

# Do Budget Deficits Cause Inflation?

BY KEITH SILL

**I**s there a relationship between government budget deficits and inflation? The data show that some countries—usually less developed nations—with high inflation also have large budget deficits. Developed countries, however, show little evidence of a tie between deficit spending and inflation. In “Do Budget Deficits Cause Inflation?,” Keith Sill states that the extent to which monetary policy is used to help balance the government’s budget is the key to determining the effect of budget deficits on inflation. He examines the theory and evidence on the link between fiscal and monetary policy and, thus, between deficits and inflation.

In 2004, the federal budget deficit stood at \$412 billion and reached 4.5 percent of gross domestic product (GDP). Though not at a record level, the deficit as a fraction of GDP is now the largest since the early 1980s. Moreover, the recent swing from surplus to deficit is the largest since the end of World War II (Figure 1). The flip side of deficit spending is that the amount of government debt outstanding rises: The government must borrow to finance the excess of its spending over its receipts. For the U.S. economy, the

amount of federal debt held by the public as a fraction of GDP has been rising since the early 1970s. It now stands at a little over 37 percent of GDP (Figure 2).

For a long time, economists and policymakers have worried about the relationship between government budget deficits and inflation. These worries stem from the possibility that the government will finance its deficits by borrowing or by printing money. Should deficit spending and a large public debt be worrisome for monetary policymakers who are concerned about the economy’s level of inflation? Do government budget deficits lead to higher inflation? When looking at data across countries, the answer is: it depends. Some countries with high inflation also have large government budget deficits. This suggests a link between budget deficits and inflation.

Yet for developed countries, such as the U.S., which tend to have relatively low inflation, there is little evidence of a tie between deficit spending and inflation. Why is it that budget deficits are associated with high inflation in some countries but not in others?

The key to understanding the relationship between government budget deficits and inflation is the recognition that government deficit spending is linked to the quantity of money circulating in the economy through the *government budget constraint*, which is the relationship between resources and spending. At its most basic level, the budget constraint shows that money spent has to come from somewhere: in the case of local and national governments, from taxes or borrowing. But national governments can also use monetary policy to help finance the government’s deficit.

The extent to which monetary policy is used to help balance the government’s budget is the key to determining the effect of budget deficits on inflation. In this article, we will examine theory and evidence on the link between fiscal and monetary policy and, thus, between deficits and inflation.

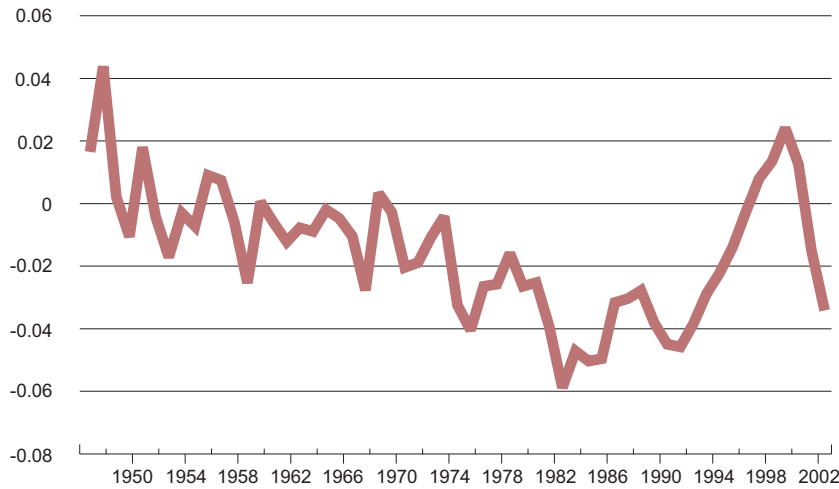
## BUDGETS AND ACCOUNTING

Budget constraints are a fact of life we all face. We’re told we can’t spend more than we have or more than we can borrow. In that sense, budget constraints always hold: They reflect the fact that when we make decisions, we must recognize we have limited resources.

