POLICYNOTE

GOVERNMENT DEBT, DEFICITS, AND ECONOMIC GROWTH: LESSONS FROM FISCAL ARITHMETIC

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EXECUTIVE SUMMARY

This note discusses the recent history and possible evolution of the fiscal situation in the USA. The bottom line is that growth is a requirement for fiscal restraint, not the other way `round.

A key indicator of the demand generated by any sector of the economy is the difference between its total spending and income, or its net borrowing. In the recent recession, the private sector's net borrowing fell by an unprecedented 12% of GDP while the government deficit rose by only 8%. Such a shortfall in fiscal stimulus was unprecedented historically, and helps explain why the recession was so deep.

The primary deficit of the federal government (current spending on goods and services minus revenue) is the best single metric for fiscal policy, rising when real GDP declines and falling when GDP increases. This countercyclical pattern helps stabilize the economy against shifts in private sector demand. A larger primary deficit in a downswing is partly due to "automatic stabilizers" (such as lower tax receipts and higher social spending) and partly the result of ad-hoc fiscal policy measures. The change of net federal debt is the sum of the primary deficit and net interest payments (or total net borrowing) of the federal government.

Econometric estimates for the U.S. economy verify that growth in real federal debt responds negatively to an increase in real GDP growth. In other words the economy has to get back to a sustainable growth path to slow the increase in debt. According to our calculations, a one-time increase of 1% in the quarterly GDP growth rate, which itself generates higher growth for a few quarters, would reduce the primary deficit from current 8.4% to 6.5% of GDP after one year and 3.7% after two years, causing the debt-to-GDP ratio to stabilize.

Macro linkages in the economy also run the other way – from the growth of debt to the growth of GDP. For the U.S. at least, our empirical results do not support the currently popular assertion that a higher primary deficit reduces growth of real GDP. On the contrary, model simulations suggest that a 1% increase in real debt growth leads to an accumulated 0.4% increase in quarterly real GDP growth after two or three years, even when possible impacts on interest rates are considered.

In order to achieve a situation with a low fiscal deficit and high economic growth, the federal government needs to focus on further stimulating economic activity, which would subsequently increase revenues, rather than on cutting spending. In a context in which other components of effective demand are not recovering strongly and monetary policy is proving to have limited impact, a restrictive fiscal policy is not the right course of action.

POLICY BACKGROUND

The economic policy debate in the United States and other rich economies throughout 2010 has been obsessed with the effects of the fiscal deficit on economic performance. In the eyes of many, severe austerity is needed to reestablish fiscal sustainability, economic stability, and growth. Writing in the Financial Times, Germany's finance minister Wolfgang Schäuble justified fiscal austerity as follows: "[…] restoring confidence in our ability to cut the deficit is a prerequisite for balanced and sustainable growth. Without this confidence there can be no durable growth. […] This is the lesson of the recent crisis. This is what financial markets, in their unambiguous reaction to excessive budget deficits, are telling us and our partners in Europe and elsewhere."

A similar point of view animates recent empirical attempts to find a negative long-run impact of high levels of debt on capital formation and economic growth. Using a multi-country historical data set on central government debt to search for a systematic relationship between debt levels and growth, Reinhardt and Rogoff (2010) conclude that whereas the link between growth and debt seems relatively weak at "normal" debt levels, in the years when public debt is over 90 percent of GDP, the median growth rates across countries are about one percent lower than otherwise, both for advanced and emerging economies. To argue from this observation that by reaching a 90% threshold for the debt-to-GDP ratio, a country would be harming its economic growth is to ignore the other direction of causality, i.e. that high levels of debt-to-GDP ratio were driven by low growth rates which prevailed in many countries.

A more nuanced, though also misleading, view is presented by Citigroup's chief economist, Willem Buiter. Based on decades-old fiscal arithmetic used below, he shows how the change in the public debt-to-GDP ratio depends on the evolution of four core economic variables: the primary deficit of the government, the effective real interest rate on public debt, the rate of inflation, and, finally, the growth rate of real GDP. But Buiter for some reason assumes that the interest rate and the growth rate of GDP cannot be influenced

by the government.

