Accounting for the federal government's cost of funds

George J. Hall and Thomas J. Sargent

The press routinely reports extraordinarily large government deficits, mainly consisting of interest costs, for countries experiencing high rates of inflation.[1] For example, the *New York Times* reported that in 1993 Brazil's government deficit was 30 percent of the country's gross domestic product (GDP).[2] Most of this deficit was accounted for by interest costs. In the late 1980s, less dramatic but still large government interest costs (around 12 percent of GDP) were reported for Italy. These large ratios are computed by dividing a government's nominal interest payments by nominal GDP. Financial specialists know such figures to be substantial overstatements because they fail to account for the real capital losses that government creditors experience during high inflation.[3]

Every year, an equally flawed ratio is reported in the federal budget of the United States. Figure 1 reports these official interest expenses as a percent of federal outlays over the period 1960 to 1995.[4] The figure displays the well-known 1980s growth in interest payments as a fraction of outlays, a hallmark of Reaganomics. Figure 2 displays our corrected estimates of federal interest expenses as a fraction of federal outlays. Compared with the official numbers, the true figures are much more variable, and lower on average.

It is timely to note that section 7 of the recently proposed balanced budget amendment explicitly includes the official interest payments on the federal debt as expenditures.[5] We are not necessarily suggesting that the framers of the amendment are unaware that this measurement is flawed from an purely economic standpoint. The current measure tends to overstate interest payments more the higher the inflation rate is. By including the official measure of interest costs, the amendment's framers may intend to add incentives to lower both inflation and expenditures.

This article describes and defends our corrections to the official series. After showing how to do the accounting correctly, we calculate how the interest costs of the government would have been affected had it used a different debt-management strategy. We simulate the consequences of particular versions of *shorts only* and *longs only* debt-management policies, two classic policies that have been advocated.

A flawed measure of the government's cost of funds

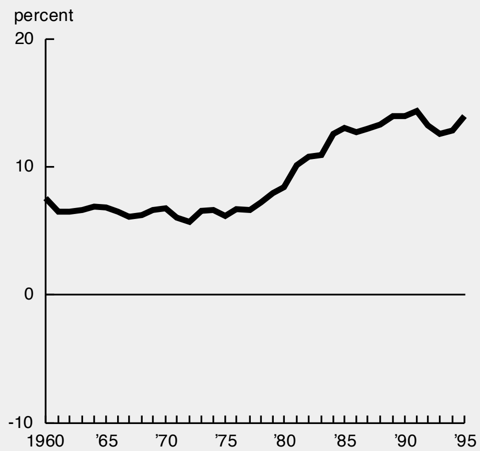
When investors compute the real return on an equity or debt investment, they take into account dividend and coupon payments, the change in price of the stock or bond, and the effect of inflation on the general price level. So should the government in accounting for its interest costs to the public.

In each time period, the government repays its debtholders in two ways: *explicitly* in the form of coupon payments and principal repayments, and *implicitly* in the form of real capital gains on outstanding debt stemming from the diminished term to maturity of the debt, interest rate changes, and inflation. To measure the government's cost of funds, one must account for

George J. Hall is an economist at the Federal Reserve Bank of Chicago. Thomas J. Sargent is a senior fellow at the Hoover Institution at Stanford University, the David Rockefeller Professor of Economics and Social Sciences at the University of Chicago, and a consultant to the Federal Reserve Bank of Chicago.

FIGURE 1

Net interest costs as a share of government spending



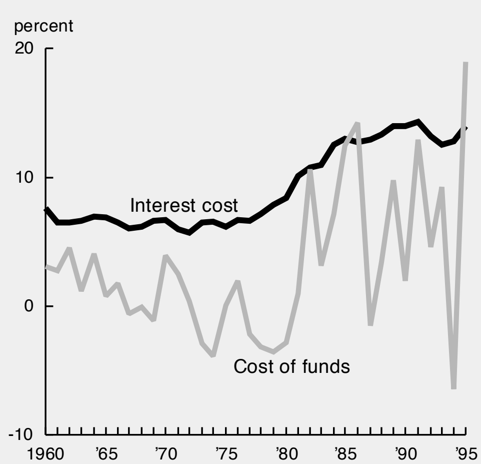
Source: U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, various years.

the capital gains and losses on all outstanding Treasury securities.

The federal government reports an incorrect measure of its cost of funds. It records an imperfect measure of its explicit interest costs and ignores its implicit interest costs. The government computes its cost of funds by forming the sum of current coupons on long-term

FIGURE 2

Total cost of funds and interest costs as a share of government spending



Note: The cost of funds was calculated using equation 5.
Sources: Authors' calculations and U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, various years.

coupon bonds and the appreciation on short-term discount bonds.[6] This measure of the government's cost of funds, shown in figure 1, is a remarkably smooth series, and it is always positive.

