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Inflation and the Financing of Government Expenditure: an Introductory Analysis with an Application to Turkey

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This article presents a simple framework to assess the consistency of appropriately defined fiscal deficits with other macroeconomic targets, such as inflation. It also considers the relation of fiscal deficits to output growth, real exchange rate developments, and management of internal and external debt. Finally, it considers the implications of relying on interest-bearing government debt to postpone the adjustment necessary to restore consistency with inflation targets. It demonstrates how the intertemporal budget constraint of the government creates a tradeoff between current and future adjustment. Real interest rates and output growth rates are shown to determine the terms at which this tradeoff takes place. The usefulness of this framework is demonstrated through an analysis of fiscal policy options in Turkey in 1985.

This article presents an integrated framework to assess the consistency between fiscal deficits and output growth, the rate of inflation, and other macroeconomic targets. The model centers on the government budget constraint and can be used either to derive the "financeable" deficit given inflation targets or to derive an equilibrium inflation rate for which no fiscal adjustment would be necessary. The financeable deficit is defined as the deficit that does not require more financing than is compatible with sustainable external and internal borrowing and with existing targets for inflation and output growth. The work presented here draws on theoretical contributions by Phelps (1973), Dornbusch (1977), Sargent and Wallace (1982), and Buiter (1983). (For similar work in the context of open economies, see also Drazen and Helpman 1987 and van Wijnbergen 1988.)

Consistency between fiscal deficits and other macroeconomic targets can be judged starting from the government budget identity. This identity says that

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the sum of the deficit, including the interest due on foreign and domestic debt, is equal to the sum of financing from all sources. Fiscal deficits can be financed in three ways: by issuing external debt, by issuing interest-bearing internal debt, and through monetary financing.

Macroeconomic targets, such as a target inflation rate, imply restrictions on these sources of financing which then determine the financeable deficit. If the actual deficit exceeds the financeable deficit, one or more of the macroeconomic targets will not be met without fiscal policy adjustment.

We should indicate, at the outset, the limitations of the approach developed in this article, which is not a general equilibrium analysis of inflation and output growth. It cannot provide the government with a tool to set policy variables such that a particular welfare function is maximized. Our aim, the design of consistent fiscal policy, is more modest. We answer the question, what is a *sustainable* fiscal deficit given targets for inflation, output growth, real exchange rate developments, and others. The guidelines developed in this article do not guarantee that the stated macroeconomic goals will be achieved, only that fiscal policy in itself is not inconsistent with them.

Section I presents the framework for an analysis of the link between inflation and the financing of government expenditure. As an example, section II then applies the methodology to Turkey, which has faced inflation and deficit problems since 1980. This section also analyzes how the future adjustment burden increases if current adjustment is postponed through the issue of interest-bearing debt. Finally, we analyze how much future inflation will increase compared with what it would be today if tight monetization policies are pursued in conjunction with the issue of unsustainable debt. Section III gives our conclusions.

I. Analytical Framework

Shifts in wages or prices of intermediate goods, devaluation, and changes in the money stock all affect the price level. But they do not explain the root cause of prolonged inflation. Any real wage can be sustained at any rate of inflation, especially in the presence of indexation agreements. An increase in the price of imported intermediate goods would not explain sustained domestic inflation rates in excess of world levels, since relative world prices of intermediate goods cannot rise forever. Although continued nominal devaluation of the exchange rate can sustain a matching excess of home inflation over world inflation, that does not explain what is behind this continued process of nominal devaluation. Similarly, while any sustained rate of inflation must be matched by a corresponding rate of money growth, that explanation begs the question of what drives the sustained increase in money growth in excess of what would be compatible with announced inflation targets.

Theory suggests that the answer to that question is the maintenance of fiscal deficits in excess of what can be financed through debt issue on a sustainable

basis. While short-term links between inflation and deficits are likely to be tenuous, any deficit, coupled with sustained debt-output ratios, implies a particular inflation rate. This is the inflation rate at which inflation tax revenue covers the difference between the government's financing needs and its issue of interest-bearing debt.

