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Fiscal Policy in an Era of Surpluses: Economic and Financial Implications

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Note to Our Readers:

This special issue, devoted to the proceedings of the conference "Fiscal Policy in an Era of Surpluses: Economic and Financial Implications," introduces a new cover and interior page design for the *Economic Policy Review*. Our aim is to give the publication a fresh look, with bolder color and more contemporary styling of text and graphics.

The new design has two variants—one for conference volumes covering a single theme and another for a regular research issue containing articles on diverse economic and financial topics. The creation of a separate design for conference volumes is a reflection of the growing public interest in the conferences sponsored by the Federal Reserve Bank of New York. In recent years, Bank symposia have provided a valuable forum for the discussion of such important policy issues as income inequality, the economics of education reform, and the future of capital regulation.

As part of the redesign, regular research issues of the *Economic Policy Review* will now preface each article with a helpful bullet-point summary of key arguments. The cover of these issues will also give greater prominence to the names of the authors and the titles of their articles—a nod to the considerable contribution that our economists are making to the literature in their fields.

It is a particular pleasure for me to introduce the redesign of our publication at this time. This issue of the *Economic Policy Review* is the first of the year 2000 and the first to appear during my tenure as director of research. I hope that you will share my enthusiasm for the new look and features of the *Review*.

Christine M. Cumming
Executive Vice President and Director of Research

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Session 4

William J. McDonough

Opening Remarks

I am very happy to welcome you this morning to our conference "Fiscal Policy in an Era of Surpluses: Economic and Financial Implications." It is gratifying that so many distinguished scholars, policymakers, and market participants have taken the time to attend at this very busy time of the year—and century!

Our topic today is federal fiscal policy and the market for U.S. Treasury debt. Only a few years ago, a conference such as this would have been devoted to the problems associated with large deficits and mounting debt. As recently as fiscal year 1992, the federal deficit was $290 billion—nearly 5 percent of GDP—and the stock of debt held by the public was fast approaching 50 percent of GDP. The prospect of "deficits as far as the eye can see" kept policymakers searching for ways to slow the growth of spending and increase the growth of receipts while the financial markets struggled to absorb a stream of massive new Treasury debt issues.

Over the past several years of surprisingly strong real growth and low inflation, our fiscal situation has improved dramatically. In the fiscal year just ended, federal receipts exceeded outlays by $123 billion (0.8 percent of GDP). This achievement came on the heels of a $70 billion surplus the previous year, giving the country its first two consecutive surpluses since the late 1950s. Moreover, under consensus projections, surpluses will continue to rise over the next decade. Accordingly, policymakers today debate the wisest use of this bounty while financial markets learn to cope with a rapidly shrinking supply of new issues of Treasury debt.

In the less prosperous years of the late 1980s and early 1990s, research interest in fiscal policy and the debt market centered on objectives such as containing the explosive growth of the federal health care programs, ensuring the long-term viability of Social Security, identifying the optimal tax structure for long-term growth and well-being, and extracting information from the shape of the Treasury yield curve. Of course, these remain topics of vital interest. But to our mind, the dramatic improvement of our fiscal balance has shifted the spotlight to the topics we will be dealing with today:

- First, how did we come to the very enviable situation in which we find ourselves? Has it been the result of brilliant policymaking, or simply good luck? This year, which marks the twenty-fifth anniversary of the Congressional Budget Act, is a good time to review how the budget process has evolved over the past twenty-five years and to assess how well it has worked.
- How has the interaction between the budget and the economy changed? More specifically, how do we measure the stance of fiscal policy? Years ago, we talked about the full-employment balance as a guide to the government's effect on the economy. However, both the outlay and the receipt sides of the budget have changed significantly over the years. Entitlement outlays have

William J. McDonough is the president of the Federal Reserve Bank of New York.

grown as a share of the budget while discretionary spending and net interest have declined. On the revenue side, payroll taxes and taxes on capital gains have grown in importance.

- How do we measure the full-employment balance when a very large portion of federal spending consists of indexed entitlement payments and a significant portion of revenues comes from taxes on capital gains? At a time when we are more focused on the fundamentals required for sustainable long-run economic growth, is the full-employment balance still the best measure of fiscal impact?

We at the Federal Reserve have been studying how monetary policy should be conducted to achieve and maintain a low-inflation environment. We see a low-inflation environment as the central bank's major contribution to sustainable long-run economic growth. There are important parallel issues for fiscal policy as well.

As the federal budget has moved from large deficits to surpluses, new issuance of Treasury debt has fallen off quite dramatically. For example, from fiscal year 1996 to fiscal year 1999, new issuance of Treasury notes and bonds declined by nearly one-third. And if the consensus projections turn out to be true, or even if they turn out to be optimistic, new issuance will decline a great deal further in the near future. In contrast, financial markets have come to rely on a plentiful supply of newly auctioned "on-the-run" Treasuries to use for trading and collateral. What does this mean for our debt management policy? Closer to home, what does this mean for management of the System Open Market Account?

Furthermore, with this decline in new issuance, will the Treasury market lose its special role in the financial system? Moreover, what role will the Treasury market play in the price-discovery process determining the general level of interest rates? What changes should we expect in the Treasury market's position as the benchmark against which many fixed-income yields are evaluated? Finally, will the Treasury market's "safe haven" role be shared with other markets, or will safety become more scarce in the financial system?

The troubled state of financial markets last year following the Asian crisis and the Russian default illustrates our concerns. Traditionally, financial crises have precipitated a flight to quality—credit spreads widen and Treasuries become the "market of last resort" as investors seek a safe haven. But a year ago, Treasuries were scarce. Volumes in the Treasury market thinned and bid-ask spreads ballooned. The price-discovery process did not work well, and the uncertainty in the Treasury market amplified the troubles in the rest of the financial system. Certainly, I do not want to repeat that experience.

Of course, we can say that the best way to avoid repeating it is to eliminate the underlying problems, which were not based in the U.S. government debt market. However, history has shown that episodes of this kind can and do happen. When they do, the existence of a liquid market for default-free securities is extremely helpful in seeing us through them.

Ironically, the issues we are addressing are, to a great extent, by-products of the extremely successful performance of the American economy. I believe that to sustain that success, we need to make every effort to understand these issues.

We are indeed fortunate to have assembled today an esteemed group to consider these issues from a variety of perspectives. In looking over the list of conference participants and attendees, I am struck by the diversity of our backgrounds and interests. We have experts in public finance, macroeconomics, and capital markets from universities, the Federal Reserve System, scholarly institutes, and the private sector. In addition, the group includes public officials from the United States and other nations, representatives from international agencies, and active participants in the financial markets.

Your presence here confirms the importance of these issues in our economy and in our financial markets. I encourage your active participation in today's conference and your continued good work in this area.

Richard Peach and Charles Steindel

Summary of Observations and Recommendations

Benefiting from sustained economic growth and low inflation, the country's fiscal outlook has undergone a remarkable reversal. The trend toward large and growing budget deficits has given way to two straight years of budget surpluses and projections for a continued rise in surpluses over the next decade. Yet this solid fiscal performance poses challenges for the financial markets, which have had to adjust to the diminishing supply of new Treasury securities resulting from the surpluses.

To offer insight into these developments, the Federal Reserve Bank of New York hosted "Fiscal Policy in an Era of Surpluses: Economic and Financial Implications." The December conference focused on the forces behind the recent trends in federal receipts and outlays, the federal budget's effect on the overall economy, and the financial market consequences of the shrinking stock of U.S. Treasury securities. More than 100 academics, policymakers, and market participants attended the day's discussions.

Factors Contributing to the Improved Fiscal Situation

The first of the day's sessions focused on the economic forces and policy developments that have led to the nation's dramatic fiscal improvement over the past several years. Alan Auerbach provided a broad overview of the key economic trends shaping the federal budget over the past quarter-century and the main currents in fiscal policy, which to a large extent were reactions to those trends. For example, he explained that the across-the-board reductions of marginal tax rates and the indexing of the tax code in 1981 were mainly a response to the inflation-induced "bracket creep" of the 1970s, which pushed federal tax receipts as a percentage of GDP to very high levels. More recently, tax policy has been strongly influenced by the pronounced increase in the share of income going to those in higher tax brackets. Accordingly, efforts to boost tax revenues in 1990 and 1993 were directed primarily at these taxpayers.

With regard to outlays, Auerbach emphasized that the composition of federal spending has changed significantly over the past twenty-five years, with outright purchases of defense and nondefense goods and services yielding in importance to entitlement spending—particularly in the form of Social Security, Medicare, and Medicaid payments. Although defense and nondefense discretionary outlays as a percentage of GDP have fallen greatly over the period, Auerbach speculated that this trend was unlikely to persist. Indeed, he suggested that the trend could start to reverse itself, particularly now that the unified budget balance is in surplus. Auerbach stressed that the growing importance of entitlements—combined with demographic projections of a steep decline in the ratio of taxpayers to beneficiaries—makes the current unified budget surplus a poor indicator of the country's long-term fiscal position. Furthermore, over a longer time horizon, the federal budget will remain seriously in deficit, and recent policy proposals could exacerbate that situation considerably.

In the ensuing panel discussion, Barry Bosworth built on the themes of Auerbach's paper. He noted that over the past twenty-five years, fiscal policy's role in short-run economic stabilization has nearly disappeared because of an inability to

reach political agreement on how to eliminate persistent deficits. Consistent with that development, legislative changes have played a relatively minor role in the improvement in the federal fiscal balance over the past several years. Bosworth suggested that much of the improvement can instead be traced to the rapid growth of individual income tax receipts resulting from the shift in the distribution of income and from substantial capital-gains realizations. Yet he acknowledged the potential for deficits in the long run, particularly given the fact that entitlements for the elderly claim a growing share of the federal budget. He proposed that entitlement programs be budgeted and funded according to principles that differ from those applied to day-to-day government operations. Eugene Steuerle reiterated Auerbach's concerns about the emergence of future deficits as well as Bosworth's concerns about entitlement funding. He observed that the current surplus might be seen as "the eye of the storm" between two periods of chronic large deficits.

The Budget and the Macroeconomy

In the second session, the focus shifted to the federal budget's effect on the performance of the macroeconomy. Darrel Cohen and Glenn Follette offered a theoretical and empirical analysis of how the federal tax code and expenditure policy work to stabilize the economy automatically. Cohen and Follette began by presenting new theoretical findings using the modern two-period, representative agent model. They showed that, even in the case of forward-looking consumers, automatic stabilizers in the form of progressive income taxes and income-support programs should reduce the volatility of consumption by providing insurance against income uncertainty. In the empirical part of their paper, Cohen and Follette outlined the results of experiments involving the FRB/US econometric model—results suggesting that the automatic stabilizers play a real, but surprisingly modest, role in reducing the impact of demand shocks on the economy. Moreover, their FRB/US model experiments indicated that automatic stabilizers have virtually no effect on supply shocks, such as changes in oil prices. Cohen and Follette also presented updated estimates of the responsiveness of various federal taxes and spending programs to fluctuations in total output.

Olivier Blanchard, commenting on the Cohen-Follette paper, noted that much economic theory disputes the effectiveness of automatic stabilizers. Although Blanchard expressed his own view that stabilizers do work, he questioned the evidence from large-scale econometric models such as FRB/US. These models, he suggested, are constructed in such a way that they will invariably show that the existence of a progressive income tax and income-support programs dampens output fluctuations. Blanchard then offered alternative evidence supporting the effectiveness of stabilizers. For instance, he explained that in international data, output volatility tends to vary inversely with government expenditures as a percentage of GDP.

In an address to the conference, Rudolph Penner reviewed the passage of the fiscal year 2000 budget and presented his views on the near-term outlook for fiscal policy. He described the ongoing pressures to increase spending, which have led to a significant increase in discretionary spending for fiscal year 2000, as well as some of the political forces potentially at work in the budget process over the next few years. Although he agreed that it is difficult to project the budget and Treasury debt supplies, Penner was optimistic that the next decade will see a continued reduction in Treasury debt as a share of GDP.

Treasury Market Liquidity

The afternoon sessions addressed the implications of a shrinking supply of Treasury debt for the Treasuries market in particular and for the financial markets in general. In his keynote address, Treasury Department Under Secretary Gary Gensler described the ongoing changes in the auction schedule for debt as well as the Treasury's plans to repurchase existing debt and reopen issues. He acknowledged that Treasuries might lose their importance as financial market benchmarks and that other instruments might take over this role.

The following session was devoted to the preservation of Treasury market liquidity in the face of the declining volumes of new issues. Paul Bennett, Kenneth Garbade, and John Kambhu explored ways in which liquidity might be enhanced. For example, they proposed increasing the homogeneity of stripped Treasury coupon and principal components by allowing any stripped instruments of the proper maturity to reconstitute any issue. Bennett, Garbade, and Kambhu also recommended issuing 104-week Treasury bills and allowing market participants to create new stripped instruments by exchanging with the Treasury coupons or principal payments of similar maturities.

Vaughn O'Regan, drawing on his experience with similar innovations in Canadian debt management, mentioned the potential hurdles that these proposals could face. Charles Parkhurst cited some peculiarities in the current market for STRIPS that suggest that further expansion of the STRIPS

program may not enhance Treasury market liquidity greatly. However, Parkhurst did support the idea of a 104-week bill.

The Treasury Market's Benchmark Status

In the closing session, the participants considered the Treasury market's benchmark role. Michael Fleming examined the implications of the market's recent performance for the use of Treasury securities as a pricing and hedging tool. He observed that some of the attributes that have made the Treasury market a useful benchmark were weakened by the financial crisis of 1998 and have not yet fully recovered. Fleming also spoke about the possibility that federal agency debt issues, corporate debt issues, and interest-rate swaps would ultimately displace Treasuries as benchmarks.

In the panel discussion, Lou Crandall noted that the Treasury market lost its benchmark status on the short end of the yield curve some time ago because of the unpredictable supply of issues and the fact that the credit risk inherent in Treasuries differs markedly from the credit risk of the instruments hedged with Treasuries. For these same reasons, Crandall expected that Treasury coupons would eventually lose their benchmark status and be replaced by interest-rate swaps. Voicing a differing opinion, Thomas Glaessner contended that the Treasury market has in fact retained many of the important features of a benchmark market and that any deterioration in its benchmark role would consequently be slow. Moreover, Glaessner noted that a number of the alternatives to Treasuries lack some of the major attributes desirable in a benchmark security. Adding to the debate, Stan Jonas argued that swaps would eventually take over the benchmark role. He emphasized that Treasuries' lack of credit risk is only a relatively minor advantage; during financial crises, other sources of risk—such as a lack of liquidity—can be far more important.

Session 1

Paper by

Alan J. Auerbach

Commentaries by

Barry Bosworth
C. Eugene Steuerle

Alan J. Auerbach

Formation of Fiscal Policy: The Experience of the Past Twenty-Five Years

Introduction

The Congressional Budget Act, passed in 1974, established new procedures for the budget process itself, and created the Congressional Budget Office (CBO) to provide information needed by Congress to carry out this process. The quarter century since then has witnessed repeated changes in the rules governing the budget process, in response to economic changes as well as to the perceived performance of the budget process itself.

With fiscal affairs apparently in order—at least in the short run—and with some perspective on the past twenty-five years' economic performance, we are in a position to ask how well the budget process has worked to produce a coherent and responsive fiscal policy, particularly given the important changes in the U.S. economy over the period.

It is with these economic changes that I begin in the next section, discussing the consequences for tax and expenditure policies. I then turn to a more complete discussion of how the state of the federal budget has changed over the past twenty-five years. Next, I discuss how these changes in the budget have led to changes in budget procedures, and what impact these changes in the budget process have had. Finally, I review where we are, and how well the short-term budget surplus reflects the longer run state of U.S. fiscal policy.

The Economy, Then and Now

Since the mid-1970s, several changes in the economy have altered the landscape of fiscal policy.

The Rise and Fall of Inflation

Just a few years after President Nixon's ultimately unsuccessful attempt to moderate inflation through the imposition of price controls, the first OPEC oil shock drove the inflation rate up to around 9 percent during the 1974-75 period, as measured by the GDP deflator. Although it fell somewhat during the years immediately following, the inflation rate was already on the rise when the second oil shock hit in 1979 and it rose to about 9 percent again in 1980 and 1981. Based on the consumer price index, inflation was several percentage points higher.

The rapid inflation of the 1970s and early 1980s had significant impacts on the federal budget and, ultimately, tax and expenditure policies. First, it led to a surge in federal income tax revenues, as "bracket creep" drove individuals into higher tax brackets, and the real values of the personal exemption and standard deduction fell. Based on simulations using annual tax return files, Auerbach and Feenberg (1999) calculate that the average marginal individual tax rate rose from .21 in 1975 to .27 in 1981, just before the Reagan tax cut was introduced—a

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The author is grateful to Nancy Nicosia for research assistance. The views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

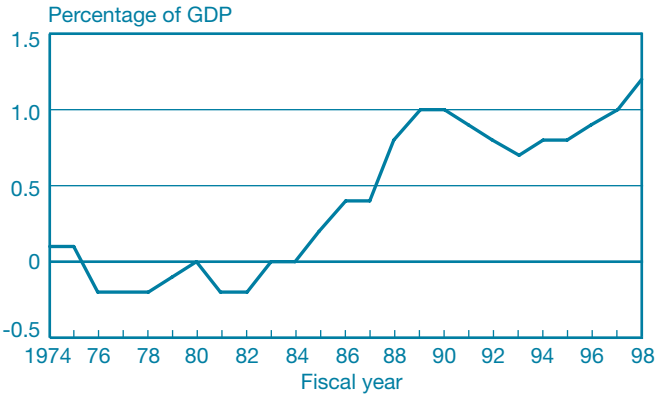
period over which there was no significant legislation increasing marginal tax rates. Indeed, the average marginal tax rate was higher in 1981 than in any other year for which calculations were made, spanning the 1962-95 period, from before the Kennedy-Johnson tax rate reductions of 1964 to after the Clinton tax rate increases of 1993. The Economic Recovery Tax Act (ERTA) of 1981, which substantially reduced marginal tax rates and then provided for bracket indexing beginning in 1985, may thus be traced to the inflation of the preceding years. In a sense, then, the deficits of the 1980s may be attributed in part to the inflation of the 1970s.[1]

A second major impact of inflation occurred within the Social Security System, via the calculation of benefits. Prior to the 1970s, benefits were not explicitly indexed, but were increased regularly to account for rises in the cost of living. This changed in 1972, but the initial indexing method was flawed and resulted in *real* benefit increases. By the time this mistake was corrected in 1977, retirees had seen a substantial increase in their real benefits, and those in the succeeding cohort—whose benefits were gradually phased back to intended levels—became the infamous "notch babies," deprived of the full windfall given earlier generations. This unintended expansion of Social Security benefits helped contribute to the funding crisis of the early 1980s, and led to the 1983 Greenspan Commission. The commission's recommendations resulted in increases in the payroll tax rate and base that have brought us the massive "off-budget" cash-flow Social Security surpluses of the 1990s (Chart 1).

This curious notion of budget items that are off-budget highlights the issue of proper budget measurement, for which the inflation of the 1970s was also relevant. With the federal budget being measured in nominal terms, the inflation-induced erosion of the national debt during the late 1970s was excluded from deficit calculations. Had such erosion been counted, the "massive" deficits of the late 1970s would have been much smaller. Indeed, how to measure the budget deficit, and the deficit's usefulness as a measure of fiscal policy sustainability, has become central in the recent confusion over the appropriate response to short-term surpluses.

Chart 1

Social Security Surplus



Source: U.S. Congressional Budget Office (1999a).

The "Demise" of the Business Cycle

The United States was in the midst of a serious recession in 1974. Two more recessions followed within the next decade. However, over the seventeen-year period since the end of 1982, the U.S. economy has spent just eight months in recession, during the relatively mild one of 1990-91. The sustained growth over this period, particularly the expansion in the 1990s, has contributed to the decline in budget deficits experienced.

Shifts in the Distribution of Income

Since the late 1970s, the distribution of income in the United States has become less equal. A substantial literature has arisen to explain the sources of this trend, and the exact magnitude of the trend itself depends on the years chosen for comparison and the measure of income used. But there is no doubt that the change has occurred and that it is large.

Table 1 presents recent Congressional Budget Office estimates of the changes in average real pretax family income by quintile over the 1977-99 period. The table also provides measures for subgroups of the top quintile. Over the full twenty-two-year period, real incomes *fell* in the bottom three quintiles, rose slightly in the fourth quintile, and jumped in the top quintile, rising faster still for higher income groups within the top quintile.

The rise in the share of income going to those facing higher marginal tax rates has driven individual income tax collections to unprecedented levels. As a share of GDP, federal tax collections have risen sharply in recent years, to 20.5 percent in fiscal year 1998 and an estimated 20.6 percent in fiscal year 1999—the highest share since 1944 and the highest peacetime share ever. While trends since the 1970s are complex, essentially all of the *recent* rise in this fraction is attributable to the individual income tax. From 1994 to 1999—a period during which the only important tax legislation was the tax cut included in the 1997 Taxpayer Relief Act—federal taxes as a share of GDP rose from 18.4 percent to 20.6 percent, while individual income taxes rose from 7.9 percent to 10.0 percent.

Table 1

Average Real Pretax Family Income

Category	1977	1993	1999	Percentage Change 1977-99	Percentage Change 1993-99
Lowest quintile	$10,000	$ 7,800	$ 8,400	-16.0	7.7
Second quintile	23,700	19,600	21,200	-10.5	8.2
Middle quintile	36,400	32,300	35,400	-2.7	9.6
Fourth quintile	49,300	49,000	53,000	7.5	8.2
Highest quintile	94,300	114,000	132,000	40.0	15.8
All families	42,900	44,100	49,500	15.4	12.2
Top 10 percent	125,000	158,000	188,000	50.4	19.0
Top 5 percent	166,000	225,000	276,000	66.3	22.7
Top 1 percent	356,000	584,000	719,000	102.0	23.1

Source: U.S. Congressional Budget Office (1999c, Table 1).

Note: Dollar figures are in 1995 dollars.

Some of this rising tax share is attributable simply to the progressivity of the individual income tax, as real incomes in all quintiles rose during the mid- and late 1990s. Even with indexing for inflation, taxes as a share of income should rise as taxpayers' incomes face higher marginal tax rates—a consequence traditionally referred to as the "fiscal dividend." In Auerbach and Feenberg (1999), we calculate that the elasticity of individual income taxes with respect to real income is approximately 1.67, an historically high value for the United States. With average real pretax family income rising by 12.2 percent between 1993 and 1999 (Table 1), this elasticity predicts that individual income tax revenues should have grown by 12.2 x 1.67 = 20.4 percent, or from 7.9 percent of GDP to 8.5 percent of GDP. This is less than one-third the actual rise. The rest of the increase is attributable to the rising share of income going to high-income individuals, and to the increase in capital gains realizations (which are not included in GDP) fueled by the recent stock market boom.

The shifting income distribution has contributed to the improved health of the federal budget. But it has also influenced the character of tax legislation, which has made distributional consequences a more central concern. The Economic Recovery Tax Act of 1981 reduced marginal tax rates across the board, and hence provided the greatest absolute *and* relative benefits to those in higher tax brackets. By contrast, the Omnibus Budget Reconciliation Act of 1993 raised marginal tax rates only on a very small group within the top few percent of the income distribution by introducing two new marginal tax brackets.

The Tax Reform Act of 1986 represented something of a midpoint in this evolution. It sought to maintain rough balance in the relative individual tax burdens across income classes, raising taxes on capital income—the type of income most concentrated at the top—to offset the substantial reduction in top marginal tax rates. In doing so, it made use of an unfortunate tax policy innovation—the "phase-out"—that has come to plague our tax system in the years since. In that particular instance, the most significant phase-out (with respect to adjusted gross income) applied to eligibility for deductible contributions to individual retirement accounts.[2] But subsequent legislation has caused these phase-outs to proliferate, applying them to itemized deductions and personal exemptions in 1990 and adding such items as the child credit, HOPE scholarships, and the Roth IRAs in 1997. Thus, unlike those in 1993, the tax increases in 1997 on high-income taxpayers occurred not through explicit rate increases, but through a denial of tax benefits through the use of phase-outs. While phase-outs were with us before 1986 (applied, for example, to the Earned Income Tax Credit), they have now become so prominent that, as of 1998, fully 25 percent of individual taxpayers were in effective marginal income tax brackets other than their official ones (U.S. Joint Committee on Taxation 1998, Table 3).

It is not entirely clear why the process of raising taxes on higher income groups has taken the form of phase-outs, although its lack of transparency appears to provide some political benefit (and hence some comfort to those opposed to "new" taxes). But this political advantage has come at the cost of considerable complication of the tax system, with its welter of phase-out ranges producing a marginal rate schedule that some have compared with the New York City skyline (Furchtgott-Roth and Hassett 1997). How to achieve "urban renewal" is as daunting a task in this context as in the original.

The Aging Baby-Boomers

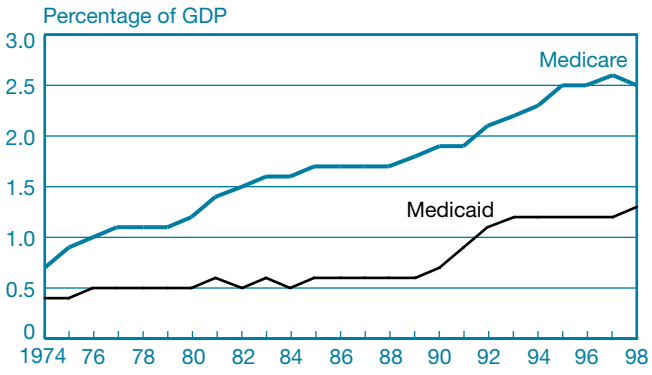
The baby-boom generation, born between the mid-1940s and the mid-1960s, is still in its preretirement period, but its coming retirement has loomed more and more prominently in fiscal policy decisions made over the past quarter century. Most evident among the fiscal policy actions taken was the initiation in the 1980s of the pattern of trust fund accumulations depicted in Chart 1. In 1998, the accumulations accounted for 1.2 percent of GDP; the CBO projects them to grow to 1.8 percent of GDP by 2009 (U.S. Congressional Budget Office 1999c). Over the coming years, the Social Security System projects the ratio of covered workers per beneficiary to drop

from its current value of 3.4 to 2.5 by 2020 and to 2.0 by 2035 (Board of Trustees, Federal Old-Age, Survivors, and Disability Insurance Trust Funds 1999, Table II.F19). These accumulations have been viewed as necessary to help cushion the impact of the coming adverse demographic change. However, the most recent Social Security Trustees Report projects that the Old-Age, Survivors, and Disability Insurance Trust Fund will vanish in 2034, at a time when the system's benefit payments will greatly exceed its income.

The Growth in Spending on Medical Care

The anticipated rapid increase in Social Security benefits poses a future problem with implications for current budget policy. By contrast, government medical spending—the other major component of federal entitlements—is very much a "current" problem, not having waited for the baby-boom generation to retire. Along with aggregate U.S. public and private spending on medical care, which now accounts for about 14 percent of GDP, Medicare and Medicaid have grown very rapidly since their introduction in the mid-1960s. As Chart 2 illustrates, these programs together grew from 1.1 percent of GDP in fiscal year 1974 to 3.8 percent in fiscal year 1998. At present, the three largest entitlement programs—Medicare, Medicaid, and Social Security—account for more than three-quarters of all entitlement spending and nearly half of the federal budget, excluding interest.

Chart 2
Federal Medicare and Medicaid Spending



Source: U.S. Congressional Budget Office (1999a).

Summary

The U.S. economy has made the transition from high inflation, but not before prompting the indexation of its individual income tax and public retirement systems and a major income tax reduction. The economy's favorable performance has helped improve the budget situation, but so have the tax revenues generated by the widening income distribution, which has also contributed to a shift in the character of tax legislation. Tax cuts for high-income taxpayers have given way to tax increases, but the increases have often taken an indirect form. An aging population presents a challenge for the years to come, and measures taken by the Social Security System to provide for this have been a major component of the recent shift toward budget surpluses. Medicare and Medicaid spending already has increased sharply, in advance of the further increases that will come with an aging population.

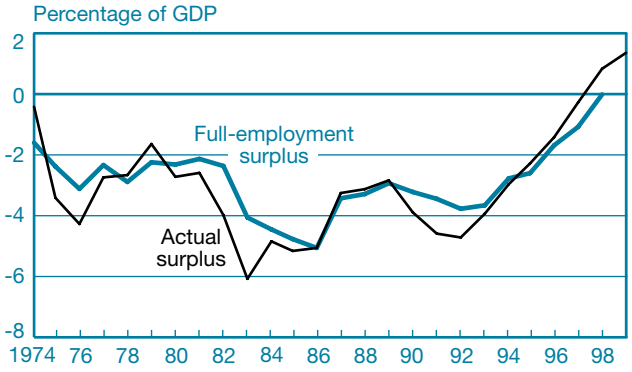
Changes in the Budget and Its Components

The federal budget situation has also changed markedly over the past twenty-five years. The rise and fall in deficits alone, though remarkable, masks important transitions that have occurred on the tax and expenditure sides of the budget.

From Deficits to Big Deficits to Surpluses

Chart 3 shows the federal budget surplus, as a percentage of GDP, since 1974. Superimposed on the chart for comparison is the full-employment, or "standardized," surplus, as calculated by the CBO. Based on the examination of these two series, it is useful to distinguish three periods. During the first, through fiscal year 1981, the full-employment deficit stayed relatively stable, at between 2 and 3 percent of GDP. The second period was one of deficit expansion, beginning with the recession of 1982 and compounded in the years that followed by the trend in the underlying full-employment surplus itself. Since 1986, the full-employment and actual deficits have shrunk steadily, except during the recession of 1990-91 and the slow initial stages of recovery that followed.

Chart 3
U.S. Federal Budget Surplus, 1974-99



Source: U.S. Congressional Budget Office (1999a).

The Shift in Spending

As noted, Chart 2 illustrates the shift to spending on health care that has occurred since 1974. Chart 4 shows the growth in overall entitlement spending, which was more modest over the period, as a result of a fall in spending on entitlement programs *other than* Social Security, Medicare, and Medicaid. Indeed, spending on these three programs has risen from just over half of all entitlement spending in 1974 to nearly three-fourths of all entitlement spending at present. Still, 1974 was the last year in which discretionary spending exceeded aggregate entitlement spending. Since then, discretionary spending as a share of GDP has fallen, from around 10 percent until the mid-1980s to about two-thirds of that fraction today. The cuts in nondefense discretionary spending that helped finance the defense build-up in the 1980s were sustained in the 1990s even as defense spending fell sharply.

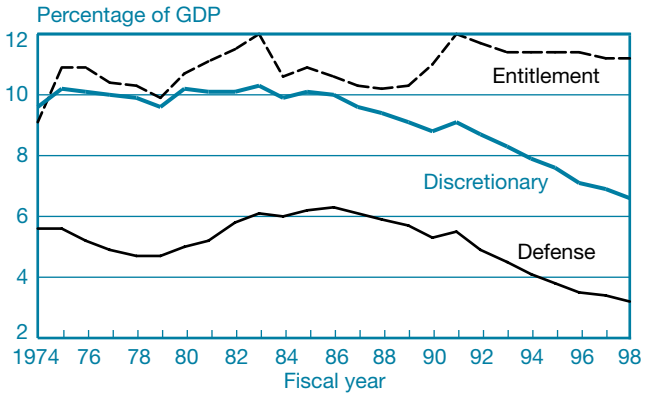
The Rise in Individual Income and Payroll Taxes

Since 1974, the individual income tax and the payroll tax have grown to account for more than 80 percent of all federal revenue (Chart 5). The payroll tax has grown steadily with the size of the Social Security System. The individual income tax has experienced two periods of sustained growth, both associated with the economic changes discussed above. The first was the bracket creep of the late 1970s and early 1980s, before the tax system was indexed. The second, the recent growth spurt, is primarily the result of a shift in the distribution of income during the 1990s. In between, the tax cuts of the early Reagan years are quite apparent. These tax cuts also affected corporate tax collections.

Summary

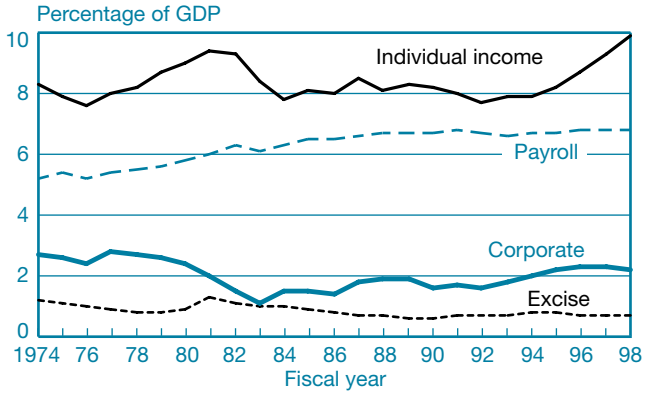
Since 1974, the federal budget deficit has risen and fallen while revenues have come more from income and payroll taxes, and expenditures have shifted away from discretionary spending and toward entitlements. Within entitlements, expenditures have shifted toward Social Security, Medicare, and Medicaid

Chart 4
Composition of Federal Spending, 1974-98



Source: U.S. Congressional Budget Office (1999a).

Chart 5
Composition of Federal Revenue, 1974-98



Source: U.S. Congressional Budget Office (1999a).

and away from other programs. Much of these changes are attributable to the economic forces discussed above. But there have also been significant policy initiatives during the past quarter century, with respect both to the levels of spending and revenues and to the manner in which these levels are determined. The next section offers a closer look at policy during the period.

Major Elements of Fiscal Policy, 1974-99

Since 1974, there have been several major pieces of tax legislation and several changes in regime with respect to the determination of expenditures and the reconciliation of revenue and expenditure totals. Charts 6 and 7 present estimates of the effects of these policy changes—based on contemporaneous Congressional Budget Office projections—covering most of the period, from just before fiscal year 1982 to the present. Before considering the charts, some discussion of the underlying data will be helpful.

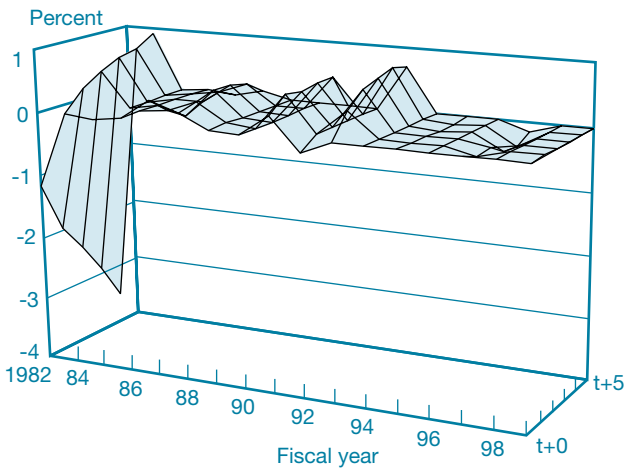
For many years, the CBO has provided frequent updates of its baseline revenue and expenditure forecasts for the federal budget, covering the current fiscal year and several—until recently, five—future fiscal years. With each update, the CBO allocates changes in forecast revenues and expenditures to legislative or policy actions on the one hand, and economic factors on the other hand (which it breaks down further into "economic"—macroeconomic—and "technical" sources).[3] The series graphed in Charts 6 and 7 are these projected policy changes, scaled by the appropriate year's GDP and organized by the fiscal year in which the changes were recorded. For each date in the charts, the projected changes for the current fiscal year and five subsequent fiscal years are presented. For example, changes recorded by CBO documents during fiscal year 1999 would be grouped together, presenting estimated changes to the current fiscal year's budget and those of the next five fiscal years.

As the CBO typically publishes an update of its *Economic and Budget Outlook* during the summer, near the end of each fiscal year, the changes in the charts will correspond roughly to the policy changes adopted during that fiscal year. An important exception to this timing convention occurs during the 1981-84 period, when the CBO's updates were less frequent. In particular, there were no updates providing breakdowns of budget changes in the summer of 1982 or in the summer of 1983. Hence, the changes listed for 1982 in the charts correspond to all those occurring between July 1981 and February 1983, or roughly all of fiscal year 1982 and half of fiscal year 1983. The changes listed for 1984 correspond to all those occurring between February 1983 and August 1984, or roughly half of fiscal year 1983 and all of fiscal year 1984. With their layout established, we turn now to the charts.

Tax Policy

Even a quick look at Chart 6 indicates that something very important and atypical for the period occurred in fiscal year 1982. Just before that fiscal year (and just after the previous CBO forecast), Congress enacted and President Reagan signed the Economic Recovery Tax Act, which included among its most important provisions a phased reduction in marginal tax rates and substantial accelerated depreciation incentives for businesses. What is all the more remarkable is that the changes shown in Chart 6 for fiscal year 1982 are *net* of the offsetting effects of that year's Tax Equity and Fiscal Responsibility Act (TEFRA), which raised taxes substantially. At the time, the CBO estimated that ERTA had reduced fiscal year 1986 revenues by $205 billion—27 percent of that year's baseline revenues in February 1983, 4.7 percent of that fiscal year's GDP, and an amount nearly as large as that fiscal year's budget deficit of $221 billion. While other factors contributed to the deficit, it is clear that the 1981 tax cut played a big role. It is also clear from Chart 6 that no changes since then have reached a similar magnitude, and that nearly all have been in the opposite direction. Other than TEFRA, the largest of the tax increases (in descending order of magnitude relative to GDP) occurred

Chart 6
Tax Policy Revisions as a Share of GDP



with the Deficit Reduction Act of 1984; the Omnibus Budget Reconciliation Act of 1993 (OBRA93), which raised marginal tax rates and uncapped the Medicare payroll tax; and OBRA90, which introduced luxury excise taxes and the phase-out of itemized deductions and personal exemptions.

The period since 1993 is notable both for its quietude—the tax cuts contained in the Taxpayer Relief Act of 1997 were insignificant relative to GDP, when compared with the previous tax changes—and its drift toward lower taxes. Most other changes during the period were also tax reductions, albeit very small ones.

The remaining important piece of tax legislation during the period, the Tax Reform Act of 1986, does not stand out in Chart 6 because that legislation by design was aimed at maintaining revenues at their previous level by raising the tax base and lowering marginal tax rates simultaneously.

In summary, it seems evident that tax policy—*after* the tax cuts made in 1981—was driven at least in part by the contemporaneous movement in the federal budget deficit over the period. A simple regression confirms what appears to the naked eye. The equation considered is given in the first column of Table 2. It is estimated over the period 1984-99 and has as its dependent variable the sum (over the current and subsequent five fiscal years) of that year's legislated tax changes relative to GDP. I use this variable rather than the changes for the current or some other specific fiscal year because the time pattern of changes differs somewhat over time. The equation's independent variable is the previous year's budget deficit, also relative to GDP. The estimated coefficient is 0.33, with a *t*-statistic of 2.11. That is, the cumulative impact of each year's legislated changes over a six-year budget window equals 33 percent of the previous fiscal year's deficit.

An alternative specification, given in the table's second column, substitutes the lagged *change* in the deficit-to-GDP ratio. This specification, which fits slightly better, indicates that policy acts to offset 70 percent of any deficit increases with revenue changes. To gauge this magnitude, remember that the policy changes include those over six years, although they often do not begin until the subsequent fiscal year. Thus, the permanent reduction in revenues would be around one-fifth or one-sixth as large as the cumulative change used as dependent variable. This implies that perhaps 12 to 15 percent of a rise in the deficit is immediately undone by revenue policy changes.

The third column of Table 2 adds to the list of independent variables the cyclical GDP gap, equal to the percent deviation of actual GDP from the CBO's estimate of potential GDP. This variable, which is positive when the economy is operating below capacity, has a coefficient with the "wrong" sign, in that it suggests that a rise in the output gap leads to tax increases. While it is doubtful that the government has actually chosen to follow a *pro*-cyclical tax policy, this coefficient reflects the fact that the largest tax increases occurred in fiscal years in which the economy was either in recession (1990) or was not fully recovered from a recent recession (1984, 1993). During the

Table 2

Response to Deficits and the State of the Economy, 1984-99

	Dependent Variables								
	Revenues			Expenditures			Expenditures Less Revenues		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Independent variables									
Constant	-0.47	0.85	0.63	0.35	-1.78	-1.88	0.83	-2.63	-2.52
	(0.80)	(2.97)	(1.88)	(0.27)	(2.87)	(2.45)	(0.53)	(3.55)	(2.74)
Deficit-GDP ratio, lagged	0.33	—	—	-0.53	—	—	-0.87	—	—
	(2.11)	—	—	(1.58)	—	—	(2.10)	—	—
Change in deficit-GDP ratio, lagged	—	0.70	0.49	—	-1.15	-1.25	—	-1.85	-1.74
	—	(2.49)	(1.46)	—	(1.87)	(1.64)	—	(2.53)	(1.91)
Cyclical GDP gap	—	—	0.18	—	—	0.09	—	—	-0.10
	—	—	(1.15)	—	—	(0.24)	—	—	(0.22)
Adjusted R^2	.19	.26	.27	.09	.14	.08	.19	.26	.21

Notes: The dependent variable is the sum of a fiscal year's legislated changes, relative to GDP. *t*-statistics are in parentheses.

recent period of strong economic performance, however, tax legislation has tended toward reduced revenues.

In all, revenue as a share of GDP has actually risen since 1974, from 18.3 percent of GDP to 20.5 percent in 1998. However, as of 1994, *after* the most recent legislative tax increase, the share stood at 18.4 percent, virtually the same as that of 1974. Hence, the recent increase is not directly attributable to changes in tax policy. The succession of tax cuts and tax increases has left the federal income tax with a less progressive rate structure, with the top marginal rate declining from 70 percent prior to the 1981 tax cut to a statutory maximum of 39.6 percent at present.

Expenditure Policy

It is much more difficult to summarize the evolution of expenditure policy over the past quarter century. First of all, the expenditure side of the budget is much more heterogeneous than the tax side. As discussed, the composition of expenditures changed markedly over the period, with a shift to Medicare, Medicaid, and Social Security from all other parts of the budget. Indeed, the rapid growth in these areas had little to do with actual policy changes. Second, changes in expenditure policy typically have involved not simply changes in program rules, but rather changes in future spending targets, with the ultimate details left to be worked out later and the feasibility of eventually meeting the targets uncertain. As a result, the timing of the actual policy changes is ambiguous. Should we count the changes when the determination was made—as we actually do—or when (and if) the changes were successfully implemented?

With this cautionary preamble, we may now turn to consider the history of expenditure policy changes since 1982, shown in Chart 7. The chart follows the same approach as Chart 6 did with revenue changes. Whereas the major post-1981 revenue changes all represented tax increases, most of the changes in expenditure policy during this period have been toward decreasing expenditures. The one important exception was in fiscal year 1982, when out-year expenditures were projected to rise as a result of the combined impact of the defense build-up and the increased debt service due to that year's large tax cut, despite large cuts in nondefense programs.

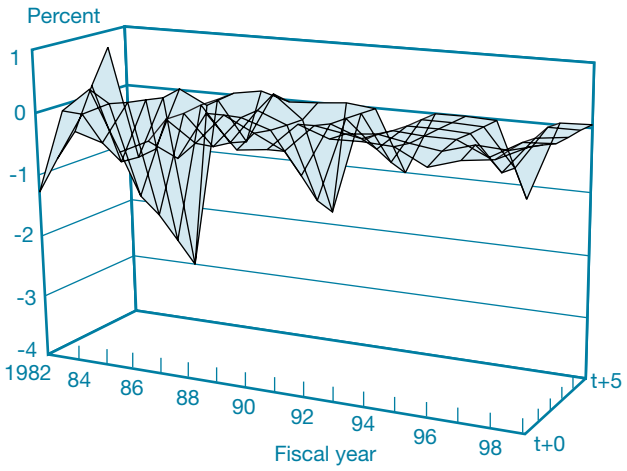
The four largest policy reductions in expenditures, relative to GDP, occurred in fiscal years 1986, 1991, 1997, and 1993, in decreasing order of importance. The first represents the establishment of deficit targets—and automatic spending cuts, should those targets be missed—by the Balanced Budget and Emergency Deficit Control Act, the initial Gramm-Rudman-Hollings (GRH) bill, passed in late 1985. The second reduction corresponds to the late-1990 passage of the Budget Enforcement Act. This act jettisoned the GRH approach and replaced it with limits, or "caps," on discretionary spending, along with the requirement that any new measures to increase entitlement spending or reduce taxes had to be offset, during the five-year "budget window," by offsetting entitlement cuts or tax increases. The remaining two reductions came with the 1993 and 1997 extensions of the Budget Enforcement Act, with the establishment of new discretionary spending caps. Thus, all of the period's major legislative reductions in spending have coincided with the adoption or amendment of budget procedures.

Like revenue changes, expenditure changes have occurred in times of large deficits. The middle three columns of Table 2 repeat the exercise just considered for revenues, relating cumulative changes in spending to the lagged deficit, lagged change in deficit, and lagged GDP gap. These results suggest that the spending response to deficits has been larger than the revenue response, although this response is estimated less precisely. Unlike revenue policy, expenditure policy has been countercyclical, but the estimated effect is very weak. The final three columns of Table 2 repeat the previous regressions, with expenditures less revenues as the dependent variable. Again adjusting the coefficient to account for the fact that the cumulative changes in revenues and expenditures include those of five or six years, this implies a total policy response that offsets 30 to 40 percent of deficit changes.

In summary, U.S. fiscal policy on both the revenue and spending sides of the budget has been responsive to the fluctuations in the deficit in recent years, after the period's largest single policy change: the enormous tax cut of 1981.[4]

Chart 7

Expenditure Policy Revisions as a Share of GDP



Have Budget Rules Worked?

The unified budget deficit that stood at nearly 6 percent of GDP in the early 1980s has disappeared, at least for the moment. What role did the various budget restrictions introduced during the period play in effecting this change?

One might count the measures as successful, based on the reductions in the deficit that followed the GRH legislation in 1985 and the Budget Enforcement Act in 1990. But how can we distinguish this hypothesis from the alternative one that Congress intended to change its behavior, and that the succession of budget rules simply coincided with these changes, exerting no additional impact? Or, perhaps these two episodes were simply fortuitous coincidence. Research conducted at the state level—considering the impact of alternative, longstanding budget restrictions on fiscal policy (for example, Poterba [1997])—has generally found that such restrictions do have an impact. But unlike the situation at the state level, we have only one federal government; we cannot compare policy rules across different regimes at a given time. Over time, we can make no claim that the budget rule changes have been "exogenous," and so we cannot necessarily attribute subsequent changes in taxes and spending to the changes in regime. For example, discretionary spending has, indeed, declined very rapidly as a share of GDP since 1991, following the introduction of discretionary spending targets (Chart 4). But this coincided with the decline in defense spending after the collapse of the Soviet Union.

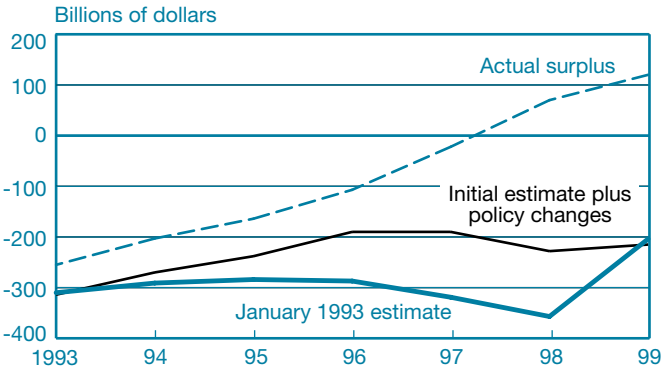
Perhaps the best evidence that the budget rules have worked lies in the instances in which they have failed, when legislators have sought ways around them. Had the restrictions simply ratified planned policy actions, then no such "end runs" would have been needed. During the GRH period, when *annual* deficit targets were set, there appears to have been a significant reliance on "one-time" savings such as asset sales (Reischauer 1990), and the timing of deficit-reduction polices appeared to be skewed more heavily toward first-year changes (Auerbach 1994). More recently, during the Budget Enforcement Act period, discretionary spending caps have been associated with an expansion of "emergency" spending not subject to the caps. In fiscal year 1999, authorized emergency spending reached $34.4 billion (U.S. Congressional Budget Office 1999b). At least some of this spending—for such items as farm price support, Y2K computer conversion, and drug interdiction activity—is not consistent with the uninitiated observer's conception of emergencies. Other initiatives that might have been introduced as discretionary spending programs, such as the HOPE scholarships contained in the 1997 tax bill, have appeared as tax expenditures instead.

But if these responses indicate that budget rules have had an impact, they also are likely to have introduced economic distortions. Using the tax code as an alternative to proscribed increases in discretionary spending appears to have greatly complicated the tax system, particularly in combination with the various income phase-outs used to limit the access to new tax expenditures by higher income households.

Ultimately, budget rules that are too much at odds with underlying legislative preferences do not last, as evidenced by the repeal of GRH in 1990, when it was clear that upcoming deficit targets would be missed and, perhaps, at present, when the looming discretionary spending caps appear unreasonable to many.

It is also important to recognize that policy changes are responsible for only a portion of the recent improvement in the deficit. The impact of legislation during the 1993-99 period is shown in Chart 8, which starts with the January 1993 surplus forecasts and adds to them the cumulative estimated effects of policy changes that have occurred since then. As late as 1996, these changes explain a significant part of the improvement over the original forecast. However, since 1997, a growing part of the improvement must be attributed to other factors. Indeed, by 1999, *more than all* of the improvement from the original forecast must be explained by factors other than policy changes, because the policy changes since January 1994 (when the initial forecast for fiscal year 1999 was reported) have been estimated to *reduce* the budget surplus. This gap is much larger than would be associated with normal cyclical variation. For example, in 1998, the cyclical boom then under way was

Chart 8
Changes in the Budget Surplus since January 1993



Note: The initial estimate is for fiscal year 1999 from January 1994.

estimated by the CBO to have pushed the surplus $71 billion *above* its standardized, or "full-employment," deficit of $1 billion. Yet the surplus was $298 billion higher than what was forecast in January 1993, even after account had been taken of the $129 billion attributable to deficit-reduction policy.

What other factors might be at work? First, the view of what constitutes full employment has shifted, as unemployment rates substantially below 5 percent have now been sustained for a long period without any significant rise in the inflation rate. Thus, even though the economy is still deemed to be "above" its full-employment level of output, that level itself has risen; that is, a larger share of the current surplus would be attributed to cyclical factors using the 1993 view of full employment. However, the CBO estimate of the natural rate of unemployment embodied in its estimate of the standardized employment surplus actually has not fallen much since 1993, only from 5.8 percent in 1993 to 5.6 percent in 1998 (U.S. Congressional Budget Office 1999a).

If one applies an Okun's Law coefficient of 2 to translate this into 0.4 percent higher implied real GDP and assumes that revenues increase roughly in the same proportion, this implies that revenues are now about 0.4 percent higher—and the standardized employment deficit is smaller by the same amount—because of the estimated drop in the natural rate of unemployment. But with revenues of about $1.8 trillion, this is barely $7 billion a year—quite small an amount relative to the recent improvement in revenues.

The remaining share of the increased surplus has come in large part from the surge in federal tax revenue and its components, already discussed above.

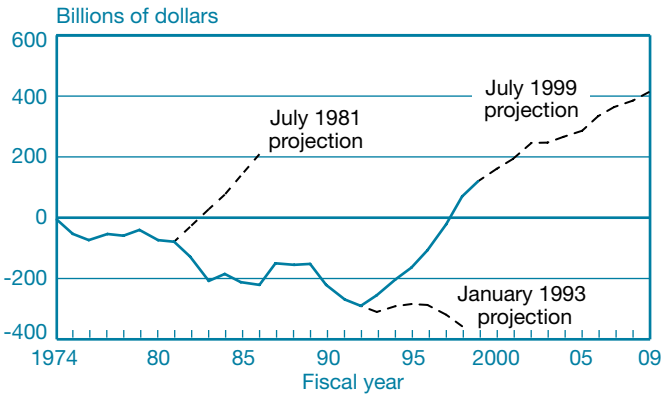
Where Do We Stand Today?

As we consider the current state of fiscal policy, reflecting on the success of budget rules and other factors in reducing the deficits of the past two and a half decades, we may ask what the current state of fiscal policy is. Do the rising surpluses and high ratio of revenues to GDP represent sufficient grounds for fiscal leniency? Unfortunately, these trends are misleading, for a number of reasons.

Forecast Uncertainty

Chart 9 presents the federal budget surplus since fiscal year 1974, along with the most recently published (July 1999) CBO

Chart 9
Federal Budget Surplus, 1974-2009



projections for the fiscal years through 2009, indicating that increases in the surplus are projected to continue. But the chart also presents two earlier sets of CBO projections of future deficits, one from July 1981 and the other from January 1993. As discussed, the 1993 projection turned out to be too pessimistic, even controlling for policy changes that occurred thereafter. Very much the opposite was true in 1981, when the subsequent tax cuts were compounded by much lower levels of GDP and tax revenue than had been predicted. Over this entire period, budget forecasting has proved very challenging, and errors have been quite large in absolute value relative to the totals being projected (Auerbach 1999). Thus, the very uncertain nature of the forecasting process means that we cannot be confident that surpluses in the range of current projections will be realized.

Optimistic Policy Assumptions

The surplus projections for the next decade reflect current policy. But current policy incorporates the discretionary budget caps, updated most recently in 1997. By fiscal year 2009, this would leave discretionary spending at just 5.0 percent of GDP. These assumptions may be unrealistic, a point brought home by the recent surge in "emergency" discretionary spending.

From an historical perspective, the levels of discretionary spending projected are nearly unprecedented. For example, suppose that international spending (currently 0.2 percent of GDP) was eliminated entirely and that the remaining components of discretionary spending—defense and domestic nondefense spending—were each allocated 2.5 percent of GDP in 2009. For domestic spending, this would be the lowest

percentage since 1962. For defense, it would be the lowest percentage since before World War II.

Yet changing the discretionary spending trajectory to one reflecting perhaps more realistic spending levels would have huge effects on future budget outcomes. Table 3, taken from Auerbach and Gale (1999), reports the results of making alternative assumptions about changes in discretionary spending over the next decade, accounting not only for the direct effect of the change in discretionary outlays but also for the associated change in debt service.[5] Holding discretionary spending at its current level of GDP—that is, sustaining the reductions of the past two decades but going no further—would cost more than $1.3 trillion over the next ten years. Just holding discretionary spending constant in real terms from 1999 to 2009 would cost $556 billion relative to baseline.

The Limited Meaning of the Unified Budget

Chart 10 repeats the surplus projections for the decade 1999-2009 from Chart 9, along with two modified versions of the surplus. The first alternative is the "on-budget" surplus that excludes accumulations of the Social Security trust fund.[6] These trust fund accumulations are currently running at about 1.2 percent of GDP and are projected to rise to 1.8 percent of GDP by 2009. While much has been made of the appropriate treatment of the Social Security surplus, far less attention has been paid to the fact that the on-budget surplus still contains the accumulations of other trust funds—those of Medicare Part A (HI), and the civilian and military retirement systems. Any argument for excluding the Social Security surplus applies to these trust fund accumulations as well, and excluding them from the on-budget surplus yields the final series in Chart 10. This "modified" on-budget surplus actually becomes positive only in fiscal year 2002.

Many argue that it is misleading to include the Social Security surplus in the overall budget surplus calculation, because this surplus is being intentionally accumulated for the purpose of paying future Social Security benefits, an associated implicit liability that is not included in the overall budget. However, following this logic, one should not exclude Social Security trust funds from the accounting, but rather should *include* the associated liabilities that are accruing—liabilities that exceed trust fund accumulations. It is only through such a comprehensive approach that one can make sense of the coexistence of a budget "surplus" and a Social Security "crisis" at the same time. This issue is even more relevant for Medicare, expenditures on which are projected to grow much more rapidly over time than those on Social Security because of the continued rise in medical expenditures per capita.

If one looks at the long-run budget picture, rather than that of the current year or the near term, even taking the current projections as given, then there is no surplus.

Using long-run CBO projections through 2070, and the assumption that tax and spending aggregates maintain their 2070 ratios to GDP thereafter, Auerbach and Gale (1999) update the calculations presented in Auerbach (1994) to solve for the permanent "fiscal gap." This gap is defined as the size of the permanent increase in taxes or reductions in noninterest expenditures (as a constant share of GDP) that would be

Chart 10
Projected Surplus, 1999-2009

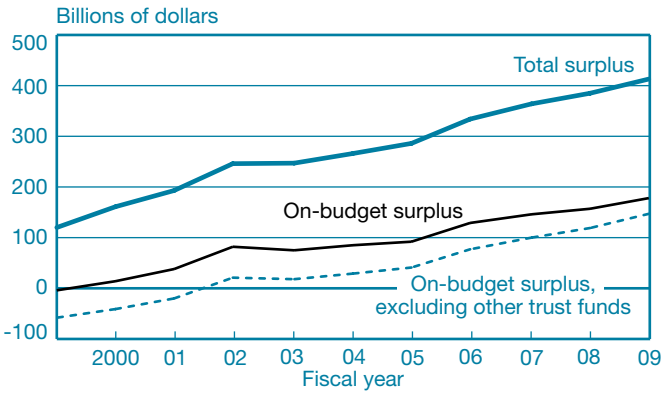


Table 3
Ten-Year Costs of Changes in Discretionary Spending (DS)

Policy		Discretionary Spending in 2009	Cost Relative to Baseline[a]
1999-2002	2002-09	(Percentage of GDP)	(Billions of Dollars)
Nominal DS declines	Real DS constant	4.99	—
Nominal DS constant	Real DS constant	5.04	43
Real DS constant	Real DS constant	5.43	566
Maintain percentage of GDP	Maintain percentage of GDP	6.49	1,343

Source: Auerbach and Gale (1999).

[a]Includes added debt service costs to higher outstanding public debt.

required to satisfy the constraint that the current national debt equals the present value of future primary surpluses. The hypothetical change, denoted Δ, satisfies the equation:

$$B_{1999} = \sum_{s\,=\,1999}^{\infty} (1+r)^{-(s+1-1999)}(S_s^p + \Delta \cdot GDP_s),$$

where B_{1999} is the current value of the national debt, r is the government's nominal discount rate, GDP_s is the level of nominal GDP in year s, and S_s^p is the primary surplus in year s absent the change in policy. The government constraint in the equation is implied by the assumption that the debt-to-GDP ratio cannot grow forever without bound. It would also follow from the assumption that the debt-to-GDP ratio eventually (that is, as time s approaches infinity) converges to its current value.[7,8]

Table 4, taken from Auerbach and Gale (1999), reports estimates of long-run fiscal gaps under different scenarios. The first row reports the gap under baseline assumptions, with no change in policy. The 1.30 percent figure in this row means that a permanent and immediate tax increase or spending cut of 1.3 percent of GDP would be required to maintain long-term fiscal balance—roughly $120 billion at current GDP levels. That estimate, however, depends crucially on the assumption that real discretionary spending is reduced as projected in the budget forecast. If discretionary spending was held constant at its 1999 level relative to GDP, the long-term fiscal gap would rise to more than 3 percent, as noted in the table's second row. In a sense, the true gap is this latter figure, with discretionary spending cuts presently projected to account for just under 60 percent of the necessary adjustment.