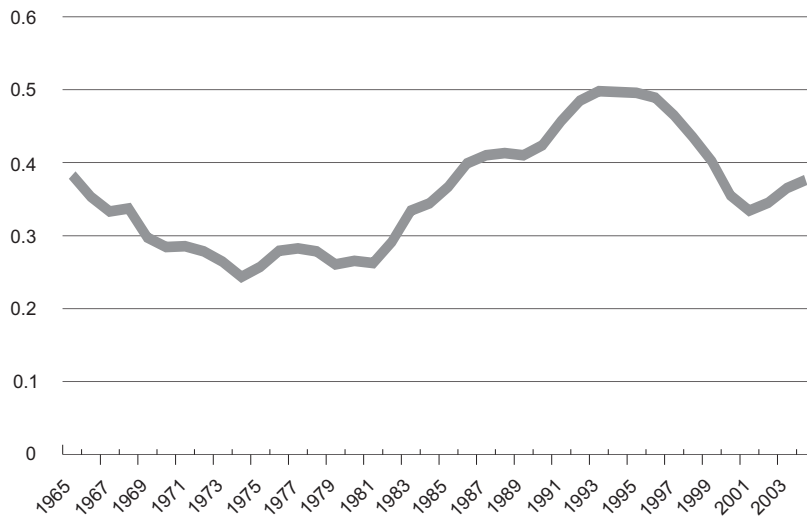
An example can help fix the idea. Imagine a household that gets income



**Keith Sill** is a senior economist in the Research Department of the Philadelphia Fed.

**FIGURE 1****Federal Surplus/Deficit Relative to GDP**

Source: Haver Analytics

**FIGURE 2****Federal Public Debt Outstanding as a Fraction of GDP**

Source: Office of Management and Budget, Flow of Funds Accounts

from working and from past investments in financial assets. The household can also borrow, perhaps by using a credit card or getting a home-equity loan. The household can then spend the funds obtained from these sources to buy goods and services, such as

food, clothing, and haircuts. It can also use the funds to pay back some of its past borrowing and to invest in finan-

<sup>1</sup> The household can also sell some of its assets to finance consumption. This is tantamount to negative investment in assets.

cial assets such as stocks and bonds.<sup>1</sup>

The household's budget constraint says that the sum of its income from working, from financial assets, and from what it borrows must equal its spending plus debt repayment, plus new investment in financial assets. There are no financial leaks in the budget constraint: The household's sources of funds are all accounted for, its spending is all accounted for, and the two must be equal. The household may use borrowing to spend more than it earns, but that source of funding is accounted for in the budget constraint. If the household has hit its borrowing limit, fully drawn down its assets, and spent its work wages, it has nowhere else to turn for funds and would therefore be unable to finance additional spending.

Just like households, governments face constraints that relate spending to sources of funds. Governments can raise revenue by taxing their citizens, and they can borrow by issuing bonds to citizens and foreigners. In addition, governments may receive revenue from their central banks when new currency is issued. Governments spend their resources on such things as goods and services, transfer payments such as Social Security to its citizens, and repayment of existing debt. Central banks are a potential source of financing for government spending, since the revenue the government gets from the central bank can be used to finance spending in lieu of imposing taxes or issuing new bonds. For example, the U.S. Treasury received a little more than \$22 billion from the Federal Reserve in 2003.<sup>2</sup>

Much of a central bank's revenue comes from its monetary policy opera-

<sup>2</sup> Recent detail on Federal Reserve payments to the Treasury can be found in the 90<sup>th</sup> Annual Report, Board of Governors of the Federal Reserve System, 2003, Table 5, page 270.

tions. An important aspect of modern monetary policymaking is controlling the short-term interest rate. Central banks do this by purchasing and selling interest-earning government bonds. If the central bank wants to raise the interest rate, it sells government bonds. If it wants to lower the interest rate, it buys government bonds. As a consequence of these *open market operations*, central banks have government bonds in their portfolios, and these bonds earn interest. Thus, one component of central bank revenue is interest earned on the government bonds it holds.