The inflation tax equals the amount of nominal money the private sector needs to accumulate so as to maintain the real value of its stock of money. Within a given financial structure, the real money stock is usually a stable function of interest rates and income. For given interest rates, level of income, and structure of the financial system, if consumers wish to maintain money balances fixed in real terms, they will have to accumulate nominal balances at the rate of inflation and in proportion to their desired level of real balances, L. Thus the revenue from the inflation tax is:

$$IT = \hat{P}L\,(i,..,y) \tag{1}$$

where P is the price level and " ˆ " indicates percentage change, so that $\hat{P}$ equals inflation, i is the nominal rate of interest, and y is real income. Other variables, such as inflation and regulatory restrictions on reserves, typically also will enter demand for base money.

Base money is an interest-free liability of the public sector, which can thus cover real expenditure through the issue of nominal liabilities. The private sector will have to run a matching surplus of income over expenditure to accumulate these money balances when inflation is positive; it thus pays what is called "the inflation tax." By analogy with more conventional taxes, inflation can be considered the tax rate and L, the level of real money demand, the tax base.

The fiscal authorities only make a net gain to the extent that the inflationary erosion of the money stock is not offset by inflationary gains by domestic borrowers. Hence the proper tax base is not the broad money stock (currency held by the public plus demand and time deposits, $M2$), but the more narrow concept of "outside" or base money, none of which is offset by private-sector debt owed to the banking system.

In addition, the government derives what we call seignorage revenue, SR, when real balances rise:

$$SM = \dot{m} \tag{2}$$

where m is real money balances and we use "•" to indicate a change in value. In equilibrium, changes in real balances will equal changes in demand for real balances, arising from movement in interest rates, inflation, real income, and even from changes in financial regulation (see van Wijnbergen, Anand, and Rocha 1988 for a detailed discussion of the latter effect). But by definition, in the steady state, inflation, nominal interest rates, and financial structure are constant. Our medium-term focus on sustainability allows us to ignore the once-off increases or decreases in demand for base money caused by changes in

those variables. In the steady state, however, real income will not be constant. Hence if money demand is unit-elastic with respect to real income, Y, we get as steady state seignorage revenue:

$$SR_{steady\ state}/Y = nL(i,..,Y)/Y$$

To link revenue from the inflation tax, IT, and seignorage, SR, to debt management and budget deficits, one needs to look at the government budget identity linking expenditure categories to sources of financing. We discuss below the appropriate concept of deficits and the link between deficits and changes in debt and monetary aggregates. We then show how to go beyond accounting to derive deficit levels that are consistent with internal and external debt strategies, inflation targets, and exchange rate policy.

On the Definition of the Public Sector

Problems with the measurement of public deficits involve both accounting conventions and issues of economic analysis. Most countries have several layers of government: national, provincial, and local. In Turkey, this is complicated further by the recent proliferation of extrabudgetary funds and by the existence of an extensive state economic enterprise (SEE) sector.

Focusing on central government budget data alone gives a misleading impression of recent public developments in Turkey. The size of central government has fallen between 1981 and 1986. A different picture emerges, however, once other components of the public sector are taken into account. Central government budget expenditure declined by 3 percentage points (as a share of gross national product, GNP) between 1981 and 1986; however, the share of the public sector in GNP, inclusive of local governments, extrabudgetary funds, and SEEs, increased from 34 percent in 1981 to 37 percent in 1986 (table 1). Similarly, in computing the deficit it is important to include the entire public sector because SEEs are the major factor behind the high public deficits.