Table 4
Estimates of the Long-Term Fiscal Imbalance

Details	Fiscal Gap (Percentage of GDP)
Baseline	1.30
Discretionary spending constant at 1999 share of GDP	3.17
Congressional Conference Agreement	2.47
Congressional Conference Agreement delays adjustment until 2010	2.98
Clinton plan	1.83
Clinton plan delays adjustment until 2010	2.21

Source: Auerbach and Gale (1999).

The remaining four rows in the table list the values of the long-run gap under four alternative policy scenarios. The first of these, in the third row, assumes enactment of the tax cut agreed to in conference by the House and Senate in the summer of 1999, and ultimately vetoed by President Clinton.[9] Had the changes included in this legislation been adopted, the long-run gap would have nearly doubled. Indeed, given that the tax cut was specified through 2009, it might make sense to express the long-run gap under the assumption that no further action would be taken until fiscal year 2010. This delay, of course, would make the eventual adjustment larger on an annual basis, as the next row of the table shows.

The final two rows of the table present the results of a similar set of exercises for the proposals put forward in President Clinton's fiscal year 2000 budget, presented to Congress in early 1999. This budget proposed a series of tax changes—including some tax increases but, overall, a net tax decrease—coupled with a range of increased spending. As the table shows, this plan, too, would have worsened the long-run gap, although by less than the Congressional plan.

The results of these calculations are sobering, given how much improved the current fiscal picture is relative to its condition just a few years ago. The long-run forecast, even assuming continued strength in federal tax revenues and a continuing decline in discretionary spending—each of which is subject to considerable debate—still embodies a large imbalance. To eliminate this imbalance would require significant further cuts in government spending or increases in tax revenues—budget tightening totally at odds with the proposals put forward this year by both parties and both branches of government.

Conclusions

Since 1974, the setting of U.S. fiscal policy has passed through several budget regimes, reflecting a series of attempts to control the large budget deficits that began in 1981. The composition and levels of federal taxes and expenditures have changed as a result of numerous policy changes, but also because of changes in the economy and even the international environment, which permitted the decline in defense spending that occurred. Now, and even more in the years to come, the federal budget will consist of transfer payments. By 2009—*before* the retirement of the baby-boom generation commences—Social Security, Medicare, and Medicaid are projected to account for 60 percent of the federal budget, excluding interest.

This shift from discretionary spending to age-based entitlement spending has important implications. First, it means that short-term deficits have become less and less useful as indicators of the longer term fiscal situation, because of the current budgetary approach of ignoring implicit federal commitments. Second, it suggests that the recent reliance on discretionary spending cuts to "make room" for ongoing entitlement growth may have reached the end of its effectiveness, as discretionary spending is approaching an historically low share of GDP. Third, as entitlement growth is driven by demographic and economic factors rather than by explicit legislation, it will require active program *reductions*, rather than simply legislative forbearance, to improve the current fiscal situation. With the increasing complexity of the tax system that has arisen under the regime of discretionary spending caps, one may hope that—under whatever the next budget process is—the distortions of the past approaches, as well as their successes, will be remembered.

Endnotes

1. This issue is discussed at greater length in Steuerle (1992).

2. There was also an income-based phase-out of the ability of taxpayers to deduct real estate losses.

3. Although the distinction is not always clear, these changes are meant to be those resulting from policy actions rather than from autonomous growth, an important distinction when considering the rapid growth of entitlement programs such as Medicare. Thus, a policy of continuous program cuts need not actually lead to declines in spending over time if there is an underlying trend in the opposite direction, as has been the case in health care spending.

4. This finding is consistent with previous results, which typically have not distinguished between policy changes and other, autonomous changes in the budget. For example, Bohn (1998) finds that primary surpluses have responded to increases in debt-GDP ratios.

5. To account for the added net interest costs of reductions in the surplus relative to baseline, we use the three-month Treasury bill rate (U.S. Congressional Budget Office 1999b, p. 18).

6. This measure also excludes the U.S. Postal Service budget surplus, which is negligible by comparison.

7. The CBO undertakes a similar calculation by measuring the size of the immediate and permanent revenue increase or spending cut that would be necessary to result in a debt-to-GDP ratio in 2070 equal to today's ratio. The cutoff at 2070 is arbitrary, however, and understates the magnitude of the long-term problem. This is because the primary deficits in the years after 2070 are projected to be larger than those of the typical year between now and 2070. Thus, including such years, which provides a more accurate and complete picture of the situation, also makes the situation appear worse.

8. The calculation based on the equation also requires a long-term discount factor (r) and a long-term GDP growth rate. For these, I use the ones constructed for a similar purpose by the Social Security Board of Trustees, taken from their 1999 annual report (Board of Trustees, Federal Old-Age, Survivors, and Disability Insurance Trust Funds 1999, Table III.B.1).

9. Because the legislation did not specify any changes after fiscal year 2009, the simulation takes the changes for the last full fiscal year specified and assumes them to be constant, relative to GDP, in the fiscal years after 2009.

References

Auerbach, Alan J. 1994. "The U.S. Fiscal Problem: Where We Are, How We Got Here, and Where We're Going." In Stanley Fischer and Julio Rotemberg, eds., NBER Macroeconomics Annual, 141-75. Cambridge: MIT Press.

———. 1999. "On the Performance and Use of Government Revenue Forecasts." National Tax Journal (December): 767-82.

Auerbach, Alan J., and Daniel Feenberg. 1999. "The Significance of Federal Taxes as Automatic Stabilizers." Unpublished paper, September.

Auerbach, Alan J., and William G. Gale. 1999. "Does the Budget Surplus Justify Large-Scale Tax Cuts? Updates and Extensions." Tax Notes, October 18: 369-76.

Board of Trustees, Federal Old-Age, Survivors, and Disability Insurance Trust Funds. 1999. 1999 Annual Report.

Bohn, Henning. 1998. "The Behavior of U.S. Public Debt and Deficits." Quarterly Journal of Economics (August): 949-63.

Furchtgott-Roth, Diana, and Kevin Hassett. 1997. "The Skyline Tax." Weekly Standard, September 29.

Poterba, James M. 1997. "Do Budget Rules Work?" In Alan Auerbach, ed., Fiscal Policy: Lessons from Economic Research, 53-86. Cambridge: MIT Press.

Reischauer, Robert D. 1990. "Taxes and Spending under Gramm-Rudman-Hollings." National Tax Journal (September): 223-32.

Steuerle, C. Eugene. 1992. The Tax Decade: How Taxes Came to Dominate the Public Agenda. Washington, D.C.: Urban Institute.

U.S. Congressional Budget Office. 1999a. "The Economic and Budget Outlook: Fiscal Years 2000-2009." January.

———. 1999b. "Emergency Spending under the Budget Enforcement Act: An Update." June.

———. 1999c. "The Economic and Budget Outlook: An Update." July.

———. 1999d. "Preliminary Estimates of Effective Tax Rates." September.

U.S. Joint Committee on Taxation. 1998. "Present Law and Analysis Relating to Individual Effective Marginal Tax Rates." JCS-3-98, February 3.

Barry Bosworth

Commentary

In a relatively brief paper, Alan Auerbach takes on a large task of trying to summarize and draw some conclusions from a quarter century's experience with fiscal policy. With a series of charts and tables, he provides a survey of the major themes in fiscal policy since the early 1970s; but the focus of the paper is on the effort to control the budget deficits that emerged after 1981. Auerbach argues convincingly that the 1981 tax reduction was the dominant event of the period and that it strongly influenced the future direction of both tax and expenditure policies. In my remarks, I would like to extend his theme by trying to ask what has changed as a result of our experience over the past twenty-five years. In that regard, I am most struck by two major innovations. First, in contrast to the late 1960s and early 1970s, fiscal policy has nearly disappeared as a serious tool of short-term stabilization policy. Second, after more than a decade of bitter partisan battles and frequent pronouncements of doom by economists, the budget deficit itself also simply disappeared.

In part, the decline in fiscal policy is simply a reflection of political partisanship that impedes cooperation on economic policy. But beyond the political factors, there are important economic reasons for its fading role. The stature of monetary policy has grown enormously compared with the 1970s. That ascendancy reflects a combination of change in the economic environment in which monetary policy operates, new insights into how to conduct it, and a continuing evolution of the longstanding debate within the profession about the relative effectiveness of monetary and fiscal policy. U.S. monetary policy also emerged in the 1980s with a clear and simple set of policy priorities, something largely absent from fiscal policy.

However, before we write off fiscal policy too quickly as an unneeded redundancy, it is worthwhile to note that the ascendancy of monetary policy has occurred during a period in which the United States was faced with an extraordinary, benevolent economic environment. There have been no unfavorable economic shocks comparable to the energy price increases of the 1970s, and slow growth in the rest of the world has provided the United States with substantial gains in terms of trade. I think we can all agree that the primary credit accruing to the monetary authorities is that they have done nothing at a time when nothing turned out to be the best policy. Regardless, monetary policy has become the primary tool of short-run stabilization, with fiscal policy relegated to a backstopping role. That development has had the added benefit of allowing the focus of fiscal policy to shift toward longer term goals such as promoting economic growth.

Another surprise has been the dramatic reversal of the trend in the fiscal balance within the past few years. For more than a decade, large and growing budget deficits were at the center of any discussion of American budgetary policy. The inability of the Congress and the President to cooperate on a program of deficit reduction was central to the creation of a highly partisan paralysis of the federal government throughout the late 1980s and most of the 1990s. Yet today, the outlook is for a future of

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large and rising budget surpluses; and most surprising of all, that appears to have occurred without the Congress and the President changing policy in any considerable way.

The magnitude of the revisions to the outlook is highlighted in Chart 1, which shows the progression of the ten-year budget projections, based on current policy, of the Congressional Budget Office (CBO) from 1997 to the present. As recently as early 1996, the outlook was for large and ever-growing deficits that were expected to be about $375 billion by 2005. Today, those same current policy projections show a surplus of $300 billion by 2005, a turnaround of more than 30 percent of government outlays. Those revisions can be divided into three components: legislative actions, changes in the economic projections, and technical reestimates. Except for actions taken in 1997, legislative changes have played a trivial role in the changed outlook. And even in 1997, the Congress acted only in the sense of imposing discretionary spending limitations on future congresses.

Over the three-year period, the changes have been about equally split between revisions to the economic outlook and technical changes. In the summer of 1997, the CBO raised its estimate of the long-run growth rate from 2.0 to 2.3 percent annually and lowered the projected bond rate by half a percentage point. In addition, revisions to the national accounts indicated a much higher proportion of the GDP going to taxable forms of income. The result was a shift in the projected balance for fiscal year 2005 of more than a full 1 percent of GDP. Further upward revisions can be anticipated in the year ahead.

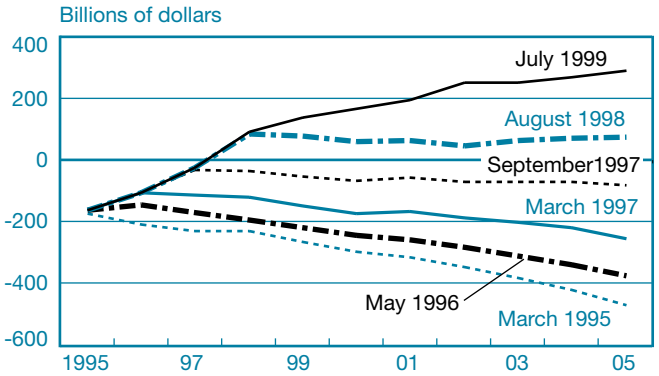
The technical changes can be traced in part to lower rates of growth in the medical programs, but the big surprise has been on the revenue side, as personal income tax receipts have been far above expected levels in 1995-98. It has been difficult to account fully for the surge in revenues. There is a substantial lag in the availability of detailed data on personal income taxes, and there are two major competing explanations: a higher-than-expected flow of capital-gains taxes and a concentration of the aggregate income gains among high-income individuals with high marginal tax rates. At present, data are available only through 1997 and they suggest that both factors have been important, but the biggest contribution is from unexpectedly high capital-gains taxes. Initially, the CBO treated the revenue surprise as a transitory phenomenon and reduced the effective tax rate in future years, but it is now projected to continue indefinitely. There are, however, no new projected April surprises.

The current budgetary outlook is summarized in Chart 2. It is evident that the projected balance for the total budget is heavily dominated by the surplus in the Social Security account, which will continue until the baby-boom generation reaches retirement. Both political parties have pledged to save the Social Security surplus, and that statement is interpreted as necessitating a surplus or balance in the non–Social Security (on-budget) accounts.

Exclusive of Social Security, the Congress will find it difficult to achieve balance in the fiscal year 2000 budget and beyond because the discretionary spending caps imposed in 1997 will become progressively more difficult to meet. In essence, discretionary expenditures, representing about one-third of the budget, are capped at their current nominal values. Furthermore, the effective tax rate is assumed to stay at

Chart 1

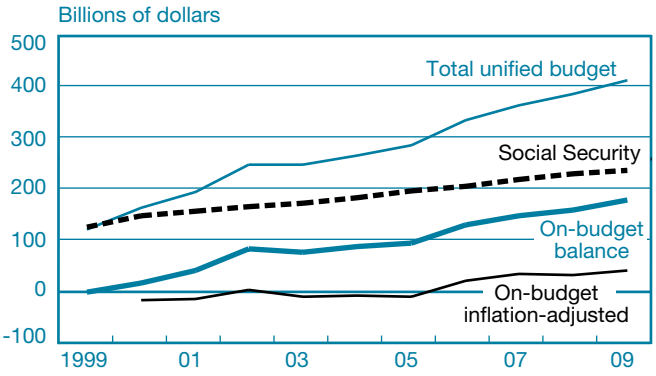
CBO Unified Budget Projections, 1995-99



Source: U.S. Congressional Budget Office; data compiled by Robert Reischauer of the Brookings Institution.

Chart 2

Projected Budget Balance, 1999-2009



Source: U.S. Congressional Budget Office.

Note: An inflation-adjusted balance allows for discretionary spending to grow in line with inflation.

its current high level. On that basis, the on-budget surplus would be substantial in future years, exceeding $100 billion annually after 2005. But if discretionary spending is assumed simply to grow in line with inflation, there is no significant surplus.

Auerbach wants to argue that the current surpluses are illusionary because the Social Security trust fund will be in substantial deficit, beginning a quarter century from now. That is true, but I do not believe that it will negate the economic effect of a large surplus today. I doubt that projected unfunded future liabilities have the same effect as spending today, and I am not sure that the calculation of an infinite-horizon budget balance helps the public or the Congress to evaluate the budget options before us. Unlike Auerbach, I would prefer to separate the public retirement funds from the rest of the budget and argue for a steady shift toward greater funding and a reduced emphasis on a pure "pay-as-you-go" approach. Much of the current discussion focuses on the distinction between discretionary spending and entitlements; but I think it misstates the issue to some extent. I agree with the point in Auerbach's paper that the more relevant problem lies in the dominant role of budget programs that benefit the elderly.

C. Eugene Steuerle

Commentary

To tell the tale of recent fiscal policy, one must relate it to the recent past. The postwar period to about 1974 was an era of easy financing. Not only was economic growth high, it far exceeded the expectations conditioned partly on the Depression experience. But economic growth told only a small part of the story. Domestic policy actions were financed by an extraordinary shift out of defense—from about 14 percent of GDP in 1953 to 5.5 percent in 1974 and to about 3 percent today. This shift—most of which had occurred by the end of the Vietnam War—in today's economy produces about $1 trillion that can be spent on domestic programs without any increase in tax rates. Inflation led to significant bracket creep in the income tax and, as it accelerated, it made real interest rates on government debt very low. Social Security tax rates were also rising with little notice, partly because most retirees until today—rich and poor alike—paid net negative tax rates when their increasing levels of benefits were compared with their tax liabilities.

All of these factors led to extraordinary growth in the rate of domestic spending—so high that more than half of all this country's domestic spending growth (as a percentage of GDP) took place during the Eisenhower and Nixon presidencies alone (Steuerle and Mermin 1997). Moreover, the public was receiving legislative tax cuts at the same time.

Only gradually has the exceptional nature of this Era of Easy Finance, as I have labeled it, come to be recognized, long after its financing sources for domestic spending expansion began to wane. In the post-1974 period, defense declines as a percentage of GDP continued, but a moderate build-up in the early 1980s warned that they could not continue forever. Then the tax system was indexed for inflation. Meanwhile, the rate of inflation slowed, leading to high realized real interest rates. By the 1990s, we also entered the first postwar decade in which Social Security tax rates were not increased. Of course, economic growth also was slower. The easy spending/tax cutting days were coming to an end, and budget acts began to take gradual recognition of the new period.

While before 1982, almost every major budget act was either an expenditure increase or a tax cut, from 1982 until 1997, almost all major legislation was, *on net*, a tax increase or an expenditure cut.

The 1981 tax cuts were really old wine in a new bottle. In many ways, they duplicated the Kennedy tax cuts in substance and form. Only fiscal policy was fundamentally different. In the early 1960s, it did not matter whether the Keynesians were right or not. If right, surpluses would come in three years; if wrong, they would take five years or so to appear. However, in the early 1980s, it also did not matter whether the supply-siders were right or not. Even with a remarkable spurt in economic growth, the budget was still headed toward large future deficits.

What was different? In the earlier period—indeed, throughout all of the nation's history up until then as well—fiscal slack was scheduled for the indefinite future, and it would rise over time. In the later period, little fiscal slack was available,

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These comments are based in part on Steuerle et al. (1998). The views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

and it was declining rather than rising over time. If one looks closely at the Reagan cuts, especially in terms of revenues as a percentage of GDP, federal taxes by the mid-1980s were still as high as they were in the mid-1970s, right before inflation caused enormous bracket creep and large tax increases. Today, despite those cuts, average tax rates by some measures are at a peacetime high (primarily because a less even distribution of income has added to average tax rates indirectly through the progressive income tax).

None of this fully explains why fiscal slack has dried up. Even if all sources of easy financing are eliminated and the economy slows, real revenues still rise about as fast as GDP over time. This implies that the future would portend enormous slack between future revenues and *existing* levels of expenditures "as far as the eye could see."

This type of slack used to be available when revenues were compared with expenditures under current law, as well as with existing levels of expenditures. But since the former fiscal or budgetary slack is gone, something must be different. And it is! What is fundamentally different is the composition of expenditures under current law. The nation moved from a budget that was primarily discretionary to one that was primarily one of entitlements. Moreover, it was not just that money was now put into programs that were scheduled to last forever. Some programs were also scheduled to grow, even at rates faster than GDP, forever and ever. Is it any surprise, then, that budget crises started to arise, and are scheduled to reappear once the baby-boomers start to retire?

Now, when the growth rate of entitlements is, say, 2 percent per year higher than GDP, there is still a lot of slack when those programs represent only one-tenth of the budget. When they start to occupy more than half of the budget, however, they start to matter a great deal. Chart 1, for example, shows Social Security, Medicare, and Medicaid as a share of GDP over the past few decades and according to future projections.

Never before in our history has so much been preordained in the budget even before the Congress votes on it. Imagine if at the Constitutional Convention our founding fathers had decided to set the entire expenditure budget for today. We would find that effort almost laughable. Yet that is exactly what we have done for the budget more than 200 years from now.

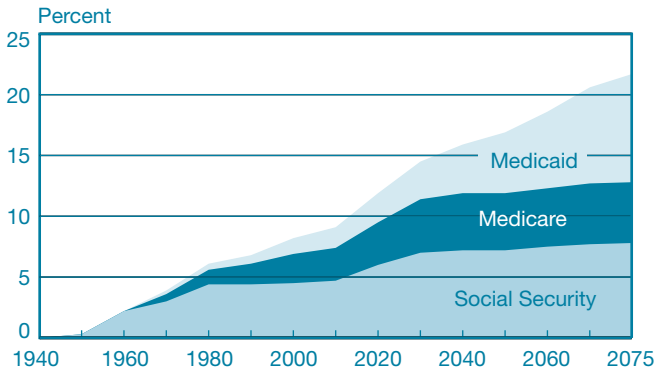
The reasons are not as complex as they might appear. In Social Security, the program is set up to grow forever faster than the economy because of the way it is indexed for wage growth and because it provides more and more years of benefits as we live longer. In many of the nation's health programs, access to new health goods and services is provided at no cost to the consumer, and the producer is in a position to bargain with the consumer over what the rest of society can be charged. Some think these problems are only an issue of demographics. Certainly, declining fertility and mortality lead to an aging of the population, exacerbating the potential budget crisis severely once the baby-boomers begin to retire, but the problem exists even without these additional demographic pressures. Most of the entitlements in question were designed around wants independently of the number of taxpayers who would be around to finance them. Thus, demographic factors simply bring to a head the difficulty of designing an expenditure program that has growth rates independent of the taxes available to pay for it.

Just how different this era is can be seen by ranking presidents by the growth in domestic spending as a percentage of GDP when they were in office (Steuerle and Mermin 1997). President Roosevelt ranks near to last. It was not merely that spending increased under Hoover more than most historians recognize or that World War II led to massive increases in defense spending. Most importantly, the majority of the spending increases under Roosevelt were always meant to be temporary, to meet the needs of the time. Thus, they were very different than the modern, large entitlement programs that are scheduled to grow in good times and bad alike. (Social Security itself was established under FDR, but it was much smaller in scope and did not have nearly as much growth built into its formulas.)

Go back further into the nation's history, and the same lesson applies. Almost all prior expenditure increases—for example, for the Louisiana Purchase, payments to war veterans, fighting the Depression—were temporary, no matter how large or grand they were at first.

Chart 1

Social Security, Medicare, and Medicaid as a Share of GDP



Source: Urban Institute. Based on the U.S. government budget, fiscal year 2000.

Alan Auerbach suggests in his paper that assumptions used to project future discretionary spending are unreasonable. He is right. These assumptions would have such spending falling toward zero as a percentage of GDP over time. Today, we are sitting in the eye of the storm. A temporary reprieve is granted while the ranks of the elderly are filled with the baby-bust generation of the Depression and World War II and the baby-boomers continue to represent a large share of the labor force. But future deficits are scheduled because of the entitlement spending growth of current law.

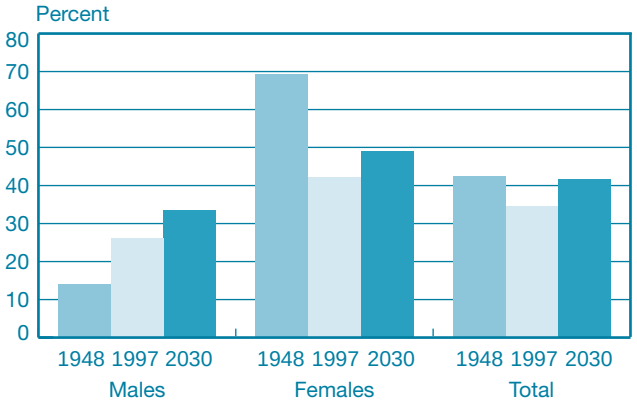
One final note. Fiscal policy is often considered an issue of how government is influencing the market for saving or investment. Similarly, economists love to try to demonstrate how they can solve almost any problem by tweaking (controlling) the market for saving and investment. However, we need to start changing our way of looking at macro or fiscal policy to take into account the human capital market as well.

What I am suggesting is that barriers to labor were much less of a macro issue over the past few decades, but for reasons that will not continue. While federal policy was affecting the labor market greatly over the past twenty-five years, largely by subsidizing earlier and earlier retirement, there was one large mitigating factor. Despite the fact that men were dropping out of the labor market at very high rates as they sought more and more years in retirement, the entrance of women into the market in increasing numbers more than made up for the difference.

In Chart 2, I present a measure that I have developed and call the adult nonemployment rate (Steuerle and Spiro 1999). Over the postwar period, the nonemployment rate has gone down in almost every year other than a recession year. What this means, interestingly, is that over the past few decades, leisure—at least in aggregate—was not being demanded increasingly as the economy got richer. But our laws now schedule an increase in the nonemployment rate that is on the order of the labor market plunge of the Great Depression. Only this time the decline is scheduled to be permanent. On a year-to-year basis, the analogy would be with several small back-to-back recessions, one following the other for a period of more than twenty years. Thus, I believe that these labor market pressures are a macro as well as a micro issue, and that they could have serious effects on short-term as well as long-term fiscal policy if and when these labor market declines start.

Mind you, the rise in the nonemployment rate does not have to occur at the rate currently scheduled, although the retirement of the baby-boomers may make some part of this rise inevitable. Interactions with the labor demand side of the market will lead to shifts in employment that I do not believe are being anticipated well in most economic forecasting models. Nonetheless, freeing up older workers to respond to demand requires facing up to a whole series of dams in institutional government policy, and in some private retirement policy as well (Steuerle and Spiro 1999). Getting rid of only one or two dams may be an inadequate way to allow the water to flow. Thus, the traditional focus on saving (whether private or public) as the core element of macro policy may be seriously deficient in the presence of a structure that now assumes such large withdrawals from the work force.

Chart 2
The Adult Nonemployment Rate



Source: Urban Institute. Based on data from the U.S. Department of Labor, Bureau of Labor Statistics, and the U.S. Social Security Administration.

Note: The chart depicts those people age twenty or older who are unemployed or who are not in the labor force.

References

Steuerle, C. Eugene, et al. 1998. THE GOVERNMENT WE DESERVE: RESPONSIVE DEMOCRACY AND CHANGING EXPECTATIONS. Washington, D.C.: Urban Institute.

Steuerle, C. Eugene, and Gordon Mermin. 1997. "The Big-Spending Presidents." URBAN INSTITUTE BRIEF, no. 11. The Future of the Public Sector series. April.

Steuerle, C. Eugene, and Christopher Spiro. 1999. "Nonemployment: A Necessary Economic Indicator." STRAIGHT TALK ON SOCIAL SECURITY, no. 2 (June 30). Washington, D.C.: Urban Institute.

_____. 1999. "The Many Reinforcements for Retiring Early." STRAIGHT TALK ON SOCIAL SECURITY, no. 7 (September 15). Washington, D.C.: Urban Institute.

Session 2

Paper by

Darrel Cohen and Glenn Follette

Commentary by

Olivier Blanchard

Darrel Cohen and Glenn Follette

The Automatic Fiscal Stabilizers: Quietly Doing Their Thing

I. Introduction

The cyclical nature of the U.S. economy has undergone profound changes over the past century. As carefully documented by Diebold and Rudebusch (1992) and Romer (1999), since World War II, recessions have become less frequent and business expansions have become substantially longer. In addition, Romer argues that recessions are now less severe: Output loss during recessions is about 6 percent smaller on average in the post–World War II period than in the thirty-year period prior to World War I and substantially smaller than in the 1920 to 1940 interwar period. Furthermore, the variance of output growth has declined as well. Romer attributes these changes largely to the rise of macroeconomic policy after World War II; in particular, she argues that the automatic fiscal stabilizers—including the income-based tax system and unemployment insurance benefits—have played a prominent role in converting some periods of likely recession into periods of normal growth as well as in boosting growth in the first year following recession troughs. Given the Keynesian-style models used by Romer to support her claims, one would expect that personal consumption also would have been stabilized since World War II. Indeed, Basu and Taylor (1999) present evidence that the volatility of aggregate U.S. consumption has declined in the postwar period.

This paper presents theoretical and empirical analysis of automatic fiscal stabilizers. Using the modern theory of consumption behavior, we identify several channels through which optimal reaction of household consumption plans to aggregate income shocks is tempered by these stabilizers. Such automatic stabilization occurs even when households have full understanding of the constraints on their behavior implied by the government's intertemporal budget constraint and have full awareness of the difference between aggregate and idiosyncratic shocks to their labor income. This does not necessarily imply that the current fiscal stabilizers in the United States are set at optimal levels. The analysis of optimal tax rates, for example, is the subject of a large literature that involves comparing the benefits and costs of different settings and would take us well beyond the scope of this paper.

Moreover, our theoretical findings raise the issue of whether the insurance, wealth, and liquidity effects of the income tax system that we identify are realistic channels through which the effects of income shocks are stabilized. Furthermore, there is the issue of whether these channels are more or less empirically important than the wealth channel identified in earlier work, a channel whose effect requires that households have incomplete information about the nature of income shocks. We believe that these remain important open issues, although we would not be surprised if elements from each channel eventually were found to be empirically meaningful.

However, in an attempt to bring at least some evidence to bear on these issues, we present results from several empirical exercises using postwar U.S. data. Using standard time-domain

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techniques, we estimate elasticities of the various federal taxes with respect to their tax bases and responses of certain components of federal spending to changes in the unemployment rate. Using frequency-domain techniques, we confirm that the relationships found in the time domain are strong at the business-cycle frequencies. Together, these results showing strong ties between cyclical variation in income and federal government spending and taxes suggest the potential for the automatic fiscal stabilizers to play a quantitatively important role in the economic stabilization process.

Using the Federal Reserve Board's FRB/US quarterly econometric model, however, we find that the automatic fiscal stabilizers play a rather limited role in damping the short-run effect of aggregate demand shocks on real GDP, reducing the "multiplier" by about 10 percent, although they have a somewhat larger damping impact (in percentage terms) on personal consumption expenditures. Very little stabilization is provided in the case of an aggregate supply shock.

Before turning to the details of our analysis, it is worth mentioning the startling result developed by Lucas (1987). In the context of a standard model of an optimizing representative consumer, Lucas argues that perfect stabilization—that is, complete elimination of the variance of consumption in the United States—would yield virtually no utility gain to households both in absolute terms and relative to the huge utility gain associated with only a modest increase in the growth rate of consumption. Moreover, much of the subsequent literature has supported the robustness of this result. As such, this finding calls into question the act of devoting resources to the study (as well as to the practice) of stabilization policy.

While a complete response is well beyond the scope of this paper, we would make the following brief points. First, national election outcomes and, indeed, the very cohesiveness of societies appear to depend on the state of the business cycle; such factors generally are not captured in the standard utility-maximizing framework. Second, cyclical downturns have a negative and, quite possibly, sizable impact on a minority of the work force; thus, stabilization policy may generate a large welfare gain even if the gain averaged across the entire population is small.[1] Third, business-cycle variation and long-term growth (or the mean level of consumption) may not be completely independent, as assumed by Lucas; for example, the loss of human capital associated with job loss during a cyclical downturn might have long-lasting impacts. Fourth, the Lucas result depends partly on the actual variance of U.S. consumption over the post–World War II period, a variance that has declined relative to the prewar period to a fairly low level. If this outcome has resulted largely from macroeconomic stabilization policy, as argued by Romer (1999), then elimination of stabilization policy might cause a large enough increase in aggregate consumption variance to alter the Lucas result.

The rest of our paper is structured as follows. The next section offers three theoretical arguments for the effectiveness of automatic stabilizers; each is formally developed as a variation on the same underlying consumer optimization problem. While these modeling exercises, as well as a brief analysis of firms' investment demand, are carried out in a partial equilibrium context, there will be some discussion of general equilibrium issues as well. Section III reports simulations of the Federal Reserve Board's FRB/US quarterly econometric model. Section IV analyzes the business-cycle relationship between income and certain federal government taxes and spending using frequency-domain techniques. Section V presents a complete reestimation of the high-employment budget model used by staff at the Federal Reserve Board and the U.S. Congressional Budget Office (CBO) for the past twenty years. Section VI concludes.

II. The Analytics of Automatic Fiscal Stabilizers

A. Review of the Literature

This section examines theoretically the role of automatic fiscal stabilizers—in particular, the income tax—in modifying the response of consumption to income shocks. Perhaps surprisingly, there has been very little written on this subject in the academic literature since the mid-1980s, despite numerous legislative changes in individual income tax rates beginning with the Tax Reform Act of 1986.[2] We will briefly discuss earlier work on the role of automatic stabilizers, drawing on the excellent summary in Blinder and Solow (1974) in the context of the basic Keynesian model and on the seminal work in Christiano (1984) showing the possibility that the automatic stabilizers could work using an explicit framework of an optimizing consumer facing uncertain income prospects.[3] We then present new models of the effects of the income tax on optimizing consumers that we feel are a move toward greater realism. In contrast to the earlier Keynesian tradition, our models are not full general equilibrium exercises. However, we would argue that the consumer's decision problem must be central to any sensible analysis of the role of automatic stabilizers and, at the end of the section, we conjecture that general equilibrium feedback is unlikely to change qualitatively

the results of the partial equilibrium analysis. At the end of the section, we also briefly discuss the relationship between investment demand and the automatic stabilizers.

The basic idea of the textbook Keynesian model is that the impact on aggregate current consumption and output of an exogenous shock to aggregate demand, for example, is mitigated by the automatic stabilizers, which damp any effect of the shock on current personal disposable income. By evaluating the multiplier (the impact of an exogenous change in aggregate demand on output) for positive and zero values of the income tax rate, one can show that automatic stabilizers reduce the multiplier by $\alpha\tau/(1-\alpha+\beta)(1-\alpha+\alpha\tau+\beta)$, where α denotes the marginal propensity to consume out of after-tax income, τ denotes the marginal income tax rate, and β is a term that captures the crowding-out effect of higher interest rates and prices on aggregate demand.[4] A key assumption underlying such results is that current—rather than permanent or lifetime—personal income and taxes are the only determinants of consumption demand.[5]

These Keynesian results are seemingly at odds with the predictions of the basic life-cycle permanent income models of consumer behavior with no government (Deaton 1992). Under several simplifying assumptions—including quadratic utility, equality of the interest rate and rate of time preference, and lack of borrowing constraints—those models suggest the feasibility and optimality of constant consumption throughout the life cycle. If a household's labor income is anticipated to rise over time, for example, then the household simply would borrow to support consumption in excess of labor income early in the life cycle. Furthermore, unanticipated changes in a household's income—for example, owing to temporary changes associated with the business cycle—would alter the level of the desired consumption path but not its slope. Moreover, the impact on the level of consumption would not be mitigated in the presence of an income tax provided that the change in income taxes (induced by the business-cycle shock to income) was offset by a change in future taxes necessary to keep the government's intertemporal budget constraint in balance, because the present value of household lifetime tax liabilities would be unchanged. How, then, can policies—in particular, government taxes and spending—help to stabilize household consumption when households optimally should be doing the stabilizing themselves?

Christiano (1984) appears to be the first to find a role for the automatic tax stabilizers in the context of an optimizing consumer choice problem. In his two-period model, consumers maximize expected utility; specifically, a constant absolute risk-aversion utility function of consumption in each period (but not leisure) is used. Labor income is uncertain in the first period owing to the possibility of both common (aggregate) and idiosyncratic shocks that are normally distributed, while labor income in the second period is certain. There is an income tax on wages in the first period and lump-sum taxes in the second period, which rules out the possibility that the income tax can play an insurance role (even if second-period wage income was uncertain). Also, any change in aggregate income taxes in the first period is offset by an equal present value increase in taxes in the second period. Borrowing is allowed by individuals and the government, and the interest rate is tied down by a storage technology.

Christiano first considers the full information case in which households are able to distinguish between the aggregate and idiosyncratic income shocks. In this case, the automatic income tax stabilizer has no effect on the positive correlation between aggregate income shocks and consumption, because there is no insurance effect provided by the tax structure and because there is no wealth effect, as the present value of tax payments is unchanged by assumption. However, the positive correlation between individual consumption and idiosyncratic income shocks is reduced by the presence of an income tax. This arises because the income shock has an imperceptible effect on aggregate taxes in both periods but does alter an individual's tax bill, thereby providing an offsetting wealth effect. In the case of incomplete information, households respond to a common shock as though it were partly idiosyncratic; based on the results in the full information case, the more the shock is perceived as being idiosyncratic, the more the income tax will serve as an automatic stabilizer.

The new analysis of automatic tax stabilizers developed below builds on the work of Christiano as well as that of Chan (1983) and Barsky, Mankiw, and Zeldes (1986), although the latter two do not consider automatic stabilizers. The basic framework of these three papers is remarkably similar. All develop two-period models of optimizing representative agents facing labor income uncertainty and a government intertemporal budget constraint that requires second-period taxes to adjust to maintain balance. Labor supply is fixed, and each allows for precautionary saving (a positive third derivative of the utility function). However, there are some interesting differences. For example, Christiano assumes that in period one there is labor income uncertainty and an income tax, but in period two there is no uncertainty and a lump-sum tax. By contrast, Barsky, Mankiw, and Zeldes assume that in period one there is a lump-sum tax and no income uncertainty, while in period two there is an income tax and idiosyncratic income uncertainty.

Chan makes the same assumptions as Barsky, Mankiw, and Zeldes about labor income uncertainty; however, in his benchmark model, second-period lump-sum taxes are randomly assigned to individuals (even though aggregate taxes

in period two are known with certainty). He further assumes that a tax cut in period one is accompanied not only by higher taxes in period two (to maintain the government's intertemporal budget constraint) but by an increase in the cross-sectional randomness of tax shares as well. This additional randomness is understood by households who accordingly increase their precautionary saving or reduce first-period consumption; that is, the tax cut reduces consumption. We do not incorporate the uncertainty about future tax shares below because it is not clear that a current tax cut should necessarily raise future income uncertainty. There is always uncertainty about who will pay (and how much) in future taxes even without a current tax cut. For example, even if the budget is always balanced, there can be future revenue-neutral tax reforms that change the distribution of tax burdens.

B. New Results—Approach 1

Our first approach adopts the core two-period optimizing framework of the above models. In particular, we assume that there is future idiosyncratic labor income uncertainty and the absence of private insurance and financial instruments that can provide complete insurance. Moral hazard and anti-slavery laws often are cited as underlying reasons for the inability of individuals to privately diversify away labor income risk. We differ from the above models by assuming—perhaps more realistically—that there is an income tax in both periods; this allows an income shock in the first period automatically to affect taxes in the first period and hence the income tax rate in the second period. It is through this channel that the automatic stabilizers work. The idea is that the income tax provides insurance against otherwise uninsurable future uncertain variation in labor income, because a higher income tax rate reduces the variance of future after-tax income (for a given variance of before-tax income); as a result, the higher tax rate lowers precautionary saving or increases current consumption.

In the model, each individual $j(= 1,\ldots,N)$ maximizes expected utility:

(1) $$EU(C_1,C_2,G_1,G_2) ,$$

where C_i denotes private consumption in period $i = 1,2$; G_i denotes government consumption in period i; and E is the expectations operator conditional on information available in the first period. We assume that $U_{11} < 0$, $U_{22} < 0$, and $U_{12} \geq 0$. Derivatives with respect to G will be discussed below. In our first model, government consumption expenditures are fixed in both periods.

Each person (assumed identical) has labor income, Y, in period i:

(2) $$Y = \mu_i + \varepsilon_i ,$$

where μ_i denotes certain endowment labor income in period i, assumed the same for each individual; and ε_i denotes the idiosyncratic shock in period i, has zero mean, and is uncorrelated across individuals. We analyze the effects of unanticipated changes to each individual's endowment income and, in this sense, our approach is similar to the one in Barsky, Mankiw, and Zeldes.

There is a proportional tax on labor income in each period, where τ_i denotes the tax rate in period i. Individuals save by holding government bonds, which pay a gross return of $R(= 1 + r$, where r is the risk-free interest rate).[6] Note that there is no tax on interest income, an issue to which we return below. Also note that labor is supplied inelastically. At the end of the first period, the wealth of each individual, W, is given by:

(3) $$W = (\mu_1 + \varepsilon_1)(1 - \tau_1) - C_1 .$$

Consumption of each individual in the second period is:

(4) $$C_2 = RW + (\mu_2 + \varepsilon_2)(1 - \tau_2) .$$

Aggregate tax revenue in period i is denoted by T_i. Thus, the government's intertemporal budget constraint (assuming zero initial government debt) is:

(5) $$T_1 + R^{-1}T_2 = G_1 + R^{-1}G_2 .$$

But aggregate taxes in period i simplify to:

(6) $$T_i = \tau_i[\Sigma\mu_{ij} + N\Sigma\varepsilon_{ij}/N] = \tau_i\mu_{iA} ,$$

since $\Sigma\varepsilon_{ij}/N = 0$, and the summations are taken over j. Also, μ_{iA} denotes aggregate endowment labor income in period i; because all N individuals are assumed identical, $d\mu_{iA} = Nd\mu_i$. Thus, the income tax rate in period i faced by individuals is $\tau_i = T_i/\mu_{iA}$. Because equation 5 implies that aggregate taxes in period two depend on taxes in period one, the tax rate in period two depends on T_1 and hence on the tax rate in period one:

(7) $$\tau_2 = (RG_1 + G_2)/\mu_{2A} - (R\tau_1\mu_{1A})/\mu_{2A} .$$

In analyzing this model, we adopt an approach similar to that in Chan (1983) and in Barsky, Mankiw, and Zeldes (1986). Consumers maximize expected utility (equation 1) subject to equations 2-7. Now, suppose that a recession, for example, causes a temporary (that is, period-one) shock to endowment income, μ_1, of all individuals. Differentiation of the first-order conditions with respect to μ_1 establishes that:

(8) $$\begin{aligned} dC_1/d\mu_1 &= (1/H)\{-RE[RU_{22} - U_{12}] \\ &\quad + E(RU_{22} - U_{12})(-R(\varepsilon_2/\mu_{2A}))\tau_1 N\} \\ &= (1/H)(-RE[RU_{22} - U_{12}]) \\ &\quad -(R_{\tau 1}N/\mu_{2A}H)Cov[RU_{22} - U_{12}, \varepsilon_2] , \end{aligned}$$

where $H = -E[U_{11} - 2RU_{12} + R^2U_{22}] > 0$.

The first term on the right-hand side of equation 8 is the positive "wealth effect" associated with an unanticipated increase in before-tax labor income. Note that because higher first-period income taxes are exactly offset in present value terms by lower second-period income taxes, there is no impact

of taxes on the wealth effect. The second term represents the offsetting negative effect on consumption owing to higher precautionary saving: higher aggregate first-period income tax receipts imply a lower second-period income tax rate and thus less insurance against idiosyncratic income shocks. As shown in Barsky, Mankiw, and Zeldes, the precautionary saving effect requires that $RU_{222} - U_{122}$ be positive (so that the covariance term in equation 8 is positive). We assume that the wealth effect dominates the precautionary saving effect and hence that a positive (negative) increment to labor income boosts (reduces) first-period consumption. Differentiation of equation 8 with respect to τ_1 establishes that a stronger automatic stabilizer (that is, a larger τ_1) reduces the positive impact of a temporary income shock on first-period consumption—that is, it establishes that $\partial[\partial C_1/\partial\mu_1]/\partial\tau_1 < 0$; it does so by strengthening the precautionary saving effect.

Before moving on to our next models, we briefly discuss the assumption made here and in the prior literature: that interest income is not taxable. The introduction of interest income taxation into our model would tend to strengthen the above results regarding automatic stabilizers for two reasons. First, higher before-tax income in period one would lead to a reduction in the income tax rate in period two for the same reason as before, and because the second-period tax base is larger (higher labor income boosts first-period saving and hence interest income subject to tax in the second period) and total second-period tax receipts are determined completely by first-period taxes and government spending. The resulting lower income tax rate in period two further strengthens precautionary saving. Second, a lower second-period tax rate boosts the after-tax interest rate, for a given before-tax rate, which further increases the incentive to save (if the substitution effect exceeds the income effect).

C. New Results—Approach 2

We now modify the model to allow a change in income taxes induced by a temporary income shock to be matched by a change in government consumption spending; both are assumed to occur in the first period. It is thus useful to rewrite equation 7 as follows:

(9) $$G_1 = \tau_1\mu_{1A} + \tau_2\mu_{2A}R^{-1} - G_2R^{-1}.$$

In addition, it is assumed that private and government consumption expenditures are directly substitutable (although not necessarily perfect substitutes) within periods; that is, G_1 is a substitute for C_1 but not for C_2, and similarly for G_2. Thus, for the utility function in equation 1—that is, for $U(C_1, C_2, G_1, G_2)$—we assume that $U_{13} < 0$ and $U_{24} < 0$ and $U_{23} = U_{14} = 0$. In our example, however, G_2 is fixed and hence only the conditions $U_{13} < 0$ and $U_{23} = 0$ are relevant.[7] To evaluate the effect of a shock to the first-period endowment labor income of each person, we again differentiate the first-order conditions, giving:

(10) $$dC_1/d\mu_1 = (1/H)(-RE[RU_{22} - U_{12}])(1 - \tau_1) + (N\tau_1/H)(EU_{13}),$$

where H is defined above.

The first term on the right-hand side of equation 10, which is positive, represents the "wealth effect" of higher *after-tax* labor income; before-tax labor income is higher, but this is partially offset by higher income taxes in the first period. This offset, owing to the automatic stabilizers (that is, the income tax), is reinforced by the second term on the right-hand side of equation 10. The latter term, which is negative, represents the direct substitution effect of higher government consumption spending (owing to higher income taxes) on private consumption. We assume that the wealth effect dominates the direct substitution effect and hence $dC_1/d\mu_1 > 0$. Differentiation of equation 10 with respect to τ_1 establishes that a stronger automatic stabilizer (that is, a higher τ_1) weakens the positive impact of a temporary shock to before-tax labor income, that is, it establishes that $\partial[\partial C_1/\partial\mu_1]/\partial\tau_1 < 0$.

D. New Results—Approach 3

In the final variant of our model, we introduce explicit constraints on borrowing by households following the approach in Chan (1983). We assume that borrowing cannot exceed a fixed fraction of current after-tax labor income and, for simplicity, that $\varepsilon_1 = 0$. If L denotes household lending $(L > 0)$ or borrowing $(L < 0)$, the constraint can be written as:

(11) $$b(1 - \tau_1)\mu_1 + L \geq 0,$$

where b is some fixed, positive number. For example, if $b = 1$ and if the constraint is binding in the sense that household borrowing equals after-tax income, then first-period consumption is double after-tax income (that is, the sum of disposable income and the borrowed amount, also equal to disposable income). Such a constraint is consistent with home mortgage payment rules-of-thumb in which monthly interest payments cannot exceed a fixed fraction of income. The possibility of borrowing or liquidity constraints is appealing, especially in light of recent empirical work, such as that of Parker (1999) and Souleles (1999), which finds that individual consumption rises when fully anticipated increases in after-tax income are realized.

The rest of the model is the same as in Section II B, in which future income taxes are assumed to adjust to maintain the

government's intertemporal budget constraint (and in which W is replaced by L in equations 3 and 4). We consider households for whom the borrowing constraint (equation 11) is binding. For such individuals, the model solution for first-period consumption follows immediately, as in the example above, because the borrowing constraint (along with current after-tax labor income) completely determines first-period consumption. It follows that a higher income tax rate—that is, stronger automatic stabilizers—reduces first-period consumption and hence reduces the effect of a labor income shock on first-period consumption. With an adverse shock to labor income, for example, private borrowing is reduced but, because income taxes decline, government borrowing is increased. As noted by Chan (1983) in a related problem, the government—which is not subject to a borrowing constraint—is effectively borrowing on households' behalf, thereby circumventing the household limit.

E. Investment and General Equilibrium Considerations

We now address some loose ends in the prior analysis. We begin with a discussion of the relationship between investment demand and the automatic stabilizers in a partial equilibrium, optimizing framework. We then discuss general equilibrium issues, offering several conjectures but not the development of a full model.

Conventional models of business-fixed investment—under the key assumptions of convex adjustment costs, complete information, and perfect capital markets—imply that a firm's investment demand depends on marginal "q," that is, on the present discounted expected value of profits from new investment. To the extent that business cycles are viewed as symmetric variations of economic activity (and hence profits) about trend, a recession will be followed by above-trend activity, implying that the recession likely would have little effect on the present value of a representative firm's expected profit stream and hence on investment demand. In this case, a corporate profits tax would not be expected to damp the effect of cyclical swings in economic activity on investment demand.

Other models, based on asymmetric information and the resulting incentive problems in capital markets, imply that information costs and the internal resources of firms influence the cost of external funds. Consequently, investment demand depends on the "financing constraint" of a firm's net worth, proxied for by current after-tax cash flow, in addition to marginal q. Hubbard (1998) provides an excellent discussion of such models, whose empirical importance is the subject of some controversy. These models imply that the impact of a cyclical downturn on before-tax cash flow and hence on investment demand would be attenuated by the presence of an income tax; thus, the tax would serve as an automatic stabilizer for investment demand.

We now briefly discuss general equilibrium issues. The most basic question is whether the economy is better modeled using the equilibrium real business-cycle approach, as in Baxter and King (1993), or using an approach that allows for nominal demand shocks to have real effects in the short run, as in New-Keynesian models. Although the appropriate framework has been the source of ongoing tension among macroeconomists, in qualitative terms the effectiveness of automatic stabilizers appears invariant to the choice of framework. For the remainder of this section, we assume that both frameworks embed the basic consumer optimization model analyzed above.

In the equilibrium business-cycle approach, a shock that reduces aggregate equilibrium output—such as a temporary negative labor income endowment shock—generally originates on the supply or production side of the economy, and the components of aggregate demand must adjust to maintain goods market equilibrium. Thus, if personal consumption falls (as the above analysis suggests) and if government purchases of goods and services are reduced to offset the budget impact of lower income tax receipts, then investment likely will decline to maintain goods market equilibrium.[8] The decline in real income net of tax, as well as the decline in government purchases, has no immediate effect on output unless labor supply adjusts in response to wealth and interest rate effects. However, over time, as the capital stock falls relative to baseline, output also declines, which in turn reduces consumption possibilities. The magnitude of the consumption decline will vary inversely with the strength of the automatic stabilizers.

By contrast, in a model with sticky wages and prices, negative shocks to any component of nominal aggregate demand (for example, export demand) can lead to short-run reductions in output as labor demand and hours worked decline. The resulting fall in after-tax income reduces private consumption demand (and government purchases fall if they are adjusted to maintain budget balance); the decline in consumption is mitigated by the automatic stabilizers for the same reasons as discussed earlier. Of course, investment demand likely will be boosted by lower interest rates, which implies subsequent increases in the capital stock and output; again, the magnitude of such increases will vary inversely with the strength of the automatic stabilizers. Simulation results from a general equilibrium econometric model with New–Keynesian-style features are presented in the next section.

III. Results from the FRB/US Model

In Sections III, IV, and V, we present our empirical results. This section presents estimates of the impact of automatic stabilizers—particularly income taxes—based on simulations of the Federal Reserve Board's FRB/US quarterly econometric model of the U.S. economy. Detailed discussions of the new model can be found in Brayton and Tinsley (1996) and in Reifschneider, Tetlow, and Williams (1999). Households and firms are optimizers whose current decisions are based on expectations of future conditions. For estimation purposes, sectoral expectations are derived from forecasts of small vector autoregressions (VARs). Each VAR has a common set of variables, including consumer price inflation, the output gap, and the federal funds rate. Inclusion of the funds rate means that this form of expectations incorporates an average sample view of how monetary policy was conducted historically. Simulation exercises in this paper also use the same VAR systems.

In terms of dynamic adjustments in the model, financial market variables such as interest rates and stock prices adjust immediately to changes in expectations because financial decisions are assumed unaffected by frictions, given the small cost of transacting in these markets. However, the response of nonfinancial variables such as consumption, investment, and employment to changes in fundamentals is not immediate because of (nonexplicitly modeled) frictions in the dynamic adjustment process such as contracts and capital adjustment costs. Indeed, prices and quantities do not adjust quickly enough to ensure full resource utilization at all times. In the long run, however, all adjustments are complete and all markets are clear.

Of particular relevance for the simulation results reported below—as well as for a comparison with the prior theoretical discussion of Section II and subsequent empirical analysis of tax elasticities in Section V—is the modeling of aggregate income taxes and consumption in FRB/US. Starting with taxes in FRB/US, the average federal personal income tax rate is procyclical, implying an elasticity of personal taxes with respect to the taxable income base somewhat greater than the corresponding elasticity of 1.4 estimated in Section V.[9] Social insurance contributions are specified as proportional to its tax base, implying a unitary elasticity; in Section V, we estimate that the elasticity is about 0.9. The average corporate income tax rate is mildly procyclical in FRB/US; this contrasts with the mildly countercyclical tax rate found in Section V.

Turning to the modeling of aggregate consumption in FRB/US, we see that a small fraction of consumption decisions is made by liquidity-constrained households; the share of after-tax income associated with this group of households is estimated at about 10 percent. This group's behavior would be consistent with the model in Section II D.

However, for most households, consumption depends on current property wealth plus the present value of expected after-tax labor (and transfer) income in FRB/US. Expected future income flows are discounted at a high—25 percent—annual rate in computing present values, because it is argued that households are quite averse to the uncertainty of future uninsurable income. As a result of the heavy discounting, current consumption is not affected much by changes in income taxes in the distant future that might be necessary to satisfy the government's intertemporal budget constraint. Put another way, the rate used by individuals to discount future taxes exceeds the government's borrowing rate.

Moreover, the simulations below are based on VAR expectations that do not incorporate expectations of future tax rate changes. Thus, a change in income taxes (owing, say, to an aggregate demand shock) has a wealth effect on consumption.[10] While this is similar to the wealth effect in the model of Section II C, there is a difference in that current government purchases are not adjusted in FRB/US (and so there is no substitution of private for government consumption).

Finally, FRB/US may be consistent with a precautionary saving motive. This is because prudent households act as if they apply a high discount rate to future uncertain income, which is the case in the model. Furthermore, consumption depends positively in FRB/US on the expected output gap, which is viewed as capturing countercyclical variation in the perceived riskiness of future before-tax income. Even granting these interpretations, the model does not capture the insurance effect of income tax rates developed in Section II B; that is, an anticipated change in the income tax rate has no effect in FRB/US on the variance of after-tax income. Summing up, FRB/US captures liquidity and wealth effects associated with the income tax system, but does not capture the insurance effect.[11] However, there is a sense in which the impact of changes in taxes (and transfers) on consumption demand is assumed: for example, there is no formal testing of the hypothesis that the effects of changes in before-tax income and in taxes are of equal and opposite signs (and separately statistically significant). Rather, after-tax income is the variable included in the FRB/US model consumption equations.

Results of the simulation exercises are reported in Tables 1 and 2. The model has four federal tax rates (for personal income taxes, corporate income taxes, indirect business taxes, and social insurance contributions). The effects of automatic stabilizers are measured by comparing simulations in which each federal tax rate is at its actual value with simulations in which each tax rate is set to zero and an add factor (essentially

a lump-sum tax) is introduced that sets tax receipts equal to their baseline values (given the baseline values of the tax bases). A demand shock and a supply shock are considered. The demand shock (to state and local government purchases) is scaled to equal 1 percent of the level of real GDP in the baseline. The supply shock is a $5-per-barrel increase in the price of oil. Each simulation is run under two monetary policy settings. One setting holds the real federal funds rate constant and the other uses the Taylor rule—which relates the nominal federal funds rate to the output gap and to a four-quarter moving average of the inflation rate.[12]

As shown in Table 1 (panel A), with a fixed real federal funds rate, the model's real GDP "multiplier" is increased only modestly by the substitution of lump-sum for income (and social insurance and indirect business) taxes, from 1.23 to 1.35 at the end of four quarters (and increased by a similarly modest amount at the end of eight quarters) in the case of the demand shock. The impact of the demand shock on personal consumption expenditures is also increased only modestly at the end of four quarters (although by a much larger percentage amount).[13] This outcome owes largely to the model's property that consumption is not very sensitive to movements in after-tax income that are essentially transitory. Moreover, households expect (through the VAR system) a countercyclical policy response to the demand shock. When monetary policy is characterized by the Taylor rule (panel B), the multipliers on output and consumption are smaller than in the prior case, but the increase owing to the elimination of the income tax is about the same.

As shown in Table 2, the income tax has very little effect on the model multipliers in the case of the adverse supply (oil-price) shock. Because the shock pushes real output and prices in opposite directions, nominal taxable incomes are not affected much. As a result, the level of tax receipts is not very sensitive to the presence of income taxes. Of course, taxes in real terms are lower; similarly, in the lump-sum tax simulation, real taxes are lower following the shock (owing to a higher price level and an unchanged level of nominal taxes). Indeed, real taxes in the two simulations are similar enough following the shock that the tax structure (income versus lump-sum) makes little difference to multiplier values.[14] The fact that the presence of an income tax has virtually no effect on supply shock multipliers is interesting, because arguably it is optimal to have no automatic stabilization in the face of a supply shock.[15]

Finally—noting that FRB/US is approximately linear, so that positive and negative shocks of equal size have roughly the same absolute effect on the major endogenous variables—our simulation results shed light on the issue of whether the presence of automatic fiscal stabilizers reduces the variance of U.S. real GDP. To the extent that variation in real GDP is driven primarily by supply-side shocks, our results suggest an extremely limited stabilizing role of the income tax system. By contrast, if demand-side shocks are the primary driving force, income taxes provide a modest degree of stabilization. Unfortunately, because our results are based on a model estimated over the postwar sample period, they are of limited value in answering the question of whether the automatic stabilizers have contributed to the reduction in the

Table 1
Simulated Macroeconomic Effects of a Shock to Autonomous Aggregate Demand
Percentage Change from Baseline

	Historical Tax Rates			Tax Rates = 0		
Response in Quarter	Real GDP	Consumer Prices	Real PCE	Real GDP	Consumer Prices	Real PCE
Panel A: Fixed Real Federal Funds Rate						
Four	1.23	.10	.30	1.35	.10	.43
Eight	1.05	.56	.01	1.23	.58	.30
Panel B: Taylor Rule						
Four	.89	.01	.02	.97	.01	.12
Eight	.22	.13	-.57	.30	.14	-.46

Notes: The demand shock is to state and local government purchases and is scaled to equal 1 percent of the level of real GDP in the baseline. Real GDP is gross domestic product in chain-weighted 1992 dollars; consumer prices is the personal consumption expenditure chain-weighted price index; real PCE is personal consumption expenditure in chain-weighted 1992 dollars.

Table 2
Simulated Macroeconomic Effects of a $5-per-Barrel Increase in Oil Prices
Percentage Change from Baseline

	Historical Tax Rates			Tax Rates = 0		
Response in Quarter	Real GDP	Consumer Prices	Real PCE	Real GDP	Consumer Prices	Real PCE
Panel A: Fixed Real Federal Funds Rate						
Four	-.04	.36	-.15	-.05	.36	-.16
Eight	-.16	.78	-.51	-.16	.77	-.50
Panel B: Taylor Rule						
Four	-.22	.32	-.30	-.24	.32	-.32
Eight	-.47	.59	-.71	-.50	.59	-.75

Note: Real GDP is gross domestic product in chain-weighted 1992 dollars; consumer prices is the personal consumption expenditure chain-weighted price index; real PCE is personal consumption expenditure in chain-weighted 1992 dollars.

volatility of the U.S. macroeconomy that evidently has occurred over the past century.

IV. Empirical Results from the Frequency Domain

In this section, we examine the frequency-domain, or spectral, properties of certain federal taxes and tax bases as well as the properties of unemployment insurance benefits. To the best of our knowledge, this approach has not been taken before. We initially present the estimated spectral density functions for several types of taxes and then show the squared coherencies of these taxes with their respective tax bases. We use National Income and Product Account (NIPA) quarterly current-dollar tax and income data as well as unified budget tax data, both for most of the postwar period. The analysis of unemployment insurance benefits also utilizes postwar NIPA data as well as the civilian unemployment rate.