The following example illustrates how the government's methodology mismeasures its cost of funds. Consider two bonds that would raise the same value for the government at time $t = 0$, assuming no uncertainty and a constant real interest rate, r. One is a *pure discount* (zero-coupon) bond with ten periods to maturity, paying off P_0 at time 10; the second is a coupon bond with coupon c, paying off P_1 at time 10. From the net one-period interest rate we can compute the *discount factor*, $1/(1 + r)$. The value of the pure discount bond $p_0(t)$ satisfies $p_0(t) = (1 + r)^{-1}p_0(t + 1)$, for $t = 0, 1, \ldots, 9$, where $p_0(10) = P_0$. Evidently, for the pure discount bond, interest accrues through the gradual appreciation in the value of the bond from $p_0(0) = (1 + r)^{-10} P_0$, at time 0 to $p_0(10) = P_0$ at time 10. The rate of appreciation equals the gross interest rate:

$$1 + r = \frac{p_0(t + 1)}{p_0(t)}.$$

The value $p_1(t)$ of the coupon bond satisfies $p_1(t) = c + (1 + r)^{-1} p_1(t + 1)$, $t = 1, \ldots, 9$ and $p_1(0) = (1 + r)^{-1}p_1(1)$, where $p_1(10) = P_1$. The interest rate satisfies

$$1) \quad 1 + r = \frac{c}{p_1(t)} + \frac{p_1(t + 1)}{p_1(t)}$$

for $t = 1, \ldots, 9$.

For coupon bonds of finite maturity with a *principal* payment at the end (really a last big coupon), interest payments (that is, the left-hand side of equation 1) include more than the coupon. Hence, it is not appropriate to measure the interest costs associated with coupon bonds by simply adding up the coupons due this period. Indeed, coupon payments do not represent pure interest in an economic sense; they are partly a repayment of principal. Furthermore, part of the return to investors, and of the cost to the issuer, is in the form of capital gains or losses on bonds as time passes. Any bond with a large final payment is partly a pure discount bond with a significant portion of its return coming in the form of capital gains or losses over time.

Our example indicates some but not all of the corrections that we want to make in the government's accounting for its interest costs. The other adjustments have to do with the treatment of inflation, the time variation in interest rates, and the existence at any moment of a variety of bonds with various coupon schedules and maturities. Next we expand our example to incorporate all of these features and show how to do the accounting properly.

Doing the accounting right

We can build a system for properly counting the government's real interest costs by carefully rearranging the government's period by period budget constraint. We manipulate the budget constraint algebraically to isolate explicit and implicit interest expenses. Explicit interest expenses are the real capital gains on one-period discount bonds; implicit interest expenses are the capital gains to the public from holding longer term bonds.

First we need to convert nominal yields to maturity on government debt into prices of claims on future dollars in terms of current goods. The modern theory of the term structure of interest rates prices a coupon bond in three steps: 1) viewing the coupon bond as a bundle of pure discount bonds; 2) unbundling it into the constituent pure discount bonds and valuing these components; and 3) adding up the values of the components to attain the value of the bundle. The theory thus strips the coupons from the bond, and prices the bond as though it is a weighted sum of pure discount bonds of maturities 1, 2, . . . , j. (The market and the government have followed theory: pre-stripped zero-coupon bonds, or STRIPS, themselves are available in the market.)

Let s_{jt} be the number of dollars at time $t + j$ that the government has promised to deliver, as of time t. To compute s_{jt} from historical data, we have to add up all of the dollar principal-plus-coupon payments that the government has promised to deliver at date $t + j$ as of date t.

Let a_{jt} be the number of time t goods that it takes to buy a dollar in time $t + j$. We work with a real (inflation-adjusted) price, a_{jt}, denominated in units of time goods (so-called dollars of constant purchasing power) and not time t dollars, because we want to keep track of the government accounts in *real* (in goods) terms. We can calculate the prices a_{jt} from

$$2)\quad a_{jt} = \frac{\nu_t}{(1+\rho_{jt})^j},$$

where ν_t is the value of currency (the reciprocal of the price level, measured in goods per dollar), and ρ_{jt} is the yield to maturity on a j-period pure discount bond.[7] Equation 2 tells how to convert the yield to maturity ρ_{jt} on a j-period nominal pure discount bond into the real price of a promise, sold at time t, to one dollar at time $t + j$.

Let def_t be the government's real net-of-interest budget deficit, measured in units of time t goods. We can write the government's time t budget constraint as:

$$3)\quad \sum_{j=1}^{n} a_{jt}s_{jt} = \sum_{j=1}^{n} a_{j-1,t}s_{j,t-1} + \text{def}_t,$$

where it is understood that $a_{0,tm} \equiv \nu_t$ and n denotes the longest years to maturity for bonds.[8] The left-hand side of equation 3 is the real value of the interest bearing debt at the end of period t, determined by multiplying the number of time $t + j$ dollars that the government has sold in the form of j period pure discount bonds, s_{jt}, by their price in terms of time t goods, a_{jt}, and then summing this product (or value) over all such outstanding bonds, $j = 1, \ldots, n$. The right side of equation 3 is the sum of the current net-of-interest real deficit, def_t, and the value of the outstanding debt that the government owes at the beginning of the period, which in turn is simply the value this period of the outstanding promises to deliver future dollars, $s_{j,t-1}$, that the government issued last period.

