*, June 2000.
a. Change in the annual average for the first period to that for the second. Data for 2000 and 2001 are projections.

The Effects of Fiscal Restraint on a Global Scale

The policy literature most relevant to current circumstances is the work in the early 1980s on a seeming oxymoron: contractionary fiscal stimulus. The main insight of this literature was that fiscal policy should be thought of as a process that affects the entire future path of short-term interest rates, which, in turn, is embedded in the current prices of long-lived assets. A fiscal policy that exerts a stimulus through its direct effects on aggregate demand may have the offsetting effect of increasing long-term interest rates (and decreasing the prices of long-lived assets), because market participants anticipate that government borrowing will strain the available pool of savings over time. In effect, financial markets bring forward in time the interest rate restraint associated with fiscal stimulus before that stimulus is felt. This theory owes mostly to Olivier Blanchard, who first identified the mechanism through which capital markets can

accomplish this "expectational crowding out," provided more compelling theoretical underpinnings for household behavior, and considered more complicated descriptions of policy.[10] Other contributors emphasized the role of foreign exchange markets in the process,[11] and still others stressed sectoral dislocations.[12]

If fiscal policy launches along a path of continued restraint, investors will come to expect declining stocks of government debt over time. The impact of such expectations will depend on whether government debt is considered part of net worth. If households discount future taxes at a rate that exceeds the government interest rate, the declining stock of government debt represents a predictable reduction in household net worth over time.[13] Because net worth is an important determinant of consumption spending, investors who foresee a declining path of government debt should also anticipate lessening pressures on aggregate demand. In those circumstances an activist central bank would lower short-term real interest rates over time to crowd in enough interest-sensitive spending to keep resource utilization from slipping. Thus the expectation of a declining path of government debt will also be associated with the expectation of falling short-term real interest rates.

But economic theory is by no means settled on this issue. If households discount future taxes at the same rate as interest income from government bonds,[14] government bonds should not be considered part of net worth, and the economy would exhibit Ricardian equivalence. Were that the case, our search for imprints of declining government debt on the macroeconomy would end here. There would be none, as the shrinkage of future tax liabilities would offset, in a present-value sense, the effects of a lower debt stock. But the evident reaction in financial markets to announcements of future government debt reductions, discussed below,

10. These contributions are to be found in Blanchard (1981, 1985, and 1984, respectively).

11. Blanchard and Dornbusch (1984); Dornbusch (1986); Branson, Fraga, and Johnson (1985).

12. Feldstein (1984).

13. In Blanchard's (1985) model, for instance, future taxes are discounted at the rate of time preference *plus* the probability of dying in a given period, implying that government debt is part of net worth.

14. How this might happen was first identified by Mundell (1960) and later expanded on by Barro (1974).

along with a general incredulity that the strict assumptions of Ricardian equivalence actually hold (and the lack of convincing empirical support), leads us to consider the case in which government bonds are included in net worth.

As long as government debt is considered part of net worth, a path of declining government debt arising from a shift to fiscal surpluses offers the prospect of falling short-term real interest rates. This is the crux of expectational crowding out as discussed in the 1980s—or, in this case, expectational crowding in. The current price of a long-lived asset will incorporate the expectation of a fall in short-term real interest rates as soon as that expectation emerges, which may be well before the actual fiscal restraint is put in place. For instance, under the explanation of the term structure of interest rates based on expectations hypotheses, a long-term real interest rate should be a weighted average of current and expected future short-term real interest rates. As a result, as soon as budgetary restraint comes to be expected, the long-term rate should drop. Moreover, as long as the stock of government debt is declining, the long-term rate should be below the short-term rate, reflecting the expectations of lower future short-term rates embodied in the longer-maturity instrument.

Of course, long-maturity instruments might also include a risk premium in their return that provides an inducement to investors to lengthen the duration of their holdings. The important point relates to changes in returns: a new official commitment to lower debt levels should produce a more pronounced decline in longer-term rates at first, followed by a decline in short-term rates over time. That is, the term structure of real interest rates should flatten or even tilt downward. This statement holds both over time as the debt stock varies, and across countries as policies toward debt differ.

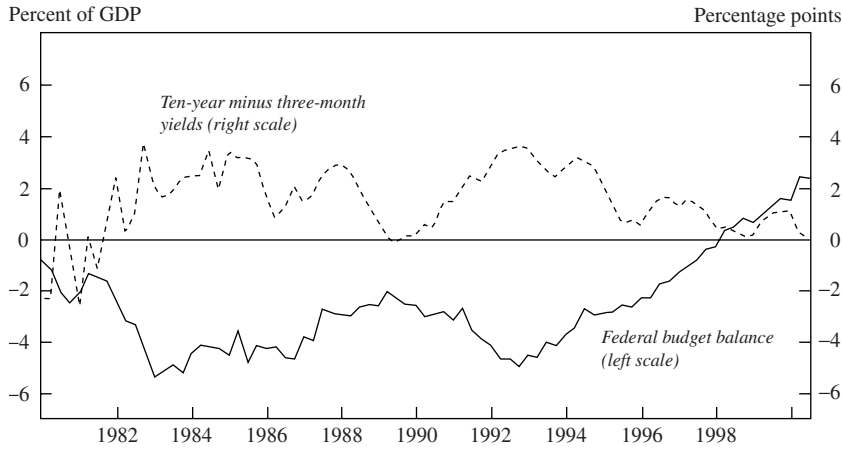
But expectational crowding in should work with other long-term assets as well. Equity prices and the present value of human capital should rise once investors and households come to anticipate that future earnings and income will be discounted at lower rates. If fiscal restraint were to occur in the United States alone, investors would also anticipate a growing disadvantage to holding dollar assets relative to holding foreign assets, as the U.S. short-term real interest rate would fall while the foreign rate remained unchanged. In such a circumstance, the dollar's value on foreign exchange

markets would likely fall. In essence, the prospect of weaker U.S. domestic aggregate demand would be matched by a decline in the dollar's value that would tip some additional foreign demand toward the United States. No such tipping of demand is required, however, if the move toward fiscal restraint is global in scope, as the previous section indicated. If other countries are also trimming their debt stocks, real short-term interest rates will be falling worldwide, and no rate-of-return disadvantage will arise. As global aggregate demand falls more or less evenly, declines in real short-term interest rates will crowd in spending everywhere, without the need for adjustments to exchange rates to shift demand from one country to another.

To test these predictions against actual data, we compiled annual observations on nineteen industrial countries since 1981 from successive issues of the *OECD Economic Outlook.* For each year we obtained the OECD staff's midyear forecast of the general government fiscal balance for the current and the following year relative to contemporaneous nominal GDP, as well as data on various asset prices in each country at the time of the forecast, including the three-month interest rate, the ten-year interest rate, and the trade-weighted real exchange rate. The database also includes OECD forecasts of a number of macroeconomic variables, including the unemployment rate, the rate of GDP growth, the inflation rate, and the level of government debt.

The crowding-in effects discussed above imply that expectations of a budget surplus should prompt the expectation that real short-term interest rates will decline over time. But because investor expectations are not directly observed, we must make an inference about them based on asset prices observed at the time or on the realized path of real short-term interest rates. For instance, the movements in the slope of the U.S. term structure and the budget balance shown in figure 3 support the view that long-term interest rates come to embody anticipations of short-term rate movements associated with changes in the fiscal outlook. The U.S. fiscal balance deteriorated considerably in the early 1980s and again in the early 1990s, and the yield curve steepened noticeably during both periods. Of course, each of these episodes came immediately after a recession that could have worsened the fiscal balance and increased the slope of the yield curve as monetary policy eased. However, the experience of recent years suggests that the fiscal balance may have an independent effect. Indeed, since the early

Figure 3. U.S. Federal Budget Balance and Spread between Long- and Short-Term Treasury Yields, 1980–2000[a]



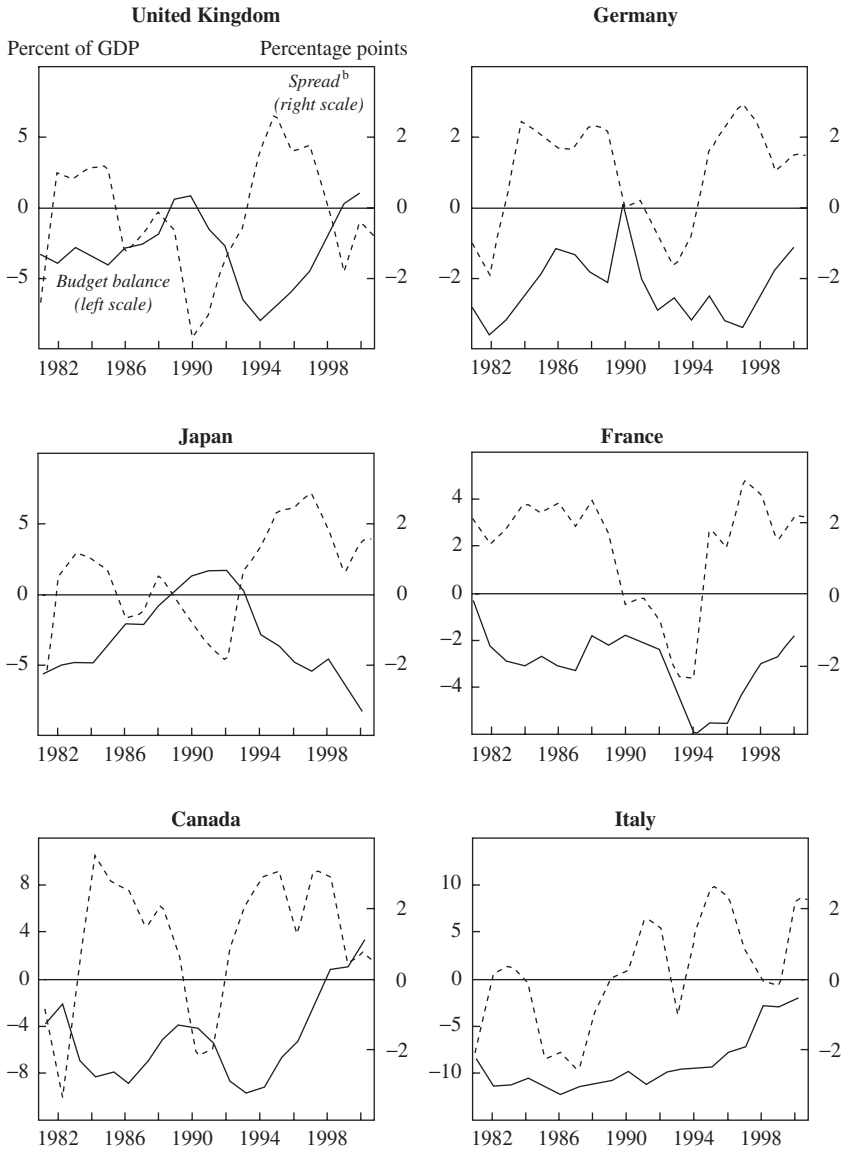
Sources: Bureau of Economic Analysis, National Income and Product Accounts; *Federal Reserve Bulletin*, various issues.
a. Through the second quarter.

