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Conventionally Measured and Inflation-Adjusted Deficits as Indicators of the Stance of Fiscal Policy in Inflationary Periods

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I. Introduction

The budgetary deficit as a ratio to gross domestic product (GDP) is often used as a crude indicator of the stance of fiscal policy, particularly in the assessment of fiscal policy in less developed economies. The ratio which prevailed in some period when macroeconomic performance was judged to be satisfactory is taken as the norm. When the ratio in a given year exceeds the norm, the stance of fiscal policy is judged to be expansionary and/or inflationary, and vice versa. When the available data permit, more sophisticated measures, which abstract from the influence of fluctuations in the level of economic activity, are constructed. 1/

The use of the conventionally measured deficit as an indicator of the stance of fiscal policy, whether or not it has been adjusted for the influence of the cycle, has been criticized recently for failing to provide a true measure of the deficit in real terms in an inflationary

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1/ These adjusted indicators of the stance of fiscal policy are meant to measure changes in the deficit that result from deliberate acts of policy, and not swings in the deficit attributable to the influence of the cycle on tax revenue and cyclically sensitive expenditure categories. Two such indicators are the full-employment budget and the cyclically neutral budget. For a discussion, see Sheetal Chand, "Summary Measures of Fiscal Influence," Staff Papers, International Monetary Fund (Washington), Vol. 24 (July 1977), pp. 405-49.

period. It is argued that inflation acts to increase the deficit, as conventionally measured, as a ratio to GDP, and that this leads to an overstatement of the "true" deficit. In a number of studies on particular countries, it has been argued that when deficits are adjusted for the impact of inflation, a substantially different view of the appropriateness of fiscal policy emerges. Typically, fiscal policy is found to have been overly contractionary. 1/

This paper has two purposes. The first is to evaluate the reliability of the conventional measure of the deficit as an indicator of the stance of fiscal policy in an inflationary period. The second is to describe and appraise the type of inflation adjustments that have recently been proposed. Section II discusses the interpretation of the deficit in an inflationary environment, and Section III examines the inflation adjustment proposed by recent writers and considers the usefulness of the inflation-adjusted deficit as an indicator of the stance of fiscal policy. Section IV discusses some of the statistical and definitional problems that have been encountered in the calculation of inflation-adjusted deficits. Conclusions are presented in Section V.

II. The Interpretation of the Deficit in an Inflationary Period

The chronic inflation that has plagued the industrial economies since the early 1970s has often been attributed, at least in part, to overly expansionary fiscal policies. 2/ But if higher rates of inflation have been partly the result of excessive deficits, high rates of inflation have also led to higher nominal deficits through their

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1/ See, for example, John Bossons and D.P. Dungan, "The Government Deficit: Too High or Too Low?," Canadian Tax Journal (Toronto), Vol. 31 (January-February 1983), pp. 1-29, for a study on Canadian fiscal policy; Willem H. Buiter, "Measurement of the Public Sector Deficit and Its Implications for Policy Evaluation and Design," Staff Papers, International Monetary Fund (Washington), Vol. 30 (June 1983), pp. 306-49, for estimates of inflation-adjusted deficits for the United States and the United Kingdom (public sector); Marcus Miller, "Inflation-Adjusting the Public Sector Financial Deficit" in the 1982 Budget (Oxford, 1982), edited by John A. Kay, for a study of the United Kingdom; and Robert Eisner and Paul J. Pieper, "A New View of the Federal Debt and Budget Deficits," America's Economic Review (Nashville), Vol. 74 (March 1984), pp. 11-29, for a different set of estimates for the United States.

2/ For the seven major industrial countries, net lending of the general government sector as a percentage of GDP declined from 0.8 percent in 1969 to a deficit of 2.3 percent in 1981; see OECD, Historical Statistics, 1960-81 (Paris, 1983), p. 65. Cyclically adjusted balances also deteriorated over this period: see OECD Economic Outlook, Occasional Studies (Paris, June 1983), p. 19.

impact on interest rates. 1/ While there is considerable debate over the exact relationship between the rate of inflation and interest rates, there is general agreement that higher rates of inflation result in higher rates of interest. If a Fisher effect exists, then an increase in the expected rate of inflation results in an equal increase in the nominal rate of interest; the real interest rate--the difference between the nominal interest rate and the rate of inflation--remains constant.

The magnitude of the impact of inflation on the government's interest payments depends essentially on the directness of the link between inflation and interest rates and the length of the average maturity of the stock of outstanding public debt. The lack of a strong Fisher effect combined with a stock of public debt, which is on average of long-term maturity, would imply that the impact of inflation on the interest payment of the government would be small; this impact will be greatest when all debt is recontracted each period, and the real rate of interest is positive and constant.

In order to develop some idea of the effect of inflation on the deficit in this latter case, it is useful to consider a numerical example and to examine the impact of inflation on the size of the conventionally measured deficit when all else is held constant.

Consider an economy in a steady state where the real rate of growth is a constant g percent. Public expenditure on goods and services in real terms is a constant ratio of gross national product (GNP). Private consumption and investment are constant ratios of GNP at a given real rate of interest and are assumed to be unaffected by changes in the rate of inflation. For the sake of simplicity, the economy is assumed closed. The public sector's deficit is financed by the sale of bonds to the private sector. The demand for these bonds in real terms is a function of their real rate of return. The rate of inflation, π, will be allowed to vary. By assumption, the nominal rate of interest r_n will equal π plus the real rate of interest, r_r (plus the cross-product term, $r_n \pi$).