In evaluating our results, it is useful to recall that the area under the spectrum is simply the variance of a series; also, the spectrum is symmetric about the zero frequency, so we plot only the estimated spectra for frequencies, ω, between 0 and π.[16] Because the techniques of spectral analysis apply to stationary time series, we examine the growth rates of the various taxes (which are stationary series), rather than the dollar levels. In addition, to achieve stationarity, we examine unemployment insurance outlays as a percentage of nominal GDP. We focus attention on whether a sizable portion of the variance of a series is explained by variation at the business-cycle and seasonal frequencies—that is, we look for sizable peaks in the estimated spectra at these frequencies. In our charts (A1-A12 in the appendix), business-cycle frequencies occur between 0.2 and 1.0, which correspond to periods ($= 2\pi/\omega$) of roughly thirty-two quarters and six quarters, respectively (the range of values used in the recent literature). Seasonal frequencies are at (or near) $\pi/2$ and π, corresponding to periods of four quarters and two quarters, respectively.

We also present squared coherencies between taxes and tax bases.[17] The coherency measures the square of the linear correlation between the two variables at every frequency and is analogous to squared correlation coefficients; the coherency can vary between zero and one. For example, if the squared coherency is near one at frequency ω, it means that the ω-frequency components of the two series are highly related, but a value near zero means that the corresponding frequency components are not closely related. One must be careful in interpreting the squared coherencies in the business-cycle frequency range, because the coherency is simply a bivariate measure. While it undoubtedly reveals information about the "automatic" response of taxes to income (and unemployment insurance outlays to the unemployment rate), it also contains information about the relationship between business-cycle fluctuations in income and legislated changes in tax rates (and between fluctuations in the unemployment rate and legislated changes in the unemployment insurance program).

Beginning with the NIPA tax data, we see that personal income, corporate income, and indirect business tax receipts (all in growth rate form) display pronounced spectral peaks at business-cycle frequencies (see the charts in the appendix). Perhaps surprisingly, social insurance contributions show little spectral power at business-cycle frequencies although they show substantial power at the seasonal frequencies. The latter occurs, even though the data are seasonally adjusted, because of the NIPA convention of "level adjusting" this series once every four quarters to reflect the impact of a change in the taxable maximum wage base.

Squared coherencies at the business-cycle frequencies are quite high between the personal income tax and its tax base (personal income, less other labor income, less government transfer payments, plus personal contributions to social insurance) and between corporate income taxes and taxable corporate profits. Again, one must be careful in interpreting these results because the squared coherencies conceptually are picking up both automatic and discretionary changes in taxes.

To shed a bit more light on this matter, one can compute the gain at the business-cycle frequencies; the gain is interpretable as the regression coefficient of taxes on income. Because both variables are in growth-rate form, the gains provide estimates of tax elasticities at every frequency. The gain in the case of corporate income taxes varies within the narrow range of 1.0 to 1.1 across the business-cycle frequencies, only slightly larger than more standard time-series estimates (as in Section V) of the "automatic" effect of changes in profits on taxes. Thus, the squared coherency likely is showing that the automatic piece of the relationship is strong at the business-cycle frequencies. A somewhat different situation is revealed by the gain between the personal income tax and its base, which varies from about 1.0 to 2.9 across the business-cycle frequencies. Certainly, one could reasonably expect, as discussed in Section V, an elasticity owing to business-cycle-induced changes in incomes greater than or equal to 1, but it is likely that the high values of the gain might well be picking up a tendency for legislated personal tax cuts to occur during recessions as well as picking up the automatic decline in receipts.

Finally, on the NIPA tax side, squared coherencies between social insurance contributions and wages and salaries and between indirect business taxes and nominal GDP are only of moderate size (up to about 0.5).

We now discuss results using unified individual income tax data (on a quarterly basis). Because these data are not seasonally adjusted (NSA), we also need an NSA personal income tax base. Since this is not available, we use NSA nominal GDP, which is publicly available. The use of NSA data gives a pure reading of real-time fluctuations in taxes and income faced by households, but at the cost of introducing a lot of noise, especially into the analysis of individual nonwithheld taxes (declarations, paid four times per year, plus final payments, paid once each year). The squared coherency between NSA withheld income taxes and nominal GDP (again, both in quarterly growth-rate form) is sizable, both at the business-cycle frequencies and at the primary seasonal frequency ($\omega = \pi/2$). The former is strongly suggestive of the working of automatic stabilizers during business-cycle swings while the latter reflects seasonal patterns in labor incomes and withheld taxes (such as increases in each that often occur at the beginning of calendar years). The gain varies between 1 and 3 at the business-cycle frequencies, again suggestive of discretionary tax changes in addition to the automatic stabilizer component. Very similar results at the business-cycle frequencies arise when the raw data are filtered using four-quarter growth rates (although the strong seasonal relationship is eliminated, as would be expected).

By contrast, the squared coherency between NSA individual nonwithheld taxes and nominal GDP is not large at business-cycle frequencies; indeed, the relatively small coherencies apply both to declarations and final payments. Such results suggest the relative ineffectiveness of automatic stabilizers via this tax channel.

Finally, on the spending side of the budget, the squared coherency between unemployment insurance outlays as a percentage of GDP and the unemployment rate is very high at the business-cycle frequencies. Thus, even though there may be a short waiting period to collect benefits, the unemployment insurance program appears to operate as an effective, virtually automatic, income stabilizer for unemployed individuals.[18]

To sum up, the frequency-domain analysis establishes a very strong relationship between income taxes and tax bases at the business-cycle frequencies. In all cases, this reflects the automatic nature of tax variation—particularly of individual withheld taxes—when incomes change, and in some cases it likely reflects discretionary tax changes as well. Furthermore, unemployment insurance also appears effective as an automatic stabilizer of income.

V. The High-Employment Budget Surplus

In this section, using standard time-domain techniques, we present updated empirical estimates of the responsiveness of federal taxes and certain spending programs to cyclical swings in the economy. While such estimates are useful for many purposes, they are used here as a basis for computing the cyclically adjusted, or high-employment budget surplus (HEB), of the federal government. Although the HEB is not without its faults, as discussed in Blinder and Solow (1974), it nonetheless has been used as a summary measure of the stance of fiscal policy by many U.S. government agencies (and many countries) since the 1960s. Twenty years ago, an intergovernmental task force developed the "gross-up" methodology currently used by staff at the U.S. Congressional Budget Office and the Federal Reserve Board (see deLeeuw et al. [1980]).

Using taxes to illustrate the method, high-employment tax receipts equal a cyclical adjustment, or a gross-up, plus actual (or projected actual) tax receipts. The gross-up is the difference between an estimate of taxes at a benchmark (that is, high-employment) level of economic activity—computed by setting the GDP gap equal to zero in key econometric equations—and at the actual level of economic activity—computed by using the actual GDP gap. As a result, the gross-up method has the property that actual and high-employment taxes are equal when the economy is operating at potential. More fundamentally, the method has the property that unexplained shocks to taxable income shares and tax receipts are allowed to pass through to high-employment estimates. The remainder of this section presents detailed estimates.

A. High-Employment Receipts

The calculation of high-employment receipts involves three steps. First, income share equations are estimated to determine the level of the tax bases if actual GDP was equal to potential GDP. Second, the tax elasticities with respect to cyclical changes in income must be estimated. Finally, these two estimates are combined to obtain cyclical components of tax revenues, which are added to actual revenues to obtain high-employment revenues. The basic equations for receipts are:

$$SHAREK_{j,t} = SHARE_{j,t} - \Sigma\beta_i * GDPGAP_{t-i} \quad (12)$$

$$BASEK_{j,t} = GDPK_t * SHAREK_{j,t} \quad (13)$$

$$TAXK_{j,t} = TAX_{j,t} * (BASEK_{j,t} / BASE_{j,t})^{\varepsilon(j,t)} \quad (14)$$

$$RECEIPTSK_t = \Sigma TAXK_{j,t}, \quad (15)$$

where $SHARE$ is the ratio of the tax base to GDP; $BASE_j$ is the tax base applicable to the j th tax; TAX_j is tax revenues from tax j; and $RECEIPTS$ is the sum of all taxes from all sources.

The suffix K denotes a high-employment estimate; β is the sensitivity of the share of the tax base in GDP to changes in the GDP gap ($GDPGAP$); and ε is the elasticity of the tax with respect to cyclical changes in the tax base.

On the income side, GDP is composed of labor compensation (wages and salaries, and supplements to wages and salaries such as employer-provided health insurance), capital income (corporate profits, proprietors' income, rental income, dividends, and net interest), and GDP less national income (the statistical discrepancy between income- and product-side measures of GDP as well as indirect taxes and net subsidies to businesses). We estimate the cyclical properties of each of these income sources using the U.S. Congressional Budget Office's estimates of potential GDP, the Non-Accelerating Inflation Rate of Unemployment (NAIRU), and the potential labor force. From these estimates, we construct estimates of the GDP gap, $(GDPK - GDP)/GDPK$, and the employment gap (Table 3).[19] Our regression equations for income shares are in first-difference forms of equation 13 because the shares are not stationary over the sample period.[20] The cyclically adjusted share is equal to the actual share less the sum of the products of the estimated gap terms and the coefficients. The cyclically adjusted shares are obviously smoother (Table 4).

NIPA personal taxes are roughly 45 percent of federal NIPA-based receipts. They are composed of personal income taxes, estate and gift taxes, and nontaxes (essentially fees and fines). As income taxes are about 97 percent of personal taxes, we use the personal income tax elasticity for all personal taxes. This elasticity, $Epersonal$, can be decomposed into two elasticities: the change in income taxes with respect to adjusted gross income (AGI), and the change in AGI with respect to NIPA-adjusted personal income, E_{agi}.[21] Furthermore, the elasticity of income taxes with respect to a change in AGI is a weighted sum of the elasticity of taxes to number of returns, En, and the elasticity of taxes with respect to average income per return, Ey, where the weights equal the relative contributions of changes in returns and average income to cyclical changes in income. Thus, $Epersonal$ may be written as:

$$(16)\quad Epersonal = \{En*ngap + Ey*ygap*(1 + ngap)\} / [ngap + ygap*(1 + ngap)]\}*E_{agi},$$[22]

where:

$ngap$ is the percentage gap in number of income tax returns,

$ygap$ is the percentage gap in AGI per tax return,

En is elasticity of personal income taxes with respect to the change in number of returns,

Ey is elasticity of personal income taxes with respect to the change in AGI per return, and

E_{agi} is the elasticity of AGI with respect to NIPA-adjusted personal income.

Table 3

Potential GDP, NAIRU, and Labor Force Participation

Year	Potential GDP (Billions of Dollars)	NAIRU (Percent)	Potential Labor Force (Millions)	GDP Gap (Percent)	Employment Gap (Percent)
1951	327.5	5.3	61.9	-3.7	-2.3
1952	348.6	5.4	62.2	-2.9	-2.4
1953	367.2	5.4	62.7	-3.4	-3.1
1954	383.9	5.4	63.8	0.7	0.5
1955	402.2	5.4	65.0	-3.2	-1.1
1956	429.2	5.4	66.1	-2.0	-2.1
1957	458.6	5.4	67.1	-0.5	-0.9
1958	485.7	5.4	67.7	3.8	1.5
1959	508.6	5.4	68.2	0.3	-0.2
1960	534.9	5.5	68.9	1.6	-1.0
1961	562.0	5.5	70.1	3.1	0.7
1962	591.7	5.5	71.2	1.1	0.9
1963	622.6	5.5	72.4	0.8	0.8
1964	657.5	5.6	73.6	-0.8	0.2
1965	698.6	5.7	74.8	-2.9	-0.8
1966	749.9	5.8	76.0	-5.1	-1.8
1967	807.8	5.8	77.3	-3.2	-2.2
1968	879.4	5.8	78.5	-3.6	-2.7
1969	957.8	5.8	79.8	-2.5	-3.6
1970	1,046.1	5.9	82.0	1.0	-1.9
1971	1,138.2	5.9	84.4	1.1	-0.0
1972	1,225.9	6.0	86.8	-0.9	-0.7
1973	1,339.7	6.1	89.3	-3.2	-1.4
1974	1,510.5	6.2	91.8	0.9	-0.8
1975	1,705.9	6.2	94.2	4.4	2.9
1976	1,862.7	6.2	96.8	2.3	2.2
1977	2,045.9	6.2	99.4	0.9	1.2
1978	2,269.3	6.3	102.0	-1.0	-0.4
1979	2,544.5	6.3	104.8	-0.5	-0.6
1980	2,860.6	6.2	107.0	2.7	1.0
1981	3,208.4	6.2	108.8	2.9	1.6
1982	3,488.4	6.1	110.6	7.1	4.1
1983	3,721.1	6.1	112.3	5.6	4.4
1984	3,958.5	6.0	114.1	1.4	2.1
1985	4,206.8	6.0	115.9	0.6	1.6
1986	4,442.1	6.0	117.8	0.4	1.0
1987	4,709.1	6.0	119.7	0.4	0.1
1988	5,015.9	5.9	121.6	-0.7	-0.5
1989	5,366.1	5.9	123.6	-1.4	-0.9
1990	5,736.0	5.9	125.4	-0.1	-0.6
1991	6,092.7	5.9	126.9	2.9	1.4
1992	6,382.8	5.8	128.3	2.2	1.9
1993	6,679.4	5.8	129.7	1.8	1.6
1994	6,981.9	5.8	131.2	0.5	0.4
1995	7,312.3	5.7	132.6	0.6	0.1
1996	7,644.9	5.7	134.1	-0.2	-0.2
1997	8,005.5	5.7	135.9	-1.3	-1.1
1998	8,328.8	5.6	137.4	-2.2	-1.4

Source: U.S. Congressional Budget Office.
Note: NAIRU is the Non-Accelerating Inflation Rate of Unemployment.

Table 4
Share Equations

	Dependent Variable							
	Wages	Supplements	Profits	Proprietors' Income	Rental Income	Net Interest	Other Personal Interest	Dividends
Constant	-0.018	0.038	-0.005	-0.027	-0.010	0.022	0.010	0.004
	(-1.15)	(5.27)	(-0.21)	(-1.69)	(-1.56)	(1.98)	(2.09)	(0.85)
Gap	0.221	0.030	-0.319	-0.009	0.021	0.030	0.016	0.003
	(12.6)	(3.81)	(12.5)	(-0.53)	(2.93)	(2.45)	(3.20)	(0.60)
Gap[*t-1*]	-0.106	-0.010	0.054	0.015	-0.010	0.010	-0.019	-0.008
	(-5.89)	(-1.21)	(2.05)	(0.85)	(-1.38)	(0.76)	(-3.78)	(-1.67)
Gap[*t-2*]	-0.059	0.002	0.052	-0.010	0.002	-0.012	-0.005	-0.013
	(-3.26)	(0.30)	(1.97)	(-0.54)	(0.25)	(-0.94)	(-1.05)	(-2.67)
Gap[*t-3*]	-0.056	-0.011	0.006	-0.023	0.001	-0.016	-0.001	-0.002
	(-3.09)	(-1.31)	(0.24)	(-1.30)	(0.08)	(-1.28)	(-0.02)	(-0.41)
Gap[*t-4*]	-0.018	0.001	0.067	0.006	-0.004	0.003	-0.008	0.006
	(-1.06)	(0.16)	(2.67)	(0.34)	(-0.58)	(0.26)	(-1.71)	(1.20)
Sum of gap coefficients	-0.018	0.013	-0.139	-0.021	0.010	0.015	-0.017	-0.014
Adjusted R^2	0.55	0.07	0.50	0.02	0.03	0.03	0.12	0.06
Durbin-Watson	1.63	1.78	2.20	2.02	2.05	1.27	1.80	1.37

Notes: The sample period is first-quarter 1955 to fourth-quarter 1997. Dependent variables are measured as first differences of the variable divided by GDP. Gap terms are first differences of *(GDPK-GDP)/GDPK*; *t*-statistics are shown in parentheses.

En is set equal to 1 by assuming that changes in the number of tax filers occur in proportion to the existing distribution. By assuming that *En* is 1, we see that *Ey* should account for the elasticity of the tax code, given the distribution of income, and the change in the distribution of income over the cycle. Our estimate of *Ey* , though, is based solely on the tax structure and the existing distribution of income; thus, it abstracts from any potential cyclical sensitivity of the income distribution. Equation 16 was modified to account for two types of filers, as the number of returns and the incomes of single filers appear to exhibit different cyclical properties than those of nonsingle filers.

We calculate *Ey* for single and nonsingle filers (overwhelmingly married filing jointly, but also heads of households, married filing separately, and surviving spouses) using SOI cross-sectional data for each year. *Ey* for a given type of filer is the weighted sum of the elasticities of the AGI groups shown in the SOIs where the weights equal the tax shares of the groups. The elasticity is estimated by dividing the *effective* marginal tax rate by the average tax rate for the group.[23] The effective marginal tax rates are lower than the statutory rates because the effective rates incorporate the rise in deductions that occurs as income rises and include the tax preference for capital-gains realizations.[24]

Table 5 displays the resulting elasticity estimates, *Ey* . Over the 1951-96 period, the AGI per return elasticity for nonsingle returns averaged 1.6, and was 1.5 for single returns. This largely reflects differences in the 1950s and 1960s owing to lower average tax rates faced by nonsingles in the lower income brackets because of the relatively more generous personal exemptions in place at the time. Focusing on nonsingle filers, we see that their elasticity fell by 0.1 as a result of the Reagan tax cuts in the early 1980s and fell by another 0.1 with the 1986 Tax Reform Act. During the 1990s, the overall elasticity of the tax schedule has hardly changed, as the elasticity-boosting effects of the expansion of the Earned Income Credit (EIC) and increased marginal income tax rates for high-income filers have been offset by the decrease in the tax rate on capital-gains realizations and the shift in income distribution toward high-income filers who have lower elasticities.

Table 5
Personal Income Tax Elasticities

	Ey				*Ey*				*Ey*		
Year	Single	Nonsingle	*Epersonal*	Year	Single	Nonsingle	*Epersonal*	Year	Single	Nonsingle	*Epersonal*
1951	1.55	1.71	1.48	1967	1.50	1.61	1.39	1983	1.55	1.59	1.40
1952	1.55	1.70	1.47	1968	1.49	1.56	1.35	1984	1.53	1.58	1.40
1953	1.54	1.69	1.46	1969	1.53	1.56	1.36	1985	1.57	1.57	1.40
1954	1.52	1.70	1.46	1970	1.54	1.56	1.36	1986	1.52	1.53	1.36
1955	1.53	1.69	1.45	1971	1.58	1.59	1.38	1987	1.51	1.54	1.37
1956	1.46	1.68	1.44	1972	1.61	1.61	1.39	1988	1.46	1.51	1.34
1957	1.48	1.67	1.43	1973	1.59	1.60	1.39	1989	1.45	1.48	1.33
1958	1.56	1.67	1.44	1974	1.57	1.59	1.38	1990	1.46	1.46	1.31
1959	1.47	1.64	1.41	1975	1.63	1.67	1.45	1991	1.46	1.49	1.33
1960	1.46	1.65	1.41	1976	1.64	1.69	1.46	1992	1.46	1.49	1.33
1961	1.45	1.62	1.39	1977	1.71	1.73	1.50	1993	1.46	1.50	1.33
1962	1.45	1.61	1.38	1978	1.68	1.70	1.48	1994	1.47	1.51	1.34
1963	1.38	1.64	1.39	1979	1.64	1.68	1.47	1995	1.46	1.49	1.32
1964	1.52	1.67	1.43	1980	1.62	1.66	1.45	1996	1.44	1.47	1.31
1965	1.52	1.67	1.43	1981	1.58	1.63	1.43				
1966	1.51	1.63	1.40	1982	1.53	1.59	1.40				

The weights applied to En and Ey are estimated by calculating relative magnitudes of the effects of the GDP gap on filing a return and the cyclical change in income per return. The change in returns is modeled as a function of changes in employment, tax filing rules, and a dummy variable to capture the apparent change in the coefficients after 1977. Regression results in Table 6 indicate that until 1977 a 1 percent change in employment led to a 2 percent change in single returns, while after 1977 there is a one-to-one relationship. The reduction probably reflects a variety of demographic factors such as the falloff in marriage rates and the entry of married women into the labor force over the later period. By contrast, changes in employment have a negligible impact on nonsingle filers, probably owing to lower levels of unemployment and higher levels of income-generating assets of married households. Similar results hold for our estimates of the cyclical response of AGI per return (Table 7): average income is more cyclically sensitive for single filers than for nonsingles. A 1 percent increase in aggregate per-employee income results in a 1.41 percent increase in income on returns of singles (there is no break in the 1970s), while the estimate of the coefficient in the case of nonsingles is 0.81, but it has not been stable over time.

With these regression results, we can construct the weights on En and Ey for single returns (the weight on En for nonsingles is zero owing to the lack of response of the number of returns to economic activity). The return gap, $ngap$, equals

Table 6
Personal Income Tax Elasticity Regressions, Number of Returns Elasticity

	Dependent Variable	
	Single Returns	Nonsingle Returns
Constant	-0.016	0.012
	(-3.14)	(5.28)
Employment	2.33	0.16
	(10.07)	(1.49)
Employment*T78	-1.21	—
	(-3.12)	
Filing requirements	-0.072	-0.032
	(-4.42)	(-2.56)
T78	0.014	—
	(1.66)	
D87	0.064	—
	(3.49)	
Adjusted R^2	0.77	0.15
Durbin-Watson	1.58	1.54

Notes: The sample period is 1951 to 1996. All variables are first differences of the log of the series. Employment is civilian payroll employment. Filing requirements is the nominal threshold for filing an income tax return. T78 is a dummy of ones beginning in 1978 and D87 is a dummy to capture the change in filing requirements from the Tax Reform Act of 1986, which raised the number of returns from minors.

the product of the coefficient on employment in the returns equation and the employment gap. The income per return gap, $ygap$, is the product of the coefficient estimate for the average income per return and the per-capita income gap. The resulting annual weights on En and Ey vary wildly over time and are quite sensitive to the GDP and employment gap measures. In response, we opted to make the weights constant over time by taking their average value: the weights on En and Ey are both 0.5.[25] The regressions, in panel B of Table 7, provide us with estimates of the elasticity of aggregate AGI to NIPA-adjusted personal income—the final elasticity needed to evaluate equation 16, the elasticity of personal income taxes to adjusted personal income. Our estimate, $Epersonal$, is shown in Table 5, and it has varied between 1.3 and 1.5.

Social insurance taxes currently exceed 35 percent of NIPA-based federal revenues. The major components of these taxes are Social Security taxes (for Old-Age, Survivors, and Disability Insurance [OASDI], Medicare [HI], and railroad retirement benefits), federal and state unemployment taxes, federal civilian and military retirement contributions, and supplemental medical insurance (SMI) premiums.[26] An estimate of the overall elasticity of social insurance taxes is calculated by estimating separate elasticities for employed Social Security taxes (FICA), self-employed Social Security taxes (SECA), and unemployment insurance taxes. It is assumed that railroad retirement taxes have the same elasticity as FICA taxes and that other taxes and contributions have a zero elasticity with respect to cyclical changes in the economy.[27]

The cyclical income elasticity of FICA contributions—EFICA—and similarly of SECA contributions, is estimated as a weighted average of the elasticities of taxes to changes in employment and changes in wages per employee.

$$(17) \qquad EFICA = \{En*ngap + Ey*ygap*(1 + ngap)\} \Big/ [ngap + ygap*(1 + ngap)],$$

where:

$ngap$ is the percentage gap in wage earners,

$ygap$ is the percentage gap in average wage,

En is the elasticity of FICA contributions to a change in employment, and

Ey is the elasticity of FICA contributions to a change in average wages.

As with personal income taxes, we assume that En equals 1 and Ey should account for the elasticity of the tax code, given the distribution of income.[28] Ey is less than 1 because wages and salaries above a maximum amount of taxable earnings are not subject to OASDHI taxes. The share of workers above the wage cap has fallen from 25 percent in the 1960s to about 6 percent now (and the Medicare portion of the OASDHI tax covers full wages). Equation 18 states that aggregate FICA taxes are the product of the FICA tax rate and the wages subject to tax, broken into two parts: earnings by those below the wage cap and

Table 7
Elasticities of AGI per Return and AGI to NIPA-Adjusted Personal Income

	Dependent Variable						
	AGI per Return: Singles			AGI per Return: Nonsingles			
	1951-96	1951-77	1977-96	1951-96	1951-77	1977-96	1987-96
Panel A							
Constant	-0.008	-0.002	-0.001	0.012	-0.006	0.012	-0.010
	(-1.13)	(-1.02)	(-0.19)	(1.57)	(-0.50)	(1.01)	(-0.53)
NIPA-adjusted income per employee	1.13	1.07	1.08	0.79	1.18	0.82	1.32
	(8.34)	(3.58)	(10.06)	(5.28)	(5.37)	(4.15)	(2.30)
Filing requirements	0.064	0.067	0.004	0.020	-0.008	0.154	.214
	(4.05)	(3.45)	(0.11)	(0.82)	(-.36)	(2.72)	(2.30)
Adjusted R^2	0.64	0.45	0.86	0.37	0.52	0.47	0.50

	Dependent Variable				
	AGI: Singles	AGI: Nonsingles			
	1951-96	1951-96	1951-77	1977-96	1987-96
Panel B					
Constant	-0.027	0.013	0.011	0.013	-0.010
	(-2.55)	(2.38)	(2.22)	(1.34)	(-0.67)
NIPA-adjusted income	1.41	0.81	0.84	0.79	1.20
	(10.14)	(11.01)	(11.68)	(6.30)	(4.57)
Filing requirements	0.008	0.000	-0.027	0.086	.161
	(0.31)	(0.00)	(-1.91)	(1.86)	(2.50)
Adjusted R^2	0.70	0.74	0.85	0.67	0.77

Note: All variables are first differences of the log levels.

the taxable portion of earnings of those with earnings above the cap. A little algebra yields the elasticity of taxes with respect to an increase in income, equation 19.

(18) $T(t, w, y, x, n) = t^*[y^*x^*n + w^*(1-x)^*n]$,

where:

t = the statutory tax rate,

y = the average wage of those below the wage cap,

x = the fraction of wage earners below the wage cap,

w = the maximum wages subject to taxation, and

n = the number of wage earners.

(19) $$Ey = (y^*x)/(y^*x + w^*(1-x)).$$

Calculations using data on the distribution of earners and earnings above the wage cap from the annual *Social Security Bulletin* yield the tax-schedule elasticities, Ey, shown in Table 8. The elasticity of FICA taxes with respect to wages and salaries rises after the early 1970s because the share of workers below the wage cap rises as a result of the 1972 and 1977 amendments to the Social Security Act. Similar calculations were made for the elasticity of SECA taxes; the elasticity of the SECA tax schedule is, on average, 25 percent lower than the elasticity of the FICA schedule because a smaller share of the income earned by the self-employed is earned by those below the caps.[29]

The next step is to estimate the relative shares of the cyclical changes to aggregate wage and salary income that result from greater employment and greater income per worker. The percentage gap in wage earners and percentage gap in average wages are estimated by the following regressions (with *t*-statistics in parentheses):

FICA:

$$\Delta ln(covemp) = .001 + 1.00\Delta ln(emp) + .013*law,$$
$$(.23)\ (10.0)\qquad (3.74)$$

adj. R^2 =.72

$$\Delta ln(avecovwage) = .000 + 1.031*\Delta ln(avewage),$$
$$(.20)\ (12.5)$$

adj. R^2 =.79

SECA:

$$\Delta ln(covemp) = -.013 + 1.71*\Delta ln(emp) + .066law,$$
$$(-.61)\ (2.43)\qquad (2.50)$$

adj. R^2 =.21

Table 8

FICA and SECA Tax Elasticities

	Ey		*Esocial*				*Ey*		*Esocial*		
Year	FICA	SECA	FICA	SECA	Total	Year	FICA	SECA	FICA	SECA	Total
1951	.49	.26	.81	.72	.80	1974	.61	.30	.85	.74	.84
1952	.45	.26	.79	.72	.79	1975	.60	.31	.85	.74	.84
1953	.41	.25	.78	.72	.77	1976	.60	.32	.85	.74	.84
1954	.40	.25	.77	.72	.77	1977	.60	.34	.85	.75	.84
1955	.46	.34	.80	.75	.79	1978	.58	.32	.84	.74	.83
1956	.43	.31	.79	.74	.78	1979	.68	.40	.88	.77	.87
1957	.41	.29	.78	.73	.77	1980	.71	.45	.89	.79	.88
1958	.40	.29	.77	.73	.77	1981	.73	.49	.90	.81	.89
1959	.45	.31	.79	.74	.79	1982	.74	.51	.90	.81	.90
1960	.43	.31	.78	.74	.78	1983	.76	.52	.91	.82	.90
1961	.41	.30	.78	.74	.77	1984	.75	.49	.91	.81	.90
1962	.39	.27	.77	.73	.76	1985	.75	.48	.90	.80	.90
1963	.37	.25	.76	.72	.76	1986	.75	.48	.91	.80	.90
1964	.35	.23	.75	.71	.75	1987	.74	.47	.90	.80	.90
1965	.33	.18	.75	.69	.74	1988	.72	.43	.89	.79	.89
1966	.48	.25	.80	.72	.80	1989	.73	.45	.90	.79	.89
1967	.45	.22	.79	.71	.78	1990	.75	.47	.90	.80	.90
1968	.52	.26	.82	.72	.81	1991	.77	.52	.91	.82	.91
1969	.47	.25	.80	.72	.79	1992	.76	.53	.91	.82	.90
1970	.45	.23	.79	.71	.79	1993	.77	.54	.91	.83	.91
1971	.41	.22	.78	.71	.77	1994	.80	.60	.92	.85	.92
1972	.45	.25	.79	.72	.79	1995	.78	.60	.92	.85	.91
1973	.52	.26	.82	.72	.81	1996	.78	.60	.92	.85	.91

$$\Delta ln(avecovwage) = .027 + .24*\Delta ln(avepro),$$
$$(3.30)\ (3.39)$$

adj. R^2 =.25,

where:

$covemp$ = covered employment, from the Social Security Administration,

emp = civilian employment,

law = a dummy for changes in coverage, 1 for 1955, 1957, 1966, 1983, 1984, 1988, 1991,

$avecovwage$ = the average wage for covered employment, from the Social Security Administration,

$avewage$ = average wage: total wages and salaries divided by civilian employment, and

$avepro$ = proprietor's income divided by covered workers.

As with the personal income tax elasticity estimates, the weights on En and Ey implied by the regressions move dramatically over time—especially when the sum of $ngap$ and $ygap$ is close to zero—and thus they are very sensitive to estimates of potential GDP. As before, we decided to use the average weight over time, which placed 62 percent of the weight on the employment term for FICA. The resulting point estimate for the weight on the employment elasticity for SECA was 1.1. This value seemed unreasonable and probably reflected the poor fit of the SECA equations, so we opted to use the weights from the FICA. Plugging this information into equation 17 gives the cyclical income elasticities of FICA and SECA, summarized in the *Esocial* columns in Table 8. The weighted average of these two elasticities is shown in the total columns.

The elasticity of unemployment taxes to cyclical income was approached in a distinct manner. The unemployment insurance (UI) tax system has two key features. In most states, the wage cap is quite low: indeed, in twelve states the cap is $7,000, and the weighted average across states was only $9,000 in 1997.[30] The second key feature of the system is that tax rates for firms are experience-rated. Thus, tax rates tend to rise for several years after a recession and fall during an expansion. To capture this endogenous behavior, we modeled the UI tax rate ($UIrate$) as a function of lagged unemployment rates and changes in federal tax laws concerning the Federal Unemployment Tax (FUTA) wage cap and statutory tax rate.[31] Lagged changes in unemployment rates for four years and the change in the wage cap were significant, but changes in the statutory tax rate—which have been small and infrequent—had no explanatory power (with *t*-statistics in parentheses):

$$\Delta UIrate = -.026 + .042\Delta UR_{t-1} + .074\Delta UR_{t-2}$$
$$(-2.85)\ (4.25)\qquad (7.77)$$
$$+ .004\Delta UR_{t-3} + .025\Delta UR_{t-4} + .60\Delta WAGECAP,$$
$$(-.32)\qquad (2.65)\qquad (5.51)$$

adj. R^2 =.84

Corporate profits taxes, excluding Federal Reserve earnings, are about 10 percent of federal revenues. Corporate profits tax liability (CPT) is defined as the product of the average tax rate on income subject to tax (τ) and income subject to tax before credits (IST), less tax credits (C): $CPT = \tau*IST - C$. The average tax rate is derived from the data, given the BEA's estimates for the other three terms. Income subject to tax equals modified NIPA economic profits (corporate profits less Federal Reserve earnings and rest-of-world profits), CP, less adjustments, ADJ. The adjustments are losses and capital gains, which are added to CP, as well as tax-exempt interest, state and local corporate taxes, and deductions for loss carryovers, which are subtracted. These data are found in *SOI Corporate Income Tax Returns* and in the BEA's reconciliation tables between IRS measures of profits and taxes and the NIPA economic profits and profits taxes. Tax credits are primarily for foreign taxes and the investment tax credit. The elasticity of corporate profits taxes to changes in modified corporate profits (CP) is determined as follows:

$$(20)\qquad E_{cpt,\,cp} = (\tau*IST(E_{\tau,\,cp} + E_{ist,\,cp}) - C*E_{c,\,cp})/(\tau*IST - C),$$

where $E_{\tau,\,cp} = E_{\tau,\,ist}*E_{ist,\,cp}$,

and $E_{ist,\,cp} = (CP - \Sigma ADJ_i*E_{adj,\,cp})/(CP - \Sigma ADJ_i)$.

The elasticity of income subject to tax with respect to modified corporate profits in equation 20 is found by estimating the cyclical sensitivity of the major adjustments to corporate profits (Table 9). The elasticities are calculated in two steps. In the first step, the adjustments and modified profits are regressed against the GDP gap and potential GDP.[32] The elasticity with respect to GDP is estimated by evaluating the marginal change at mean GDP. Second, the elasticities of the adjustments with respect to GDP are divided by the elasticity of modified profits with respect to GDP to produce the estimates of the elasticity with respect to modified profits. When we plug these results back into equation 20, we obtain an average elasticity of income subject to tax with respect to modified profits of 0.8; the annual figures vary from 0.3 in 1982 to 0.96 in 1968 (Table 10).[33] These estimates are similar to those of deLeeuw et al. (1980). The low elasticity reflects the importance of corporate losses, which is the only adjustment that causes the elasticity to fall below one.

$E_{\tau,\,ist}$ is the elasticity of the corporate profits tax rate. This is only slightly higher than zero because the corporate income tax is not very progressive and few corporate profits are generated by firms in the lower tax bracket.[34] We have assumed that the elasticity of credits with respect to modified profits varies with the share of credits that are for foreign taxes (which appears to have a zero elasticity) and the share of credits owing to investment tax credits (with an assumed 1.0 elasticity). Combining the elasticities in equation 20 produces an overall

Table 9

Elasticities of Adjustments to Modified Corporate Profits

	Dependent Variable					
	Modified Profits	State Profits Taxes	Tax-Exempt Interest	Capital Gains	Losses	Loss Carryovers
Constant	17.4	-2.23	-1.53	-0.25	-1.87	-0.96
	(4.26)	(-13.0)	(-17.0)	(-0.50)	(-2.36)	(-5.62)
Gap	-0.262	-0.003	-0.001	-0.048	0.038	-.005
	(-3.34)	(-0.94)	(-0.72)	(-4.97)	(2.47)	(-1.66)
Potential GDP	0.063	0.006	0.005	0.007	0.015	0.004
	(19.0)	(44.5)	(65.3)	(17.2)	(22.9)	(30.5)
Elasticity with respect to GDP at mean	3.75	0.58	0.37	7.05	-2.90	1.64
Elasticity with respect to modified profits	N.A.	0.16	0.11	2.13	-0.88	0.50
Adjusted R^2	.94	.99	.99	.93	.96	.98

Note: The sample period is 1956 to 1994.

Table 10

Corporate Income Tax Elasticities

Year	$E_{ist,\,cp}$: Income Subject to Tax Relative to Modified Profits	$E_{cpt,\,ct}$: Corporate Tax Accruals Relative to Profits	Year	$E_{ist,\,cp}$: Income Subject to Tax Relative to Modified Profits	$E_{cpt,\,ct}$: Corporate Tax Accruals Relative to Profits
1954	.94	1.00	1975	.76	1.11
1955	.94	1.01	1976	.84	1.23
1956	.94	1.01	1977	.88	1.28
1957	.90	.97	1978	.90	1.26
1958	.88	.96	1979	.85	1.29
1959	.92	.99	1980	.68	.90
1960	.85	.92	1981	.54	.64
1961	.89	.98	1982	.31	.22
1962	.90	.98	1983	.52	.60
1963	.90	.99	1984	.58	.67
1964	.92	1.01	1985	.63	.78
1965	.95	1.05	1986	.70	.88
1966	.95	1.06	1987	.66	.81
1967	.94	1.06	1988	.64	.82
1968	.96	1.08	1989	.58	.72
1969	.88	.99	1990	.49	.62
1970	.74	.86	1991	.48	.60
1971	.81	.96	1992	.59	.72
1972	.88	1.05	1993	.70	.85
1973	.87	1.08	1994	.70	.85
1974	.73	1.07			

elasticity of corporate profits taxes to NIPA economic profits of 0.9 on average (Table 10).

Indirect business taxes, which constitute only 5 percent of federal receipts, are composed of excise taxes, customs duties, and business nontaxes. As before, the elasticity is the weighted sum of the elasticities of each tax, where the weights are the share of the receipts in total taxes and the elasticity of excise taxes and customs duties are the demand elasticities with respect to cyclical GDP.

The share estimates are constructed using the BEA's annual estimates of these taxes. The elasticities for excise taxes and nontaxes are built up from the elasticities of their components. The elasticities of the various components are assumed to be constant over time; thus, the variation over time in the excise tax and nontax elasticities reflects changes in the composition of these taxes. The elasticity of customs duties is set at 2.0, the cyclical elasticity found in the FRB/US model. Our estimates of the elasticities of indirect business taxes and their components with respect to cyclical income are shown in Table 11.

The elasticity of excise taxes with respect to cyclical income is obtained by taking the sum of the products of the share of each tax receipt in total excise taxes and the demand elasticity of the taxed good (the latter drawn from various prior studies). Table 11 shows the change in the composition of excise taxes over the years and the elasticities used for each tax. The rise and decline of importance of auto excise taxes and windfall profits taxes are the major contributors to changes in the elasticity of excise taxes over time.

The elasticity of business nontaxes has risen over time owing to the rising share of deposit insurance premiums in nontaxes. We assume that the cyclical income elasticity of deposit premiums is equal to one, reflecting the income elasticity of deposits. Note that the cyclical elasticity will be different than one to the extent that the opportunity costs of deposits are cyclical. The other major element of nontaxes is rents and royalties from resource extraction on the outer continental shelf; we assume that it has a zero elasticity. Finally, other nontaxes consist largely of proprietary receipts paid to the Department of Agriculture (for example, inspection fees), the Department of the Interior (timber, mineral, and water), and fines. Some of the fees are a condition of doing business and presumably are inelastic with respect to the level of output, while others depend upon the level of business activity and thus are more elastic. As a guess, we assume that these other nontaxes

Table 11

Indirect Business Taxes: Shares of Receipts for Selected Years

	1955	1965	1975	1980	1985	1990	1995	Elasticity
Share in indirect business taxes								
Excise	91	80	71	68	59	54	63	—
Customs	7	12	19	18	21	27	21	2.0
Nontaxes	3	8	9	14	20	19	16	—
Share in excise								
Alcohol	30	26	32	21	16	16	13	0.75
Gas	10	18	24	15	26	29	36	0.5
Tobacco	17	15	14	9	13	12	10	0.0
Diesel	0	1	2	2	8	9	11	0.5
Airline	2	1	5	6	7	10	10	1.5
Telephone	6	7	12	3	7	8	7	1.0
Windfall oil profits	0	0	0	35	15	0	0	0.0
Motor vehicle	13	18	4	3	3	4	3	2.7
Other manufacturing	7	10	8	0	0	0	0	2.0
Other	14	3	0	6	6	11	9	1.0
Share in nontaxes								
Off-shore oil	0	9	30	42	30	19	18	0.0
Deposit insurance premiums	33	18	20	12	27	39	29	1.0
Other	67	73	50	46	43	42	52	0.5

Note: Figures in the first seven columns are in percent.

Table 12

Indirect Business Tax Elasticities

Year	Excise Taxes	Customs Duties	Business Nontaxes	Indirect Business Taxes	Year	Excise Taxes	Customs Duties	Business Nontaxes	Indirect Business Taxes
1951	1.03	2.0	.75	1.09	1974	0.82	2.0	.49	0.99
1952	0.97	2.0	.75	1.03	1975	0.82	2.0	.45	1.08
1953	1.02	2.0	.75	1.07	1976	0.78	2.0	.44	0.99
1954	1.03	2.0	.75	1.06	1977	0.75	2.0	.42	0.98
1955	1.02	2.0	.67	1.08	1978	0.76	2.0	.42	1.03
1956	1.09	2.0	.67	1.13	1979	0.79	2.0	.39	1.03
1957	1.04	2.0	.67	1.09	1980	0.50	2.0	.35	0.75
1958	1.04	2.0	.67	1.09	1981	0.32	2.0	.34	0.58
1959	1.00	2.0	.66	1.07	1982	0.40	2.0	.36	0.67
1960	1.04	2.0	.67	1.11	1983	0.49	2.0	.40	0.74
1961	0.99	2.0	.54	1.05	1984	0.53	2.0	.41	0.81
1962	1.01	2.0	.55	1.07	1985	0.60	2.0	.49	0.87
1963	1.05	2.0	.55	1.10	1986	0.70	2.0	.55	1.01
1964	1.07	2.0	.55	1.12	1987	0.72	2.0	.57	1.04
1965	1.12	2.0	.55	1.16	1988	0.72	2.0	.58	1.04
1966	1.03	2.0	.55	1.11	1989	0.75	2.0	.56	1.07
1967	0.99	2.0	.52	1.07	1990	0.76	2.0	.60	1.06
1968	0.98	2.0	.53	1.08	1991	0.72	2.0	.65	0.98
1969	1.05	2.0	.52	1.13	1992	0.71	2.0	.64	0.99
1970	1.04	2.0	.51	1.13	1993	0.73	2.0	.67	1.01
1971	1.03	2.0	.46	1.14	1994	0.73	2.0	.65	0.98
1972	0.86	2.0	.44	1.00	1995	0.73	2.0	.55	0.98
1973	0.81	2.0	.49	0.97	1996	0.68	2.0	.62	0.93

had an elasticity of 0.5. Table 12 reports our estimates of the elasticity of indirect business taxes with respect to cyclical GDP.

After calculating the high-employment income shares and elasticities, we calculated HEB taxes using the gross-up method by adjusting actual taxes by the tax elasticity times the percentage difference between the actual and the high-employment tax base. To compute HEB taxes through 1998, we extend forward the various tax elasticities using the most recent historical estimate. The results are summarized in Tables 13 and 14. The far right column of Table 13 shows the cyclical change in tax revenues as a percentage of potential GDP per 1 percentage point of GDP growth. Thus, in 1998, a pick-up of GDP growth of 1 percentage point would boost revenues by 0.31 percent of GDP. This corresponds to an elasticity of receipts to cyclical changes in GDP of 1.5, a figure in excess of the individual tax elasticities because of the relatively elastic changes of the tax bases. Over time, this 0.3 response of taxes with respect to cyclical changes in GDP has been relatively constant, ignoring the values obtained when the GDP gap is small, despite the large changes in marginal tax rates, because the individual tax elasticities have not changed as much as implied by the changes in statutory rates and because the downward drift in the personal income tax elasticity has been offset by the rise in the elasticity of social insurance taxes.

Table 14 highlights the sources of cyclical variation in receipts. Historically, 40 to 50 percent of the change has come from personal taxes while another 33 to 50 percent has come from corporate taxes. Social insurance contributions have grown in importance over time and now account for roughly 20 percent of the cyclical variation in taxes. Corporate income taxes generate more of the cyclical response than social insurance contributions, despite their smaller share of overall receipts and similar tax elasticity, because their tax base—profits—is much more cyclical than wages.

Table 13

High-Employment Receipts

Year	HEB Receipts (Billions of Dollars)	Actual Receipts (Billions of Dollars)	Cyclical Receipts (Billions of Dollars)	Cyclical Receipts (Percentage of GDPK)	GDP Gap	Response of Taxes to a 1 Percent GDP Change (Percentage of GDP)
1951	60.2	64.7	-4.5	-1.4	-3.7	0.37
1952	64.5	67.8	-3.3	-1.0	-2.9	0.33
1953	66.5	70.5	-4.0	-1.1	-3.4	0.32
1954	65.7	64.3	1.4	0.4	0.7	0.54
1955	69.3	73.2	-3.8	-1.0	-3.2	0.30
1956	75.9	78.6	-2.7	-0.6	-2.0	0.31
1957	82.2	82.6	-0.4	-0.1	-0.6	0.15
1958	85.7	79.5	6.2	1.3	3.8	0.34
1959	91.2	90.6	0.6	0.1	0.3	0.45
1960	99.3	97.0	2.3	0.4	1.5	0.29
1961	105.0	99.0	6.0	1.1	3.1	0.35
1962	109.1	107.2	1.9	0.3	1.1	0.29
1963	117.0	115.5	1.5	0.2	0.8	0.29
1964	114.5	116.2	-1.7	-0.3	-0.8	0.30
1965	119.5	125.8	-6.4	-0.9	-2.9	0.31
1966	131.5	143.5	-12.0	-1.6	-5.1	0.32
1967	144.8	152.6	-7.8	-1.0	-3.2	0.30
1968	167.2	176.9	-9.6	-1.1	-3.6	0.31
1969	192.0	199.5	-7.5	-0.8	-2.6	0.30
1970	199.5	195.1	4.4	0.4	1.0	0.43
1971	208.9	203.3	5.6	0.5	1.1	0.44
1972	230.5	232.6	-2.0	-0.2	-0.9	0.18
1973	250.9	264.0	-13.1	-1.0	-3.2	0.30
1974	299.5	295.2	4.4	0.3	0.8	0.34
1975	321.9	297.4	24.5	1.4	4.4	0.32
1976	357.6	343.1	14.5	0.8	2.3	0.33
1977	395.0	389.6	5.4	0.3	0.9	0.28
1978	438.8	446.5	-7.7	-0.3	-0.9	0.36
1979	504.1	511.1	-6.9	-0.3	-0.5	0.52
1980	581.9	561.5	20.3	0.7	2.6	0.27
1981	674.3	649.3	25.0	0.8	2.9	0.27
1982	696.9	646.4	50.5	1.4	7.0	0.21
1983	725.5	671.9	53.6	1.4	5.6	0.26
1984	757.5	746.9	10.6	0.3	1.4	0.19
1985	812.4	811.3	1.2	0.0	0.6	0.04
1986	850.5	850.1	0.5	0.0	0.4	0.02
1987	937.5	937.5	0.1	0.0	0.4	0.00
1988	983.9	997.2	-13.3	-0.3	-0.7	0.40
1989	1,056.9	1,079.4	-22.4	-0.4	-1.4	0.31
1990	1,124.8	1,129.8	-5.0	-0.1	-0.2	0.56
1991	1,192.8	1,149.0	43.8	0.7	2.9	0.25
1992	1,240.7	1,198.5	42.2	0.7	2.2	0.30
1993	1,307.1	1,275.1	32.1	0.5	1.8	0.26
1994	1,380.4	1,374.7	5.7	0.1	0.5	0.16
1995	1,466.1	1,460.4	5.8	0.1	0.6	0.14
1996	1,577.8	1,584.7	-6.9	-0.1	-0.2	0.42
1997	1,687.1	1,720.0	-32.8	-0.4	-1.3	0.31
1998	1,788.1	1,844.2	-56.1	-0.7	-2.2	0.31

Table 14

Decomposition of Cyclical Taxes

Billions of Dollars

Year	Total Cyclical Receipts	Personal Taxes	Corporate Income Taxes	Social Insurance	Indirect Business Taxes
1951	-4.5	-1.4	-2.6	-0.1	-0.4
1952	-3.3	-1.4	-1.8	0.2	-0.3
1953	-4.0	-1.7	-2.3	0.4	-0.4
1954	1.4	0.0	0.8	0.5	0.1
1955	-3.8	-1.1	-2.7	0.3	-0.4
1956	-2.7	-1.3	-1.3	0.1	-0.3
1957	-0.4	-0.6	-0.2	0.5	-0.1
1958	6.2	1.9	3.2	0.6	0.5
1959	0.6	0.5	-0.1	0.2	0.0
1960	2.3	0.7	1.4	-0.1	0.2
1961	6.0	2.2	2.9	0.5	0.5
1962	1.9	1.0	0.8	-0.1	0.2
1963	1.5	0.8	0.8	-0.2	0.1
1964	-1.7	-0.4	-1.1	-0.1	-0.2
1965	-6.4	-1.8	-3.6	-0.4	-0.5
1966	-12.0	-4.2	-6.3	-0.7	-0.8
1967	-7.8	-3.5	-3.6	-0.1	-0.5
1968	-9.6	-3.7	-5.4	0.2	-0.7
1969	-7.5	-3.8	-3.6	0.5	-0.5
1970	4.4	0.3	2.1	1.9	0.2
1971	5.6	1.5	1.7	2.1	0.3
1972	-2.0	-0.4	-2.3	0.8	-0.2
1973	-13.1	-4.8	-6.8	-0.8	-0.7
1974	4.4	-0.2	3.3	1.0	0.2
1975	24.5	8.0	11.4	3.9	1.2
1976	14.5	6.4	5.9	1.6	0.6
1977	5.4	3.7	2.3	-0.8	0.2
1978	-7.7	-1.4	-4.5	-1.6	-0.3
1979	-6.9	-3.0	-1.6	-2.2	-0.2
1980	20.3	7.8	9.6	2.0	0.9
1981	25.0	13.3	6.9	3.8	1.0
1982	50.5	30.4	8.6	9.0	2.5
1983	53.6	29.7	13.5	8.0	2.3
1984	10.6	10.2	3.0	-3.3	0.7
1985	1.2	4.1	2.1	-5.4	0.3
1986	0.5	2.1	2.6	-4.5	0.2
1987	0.1	2.9	1.7	-4.8	0.2
1988	-13.3	-2.8	-4.5	-5.6	-0.4
1989	-22.4	-8.3	-8.0	-5.2	-0.9
1990	-5.0	-3.8	0.3	-1.5	-0.1
1991	43.8	16.5	15.1	9.8	2.3
1992	42.2	19.8	11.7	8.9	1.8
1993	32.1	13.8	12.8	3.8	1.6
1994	5.7	4.4	2.3	-1.5	0.5
1995	5.8	2.3	4.5	-1.6	0.5
1996	-6.9	-1.4	-2.7	-2.5	-0.2
1997	-32.8	-12.2	-12.8	-6.6	-1.1
1998	-56.1	-24.1	-20.6	-9.4	-1.9

B. High-Employment Expenditures

Among expenditures, only those transfers and grants that are oriented toward income support respond automatically to changes in economic activity. Among these, unemployment benefits rise rapidly during a downturn in activity. The number of beneficiaries of low-income and disability programs—such as Food Stamps, the Earned Income Credit, welfare (Aid to Families with Dependent Children, or AFDC, and Temporary Assistance for Needy Families, or TANF), and disability insurance—expand as well, but only to a small extent. The large retirement transfers are essentially unaffected by fluctuations in the economy.[35]

Unemployment benefits are available for involuntarily unemployed workers who were recently employed and meet certain criteria. In general, benefits can last for up to twenty-six weeks, or up to thirty-nine weeks under the extended benefits program for workers in areas with high unemployment. This permanent extended benefits program was instituted in 1970. The HEB excludes expenditures by the permanent program. However, both before and after that time, temporary extended benefits programs were enacted near the end of each recession. HEB estimates typically include these expenditures because they are not automatic; they result from discretionary policies. However, for some uses of the HEB it may be appropriate to exclude these payments as well. Table 15 provides a summary of the temporary programs.

Unemployment benefits have become less sensitive to business-cycle fluctuations over the past two decades as the criteria for obtaining benefits have been tightened and the taxation of benefits effectively reduced their value. In 1975, 76 percent of the unemployed qualified for benefits, but this share had fallen to only 52 percent by 1992. Excluding the temporary extended benefits programs (but not benefits

paid under the 1970 Extended Unemployment Compensation Act), a 1-percentage-point increase in the unemployment rate would boost unemployment benefits by about $5 billion in 1998 and would boost the permanent extended benefits program by varying amounts depending on the level of unemployment.[36]

The Aid to Families with Dependent Children program was never very cyclically sensitive. Its successor program, Temporary Assistance for Needy Families, is essentially a block grant to states and thus it is no longer sensitive to the business cycle from the federal government's perspective. Our estimates of the cyclical response of AFDC are based on Blank (1997). She finds that a 1-percentage-point increase in the unemployment rate raises traditional AFDC caseloads (single-parent households) by 3½ percent over an eighteen-month period, which then declines to about a 2 percent increase after three years. About 10 percent of AFDC expenses are for AFDC-Unemployed Parent (AFDC-UP), a program for couples that appears to be much more cyclically responsive. AFDC-UP caseloads rise by about 20 percent during the first one and a half years, before easing to a 15 percent rise after three years.[37] The following equation approximates the dynamic response of total caseloads to an increase in unemployment as estimated by Blank:

$$\begin{aligned}\Delta AFDC = AFDC^{*}\,(&.006\Delta UR_{t-1} + .006\Delta UR_{t-2} \\ &+ .006\Delta UR_{t-3} + .006\Delta UR_{t-4} \\ &+ .006\Delta UR_{t-5} + .006\Delta UR_{t-6} \\ &- .003\Delta UR_{t-7} - .003\Delta UR_{t-8} \\ &- .003\Delta UR_{t-9} - .003\Delta UR_{t-10} \\ &- .003\Delta UR_{t-11} - .003\Delta UR_{t-12}).\end{aligned}$$

A rise in the unemployment rate of 1 percentage point would boost AFDC payments by 5 percent after one and a half years and by only 2½ percent after three years. In its peak year—1994—the federal government spent $13 billion for program

Table 15
Temporary Unemployment Insurance Extended Benefits

Year	Provisions	Expenditures
1958-59	Temporary Unemployment Compensation Act provided a voluntary program under which states could extend benefits for up to thirteen weeks. Financed by interest-free loans to the states.	2 million workers received $0.6 billion from June 1958 to April 1959.
1961-62	Temporary Extended Unemployment Compensation Act extended benefits for thirteen weeks. Financed by a temporary tax.	2.8 million workers received $0.82 billion from March 1961 to June 1962
1970	Extended Unemployment Compensation Act initiated permanent extended benefits program.	Outlays under this program have been made every year.
1971-72	Emergency Unemployment Act provided thirteen weeks beyond the extended benefits period, for a total of fifty-two weeks.	$0.6 billion in 1971 and 1972
1974-78	Emergency Unemployment Compensation Act of 1974 (plus three subsequent extensions) extended benefits for up to sixty-five weeks.	$6.5 billion in 1975-78
1974	Emergency Jobs and Unemployment Assistance Act provided a temporary program for the uninsured: farm workers, domestic workers, and S&L employees.	$2.5 billion
1982-85	Federal Supplemental Compensation Program (and six subsequent extensions) provided for up to fourteen weeks of assistance to workers who had exhausted their benefits.	$9.3 billion: $1.2 billion in 1982 $5.4 billion in 1983 $2.3 billion in 1984 $0.7 billion in 1985
1991-94	Emergency Unemployment Compensation Act (and four extensions).	$27.8 billion: $0.8 billion in 1991 $13.6 billion in 1992 $11.9 billion in 1993 $1.4 billion in 1994

benefits (and another $1.5 billion for administrative expenses): thus, a 1-percentage-point increase in the unemployment rate would have raised federal outlays by only $0.5 billion, or $1 billion for the combined federal and state governments. The equation is set to zero beginning in 1997.[38]

The Food Stamp program has similar responsiveness to unemployment rates as found in AFDC. Thus, we used the same estimates. By contrast, this program may have become more cyclically sensitive for the federal government because the eligibility rules enacted in 1996 limit the amount of time nonworking individuals are eligible for benefits. Here, a 5 percent increase in expenditures after one and a half years implies that expenditures would rise by $1 billion.

Medicaid expenditures will also be raised by an increase in unemployment, as more individuals qualify for AFDC/TANF and become eligible for benefits. Only one-third of Medicaid payments go to the nonaged poor; thus, a 5 percent increase in AFDC enrollments would boost overall Medicaid expenditures by 1½ percent, or about $1.5 billion in 1998.