The second component of central bank revenue is also related to open market operations. Central banks are able to create and issue money to pay for the government bonds they purchase. The money that central banks create is called *high-powered money*, and it takes the form of currency held by the nonbank public plus the reserves banks are required to hold against certain types of deposits. Since the central bank can issue high-powered money to pay for things like government bonds, an increase in high-powered money represents a source of central bank revenue.

Revenues are one side of the central bank's budget constraint. What does the central bank spend its revenue on? As mentioned, a major use of funds is to purchase government debt in the conduct of open market operations. The other component of central bank spending is residual: what is left over after the central bank pays its expenses. In the U.S., this residual gets turned over to the Treasury each year.

We can get a *consolidated government budget constraint* by combining the budget constraints of the treasury and the central bank. The government spends its revenue on:

- Goods and services;
- Transfer payments; and

- Interest payments on government debt held by the public.<sup>3</sup>

This spending is funded by:

- Tax receipts;
- The increase in debt held by the public; and
- The increase in high-powered money.

Note that if the government increases the quantity of high-powered money it can reduce other taxes or borrowing.

The revenue the government gets from the increase in high-powered money is called *seigniorage*.<sup>4</sup> The extent to which governments use seigniorage as a means for financing budget deficits plays a key role in the link between budget deficits and

<sup>3</sup> Recall that interest paid on government debt held by the central bank goes back to the treasury.

<sup>4</sup> More technically, seigniorage is the real increase in the stock of high-powered money (currency held by the nonbank public plus bank reserves), i.e., the increase in the stock of high-powered money adjusted for the level of prices in the economy. As shown in Figure 3, for the U.S., this measure of seigniorage has been small. See the book by Frederic Mishkin.

inflation. Since the creation of high-powered money, and thus seigniorage, is undertaken by the central bank, the consolidated budget constraint shows the link between fiscal policy and monetary policy. Money creation is a source of revenue for the government. The amount of revenue the government gets from seigniorage has implications for the government's choices about taxes, borrowing, and spending.<sup>5</sup>

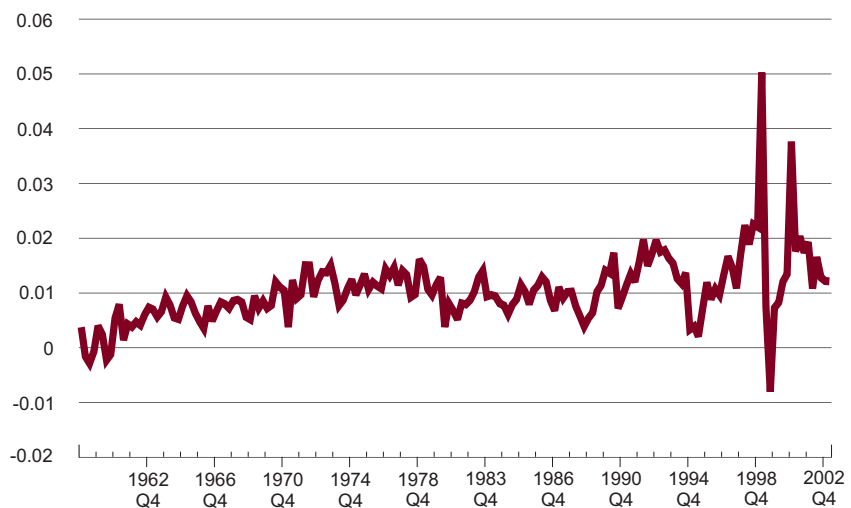
### HOW MUCH CAN THE GOVERNMENT BORROW?