He argues that the U.S. needs to promote a permanent tightening of the primary fiscal balance of at least 8% of GDP, else it would have to inflate away the real burden of its debt in order to achieve fiscal sustainability.

All these arguments support fiscal austerity. They ignore the fact that economic growth is not only affected by fiscal policy, but may improve public finances and contribute to fiscal sustainability. Such dynamic interactions are crucial for determining the causes and consequences of the recent deterioration of the deficit and prospects for the future. These issues are addressed herein.

ASYMMETRIC RECESSION

From a historical perspective the 2007-09 recession stands out not only for the severity of the downturn, but also for a subsequent weak government response in several dimensions.

Figure 1 summarizes background data on spending by all levels of government in the U.S. Since the 1980s the level has varied in the range of 30% to 38% of GDP. Total revenue has ranged between 33% and 26%. Except for a short period in the late 1990s when Federal receipts reached 21% of GDP, there has been an overall government deficit, the normal situation in developed economies. The 21% figure attained notoriety in the Bowles-Simpson report on deficit reduction when it was proposed, with no obvious justification, as an absolute ceiling on Federal revenue.

A closer look at the dynamic pattern of real government outlays and receipts around the peaks and troughs of the U.S. business cycle (see Figure 2) delivers additional insight into the special character of this recession. Compared to previous recessions, the increase in real government spending in 2007-2008 was relatively weak, whereas the decrease in real revenues (basically lower tax receipts) was much stronger. The government did not spend enough, given the severity of the slowdown.

Figure 3 shows "net borrowing" or deficit finance as practiced by the government and private sector, with the shaded areas representing periods of recession as defined by the National Bureau of Economic Research. A positive level of net borrowing by a sector signals that it is adding to the level of aggregate demand. Private net borrowing (or spending on investment, consumption, interest, and taxes minus income) typically rises as the economy emerges from a recession while government net borrowing falls.

Private borrowing typically peaks soon before a new recession, when government borrowing starts to rise. Government revenue declines and spending rises during and after recessions due to the functioning of "automatic stabilizers" (falling tax receipts, rising social spending) which leads the overall fiscal deficit to have a counter-cyclical pattern. Changes in the government deficit stabilize the system against fluctuations in private borrowing. Historically, private net borrowing has led the cycle, with government borrowing lagging behind.

These observations are well-known. The recent period, however, differs from the historical pattern in a crucial dimension. In previous recessionary periods swings in net borrowing by the government and private sectors have been by and large symmetric. But during the 2007-2009 crisis the reduction in net private borrowing was not matched by the increase in net government borrowing. Indeed, Figure 3 shows that the (roughly) 8% increase in government net borrowing as a share of GDP did not offset a fall of about 12% in private spending minus income.

Large decreases in the different components of private spending as compared to the evolution of real government revenues and expenditures can also be seen in Figure 4. Both diagrams suggest that the recession was "great" precisely because the government did not offset the decrease in private sector effective demand, as it had in prior recessions (as can be observed from the nearly offsetting movements of the solid and dashed curves in Figure 3). Figure 4 also shows that household residential investment, which has historically
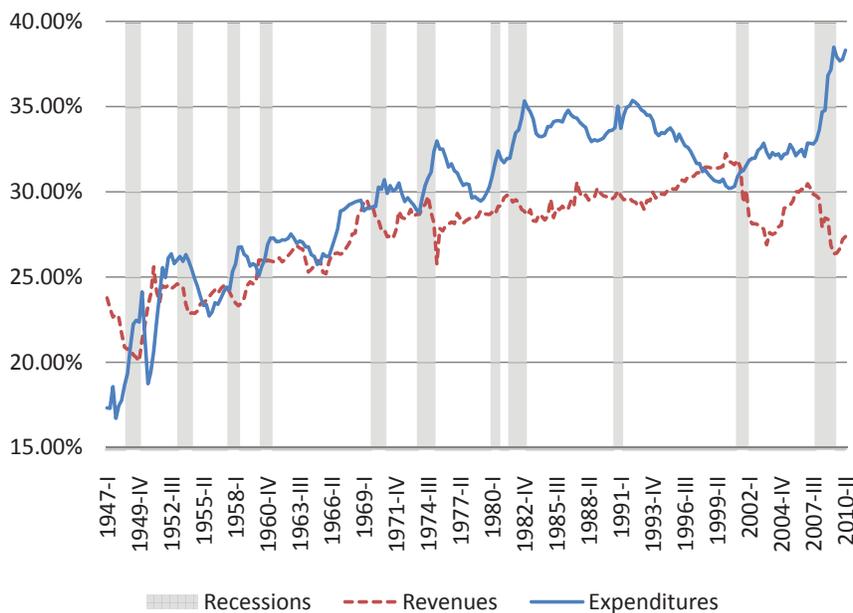