The Earned Income Credit was greatly expanded in the 1990s, from a minor program to the federal government's largest low-income support program. The portion of the credit that exceeds the income tax due is recorded in the budget as an outlay.[39] There is no cyclical experience with this greatly expanded credit. To fill the gap, we estimated the elasticity using the personal income tax methodology, assuming that all changes occur owing to income per family rather than to number of families.[40]

For a family with one child, the EIC in 1996 rose by 34 percent per dollar of earned income until annual earned

Table 16
High-Employment Current Expenditures

Year	Total Expenditures: HEB (Billions of Dollars)	Total Expenditures: Actual (Billions of Dollars)	Cyclical Expenditures (Billions of Dollars)	Cyclical Expenditures (Percentage of GDPK)	Unemployment Rate Gap
1951	55.0	54.4	0.6	0.2	-2.0
1952	64.2	63.3	1.0	0.3	-2.3
1953	69.2	68.1	1.1	0.3	-2.4
1954	65.4	65.5	-0.1	-0.0	0.2
1955	67.2	66.9	0.3	0.1	-1.0
1956	70.6	70.0	0.5	0.1	-1.3
1957	78.9	78.4	0.6	0.1	-1.1
1958	84.0	84.9	-0.9	-0.2	1.4
1959	87.9	88.0	-0.1	-0.0	0.0
1960	89.6	89.6	-0.0	-0.0	0.0
1961	95.4	96.1	-0.7	-0.1	1.2
1962	104.3	104.4	-0.1	-0.0	0.1
1963	110.1	110.2	-0.0	-0.0	0.1
1964	115.6	115.4	0.3	0.0	-0.4
1965	123.1	122.5	0.7	0.1	-1.2
1966	142.1	140.9	1.2	0.2	-2.0
1967	162.3	160.9	1.4	0.2	-1.9
1968	181.3	179.7	1.6	0.2	-2.2
1969	192.7	190.8	1.9	0.2	-2.4
1970	210.1	209.1	1.0	0.1	-0.9
1971	228.5	228.6	-0.1	-0.0	0.0
1972	253.3	253.1	0.2	0.0	-0.4
1973	276.5	275.1	1.4	0.1	-1.3
1974	313.1	312.1	1.1	0.1	-0.5
1975	367.2	371.3	-4.1	-0.2	2.3
1976	397.0	400.3	-3.3	-0.2	1.5
1977	434.2	435.9	-1.7	-0.1	0.8
1978	478.6	478.1	0.4	0.0	-0.2
1979	530.7	529.5	1.2	0.0	-0.4
1980	620.4	622.5	-2.0	-0.1	1.0
1981	703.1	707.1	-4.0	-0.1	1.4
1982	770.8	781.1	-10.3	-0.3	3.6
1983	836.0	846.4	-10.3	-0.3	3.5
1984	898.3	902.9	-4.6	-0.1	1.5
1985	971.7	974.2	-2.5	-0.1	1.2
1986	1,024.9	1,027.6	-2.7	-0.1	1.0
1987	1,065.5	1,066.3	-0.8	-0.0	0.2
1988	1,120.1	1,118.5	1.7	0.0	-0.4
1989	1,195.7	1,192.7	3.0	0.1	-0.6
1990	1,286.3	1,284.5	1.7	0.0	-0.3
1991	1,340.3	1,345.0	-4.8	-0.1	1.0
1992	1,479.8	1,479.4	-9.6	-0.1	1.7
1993	1,518.4	1,525.8	-7.3	-0.1	1.1
1994	1,559.0	1,561.4	-2.4	-0.0	0.3
1995	1,636.3	1,634.7	1.6	0.0	-0.1
1996	1,697.6	1,695.0	2.6	0.0	-0.3
1997	1,745.1	1,741.0	4.1	0.1	-0.7
1998	1,778.8	1,771.4	7.4	0.1	-1.1

Table 17

Decomposition of Cyclical Expenditures

Billions of Dollars

Year	Cyclical Expenditures	Unemployment Insurance Benefits	Other	Memo: Extended Unemployment Insurance Benefits	Year	Cyclical Expenditures	Unemployment Insurance Benefits	Other	Memo: Extended Unemployment Insurance Benefits
1951	0.6	0.6	0.0	0.0	1975	-4.1	-3.5	-0.6	5.3
1952	1.0	0.9	0.1	0.0	1976	-3.3	-2.0	-1.3	6.0
1953	1.1	1.0	0.1	0.0	1977	-1.7	-1.1	-0.6	3.6
1954	-0.1	-0.1	0.0	0.0	1978	0.4	0.3	0.2	0.9
1955	0.3	0.4	-0.0	0.0	1979	1.2	0.6	0.6	0.2
1956	0.5	0.5	0.0	0.0	1980	-2.0	-2.0	0.0	1.6
1957	0.6	0.5	0.1	0.0	1981	-4.0	-2.8	-1.3	1.3
1958	-0.9	-0.9	-0.0	0.0	1982	-10.3	-8.1	-2.2	3.5
1959	-0.1	-0.0	-0.1	0.0	1983	-10.3	-7.1	-3.2	7.2
1960	-0.0	-0.0	0.0	0.0	1984	-4.6	-2.7	-1.9	2.3
1961	-0.7	-0.7	-0.0	0.6	1985	-2.5	-2.4	-0.1	0.8
1962	-0.1	-0.0	-0.1	0.2	1986	-2.8	-2.3	-0.4	0.1
1963	-0.0	-0.1	0.0	-0.0	1987	-0.8	-0.5	-0.3	0.1
1964	0.3	0.2	0.0	-0.0	1988	1.7	1.1	0.6	0.0
1965	0.7	0.6	0.1	-0.0	1989	3.0	1.8	1.2	0.0
1966	1.2	1.0	0.2	-0.0	1990	1.7	0.9	0.9	0.0
1967	1.4	1.1	0.2	-0.0	1991	-4.8	-3.7	-1.0	1.0
1968	1.6	1.4	0.2	-0.0	1992	-9.6	-5.9	-3.7	13.5
1969	1.9	1.6	0.3	-0.0	1993	-7.3	-3.7	-3.6	12.0
1970	1.0	0.7	0.3	-0.0	1994	-2.4	-1.2	-1.2	1.8
1971	-0.1	-0.0	-0.1	0.7	1995	1.6	0.5	1.1	0.0
1972	0.2	0.4	-0.2	0.5	1996	2.6	1.2	1.3	0.0
1973	1.4	1.2	0.2	0.0	1997	4.1	3.0	1.1	0.0
1974	1.1	0.6	0.5	0.0	1998	7.4	5.1	2.2	0.0

Note: The temporary portion of extended benefits is not included in cyclical expenditures.

income reached $6,330. It was constant for earned income up to $11,610 and then was phased out at the rate of sixteen cents per dollar until $25,078. Thus, the sign of the elasticity to an increase in earned income depends upon the relative magnitudes of the amount of earnings in the three regions. Most EIC payments go to those in the phase-out range, and a 1 percent increase in incomes would, on net, reduce the EIC by 0.9 percent.[41] Using our earlier result—that a 1 percent increase in NIPA-adjusted personal income raises AGI for nonsingles by 0.8 percent—we obtain the following equation for the cyclical component of the EIC:

$$\Delta EIC = EIC(t)*(100 + YADJGAP(t-1) *0.8*(-0.9))/100,$$

where *YADJGAP* is the gap of adjusted personal income (in percentage points) and is lagged one year because EIC outlays are paid out largely when tax returns are filed. With refundable credits totaling $24 billion, a 1-percentage-point increase in NIPA-adjusted personal income would reduce outlays by $0.2 billion.

The federal government provides cash benefits for persons with severe disabilities through two programs: the Disability Insurance (DI) program of OASDI and the Supplemental Security Income (SSI) program. Eligibility for the DI program is based on work experience while the SSI program does not require work experience and is means-tested. Econometric evidence indicates that one of the factors that affects applications and awards for these programs is the unemployment rate. While the unemployment rate appears to have a stronger impact on DI applications than it does on SSI applications, the impacts on

Table 18

Current Surplus (+)/Deficit (-)

Year	HEB (Billions of Dollars)	Actual (Billions of Dollars)	Cyclical (Billions of Dollars)	HEB (Percentage of GDP)	Actual (Percentage of GDP)	Cyclical (Percentage of GDP)
1951	5.2	10.3	-5.1	1.6	3.1	-1.6
1952	0.2	4.5	-4.3	0.1	1.3	-1.2
1953	-2.7	2.4	-5.1	-0.7	0.7	-1.4
1954	0.3	-1.2	1.5	0.1	-0.3	0.4
1955	2.1	6.3	-4.2	0.5	1.6	-1.0
1956	5.3	8.6	-3.3	1.2	2.0	-0.8
1957	3.3	4.2	-1.0	0.7	0.9	-0.2
1958	1.7	-5.5	7.1	0.3	-1.1	1.5
1959	3.3	2.6	0.7	0.6	0.5	0.1
1960	9.7	7.3	2.4	1.8	1.4	0.4
1961	9.5	2.8	6.7	1.7	0.5	1.2
1962	4.8	2.8	2.0	0.8	0.5	0.3
1963	6.9	5.3	1.5	1.1	0.9	0.2
1964	-1.1	0.9	-2.0	-0.2	0.1	-0.3
1965	-3.7	3.4	-7.1	-0.5	0.5	-1.0
1966	-10.6	2.6	-13.2	-1.4	0.4	-1.8
1967	-17.5	-8.3	-9.2	-2.2	-1.0	-1.1
1968	-14.1	-2.8	-11.3	-1.6	-0.3	-1.3
1969	-0.7	8.7	-9.4	-0.1	0.9	-1.0
1970	-10.7	-14.1	3.4	-1.0	-1.3	0.3
1971	-19.6	-25.4	5.7	-1.7	-2.2	0.5
1972	-22.8	-20.5	-2.3	-1.9	-1.7	-0.2
1973	-25.6	-11.1	-14.5	-1.9	-0.8	-1.1
1974	-13.6	-16.9	3.3	-0.9	-1.1	0.2
1975	-45.3	-73.9	28.6	-2.7	-4.3	1.7
1976	-39.4	-57.2	17.8	-2.1	-3.1	1.0
1977	-39.2	-46.3	7.1	-1.9	-2.3	0.3
1978	-39.8	-31.7	-8.1	-1.8	-1.4	-0.4
1979	-26.6	-18.5	-8.1	-1.0	-0.7	-0.3
1980	-38.5	-60.9	22.4	-1.3	-2.1	0.8
1981	-28.8	-57.8	29.0	-0.9	-1.8	0.9
1982	-73.9	-134.7	60.8	-2.1	-3.9	1.7
1983	-110.5	-174.4	63.9	-3.0	-4.7	1.7
1984	-140.8	-156.0	15.2	-3.6	-3.9	0.4
1985	-159.3	-163.0	3.7	-3.8	-3.9	0.1
1986	-174.3	-177.5	3.2	-3.9	-4.0	0.1
1987	-128.0	-128.9	0.9	-2.7	-2.7	0.0
1988	-136.3	-121.3	-15.0	-2.7	-2.4	-0.3
1989	-138.7	-113.3	-25.4	-2.6	-2.1	-0.5
1990	-161.5	-154.7	-6.8	-2.8	-2.7	-0.1
1991	-147.5	-196.1	48.5	-2.4	-3.2	0.8
1992	-229.1	-280.9	51.8	-3.6	-4.4	0.8
1993	-211.3	-250.7	39.4	-3.2	-3.8	0.6
1994	-178.6	-186.7	8.0	-2.6	-2.7	0.1
1995	-170.2	-174.3	4.2	-2.3	-2.4	0.1
1996	-119.8	-110.3	-9.5	-1.6	-1.4	-0.1
1997	-58.0	-21.1	-36.9	-0.7	-0.3	-0.5
1998	9.3	72.8	-63.5	0.1	0.9	-0.8

awards are equivalent. In each case, a rise in the unemployment rate of 1 percentage point raises awards by 2 percent.[42] In the case of the DI program, new awards represent about 10 percent of the total caseload. For SSI, only half of the caseload is disabled working-age adults (the rest are disabled children and the elderly), and new awards are about 10 percent of this subset of the overall caseload. In 1998, expenditures on these two programs were $50 billion for DI and $30 billion for SSI. Thus, a 1-percentage-point increase in the unemployment rate would boost outlays by $0.1 billion in the DI program and by $0.03 billion in the SSI program.[43]

C. The High-Employment Surplus

As shown in Table 16, in 1998 the actual unemployment rate was 1.1 percentage points below the CBO estimate of the NAIRU, which depressed expenditures by $7 billion, about 0.4 percent of total expenditures (a 4 percent increase in the affected programs).[44] Most of the increase occurred as increased unemployment benefits (Table 17). To put this in context with receipts, a 1 percent fall in GDP is comparable to about a ½ percent increase in unemployment; thus, a 1 percent fall in GDP would boost expenditures by $3 billion, compared with a $30 billion reduction in receipts in the first year.

Table 18 shows the effects of the business cycle on the budget surplus. Over the past decade, the cyclical component of the surplus has swung by 1.5 percentage points of GDP, from adding 0.8 percentage point to the *deficit* in 1992 to boosting the *surplus* by 0.7 percentage point in 1998.

VI. Conclusion

This paper presents theoretical and empirical analysis of automatic fiscal stabilizers, such as the income tax and unemployment insurance benefits. Using the modern theory of consumption behavior, we identify several channels through which the optimal reaction of household consumption plans to aggregate income shocks is tempered by the automatic fiscal stabilizers.

The insurance channel—through which higher anticipated income tax rates reduce the variance of uncertain future after-tax income—is effective, provided that the precautionary motive for saving is important and that individuals understand the implications of the government's intertemporal budget constraint. The wealth channel—in which current income taxes are lower as a result of, say, a recession—is effective if individuals expect government purchases (rather than income tax rates) to adjust to maintain the government's intertemporal budget constraint. This channel can also be effective if the rate used by individuals to discount future income tax hikes exceeds the government's borrowing rate (as in the FRB/US model). The liquidity channel—in which lower current income taxes relax borrowing or liquidity constraints—is effective to the extent that such constraints are in fact binding for a nontrivial fraction of the population.

To bring some evidence to bear on these issues, we present results from several empirical exercises using postwar U.S. data. Using standard time-domain techniques, we estimate elasticities of the various federal taxes with respect to their tax bases and responses of certain components of federal spending to changes in the unemployment rate. Such estimates are useful for analysts who forecast federal revenues and spending; the estimates also allow high-employment or cyclically adjusted federal tax receipts and expenditures to be estimated. Using frequency-domain techniques, we confirm that the relationships found in the time domain are strong at the business-cycle frequencies. Such results suggest the potential for the automatic fiscal stabilizers to play a quantitatively important role in the economic stabilization process.

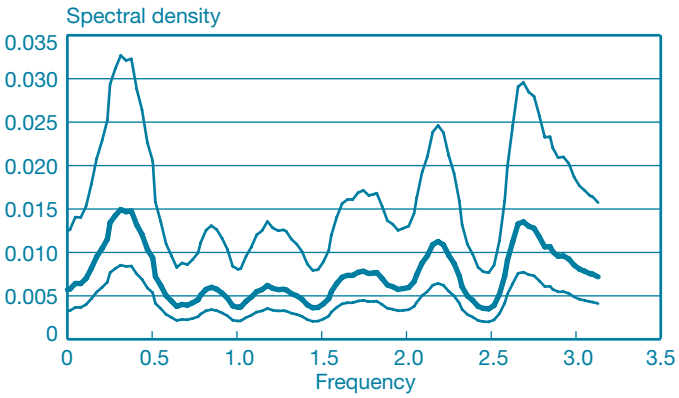
However, in one large-scale, macroeconometric model of the U.S. economy—FRB/US—the automatic fiscal stabilizers are found to play a modest role in damping the short-run effect of aggregate demand shocks on real GDP, reducing the multiplier by about 10 percent, although they have a somewhat larger damping impact (in percentage terms) on personal consumption expenditures. Very little stabilization is provided in the case of an aggregate supply shock. In light of the findings from the FRB/US simulations, perhaps the title and conclusion of our paper should be "The Automatic Fiscal Stabilizers: Quietly *and Modestly* Doing Their Thing."

Appendix: Empirical Results from the Frequency Domain

Chart A1

Personal Receipts

Second-Quarter 1946 to First-Quarter 1999



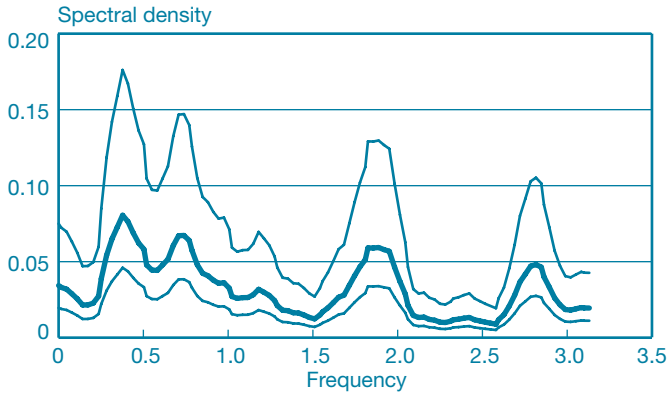
Source: National Income and Product Accounts.

Note: Growth rate, seasonally adjusted annual rate.

Chart A2

Corporate Receipts

Second-Quarter 1946 to First-Quarter 1999



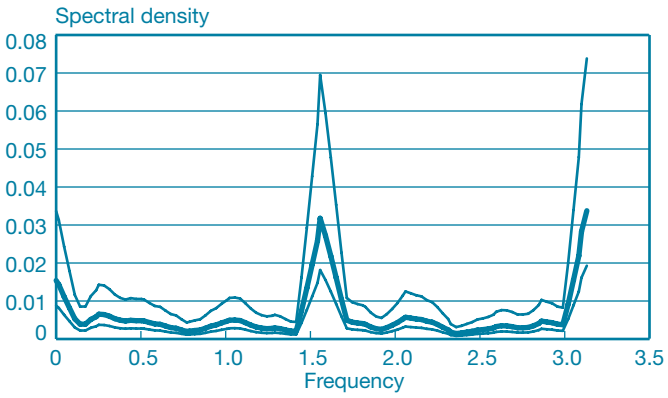
Source: National Income and Product Accounts.

Note: Growth rate, seasonally adjusted annual rate.

Chart A3

Social Insurance Contributions

Second-Quarter 1946 to First-Quarter 1999



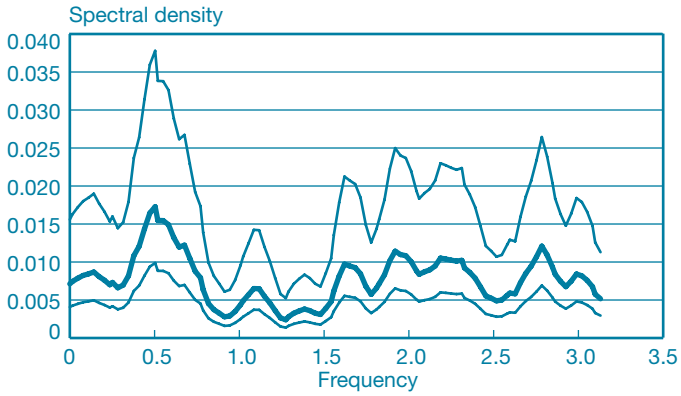
Source: National Income and Product Accounts.

Note: Growth rate, seasonally adjusted annual rate.

Chart A4

Indirect Business Taxes

Second-Quarter 1946 to First-Quarter 1999



Source: National Income and Product Accounts.

Note: Growth rate, seasonally adjusted annual rate.

Chart A5

Growth Rate of Personal Income Taxes and Growth Rate of Tax Base

Second-Quarter 1946 to First-Quarter 1999

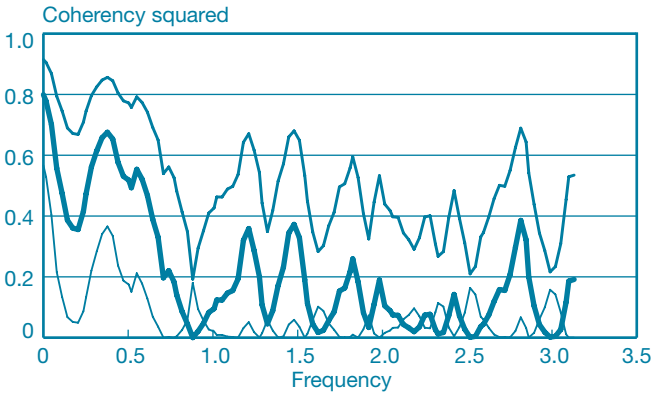


Chart A6

Growth Rate of Corporate Taxes and Growth Rate of Tax Base

Second-Quarter 1946 to First-Quarter 1999

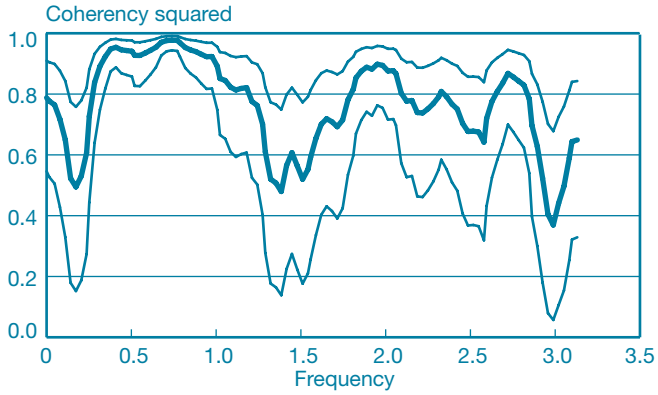


Chart A7

Growth Rate of Social Insurance Contributions and Growth Rate of Tax Base

Second-Quarter 1946 to First-Quarter 1999

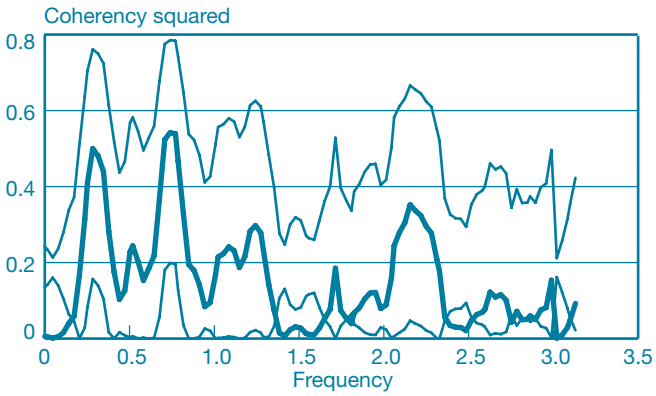


Chart A8

Growth Rate of Indirect Business Taxes and Growth Rate of Nominal GDP

Second-Quarter 1946 to First-Quarter 1999

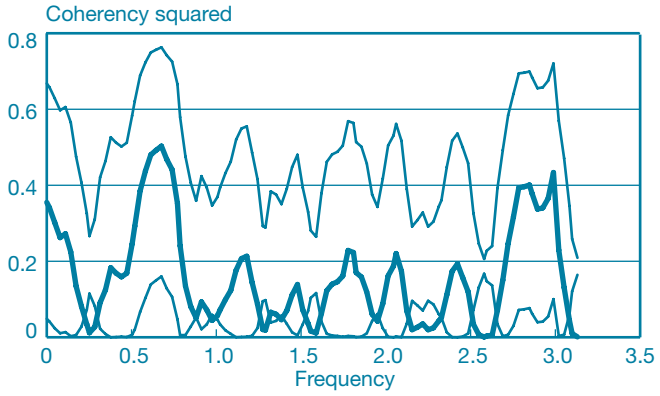
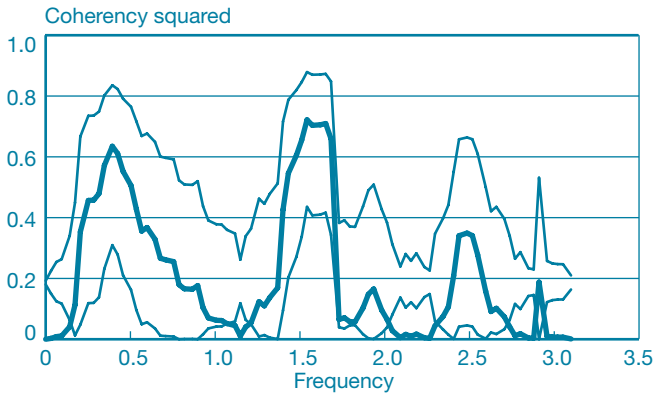
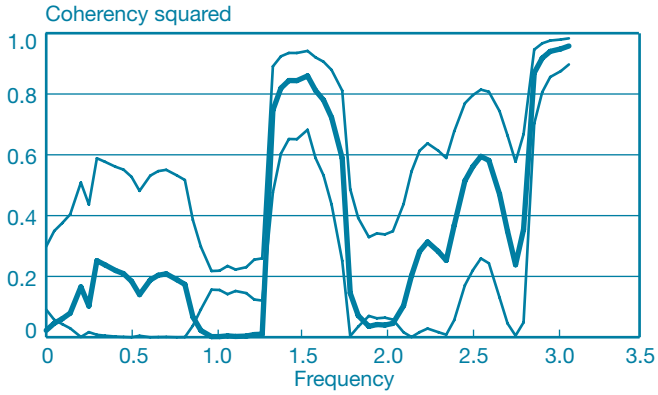


Chart A9
Growth Rate of Withheld Taxes and Growth Rate of Nominal GDP
First-Quarter 1955 to Fourth-Quarter 1997



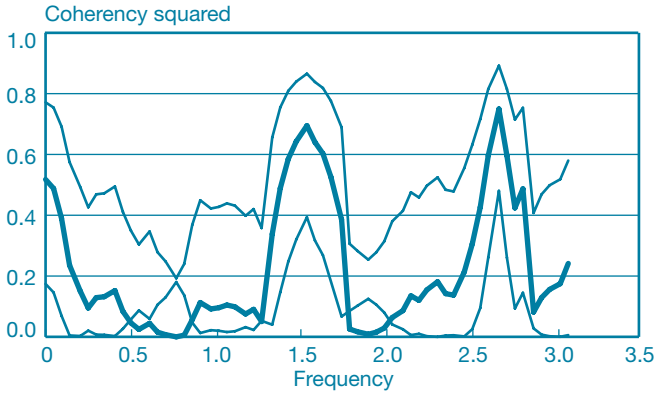
Note: Not seasonally adjusted.

Chart A10
Growth Rate of Declarations and Growth Rate of Nominal GDP
First-Quarter 1968 to Fourth-Quarter 1997



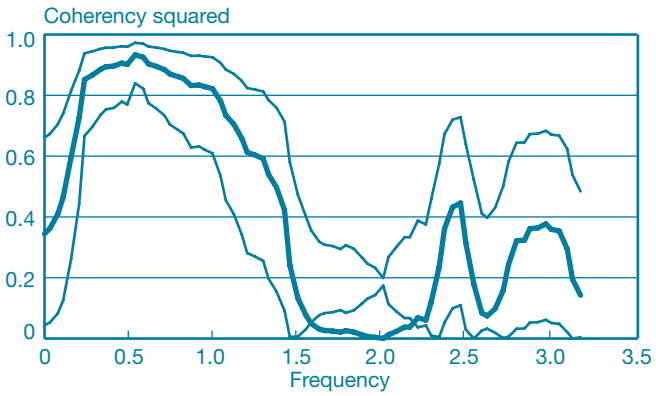
Note: Not seasonally adjusted.

Chart A11
Growth Rate of Final Payments and Growth Rate of Nominal GDP
First-Quarter 1968 to Fourth-Quarter 1997



Note: Not seasonally adjusted.

Chart A12
Unemployment Insurance as a Percentage of Nominal GDP and the Unemployment Rate
Second-Quarter 1959 to First-Quarter 1997



Endnotes

1. For an opposing view, see Atkeson and Phelan (1994).

2. One notable exception is Auerbach and Feenberg (1999).

3. Blinder and Solow (1974) do not evaluate automatic fiscal stabilizers under the assumption of rational expectations. In a rational expectations macroeconomic model, McCallum and Whitaker (1979) establish that automatic stabilizers can be effective at stabilizing output; however, like those of Blinder and Solow, their results are not based on an explicit set of optimizing models for consumers and firms.

4. The basic Keynesian model result—that the automatic stabilizers, in fact, stabilize—obviously does not hold in versions of the model in which the aggregate demand multiplier is zero and stabilization is unnecessary. For example, the automatic stabilizers are irrelevant when there is a completely inelastic aggregate supply of goods (the full-employment version of the model) or flexible exchange rates. In these cases, flexible wages, prices, or exchange rates do the stabilizing.

In addition to possibly being irrelevant, the automatic stabilizers may be a destabilizing force. An example involves forward-looking expectations (and thus deviates from the basic Keynesian framework). If an income tax rate is varied countercyclically (but not completely automatically, if Congress must first recognize that a recession is under way), employed households may optimally reduce labor supply at the start of a recession (in response to an anticipated increase in after-tax wages), further reducing output. Similarly, if an investment tax credit were varied countercyclically, firms might postpone investments at the start of a recession and accelerate them during booms, thereby exacerbating cyclical fluctuations.

5. Indeed, it is not clear how best to incorporate (expected) future taxes into the basic Keynesian framework; perhaps the present discounted value of the tax stream could be included as a component of private nonhuman wealth, itself a determinant of consumption demand. Alternatively, one could modify the simple textbook model to allow for dynamic and forward-looking elements along the lines of Blanchard (1981).

6. Chan (1983) and Christiano (1984) both allow for households to invest in a private, risky asset. We abstract from such investment opportunities. Also, implicitly households are allowed to borrow and lend at the risk-free interest rate, r.

7. A way to motivate this setup is found in Aschauer (1985). In his model, utility is a function of effective consumption in period i, C^*_i, defined as $C_i + \theta_i G_i$, where θ_i is positive if C and G are substitutes. That is, for a given level of effective consumption, an additional unit of government spending will induce the individual to reduce private consumption by θ units. Defining $U_1 = \partial U / \partial C^*_1$, $\partial U_1 / \partial G_1 = U_{11} \partial C^*_1 / \partial G_1 = U_{11} \theta_1 < 0$ since $U_{11} < 0$. $\partial U_1 / \partial G_1 < 0$ corresponds to our assumption $U_{13} < 0$.

8. For example, if income falls temporarily by $100, personal consumption should fall by about $5 (given econometric estimates of the marginal propensity to consume out of wealth); with a 20 percent income tax rate, taxes and hence government purchases would fall by $20. Thus, investment would fall by $75. The decline in investment likely will be larger if future income taxes are raised, rather than if government purchases are reduced, to maintain a budget balance.

9. The elasticity estimated in FRB/US probably captures discretionary changes in the tax code as well as endogenous changes in receipts.

10. When fully rational (rather than VAR) expectations are incorporated into the simulations, the model assumes that the government's intertemporal budget constraint is satisfied by altering future income tax rates to stabilize the government's debt-to-GDP ratio.

11. In addition, after-corporate-tax cash flow has a positive impact on investment in producers' durable equipment and on personal consumption expenditures (via stock market wealth) in FRB/US. However, these channels of influence play only a minor role in the subsequent simulation results.

12. Note that there can be a slight tension between the expected federal funds rate generated by the VAR system and the "actual" federal funds rate resulting under either of the two monetary policy assumptions; that is, policy misperceptions are possible, at least in the short run.

13. Note that the table shows increases in the *percentage* deviation from baseline in real PCE; this translates into an increase in the PCE "multiplier" from about 0.2 to 0.3.

14. Although we have not explicitly considered non-oil-price supply shocks, results reported in Reifschneider, Tetlow, and Williams (1999) suggest that the role of the automatic stabilizers in the face of other supply shocks would differ somewhat from those described above. For example, in FRB/US, a productivity shock affects supply and demand (the latter by altering permanent income) and thus the impact of the automatic stabilizers on model multipliers would be intermediate to the separate demand and supply shock cases considered above.

15. The idea is that the sensitivity of the output gap (actual minus potential) with respect to an aggregate supply shock is greater the stronger the automatic stabilizers are in a simple textbook model of aggregate demand and supply. For example, with a negative aggregate supply shock that reduces desired output, actual output will also decline as prices rise; however, the price rise will be smaller—and hence the narrowing of the output gap more limited—the stronger the automatic stabilizers are.

16. See the appendix in Cohen (1999) for a review—aimed at the practitioner—of the key results of spectral analysis used in this paper as well as references to the literature.

17. We utilize PROC SPECTRA from SAS to generate the basic spectral densities and squared coherencies. We use kernel estimation of the spectrum with a bandwidth parameter of 4. The respective 95 percent confidence bands were programmed by us. On rare occasions, the squared coherencies will lie outside the lower 95 percent confidence band; this is possible because of the squaring operation.

18. Furthermore, as shown in Cohen (1999), other federal transfer programs—such as Social Security, Medicare, Medicaid, and Food Stamps—have low squared coherencies with the unemployment rate at business-cycle frequencies, implying that these programs are weak automatic stabilizers at best.

19. The CBO data are based on Bureau of Economic Analysis (BEA) estimates of GDP before the comprehensive revision, which was published in October 1999. Our estimates use the same data.

20. Indeed, this was a problem for deLeeuw et al. (1980), which they addressed by using time trends. Our difference approach creates stationary series and does not rely on deterministic time trends. That said, levels specifications, using cubic-spliced time trends, yield similar results for the coefficients on the $GDPGAP$ terms.

21. Using the annual Statistics of Income (SOI) data on tax liabilities implies that we are estimating a liability elasticity. Both the NIPA budget estimates and the unified budget record taxes on a payments basis. Our estimates may not capture the precise timing of the changes in payments being estimated. For example, during a downturn in the economy, tax payments may be accelerated relative to liabilities.

22. Simplifying to the case where AGI equals adjusted personal income ($E_{agi} = 1$), equation 16 is obtained by taking the total differential of the tax function, $T = F(n, y)$—which implicitly allows tax revenues to respond differently to changes in the number of returns and changes in income per return—and dividing the resulting expression by the total differential of the aggregate income function, $AGI = n^{*}y$, all multiplied by AGI/T.

23. The elasticity of each group equals the slope of the line traced out by the natural logarithms of average taxes and average income. The slope for an AGI group is estimated by calculating the derivative of the parabola defined by three points consisting of the group and the groups above and below.

24. Some deductions—mortgage interest, for example—may be more closely related to permanent income than cyclical income while other deductions—such as state and local income taxes—are closely related to cyclical income. Thus, our calculations may understate the true cyclical marginal tax rate. The lower tax rate for capital gains may also unduly reduce the effective cyclical marginal tax rate to the extent that realizations do not reflect cyclical factors.

25. The chief problem is that the weights become unstable when the gaps are very small. By contrast, our 0.5 estimate is consistent with the swings in the gaps—and the weights—from business-cycle peaks to troughs throughout the sample period. For example, we estimate that the gap in the number of returns swung from -1.0 in 1989 to 1.6 in 1991, while the gap in the average income per return swung from -0.5 to 2.0 over the same period. Thus, the changes in the gaps were approximately equal. Similar results were obtained across earlier business cycles.

26. In addition, there is a small amount collected for veteran's life insurance, workmen's compensation, CHAMPUS (the military health program for dependents), and private employer pension benefits (PBGC premiums).

27. The elasticity of federal employee retirement contributions is assumed to be zero because there have been no endogenous changes in federal employment or pay owing to the business cycle. The income elasticity of SMI is approximately zero because Medicare status is based largely on age.

28. Our analysis indicates that the distribution of income between those above the taxable wage cap and those below the cap is not sensitive to the business cycle. We developed two parameters that are sufficient to describe the distribution of wages to make OASDI tax calculations—the share of wage earners below the cap, and the ratio of wages of those above the cap to those below the cap. The former is not

Note 28 continued
correlated with the business cycle; the latter has only a weak correlation. Thus, we ignore cyclical sensitivity of the income distribution.

29. For example, in 1997 6 percent of the self-employed had income exceeding the caps, and they earned 21 percent of total self-employed income. Among wage earners, only 5 percent were above the caps, and they earned 14 percent of total income.

30. Program specifics are legislated at the state level subject to general federal criteria as well as strong incentives to tax at least $7,000.

31. This exercise may also capture legislated changes by state governments in response to UI trust fund reserves.

32. This step is identical to the deLeeuw et al. (1980) procedure, which has potential econometric problems as the adjustments and potential GDP are nominal values in level terms. "Share style" equations showed no explanatory power.

33. The elasticity tends to fall during recessions owing to the rise in losses.

34. deLeeuw et al. (1980) estimated that the elasticity of the tax code declined from 0.08 in 1955 to 0.02 in 1979. We have assumed that it has remained at that level.

35. Medicare enrollments are insensitive to business-cycle fluctuations because enrollment is based largely on age. OASI enrollments and outlays are boosted during recessions because some workers take early retirement when faced with poor employment prospects. This factor would raise benefit payments by about 0.3 percent for each percentage-point change in the unemployment rate. However, OASI payments are held down by the effects of previous recessions because the additional claimants from those recessions receive lower benefits than they would have if they had retired at the normal age. Given that the present value of the benefit stream is approximately the same for those who take early retirement as it is for those who retire at age sixty-five, we have assumed that the net cyclical effect for the government is zero.

36. Until the extended benefits program is triggered by high levels of unemployment, an increase in the unemployment rate will have little effect on these expenditures. For example, in 1982 $2.5 billion was spent on extended benefits, but only $0.3 billion was spent in 1991, largely because the latter recession was milder.

37. This result appears to be dependent on the states included in the sample. The reported result is obtained when the sample is limited to the nineteen states that provided the AFDC-UP program continuously over the 1975-95 period. When the sample is enlarged to include states that were forced to initiate the program in the 1990s, the unemployment rate becomes insignificant.

38. The zeroing out of welfare abstracts from the small contingency program ($2 billion over five years) for states with high and rising unemployment.

39. The rest appears as lower taxes and is captured by our tax elasticity estimates.

40. The regressions for the personal income tax indicated that the number of nonsingle filers is not sensitive to the business cycle and the lion's share of EIC beneficiaries is nonsingles.

41. The actual elasticity for the expenditure portion may be smaller, as the refundable portion (about $24 billion of the $28 billion in 1996) would be less heavily weighted in the phase-out region.

42. See Rupp and Stapleton (1995).

43. These calculations ignore any hysteresis that is probably especially evident in the DI program, where few leave the rolls. But if the rolls do tend to ratchet up over time, it is not clear that the increases owing to recessions should be included in cyclical measures.

44. The ultimate effect would be somewhat larger owing to the lagged response of these programs.

References

Aschauer, David. 1985. "Fiscal Policy and Aggregate Demand." American Economic Review (March): 117-27.

Atkeson, Andrew, and Christopher Phelan. 1994. "Reconsidering the Costs of Business Cycles with Incomplete Markets." NBER Macroeconomic Annual 1994. Cambridge, Mass.: National Bureau of Economic Research.

Auerbach, Alan J., and Daniel Feenberg. 1999. "The Significance of Federal Taxes as Automatic Stabilizers." Unpublished paper, September.

Barsky, Robert, N. Gregory Mankiw, and Stephen Zeldes. 1986. "Ricardian Consumers with Keynesian Propensities." American Economic Review (September): 676-91.

Basu, Susanto, and Alan Taylor. 1999. "Business Cycles in International Historical Perspective." NBER Working Paper no. 7090, April.

Baxter, Marianne, and Robert King. 1993. "Fiscal Policy in General Equilibrium." American Economic Review (June): 315-34.

Blanchard, Olivier. 1981. "Output, the Stock Market, and Interest Rates." American Economic Review (March): 132-43.

Blank, Rebecca M. 1997. "What Causes Public Assistance Caseloads to Grow?" NBER Working Paper no. 6343, December.

Blinder, Alan, and Robert Solow. 1974. "Analytical Foundations of Fiscal Policy." In The Economics of Public Finance, 3-115. Washington, D.C.: Brookings Institution.

Brayton, Flint, and Peter Tinsley, eds. 1996. "A Guide to FRB/US: A Macroeconomic Model of the United States." Board of Governors of the Federal Reserve System Finance and Economics Discussion Series no. 1996-42.

Chan, Louis. 1983. "Uncertainty and the Neutrality of Government Financing Policy." Journal of Monetary Economics 11 (May): 351-72.

Christiano, Lawrence. 1984. "A Reexamination of the Theory of Automatic Stabilizers." In Carnegie-Rochester Conference Series on Public Policy, 147-206.

Cohen, Darrel. 1999. "An Analysis of Government Spending in the Frequency Domain." Board of Governors of the Federal Reserve System Finance and Economics Discussion Series no. 1999-26.

Deaton, Angus. 1992. Understanding Consumption. Oxford, England: Clarendon Press.

deLeeuw, Frank, Thomas Holloway, Darwin Johnson, David McClain, and Charles Waite. 1980. "The High-Employment Budget: New Estimates, 1955-80." Survey of Current Business (November): 13-43.

Diebold, Francis, and Glenn Rudebusch. 1992. "Have Postwar Economic Fluctuations Been Stabilized?" American Economic Review (September): 993-1005.

Hubbard, Glenn. 1998. "Capital Market Imperfections and Investment." Journal of Economic Literature (March): 193-225.

Lucas, Robert. 1987. Models of Business Cycles. New York: Basil Blackwell.

McCallum, B., and J. Whitaker. 1979. "The Effectiveness of Fiscal Feedback Rules and Automatic Stabilizers under Rational Expectations." Journal of Monetary Economics (April): 171-86.

Parker, Jonathan. 1999. "The Reaction of Household Consumption to Predictable Changes in Social Security Taxes." American Economic Review (September): 959-73.

Reifschneider, David, Robert Tetlow, and John Williams. 1999. "Aggregate Disturbances, Monetary Policy, and the Macroeconomy: The FRB/US Perspective." Federal Reserve Bulletin (January).

Romer, Christina. 1999. "Changes in Business Cycles: Evidence and Explanations." Journal of Economic Perspectives (spring): 23-44.

Rupp, Kalman, and David Stapleton. 1995. "Determinants of the Growth of SSA's Disability Programs—An Overview." Social Security Bulletin (winter).

Sargent, Thomas. 1979. Macroeconomic Theory. New York: Academic Press.

Souleles, Nicholas. 1999. "The Response of Household Consumption to Income Tax Refunds." American Economic Review (September): 947-95.

Olivier Blanchard

Commentary

Automatic stabilizers are a very old idea. Indeed, they are a very old, very Keynesian, idea. At the same time, they fit well with the current mistrust of discretionary policy and the focus on policy rules. Yet in the last ten years, they have not been discussed much by academics. For all of these reasons, it is indeed a good time to revisit the issues. Are automatic stabilizers an old and good idea? Or an old and bad one? Should we use them more? Less? Differently? That is why the paper by Darrel Cohen and Glenn Follette is so useful. It should be seen as a start: the paper raises more questions than it answers. It is full of interesting bits and pieces, although its most lasting contribution will surely be the most careful construction to date of the elasticity of taxes and transfers to output.

I shall use the wide-ranging structure of the paper as an excuse to also make a number of wide-ranging points.

1. Should We Expect Automatic Stabilizers to Work, That Is, to Stabilize?

This question is clearly a special case of a more general question: Does fiscal policy, defined here as the intertemporal reallocation of taxes, matter?

The standard discussion typically starts from the proposition of Ricardian equivalence, the proposition that the timing of taxes does not matter because, given spending, taxes will have to be paid sooner or later. Some of us stop here. Most of us go on to list a number of reasons why Ricardian equivalence is likely to fail:

- Death: Current taxpayers will not be there to pay when taxes are adjusted in the future.
- Myopia: The adjustment of taxes may be too far in the future to even think about.
- Credit constraints: If some people cannot borrow against future income, then changing taxes today will lead them to change consumption today.
- Insurance: To the extent that taxes are proportional, rather than lump-sum, they will reduce the uncertainty associated with labor income and affect consumption.

Which of these factors is most relevant? The answer is likely to depend on the fiscal experiment being conducted or examined.

Take, for example, the debate over the effects of Social Security on saving and capital accumulation, or the discussion of the effects of the increase in deficits in the 1980s or of the large fiscal consolidation in the 1990s. In that case, we are dealing with long-lasting changes in the path of taxes. Factors 1 and 2, death and myopia, are almost surely central to the issue. But the answer is likely to be different for automatic stabilizers. Recessions rarely last more than a year or two: lower taxes during a recession are likely to be offset by higher taxes only a

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few years down the line. Thus, factors 3 and 4 are likely to be the most important ones. How many households find themselves credit-constrained is likely to be the critical factor.

This has an important implication. What we learn about the effects of fiscal policy in one case (the effect of Social Security reform or of fiscal consolidations on consumption) may not be sufficient to give us the information we need to understand the other case (the effect of automatic stabilizers on consumption). Given the recent progress both in developing models of consumption that allow for credit constraints and precautionary saving, and in fitting them to panel data, we can probably make progress here, at little extra cost. This may help us to predict what will happen to automatic stabilizers as changes in financial markets continue to modify the nature of credit constraints faced by consumers.

2. Do Automatic Stabilizers Stabilize?

This is again part of a more general question: Does fiscal policy, again defined here as an intertemporal reallocation of taxes, affect output? Let me start with the more general question, and then return to automatic stabilizers.

The macroeconometric models we have say yes. And the FRB/US model is no exception. But there is a clear sense in which they largely assume the answer. Nearly always, they rule out Ricardian equivalence in their specification of the consumption function. (In the FRB/US model, future labor income net of taxes is assumed to be discounted at a high rate, independent of the nature of the income being discounted—the tax part or the labor income part. This high discount rate, higher than the rate paid by the government on government bonds, implies an effect of an intertemporal reallocation of taxes on consumption.) And nominal rigidities imply that shifts in aggregate demand translate into shifts in output. I happen to believe these two assumptions (the failure of Ricardian equivalence and the effects of aggregate demand on output). However, to somebody who is skeptical of either or both, showing the results of a model that takes them as given is hardly proof. One wants to see evidence not based on these assumptions. I will briefly discuss two such pieces of evidence.

I discuss the first mostly for fun, and a bit for provocation. An implication of Ricardian equivalence is that, other things equal, exogenous shifts in public saving should be reflected one-for-one in shifts in private saving. This suggests looking at the joint evolution of the two. Because shifts in public saving are not exogenous, and because other things are not equal, this can only be suggestive, but it is still worth doing. The relationship between U.S. private and public saving since 1970 is shown in Chart 1; the relationship between U.S. personal and public saving is shown in Chart 2. One is struck at how good the inverse relationship is, especially in recent years: as fiscal deficits have vanished, so has personal saving. The coefficients in simple regressions of private or personal saving on public saving since 1980 are -0.68 and -0.82, respectively. Can one look at these charts and still not believe in Ricardian equivalence? I think so. I believe both evolutions are caused by higher growth—actual growth, which leads to an automatic improvement in the budget, and expected growth, which leads to an increase in wealth and a decrease in saving. But I would feel better if I had done the algebra and convinced myself that this explanation can indeed account for the data.

Chart 1
U.S. Private and Public Saving, 1970-99

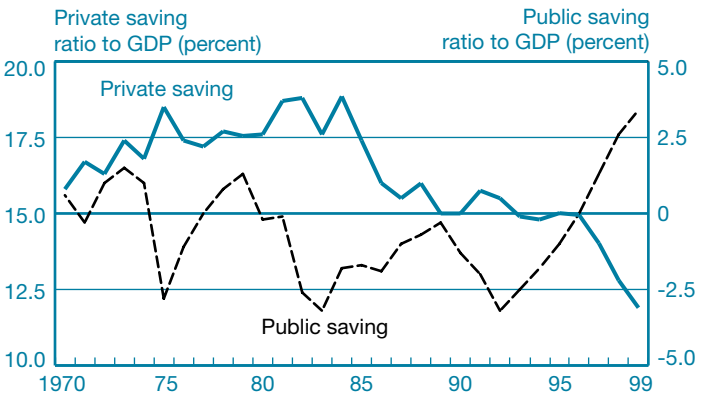
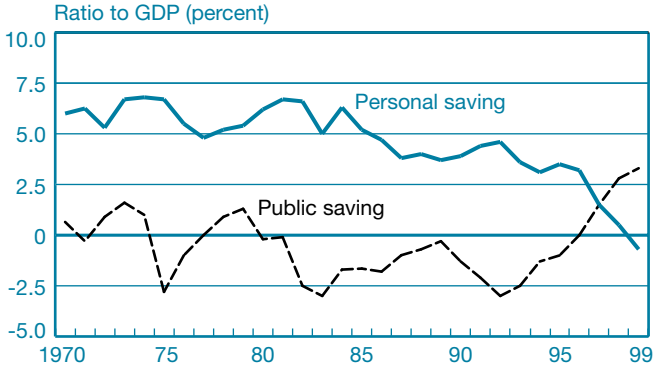


Chart 2
U.S. Personal and Public Saving, 1970-99



The second piece of evidence I take more seriously, for the simple reason that it comes from my own research. In work with Roberto Perotti (1999), we have done for fiscal policy what had been done earlier by Ben Bernanke and others for monetary policy, that is, we have estimated the dynamic effects of exogenous changes in taxes on activity. This is actually easier to do for fiscal than for monetary policy. Given information about the tax structure (very much the same information used in the last part of the Cohen-Follette paper to construct the high-employment budget), one can easily decompose, for each quarter, the part of the change in taxes that is a response to activity and the part that is not. One can then trace the effects of the second part on output and on taxes themselves. The basic results, taken from Blanchard and Perotti (1999), are reproduced in Chart 3. Panel A shows that a change in taxes of, say, one dollar, has an effect on taxes that lasts for about six quarters, and an effect on output that builds up before going away. The multiplier is around 1. In general, our paper finds strong but not overwhelming evidence that fiscal policy indeed affects output, typically with a multiplier around 1 (as in the FRB/US simulations with a Taylor rule reported in the Cohen-Follette paper).

What about automatic stabilizers? As discussed in my first point, the fact that one type of fiscal policy has an effect on output does not imply that automatic stabilizers will have the same impact, or indeed any impact at all.

To learn more, one can think of exploiting either the change in automatic stabilizers over time, or over countries.

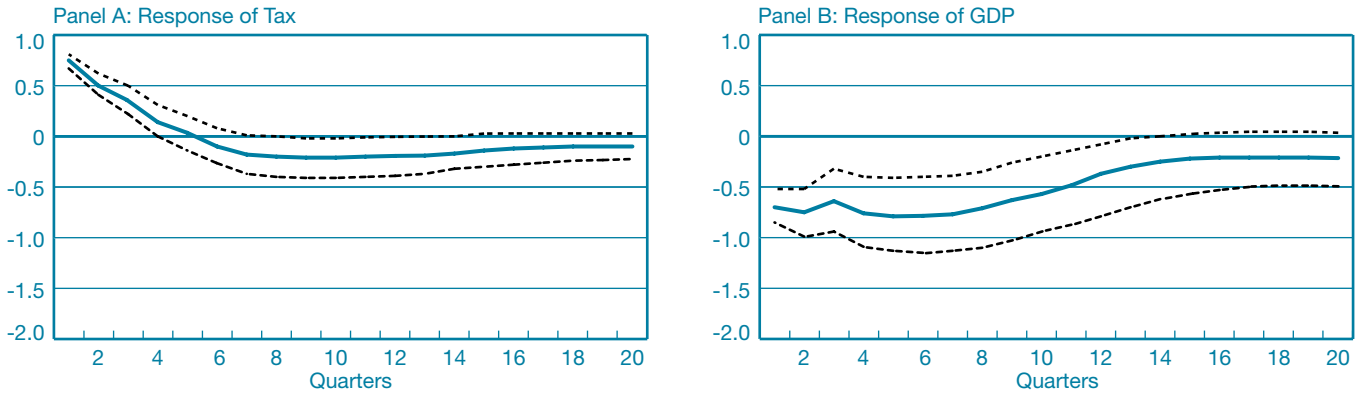
In the United States, as in most countries, the share of taxes and transfers in GDP has increased over time, suggesting an increase in automatic stabilizers. And indeed, the variance of output has decreased over time as well. But given the number of other factors that have changed, this seems like a weak reed to rely on.

Some researchers have looked at the cross-sectional evidence, either across countries or across U.S. states. Two scatterplots of the variance of output growth versus the share of government spending in GDP, taken from Fatas and Mihov (1999), are shown in Chart 4. Panel A presents the evidence across OECD countries. Panel B presents the evidence across U.S. states. There indeed appears to be an inverse relationship in both cases. From the results in Fatas and Mihov, the relationship appears robust to a number of obvious controls. This offers suggestive evidence that automatic stabilizers indeed stabilize. (The estimated relationship implies, however, an effect of automatic stabilizers on the variance of output much larger than the numbers implied by the FRB/US model simulations presented in the Cohen-Follette paper. This makes the evidence a bit suspicious.)

3. If We Accept That the FRB/US Model Is a Good Representation of Reality, What Do We Learn?

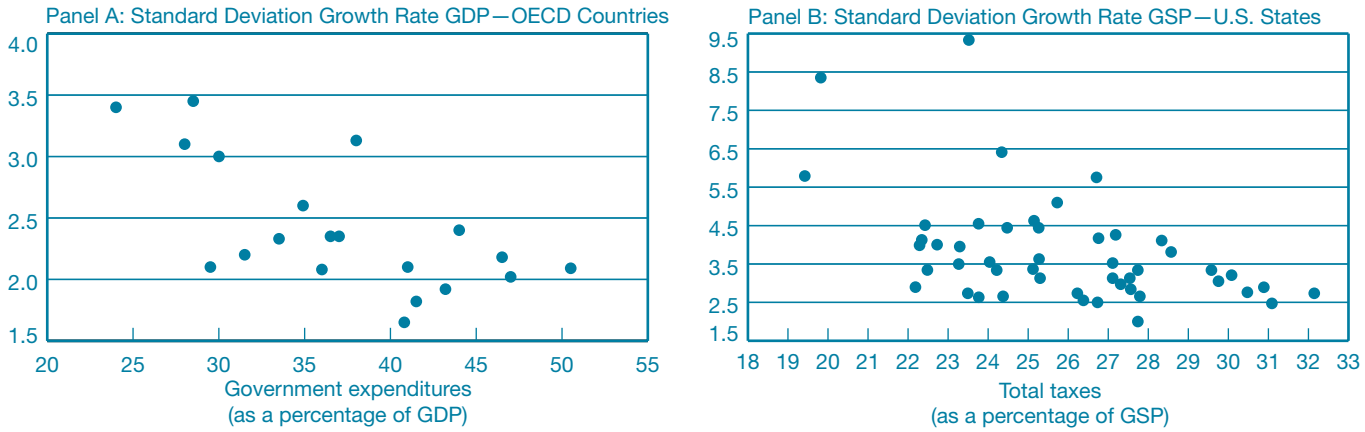
First, we learn that the direct effect of activity on taxes and transfers is substantial. If GDP goes up by 1 percent, the increase in taxes and the decrease in transfers lead to an improvement in the budget—equivalently an increase in the net income of firms and consumers—of about 0.3 percent of GDP.

Chart 3
Responses of Tax and GDP, Deterministic Trend



Source: Blanchard and Perotti (1999).

Chart 4
Volatility and Government Size



Source: Fatas and Mihov (1999).

Second, and somewhat surprisingly, we learn that this large effect on net income leads to only a small reduction in the multiplier, and thus a small reduction in the variance of GDP. In Table 1 of the Cohen and Follette paper, for example, for a given real interest rate (looking just at the IS part of the FRB/US model), the multiplier decreases only from 1.35 (after four quarters) to 1.23. Should we be surprised? Yes and no.

- The part that is surprising is how small the multiplier is—even when the interest rate is kept constant, that is, when we are just looking at the IS relationship. A multiplier of 1.35 corresponds to a marginal propensity to spend out of changes in net income (consumption plus investment) of 0.35/1.35 = 0.26. I am not sure that I understand why it is so low. True, in the FRB/US model, only 10 percent of the consumers simply consume their income. The others are more forward-looking. Given that the simulation shows that income goes up for quite some time (the multiplier effect is still above 1 after eight quarters), one would expect them to respond to the change in income more strongly than they appear to do. The same question applies to firms. It would be useful here for the authors to look a bit more into the entrails of the model and explain to us what is going on.
- The part that is not surprising is the small effect of automatic stabilizers on the multiplier. Given the small marginal propensity to spend, this is exactly what we would expect. Write the IS as:

$$Y = .26\,(Y - T) + X,$$

where X is autonomous spending. If T is fixed, the multiplier is 1.35. If $T = .3\,Y$, as Cohen and Follette document, then the multiplier is 1.22, exactly as shown in Table 1. In other words, given the small marginal propensity to spend, the effect of automatic stabilizers on the multiplier has to be small as well.

4. Where Do We Go from Here?

Based on the findings of the paper, should we use automatic stabilizers less, more, differently?

The distinction made in the paper between aggregate supply and aggregate demand shocks is nice, and I had not seen it before. The argument is not exactly right, however. The right one goes as follows. With respect to aggregate demand shocks, automatic stabilizers stabilize, and this is good. With respect to aggregate supply shocks, automatic stabilizers also stabilize, but this is not good: they do not allow for the adjustment of output that would be desirable in this case. Simple algebra will help here. Consider a textbook aggregate demand–aggregate supply model:

$$AD:\ y = c\,(-p + e_d)$$

$$AS:\ p = y + e_s.$$

All variables are in logs, y and p are output and the price level, and e_d and e_s are demand and supply shocks. A higher price level decreases the demand for goods (through the decrease in real money balances). Higher output leads to a higher price level. Stronger automatic stabilizers can be thought of as decreasing the coefficient c in the AD relationship.

Then, output is given by:

$$y = \frac{c}{1+c}(e_d - e_s).$$

If there were no nominal rigidities, output would instead be given by:

$$y^* = -e_s.$$

So that the output gap, the difference between actual output and equilibrium output, is given by:

$$y - y^* = \frac{1}{1+c}(c\,e_d + e_s).$$

This algebra yields two results. Higher automatic stabilizers (lower c) stabilize output both with respect to demand shocks and with respect to supply shocks. But with respect to supply shocks, output should move and, in effect, automatic stabilizers prevent it from moving enough. Looking at the gap, we see that automatic stabilizers reduce the gap with respect to demand shocks, but increase it with respect to supply shocks.

This suggests that it may be worth thinking about automatic stabilizers that do well with respect to supply shocks. For example, a proportional tax on the price of oil is a useful automatic stabilizer in this context. It increases taxes in response to adverse supply shocks, in this case an increase in the price of oil. There are, however, many types of supply shocks other than oil prices. Can we think of automatic stabilizers that would work with respect to supply shocks in general?

Another question raised by the Cohen-Follette paper is an obvious one. If automatic stabilizers play a useful role, why should we be satisfied with the degree of stabilization implied by existing tax and transfer rules? Could we increase the degree of automatic stabilization without introducing other distortions? A few years back, John Taylor revisited the role of automatic investment tax credits in this context. It may be time to revisit this and other possible tax rules again.

References

Blanchard, Olivier, and Roberto Perotti. 1999. "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output." NBER Working Paper no. 7269, July.

Fatas, Antonio, and Ilian Mihov. 1999. "Government Size and Automatic Stabilizers: International and Intranational Evidence." Centre for Economic Policy Research Discussion Paper no. 2259, October.

Distinguished Address

Rudolph G. Penner

Rudolph G. Penner

The Near-Term Outlook for Fiscal Policy

When I accepted the invitation several months ago to speak on the near-term fiscal outlook, I was not nearly as confused by it as I am today. But since that time, I have been confused, first by the implications of the methods used to enact appropriations this year and what these methods suggest about the sustainability of the budget rules that have served us well since 1990. It is not clear what will replace these rules and how future spending and tax policy will be affected. Second—and most important—I am confused by the economy and the stock market, which continue to defy, in a good way, most of what I thought I knew about macroeconomics and financial markets. If the good economic and financial news continues, my other confusions are unimportant and there is very little to worry about.

Let me expand a bit on my confusions and run the risk of leaving you as confused as I am. But before I look at the problems created by this year's deliberations, it is important to point out that the current fiscal situation is astonishingly good. The baseline unified budget surplus is large and growing, and both political parties promise to save a large portion of it. I would say that absent a significant recession, surpluses are almost certain to last for several years. Even a significant recession is unlikely to cause deficits large enough to break the downward trend in the debt-to-GDP ratio. In summary, it is the best fiscal situation since the 1920s. Sometimes that statement makes audiences nervous, but the 1920s were a good decade if we forget about that pesky last year. What all this means for the supply of public debt is difficult to estimate with confidence, but I shall give it a shot at the end of this talk.

Turning to the bad news, it appeared at the beginning of 1999 that the caps on discretionary spending for 2000 agreed to in 1997 would require a real cut of 5 to 6 percent compared with 1999 levels. Everyone knew that such a large cut was unrealistic and that the rational course would have been to renegotiate the caps to a level that was fiscally prudent but doable. In my view, that would mean caps that allowed a real increase in spending, but an increase that was less than GDP growth. However, many House members firmly believed that having very low caps would restrain spending more than would be the case if the caps were relaxed.

Ironically, I believe that this created a dynamic in which spending grew faster than it would have if there were no caps at all, because of efforts to boost spending early in the process. In the end, the Congress resorted to mechanisms to make it seem as though the caps were adhered to and as though the unified budget surplus would at least equal the surplus in the Social Security trust fund.

The use of such mechanisms is nothing new, but this year their importance reached an extraordinary level. To lower 2000 estimated spending, outlays were pulled forward into 1999 and delayed to 2001, while receipts were moved forward from 2001 to 2000. In addition, the Congressional Budget Office (CBO) was directed to use the lower outlay estimates of the Office of Management and Budget (OMB) to the tune of $23 billion, and

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liberal use was made of emergency provisions that exempt spending from the caps. The most extreme was declaring the 2000 census an emergency, even though we have known that we would have to have one since 1789. Emergency outlays will total $19 billion in 2000, but the emergencies provided for in 2000 will continue to affect outlays in 2001.

Correcting for timing adjustments and directed scoring, I believe that 1999 discretionary outlays would be about $579 billion while 2000 spending would rise to about $623 billion, for an increase in the spending base of close to 8 percent. This implies the largest real increase since the defense increases of the Vietnam era. It is important to note that you will never see an 8 percent increase in discretionary spending recorded on the books, but I think that it is a reasonable estimate, perhaps an underestimate.[1]

The key question is, what does all this imply for future years? Is it a temporary aberration or are we entering an era of large increases in discretionary spending after a long drought? Putting the matter another way, are we seeing a permanent increase in the size of the civilian government, perhaps financed with the cold war peace dividend, or is it a temporary surge, of the kind we saw around 1990?