The consolidated budget constraint shows the link between the

<sup>5</sup> There is also a subtle way in which governments can use monetary policy to help finance spending. If the government can generate surprise inflation, the real value of the payments it makes to holders of its debt falls below what investors expected to receive when they bought the debt. Surprise inflation erodes the value of government debt, which means that a lesser amount of real tax revenue must be raised to pay off bondholders. However, generating surprise inflation to finance spending is ultimately a losing game for the government. Eventually, investors will catch on to what the government is doing and demand a high enough interest payment to compensate them adequately for the government's inflation policy.

**FIGURE 3**

### Seigniorage Relative to Government Spending



Source: Haver Analytics

government's choices about spending, taxing, borrowing, and seigniorage. This relationship is a constraint only in the sense that there may be limits on the government's ability to borrow or raise taxes. Obviously, if there were no such limits, there would be no constraint on how much the government could spend at any point in time.

Certainly governments are limited in their ability to tax citizens. (That is, the government can't tax more than 100 percent of income.) But are governments constrained in their ability to borrow? Indeed they are. Informally, the value of government debt outstanding today cannot be more than the value of the resources the government has to pay off the debt.<sup>6</sup>

How do governments pay their current debt obligations? One way is for the government to collect more tax revenue than it spends. In this case, the surplus can be used to pay bond holders. Another way to finance existing debt is to collect seigniorage revenue and use that to pay bond holders. Finally, the government can borrow more from the public to pay existing debt holders. If the government chooses this last option, any new debt it issues would, in turn, have to be paid off using future surpluses, future seigniorage, or future borrowing. As long as the amount of debt the government issues to pay its obligations does not grow too fast over time, we can think of the current value of outstanding government debt as being ultimately backed by a stream of future surpluses and future seigniorage.<sup>7</sup> Since investors generally prefer to receive payouts sooner rather than later, the future stream of surpluses and seigniorage

<sup>6</sup> A formal derivation of this relationship can be found in the Technical Appendix.

<sup>7</sup> We have assumed that in the long run, government debt does not grow at a rate faster than the interest rate.

that backs government debt must be discounted to take account of the time value of money. That is, the current value of debt must equal the present discounted value of future surpluses and future seigniorage.<sup>8</sup>

## Monetary policy does not necessarily have to adjust money growth in response to deficit spending... provided that deficit spending is expected to be offset by future surpluses.

We call this relationship the government's *intertemporal budget constraint*.<sup>9</sup> It indicates that the government must plan to raise enough revenue (in present value terms) through taxation and seigniorage to pay off its existing debt and to pay for its planned expenditures on goods, services, and transfer payments.

The intertemporal budget constraint has some interesting implications for monetary and fiscal policy. Suppose the government decides that, for a set path of future spending, it will lower current and future taxes permanently. This policy would lower the present discounted value of future surpluses. So, to fund the path of future spending, the government would need to increase the present discounted

<sup>8</sup> Present value refers to an amount of money today that will become a given amount at a stated point in the future, depending on the interest rate. For example, if the interest rate is 10 percent, \$100 today will be worth \$110 in one year. So the present value of \$110 one year from now (with an interest rate of 10 percent) is \$100.

<sup>9</sup> An "intertemporal constraint" shows how government resources and spending are linked over time.

value of seigniorage. Since seigniorage is related to high-powered money growth, the implication is that money growth must increase in the future. Similarly, if the government decides to permanently increase future surpluses — for example, a permanent increase in taxes or a permanent reduction in borrowing — so that the present discounted value of future surpluses rises, the present discounted value of future seigniorage must fall; therefore, future money growth must fall.<sup>10</sup>

Note that the constraint does not say that an increase in deficits must be accompanied by a rise in seigniorage. An increase in the deficit could be temporary in the sense that it will be offset by future surpluses. In other words, a deficit today could be negated by a future surplus, so that the present discounted value of future surpluses remains unchanged. In that case, no offsetting adjustment in the value of discounted future seigniorage would be necessary. Monetary policy does not necessarily have to adjust money growth in response to deficit spending by the government, provided that deficit spending is expected to be offset by future surpluses. But if the present discounted value of future surpluses changes, there must be an offsetting change in the present discounted value of seigniorage, and vice versa.