Figure 1. Revenues and expenditures of the general government as a share of GDP in the United States (1947-2010).

Government Expenditures during (solid) **and after**
(dashed) NBER recessions

Government total receipts during (solid) **and after**
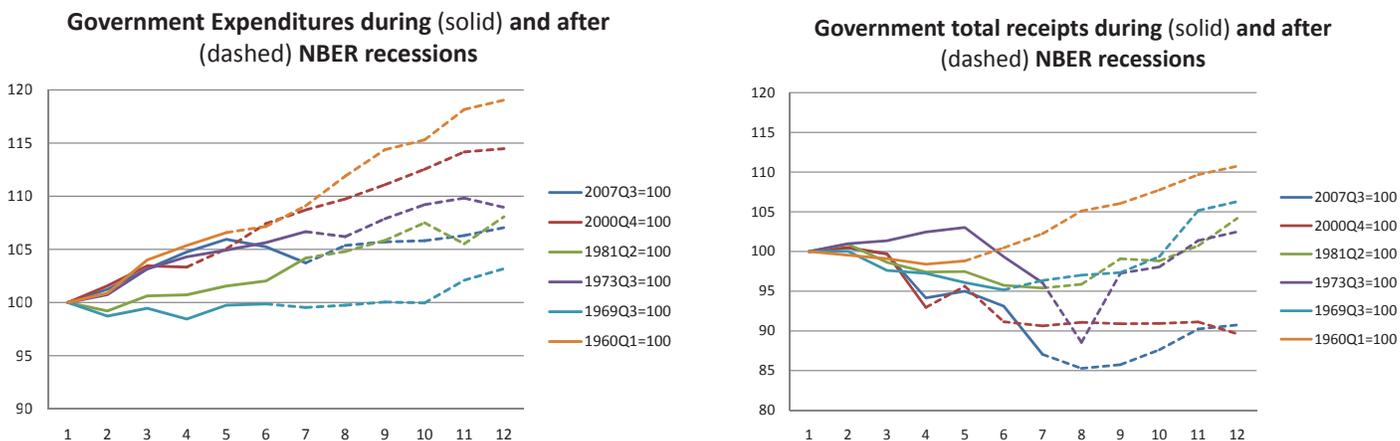**(dashed) NBER recessions**