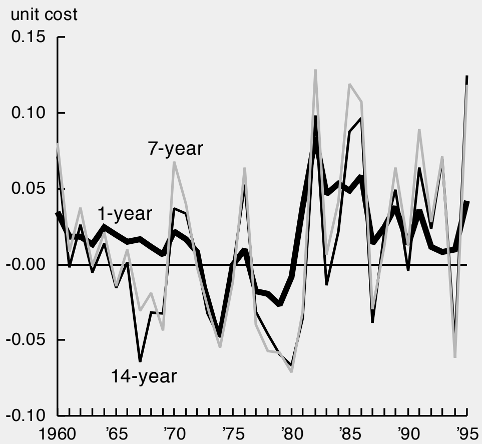
Equation 3 can be rearranged to take the form

$$4)\quad \sum_{j=1}^{n} a_{jt}s_{jt} = \sum_{j=1}^{n} (a_{j-1,t} - a_{j,t-1})s_{j,t-1} + \sum_{j=1}^{n} a_{j,t-1}s_{j,t-1} + \text{def}_t.$$

These two forms of the budget constraint are algebraically equivalent. We have remarked how equation 3 expresses the real value of total debt with which the government leaves a period t, $\Sigma_{j=1}^{n} a_{jt}s_{jt}$ as the sum of the real value of obligations with which it enters

FIGURE 3

Capital gains on zero-coupon bonds



Note: Capital gains are calculated per unit on a year $t + j - 1$ dollar, as of date t, measured in time t dollars. The authors converted the capital gains to *current* dollars by multiplying $a_{j-1,t} - a_{j,t-1}$ by the time t price level, v_t^{-1}.

the period, $\Sigma_{j=1}^{n} a_{j-1,t}\, s_{j,t-1}$, and the government's net-of-interest deficit, def_t. Equation 4 breaks the first term on the right side of equation 3 into an interest component and a previous value component. Again, the left-hand side of the budget constraint in equation 4 is the real value of government debt that the government has outstanding at the end of period t. The first term on the right-hand side of the budget constraint in equation 4 represents interest on the government debt, and can be decomposed as

$$5)\quad (\nu_t - a_{1,t-1})s_{1,t-1} + \sum_{j=2}^{n}(a_{j-1,t} - a_{j,t-1})s_{j,t-1}.$$

The first term in equation 5 is explicit interest and the second term is implicit interest or the capital gain to the public on its claims on the government. Thus, the term $\nu_t - a_{1,t-1}$ is the per dollar real capital gain accruing to one-period discount bonds issued at time $t - 1$. The term $a_{j-1,t} - a_{j,t-1}$ is the change in the price in terms of goods between $t - 1$ and t of a claim to one dollar in time $t - 1 + j$; multiplying this change in price by the dollar value of time $t - 1 + j$ claims outstanding, $s_{j,t-1}$ at time $t - 1$, and summing over j gives the capital gain to the public.

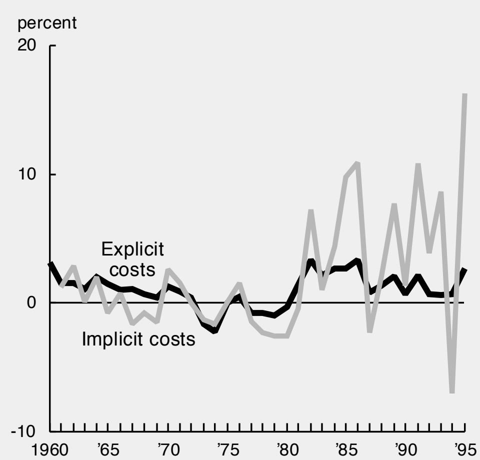
These capital gains are not trivial. In figure 3 we plot the per dollar nominal capital gains, $\Sigma_{j=1}^{n}(a_{j-1,t} - a_{j,t-1})$, for one-year, seven-year, and 14-year zero-coupon bonds. There are three things to note. First, capital losses can be quite large, and they occur frequently. These losses occur during periods of rising inflation or rising interest rates. Second, the capital gains and losses of bonds of different maturities move together. So the government could not have eliminated the inflation and interest rate risk inherent in its portfolio by manipulating the maturity structure of the debt. Third, the longer the maturity of the bond, the greater the volatility of the capital gains. Increasing (or decreasing) the average maturity of the outstanding debt increases (or decreases) the government's and the public's exposure to inflation and interest rate risks.

In figure 4 we report our breakdown of the total interest costs on the marketable federal debt between explicit and implicit real interest costs. In general, the explicit interest costs were relatively small and relatively constant from 1960 to 1995. In contrast, the implicit interest costs were substantial, variable, and often negative. Since the real value of the outstanding debt was growing over this period, s_{jt} was growing over time. So the per dollar capital gains are being multiplied by increasingly large numbers. Thus the implicit interest cost became more volatile throughout the sample period.

We compute the total interest costs born by the federal government by simply adding up the explicit and implicit interest costs. Total interest costs as a percent of government outlays are plotted in figure 2. The explicit, implicit, and total interest costs, as well as the total debt outstanding, in millions of 1983 dollars are reported in table 1. In contrast to the Treasury's

FIGURE 4

Real interest costs



Sources: See figure 2.