Table 1. *The Size of the Public Sector in Turkey*
(percentage of GNP)

Component	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*[a]
Central government budget	23.1	22.0	22.6	20.6	18.3[b]	20.1[b]
Extrabudgetary funds	1.1	1.1	1.2	1.3	3.1	4.3
Local governments	1.5	1.4	1.7	1.8	2.3	3.6
Total public administration	25.7	24.5	25.5	23.7	23.7	28.0
State economic enterprises[c]	8.4	8.2	8.6	10.4	10.6	9.4
Total	34.1	32.7	34.1	34.1	34.3	37.4

Note: Sum of all current and capital expenditure as a share of GNP. This exceeds the claim on actual resources by the public sector because it includes transfer payments.

a. Estimate.

b. Excluding value-added tax rebates paid to exporters and purchasers of capital goods.

c. Value added produced by state economic enterprises.

Source: World Bank data.

Including all these additional public components would still leave a potentially important loophole: the profit and loss account of the central bank. In many countries the restraints imposed on fiscal authorities have been circumvented by shifting expenditure items to the central bank. Therefore, inclusion of the profit and loss account of the central bank in the public accounts is necessary to establish the link between fiscal deficit and base money creation, as we will see below.

Another problem concerns the measurement problems caused by capital gains and losses due to inflation and exchange rate changes. In the next section we discuss the necessary adjustments to properly account for them. This will complete the link between public deficits and the net change in real value of public liabilities.

Accurate and internally consistent data on expenditure and revenue flows for all public entities are usually not available. Moreover, what is available is not consistent with national accounts data, complicating comparisons with, for instance, private savings and investment flows. We have therefore chosen another approach to the measurement of the fiscal deficits, an approach that starts from the stock of indebtedness. A properly measured deficit should equal the change in net indebtedness of the public sector. Since much better information is available on stocks of outstanding debt than on flow-based profit and loss accounts of the public sector, such an approach is an improvement over flow-based measures.

Fiscal Deficits, Money Creation, and Debt

To derive the relation between fiscal deficits, money creation, and debt, start from the following relation:

$$D + iB + i^*B^*E = \dot{B} + \dot{B}^*E + \dot{DC}_g \tag{3}$$

The left-hand side of equation 3 lists the expenses of the public sector (net of taxes): its noninterest deficit, D, plus nominal interest payments on domestic and foreign debt. The variable i (i^*) is the nominal domestic (foreign) interest rate on domestic (foreign) debt B (B^*). E is the nominal exchange rate (Turkish lira, TU, per U.S. dollar). These expenses are covered (on the right-hand side) by the issue of domestic or foreign debt, plus central bank advances to the public sector, the stock of which equals DC_g (with "$\cdot$" again indicating change in the value of the variable). The noninterest deficit, D, and the interest payments should include the obligations of all government entities: the central government, state enterprises, municipalities, local governments, and extrabudgetary funds.

Equation 3, while correct in an accounting sense, is not enough to assess consistency of fiscal policy with other macroeconomic targets. First, it does not cover the central bank. The government could easily shift a substantial part of its deficit into the central bank's accounts by mere changes in bookkeeping practices. For example, a substantial part of the interest payments on the

foreign debt of the central government is often handled by the central bank, without being recorded in the central government's budget. To close this loophole, the profit-and-loss account of the central bank needs to be brought into the budget balance equation, and the central bank needs to be incorporated into the definition of the public sector accordingly. The importance of this correction cannot be stressed enough.

The second issue is related. Central bank credit to the government, DC_g, is a claim of one public entity on another. Debt consolidation would make it disappear. Moreover, it does not correspond to any asset in private portfolios and bears no obvious link to inflation, output growth, and so on. For that, the link with money needs to be established.

To remedy these shortcomings, consider a simplified central bank balance sheet. The balance sheet shows that the central bank's liabilities consist of currency held by the public, Cu, and commercial bank reserves, RR. The funds so obtained are used to hold net foreign assets, NFA^*E, and to extend credit to the government, DC_g. The balancing item is the central bank's net worth, NW.