Figure 2. Real revenues and expenditures of the general government during and after NBER recessions in the United States.
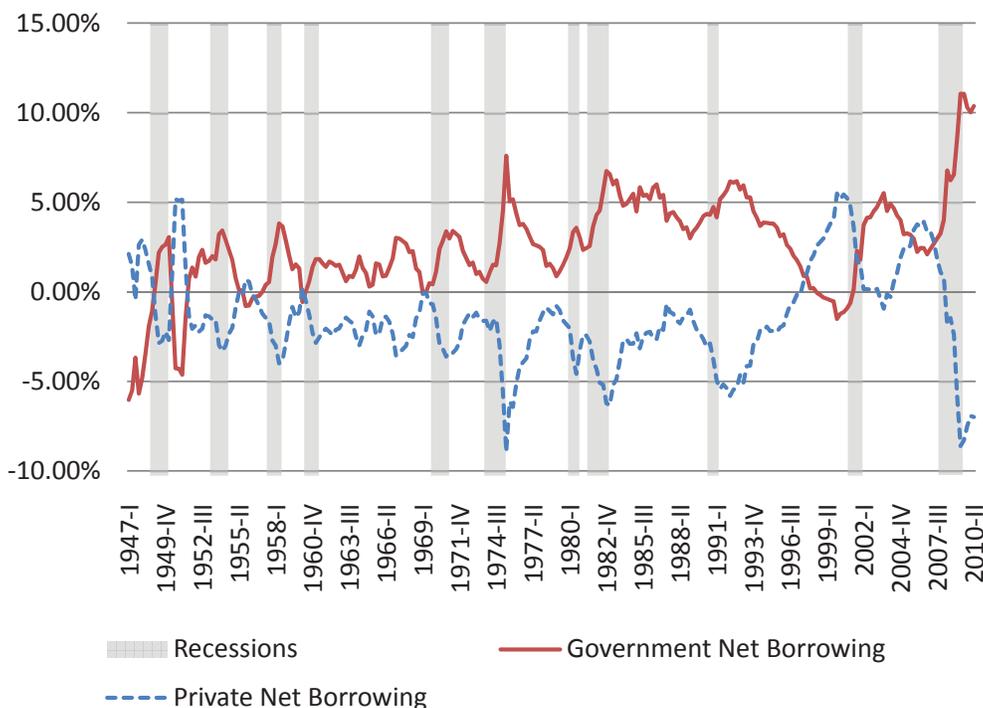

Figure 3. Government and private net borrowing as a share of GDP in the United States (1947-2010).

led previous upswings in GDP, has not yet recovered. The recovery of business investment is also on the weak side. Consumption is thus the only component of private spending to have reached again its real value of the second quarter of 2007. No wonder that government receipts are also recovering slowly.

FISCAL ARITHMETIC

In the United States fiscal decisions emerge from a *political* process where the Federal government, while being the central player, collects only around two-thirds of total government revenue,

with state and local governments receiving the rest. The key difference between the two is that while the federal government can easily sell Treasury securities to finance its deficit, states and localities largely have to cover current expenditures with current revenues. The Federal government thereby plays the major role in determining overall fiscal trends and cycle. Its primary deficit (current spending minus revenues) is the clearest single indicator of the macroeconomic impact of fiscal decisions.

Figure 5 shows the primary deficit and net Federal interest payments as shares of GDP. In wake of the recession in the early 2000s the deficit rose by about 8%, and by about 10% after 2007

The Great Recession
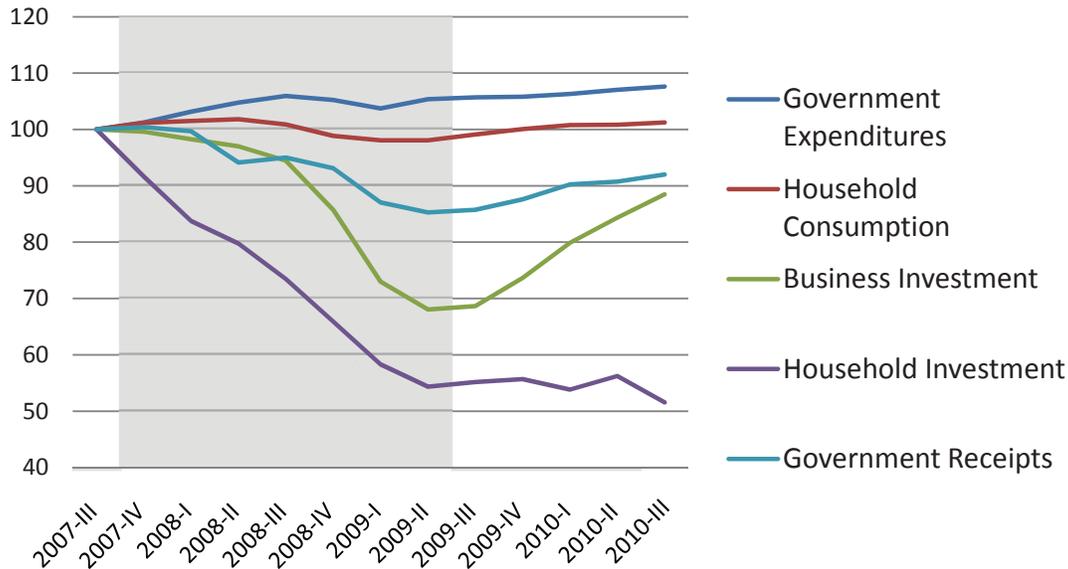## (2007Q3=100)

Figure 4. Real government revenues and expenditures as compared to private domestic components of effective demand (2007Q3=100)

(it has already fallen by 1% since the third quarter of 2009). Net Interest outlays are relatively stable and are now small (about 1.7% of GDP), so that the primary deficit and total government net borrowing move closely together.