The level of government expenditures exclusive of interest payments is assumed to be a constant share of GNP and to be equal to the share of revenues in GNP. Hence, the budget exclusive of interest payments

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1/ In some countries, the structure of the tax and expenditure systems may be such that higher rates of inflation lead to higher budgetary deficits because revenues are less responsive to inflation than are expenditures. For example, in countries where subsidies for goods sold at fixed nominal prices are important components of the budget, higher rates of inflation induce higher expenditures and thus lead to higher deficits. However, these types of effects are different from the one considered here. For a discussion, see Peter S. Heller, "Impact of Inflation on Fiscal Policy in Developing Countries," Staff Papers, International Monetary Fund (Washington), Vol. 27 (No. 4, December 1980), pp. 712-48.

is balanced, and the nominal deficit equals the value of the government's interest payments. If these payments are a function of the stock of nominal debt outstanding at the end of the previous period B_{-1} and the current nominal rate of interest r_n, then the nominal deficit, ND, is given by the expression

(1) $ND = B_{-1} * r_n$

Because we assume a steady state, the stock of nominal public debt will be growing at the rate $(\pi+g+\pi g)$, or at the same rate as nominal GNP, and the ratio of the stock of the debt to GNP will be constant. If this ratio is assumed to be 50 percent, and the real rate of growth of the economy is 3 percent, then the steady state deficit will vary with the rate of inflation as shown in Table 1. If the ratio of the stock of public debt to GDP is 100 percent, then the effect of higher rates of inflation on the ratio of the conventionally measured deficit to GNP is increased. The real rate of interest r_r in this example is equal to the rate of growth of real GNP. 1/ As Table 1 shows, the nominal deficit increases quite markedly as a percentage of GNP as the rate of inflation increases from a lower to a higher range. For example, with the public debt equal to 50 percent of GNP, the deficit is 1.5 percent of GNP when prices are stable, and almost 4 percent when the rate of inflation is 5 percent. The increase in the share of the deficit at higher rates of inflation reflects the higher nominal rates of interest the government must pay to provide the same real rate of return to the holders of its debt.

Because the public sector's financing requirement increases with the rate of inflation, the private sector's financing capacity must increase by an equal amount. 2/ Since the share of private sector consumption and investment in GNP is constant at a given real interest rate, as is the share of GNP paid in taxes, both the personal disposable income and the savings from disposable income of the private sector must rise by the increase in the public sector deficit. Inflation acts to increase the size of the deficit, as conventionally measured, of the public sector, but also increases the conventionally measured surplus of the private sector. The private sector's extra savings are devoted to the acquisition of government debt, but these extra purchases do not increase the ratio of the stock of outstanding public debt to GNP.

1/ The nominal deficit, $r_n * B_{-1}$ equals the growth in the stock of public debt in nominal terms $(g+\pi+g\pi) * B_{-1}$. Hence, $r_n = g + \pi + g\pi = r_r + \pi + r_r\pi$.

2/ Using the symbols of basic national income analysis, in a closed economy, $G - T = S - I$, where G is inclusive of interest payments. The public sector's financing requirement, $G - T$, must by definition equal the private sector's financing capacity $S - I$. In this simple model, personal disposable income equals GNP less personal taxes plus government interest payments.

Rather, the extra purchases are necessary simply to maintain the growth of the private sector's holdings of public debt at the same real rate. The higher the rate of inflation, the more rapidly the stock of debt outstanding at a particular time declines in real value. If inflation is fully reflected in the nominal interest rate, then its impact on the real value of bond holders' capital is exactly offset by higher nominal incomes. While the change in the nominal indebtedness of the public sector--the deficit--is a higher ratio of GNP, the change in the public sector's indebtedness in real terms is unaffected.

Table 1. Nominal Deficit as a Ratio of GNP at Different Rates of Inflation and Different Ratios of Public Debt to GNP

(In percent)

(Public Debt)/GNP (In percent)	Inflation rate (In percent)							
	0	5	10	20	30	40	50	100
50	1.5	3.8	5.9	9.6	12.7	15.4	17.7	25.8
100	2.9	7.5	11.7	19.1	25.3	30.7	35.3	51.5

Note: For assumptions, see text, pp. 3-4.

The positive relationship between the deficits and the rate of inflation clearly creates difficulties for any assessment of fiscal policy based on the conventionally measured deficit. Can it be concluded that the higher the deficit and the higher the rate of inflation the more expansionary or inflationary is the stance of fiscal policy? 1/ Compare the hypothetical economy with a debt/GNP ratio of 50 percent when prices are stable and the deficit is 1.5 percent of GNP with the same economy when the rate of inflation is 10 percent and the deficit is 5.9 percent of GNP. Given the propensities of the private sector to consume and invest, the stance of fiscal policy is really no different in the second case than in the first, in the sense that the higher deficit is matched by the higher propensity of the private sector to save out of disposable income.

1/ It should be noted that a comparison is being made among different steady states. The transition from one steady state to another is not considered.

The private sector receives the same real rate of return on its savings and is willing to save all of the extra income it receives in interest payments from the public sector in the inflationary state. The excess of private sector savings over investment equals the public sector deficit ex ante. The higher public sector deficit associated with the 10 percent inflation is necessary to provide the private sector with the higher level of disposable income it requires to maintain unchanged its real level of savings and consumption. 1/

Arguments along these lines suggest that using the ratio of the conventionally measured deficit to GNP as an indicator of the stance of fiscal policy in an inflationary period may be misleading. They provide a rationale for an adjustment to the conventionally measured deficit which will purge it of the effects of inflation on interest payments. As the comparative analysis shows, the conventionally measured deficit increases as a percentage of GNP at higher rates of inflation even when the rate of increase of the real stock of public sector debt is unaffected. Even when measured in constant prices it no longer measures the real increase in the claims of the rest of the economy on the public sector.

III. Adjusting the Conventionally Measured Deficit for the Influence of Inflation

The inflation adjustment proposed by a number of economists consists of subtracting from the conventional deficit an estimate of the component of the public sector's interest payments which compensates holders of the public debt for the decline in the real value of these financial assets effected by inflation. (The adjustment may also be thought of as measuring the impact of inflation on the public sector's interest expenditures--in the simple model outlined in Section II these will be the same.)

The conventionally measured real deficit is derived by the deflation of the nominal deficit (ND) by some appropriate deflator (P):

(2) Conventional deficit: ND/P

The inflation-adjusted deficit is calculated by subtracting from this expression the decline in the real value of the outstanding stock of public debt caused by inflation. In the model of Section II this adjustment equals $(B_{-1}/P) * \pi$.

(3) Inflation-adjusted deficit: $ND/P - [(B_{-1}/P) * \pi]$

1/ These arguments do not consider the role of fiscal policy in generating and sustaining inflation, something which is considered below.

