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Inflation and the Measurement of Fiscal Deficits

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Abstract

The very high rates of inflation experienced by several developing countries in recent years have raised questions about the usefulness of the conventional (cash) measure of the fiscal deficit as a gauge of the fiscal adjustment that a country needs. Economists have divided themselves in two groups: those who believe that regardless of inflation, the conventional measure is still the relevant one; and those who maintain that only a measure that excludes from the deficit the part of interest payments that compensates bondholders for inflation is the correct one. This paper analyzes the issues involved and concludes that neither measure gives the right signal so that both ought to be calculated when the rate of inflation is high.

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Summary

In the presence of domestic public debt, inflation will automatically distort the conventional (cash) measure of the fiscal deficit. This distortion is mostly associated with the fact that interest payments contain an element of amortization when there is inflation. The higher the rate of inflation, the higher the implicit amortization component of interest payments is likely to be. Thus, in a real sense, inflation forces the government to accelerate the pace at which it is amortizing its debt. This phenomenon results in an increase in the deficit as it is usually measured.

This paper analyzes the interrelationship between inflation, interest rates, and conventionally measured deficits. It attempts to assess the macroeconomic implications of the fiscal deficit in the presence of inflation by analyzing the behavior of bondholders as consumers and as investors. It also analyzes the liquidity effects of a growing nominal public debt.

The paper shows that if there is no money illusion (i.e., the individual is perfectly rational), bondholders will be able to recognize amortization payments as such regardless of whether they are called amortization or interest payments. In this case, bondholders will not be affected, as consumers, by the higher nominal interest payments that they receive during inflation. Thus, they will presumably be willing to absorb the additional bonds that the government issues to meet the higher interest payments so as to maintain the real value of their financial assets. Under these circumstances, aggregate demand and the current account of the balance of payments might not be affected by the inflation-induced component of interest payments. It is likely, however, that there will be effects on the bondholders as investors. Furthermore, the assumption of complete absence of money illusion may not hold. High inflation may induce a movement away from government bonds, forcing the government to increase the bonds' rate of return or their liquidity. Liquid bonds will in turn reduce the demand for money. In conclusion, a high conventional deficit is likely to have important effects on inflation, on portfolio allocation, and possibly on aggregate demand and the current account of the balance of payments.

The paper analyzes the usefulness of the so-called operational deficit as a possible alternative to the conventional deficit. It suggests that while the conventional deficit may exaggerate the demand impact of the deficit, the operational deficit is likely to minimize that effect. The paper concludes that in the presence of high inflation both these measures should be provided and detailed attention should be paid to the financing of the deficit.

I. Introduction to the Main Issues

Inflation affects government revenue and expenditure in different ways; as a consequence, it generally changes the size of the fiscal deficit. Revenue may be changed because (a) inflation distorts some tax bases, bringing about divergences between the true economic measure of those bases and the accounting or legal measure (for example, interest incomes, profits, and capital gains); (b) some taxes are not ad valorem but ad rem or specific (excises and, less often, import duties); (c) some taxes are imposed with progressive rates in non-indexed tax systems so that they generate a fiscal drag (income taxes and net wealth taxes); (d) many taxes are collected with significant lags; (e) the exchange rate is often not adjusted in line with the rate of inflation so that the real value of import duties and export taxes changes during a period of inflation; and, finally, (f) because of other structural changes that always occur during an inflationary process. 1/

In general, it is possible to conclude that, in industrial countries where collection lags are generally short, where specific (ad rem) elements of the tax system are limited, where progressive income taxes are important and where these taxes are often collected with a pay-as-you-earn collection system, inflation is likely to raise the ratio of total tax revenue to national income, generating what is often called the fiscal drag. This increase will tend to reduce the fiscal deficit. In developing countries, on the other hand, where progressive income taxes play a limited role, where collection lags tend to be longer, and where ad rem elements in the tax system make it particularly sensitive to the effect of inflation, inflation tends to reduce the average tax ratio. In these countries, when the rate of inflation accelerates, the tax ratio will fall unless the government takes timely and strong corrective measures. This fall has been shown to have occurred in many developing countries.

While there is now a sizable literature that discusses the relationship between tax revenue and inflation, there are very few writings that discuss the impact of inflation on the level of public expenditure (see Tanzi, 1985b). A priori it would seem realistic to assume that different parts of the budget would respond differently to inflationary pressures. However, these reactions often depend on political considerations, union power, indexation rules for wages and pensions, and so forth. It is thus difficult to generalize on the automatic relationship between the level of public expenditure and the rate of inflation with one major exception, namely, the behavior of nominal interest payments related to the servicing of the public debt. For this category of expenditure it is now generally recognized that an increase in expected inflation almost always brings about a fairly automatic increase in nominal interest payments. This reaction is

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1/ For a detailed discussion of ways in which inflation affects real tax revenues, see Tanzi (1980).

likely to be the same in developed and developing countries as long as the public debt is held domestically.

The growth of interest payments in an inflationary situation is often explained by what is now generally called the Fisher effect. In broad terms this effect, first hypothesized by Irving Fisher, indicates that in an inflationary situation the nominal rate of interest tends to approximate the real rate that would have prevailed in the absence of inflation plus the expected rate of inflation. For example, if the rate of interest would have been 5 percent when the expected rate of inflation was zero, it would approximate 15 percent when the expected rate of inflation was 10 percent. Therefore, an increase in the expected rate of inflation from, say, zero to 10 percent would tend to increase the nominal interest rate by about 200 percent. Although in actual situations nominal interest rates may increase by more or less than the level hypothesized by Irving Fisher, there should be no question that when the expected rate of inflation rises, the nominal rate of interest also rises unless artificially constrained by governmental action.

From the above example, one can easily realize how quickly and drastically an increase in the rate of expected inflation can lead to increases in nominal interest expenditure when the domestic public debt is a substantial proportion of GDP. Let us consider an example. Assume for simplicity's sake that all government debt is in the hands of just one individual. This individual derives all his income from the interest payments that he gets from the government and bases his behavior as a consumer on that income. Assume also that the debt is in instruments of very short maturity. To give dimensions to the example, assume that the size of the debt is $1 million. With expected price stability and a 5 percent nominal (and real) rate of interest, the income of the individual, and the interest expenditure of the government, would be $50,000. With an expected inflation rate of 10 percent, and assuming that the Fisher effect holds, the nominal rate of interest would become 15 percent. Thus the nominal interest income received by the individual would rise from $50,000 to $150,000 and, of course, the interest expenditure by the government would also increase by the same amount. 1/ Thus, an increase in the rate of inflation from zero to 10 percent has increased interest expenditures by the government by 200 percent.

This example allows us to focus on the main question to be analyzed in this paper: how would an individual who sees his nominal interest

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1/ In order to simplify the presentation, in all these examples the effect of compounding and the complications created by the existence of progressive income taxes levied on nominal interest incomes are ignored. See, for details, Tanzi (1976).

income increase by 200 percent react to this increase? Three possible alternative reactions can be hypothesized. 1/

The first, associated with what could be called the perfect rationality school, assumes that the individual is perfectly rational. He realizes that, while his nominal interest income has increased by 200 percent, his real income has not changed at all. He would realize that $100,000 of the $150,000 of nominal interest income is a compensation for the erosion of the real value of his financial capital. We shall call this compensation the monetary correction. This $100,000 is a return of capital rather than a return on capital, since a 10 percent inflation rate will reduce the real value of his financial capital by $100,000 after one year. The proponents of this school would argue that the individual would treat this $100,000 in exactly the same way as he would have treated an amortization payment equal to $100,000. In fact, they would argue that in a real economic sense, though not in an accounting or legalistic sense, it is amortization. His behavior as a consumer will continue to be determined by the real value of his permanent income that presumably has not changed. 2/ In other words, he will save this $100,000 monetary correction. Thus, one should not treat this monetary correction any differently from normal amortization payments. As amortization payments are not part of the fiscal deficit, the monetary correction should also not be part of the deficit. This is the argument made by Eisner in his recent book (see Eisner, 1986).