The change in total federal government debt is the sum of the primary deficit and interest payments on debt outstanding, so that:

Real debt growth rate =
$$\frac{Real\ primary\ deficit}{Real\ debt\ (previous\ period)} + \frac{Real\ interest\ payments}{Real\ debt\ (previous\ period)}$$

or equivalently

Real debt growth rate=
$$\frac{Real\ primary\ deficit}{Real\ debt\ (previous\ period)} + Effective\ interest\ rate\ on\ real\ debt$$

where the first component is the contribution of the primary deficit to real debt growth and the second is a measure of the nominal effective interest rate paid on public debt. In 2010 real debt has been growing about 4% per quarter, with the primary deficit providing around 3.5% of the increase.

Given the previous expression, the debt-to-GDP ratio increases with the ratio of the primary deficit to GDP and the difference between real effective interest rate and real GDP growth.

A formal expression (with time measured continuously) is:

$$\frac{Change\ in\ Debt}{GDP} =$$

$$\frac{Primary\ deficit}{GDP} + (Interest\ rate - Growth\ rate) \times \frac{Debt}{GDP}$$

A constant debt-to-GDP ratio is therefore achieved when the primary deficit as a share of GDP is approximately:

$$\frac{Primary\ Deficit}{GDP} = (Growth\ rate - Interest\ rate) \times \frac{Debt}{GDP}$$

The debt-to-GDP ratio is decreasing when the primary deficit-to-GDP ratio is smaller than the term in the right hand side. This relationship was emphasized in World Bank publications more than 50 years ago. It is often called a solvency condition (see for instance Buiter, 2010). As long as the growth rate of GDP is positive and higher than the real effective interest rate on debt, a positive primary deficit-to-GDP ratio can still lead to a decrease in the debt-to-GDP ratio.

As illustrated in Figure 6, in the early 1960s, the government debt to GDP ratio was around 50%. It then fell to around 30% in the 1970s, and started to grow again in the 1980s, fell in the 1990s when the government ran a primary surplus and interest rates de-

clined, and shot up during the recent recession as the primary deficit rose and GDP dropped.

Using the previous fiscal arithmetic it is easy to show, that at the steady-state, the ratio of debt to GDP must be equal to the ratio of the primary deficit to GDP, divided by the difference between the output growth rate and the real interest rate.

$$\frac{Debt}{GDP} = \frac{(Primary\ Deficit)/GDP}{(Growth\ rate - Interest\ rate)}$$

The expression in the denominator is the difference between two small numbers. An increase (faster growth or a lower interest rate) has a very large effect on reducing the debt-to-GDP ratio, which is not the case for the ratio of the primary deficit to GDP.

Figure 6 also presents the history of annual real effective interest[1] and growth rates. Prior to the late 1970s the interest rate tended to lie below the growth rate. It spiked upward with the Federal Reserve's anti-inflationary monetary shock, and has drifted downward since then, falling abruptly during the recession.

ECONOMETRICS OF DEBT, DEFICITS, AND GROWTH

To explore further how fiscal debt responds to economic growth, and in turn how economic growth reacts to the fiscal primary deficit and other variables, we estimated two standard vector auto-regressive (VAR) models using quarterly data from the Bureau of Economic Analysis for 1975-2008. The first VAR directly relates the quarterly growth of real public debt to quarterly real GDP growth, taking into account the two directions of causality: how does growth in real debt affect and how is it affected by real GDP growth? The second model extends the first one by distinguishing the two components of real debt growth described in the fiscal arithmetic: the response (and effect) of the contribution of the primary deficit and of changes in the effective interest rate. Linkages among the deficit, interest rate, and real GDP are estimated in a three-dimensional VAR.[2]

The Reaction of the Fiscal Position to Economic Growth

As can be seen in Figures 2 and 3, the shares in GDP of both total government net borrowing and the federal primary deficit rise during recessions (when GDP growth slows down). The first VAR estimation confirms this pattern and indicates that if the growth rate jumps down by 1% from an exogenous shock (say, initially, from 3% to 2% per quarter which itself implies in lower growth rates for more than a year), then quarterly real debt growth increases on average by 1.5% in two or three years (say, from 1% to 2.5% per quarter three years later).