Assets	*Liabilities*
DC_g	NW
NFA^*E	Cu
	RR

Currency in the hands of the public and required reserves held by commercial banks at the central bank equal the supply of base money: $M = Cu + RR$. From the balance sheet it is clear that M can be interpreted as the net liability of the central bank to the private sector. The balance sheet also shows the uses made of the funds raised through the issue of zero interest debt (base money): $M = DC_g + \text{NFA}^*E - NW$. Thus, base money is issued to cover credit to the government and the central bank's accumulation of net foreign assets, insofar as this is not already covered by the central bank's accumulated profits or net worth, NW.

In the simple balance sheet above, the central bank's profits consist of interest earnings on foreign reserves, $i^*\text{NFA}^*E$. The counterpart of these profits are increases in the central bank's net worth, NW. Its profit-and-loss account thus reads:

$$i^*\text{NFA}^*E = \dot{NW} \tag{4}$$

To incorporate the central bank into the public sector deficit identity, central bank profits need to be subtracted from the deficit, and its increase in net worth from the public sector's increase in liabilities (sources of financing). Thus from equation 3 one gets:

$$D + iB + i^*(B^* - \text{NFA}^*)E = \dot{B} + \dot{B}^*E + \dot{DC}_g - \dot{NW} \tag{5}$$

Equation 5 includes the central bank and thus the entire public sector, so

one important loophole is now closed. However, it is difficult to interpret. On the left-hand side, it lists interest payments on the net foreign debt of the public sector, $B^* - \text{NFA}^*$. The right-hand side, however, lists increases in gross foreign debt, $\dot{B}^*$, excluding the central bank, as a source of financing. It furthermore includes claims of one government entity on another: DC_g is really an inter-government agencies debt, which should be netted out.

Debt consolidation can be done in two steps. To switch to net public foreign debt throughout, the change in the central bank's net foreign assets, $\dot{\text{NFA}}^*$, is subtracted from the change in the government's foreign debt, $\dot{B}^*$, on the right-hand side of the equation. To maintain equality, it is also added back. The net result is

$$(6) \quad D + iB + i^*(B^* - \text{NFA}^*)E = \dot{B} + (\dot{B}^* - \dot{\text{NFA}}^*)E + \dot{DC}_g + \dot{\text{NFA}}^*E - \dot{NW}$$

The resulting equation consolidates foreign debt and assets of various government agencies, but includes an interagency debt, central bank credit to the government, DC_g. This can be remedied by recognizing that the last three terms on the right-hand side of equation 6 equal the change in the supply of base money, M, as can be seen from the central bank balance sheet above. Substituting the money supply identity into equation 6 yields:

$$(7) \qquad D + iB + i^*(B^* - \text{NFA}^*)E = \dot{B} + (\dot{B}^* - \dot{\text{NFA}}^*)E + \dot{M}$$

This analysis also suggests the proper definition of money for an analysis of inflation tax revenue and deficit finance. Revenue derived from inflationary erosion of the private sector's deposits in the banking system that is offset by inflationary erosion of loans outstanding to the private sector does not increase net revenue. This is clarified in the stylized set of balance sheets of the central bank, commercial banks, and the banking system below. The commercial banks hold reserves, RR, and make loans, L_{pvt}, to the private sector. On their liability side, they accept from the public demand deposits, DD, and time deposits, TD. Combining the commercial banks' and central bank's balance sheets yields the balance sheet of the integrated banking system:

Central bank		*Commercial banks*		*Integrated banking system*	
Assets	*Liabilities*	*Assets*	*Liabilities*	*Assets*	*Liabilities*
NFA^*E	NW	RR	DD	NFA^*E	NW
DC_g	Cu	L_{pvt}	TD	DC_g	Cu
	RR			L_{pvt}	DD
					TD

This balance sheet shows the shortcoming of $M2$ for our purpose. While nominal deposits are eroded by inflation, these capital losses are partially offset by similar gains made by the private holders of the loans, L_{pvt}. This is what is meant by the claim that $M2$ has an "inside money" component.

One can rewrite the balance sheet of the integrated banking system using standard definitions of the various concepts of money supply.

