CONSEQUENCES OF GOVERNMENT DEFICITS AND DEBT

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This draft: April 12, 2011

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I. INTRODUCTION

Neither a borrower nor a lender be,

For loan oft loses both itself and friend,

And borrowing dulls the edge of husbandry.

William Shakespeare, *Hamlet*, Act I, Scene III, 75-77

Polonius' advice to Laertes would not bode well in an intellectual discipline such as economics, in which borrowing and extending ideas is a staple of new insights. This essay is about debt and its consequences, and it is impossible for me to think of Ben Friedman without thinking of debt.

Mine.

One of the first faculty members I met as a young engineer arriving from the hinterlands in 1979, Ben's questions about economics and public policy reassured me that my choice of discipline and place of study were right for me. A clear teacher of models and methods in macroeconomics and monetary theory, Ben opened for me a lifetime curiosity about economic fluctuations and effects of monetary and fiscal policies on economic activity. That he did so at a time of such great change in economic events, public policy, and models made his loan of ideas and way of thinking all the more significant. The debt I owe only grew over time, as Ben provided advice on research and career.

Many such debts are owed to Ben Friedman. Those of us here are only a subset of borrowers. Hopefully, we crowded out no important ideas. And, hopefully, we have extended credit to others aided by his generosity.

One aspect of crowding out studied in Ben's research is the question of whether short-run activist fiscal policy has significant real effects. In careful, nuanced analysis in a portfolio model (Friedman, 1978), he illustrates that 'crowding out' or 'crowding in' are possible, depending on responses of the real and financial sectors of the economy and monetary policy. This debate has, of course, intensified in recent years, as activist fiscal policy has reasserted itself since 2001 (see, for example, Auerbach and Gale, 2009; and Hubbard, 2009).[1]

But it is the consequences of deficits for long-term capital formation that is my jumping off point for this essay. And it is the consequences of structural deficits through higher interest rates and anticipated tax burdens that occupy Friedman's attention in his 1988 book *Day of Reckoning*.[2] I now turn to an analysis of these arguments. While I recall disagreement with many of Ben's criticisms of economic policy in the 1980s (and I still have some), Friedman's focus on the costs of

[1] A key element in evaluating output effects of recent attempts at fiscal stimulus in the United States is the value of policy multipliers. A recent paper by the (then) Chair of the Council of Economic Advisers Christina Romer and Jared Bernstein (2009), using two quantitative macroeconomic models, estimates that a one percent increase in government spending would increase real GDP by 1.6 percent. This estimate stands in contrast to the negligible long-run effect estimated by Taylor (1992). Hall (2009) argues a consensus estimate for the government purchases multiplier of about 0.75. The Romer-Bernstein effect persists because they assume that the Federal Reserve continuously holds the federal funds rate at zero. This assumption is inconsistent with a long-run non-inflationary equilibrium. By contrast, Cogan, *et al.* assume the federal funds rate to be zero in 2009 and 2010, following a standard monetary rule thereafter. They also use a forward-looking model in which the stimulus spending is paid for by future taxes (conservatively assumed to be lump sum taxes). Three years out, Cogan, *et al.* estimate a multiplier for government purchases of 0.4, one fourth the value suggested by Romer and Bernstein. The negative wealth effect of future taxes on consumption and investment in Cogan, *et al.* is likely conservative, given that the Obama administration has announced its future reliance on *distortionary* taxes on labor income and capital income. Of course, going the other way, the presence of liquidity-constrained households could lead to higher marginal propensities to consume (though such an effect is likely modest if the share of constrained households is relatively low; see Hubbard and Judd, 1986).

[2] This book is part of a long-term interest, with papers (1977, 1978, 1980, 1983, 1985, 1986, and 2005) and edited volumes of research (1982, 1985, 9186, and 1992).

structural budget deficits figures in my own critique of economic policy in the 2000s (Hubbard and Navarro, 2010). This essay tackles in turn the links between structural deficits and capital formation emphasized in Friedman's research — effects of budget deficits on interest rates, future tax burdens, and, finally, moral dimensions of budget choices.

II. GOVERNMENT DEBT AND INTEREST RATES

The recent resurgence of federal government budget deficits has rekindled debates about the effects of government debt on interest rates, debates figuring prominently in Friedman's work on capital formations. While the effects of government debt on the economy can operate through a number of different channels, many of the recent concerns about federal borrowing have focused on the potential interest rate effect. Higher interest rates caused by expanding government debt can reduce investment, inhibit interest-sensitive durable consumption expenditure, and decrease the value of assets held by households, thus indirectly dampening consumption expenditure through a wealth effect. The magnitude of these potential adverse consequences depends, of course, on the degree to which federal debt actually raises interest rates.

While analysis of the effects of government debt on interest rates has been ongoing for about three decades, including Friedman's important work, there still is little empirical consensus about the magnitude of the effect, and the difference in views held on this issue can be quite stark. While some economists believe there is a significant, large, positive effect of government debt on interest rates, including Friedman, others interpret the evidence as suggesting that there is no effect on interest rates. Unfortunately, both economic theory and empirical analysis of the relationship between debt and interest rates have proved inconclusive.

In this section, I review the state of the debate over the effects of government debt on interest rates and provide some additional perspectives and empirical evidence.[3]

A. Theory: How Might Government Debt Affect Interest Rates?

A standard benchmark for understanding and calibrating the potential effect of changes in government debt on interest rates is a standard model based on an aggregate production function for the economy in which government debt replaces, or "crowds out," productive physical capital.[14] In brief, this model has the interest rate (r) determined by the marginal product of capital (MPK), which would increase if capital (K) were decreased, or crowded out, by government debt (D). With a Cobb-Douglas production function:

$$Y=AK^{\alpha}L^{(1-\alpha)},$$

in which L denotes labor units, A is the coefficient for multifactor productivity, and " is the coefficient on capital in the production function, then the total return to capital in the economy ($MPK*K$) as a share of output (Y) equals α:

$$\alpha = (MPK \times K)/Y.$$

This expression implies that the interest rate is determined by:

$$r = MPK = \alpha \times (Y/K) = \alpha \times A \times (L/K)^{1-\alpha}.$$

[3] This discussion follows the analysis in Engen and Hubbard (2005).
[4] See Ball and Mankiw (1995), Elmendorf and Mankiw (1999), and Council of Economic Advisers (2003).