1990s the Treasury yield curve has flattened considerably as the budget has moved from sizable deficits to surpluses.

The same pattern emerges for other countries to varying degrees, as figure 4 shows. The United Kingdom witnessed a sharp inversion of its yield curve in the late 1980s, when its fiscal balance moved into surplus. The yield curve then steepened as the budget deteriorated in the early 1990s, but it has once again inverted with the improvement of the budget over recent years. Japan and Canada also show a negative correlation between the slope of the yield curve and the fiscal balance. In contrast, such a relationship is not evident in France, Germany, and Italy. France and Germany, for example, saw their yield curves suddenly invert in the early 1990s even as their fiscal positions were generally worsening. However, given the strong links to the foreign exchange market, that inversion most likely reflects the response to an increase in short-term rates that followed the breakup of the European Monetary System in 1992.

A more stringent test of the crowding-out hypothesis is to look for this relationship between fiscal policy and the slope of the yield curve across a panel of developed economies, allowing for other factors that may affect

Figure 4. General Government Budget Balances and Interest Spreads on Government Debt, 1980–2000[a]



Source: *OECD Economic Outlook*, June 2000.

a. Through the second quarter. Budget data for 2000 are projections.

b. Ten-year yield minus the three-month yield.

interest rates.[15] To do so, we regressed the spread between the ten-year government interest rate and the three-month rate on the budget surplus as a percentage of GDP projected for the following year.[16] Of course, a number of factors that might be correlated with the projected surplus, such as the stage of the business cycle and inflation expectations, can also influence the shape of the yield curve. To control for these effects, we included in the regression the OECD's forecasts of the rate of inflation, unemployment, and real GDP growth for the following year.

The results of this regression are presented in the first two columns of table 2 for two different samples: the full panel of nineteen countries and the G-7 alone. The regressions allow for fixed effects, and the standard errors are corrected for heteroskedasticity and serial correlation. As the adjusted R^2 statistics indicate, these variables explain 44 percent or more of the variation in the slope of the yield curve for both samples. More important, the outlook for fiscal policy appears to be an important determinant of that slope. An improvement in the budget by 1 percent of GDP flattens the yield curve by 9 to 12 basis points. The results for the G-7 sample suggest that the observed swing in the expected U.S. budget balance from a 3 percent deficit in 1994 to a surplus of nearly 2½ percent in 2000 would have been expected to flatten the yield curve by about 67 basis points.

All the macroeconomic variables in the regression enter significantly and have reasonable coefficients. Higher expected inflation or higher expected GDP growth tends to steepen the yield curve, possibly because these variables are indicators of future monetary tightening. Higher expected inflation, if accompanied by the perception of greater inflation risk, might also increase the risk premium on longer-term government securities. The yield curve tends to steepen during periods of high unemployment as well, probably because monetary policy may be loose during those periods. The lagged short-term interest rate also appears to capture

15. The sample includes the G-7 countries (the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada) and twelve other industrial countries (Australia, Austria, Belgium, Denmark, Finland, Iceland, Ireland, the Netherlands, Norway, Portugal, Spain, and Sweden). The data are annual and date back to 1981 for most countries, resulting in a total of 325 observations.

16. The budget surplus is adjusted for expected inflation so that it more closely represents the expected change in the real level of government debt.

Table 2. Explaining Interest Rate Behavior with Government Fiscal Balances[a]

	Dependent variable			
	Yield curve slope[b]		*Real interest rate change*[c]	
Independent variable	*OECD*	*G-7*	*OECD*	*G-7*
Projected government surplus[d]	–0.088** (–2.46)	–0.122** (–2.08)	–0.064 (–0.46)	–0.452** (–3.96)
Projected GDP growth	0.341** (3.91)	0.349** (2.48)	–0.257 (–0.95)	0.153 (0.79)
Projected inflation rate	0.247** (5.22)	0.282** (4.08)	0.743** (4.85)	0.944** (6.34)
Projected unemployment rate	0.176** (4.62)	0.361** (4.36)	0.304** (3.05)	0.590** (3.56)
Lagged short-term interest rate	–0.249** (–8.60)	–0.282** (–5.96)	–0.249** (–2.63)	–0.431** (–4.04)
Summary statistics				
Adjusted R^2	0.45	0.44	0.16	0.26
No. of observations	310	133	215	98

Source: Authors' calculations based on annual data over 1981–2000 from *OECD Economic Outlook*.

a. The OECD sample contains nineteen countries. All specifications control for fixed effects. Standard errors are robust to heteroskedasticity and serial correlation. Numbers in parentheses are t statistics. ** denotes significance at the 5 percent level.

b. Difference between ten-year and three-month interest rates, measured in percentage points.

c. Realized change in short-term real interest rates over the subsequent five years, measured in percentage points.

d. Percent of GDP.

the impact of the stance of monetary policy, as the yield curve tends to be flatter when the short-term interest rate is high.[17]

Other authors have arrived at mixed results regarding the impact of fiscal developments on interest rates, which is not surprising given the tenuous relationship between the slope of the yield curve and the budget balance in other countries (figure 4). One strand of the literature attempts to measure the reaction of interest rates to exogenous changes in the fiscal outlook. Charles Plosser, for example, uses vector autoregressive analysis to mea-

17. It could be important to control for the level of government spending as well. Because we lack data on forecasts of government expenditure, we estimated a version of the equation (results not shown) that includes the actual ratio of expenditure to GDP for the following year. The magnitude and significance of the coefficient on the budget surplus increase under that specification, as higher expenditure reduces surpluses and apparently flattens the yield curve by temporarily pushing up the short-term interest rate.

sure monthly surprises in the fiscal outlook and finds no impact on the level of interest rates.[18] In contrast, Feldstein relies on a survey measure of the expected budget position and finds that the prospective five-year federal budget balance has a strong influence on the level of the long-term real interest rate in the United States.[19] The present paper similarly employs budget forecasts but instead examines the slope of the term structure and uses a panel data set. Exploiting the panel dimension of the data, we find a statistically significant relationship that would not have held in many countries had we estimated the equation country by country.

Of course, a number of factors, such as changes in inflation expectations and risk premiums, could be affecting the slope of the yield curve besides the expected path of real interest rates. It is difficult to decompose the influences on the yield curve into these various factors. However, an alternative approach is to investigate the impact of expected fiscal balances on the actual path of short-term real interest rates, in effect replacing expectations as reflected in the yield curve with the realized change in the short-term real interest rate over the subsequent five years.[20] Because the actual future path of the interest rate is used as the dependent variable rather than the expected path, the error term in the equation includes a forecast error. Under rational expectations, this forecast error will be uncorrelated with the other regressors, so that the coefficients of the regression will be unbiased. However, the dependent variable may be very noisy, as it will be influenced not just by expectations at the time of the budget forecasts but also by any additional news over the subsequent five years that affects the real interest rate. Thus it may be more difficult to identify the impact of fiscal balances than in the specification using forward-looking asset prices.

The last two columns of table 2 show the results from this specification. Although no significant effect is found in the nineteen OECD countries, perhaps because of other factors that affect future interest rates in the smaller countries, the projected surplus has a sizable and significant impact on the change in the real interest rate for the G-7 countries as a

18. Plosser (1987). Other papers along these lines include Plosser (1982) and Evans (1985, 1987a, 1987b).

19. Feldstein (1985).

20. The real interest rate is calculated by subtracting the forecasted inflation rate for the current year from the three-month interest rate.

group. Thus there is some evidence that the yield curve effects that we find reflect expectations of real interest rates, at least for the G-7 sample. The interpretation of the insignificant coefficient for the OECD sample is less clear.

As a final approach, we investigated whether this specification can predict movements in the real exchange rate. The results (not shown) indicate that budget surpluses have modest effects that are not significant for the OECD sample and marginally insignificant (at the 5 percent level) for the G-7 sample. One reason why these results may be weaker is that the exchange rate should depend on the relative fiscal positions of various countries rather than their absolute fiscal positions, as discussed above.

The empirical results indicate that fiscal balances are an important determinant of the shape of the yield curve across a number of countries, most likely because of their influence on the expected path of short-term real interest rates. According to these results, the improvement in fiscal balances throughout the OECD countries over recent years has likely led to a significant flattening of global yield curves. Indeed, fourteen of the eighteen countries in the sample that moved toward surpluses over recent years have seen a flattening in their yield curves. Aggregating across these markets, one would conclude that the global yield curve has realized a sizable repositioning over recent years owing to increased fiscal discipline around the world.

We have looked at only one influence of government budget positions on the economy, namely, their effect on the slope of the yield curve. That influence could have many consequences for the real economy over time. Perhaps most important, the fall in government debt and the attendant decline in long-term interest rates should encourage private investment, adding to the economy's potential to produce output.[21] Although this effect may depend on a number of conditions,[22] it can be seen in its simplest form through the following equation based on national income accounting:

$$\text{saving} = \text{investment} + \text{net exports}. \tag{1}$$

21. We implicitly rule out the possibility that the economy is dynamically inefficient, in which case having a higher debt stock could reduce the overaccumulation of capital and improve welfare.

22. As described in Friedman (1978).

Total saving is composed of both public and private saving, and net exports represent the accumulation of foreign assets by U.S. residents. Thus, this relationship can be rewritten as

$$\text{public saving} + \text{private saving} = \text{investment} + \text{net accumulation of foreign assets}, \tag{2}$$

which indicates that any saving in the economy—public or private—is invested either in domestic capital or in foreign assets.[23]

Under Ricardian equivalence, an exogenous change in public saving is offset one for one by a change in private saving with no impact on interest rates, so that there are no real effects on investment or on the net accumulation of foreign assets (both sides of the equation are unaffected). However, if Ricardian equivalence does not hold, an increase in public saving tends to push down the interest rate, as found in the regressions described above. In that circumstance, private saving will fall, but by less than the increase in public saving, because the fall in interest rates stimulates investment that must be financed by an increase in total saving. (If fiscal developments differ across countries, there will also be an impact on the exchange rate, so that the net accumulation of foreign assets would also adjust to bring the above identity into balance.)