It depends both on how the budget process evolves and how the economy evolves. The spending caps may be satisfied on paper this year, but for all practical purposes they are dead. Similarly, the pay-as-you-go rule requiring that tax cuts and entitlement increases be paid for with other tax increases or entitlement cuts for five years in the House and for ten years in the Senate was also violated this year.

For practical purposes, these official rules were replaced informally with a new constraining rule that says, "thou shalt not spend any of the surplus in the Social Security trust fund." If the CBO's July estimates turn out to be correct, that rule will also be violated this year. (The CBO has indicated that its January projections will be more optimistic.) And while I cannot imagine that real discretionary spending will continue to grow at this year's pace, it is my guess that we are entering a new era in which past stringency will be relaxed. If future discretionary spending growth is equal to GDP growth, I would guess that it will be sufficient to absorb all the on-budget surpluses projected under the CBO's more optimistic January 2000 assumptions.

The extreme sensitivity of budget projections to economic and technical assumptions makes the rule of balancing the non–Social Security budget impractical as a long-run constraining guide in the budget process. Changes in economic and technical assumptions over a six-month period can easily change estimates of that budget balance by $100 billion, when it is rare for policy changes to alter the balance by more than $50 billion. In other words, the Congress would be attempting to control something that is not really under its control in the short run. The time is sure to come when the CBO surplus forecast deteriorates by $100 billion or so over a relatively short period.

Moreover, the rule creates a bias toward on-budget deficits. Pleasant surplus surprises will be spent, whereas it will not be possible to adjust to adverse surprises. The latter problem afflicted the Gramm-Rudman-Hollings Act and was responsible for its demise. It was replaced by a much superior set of rules in 1990. What will happen when the new rule collapses? Will the 1990 rules be resuscitated? It is possible. But it is also possible that the new rule will be abandoned and that we will go back to trying to balance the unified budget deficit. I suspect that the latter is more probable—first, because I doubt that the new economic and technical assumptions will improve sufficiently to make it politically possible to balance the non–Social Security budget in the longer run, and second, because it will become more and more apparent that it is inane to imply that saving the Social Security surplus is directly linked to the prospects for paying future benefits. But even if we go back to the rule of balancing the unified deficit, there will be surpluses for several years while we make that transition.[2] But I may be too pessimistic about the extent to which the economic assumptions will continue to improve. I certainly have been in the past. In addition, endogenous changes in the ratio of revenues to GDP or in assumed cost growth in Medicare and Medicaid can have major effects on the long-run projections, but I suspect that those things are more likely to move in a pessimistic direction. The budget surplus in 1998 caught us by surprise, largely because of a surprising increase in the ratio of revenues to GDP and a surprising deceleration in Medicare cost growth. The revenue ratio rose from 18.8 percent in 1995 to 20.5 percent in 1998 and to 20.6 percent in 1999.

It is probable that a significant portion of the increase is related directly or indirectly to the booming stock market. Of course, rising capital-gains taxes have played a role, but ordinary tax payments by the very rich have risen remarkably, and that may also be related to the stock market. The share of tax revenues accounted for by taxpayers with an adjusted gross income above $200,000 went from 29.5 percent in 1995 to 37.2 percent in 1997, when such returns accounted for only 1.5 percent of total returns. The stock market, of course, generated huge incomes in the financial sector as well as increased the value of taxable withdrawals from retirement funds and reduced tax-deductible contributions to defined benefit pension plans.

The CBO projects that revenues will grow less rapidly than GDP until 2004, with the ratio falling to 20.1 percent. It is easily conceivable that a major stock market correction could lower the ratio another percentage point, resulting in a

revenue loss of about $100 billion, even before considering the effect of the stock market decline on the economy. But surprises on the up side are also possible. One word of warning is necessary, however. The next set of CBO projections may contain a very large optimistic bias because they will have to assume that the ever-more-stringent spending caps of 2001 and 2002 are satisfied. There is not a chance in the world of that happening.

What does all this mean for the amount of public debt that will be outstanding over the next ten years? We start with such a superb fiscal situation that it is difficult for me to envision circumstances in which the debt-to-GDP ratio ten years from now would be higher than today's 41 percent. Everything that could go wrong would have to go wrong. The stock market would have to fall significantly, the economy would have to go into a prolonged recession, and medical costs would have to accelerate far beyond recent projections.

On the other side, it is extremely unlikely that the debt-to-GDP ratio will fall to the 6.4 percent projected for 2009 by the CBO in July, even with its more ebullient January economic assumptions. That is because of the difficulty of maintaining the on-budget surplus implied by current policy, and because of my previous assumption that pleasant surplus surprises will be used for tax cuts or spending increases while unpleasant surprises will only be partially countered by spending constraint. Note that the assumption implies a destabilizing fiscal policy in the long run, but Keynes said that in the long run we are all dead and he certainly is.

Election outcomes may affect the future size of government, but I doubt there will be much effect on the size of the deficit or the public debt. My remarks thus far imply a debt-to-GDP ratio lower than 41 percent and higher than 6 percent at the end of the next decade. Maybe I should just leave it at that. But I cannot resist noting that if we simply balance the unified deficit on average over the next ten years, the debt-to-GDP ratio will fall to about 26 percent in 2009, given the CBO's July GDP assumptions. Consequently, I think that the chances are considerably more than 50 percent that we shall get below the previous post–World War II low of 24 percent achieved at the end of fiscal 1974. And remember that a considerable portion of that amount—perhaps an amount as high as 6 percent of GDP—will be in the hands of the Federal Reserve. In recent years, an amount of debt approaching 20 percent of GDP has been held by foreigners and state and local governments. Private American investors will have to compete vigorously to hold any debt at all.

Unfortunately, I am old enough to remember that it was around 1974 when we last heard people worrying about a shortage of public debt. We sure jinxed the process then. Let us hope that we are not jinxing it now.

Endnotes

1. In January and February 2000, the CBO and the OMB released new projections that improved the surplus outlook further. The president's budget adjusted for numerous budget mechanisms introduced during the appropriations process and it now estimates discretionary spending at $617.5 billion in 2000 and $575 billion in 1999, for an increase of 7.4 percent. I would move some additional monies from 1999 to 2000 and stick with my earlier estimate of an 8 percent increase. The numbers in the president's budget are lower than those that I used, in part because certain agricultural outlays that were earlier defined to be discretionary by the CBO have been reclassified as mandatory expenditures. Although both agencies added to their projected surpluses, I would not change any of the basic conclusions in this paper. As I will note, any increases in projected surpluses are likely to be used for future spending increases or tax cuts.

2. Any rule requiring a balanced unified budget is, of course, subject to the same criticisms as a rule requiring that on-budget outlays and receipts balance. Unified budget totals are as difficult to control, and there is no intellectual foundation provided by theoretical economics for the proposition that the unified budget should balance every year. However, balancing the unified budget has a very long history as an indicator of a responsible fiscal policy, and as long as it is an informal guide to policy rather than a formal rule enforced by a sequester, it can work pretty well.

Keynote Address

Gary Gensler

Gary Gensler

Fiscal Policy in an Era of Surpluses

Good afternoon. I want to thank Peter Fisher for inviting me to speak here today. I am particularly pleased to talk about debt management in this new era of budget surpluses.

The fiscal year 1999 unified surplus was $123 billion, almost twice the size of the previous year's $69 billion. These surpluses capped seven consecutive years of improvements in the federal budget since the deficit peaked at $290 billion in fiscal year 1992. This represents the longest series of improvements in budget outcomes in the history of the United States.

This progress has had a significant effect on Treasury financing. In 1993, federal debt held by the public was projected to rise to $5.4 trillion by 1999. Fortunately, the stock of publicly held debt outstanding now stands at only $3.6 trillion, more than $1.7 trillion lower than it otherwise would have been.

As a result, Treasury debt is taking up an ever smaller share of the economy and the capital markets. Treasury debt held by the public has fallen from 50 percent of GDP in 1994 to less than 40 percent today. This string of six consecutive years of declining debt as a share of GDP is the longest since the period ending in 1967 more than thirty years ago. The decline in outstanding debt is expected to continue, dropping to 26 percent of GDP within five years.

The change is even more marked in relation to the capital markets. The Treasury's share of gross new issuance in the market has dropped from 38 percent in 1995 to 16 percent through the third quarter of 1999. Since the start of the Clinton administration, the Treasury's share of outstanding debt in U.S. markets has fallen from more than 33 percent six years ago to less than 25 percent today.

Reducing Treasury debt held by the public greatly benefits the economy and all Americans. It also brings with it new challenges for Treasury debt managers in achieving our three main goals: (1) to ensure that adequate cash balances are available at all times, (2) to achieve the lowest cost financing for taxpayers, and (3) to promote efficient capital markets. In pursuing these goals, we have sought to promote market liquidity and finance across the yield curve.

Debt Management Responses to Declining Debt

To date, the Treasury has managed the declining debt by refunding our regularly maturing debt with smaller amounts of new debt. To accomplish this, we have used the financing tools of modifying issue sizes, offering schedules, and the types of securities offered.

First, while maintaining the frequency of Treasury bill auctions, we reduced their average size. In 1996, the average size of our weekly bill auctions was close to $20 billion. By 1998, the average size of weekly bill offerings had dropped 28 percent, to just over $14 billion. This year, the size has increased modestly to an average of just over $15 billion.

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These remarks were also presented in a *Treasury News* press release, December 3, 1999. The views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

Next, we reduced the number of regular coupon issuances by one-third, from thirty-nine to twenty-six a year. We accomplished this by discontinuing the three-year, moving the five-year to quarterly offerings, and discontinuing the November thirty-year bond offering. This has allowed us to continue to issue large, liquid benchmark securities. While average auction size has declined modestly, by 6 percent since 1996, we have been able to maintain it at just under $14 billion for 1999.

We continue to consider whether further revisions to our auction schedule would be appropriate. Particularly, we continue to consider the frequency of issuance of one-year bills and two-year notes. Reducing the frequency of these auctions would give us some additional leeway in maintaining the size of our benchmark issues.

Debt Management Challenges

While we have been able to meet our debt management goals through these adjustments, we face additional challenges going forward.

First, debt held by the public is forecasted to shrink further, by $720 billion over the next five years and by over $2 trillion in ten years.

Second, the effect of seven years of fiscal discipline is already showing up in our maturing debt. There will be a great deal less maturing debt to be redeemed in the very near future. This fiscal year, $476 billion of coupon debt will mature, down from a peak of $510 billion in 1998. Over the next eighteen months, the last of the old seven-year and three-year notes will mature. Thus, by 2002, debt maturing will decline significantly. Depending upon the decisions we make this fiscal year about issuance of two-year notes, debt maturing in 2002 is likely to be less than $400 billion.

Third, we face the challenge of how to continue to issue sufficient longer term debt without an unacceptable lengthening of our maturity structure. For instance, if we maintain the current level of long-term financing (ten-year and thirty-year debt), the average maturity is forecasted to lengthen from about five and three-quarter years currently to eight years by the end of 2004. Over the long term, this would impose additional cost on the taxpayers to finance our debt.

To meet these challenges, new tools will be needed. By the end of the year, we will have in place two new debt management tools. This will provide us with important new means of managing the government's debt and responding to our improved fiscal condition.

First, we have issued a rule that will make it much easier for the Treasury to reopen its benchmark securities. The new rule allows the Treasury to reopen its benchmark securities within one year of issuance without creating concerns under the original issue discount (OID) rules. Under the previous rules, the Treasury generally could reopen an issue only if the price of the issue had not fallen by more than a *de minimus* amount. This significantly constrained our ability to reopen benchmark securities. The new rules will enable us to reopen issues more easily. This important new debt management tool will improve our ability to maintain the size and liquidity of our benchmark securities.

Second, we are putting in place a new rule that will permit us to conduct debt buybacks. This new rule will permit us to buy back Treasury debt in advance of its maturity date. Buying back outstanding debt in advance of maturity will enable us to maintain larger, more liquid auction sizes for our benchmark securities. Debt buybacks also will give us the ability to manage the maturity structure of our debt by selectively targeting the maturities to be repurchased. This will provide us with additional flexibility to continue issuing our long-end maturities without unduly lengthening the maturity structure of our debt. Finally, debt buybacks could be used as a cash management tool, absorbing excess cash in periods such as late April when tax revenues greatly exceed immediate spending needs.

Looking Ahead

Treasury securities currently play an important role in the global capital markets. They are actively used for hedging purposes. They provide a risk-free pricing benchmark across the yield curve. The Federal Reserve uses transactions in Treasury securities to affect the supply of reserves in the banking system.

As the Treasury market declines in size, other markets are likely to take on these roles. We believe that the financial markets should be able to make a smooth adjustment to these changes. Investors and hedgers will switch to trading other securities and derivatives.

This transition is already taking place. Market participants today use Eurodollar futures more actively than Treasury bills to hedge in the short end of the market. In addition, the role of Treasury securities as a pricing benchmark in the investment-grade bond market is changing. While high-grade corporates are still priced relative to Treasuries, growing weight is being given to the value of other high-grade corporates. We are

already seeing underwriters pricing new issues relative to the value of similar recently issued securities in addition to Treasury yields.

Most important, the benefits of reducing our nation's debt far surpass the issues that arise for the capital markets from this reduction. As less savings flow into government bonds, more will flow into investment in businesses and housing. There will be less pressure on interest rates, reducing the borrowing costs for businesses and families alike. While debt reductions present challenges to the financial markets and to the Treasury's ability to manage the remaining debt, I think we can all agree that the enormous benefits for our economy make these challenges worth meeting.

Session 3

Paper by

Paul Bennett, Kenneth Garbade, and John Kambhu

Commentaries by

Vaughn O'Regan
Charles H. Parkhurst

Paul Bennett, Kenneth Garbade, and John Kambhu

Enhancing the Liquidity of U.S. Treasury Securities in an Era of Surpluses

1. Introduction and Summary

The market for U.S. Treasury debt provides a highly liquid underpinning for the broader markets in dollar-denominated fixed-income securities. However, liquidity in the Treasury market has become an increasing concern as the federal government's funding needs have lessened because trading is concentrated in recently issued, "on-the-run" securities (Chart 1). In August 1999, the Treasury Department outlined a strategy to maintain the supply of new notes and bonds by repurchasing "off-the-run" debt.[1] This paper describes several additional, complementary approaches to enhancing liquidity.

Our first suggestion is to reduce the fragmentation of trading in STRIPS by assigning the same CUSIP number to all STRIPS maturing on a common date—thus making those STRIPS fungible with each other. In addition to enhancing the liquidity of the STRIPS market, this action would ensure that STRIPS promising to pay the same amount on the same future date will trade at the same price, and it would enhance the internal integration of the market for notes and bonds as well as the integration of that market with the STRIPS market. In particular, it would result in very nearly identical market prices for identical cash flow streams, regardless of whether the flows are derived from notes or bonds or from portfolios of STRIPS.

We also suggest a reexamination of the structure of issue maturities, because heterogeneity with respect to maturity date can fragment trading and reduce liquidity. In particular, we suggest eliminating end-of-month maturities for two-year debt and integrating that debt with either bills (by issuing 104-week bills on a quad-weekly basis) or longer term notes and bonds (by issuing two-year notes with mid-month maturities on a monthly or quarterly basis). It would also be desirable to enhance the integration of bills with longer term notes and bonds, but aligning the maturity dates of those securities may be impractical.

The first two proposals can be viewed as extensions of steps taken previously by the Treasury Department. Our third proposal—a facility to allow market participants to exchange (with the Treasury) single-payment securities with similar but not identical maturities—is a more adventurous approach to enhancing liquidity. The proposal would result in more similar prices for securities with similar but not identical cash flows, and would further integrate the markets for Treasury debt. In particular, it would materially enhance the integration of the markets for bills and coupon-bearing notes and bonds.

The paper proceeds as follows. Section 2 defines liquidity, identifies its determinants, and comments on its benefits. Section 3 describes how recent Treasury debt management practices have promoted the goal of a liquid government securities market. Section 4 presents our proposal for the STRIPS program, Section 5 outlines two alternatives for reducing heterogeneity of issue maturity dates, and Section 6 describes the exchange facility. Section 7 summarizes our findings.

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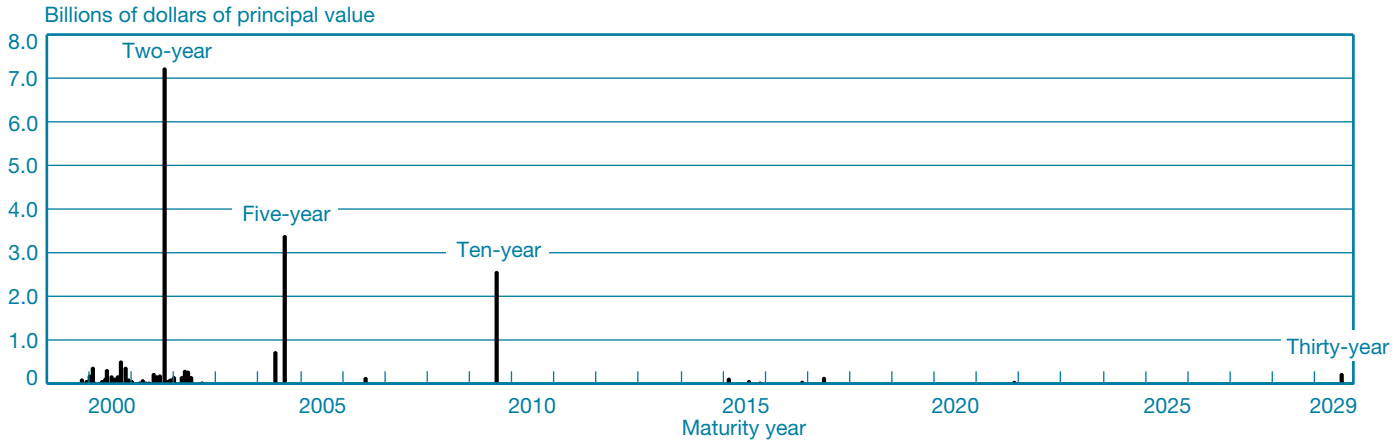
Chart 1

Interdealer Trading of Treasury Notes and Bonds on October 6, 1999



Note: On-the-run issues are labeled with term to maturity.

2. Liquidity and Asset Pricing

Asset pricing models commonly assume that markets are competitive and frictionless. Continuous time versions of such markets are perfectly liquid: an investor can purchase or sell as much as he or she wants at any time, instantaneously and at equilibrium prices. Real markets, however, are not perfectly liquid. An investor has to pay for the service of immediate order execution (in the form of a spread between the offer price at which he or she can buy and the bid price at which he or she can sell);[2] the investor faces wider spreads on larger orders; and, if the investor chooses to search for a more favorable transaction price, he or she must bear the costs of search and the risks of delay.[3]

Securities traded in markets where bid-ask spreads are narrow and relatively insensitive to the size of a transaction, where an acceptable counterparty can be located quickly and at low cost, and where prices are not volatile are said to be more liquid than securities traded in markets where spreads are both wider and more sensitive to transaction size, where search is costly and time-consuming, and where prices are volatile. For example, short-term Treasury securities are more liquid than longer term Treasury debt,[4] bills are more liquid than short-term notes and bonds,[5] larger issues are more liquid than smaller issues,[6] on-the-run securities are more liquid than seasoned obligations,[7] and—more generally—liquidity declines with the age of a security.[8]

Financial analysts concerned with minimizing capital costs have begun to pay more attention to liquidity in the wake of a series of papers establishing a connection between liquidity and asset pricing.[9] Amihud and Mendelson (1986) show that the return on common stock listed on the New York Stock Exchange is, *inter alia*, an increasing function of the bid-ask spread on the stock. Silber (1991) observes that companies issue unregistered stock (that cannot be resold in open market transactions for two years and that is relatively illiquid during that interval) at an average discount of more than 30 percent relative to the price of registered, but otherwise identical, stock. Several authors—including Garbade (1984), Amihud and Mendelson (1991a), and Kamara (1994)—point out the connection between (a) the yield spread between short-term Treasury notes and Treasury bills and (b) the superior liquidity of bills compared with notes. Warga (1992) examines the premium return on seasoned Treasury notes and bonds compared with on-the-run issues,[10] and Boudoukh and Whitelaw (1991, 1993) discuss the premium pricing of "benchmark" bonds in the Japanese government bond market. All of the papers conclude that liquidity is an important determinant of asset pricing and that more liquid issues have higher prices and lower returns.[11]

3. Liquidity and Treasury Debt Management

Minimizing the cost of funding the federal debt is a leading objective of Treasury debt management policy.[12] Since liquidity is an important determinant of borrowing costs, one could imagine a funding program designed to maximize the liquidity

of the securities issued. In the most extreme form, the Treasury Department could finance any current deficit, and refinance maturing debt, with frequent sales of large quantities of short-term bills. This would concentrate Treasury indebtedness in the most liquid sector of the market: large, short-maturity, and unseasoned discount obligations.

However, borrowing costs are affected by factors other than the liquidity of the securities issued. Most prominently, issuing exclusively in a narrow maturity sector might distort the shape of the yield curve and lead to more than minimal overall funding costs, and the Treasury has historically chosen to issue at a variety of short, intermediate, and long maturities.[13] This policy has ancillary benefits: it provides market participants with regular new issues of benchmark securities whose yields reflect the cost of credit for a default-proof borrower at a variety of maturities,[14] and it facilitates budget planning because it enhances the predictability of interest expenses during a fiscal year and over longer intervals.

Issuing securities at maturities beyond the money market sector undoubtedly reduces to some extent the liquidity of the Treasury market. Longer maturity debt is inherently less liquid than short-term debt, and a note or bond becomes more illiquid with the passage of time—as it migrates from on-the-run to off-the-run status.[15] Additionally, issuing longer term debt results in a greater number of issues and a smaller average size per issue, further reducing liquidity. These adverse consequences, however, are outweighed by the advantages of diffusing issuance across the curve.

Innovations in Debt Management

Financing the federal debt by issuing securities at a variety of maturities means that the Treasury has to choose the maturities at which it will issue, the amount to be issued at each maturity, and the frequency of issue—for example, weekly, monthly, or quarterly. The Treasury's choices have changed from time to time in light of evolving market conditions, the size of the deficit, and refinancing requirements.

The Treasury has adjusted its funding program several times during the past fifteen years with the explicit objective of minimizing borrowing costs. It canceled the twenty-year bond in April 1986,[16] the four-year note in December 1990,[17] and the seven-year note in May 1993,[18] and it increased the frequency of issuing five-year notes from quarterly to monthly in December 1990.[19]

Although the Treasury has, from time to time, adjusted its funding program for strategic reasons, it has not usually varied the size of individual offerings tactically—that is, in response to short-run changes in investor demand for particular maturities. For example, it has not attempted to benefit systematically from an unusually strong demand for bills maturing at the end of a calendar month, quarter, or year; for bills maturing immediately before a tax payment date; or for bills deliverable on a futures contract.[20] Instead, it has maintained fairly steady issue sizes and regular terms.[21] One consequence of this policy is the tendency for exceptionally large bill issues—including cash management issues and bills first issued as fifty-two-week bills and then reopened as twenty-six-week bills and again as thirteen-week bills—to trade at yields higher than those on nearby bills with smaller outstanding issue sizes.[22]

Debt Management Practices Intended to Reduce Borrowing Costs by Enhancing Liquidity

Some features of Treasury debt management practices have been adopted with the specific objective of reducing borrowing costs by enhancing the liquidity of Treasury securities. The most prominent example is the modification of the fifty-two-week bill cycle initiated in late 1979.

Up to and including the issuance, on October 16, 1979, of the bill maturing October 14, 1980, fifty-two-week bills were issued (once every four weeks) on a Tuesday and matured on a Tuesday.[23] As a result, fifty-two-week bills were not fungible with subsequent issues of twenty-six-week and thirteen-week bills, which matured on Thursdays.[24] On November 1, 1979, the Treasury announced that fifty-two-week bills would henceforth mature on a Thursday and that they would be fungible with subsequent issues of twenty-six-week bills and thirteen-week bills with the same maturity date.[25] The Treasury stated that the change would "reduce the number of separate bills outstanding . . . and *improve liquidity* [emphasis added] for the fifty-two-week bills."[26]

Similarly, the Treasury has taken advantage of opportunities to reopen outstanding notes and bonds in lieu of issuing new securities. The most important and frequent examples are reopenings of the most recently auctioned ten-year note and thirty-year bond.[27] Table 1 shows new issues and reopenings of those securities over the past decade.

Additionally, the Treasury has reopened an old five-year note in a shorter term cycle on three occasions:

- in May 1988, the 8 1/2 percent note of May 15, 1991 (issued as a five-year note on March 5, 1986), was reopened as a three-year note;

Table 1

Ten-Year Note and Thirty-Year Bond Offerings in the Quarterly Financing Auctions: 1990-99

Year	Month	Ten-Year Note	Thirty-Year Bond
1990	Feb.	8 1/2% of Feb. 15, 2000	8 1/2% of Feb. 15, 2020
	May	8 7/8% of May 15, 2000	8 3/4% of May 15, 2020
	Aug.	8 3/4% of Aug. 15, 2000	8 3/4% of Aug. 15, 2020
	Nov.	8 1/2% of Nov. 15, 2000	**8 3/4% of Aug. 15, 2020**
1991	Feb.	7 3/4% of Feb. 15, 2001	7 7/8% of Feb. 15, 2021
	May	8% of May 15, 2001	8 1/8% of May 15, 2021
	Aug.	7 7/8% of Aug. 15, 2001	8 1/8% of Aug. 15, 2021
	Nov.	7 1/2% of Nov. 15, 2001	8% of Nov. 15, 2021
1992	Feb.	**7 1/2% of Nov. 15, 2001**	**8% of Nov. 15, 2021**
	May	7 1/2% of May 15, 2002	**8% of Nov. 15, 2021**
	Aug.	6 3/8% of Aug. 15, 2002	7 1/4% of Aug. 15, 2022
	Nov.	**6 3/8% of Aug. 15, 2002**	7 5/8% of Nov. 15, 2022
1993	Feb.	6 1/4% of Feb. 15, 2003	7 1/8% of Feb. 15, 2023
	May	**6 1/4% of Feb. 15, 2003**	**7 1/8% of Feb. 15, 2023**
	Aug.	5 3/4% of Aug. 15, 2003	6 1/4% of Aug. 15, 2023
	Nov.	**5 3/4% of Aug. 15, 2003**	Not offered
1994	Feb.	5 7/8% of Feb. 15, 2004	**6 1/4% of Aug. 15, 2023**
	May	7 1/4% of May 15, 2004	Not offered
	Aug.	7 1/4% of Aug. 15, 2004	7 1/2% of Nov. 15, 2024[a]
	Nov.	7 7/8% of Nov. 15, 2004	Not offered
1995	Feb.	7 1/2% of Feb. 15, 2005	7 5/8% of Feb. 15, 2025
	May	6 1/2% of May 15, 2005	Not offered
	Aug.	6 1/2% of Aug. 15, 2005	6 7/8% of Aug. 15, 2025
	Nov.	5 7/8% of Nov. 15, 2005	Not offered
1996	Feb.	5 5/8% of Feb. 15, 2006	6% of Feb. 15, 2026
	May	6 7/8% of May 15, 2006	Not offered
	Aug.	**7% of July 15, 2006**[b]	6 3/4% of Aug. 15, 2026
	Nov.	**6 1/2% of Oct. 15, 2006**[c]	6 1/4% of Nov. 15, 2026
1997	Feb.	6 1/4% of Feb. 15, 2007	6 5/8% of Feb. 15, 2027
	May	6 5/8% of May 15, 2007	Not offered
	Aug.	6 1/8% of Aug. 15, 2007	6 3/8% of Aug. 15, 2027
	Nov.	**6 1/8% of Aug. 15, 2007**	6 1/8% of Nov. 15, 2027
1998	Feb.	5 1/2% of Feb. 15, 2008	**6 1/8% of Nov. 15, 2027**
	May	5 5/8% of May 15, 2008	Not offered
	Aug.	**5 5/8% of May 15, 2008**	5 1/2% of Aug. 15, 2028
	Nov.	4 3/4% of Nov. 15, 2008	5 1/4% of Nov. 15, 2028
1999	Feb.	**4 3/4% of Nov. 15, 2008**	5 1/4% of Feb. 15, 2029
	May	5 1/2% of May 15, 2009	Not offered
	Aug.	6% of Aug. 15, 2009	6 1/8% of Aug. 15, 2029
	Nov.	**6% of Aug. 15, 2009**	Not offered

Note: Reopenings are in bold type.

[a]30-1/4-year bond; see endnote 21.
[b]Reopening of a ten-year note first offered in July 1996.
[c]Reopening of a ten-year note first offered in October 1996.

- in October 1994, the 6 7/8 percent note of October 31, 1996 (issued as a five-year note on October 31, 1991), was reopened as a two-year note; and
- in February 1996, the 5 1/8 percent note of February 28, 1998 (issued as a five-year note on March 1, 1993), was reopened as a two-year note.

The Treasury also stated that it was prepared to reopen an old five-year note in the two-year note auctions in April, July, September, and October 1995.[28]

During 1998, the Treasury altered its debt management practices on two occasions to maintain the liquidity of Treasury securities. In early March, it announced that contrary to past practice, it would offer a larger face amount of twenty-six-week bills than thirteen-week bills in the auctions to be held on Monday, March 9. The change was in response to strong demand for twenty-six-week bills from foreign central banks and the desire to ensure that sufficient bills reached the hands of domestic investors. The Deputy Assistant Secretary for Federal Finance characterized the change as "an effort to *maintain liquidity* [emphasis added] in the market."[29] The Treasury continued to offer unequal amounts of thirteen-week and twenty-six-week bills until the auction of Monday, September 21, 1998.

In May 1998, the Treasury announced that the three-year note cycle would be eliminated and that those notes would be replaced in the quarterly financings by five-year notes.[30] The action was taken in response to substantial budget surpluses and to avoid reducing the issuance sizes of two-, five-, and ten-year notes and thirty-year bonds (out of concern that smaller issues would be less liquid). The Assistant Secretary for Financial Markets remarked, "We chose to concentrate on having fewer, larger, issues."[31]

How Some Initiatives to Reduce Borrowing Costs May Have Adversely Affected the Liquidity of Conventional Notes and Bonds

The Treasury has shown great sensitivity to the importance of maintaining and enhancing the liquidity of Treasury securities. Nevertheless, some Treasury initiatives intended to reduce borrowing costs may have adversely affected liquidity. These initiatives reflect the principle, noted in the beginning of this section, that liquidity is only one factor affecting borrowing costs and that, in some cases, it can be outweighed by other considerations.[32]

On two occasions, the Treasury introduced novel securities intended to appeal to investors with specialized interests. Between 1984 and 1986, it sold a total of four foreign-targeted

Treasury notes,[33] and in January 1997 it introduced inflation-indexed securities. (Table 2 provides details on the inflation-indexed securities offerings.) Both programs were undertaken with the intention of reducing borrowing costs by issuing securities tailored to exploit specific market niches.[34] However, both programs also led to the issuance of securities that turned out to be materially less liquid than conventional Treasury issues,[35] and both led to the reduced issuance of conventional notes and bonds, thus reducing the liquidity of the markets for those securities.[36]

The STRIPS Program

Similar comments apply to the STRIPS program, introduced in early 1985, that provided for the separation of the interest and principal payments on a note or bond into single-payment, or "zero-coupon," obligations.

The new obligations were patterned on private sector zero-coupon custodial receipts that had appeared in August 1982.[37] The statement announcing the STRIPS program indicated that "zero-coupon securities . . . have become very popular for those who wish to avoid reinvestment risk or seek greater certainty in matching the maturities of their assets and liabilities. They have been particularly attractive investments for individual retirement accounts and pension funds." The statement noted that the private receipts had "broadened the market for Treasury securities" and produced "significant savings in financing costs."[38] In addition, the statement noted that "STRIPS will greatly reduce . . . financing costs . . . and facilitate further expansion of the zero-coupon market. The savings made possible by STRIPS will be reflected in the competitive bidding for Treasury securities."[39] At the same time, however, stripping led to the creation of relatively less liquid single-payment interest component STRIPS and principal component STRIPS, and may have reduced the liquidity of underlying notes and bonds by reducing the outstanding supplies of those securities.[40]

Innovations that mitigated the STRIPS program's impact on conventional note and bond liquidity. Two subsequent modifications to the STRIPS program mitigated whatever adverse impact that program may have had on the liquidity of the Treasury market.

Effective July 29, 1985, all interest component STRIPS payable on a common date were assigned a common CUSIP number and became fungible with each other. Under the original program, interest component STRIPS payable on a common date had different CUSIPs (and, therefore, were not fungible) if they were derived from securities with different CUSIPs. The statement announcing the change noted that it would "further *increase the liquidity* [emphasis added] of the STRIPS program . . . thereby reducing transactions costs and at the same time broadening the marketability of STRIPS."[41]

The second modification became effective May 1, 1987, and provided that principal component STRIPS could be "reconstituted" with interest component STRIPS into the notes or bonds from which they were derived. The statement announcing the change observed that the new facility would "*enhance the . . . liquidity* [emphasis added] . . . of Treasury securities."[42]

Remaining limitations on the fungibility of all STRIPS maturing on a common date. Although the STRIPS program has, since July 1985, provided for fungibility of interest component STRIPS maturing on a common date, it has not provided for comparable fungibility of principal component STRIPS derived from different coupon-bearing securities maturing on the same date, or of interest component STRIPS and principal component STRIPS maturing on a common date.

As illustrated in Table 3, this has resulted in numerous cases of pairs of STRIPS—and four cases of triplets of STRIPS—trading at different prices and yields, even though they mature on the same future date.[43] It is not unreasonable to assume that fragmentation of trading in STRIPS with identical payment characteristics has led to higher transaction costs and lower liquidity than would otherwise be the case.[44]

Table 2
Offerings of Inflation-Indexed Securities

Auction Date	Description	Issue Size and Date
Jan. 29, 1997	3 3/8% of Jan. 15, 2007	$7.7 billion on Feb. 6, 1997
Apr. 8, 1997	**3 3/8% of Jan. 15, 2007**	$8.4 billion on Apr. 15, 1997
July 9, 1997	3 5/8% of July 15, 2002	$8.4 billion on July 15, 1997
Oct. 8, 1997	**3 5/8% of July 15, 2002**	$8.4 billion on Oct. 15, 1997
Jan. 8, 1998	3 5/8% of Jan. 15, 2008	$8.4 billion on Jan. 15, 1998
Apr. 8, 1998	3 5/8% of Apr. 15, 2028	$8.4 billion on Apr. 15, 1998
July 8, 1998	**3 5/8% of Apr. 15, 2028**	$8.4 billion on July 15, 1998
Oct. 7, 1998	**3 5/8% of Jan. 15, 2008**	$8.4 billion on Oct. 15, 1998
Jan. 6, 1999	3 7/8% of Jan. 15, 2009	$8.5 billion on Jan. 15, 1999
Apr. 7, 1999	3 7/8% of Apr. 15, 2029	$7.4 billion on Apr. 15, 1999
July 7, 1999	**3 7/8% of Jan. 15, 2009**	$7.4 billion on July 15, 1999
Oct. 6, 1999	**3 7/8% of Apr. 15, 2029**	$7.4 billion on Oct. 15, 1999

Note: Reopenings are in bold type.

Table 3
Yields on July 22, 1999, on Nonfungible STRIPS Maturing on the Same Date
Percent

Maturity Date	Interest Component STRIPS	Note Principal Component STRIPS	Bond Principal Component STRIPS
Feb. 15, 2004	5.80	5.69	N.A.
May 15	5.82	5.75	N.A.
Aug. 15	5.79	5.78	N.A.
Nov. 15	5.86	5.81	5.89
Feb. 15, 2005	5.91	5.84	N.A.
May 15	5.93	5.83	5.95
Aug. 15	5.95	5.86	5.97
Nov. 15	5.93	5.86	N.A.
Feb. 15, 2006	5.96	5.86	5.91
May 15	5.97	N.A.	N.A.
Aug. 15	5.99	N.A.	N.A.
Nov. 15	5.96	N.A.	N.A.
Feb. 15, 2007	6.02	N.A.	N.A.
May 15	6.03	N.A.	N.A.
Aug. 15	6.03	N.A.	N.A.
Nov. 15	6.00	N.A.	N.A.
Feb. 15, 2008	6.09	N.A.	N.A.
May 15	6.11	N.A.	N.A.
Aug. 15	6.12	N.A.	N.A.
Nov. 15	6.13	N.A.	N.A.
Feb. 15, 2009	6.14	N.A.	N.A.
May 15	6.16	N.A.	N.A.
Aug. 15	6.16	N.A.	N.A.
Nov. 15	6.17	N.A.	6.27[a]
Feb. 15, 2010	6.19	N.A.	N.A.
May 15	6.20	N.A.	N.A.
Aug. 15	6.21	N.A.	N.A.
Nov. 15	6.22	N.A.	N.A.

[a] Callable.

4. A Proposal to Reduce Heterogeneity in the STRIPS Market

Our first proposal is to reduce the fragmentation and enhance the liquidity of trading in STRIPS by eliminating distinctions among principal component STRIPS derived from different coupon-bearing securities maturing on the same date as well as eliminating the distinction between principal component STRIPS and interest component STRIPS paying on the same date. In particular, we propose that all STRIPS maturing on a common date should be fungible with each other and should be assigned a common CUSIP number.

Chart 2 shows STRIP yields on October 6, 1999. The dispersion of yields on STRIPS maturing on common dates is evident. By eliminating distinctions among STRIPS other than maturity date, the proposal would collapse STRIP yields onto a single curve of yield as a function of time to payment, and would thereby enhance the integration of the STRIPS market.

Because notes and bonds can be stripped quickly and at little cost, and because STRIPS can be similarly reconstituted into notes and bonds, arbitrage keeps the price of a note or bond very nearly equal to the sum of the prices of its component STRIPS.[45] Our proposal to reduce heterogeneity in the STRIPS market would thus result in very nearly identical market prices for identical cash flow streams—regardless of whether the cash flows are derived from portfolios of notes and bonds or from portfolios of STRIPS promising to make the same future payments—and would thereby enhance the integration of the market for notes and bonds as well as the integration of that market with the STRIPS market.

Recent Characteristics of Note and Bond Market Integration

The implication of our proposal for the integration of the market for notes and bonds is especially significant in light of evidence that the internal cohesion of that market deteriorated in the fall of 1998 and has not subsequently recovered.

Chart 2
Yields on Interest and Principal STRIPS on October 6, 1999

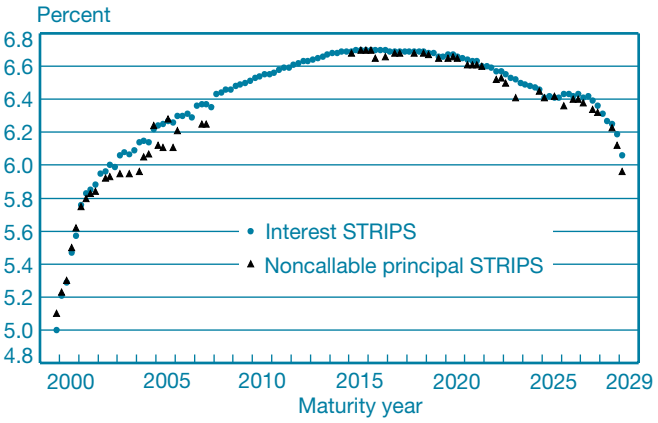
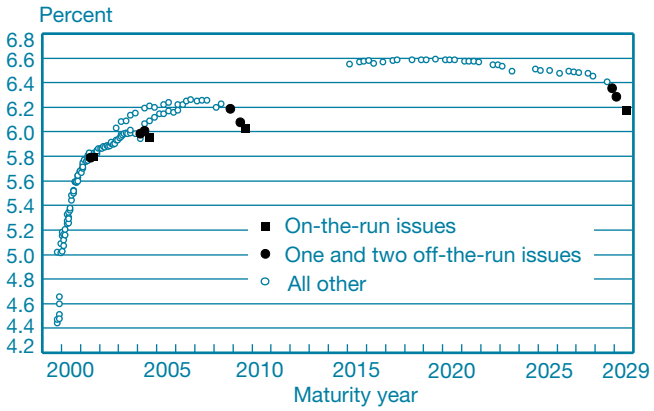


Chart 3 shows yields on coupon-bearing securities on October 6, 1999, as a function of time to maturity. There is no reason to expect the yields to lie on a curve because yield can vary with coupon rate as well as with time to maturity.

However, we might expect, at least to a first approximation, that the market prices the individual payments on notes and bonds from a common "spot," or single-payment, yield curve, so that the price of a portfolio of cash flows does not depend on the particular notes and bonds used to construct the portfolio. To examine this proposition, a cubic spline approximation to a spot yield curve pricing the underlying cash flows was fitted to the note and bond prices observed on October 6, 1999,[46] and the predicted prices were converted to yields. The median absolute difference between model yields and market yields was 1.9 basis points. This is a measure of the dispersion of the difference between the market values of the notes and bonds and the aggregate present values of the constituent future payments discounted with the fitted spot yield curve.

Chart 4 shows similar measures over the interval from July 1, 1993, to October 6, 1999. The increase in the median absolute difference in the fall of 1998 and the absence of any subsequent reversal are both evident. Since our proposal would result in very nearly identical market prices for identical cash flows, it would greatly reduce the median absolute difference between market yields and the yields computed from a spot yield curve fitted to yields on STRIPS. Therefore, it would help to reverse the increase in yield dispersion in the note and bond market.

Chart 3
Yields on Notes and Noncallable Bonds on October 6, 1999



Elasticity in the Supply of Individual Notes and Bonds

A second significant implication of our proposal is that when there is unusually strong demand for a security, market participants could use the reconstitution facility to create more of the security than the Treasury Department originally issued. The proposal would not permit market participants to alter the Treasury's *aggregate* liabilities on any future date, including both interest liabilities and principal liabilities, but it would allow market participants to alter the packaging of the liabilities. For example, as illustrated in Box A, the market could convert a higher coupon security into STRIPS and a lower coupon security.

Box A

Conversion of a Higher Coupon Security into a Lower Coupon Security and STRIPS

Here we describe how a market participant could convert $1.6 million principal value of the 11 5/8 percent bond of November 15, 2004, into (a) $1.6 million principal value of the 7 7/8 percent note of November 15, 2004, and (b) a portfolio of STRIPS, with a face amount of $30,000 each, payable every six months until and including May 15, 2004.

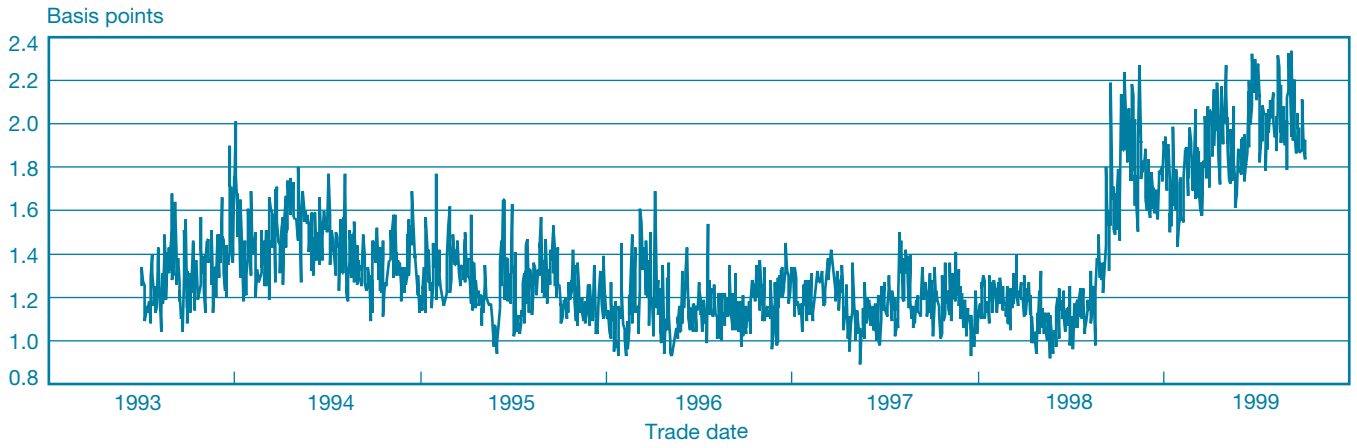
Following the interest payment on November 15, 1999, $1,600,000 principal amount of the 11 5/8 percent bond of November 15, 2004, promised to pay $93,000 interest every six months from May 15, 2000, to November 15, 2004, inclusive, and to repay principal of $1,600,000 at maturity. Assuming that all STRIPS maturing on the same date are fungible, $1,600,000 principal amount of the 11 5/8 percent bond could be stripped into nine STRIPS with a face amount of $93,000 each, payable every six months from May 15, 2000, to May 15, 2004, inclusive, and a tenth STRIP with a face amount of $1,693,000, payable on November 15, 2004.

Also following the interest payment on November 15, 1999, $1,600,000 principal amount of the 7 7/8 percent note of November 15, 2004, promised to pay $63,000 interest every six months from May 15, 2000, to November 15, 2004, inclusive, and to repay principal of $1,600,000 at maturity.

It follows that $1,600,000 principal amount of the 7 7/8 percent note could be reconstituted from the STRIPS derived from the 11 5/8 percent bond and that ten STRIPS, with a face amount of $30,000 each, payable every six months from May 15, 2000, to November 15, 2004, inclusive, would remain outstanding.

Chart 4

Median Absolute Difference between Market Yields and Model Yields, July 1, 1993, to October 6, 1999

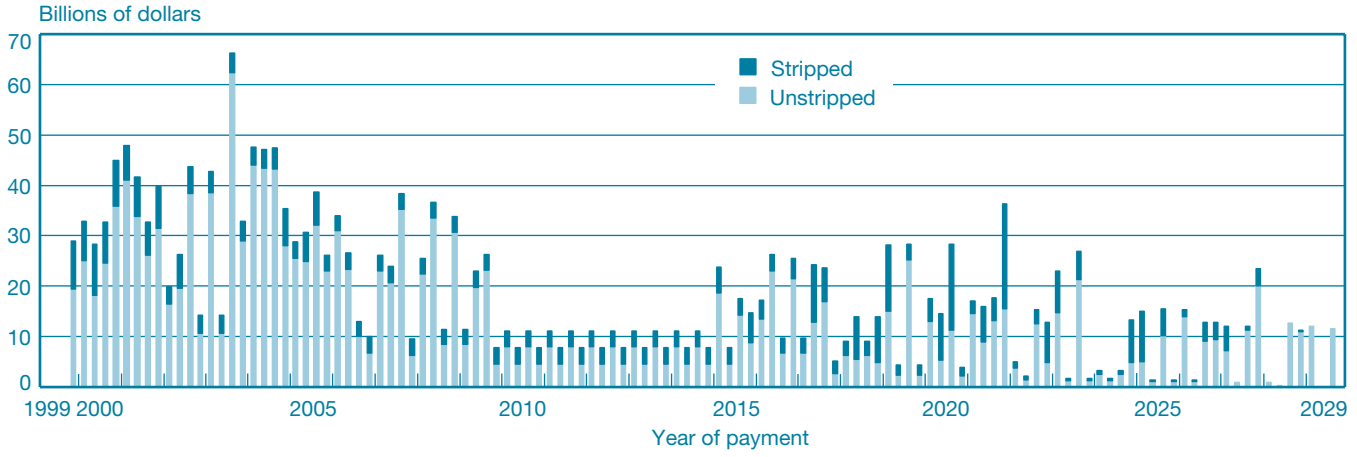


The decision of market participants to buy and strip a relatively inexpensive security, add or remove some STRIPS, and then reconstitute and sell a relatively expensive security is not undesirable because (as described above) it would keep the prices and yields of outstanding notes and bonds in line with each other. In particular, it would provide a mechanism for expanding the supply of a security that is "on special" in the financing market for specific collateral[47] and that is consequently expensive in the cash market.[48] It would also provide a "relief valve," not unlike the delivery options specified in futures contracts,[49] and would limit the prospect of squeezes and corners.[50]

Chart 5 illustrates (on a cash flow basis) how much noncallable Treasury debt with mid-quarter maturities has been stripped and how much more could be stripped. Table 4 shows (on a principal basis) the outstanding amounts and the maximum additional amounts that could be created by reconstituting STRIPS derived from other securities. The amounts are substantial, suggesting that "uncapping" the reconstitution feature could have a material impact on relative

Chart 5

Principal and Interest Liabilities Resulting from Treasury Notes and Noncallable Bonds Maturing in Mid-Quarter, as of October 6, 1999



issue supplies and prices. However, as shown in Table 4, the potential addition to supply would be smaller the more distant a security's maturity date because there are fewer other cash flows available to expand the supply of a longer dated bond. In particular, the supply of the bond with the most distant maturity date would be limited to the amount issued.

Tax Implications

Conversion of higher coupon notes and bonds into STRIPS and lower coupon notes and bonds, as illustrated in Box A, could lead to lower Treasury tax receipts on interest income. Assessing the magnitude of this effect is beyond the scope of

Table 4

Principal Amount Outstanding (PAO) and Maximum Additional Amount (MAA) That Could Be Reconstituted from the Principal and Interest Liabilities in Chart 5

Original Term (Years)	Coupon Rate (Percent)	Maturity Date	PAO (Billions of Dollars)	MAA (Billions of Dollars)	MAA as a Percentage of PAO
Ten	7.875	Nov. 15, 1999	10.77	17.13	159.0
Ten	8.500	Feb. 15, 2000	10.67	20.94	196.3
Ten	8.875	May 15, 2000	10.50	16.61	158.2
Ten	8.750	Aug. 15, 2000	11.08	20.45	184.5
Ten	8.500	Nov. 15, 2000	11.52	31.55	273.9
Three	5.750	Nov. 15, 2000	16.04	27.61	172.2
Ten	7.750	Feb. 15, 2001	11.31	34.92	308.6
Three	5.375	Feb. 15, 2001	15.37	31.40	204.3
Ten	8.000	May 15, 2001	12.40	27.66	223.1
Three	5.625	May 15, 2001	12.87	27.65	214.8
Ten	7.875	Aug. 15, 2001	12.34	19.25	156.0
Ten	7.500	Nov. 15, 2001	24.23	14.10	58.2
Ten	7.500	May 15, 2002	11.71	13.67	116.7
Ten	6.375	Aug. 15, 2002	23.86	18.65	78.2
Ten	6.250	Feb. 15, 2003	23.56	17.95	76.2
Ten	5.750	Aug. 15, 2003	28.01	36.50	130.3
Five	5.250	Aug. 15, 2003	19.85	44.82	225.8
Five	4.250	Nov. 15, 2003	18.63	13.50	72.5
Ten	5.875	Feb. 15, 2004	12.96	33.27	256.8
Five	4.750	Feb. 15, 2004	17.82	28.66	160.8
Ten	7.250	May 15, 2004	14.44	31.07	215.1
Five	5.250	May 15, 2004	18.93	27.03	142.8
Ten	7.250	Aug. 15, 2004	13.35	32.43	243.0
Five	6.000	Aug. 15, 2004	18.09	27.97	154.6
Twenty	11.625	Nov. 15, 2004	8.30	25.20	303.5
Ten	7.875	Nov. 15, 2004	14.37	19.73	137.3
Ten	7.500	Feb. 15, 2005	13.84	13.94	100.7
Twenty	12.000	May 15, 2005	4.26	24.72	580.2
Ten	6.500	May 15, 2005	14.74	15.02	101.9
Twenty	10.750	Aug. 15, 2005	9.27	27.49	296.5
Ten	6.500	Aug. 15, 2005	15.00	22.51	150.0
Ten	5.875	Nov. 15, 2005	15.21	10.24	67.3
Twenty	9.375	Feb. 15, 2006	4.76	27.83	585.2
Ten	5.625	Feb. 15, 2006	15.51	17.67	113.9
Ten	6.875	May 15, 2006	16.02	9.66	60.3
Ten	6.250	Feb. 15, 2007	13.10	12.39	94.5
Ten	6.625	May 15, 2007	13.96	9.22	66.1
Ten	6.125	Aug. 15, 2007	25.64	11.63	45.4
Ten	5.500	Feb. 15, 2008	13.58	11.31	83.2
Ten	5.625	May 15, 2008	27.19	8.52	31.3
Ten	4.750	Nov. 15, 2008	25.08	7.98	31.8
Ten	5.500	May 15, 2009	14.79	7.55	51.1
Ten	6.000	Aug. 15, 2009	14.76	10.85	73.5
Thirty	11.250	Feb. 15, 2015	12.67	9.91	78.2
Thirty	10.625	Aug. 15, 2015	7.15	9.57	133.9
Thirty	9.875	Nov. 15, 2015	6.90	7.07	102.5
Thirty	9.250	Feb. 15, 2016	7.27	9.32	128.2
Thirty	7.250	May 15, 2016	18.82	6.50	34.5
Thirty	7.500	Nov. 15, 2016	18.86	5.81	30.8
Thirty	8.750	May 15, 2017	18.19	5.02	27.6
Thirty	8.875	Aug. 15, 2017	14.02	8.74	62.3
Thirty	9.125	May 15, 2018	8.71	4.63	53.1
Thirty	9.000	Nov. 15, 2018	9.03	4.24	46.9
Thirty	8.875	Feb. 15, 2019	19.25	7.92	41.1
Thirty	8.125	Aug. 15, 2019	20.21	7.16	35.4
Thirty	8.500	Feb. 15, 2020	10.23	6.73	65.8
Thirty	8.750	May 15, 2020	10.16	3.82	37.6
Thirty	8.750	Aug. 15, 2020	21.42	5.82	27.2
Thirty	7.875	Feb. 15, 2021	11.11	5.43	48.8
Thirty	8.125	May 15, 2021	11.96	3.36	28.1
Thirty	8.125	Aug. 15, 2021	12.16	4.94	40.7
Thirty	8.000	Nov. 15, 2021	32.80	2.10	6.4
Thirty	7.250	Aug. 15, 2022	10.35	4.60	44.5
Thirty	7.625	Nov. 15, 2022	10.70	1.72	16.0
Thirty	7.125	Feb. 15, 2023	18.37	3.97	21.6
Thirty	6.250	Aug. 15, 2023	22.91	3.30	14.4
Thirty	7.500	Nov. 15, 2024	11.47	1.30	11.3
Thirty	6.750	Aug. 15, 2026	10.89	1.71	15.7
Thirty	6.500	Nov. 15, 2026	11.49	0.95	8.2
Thirty	6.625	Feb. 15, 2027	10.46	1.37	13.1
Thirty	6.375	Aug. 15, 2027	10.74	1.04	9.7
Thirty	6.125	Nov. 15, 2027	22.52	0.28	1.2
Thirty	5.500	Aug. 15, 2028	11.78	0.73	6.2
Thirty	5.250	Nov. 15, 2028	10.95	0.00	0.0
Thirty	5.250	Feb. 15, 2029	11.35	0.33	2.9
Thirty	6.125	Aug. 15, 2029	11.18	0.00	0.0

this paper. However, we observe that what is important is the *net* effect on Treasury tax revenues, including

- forgone taxes on interest income from the higher coupon securities converted into lower coupon securities and STRIPS;
- increased taxes on the interest income from the lower coupon securities created by conversion;
- increased taxes on the annual accretions of discount on the STRIPS created by conversion; and
- the tax consequences of any capital gains or losses associated with the sale (for conversion) and conversion of higher coupon securities into lower coupon securities and STRIPS.

Among other things, the magnitudes of these tax effects depend on the tax brackets of the investors who sell and convert higher coupon debt and the tax brackets of the investors who acquire the lower coupon debt and STRIPS created by conversion.[51]

Capping the Amount of a Note or Bond That Can Be Reconstituted

To limit any prospective loss of Treasury tax revenue, it would not be unreasonable to "cap" the amount of a note or bond that could be reconstituted. The cap could be set at the original issue size of the security (including any reopenings), less the currently outstanding stock of the security, plus an additional amount that could vary from security to security. The additional amount could, for example, be relatively generous for an issue priced substantially above its principal value and smaller for an issue priced at a material discount. Similarly, it could vary over time as market yields rise and fall.

Such a cap would not materially vitiate any of the benefits of the proposal related to fungibility and liquidity. However, it would allow the possibility of a note or bond becoming more expensive than the sum of the prices of the STRIPS that can be derived from the security. This would happen if reconstitution had expanded the supply of the security to its original issuance size plus the additional amount prescribed by the Treasury, so that no additional supplies could be created through further reconstitution in spite of the economic incentive.

5. A Proposal to Reduce Maturity Date Heterogeneity

The proposal presented in the preceding section was premised on the notion that fragmentation of trading in STRIPS with identical payment characteristics degrades liquidity, reduces the attractiveness of Treasury securities, and increases the cost of funding the federal debt.[52] Liquidity can also be degraded by fragmentation of trading in securities with heterogeneous payment characteristics. We observed in Section 3 that the Treasury Department has reduced the heterogeneity and enhanced the liquidity of its debt during the past twenty years by integrating fifty-two-week bills with twenty-six-week and thirteen-week bills; by reopening outstanding notes and bonds whenever possible; and—as illustrated in Table 5—by pruning selected offerings, including three-year, four-year, and seven-year notes as well as twenty-year bonds.[53]

Currently, bills mature on Thursdays, two-year notes mature at month-end, and five- and ten-year notes and thirty-year bonds mature at mid-quarter. Further simplification would be welcome.

Table 5
Number of New Treasury Securities Offerings, Excluding Reopenings

	Fiscal Year		
Offering	Oct. 1, 1984–Sept. 30, 1985	Oct. 1, 1991–Sept. 30, 1992	Oct. 1, 1998–Sept. 30, 1999
Bills			
Cash management	0	0	6
Twenty-six-week	39	38	40
Fifty-two-week	13	13	13
Subtotal	52	51	59
Conventional notes and bonds			
Two-year	13	12	12
Three-year	4	4	0
Four-year	4	0	0
Five-year	4	12	4
Seven-year	4	4	0
Ten-year	4	3	3
Twenty-year	3	0	0
Thirty-year	3	2	3
Subtotal	39	37	22
Foreign-targeted notes			
Four-year	1	0	0
Five-year	2	0	0
Ten-year	0	0	0
Subtotal	3	0	0
Inflation-indexed notes and bonds			
Five-year	0	0	0
Ten-year	0	0	1
Thirty-year	0	0	1
Subtotal	0	0	2
Total	94	88	83

One possibility is to alter the maturity of two-year notes to mid-month. In combination with our proposal to reduce heterogeneity in the STRIPS market, this would increase the integration of two-year notes maturing in the middle of the second month of each quarter with old five- and ten-year notes and thirty-year bonds maturing on the same dates. In some cases, it may be possible to reopen a seasoned security in the two-year note auction in the second month of a quarter.[54] However, unless the frequency of two-year issuance is reduced to once a quarter, the reduction in heterogeneity would be limited because there would still be cycles of two-year notes maturing in the middle of the first month and the third month of each quarter.