## POLICY, DEFICITS, AND INFLATION

Suppose that whenever there is a change in the present discounted value of seigniorage, fiscal policy adjusts so that the intertemporal budget constraint holds. In this case, monetary policy is independent in the sense that monetary policymakers take action without regard to fiscal policy, and then fiscal policy adjusts to maintain

<sup>10</sup> The government can permanently increase future surpluses by raising taxes or borrowing less.

a balanced budget.<sup>11</sup> With monetary independence, policymakers are free to pursue goals such as low and stable inflation and not have to worry about using money growth to finance treasury budget deficits. In this case, we would not expect a tight link between government budget deficits and inflation because current government budget deficits are expected to be largely offset by future government budget surpluses. In addition, the path of government budget surpluses is expected to offset changes in seigniorage, so that the intertemporal budget constraint holds.

This does not mean that we may not observe some correlation between deficits and spending. For example, if the economy is hit by a recession, the deficit is likely to rise because tax revenues fall. At the same time, monetary policymakers may lower interest rates to combat the recession, an act that may subsequently lead to higher inflation. In this case, though, deficits are not, per se, the cause of inflation. Rather, deficits and inflation are both consequences of the recession.

The alternative case is one in which monetary policy is dependent. When monetary policy is dependent, the central bank adjusts seigniorage so that the budget constraint holds. Monetary policy responds to fiscal policy, so that seigniorage revenue becomes an important component of government finance. An independent treasury might decide to run permanent deficits, a situation that requires seigniorage to make up the gap between the value of the public debt and the present discounted value of budget surpluses. In this case, we could expect to see a link between deficits and inflation, since monetary policymakers respond directly to a fiscal policy of deficit spending. Whether monetary

---

<sup>11</sup> See Michael Dotsey's article for more on independent and dependent monetary policy.

policy is independent and fiscal policy is dependent or vice versa is the key to answering the question of whether budget deficits imply higher inflation.

**Dependent Monetary Policy May Result in Unexpected Outcomes.** In a 1981 article, Thomas Sargent and Neil Wallace offer a famous example of how dependent monetary policy can lead to unexpected outcomes. Suppose fiscal policy is independent, monetary policy is dependent, monetary policy responds to fiscal policy, and the

**It seems safe to say that, for the U.S. economy, there is little, if any, link between deficits and inflation.**

intertemporal budget constraint holds. In this case, an attempt by monetary policymakers to rein in inflation today by lowering money growth can result in higher inflation in the future: Policymakers are ultimately defeated in their efforts to lower inflation. How could this happen?

Suppose monetary policymakers lower current money growth in an effort to bring down inflation. Lower money growth means lower seigniorage. If government spending and taxes do not change, the government will have to borrow more from the public in order to make up for the lost revenue from seigniorage. If the outstanding public debt increases, the intertemporal budget constraint implies that there must be a corresponding increase in the present discounted value of future budget surpluses and seigniorage. In a regime of fiscal independence, fiscal policy does not adjust, so the present discounted value of budget surpluses does not change. But that means that the present discounted

value of seigniorage must rise to match the increase in the value of public debt outstanding. That is, the central bank will be required to increase the rate of money growth (seigniorage), an action that ultimately leads to higher inflation.<sup>12</sup> In this case, efforts to use monetary policy to lower inflation are self-defeating.

## EMPIRICAL EVIDENCE ON INFLATION AND DEFICITS

Economic theory suggests that the strength of the relationship between government budget deficits and inflation depends on whether monetary policy is independent or dependent relative to fiscal policy. In countries where seigniorage is an important component of government finance, we are likely to find that government budget deficits and inflation are empirically linked. In countries with independent monetary authorities, the link between deficits and inflation is likely to be weaker.