Our results on interest rate effects do not directly address the effects on saving and investment. However, a number of authors have presented evidence suggesting that private saving does not fully offset changes in public saving one for one. Table 3 shows the components of the second equation above for the United States over various periods since 1960 (data for public saving include that by state and local governments in addition to the federal government). As Laurence Ball and Gregory Mankiw have pointed out, the decline in public saving beginning in the 1980s was not fully offset by an increase in private saving, resulting in a decline in total saving that may have contributed to the slowdown in investment and the deterioration of our foreign asset position.[24]

23. Bosworth (1993) reviews this basic national income accounting from a similar perspective.

24. Ball and Mankiw (1995).

Table 3. Saving and Investment in the United States, 1960–99
Percent of GDP

Component	*Average, 1960–81*	*Average, 1982–95*	*Change from 1960–81 to 1982–95*	*Average, 1996–99*	*Change from 1982–95 to 1996–99*
Saving					
Public	3.8	0.1	–3.7	3.2	3.1
Private	16.4	17.1	0.7	14.9	–2.2
Total	20.2	17.2	–3.0	18.1	0.9
Investment					
Domestic private	16.1	15.7	–0.4	17.0	1.3
Net foreign	0.4	–1.5	–1.9	–2.1	–0.6
Other[a]	3.7	3.1	–0.7	3.3	0.2

Source: Bureau of Economic Analysis, National Income and Product Accounts.
a. Includes government investment and statistical discrepancy.

Similar reasoning makes it tempting to consider the more recent experience of the U.S. economy as evidence of the benefits of increased fiscal discipline. As public saving has increased over the past several years, long-term interest rates have fallen and domestic investment has boomed. However, these events do not fit neatly into the crowding-in story, because the investment boom has been only partly financed by the increase in total saving. A fairly striking development over the past few years is that private saving has fallen off sharply, offsetting about two-thirds of the rise in public saving. Much of the increase in investment has instead been financed by foreign investors. The difficulty in interpreting these events arises because they have not been driven purely by an exogenous shift in fiscal policy, but also by a considerable pickup in U.S. productivity.[25] It is likely that this productivity growth has encouraged investment and stimulated capital inflows as a result of the higher real returns. In addition, to the extent it has contributed to the historic rise in stock prices, the productivity surge has pushed down the private saving rate in response to strong capital gains. To some extent, however, the increase in public saving has also contributed to the U.S. investment boom, as it has increased total saving and pushed interest rates below where they would otherwise be. For similar reasons, the increased fiscal discipline observed throughout the world should have encouraged investment and growth, given the considerable

25. Oliner and Sichel (1999) describe this development in detail.

impact that, in our estimates, fiscal discipline exerts on the shape of the global yield curve.

Portfolio Choice

In the previous section, the forces associated with fiscal restraint that have twisted the term structure of interest rates are due to current and expected future changes in real short-term rates required to stabilize the path of output. A change in fiscal policy, through its consequences for the stock of Treasury debt outstanding, could also alter risk premiums on a wide range of assets, subject to investors' risk tolerance and perception of risks. This general property has been the hallmark of the portfolio balance approach to asset pricing.[26]

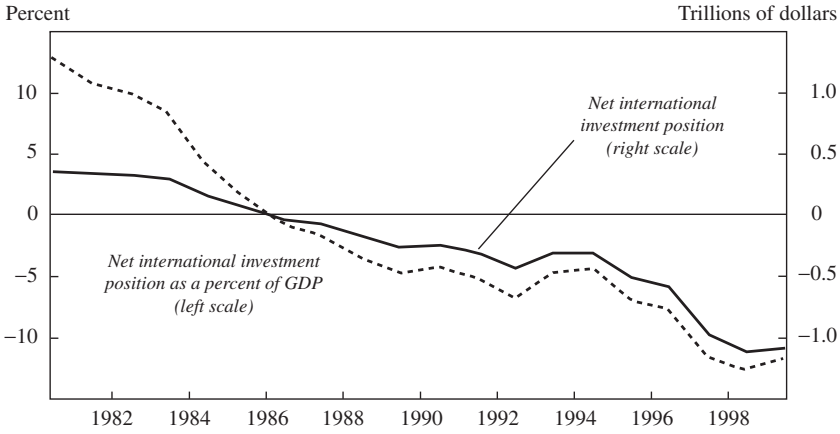
In the current context such portfolio implications of changes in the stock of government debt may hold particular force. Even as the U.S. federal budget has moved into surplus, the current account has continued to deteriorate. The overall current account balance for calendar year 1999 stood at around $350 billion, or 3½ percent of nominal GDP, slightly exceeding the record shares of the mid-1980s. Several factors should keep the current account in sizable deficit. These include strong income growth in the United States relative to its trading partners, a tendency for U.S. imports to be more sensitive to U.S. income than U.S. exports are to foreign income, and the starting position of a high level of imports compared with exports.[27] As already noted, the OECD projects that the U.S. current account deficit will run at about 4½ percent of nominal GDP in 2000 and 2001, which is unprecedented in the post–World War II experience.

These current account dynamics have striking implications for financial flows. The U.S. net external investment position has slid to more than $1 trillion in the red, and net foreign debt will continue to grow as long as the current account remains in deficit (figure 5). As the federal government has been paying down its debt, foreigners have accounted for a sharply increasing share of Treasury securities (table 4) and will eventually

26. This approach is associated with Tobin and Brainard (1963) and Tobin (1969) and has been explained systematically by Branson and Henderson (1984).

27. A recent description of the forces shaping current account dynamics can be found in Mann (1999).

Figure 5. Net International Investment Position, 1980–99



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

be forced, if they are not being forced already, to shift a greater amount of those holdings into nongovernment debt.

Portfolio theory indicates that the willingness of investors to hold assets of various types depends on the expected returns of available assets and the covariance between those returns. As the available supply of Treasuries

Table 4. Composition of Ownership of Treasury Securities, 1980–2000[a]

Holder	*1980*	*1985*	*1990*	*1995*	*2000*[b]
			Billions of dollars		
Held publicly	708.7	1,504.5	2,415.1	3,629.8	3,485.7
Federal Reserve	120.7	169.7	232.5	374.1	505.0
All others	588.0	1,334.8	2,182.6	3,255.7	2,980.7
			Percent of all others[c]		
Individuals	26.2	17.8	20.7	21.7	12.1
Depository institutions	22.8	18.0	11.0	11.0	8.3
Institutional investors[d]	12.6	26.2	26.1	27.8	28.1
State and local governments	15.3	18.4	18.4	9.0	8.7
Foreign official institutions	18.2	9.8	12.8	11.1	20.1
Other international investors	2.7	6.3	6.9	14.9	21.6
Other	2.2	3.5	4.1	4.6	1.2

Sources: *U.S. Treasury Bulletin*, various issues; Federal Reserve, Flow of Funds Accounts.
a. Estimates as of the end of the year except where noted otherwise.
b. Through June.
c. Percent of publicly held Treasury securities excluding Federal Reserve holdings.
d. Includes insurance companies, mutual funds, and pension funds.

shrinks, the relative returns on available assets will have to adjust to induce investors to shift out of Treasury securities and into other assets. According to the theory, the magnitude of this shift in expected returns depends crucially on the covariance of the returns on the alternative assets with the returns on Treasury securities.

These effects can be expressed using a simple portfolio model advanced by Frankel.[28] Consider an investor who chooses a portfolio so as to maximize his or her expected utility at the end of the period, where the utility function is quadratic in the expected returns on assets and the covariance of those returns. The investor can allocate his or her wealth into n different assets with excess returns (over the risk-free rate r^f) of r_{t+1}. Given the vector of portfolio shares $\mathbf{x}_t$ chosen, the investor's wealth at the end of the period, W_{t+1}, is expected to be

$$E_t(W_{t+1}) = W_t\left[\mathbf{x}_t' \; E_t(r_{t+1}) + 1 + E_t(r^f_{t+1})\right]. \tag{3}$$

This model can be used to show that the following relationship must hold between expected returns and portfolio shares:

$$E_t(r_{t+1}) = \rho \, \mathrm{cov}(r_{t+1}, r^f_{t+1}) + \rho \, \mathbf{\Omega} \, \mathbf{x}_t, \tag{4}$$

where ρ is the coefficient of relative risk aversion and $\mathbf{\Omega}$ represents the variance-covariance matrix of returns. This equation gives the expected returns that investors would require to hold a given set of portfolio shares. Alternatively, the equation can be inverted to express the portfolio shares as a function of the expected returns and covariances, in which case the equation represents asset demand equations.

Frankel used this relationship among portfolio shares, expected returns, and covariances to investigate whether an increase in government debt crowds out other assets by forcing them to have higher expected returns.[29] Here we explore the reverse question of how a sharp decline in outstanding U.S. Treasury debt would affect expected returns across a number of different assets.

The first step in this exercise is to characterize the portfolio of the global investor. Table 5 describes the market capitalizations of various categories

28. Frankel (1985). Similar applications of this method include Frankel and Engel (1984) and Friedman (1986), among others.

29. Frankel (1985).

Table 5. Market Capitalization of Selected Asset Classes, End of 1998[a]

Billions of dollars

Country or region	*Money market instruments*	*Bonds*				*Equities*
		Government	*Agency and mortgage-backed securities*	*Corporate*	*Total*	
Developed markets	5,160	9,236	3,785	4,104	25,484	25,065
United States	**1,864**	**3,061**	**3,321**	**1,830**	12,611	**15,413**
Europe	…	**3,892**	249	456	8,347	**7,720**
Japan	…	**2,292**	179	498	3,924	**2,496**
Emerging markets	…	…	…	…	**2,536**	**1,899**
World	5,160	…	…	…	28,020	26,964

Sources: Federal Reserve, Salomon Smith Barney, World Bank, and Bank for International Settlements.

a. Boldface type denotes items used in subsequent analyses.

of assets in global financial markets at the end of 1998. It shows that the $3.1 trillion in Treasury bonds (where bonds are defined as debt securities with original maturities of at least one year) outstanding at that time represented only about a quarter of the $12.6 trillion in outstanding bonds of all issuers in the United States. Bonds issued by U.S. government agencies and government-sponsored enterprises, including mortgage-backed securities, accounted for another $3.3 trillion, and U.S. nonfinancial corporate bonds totaled $1.8 trillion. The balance (not shown in the table) included bonds issued by state and local governments and by financial corporations.