Alternatively, the Treasury could integrate the two-year debt program with the bill program, paralleling the change from monthly offerings of one-year bills to quad-weekly offerings of fifty-two-week bills maturing on Thursday.[55] In particular, the Treasury could replace its monthly offerings of two-year notes with quad-weekly offerings of 104-week bills. The cycle of 104-week bills could be timed so that the maturity dates of the bills fall midway between the maturity dates of subsequent offerings of fifty-two-week bills.[56]

Integrating Bills with Notes and Bonds

Closer integration of the two-year debt program with either the bill program or the longer term note and bond program would reduce fragmentation and enhance liquidity, but the benefits of integrating bills with notes and bonds are potentially far greater.

Chart 6 shows that outstanding supplies of bills and short-term notes and bonds are of roughly similar magnitude. However, bills are priced quite differently from coupon-bearing securities maturing only a few days earlier or later, or even on the same day. This is illustrated by the yield spreads of 20 to 30 basis points between bills and short-term notes and bonds shown in Chart 7. The greater value (lower yield) of bills is commonly attributed to the greater liquidity of those securities compared with notes and bonds of a similar maturity.[57] Closer integration of the two classes of securities could materially enhance the liquidity (and market value) of the notes and bonds. The prospect of improved liquidity and higher prices in the market for short-term coupon-bearing securities would, in turn, enhance the liquidity and value of intermediate-term securities and consequently lower the cost of funding the federal debt.

However, integrating bills and coupon-bearing securities more closely would appear to require that coupon payments be changed from intervals of six calendar months to intervals of 182 days. This would create unusual maturity sequences—five- and ten-year notes and thirty-year bonds would mature every 91 days, rather than every three calendar months—and would constitute a significant departure from present practice. In short, while two-year debt can be integrated with bills (by converting monthly issues of two-year notes to quad-weekly issuances of 104-week bills) or with longer term notes and bonds (by converting two-year notes to midmonth maturities), directly integrating bills and coupon-bearing securities may be impractical.

In view of the substantial benefits that would follow from closer integration, it is worth examining an indirect approach to integrating the bill program with the note and bond program. The next section describes how the markets for bills and coupon-bearing securities could be more closely

Chart 6

Monthly Bill, Note, and Bond Maturities, as of October 6, 1999

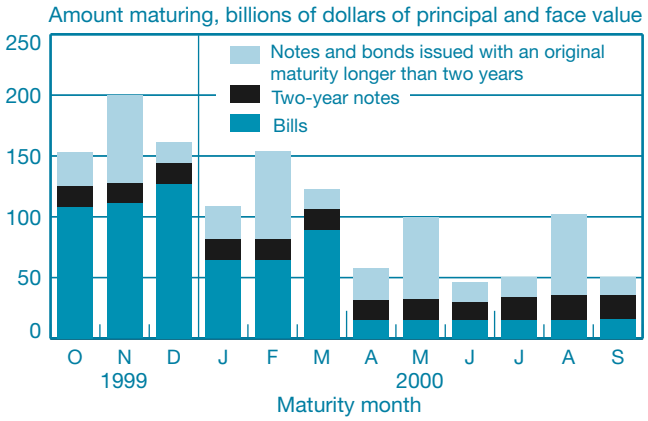
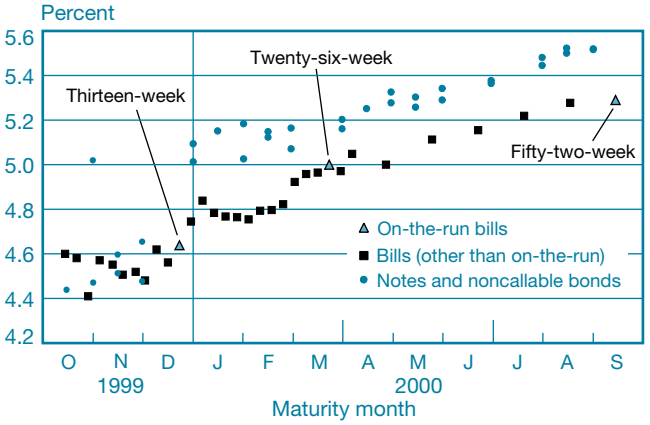


Chart 7

Yields on Treasury Bills, Notes, and Noncallable Bonds on October 6, 1999



integrated—without departing from present issuance practices—as an ancillary consequence of a facility designed to enhance further the liquidity of the markets for notes, bonds, and STRIPS.

6. A Third, More Adventurous Proposal to Enhance Liquidity

The contrast between yields on bills and yields on short-term notes and bonds shows that Treasury securities with similar payment characteristics but in different classes may be priced quite differently by market participants. Minor differences in security characteristics can also lead to anomalous yield structures within a security class.

For example, on July 22, 1999, Treasury bills maturing on September 23, September 30, and October 7, 1999, were offered at yields of 4.48 percent, 4.43 percent, and 4.51 percent, respectively. The 5-basis-point decline in yield from the September 23 bill to the September 30 bill and the relatively sharp 8-basis-point increase in yield from the September 30 bill to the October 7 bill are notable for a maturity sector where the bill yield curve generally had a mildly positive slope (Table 6).[58]

On the same date, interest component STRIPS maturing on August 15 and November 15, 2006, and on February 15, 2007, were offered at yields of 5.99 percent, 5.96 percent, and 6.02 percent, respectively. The 3-basis-point decline in yield from the August 2006 obligation to the November 2006 obligation and the more-than-offsetting 6-basis-point increase in yield from the November 2006 obligation to the February 2007 obligation are notable in a market where the yield curve for interest component STRIPS maturing between 2005 and 2010 was moderately positively sloped (Table 3).

The proposal outlined in Section 4 would enhance the liquidity of the Treasury market by making STRIPS with *identical* maturities *perfect* substitutes. Liquidity can be further enhanced by improving the substitutability of single-payment securities (including both STRIPS *and* Treasury bills) with similar, but not identical, maturities. In particular, while the Treasury cannot—and, indeed, should not—make STRIPS maturing in August and November 2006 and in February 2007 perfect substitutes for each other (in the sense of ensuring that they always trade at fixed yield spreads), it can make the securities better substitutes by permitting some elasticity in relative supplies that would reduce the prospect of more extreme variations in the relationships among the yields on the three securities.

Table 6
Treasury Bill Yields on July 22, 1999
Percent

Maturity Date	Discount Rate	Yield
July 29, 1999	3.96	4.02
Aug. 5	4.24	4.31
Aug.12	4.33	4.40
Aug. 19	4.33	4.40
Aug. 26	4.32	4.40
Sept. 2	4.39	4.47
Sept. 9	4.38	4.47
Sept. 16	4.37	4.46
Sept. 23	4.39	4.48
Sept. 30	4.33	4.43
Oct. 7	4.41	4.51
Oct. 14	4.44	4.55
Oct. 21	4.46	4.57
Oct. 28	4.47	4.59
Nov. 4	4.50	4.62
Nov. 12	4.51	4.64
Nov. 18	4.50	4.63
Nov. 26	4.50	4.64
Dec. 2	4.51	4.65
Dec. 9	4.54	4.69
Dec. 16	4.55	4.70
Dec. 23	4.56	4.71
Dec. 30	4.50	4.66
Jan. 6, 2000	4.44	4.60
Jan. 13	4.44	4.60
Jan. 20	4.46	4.63
Jan. 27	4.51	4.68
Feb. 3	4.41	4.57
Mar. 2	4.51	4.68
Mar. 30	4.51	4.69
Apr. 27	4.54	4.73
May 25	4.59	4.80
June 22	4.66	4.88
July 20	4.71	4.95

The Proposal

Our third proposal is for an "exchange facility" that would allow market participants to exchange—with the Treasury—two single-payment securities (with very similar maturities and with face values of $1,000 each) for a single-payment security with an intermediate maturity and a $2,000 face value, and vice versa.

Suppose, for example, that a November 2006 STRIP is expensive relative to the August 2006 and February 2007 STRIPS—as was the case with interest component STRIPS on July 22, 1999 (Table 3). Market participants could then

exchange $1,000 face amount of each of the less expensive STRIPS for $2,000 face amount of the more expensive November 2006 STRIPS. Conversely, if the November 2006 STRIPS were relatively cheap, market participants could exchange $2,000 face amount of that security for $1,000 face amount each of the August 2006 and February 2007 STRIPS.

As described in more detail below, the exchange facility would bound very short-range irregularities in the structure of yields on single-payment securities, but it should be structured to avoid influencing the overall level and shape of the yield curve. To preclude any effects on the curve, we suggest that the Treasury impose a fee on exchanges and limit exchanges to "nearby" securities.[59]

An Exchange Fee

We suggest that the Treasury impose a fee—specified in terms of yield and amounting to perhaps 2 or 3 basis points—on an exchange of single-payment securities. For purposes of computing the fee in dollar terms, the shorter and longer securities involved in an exchange would be valued at prevailing market yields. The intermediate security would be valued at the average, or interpolated, yield on the shorter and longer securities, plus or minus the prescribed fee.

Suppose, for example, that the exchange fee is set at 2 1/2 basis points. For illustrative purposes, let us use the yields on interest component STRIPS on July 22, 1999, from Table 3 and a settlement date of July 23, 1999. Since the average yield on the August 2006 and February 2007 STRIPS was 6.005 percent (6.005 percent is the average of 5.99 percent and 6.02 percent), a market participant could exchange $1,000 face amount of each of those STRIPS (priced at their respective market yields) for $2,000 face amount of November 2006 STRIPS priced at a yield of 5.98 percent (5.98 percent = 6.005 percent, less the 2-1/2-basis-point exchange fee). As shown in Box B, this would result in a cash payment to the Treasury of $2.27.

Alternatively, a market participant could exchange $2,000 face amount of November 2006 STRIPS priced at a yield of 6.03 percent (6.03 percent = 6.005 percent, plus the 2-1/2-basis-point exchange fee) for $1,000 face amount of August 2006 STRIPS and the same face amount of February 2007 STRIPS (priced at their respective market yields). As shown in Box C, this would result in a cash payment to the Treasury of $2.34.[60]

Appendix A discusses whether the size of the cash payment to the Treasury resulting from an exchange is sensitive to the yields used to value the obligations exchanged. We conclude that the size of the payment is relatively insensitive to modest variations in both the *levels* of the yields and the *difference between the yields* on the shorter and longer securities involved in the exchange. It does not appear that the Treasury, or its agent, would have to maintain unreasonably close contact with evolving market conditions to price an exchange with acceptable accuracy. Thus, it would not be impractical for the Treasury to announce a schedule of yields on single-payment securities at the end of the day and to receive requests for

Box B

Exchange of Shorter and Longer Maturity STRIPS for an Intermediate-Maturity STRIP

Consider the exchange of

- $1,000 face amount of STRIPS maturing August 15, 2006, quoted on July 22, 1999, at a yield of 5.99 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing February 15, 2007, quoted on July 22, 1999, at a yield of 6.02 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing November 15, 2006.

The shorter obligation has an invoice price of 65.90911 percent of face value,[a] and the longer obligation has an invoice price of 63.85172 percent of face value.[b] For purposes of the exchange, the intermediate obligation is valued at a yield of 5.98 percent (5.98 percent = 1/2 of 5.99 percent and 6.02 percent, minus 2 1/2 basis points) or at an invoice price of 64.99385 percent of face value.[c]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $2.2687, computed as

- 64.99385 percent of $2,000 for the intermediate obligation, less
- 65.90911 percent of $1,000 credit for the shorter obligation, less
- 63.85172 percent of $1,000 credit for the longer obligation.

[a] $65.90911 = 100(1+\frac{1}{2}.0599)^{-(14+(23/181))}$, where the obligation has 23 days plus 14 full semiannual periods remaining to maturity, and where there are 181 days in the semiannual interval from February 15, 1999, to August 15, 1999.

[b] $63.85172 = 100(1+\frac{1}{2}.0602)^{-(15+(23/181))}$, where the obligation has 23 days plus 15 full semiannual periods remaining to maturity.

[c] $64.99385 = 100(1+\frac{1}{2}.0598)^{-(14+(115/184))}$, where the obligation has 115 days plus 14 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999, to November 15, 1999.

exchanges pursuant to that schedule up to the opening of the market the following morning.

The proposed exchange facility would bound very short-range irregularities in the structure of yields on single-payment securities such as those described in the introduction to this section. The market yield on a single-payment security could never differ by more than the exchange fee from the average of the market yields on a pair of shorter and longer term single-payment securities for which it can be exchanged. Thus, for example, the market yield on a November 2006 STRIP would have to be in the interval of 5.98 percent to 6.03 percent if the market yields on the August 2006 and February 2007 STRIPS were 5.99 percent and 6.02 percent, respectively.

Box C

Exchange of an Intermediate-Maturity STRIP for Shorter and Longer Maturity STRIPS

Consider the exchange of

- $2,000 face amount of STRIPS maturing November 15, 2006,

for

- $1,000 face amount of STRIPS maturing August 15, 2006, quoted on July 22, 1999, at a yield of 5.99 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing February 15, 2007, quoted on July 22, 1999, at a yield of 6.02 percent for settlement on July 23, 1999.

The shorter obligation has an invoice price of 65.90911 percent of face value,[a] and the longer obligation has an invoice price of 63.85172 percent of face value.[b] For purposes of the exchange, the intermediate obligation is valued at a yield of 6.03 percent (6.03 percent = 1/2 of 5.99 percent and 6.02 percent, plus 2 1/2 basis points) or at an invoice price of 64.76355 percent of face value.[c]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $2.3373, computed as

- 65.90911 percent of $1,000 for the shorter obligation, plus
- 63.85172 percent of $1,000 for the longer obligation, less
- 64.76355 percent of $2,000 credit for the intermediate obligation.

[a] $65.90911 = 100(1+\frac{1}{2}.0599)^{-(14+(23/181))}$, where the obligation has 23 days plus 14 full semiannual periods remaining to maturity, and where there are 181 days in the semiannual interval from February 15, 1999, to August 15, 1999.

[b] $63.85172 = 100(1+\frac{1}{2}.0602)^{-(15+(23/181))}$, where the obligation has 23 days plus 15 full semiannual periods remaining to maturity.

[c] $64.76355 = 100(1+\frac{1}{2}.0603)^{-(14+(115/184))}$, where the obligation has 115 days plus 14 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999, to November 15, 1999.

Limiting Exchanges to "Nearby" Securities

To preclude the possibility that the exchange facility will do more than bound short-range irregularities in the structure of yields on single-payment securities, the difference between the maturities of the longer and shorter securities that can be exchanged for an intermediate-maturity security should be limited, possibly as suggested in Table 7. Appendix B discusses in more detail the implications of the limitations in Table 7 for the shape of the yield curve.[61]

Other Limitations

In addition to limitations like those in Table 7, it may be desirable to limit the maximum increase or decrease in the amount payable on a given date to prevent the development of large variations in rollover financing requirements. This cap would be similar to the cap on reconstitution discussed in Section 4, but here it would limit the increase or decrease in aggregate Treasury liabilities payable on a given date, rather than the principal amount of a note or bond that can be created by reconstituting STRIPS derived from other securities.

Table 7

Suggested Limitations on Exchanges of Single-Payment Securities

If the intermediate-maturity security in a proposed exchange has a remaining term to maturity of . . .	. . . Then the difference between the maturities of the shorter and longer securities that can be exchanged for the intermediate-maturity security should be no more than . . .
Less than thirteen weeks	Two weeks
Less than twenty-six weeks	Four weeks
Less than fifty-two weeks	Six weeks
Less than two years	Four months
More than two years	Six months

To facilitate the Treasury's planning for rollover financings, it may also be desirable to prohibit exchanges that involve any security with less than a month or six weeks remaining to maturity.

Benefits of the Proposal

We believe that the proposed exchange facility would enhance the liquidity of STRIPS and off-the-run Treasury notes and bonds and would increase the integration of the bill market with the markets for short-term STRIPS and coupon-bearing securities.

Liquidity Enhancement

The proposal would improve the substitutability of substantially similar single-payment securities by limiting the range of relative variation of yields on securities with very nearly identical payment characteristics. This can have important consequences for the liquidity of Treasury securities.

For example, a dealer could satisfy a customer's interest in purchasing $10 million face amount of a STRIP that the dealer did not already own by selling the STRIP short and then hedging the risk of loss on the short sale (to no more than twice the exchange fee) by purchasing $5 million each of a somewhat shorter STRIP and a somewhat longer STRIP.[62] We believe that limiting basis risk on hedged short sales will lead to a more liquid STRIPS market with narrower bid-ask spreads. Similar comments apply to the markets for notes and bonds because those securities are linked to STRIPS through stripping and reconstitution.

Market Integration

The proposal would also lead to a sharp reduction in the yield spread between STRIPS and bills as well as between short-term coupon-bearing securities and bills.

Large spreads between yields on STRIPS and yields on bills of a similar maturity cannot persist if—as illustrated in Box D—market participants can exchange (for a modest fee) $2,000 face amount of a STRIP maturing on November 15, 1999, for $1,000 face amount of a bill maturing on November 12 and $1,000 face amount of a bill maturing on November 18, 1999. The exchange facility would greatly enhance the integration of the relatively illiquid markets for short-term STRIPS and coupon-bearing securities with the much more liquid bill market. In particular, the spread between the yield on a short-term note or bond and the yield on a bill with a similar maturity would be limited to no more than the prescribed exchange fee (2 1/2 basis points in the prior example). The prospect of improved liquidity and higher prices in the markets for short-term coupon-bearing securities would, in turn, enhance the

Box D

Exchange of an Intermediate-Maturity STRIP for Shorter and Longer Bills

Consider the exchange of

- $2,000 face amount of STRIPS maturing November 15, 1999,

for

- $1,000 face amount of bills maturing November 12, 1999, quoted on July 22, 1999, at a discount rate of 4.51 percent for settlement on July 23, 1999, and
- $1,000 face amount of bills maturing November 18, 1999, quoted on July 22, 1999, at a discount rate of 4.50 percent for settlement on July 23, 1999.

The shorter bill has a yield of 4.638 percent and an invoice price of 98.59689 percent of face value,[a] and the longer bill has a yield of 4.631 percent and an invoice price of 98.52500 percent of face value.[b] For purposes of the exchange, the intermediate STRIP is valued at a yield of 4.660 percent (4.660 percent = 1/2 of 4.638 percent and 4.631 percent, plus 2 1/2 basis points) or at an invoice price of 98.53322 percent of face value.[c]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $.1583, computed as

- 98.59689 percent of $1,000 for the shorter bill, plus
- 98.52500 percent of $1,000 for the longer bill, less
- 98.55303 percent of $2,000 credit for the intermediate STRIP.

[a] $98.59689 = 100 - \frac{112}{360}\,4.51$, where the bill has 112 days remaining to maturity. The yield is the value of R that satisfies the equation $98.59689 = 100(1+\frac{112}{365}\,R)^{-1}$, or R = .04638.

[b] $98.52500 = 100 - \frac{118}{360}\,4.50$, where the bill has 118 days remaining to maturity. The yield is the value of R that satisfies the equation $98.52500 = 100(1+\frac{118}{365}\,R)^{-1}$, or R = .04631.

[c] $98.55303 = 100(1+\frac{115}{365}\,.04660)^{-1}$, where the STRIP has 115 days remaining to maturity. Note that, for consistency, here we relate the yield and invoice price of the STRIP using the same equation used to relate the yield and invoice price of a bill with less than 183 days remaining to maturity.

liquidity and value of intermediate-term securities and consequently lower the cost of funding the federal debt.

Enhanced integration of the markets for short-term STRIPS and bills would not necessarily lead to exchanges of STRIPS for bills on a wholesale basis. Since positions in short-term STRIPS could be priced and hedged more reliably with bills of a comparable maturity, the superior liquidity of the bill market would spill over into the STRIPS market, making STRIPS more valuable and reducing the economic incentive for any actual exchange.[63] Phrased another way, the stated willingness of the Treasury to exchange bills for STRIPS at a modest fee would itself limit the incidence of such exchanges.

Other Benefits

The proposed exchange facility would allow market conditions to influence, within limits prescribed by the Treasury, the amount of Treasury debt maturing on different dates. In contrast to present debt management practices, the amount payable on a particularly desirable date, such as the end of a calendar quarter, could expand in response to market demand, while the amounts payable on nearby dates contract dollar-for-dollar.

Our proposal can be viewed as a market-driven substitute for tactical variations in primary market offerings in response to unusually strong investor demand for particular maturities. It is analogous to the philosophy that motivated the 1985 decision by the Treasury to facilitate bond stripping rather than to issue zero-coupon securities itself:

> The investment community will be better able [than the Treasury] to offer zero-coupon instruments that meet particular needs in a timely manner. The market for zero-coupon securities is a rapidly changing one. The demand varies substantially for particular maturities and with changes in interest rates and in the needs of various investor classes. . . . This changing demand for zeros will be best accommodated by the STRIPS program of making a broad range of maturities eligible for stripping but *leaving it to the market to decide* [emphasis added] when and how much of an issue it will separate and market as zero-coupon instruments.[64]

As a related matter, by partially endogenizing the face amount of single-payment securities maturing on a particular date, the exchange facility—taken in conjunction with the proposal in Section 4 and the existing provision for reconstituting STRIPS into coupon-bearing securities—would provide another mechanism for expanding the supply of a security on special in the financing market for specific collateral. Additionally, the supply of a new, on-the-run security could increase beyond the original issuance amount in response to demand for the security, and then contract as the security migrated from on-the-run to off-the-run status.

And last, but not least, the revenue generated by the exchange fee would directly benefit the Treasury's objective of minimizing the cost of funding the federal debt.

A Precedent for the Proposal

The proposed exchange facility is novel, but it is not without precedent. Each foreign-targeted Treasury note sold in the mid-1980s (see endnote 33) was exchangeable (throughout its life) for an equal principal amount of a conventional note with the same coupon rate and maturity date.[65] (Conventional notes that were issued in exchange for foreign-targeted notes increased the amount outstanding of a note that was originally sold contemporaneously with the foreign-targeted note.) Depending on when an exchange was made, a market participant electing to exchange a foreign-targeted note made a cash payment to the Treasury Department or received a cash payment from the Treasury. The payment accounted for the difference in value between annual payment of interest on the foreign-targeted note and semiannual payment of interest on the conventional note.

Thus, it is not unprecedented for the Treasury to issue additional amounts of an outstanding security, in exchange for a different security, in a transaction that results in a change in the timing of its future liabilities (but leaves the aggregate quantity of liabilities unchanged) and that involves a cash payment to account for the present value of the change in the timing of the future liabilities.[66]

A Trial

We are not unaware that the proposed exchange facility may be viewed by some as a risky policy initiative. Therefore, we suggest the possibility of a limited trial.

The Treasury could adopt the facility but limit the facility's initial availability to bills and STRIPS with less than one year to maturity. If the program is deemed useful and in the public interest, it could be extended to securities with longer maturities. If, however, experience indicates that the program is ineffective or has unforeseen adverse consequences, the program could be terminated. The subsequent passage of time and redemption of debt would eradicate its effects within a year.[67]

7. Conclusion

The starting point for this paper is the belief that the reduction of limitations on the fungibility and substitutability of Treasury securities can enhance liquidity and lead to higher prices for those securities.[68]

We discussed three ways to expand the fungibility of identical cash flows and the substitutability of nearly identical liabilities. The fungibility of identical cash flows can be enhanced by allowing market participants who reconstitute STRIPS to substitute interest payments and principal payments due on the same date. Aligning the maturity dates of two-year debt with either the maturity dates of bills or the maturity dates of longer term debt would also reduce heterogeneity and enhance fungibility. Our third proposal, to establish an exchange facility, would directly enhance the substitutability of Treasury securities with nearly identical cash flows.

The market environment created by traders executing arbitrage and relative value transactions in light of expanded opportunities for reconstitution and exchange would complement efforts to maintain liquidity through buybacks of old issues and expanded offerings of new issues. The enhanced liquidity and market integration associated with improved substitutability and fungibility would increase demand and reduce the cost of funding the debt. Allowing the supply of a security to expand beyond its original issuance size would provide for some elasticity in the supply of on-the-run securities and reduce the risk of a squeeze. More generally, greater liquidity and market integration, reduced scarcity risk, and elasticity in the supply of on-the-run debt would help ensure the continued attractiveness of Treasury securities for investing, trading, and hedging in an era of surpluses.

Appendix A: Sensitivity of the Cash Payment on an Exchange to the Yields on the Shorter and Longer Securities

In this appendix, we examine whether the size of the cash payment to the Treasury Department resulting from an exchange like the one proposed in Section 6 is sensitive to the yields used to value the obligations exchanged. In particular, do small changes in the yields on the shorter and longer securities result in very different cash payments, so that the Treasury, or its agent, would have to maintain close contact with evolving market conditions to price an exchange with reasonable accuracy?

Box A1 examines the same exchange as the one in Box B in the text, but prices the shorter and longer STRIPS (and hence the intermediate STRIP) at yields that are 10 basis points *lower* than the yields in Box B. The cash payment to the Treasury is $2.29, an amount that differs by less than 1 percent from the $2.27 payment calculated in Box B.

Box A2 also examines the same exchange as the one in Box B, but it uses a yield for pricing the shorter STRIP that is 5 basis points *lower* than the yield in Box B and uses a yield for pricing the longer STRIP that is 5 basis points *higher* than the yield in Box B. The cash payment to the Treasury is $2.34, an amount that differs by a bit more than 3 percent from the $2.27 payment calculated in Box B.

We conclude that the payment to the Treasury is relatively insensitive to moderate variations in (a) the levels of the yields and (b) the difference between the yields on the securities involved in the exchange.

Box A1

Exchange of Shorter and Longer Maturity STRIPS for an Intermediate-Maturity STRIP When the Level of Yields Is 10 Basis Points Lower

Consider the exchange of

- $1,000 face amount of STRIPS maturing August 15, 2006, priced at a yield of 5.89 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing February 15, 2007, priced at a yield of 5.92 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing November 15, 2006.

The shorter obligation has an invoice price of 66.36279 percent of face value,[a] and the longer obligation has an invoice price of 64.32239 percent of face value.[b] For purposes of the exchange, the intermediate obligation is valued at a yield of 5.88 percent (5.88 percent = 1/2 of 5.89 percent and 5.92 percent, minus 2 1/2 basis points) or at an invoice price of 65.45708 percent of face value.[c]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $2.2898, computed as

- 65.45708 percent of $2,000 for the intermediate obligation, less
- 66.36279 percent of $1,000 credit for the shorter obligation, less
- 64.32239 percent of $1,000 credit for the longer obligation.

[a] $66.36279 = 100(1+\frac{1}{2}.0589)^{-(14+(23/181))}$, where the obligation has 23 days plus 14 full semiannual periods remaining to maturity, and where there are 181 days in the semiannual interval from February 15, 1999, to August 15, 1999.

[b] $64.32239 = 100(1+\frac{1}{2}.0592)^{-(15+(23/181))}$, where the obligation has 23 days plus 15 full semiannual periods remaining to maturity.

[c] $65.45708 = 100(1+\frac{1}{2}.0588)^{-(14+(115/184))}$, where the obligation has 115 days plus 14 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999, to November 15, 1999.

Box A2

Exchange of Shorter and Longer Maturity STRIPS for an Intermediate-Maturity STRIP When the Difference between the Yields on the Longer and Shorter STRIPS Is 10 Basis Points Higher

Consider the exchange of

- $1,000 face amount of STRIPS maturing August 15, 2006, priced at a yield of 5.94 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing February 15, 2007, priced at a yield of 6.07 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing November 15, 2006.

The shorter obligation has an invoice price of 66.13553 percent of face value,[a] and the longer obligation has an invoice price of 63.61776 percent of face value.[b] For purposes of the exchange, the intermediate obligation is valued at a yield of 5.98 percent (5.98 percent = 1/2 of 5.94 percent and 6.07 percent, minus 2 1/2 basis points) or at an invoice price of 64.99385 percent of face value.[c]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $2.3441, computed as

- 64.99385 percent of $2,000 for the intermediate obligation, less
- 66.13553 percent of $1,000 credit for the shorter obligation, less
- 63.61776 percent of $1,000 credit for the longer obligation.

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[a] $66.13553 = 100(1+\frac{1}{2}.0594)^{-(14+(23/181))}$, where the obligation has 23 days plus 14 full semiannual periods remaining to maturity, and where there are 181 days in the semiannual interval from February 15, 1999, to August 15, 1999.

[b] $63.61776 = 100(1+\frac{1}{2}.0607)^{-(15+(23/181))}$, where the obligation has 23 days plus 15 full semiannual periods remaining to maturity.

[c] $64.99385 = 100(1+\frac{1}{2}.0598)^{-(14+(115/184))}$, where the obligation has 115 days plus 14 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999, to November 15, 1999.

Appendix B: Implications of the Exchange Facility for the Shape of the Yield Curve

We observed in Section 6 that the proposed exchange facility would bound short-range irregularities in the structure of yields on single-payment securities. The yield on a single-payment security could never differ by more than the prescribed exchange fee from the average of the yields on a pair of shorter and longer term single-payment securities for which it can be exchanged.

To preclude the possibility that the exchange facility might affect the overall shape of the yield curve, we suggested that the difference between the maturities of the longer and shorter securities that can be exchanged for an intermediate-maturity security should be limited, as shown in Table 7. The limitations are important because if market participants can, without limitation, exchange short-term securities (such as one-year STRIPS) and long-term securities (such as twenty-five-year STRIPS) for intermediate-term securities (such as thirteen-year STRIPS) and vice versa—at an exchange fee of, for example, 2 or 3 basis points—then (in an equilibrium in which positive amounts of short-, intermediate-, and long-term STRIPS remain outstanding) the STRIPS yield curve would have to be very close to a straight (but not necessarily flat) line.

The limitations in Table 7 will not preclude indirect exchanges of much longer and much shorter securities for an intermediate-maturity security, but such indirect exchanges will be prohibitively expensive. We show in this appendix how two STRIPS maturing a year apart could be exchanged for an intermediate-maturity STRIP maturing in more than two years by combining three exchanges permitted by Table 7, and we also show that the triplet of exchanges is equivalent to a direct exchange for a fee four times larger than the fee prescribed for an exchange that falls within the limitations in Table 7. We conclude that the rapidly escalating costs of more dispersed indirect exchanges will, as a practical matter, preclude such exchanges and that the exchange facility can be structured to avoid affecting the overall shape of the yield curve.

Combining Three Exchanges to Effect an Exchange That Cannot Be Done Directly

Suppose that the fee on an exchange that falls within the limitations in Table 7 is 2 1/2 basis points. Using the yields on interest component STRIPS on July 22, 1999, from Table 3, we demonstrate how a market participant could indirectly effect an exchange of $1,000 face amount of STRIPS maturing May 15, 2006, and $1,000 face amount of STRIPS maturing a year later, on May 15, 2007, for $2,000 face amount of STRIPS maturing November 15, 2006, for a fee of about 10 basis points. (Note that this exchange cannot be done directly for a fee of 2 1/2 basis points because the difference in the maturities of the shorter and longer STRIPS exceeds the limitations in Table 7.)

Exchange 1. Consider first the exchange of

- $1,000 face amount of STRIPS maturing May 15, 2006, quoted on July 22, 1999, at a yield of 5.97 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing November 15, 2006, quoted on July 22, 1999, at a yield of 5.96 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing August 15, 2006.

The shorter obligation has an invoice price of 66.98146 percent of face value,[69] and the longer obligation has an invoice price of 65.08622 percent of face value.[70] For purposes of the exchange, the intermediate obligation is valued at a yield of 5.940 percent (5.940 percent = 1/2 of 5.97 percent and 5.96 percent, minus 2 1/2 basis points) or at an invoice price of 66.13553 percent of face value.[71]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $2.0338, computed as

- 66.13553 percent of $2,000 for the intermediate obligation, less
- 66.98146 percent of $1,000 credit for the shorter obligation, less
- 65.08622 percent of $1,000 credit for the longer obligation.

Exchange 2. Consider next the exchange of

- $1,000 face amount of STRIPS maturing November 15, 2006, quoted on July 22, 1999, at a yield of 5.96 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing May 15, 2007, quoted on July 22, 1999, at a yield of 6.03 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing February 15, 2007.

The shorter obligation has an invoice price of 65.08622 percent of face value,[72] and the longer obligation has an invoice price of 62.86808 percent of face value.[73] For purposes of the exchange, the intermediate obligation is valued at a yield of 5.970 percent (5.970 percent = 1/2 of 5.96 percent and 6.03 percent, minus 2 1/2 basis points) or at an invoice price of 64.08659 percent of face value.[74]

The net funds due the Treasury at the time of the exchange are $2.1888, computed as

- 64.08659 percent of $2,000 for the intermediate obligation, less
- 65.08622 percent of $1,000 credit for the shorter obligation, less
- 62.86808 percent of $1,000 credit for the longer obligation.

Exchange 3. Finally, consider the exchange of

- $2,000 face amount of STRIPS maturing August 15, 2006, quoted on July 22, 1999, at a yield of 5.99 percent for settlement on July 23, 1999, and
- $2,000 face amount of STRIPS maturing February 15, 2007, quoted on July 22, 1999, at a yield of 6.02 percent for settlement on July 23, 1999,

for

- $4,000 face amount of STRIPS maturing November 15, 2006.

From the calculations in Box B in the text, the net funds due the Treasury at the time of the exchange are $4.5374 ($4.5374 = 2 times $2.2687).

Summary. The net effect of the three exchanges is an exchange of

- $1,000 face amount of STRIPS maturing May 15, 2006, quoted on July 22, 1999, at a yield of 5.97 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing May 15, 2007, quoted on July 22, 1999, at a yield of 6.03 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing November 15, 2006.

The total payment due the Treasury at the time of the composite exchange is $8.7600, computed as

- $2.0338 for $1,000 face amount of the May 2006 STRIP and $1,000 face amount of the November 2006 STRIP exchanged for $2,000 face amount of the August 2006 STRIP,
- $2.1888 for $1,000 face amount of the November 2006 STRIP and $1,000 face amount of the May 2007 STRIP exchanged for $2,000 face amount of the February 2007 STRIP, and
- $4.5374 for $2,000 face amount of the August 2006 STRIP and $2,000 face amount of the February 2007 STRIP exchanged for $4,000 face amount of the November 2006 STRIP.

The box on the next page shows that this combination of exchanges is essentially equivalent to a direct exchange of $1,000 face amount of the May 2006 STRIP and $1,000 face amount of the May 2007 STRIP for $2,000 face amount of the November 2006 STRIP at an exchange fee of 10 basis points, or four times the 2-1/2-basis-point fee for an exchange that falls within the limitations in Table 7.

The foregoing calculation implies that the proposed exchange facility would bound the yield on a single-payment security maturing in more than two years to a range of about 10 basis points around the average yield on a pair of single-payment securities maturing six months earlier and six months later. Similar calculations show that if the shorter and longer securities mature eighteen months apart, then the range around the average yield is about ± 22 1/2 basis points. If the shorter and longer securities mature two years apart, the range around the average yield is about ± 40 basis points. If the securities mature three years apart, the range is about ± 90 basis points, and if they mature four years apart, the range is about ± 160 basis points.[75]

These bands are so wide that it is unlikely that the curvature of the yield curve will be large enough to induce market participants to undertake indirect exchanges of securities maturing more than six months apart for an intermediate-term security maturing in more than two years, and hence it is unlikely that the proposed exchange facility will have any effect on the overall shape of the yield curve beyond two years. Since the limitations in Table 7 shrink with the maturity of the intermediate security in an exchange, similar conclusions apply to the front end of the curve as well.

If, on further examination, the bounds on the curvature of the yield curve described above appear to be too tight, the bounds can be expanded by raising the exchange fee. For example, raising the fee from 2 1/2 basis points to 3 1/2 basis points would expand the band on the yield on a single-payment security around the average yield on a pair of single-payment securities maturing six months earlier and six months later from 10 basis points to 14 basis points. Similarly, the band around the average yield on a pair of single-payment securities maturing one year earlier and one year later would expand from 40 basis points to 56 basis points.

Exchange of Shorter and Longer Maturity STRIPS for an Intermediate-Maturity STRIP When the Exchange Fee Is 10 Basis Points

Consider the exchange of

- $1,000 face amount of STRIPS maturing May 15, 2006, quoted on July 22, 1999, at a yield of 5.97 percent for settlement on July 23, 1999, and
- $1,000 face amount of STRIPS maturing May 15, 2007, quoted on July 22, 1999, at a yield of 6.03 percent for settlement on July 23, 1999,

for

- $2,000 face amount of STRIPS maturing November 15, 2006,

when the fee for the exchange is 10 basis points. The shorter obligation has an invoice price of 66.98146 percent of face value,[a] and the longer obligation has an invoice price of 62.86808 percent of face value.[b] For purposes of the exchange, the intermediate obligation is valued at a yield of 5.90 percent (5.90 percent = 1/2 of 5.97 percent and 6.03 percent, minus 10 basis points) or at an invoice price of 65.36415 percent of face value.[c]

The net funds due the Treasury at the time of the exchange on July 23, 1999, are $8.7876, computed as

- 65.36415 percent of $2,000 for the intermediate obligation, less
- 66.98146 percent of $1,000 credit for the shorter obligation, less
- 62.86808 percent of $1,000 credit for the longer obligation.

[a] $66.98146 = 100(1+\frac{1}{2}.0597)^{-(13+(115/184))}$, where the obligation has 115 days plus 13 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999, to November 15, 1999.

[b] $62.86808 = 100(1+\frac{1}{2}.0603)^{-(15+(115/184))}$, where the obligation has 115 days plus 15 full semiannual periods remaining to maturity.

[c] $65.36415 = 100(1+\frac{1}{2}.0590)^{-(14+(115/184))}$, where the obligation has 115 days plus 14 full semiannual periods remaining to maturity.

Endnotes

1. See *Wall Street Journal* (1999b) and *New York Times* (1999b).

2. See Demsetz (1968) and Tanner and Kochin (1971).

3. See Stigler (1961), Garbade and Silber (1976), Lippman and McCall (1986), and Amihud, Mendelson, and Lauterbach (1997).

4. See Tanner and Kochin (1971), Garbade and Silber (1976), Garbade and Rosey (1977), and Elton and Green (1998).

5. See Garbade (1984), Amihud and Mendelson (1991a), Kamara (1994), and Elton and Green (1998).

6. See Tanner and Kochin (1971), Garbade and Silber (1976), Garbade and Rosey (1977), Sarig and Warga (1989), and Warga (1992).

7. See Garbade and Silber (1976), Garbade and Rosey (1977), Sarig and Warga (1989), Warga (1992), and Elton and Green (1998).

8. See Warga (1992) and Elton and Green (1998).

9. See, generally, Amihud and Mendelson (1991b).

10. See also Sarig and Warga (1989).

11. More recently, Elton and Green (1998) suggested that the effect of liquidity on the price of a Treasury security is not as large as previously reported and is restricted to longer maturity bonds with high trading volume. However, these authors measured the liquidity of an issue by the volume of trading in the interdealer market, rather than by the cost of transacting in the public market. Although the transaction costs of trading, for example, a six-month-old ten-year note are certainly higher than those of trading an on-the-run ten-year note, the ratio of transaction costs is not nearly as large as the reciprocal of the ratio of the volume of trading in the two notes. Dealers are willing to make fairly liquid markets for relatively infrequent transactions in an old ten-year note because order flow and transaction prices in the highly liquid and actively traded on-the-run ten-year note provide information on the value of the off-the-run note. In addition, the dealers can hedge much of their risk with the on-the-run note. (Price and yield changes for an on-the-run note or bond are very highly correlated with price and yield changes for other notes and bonds of a similar maturity and coupon rate. Amihud, Mendelson, and Lauterbach [1997] present evidence on the existence of liquidity spillovers across securities with highly correlated returns.) Thus, there may not be any simple relationship between the cost of liquidity for a particular Treasury security and the volume of trading in the security.

12. In 1996, the Secretary of the Treasury remarked, "the Treasury Department has through its history focused on the most cost-effective ways to finance the federal debt" (*Treasury News* 1996). The Assistant Secretary for Financial Markets recently characterized "lowest cost financing" as one of the three main goals of Treasury debt management (Sachs 1999). (He described the other two as ensuring that adequate cash balances are available at all times and promoting efficient capital markets.)

13. The Assistant Secretary for Financial Markets recently described "financing across the yield curve" as one of five principles of Treasury debt management, observing that "a balanced maturity structure enables us to appeal to the broadest range of investors and mitigates refunding risks" (Sachs 1999). (The other four principles are maintenance of the credit-risk-free status of Treasury debt, predictable issuance schedules, maintenance of market liquidity, and unitary financing of all federal government programs.)

The sensitivity of the Treasury Department to the effect of its debt management program on the shape of the yield curve is illustrated by the May 1993 statement of the Acting Assistant Secretary for Domestic Finance that the shift to greater issuance of securities with maturities of less than three years, the elimination of the seven-year note, and the change from quarterly to semiannual issuance of thirty-year bonds "wasn't intended to manipulate long-term interest rates" (*Wall Street Journal* 1993).

14. Fleming (2000) discusses the benchmark role of Treasury debt. See also *Wall Street Journal* (1999a), which describes changes in market practices that followed the appearance of a substantial liquidity premium in on-the-run Treasury securities in the fall of 1998.

15. The *net* effect of the passage of time (after an issue is no longer on the run) on the liquidity of intermediate- and long-term securities is unclear. We are unaware of any empirical assessment of the liquidity of, say, a note that has been outstanding for eight years but has only two years remaining to maturity relative to the liquidity of a note that has been outstanding for only two years but has eight years remaining to maturity.

16. In deciding to cancel the twenty-year bond, the Treasury Department concluded that "it would be more cost-effective for the Treasury to issue larger amounts of ten- and thirty-year securities rather than twenty-year issues" (Federal Reserve Bank of New York 1986; *Wall Street Journal* 1986). The Treasury yield curve had exhibited a persistent hump between the ten-year sector and the thirty-year sector, and the Treasury decided it should stop paying the higher interest rates required to issue near the hump. One market

Note 16 continued
participant also commented that "the twenty-year issue seemed to be a bond without a natural home," and that it was "too long for investors who sought to reduce the risk of falling prices when interest rates rise, but too short for other investors and speculators who want to earn the highest possible profits by correctly guessing changes in interest rates" (*New York Times* 1986).

17. The four-year note was canceled when the Treasury decided to reduce its reliance on bills and increase its use of intermediate-term debt. Contemporaneously, the Treasury moved the more popular five-year note cycle from quarterly to monthly (*Treasury News* 1990).

18. Before 1993, the yield curve had not inverted significantly for any material length of time since the early 1980s. The Treasury Department canceled the seven-year note after concluding that it could realize long-term savings by shifting to short-term issues (*Wall Street Journal* 1993; *New York Times* 1993). In 1996, the Secretary of the Treasury observed that the decision to cancel the seven-year note cycle "was initially looked on with some skepticism, but . . . since has won considerable praise and is saving the taxpayers $7 billion" (*Treasury News* 1996).

19. In May 1998, the Treasury reduced the frequency of issuing five-year notes for reasons noted in the text at endnote 30.

20. Premium pricing of bills deliverable on a futures contract or maturing at the end of a calendar period or immediately before a tax payment date is discussed in Garbade (1985b), Simpson and Ireland (1985), Park and Reinganum (1986), and Ogden (1987). See also *New York Times* (1999a), which describes unusually strong demand for bills maturing after the end of 1999.

In the course of the 1979 Treasury Department/Federal Reserve study of futures contracts on Treasury securities, the Commodities Futures Trading Commission and officers of commodity exchanges that sponsored trading in futures contracts on Treasury securities asked, "why, in situations where a potential shortage of deliverable supply against a futures contract [on three-month bills] appeared to be creating a strong demand for the part of this supply that was about to be offered in a cash auction, would the Treasury not want to expand the size of the auction and take advantage of what would likely be a relatively low borrowing cost?" (U.S. Department of the Treasury and Federal Reserve System 1979, vol. 2, pp. 83-4). For reasons discussed in the study (vol. 2, pp. 84-91), the study concluded that "having the Treasury . . . act directly to modify potential squeezes on the deliverable supply of three-month bills . . . through a Treasury increase in the size of the new bill auction . . . is not acceptable. While there may be occasions when the Treasury should add to the share of its marketable debt represented by three-month bills, such actions ought to be taken only as needed to implement the Treasury's general debt management objectives; they should not be initiated to help resolve the particular needs of the commodity exchanges" (U.S. Department of the Treasury and Federal Reserve System 1979, vol. 1, p. 26).

21. However, the Treasury Department has reacted to unusual market situations at least three times since 1990.

The first time was the reopening of the 6 3/8 percent note of August 15, 2002 (originally issued as a ten-year note in August 1992), in the ten-year note auction in November 1992. In its announcement, the Treasury stated that the reopening was intended to "alleviate an acute, protracted shortage of [the] security" (U.S. Department of the Treasury 1992).

The second time was the offering of a 30-1/4-year bond (the 7 1/2 percent bond of November 15, 2024) in the August 1994 quarterly financing. The four preceding issues of thirty-year bonds had increased the supply of STRIPS maturing in February and August (see Table 1), and the unusual 30-1/4-year maturity was chosen to accommodate market demand for STRIPS maturing in May and November.

The third time was the decision to offer more twenty-six-week bills than thirteen-week bills in the weekly auctions from Monday, March 9, 1998, to Monday, September 14, 1998, as a result of unusually strong foreign central bank demand for twenty-six-week bills. See *Wall Street Journal* (1998a).

22. Simon (1991, 1994).

23. This fifty-two-week bill cycle was adopted in the summer of 1972, when the Treasury switched from the previous practice (adopted in August 1963) of monthly auctions of one-year bills issued at the end of a month and maturing at the end of a month—similar to the current two-year note cycle (*Treasury Bulletin*, July 1963, p. A-1; September 1963, pp. A-4 and A-5; September 1972, p. II).

24. Twenty-six-week bills were first auctioned in December 1958 and, from inception, were fungible with subsequent issues of thirteen-week bills (*Treasury Bulletin*, December 1958, p. A-2; January 1959, p. A-2).

25. The first bill issued under the new procedure was the 359-day bill issued on Tuesday, November 13, 1979, to mature Thursday, November 6, 1980. That bill was issued on a Tuesday to refinance an old fifty-two-week bill maturing on the same date. The last 359-day bill was issued on Tuesday, October 14, 1980—to mature on

Thursday, October 8, 1981—to refinance the last of the fifty-two-week bills with a Tuesday maturity date. The first fifty-two-week bill with a Thursday issuance date as well as a Thursday maturity date was the November 5, 1981, bill issued on November 6, 1980 (*Treasury Bulletin*, June 1980, p. 28; June 1981, p. 33).

In June 1981, the Chicago Mercantile Exchange amended the delivery provisions on its thirteen-week Treasury bill futures contract to provide that, beginning with the contract settling in June 1983, the deliverable bill would be an old fifty-two-week bill with thirteen weeks remaining to maturity (Chicago Mercantile Exchange 1981). The change reduced the likelihood of a squeeze or corner in the bill contract—an issue discussed in U.S. Department of the Treasury and Federal Reserve System (1979, vol. 1, pp. 13-4, and vol. 2, pp. 66-72). See also Commodity Futures Trading Commission (1981, pt. 3, pp. 56-61) for an analysis of Treasury bill prices before the June 1979 settlement of the thirteen-week bill contract on the Chicago Mercantile Exchange.

26. *Treasury Bulletin* (November 1979, p. VII).

27. On one occasion, the Treasury Department reopened a thirty-year bond that was not the most recently issued bond in the series. In the February 1988 quarterly financing, the Treasury reopened the 8 3/4 percent bond of May 15, 2017, that had been issued on May 15, 1987, and that had twenty-nine and one quarter years remaining to maturity. The most recently auctioned thirty-year bond at the time of the February 1988 financing was the 8 7/8 percent bond of August 15, 2017, that had been issued on August 17, 1987, and reissued on November 16, 1987.

28. Notes and bonds issued before July 1984 could not be reopened after that date because of changes in the treatment of market discount and the 30 percent foreign withholding tax mandated by the Tax Reform Act of 1984 (*Treasury News* 1985b). On several occasions—including the auctions of five-year notes in May and November 1988 and in May 1989 and the auction of ten-year notes in August 1991—the Treasury was consequently unable to reopen an old bond in a note auction. To minimize the possibility of confusion, the Treasury announced before each auction that, regardless of auction results, it would not issue the new note with the same coupon rate as the coupon rate on the old bond with the same maturity date. See, for example, U.S. Department of the Treasury (1991), which notes that "if, under Treasury's usual auction procedures, the auction of ten-year notes results in the same interest rate as on the outstanding 8 percent bonds of August 15, 2001, the new notes will be issued with either a 7 7/8 percent or an 8 1/8 percent coupon."

29. *Wall Street Journal* (1998a).

30. The monthly cycle of five-year notes was canceled at the same time.

31. *New York Times* (1998). The Assistant Secretary for Financial Markets observed that the Treasury decided to stop issuing three-year notes because the continuing issues of two-year notes and five-year notes would offer similar investment opportunities, and because the ten-year note and thirty-year bond series "provide a critical service to overall capital markets that would be hard for anybody else to fill." See also *Wall Street Journal* (1998b), which notes that "drastically reducing the . . . amount of [Treasury] securities sold [in a single auction] . . . would likely hurt liquidity in the issues."

32. This characterization is consistent with the recent statement of the Assistant Secretary for Financial Markets that minimizing borrowing costs is one of three goals of Treasury debt management, while maintenance of market liquidity is one of five guiding principles (Sachs 1999).

33. The four issues were the foreign-targeted 11 3/8 percent four-year note of September 30, 1988 (issued October 31, 1984), the foreign-targeted 11 percent five-year note of February 15, 1990 (issued December 3, 1984), the foreign-targeted 9 7/8 percent five-year note of August 15, 1990 (issued June 4, 1985), and the foreign-targeted 8 7/8 percent ten-year note of February 15, 1996 (issued February 18, 1986).

34. Foreign-targeted notes were sold only to United States aliens or foreign branches of United States financial institutions. See, for example, U.S. Department of the Treasury (1984). The notes were intended to appeal to nonresident aliens and foreign corporations that did not care to own Treasury securities in a conventionally registered form.

In announcing the intent of the Treasury to issue inflation-indexed securities, the Secretary of the Treasury cited the potential contribution of the new asset class to reducing the cost of funding the federal debt, and noted the belief of the Department that the securities would be most attractive to individuals saving for their retirement or other long-term purposes (*Treasury News* 1996).

35. The limited liquidity of the foreign-targeted notes was mitigated by the convertibility of each of the notes into a conventional note with the same coupon rate and maturity date. See, for example, U.S. Department of the Treasury (1984). See also Garbade (1985a).

Note 35 continued

Market participants made active use of the conversion option. For example, in February 1986, the Treasury issued $1 billion of the foreign-targeted 8 7/8 percent ten-year note of February 15, 1996, and $7.5 billion of the conventional 8 7/8 percent note maturing on the same date (*Treasury Bulletin*, Spring 1986, p. 28). By March 31, 1986, $217 million of the foreign-targeted note had been converted into the conventional note (*Treasury Bulletin*, Spring 1986, p. 23). By the end of 1986, the outstanding amount of the foreign-targeted note was down to $188 million (*Treasury Bulletin*, Winter 1987, p. 28), and by the end of 1995 the outstanding amount of the foreign-targeted note was only $125 million (*Treasury Bulletin*, March 1996, p. 35).

36. Only $4 billion of foreign-targeted notes was issued, and all of the notes were issued at a time of large budget deficits, so the impact on the liquidity of other Treasury securities was likely mininal. In contrast, more than $97 billion of inflation-indexed securities has been issued through the end of 1999, at a time of significant surpluses and substantial net redemptions of conventional Treasury debt.

37. The first private sector receipt programs included Certificates of Accrual on Treasury Securities (CATS), introduced by Salomon Brothers Inc.; Treasury Investment Growth Receipts (TIGRs), introduced by Merrill Lynch White Weld Capital Markets Group; and Zero Coupon Treasury Obligations, introduced by Lehman Government Securities, Inc. These "private-label" programs were later joined by Treasury Receipts (TRs), a generic, or open, receipt program initially sponsored by Goldman, Sachs & Company and the First Boston Corporation (*New York Times* 1984).

38. *Treasury News* (1985a).

39. The Treasury Department modified its issuance practices to enhance stripping-based auction demand for ten-year notes and thirty-year bonds by issuing the securities with a full first coupon (and positive accrued interest) when the issuance date did not fall on a semiannual anniversary date. The first securities issued with positive accrued interest were the 9 1/2 percent note of November 15, 1995, and the 9 7/8 percent bond of November 15, 2015, sold in the November 1985 quarterly financing. Both securities were issued on November 29, 1985, but both were dated November 15, 1985. The modification was important because the STRIPS program provided that a security could not be stripped if it had an unpaid short or long first coupon. (This restriction delayed stripping a twenty-year bond until the bond paid its first coupon. For example, the 10 3/4 percent bond of August 15, 2005, was issued on July 2, 1985, but did not become eligible for the STRIPS program until a few days after it paid its long first coupon on February 15, 1986.)

To accommodate market demand for long-term STRIPS and further enhance stripping-based demand for new issues of thirty-year bonds, the Treasury also eliminated the call option that had been embedded in those bonds (*Treasury News* 1985a).

40. However, STRIPS proved to be far more liquid than private sector custodial receipts because private sector receipts payable on a common date were fragmented by sponsor and series and because the receipts were not direct obligations of the U.S. government and were not eligible for book-entry accounts at Federal Reserve banks.

41. *Treasury News* (1985c).

42. *Treasury News* (1987). Reconstitution would have been much more difficult in the absence of the provision for fungibility of interest component STRIPS maturing on a common date.

43. Daves and Ehrhardt (1993) examine why interest component STRIPS and principal component STRIPS maturing on the same date trade at different yields.

44. Grieves and Sunner (1999) emphasize the importance of fungibility of STRIPS maturing on a common date for market liquidity.

45. Transaction costs incurred in purchasing and selling STRIPS and coupon-bearing securities prevent arbitrage from keeping the price of a note or bond *exactly* equal to the sum of the prices of its component STRIPS.

46. Fleming (2000) describes the methodology in detail.

47. Duffie (1996), Keane (1996), and Jordan and Jordan (1997) describe and characterize the financing market for specific collateral.

48. It would, therefore, supplement the mid-1998 changes in the management of the System Open Market Account intended to "enhance liquidity in the financing market" (Fisher 1998).

49. Delivery options on futures contracts are discussed in Paul, Kahl, and Tomek (1981, pp. 110-2), Commodity Futures Trading Commission (1981, pp. 98-117), Kilcollin (1982), Garbade and Silber (1983), Gay and Manaster (1984, 1986), Kane and Marcus (1986), Arak and Goodman (1987), Kamara and Siegel (1987), Boyle (1989), and Manaster (1992).

50. The potential contribution of eliminating distinctions among STRIPS maturing on a common date to alleviating squeezes is examined in U.S. Department of the Treasury, Securities and Exchange Commission, and Board of Governors of the Federal Reserve System (1992, pp. B11-B16).

51. A similar issue arises in the context of the Treasury Department's proposal to repurchase off-the-run securities (see endnote 1). To the extent the Treasury elects to repurchase securities with high coupon rates trading at prices in excess of principal value (to maintain issuance of new debt with current coupon rates and prices close to principal value), tax revenues on interest income could decline. However, as with the conversion of high coupon debt into low coupon debt that could result from our proposal, the magnitude of any such effect will depend on the tax brackets of the investors selling the high coupon debt and those of the investors buying the new (current coupon) debt, as well as any offsetting tax revenues derived from capital gains on the sale of the high coupon debt.

52. The Treasury recognized explicitly that fragmentation of trading in interest component STRIPS with identical payment characteristics degrades liquidity and reduces the attractiveness of those STRIPS; in mid-1985, it acted to eliminate that fragmentation. See text at endnote 41.

53. Eliminating seven-year notes also eliminated an odd cycle of notes maturing in the middle of the first month of each quarter.

54. This would be similar to the reopenings described in the text at endnote 28.

55. As noted in endnote 25 and in the text at endnotes 23, 24, and 25, the integration of one-year bills with twenty-six-week and thirteen-week bills was accomplished in two separate steps, in 1972 and in 1979-80.

56. For example, on January 22, 1998, the Treasury could have issued a 104-week bill maturing on January 20, 2000. That bill would have matured midway between the maturity dates of two subsequent issues of fifty-two-week bills: the January 6, 2000, bill (issued on January 7, 1999) and the February 3, 2000, bill (issued on February 4, 1999).

57. See Garbade (1984), Amihud and Mendelson (1991a), and Kamara (1994).

58. The September 30 bill was an end-of-quarter bill as well as an end-of-month bill. Garbade (1985b), Park and Reinganum (1986), and Ogden (1987) discuss the premium pricing of such bills.

59. Left in the simple form described in the above paragraph, the exchange facility would result in an equilibrium whereby the price of any single-payment security would be equal to the average price of a pair of shorter and longer term single-payment securities. If positive amounts of single-payment securities of all maturities remained outstanding, the price of a single-payment security would be a linear function of its time to maturity.

60. The payment to the Treasury is slightly larger for the exchange of the intermediate STRIP for the shorter and longer STRIPS, because the price of a STRIP is a convex function of both its yield and its time to maturity.

61. In the absence of limitations like those prescribed in Table 7, the exchange facility would result in an equilibrium whereby the yield on any single-payment security could not differ from the average of the yields on a pair of shorter and longer term single-payment securities by more than the exchange fee. If positive amounts of single-payment securities of all maturities remained outstanding, the yield on a single-payment security would very nearly be a linear function of its time to maturity. This issue is discussed further in Appendix B.

62. The maximum loss of twice the exchange fee would occur if the dealer sold the intermediate STRIP short at a yield close to the average yield on the shorter and longer STRIPS *plus* the fee, and then liquidated the hedged short position when the yield on the intermediate STRIP was close to the average yield on the shorter and longer STRIPS *minus* the fee. The smaller the difference between (a) the yield at which the intermediate STRIP is sold short and (b) the average yield on the shorter and longer STRIPS, the smaller the maximum loss.

63. Liquidity spillovers are discussed in Amihud, Mendelson, and Lauterbach (1997, pp. 378-80). See also the related analysis in Amihud and Mendelson (1996, pp. 1455-64).

64. *Treasury News* (1985a).

65. See endnote 35 for an example of the use of the exchange option by market participants.

66. The exchange facility may also be analogized to a "tap," or continuing, offering of new securities (in this case, single-payment securities), where payment is made largely with other securities—rather than with cash only.

67. The authors are grateful to Yakov Amihud for suggesting such a trial.

68. Liquidity (and security prices) can also be enhanced by improving the microstructure of a market. See, for example, Amihud, Mendelson, and Lauterbach (1997). Amihud and Mendelson (1996) suggest that an issuer should have a property right to determine the market or markets in which its securities are traded as a way to incentivize the innovation of liquidity-enhancing market microstructures.

69. Calculated as $66.98146 = 100(1+\frac{1}{2}.0597)^{-(13+(115/184))}$, where the obligation has 115 days plus 13 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999 to November 15, 1999.

70. Calculated as $65.08622 = 100(1+\frac{1}{2}.0596)^{-(14+(115/184))}$, where the obligation has 115 days plus 14 full semiannual periods remaining to maturity.

71. Calculated as $66.13553 = 100(1+\frac{1}{2}.0594)^{-(14+(23/181))}$, where the obligation has 23 days plus 14 full semiannual periods remaining to maturity, and where there are 181 days in the semiannual interval from February 15, 1999, to August 15, 1999.