When the deflator's current period value is set equal to unity, this expression becomes

(4) Inflation-adjusted deficit: $ND - (B_{-1} * \pi)$

The inflation-adjusted deficit thus calculated equals the increase in real terms in the stock of public debt (and also equals the real rate of interest times the stock of debt): 1/

(5) $ND - (B_{-1} * \pi) = (B_{-1}/P_{-1}) * g = (B_{-1}/P_{-1}) * r_r$

To refer again to the model of Section II, the inflation-adjusted deficit is equal to the conventionally measured deficit when prices are stable. With a debt-to-GNP ratio of 100 percent and an inflation rate of 10 percent, the inflation adjustment (as a percentage of GNP) is equal to 8.8 percent and the "real" deficit equals 2.9 percent of GNP, which equals the conventionally measured deficit ratio when prices are stable. With an inflation rate of 15 percent, the inflation adjustment is 13.0 percent of GNP.

Compare two steady states of zero and 10 percent inflation of the hypothetical economy used here, and suppose these steady states represent the same economy in different periods (the debt/GNP ratio is assumed to equal 50 percent). Suppose further that the rate of inflation is insensitive in the short run to demand pressures so that changes in the stance of fiscal policy primarily affect real economic activity. If during the period when the rate of inflation is 10 percent, the government had introduced expenditure reductions equal to 1 percent of GNP, the deficit would have been reduced to about 4.9 percent of GNP. The expenditure reductions would have had the effect of reducing the rate of growth of government debt in real terms. It can be shown that the post-discretionary measures deficit, once adjusted for inflation, will be lower (at 0.5 percent of GDP) than the deficit that would have prevailed when prices were stable (1.5 percent). The expenditure reductions would have been contractionary, in the sense that they would have led to a reduction in real economic activity and ultimately to a reduction in the rate of inflation; this assessment would have been drawn from a comparison of inflation-adjusted deficits. However, the unadjusted deficit (at 4.9 percent) would have remained higher than the deficit of

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1/ $$\frac{ND}{P} - \frac{B_{-1} * \pi}{P} = \frac{\Delta B}{P_{-1}(1+\pi)} - \frac{\pi B_{-1}}{P}$$

$$= \frac{B_{-1}}{P_{-1}(1+\pi)} + \frac{\Delta B}{P_{-1}(1+\pi)} - \frac{B_{-1}(1+\pi)}{P_{-1}(1+\pi)}$$

$$= B/P - B_{-1}/P_{-1}$$

1.5 percent of GNP associated with price stability. If the unadjusted deficit were used as the standard of comparison, then fiscal policy after the expenditure reductions would still have been characterized as expansionary or inflationary, or both, although less so than it was before the expenditure reductions.

Suppose now that the authorities had introduced expenditure increases during the period of price stability equal to 1 percent of GNP, which increased the deficit to about 2.5 percent of GNP. These expenditure increases would have clearly been unambigously expansionary or inflationary. The conventionally measured deficit would have increased, so that the inference that would have been drawn from a comparison of this deficit with the deficit of 1.5 percent of GNP used as the standard of comparison would be correct. Yet the postdiscretionary measures deficit would still be less than the deficit of the high inflation state (4.9 percent) after implementation of the restrictive measures. A comparison of the unadjusted deficits of the two states' postdiscretionary measures would have been misleading. But no such incorrect inference would have been drawn from a comparison of the inflation-adjusted deficits.

The model of Section II does illustrate the problems that arise in the comparison of deficits as conventionally measured when rates of inflation differ. One serious shortcoming of the model is that it assumes that the demand for government debt in real terms is unaffected by the rate of inflation. Another shortcoming is that its formulation is such that the direct impact of inflation on the government's interest expenditures (the premium lenders demand) equals the decline in the real value of the debt. However, unexpected inflation results in a decline in the real value of the public debt but may have little effect on the government's interest payments in the short run if the average maturity of the debt is long.

This simple formulation has just one kind of public debt when there are, in fact, many. Should increases in notes and coin be included in the aggregate that is to be subject to the adjustment for inflation, for example? They are certainly an instrument of government finance and are amortized by inflation. Another important question is the choice of the deflator: not only which price index or deflator to choose, but whether a current period deflator or index instead of an average of several periods should be employed. These latter issues are explored further in Section IV.

This section now explores a simple model where the public debt is all in the form of high-powered money and where the demand for public debt in real terms is a function of the rate of inflation. This allows us to consider what happens to the deficit when the demand for public debt is affected by inflation. If the deficit is financed entirely by the creation of money, its real value will depend on the growth of money in real terms that the private sector is willing to absorb.

As the only source of money is the budgetary deficit (D), the following relationship must hold, where M stands for the stock of high-powered money (which we shall equate with the money supply, for convenience):

(6) $D = \Delta M$

Expressed as a percentage of nominal income, this becomes

(7) $D/Y = \Delta M/Y$

If the demand for money expressed as a proportion of nominal income can be expressed as a simple function of the rate of inflation, π, as follows:

(8) $M/Y = a * \exp(-b\pi)$

then the following relationship holds in a steady state:

$$(9)\quad \frac{D}{Y} = \frac{\Delta M}{Y} = \frac{\Delta M}{M} * \frac{M}{Y}$$

$$= \frac{\Delta M}{M_{-1}(1+\pi+g+\pi g)} * \frac{M}{Y}$$

$$= \frac{(\pi+g+\pi g)}{(1+\pi+g+\pi g)} * a * \exp(-b\pi)$$

(In the steady state, the rate of growth of the money supply, $\Delta M/M_{-1}$, is equal to $\pi + g + \pi g$.)

When comparing steady states with different rates of inflation, it is clear from equation (9) that the share of the steady-state deficit will vary with the rate of inflation. It need not be the case, however, that the greater the rate of inflation, the greater the deficit. The analysis is just that of the inflation tax: past a certain point, a higher rate of inflation will be associated with a lower deficit. The analysis of the inflation tax has shown that the "revenue" obtained by the government from the issue of high-powered money is maximized at some rate of inflation that depends on the elasticity of the demand for money with respect to the rate of inflation, the propensity to hold money balances, and the rate of growth of real income. Similarly, given the structure of this model, there is a maximum ratio of the deficit to GNP. 1/

1/ For given values of a, b, and g, this is obtained by differentiating expression (9) with respect to π and setting it equal to zero, yielding

$$\frac{1+g}{(1+\pi+g+\pi g)^2} - \frac{b(\pi+g+\pi g)}{(1+\pi+g+\pi g)} * (a\, e^{-b\pi}) = 0$$

This is then solved for π.