Integrated banking system

Assets	*Liabilities*
M	$M2$
L_{pvt}	

The proper money concept should exclude this "inside" component. It thus equals total currency held by the public plus total bank deposits ($M2$) minus bank loans to the private sector, L_{pvt}. But the tables above show that $M2$ minus bank loans equals base money or "outside money":

$$M2 - L_{pvt} = Cu + DD + TD - L_{pvt} = Cu + RR = M \tag{8}$$

In practice, there will be further complications, and these require adjustments to the reserve money concept underlying, for example, the International Monetary Fund's *International Financial Statistics* data base. The central bank not only holds reserves from commercial banks; in many countries it also lends to them, and to other actors in the private sector too. This requires adjustment in the definition of base money, so that the definition coincides with the central bank's net liabilities to the private sector.

Extended central bank

Assets	*Liabilities*	
NFA*E	NW	
DC_g	Cu	Monetary base
DC_{cml}	RR	Monetary base
DC_{pvt}		

Adjusted central bank

Assets	*Liabilities*	
NFA*E	NW	
DC_g	$Cu - DC_{pvt}$	Adjusted monetary base
	$RR - DC_{cml}$	Adjusted monetary base

The adjusted monetary base equals the monetary base minus central bank credit to commercial banks, DC_{cml}, and to other private agents, DC_{pvt}. This concept equals the central bank net non-interest-bearing liabilities to the private sector and is the appropriate concept to use for calculations of consistency of fiscal deficits with levels of inflation tax revenue.

Using this concept has an important consequence for the measurement of public foreign debt. If all of the central bank's liabilities (base money) are counted as public liabilities, then the central bank's claims on nongovernment agents, correspondingly, must be subtracted from the public sector's debt. Thus, public foreign debt needs to be measured net of the central bank's foreign assets (that is, $B^* - \text{NFA}^*$).

The deficit as defined in equation 7, however, still does not adequately capture the public sector's claim on resources, at least not in periods of nonzero inflation. While the right-hand side lists all the increases in the public sector's net liabilities, these are increases in the nominal value, not the real value. The counterpart of this is the inclusion of nominal instead of real interest payments in the definition of expenditure. This is misleading: as is by now widely recognized, the domestic and foreign inflation components in nominal interest rates,

$\hat{P}B$ and $\hat{P}^*$ $(B^* - \text{NFA}^*)$, respectively, represent repayment of (real) principal and thus are capital account rather than current account transactions.

Taking this capital account transaction out of the identity on both sides and dividing all variables by the price level, P, yields:

$$(9) \qquad d + rb + r^*(b^* - nfa^*)\, e = \dot{b} + (\dot{b}^* - \dot{nfa}^*)\, e + \dot{M}/P$$

Lower-case letters denote real variables, so $d = D/P$, the real value of the noninterest deficit; P and P^* are the domestic and foreign price levels. The variables b and b^* are the real values of domestic and foreign debt in terms of domestic and foreign goods, respectively, and m is the real money stock, M/P. The variable nfa^* is the real value of the central bank's net foreign assets in terms of foreign goods. The variable e is the real exchange rate, $e = EP^*/P$. The real rates of interest in terms of home and foreign goods, respectively, are:

$$r = i - \hat{P}, \text{ and } r^* = i^* - \hat{P}^*$$

where a " ˆ " above a variable indicates the percentage change in that variable. As an aside, the exact formula is slightly different in discrete time:

$$(10) \qquad 1 + r = (1 + i)/(1 + \hat{P}), \text{ and } 1 + r^* = (1 + i^*)/(1 + \hat{P}^*)$$

The difference between the two ways of calculating r and r^* is of second order, but in discrete time and with substantial inflation rates, may still be substantial. We always use the exact formula given as equation 10 in the actual calculations.