The results of the second model (the 3-dimensional VAR model of growth, the primary deficit, and the interest rate) are slightly stronger. They suggest that a 1% decrease in real GDP growth

1 The real effective interest rate in the diagram is real interest payments divided by the real level of debt lagged one quarter minus the quarterly inflation rate, annualized. It closely tracks real 10-year returns given by the Fed.
2 Because the two VAR models discussed here were estimated using the (stationary) first differences of the macroeconomic variables previously mentioned, the following results have a clear short-term focus. However, estimates of analogous vector-error-correction (VEC) models (which are able to capture long-term relationships) delivered comparable results.

generally leads to a contribution of the primary deficit to the growth of real debt almost 2% higher after two years, with the difference (from the 1.5% just mentioned) explained by an initial decrease in the effective interest rate.

Using initial values corresponding to the ones observed in the second quarter of 2008[3], the models suggest that a jump down of 1% in quarterly real GDP growth (or a drop of 4% in the annualized growth rate) would, ceteris paribus, make the ratio of the primary deficit to GDP jump by 1.7% after one year and 3.6% after two years. An initial primary deficit of 3.7 % of GDP as in 2008-II would have increased to 7.31% of GDP in 2011-II if only the "normal" counter-cyclical features of fiscal policy are considered.[4] These estimates are broadly consistent with data presented in Figure 5 prior to the Great Recession.

They also imply that given the value of the primary deficit in 2010-III of US$ 308 billion (or 8.4% of GDP) and debt-to-GDP ratio of about 71%, a further drop of 0.25% in quarterly GDP growth (initially from 0.61% to 0.36%, but leading to lower rates for many quarters) would make the primary deficit as a share of GDP jump by 1.2% in one year (to 9.6% of GDP or around US$ 352 billion at present value), increasing the debt-to-GDP ratio to more than 80% in the end of 2011. This result is broadly consistent with the findings of Reinhardt and Rogoff (2010) associating high debt-to-GDP ratios with low real GDP growth rates, except that causality runs the other way: high debt-to-GDP ratios are a consequence, and not the cause, of low growth. The policy implication is that avoiding a double dip recession in 2011 is essential for fiscal sustainability.

Conversely, a return to growth can substantially improve the fiscal position of the government. An increase of 1% in the annual growth rate of GDP (say, from the current rate of 2.42% to 3.42% in the next quarter, which due to its estimated persistence would lead to higher rates for more than a year) would reduce the primary deficit from 8.4% of GDP to 6.5% after a year and to 3.7% after two years, with the debt-to-GDP ratio tending to stabilize.

The Reaction of Economic Growth to Fiscal Policy (and Bond Vigilantes)

The second estimated VAR model provides empirical estimates of the effects of changes in real debt growth and its different components (contribution of primary deficit and effective interest rate on federal debt) on the growth rate of GDP, as well as the interaction between the primary deficit and the effective interest rate itself.

The dynamic reaction of real GDP growth to an exogenous increase in real debt growth, and particularly to an increase in the contribution of the primary deficit, is statistically significant and non-negligible. A one-time increase of 1% in the quarterly real debt growth persists for a few quarters, but leads to an accumulated increase of quarterly real GDP growth of 0.4 after two or three years (or 1.6% in the annual growth rate).