If government debt completely crowds out capital, so that

$$\partial K/\partial D = -1,$$

then an exogenous increase in government debt (holding other factors constant) causes the interest rate to increase:

$$\partial r/\partial D = (\partial r/\partial K)(\partial K/\partial D) = \alpha \times (1- \alpha) \times (Y/K^2) > 0$$

(because $0< \alpha <1$ *and* $Y, K >0$).

In this theoretical framework, which is commonly used to describe the potential effects of government debt on interest rates, there are several important implications for empirical analysis of those effects. First, the level of the interest rate is determined by the level of the capital stock and, thus, by the level of government debt. It is the change in the interest rate that is affected by the government budget deficit, which is essentially equal to the change in government debt. Empirical estimates of the effect on interest rates tend to differ markedly depending on whether the deficit or debt is used, and most empirical work uses a specification different from that implied by a this economic model; that is, the deficit is regressed on the level of the interest rate.

A model that suggests that deficits affect the level of the interest rate is a Keynesian *IS-LM* framework or where in *IS-MP* framework, deficits increase the interest rate not only because debt may crowd out capital but also because deficits stimulate aggregate demand and raise output (see, for example, Hubbard and O'Brien, 2011; and Hubbard, O'Brien, and Rafferty, 2012). However, an

increase in interest rates in the short run from stimulus of aggregate demand is a quite different effect than an increase in long-run interest rates owing to government debt crowding out private capital. Moreover, as discussed by Bernheim (1987), it is quite difficult (requiring numerous assumptions about various elasticities) to construct a natural Keynesian benchmark for quantifying the short-term stimulus from deficits and the long-term crowding out of capital in trying to parse out the effect of government deficits on interest rates.

Second, factors other than government debt can influence the determination of interest rates in credit markets. For example, in a growing economy, the monetary authority will purchase some government debt in order to expand the money supply and try to keep prices relatively constant (McCallum, 1984). Government debt held by the central bank does not crowd out private capital formation, but many empirical studies of federal government debt and interest rates ignore central bank purchases of government debt.

More difficult econometric problems are posed by the fact that other potentially important, but endogenous, factors are involved in the supply and demand of loanable funds in credit markets. In addition to public sector debt, private sector debt incurred to increase consumption also could potentially crowd out capital formation. Typically, measures of private sector debt or borrowing are not included in empirical studies of government debt. In a variant of a neoclassical model of the economy that implies Ricardian equivalence, increases in government debt (holding government consumption outlays and marginal tax rates constant) are offset by increases in private saving and thus the capital stock is not altered by government debt and the interest rate does not rise (see, for example Bernheim (1987), Barro (1989), and Seater (1993) for discussions of the Ricardian equivalence hypothesis). Private sector saving is usually not included in empirical analyses of government debt and the interest rate. Also, in an economy that is part of a global capital market,

increases in government debt can be offset by increases in foreign sector lending. Many empirical analyses of government debt and interest rates do not account for foreign-sector lending and purchases of U.S. Treasury securities.

Finally, the interest rate is also affected by other general macroeconomic factors besides capital that influence output (Y); in the simple model here, those factors include labor and multifactor productivity. Thus, there is usually some accounting for general macroeconomic factors that can affect the performance of the economy in empirical analyses of the effect of government debt on interest rates.

Certain assumptions—Ricardian equivalence or perfectly open international capital markets in which foreign saving flows in to finance domestic government borrowing—provide one benchmark for the potential effect of government debt on the interest rate. In these scenarios, government debt does not crowd out capital (that is, $\partial K/\partial D = 0$) and, thus, has no effect on the interest rate. For the alternative crowding-out hypothesis (that is, $-1 \leq \partial K/\partial D < 0$), the production-function framework presented above can provide a range of plausible calculations of the potential increase in interest rates from an increase in the government debt.

By taking logs of the interest rate equation above, differentiating, and noting that $dlnx$ is approximately equal to the percentage change ($\%\Delta$) in x yields:

$$\%\Delta r = \%\Delta Y - \%\Delta K = (\alpha - 1)(\%\Delta K) + (1 - \alpha)\%\Delta L.$$

Because labor input is typically held constant (i.e., $\%\Delta L = 0$) in the debt-crowd-out experiment,

$$\%\Delta r = (\alpha - 1)(\%\Delta K).$$

For the purpose of calculating a benchmark, we assume that the capital share of output is $\alpha = 0.33$, which is approximately equal to its historical value in the United States. National accounts data suggests that the marginal product of capital is about 10 percent. Engen and Hubbard (2005) estimate that an increase in government debt of one percent of GDP would reduce the private capital stock by 0.36 percent, assuming that there is no offset to the increase in federal debt from increased domestic saving or inflows of foreign saving (that is, $\partial K/\partial D = -1$). Multiplying this percentage decline by -0.67 (equal to $\partial - 1$, where $\partial = 0.33$) implies an increase in the marginal product of capital of 0.24 percent. The resulting increase in interest rates is 2.4 basis points.

If the increase in federal debt were five percent of GDP, interest rates are calculated to rise by 11.8 basis points. This effect could be the result of an increase in federal debt in a single year, or the result of a persistent increase in federal debt (that is, a persistent deficit) of one percent of GDP per year over five years. An increase in federal debt of ten percent of GDP — again, the result of a one-time increase (as in our recent experience) or the consequence of a persistent increase in the United States, we first examine some basic empirical facts about government debt, interest rates, and other related factors in the U.S. economy. These facts illustrate some of the difficulties posed for econometric analysis.

Some Basic Facts

Over the past half-century U.S. federal government debt held by the public as a percent of GDP has fluctuated from a high of about 60 percent of GDP to a low of around 25 percent of GDP in the mid-1970s. While federal debt climbed during the 1980s and early 1990s to almost 50 percent of GDP,

declining thereafter to below 40 percent of GDP, then rising sharply to over 60 during the 2007-2009 financial crisis and its aftermath. The Congressional Budget Office (2010) estimates that this ratio will rise to 90 percent by 2020.