The U.S. fixed-income market is the world's largest. Japanese institutions had only $3.9 trillion in bonds outstanding at the end of 1998, and those of the European countries were $8.3 trillion. A considerable portion of bonds in both Japan and Europe are government issued. The other major global issuers are the emerging market economies, which had $2.5 trillion outstanding as of the end of 1998, mostly denominated in developed-country currencies such as the dollar. These figures sum to about $28 trillion in bonds outstanding in the world economy at the end of 1998, a figure that slightly exceeds the market capitalization of global equity markets at about $27 trillion. Of that amount, the U.S. equity market accounted for about $15.4 trillion, or 57 percent, while European stock markets represented about $7.7 trillion. Looking across all assets, the global investor appears to hold about equal shares of equities and fixed-income securities, with half of those assets issued in U.S. markets.

Returns on various classes of financial assets can be measured using broad market indexes computed by Salomon Smith Barney, J. P. Morgan, and Morgan Stanley Capital International. These indexes cover four different categories of U.S. bonds as well as U.S. money markets (approximated by the one-month Treasury bill), U.S. equities, and government bonds and equities from Japan, Europe, and the emerging markets. Each index can be used to calculate the total return in dollars on a representative set of securities, weighted by their market capitalization, in a given asset class.

Table 6 provides summary statistics on the returns of those assets from the first quarter of 1991 to the second quarter of 2000. U.S. Treasury securities, for example, returned 7.4 percent a year, on average, over the sample, with a standard deviation of quarterly returns of 2.4 percentage points. Other U.S. bonds performed similarly, with returns that were highly cor-

Table 6. Returns on Selected Asset Classes, 1991–2000[a]

Percent, except where noted otherwise

Asset type	*Average annualized quarterly return*	*Standard deviation of return*	*Assumed portfolio share*	*Correlation with U.S. government bonds*[b]
U.S. Treasury bonds	7.35	2.39	6.6	1.00
U.S. agency bonds	7.34	2.37	2.8	0.99
U.S. mortgage-backed securities	7.23	1.78	4.4	0.89
U.S. corporate bonds	8.00	2.65	4.0	0.93
U.S. money market instruments	4.32	0.22	4.0	0.23
Japanese government bonds	9.29	7.85	4.9	0.22
European government bonds	5.27	4.86	8.4	0.42
Emerging market bonds	16.55	8.33	5.5	0.29
U.S. equities	18.64	5.23	33.3	0.27
Japanese equities	4.51	11.21	5.4	–0.08
European equities	14.80	5.60	16.7	0.10
Emerging market equities	11.16	12.66	4.1	–0.25

Sources: Authors' calculations based on quarterly data from Salomon Smith Barney, J.P. Morgan, Morgan Stanley Capital International.

a. Returns are calculated in U.S. dollars. Data for 2000 are through the second quarter.

b. Expressed as a correlation coefficient.

related with Treasury returns, as the last column shows. The U.S. money market index, which represented a nearly risk-free asset, had the lowest average return of all assets. Foreign bond indexes recorded a fairly wide range of performances. All equity indexes did extremely well over the sample period, with the exception of the Japanese stock market, which had a lower return than other equity markets and experienced considerable volatility. These indexes represent many of the major components of the global investor's portfolio, capturing the asset holdings printed in boldface in table 5. In the exercise that follows, we assume that these indexes represent the entire universe of assets available to the global investor, a simplification that ignores some other types of financial as well as nonfinancial assets.

Equipped with this snapshot of portfolio shares and the data on returns, we can use the model described above to assess what might happen to the relative returns of these asset classes if U.S. Treasury debt were to be paid off. The impact of a change in portfolio shares on the returns on the various

assets should depend on the coefficient of risk aversion and the covariance between the various asset returns, as follows:

$$d\left[E_t(r_{t+1})\right] = \rho\, \mathbf{\Omega}\, d(\mathbf{x}_t), \tag{5}$$

where d represents a differential with respect to time. The vector $\mathbf{x}_t$ now represents the portfolio shares of the various asset types listed in table 6, except the U.S. money market index, which is assumed to be the risk-free asset. The covariance matrix is calculated under the assumption that the expected return for each asset is constant over the sample.[30]

A couple of important assumptions underlie this equation. One is that the covariance between returns is itself unaffected by the disappearance of Treasury debt. There are a number of reasons why this assumption may not hold. For example, if Treasury debt is replaced by private debt in the market—a possibility that is explored shortly—the increased leverage by corporations could affect the probability of default and hence the uncertainty surrounding the returns on those securities. However, assuming that $\mathbf{\Omega}$ is unchanged should provide a useful approximation of the effects of the debt paydown. In addition, we have measured all returns in dollar terms. Hence the results apply most directly to dollar-based investors who invest across all global assets.[31]

Table 7 shows the changes in expected excess returns on the various assets that, according to the model, would result if the share of U.S. Treasury securities in investors' portfolios were to fall to zero. The impact depends on how the portfolio shares of other assets react to the disappearance of Treasuries. Over the past few years, as Treasury debt has disappeared, U.S. private debt has crowded in about one for one, keeping the ratio of total domestic nonfinancial debt to GDP relatively stable. In contrast, when Treasury debt mounted in the 1980s, total debt relative to GDP rose well above the relatively constant level that had prevailed since

30. We proxy expected returns by their realizations, which should be reasonable for long enough samples under the maintained rational expectations hypothesis. However, as Benjamin Friedman pointed out in response to an earlier draft of this paper, survey-based measures of expected returns would likely be less correlated than ex post returns, implying less substitutability among assets. Unfortunately, survey-based measures are not available for all the asset categories we have specified.

31. We ignore the impact of taxes on the relative returns of assets, which would be difficult to measure for the global investor.

Table 7. Changes in Expected Excess Returns on Selected Asset Classes from Eliminating Treasury Securities[a]

Basis points

	U.S. corporate bonds crowd in		*Foreign government bonds crowd in*		*All assets crowd in*	
Asset type	*Return*	*Spread*[b]	*Return*	*Spread*	*Return*	*Spread*
Coefficient of risk aversion = 2						
U.S. government bonds	0.1	0.0	–0.3	0.0	–1.5	0.0
U.S. agency bonds	0.3	0.2	–0.3	0.0	–1.2	0.3
U.S. mortgage-backed securities	0.3	0.2	–0.2	0.2	–0.6	0.9
U.S. corporate bonds	0.6	0.5	–0.2	0.1	–0.4	1.0
Japanese government bonds	–1.0	–1.1	8.1	8.5	–0.5	0.9
European government bonds	–0.4	–0.5	4.0	4.3	–2.3	–0.8
Emerging market bonds	2.0	1.9	3.7	4.0	8.3	9.8
U.S. equities	1.5	1.4	0.2	0.5	7.8	9.3
Japanese equities	0.5	0.4	6.4	6.7	9.8	11.3
European equities	1.3	1.2	2.3	2.6	8.6	10.1
Emerging market equities	2.7	2.6	8.2	8.5	19.8	21.3

(*continued*)

Table 7. (*continued*)
Basis points

Asset type	*U.S. corporate bonds crowd in*		*Foreign government bonds crowd in*		*All assets crowd in*	
	Return	*Spread*[b]	*Return*	*Spread*	*Return*	*Spread*
Coefficient of risk aversion = 23						
U.S. government bonds	1.2	0.0	–3.7	0.0	–17.3	0.0
U.S. agency bonds	3.2	2.0	–3.5	0.2	–13.8	3.6
U.S. mortgage-backed securities	3.5	2.3	–1.9	1.8	–6.8	10.6
U.S. corporate bonds	7.0	5.8	–2.9	0.8	–5.2	12.1
Japanese government bonds	–11.4	–12.6	95.4	99.1	–6.4	10.9
European government bonds	–4.6	–5.8	46.7	50.4	–26.7	–9.4
Emerging market bonds	24.0	22.8	42.9	46.6	97.6	115.0
U.S. equities	18.1	16.9	2.5	6.2	91.3	108.6
Japanese equities	6.1	4.9	75.3	79.0	114.9	132.2
European equities	15.5	14.3	27.1	30.8	101.4	118.7
Emerging market equities	32.2	31.0	95.7	99.4	232.5	249.8

Sources: Authors' calculations based on data from Salomon Smith Barney, J.P. Morgan, and Morgan Stanley Capital International.
a. Returns are calculated in U.S. dollars.
b. Difference between the return on the indicated asset and that on U.S. government bonds.

World War II.[32] In light of the various possibilities, we discuss three different scenarios.

Our first scenario explores the possibility that issuance of U.S. corporate bonds would increase in response to the decline in Treasury securities. As shown in the upper panel of table 7, under a coefficient of risk aversion of 2, this shift would have very little impact on the returns on all assets. In fact, the spread between the returns on corporate bonds and Treasuries would have to widen a mere ½ basis point to encourage investors to shift about 6½ percent of their portfolios—over $3 trillion—currently in Treasuries into corporate bonds. Although this seems a surprisingly small effect, the reason for it is fairly clear from the correlations of the returns. All U.S. fixed-income securities are highly correlated over the sample, so that shifting between those assets has little impact on the overall risk of investors' portfolios. Thus investors are willing to substitute readily between those assets, with little disruption to the returns on any asset.

These results, however, depend on the assumed coefficient of risk aversion. We can roughly calibrate the level of risk aversion using the snapshot of investor portfolio shares reported above. Given the average returns of the assets and their covariance matrix, we can use the model to assess the level of risk aversion needed to entice investors to hold the observed portfolio shares of various risky assets on average. A problem with this approach is that the limited data make the estimated parameter sensitive to each individual asset. Japanese equities are particularly influential, because they have a very low average return over the sample and a large amount of risk. Basing our estimate on U.S. assets alone, we find that a coefficient of relative risk aversion of 23 is needed to explain actual holdings.[33] Under this higher coefficient of risk aversion, as shown in the bottom panel of table 7, the impact of the paydown in Treasury debt increases but remains small. Indeed, the corporate yield spread would have to rise by

32. Friedman has noted, in a number of papers (for example, Friedman, 1982), the stability of the ratio of total nonfinancial debt to GDP through the early 1980s.

33. Although this coefficient seems high, it is still well below that found by Frankel (1985), who estimated it to be in the neighborhood of 110. There are a number of differences between the data used by Frankel and those used here. Frankel considers annual returns on tangible assets, long-term federal debt, state and local debt, corporate bonds, and equities over the period from 1954 to 1980. Our own analyses using a risk aversion coefficient of 110 resulted in a predicted widening of the spread on corporate yields over Treasuries of only 28 basis points.

only 6 basis points to entice investors to shift completely out of Treasury securities and into U.S. corporate bonds.