The second reaction, associated with what could be called the perfect irrationality school, assumes that individuals do not distinguish at all between real interest payments and monetary corrections regardless of how high is the expected rate of inflation. This school assumes that, in our example, the individual, qua consumer, would treat the full $150,000 interest payments received when the rate of inflation is 10 percent in the same way as he would treat the $50,000 interest payments received when the rate of inflation was expected to be zero. In other words, the individual would ignore the fact that inflation is reducing the real value of his financial assets and that he, thus, needs to save his monetary correction in order to preserve that value. He would behave as if his income had in fact increased from $50,000 to $150,000. Under this assumption, which is the one implicit

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1/ There is a large and growing literature on inflationary accounting of fiscal deficits and on the different deficit definitions that should apply in the presence of inflation. See, among others, Buiter (1983), Cukierman and Mortensen (1983), Eisner and Pieper (1984), Eisner (1986), and Miller (1982). Given its important operational implications, this issue has been the subject of much research among IMF staff members. Some of the recent contributions include Bierman (1985), Tanzi (1985a), Catsambas (1986), Heller, Haas, and Mansur (1986), Mackenzie (1984), and Molho (1986).

2/ Whether his behavior as an investor will continue to be the same is a different issue to be discussed later.

in the conventional way in which the fiscal deficit is measured, while amortization payments are not considered income and are thus not assumed to increase the deficit and to affect aggregate demand, monetary corrections are treated as income. The conventional measure of the deficit is thus highly sensitive to the rate of inflation whenever the size of the domestic debt is significant.

Finally, one can assume that both of the two alternatives mentioned above present an unrealistic version of reality. As the rate of expected inflation rises, the conventional school (what we have called the perfect irrationality school) provides a progressively more distorted measure of the size of fiscal adjustment needed by the country to achieve economic stability. By fiscal adjustment we mean here the increase in the ratio of government revenue to GDP, or the reduction in the ratio of non-interest government expenditure to GDP. 1/ By the same token the inflation adjustment school (the perfect rationality school) is equally likely, for reasons to be elaborated later on, to underestimate the size of the needed fiscal adjustment, measured as defined above. Unfortunately, while it is easy to criticize these two polar versions of the measure of the fiscal deficit that will provide the correct gauge of the needed fiscal adjustment, it is very difficult or, perhaps, impossible to propose an alternative measure that does not suffer from the shortcomings ascribed to those versions.

Chapter II discusses definitional aspects and illustrates the differential impact of inflation when alternative debt instruments are used and shows that, while an acceleration of inflation may result in a substantial increase in fiscal deficits as conventionally measured when floating debt instruments are prevalent, 2/ it will not produce such an effect when the country has relied on foreign debt or on domestic index-linked debt financing and the monetary correction is explicitly excluded from the deficit. This differential impact on the size of the deficit arises mainly from definitional and accounting conventions rather than from economic considerations.

Chapter III discusses the rationale for the use of the conventional definition of the deficit and some of its expected macroeconomic implications under high inflationary conditions. Chapter IV discusses an alternative and inflation-adjusted definition of fiscal deficit, namely, the 'operational' deficit, which, according to its proponents, would reduce the shortcomings of conventional deficits in inflationary situations. However, we shall show that this definition has, indeed, shortcomings of its own.

1/ Thus, fiscal adjustment is related to the so-called primary deficit, that is, the conventional fiscal deficit net of all interest payments.

2/ Floating debt is defined as either short-term debt, or long-term debt with a frequently adjustable nominal rate.

In its conclusion, the paper emphasizes the difficulties encountered in providing an unambiguous alternative definition that would not have the shortcomings of conventional deficits to provide short-cut indicators of the macroeconomic implications of fiscal performance over time. The paper concludes that in an inflationary context special emphasis must be placed on the mechanisms through which the deficit will be financed. It also emphasizes the importance of providing empirical answers to some of the central issues upon which the usefulness of the alternative definition depends. These issues include the behavior of the private sector demand for government bonds, the liquidity of these bonds, and their potential effects on the monetary conditions of the economy.

II. Effects of Inflation on Fiscal Deficits

1. The conventional definition of fiscal deficits

Fiscal deficits, as conventionally defined on a cash basis, 1/ measure the difference between total government cash outlays, including interest outlays but excluding amortization payments on the outstanding stock of public debt, and total cash receipts, including tax and nontax revenue and grants but excluding borrowing proceeds. 2/ Therefore, not all outlays related to public debt servicing are included in the measure of the deficit: interest payments are added to nondebt-related expenditures but amortization payments are excluded. On the other hand, current revenues are accounted as government income while proceeds from borrowing are excluded. In this manner, fiscal deficits reflect the gap to be covered by net government borrowing, including direct borrowing from the central bank. Fiscal deficits so defined do not provide, therefore, a direct measure of monetary expansion 3/ nor a measure of gross government pressure on credit markets, as borrowings required to finance amortization payments are not included as part of the deficit. 4/

Under this definition there are two kinds of financial government operations, both involving domestically held debt, that do not affect

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1/ See IMF, Manual on Government Finance Statistics, 1986.
2/ This definition differs from the System of National Accounts (SNA) definition in two important respects: (a) it is calculated on a cash basis while the SNA definition is based, in principle, on accrual concepts; (b) it considers net lending to the private sector as expenditure contributing to the determination of the deficit.
3/ A measure of needs of monetary transfers from the central bank would be given by the difference between total expenditures and total receipts (including receipts from the sale of bonds).
4/ A measure of gross financing needs would be given by the difference between total outlays and total receipts excluding borrowing proceeds. As this is a cash concept, changes in the size of arrears do not affect its size.

the current fiscal deficit. First, any operation which only involves changes in the composition of government debt, as, for example, when long-term bonds are replaced by short-term Treasury bills and vice versa. Second, any operation that involves the monetization of existing government debt. The first type of operation reflects debt management policy designed to get a particular maturity structure of the government debt. The second type of operation reflects open-market operations by the central bank, that is, pure monetary policy. Thus, the conventional definition of fiscal deficit is independent from the maturity structure of the outstanding domestic government debt and from the degree of debt monetization that the central bank may pursue for purely monetary policy purposes. This conclusion is not valid for the longer run, as both debt-management policy and open-market operations will eventually affect the size of the deficit.

2.   Effects of inflation on interest payments and on conventional fiscal deficits

When incorporated into expectations and, thus, reflected in nominal interest rates, inflation has a direct impact on the nominal interest service of the public debt. In order to isolate this effect from the other consequences of inflation on the government budget, it is assumed (a) that non-interest expenditures grow pari passu with inflation, and (b) that through discretionary actions policymakers adjust the tax system to a new inflationary environment so as to maintain constant the ratio of tax revenue to gross domestic product. 1/ Clearly, however, a similar assumption cannot be adopted for interest payments on government debt. The growth of nominal interest payments on existing domestic debt is generally beyond the control of the fiscal authorities, as it is tied to the evolution of market interest rates and to indexation clauses. 2/ Often, however, as indicated earlier, the increase in nominal interest payments does not represent a real transfer of purchasing power from the government to the debt holders. Rather, as long as the real rate of interest does not change, that increase tends to compensate the latter for the erosion in the value of their principal caused by the higher inflation rate. Debt holders are, therefore, no richer in real terms because of the higher level of nominal interest

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1/ The above assumption about the de facto behavior of tax revenue is somewhat unrealistic especially when the rate of inflation accelerates or decelerates (see Tanzi (1977)). Reduction of collection lags, adjustment of tax bases, as well as increases in the tax rates of some excises are measures that would prevent the deterioration of revenues in real terms. Indexation of brackets and deductions would prevent the fiscal drag.