Federal borrowing, or the yearly change in federal debt, as a percent of GDP has averaged over two percent over the past fifty years, and has fluctuated from peaks around ten percent of GDP to the retirement of debt equal to about three percent of GDP in 2000. Not surprisingly, federal borrowing tended to rise shortly after the recession episodes in 1974-1975, 1980-1981, 1990-1991, 2001, and 2007-2009.

Foreign saving is an ever more important source of funds to U.S. credit markets, one which could also potentially influence the effect of federal government debt on interest rates. Indeed, foreign funds increasingly have been used to purchase U.S. federal government debt. While foreign holdings of U.S. Treasury securities were less than five percent of total outstanding federal debt just over 30 years ago, foreign purchases of Treasury securities have increased dramatically since then, and foreigners currently hold than 40 percent of total federal debt. Note that the recent surge in foreign holdings of U.S. Treasury securities is not unprecedented, as both the early 1970s and the mid-1990s were periods in which foreigners significantly increased their holdings of Treasury instruments.

Domestic private savers and foreign savers are not the only sectors that hold debt issued to the public by the federal government. As the U.S. monetary authority, the Federal Reserve also holds Treasury securities, using them in conducting monetary policy. The Federal Reserve currently holds about 11 percent of outstanding Treasury securities. In a growing economy, the Federal Reserve must consistently acquire some Treasury securities in open-market operations to expand

the money supply and prevent deflation, as we noted in the previous section. Treasury debt that is purchased by the Federal Reserve in order to increase the money supply may not have the same effect of crowding out private capital formation as federal debt purchased by the private sector.

Financing decisions of the federal government along with those of private sector borrowers, state and local government borrowers, domestic and foreign savers, and the Federal Reserve all interact in the U.S. and international credit market to influence interest rates on U.S. Treasury debt and other debt. To get a sense of what effect U.S. federal government debt has had on interest rates, it is instructive to look at the historical evolution in federal debt (relative to GDP) compared to interest rates over the past 50 years. While federal debt relative to GDP has varied substantially, the real interest rate has been less variable, and is currently equal to its average value over the past 50 years of about three percent. Indeed, Engen and Hubbard (2005) estimate the simple correlation between the stock of federal debt and this measure of the real interest rate over the entire period shown is only 0.15. Over the 20-year period from the early 1950s to the early 1970s—when federal debt decreased by 50 percent relative to the size of the economy—the real interest rate remained relatively constant. The real interest rate did rise in the early 1980s, coincident with an increase in federal debt, but the real interest rate then declined and remained quite steady even as federal debt continued to grow in the 1980s and early 1990s, and then fell in the late 1990s.

In addition to the concern that federal government debt might crowd out private capital formation by causing real interest rates to rise, federal government debt may also pose the temptation to monetize the debt, causing inflation. Engen and Hubbard show that the historical correlation is actually negative, likely dominated by the experience of inflation's peaking when the federal debt relative to GDP was at its lowest points and declining as federal debt grew in the 1980s.

Returning to the potential effects of government debt on real interest rates, it is also useful to examine the difference in real interest rates between the United States and other major industrial economies. If international capital markets were not well integrated, then real interest rates might vary according to differences in government debt and borrowing patterns. Alternatively, if credit markets were integrated in the global economy, then real interest rates might be expected to be more similar across these different economies. Engen and Hubbard present real interest rates on ten-year government securities for the United States, Canada, France, Germany, Italy, Japan, and the United Kingdom since 1990. The similarity of real interest rates across these countries despite having very different government borrowing needs suggests that global credit markets are fairly integrated, so that the pool of loanable funds that any government may draw from substantially exceeds funds in the domestic credit market alone.

Review of Previous Studies

Several different surveys over the past 25 years have evaluated the empirical literature on the relationship between federal government debt and interest rates: Barth, Iden, and Russek (1984), Bernheim (1987, 1989), Barro (1989), Barth, Iden, Russek, and Wohar (1991), Seater (1993), Elmendorf and Mankiw (1999), and Gale and Orszag (2003), for example. Despite the volume of work, no universal consensus has emerged.

In their surveys of studies of Ricardian equivalence, Bernheim (1987, 1989) and Seater (1993) enumerate problems with tests of this hypothesis performed by examining the relationship between federal government debt and deficits with interest rates. Bernheim (1989) concludes that: "…it is easy to cite a large number of studies that support any conceivable position." However, in the end, Seater generally finds more overall support for the Ricardian equivalence hypothesis,

which implies that federal government debt has no effect on interest rates, than does Bernheim, who argues that the Ricardian equivalence hypothesis should be rejected, which would make a positive relationship between federal government debt and interest rates more likely. Barro (1989) takes a similar position as Seater, concluding: "Overall, the empirical results on interest rates support the Ricardian view. Given these findings, it is remarkable that most macroeconomists remain confident that budget deficits raise interest rates."

In discussing empirical research on federal government debt and interest rates, Elmendorf and Mankiw (1999) state that: "…it is worth noting that this literature has typically supported the Ricardian view that budget deficits have no effect on interest rates." However, they go on to evaluate this evidence, writing: "Our view is that this literature, like the literature regarding the effect of fiscal policy on consumption, is ultimately not very informative. Examined carefully, the results are simply too hard to swallow…".

Thus, while surveys of the empirical literature on federal government debt and interest rates note the wide range of results reported in different studies, interpretations and assessments of these mixed empirical results still differ.