TABLE 1

Federal government's interest costs in millions of 1983 dollars

Year	Explicit	Implicit	Total
1960	9,358	0	9,358
1961	4,886	3,863	8,748
1962	5,484	10,142	5,626
1963	3,916	394	4,310
1964	7,536	7,593	15,129
1965	5,809	–2,738	3,071
1966	4,523	3,325	7,848
1967	5,370	–7,843	–2,472
1968	3,440	–3,733	–293
1969	2,027	–7,477	–5,449
1970	6,780	13,596	20,376
1971	5,174	8,640	13,813
1972	2,501	–1	2,500
1973	–9,354	–7,662	–17,016
1974	–13,212	–9,568	–22,780
1975	–3	539	536
1976	3,596	10,573	4,169
1977	–4,796	–10,077	–14,874
1978	–5,321	–16,504	–21,825
1979	–6,629	–17,580	–24,208
1980	–2,081	–17,979	–20,060
1981	10,887	–3,618	7,269
1982	27,383	57,556	84,939
1983	18,009	8,730	26,739
1984	23,430	37,918	61,349
1985	24,336	87,049	111,385
1986	31,339	101,356	132,696
1987	7,496	–20,884	–13,388
1988	12,637	19,428	32,066
1989	19,623	73,032	92,655
1990	6,981	12,851	19,832
1991	20,768	105,116	125,884
1992	7,037	40,695	47,732
1993	5,884	90,648	96,532
1994	6,882	–73,186	–66,304
1995	28,537	173,862	202,399

calculations plotted in figure 1, our computed costs of funds are quite volatile.[9] These costs were negative during periods of large capital losses in the Treasury bond market (for example, the high inflation episodes of the 1970s and the dramatic fall in bond prices in 1994).

Ultimately how volatile the federal government's interest costs are depends on how the government shares inflation risk and interest rate risk with the public. The Treasury and the Federal Reserve can alter this risk-sharing arrangement between the government and the public by manipulating the maturity structure of the outstanding debt. To illustrate this, we run three counterfactual portfolio strategies.

Evaluating alternative portfolio strategies

Assuming that postwar U.S. interest rates had remained unchanged, how would the government's interest expenses have been affected if it had followed a different debt-management policy? If we restrict the government to issuing from its historically observed menu of instruments, this question can be answered by mechanical calculations. We compose alternative hypothetical portfolio strategies, and track the net costs the government would have incurred at historically realized interest rates.[10] Below we describe how these costs can be calculated, and perform some of these calculations.[11]

Given historical time series data on $\{a_{jt}, s_{jt}, \text{def}_t, v_t\}_{t=t_0}^{T}$ we can use equations 4 and 5 to account for interest payments on the government debt. Given $\{a_{jt}, \text{def}_t, v_t\}_{t=t_0}^{T}$, we can evaluate the effects on the government budget of portfolio strategies $\{s_{jt}\}_{t=t_0}^{T}$ other than the historical one. These alternative portfolio strategies must be constructed to respect the government budget constraint in equation 3.

The alternative strategies are:

1. Shorts only: Set $s_{jt} = 0$ for $j > 1$, $\forall t$.
2. Tens only: Set $s_{jt} = 0$ for $j \neq 10$, $\forall t$.
3. Longs only: Set $s_{jt} = 0$ for $j < n$, $\forall t$, where n is the longest bond priced by the McCulloch and Kwon (1993) dataset.

The first and third policies represent the poles of proposed debt-management policies.[12] For an economy with only nominal interest bearing debt, the class of feasible financing rules is

$$6)\quad \frac{a_{kt}s_{kt}}{\text{def}_t + \sum_{j=1}^{n} a_{j-1,t}s_{j,t-1}} = f_{kt},$$

and

$$7)\quad \sum_{k=1}^{n} f_{kt} = 1.$$

In words, f_{kt} is the fraction of the outstanding debt at time t that is due at time $t + k$.

Restrictions in equations 6 and 7 are algebraic implications of the government budget constraint in equation 3. Let $\Sigma_{j=1}^{n} a_{j-1,t}s_{j,t-1} \equiv V_t$ be the value of interest bearing government debt at the beginning of period t. Given a policy f_{kt}, $k = 1, \ldots n$, together with observed interest rates, equation 5 can be solved for s_{kt}, $k = 1, 2, \ldots n$:

$$s_{kt} = \left(\frac{f_{kt}}{a_{kt}}\right)(\text{def}_t + V_t).$$

This equation can be solved recursively to build up records s_{kt} and decompositions of interest cost under alternative hypothetical debt-management rules.

The first two policies fall into the set of simple rules that are time invariant, that is, $f_{it} = f_j \ \forall\ t$.

For the bills only policy, $f_{1t} = f_1 = 1$ and $f_{kt} = f_k = 0$ for all $k \neq 1$. For the tens only policy $f_{10t} = f_{10} = 1$ and $f_{kt} = f_k = 0$ for all $k \neq 10$. Our third policy, longs only, is a time varying policy, which depends on the maturity of the longest bond outstanding each year during our sample period. For each of these policies, the entire debt is purchased and resold to make sure *all* the debt is held in either one-year bills, ten-year zero-coupon bonds, or n-year zero-coupon bonds (depending on the experiment).

For any feasible specifications of f_{jt}, we can evaluate the implicit and explicit interest costs of financing a stream of government deficits. Our three policies will have quite different effects, largely through the behavior of the value of currency, ν_t.