2/ Obviously, the government may try to control interest rates or suspend indexation clauses. This alternative could, however, be ruled out for an extended period of time due to its undesirable consequences in terms of sectoral transfers, misallocation of resources, and capital flight.

rates, although, in relative terms, they might be if inflation has reduced the real incomes of other groups.

In Appendix I, the effect that an increase in the rate of inflation produces on conventional fiscal deficits in the presence of a floating interest debt instrument is formally illustrated. The exercise assumes that government revenues and nondebt-related expenditures follow the evolution of the price level. In other words, it assumes that the primary deficit is not affected by the rate of inflation. 1/ The presence of a full Fisher effect is assumed, such that nominal interest rates completely adjust to the expected rate of inflation to yield a constant expected real rate of return. Moreover, actual and expected inflation are assumed to be equal and all the debt is domestically held. Of course, if the actual rate of inflation diverges from the expected rate, the ex post real rate will change. Under these assumptions, it is shown that when inflation accelerates, the nominal interest bill rises more than proportionally to the price level, leading to an increase in the fiscal deficit in terms of GDP. The contrary happens if the rate of inflation decelerates. 2/ The explanation for this result is that while inflation, by assumption, does not affect the real value of revenues and non-interest expenditure and, therefore, it does not affect the primary deficit, it increases the real value of interest payments in order to compensate those who hold government bonds for the reduction in the real value of the stock of the outstanding debt. The magnitude of this effect depends on both the rate of inflation and the size of the stock of floating interest domestic debt.

A similar demonstration provided in Appendix I indicates that conventional deficits are not affected by inflation when the public debt is either index-linked (and the monetary correction is then considered as amortization) or when it is denominated in foreign currency. 3/ To show this result, the exchange rate is assumed to follow the evolution of domestic prices. 4/ When inflation accelerates, the depreciation of the currency leads to an increase in the domestic value of the external debt that is proportional to the change in the country's price level. Since the real value of the stock of debt remains, therefore, unchanged, interest payments will increase at the same rate as domestic prices, thus maintaining constant their share of GDP.

Therefore, in the presence of inflation, and provided that the domestic debt is in short-term instruments, the share of the conven-

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1/ The primary deficit is the difference between government expenditure, excluding all interest payments, and government revenue.

2/ See Table 1 in Appendix I for a numerical example.

3/ This is applicable to index-linked domestic debt as long as the increase in the nominal value of the debt due to indexation is excluded from the conventional definition of the deficit. If the indexed part is included, the results are the same as with floating debt.

4/ That is, no change in the real exchange rate takes place. Furthermore, it is assumed that foreign inflation is zero.

tional fiscal deficit relative to GDP becomes a function of (a) the rate of inflation, (b) the size of the domestic public debt, and (c) the domestic/external composition of total public debt. Countries with all their public debt in foreign currencies will not have their fiscal deficits as shares of GDP affected by their inflation rate, irrespective of the magnitude of such debt. On the contrary, countries whose debt is held in the form of floating interest domestic debt, will have a fiscal deficit that depends on the rate of inflation and on the magnitude of their public debt. This asymmetry results only from the convention that while all <u>nominal</u> interest payments (including the inflation premium contained in the nominal interest rate) are considered expenditures, and thus contribute to the fiscal deficit, amortization payments are not considered expenditure and thus do not contribute to the increase in the deficit as conventionally measured. During high inflation, the rate at which a country is implicitly forced to amortize its debt increases but *the de facto amortization is not recognized as such. The higher is the* rate of inflation the faster is the implicit amortization.

The consequences of inflation on the deficit in the presence of some other types of debt instruments also deserve some comment. When long-term fixed interest bonds have been the main instrument of government financing, the nominal interest bill will not be affected by a burst of inflation that had not been anticipated at the time the bonds were sold. This means that initially, the interest bill and, thus, the fiscal deficit will tend to fall as a share of GDP. 1/ However, when those long-term instruments become due, their amortization will have to be financed by the issuance of new bonds. These will bear a higher interest rate which will reflect the increased expected inflation rate. 2/

As mentioned above, the case of domestic index-linked debt is almost identical to the foreign debt case provided that the adjustment of the principal for inflation (the monetary correction) is treated as

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1/ In this case, the government has an inflationary gain at the expense of the holders of long-term bonds. There is, thus, an implicit capital levy on those who hold the public debt. This capital levy can be considered part of the inflation tax levied by the government on its monetary and other nominal liabilities.

2/ Long-term fixed interest domestic debt may be found to be relevant only in countries with very mild levels of inflation or where inflation is a new phenomenon. In the United States the high level of public debt accumulated during World War II consisted of long-term bonds carrying low interest rates in anticipation of very low rates of inflation after the war. The inflation rate that accompanied the post-war period, though low, was enough to substantially reduce the burden of the debt until the late 1970s.

amortization and is thus not considered an interest expenditure. 1/ Index clauses, be they tied to domestic prices or to the value of the foreign exchange, adjust the value of the principal, affecting the nominal magnitude of present or future amortization payments. Interest payments are also affected, up to the extent that the (fixed) interest rate has to be applied on an inflation (or exchange rate) adjusted principal. This effect, however, tends to increase interest payments only in proportion to the domestic rate of inflation, leaving the interest bill and the deficit unaltered in terms of GDP. 2/ The magnitude of the adjustments produced by index-linked debt is, in principle, similar to that produced by foreign debt. The potential source of difference may be related to changes of the real exchange rate, a possibility quite relevant in many countries, particularly when those changes take place for macroeconomic or for stabilization purposes. 3/

3. Summary

This chapter has described the main effects that inflation may produce on the ratio of measured fiscal deficits (as conventionally defined) to GDP. The analysis concentrated on those effects arising from the increase in nominal interest payments on the public debt. It was shown that an acceleration of inflation does not affect the magnitude of the conventional deficit in terms of GDP when the public debt is held as foreign debt or as domestic index-linked debt. On the contrary, the presence of floating interest domestic debt leads to an increase of the deficit (as conventionally defined) in a magnitude that is a function of the acceleration of the inflation rate and the ratio of floating interest debt to GDP. These differential effects arise exclusively out of accounting or definitional principles. Appendix I derives these results in a formal manner.

1/ Neither the guidelines of the Manual on Government Finance Statistics nor those of the National Accounting System recommend including indexation payments or accruals as deficit determining expenditure.

2/ This assumes that the index used for the monetary correction does not diverge from the one reflecting the rate of inflation of GDP. It also assumes that real GDP does not change.

3/ Other types of debt instrument are the so-called zero-coupon bonds. They constitute a particular case which creates some conceptual difficulties even in the absence of inflation arising from the distinction between accruals and realizations; however, they are likely to be irrelevant in high-inflation countries, as the risk associated with the expected real return on that type of asset will grow significantly with inflation.

III. Macroeconomic Implications of Conventionally Defined Fiscal Deficits

1. Introduction

An important conclusion arising from the preceding analysis is that countries (a) with identical rates of inflation, (b) with the same total public debt in terms of GDP, and (c) with identical ratios of tax revenue and non-interest expenditure to GDP may, nevertheless, show very different conventional fiscal deficits depending solely on the composition of their debt. The question then arises about the economic implications of the fiscal deficit as conventionally defined, and about the merits and the shortcomings of such a definition.