3 In the second quarter of 2008, quarterly real GDP growth was 0.22%, real debt growth was 3.12%, the contribution of the primary deficit to real debt growth was 2.1% and the ratio of the primary deficit to GDP was 3.7%.
4 All scenarios were based on hypothetical initial values and on the accumulated impulse response functions of the VARs.
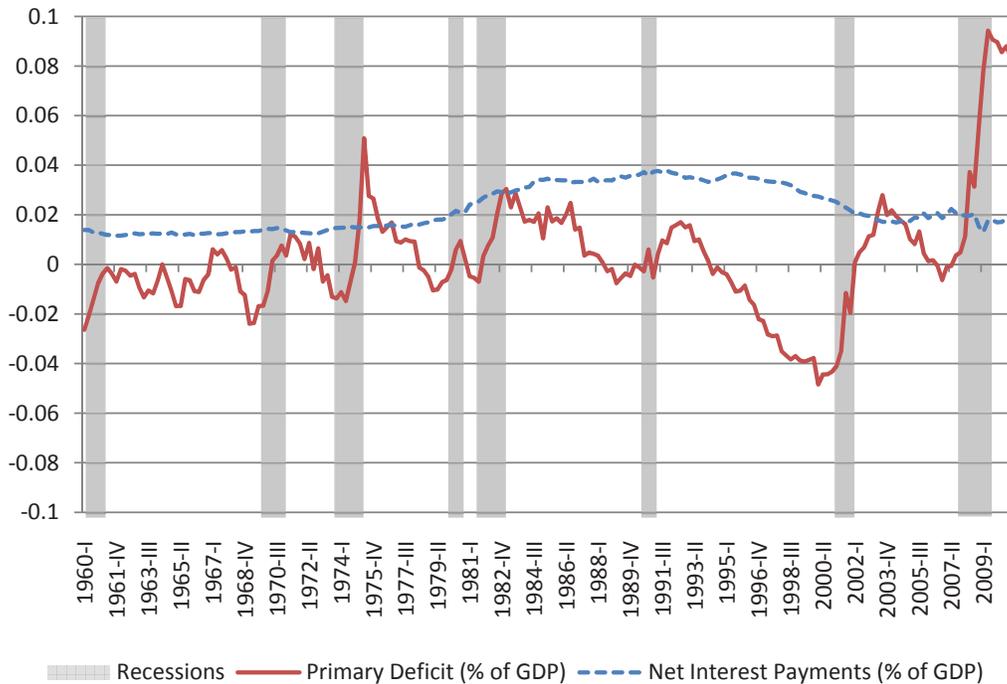
Figure 5. Primary Deficit and Net Interest Payments of the Federal Government as a share of GDP in the United States (1947-2010).
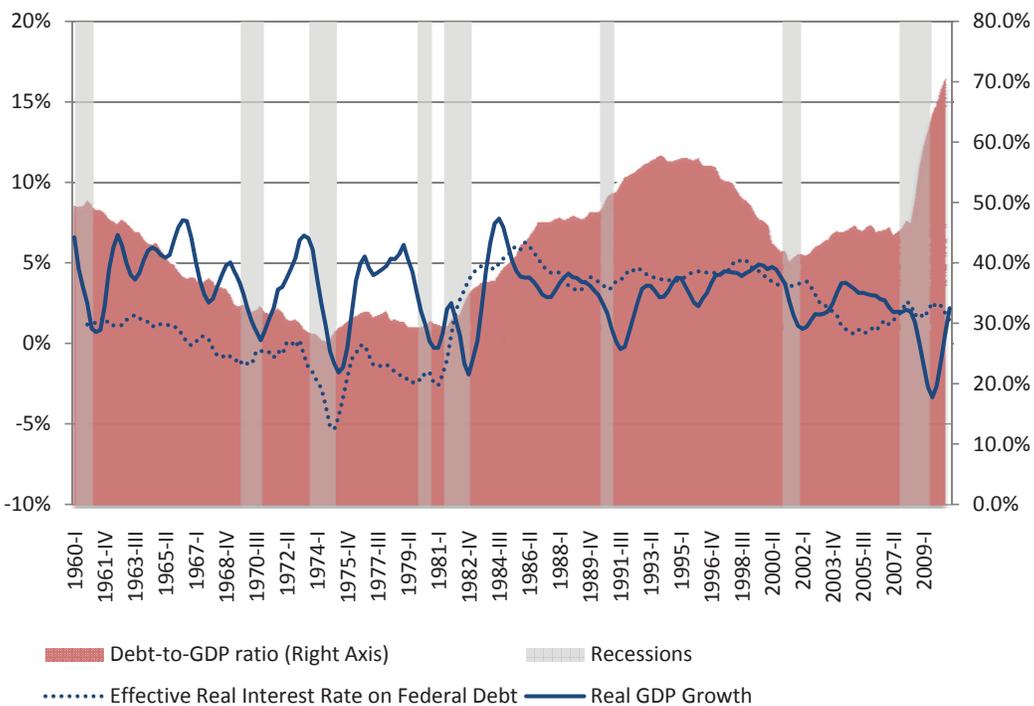