### Evidence for the U.S. Economy.

As we can see from a plot of deficits and inflation for the U.S. economy since the end of World War II, there does not appear to be much of a relationship between government budget deficits and inflation (Figure 4). The contemporaneous correlation between federal budget deficits and inflation (GDP deflator inflation) is essentially zero. It is possible that deficits today are more highly correlated with future inflation than with current inflation — it may take some time for deficits to be felt in the form of higher inflation. But even if we look for the largest correlation between current deficits and future inflation, we find that it is still rather low at 10 percent, when current deficits are correlated against inflation

---

<sup>12</sup> There is a strong empirical link between money growth and inflation for a wide range of countries over a long span of time. See the article by George McCandless and Warren Weber.

six quarters ahead. It seems to be the case that for the U.S. economy, deficits and inflation are largely unrelated.

It seems safe to say that, for the U.S. economy, there is little, if any, link between deficits and inflation. The reason is that the Federal Reserve largely sets monetary policy independently of what the Treasury is doing to finance the federal government budget deficit. The Fed turns over its profit to the Treasury each year, but the Fed does not conduct monetary policy to raise revenue for the Treasury. Rather, the Fed focuses on stabilizing inflation and unemployment and does not conduct monetary policy with an eye toward financing fiscal deficits.

More thorough evidence than simple correlations bears out the finding that deficits and inflation are weakly linked, if at all, in the U.S. and, for that matter, in most of the world's advanced economies.<sup>13</sup> However, there does seem to be a link between deficits and inflation in the world's less-developed economies. For those countries, high inflation is often associated with high average government budget deficits.

**Evidence for the Rest of the World.** A recent study by Stanley Fischer, Ratna Sahay, and Carlos Vegh classified a sample of 94 countries into high-inflation and low-inflation countries. High-inflation countries, of which there were 24 in their sample, are those that experienced at least one episode of 12-month inflation exceeding 100 percent over the span 1960 to 1995. On average, inflation in those countries was a bit over 150 percent per year. Seigniorage as a fraction of

<sup>13</sup> An older set of empirical studies tended to find that there was at best a tenuous link between deficits and inflation for the U.S. economy. See the papers by G. Demopoulos, G. Katsimbris, and S. Miller; K. Grier and H. Neiman; D. Joines; and Robert King and Charles Plosser.

GDP averaged about 4 percent in high-inflation countries versus an average of 1.5 percent in low-inflation countries. High-inflation countries rely more on seigniorage to help finance government spending. The authors find that for high-inflation countries, a worsening fiscal balance is much more likely to be accompanied by an increase in seigniorage than is the case in low-inflation countries.

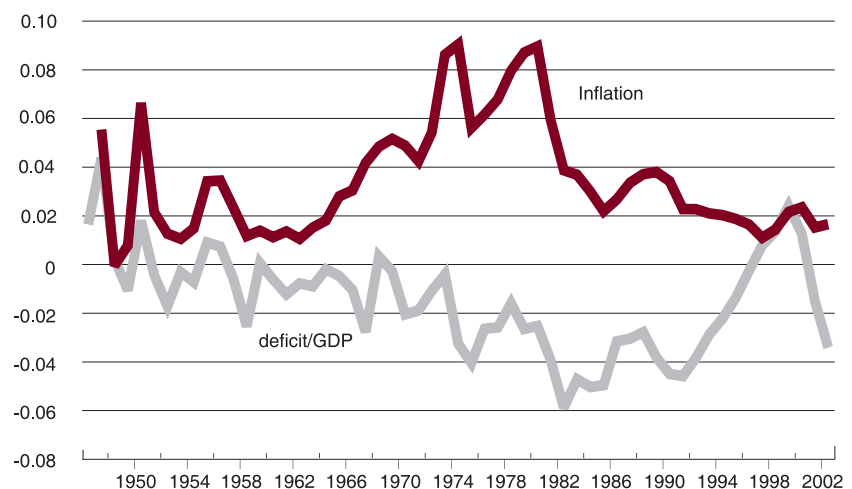
What triggers inflation? The authors use standard techniques to show that fiscal deficits lead to high inflation when the government depends on revenue from seigniorage to finance debt. They find that for high-inflation countries, a 10-percentage-point reduction in the fiscal balance (i.e., deficit) as a fraction of GDP is associated with, on average, a 4.2 percent increase in seigniorage. For low-inflation countries, there is no significant link between deficits and seigniorage. Also, when high-inflation countries experience episodes of low inflation, the link between deficits and inflation weakens dramatically.