72. Calculated as $65.08622 = 100(1+\frac{1}{2}.0596)^{-(14+(115/184))}$, where the obligation has 115 days plus 13 full semiannual periods remaining to maturity, and where there are 184 days in the semiannual interval from May 15, 1999, to November 15, 1999.

73. Calculated as $62.86808 = 100(1+\frac{1}{2}.0603)^{-(15+(115/184))}$, where the obligation has 115 days plus 15 full semiannual periods remaining to maturity.

74. Calculated as $64.08659 = 100(1+\frac{1}{2}.0597)^{-(15+(23/181))}$, where the obligation has 23 days plus 15 full semiannual periods remaining to maturity, and where there are 181 days in the semiannual interval from February 15, 1999, to August 15, 1999.

75. It can be shown that the magnitude of the range is twice the exchange fee times the square of the number of half-years between the maturities of the shorter and longer STRIPS. For example, if the fee is 2 1/2 basis points and the shorter and longer STRIPS mature two years apart, the magnitude of the range is 80 basis points (80 = 2 times 2 1/2 times 4^2, where two years is equivalent to four half-years).

References

Amihud, Y., and H. Mendelson. 1986. "Asset Pricing and the Bid-Ask Spread." Journal of Financial Economics 17, no. 2: 223-49.

———. 1991a. "Liquidity, Maturity, and the Yields on U.S. Treasury Securities." Journal of Finance 46, no. 4: 1411-25.

———. 1991b. "Liquidity, Asset Prices, and Financial Policy." Financial Analysts Journal 47 (November-December): 56-66.

———. 1996. "A New Approach to the Regulation of Trading across Securities Markets." New York University Law Review 71, no. 6: 1411-66.

Amihud, Y., H. Mendelson, and B. Lauterbach. 1997. "Market Microstructure and Securities Values: Evidence from the Tel Aviv Stock Exchange." Journal of Financial Economics 45, no. 3: 365-90.

Arak, M., and L. Goodman. 1987. "Treasury Bond Futures: Valuing the Delivery Options." Journal of Futures Markets 7 (June): 269-86.

Boudoukh, J., and R. Whitelaw. 1991. "The Benchmark Effect in the Japanese Government Bond Market." Journal of Fixed Income 1 (September): 52-9.

———. 1993. "Liquidity as a Choice Variable: A Lesson from the Japanese Government Bond Market." Review of Financial Studies 6, no. 2: 265-92.

Boyle, P. 1989. "The Quality Option and Timing Option in Futures Contracts." Journal of Finance 44, no. 1: 101-13.

Chicago Mercantile Exchange. 1981. "90-Day U.S. Treasury Bill Amendment Approved by CFTC." Special Executive Report S-848, June 2.

Commodity Futures Trading Commission. 1981. "Report to the Congress in Response to Section 21 of the Commodity Exchange Act, Pub. L. No. 96-276, 96th Cong., 2d Sess. Section 7, 94 Stat. 542 (June 1, 1980)." May 29.

Daves, P., and M. Ehrhardt. 1993. "Liquidity, Reconstitution, and the Value of U.S. Treasury STRIPS." Journal of Finance 48, no. 1: 315-29.

Demsetz, H. 1968. "The Cost of Transacting." Quarterly Journal of Economics 82, no. 1: 33-53.

Duffie, D. 1996. "Special Repo Rates." Journal of Finance 51, no. 2: 493-526.

Elton, E., and T. Green. 1998. "Tax and Liquidity Effects in Pricing Government Bonds." Journal of Finance 53, no. 5: 1533-62.

Federal Reserve Bank of New York. 1986. "Treasury Announces Elimination of Twenty-Year Bond and Consideration of Reduction in Savings Bonds Interest Rate." Circular no. 10,030, May 2.

Fisher, P. 1998. Letter of June 16, 1998, to Primary Dealers from Peter Fisher, Executive Vice President, Federal Reserve Bank of New York.

Fleming, M. 2000. "The Benchmark U.S. Treasury Market: Recent Performance and Possible Alternatives." Federal Reserve Bank of New York Economic Policy Review 6, no. 1: 129-45.

Garbade, K. 1984. "Analyzing the Structure of Treasury Yields: Duration, Coupon, and Liquidity Effects." Topics in Money and Securities Markets. Bankers Trust Company, November. Reprinted in Garbade, K. Fixed Income Analytics. Cambridge: MIT Press, 1996.

———. 1985a. "Foreign-Targeted Treasury Bonds." Topics in Money and Securities Markets. Bankers Trust Company, January. Reprinted as "Foreign-Targeted Treasury Securities" in Fabozzi, F., ed. The Handbook of Treasury Securities. Chicago: Probus Publishing Company, 1987.

———. 1985b. "Treasury Bills with Special Value." Topics in Money and Securities Markets. Bankers Trust Company, December. Reprinted in Garbade, K. Fixed Income Analytics. Cambridge: MIT Press, 1996.

Garbade, K., and I. Rosey. 1977. "Secular Variation in the Spread between Bid and Offer Prices on U.S. Treasury Coupon Issues." Business Economics 12 (September): 45-9.

Garbade, K., and W. Silber. 1976. "Price Dispersion in the Government Securities Market." Journal of Political Economy 84, no. 4 (part 1): 721-40.

———. 1983. "Futures Contracts on Commodities with Multiple Varieties: An Analysis of Premiums and Discounts." Journal of Business 56, no. 3: 249-72.

Gay, G., and S. Manaster. 1984. "The Quality Option Implicit in Futures Contracts." Journal of Financial Economics 13, no. 3: 353-70.

———. 1986. "Implicit Delivery Options and Optimal Delivery Strategies for Financial Futures Contracts." Journal of Financial Economics 16, no. 1: 41-72.

Grieves, R., and M. Sunner. 1999. "Fungible STRIPS for the U.S. Treasury's Inflation-Indexed Securities." Journal of Fixed Income 9 (June): 55-62.

Jordan, B., and S. Jordan. 1997. "Special Repo Rates: An Empirical Analysis." Journal of Finance 52, no. 5: 2051-72.

Kamara, A. 1994. "Liquidity, Taxes, and Short-Term Treasury Yields." Journal of Financial and Quantitative Analysis 29, no. 3: 403-17.

Kamara, A., and A. Siegel. 1987. "Optimal Hedging in Futures Markets with Multiple Delivery Options." Journal of Finance 42, no. 4: 1007-21.

Kane, A., and A. Marcus. 1986. "The Quality Option in the Treasury Bond Futures Market: An Empirical Assessment." Journal of Futures Markets 6 (summer): 231-48.

Keane, F. 1996. "Repo Rate Patterns for New Treasury Notes." Federal Reserve Bank of New York Current Issues in Economics and Finance 2, no. 10.

Kilcollin, T. 1982. "Difference Systems in Financial Futures Markets." Journal of Finance 37, no. 5: 1183-97.

Lippman, S., and J. McCall. 1986. "An Operational Measure of Liquidity." American Economic Review 76, no. 1: 43-55.

Manaster, S. 1992. "Economic Consequences of Delivery Options for Financial Futures Contracts: Analysis and Review." Review of Futures Markets 11, no. 2: 142-60.

New York Times. 1984. "Zero Coupon Selling Revised, Dealers Seek One Receipt." January 10, p. D7.

———. 1986. "U.S. Plans Its Biggest Financing." May 1, p. D1.

———. 1993. "Treasury Maturities Shortened." May 6, p. D1.

———. 1998. "It's Two Steps Back for Short-Term Treasurys." May 7, p. C1.

———. 1999a. "Seeing Signals from Investors on Year 2000: Treasury Bill Auction Shows Concern on Risk." July 27, p. C1.

———. 1999b. "Government Plans to Buy Back Bonds and Save Interest." August 5, p. A1.

Ogden, J. 1987. "The End of the Month as a Preferred Habitat: A Test of Operational Efficiency in the Money Market." Journal of Financial and Quantitative Analysis 22, no. 3: 329-43.

Park, S., and M. Reinganum. 1986. "The Puzzling Price Behavior of Treasury Bills That Mature at the Turn of Calendar Months." Journal of Financial Economics 16, no. 2: 267-83.

Paul, A., K. Kahl, and W. Tomek. 1981. "Performance of Futures Markets: The Case of Potatoes." U.S. Department of Agriculture, Economics and Statistics Service Technical Bulletin no. 1636.

Sachs, L. 1999. Statement of Lee Sachs, Assistant Secretary, Financial Markets, before the House Committee on Ways and Means, Hearing on Treasury's Debt Buyback Proposal. September 29.

Sarig, O., and A. Warga. 1989. "Bond Price Data and Bond Market Liquidity." Journal of Financial and Quantitative Analysis 24, no. 3: 367-78.

Silber, W. 1991. "Discounts on Restricted Stock: The Impact of Illiquidity on Stock Prices." Financial Analysts Journal 47 (July-August): 60-4.

Simon, D. 1991. "Segmentation in the Treasury Bill Market: Evidence from Cash Management Bills." Journal of Financial and Quantitative Analysis 26, no. 1: 97-108.

———. 1994. "Further Evidence on Segmentation in the Treasury Bill Market." Journal of Banking and Finance 18, no. 1: 139-51.

Simpson, W., and T. Ireland. 1985. "The Impact of Financial Futures on the Cash Market for Treasury Bills." Journal of Financial and Quantitative Analysis 20, no. 3: 371-9.

References (Continued)

Stigler, G. 1961. "The Economics of Information." Journal of Political Economy 69, no. 3: 213-25.

Tanner, J., and L. Kochin. 1971. "The Determinants of the Difference between Bid and Ask Prices on Government Bonds." Journal of Business 44, no. 4: 375-9.

Treasury Bulletin. 1958-96. Various issues.

Treasury News. 1985a. "Treasury Announces New STRIPS Program." January 15.

———. 1985b. "Questions and Answers on STRIPS." An addendum to *Treasury News* (1985a), p. 6.

———. 1985c. "Treasury Announces Change to Generic CUSIPs for STRIPS." June 14.

———. 1987. "Treasury Announces Date for Reconstitution of Securities in STRIPS Program." March 31.

———. 1990. "Treasury Announces Change in Regular Quarterly Auction Cycles Beginning in 1991." December 11.

———. 1996. Statement of Treasury Secretary Robert E. Rubin, Inflation-Indexed Bonds Press Conference, May 16.

U.S. Department of the Treasury. 1984. "Foreign-Targeted Treasury Notes of September 30, 1988, Offering Circular, October 10, 1984." Public Debt Series no. 31-84.

———. 1991. "Treasury August Quarterly Financing." Press release, July 31.

———. 1992. "Treasury November Quarterly Financing." Press release, November 3.

U.S. Department of the Treasury and Federal Reserve System. 1979. "Treasury/Federal Reserve Study of Futures Markets." May.

U.S. Department of the Treasury, Securities and Exchange Commission, and Board of Governors of the Federal Reserve System. 1992. "Joint Report on the Government Securities Market." January.

Wall Street Journal. 1986. "Treasury Plans Note, Bond Sale of $27 Billion." May 1, p. 44.

———. 1993. "Treasury Slashes Sales of Long-Term Bonds." May 6, p. C1.

———. 1998a. "U.S. Sets Uneven Split in Coming T-Bill Sale to Maintain Liquidity." March 4, p. C21.

———. 1998b. "Bonds Stay Put as Traders Wait for Jobs Report; Fannie Mae to Offer Additional Benchmark Bonds." May 5, p. C25.

———. 1999a. "Quirk in Yields Is Making Bonds More Attractive." February 2, p. C1.

———. 1999b. "U.S. May Buy Back Bonds to Trim Debt." August 5, p. A2.

Warga, A. 1992. "Bond Returns, Liquidity, and Missing Data." Journal of Financial and Quantitative Analysis 27, no. 4: 605-17.

Vaughn O'Regan

Commentary

Over the years, I have been involved with issues related to the Canadian government's debt management activities and the functioning of capital markets in Canada. Recently, as in the United States, a key issue has been the repercussions of much smaller government borrowing requirements. The Canadian government moved into a fiscal surplus situation three years ago. As we like to point out, this was a year before the United States did.

The focus of this conference is on the implications of a rather substantial pay-down of U.S. Treasury debt over the coming years. In Canada at this time, further pay-down of government debt is part of discussions on how to make use of the improved fiscal situation, but so are tax cuts and reinstated spending in such areas as health and education.

However, regardless of what happens going forward, there already has been a significant change in Canadian debt markets as a result of shifts in government borrowings. The most dramatic impact has been on the treasury bill market, where the outstanding supply has been cut sharply. This has reflected not only the swing from a sizable federal government deficit to a surplus, but also a move to reduce the government's exposure to interest rate changes by substituting bond borrowings for bills. This substitution has limited the reduction in the supply of Government of Canada bonds to a modest amount, at least so far.

Of interest, the decline in trading volumes in both the bill and bond markets is greater than the decline in outstandings. In other words, the rate at which the supply is turning over is down. Turnover ratios had increased through the mid-1990s, but now have returned to the levels of earlier in the decade. Presumably, this reflects the more stable role of "buy-and-hold" investors, compared with trading accounts, and the proportionately lower trading volumes by distributors of new issues when handling smaller offerings.

I will return to the Canadian situation later, as I expect this is where I can most add value to these discussions. In the meantime, I will make some comments on the paper by Paul Bennett, Kenneth Garbade, and John Kambhu. Given my background, I will defer to the experts on the technical workings of the New York debt market and limit my comments to a general nature.

In the preamble to the specific proposals in the paper, I found the discussion of liquidity and Treasury debt management objectives to be quite useful. Several of the issues covered in this section are very familiar to me from discussions of the Canadian situation. While the authors cite three goals and a number of principles used by the U.S. Treasury Department for its debt management, it seems to me that this list could be boiled down to: 1) minimizing borrowing costs and 2) enhancing the workings of the capital market. And since liquid markets help to achieve both of these objectives, steps to improve liquidity are certainly worth serious consideration.

The proposal to reduce the fragmentation of the market for STRIPS is similar to one that we are now considering in

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Canada. We have assured ourselves, after reviewing the authority under which our federal government borrows, that there is no legal impediment to the creation of an issue in excess of the original principal amount; I assume that this is also the case for U.S. Treasury issues.

I would agree with the authors that there is considerable merit to their STRIPS proposal. However, they should note that there are trade-offs involved: some issues will lose liquidity while others (and the overall market) will gain as a result of stepped up stripping and reconstitution activity. That is, irregularities will be dispersed over the market but not eliminated. Also, the placing of a cap on the amount that can be reconstituted can be a source of uncertainty for market participants, in that the gathering of relevant pieces for reconstitution could prove fruitless if it was later discovered that the limit had been reached. To ease these concerns and to provide as transparent a marketplace as possible, a means should be provided for making available on a regular basis information on the amounts of debt pieces outstanding.

As for the proposal to alter the two-year note issues, I see the more natural choice as integrating these issues with the rest of the note and bond programs. A shift to a 104-week bill would introduce a zero-coupon instrument providing no cash flow for two years—an instrument that may not be accepted by a segment of the conventional bill and note markets. For this reason, I would think that this proposition has some risk attached. Also, there is the risk that transferring supply from the note market to the bill market would further widen the liquidity gap that now exists between the two markets.

It is at this gap that the "more adventurous" proposal in the paper is aimed. As an outsider, I clearly am in no position to pass comments on the particular workings of the U.S. market. The proposal assumes that the Treasury is able and prepared to issue and cancel debt expeditiously and that it will accept a shuffling, from one month to another, of refunding requirements. It assumes as well that investors will accept cancelations of pieces of issues that they hold (which has a somewhat different meaning than investors accepting that stripping and reconstitution can affect their holdings).

As a summary comment, I see value in seeking ways to enhance liquidity in a market that is no longer receiving as much new supply. However—and I sense that this may be the case with the paper by Bennett, Garbade, and Kambhu—there can be excessive expectations as to what can be accomplished with technical adjustments. Enhanced stripping and reconstitution possibilities will provide more overall liquidity and will help ease "squeeze" situations, but this can also leave the market with more "loose ends." The exchange proposal would establish more uniform pricing with the market and would help dealers to accommodate transactions, but trading volumes and bid-ask spreads would still not be uniform.

There are, and presumably will continue to be, underlying reasons why anomalies exist even in very sophisticated markets with large numbers of arbitrage players. In the case of the Treasury market, I assume that a major influence can be the number of buy-and-hold investors, who have requirements for a specific issue to match flows or offset liabilities, or who are governed by legislation or guidelines to hold Treasuries, or who simply are risk-averse and are comfortable only with top creditworthiness. These are not investors who will move for a few basis points, and their role vis-à-vis that of opportunistic players will affect market liquidity. The authors do not discuss this underlying situation, perhaps because it is addressed in references and taken as understood.

I will finish with a return to the Canadian situation, making three comments:

1. For some time, the Canadian government has favored the reopening of existing bond issues whenever possible. As a result, the market does not have the same number of different "pieces" as the U.S. Treasury market does, and the reconstitution potential is not as large. Therefore, while a proposal is being examined to allow for full fungibility of interest and principal STRIPS, the potential benefits seem more marginal for the Canadian market.
2. The Canadian government, through the Bank of Canada, has been running a bond buyback program for a year. Off-the-run bonds have been purchased around the time of new issues on six occasions so far. Payment for these bonds has been covered by a larger amount of new issue offerings than would otherwise be the case. The primary goal has been to maintain benchmark issuance size. Of note, with this substitution of benchmarks for off-the-run issues, the spread between the two has not changed much, presumably reflecting the overall spread environment of the past year.
3. While the turnover in Government of Canada debt has fallen recently, in Canada there has been a pick-up in activity in asset-backed securities, futures markets, and, to a degree, in the corporate market. This pick-up in activity does suggest that other markets will fill at least some of the void created by diminished government borrowings.

Charles H. Parkhurst

Commentary

One important issue that has not been discussed today concerns the mechanisms and goals of enhanced liquidity in the Treasury market. In particular, can enhanced liquidity have spillover effects in all fixed-income markets? Market participants who trade U.S. Treasuries will feel more comfortable venturing out into other markets, which will improve market liquidity. So the ramifications are not just for the Treasury market, but for all fixed-income markets. I think this is an important point that we need to highlight.

The paper by Paul Bennett, Kenneth Garbade, and John Kambhu has made a number of interesting findings. In addition to discussing this paper, I want to talk more generally about the role of the U.S. Treasury market as I see it from the dealer community.

The first issue I would like to focus on is STRIPS fungibility. Here, I have a couple of points to make. First, when one considers the size of the ten-year note and its current reopened form, at about $22 billion, one realizes that the marginal supply of new ten-year notes would be relatively small. As a result, reopening the ten-year note is not going to add appreciably to the supply of the rich, liquid benchmark. Unfortunately, as I will argue, at the same time there would be a negative ramification—given the Treasury's current penchant for conducting reopenings, as opposed to having a regularly scheduled new issue every quarter—that could create distortions in the yield curve. Second, as was touched upon earlier, the whole reconstitution-fungibility issue would make the total size of an outstanding issue uncertain at any given time. An unstable level of an outstanding size of an issue could potentially hurt liquidity.

I want to address this first point in some detail. Currently, the ten-year note matures in August 2009. The Treasury, in its most recent refunding auction, chose to reopen the August ten-year issue instead of issuing a security maturing in November 2009. Presumably, the Treasury plans to issue a new ten-year security in February 2000 that would mature in 2010. So what you have is holders of the August 2009 and February 2010 STRIPS feeling very comfortable that they can effectively tap into the liquidity of the ten-year sector through a reconstitution. Even if they do not conduct the reconstitution themselves, they know others can do it. The holder of a November 2009 STRIP, by comparison, has no such luck, since there will be no outstanding principal payment in the market. It is reasonable to say that a November 2009 coupon STRIP would trade 25 to 35 basis points cheaper than the two issues around it, creating a distortion in the yield curve. I do not believe that this is what the authors, or anyone else, have in mind when they propose these strategies.

I would like to digress a little bit here because, in terms of the fungibility issue, one thing that struck me as a very obvious mechanism that could greatly enhance overall market liquidity would be to make all bonds strippable. I believe that all bonds issued after 1984 are currently eligible to be stripped. As result, you have a whole crop of bonds, particularly high-coupon

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bonds, that perpetually trade cheap because they are not strippable. These bonds, which mature between 2002 and 2014, are liquidity-impaired because they cannot be stripped. Making them strippable would truly enhance the overall liquidity of the market because it would create a fresh supply of coupon STRIPS, which in turn would actually facilitate the reconstitution process.

As a final point on this topic, it struck me while considering the fungibility of coupon and principal STRIPS that there is a whole class of securities in the marketplace created by the dealer community during the 1982-85 period. I am referring specifically to CATS, TRs, and TIGRs. Believe it or not, these securities are still traded on the Street, but I can tell you without equivocation that they have traded with very poor liquidity, especially after the 1998 crisis. However, these financial instruments are Treasury obligations pure and simple. Like other Treasury obligations, they are AAA-rated. Furthermore, three or four years ago, the creators of CATS and TIGRs—like Salomon Brothers and Merrill Lynch—decided to change their agreements with the custodian banks to allow for, effectively, fungibility across the instruments. One could argue that making coupon STRIPS fungible with like-maturity CATS, TRs, and TIGRs would have a positive impact on Treasury liquidity. The ability to interchange these financial instruments would greatly enhance the overall liquidity of the market as well.

With regard to the two-year issue, I have just a few comments. I do not see the appeal of putting the two-year note at a mid-quarter funding (that is, mid-quarter of maturity date). From a stripping standpoint, there would be no demand for a STRIP of a recently auctioned security. Furthermore, there are plenty of old five-year notes, ten-year notes, and thirty-year bonds that have rolled down into the front end of the yield curve that would trade cheaper and would be eligible for stripping. I do believe, however, that the 104-week bill concept does have some merit for the reasons mentioned by the authors: enhancing liquidity and potentially providing the Treasury with better funding. Certainly, in conjunction with any kind of exchange facility, it is very clear to see the appeal there.

I would also like to discuss the exchange program. When Bennett, Garbade, and Kambhu talk about micro exchanges, it is my impression that what they actually are referring to on this micro level is the buyback proposal that the Treasury has talked about on a macro level. Considering the dramatic yield differences that exist in the market today, issuing ten-year and thirty-year securities and buying back twenty-year bonds is not very different from what the authors have talked about. In some sense, the Treasury already is thinking along those lines.

However, one very large problem with the program is that I do not see the Treasury willing to carry assets on its books that it is not issuing. The Treasury does not issue STRIPS. Instead, it issues coupon-bearing bonds that the Street then strips. I do not believe that the Treasury will want to have a liability that looks like a STRIP. One possible way around the premium accounting issue associated with buybacks would be for the Treasury to purchase debt in the market and, instead of retiring it, to place it in the Social Security trust fund.

In reading the exchange proposal, I found the 2.5 basis points to be a very modest amount for the Treasury to consider capturing. Frankly, if the Treasury was going to do something like that, I would recommend a significantly wider band because 2.5 basis points is too small an amount to induce the Treasury to get excited—particularly considering the fact that existing assets issued several years back, which effectively have a Treasury guarantee, do not trade 2.5 basis points cheap to the curve. Instead, these assets trade anywhere from 15 to 25 basis points cheap. Here, I am referring to Refcorps. Refcorps were issued around 1989 as second-generation savings and loan bailout bonds. The bonds carry a Treasury guarantee and trade significantly cheaper today than they did a year ago. The liquidity crisis of 1998 hurt Refcorps. Thus, if the Treasury wanted to consider "arbitraging" cheap securities effectively, I do not think that a spread of 2.5 basis points is anything to get excited over—especially since there are other significant opportunities in these markets that could save a lot of money for the Treasury and enhance liquidity at the same time.

I also want to turn to some of the comments made by Under Secretary Gary Gensler and other discussants. Despite rumors to the contrary, the Treasury market is still the benchmark market of fixed-income markets. It is where market participants go to hedge interest rate risks, whether for on-the-run Treasuries or futures contracts. I believe that this is not going to change tomorrow or in the near future. The steady supply of on-the-run securities, as has been alluded to, will assure the continuation of that status. Frankly, the benchmark status, which Gensler said may eventually move away from the Treasury market, has been beneficial to taxpayers and bondholders.

In addition, I would like to address the unique role that the thirty-year bond plays in the market. There are really three separate premiums, if you will, associated with issuance of benchmark securities: the repo premium, the liquidity premium, and the sector premium. I will focus on the ten-year and thirty-year sectors first. The repo premium is related to the fact that Treasuries trade tight in the repo market after they have been issued. In some cases, this premium can last up to a year and a half, especially for long-term securities such as ten-year notes and thirty-year bonds. Hence, the Treasury issues those

securities at a significantly lower yield than it would otherwise; this benefit to the Treasury comes to about 20 basis points in the ten-year sector and about 15 basis points in the thirty-year sector. The liquidity premiums are approximately 5 basis points. This means that because these benchmarks have better liquidity, people are willing to accept a lower yield, which is worth around 5 basis points.

The sector premium is a premium that typically is not talked about or recognized. This premium is particularly important in the ten-year and thirty-year sectors. In 1986, the Treasury discontinued the auctioning of twenty-year securities because it correctly recognized that the demand for this maturity was no longer there. The demand for ten-year issues exists primarily because a lot of foreign markets do not issue beyond the ten-year maturity. As a result, over the years ten-year securities have served as the benchmark for many international investors. By comparison, the demand for thirty-year bonds is there for long-duration players, who typically have long-duration liabilities. Moreover, the scarcity of comparable-maturity thirty-year paper, particularly of high quality, has also enhanced the demand for thirty-year bonds relative to that for twenty-year securities. Indeed, there truly are three separate premiums associated with Treasury securities. If the Treasury decides to reduce issuance in the ten-year or thirty-year sectors or to allow some other mechanism to replace the current Treasury benchmarking, it will effectively result in a large loss to taxpayers.

I would also like to point out the fact that the Treasury not only issues bills, notes, and bonds in conventional forms, but it also issues inflation-linked notes and SLUGS (that is, special State and Local Government Securities). I am not going to dwell much on the inflation-linked program. However, I would like to say that the premiums that I just mentioned, which exist for the ten-year and thirty-year sectors, are absent in inflation-linked notes. It is therefore a very inefficient way for the government to raise money, particularly in an era in which the government does not actually need it. Furthermore, SLUGS, which are issued essentially on a tap basis for deficit-financing programs, once again are priced a little bit like Treasuries but nothing like the on-the-run Treasury securities. So one could argue that perhaps the Treasury should discontinue those programs.

Finally, I want to talk briefly about the thirty-year sector because I think it is very important. I have already noted the scarcity of long-duration high-quality assets. If investors lend you money for a long period of time, they generally want to know that you are going to be around for a while. Clearly, the Treasury plays a special role as an institution free of credit risk. This is particularly true in the STRIPS market. Consider the cycle of a security that does not get stripped in the first couple of years. As the security ages, it cheapens up and tends to get stripped when it is about twenty-five to twenty-seven years old because of the demand for long-duration assets. By the time the security rolls up the yield curve into the twenty-year sector, it typically starts getting reconstituted because people no longer need that duration; rather, they prefer to be further out on the curve. There is a natural inversion on the long end of the curve, and the thirty-year issue effectively takes advantage of it and the value accrues to the Treasury and the taxpayer.

Another point that I want to stress is that bond futures are really the biggest source of market liquidity, possibly aside from on-the-run securities. Any interruptions of the supply of thirty-year bonds potentially hampers the liquidity in the bond futures market, which may not be good for anyone involved in the fixed-income markets.

Perhaps as a cautionary tale we should look at the yield curve in the United Kingdom. There, the curve is very distorted relative to that of other European countries. One reason for this distortion is a real supply-demand imbalance in the long end of the curve because of recent pension law changes and requirements that have led to a dearth of supply. To be honest, I do not think that we would ever get to that extreme, with the absence of the Treasuries supply, but I believe that the U.K. experience could serve as a warning and illustrate the important role of the Treasury market. As an aside, the agency issues obviously are trying to usurp the Treasury issues' role as the benchmark. However, the agencies are not equipped to issue in the thirty-year sector because they do not have assets with durations approaching that of a thirty-year security. One might say that the agencies currently are being opportunistic in issuing thirty-year bonds. It is not clear whether they would actually continue to issue these securities over the long haul. Thus, from my perspective, the Treasury has a unique role to play.

In closing, I think that many of the ideas discussed here have a lot of merit. Perhaps with some tweaking and some enhancements, one could significantly increase or maximize the liquidity of the Treasury market. Maximizing liquidity in the Treasury market is coincident with minimizing the Treasury's long-term interest expense. I think it is in everyone's best interest to achieve that goal.

Session 4

Paper by

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Commentaries by

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The Benchmark U.S. Treasury Market: Recent Performance and Possible Alternatives

The U.S. Treasury securities market is a benchmark. As obligations of the U.S. government, Treasury securities are considered to be free of default risk. The market is therefore a benchmark for risk-free interest rates, which are used to forecast economic developments and to analyze securities in other markets that contain default risk. The Treasury market is also large and liquid, with active repurchase agreement (repo) and futures markets. These features make it a popular benchmark for pricing other fixed-income securities and for hedging positions taken in other markets.

The Treasury market's benchmark status, however, is now being called into question by the nation's improved fiscal situation. The U.S. government has run a budget surplus over the past two years, and surpluses are expected to continue (and to continue growing) for years. The debt held by the public is projected to fall accordingly and, under reasonable assumptions, much of the outstanding debt could be paid back within the next decade. The declining stock of debt may impact Treasury market liquidity and efficiency, thereby making Treasuries a less useful benchmark of risk-free interest rates as well as a less useful benchmark for pricing and hedging other fixed-income securities.

Moreover, recent market events have heightened concerns about the Treasury market's benchmark role and provided insight into how the market may perform in the future. For instance, yield spreads between Treasuries and other fixed-income securities widened sharply amid the financial markets crisis in the fall of 1998 in a so-called "flight to quality." A related "flight to liquidity" also caused yield spreads among Treasury securities of varying liquidity to widen sharply. Consequently, some of the attributes that make the Treasury market an attractive benchmark were adversely affected.

This paper examines the benchmark role of the U.S. Treasury market and the features that make it an attractive benchmark. In it, I examine the market's recent performance, including yield changes relative to other fixed-income markets, changes in liquidity, repo market developments, and the aforementioned flight to liquidity. I show that several of the attributes that make the U.S. Treasury market a useful benchmark were negatively affected by the events of fall 1998, and that some of these attributes did not quickly return to their precrisis levels. Furthermore, I demonstrate that the agency debt, corporate debt, and interest-rate swaps markets have features that might make them attractive benchmarks, and that the agency debt and swaps markets in particular are already assuming a limited benchmark role.

The Benchmark U.S. Treasury Market

A number of features contribute to the U.S. Treasury market's role as a benchmark. Treasuries are backed by the full faith and

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credit of the U.S. government and are therefore considered to be free of default risk.[1] Issuance to pay off maturing debt and raise needed cash has created a stock of Treasuries held by the public that totaled $3.6 trillion on September 30, 1999. The creditworthiness and supply of Treasury securities have resulted in a highly liquid round-the-clock secondary market with high levels of trading activity and narrow bid-ask spreads. Treasuries trade in an extremely active repo market in which market participants can borrow securities and finance their positions, as well as in an active futures market in which market participants can buy and sell securities for future delivery.

As Treasuries are considered to be free of default risk, yields on these securities represent risk-free rates of return. These risk-free rates are used in a variety of analytical applications to forecast interest rates, inflation, and economic activity. The rates are also used as benchmarks in the analysis and monitoring of other fixed-income and non–fixed-income securities. The performance of corporate bonds, for example, is often examined relative to that of Treasury securities, as the comparison allows one to separate yield changes due to changes in the risk-free rate from yield changes due to changes in credit risk (or due to the pricing of such credit risk).

Treasury securities are also used extensively for pricing securities and hedging positions in other U.S. dollar fixed-income markets. When a fixed-rate corporate debt issue is initially sold, for example, it is typically marketed in terms of a yield spread to a particular Treasury security rather than at an absolute yield or price.[2] Similarly, a position taken in a corporate debt issue is frequently hedged in the Treasury market. The ability to hedge in the Treasury market increases dealers' willingness to make markets and take positions in other markets, and thereby improves the liquidity of these other markets.

While the creditworthiness of Treasury securities is critical to their use as benchmark risk-free rates, the liquidity and efficiency of the market are also important. A highly liquid Treasury market ensures that observed Treasury prices are close to the market consensus of where prices should be and that changes in prices reflect revisions in the market consensus. An efficient market ensures that the risk-free rates implied by Treasury yields closely reflect the market's views of risk-free rates and that prices are no more than minimally affected by issue-specific differences in liquidity, supply, or demand.

When one evaluates the Treasury market's use as a benchmark for pricing and hedging purposes, features such as relative market performance, well-developed repo and futures markets, and liquidity are important. To be a good pricing or hedging vehicle, Treasury prices should be highly correlated with prices in other markets. A loss in a dealer's long position in mortgage-backed securities, for example, could then be offset by a dealer's short position in Treasuries. Hedges frequently involve taking short positions, so the ability to borrow Treasury securities at a low cost in the repo market is important. (The futures market can also be used to take short positions.) Finally, Treasury market liquidity is important, as hedgers must be able to buy and sell large Treasury positions quickly with minimal transaction costs.

Features of the Treasury market that make it a good benchmark thus depend on how one uses the market as a benchmark. Creditworthiness, liquidity, and efficiency are important as a reference benchmark for risk-free rates, but relative market performance is not important and active repo and futures markets are important only so far as they benefit liquidity. Relative market performance, active repo and futures markets, and liquidity are important as a pricing and hedging benchmark, but creditworthiness and efficiency are important only so far as they influence liquidity and relative market performance.

The Shrinking Public Debt

As noted, the benchmark status of the U.S. Treasury market is being called into question by the country's improved fiscal situation. In fiscal year 1999, U.S. government revenues exceeded outlays by $123 billion, resulting in the first consecutive budget surpluses since 1956-57. As of July 1999, the U.S. Congressional Budget Office (1999), or CBO, was projecting growing budget surpluses for the next ten years (under existing laws and policies), rising from $161 billion in fiscal year 2000 to $413 billion in fiscal year 2009 (including Social Security trust funds).

The budget surpluses are reducing the stock of Treasury debt outstanding. Debt held by the public stood at $3.6 trillion on September 30, 1999, down from its peak of $3.8 trillion a year and a half earlier.[3] As of July 1999, the CBO was projecting that such debt would continue to fall over the next ten years, to $0.9 trillion at the end of fiscal year 2009. As a percentage of GDP, debt held by the public was projected to fall from 40.9 percent in 1999 to 6.4 percent in 2009.

The U.S. Treasury Department initially responded to its decreased funding needs by cutting issue sizes. In particular, bill sizes were cut sharply in March 1997 such that three-month bill sizes, for example, fell from the $11-$14 billion range to the $6.0-$8.5 billion range (excluding amounts issued to Federal Reserve Banks).

To continue to ensure large, liquid issues, the Treasury announced in May 1998 that it would limit further contraction of bill sizes and concentrate coupon offerings around larger, less frequent issues.[4] The Treasury thus reduced issuance of the five-year note from monthly to quarterly and eliminated issuance of the three-year note altogether. In August 1999, the Treasury announced that is was reducing the issuance frequency of the thirty-year bond from three times a year to twice a year and that it was considering reducing the issuance frequency of one-year bills and two-year notes.

To maintain large auction sizes and the liquidity of the most recent (on-the-run) issues, the Treasury proposed a debt buyback program in August 1999 and announced a revision to the original issue discount (OID) rules in November 1999. Under the buyback program, launched in January 2000, the Treasury will redeem outstanding unmatured Treasury securities by purchasing them from their current owners.[5] Changes to the OID rules allow the Treasury to reopen its most recent issues within one year of issuance without concern that the price of the issues may have fallen by more than a small amount.

Changes in policy or economic conditions may forestall a considerable shrinkage of the Treasury debt. Even if the market does shrink substantially, the Treasury Department's efforts to maintain large and liquid issues may stave off significant market repercussions. Nonetheless, the improved fiscal situation advances the possibility that the Treasury market will shrink considerably and that issuance sizes and/or frequencies will have to be reduced further.[6]

Reduced debt outstanding and reduced issuance sizes and/or frequencies would likely impact several Treasury market attributes. The market would likely become less liquid, with wider bid-ask spreads, reduced depth, and less trading activity. Reduced issuance sizes and/or frequencies would likely decrease the supply of lendable securities and thereby drive up the cost of borrowing issues in the repo market. Issue-specific differences in liquidity would probably become more important in determining prices. In turn, Treasuries might perform more disparately from other fixed-income securities.

Persistent fiscal surpluses could thereby make the Treasury market a less attractive benchmark. While Treasuries will remain free of default risk, the reduced market liquidity and efficiency would decrease their usefulness as risk-free benchmarks. Greater costs of borrowing securities in the repo market combined with reduced liquidity and increasingly disparate performance would make Treasuries less desirable benchmarks for pricing securities or hedging positions in other markets.

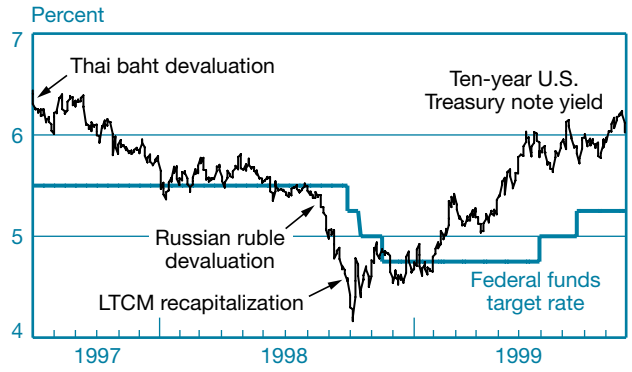
The Recent Performance of the Benchmark U.S. Treasury Market

Recent financial market events have heightened concerns about the U.S. Treasury market's benchmark role and have provided direction as to how the market may perform in the future. In the fall of 1998, global financial market turmoil spurred investors to seek the safety of U.S. Treasury securities, driving prices up and yields down. As shown in Chart 1, the yield on the ten-year U.S. Treasury note dropped 125 basis points, to 4.16 percent, between August 19, 1998, and October 5, 1998. While this paper does not explain the events behind the financial crisis, a few notable events are included in the chart as reference points.[7]

One aspect of the financial crisis was a flight to quality in which yield spreads widened sharply between Treasuries and other fixed-income securities. Another aspect was a reduction in market liquidity, as an aversion to risk-taking decreased dealers' willingness to take positions and make markets. An increased cost of borrowing securities in the repo market also resulted from the financial crisis as did a sharp widening in yields between more and less actively traded Treasury securities.

This paper's analysis of these disruptions demonstrates why the benchmark topic is receiving increased attention and, more importantly, clarifies the market attributes that should be examined when evaluating alternative benchmarks. It also provides insight into how the Treasury market may perform if the outstanding debt starts declining more quickly, although it does not attribute the market's recent performance to the

Chart 1
Ten-Year U.S. Treasury Note Yield and Federal Funds Target Rate



Source: Bloomberg.

Note: LTCM is Long-Term Capital Management.

improved fiscal situation. Moreover, the analysis does not rate the Treasury market's performance as a benchmark, but rather illustrates the growing prominence of the benchmark topic and the features that are important to a benchmark market.

Relative Market Performance

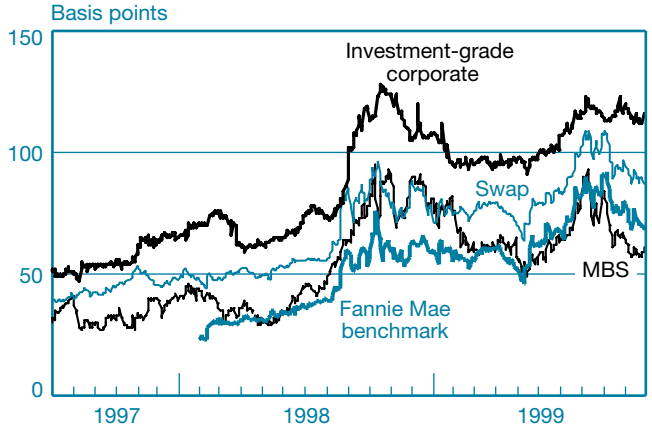
The performance of Treasuries and other fixed-income securities diverged sharply in the fall of 1998. Investors sought the safety of risk-free Treasuries at the expense of securities with credit risk in the so-called flight to quality, driving a wedge between their performance. Chart 2 shows that yield spreads of various fixed-income securities over Treasuries widened between mid-August and mid-October 1998, and remained fairly wide afterward. The yield spread between investment-grade corporate debt securities and Treasuries, for example, widened from 74 basis points on August 13, 1998, to 128 basis points on October 19, 1998. It was 116 basis points on October 31, 1999.

The widening of the spread in the fall of 1998 is not unprecedented. Credit spreads often rise during or preceding a recession, and they were quite high in the early 1980s, for example. One of the attractive features of Treasury securities is their absence of default risk. This means that Treasury yield changes do not reflect changes in credit risk, by definition, and that Treasuries are inherently limited in their ability to serve as good hedges of fixed-income securities that contain credit risk.

Despite the widening of the spread, there does not seem to have been a fundamental shift in the relationship between Treasury yield changes and other fixed-income yield changes. An analysis of weekly yield changes shows that Treasuries remained highly correlated with other fixed-income securities during the height of the financial crisis (Table 1). The correlation between ten-year Treasury yield changes and investment-grade corporate yield changes, for example, fell only slightly—from 0.975 before the crisis to 0.965 during the crisis and to 0.963 after the crisis.[8, 9]

The disparate performance of Treasury securities and other fixed-income securities raises questions about the attractiveness of Treasuries as hedging vehicles. Those who shorted Treasuries as a hedge preceding the widening of the spread in the fall of 1998 found that their losses on Treasuries more than offset any gains they may have had on their long positions. Nonetheless, the widening of the spread was not unprecedented, and Treasury yield changes maintained a high correlation with other fixed-income yield changes.

CHART 2
Yield Spreads to the Ten-Year U.S. Treasury Note



Sources: Bloomberg; Goldman Sachs; Merrill Lynch.

Notes: The investment-grade corporate yield is the industrials ten-year A2/A yield from Bloomberg. The swap rate is the ten-year semiannual fixed rate versus three-month LIBOR compiled by Bloomberg from various sources. The mortgage-backed security (MBS) yield is a weighted-average, option-adjusted yield calculated by Goldman Sachs. The Fannie Mae benchmark yield is the on-the-run ten-year benchmark note yield from Merrill Lynch, via Bloomberg.

Market Liquidity

While the Treasury market was seen as a safe and liquid haven for investors in fall 1998, its liquidity was adversely affected nonetheless. One measure of liquidity is the bid-ask spread, or the difference between quoted bid and offer prices. As shown in Chart 3, spreads in the interdealer Treasury market widened sharply in fall 1998 for the on-the-run ten-year note and had not returned to precrisis levels as of October 1999. The ten-year note typically trades with a spread of 1/64 or 1/32 of a point (where one point equals 1 percent of par), but it traded with nearly a 3/32 average spread on October 9, 1998, and just over a 1/32 spread on October 29, 1999. For the ten-year note, 1/32 of a point equals just under half a basis point in yield terms.

Another measure of liquidity is the depth of the market. Market depth refers to the quantity of securities that dealers are willing to buy and sell at various prices, and is measured here by the average quantity firmly offered at the best quoted bid and offer prices in the interdealer market. As shown in Chart 4, the quoted depth of the on-the-run ten-year note fell from the $9-$11 million range in July and August 1998 to roughly $6 million in October 1998. Quoted depths did not recover quickly after fall 1998, averaging slightly more than $5.5 million in 1999 (through October).

Table 1

Correlations of U.S. Treasury and Other Fixed-Income Yield Changes

Period	Investment-Grade Corporate	Mortgage-Backed Security	Fannie Mae Benchmark	Swap	High-Yield Corporate
Precrisis: July 3, 1997-Aug. 14, 1998	0.975	0.956	0.976	0.987	0.473
Crisis: Aug. 14, 1998-Nov. 20, 1998	0.965	0.957	0.970	0.968	0.199
Postcrisis: Nov. 20, 1998-Oct. 29, 1999	0.963	0.924	0.956	0.961	0.429
Full sample: July 3, 1997-Oct. 29, 1999	0.966	0.945	0.964	0.970	0.286

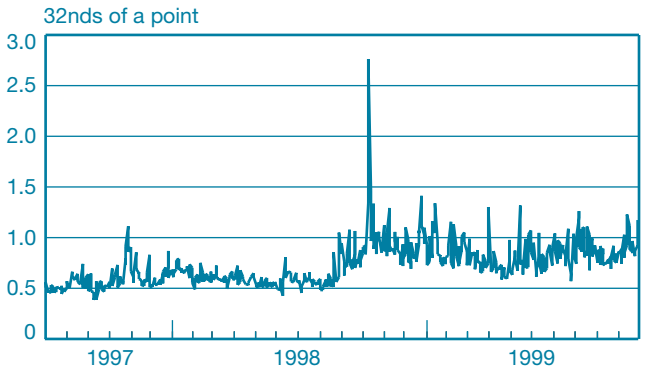
Source: Author's calculations, based on data from Bloomberg, Goldman Sachs, and Merrill Lynch.

Notes: The table reports the correlations of weekly yield changes between the on-the-run ten-year U.S. Treasury note and the indicated index or security. Correlations with the Fannie Mae benchmark are limited to the period starting February 3, 1998. The investment-grade corporate yield is the industrials ten-year A2/A yield from Bloomberg. The mortgage-backed security yield is a weighted-average, option-adjusted yield calculated by Goldman Sachs. The Fannie Mae benchmark yield is the on-the-run ten-year benchmark note yield from Merrill Lynch, via Bloomberg. The swap rate is the ten-year semiannual fixed rate versus three-month LIBOR compiled by Bloomberg from various sources. The high-yield corporate yield is from Merrill Lynch's High-Yield Master Index, via Bloomberg.

One other measure of liquidity is trading volume. Volume is not an ideal measure of liquidity, as it may reflect dealers' eagerness to rebalance and hedge positions amid market turmoil, rather than their willingness to take positions and make markets. In fact, the volume numbers in Chart 5 show that trading activity actually increased throughout August and into early September 1998. Trading activity then declined fairly steadily throughout the fall before dropping off sharply at the end of the year; it remained lower than usual through October 1999.

Chart 3

Bid-Ask Spread of Ten-Year U.S. Treasury Note



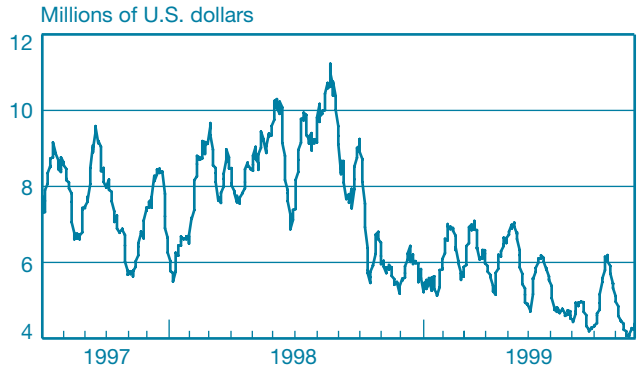
Source: Author's calculations, based on data from GovPX.

Note: The chart plots the mean daily bid-ask spread in the interdealer market for the on-the-run ten-year note.

The evidence suggests that Treasury market liquidity was adversely affected by the events of fall 1998 and that it did not recover quickly. While the market was quite volatile in fall 1998—and somewhat more volatile after the crisis than before it—such volatility does not explain the diminished liquidity.[10] The events of fall 1998, concerns about Y2K, the withdrawal of market participants, and the reluctance of remaining participants to take risks are some of the factors that may have inhibited market liquidity even after the crisis.

Chart 4

Quote Depth of Ten-Year U.S. Treasury Note

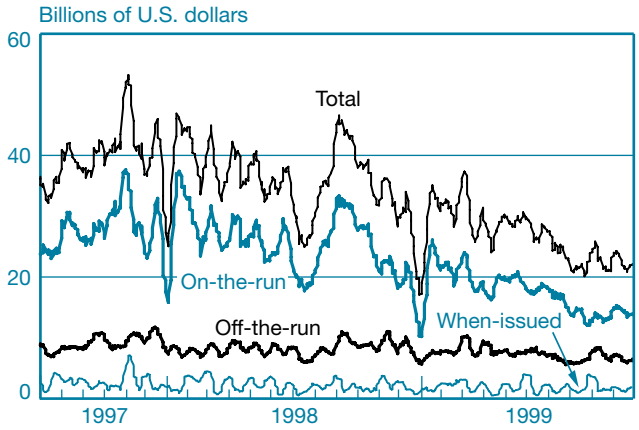


Source: Author's calculations, based on data from GovPX.

Notes: The chart plots the ten-day rolling average of the mean daily quote size in the interdealer market for the on-the-run ten-year note. The quote size refers to the quantity of securities bid for or offered for sale at the best bid and offer prices posted by GovPX; the mean daily figure is calculated with both bid and offer quantities.

Chart 5

Daily Trading Volume of U.S. Treasury Securities



Source: Author's calculations, based on data from GovPX.

Notes: The chart plots the ten-day rolling average of daily trading volume in the interdealer market. The volume figures are reported on a one-way basis (so that a trade between two parties is counted only once) and cover about 65 percent of the interdealer broker market.

Reduced market liquidity can diminish the attractiveness of the Treasury market both as a risk-free benchmark and as a benchmark for pricing and hedging. Decreased liquidity increases the chances that implied risk-free rates will deviate from the market consensus as to where risk-free rates should be. Decreased liquidity also raises hedgers' direct costs of trading and reduces their ability to take or unload large positions quickly with minimal price impact. Despite the disruptions to Treasury market liquidity, it should be noted that the market remains highly liquid and that it may have been less disrupted by liquidity problems in fall 1998 than were other fixed-income markets.

The Repo Market

A repo is an agreement to exchange collateral for cash with a simultaneous agreement to buy back the collateral at a specified price at some point in the future. A dealer owning a particular Treasury note, for example, might agree to sell that security to another dealer while simultaneously agreeing to buy back the security the next day. The first dealer can thus use the repo market to finance its positions, often at a favorable rate, while the second dealer can use the repo market to borrow and then sell securities it does not hold in its portfolio.

The repo market for Treasury securities was temporarily disrupted by the events of fall 1998. One measure of disruption examines the spread between the general collateral rate and the collateral rate on a particular security. When an issue is in high demand, a dealer in effect lends funds at a rate below the rate that would otherwise be required to borrow a security, and the issue is said to be "on special." Table 2 shows that the on-the-run two-year note, five-year note, and thirty-year bond (but not the ten-year note) traded at an increased rate of specialness during the fall 1998 crisis, but that specialness declined after the crisis. The five-year note, for example, was lent at an average overnight rate that was 77 basis points below the general collateral rate before the crisis, 126 basis points during the crisis, and 75 basis points after the crisis.

Repo activity in on-the-run coupon securities was not negatively affected by the events of fall 1998. As shown in Table 3, overnight repo trading volume increased in fall 1998 for the two-year and five-year notes, but it fell for the ten-year note and thirty-year bond. After fall 1998, repo activity changed little for the two-year and five-year notes, but it increased for the ten-year note and thirty-year bond. Overall, repo activity was higher after the crisis than it was before it for three of these four securities (all but the ten-year note). Repo trading volume numbers do not suggest that the use of Treasuries as hedging vehicles declined as a result of the fall 1998 crisis.

Table 2

Repo Specialness of On-the-Run U.S. Treasury Coupon Securities

Basis Points

Period	Two-Year	Five-Year	Ten-Year	Thirty-Year
Precrisis:				
July 1, 1997-Aug. 14, 1998	21.0	76.9	165.8	120.6
	(30.4)	(80.5)	(135.8)	(135.0)
Crisis:				
Aug. 17, 1998-Nov. 20, 1998	52.8	126.1	115.6	211.1
	(86.6)	(149.3)	(143.4)	(164.9)
Postcrisis:				
Nov. 23, 1998-Oct. 29, 1999	35.3	75.0	200.3	120.1
	(48.6)	(86.2)	(155.0)	(123.9)
Full sample:				
July 1, 1997-Oct. 29, 1999	30.4	81.8	173.9	130.8
	(48.5)	(94.3)	(146.8)	(137.4)

Source: Author's calculations, based on data from GovPX.

Note: The table reports the means and standard deviations (in parentheses) of the daily average differences between the overnight general collateral rate and the collateral rates on the indicated on-the-run securities.

Table 3

Repo Trading Volume of On-the-Run U.S. Treasury Coupon Securities

Billions of U.S. Dollars

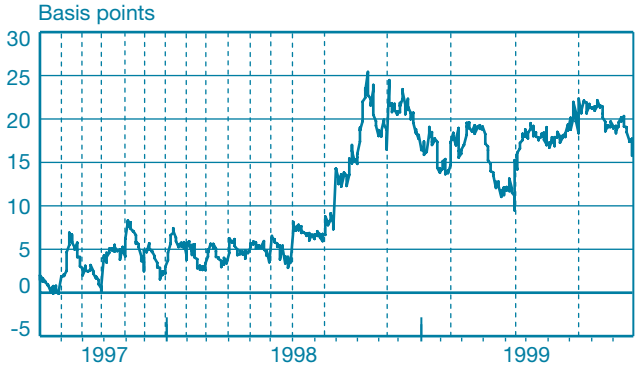
Period	Two-Year	Five-Year	Ten-Year	Thirty-Year
Precrisis:				
July 1, 1997-Aug. 14, 1998	5.69	7.42	10.39	4.09
	(2.94)	(3.09)	(4.00)	(2.10)
Crisis:				
Aug. 17, 1998-Nov. 20, 1998	8.33	8.72	8.44	3.54
	(3.50)	(3.14)	(2.79)	(1.69)
Postcrisis:				
Nov. 23, 1998-Oct. 29, 1999	8.31	8.78	9.54	4.25
	(3.15)	(3.19)	(4.61)	(1.87)
Full sample:				
July 1, 1997-Oct. 29, 1999	7.04	8.11	9.82	4.09
	(3.36)	(3.20)	(4.18)	(1.97)

Source: Author's calculations, based on data from GovPX.

Note: The table reports the means and standard deviations (in parentheses) of daily overnight repurchase agreement trading volume in the indicated on-the-run securities as reported to GovPX.

Chart 6

Off-the-Run/On-the-Run Yield Spread of Five-Year U.S. Treasury Note



Source: Author's calculations, based on data from Bear Stearns and GovPX.

Notes: The chart plots the predicted yield less the market yield on a daily basis for the on-the-run five-year note. The predicted yield is the yield of a comparable-duration off-the-run security as derived from a model of the yield curve estimated with off-the-run prices. Changes in the on-the-run security are indicated by the dashed vertical lines.

Increased repo market specialness can decrease the attractiveness of Treasury securities as hedging vehicles because it makes borrowing securities more costly. Increased borrowing costs may also reduce market liquidity, further hurting the attractiveness of the Treasury market for various purposes, including pricing, hedging, and as a benchmark of risk-free rates. The evidence suggests, however, that the cost of borrowing on-the-run Treasury securities increased only briefly during the fall 1998 crisis and that repo market activity generally did not decline either during or after fall 1998.

Market Efficiency

One of the most striking developments in fall 1998 was a divergence in performance between more and less actively traded Treasury securities. As shown in Chart 6, the yield spread between the on-the-run five-year note and a comparable off-the-run security rose sharply in late August 1998 and again in mid-October 1998, reaching 25 basis points on October 15, 1998.[11] Table 4 shows that the comparable spread also widened sharply in fall 1998 for the two-year note and the thirty-year bond, albeit not for the ten-year note. On-the-run Treasuries generally became relatively more valuable as investors sought not only the safety of Treasury securities but

Table 4

Off-the-Run/On-the-Run Yield Spreads of U.S. Treasury Coupon Securities

Basis Points

Period	Two-Year	Five-Year	Ten-Year	Thirty-Year
Precrisis:				
July 1, 1997-Aug. 14, 1998	2.80	4.48	7.87	5.01
	(1.80)	(1.90)	(1.71)	(1.71)
Crisis:				
Aug. 17, 1998-Nov. 20, 1998	11.62	16.68	6.63	12.99
	(5.76)	(4.89)	(3.30)	(4.65)
Postcrisis:				
Nov. 23, 1998-Oct. 29, 1999	5.02	17.93	13.55	13.50
	(2.37)	(2.75)	(6.93)	(1.83)
Full sample:				
July 1, 1997-Oct. 29, 1999	4.72	11.33	10.03	9.36
	(3.86)	(7.14)	(5.54)	(4.78)

Source: Author's calculations, based on data from Bear Stearns and GovPX.

Note: The table reports the means and standard deviations (in parentheses) of the daily off-the-run/on-the-run yield spreads of the indicated securities. The spreads are calculated as the predicted yields less the market yields, where the predicted yields are those of comparable-duration off-the-run securities as derived from a model of the yield curve estimated with off-the-run prices.

also the liquidity of the on-the-run issues in the so-called flight to liquidity.[12] After the crisis, spreads remained high on the five-year note and the thirty-year bond, they increased for the ten-year note, but they declined for the two-year note.

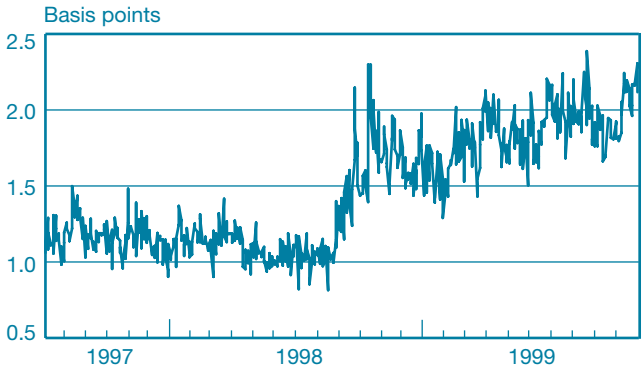
Another development in fall 1998 was a divergence in pricing among off-the-run securities, possibly due to a decline in Treasury market arbitrage. The efficiency of the Treasury market typically results in off-the-run securities of similar maturity trading relatively close to one another in terms of yield. When Treasury yields are plotted against time to maturity, they usually form a relatively smooth curve, as shown for May 13, 1998 (Chart 7). The smoothness of the yield curve over time is estimated here as the median absolute error between market yields and the yields predicted by a term structure model.[13] As shown in Chart 8, the median rose sharply between late August and mid-October 1998—peaking at 2.3 basis points on October 8, 1998—and remained relatively high after the crisis.

The relative performance of Treasuries in the fall of 1998 is summarized in Chart 9, which plots yields against years to maturity for October 9, 1998. The chart shows the wide dispersion of off-the-run yields, as documented in Chart 8. It also shows the wide yield spreads between on-the-run coupon securities and comparable-maturity off-the-run securities, as shown in Chart 6.