Cohen and Garnier (1991) use forecasts of federal deficits for the United States provided by the Office of Management and Budget (OMB), and in additional analysis also investigate the effects of forecasts of general government deficits made by the Organization for Economic Cooperation and Development (OECD) on interest rates across the G7 countries. Their analysis yields mixed results. For the United States, they generally do not find significant effects of the current deficit or expected deficits on interest rates, although they do find a significant statistical relationship between OMB deficit forecast *revisions* and interest rates in the United States. Their estimates imply that an

upward revision in OMB's federal deficit forecast of one percentage point of GDP could increase real interest rates by about 80 to100 basis points. However, the theoretical calculations that we presented earlier raise the question of whether this result is economically plausible. In their analysis of the G7 countries, they find no evidence of a positive and significant relationship between home country current debt or deficits and current interest rates, similar to Barro and Sala-i-Martin (1990) and Barro (1992), and find that one-year-ahead forecasts of home-country government deficits by the OECD tend to have a significant negative effect on nominal short-term interest rates, in contrast to the prediction of the government deficit crowding-out hypothesis. However, one-year ahead forecasts of other-country government deficits by the OECD tend to have a significant effect on home-country nominal short-term interest rates in the direction consistent with the government deficit crowding-out hypothesis, and also imply that credit markets across these countries are integrated.

Cebula and Koch (1989) explore the effect of the current U.S. federal government deficit, split into its cyclical and structural components, on both ten-year Treasury yields and corporate bond yields, while also controlling for foreign capital inflows. Their results imply that positive foreign capital inflows significantly lower both Treasury and corporate rates, consistent with integrated global credit markets, and significantly reduce the estimated effect of structural government deficits on interest rates. They find a statistically insignificant effect of the structural federal government deficit on Treasury yields, while reporting a statistically significant effect of the structural federal government deficit on corporate bond yields, implying that the structural federal government deficit affects the yield spread between corporate and Treasury rates. It is not obvious why structural federal government deficits should affect the corporate to Treasury yield spread. In contrast, Laubach (2009) reports that, based on regression analysis, he finds no evidence that yield spreads between corporate bonds and Treasuries, adjusted for cyclical variation, are systematically

related to projected deficit-to-GDP ratios. Thus the fact that Cebula and Koch are using current federal deficits in their analysis instead of expected federal deficits may be contributing to their result.

Elmendorf (1993) analyzes the effect of expected federal government deficits on Treasury yields using a private-sector forecast of the federal government deficit from Data Resources, Inc. (DRI), instead of federal government deficit projections made by OMB or the Congressional Budget Office (CBO). Presumably, the DRI deficit forecast incorporates expectations of fiscal policy changes that are not part of CBO and OMB projections, and thus may be a more accurate reflection of financial market participants' expectations of future federal government deficits. Regression results show that the DRI forecasts of federal government deficits have significant and large (and statistically significant) positive effects on medium-term (three- or five-year) Treasury yields—an increase in the expected deficit of one percent of GDP is estimated to increase medium-term Treasury rates by more than 40 basis points—but have a smaller and statistically insignificant effect on a long-term (20-year) Treasury rate. If federal government borrowing is crowding out private capital formation then one would expect to find a larger impact on long-term interest rates than on shorter-term interest rates.

Laubach (2009) estimates the effect of five-year-ahead projections by CBO of federal government debt or deficits on the five-year-ahead real ten-year Treasury yield. The purpose for using five-year-ahead interest rates and debt or deficit projections is to try to omit any effects of current economic conditions from measuring the effects of federal government deficits on the interest rate. He finds that a one-percentage-point (relative to GDP) increase in the measure of the expected federal government deficit increases the forward-looking ten-year Treasury rate by 28 basis points. However, when Laubach estimates an econometric specification that uses expected federal

government debt instead of the deficit, which, in contrast to using a deficit measure, is a specification consistent with a standard economic model of crowding-out, he estimates that a one-percentage-point increase in the expected debt-GDP ratio increases the forward-looking ten-year Treasury rate by only five basis points—an estimate close to the benchmark calculations we presented previously. Thus these results illustrate that whether an interest rate measure is regressed on the federal government deficit or on the federal government debt can yield markedly different implications for the magnitude of the associated interest rate effect.

Laubach suggests that the difference in these results can be reconciled by the fact that federal budget deficits tend to be serially correlated in historical U.S. data, and thus financial market participants may expect an increase in the federal government deficit to be persistent, and thus there is a larger increase in interest rates. However, federal government debt is also serially correlated in U.S. data. This observation is not surprising because federal government debt ($DEBT_t$) at the end of time period *t* is the sum of the federal budget deficit ($DEFICIT_t$) during time period t and federal government debt at the end of the prior period, *t-1*:

$$DEBT_t = DEFICIT_t + DEBT_{t-1}.$$

If financial market participants expect an increase in federal government deficits to be persistent then they should also expect increases in federal government debt to be persistent, so it is not clear that this explanation reconciles the difference in the estimated interest rate effects when using federal deficits instead of federal debt. Indeed, current (end-of-period) debt contains information not only about the current deficit but also captures all information about previous government borrowing, and thus is a better measure to evaluate the effect of government borrowing on the level of the interest rate, as suggested in our theoretical discussion above. The change in government

debt, or the deficit, would be expected to affect the change in the real interest rate, not necessarily the level of the interest rate, but that is not the econometric specification used by Laubach. I return to this point below.

Evans and Marshall (2007) use a VAR framework to investigate the macroeconomic determinants of the variability in the nominal Treasury yield curve. They find that general macroeconomic shocks account for most of the variability in nominal Treasury yields, with fiscal policy shocks generally having mixed effects. Their measure of fiscal deficit shocks—derived from Blanchard and Perotti (2002)—does not significantly explain nominal Treasury yield variability. However, they do find that the measure of military buildup shocks suggested by Ramey and Shapiro (1998) tends to increase nominal Treasury rates.

Another approach to looking at the effects of federal government deficits on interest rates has been to focus on media-reported budget news. If news concerning federal government deficits occasionally leads to significant movements in bond market prices then standard time-series techniques may have little power to identify these occasional, possibly nonlinear, events. Previous economic research that has analyzed the effects of news announcements about federal government deficits on interest rates (Wachtel and Young, 1987; Thorbecke, 1993; and Quigley and Porter-Hudak, 1994) has generally found only small or transitory effects.