The data

The s_{jt} series are computed using data from the CRSP Government Bonds Files. For each Treasury note and bond outstanding, CRSP reports the maturity date, the coupon rate, and the face value held by the public. The original source for these data is table PDO-1 of the *Treasury Bulletin*. Since neither the *Treasury Bulletin* nor CRSP reports the face value of Treasury bills held by the public, these data are backed out of table FD-5 of the *Treasury Bulletin*. All data are as of December 31 of each year.

The value of the currency, v_t, is computed by:

$$v_t = \frac{100}{p_t},$$

where p_t is the price level. The price level is the monthly series CPI—all items, from the Bureau of Labor Statistics. The base for the CPI series is 1982–84 = 100. We sample the December observation of each year to create the annual p_t series.

The yield to maturity series, ρ_{jt}, is constructed by point sampling end-of-month data from McCulloch and Kwon (1993) and Bliss (1996) containing the zero-coupon yield curve implicit in U.S. Treasury coupon bond prices. Hence ρ_{jt} is the yield to maturity on a j-period pure discount bond as of December 31 of year t.

We calculate the prices, a_{jt}, using equation 2:

$$a_{jt} = \frac{v_t}{(1 + \rho_{jt})^j},$$

where $j = 1, 2, \ldots, 30$ and $t = 1960, \ldots, 1995$.

In constructing our counterfactual debt-management figures, we use equations 4 through 7 with the appropriate time-invariant f_{it}. We imputed the real net-of-interest deficit series, def_t, from the government budget constraint, equation 3, using the actual a_{jt} and s_{jt} series.

The results

Below, we discuss some of the properties of the actual s_{jt} and f_{jt} series, review the historical paths for inflation and the term structure of interest rates, and report the results of our experiments.

Figure 5 shows the average maturity for our calculated s_{jt} series. Its variations generally match those of the average maturity of the federal debt series reported by the Treasury, though the levels differ. We believe there are

FIGURE 5

Average maturity of constructed pure discount bonds

FIGURE 6

Maturities of federal debt due in *j* years

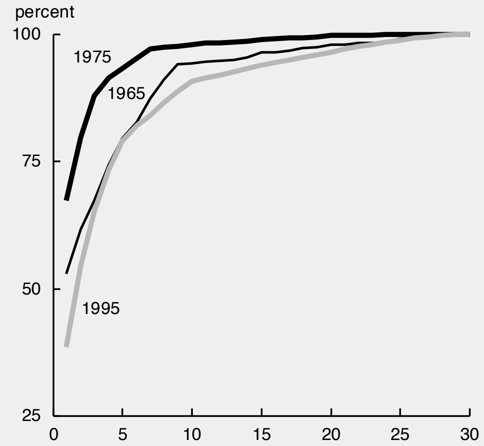
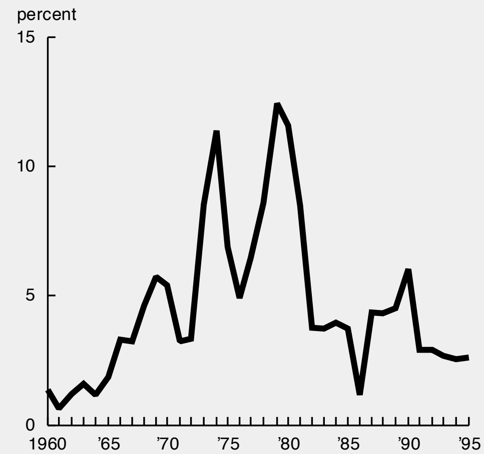


FIGURE 7

Inflation rate



Sources: U.S. Department of Labor, Bureau of Labor Statistics and Federal Reserve Board of Governors.

some problems the Treasury's series (for example, it confines itself to marketable securities only after 1975) and prefer our methodology of reducing each bond to a zero-coupon basis by allocating coupons to the year in which they fall due.

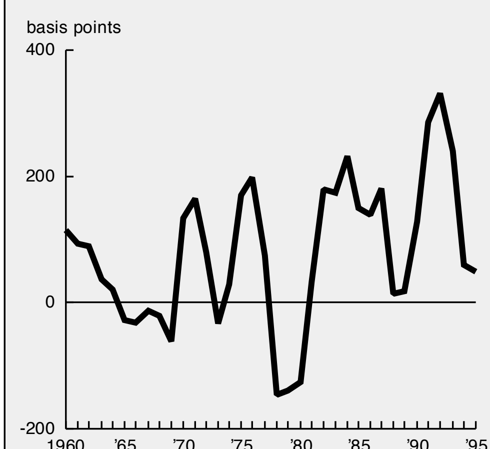
The average maturity falls from the mid-1960s to 1975 and rises steadily for about thirteen years before leveling off at four years for the last seven years of the sample. The steady fall in the average maturity during the late 1960s and early 1970s is partly the consequence of federal legislation, repealed in 1975, which prevented the Treasury from issuing long-term instruments paying interest above a threshold rate that market rates were then exceeding. As we shall see, by causing the Treasury to shorten the average maturity of its debt during the high inflation years of the 1970s, this law prevented the government from fully benefiting from the negative implicit real interest it managed to pay through inflation.[13]

Figure 6 plots the percentage of the federal debt due within *j* years for 1965, 1975, and 1995. This figure was constructed by taking a cumulative sum of the observed f_{jt} series for each of the three years. Throughout the period we studied, the federal debt was heavily weighted toward securities with maturities of one year or less. In 1995, almost 40 percent of the government's portfolio was due within one year. Only a tiny fraction of the federal debt is financed with long-term bonds.