Larger shifts in relative returns are needed for other assets to crowd in to replace declining Treasury securities. Foreign government bonds, for example, are not close substitutes for Treasury securities, in part because of exchange rate risk. In our second scenario, under the higher risk aversion coefficient, annual returns on foreign bonds would have to increase about ½ to 1 percentage point above returns on U.S. Treasuries for investors to be willing to shift all of their present Treasury holdings into those securities. The increase in holdings of foreign bonds also would cause returns on foreign equity markets to rise sharply but would have little effect on the U.S. equity market. The reason is that foreign equity returns tend to be positively correlated with foreign bond returns, in part because the exchange rate is a common factor. Investors would prefer to shed some of that common risk by selling foreign equities and would only maintain their holdings if they received greater compensation on those securities.

Our final scenario assumes that all types of financial assets crowd in the decline in Treasury debt by amounts proportional to their initial portfolio weights. For this to happen, the expected returns on various equity indexes would have to rise by amounts ranging from nearly 1 percentage point for the U.S. market to over 2¼ percentage points for emerging markets, in the case where the coefficient of risk aversion is 2. This increase in expected returns is needed for investors to bear the risk of increasing their equity holdings, which jump more than $1¾ trillion across these markets. In this scenario Treasury yields would fall 17 basis points, and the U.S. corporate yield spread would widen by 12 basis points. Japanese and European government bond returns would decrease slightly. This is the net effect of two opposing forces, with the decline in Treasury yields pulling their returns down, and higher returns on foreign equities pulling them up. Emerging market bond returns would instead increase noticeably, as they are more risky and more highly correlated with equity returns.

Although this exercise does not directly address which asset type might replace Treasuries on investors' balance sheets, the results suggest that U.S. corporate, agency, and mortgage-backed debt securities are the most likely candidates. Because returns on these securities are highly correlated with returns on Treasuries, it appears that U.S. corporations and agencies could step up their issuance of debt securities in the wake of Treasury debt paydowns with little disruption to financial markets. It is no coinci-

dence that Fannie Mae and Freddie Mac have made significant efforts in recent years to increase their issuance (as discussed in the next section).[34] By contrast, the results suggest that any increase in the issuance of international debt securities or equities would require a more sizable increase in the returns on those securities, which may deter issuance.

In summary, according to the model, the disappearance of Treasury securities would require only small adjustments to the relative returns of various financial assets, particularly if U.S. agency and corporate debt securities crowd in much of the decline in Treasury securities. As noted, to entice investors to completely shift their Treasury holdings into U.S. corporate bonds, the corporate yield spread would have to widen by a mere 6 basis points under a coefficient of risk aversion of 23.

The modest impact on relative asset returns suggested by this empirical exercise seems inconsistent with the widespread concern expressed by market participants over the shrinking supply of Treasury debt. The prospect of declining availability of Treasury securities has coincided with large movements in their yields relative to those of other fixed-income assets. Spreads between ten-year agency and corporate yields and the yield on the ten-year Treasury note widened considerably in early 2000. Many market participants have attributed this widening to a "scarcity premium" on Treasury securities, which has intensified this year with the release of CBO budget forecasts indicating that the outstanding Treasury debt held by private investors could be paid down nearly in full during this decade.

The continued demand for U.S. Treasury securities despite the sharp widening of yield spreads may arise from several characteristics that distinguish Treasuries from other fixed-income securities.[35] First, Treasury securities are regarded as being free of credit risk, because payments of principal and interest on those securities are backed by the full faith and credit of the U.S. government. Second, Treasury securities are extraordinarily liquid compared with most other fixed-income securities. The empirical exercise above does not capture the importance of these characteristics to particular classes of investors.

Indeed, it is not clear to what extent other fixed-income securities could substitute for the safety and liquidity of Treasury securities. The liquidity

34. These securities also mimic the characteristics of Treasury securities that contribute to their liquidity.

35. See Dupont and Sack (1999) for a comprehensive description of the Treasury market.

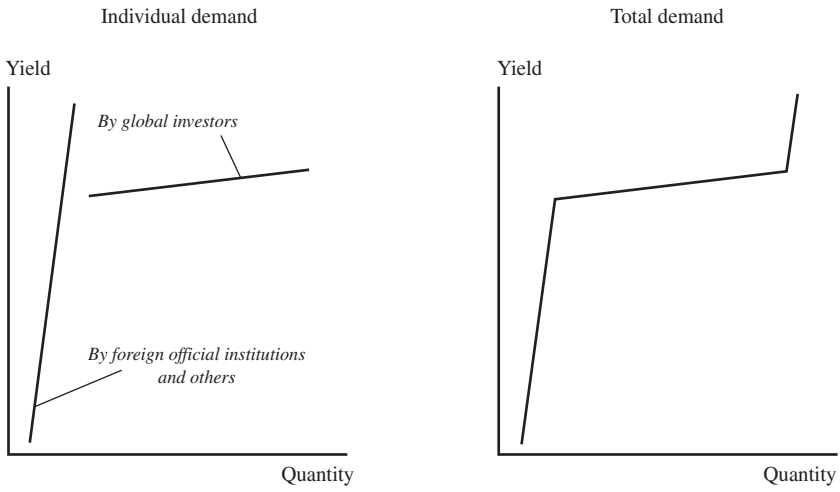
of some other securities has increased and could, in principle, eventually rival that of Treasuries. However, as discussed in the following section, the magnitude and the speed of shifts in market liquidity are very unpredictable. Replicating the safety of Treasury securities may be even more difficult. In the extreme, if government debt does disappear, investors will no longer have the certainty of repayment in nominal or real terms provided by holding, respectively, conventional or inflation-indexed Treasury securities. Those default-free obligations allow investors the opportunity of reducing the total risk exposure of their portfolios according to their appetite for bearing risk. In that sense the presence of risk-free Treasury debt can be thought of as helping to complete markets. Presumably, a welfare loss would be incurred if households no longer had recourse to such obligations.[36] Of course, the force of this argument would be lessened over time should progress in financial engineering result in instruments that increasingly mimic the characteristics of Treasury securities.

For now, however, the availability of adequate substitutes seems limited, as evidenced by the considerable premium that some investors have been willing to pay for Treasury securities. Among these investors, foreign official institutions have been accumulating an increasing share of Treasury securities (table 4), which has nearly doubled over the past five years. Such institutions likely place great importance on liquidity and would view a default on their holdings as having more significant repercussions than is captured by the mean-variance framework above. As a result, these institutions would likely be unwilling to substitute alternative assets for Treasuries at the narrow yield spreads indicated by our empirical results. The same may be true to some degree for a wider range of investors who hold Treasury securities, making their demand more inelastic than suggested above.

Total demand for Treasury securities may therefore be an aggregation over global investors who have very elastic demand, which our mean-variance optimization accurately represents, and other holders, possibly including foreign official institutions, who are much less sensitive to current market yields. These individual demands, illustrated in the left-hand panel of figure 6, aggregate to the kinked demand schedule in the right-hand panel. In such circumstances, calculations of the consequence of a

36. Milne (1995, chapter 3) offers an analysis of welfare and portfolio decisions with incomplete financial markets.

Figure 6. Aggregation of Demands for Treasury Securities



small shift in supply cannot be scaled up to infer the effects of a large shift, because such a shift would move the market from the flat portion of its demand schedule to the steep portion. That is, the shrinking supply of Treasuries would increasingly be held by only those investors who value them the most. Realizing this, investors would incorporate these expectations into asset prices today, causing yields to fall even though the marginal investor is still the global investor.

The critical question is why some classes of investors desire to hold Treasury securities even when yields are relatively low. On the one hand, if this interest-insensitive demand reflects a desire for the default-free status that only Treasury securities provide, these investors presumably would continue to bid to maintain those holdings—and would do so increasingly aggressively—as the national debt shrinks. This would cause returns on government debt to fall even lower. However, even these investors may eventually be forced to shed their Treasuries as the supply disappears. That could have considerable implications for international capital flows and the exchange value of the dollar, depending on which securities these investors choose as substitutes. The impact would be limited if these investors decided to maintain dollar-based holdings but to take on some credit risk by holding private assets. However, if they instead should decide to shift their holdings into foreign government bonds, for

example, the result could be sizable capital outflows that would limit the United States' ability to finance its large current account deficit. The potential magnitudes of these flows are large, considering that foreign official institutions' holdings of Treasuries alone total $600 billion, well over 1½ times the amount needed to finance last year's current account deficit.

On the other hand, if these interest-insensitive investors are holding Treasury securities because they desire to be in the most liquid market, they might be easier to dislodge—without putting strong downward pressure on government yields or causing sharp movements in the exchange rate—if another benchmark asset becomes established. That is, the nearly vertical segment of the demand schedule in figure 6 could disappear if these investors suddenly shifted to the new liquid instrument. But in order to consider this possibility we must first discuss the unique nature of Treasury market liquidity.

The Self-Referencing Nature of Market Liquidity

The Treasury market is remarkably liquid, as evidenced by a large volume of trading at narrow spreads. Daily transactions in Treasury securities of primary dealers alone averaged about $200 billion over the first three quarters of 2000.[37] Because of this extensive trading and the high degree of competition and transparency among dealers, transactions costs in the Treasury market are very low. Although these costs vary from one security to another, dealers typically make markets at bid-offer spreads of 3.1 cents or less per $100 face value; by comparison, bid-offer spreads on corporate bonds average about 13.3 cents per $100 for investment-grade issues and 19.1 cents for high-yield issues.[38]

The size of the Treasury market has likely contributed to its liquidity. Even after the recent paydown of some Treasury debt, more than $3 trillion in marketable Treasury securities remained in the hands of the public as of June 2000. Also contributing to the liquidity of the Treasury market are the various active derivatives contracts written on Treasury securities, including futures on securities in various maturity ranges and options on

37. Federal Reserve Bank of New York (www.ny.frb.org/pihome/statistics/msytd.00).

38. Federal Reserve Bank of New York data; figures for corporate debt securities are from Hong and Warga (2000).

those futures listed by the Chicago Board of Trade. A huge market for repurchase agreements (repos) on Treasury securities also exists, which is crucial for allowing market participants to establish long and short positions without committing much capital.

Besides making them highly valuable to many types of investors, the liquidity of Treasury securities allows them to serve several important functions in global financial markets. Treasury securities are extensively used in hedging interest rate exposure and in pricing other fixed-income securities. In part because of these functions, Treasury securities are often referred to as benchmarks in the fixed-income market. Market participants often find it convenient to quote corporate bonds in terms of the spread between their yields and that of a Treasury security of comparable maturity. Any spread over the default-free Treasury base rate largely represents compensation for credit risk and not other factors that may influence yields. The liquidity of Treasury securities ensures that the quoted yield available at a particular time is never stale, but rather reflects current market conditions.