Evaluating effects of government debt on interest rates is difficult given the lack of consensus on the appropriate underlying economic model of how federal debt or deficits and interest rates should interact. Moreover, variable definitions and other features of the data and econometric methodology vary across these studies, making it difficult to make comparisons. As with most of the earlier reviews of the economic literature on federal debt, deficits, and interest rates, our view

is that the existing evidence is quite mixed. Some studies find positive effects of federal deficits on interest rates and others do not. Moreover, even among the studies that do find a positive effect of deficits on interest rates, the magnitude of the effect on interest rates is still uncertain. However, looking systematically at the influence of different econometric specifications, different measures of federal government debt or deficits, different measures of the interest rate, and different of econometric methodologies the estimated effect of federal government debt on interest rates hopefully will provide some insight into this issue.

B. Empirical Analysis of Federal Debt and Interest Rates

I now provide empirical evidence presented by Engen and Hubbard (2005) on the potential effects of federal government debt on interest rates. Consistent with most analysis, Engen and I initially examine this relationship by estimating a reduced-form equation:

$$i_t = \beta_0 + \beta_1 d_t + \Gamma Z + \varepsilon_t ,$$

where i_t is a measure of the interest rate (in time period t), d_t is a measure of federal government debt, and Z is a vector of other relevant variables that may influence interest rates. The effect of federal government debt on the interest rate is described by the estimate of the coefficient, β_1.

The specification of the interest rate variable, i, and the federal government debt variable, d, in the reduced-form equation can take different forms. As noted earlier, the hypothesis that federal government debt might crowd out private capital formation, and thus raise long-term real interest

rates, is typically based on a simple economic model as we presented above.[5] This model implies that:

(1) the *level* of the real interest rate, i, is related to the *level*, or stock, of federal government debt, d, or

(2) the change in the real interest rate, Δi, is related to the change in federal government debt, Δd, which is equal to federal government borrowing, or the deficit.

Engen and I estimate this reduced-form equation using both of these specifications for i and d. Although not consistent with the specifications for i and d implied by an economic model of crowding-out, we also estimate this reduced-form equation using a third specification in which:

(3) the level of the real interest rate, i, is regressed on federal government borrowing (or the deficit), Δd.

A number of prior studies have used this third specification, and it is informative to compare the results from using this specification with those that employ the previous two specifications, even though it is not consistent with a simple crowding-out model. Economic theory suggests that it is the total *stock* of government debt that is the most relevant for explaining the *level* of the interest rate, not just the one-period change in government debt.

Another important issue for specifying i and d is whether these are *forward-looking*, or expected, measures of real interest rates and federal government debt, or whether they are *current* measures

[5] Engen and I focused on the effect of federal government debt on a measure of the real, long-term interest rate because that is the measure of the interest rate most likely to be affected by federal government debt if it is crowded out private capital formation. Accordingly, Engen and I used a measure of the ten-year Treasury yield, adjusted for expected inflation, for our analysis.

of these variables. Previous studies have varied in whether forward-looking or current measures of interest rates and federal government debt were used in their analysis. To compare how these different specifications for *i* and *d* affect estimates of the relationship between these two variables, Engen and I provided estimates.

A number of other economic variables should be included in the vector *Z*, as they also presumably influence the determination of the real interest, *i*, and excluding them could bias the estimate of the coefficient β_1. As noted in the earlier section discussing the potential theoretical effect of federal government debt on interest rates, it is important to account for general macroeconomic factors that can affect the performance of the economy. Accordingly, in the vector *Z*, Engen and I included the growth rate in real GDP, which is a variable usually included in these types of regressions. Moreover, the studies by Barro and Sala-i-Martin (1991) and Barro (1991) find that real oil prices also are an important exogenous macroeconomic variable that can affect real interest rates, so Engen and I included a measure of real oil prices in the vector *Z*.

Laubach (2009) observes that in a Ramsey model of economic growth, where the preferences of a representative household are incorporated with a production function similar to the one presented above, the real interest rate, *r*, is determined by:

$$r = \sigma g + \theta,$$

where σ is the coefficient of relative risk aversion for the representative household in the model, g is the growth rate of technology, and θ is the rate of time preference for the representative household. He estimates that a measure of the equity premium—used as a proxy for risk aversion—is an important factor affecting real interest rates, so Engen and I included it in the

vector *Z*. If relative risk aversion declines, then households may be more willing to purchase equities than debt instruments, thereby leading to a rise in the interest rate.

Fiscal policies other than federal government debt may also affect real interest rates. Ramey and Shapiro (1998) and Evans and Marshall (2007) find that exogenous defense spending shocks—measured by Ramey and Shapiro as a dummy variable denoting the time period in which a significant military buildup begins—tend to increase interest rates. This effect is consistent with the theoretical implication of an exogenous increase in government consumption in a neoclassical model even if the Ricardian equivalence hypothesis is operative. Therefore, Engen and I included a variable to capture exogenous defense spending shocks in the vector *Z*.

While conducting monetary policy the Federal Reserve regularly purchases U.S. Treasury securities as the economy grows, which may reduce the impact of federal government debt on the real interest rate. Thus, Engen and I included a variable measuring the purchase of U.S. Treasury securities by the Federal Reserve, relative to GDP, in our specification of the regression equation.

To summarize, in vector *Z* of the regression equation, we include the following variables:

(1) the rate of growth in real GDP,

(2) the real domestic crude oil price,

(3) a measure of the equity premium (as a proxy for risk aversion),

(4) a dummy variable for military buildups,

(5) Federal Reserve purchases of U.S. Treasury securities.

Forward-looking Interest Rates and Federal Government Debt

The only study pre-dating the Engen-Hubbard analysis of which I am aware that analyzes the effect of forward-looking projections of federal government debt on a forward-looking measure of the real interest rate is Laubach (2009). The purpose for using these forward-looking measures is to attempt to omit any effects of current economic conditions and policies from the empirical estimate of the effect of federal government debt on interest rates.

Laubach constructs data from 1976 through 2003 on nominal ten-year Treasury rates expected to prevail five years ahead, and then subtracts a series of inflation expectations taken from the Federal Reserve's econometric model of the United States. These data on real five-year-ahead ten-year Treasury yields are calculated to coincide with the CBO's five-year-ahead projections of federal government debt and deficits, relative to GDP, released in its annual Economic and Budget Outlook. Engen and I used these measures of the forward-looking real interest rate and forward-looking federal government debt in our analysis, used the CBO's five-year ahead projection of real GDP growth rate. The other variables correspond to the time period just preceding the release of the CBO's annual report.