A 2003 study by Luis Catao and Marco Terrones uses a broader sample of 107 countries over the period 1960 to 2001 to look for a link between fiscal deficits and inflation. They find a strong link between fiscal deficits and inflation in developing countries. For example, a 1 percent reduction in the ratio of the budget deficit to GDP is associated with an 8.75 percent lower inflation rate. Catao and Terrones also find results similar to those of Fischer, Sahay, and Vegh when the sample is broken into high-inflation and low-inflation countries using the 100 percent annual inflation rule. But they also find a statistically significant relationship between deficits and inflation in countries with moderate inflation as well, though the link is weaker. For low-inflation and advanced countries, Catao and Terrones find no link between fiscal deficits and inflation.

For developing countries, seigniorage is a significant source of revenue, and fiscal policy appears to be an important ingredient for the amount of inflation. Indeed, over the period

**FIGURE 4**

**Federal Deficit and Inflation**



Source: Haver Analytics

1980 to 1995, seigniorage as a fraction of GDP averaged about 2.2 percent, compared with only 0.64 percent in advanced economies such as the U.S., Germany, and Japan.<sup>14</sup> One possible reason for the greater reliance on seigniorage revenue in developing economies is that, for them, seigniorage may be a relatively efficient method to raise revenue compared with other forms of taxes. In developing countries, it may be difficult to collect tax revenue, since the tax base tends to be small and difficult to identify, especially when the government does not have a

<sup>14</sup> For more detail on seigniorage revenue in developing and advanced economies, see the article by Paul Masson, Miguel Savastano, and Sunil Sharma.


lot of resources to devote to building an efficient tax-collection system.

### SUMMARY

Monetary policy and fiscal policy are linked because money growth, in the form of seigniorage, provides revenue to the fiscal branch of the government. But whether deficits lead to inflation depends on the extent to which monetary policy is independent, that is, the extent to which monetary policymakers must react to fiscal financing developments when setting

<sup>15</sup> We have focused on the possible inflation consequences of government budget deficits. Other questions of interest we have not explored include the impact of budget deficits on real interest rates and exchange rates.

policy goals and implementing them.<sup>15</sup>

For the U.S. economy, there is little evidence of a link between fiscal deficits and inflation, precisely because monetary policymakers have been free to pursue goals such as low and stable inflation. They are able to do this because fiscal policy is seen as sustainable, in the sense that deficit spending today is not expected to continue to the extent that monetary policy will have to provide major funding for the Treasury. This is largely the case for the developed countries of the world. Developing countries, however, often require revenue from seigniorage to meet their fiscal financing needs. Thus, these countries tend to show a strong link between fiscal deficits and subsequent inflation. 

## Technical Appendix

### The Government's Intertemporal Budget Constraint

We can express the consolidated budget constraint in the symbolic form:

$$i_{t-1}B_{t-1} + G_t = T_t + (B_t - B_{t-1}) + (H_t - H_{t-1})$$

where  $G_t$  is government spending at time  $t$ ,  $i_{t-1}B_{t-1}$  is interest payments on publicly held government debt outstanding,  $T_t$  is tax receipts, and  $H_t$  is high-powered money. The left-hand side of the expression is total spending by the government and the right-hand side is total sources of revenue. It is convenient to put the budget constraint in inflation-adjusted, or real, terms by dividing through by the price level  $P_t$ . Define the real interest factor as