This corollary to the theory of the inflation tax does have a rather important implication for the assessment of the stance of fiscal policy. Even without financing the deficit through the issue of interest-bearing securities, the fiscal balance will vary with the rate of inflation in a way that depends on the characteristics of the demand for money function or more generally on the relationship between inflation and the demand for public debt.

In order to see if the deficit varies appreciably with the rate of inflation, and to see how sensitive the calculation of the deficit associated with a given rate of inflation is to the characteristics of the demand for money function, a broad range of values for each of the parameters a, b, and g was chosen and the ratio $\Delta M/Y$ associated with each of a series of inflation rates was calculated. This was the approach used by Tanzi in his study of the inflation tax. 1/

The following values for the parameters of the demand-for-money function and the growth rate of the economy were used.

Values of Parameters of Demand for Money Function and Real Growth Rates Used in Simulation

Parameters	Values			
a: (ratio of money to income at zero rate of inflation)	0.20	0.30		
b: (semi-elasticity of demand for money with respect to rate of inflation)	1.0	2.0	3.0	
g: (real growth rate of economy)	0	0.02	0.04	0.05

The results of the simulations to determine the budget deficit associated with inflation rates ranging from zero to 50 percent for the various combinations of the parameters a, b, and g are shown in Tables 2 and 3.

1/ Tanzi, Vito, "Inflation, Real Tax Revenue, and the Case for Inflationary Finance: Theory with an Application to Argentina," Staff Papers, International Monetary Fund (Washington), Vol. 25 (September 1978), pp. 417-51. The elasticity of the demand for money balances with respect to inflation equals $-b\pi$, and so varies directly with b for a given rate of inflation.

Table 2. Deficit as Percentage of GNP at Different Rates of Inflation and Rates of Real Growth 1/

	a=0.20 b=1.0				a=0.20 b=2.0				a=0.20 b=3.0			
	g				g				g			
π	0	0.02	0.04	0.05	0	0.02	0.04	0.05	0	0.02	0.04	0.05
0	0	0.4	0.8	1.0	0	0.4	0.8	1.0	0	0.4	0.8	1.0
.01	0.2	0.6	1.0	1.1	0.2	0.6	1.0	1.1	0.2	0.6	0.9	1.1
.02	0.4	0.8	1.1	1.3	0.4	0.7	1.1	1.3	0.4	0.7	1.1	1.2
.03	0.6	0.9	1.3	1.5	0.5	0.9	1.3	1.4	0.5	0.9	1.2	1.4
.04	0.7	1.1	1.4	1.6	0.7	1.1	1.4	1.6	0.7	1.0	1.3	1.5
.05	0.9	1.3	1.6	1.8	0.9	1.2	1.5	1.7	0.8	1.1	1.5	1.6
.10	1.6	2.0	2.3	2.4	1.5	1.8	2.1	2.2	1.3	1.6	1.9	2.0
.15	2.2	2.5	2.8	3.0	1.9	2.2	2.4	2.5	1.7	1.9	2.1	2.2
.20	2.7	3.0	3.3	3.4	2.2	2.5	2.7	2.8	1.8	2.0	2.2	2.3
.25	3.1	3.4	3.6	3.7	2.4	2.6	2.8	2.9	1.9	2.0	2.2	2.2
.30	3.4	3.6	3.9	4.0	2.5	2.7	2.9	2.9	1.9	2.0	2.1	2.2
.35	3.7	3.9	4.1	4.2	2.6	2.7	2.9	2.9	1.8	1.9	2.0	2.1
.40	3.8	4.0	4.2	4.2	2.6	2.7	2.8	2.9	1.7	1.8	1.9	1.9
.45	4.0	4.1	4.3	4.4	2.5	2.6	2.7	2.8	1.6	1.7	1.7	1.8
.50	4.0	4.2	4.4	4.4	2.5	2.5	2.6	2.7	1.5	1.5	1.6	1.6

1/ a represents the ratio of money to GNP at zero inflation; b represents the semi-elasticity of the demand for money balances with respect to the rate of inflation; g stands for the rate of growth of real GNP; and π represents the rate of inflation. The elasticity of the demand for money with respect to inflation equals $-b\pi$.

Table 3. Deficit as Percentage of GNP at Different Rates of Inflation 1/

a=0.30 b=1.0				a=0.30 b=2.0				a=0.30 b=3.0			
g				g				g			
0	0.02	0.04	0.05	0	0.02	0.04	0.05	0	0.02	0.04	0.05
0	0.6	1.2	1.4	0	0.6	1.2	1.4	0	0.6	1.2	1.4
0.3	0.9	1.4	1.7	0.3	0.9	1.4	1.7	0.3	0.9	1.4	1.7
0.6	1.1	1.7	1.9	0.6	1.1	1.7	1.9	0.6	1.1	1.6	1.9
0.8	1.4	1.9	2.2	0.8	1.4	1.9	2.1	0.8	1.3	1.8	2.1
1.1	1.7	2.1	2.4	1.1	1.6	2.1	2.3	1.0	1.5	2.0	2.2
1.4	1.9	2.4	2.7	1.3	1.8	2.3	2.5	1.2	1.7	2.2	2.4
2.5	3.0	3.4	3.6	2.2	2.7	3.1	3.3	2.0	2.4	2.8	3.0
3.4	3.8	4.2	4.4	2.9	3.3	3.6	3.8	2.5	2.8	3.1	3.3
4.1	4.5	4.9	5.1	3.4	3.7	4.0	4.1	2.7	3.0	3.3	3.4
4.7	5.0	5.4	5.6	3.6	3.9	4.2	4.3	2.8	3.1	3.3	3.4
5.1	5.5	5.8	5.9	3.8	4.0	4.3	4.4	2.8	3.0	3.2	3.3
5.5	5.8	6.1	6.2	3.9	4.1	4.3	4.4	2.7	2.9	3.0	3.1
5.7	6.0	6.3	6.4	3.9	4.0	4.2	4.3	2.6	2.7	2.8	2.9
5.9	6.2	6.4	6.6	3.8	4.0	4.1	4.2	2.4	2.5	2.6	2.7
6.1	6.3	6.5	6.6	3.7	3.8	4.0	4.0	2.2	2.3	2.4	2.4

a represents the ratio of money to GNP at zero inflation; b represents the semi-
icity of the demand for money balances with respect to the rate of inflation; g stands
ıe rate of growth of real GNP; and π represents the rate of inflation. The elasticity
ɜ demand for money with respect to inflation equals $-b\pi$.