The measurement of the fiscal deficit in a non-inflationary context is supposed to provide the policymakers with an indication of the net impact of the government budgetary activity on aggregate demand and on financial markets. It is intended to indicate the magnitude of additional resources over the ordinary government revenue that the government must attract from the private sector, or from external sources, to finance its own operations. The conventional definition is, thus, designed to be a measure of the government contribution to aggregate demand and, through this, to the external current account disequilibrium; or, alternatively, it may measure the crowding-out of the private sector in financial markets. 1/

Under this definition, amortization payments are not added to other government outlays in the computation of the deficit (i.e., are considered different from other types of government expenditures such as wages, pension payments, purchases of goods and services, or capital expenditures) because of the implicit assumption that those amortization payments will not be regarded as income by those who receive them. In other words, it is assumed that the level of private consumption will not be changed by amortization receipts as these receipts do not change the value of the total net wealth and, thus, the permanent incomes of those who receive them. Thus, one basic assumption is that the behavior of the bondholders as consumers will not be changed by the amortization payments. Furthermore, and this is another important assumption, bondholders are expected to willingly reinvest those receipts in new government bonds issued at current market conditions. In other words, their behavior as financial investors will also not be affected. Amortization services are, therefore, not expected to create additional

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1/ In a medium-term framework, monetization of the deficit would lead to inflation and/or reserve losses; foreign financing would lead to appreciation of the real exchange rate and current account disequilibrium as well as inflation if the nominal exchange rate is not allowed to appreciate; domestic financing would push interest rates up, crowding out domestic investment or encouraging capital inflows and a consequent current account deficit. In the short run, changes in the deficit may also affect the level of economic activity.

pressures on financial or goods markets. However, in a non-inflationary context, government interest payments should be treated differently from amortization payments. Interest payments are assumed to be regarded, by those who receive them, as just any other type of income to be consumed or saved depending on their propensity to consume. They are a return on wealth rather than a return of wealth. Thus they can be consumed without reducing the bondholder's accumulated net wealth. Therefore, interest payments would be similar in their macroeconomic effects to any other type of expenditure. 1/

2. The bondholder as a consumer

In the presence of inflation, however, the situation becomes more complicated. As already argued, in an inflationary environment, interest payments reflect--at least partially--compensation for the erosion in the real value of the invested capital. The part of interest payments that simply reflects the erosion of the principal as a consequence of inflation constitutes, therefore, an implicit repayment of the principal. 2/ One can argue that, in a true economic sense, this part is similar to the amortization payment and that a rational bondholder would treat it in the same way. The relevant question, then, is whether such inflation-induced portion of interest payments should be treated as other deficit-determining government expenditures, or whether it should be treated in the same way as amortization payments.

The answer to the above question rests largely on the use that individuals are expected to make of the monetary correction. If individuals do not consider these interest payments as income (that is, if they do not suffer from money illusion) but, rather, they recognize them as the repayment of a real loan made in the past, they should treat these interest payments in the same way as they would treat explicit amortization payments. As a consequence, these payments might have monetary, current account or crowding-out implications similar to those of explicit amortization payments. 3/ In order to maintain unchanged the real value of their net wealth, bondholders might reinvest these proceeds in additional government bonds, at existing market conditions, provided that these bonds retain their relative attractiveness as earlier. In such a case, the conventional measure of the deficit is likely to overstate the aggregate demand impact of the deficit on the economy and an argument could be made for correcting that deficit for

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1/ It is well known that real expenditures may have different effects on demand from transfer payments. This distinction is ignored in the discussion. For a discussion of this issue, see Ter-Minassian and Borpujari (1973); and Bent Hansen, assisted by Wayne W. Snyder (1969).

2/ This issue is similar to that encountered in the taxation of interest income during inflation; it has been argued that only real interest should be taxed (see Tanzi, 1976).

3/ This, of course, does not necessarily mean that there would not be any such implications at all; just that they would be the same as for explicit amortization payments.

the effect of inflation. Notice that these considerations apply equally to nominal interest payments and to payments arising from the formal indexation of the principal.

In order to analyze the potential different impacts on the economy of the inclusion or exclusion of the inflationary debt service, a useful starting point is the national income identity from which the impact of government deficits on the current account is frequently derived: 1/

$$CA = D_G + D_P \tag{1}$$

where CA is the current account deficit, D_G is the government fiscal deficit, and D_P is the private sector net balance, all in nominal terms. 2/ The government deficit could be defined as:

$$D_G = G + I - T \tag{2}$$

where G are nominal government expenditures including the real component of interest payments, I stands for the monetary correction, 3/ and T are current tax and nontax revenues.

It is observed from equation (1) that when the private sector is in balance ($D_P = 0$), the current account deficit equals the fiscal deficit. Under noninflationary conditions, a certain stability of the private sector balance may be expected at least in the short run; then, the relationship between changes in the government fiscal deficit and changes in the current account becomes obvious.

With inflation, however, government deficit and private sector surplus may become correlated. An increase in the public sector deficit caused by the increase in interest payments that simply compensates for inflation would raise by an equivalent magnitude the private sector surplus if those payments are fully reinvested in public bonds by the private sector. In that case, the current account would remain unaltered and, since there is no need for other financing, the increase in the public sector deficit is unlikely to result in further demand pressures.

This point can be better illustrated if the public and private sector balances are defined in terms of their financing:

$$D_G = F_G + \Delta M^S + \Delta B^S \tag{3}$$

$$D_P = F_P - \Delta M^D - \Delta B^D \tag{4}$$

1/ A further discussion of some of these aspects is contained in Appendix II.

2/ Notice that $D_P < 0$ indicates an increase in private sector net nominal savings.

3/ Or, alternatively, for the accrued increase in the nominal value of indexed debt, if it were treated as deficit-determining expenditure.

where F_G is foreign financing to the public sector, ΔB^S is the net increase in domestic government borrowing, and ΔM^S is the (nominal) increase in the supply of base money. The left-hand side of equation (3) represents the fiscal deficit as conventionally measured, 1/ while the right-hand side summarizes the financing alternatives for the fiscal deficit. F_P in equation (4) is foreign financing to the private sector, ΔM^D is the increase in the private sector money holdings, and ΔB^D is the increase in the holdings of government bonds. Equation (4) simply indicates that the deficit or surplus of the private sector must show up in changes in its net financial asset position.

Assuming, for simplicity, zero net foreign financing to both private and public sector (i.e., $F_G = F_P = 0$) and replacing equation (4) into equation (1), we obtain:

$$CA = D_G - \Delta M^D - \Delta B^D \tag{5}$$

It is clear from equation (5) that changes in the conventionally defined deficit will affect the current account only if those changes are not matched by changes in the same direction in the nominal demand for either money or government bonds. A more specific result could be obtained by assuming $\Delta M^D = 0$ and replacing equation (2) into equation (5), as follows:

$$CA = (G - T) + (I - \Delta B^D) \tag{6}$$

which implies that, if all the increase in the deficit arises from higher inflation-induced interest payments on the outstanding debt, I, and if this is fully matched by an equivalent increase in the nominal holdings of bonds (in order to maintain the real value of the stock constant), then $I = \Delta B^D$; therefore, the higher deficit does not have current account implications. It could be said, therefore, that inflation, by creating the possibility of a significant correlation between increases in government deficits as conventionally defined and increases in private sector nominal savings represented by an increase in the nominal demand for bonds, eliminates, or at least weakens, the link between changes in conventionally defined budget deficits and changes in the current account. 2/ That this argument has some empirical validity is demonstrated by the fact that in countries with very high rates of inflation and very high (conventional) fiscal deficits little correlation is often observed between the size of the fiscal deficit (as a share of GDP) and the size of the current account deficit. Such

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1/ It could also be identified with a definition in which the accrued increase in the value of indexed principal was treated as interest payments.