The principal conclusions are as follows: First, the results imply that a one-percentage-point (relative to GDP) increase in CBO's five-year-ahead projection of federal government debt increases the real five-year-ahead ten-year Treasury yield by a little less than three basis points, and the estimate is statistically significantly different from zero. This estimate is also consistent with the theoretical calculations I presented earlier.[6]

[6] The estimated coefficients on all of the other variables have the expected sign and are statistically significant from zero, except for the insignificant coefficient estimate on the projected real GDP growth rate.

Coefficient estimates obtained by regressing the *change* in the real five-year ahead ten-year Treasury yield on the CBO's five-year-ahead projection of the federal government deficit implies that a one-percentage-point (relative to GDP) increase in CBO's five-year-ahead projection of the federal government deficit increases the change in the real five-year-ahead ten-year Treasury yield by about three basis points, but this estimate is not statistically significantly different from zero.

Finally, the Engen-Hubbard regression results suggest that a one-percentage-point (relative to GDP) increase in CBO's five-year-ahead projection of the federal government deficit increases the real five-year-ahead ten-year Treasury yield by about 18 basis points, and that estimate is statistically significantly different from zero. As I noted earlier, however, this specification is not consistent with one implied by an economic model of crowding out, so interpreting this result is difficult. The *stock* of federal debt is most relevant for determining the level of the interest rate, and the deficit, which represents only the most recent period's *change in the debt*, does not contain all relevant information—specifically, prior accumulated federal debt—contained in the measure of total federal debt. However, because CBO's projections of federal deficits (as a percentage of GDP) are closely correlated with their projections of federal debt (as a percentage of GDP), the coefficient estimate on the smaller deficit component also picks up the effect of prior accumulated government debt, and the coefficient estimate is larger than when total government debt is used.

These results indicate that the estimated effect of projected federal government debt or deficits on a forward-looking measure of the real interest rate depends importantly on the specification. The estimates for the two specifications consistent with the analytical model of crowding out presented earlier imply that an increase in federal government debt of one percent of GDP raises the real interest rate by, at most, about three basis points.

Current Interest Rates and Expected Federal Government Debt

One can also examine crowding out employing a measure of the *current* real ten-year Treasury yield in our analysis while all of the other variables remain the same as before. Engen and I did so by adjusting the nominal ten-year Treasury yields over the months that the CBO projections were released for expected inflation to construct the current real interest rates.[7]

In this case, all else equal, the estimates imply that a one-percentage-point increase in the expected federal government debt-to-GDP ratio increases the current real ten-year Treasury yield by a little more than three basis points, and is statistically significantly different from zero. This estimate is about one-half of one basis point larger than when the forward-looking real ten-year Treasury yield was used.

The estimated coefficient on the projected deficit variable implies that a one-percentage-point increase in CBO's projection of the federal government deficit (relative to GDP) increases the current real ten-year Treasury yield by about three basis points, but here this estimate is not statistically significantly different from zero. In contrast, when instead the level of the current real ten-year Treasury yield is regressed on CBO's projection of the federal government deficit, the estimated relationship suggests that increasing the expected federal deficit-to-GDP ratio by one by one percentage point causes the current real ten-year Treasury yield to increase by almost 24 basis points. While this estimate is statistically significant from zero, it is far larger than the benchmark calculations presented earlier, and it is also about five basis points larger than the corresponding estimate in which the forward-looking measure of the real ten-year interest rate was used. However, as discussed previously, this specification is not consistent with an economic model of

[7] We obtained data for the nominal ten-year Treasury from the Federal Reserve Board, and the data for average inflation expectations from the Livingston Survey maintained by the Federal Reserve Bank of Philadelphia.

crowding out. The coefficient estimate on the deficit is larger because it also incorporates the effect of prior accumulated federal government debt that is included in the total federal debt variable in the first column but is not included when just using the deficit measure in the third column.

These results indicate that the estimated effect of projected federal government debt or deficits on a current measure of the real interest rate are only a bit larger than those in which the forward-looking measure of the real interest rate was employed. However, the forward-looking measure of the real interest rate may be a better measure for trying to separate the effect of current economic conditions on the interest rate and isolate the effect of expected federal government debt on real interest rates.

As before, the estimated results from Engen and Hubbard (2005) also depend importantly on the specification of the regression equation. The coefficient estimates derived using the two specifications of real interest rates consistent with a an economic model of crowding out—the first two columns—imply that federal government debt may have a statistically significant effect on the level of real interest rates (or not, as shown in second column), but, if so, the effect—about 3 basis points for an increase in the debt of one percent of GDP—is consistent with benchmark calculations presented earlier.

Current Interest Rates and Current Federal Government Debt

While using expected measures of interest rates and federal debt is a much more theoretically appealing approach to estimating the relationship between these variables, many studies have used only current measures federal debt and interest rates. Thus, it is informative to estimate the effects

of current federal debt on current real ten-year Treasury yields in order to compare the results to those of the prior sections.

To do so, Engen and I replaced the data for CBO's annual projections of federal government debt and deficits with data on current federal government debt and borrowing. We also replaced CBO's projections for the rate of growth in real GDP with current real GDP growth rates. The current real ten-year Treasury yield measure reflects the prevailing rate at the end of each year and is constructed the same as in the prior section. All of the other variables are the same as in the previous analysis.

When using current federal government debt (relative to GDP) and a measure of the current real ten-year Treasury yield, the regression results imply that a one-percentage-point increase in the federal debt-to-GDP ratio is estimated to increase the real ten-year Treasury rate by a little less than five basis points, but the coefficient estimate is not statistically significantly different from zero. A one-percentage-point increase in federal government borrowing (relative to GDP) increases real ten-year Treasury rates by seven basis points, but again this estimate is not statistically significantly different from zero.