While the deficit does not vary sharply with respect to modest changes in the rate of inflation, the deficit at double-digit rates of inflation is markedly higher than the deficit at low inflation rates, especially for the lower values of b, the semi-elasticity of demand for money with respect to inflation. For example, with values for b of 1, a of 0.20, and g of 0.04, the deficit when prices are stable is 0.8 percent of GNP. At a rate of inflation of 5 percent, the deficit is 1.6 percent of GNP and at a rate of 10 percent, the deficit is 2.3 percent of GNP. The deficit at a rate of inflation of 30 percent is 3.9 percent of GNP. These deficits can also be adjusted for inflation by subtracting the term $(M_{-1}/P) * \pi$, which corresponds to the term $(B_{-1}/P) * \pi$ of the model of Section II. Because in the simulation shown in the tables the demand for money is not completely inelastic with respect to inflation, the subtraction of an inflation adjustment factor equal to $M_{-1}/P*\pi$ from the nominal deficit results in an underestimate of the size of the deficit at a zero rate of inflation. In the above example, when the rate of inflation is 30 percent the value of $M_{-1}/P*\pi$ is 3.3 percent of GNP so that the inflation adjusted deficit is (3.9-3.3) = 0.6 percent of GNP, compared with a deficit at a rate of zero inflation of 0.8 percent of GNP. Thus, even the inflation-adjusted deficit can be misleading. Deficits, even when adjusted for inflation, are not strictly comparable when the rates of inflation differ significantly. Nonetheless, it is clear that when the underlying rate of inflation is significantly different, it is misleading to compare deficits without making some adjustment for inflation.

The maximum value of the deficit (as a share of GNP) is quite sensitive to the changes in the values of the parameters a, b, and g, as shown by Tables 2 and 3. Note that with a high semi-elasticity of demand for money, the maximum size of the deficit is reached at relatively low rates of inflation. For example, with a semi-elasticity of 3, a equal to 0.2, and g equal to 0.4, the maximum deficit of about 2.2 percent of GNP is reached at a rate of inflation of about 25 percent (see Table 2). When the rate of inflation is higher than this, the deficit is lower. For example, the deficit is 1.6 percent of GDP at a rate of inflation of 50 percent. Yet it would not be sensible to conclude that the deficit of 1.6 percent at a rate of inflation of 50 percent was less expansionary than a deficit of 2.2 percent at a rate of inflation of 20 percent. The inflation-adjusted deficit at a rate of inflation of 20 percent remains larger than the inflation-adjusted deficit at a rate of inflation of 50 percent. 1/ Again, in such a situation, a comparison of deficits at high and low rates of inflation must take into account the sensitivity of the demand for the government's debt to changes in the rate of inflation.

1/ The inflation adjustment when the rate of inflation is 50 percent equals 1.4 percent of GDP, and at a rate of inflation of 20 percent equals about 1.8 percent of GDP. Thus, the inflation-adjusted deficits are 0.2 percent and 0.4 percent of GDP, respectively.

For a given demand for real money balances, the higher the rate of inflation, the greater the increase in money necessary to maintain those money balances in real terms. This is analogous to the case of the bond-financed deficit model discussed above. In that model, where the demand for bonds in real terms is not a function of the rate of inflation, the private sector's saving rate as conventionally measured increases as the government deficit, as conventionally measured, increases. In the money-financed model, when the demand for money balances is not too elastic with respect to the rate of inflation, the private sector desires to devote a greater share of its income to increasing its money balances at higher rates of inflation.

The money-financed deficit model also illustrates one of the pitfalls of inflation adjustment when the demand for public debt is a function of the rate of inflation. When the demand for public debt in real terms is not affected by the rate of inflation, a comparison of inflation-adjusted deficits allows an inference concerning the rate of growth of the stock of public debt in real terms. This is not the case when the desired stock of public debt is itself a function of the inflation rate. If the public debt is interest bearing, and if the rate of interest is directly related to the rate of inflation, so that debt holders receive the same real rate of return at different rates of inflation, then it would probably be reasonable to assume that the demand for public debt in real terms would not vary appreciably with the rate of inflation. But bond holders do suffer losses when rates of interest rise unexpectedly, as happens when the rate of inflation increases unexpectedly. If high rates of inflation are associated with uncertainty regarding the real rate of return from holding public debt, then the demand for public debt may well be affected by inflation even if interest rates reflect the expected rate of inflation. At higher rates of inflation, the expected real rate of return may not be affected, but its variance may be. The inflation adjustment under consideration does not take this into account.

Another problem with this approach to inflation-adjustment is its treatment of inflationary shocks. Using the money-financed model again, and abstracting from the effect of inflation on the demand for real money balances, suppose that an economy on a steady-state growth path experiences an inflationary shock. With any downward rigidity of prices, the failure of fiscal policy to accommodate the increase in the current price level must entail some decline in the level of real economic activity. To accommodate the inflationary shock, M is therefore increased by enough to maintain unchanged the ratio of money to income at the same level of real income and a higher price level. This implies that the real stock of money is unchanged by the shock. The shock need not entail a permanent increase in the rate of inflation, and perhaps its accommodation should not then be described as an expansionary fiscal policy. But it is not unreasonable to assume that such an accommodating policy would lead to an upward revision in the expected

rate of inflation. If, however, the enlarged deficit is adjusted for the impact of inflation and compared with an inflation-adjusted but pre-price-shock deficit, it will be found that the two are the same. 1/

Thus, a policy that tolerates an increase in inflation would be judged by these measures to be neutral. It is worth adding that the cyclically neutral budget balance and the fiscal impulse measure derived from it, which is used by the Fund, has similar implications. This measure of the stance of fiscal policy is not affected by proportional increases in revenues, expenditures, and the GNP deflator. 2/

IV. Some Definitional and Statistical Problems

Many of the statistical problems encountered in the empirical estimation of inflation-adjusted sectoral deficits have been described elsewhere. This section briefly reviews some of the more important problems. 3/ Specifically, what liabilities of the government should be

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1/ This may be shown using the money-financed model. If the money supply is automatically expanded (through a larger deficit) to accommodate an inflationary shock, then the conventional deficit, deflated by the current period deflator, will be:

$$\frac{M_{-1}\ (g+\pi_{SH}+(\pi_{SH}*g))}{P_{-1}\ (1+\pi_{SH})}$$

where π_{SH} equals the rate of inflation in the current period. The inflation adjustment factor will be $\frac{M_{-1}}{P_{-1}}\frac{\pi_{SH}}{(1+\pi_{SH})}$. Subtracting the latter from the former yields $\frac{M_{-1}}{P_{-1}}*g$, the value of the inflation-adjusted deficit, which is independent of the rate of inflation in the current period.