Liquidity is perhaps even more important for the use of Treasury securities as hedging instruments. The deep market for Treasury securities allows market participants to establish large positions and change them quickly at low cost, as is needed for hedging purposes. Indeed, on average over the first three quarters of 2000, primary dealers reported having an aggregate of $119 billion in long positions in Treasury securities and $171 billion in short positions.[39] Many of these positions were established to hedge the interest rate risk of positions in other fixed-income securities, whereas others may simply reflect portfolio decisions or market-making activity. The use of Treasury securities for hedging and other trading-related purposes in turn further contributes to the market's liquidity.

Although the liquidity of the Treasury market remains impressive, it appears to have deteriorated somewhat in recent years. Market participants have become increasingly concerned about the outlook for the continued paydown of Treasury debt, and they question whether the Treasury will be able to maintain large, regular offerings of new issues much longer.[40] Large issue sizes make a security easier to find in the market when an

39. *Federal Reserve Bulletin*, September 2000.

40. For a more detailed discussion of the liquidity issues surrounding the federal debt paydown, see Fleming (this volume).

investor wants to trade. Regular issuance allows investors to anticipate when they can roll their hedging positions into a new issue, and it facilitates the longer-term repo transactions used to establish those positions.

Partly because of these concerns, dealers are reportedly committing less capital to market-making activity in Treasury securities and have been requiring a larger spread for engaging in transactions. Bid-ask spreads on five- and ten-year Treasury notes, which initially widened during the financial market turmoil in the fall of 1998, have remained elevated over 1999 and 2000, as the liquidity of the market has not fully recovered. Moreover, investors have been willing to pay unusually large premiums for the most liquid Treasury securities, especially on-the-run issues, which are the most recently issued securities in each maturity class. Those premiums widened considerably during the fall of 1998, as investors became more concerned about liquidity, and have remained quite wide since then, partly reflecting the impact of cutbacks in the supply of on-the-run issues in the presence of continued strong demand for liquid benchmark securities.

The deterioration in the liquidity of Treasury securities and the idiosyncratic movements in their yields, driven by their potential scarcity, have led market participants to search for alternative liquid securities that might be able to replace Treasuries as benchmarks. The two most widely discussed alternatives are the debt securities issued by several government-sponsored enterprises, and swaps to exchange fixed and floating interest rate payments in dollars.

Fannie Mae and Freddie Mac, which are congressionally chartered private entities, have initiated programs to issue large amounts of debt securities on a regular schedule. The securities issued under these programs attempt to mimic the characteristics of Treasury securities that have contributed to their liquidity. Trading volume and dealer positions in agency securities have risen sharply since 1998, when data first became available, and these securities have reportedly become more actively traded in overnight and term repo markets. Similarly, open interest in futures on ten-year agency notes, which the Chicago Board of Trade only began offering in March, has picked up impressively, although it remains only a small fraction of open interest in the ten-year Treasury note.

The market for interest rate swaps has also become considerably more active in recent years. By engaging in a swap to exchange fixed and floating streams of interest payments, two parties can establish offsetting exposures to interest rate risk with little commitment of capital. This makes

swaps an appealing instrument for hedging. Anecdotal evidence indicates that some market participants have begun to shift their hedging away from Treasury securities and into swaps. Data on swaps market activity are not as readily available as are data for agency securities, but the notional amount of outstanding interest rate swaps reported by the Bank for International Settlements increased a remarkable 129 percent from 1996 to 1999.[41]

Despite some evidence of a shift in liquidity in the U.S. fixed-income market, the extent to which these securities will become liquid alternatives to Treasury securities is not yet clear. One reason is that changes in investors' participation in a market can have highly nonlinear effects on market liquidity due to the externalities generated by trading. The overwhelming majority of debt instruments are bought and sold on the over-the-counter market, where trading conventions evolve based on prevailing practices. In this environment a small change in the willingness of investors to participate can cause a fairly sharp contraction in market activity.[42] Treasury securities remain the market benchmark only because participants believe that most other participants also think of them as the benchmark. In other words, market participants commit to trade in Treasury securities because they expect others to do so. Should they come to believe that others will not participate, neither will they, and the result will be a self-fulfilling prophecy. Thus the mere threat that Treasuries could lose their benchmark status could have serious consequences for market activity.

We can make this explicit by modeling trading as an activity needing aggregate effort on both the buy and the sell side. For simplicity, suppose there are two agents, j and k, and that the benefit (B^j and B^k, respectively) each accrues from an activity is increasing in the agent's own participation (p^j and p^k, respectively) and that of the other agent (p^k and p^j, respectively), who has a symmetric benefit calculus. If there is a constant marginal cost c to participating, each potential entrant will equate marginal cost and benefit for possible levels of the other's participation. This individual choice problem traces out a locus of participation as a function of that of the other agent, which depends on the functional form of benefits. For example, suppose that the benefit that agent j accrues from participation can be expressed as

41. Bank for International Settlements (2000).

42. More complicated interactions of individual choice and aggregate outcomes are discussed by Schelling (1978) and are more formally modeled by Katz and Shapiro (1985, 1986) and Economides (1994).

$$B_j = A p_j^{\alpha}\ p_k^{\beta}. \tag{6}$$

This specification reflects both diminishing marginal returns to personal activity and a positive externality conveyed by the other's effort. Cost is assumed to be proportional to scale:

$$C_j = c p_j. \tag{7}$$

We assume that the externalities are limited, so that each agent benefits directly from his or her own participation more than he or she benefits indirectly from the participation of the other agent ($\alpha > \beta$). Also, marginal benefit is diminishing in aggregate participation, $\alpha + \beta < 1$.

Under these assumptions, equating marginal benefit with the constant marginal cost of participation implies that the optimal degree of effort by agent *j* is

$$p_j = \left(\frac{\alpha\ A p_k^{\beta}}{c} \right)^{\frac{1}{1-\alpha}}. \tag{8}$$

Participation is increasing in the participation of the other agent, steeply at first because the marginal benefit of one's own effort is high. Ultimately, however, diminishing returns set in.

The other potential participant, agent *k*, confronts exactly the same calculation, which produces a participation function mirroring that of agent *j*. Because the two schedules are mirror images, the market clears when the effort of both participants is equal (solid lines in figure 7). Algebraically, there are two fixed points at which effort is equal, $p_1 = p_2 = p^*$:

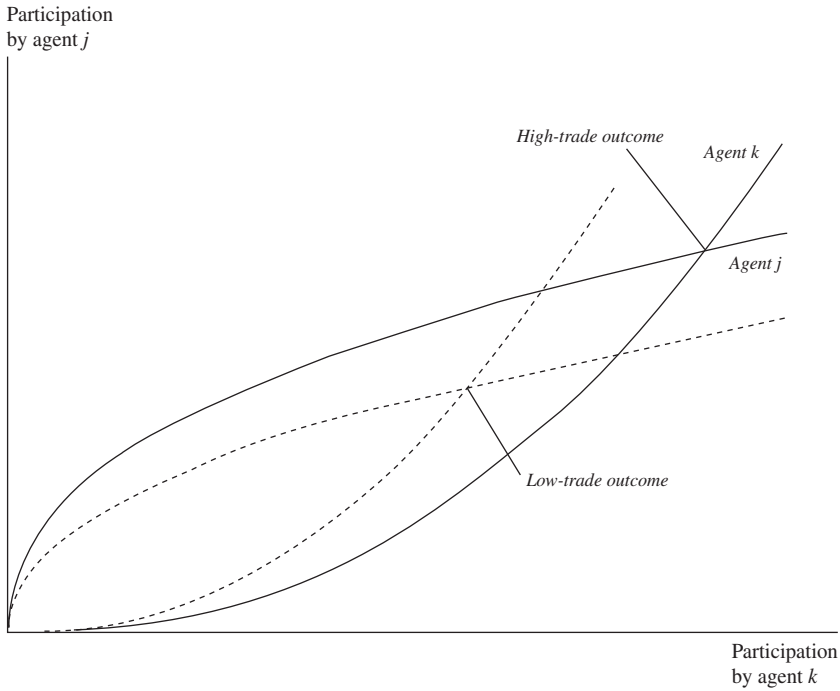
$$p^* = \left(\frac{\alpha\ A}{c} \right)^{\frac{1-\alpha}{1-\alpha-\beta}}, \tag{9}$$

and trivially, $p^* = 0$.

The point that this model makes is simple: there are two possible outcomes, one with high participation by both parties and one with zero participation.[43] Although the high-trade outcome makes both parties better off, there is no guarantee that they will achieve that outcome if they are not

43. There could also be an outcome with small, but positive, participation rates. Such an outcome would result, for example, if agent *j* benefited from the participation of agent *k* only above some fixed threshold.

Figure 7. Theoretical Determination of Treasury Market Participation



allowed to communicate. And communication is difficult given the mistrust between entities that provide similar services to the same client base, and given the problems of antitrust enforcement. The situation resembles a classic prisoners' dilemma.

Perhaps market participants will recognize their self-interest and voluntarily and independently choose the high-trade outcome, but again there is no guarantee—that is the prisoner's dilemma. Market convention, the creation of an industry group that sets standards, and government leadership are among the means available to allow parties to cooperate in finding the high-trade outcome without trusting to luck or to private communication between rivals. Importantly, this might be an area where the size of the market matters. In the last half of the twentieth century, the sheer magnitude of Treasury securities outstanding, and the expectation that they would be around for a while to come, offered reassurance that the high-trade outcome could be supported. As an infrastructure developed around

these joint but uncoordinated decisions, market conventions strengthened the retention of that outcome.

The prospect of a paydown of government debt, however, could perturb that equilibrium. This disturbance can be translated into the model by raising the cost to trade. Such a change lowers the benefits associated with participation by the other person and raises the cost of one's own participation. This pulls both offer curves toward the origin and, because the two curves are highly nonlinear, may produce a large reduction in participation for even small revisions to benefits or costs (dashed lines in figure 7). Indeed, that reassessment might lead participants to doubt the power of market convention to enforce the high-trade outcome. Thus, depending on the market, volume could decline dramatically or even dry up altogether.