Figure 6. Federal public Debt-to-GDP ratio, real GDP growth and real effective interest rate (annualized moving averages) in the United States (1960-2010)

This response is even stronger if the increase in real debt growth fully comes from an increase in the primary deficit: A jump of 1% in the contribution of the primary deficit to the quarterly growth of real debt (say, from current 3.2% to 4.2%) would generate an accumulated increase of 0.8% in quarterly real GDP growth after two years (from current 0.61% to 1.41% in 2012-III). At a current level of federal debt of more than US$10.3 trillion, such response would require an increase in the primary deficit of US$128 billion (from 8.4 to 11.8% of current GDP).

While an increase in the growth rate of the nominal effective interest rate has on average a negative impact on growth, the response is weak and not persistent. A drop in the growth rate of the annualized effective rate of 0.1% leads to an increase in annual real GDP growth of less than 0.1% after two years (or 0.025% in the quarterly rate).

In the opposite direction, the effect of faster growth increases the effective interest rate, but the positive impact is statistically less significant. The implication is that in the historical record as captured by the VAR model, bond vigilantes have not ridden in when the U.S. federal primary deficit has gone up.

THE CURRENT DEBATE

The scenarios just discussed indicate that, without a policy-driven increase in the primary deficit, recovery of growth to a rate of 3% per year would drive the deficit down toward its historical levels. However, projections discussed toward the end of 2010 show that Federal expenditures might rise from around 20% of GDP in 2020 to 24.5% in 2050. If revenue stays constant in the range of 18-20% of GDP then Federal debt would expand rapidly.

Figure 5 shows that after the early 1990s and prior to the Great Recession, the primary deficit peaked at 3-4% of GDP after a downswing, and then fell to around or below zero. Fiscal expansion, losses in revenue and the considerable fall in GDP after 2007 led the deficit to rise well above previous peak levels. Figure 4 shows that government total receipts have recovered after the increase in GDP growth in the recent quarters, but total net borrowing is still at 8.4% of GDP.

There are many ways to increase Federal revenue above its historical peak of 21% of GDP. A broad-based value-added tax would be one possibility, as would be a more progressive social security system, a tax of (say) 1% on household net worth, and/or larger high-income tax rates. On the expenditure side, tight cost controls for national health insurance provision would be essential; reducing the defense budget could also be a possibility worth analyzing.

Moreover, as previously argued, the key determinant of growth of the debt/GDP ratio over time is the difference between real GDP growth and real interest rate. If the GDP growth rate is less than the interest rate, the economy cannot "grow out" of a fiscal primary deficit, and the debt to GDP ratio would ultimately increase exponentially if the deficit were to remain positive.

Figure 6 shows that this requirement is currently being satisfied in a time of extremely low interest rates, but the future of course remains unclear. The real rate unambiguously fell below the growth rate after around 2000. The debt burden could become intolerable unless the GDP growth rate over time averages out to be 2% per year or higher. A debt trap can only be avoided if the real interest rate is held down.

The need for relatively expansionary monetary policy is clear. But it must be complemented by further fiscal expansion to restart growth. An effort to reduce the deficit must start with an increase in spending to generate higher growth and subsequently, higher revenues. The case for another fiscal stimulus is strengthened by the large fall and slow recovery of the private components of effective demand as shown in Figure 4. With the exception of the recent real increase in business investment and in government revenues, the Great Recession does not show any sign of being over.

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