2/ What is implicitly assumed here is that the issuance of new bonds is limited to the refinancing of the inflationary component of the debt service; issuance of bonds over and above that level would clearly crowd out the private sector from financial markets.

correlation is obvious, however, for countries with low rates of inflation.

3.   The bondholder as an investor

The relevant question then becomes: should the interest payment that represents the monetary correction (I) be included in the deficit concept in order to provide an accurate estimate of the latter's potential impact on the economy? The answer to this question is not as straightforward as the above discussion may have led one to believe. It depends largely, though not completely, upon whether the debt service that just compensates bondholders for inflation can be indeed refinanced under the same conditions as assumed above. 1/ In this regard, the factors affecting the determination of the private sector demand for government bonds become crucial.

One way of dealing with the above question is by considering the behavior of a typical bondholder as a consumer and as an investor. For his behavior as a consumer not to be affected by the interest payment that represents the monetary correction, it is sufficient to assume that he does not suffer from money illusion. As long as he fully realizes that the monetary correction that he is receiving is nothing but an amortization under a different guise, he is likely to treat it as such and his consumption behavior will not be affected by it. Thus, in terms of the direct impact on aggregate demand, one can argue, as we just did, that, in the absence of money illusion, the inflationary component of interest payments will not affect aggregate consumption and, thus, the current account of the balance of payments. However, when the rate of inflation is not high, or when it is changing, or when inflation is a new phenomenon, or when inflation is being repressed by various government policies so that there are doubts about the underlying rate of inflation, money illusions are likely to be present in at least some of the bondholders so that the importance of this assumption must be kept in mind. The complete absence of money illusion can be accepted only when the rate of inflation has stabilized for some time and is relatively high.

However, while a good case can be made that a high conventional deficit that results mainly from the effect of inflation on nominal interest payments may not, under the assumption of no money illusion, have any direct effect on the bondholder as a consumer, it is very likely that it is going to influence him as an investor. The point to be understood is that a high conventional deficit will increase the nominal payments that the government makes to bondholders (i.e., it will accelerate the pace at which the debt is being implicitly amortized) exactly at the time when their perceptions of expected rates of returns on different assets and of the risks associated with those returns are changing rapidly. Thus, it is unlikely that, under such circumstance,

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1/ By the same conditions, it is meant at a given real rate of interest and at given liquidity characteristics.

the government will be able to refinance the inflation-induced component of interest expenditure exactly at the same real conditions (i.e., equal real rate for identical maturity) as it would have in the absence of inflation.

Full bond refinanceability of inflation-induced interest service would require (1) that there is a stable demand for bonds in real terms, and (2) that the rate of inflation is not an argument in that function. These two conditions would imply that the private sector is willing to hold in its portfolio the same real amount of government bonds, denominated in domestic currency, without changes in conditions vis-à-vis other domestic or foreign financial assets, regardless of the magnitude of the inflationary process. If such behavioral assumption does hold, the government would be able to issue and place, without changing rates of returns and liquidity conditions, new nominal bonds to finance the part of the debt service that compensates bondholders for inflation. This issue of new bonds would not change the real stock of bonds outstanding and, since it would be willingly held, would not change spending patterns or create pressures on interest rates.

How plausible is it that the demand function for government bonds does not include inflation as an argument? Although this is essentially an empirical question, most of the theoretical arguments based on port-folio theory support the existence of such a function. 1/ These arguments were developed for large industrial countries without high rates of inflation. There are, however, some channels through which inflation may reduce the real demand for bonds. These include (a) money illusion effects which would induce bondholders to increase their consumption and, much more likely, (b) the possible perception of increased default risk which would accompany a higher nominal stock of debt and a high rate of inflation.

If, indeed, inflation reduced the real demand for bonds, inflation-induced interest payments (as well as indexation payments) would not be fully refinanceable at the existing conditions. The sale of these bonds would require either higher real interest rates or higher liquidity of the bonds. This would result in higher demand pressures throughout the economy. Therefore, in this case, inflation-induced interest payments should not be excluded from deficit calculations. Whether they should be completely included in these calculations is a different issue.

Regarding money illusion, it is difficult to rationalize it on a significant scale and beyond a short period of time when the rate of inflation is high and stable. But when inflation is a new phenomenon, or when the rate of inflation is changing rapidly, there must likely be some of these effects. For sure, some individuals will, in these cases,

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1/ There is very little empirical evidence about the independent role of inflation in the determination of the real demand for bonds. Some preliminary results based on portfolio analysis for the United Kingdom are presented in Perraudin (1987).

be unable to distinguish between real and nominal interest payments so that their consumption will be affected.

The notion of default risk associated with the level of the nominal debt is, however, more plausible, and needs some elaboration. Increase in risk perception related to growth in the stock of real debt does not need explanation; with respect to nominal debt, it could be rationalized mainly on the basis of the relative increase in the weight of public debt compared with other sources of revenue and financing. This includes basically three elements: (a) the growth of public financial debt in relation to government tax revenues, as in actual situations these are likely to lag the inflationary process; (b) its growth relative to the monetary base, as this monetary base falls in real terms, given the reduction in money demand as inflation accelerates; and (c) its growth relative to the capacity to borrow abroad, as inflation is likely to reduce foreign confidence.

If inflation brings about a fall in the capacity to raise taxes, to collect the inflation tax on the monetary base, and to borrow abroad, it will also increase the risk of default on the public debt or, at least, the public's perception of such a risk. As such it may reduce the willingness of individuals to lend to the government. This attitude on the part of the public will be reinforced by the fact that the deterioration of the inflationary situation will increase the probability of adoption of adjustment programs which might include capital levies on bondholders, higher income taxes on interest incomes, and restriction on capital movements.

It could be argued that, under certain circumstances, the demand for government bonds may actually rise in real terms as inflation increases. This may happen first because individuals may attempt to get out of non-interest-bearing money and may thus increase their demand for interest-bearing assets. However, more importantly, this may happen when government bonds are fully indexed or bear returns closely related to the rate of inflation. In such case, there might be little risk in holding government bonds as long as the bondholders continue to have confidence in the government's ability and willingness to continue meeting its financial obligations. In such case, government bonds may come to be seen as more desirable investments than other available alternatives because the risk associated with the return on specific real assets (like stocks or real estate) as well as non-indexed financial assets is expected to increase due to the higher variability of relative prices in inflationary situations. 1/

1/ On the relationship between high inflation and the variability of relative prices, see Blejer (1983) and Hercowitz (1981). There is, however, evidence that relative price variability may result in a reduction in economic activity and in a contraction of real income (Blejer and Leiderman, 1980). In such case, the real demand for bonds may be negatively affected, offsetting the positive effect from indexation described above.

The strength of the above argument is, however, weakened when the rate of inflation becomes high and when the alternative of financial investments abroad is feasible, especially when the possibility that the government might change its treatment of indexed bonds or that it might default is introduced. In that case, indexed government bonds may be seen, at least by some investors, as less attractive investments than the foreign alternatives, so that financial savings may be channelled abroad. The dollarization of the economy may be one of the results of this shift. Capital flight might be another.