2/ The fiscal impulse as calculated for the IMF's World Economic Outlook is equal to the difference from one year to the next in the gap between the actual budget deficit and the cyclically neutral budget deficit expressed as ratios to GNP. If T, G, Y, and Y_p represent taxes, expenditure, actual GNP, and potential GNP, respectively, all measured in current values, and g_o is a constant, then the fiscal impulse in year t is expressed as follows:

$FI_t = -(T_t/Y_t - T_{t-1}/Y_{t-1}) + (G_t/Y_t - G_{t-1}/Y_{t-1}) - g_o(Y_{pt}/Y_t - Y_{pt-1}/Y_{t-1})$

This measure will be unaffected by an inflationary shock which raises T_t, G_t, Y_t, and Y_{pt} in equal proportions.

3/ See, for example, Alex Cukierman and Jorgen Mortensen, "Monetary Assets and Inflation-Induced Distortions of the National Accounts—Conceptual Issues and Correction of Sectoral Income Flows in Five EEC Countries," Commission of the European Communities Economic Papers, No. 15 (June 1983), for a discussion of these issues.

included when measuring the change in the real value of the stock of public debt? How should these liabilities be valued? How should debt denominated in foreign currency be treated? How should the change in the price level be measured?

1. Coverage and the treatment of government financial assets

Typically, public debt is defined to exclude noninterest-bearing obligations of the government, the most important of which are notes and coins in circulation, as well as bonds held by the central bank. Yet as we have seen, this debt is amortized in real terms by inflation just as surely as are interest-bearing bonds. There is no good theoretical reason for excluding it. A more practical problem is the possible lack of correspondence between the definition of government in the budget and its definition in the debt statistics--the one being concerned with flows, the other with stocks.

If the conventionally defined budget should be adjusted to take account of the impact of inflation on the real value of the outstanding stock of public debt, it might appear that parallel treatment should be accorded the government's financial assets--its own cash balances and holdings of the financial liabilities of other sectors.

Whether changes in the real value of a government's financial claims on other sectors should be offset against changes in the real value of public debt depends on the nature of the claims and on the nature of the demand for public debt. If the transaction that gives rise to the claim is classified above the line as net lending for policy purposes, then it may be inconsistent to treat it as a true claim on the other sectors. Some net lending is expenditure in all but name, even though it gives rise to a claim on other sectors by the government.

If all of a government's financial assets resulted from lending of this type, there would be no rationale for an inflation adjustment on the assets side of the accounts. But governments do hold marketable financial assets which represent genuine claims on other sectors, and the real value of these is reduced by inflation. In the bond-financed deficit model of Section II above, it was assumed that the rate of interest paid on the public debt increased with the rate of inflation, and that the demand for government debt was constant (at a given level of real income) in real terms. The increase in the nominal rate of interest allows the private sector to finance the extra purchases of bonds necessary to maintain the real value of their holdings of public debt. But if the interest rate on the private sector's liabilities to the government increases, the government's holdings of private sector debt must increase as well to allow the private sector to pay the higher interest payments without reducing its level of consumption or its acquisition of government bonds. It is inconsistent to assume that

the private sector would maintain its holdings of public debt constant in real terms while not making the same assumption regarding its liabilities to the government.

If the purpose of the inflation adjustment is solely to produce a measure of the change in the real net worth of the government, then the assets side of the government's accounts must be adjusted as well, with increases in the relative price of the real assets being included. But it is not clear what the economic significance of such a comprehensive adjustment would be. For the private sector, increases in the real value of real assets, such as residential real estate, represent an increase in wealth and presumably lead to an increase in consumption. An increase in the real net worth of the government from this source would not typically result in an increase in public consumption, nor would it reduce the net claims in real terms on the public sector, or affect demand for public sector debt.

2. Valuation of the stock of public debt

An unexpected increase in inflation, if it entails an increase in interest rates, results in a fall in the market value of government debt of medium- and long-term maturities. Demand for securities presumably should depend on their current value, so that if possible public debt should be valued at its current market value. However, for most countries (the United States and the United Kingdom being significant exceptions), data on market values are not available.

It may be useful to consider how unexpected inflation changes the value of the stock of public debt. In the bond-financed deficit model used in Section II, the value of the outstanding stock of government debt in nominal terms will equal the sum of the present and past budgetary deficits, which in a steady state will be the sum of an infinite geometric series. The outstanding stock (OS) is given by the following expression, where D_0 represents the current period deficit.

$$(10) \quad OS = \sum_{i=0}^{\infty} D_0/(1+g+\pi+g\pi)^i$$

or,

$$(11) \quad OS = D_0 * (1+g+\pi+g\pi)/(g+\pi+g\pi)$$

Thus, the ratio of the nominal stock of public debt to GNP will be in this case a simple function of the ratio of the deficit to GNP and the steady-state rate of inflation and real growth. Note that even if public debt is not all recontracted in each period but has a maturity of N periods, this expression will still hold. The nominal value of the stock of outstanding debt is not reduced by inflation because the inflation is expected, and the future income stream from the bonds is discounted at the rate $r_n = r_r + \pi + r_r \pi$.

An unexpected increase in the rate of inflation reduces the nominal market value of the stock of outstanding debt, so that the real decline in its value is understated by an adjustment equal to π^*OS. For one unit of debt with a term to maturity of N periods and a nominal interest rate of r_n, an increase in the rate of inflation of $\Delta\pi$ (assuming it results in an equal increase in the nominal interest rate) reduces the nominal value of the debt by a factor equal to

$$(12)\quad 1 - \left(\frac{\Delta\pi/(r_n+\Delta\pi)}{(1+r_n+\Delta\pi)^N} + \frac{r_n}{r_n+\Delta\pi} \right)$$

If the public debt is of the consol type (so that $N = \infty$), this reduces to $(1 - \frac{r_n}{r_n + \Delta\pi})$, in which case a doubling in the nominal rate of interest, for example, from 5 percent to 10 percent with $\Delta\pi = 5$ percent, results in a halving of the value of the debt. If N equals 0, then the expression reduces to 0, and the value of the debt is unaffected by the increase in the rate of inflation. Real-life cases will be somewhere in between.