Alternatively, if the level of the real ten-year Treasury yield is regressed on this measure of federal government borrowing, the coefficient estimates imply that a one-percentage-point increase in the federal government borrowing-to-GDP ratio increases the real ten-year Treasury rate by about nine basis points, although this effect is not statistically significantly different from zero, as in the first two specifications. This estimate of the empirical relationship between federal government borrowing and the level of the real ten-year Treasury yield is markedly smaller than the

corresponding estimates, which used forward-looking measures of federal government borrowing and the real interest rate.[8]

C. Conclusions Thus Far

Taken together, the bulk of the empirical results I present suggest that an increase in federal government debt equivalent to one percent of GDP, all else equal, would be expected to increase the long-term real rate of interest by about three basis points, while some estimates are not statistically significantly different from zero. Of course, this analysis is deliberately narrow in its scope — the interest rate effects of government debt. The effect of debt and deficits on interest rates has been the focus of much of the recent and previous policy discussions concerning the effects of government borrowing on investment and economic activity — and have been central to Ben Friedman's own analysis. However, we do believe that other effects of federal debt and deficits on economic factors other than interest rates are important topics for analysis.

Likewise, as I argue in the next section, these results should not be construed as implying that "deficits don't matter." Substantially larger, persistent, and unsustainable levels of government debt can eventually put increasing strains on the available domestic and foreign sources of loanable funds, and can represent a large transfer of wealth to finance current generations' consumption from future generations which much eventually pay down federal debt to a sustainable level. Holding the path of non-interest government outlays constant, deficits represent higher future tax burdens to cover both these outlays plus interest expenses associated with the debt, which have adverse consequences for economic growth. In the United States at the present time, unfunded

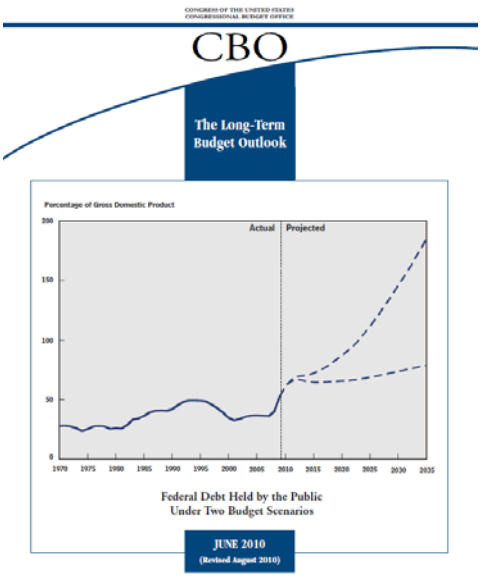
[8] Though not discussed here, Engen and I also estimated the relationship among federal government debt (or federal borrowing) and the level of the real ten-year Treasury rate in a VAR framework. In general, those results are similar to the results from reduced-form regression estimates.

implicit obligations associated with the Social Security and Medicare programs are particularly of concern, a topic to which I now turn.

III. IMPACTS OF ANTICIPATED FISCAL CONSOLIDATION ON ECONOMIC ACTIVITY

"If something cannot go on forever, it will stop."

Herbert Stein (1980s)



About two years ago, I had the pleasure of moderating an event at the Council on Foreign Relations in New York on the Obama administration's stimulus package and the outlook for the federal budget and the U.S. economy with then Office of Management and Budget Director Peter Orszag. Knowing that the Director is a country-and-western music fan, I asked him if his views called to mind the Johnny Cash line: "I'm just a chunk of coal, but I'll be a diamond soon." He, indeed, outlined a path of fiscal rectitude after the stimulus package. But the long-term fiscal outlook is

generally asses as grim. A favorable path is most unlikely, absent much more drastic, forward-looking, long-term action than that contemplated in present discussions.

Alan Auerbach and William Gale, with their expertise in public economics and Washington budget experience, drove this point home in an important (2009) paper. As Auerbach and Gale noted there, the federal fiscal picture darkened over the past decade. The budget deficit, for recent fiscal years, is very large[9], and the ten-year projections are even worse.

Their work in that research offers three interesting conclusions about the "long run." The first underscores the bipartisan tolerance of large deficits over the past decade. The Auerbach-Gale adjusted baseline, which extends the 2001 and 2003 tax cuts and the AMT provisions, yields a projected deficit of 4.8 percent of GDP in 2012, increasing to 6.4 percent of GDP by 2019. The Obama administration's budget follows a similar path — projected deficits fall to 4.0 percent of GDP in 2012, and then gradually rise to 5.5 percent of GDP by 2019. The Obama Administration's budget would lead by the end of the ten-year period to a doubling of the debt-to-GDP ratio, with federal spending at its highest level relative to GDP since World War II (and this analysis does not include large changes in spending and deficits accompanying the Patient Protection and Affordable Care Act of 2010).

The second codifies the grim reality of the long-term U.S. fiscal outlook, extending the fiscal gap methodology developed by Auerbach (1994). Under the Auerbach-Gale adjusted baseline, the fiscal gap over the infinite horizon is 9.34 percent of GDP. The results under the Obama administration's budget produce a fiscal gap over the infinite horizon of more than 8.61 percent. And, in either case,

[9] And the full effects of the financial crisis have likely not been felt. Reinhart and Rogoff (2008a, 2008b) provide compelling evidence using date over time and across countries that financial crises increase government debt substantially — by an average of 86 percent. These increases reflect not so much "bailout" funds as consequences for revenue of lower output and costly countercyclical policies

the economy would pass its highest-ever debt-to-GDP ratio (108.6 percent, in 1946) in about 15 years.

The late Chairman of the Council of Economic Advisers Herb Stein famously noted that "something that cannot go on forever will stop." And so it must be for fiscally unsustainable budget paths. While we must find a way to close the deficit gap, how?

Mounting interest on the government's existing debt offers the fillip for early action, of course. But the cost of the delay is not simply one of larger outstanding debt balances and interest bills for debt service. While low interest rates would mitigate interest additions to outstanding debt, low interest rates raise the present value of the implicit liabilities in the future.