Another important factor that leads to a reduction of the real demand for government bonds in a period of high inflation is introduced by the tax system. Income taxes are generally, though not always, levied on nominal incomes. Thus, when individuals receive nominal interest payments, they are taxed on the total of these payments without an adjustment for the effect of inflation. This fact, per se, would induce a shift from financial assets (including government bonds) toward real assets or foreign investments since the unrealized capital gains on real assets are tax free while the foreign investments are often totally tax free. Furthermore, since it is difficult, if not impossible, to evade taxes on incomes derived from government bonds while it is much easier to evade taxes on incomes derived from private sources, there will be a fall in the demand for government bonds unless these are made tax exempt. In fact, to induce bondholders to continue holding these bonds, governments have at times increased their real return by making them tax free.

There are two additional factors which should be considered when analyzing the stability of the real demand for public debt. One is related to the overall confidence inspired by the economic policies followed by the government. In general, the persistence of high rates of inflation is likely to lead to an erosion in the confidence of economic agents on the ability of the authorities to conduct sound economic policies. Such an erosion in confidence leads to a fall in the credibility of the government which may, in turn, lead to a desire to reduce the exposure of individual portfolios to assets linked directly to government policies. A credibility crisis will tend, therefore, to shift preferences away from government bonds and, most likely, toward foreign or speculative domestic assets. As already mentioned, tax considerations are likely to contribute to this shift.

The second consideration is related to financial innovation. Although new financial instruments are introduced constantly into the system, it is in periods of high and sustained inflation that many new alternatives to the existing instruments enter the market responding to the demand for inflation hedges. In those circumstances, the demand for government bonds may not be stable enough to warrant the assumption of full refinanceability of the whole volume of inflation-induced interest payments.

4. Liquidity effects

Another important consideration which bears on the question of whether debt service should be included or excluded from the deficit measure, is the potential impact of the volume of nominal government debt on the general monetary conditions of the economy. Even if full refinanceability of the debt service were assured, its relevance could still be challenged from a conceptually different angle. When the rate of inflation accelerates and becomes high, the government is likely to be forced to increase the effective real return on its liabilities through an improvement in the quality of debt instruments, i.e., by increasing their liquidity. 1/ Such an increase in liquidity would increase the 'moneyness' of the public debt making it more suitable to replace part of the monetary base in its role as a medium of exchange. This possibility of substitution would accelerate the reduction in the demand for the monetary base with inflationary and, depending on the behavior of the exchange rate, balance of payments consequences similar to those associated with an increase in its supply. 2/ If, as inflation accelerated, this substitution process were carried to the extreme, the government debt could become the relevant money supply in the system and its inflationary service could be equivalent to indexing the money supply. Again, this effect on the demand for money associated with the increasing liquidity of public debt has been observed in countries with very high rates of inflation.

In conclusion, even though the inflationary component of the debt service (whether arising from interest or indexation payments) is likely to put less pressure on financial or goods markets than the real component of interest payments or other government expenditures, the many qualifications to that conclusion and, in addition, the likely monetary consequences of this type of expenditure make it doubtful whether a complete exclusion of inflationary debt services from deficit calculations is warranted.

IV. An Alternative Definition: The Operational Fiscal Deficit

After recognizing the shortcomings of the conventional definition of the fiscal deficit in an inflationary context, the question to be asked is whether there are alternative measures that would solve some of

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1/ In the absence of this increase in liquidity, the government may have to increase the real interest rate by much larger amounts. A shortening of the maturity structure of public debt has been observed in several countries experiencing high rates of inflation.

2/ In addition to reducing the real demand for money in a once-and-for-all-fashion, the introduction of close monetary substitutes also increases the elasticity of the money-demand function which implies a larger sensitivity of money balances to further changes in the rate of inflation. It also implies a fall in the revenue from the inflation tax.

its analytical problems. An alternative that has been proposed and sometimes used is the so-called 'operational fiscal deficit'. In general, it is defined as the conventional deficit minus the part of the debt service that compensates debt holders for actual inflation. Or, alternatively, it is equal to the primary deficit plus the real component of interest payments. Only real interest payments, i.e., the part of interest payments that exceeds the product of the outstanding debt and the actual inflation rate, are included among the government expenditures that determine the operational deficit. The economic rationale of this definition is the assumption that inflation-induced interest payments are similar in their effects to amortization payments. Conventional deficits exclude amortization payments from deficit calculation independently of the way in which those payments are financed. The operational deficit concept gives the same treatment to the portion of the debt service that just compensates for inflation.

In addition to the challenges discussed in the previous section to the notion that the debt service that compensates inflation is fully refinanceable, the actual calculation of the operational deficit requires precise estimation of the part of interest payments that compensates for inflation. Such operation often involves great technical difficulties; for instance, there may be several inflation indeces that would be chosen to calculate real interest rates; a selection has to be made of the more appropriate one. And, of course, none of these indeces may reflect the expected rate of inflation. Another problem is faced when interest rates are negative in real terms. To apply a general index in these circumstances would mean to adjust downwards the conventional deficit measure by a magnitude that is larger than the actual interest payments. What is the appropriate adjustment under such circumstances? Is bond refinanceability better measured by actual interest payments or by the inflationary erosion of the principal value of outstanding public debt? In this particular case, even a third possibility has been suggested, namely, to reduce the computable interest payments to an amount equivalent to a (trend) real interest rate calculated over the outstanding public debt; the difficulties of choosing the appropriate methodology originate from the evaluation of which alternative better reflects bondholders' behavior. 1/

In spite of these difficulties, the operational deficit definition can provide, along with the conventional deficit, useful information to policymakers when the rate of inflation is very high. It would, in principle, reflect a lower-bound estimate for the public sector deficit,

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1/ In some cases, the suggestion to adjust the deficit measure for inflation has gone far enough to correct for the inflationary impact on all public debt, including the non-interest-bearing monetary base; such proposal would additionally amount to considering as fiscal revenue the inflation tax on the monetary base. The problem with this extreme formulation is that it leaves inflation out as one of the variables to be explained by fiscal deficits.

which will turn to be the relevant one only if the refinanceability of
the debt service is feasible to the assumed extent and if this
refinancing does not itself have inflationary implications.

V. Conclusions

1. Relevance of the issues involved

In the presence of floating interest domestic debt, inflation
brings about three types of difficulties to the conventional definition
of fiscal deficits: (a) difficulties to evaluate the precise meaning
and implications of the fiscal deficit; (b) difficulties to evaluate
fiscal performance over time when the rate of inflation and/or the
composition of the debt are changing; and (c) difficulties to compare
the deficits of countries with different rates of inflation and
different uses of debt instruments.

a. Meaning of deficit

The fiscal deficit is, under any circumstances, a crude tool for
assessing the impact of fiscal policy on the economy. However, when
supported by relevant economic analysis, it can be an indicator of the
need for and the extent of adjustment either on the expenditure or the
revenue side of the budget. In spite of its obvious limitations, it is
generally considered a useful tool for interpreting economic
developments and for meaningful discussions of policy choices.
Nevertheless, the fact that countries with identical but substantial
rates of inflation, with identical ratios of receipts and non-interest
expenditure to GDP, and with equal debt-GDP ratios may show very
different fiscal deficits, when the composition of their total debt is
different, raises difficult questions as to the interpretation of this
concept under inflationary circumstances. For this reason, as the rate
of inflation accelerates, it becomes essential to supplement in various
ways the information provided by the conventional deficit.

b. The evaluation of fiscal performance over time

The complications introduced by an acceleration or deceleration of
inflation in the interpretation of conventional fiscal deficits create
difficulties in the evaluation of fiscal performance over time. A pure
debt management action that changes the composition of the public debt
without affecting its size can illustrate the nature of this problem.
Under inflationary circumstances, debt management policies that modify
over time the debt structure between floating interest domestic debt and
foreign debt, for example, would affect the apparent magnitude of the
conventional deficit, changing the image of the country's fiscal
performance. 1/ Changes in the availability of foreign financing or in

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1/ Real interest rate differences explained by exchange risk premiums
are, however, legitimate elements in the computation of the deficit.

the level of reserves may allow for large changes in the stock of floating interest domestic debt that, under inflationary circumstances, would bear important consequences for the conventional deficit figure. 1/ Therefore, such policy action would project an image of fiscal improvement when, in fact, there may not have been any basic change in the fiscal policy of the country.

c. The comparison of fiscal policies across countries

The factors already described will also affect any exercise of comparability across countries should such comparisons be made. As an example, countries that have identical debt ratios to GDP, similar but high inflation rates, and otherwise identical fiscal positions, may show quite different levels of conventional deficits if the set of government debt instruments is different. This problem may be serious when the comparison concerns countries with high and accelerating inflation. It may also be of some relevance for comparability among countries with milder inflation, provided that their total debt to GDP ratios are high and that the structure of their debt differs significantly.