The divergent performance of Treasury securities raises concerns about the market's usefulness both as a risk-free interest-rate benchmark and as a benchmark for pricing and hedging. Differences in the liquidity or specialness of Treasury securities can result in different implied risk-free rates, raising the issue of which risk-free rate is the appropriate one. Such differences also create an additional performance wedge between Treasuries and other fixed-income securities, possibly

Chart 8

Median Absolute Error between Predicted and Market U.S. Treasury Yields

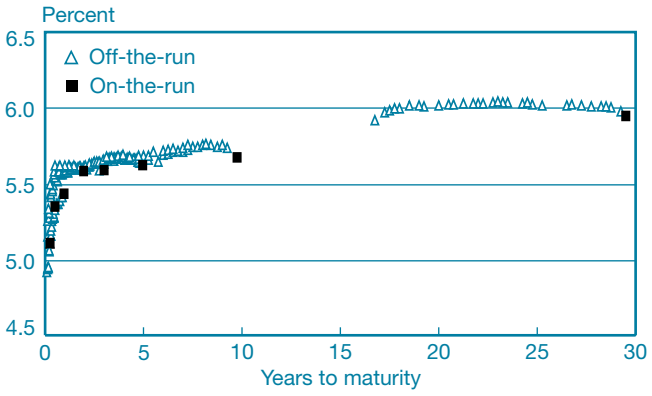


Source: Author's calculations, based on data from Bear Stearns and GovPX.

Notes: The chart plots the median absolute daily error between predicted and market yields for off-the-run notes and bonds with more than thirty days to maturity (excluding callable bonds, flower bonds, and inflation-indexed securities). Predicted yields are derived from a model of the yield curve estimated with off-the-run prices.

Chart 7

May 13, 1998, U.S. Treasury Yields

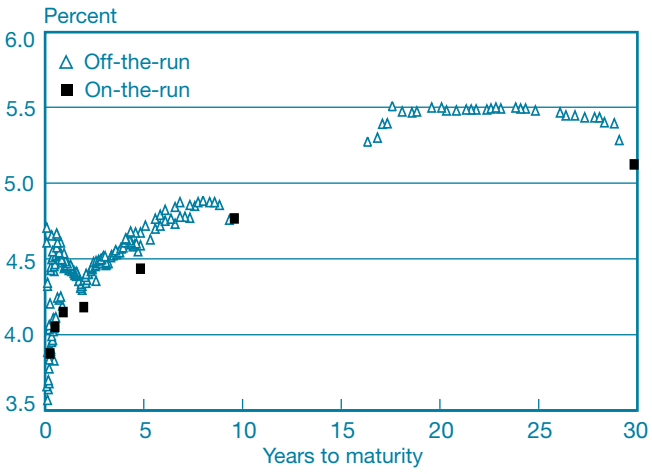


Sources: Bear Stearns; GovPX.

Note: The chart plots yields against years to maturity for Treasury securities with more than thirty days to maturity (excluding callable bonds, flower bonds, and inflation-indexed securities).

Chart 9

October 9, 1998, U.S. Treasury Yields



Sources: Bear Stearns; GovPX.

Note: The chart plots yields against years to maturity for Treasury securities with more than thirty days to maturity (excluding callable bonds, flower bonds, and inflation-indexed securities).

decreasing their correlation.[14] Nevertheless, while the divergent performance of Treasuries may hinder their role as a benchmark, it is noteworthy that this divergence may largely reflect market participants' demand for the securities' safety and liquidity. Characteristics that make the Treasury market an attractive benchmark in some ways may therefore result in performance undesirable of a benchmark in other ways.

Alternative Benchmarks

The recent performance of the benchmark U.S. Treasury market and the improved fiscal situation raise the issue of which market or markets might serve as a future benchmark. While there is no obvious U.S. dollar alternative for risk-free rates, several markets are already assuming a limited benchmark role for pricing and hedging securities and as reference rates for monitoring and analytical purposes. These markets include the agency debt market, the corporate debt market, and the interest-rate swaps market. Each is examined in turn with regard to the features that make a good benchmark market.

The Agency Debt Market

Agency securities are obligations of federal government agencies or government-sponsored enterprises such as Fannie Mae, Freddie Mac, the Federal Home Loan Banks (FHLBanks), the Farm Credit Banks, Sallie Mae, and the Tennessee Valley Authority.[15] The agencies issue debt securities to finance activities that are supported by public policy, including home ownership, farming, and education. The securities typically are not backed by the full faith and credit of the U.S. government, as is the case with Treasury securities, and therefore trade with some credit risk. They are nevertheless considered to be of very high credit quality and are rated Aaa/AAA by the major rating agencies.

Seeking to capitalize on the market's interest in large, liquid issues amid reduced Treasury supply, the agencies have introduced their own benchmark debt issuance programs, starting with Fannie Mae's Benchmark Notes Program in January 1998. The programs provide for the regular issuance of large-size, noncallable coupon securities in a range of maturities (originally two to ten years), and thus mimic the Treasury Department's issuance practices. The benchmark securities are intended to appeal to investors who might typically buy Treasury securities, and are promoted as Treasury substitutes.[16]

The agency benchmark programs have expanded rapidly in their breadth and depth. Freddie Mac introduced its Reference Notes Program in April 1998; the FHLBanks introduced their Tap Issuance Program in July 1999 and also increased issuance sizes in their Global Debt Program; and the Farm Credit Banks introduced their Designated Bonds Program in March 1999. The programs have expanded beyond their original scope with the introduction of callable benchmark programs, the issuance of longer term securities, and the announcements of auction schedules. In November 1999, both Fannie Mae and Freddie Mac announced the introduction of benchmark bill programs, with weekly auctions of large-size discount securities.

As shown in Table 5, benchmark issues of the three largest agencies generally range from $3-$6 billion in size (as of October 1999), and thus are about one-fifth to one-half as large as comparable Treasury issues. As shown in Table 6, total benchmark issuances in 1999 through October were roughly $40 billion for each of the three largest agencies, versus $234 billion in Treasury coupon security issuances. Agency benchmark debt outstanding is even smaller relative to that of the Treasury Department, due to the recent introduction of the agency benchmark programs. Fannie Mae, for example, had $94 billion in noncallable benchmark securities outstanding on October 31, 1999 (Fannie Mae 1999b), whereas the Treasury Department had $2.4 trillion in marketable fixed-rate coupon securities outstanding (Bureau of the Public Debt 1999).

Table 5

Issue Sizes of Agency and U.S. Treasury Coupon Securities as of October 31, 1999

Billions of U.S. Dollars

Issue	Fannie Mae Benchmark	Freddie Mac Reference	FHLBanks Global	FHLBanks Tap	U.S. Treasury
Two-year	—	5.0[a]	3.0	3.5[a]	15.0
Three-year	3.0	5.0	3.0	3.4[a]	—
Five-year	6.5[a]	3.0	—	2.0[a]	15.0
Seven-year	—	—	—	1.1[a]	—
Ten-year	3.5	6.0	—	0.6[a]	12.0
Thirty-year	4.25[a]	—	—	—	10.0

Sources: Bloomberg; FHLBanks, Office of Finance; Freddie Mac.

Notes: The table reports the sizes of the most recent noncallable benchmark coupon issues as of October 31, 1999. Securities more than one year old are excluded. FHLBanks Global Debt Program issues exclude a $1 billion one-year coupon issue and a $3.5 billion issue originally issued with three years to maturity. U.S. Treasury issue sizes exclude amounts issued to refund maturing securities of Federal Reserve Banks as well as amounts bid for by Federal Reserve Banks on behalf of foreign and international monetary authorities.

[a] Reopened.

Table 6

Issuance of Agency and U.S. Treasury Coupon Securities from January to October 1999

Billions of U.S. Dollars

Issue	Fannie Mae Benchmark	Freddie Mac Reference	FHLBanks Global	FHLBanks Tap	U.S. Treasury
Two-year	—	9.0	17.0	3.9	135.0
Three-year	3.0	10.5	9.0	3.4	—
Five-year	19.5	9.0	—	2.3	45.0
Seven-year	—	—	—	1.3	—
Ten-year	15.5	13.0	—	0.7	34.0
Thirty-year	4.25	—	—	—	20.0
Total	42.25	41.5	26.0	11.7	234.0

Sources: Bloomberg; Fannie Mae; FHLBanks, Office of Finance; Freddie Mac.

Notes: The table reports noncallable benchmark coupon security issuance between January 1 and October 31, 1999. The FHLBanks Global Debt Program two-year amount includes a one-year issue as well as the reopenings of an old three-year note at two-and-a-half and two-and-a-quarter years to maturity. The FHLBanks two-year Tap Issuance Program amount includes a one-and-a-half-year issue, the three-year amount includes a two-and-a-half-year issue, the five-year amount includes a four-year issue, the seven-year amount includes an eight-year issue, and the ten-year amount includes a fifteen-year issue. U.S. Treasury issuance excludes amounts issued to refund maturing securities of Federal Reserve Banks as well as amounts bid for by Federal Reserve Banks on behalf of foreign and international monetary authorities.

The stock of agency debt securities outstanding provides a guide as to how large the agency benchmark programs can become. As of June 30, 1999, agency debt outstanding totaled $1.4 trillion, versus $3.7 trillion of Treasury debt held by the public (*Federal Reserve Bulletin* 1999; *Treasury Bulletin* 1999). As shown in Chart 10, the agency debt market has grown rapidly in recent years, whereas the Treasury market has leveled off. Even if agency debt growth slowed to the rate of GDP growth (projected by the CBO), the agency debt market would surpass the U.S. Treasury market in size in fiscal year 2007 if the Treasury market shrinks according to the CBO's July 1999 projections.

The performance of agency securities versus other fixed-income securities suggests that agencies may be good pricing and hedging benchmarks. Fixed-income securities with credit risk (or spread products) largely moved together during and after the fall 1998 crisis, as shown in Chart 2. The correlations of the weekly yield changes of the Fannie Mae ten-year benchmark with those of other spread products are high, as shown in Table 7, and are comparable to those of Treasuries with other spread products (Table 1). The correlation between the Fannie Mae benchmark and mortgage-backed securities, for example, was 0.954 for the postcrisis period, versus 0.924 for Treasuries and mortgage-backed securities.

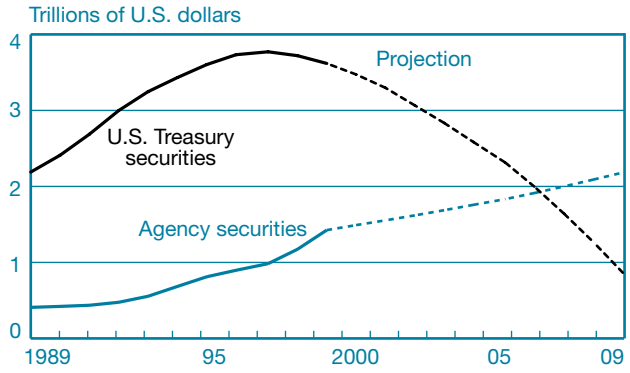
Agency market liquidity does not yet approach that of the U.S. Treasury market. As shown in Table 8, trading in agency coupon securities by the primary government securities dealers averaged $7.9 billion per day before the fall 1998 crisis, versus $183 billion in Treasury coupon securities. Trading in agency coupons increased to $10.7 billion per day after the crisis, while comparable Treasury trading fell, but agency coupon trading still equaled only 6.8 percent of postcrisis Treasury trading. Fannie Mae reports that its benchmark securities have liquidity comparable to off-the-run Treasury securities, with bid-ask spreads of 0.5 to 2.0 basis points (Fannie Mae 1999a).

An active overnight repo market in agency securities has developed, allowing market participants to borrow securities for hedging and trading purposes, although an active term repo market has not yet emerged. Agency issues sometimes trade on special, although typically still close to general collateral. As a result, Fannie Mae reports that its issues are largely unaffected by issue-specific differences in specialness or liquidity (Fannie Mae 1999a). Unlike the Treasury market, there is no futures market for agency securities.[17]

Agency debt securities are treated as benchmarks in a few respects. First, the yields on benchmark securities are used as

Chart 10

Historical and Projected Agency and U.S. Treasury Debt



Sources: Author's projections; U.S. Congressional Budget Office (CBO) projections; *Federal Reserve Bulletin* (various issues); *Treasury Bulletin* (various issues).

Notes: Figures are reported as of September 30, except for the 1999 agency debt figure, which is reported as of June 30. Treasury debt projections are the CBO's as of July 1999; they assume that current laws and policies remain unchanged and they exclude debt held in U.S. government accounts. Agency debt projections assume that the market grows at the same rate as the economy (according to CBO projections of GDP).

Table 7

Correlations of Fannie Mae Benchmark and Other Fixed-Income Yield Changes

Period	Investment-Grade Corporate	Mortgage-Backed Security	Swap	High-Yield Corporate	U.S. Treasury
Precrisis: Feb. 3, 1998-Aug. 14, 1998	0.948	0.926	0.976	0.422	0.976
Crisis: Aug. 14, 1998-Nov. 20, 1998	0.915	0.949	0.990	0.292	0.970
Postcrisis: Nov. 20, 1998-Oct. 29, 1999	0.934	0.954	0.983	0.450	0.956
Full sample: Feb. 3, 1998-Oct. 29, 1999	0.926	0.950	0.985	0.309	0.964

Source: Author's calculations, based on data from Bloomberg, Goldman Sachs, and Merrill Lynch.

Notes: The table reports the correlations of weekly yield changes between the on-the-run ten-year Fannie Mae benchmark note and the indicated index or security. The Fannie Mae benchmark yield is from Merrill Lynch, via Bloomberg. The investment-grade corporate yield is the industrials ten-year A2/A yield from Bloomberg. The mortgage-backed security yield is a weighted-average, option-adjusted yield calculated by Goldman Sachs. The swap rate is the ten-year semiannual fixed rate versus three-month LIBOR compiled by Bloomberg from various sources. The high-yield corporate yield is from Merrill Lynch's High-Yield Master Index, via Bloomberg.

barometers of the agency market for monitoring and analytical purposes. Second, agencies are used as hedging vehicles to a certain extent, particularly for mortgage-backed securities. Finally, at least one new debt issue has been priced relative to a benchmark agency security as of October 1999.[18]

Table 8

Agency and U.S. Treasury Coupon Security Trading Volume

Period	Agency Securities (Billions of U.S. Dollars)	U.S. Treasury Securities (Billions of U.S. Dollars)	Agency-U.S. Treasury Ratio (Percent)
Precrisis:			
Jan. 22, 1998-Aug. 12, 1998	7.9	183.3	4.4
	(1.3)	(29.1)	(0.8)
Crisis:			
Aug. 13, 1998-Nov. 18, 1998	9.5	223.1	4.3
	(1.2)	(34.1)	(0.6)
Postcrisis:			
Nov. 19, 1998-Oct. 27, 1999	10.7	156.7	6.8
	(3.0)	(25.8)	(1.8)
Full sample:			
Jan. 22, 1998-Oct. 27, 1999	9.6	175.2	5.7
	(2.7)	(36.5)	(1.9)

Source: Author's calculations, based on data from the Federal Reserve Bank of New York and *Federal Reserve Bulletin* (1999).

Notes: The table reports the means and standard deviations (in parentheses) of average daily coupon security trading volume (reported weekly) of the primary government securities dealers.

Several attributes favor the agency debt securities market as a benchmark market. Namely, the performance of agency securities is highly correlated with that of other spread products, and agencies—because of their credit risk—have the potential to be better pricing and hedging vehicles than Treasuries. The market is also reasonably liquid, agencies trade in an active overnight repo market, and agencies reportedly have been relatively unaffected by issue-specific differences in liquidity or specialness. Steps taken by the agencies to increase issuance sizes are likely to improve market liquidity, and the announcements of issuance schedules and the resulting predictability of agency issuance are likely to improve activity in the term repo market.[19]

Nevertheless, other attributes do not favor the agency debt securities market as a benchmark. Credit risk, for example, may cause agencies to trade in line with other spread products, but the presence of such risk also means that there is an idiosyncratic risk component to agency securities that could become important in the future. Market liquidity also does not compare with that of the Treasury market, the overnight repo market is less active than the Treasury market, the term repo market is not active at all, and there is not yet an agency futures market. Furthermore, while agency securities may not be affected by issue-specific differences in liquidity or repo market specialness, this condition may reflect the lack of demand among market participants to borrow and trade agency benchmark issues. If the popularity of agency benchmark securities increases, issue-specific differences may become more important.

The Corporate Debt Market

Corporate debt securities are issued to meet a variety of longer term corporate financing needs. Their credit risk varies significantly across issues, from relatively safe Aaa/AAA-rated issues to non–investment-grade Ba/B, B/B, and Caa/CCC issues. The corporate debt market is larger, but far more segmented, than the agency debt market, with debt outstanding totaling $2.9 trillion on September 30, 1999 (Bond Market Association 1999).

Corporate issuers recently have increased issuance sizes and regularity to appeal to investor demand for large, liquid issues. Ford Motor Company, in particular, announced its Global Landmark Securities (GlobLS) Program in June 1999, modeled on the programs of Fannie Mae and Freddie Mac. Under the program, Ford and its financing subsidiary, Ford Motor Credit Company, announced that they would bring offerings of at least $3 billion to market two to four times per year. Ford issued $8.6 billion in four parts in July 1999 as part of the program and $5 billion in a single part in October 1999.

While the Ford issuances are large by corporate standards, they are significantly less than those of the agencies. In 1999, through October, Ford issued $13.6 billion in its GlobLS Program, as opposed to roughly $40 billion each in the three largest agencies' benchmark programs. It is worth noting that Ford's issuances are constrained by the size of the company's balance sheet. Ford had debt outstanding of $144 billion on June 30, 1999 (Ford Motor Company 1999), versus $500 billion for Fannie Mae, $437 billion for the FHLBanks, and $314 billion for Freddie Mac (*Federal Reserve Bulletin* 1999).

Liquidity of the large Ford issues is reportedly favorable, with bid-ask spreads of 1 to 2 basis points, compared with 3 to 5 basis points for smaller issues of similar quality (*Bloomberg* 1999). There is no futures market for Ford or other corporate issues, and corporate issues are not actively traded in the repo market.

Ford GlobLS play a limited benchmark role in the corporate market. They are used as reference rates for monitoring the performance of the corporate market, for evaluating other outstanding corporate debt securities, and for helping to decide how other new corporate debt issues should be priced. Hedging activity using corporate issues is limited.

The corporate market's potential as a benchmark is limited by its fragmented nature, with the largest corporate issuers being smaller than the large agency issuers. Corporates also do not have the creditworthiness of the agencies (Ford is rated A1/A), so that firm-specific developments may be more important in explaining the performance of any particular issuer's securities. Nevertheless, the trend toward increased issuance sizes and regularity will likely increase the role of corporates as benchmarks for monitoring and analysis within the corporate market.

The Interest-Rate Swaps Market

An interest-rate swap is an agreement between two parties to exchange one stream of interest payments for another stream. The most common interest-rate swap is used to exchange fixed interest-rate payments for floating interest-rate payments for a given principal amount and period of time. The floating rate in such contracts is often based on the London Interbank Offer Rate (LIBOR)—the rate that banks charge one another for funds in the Eurodollar market.

Swap rates are quoted in terms of the fixed rate that must be paid to convert to a floating rate. At the close of September 30, 1999, for example, the quoted ten-year swap rate on Bloomberg was 6.85 percent. An entity therefore had to make semiannual fixed interest payments for ten years at an annual rate of 6.85 percent to get semiannual floating interest payments for ten years based on three-month LIBOR (for the same principal amount). Swap rates are often quoted relative to the Treasury benchmark, so that the ten-year spread on September 30 was quoted as 97 basis points (calculated as the 6.85 percent swap rate less the 5.88 percent yield on the on-the-run ten-year Treasury note). Swap rates exceed those on Treasuries mainly because the floating payments are based on a rate that contains credit risk (LIBOR is an Aa/AA rate).

Since they are based on a floating rate that contains credit risk, swap rates often change in line with yields on other spread products. Swap spreads thus widened sharply in fall 1998 along with those of corporates, agencies, and mortgage-backed securities, as shown in Chart 2. Correlations of weekly changes in ten-year swap rates with yields of other spread products, shown in Table 9, are close to those of Treasuries with other spread products (Table 1). The correlation with Fannie Mae's benchmark note, for example, is 0.985 for swaps, versus 0.964 for Treasuries (for the full sample period).

The interest-rate swaps market is very active, with narrow bid-ask spreads. A market survey by the Federal Reserve Bank of New York (1998) found daily trading in U.S. dollar interest-rate swaps to be $22 billion per day in April 1998.[20] Turnover is thus considerably higher than it is in agency coupon securities, but less than it is in Treasury securities. Bid-ask spreads on active contracts reportedly are about 1 basis point, somewhat wider than those on active Treasury securities.

The liquidity of the swaps market is hindered by counterparty credit risk. Counterparty credit risk is the risk that one's counterparty in a swap defaults on its end of the agreement. The risk is an obstacle to liquidity because, by

Table 9

Correlations of Swap Rate and Other Fixed-Income Yield Changes

Period	Investment-Grade Corporate	Mortgage-Backed Security	Fannie Mae Benchmark	High-Yield Corporate	U.S. Treasury
Precrisis: July 3, 1997-Aug. 14, 1998	0.960	0.942	0.976	0.527	0.987
Crisis: Aug. 14, 1998-Nov. 20, 1998	0.918	0.936	0.990	0.291	0.968
Postcrisis: Nov. 20, 1998-Oct. 29, 1999	0.941	0.954	0.983	0.454	0.961
Full sample: July 3, 1997-Oct. 29, 1999	0.938	0.946	0.985	0.346	0.970

Source: Author's calculations, based on data from Bloomberg, Goldman Sachs, and Merrill Lynch.

Notes: The table reports the correlations of weekly yield changes between the ten-year swap rate and the indicated index or security. Correlations with the Fannie Mae benchmark are limited to the period starting February 3, 1998. The swap rate is the semiannual fixed rate versus three-month LIBOR compiled by Bloomberg from various sources. The investment-grade corporate yield is the industrials ten-year A2/A yield from Bloomberg. The mortgage-backed security yield is a weighted-average, option-adjusted yield calculated by Goldman Sachs. The Fannie Mae benchmark yield is the on-the-run ten-year benchmark note yield from Merrill Lynch, via Bloomberg. The high-yield corporate yield is from Merrill Lynch's High-Yield Master Index, via Bloomberg.

definition, it depends on the parties involved in a transaction. A dealer that has engaged in a swap contract and wants to unwind it either has to go back to the original counterparty, which may not want to unwind, or find a third party to take its side of the swap—one that is also acceptable to the original counterparty. To mitigate counterparty credit risk, some dealers execute swaps out of credit-enhanced subsidiaries and structure swaps so that they automatically unwind if a party's Aaa/AAA credit rating is lost.

The absence of an underlying fundamental asset is also an advantage of the swaps market. There is no supply limit on swap contracts and no need to borrow securities to go short, as an entity can enter into as many swap contracts as it wants. Specific issue concerns are also mitigated by the nature of swaps. The ability to create a swap combined with the fungible nature of the underlying cash flows precludes swaps with the same or nearly the same cash flows from trading at widely different rates.

Swaps are used as benchmarks for hedging positions taken in other markets, including the agency debt, corporate debt, and mortgage-backed securities markets. They are used as well for analytical and monitoring purposes in evaluating the performance of other fixed-income markets. Swap rates are also used as reference rates for forecasting, for example, the path of LIBOR.

Several features favor the interest-rate swaps market as a benchmark. As the underlying floating rate has credit risk, the performance of swaps is highly correlated with that of other spread products, and swaps have the potential to be a better hedge than Treasuries. The absence of an underlying asset allows for dealers to take unlimited long or short positions without having to worry about obtaining securities in the repo market. These same features mitigate security-specific issues that might cause a particular maturity swap to deviate sharply from the performance of the whole swaps curve.

However, counterparty credit risk is a feature that does not favor the swaps market as a benchmark. Such risk means that swaps created by different parties have different risks and are not perfectly fungible. Lack of fungibility adversely affects liquidity. Market participants have taken steps to mitigate the effects of counterparty credit risk, but it remains a hindrance to the market's liquidity and to the market assuming a larger benchmark role.

Conclusion

The country's improved fiscal situation raises questions about the U.S. Treasury market's benchmark status. If projected budget surpluses materialize, they could lead to a significant reduction in the Treasury market's size and to a deterioration in the market's liquidity and efficiency. A less liquid and less efficient market would represent a less useful benchmark of risk-free interest rates as well as a less useful benchmark for pricing and hedging positions in other markets.

The financial markets crisis of fall 1998 heightened investors' concerns about the Treasury market's benchmark role and provided insight into how the market may perform in the future. A flight to quality into Treasury securities caused yields between Treasuries and other fixed-income securities to diverge. A related flight to liquidity also led yields among similar Treasury securities to diverge. Market liquidity also

declined, and the cost of borrowing securities through the repo market increased. After fall 1998, market conditions did not quickly return to precrisis levels, possibly reflecting a more general decline in fixed-income liquidity as well as a continued high demand among market participants for benchmark Treasuries.

Other fixed-income markets—including the agency debt, corporate debt, and interest-rate swaps markets—have demonstrated some of the characteristics that potentially make them suitable benchmarks for pricing and hedging purposes. Furthermore, the attributes that are favorable to a benchmark have been improving in the agency and corporate debt markets as benchmark debt issuance programs are expanding and steps are being taken to develop repo market activity. At this point, the agency debt and swaps markets are already assuming a limited benchmark role as hedging vehicles and as reference yields for market monitoring and analytical purposes.

Endnotes

1. For recent reviews of the U.S. Treasury market, see Dupont and Sack (1999) and Fabozzi and Fleming (forthcoming).

2. In contrast, floating-rate issues typically are priced relative to the London Interbank Offer Rate (LIBOR), the short-term rate charged among banks in the Eurodollar market. A recent issue of Daimler-Chrysler AG, for example, had a three-year floating-rate portion priced relative to three-month LIBOR along with five-year and ten-year fixed-rate portions priced relative to comparable Treasuries (*Wall Street Journal* 1999b).

3. Debt held by the public excludes $2.0 trillion held in U.S. government accounts. Debt figures are from the U.S. Congressional Budget Office (1999) and *Treasury Bulletin* (1999).

4. Significant debt management changes typically are announced at the Treasury's Quarterly Refunding Press Conferences. The press releases for such conferences are posted at http://www.treas.gov/press/releases. Also see U.S. General Accounting Office (1999) for a more extensive discussion of recent changes in Treasury debt management.

5. The buyback rules are described in detail in the Federal Register and are available at http://www.publicdebt.treas.gov/gsr/gsrbuyback.htm.

6. In fact, in February 2000, the Treasury announced a number of additional debt management changes at its Quarterly Refunding Press Conference, including a reduction in the issuance frequency of one-year bills from every four weeks to four times per year. This followed the release of a CBO budget and economic outlook in January 2000 that projected even larger surpluses over the next ten years.

7. See Bank for International Settlements (1999) for an analysis of the events of fall 1998.

8. The precrisis, crisis, and postcrisis time periods are defined somewhat arbitrarily. The precrisis period runs from July 1, 1997, through August 14, 1998—the Friday preceding the Russian effective default and ruble devaluation on August 17, 1998. The crisis period runs from the close of August 14, 1998, through November 20, 1998—the Friday after the Federal Reserve System's third and final fed funds target-rate cut of 1998, on November 17. The postcrisis period runs from the close of November 20, 1998, through October 29, 1999.

9. It is possible that such subperiod correlations mask a shift in the relationship among yield changes between periods. To test this possibility, we also estimated correlations between actual yield changes and the yield changes predicted for a security from a least-squares regression of that security's yield changes on Treasury yield changes for the preceding ten weeks. These correlations are similar to those reported in Table 1 and are therefore not reported separately.

10. Volatility was estimated on a daily basis over the full sample period using a GARCH(1,1) model of on-the-run ten-year note yield changes. Predicted volatility from this model helps explain the variation in both bid-ask spreads and quoted depths. However, dummy variables representing the crisis and postcrisis periods remain highly significant explanatory variables, even after controlling for predicted volatility.

11. The comparable off-the-run yield is calculated as the yield predicted for the on-the-run security from a model of the yield curve estimated with off-the-run prices. The model is estimated using a flexible functional form proposed by Fisher, Nychka, and Zervos (1995) in which a set of simple functions (cubic splines) covering different maturity ranges are used to describe the zero curve. The model is estimated to fit Treasury bid prices, excluding the two most recently issued securities of a given maturity, securities with less than thirty-one days to maturity, callable bonds, flower bonds, and inflation-indexed securities.

12. The increased relative value of on-the-run securities also likely reflected the securities' increased specialness in the repo market. The relationship between Treasury security value and specialness is discussed and documented in Duffie (1996) and Jordan and Jordan (1997).

13. The predicted yields are estimated according to the process described in endnote 11. The median is estimated daily for off-the-run notes and bonds with more than thirty days to maturity, excluding callable bonds, flower bonds, and inflation-indexed securities.

14. The premium afforded to liquid on-the-run securities may explain why some market participants started using off-the-run Treasury yields for pricing corporate securities and as market barometers (*Wall Street Journal* 1999a). Unfortunately, the same feature that may make off-the-run Treasuries a better gauge of Treasury market performance—their relative lack of liquidity—also makes them poor vehicles for hedging purposes as well as more susceptible to idiosyncratic price changes.

15. See Fabozzi and Fleming (forthcoming) for a recent review of the agency debt securities market.

16. Fannie Mae stated that "the liquidity of the benchmark notes combined with the outstanding credit quality should cause benchmark notes to be viewed by many investors as a higher yielding alternative to off-the-run Treasuries" (http://www.fanniemae.com/markets/debt/benchmark_prod.html). Freddie Mac indicated that "the fundamental characteristics of reference notes are designed to appeal to investors seeking alternatives to the declining supply of U.S. Treasury notes and bonds" (http://www.freddiemac.com/debt/html/borrowprog.html). Finally, the FHLBanks remarked that "TAP issues have many of the properties of U.S. Treasuries" (Federal Home Loan Banks 1999).

17. However, in January 2000, both the Chicago Board of Trade and the Chicago Mercantile Exchange announced plans to list agency note futures and options contracts.

18. In August 1999, a new issue of Private Export Funding Corp. was marketed in terms of Fannie Mae's benchmark ten-year note, reportedly the first private debt issue priced off an agency security (*Wall Street Journal* 1999c).

19. Freddie Mac, for example, announced a financing calendar in June 1999 (Freddie Mac 1999) and Fannie Mae announced a goal of $6-$8 billion issuance sizes for new benchmark notes in October 1999 (Fannie Mae 1999c).

20. Note that this is the average notional principal amount on which parties agreed to exchange interest payments, rather than the value of securities traded.

References

Bank for International Settlements. 1999. "A Review of Financial Market Events in Autumn 1998." October.

Bloomberg. 1999. "Ford Credit's $5 Billion Sale Taps Demand for Big Issues." October 21.

Bond Market Association. 1999. Research Quarterly (November).

Bureau of the Public Debt. 1999. "Summary of Public Debt Outstanding." October 31.

Duffie, Darrell. 1996. "Special Repo Rates." Journal of Finance 51, no. 2 : 493-526.

Dupont, Dominique, and Brian Sack. 1999. "The Treasury Securities Market: Overview and Recent Developments." Federal Reserve Bulletin 85, no. 12 (December): 785-806.

Fabozzi, Frank J., and Michael J. Fleming. Forthcoming. "U.S. Treasury and Agency Securities." In Frank J. Fabozzi, ed., The Handbook of Fixed Income Securities. 6th ed. New York: McGraw-Hill.

Fannie Mae. 1999a. "Using the Fannie Mae Bullet Benchmark Securities Yield Curve as a Market Pricing Reference." Fundingnotes 4 (September).

———. 1999b. "Fannie Mae Makes Enhancements to the Benchmark Securities Program." Fundingnotes 4 (October).

———. 1999c. "Fannie Mae Announces Monthly Calendar for Issuance of Bullet Benchmark Securities Spanning Yield Curve." News release, October 21.

Federal Home Loan Banks. Office of Finance. 1999. "Investors and Dealers Embrace the New FHLBank Program." OF Interest (November).

Federal Reserve Bank of New York. 1998. "Foreign Exchange and Interest Rate Derivatives Market Survey: Turnover in the United States." September 29.

Federal Reserve Bulletin. Various issues.

———. 1999. November.

Fisher, Mark, Douglas Nychka, and David Zervos. 1995. "Fitting the Term Structure of Interest Rates with Smoothing Splines." Board of Governors of the Federal Reserve System Finance and Economics Discussion Series no. 95-1, January.

Ford Motor Company. 1999. "Quarterly Report, 1999 2nd Quarter." News release, July 14.

Freddie Mac. 1999. "Freddie Mac Announces New Reference Note Financing Calendar." News release, June 8.

Jordan, Bradford D., and Susan D. Jordan. 1997. "Special Repo Rates: An Empirical Analysis." Journal of Finance 52, no. 5: 2051-72.

Treasury Bulletin. Various issues.

———. 1999. September.

U.S. Congressional Budget Office. 1999. "The Economic and Budget Outlook: An Update." July 1.

U.S. General Accounting Office. 1999. "Federal Debt: Debt Management in a Period of Budget Surplus." Report no. AIMD-99-270, September.

Wall Street Journal. 1999a. "Quirk in Yields Is Making Bonds More Attractive." February 2.

———. 1999b. "Treasurys' Trading Volume Is Down Sharply amid Budget Surplus, Weak Market for Bonds." August 17.

———. 1999c. "Bonds Sustain Rally on Low Inflation, Expectation of Fed Restraint on Rates." August 26.

Lou Crandall

Commentary

When thinking about how different asset classes might take over benchmark status from Treasury securities, it is useful to look back at history. We have been here before. Twenty-five years ago, Treasury securities were the benchmark securities for the fixed-income markets at *all maturities*. Today, they are benchmarks only at the intermediate and long ends of the yield curve. In the late 1970s, the Eurodollar (LIBOR) cash market began to take over the benchmark status that Treasury bills had occupied. Starting in the mid-1980s, the Eurodollar futures market became the hedging and trading vehicle of choice for the entire short end of the market. While some of the factors that have led to the migration of the benchmark from Treasury bills to Eurodollars are not particularly relevant to the situation today, other lessons from that experience may be instructive for the issues we will face in the coming months.

One of the reasons—perhaps *the* reason why Treasury bills lost their benchmark status—is that they are not ideal hedging vehicles. Treasury bills are subject to very substantial supply shocks and the supply of bills is interest-inelastic. Thus, the Treasury market is a less efficient market than other fixed-income markets in which both supply and demand respond to changes in interest rates. Inelastic supply is also a feature of the markets for intermediate- and long-term Treasury coupon securities.

In the Treasury bill sector, inelastic supply has been exacerbated by large shifts in supply—month to month, year to year, and over the course of the business cycle. For example, if tax receipts are extraordinarily high, the supply of bills may fall dramatically in the spring, effectively decoupling the Treasury bill from private sector interest rates. As a result of uncertainties in supply, the bill market's benchmark status became vulnerable as soon as more liquid, private sector short-term securities became available.

A related issue, alluded to in Michael Fleming's paper, is the fact that risk-free assets like Treasury securities can be poor hedging vehicles for other fixed-income securities because they do not have the same credit risk characteristics. At the end of the yield curve, LIBOR and Eurodollar futures are inherently superior hedging vehicles (relative to Treasury bills) for most private securities because they incorporate a sort of generic private sector risk premium.

As an aside, I would like to note that what we commonly call the credit risk spread—the difference between private fixed-income yield and comparable Treasury yield—is actually only half of a credit risk premium. The other half is a supply effect reflecting the fact that supply in the Treasury market, particularly the supply of bills, is arbitrary and interest-inelastic, and thus creates a distortion. A lot of things that we historically have called a credit risk spread are in fact just the result of shifts in the supply of Treasuries.

While the market for Treasury coupon securities has some of the same attributes as the bill market, the coupon sector did not lose its benchmark status in the 1980s for two main reasons: market liquidity and the lack of deep alternative markets. First, the Treasury traditionally has worked to keep coupon sector supply as regular and predictable as possible. This (relatively) fixed supply schedule has been very important in developing liquidity in the Treasury market over the years.

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While no private sector borrowers would commit to a fixed supply schedule because it is not optimal for them, a fixed supply has paid off for the Treasury in terms of vastly increased liquidity and an accompanying liquidity premium. In addition, the fact that Treasury coupon supply is inelastic may have increased trading volume and liquidity over the years, because it leaves a small market inefficiency for traders in Treasury securities to arbitrage away. Thus, the Treasury may benefit from forgoing the opportunity to exploit inefficiencies in its own market.

Looking ahead, it is not clear that supply even in the coupon sector can stay predictable. That is precisely the reason why people are asking whether coupons, like bills, are going to cease to be the benchmark.

The other reason why Treasury coupon securities did not lose their benchmark status in the 1980s is that there were no deep alternative private markets. That has changed. With the improvement of information technology and credit monitoring techniques, a much broader array of private sector borrowers now issue fixed-income securities with long maturities.

I will now turn to why LIBOR and Eurodollar futures replaced bills as short-term benchmarks fifteen or twenty years ago. From there, I will draw lessons from what might happen if coupon Treasuries now begin to lose their benchmark status.

What were the factors that gave Eurodollars the advantage over other private sector alternatives? The first factor was pricing transparency, particularly the fact that the Eurodollar market had a published reference rate (LIBOR) that was commonly accepted. The British Bankers Association LIBOR fixings were crucial to the acceptance of LIBOR as a pricing standard—and, ultimately, when a futures contract was offered, as a transaction and hedging vehicle.

The second factor was that the Eurodollar futures contract was designed as a cash-settled rather than a deliverable contract. Previous attempts to develop short-maturity private sector alternatives—commercial paper futures, domestic CD futures—died because of the messiness of deliverability. For Eurodollars, the futures market capitalized on the success of the published reference rate—LIBOR—to create a hugely liquid vehicle that traded just as a derivative.

What does that tell us about the options for alternative benchmarks going forward? One general lesson is that the better match between the credit risk of Eurodollars and that of other short-term securities gave Eurodollars a leg up in liquidity (relative to Treasury bills), particularly in times of market stress. Also, the Treasury bill market did not disappear when Eurodollars took over the benchmark status. It kept thriving as a store of liquidity and as a place to put money in tough times. It continued to be an extremely cheap source of funding for the Treasury. In other words, the Treasury does not have to worry about losing the benchmark status. Treasury securities will still have a role to play as a safe haven; they will still have very low rates even if they cease to be a primary trading vehicle.

Going forward, swaps may have an edge as benchmarks over agencies in part because it would be very easy to develop a widely recognized and accepted swap reference series. There is already an International Swaps and Derivatives Association swap series that could be improved and promoted and could become the basis of organized futures trading. This has not happened yet, and attempts to make it happen thus far have not been successful. However, if an improved hedging vehicle that does not decouple from private sector instruments in times of stress is needed, it would not be hard to create such a reference rate.

Finally, I believe that the same lesson applies to agency securities. Agencies right now are a hot candidate to be benchmarks because their individual issue sizes come close enough to Treasury issue sizes to be liquid and tradable. However, history suggests that an agency futures contract based not on messy deliverability considerations but on an index of agency yields (with no balance-sheet implications for those who use it only as a hedging vehicle) is probably superior to a system in which individual cash agency securities are treated as the benchmark. The agencies would love to see this happen because such a system does not rely on large trading volume in the underlying security, but rather on the development of an index-based futures contract.

One of the major lessons learned from October 1998 concerned the use of Treasuries as hedging vehicles for private sector securities that have different credit risk as well as different supply characteristics. If we accept the notion that a derivatives instrument based on an index of securities is a desirable benchmark for hedging, then the corporate bond market is also attractive. If the corporate bond market develops an index made up of large issue sizes—such as Ford's global bonds—then you will have an ample supply of issuers trying to participate in that index. As a result, a futures contract on such an index could easily be traded, and might ultimately be the best hedging vehicle for those who underwrite corporate issuance.

Thomas C. Glaessner

Commentary

This thought-provoking paper by Michael Fleming raises several interesting issues in light of my experience, and makes an effort to establish some empirical regularities relating to different benchmark securities. After a brief review of the paper's major conclusions, I will address a set of public policy issues that the paper raises.

Major Conclusions of the Paper

First, the premise of the Fleming paper is that the value of the Treasury market as a benchmark will be called into question by improved fiscal performance. This conclusion is itself predicated on a trend shift in productivity growth and greater fiscal restraint that will lead to extensive efforts to pay down debt over a protracted period.

Second, the paper contends that recent worldwide shocks and events including the Long-Term Capital Management (LTCM) crisis "heightened concerns about the Treasury market's benchmark role."

Third, the paper argues that increasingly there will be alternative benchmarks emerging for the pricing and hedging of securities, including the agency debt, corporate debt, and swaps markets. Much of this argument is based on the idea that these forms of debt are characterized by credit risks that will be more correlated with spread products and that these forms of debt will be a better hedge than Treasuries—despite disadvantages in such areas as market size and liquidity.

Public Policy Issues Raised by the Paper

Although the Fleming paper presents some interesting empirical correlations, relationships, and trends, it leaves the reader asking several questions—all of which have a public policy implication and none of which are actually discussed that explicitly.

These questions include:

- What characteristics should a benchmark security actually have and, more basically, what do we mean by a "benchmark"?
- Is the premise of the paper, which suggests the need for new benchmarks versus a Treasury benchmark, actually relevant?
- Might it be that the Treasury market (on-the-run and off-the-run issues) actually functioned quite well during the fall 1998 crisis and during the run-up to Y2K in recent months?

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The author thanks Alan Boyce and Duncan Hennes for helpful discussions in the preparation of these comments. The views expressed are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

- Are the recent changes relating to the repo market and the eligibility of agency debt as collateral in Federal Reserve System open market operations worth maintaining in light of the discussion of alternative benchmarks, or are there reasons why this would be dangerous public policy?
- What are some of the specific advantages and disadvantages of each form of alternative "market benchmark" noted in the paper?
- Can we expect systemic and other forms of risk to increase with the introduction or proliferation of many different benchmarks and with the advent of many types of trading formats—such as ECNs and the new E-bond market?

What Do We Want in a Benchmark Security?

A benchmark is a concept that can have a variety of meanings. One definition used in portfolio management refers to a benchmark portfolio of securities against which performance can be measured. Another meaning refers to a benchmark security whereby the market determines what specific issue or form of security can serve in such a capacity. Several characteristics seem critical: the credit quality of the issuer must be very strong, the issue must be very liquid (transactions should not materially impact the price of the security), and the overall structure of the market for the contract or security in question must have what we might call "integrity." Therefore, the market for a benchmark security should have minimal prospects of being squeezed or cornered by participants.

Benchmark securities are also important for properly measuring and calculating the value of other securities in the same class or other financial contracts more broadly. Often, Treasury securities are useful because they reflect a riskless rate of return. As such, these securities can be compared with other nongovernment-backed securities subject to greater credit risks. In this way, Treasury securities help to define the shape of the credit curve by pinning down the overall level of the credit curve that all lenders and borrowers can see. It is important to note, however, that even Treasury spreads (and securities) reflect a large number of risks—including duration (or average life risks), financing risks, haircuts in repurchase-related transactions, and supply and demand pressures—for on-the-run and off-the-run issues.

Fleming's paper often tends to confuse the roles and functions of a benchmark security with hedging, pricing, and liquidity. Although these many aspects of a security or market can be interrelated, it is clear that markets are evolving in the United States to separate these risks. For example, the swaps markets are critical for hedging and immunizing against certain forex or interest rate risks. However, swap rates themselves are based on underlying cash flows on fixed-income instruments or foreign exchange contracts—in spot or cash markets. Moreover, credit counterparty risk in swaps—thanks to International Swaps and Derivatives Association (ISDA) conventions—is being reduced as a form of variation, and initial margining is beginning to make these contracts similar to exchange-traded contracts. Hence, swaps or other derivatives are somewhat difficult to think of as benchmark securities under the kind of definition one might normally use.

The above considerations highlight the concern that the paper needs to be a bit more precise in defining what is meant by a benchmark security. It seems clear that a benchmark security should above all be liquid. Such a security should have simple properties and should be capable of being used as a building block in valuing other, more complex financial contracts or securities. In this context, it is *critical* that this financial contract and the market in which it trades have integrity, as I indicated above.

Why Will the Treasury Benchmark Cease to Exist?

One premise of the Fleming paper rests on the assumption that a business cycle as we know it will not be present in the next decade. Instead, economic growth combined with a small but persistent trend shift in productivity to about 1.7 to 2.0 percent per annum will generate very large fiscal surpluses. If the trend shift were to be larger (all else being equal)—as implied by some recent studies—then the speed at which the size of the Treasury market would be reduced would accelerate. Such assumptions have always proved questionable, as explicitly mentioned in Office of Management and Budget and Congressional Budget Office projections. Changes in tax and expenditure policies as well as possible modifications to the U.S. health and pension systems could greatly alter many such forecasts. In addition, despite the unprecedented strength of the current business cycle, a slowing in economic growth needs to occur—given current rates, which are close to 5 percent in real terms—with implications for future surpluses.

Even if one feels that the U.S. debt-to-GDP ratio and the absolute debt level will fall dramatically, there are many actions that could be taken to preserve Treasury securities as a liquid

benchmark. Among these would be a number of simple steps that, if combined, could act as a powerful force to improve the depth and liquidity of the Treasury market.

These actions could include:

- Further efforts could be made to reduce the effective Federal Reserve holdings of on-the-run Treasury securities. Here one can ask if the current holdings are justified from the vantage point of monetary control versus the obvious fiscal gains associated with holding a greater proportion of off-the-run Treasury securities, given the Federal Reserve's role as fiscal agent of the Treasury.
- The selective reopening of key Treasury issues or the removal of issues from the calendar and the concentration of issues to create liquid benchmarks, which has already begun, could be continued or intensified. The Canadian authorities and many other treasuries throughout the world are adopting this type of strategy.
- A reevaluation of the issuance of Treasury Inflation Protection securities could be conducted. There is a variety of other, more liquid contracts trading that could be used to gauge inflation expectations.
- The investment guidelines for the Social Security trust fund could be changed to permit a somewhat greater range of investments, which would free up room for private market participants to gain greater access to the on-the-run and off-the-run Treasury markets. Ginnie Mae mortgage-backed securities, Fannie Mae mortgage-backed securities, and Federal Home Loan Mortgage Corporation mortgage-backed securities (subject to proper structures) are examples. The investment guidelines would have to be specified very carefully and stress capital preservation. Such activities versus equity investment would certainly not seem unsound—particularly in the case of Ginnie Mae securities.
- In the extreme case—where the supply of Treasury securities becomes very small and where the Federal Reserve feels uncomfortable undertaking repo transactions based on the use of agency or other debt as collateral and sees value in a Treasury market—other alternatives could be contemplated. Specifically, the Federal Reserve could act to issue debt that it backs and simultaneously sterilize this debt issuance by originating an asset. Under these circumstances, changes in the U.S. legislative framework would be needed, as the central bank presently can act only as the fiscal agent of the Treasury. This idea presumes that having a government Treasury benchmark security is important enough to change the nature of the relationship between the fiscal authorities and the central bank. Such arrangements are not at all uncommon in both developed and developing countries throughout the world. This alternative is obviously not an option that needs to be considered in the short term.

The above considerations highlight the notion that there need not be a rapid deterioration in the effectiveness of the U.S. Treasury market as a benchmark for either on-the-run or off-the-run Treasury securities.

The Fall LTCM Crisis and the Treasury Market

Fleming's paper does a good job of documenting the complex issues raised by the crisis in 1998 and the problems of Long-Term Capital Management, as well as the total seizing up of credit markets and the flight to quality into on-the-run Treasuries. However, it is very difficult to see how those events call into question the effectiveness of the Treasury market as a benchmark.

First, even prior to the crisis, spreads between swaps and off-the-run Treasuries were wide.

Second, and more importantly, the widening of yield spreads between on-the-run and off-the-run Treasuries is in fact the kind of reaction one can expect in a generalized market panic, where many counterparties were unclear as to the extent of risks being undertaken.

Third, recent movements in swap and other spreads have had more to do with large anticipated borrowing requirements prior to Y2K and less to do with systemic risks.

Perhaps most importantly, the LTCM crisis illustrates the fact that the Treasury market enabled markets to absorb an unprecedented shock. The lessons, in my view, have much more to do with the risk management techniques being used and the inability of models and techniques such as value-at-risk to account properly for extreme cases of liquidity risk, than they have to do with defects in the Treasury market per se.

Finally, the role of hedge funds and prop desks in providing liquidity to the Treasury market is also important. Ironically, this will require very careful changes in disclosure policies, as the very nature of trading in any market requires that the participants have no knowledge of the size of the other participants' positions. Moreover, recommendations relating to the disclosure of positions to regulatory agencies could also be problematic depending on how and for what purpose such information is used. It is very clear that the credit evaluation process used in lending to hedge funds like LTCM is among the more critical areas where improvements have been and will continue to be made.

Extending Y2K-Related Changes and Benchmarks

As part of the effort to mitigate problems related to Y2K monetary authorities, the United States undertook a number of actions, including a broadening of the set of securities that can serve as eligible collateral in repos with the Federal Reserve. It is worth noting that these changes in procedure will be reviewed to see if they should be kept in force beyond April 2000.

Although not discussed in Fleming's paper, the implications of allowing most forms of agency debt to be eligible collateral in repos with the Federal Reserve represent a significant step. This action provides added liquidity and credibility to these markets and might be viewed by market participants as enhancing the liquidity of the special benchmark security programs initiated by the agencies.

Ironically, and in contrast with the argument above, in many emerging markets questions would typically be raised if the monetary authorities were thought to be taking on credit risk by dealing in these securities. In the U.S. context, some would argue that this is a kind of back-door method for these agencies to assert that their securities are in fact backed by the central bank and U.S. government, thereby lowering funding costs. Such arguments might apply even if the U.S. authorities made haircuts when such paper is pledged as collateral. The public policy issues surrounding extension of this policy would be worthy of study, either separately or in Fleming's paper. One could even look at the impact on the liquidity of the agency and other markets that these policies have implied to date.

Alternatives to the Treasury Benchmark

Fleming suggests that agency debt, swaps, and corporate debt markets will all become more important as benchmarks. Evidence does suggest that these markets are growing quickly, and agencies have been quick to see that their funding costs can be reduced through careful and strategic placements of debt, including the use of benchmark notes (for example, Fannie Mae) or reference notes (Freddie Mac). In the paper, some of the arguments made for the effectiveness of these benchmarks rest on their correlation with the U.S. Treasury market. In this context, much of the data in the paper are a bit confusing because at times it is unclear if the correlation coefficients are derived on the basis of first differences or levels when the paper refers to the correlation of daily yield changes. In other sections on market liquidity, it is unclear that proper account has been taken of seasonal impacts. In sum, I have some trouble seeing how the empirical work done in the paper supports the contentions made about the effectiveness of specific benchmarks.

The fact is that agency debt carries credit risk, and its correlation with spread products does not automatically make such debt a better hedge, as is claimed in the paper. Rather, the issue here is which financial contracts provide the best means at the lowest costs, including liquidity and other risks of hedging specific forms of risk. In this context, the swaps market offers advantages under many circumstances if such contracts are ISDA-conforming relative to agency debt.

Finally, the adequacy of each of these markets must also be assessed in terms of the credit quality of the underlying issuer and the implications for market integrity and systemic risks. Here, even the agency benchmark market could be viewed with some question. For example, the agencies have to increase the size of their mortgage loans and make other changes in their asset-side origination policies to be able to meet continually their supply commitments on benchmark issues. In addition, as interest rates continue to rise and as mortgage loan origination and refinancing drop off, credit quality could in effect be hurt and the integrity of the new benchmarks could be damaged.

In sum, many of the new benchmark securities may be subject to credit quality issues that are business-cycle-dependent.

The Internet, E-Bonds, and Benchmark Securities

A last area not addressed by the Fleming paper, but a fruitful area for future research, is the confluence of risks that may start to be created by internet banking and the much more active use of electronic trading formats (for example, Trade Web). These risks would apply to the market for new bond issues as well as to secondary-market and after-market trading coupled with the development of many forms of portfolio benchmarks and many different benchmark securities.

These developments will present great challenges in the design of regulations for the Securities and Exchange Commission and even for the Federal Reserve. Although such technological developments can create tremendous scope for reductions in transaction costs and can reduce the operational costs faced by financial institutions on the sale side of the business, the maintenance of market integrity could become challenging.

It would not take much imagination to envision situations in which a shock leads to a flight to quality and many benchmark securities begin to fall in price simultaneously.

Importantly, the transmission of a shock to asset-price movements and the extent of volatility might be much more rapid as technological advances in trading formats become more commonplace. In such cases, the authorities' latitude in ways to deal with the problem might be limited—purely because the speed of reaction necessary would not be feasible. More generally, issues relating to operational and systemic risk would become important.

Stan Jonas

Commentary

Much of what was discussed in Michael Fleming's paper and those that preceded it was, in my opinion, interesting, but methodologically flawed. Of course, the data in the papers are all correct, but I would like to present an alternative view that explains what happened to the fixed-income markets in the fall of 1998 as well as shows that the concern over Treasuries' benchmark status is sort of a black flag without much meaning.

To begin, there is not enough historical perspective in these papers. We have been here many times before. The major problem we encounter is that Treasuries are a poor hedging vehicle. One reason for this problem is that people always assume that the representative investor is long securities and wants to short on-the-run Treasuries as a hedge. In the first half of 1998, the spread between on-the-run and off-the-run Treasuries was almost zero. The question, then, is who would want to be long an off-the-run security and short an on-the-run security at a yield spread approaching zero? This is a position in which a trader will make no money if things go well (if spreads remain narrow) and one in which a trader will get hurt badly if spreads widen. Moreover, history tells us that under such conditions there is a very big possibility that a large "event" will cause spreads to widen. This is exactly what happened in the second half of 1998.

Part of the problem leading up to fall 1998 was the poor use of econometrics, particularly by certain hedge funds. Modern risk management systems rely heavily on calculating value at risk and other measures of potential losses using statistics based on data from the recent past. Of course, these statistics cannot evaluate gains and losses for events that did not happen. As a result, if we develop a value-at-risk statistic during relatively stable times with narrow spreads, many spread trades will look relatively safe, and market participants—in this case, certain hedge funds—will start investing in them on a heavily leveraged basis.

Furthermore, the increased speed of trading and data analysis in recent years has made this problem more complex. All traders use essentially the same methodology to evaluate risk. In addition, everyone analyzes the same data on a daily basis. Thus, everyone conducts the same basic trades and arbitrages. In such a marketplace, when a large (negative) shock to the system occurs, the risk management systems indicate that traders should liquidate their positions at approximately the same time. By doing so, of course, the traders push prices down even further, which causes them to liquidate even more positions, and so on.

This situation was complicated last year by the structure of the Treasury repo market. First, this market is, at least during normal times, almost 100 percent leveraged. This is a poorly understood fact of the market. Dealers themselves do not pay any margins, and market making is so competitive (in good times, at least) that anyone making large trades can shop around until a dealer is found who is willing to finance at nearly 100 percent. During the 1998 crisis, some of the leverage

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disappeared. Large traders, such as hedge funds and relative-value firms, very quickly were asked to put up 2 percent margin, rather than almost zero. As a result, many relative-value trades, which had looked attractive when financed at 100 percent, became *de minimis* trades when financed at 98 percent. This issue highlights the nature of arbitrage: trading huge amounts of securities for a miniscule spread on a highly leveraged basis. A small change in the cost of leverage will force traders out of arbitrage because of their risk management constraints.

By the way, one reason why margins rose and leverage fell was that the dealer community and the bank community had exactly the same kinds of trades as the hedge funds did. When dealers and banks began to post their own spread losses, their risk management systems indicated that they should reduce their positions and their lending, which raised margins.

My conclusion is that there was no flight to quality into Treasuries in the fall of 1998: instead, there was a liquidation of short Treasury positions by massively leveraged hedge funds. These actions drove spreads up to such an extent that other market participants, many of whom had entirely different trading strategies, were forced to sell or close positions when their value-at-risk models indicated that their hedges had deteriorated. The irony is that the existence of a Treasury benchmark worsened the situation. As Treasury yields were pushed lower, all spreads widened, making even more positions unprofitable and causing dealers to raise margins on repos, which in turn caused even more liquidation of short Treasury positions, pushing Treasury yields even lower, and so on.

As a result of these events, it is important to think about hedging within a more generic framework. The basic risk borne by the financial marketplace—that is, the dealer community—is not "level" risk, but correlation risk. For example, how does the yield spread of one country move against that of another country? What happens to the shape of the entire yield curve under different scenarios? How does one price a Bermuda swaption in the United States? For these risks, the key criterion is the correlation between asset-price movements and spreads. Therefore, Treasuries often end up being the worst hedges for such complicated risks, in part because large shocks can significantly change their correlations with other asset prices.

I believe that the usefulness of employing Treasuries for hedging purposes has already passed. I have to agree with those who argue that swaps, as the market is now structured, are almost risk free and in some ways probably less risky than Treasuries. Certainly, the credit risk in the underlying LIBOR is very small, because poorly performing banks are dropped out of that index by the British Bankers Association. In addition, nearly all swap transactions are now (or soon will be) marked to market daily. Thus, no matter what the underlying credit problem is, a trader will have at most one day's price movement risk on a swap, which is essentially the same risk that traders have on Treasury and repo transactions. That is to say, when you buy a Treasury issue or you do a repo, your credit risk is the risk that the dealer might not be around the next day to deliver the security. Furthermore, in good times at least, the Treasury repo market—like the swaps market—is almost 100 percent leveraged.

It seems clear to me that a benchmark futures contract based on LIBOR swaps will be able to replace Treasuries. In this sense, the United States will be following Europe. When the European swaps market first began to develop, I recall visiting European institutions and explaining how we priced instruments from government benchmarks. People there found this practice surprising—nobody knew what a government benchmark was. The institutions traded their securities from swaps and futures benchmarks rather than from governments. Today, the European marketplace has the largest futures trading in the Eurex, far surpassing U.S. futures contracts and fixed-income securities. Furthermore, because the swaps market in the euro is the universal market, swaps spreads usually trade below government spreads. This is completely rational for the euro because swaps are far more liquid than instruments such as European government bonds.

Interestingly enough, the benchmark shift has already started in the United States. The thirty-year Treasury bond is no longer the lead contract for the U.S. futures markets. About four weeks ago, the ten-year note futures became the dominant futures contract in the United States, trading more open interest and volume than the thirty-year bond futures did. In addition, corporate bond debt and mortgage-backed debt traders are now hedging their collateral with interest-rate swaps. This is certainly not a risk-free game and, looking forward, we are likely to see the swaps market change its characteristics. For example, swap rates may be influenced by mortgage prepayment risk, if mortgage-backed securities are hedged in swaps first and then filtered through to the Treasury market.

In point of fact, the benchmark status of the Treasury market has been changing over the past ten to twelve years. Within five to ten years, it seems almost certain that we will have a swaps-based financial marketplace, where only the cash flows will matter, and where market participants will not be concerned with how the flows are bundled. This scenario will be an improvement over the uncertain supply conditions that often drive Treasuries and, more importantly, the Treasury repo market.

In fact, the Treasury repo market is unique: no other country has or is developing the kind of liquid repo markets that we have in the United States, and these markets certainly

do not serve as benchmarks. Elsewhere, when a government security position is financed, it is done at about the swaps or the LIBOR rate. Yet it is precisely this phenomenal institutional repo system in the United States that drives the market for Treasuries and, as such, sometimes makes Treasuries appear to be so strange and distorted in their relationships with other instruments. If the Treasury market's benchmark status is changed, and there is much less need to borrow and lend Treasuries directly, I believe we will see a much more stable environment for trading and hedging. In addition, the combination of Treasuries being "risk-free" and being a benchmark is detrimental to hedging, because only the government can actually borrow risk-free. By changing benchmarks, we will alleviate some of that hedging problem.

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