The Treasury bill market perhaps provides a case study of what happens when market participants come to doubt that the high-trade outcome will be sustained. Historically, issuance of Treasury bills has served as a shock absorber, balancing the government's overall need for funds with a desire to keep auction amounts of coupon securities as predictable as possible. When tax coffers began to bulge unexpectedly in 1997 and 1998, the Treasury trimmed bill issuance first and by more than its other offerings. In the six quarters beginning in April 1997, the Treasury paid down nearly $150 billion, or about 19 percent, of the amount of bills outstanding. Since then both trading volume and dealer positions in bills have moved considerably lower: average daily trading volume has fallen from $51½ billion in 1996 to $25½ billion by 2000 (figure 8). What is particularly instructive in that example is the speed and extent to which market participants changed their perception of the market benchmark. Discussions with market participants indicate that the market has increasingly viewed Eurodollar cash and futures as replacing Treasury bills as the benchmark securities at shorter maturities. Lou Crandall points out that this transition began many years earlier,[44] but the cutbacks in bill issuance over recent years have likely accelerated the shift.

Going forward, the important issue is whether a similar shift will be observed among coupon securities. As figure 8 shows, although trading volume in Treasury coupon securities has remained fairly steady, market activity in agency debt securities has picked up sharply. Moreover, the evi-

44. Crandall (1999).

Figure 8. Average Daily Trading Volume in Treasury and Agency Debt Markets, 1996–2000[a]

Sources: *Federal Reserve Bulletin*, various issues.
a. Through August.
b. Includes coupon securities and discount notes.

dence cited above indicates that liquidity in the coupon sector has deteriorated somewhat over recent years. The model suggests that a shift in activity, if it does take place, may be uneven and unpredictable.

The stakes involved in becoming the next benchmark are quite large. From the perspective of an alternative issuer, efforts to reduce the costs of trading in its own issues and to increase market confidence that a high-trade outcome in that market segment will ensue may be rewarded with significant savings on borrowing costs. Moreover, if an issuer is able to achieve benchmark status, the liquidity of its securities will tend to reinforce that status. Hence the potential shift in activity in fixed-income markets over the next several years may have implications that will persist for some time.

The potential shift also has implications for the U.S. government, because the depth and breadth of the Treasury market have long given the government access to cheaper funding than other issuers. Given the self-reinforcing nature of market liquidity, that avenue to funding may be costly to rebuild should it fall into disrepair. In framing their current debt management strategy, the national authorities have to consider their confidence in projections that budget surpluses will continue to the point where debt disappears. They must also consider how soon thereafter adverse demographic trends will cause budget deficits to recur, forcing the government to return to the market. Under current projections, the disappearance of the debt will come soon, and its reappearance seems remote.

But a breakdown in the political consensus on fiscal restraint, or a stumble in economic performance, could quickly change that outlook.[45] Thus the path of declining Treasury debt and the associated withdrawal of market liquidity are subject to considerable uncertainty. In such an environment, continuing to issue debt (either by relaxing fiscal restraint or by accumulating assets) has an option value, keeping the market viable on the possibility that it will be needed again in the future.[46] Such considerations, of course, have to be weighed against the macroeconomic benefits, which include the crowding in of physical capital as debt disappears.

Conclusion

Considerable attention has been directed toward official projections that U.S. federal budget surpluses will accumulate to the point that, with unchanged fiscal policies, Treasury debt will be paid down early in the next decade. Less attention has been paid to projections of central government budget balances in many industrial countries that are similar to that in the United States. From the perspective of the global economy, if current policies continue, current and expected future fiscal restraint should lessen demands on the pool of available world saving. This can be viewed as the mirror image of the huge federal deficits of the early 1980s. Economists at that time pointed out that prices of long-lived instruments bring forward expectations of pressures on short-term interest rates associated with projected budgetary excesses. By analogy to the 1980s precedent, expectations of future fiscal restraint should now be holding long-term interest rates down. Indeed, a panel data set of nineteen countries indicates that fiscal policy has been an important factor in the recent flattening of yield curves in many countries worldwide.

In the United States, budget surpluses have coincided with a widening current account deficit. Basic accounting dictates that, as long as that deficit persists, foreign investors will be adding claims on U.S. entities to their portfolios. However, as budget surpluses mount and Treasury debt is paid down, foreigners either will have to be satisfied increasingly with pri-

45. This is a point that Auerbach and Gale (2000) emphasize.

46. Allowing the Treasury market to disappear could be thought of as akin to having to make an irreversible investment in an environment of great uncertainty, a topic treated formally by Dixit and Pindyck (1994).

vate obligations or will have to bid the remaining Treasury obligations away from domestic holders. This could require considerable changes in market prices if foreign investors have a strong preference for U.S. Treasury obligations. Analysis using a portfolio balance model, however, finds that the implications for the foreign exchange value of the dollar are not obvious, because other market returns, including public-private interest rate spreads, also can adjust. And given the high correlation among rates of return across major classes of financial assets, a mean-variance optimization approach projects quite modest changes in risk premiums.

Any discussion of paydowns of government debt also has to consider the adjustments in the structure of financial markets attendant on the disappearance of benchmark securities. If market liquidity is self-referencing in nature—that is, if market participants frequent a particular trading venue because they expect others to do the same—the drying up of liquidity in the Treasury market and the emergence of an alternative benchmark could follow a nonlinear path.

Although we have considered these various factors separately, their effect on interest rates is not necessarily additive. By itself, the dwindling supply of Treasury securities should work to lower longer-term yields on those securities when, as is probably the case today, it reflects a fiscal policy path that investors anticipate will put downward pressure on real interest rates over time. Because these developments also imply a markedly declining share of Treasury securities in the portfolios of investors who view other assets as imperfect substitutes, Treasury yields may fall somewhat more quickly than the returns on other assets. At the same time, however, liquidity in the Treasury market may suffer if participants come to see less of a direct benefit from being active in that market and infer that other participants will make that same determination. Although the premium on Treasury securities has apparently risen as their supply has been reduced, in the longer run the liquidity advantage that Treasury securities now enjoy may erode, and this will tend to raise interest rates.

Even this calculation falls well short of a prediction about the current level of interest rates, because our analysis has remained silent about the forces that have produced the underlying change in policy. For instance, if the effective tax rate has risen because of a pickup in the rate of growth of productivity, the expectation of higher profits from investment might be expected to push real interest rates higher. The point of this paper is

that, by itself, the effect of declining debt on the economy over time is a force working to offset some of the upward pressure.

Among the factors affecting current interest rates and investors' anticipations of future rates is the reaction of monetary policymakers to the changed fiscal position.[47] Indeed, in an influential class of models, the level of debt itself is seen as an influence shaping monetary policymakers' incentives. Simply put, with a large stock of nominal government debt outstanding, unexpected inflation acts like a capital levy.[48] But from the reputational models of central bank action pioneered by Robert Barro and David Gordon,[49] agents' knowledge that the return to unexpected inflation is high should lead them to expect a bit more inflation on average. By that logic, lower nominal debt loads should help trim inflation expectations. Although such considerations may be quite important in emerging market economies, where the separation between fiscal and monetary authorities is sometimes indistinct, we have chosen, given our emphasis on industrial countries, not to model such mechanisms.

Although the models presented in this paper do not indicate a clear direction for macroeconomic policy as debt disappears, they do caution that this fall in the debt will send multiple ripples through financial markets. The last model presented opens another window on policy setting: in particular, authorities should recognize that financial markets may well be in the midst of a race among private sector and quasi–private sector institutions to become the issuer of the next benchmark. The stakes are high, and the race may become quite heated. If one entity does become the new benchmark issuer, its securities will trade at a yield advantage, reflecting both their superior liquidity and the presumption that public authorities will be likely to step in to avoid systemic problems should the issuer falter. Moreover, there is a good chance, given the self-referencing nature of liquidity, that a security that achieves benchmark status will become entrenched. Hence the window for public policy action may be constrained to the period of transition—which appears to be right now. At a minimum, authorities may have to consider mechanisms that facilitate the emergence of an alternative benchmark that does not rely on the credit

47. Taylor (1995) considers this issue.
48. As explained by Calvo (1988).
49. Barro and Gordon (1983).

quality of any one firm. More broadly, the authorities may want to consider whether the overall benefits of maintaining a liquid Treasury debt market should factor into their policy decisions on taxation, spending, and the accumulation of assets. Weighed against this, however, must be the benefits that accrue from a net saving and investment balance that favors more rapid capital accumulation over time.

Comment and Discussion

John Heaton: Vincent Reinhart and Brian Sack examine a very important and timely question, namely, are the projected government surpluses both in the United States and in other major industrial countries having a significant effect on financial markets in the United States and around the world? The authors attack this problem in three related ways. First, they ask whether the bond market is reacting to the expected decline in the stock of government debt by bidding up the prices of long-term government bonds relative to short-term bonds. Second, they ask whether changes in the supply of government debt are likely to have important spillover effects on the returns to other securities. Third, they examine whether a decline in liquidity in the market for U.S. government securities is likely to cause important problems for financial markets. From this analysis they conclude that the magnitude of the effect of reducing U.S. government debt is difficult to predict.

Reinhart and Sack argue that the projected surpluses appear to be having a significant effect on the term structure of interest rates. Long-term interest rates are likely to be low as these surpluses continue and are used to retire government debt. This may produce a benefit if the lower rates on long-term Treasury securities lead to lower long-term borrowing rates for households and corporations. There is a potentially offsetting welfare effect from a reduction in the liquidity of the market for Treasury securities, however. The government may therefore want to proceed carefully in how it retires the national debt.

After reviewing the latest facts about government surpluses and GDP around the world, Reinhart and Sack present a qualitative discussion of the economic effects of a predictable decline in the outstanding stock of government debt. When government debt is viewed as net wealth, a fore-

castable decline in this debt results in a forecastable decline in wealth. This should lead to a decline in consumption and therefore to a decline in future interest rates. To quantify this effect with an economic model would require a very detailed analysis, in which the exact role for government debt in the determination of wealth is specified and quantitatively believable. Standard mechanisms that could be considered would be finite lives or various financial market imperfections, such as borrowing constraints. Since the pattern of government spending in most countries also changes along with the decline in outstanding debt, it would likely be quite difficult to calibrate the effect of all of these changes using a simple economic model.

To avoid these problems, the authors instead look empirically at the reaction of financial markets to changes in the fiscal balance of various governments. Using a panel data set of countries that are members of the Organization for Economic Cooperation and Development, they examine whether the slope of the yield curve in a country is related to its budget surplus. The expectations hypothesis of the term structure predicts that expectations about future interest rates determine the slope of the yield curve. When interest rates are expected to decline because of, say, predicted lower government debt in the future, long-term interest rates should be relatively low compared with short-term rates. Hence by examining the relationship between the slope of the yield curve and budget deficits or surpluses, Reinhart and Sack are attempting to directly test the idea that there is an important expectational crowding-out effect.