2. General conclusions

This paper has discussed and analyzed various ways in which the usual or conventional definition of the fiscal deficit is affected by high rates of inflation. It has shown that, as the rate of inflation rises, the picture emerging from the conventional measure may, under certain circumstances, become somewhat blurred since the conventional measure may magnify the size of the fiscal adjustment that a country needs. For example, a country with a high rate of inflation and a high domestic debt ratio that, say, shows a conventionally measured deficit of 20 percent of GDP, is unlikely to require an increase in revenue or a reduction in non-interest public spending of that magnitude in order to restore fiscal balance. Normally a smaller adjustment would suffice as the fiscal adjustment undertaken would reduce the rate of inflation and, thus, interest payments. Ex post, the conventional deficit would decrease by more than the ex ante fiscal adjustment.

While pointing out the nature of the problems with the conventional definition, we do not agree with the argument that, under inflationary conditions, a definition that fully subtracts from the conventional deficit the inflation-induced interest payments is fully comparable to the deficit of countries with low inflation and is thus the relevant one to guide fiscal policy. Such alternative definition may give the impression that no fiscal adjustment is required, a conclusion that is often invalid in high inflation countries. 2/ In other words, while in

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1/ That is, greater recourse to foreign financing would help to reduce the deficit as conventionally measured, provided that such financing is used to repay floating interest on the domestic debt.

2/ This alternative definition implies that inflation is an exogenous phenomenon that has little to do with fiscal policy.

high-inflation countries the conventional measure may overstate the size of the fiscal adjustment required, the operational measure in all likelihood understates that adjustment. Various reasons were discussed why this alternative definition cannot serve as a substitute for the conventional one and why it often fails to reflect the true impact of the government's fiscal stance on inflation and on the balance of payments. A measure that corrects the deficit ex post for the effect of inflation (as is the case with the operational deficit) may miss its ex ante impact on inflation.

The implicit conclusion that follows is that when the rate of inflation of a country rises and becomes high, the usual interpretation given to single and standard measures of fiscal deficits should be qualified. In high-inflation countries both the conventional measure of the deficit, *as well as a measure that adjusts the deficit for the* effect of inflation, should be provided. Both of these measures have their own shortcomings and both are based on specific behavioral assumptions. However, both of them jointly provide more information than either one in isolation. 1/

Whether the fiscal adjustment required comes closer to the conventional measure or to the inflation-corrected measure should be determined on a case-by-case basis that takes into account the behavior of prices, that of the current account of the balance of payments, the financial resources available to finance the deficit, and the main identifiable cause of inflation. As a practical matter, the size of the debt service that compensates bondholders for the reduction in the real value of their assets arising from inflation should be made explicit so as to indicate the part of the deficit whose impact depends mainly on portfolio decisions regarding the public's demand for government bonds, and on the potential effects of these bonds on the monetary and liquidity conditions of the economy.

1/ Furthermore, it would also be worthwhile to provide a measure of the primary deficit that is a measure that excludes the total interest payment in order to focus on the variables (current revenue and non-interest expenditure) that are, to some extent, under the direct government control and that must reflect the fiscal adjustment that must be made.

Impact of Inflation on the Deficit in the Presence
of Alternative Types of Debt Instruments

In this Appendix, a formal demonstration is developed in order to show the differential impact of inflation on conventionally defined deficits in the presence of alternative types of debt instruments.

In order to keep the demonstrations as simple as possible, it is assumed that: (a) real income is constant over time; (b) the budget is initially in equilibrium, being (real) interest payments financed by a surplus from all other operations; (c) nominal interest rates on the public debt change immediately following changes in the inflation rate, so as to keep the real rate of interest constant; (d) expected and realized inflation rates are equal; (e) government policies keep revenues and non-interest expenditures growing pari passu with inflation; and (f) a constant rate of inflation.

Initial equilibrium in the budget implies that:

$$D_o = G_o - R_o + S_o \; r = 0 \tag{1}$$

where

D_o = fiscal deficit in the initial period;

R_o = revenues in the initial period;

G_o = non-interest expenditures in the initial period;

S_o = stock of public debt at the beginning of the initial period; and

r = real rate of interest.

1.   Floating interest debt case

The assumption of full adjustment of the nominal interest rate (i) to inflation implies that:

$$i = (1 + \pi)(1 + r) - 1 = \pi + r \, (1 + \pi) \tag{2}$$

the fiscal deficit in period n (Dn) would then become:

$$D_n = (G_o - R_o)(1 + \pi)^n + [S_o + \sum_{i=o}^{n} D_{n-i}][\pi + r \, (1 + \pi)] \tag{3}$$

The first term of the right-hand side of equation (3) reflects the assumption that government revenues and non-interest expenditures grow pari passu with inflation. The second term represents the amount of interest payments in period n; the stock of debt on which nominal

interest is paid in period n is equal to the stock of debt in period 0 (So) plus the accumulated deficits until the beginning of period n.

Equation (3) implies that, given equation (1), the deficit in period 1 is:

$$D_1 = (G_o - R_o)(1 + \pi) + S_o\ r\ (1 + \pi) + S_o\ \pi =$$

$$(1 + \pi)[G_o - R_o + S_o r] + S_o \pi = S_o \pi$$

For period 2, equation (3) becomes:

$$D_2 = (G_o - R_o)(1 + \pi)^2 + [S_o + S_o \pi][\pi + r\ (1 + \pi)] =$$

$$(1 + \pi)^2 [G_o - R_o + S_o r] + S_o \pi\ (1 + \pi) = S_o \pi\ (1 + \pi)$$

As a general result,

$$D_n = S_o\ \pi\ (1 + \pi)^{n-1} \tag{4}$$

Given the assumption of a fixed real income level, i.e., that nominal GDP grows as the same rate as inflation, we have:

$$GDP_n = GDP_o\ (1 + \pi)^n \tag{5}$$

It can therefore be concluded that the deficit in terms of GDP,

$$\frac{D_n}{GDP_n} = \frac{S_o}{GDP_o}\ \frac{\pi}{1 + \pi} \tag{6}$$

becomes a positive function of the rate of inflation and of the initial stock of floating interest debt in terms of GDP. Table 1 reproduces the numerical results of equation (6) for alternative rates of inflation and of floating interest debts in terms of GDP. 1/

2.   Foreign debt case

In the case of foreign debt, as well as in the case of domestic indexed debt in which indexation is not treated as deficit determining expenditure, the rate of interest is not affected by domestic inflation; 2/ total interest payments will, however, grow with inflation because the nominal value of the stock of debt in domestic currency

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1/   It is possible to arrive at somewhat different results depending on whether inflation rates are defined in an annual, monthly, or even daily basis. What the relevant rate is depends upon the time profile of government revenues and expenditures; for construction of Table 1, inflation rates have been defined on a daily basis, reflecting the implicit assumption of a uniform daily flow of revenues and outlays.