The impact of an unexpected increase in the rate of inflation (or a once-and-for-all increase in the price level) depends on the maturity distribution of the public debt. Assuming that all government debt has a term of N periods, the impact of an increase in the rate of inflation of $\Delta\pi$ on the market value of public debt is given by the expression:

$$(13)\quad 1 - \frac{\sum_{i=1}^{N} \frac{D}{(1+\pi+g)^i} \left[\frac{(\Delta\pi/r_n+\Delta\pi)}{(1+r_n+\Delta\pi)^{N-i}} + \frac{r_n}{r_n+\Delta\pi} \right]}{\sum_{i=1}^{N} D/(1+\pi+g)^i}$$

The impact of the increase on debt issued N periods ago--to finance the deficit of that period, which will be equal to $D/(1+\pi+g)^N$--is the smallest, and the impact on the debt just issued is the greatest. 1/

Table 4 illustrates the impact of an inflationary shock on the market value of the outstanding stock of public debt for hypothetical values of real growth and the real interest rate, and differing assumptions regarding the term to maturity of government debt. With an initial inflation rate of 5 percent, the assumption of a 15-year term to maturity of public debt, real growth of 4 percent, and a real interest

1/ The market value of debt about to mature is not greatly affected by an increase in nominal interest rates.

Table 4. Impact of an Inflationary Shock on the Initial Market Value of Public Debt

(In percent)

Initial Inflation Rate (In percent)	Terms of Public Debt (In years)					
	15			20		
	Inflationary Shock (In percent)			Inflationary Shock (In percent)		
	1	2	3	1	2	3
5	-5.7	-10.9	-15.6	-6.9	-13.1	-18.7
10	-4.8	-9.3	-13.4	-5.6	-10.7	-15.4
15	-4.1	-8.0	-11.6	-4.6	-8.9	-12.8
20	-3.6	-6.9	-10.0	-3.9	-7.4	-10.8
30	-2.7	-5.3	-7.8	-2.8	-5.5	-8.0

Note: Assumes real growth rate of 0.04 and a real interest rate of 0.03.

rate of 3 percent, an inflationary shock of 1 percent (i.e., an increase in the underlying rate of inflation from 5 to 6 percent) lowers the market value of public debt by 5.7 percent. With an initial inflation rate of 10 percent, an inflationary shock of 2 percent lowers the market value of the public debt by 9.3 percent. Table 5 shows the impact on the market value of the public debt as a percent of GNP under various assumptions concerning the relative size of the deficit. 1/ With a deficit equal to 4 percent of GNP, an initial inflation rate of 5 percent, and an inflationary shock of 1 percent, the reduction in market value equals 2.7 percent of GNP. The additional adjustment to the deficit to account for the impact of unexpected inflation on the market value of the public debt may thus be quite substantial. In fact, the impact reaches the value of 22.2 percent of GNP with an initial inflation rate of 5 percent, a deficit of 10 percent of GNP, debt of 20 years term to maturity, and an inflationary shock of 3 percent.

3. Inflation adjustment and foreign currency-denominated debt

In nearly all developing countries and in not a few industrial countries, a significant share of public debt will be denominated in the major convertible currencies. Domestic inflation has a different impact on the conventionally measured budget deficit in this case. By way of illustration, consider the case of a small, developing open economy with the exchange rate e (measured in terms of units of domestic currency per unit of foreign currency). The budget deficit is financed by monetization and the issue of bonds denominated in foreign currency. For simplicity it is assumed that the inflation rate of the rest of the world is zero and that the domestic rate of inflation equals $\frac{e - e(-1)}{e(-1)} \times 100$ percent, or the change of the exchange rate in local currency terms from one period to the next. For example, if the exchange rate depreciates from 10 to 11 units of domestic currency per unit of foreign currency, the domestic rate of inflation is $\frac{11 - 10}{10} \times 100$ percent = 10 percent. Thus, a rather extreme (and for the short run, implausible) version of purchasing power parity determines the domestic price level.

If the deficit is entirely financed by bonds denominated in foreign currency, a more rapid rate of domestic inflation will not increase the ratio of interest payments to GNP and thus, through this channel, will have no impact on the conventionally measured budgetary deficit ratio, provided that the demand for government bonds in real terms is unaffected, and that the rate of inflation does not change unexpectedly. Holders of the foreign currency-denominated bonds do not have to be compensated

1/ Note that the ratio of public debt to GNP is determined by the assumptions regarding the deficit-to-GNP ratio and the steady-state growth rates of real GNP and prices.

Table 5. Impact of an Inflationary Shock on the Market Value of Public Debt

(As a percent of GNP)

Initial Inflation Rate (In percent)	Initial Deficit (In percent of GNP)	Term of Public Debt (In years)					
		15			20		
		Inflationary Shock (In percent)			Inflationary Shock (In percent)		
		1	2	3	1	2	3
5	2	-1.4	-2.7	-3.8	-1.6	-3.0	-4.3
	4	-2.7	-5.2	-7.4	-3.2	-6.1	-8.7
	5	-3.3	-6.3	-9.0	-4.1	-7.8	-11.1
	10	-6.7	-12.8	-18.3	-8.2	-15.6	-22.2
10	2	-0.8	-1.6	-2.2	-0.9	-1.7	-2.5
	4	-1.5	-2.9	-4.2	-1.8	-3.4	-5.0
	5	-1.9	-3.7	-5.3	-2.2	-4.2	-6.1
	10	-3.8	-7.4	-10.6	-4.4	-8.4	-12.1
15	2	-0.5	-1.0	-1.4	-0.6	-1.2	-1.6
	4	-1.0	-2.0	-2.8	-1.1	-2.2	-3.1
	5	-1.2	-2.3	-3.4	-1.4	-2.7	-3.9
	10	-2.5	-4.9	-7.1	-2.8	-5.4	-7.8
20	2	-0.3	-0.6	-0.9	-0.4	-0.8	-1.1
	4	-0.7	-1.3	-1.9	-0.9	-1.7	-2.5
	5	-0.9	-1.7	-2.5	-1.0	-1.9	-2.8
	10	-1.8	-3.5	-5.1	-2.0	-3.8	-5.5
30	2	-0.2	-0.4	-0.6	-0.2	-0.4	-0.6
	4	-0.4	-0.8	-1.2	-0.4	-0.8	-1.1
	5	-0.5	-1.0	-1.4	-0.5	-1.2	-1.5
	10	-1.0	-2.0	-2.9	-1.1	-2.1	-3.1