Figure 7 plots the percentage change in the price level, the inflation rate, and is dominated by the high inflation rates of the 1970s. The spread between the ten-year bond rate and the one-year bond rate is plotted in figure 8. When this difference is positive, the yield curve is upward sloping. When it is negative, the yield curve is inverted. In general, the inflation rate and the slope of the term structure moved in opposite directions. The yield curve tended to

FIGURE 8

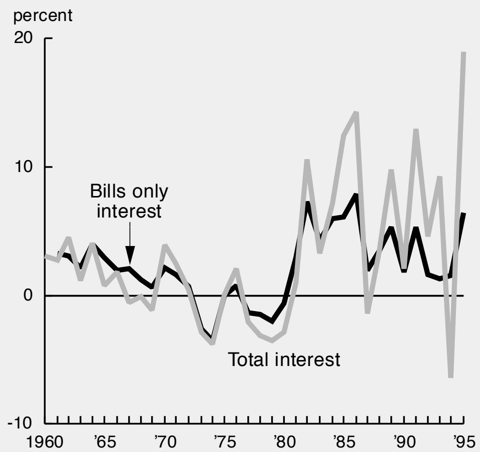
Ten-year rate minus one-year rate



Source: J. McCulloch and H. Kwon, "U.S. term structure data, 1947–1991," Ohio State University, working paper, No. 93-6, 1993; and R. Bliss, "Testing term structure estimation methods," *Advances in Futures and Options Research*, 1996.

FIGURE 9

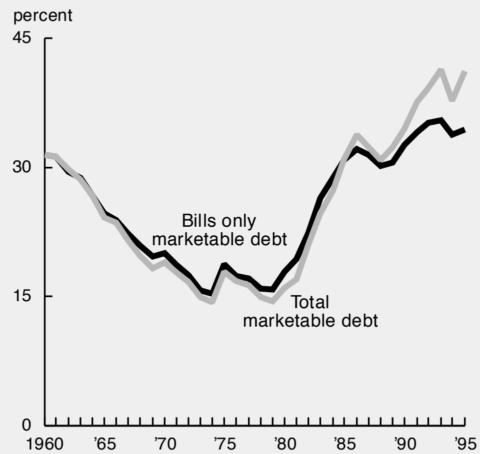
Interest as a share of total government expense, bills only



Sources: See figure 2.

FIGURE 10

Marketable debt as a share of gross domestic product, bills only



Sources: See figure 2.

flatten or become downward sloping during periods of rising inflation.

Figures 9 and 10 display the results of our first experiment: a bills only policy. Figure 9 shows that the realized total real interest (explicit plus implicit) would have been somewhat higher during the late 1960s and most of the 1970s under the bills only policy than under the actual policy followed. During the late 1960s the yield curve was inverted, so long-term rates were below short-term rates. But, more importantly, the high inflation of the 1970s substantially decreased the real value of the federal government's outstanding obligations.[14] However, this pattern reversed in the early 1980s; in the second half of the sample, as inflation fell and the yield curve became consistently upward sloping, the interest costs under the bills only policy would have been lower than under the actual policy.

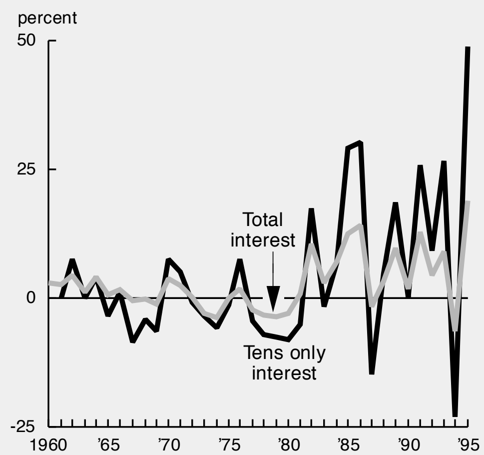
Figure 10 shows that under the bills only policy the real value of the marketable interest-bearing debt would have been higher through the mid-1980s. But by the end of the period the real value of marketable interest-bearing debt would have been lower under the bills only policy than under the actual policy. Had the bills only policy been followed, the outstanding debt would have been 34 percent of GDP. In 1995, the actual debt to GDP ratio was 41 percent.

Figures 11 and 12 show what would have been the total real interest costs and the real value of marketable debt had a policy been in place of leaving only ten-year bonds outstanding at the end of each year. Figure 11 shows that relative to the actual policy, real interest costs would have been much more variable year to year and would have been negative for many years, especially during the inflationary years of the 1970s. Note that as the size of the federal debt grew, following such a policy would have substantially increased the volatility of the federal government's cost of funds. Figure 12 shows that under a tens only policy, real government debt would have been 53 percent of GDP in 1995.