2/   Foreign inflation is assumed to be zero.

Table. The Impact of Inflation on Conventional Fiscal Deficits in the
Presence of Floating Interest Domestic Debt 1/

Floating Interest Domestic Debt (as percentage of GDP)	Rate of inflation										
	Monthly	1	2	3	4	5	6	7	8	10	15	20
	Annually	12.7	26.8	42.5	60.0	80.0	100.0	125.0	151.8	213.8	435.0	791.6
	(Fiscal deficits as percentage of GDP)											
10		1.2	2.4	3.6	4.7	5.8	7.0	8.1	9.2	11.4	16.7	21.8
20		2.4	4.7	7.1	9.4	11.7	14.0	16.2	18.4	22.8	33.5	43.6
30		3.6	7.1	10.6	14.1	17.5	21.0	24.3	27.7	34.3	50.2	65.4
40		4.8	9.5	14.2	18.8	23.4	28.0	32.4	36.9	45.7	66.9	87.2
50		6.0	11.8	17.7	23.5	29.2	35.0	40.5	46.1	57.1	83.6	109.0
60		7.1	14.2	21.3	28.2	35.1	41.9	48.7	55.3	68.5	100.4	130.9
70		8.3	16.6	24.8	32.9	40.9	48.9	56.8	64.5	79.9	117.1	152.7
80		9.5	19.0	28.4	37.6	46.8	55.9	64.9	73.8	91.4	133.8	174.5
90		10.7	21.3	31.9	42.3	52.6	62.9	73.0	83.0	102.8	150.6	196.3
100		11.9	23.7	35.5	47.0	58.5	69.9	81.1	92.2	114.2	167.3	218.1

1/ It is assumed for simplicity that there is no fiscal deficit when inflation is zero and that tax revenues and non-interest expenditures grow in proportion to the price level. The methodology and assumption for the construction of this table is explained in the text and follows equation (6), Appendix I.

terms grows as the exchange rate depreciates. Equation (3) has to be reformulated therefore in the following terms:

$$D_n = (G_o - R_o)(1 + \pi)^n + [S_o (1 + d)^n + \sum_{i=o}^{n} D_i (1 + d)^{n-i}] r \quad (3')$$

The second term of the right-hand side reflects the interest payments; the interest rate (r) is applied over the initial debt indexed by the currency's depreciation rate (d) and over the debt accumulated out of subsequent deficits, indexed also up to the end of period n. Taking into account the assumption that $d = r$, equation $(3')$ for period 1 becomes:

$$D_1 = (G_o - R_o)(1 + \pi) + S_o (1 + \pi) r = (1 + \pi)[G_o - R_o + S_o r] = 0$$

and for period 2:

$$D_2 = (G_o - R_o)(1 + \pi)^2 + S_o (1 + \pi)^2 r = (1 + \pi)^2 [G_o - R_o + S_o r] = 0$$

The budget therefore stays balanced as the increase in nominal interest payments is equal to the increase in the original excess of revenues over non-interest expenditures.

Inflation and National Accounts

The purpose of this Appendix is to indicate the distortions and consequent limitations of national account figures in the presence of inflation. It is the usual practice to adjust the measures of GDP or GNP by inflation so as to obtain a measure of changes in output in real terms. A similar adjustment is not usually performed, however, for the sectoral income and expenditure flows from which indicators like the personal savings ratio, the budget deficit, and the current account are built.

The usual identity between output produced and sold is:

$$GDP = C + I + G + X - M \qquad (1)$$

which states that gross domestic product equals private consumption plus investment plus government expenditure plus exports minus imports; government expenditure is defined as excluding all transfer payments, be they interest payments or subsidies. Therefore, it comprehends only government purchases of goods and services. Real GDP is estimated deflating the components on the right-hand side by either an average GDP deflator or by applying price indices relevant to each component. 1/

Alternatively, the adjustment of nominal to real figures could be done on a gross national product figure, which is obtained by adding or subtracting net factor income from abroad to GDP. 2/

$$GNP = GDP \pm FI \qquad (2)$$

or

$$GNP = C + I + G + CA \qquad (3)$$

where

FI = factor income from abroad, and

CA = current account.

Another usual presentation of the national accounts involves sectoral flows; assuming that GNP equals national disposable income, personal disposable income (Yd) would be:

1/ Differences between both methods may be significant in the presence of changes in the terms of trade if foreign trade is important.

2/ In this case, the problem of choosing the appropriate indices to deflate the nominal figures is compounded if factor payments (i.e., interest on foreign debt, worker's remittances) are important. In general, changes in the terms of trade or in foreign debt interest rates or in migrant remittances may produce serious divergences between the volume and purchasing power measures of the national product.

$$Yd = GNP + R - T = C + S \tag{4}$$

where

R = transfers received by the private sector, including
      nominal interest payments on the public debt

T = taxes paid

C = private consumption

S = private savings

Therefore,

$$C = GNP + R - T - S \tag{5}$$

and, replacing C in equation (3),

$$CA = (G + R - T) + (I - S) \tag{6}$$

Equation (6) states that the result of the current account of the balance of payments must be equal to the deficit of the public sector plus the net balance of the private sector. As usually presented, these sectoral flows are not adjusted for inflation. In the public accounts, interest payments are included in nominal terms as transfers (R) and they are implicitly considered as disposable income of the private sector (see equation (4)) except for the case of interest payments abroad. In the presence of inflation, the deficit of the public sector may not be identified any longer with increases in the public debt in real terms. Similarly, savings of the private sector would reflect an increase in its assets in nominal rather than in real terms.

Equation (6) is an identity which suggests important relations between the accounts of the government, the private sector, and the current account. There have been some attempts to bring a behavioral content into these identities in the context of the fiscal approach to the balance of payments. Even in the absence of inflation, testing the hypothesis that changes in fiscal deficits would be followed by similar changes in current account disequilibria is a joint test involving an assumed constancy of the net balance of the private sector. This may change due to many factors, be they associated to changes in fiscal policies (for example, tax changes) or to exogenous shocks. The test would then implicitly make the hypothesis that either the net private balance does not change or, that if it does ex ante, the unavailability of foreign credit to the private sector and the lack of accommodation of domestic credit policies would leave the ex post net balance of the private sector unaltered.

The assumed independence between changes in the fiscal deficit and the behavior of the net balance of the private sector may be further complicated under inflationary conditions. Changes in the size of conventional fiscal deficits caused by changes in the inflationary service of the public debt may be reflected by changes of similar magnitude, but of opposite sign, in the net balance of the private sector. This result would be obtained if bondholders willingly reinvested the inflationary service of the public debt so as to keep their stock of real bonds unaltered in real terms.

Inflation may also weaken the relation between conventional fiscal deficits and current account disequilibrium as it would increase the nominal demand for monetary base. The inflation tax on the monetary base is an alternative source of financing the deficit, which is likely to be intensively used when the availability of foreign credit and reserves is exhausted. In general, there is a strong presumption that fiscal deficit will influence current account developments when the country has its foreign financing possibilities opened, foreign reserves are plentiful, and it is desired to avoid the crowding-out of the private sector in financial markets. However, when foreign financing becomes tight and foreign reserves are exhausted, the size of the current account deficit may be limited. Inflation may then become the main consequence of fiscal deficits. In any of these stages, the refinanceability of the inflationary service of the public debt reduces the need for either foreign financing or monetization of deficits, without crowding the private sector out of financial markets.

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