Model specifics matter: The terms "deficit" and "debt" are accounting terms; it is "taxing" and "spending" decisions that are underlying economic variables. One problem with an emphasis on deficits and debt in a discussion of fiscal consolidation and economic growth is a possible implication that changes in taxes and spending have similar economic effects. Empirical evidence suggests much caution on this point. Alesina and Ardagna (2009) find that spending reductions are more effective at stabilizing debt than tax increases and that fiscal adjustments associated with higher GDP growth are those dominated by spending cuts (see also Ali Abbas, *et al*., 2010). They also conclude that spending cuts to reduce government budget deficits can be expansionary (by lowering future required tax burdens); see also Giavazzi and Pagano (1990), Alesina and Perotti (1997), and Alesina and Ardagna (1998).

In the present, large required changes in taxes or spending would have substantially different effects on output, well-being, and the fiscal gap itself in most economic models. This point is in high

relief when one considers raising taxes in saving and investment (for example, repeal of the 2001 and 2003 tax cuts) versus changing incentives to reduce the growth rate of medical spending[10]. Indeed, using estimates from earlier work by Engen and Skinner (1992), validating the projected spending increases in the long-term budget outlook of the Congressional Budget Office with tax increases could reduce GDP growth by about a full percentage point. That is, the real choice for policymakers lies between slower-growing living standards with a larger state and lower levels of spending relative to GDP. The "fiscal gap" simply highlights a fiscal problem.

And political compromise focusing on future deficits tipping evenly between tax increases and spending restraint — as recommended in *Day of Reckoning* — calls to mind the alternative country and western music line from Toby Keith that I reminded (then) Director Orszag — "There ain't no right way to do the wrong thing."

Friedman's policy solutions — both in *Day of Reckoning* and in his magisterial book *The Moral Consequences of Economic Growth* — are eclectic and center on the need to reduce structural budget deficits. For example, in Friedman (2005, p.414), he notes:

> In principle, four different approaches to solving this problem [of structural budget deficits] are possible: (1) Economize on government spending apart from programs for the retired elderly. (2) Raise taxes. (3) Restructure Social Security and Medicare. (4) Increase what America saves, so that the

[10] This point applies to the Bush administration as well as to the Obama administration. The dividend and capital grain tax cuts of 2003 had both efficiency gains and substantial positive feedback effects on revenue — not so, the costly addition of the Part D benefit to Medicare. In a (2005) paper, I estimated that even a debt-financed elimination of the double taxation of corporate equity capital would increase the level of potential output permanently by 0.48 percent, making possible a significant reduction in revenue cost (see also U.S. Department of the Treasury, 2003).

> country can finance both adequate capital formation and a chronic government deficit.
>
> In fact, several of these routes are unpromising, at least one the scale required to address the problem that now exists.

He goes on to say (Friedman, 2005, p.434):

> Limiting government spending, undoing tax cuts, accelerating the increase in the Social security retirement age, reshaping Medicare on choice-based lines, providing intensive early-intervention programs for the youngest school children, encouraging more students to finish high school and enabling more to attend and finish college, restructuring primary and secondary public education to provide more choice among schools — these are all hard choices for public policy, and in some cases they are radical choices. But the stakes are high, and the consequences far-reaching.

Indeed, but how should these choices be made? Having identified structural budgets as a limit to physical capital formation, economic growth, and the social benefits of that growth, Friedman's recommendations focus as much or more on "principal" than "principle." By this observation, I harken back to my earlier argument that decisions are not just about the level of deficits per se, but about the economic consequences of changes in the nation's trajectories of tax burdens and federal spending.

If we accept, as we must, the notion that structural budget deficits must fall and debt burdens relative to GDP must be stabilized (again, Stein's law), how? To frame the question, it is important to understand that according to the Congressional Budget Office (2010), the higher structural federal budget deficits trace to higher spending relative to GDP, not lower tax revenue relative to GDP. The CBO also identifies the largest contributions to future structural deficits in the major "entitlement" programs — Social Security, Medicare, and Medicaid.

Now, for possible principles consistent with the critiques offered in Friedman (1988) and Friedman (2005): First, deficit reduction should be consistent with the greatest potential enhancement of economic growth (*Possible translation*: Emphasize spending reductions, not tax increases — particularly increases in marginal tax rates on saving and investment. Any tax increases require fundamental tax reform to reduce the dead weight loss of those increases.). Second, deficit reduction should require a progressive sharing of burdens, with relatively greater burdens of adjustment by higher-income individuals. (*Possible translation*: Slow the rate of growth of entitlement benefits to more affluent seniors. Reduce tax expenditures for upper-income households).

These principles, consistent with Friedman's arguments, are also consistent with the bipartisan suggestions of the Bowles-Simpson Commission, ten former Chairs of the Council of Economic Advisers (Baily, *et al*., 2011) and, for that matter, the budget plans advocated by many conservative economists (see, for example, Becker, Shultz, and Taylor, 2011). What they are not is codified in the law of the land.

Making them so would solidify the lasting contribution of the warnings of many economists, but, particularly and importantly, Ben Friedman.

IV. CONCLUSION

"A good man leaveth an inheritance to his children's children."

Proverbs, XIII :22

"If not now, when?"

Fathers, I: 14

These quotes appear before the first and last chapters of Ben Friedman's *Day of Reckoning*. They also frame a moral dimension of the need for fiscal consolidation in the United States. In his later (2005) book, *The Moral Consequences of Economic Growth*, Ben emphasizes the salutary effects economic growth for openness and social cohesion. Will government budget deficits and debt threaten both economy and society?

The U.S. economy did not, in many respects, flounder after the budget deficits of the 1980s. Indeed, by the middle of the 1990s, the U.S. economy began a long-lasting expansion in productivity growth. While direct crowding out of private investment through higher real interest rates has, at least in the view of the empirical evidence reviewed here, been modest, three concerns remain. The first is that cumulative increases in debt are so large that even the small estimated effects identified here can lead to large increases in real interest rates. The second is that one attenuation of effects of higher government debt levels on interest rates may trace to greater reliance on foreign saving,

with an accompanying problem of imbalances. The third is that the present trajectory of government spending in the United States presents the very real possibility of higher tax burdens, reducing capital formation, economic growth, and living standards.

The course of U.S. fiscal policy must change. Ben's 1988 observation sounds spot on 23 years later: 'If not now, when?' — Indeed.

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