Expectations of future nominal interest rates are determined by expectations of future inflation and future real interest rates. These expectations are likely influenced by projections of budget surpluses. However, forecasts of the future course of monetary policy and of the business cycle are likely to be important as well. To control for these effects, the authors include GDP growth, forecasts of inflation, the unemployment rate, and the lagged short-term interest rate in their regressions of the slope of the yield curve on the budget surplus. Consistent with an important expectational crowding-out effect, these regressions indicate that the slope of the yield curve is significantly negatively related to the ratio of the budget surplus to GDP. This result is certainly interesting. It is at odds, however, with some previous work that finds no relationship between the slope of the yield curve and budget deficits.[1] Also, before we interpret their result as implying that a reduction in the outstand-

1. For example, Plosser (1987).

ing stock of government debt is likely to result in a reduction in borrowing costs for corporations and households, several issues need to be addressed.

Most empirical studies of the expectations hypothesis of the term structure include several lags of the state variables.[2] The lag structure seems to be needed to capture slowly moving expectations and the dynamics of the business cycle and inflation. The budget surplus–to-GDP ratio that the authors use could easily be capturing the missing variables that are often found to predict future interest rates. Further, the economic effect identified in this paper could easily run from the surplus-to-GDP ratio to expectations of future monetary policy that lead to a forecast of interest rates.

Analyses of the expectations hypothesis also typically conclude that the model is very much at odds with the data. For example, the forward premium does a poor job of predicting changes in interest rates. This is a potentially significant issue for the authors' regression of future interest rates on variables that include the surplus-to-GDP ratio. They would like this regression to identify the effect of the right-hand-side variables on expected interest rates. Given the fact that the forward premium does not clearly serve this role, I find it very difficult to interpret the variables in the authors' regressions.

The basic problem with the expectations hypothesis as a description of the term structure of interest rates is that risk premiums likely exhibit significant variation over time. This variation appears to be a function of the business cycle, inflation, and other variables. It is quite possible that the surplus-to-GDP variable is correlated with variables that predict risk premiums.

A final difficulty involves the application of the authors' regression methodology to a panel regression. It appears that the panel has been treated as if there were no cross-sectional dependence in the error term. Since these regressions use data taken from open economies with integrated capital markets, this assumption is unlikely to be satisfied. The authors' figure 3 suggests that a substantial part of the identified effect is coming from a few episodes in the United States. The cross-country analysis is supposed to bolster this evidence, but the yield curves of the various countries are correlated with the U.S. yield curve. As a result, there is quite likely to be less information about the coefficient on the surplus-to-GDP ratio than the reported *t*-statistics capture.

For all of these reasons, I find the results of the authors' panel study difficult to interpret. The ratio of the budget surplus to GDP could easily be picking up expectations of future inflation, GDP, and risk premiums, all

2. See, for example, Campbell and Shiller (1991).

of which affect the term structure of interest rates, independent of any expectational crowding-out effect. Much additional work remains to be done before we can conclude that the current and projected surpluses have a large effect on the yield curve and therefore on interest rates in general.

The authors' analysis of the term structure represents an attempt to use the yield curve to gauge the extent of non-Ricardian equivalence using financial market data and observed variation in the budget deficit. An alternative approach is to take a stand on an economic model and subject it to the predicted variation in the outstanding quantity of government securities. This is what the authors do in the next part of their paper.

Suppose that investors' utility functions are quadratic and that these investors derive all of their consumption from their investments in assets (or that consumption is proportional to wealth). These investors rank portfolios on the basis of their expected returns and the variance of those returns. The optimal portfolio chosen by each investor depends on his or her risk tolerance, and on the expected returns and covariances of returns between the various assets in the market. Market equilibrium requires that supply equal demand. Given the supplies of the assets, the covariances between their returns, and the degree to which the typical investor is risk averse, the equilibrium of the model predicts the expected returns on these assets.

The authors calculate the supply of a large number of assets, including government debt, corporate equity, corporate debt, and agency debt, worldwide. They also estimate the covariance structure for the returns to these assets. They then examine what happens to expected returns if the supply of U.S. government debt is set to zero in the model.

Their general conclusion is that the returns to other securities are not greatly affected by setting the supply of government debt to zero, because the return to U.S. government debt is highly correlated with the returns to many other securities, including corporate debt and U.S. agency debt. Investors therefore have a simple time substituting away from U.S. government debt and into other securities. Because these other securities are in ample supply, the effect on expected returns is not substantial.

This conclusion seems very reasonable. The largest risk in the market for fixed-income securities of all types is interest rate risk. Variation in this single factor dominates most of the other risks for agency debt and for high-quality corporate debt. These other securities can therefore easily substitute for government debt as a relatively risk-free investment.

In interpreting this type of analysis, however, one must keep several important issues in mind. First, in their baseline calculations the authors

assume that the stock of government debt equals the value of this debt in investors' portfolios. Essentially, they are making an extreme assumption about non-Ricardian equivalence, where investors completely discount all future tax liabilities. Since this polar extreme should put an upper bound on the predicted changes in returns, modifying this assumption should, if anything, reinforce their conclusion.

Second, this type of model has a very difficult time explaining observed average returns once the implications for consumption are added to the model. In particular, an important part of aggregate consumption is unrelated to the returns to risky securities generally. As a result, the historical-average returns to many risky securities seem much too high unless investors are very risk averse. In some of their analysis the authors assume a very high level of risk aversion, however, and so their results are likely robust to a modification to the model that adds additional sources of consumption risk.

A final objection to the authors' analysis of portfolio choice is that investors have other reasons to hold U.S. Treasury securities, independent of their expected return and their one-period covariance with other securities. For example, institutions that seek to hedge such long-term obligations as mortgages and mortgage-backed securities generate demand for Treasuries. Further, the market for U.S. Treasury securities is much more liquid than the markets for corporate or agency debt, and this makes Treasury securities very useful for purposes of hedging and as collateral. These considerations have contributed to making these securities a standard benchmark against which other securities are priced.

The authors recognize this, and in the last part of their paper they discuss the special role played by Treasury securities and the fact that their declining supply seems associated with increasing spreads between Treasury yields and other long-term securities, such as swaps. This could indicate that, in the short run at least, market participants cannot easily substitute other relatively risk-free, long-term securities for Treasuries because of the particular role that Treasuries play. The spreads in these markets could also reflect uncertainty about what set of securities will ultimately replace Treasury securities as a source of liquidity. However, the interpretation of changes in spreads is difficult because we know that these spreads vary over time in response to systematic variation in credit risk and liquidity.[3] Given that caveat, it is interesting to consider how the

3. See, for example, Elton and others (2000).

market will evolve to duplicate the special role now played by Treasury securities.

The authors also discuss a model in which rising liquidity in a market is self-reinforcing. Once a set of securities becomes liquid, it begins to serve a special purpose in trading, which in turn generates more liquidity. Investors may also develop specialized technology and new trading methods that are suitable for this particular class of securities but not easily transferable to others. If the supply of the liquid security is then reduced exogenously, this could cause substantial difficulties for traders and investors in the short run. Essentially, a new liquid market needs to be established. As Reinhart and Sack point out, this means that considerable uncertainty could prevail in this market in the short run until a new liquid market is established. They argue that government may properly play a role in creating this market so that the liquid benchmark security is not subject to credit risk.

The government may also have a potentially important role in providing the regulatory environment that allows the market to react flexibly to changes in liquidity. The financial market will probably settle on a new set of securities that can ultimately play the special role currently played by Treasury securities. As the government withdraws from the market, agencies and corporations will have an incentive to increase their supply of debt. In the past, as the supply of government debt changed, so did the supply of corporate debt, reflecting the general demand for debt instruments generated by frictions such as the tax code.[4] Although the market's reaction to changes in the liquidity of Treasury securities probably conveys an important regulatory message, it is unlikely that there is an important lesson here for fiscal policy.

To conclude, my reading of the evidence presented in this paper is that the direct effect of the declining supply of U.S. government debt on returns on other securities is likely to be small. In the short run, changes in liquidity may cause some problems, but this does not have important implications for the conduct of fiscal policy or for what should be done with the budget surplus. An important issue not addressed in this paper is one of political economy. The most important effect of government debt may be as a device for disciplining future governments. If the debt is retired, this may create an incentive for future governments to spend and increase the debt once again.

4. See, for example, McDonald (1983).

General discussion: Benjamin Friedman suggested that the mean-variance analysis used in the paper may overstate the substitutability between Treasuries and corporate bonds, and hence underestimate the price changes that would accompany a substantial decline in the supply of Treasuries. Differences in liquidity, default risk, legal or regulatory eligibility for some portfolios, tax features, and call features all affect substitutability in ways not captured well in that kind of analysis, which focuses purely on the volatility of market returns due to interest rate fluctuations. Friedman reported that starting with independent estimates of expected returns and estimating portfolio behavior directly from observed movements in investors' portfolio holdings usually implies lower estimates of asset substitutability in these circumstances. Friedman also recalled that the restriction against the Treasury issuing long-term debt was removed in the mid-1970s. He suggested testing whether the effect of deficits on the term structure was changed by removing this restriction.

Daniel Sichel reasoned that the underlying factors leading to the increase in the budget balance may themselves have an effect on the term structure. For example, to the extent that faster productivity growth has been a source of the rise in the surplus-to-GDP ratio, this increase should also be associated with an outward shift in investment demand by business and a higher equilibrium interest rate. He suggested that recognizing this and possibly other sources of the change in the budget balance might improve explanations of the term structure. As to whether the estimated term structure effects come from inflation expectations or from the real term structure, Stephen Zeldes noted that the present downward slope cannot answer that question. One has to look historically at how the real term structure has changed with changes in the surplus. Zeldes also noted a disconnect between present concerns that the government debt may get too small and present projections of huge unfunded liabilities in the Social Security trust fund. In the argument over privatizing Social Security, some have suggested issuing "recognition bonds" to compensate those who have paid into the system but who, under privatization, would not receive the benefits they now expect. Zeldes wondered how the market would accept making this implicit liability explicit through the issuance of such bonds.

James Duesenberry reasoned that any projection of future interest rates needed to recognize the saving and investment balances that would accompany the projected surpluses. At present, private investment exceeds private saving by a large margin, with the gap filled by surpluses in the

federal, state, and local governments and the current account deficit. Model projections at the Federal Reserve show interest rates declining as the federal surplus grows, with interest rates stimulating investment and reducing the current account deficit, but with the ratio of private saving to GDP, which is relatively insensitive to interest rates, changing little. However, he questioned the validity of such projections, which keep the personal saving rate near zero, since history records few periods when saving rates were that low.

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