by a higher rate of interest (unless an increase in the rate of domestic inflation is associated with a heightened risk of default). Thus, when steady states are compared, there will be no difference in the ratio of interest payments to GNP. 1/ To the extent that the depreciation (measured in local currency terms) exceeds the domestic rate of inflation, the ratio of interest payments to GNP will increase, and of course a discrete devaluation will raise the ratio. A sharp devaluation raises (temporarily at least) the real value of public debt denominated in foreign currency. The adjustment to the conventionally measured deficit could in this case be positive, and the adjusted deficit would be greater than the conventional deficit. An adjusted deficit calculated in this way would overstate the trend increase in real terms in the public debt, and appears to be an unreliable indicator of the stance of fiscal policy.

4. Choice of deflator

In the calculation of the inflation adjustment to be made to the conventional measure of the deficit, a choice of deflator must be made. Deflation with a government expenditure deflator would yield a figure which would measure the change in the value of the outstanding stock of debt in terms of its purchasing power of the goods and services consumed by the government. However, it would not measure the change in the value of the debt in terms of its command over the goods and services forgone by the holders of the debt, which is the more relevant measure with which to assess the impact of the budget on the economy. Therefore, some sort of general deflator, such as that for GDP, would be preferable.

One of the difficulties with the use of a current period deflator has already been noted in Section III. Its use results in an inflation-adjusted deficit which understates the trend rate of the real growth in public debt when an economy is subject to an inflationary shock. The obvious advantage of using it is that it is far simpler than the alternative of constructing some sort of index of the underlying rate of inflation. The results of the calculations will depend greatly on which type of index is used.

1/ If B_f represents the stock of foreign-currency-denominated bonds measured in foreign currency terms, the ratio of interest payments to GNP measured in local currency terms will equal $r_n * B_f * e/GNP$, where r_n is the rate of interest. If the rate of interest and the ratio of debt to GNP measured in local currency terms is unaffected by changes in the rate of inflation, then the ratio of interest payments to GNP will not vary with the rate of inflation.

V. Conclusions

It is clear that inflation distorts the meaning and complicates the interpretation of the conventional measure of the budget deficit. Some allowance for the impact of inflation in the budget should be made. The nominal deficit, even when purged of cyclical influences, will be an unreliable indicator of the stance of fiscal policy in an inflationary environment. However, adjusting for inflation is not a straightforward matter either conceptually or practically, and different conventions of adjustment will yield quite different results.

The choice between a current period deflator and some sort of long-run average deflator is crucial. The use of a current period deflator means that a short-term inflationary upsurge will result in a significant reduction in the inflation-adjusted deficit if the ratio of public debt to GNP is fairly high. If a current period deflator is used, then an assessment of fiscal policy after the event is given an inflationary bias. A sensitivity analysis of the effect on the final calculation of the assumptions made regarding the deflator would be necessary before any confidence could be placed in any method of calculation.

If the demand for public debt is highly elastic with respect to the rate of inflation, then a comparison of deficits at different rates of inflation may be misleading, even if they have been adjusted for inflation. At very high rates of inflation, the sustainable budget deficit may be lower than at low rates of inflation, and the inflation-adjusted deficit may be lower at the high rates of inflation than at the low rates. If the desired ratio of public debt to income falls significantly at higher rates of inflation, the same inflation-adjusted deficit may imply no growth in the ratio of public debt to GNP in one case and quite substantial growth in another.

There is nothing inconsistent in the prudent use of noninflation-adjusted deficits as an intermediate target in financial stabilization programs. The current account of the balance of payments is not generally adjusted for the impact of inflation on the real value of the claims of nonresidents on the domestic economy. If the burden of financial adjustment is meant to fall on the public sector, then the programmed improvement in the current account of the balance of payments must be mirrored by an improvement in the public sector deficit. It is preferable to use the unadjusted deficit to illustrate the required improvement. The sectoral balances must add up, whether or not they are adjusted for inflation.

In addition to various conceptual problems, a number of empirical and statistical problems make it difficult to construct accurate measures of inflation-adjusted budgets. Data on the market value of public debt are not readily available for most countries, and market and nominal

values can diverge fairly significantly when the rate of inflation differs from that expected at the time of the issue of the debt or simply when the real rate of interest changes. The debt of some countries is not even actively traded, as it consists largely of bank loans.

The problems that arise in the interpretation even of inflation-adjusted deficits suggest that such indicators be used cautiously in the assessment of the stance of fiscal policy. They can be used with the most confidence when rates of inflation have not varied dramatically from one period to the next, and when there is some assurance that the demand for public debt in real terms has not been significantly affected by changes in the rate of inflation. The arguments of this paper suggest that when these conditions are not met, even inflation-adjusted deficits will be unreliable guides to the stance of fiscal policy.

The construction of inflation-adjusted deficits does not absolve the analyst from the responsibility to judge the appropriateness of fiscal policy in the light of current economic conditions and the goals of economic policy of the authorities. A budget, which when adjusted for inflation is in surplus, or is a smaller ratio to GNP than in some base period, may or may not represent appropriate fiscal policy. One study noted that by one measure the United Kingdom was running an inflation-adjusted budget surplus during a severe recession. 1/ To maintain such a budgetary stance under these circumstances is not inappropriate policy if the authorities seek to effect a sharp reduction in the rate of inflation. It does not follow that fiscal policy is excessively contractionary if the inflation-adjusted budget balance is in surplus. Even when prices are stable and a government's objectives of economic policy do not change over a period, the deficit which is consistent with a given set of targets for the level of economic activity, the rate of inflation, and the balance of payments target, will clearly vary with a host of factors, of which private sector savings behavior and the external environment are two of the more obvious.

1/ Buiter, op. cit.