Figures 13 and 14 show the total real interest costs and the real value of the debt under a policy of issuing the longest available maturity (that is, the longest maturity that was actually priced in McCulloch and Kwon's (1993) data set). We see more variable interest costs but less accumulation of debt under the longs only policy than under the tens only policy. Note that in the 1970s, due to the high inflation, the real value of the outstanding debt would have been substantially lower under the longs only than under the actual policy. However, by the end of the sample period, the ratio of the outstanding debt to GDP under the longs only policy would have been considerably higher than the ratio under the actual policy.

FIGURE 11

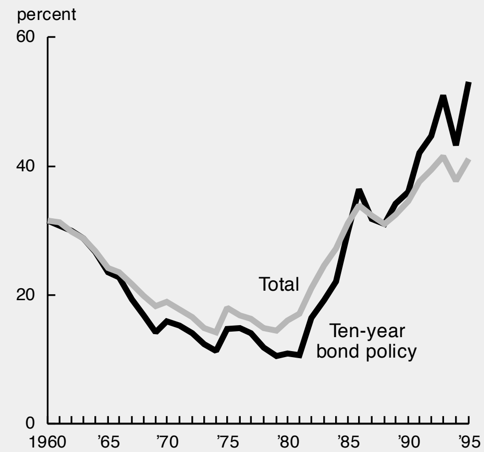
Interest as a share of total government expense, tens only



Sources: See figure 2.

FIGURE 12

Marketable debt as a share of gross domestic product, tens only



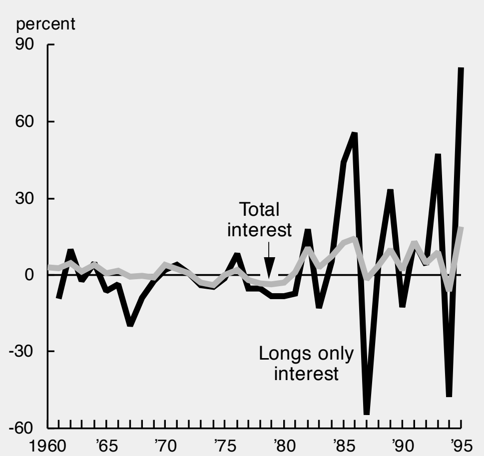
Sources: See figure 2.

These results indicate that debt-management policies weighted toward *longer* maturities would have led to lower interest costs and less accumulation of debt over the period from 1960 to 1980. After 1980, debt-management policies weighted toward *shorter* maturities would have generally lowered interest costs and led to less accumulation of debt. From figure 5 it is clear that the Treasury and Federal Reserve reduced the average maturity of outstanding debt throughout the 1960s and early 1970s; they then increased the average maturity during the late 1970s and throughout the 1980s. Our analysis indicates that to have minimized its borrowing costs, the government should have engaged in the opposite strategy.

Of course, with hindsight we could have found the portfolio-share policy that would have minimized the government's cost of funds. However, the purpose of these counterfactual

FIGURE 13

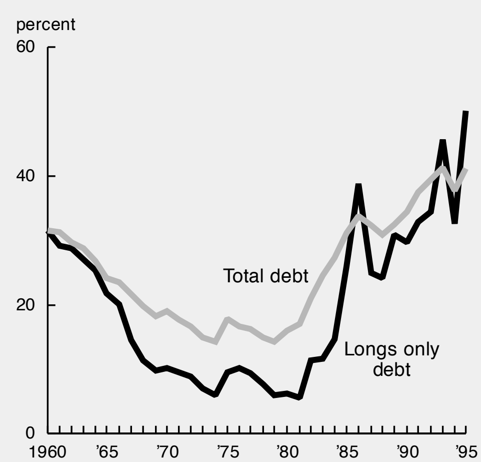
Interest as a share of total government expense, long bonds only



Sources: See figure 2.

FIGURE 14

Marketable debt as a share of gross domestic product, long bonds only



Sources: See figure 2.

exercises is not to engage in "Monday morning quarterbacking" but to illustrate how the maturity structure of the debt affects how the government and bondholders share inflation and interest rate risk.

Moreover, caution is in order in interpreting the results of an evaluation of a counterfactual debt-management policy. Interest rates are a random process, and the result of following a given strategy is too. What most drives the outcome of our counterfactual exercises is the outcome for inflation. In issuing nominal securities, the government is offering the public a risky instrument whose real return is sensitive to the rate of inflation over the life of the bond. Our results indicate that from 1960 to 1995, inflation came in high with sufficient frequency to let the government often pay negative real interest and sometimes substantially negative real interest. These high inflation rates make the longer maturity portfolio policies come in with lower interest costs during the 1970s. Clearly, the outcome would have been different had inflation come in much lower.

Conclusion

This article makes two points. First, the federal government reports a flawed measured of its own cost of funds. Second, the maturity structure of the debt influences the way inflation risk and interest rate risk are shared by the government and its creditors.

The first point is not just nit-picking. By ignoring the effects of inflation and changes in interest rates on the value of the outstanding federal obligations, the official interest payment calculations make it difficult to evaluate the true cost of various proposals. For example, the introduction of index bonds will change how the government shares inflation risk with its creditors since the government can not induce capital losses on these bonds through inflation. How these bonds can be expected to influence to government's cost of funds is beyond the scope of this paper; but it should be clear that the Treasury's accounting methods are inappropriate for evaluating the costs of these new bonds.