$$(1+r_t) = \frac{1+i_t}{(P_t/P_{t-1})}$$

We'll use lower case to denote real values. Then re-arranging terms, we can write the consolidated budget constraint as:

$$(1+r)b_{t-1} + g_t = t_t + b_t + s_t$$

In this expression,  $t_t$  is the real value of taxes collected, and  $s_t$  is the real value of the increase in money, or seigniorage. Finally,  $(1+r)$  is the real interest factor on government debt, which we assume (for simplicity) is constant over time. If we iterate the budget constraint forward  $T$  times into the future, we get:

$$(1+r)b_{t-1} = \sum_{i=0}^{T-1} \frac{t_{t+i} - g_{t+i}}{(1+r)^i} + \sum_{i=0}^{T-1} \frac{s_{t+i}}{(1+r)^i} + \frac{b_{t+T}}{(1+r)^T}$$

As long as the real amount of debt outstanding grows no faster than the real interest rate, which is a condition that says enough economic resources will be available to fully pay off any debt outstanding, then as  $T$  gets larger, the last term in the expression should get closer and closer to zero.

The first term on the left-hand side of the equal sign is the present discounted value of future budget surpluses. The second term is the present discounted value of future seigniorage. The equation shows that the real value of debt held by the public (principal and interest) is constrained by the government's ability to raise revenue to pay it off.

## REFERENCES

- Board of Governors of the Federal Reserve System. *90<sup>th</sup> Annual Report*, 2003.
- Catao, Luis, and Marco Terrones. "Fiscal Deficits and Inflation," IMF Working Paper WP/03/65 (2003).
- Demopoulos, G, G. Katsimbris, and S. Miller. "Monetary Policy and Central-Bank Financing of Government Budget Deficits," *European Economic Review*, 31(5), July 1987, pp. 1023-50.
- Dotsey, Michael. "Some Not-So-Unpleasant Arithmetic," Federal Reserve Bank of Richmond *Economic Quarterly*, 82, 4 Fall 1996.
- Dwyer, Gerald P, Jr., and R.W. Hafer. "The Federal Government's Budget Surplus: Cause for Celebration," Federal Reserve Bank of Atlanta *Economic Review*, July 1998.
- Fischer, Stanley, Ratna Sahay, and Carlos Vegh. "Modern Hyper- and High Inflation," *Journal of Economic Literature* 60 (2002), pp. 837-80.
- Grier, K., and H. Neiman. "Deficits, Politics and Money Growth," *Economic Inquiry*, 25(2), April 1987, pp. 201-14.
- Joines, D. "Deficits and Money Growth in the United States 1872-1983," *Journal of Monetary Economics*, 16(3), November 1985, pp. 329-51.
- King, Robert, and Charles Plosser. "Money, Deficits, and Inflation," Carnegie-Rochester Conference Series on Public Policy, 22, Spring 1985, pp. 147-96.
- Klein, Martin, and Manfred Neumann. "Seigniorage: What Is It and Who Gets It?" *Weltwirtschaftliches Archiv.*, 126(2), 1990, pp. 205-21.
- Masson, Paul R., Miguel A. Savastano, and Sunil Sharma. "Can Inflation Targeting Be a Framework for Monetary Policy in Developing Countries?" *IMF Finance and Development*, March 1998, pp. 34-37.
- McCandless, George, and Warren Weber. "Some Monetary Facts," Federal Reserve Bank of Minneapolis *Quarterly Review*, 19(3), Summer 1995, pp. 2-11.
- Mishkin, Frederic A. *The Economics of Money, Banking and Financial Markets*, 6<sup>th</sup> edition. Reading, MA: Addison-Wesley, 2001.
- Sargent, Thomas, and Neil Wallace. "Some Unpleasant Monetarist Arithmetic," Federal Reserve Bank of Minneapolis *Quarterly Review*, 5(3), Winter 1981, pp. 1-17.
- Walsh, Carl. *Monetary Theory and Policy*. Cambridge, MA: MIT Press, 2003.