The second point is a word of caution regarding periodic calls for the Treasury to "painlessly pare billions from its interest bill by refinancing the government's existing debt with bonds that mature more quickly."[15] While our counterfactual experiments demonstrate that shortening (or lengthening) the average maturity of the U.S. debt can at times save the Treasury billions of dollars, these savings depend on the future paths of interest rates and inflation—two series which are notoriously hard to predict. And if the government bets the wrong way, the mistake can be quite expensive.

NOTES

[1]This article extends estimates and arguments from Sargent (1993).

[2]See the article by Nash (1993).

[3]See Ljungqvist and Sargent (1997) chapter 8, exercise 1; and Blanchard and Sachs (1981).

[4]The series plotted is net interest paid by the federal government from the *National Income and Product Accounts*. The figure displays a series which is remarkably smooth and always positive.

[5]See H.J. Resolution 1, 105th Congress, 1st Session.

[6]The Department of the Treasury calculates the net interest as the sum of coupon payments, accrued interest on bills and zero-coupon bonds, and interest on nonmarketable debt.

[7]We use the yield to maturity series for pure discount bonds constructed by McCulloch (1990) and McCulloch and Kwon (1993). These data were updated by Bliss (1996).

[8]See Sargent and Wallace (1981) for a discussion of this form of the government budget constraint, in particular for a defense of the use of pre-tax real yields on government debt and a net of interest government deficit. Sargent and Wallace use a 'crowding out' assumption to justify the use of pre-tax yields.

[9]The Treasury's calculations include some assets (chiefly savings bonds and some securities issued to state and local governments) that are not included in our analysis. So these two graphs are not strictly comparable. Nevertheless, we expect that adding these assets to our analysis would not change the results in any meaningful way.

[10]Under the assumption that historical interest rates would have been unaffected by the switch in debt policy, this accounting exercise involves no use of economic theory. To infer the government's costs had it issued *different* assets, for example indexed bonds, we would need a theory about the price of pure discount indexed bonds.

[11]The standard theory of the term structure of interest rates assumes that interest rates on all maturities would be

unaffected by alterations in the maturity structure of the government's debt. This assumption can be justified by appealing to the logic of the Modigliani-Miller theorem from finance.

[12]Actually, not quite the extreme poles. Milton Friedman (1948) advocated the policy that the government finance its deficits and surpluses only by issuing or retiring currency. This is a 'shorts only' policy in which only $j = 0$ maturity debt is issued. At the other end of the spectrum, the classic British policy was to issue only consoles, which are infinite maturity bonds, which amount to an infinite stream of pure discount bonds, one for each date in the future.

[13]This is the type of law that Missale and Blanchard (1994) suggest as a device that governments with a large ratio of debt to gross domestic product use to assuage investor inflation fears by reducing the government's returns from inflation.

[14]Recall that a Treasury bond is a promise to pay a certain number of nominal dollars at a future date. When inflation increases, the real value of those nominal dollars falls.

[15]The quote is from Blinder (1992). Also see Forsyth (1993) and Passell (1993).

REFERENCES

Blanchard, Olivier Jean, and Jeffrey Sachs, "There is no significant budget deficit," *New York Times*, March 6, 1981, p. 26.

Blinder, Alan, "Let's start the new year by cutting the debt load," *Business Week*, January 13, 1992, p. 18.

Bliss, Robert, "Testing term structure estimation methods," in *Advances in Futures and Options Research*, Vol. 8, Peter Ritchken (ed.), November 1996.

Forsyth, Randall, "Don't stop thinkin' of how to borrow," *Barron's*, January 25, 1993, pp. 52–53.

Friedman, Milton, "A monetary and fiscal framework for economic stability," *American Economic Review*, Vol 48, June 1948, pp. 245–264.

Ljungqvist, Lars, and Thomas J. Sargent, "Recursive macroeconomic theory," Stanford University, manuscript, Internet, available from http://riffle.stanford.edu, March 1997.

McCulloch, J. Huston, "U.S. term structure data, 1946–87," in *Handbook of Monetary Economics*, Vol 1, Benjamin Friedman and Frank Hahn (eds.), Amsterdam: North-Holland, 1990, pp. 672–715.

McCulloch, J. Huston, and Heon-Chul Kwon, "U.S. term structure data, 1947–1991," Ohio State University, working paper, No. 93-6, 1993.

Missale, Alessandro, and Olivier Jean Blanchard, "The debt burden and debt maturity," *American Economic Review*, Vol. 84, No. 1, March 1994, pp. 309–319.

Nash, Nathaniel C., "Brazil seeks to revive its economic miracle, lying in ruins," *New York Times*, February 16, 1993, Section A, p. 9.

Passell, Peter, "Economic scene," *New York Times*, January 21, 1993, Section D.

Sargent, Thomas J., "Fact or fiction: Shortening debt maturity lowers interest costs," Catalyst Institute Research Project, manuscript, December 1993.

Sargent, Thomas J., and Neil Wallace, "Some unpleasant monetarist arithmetic," Federal Reserve Bank of Minneapolis, *Quarterly Review*, Vol. 5, Fall 1981, pp. 1–17.