Equation 9 still does not include the capital losses due to real exchange rate changes which are part of the cost of servicing foreign debt. We use the identity:

$$\dot{\widetilde{(b^* - nfa^*)\, e}} = (\dot{b}^* - \dot{nfa}^*)\, e + \hat{e}(b^* - nfa^*)\, e$$

and add real exchange rate changes to both sides of equation 9 to obtain:

$$(11) \qquad d + rb + (r^* + \hat{e})(b^* - nfa^*)e = \dot{b} + \dot{\widetilde{[(b^* - nfa^*)e]}} + \dot{M}/P$$

One further rearrangement is illuminating. Simple differentiation allows us to rewrite the real value of the increase in nominal base money as the sum of two components:

$$(12) \qquad \dot{M}/P = \dot{m} + \hat{P}m$$

The first component represents the increase in the real value of base money, or seignorage. The second term on the right-hand side represents the amount of nominal balances that need to be accumulated just to keep the real value of the money stock constant (the inflation tax). Insertion of equation 12 into 11 yields:

$$(13) \qquad d + rb + (r^* + \hat{e})(b^* - nfa^*)\, e = \dot{b} + \dot{\widetilde{[(b^* - nfa^*)\, e]}} + \dot{m} + \hat{P}m$$

Equation 13 states that the fiscal deficit, inclusive of the central bank's profit-and-loss account, but counting real interest payments only, equals changes in

the real value of domestic and foreign debt, plus revenue from the seignorage and from the inflation tax. In the steady state, the revenue from the seignorage equals nm, with n the real growth rate of the economy. The sum of revenue from the inflation tax and seignorage equals revenue from monetization. Outside the steady state there could also be other sources of revenue from monetization: one-time changes in the real money stock because of changes in inflation, interest rates, or financial innovations that shift money demand.

Equation 13 as it stands is merely an accounting identity, but it is at the base of most of the analysis to come. Macroeconomic variables such as output growth and inflation have implications for the amount of money the private sector is willing to absorb for given interest rates. Similarly, changes in financial structure and regulation will also have an impact on the amount of revenue from monetization that can be expected. Finally, the government's creditworthiness and the perceived sustainability of the deficit-financing policy imply constraints on the issue of interest-bearing debt. All such restrictions can be incorporated into equation 13.

Money Demand and Inflation

An example of an application of the apparatus developed above requires quantification of the effect of inflation on money demand. An applied analysis to derive the policy implications for a particular country, however, would require a detailed study of base money demand. Aggregate money demand depends not only on inflation and rates of return on alternative assets but also on monetary policy instruments such as reserve requirements (see van Wijnbergen, Anand, and Rocha 1988 for such a study in a similar framework).

A simple unit income elasticity demand function is sufficient for the examples presented below. The government derives revenue from the inflation tax, but as inflation (the "tax rate") rises, money demand and hence the tax base falls. At the point where the inflation elasticity of money demand equals one, the revenue increase from the rise in the rate equals the revenue decrease from the decline in money demand, and inflation tax revenues reach their maximum value (Cagan 1956).

The demand function used in the text yields the following results:

$$\begin{aligned} \log m/y = & \underset{(0.2)}{-0.1} - \underset{(2.5)}{0.5} \log(1 + \hat{P}) \\ & + \underset{(2.2)}{3.1} \log(1 + i_{TD}) + \underset{(5.6)}{0.03} \text{ time} \qquad (14) \\ R^2 = & \ 0.84 \qquad DW = 1.96 \end{aligned}$$

The equation shows a strong negative dependence on inflation, as expected, and a high positive time trend—3 percent (quarter to quarter, from the fourth quarter of 1981 to the third quarter of 1985). The time trend reflects increased

monetization of the Turkish economy. In addition, base money demand is shown to depend strongly on time deposit rates. Equation 14 is used in the inflation tax calculations presented in section II.

Fiscal Policy and Macroeconomic Consistency

Consistency between fiscal deficits and other macroeconomic targets can be judged from the government budget constraint, linking deficits to sources of financing. Fiscal deficits can be financed in three ways: through the issue of external or internal interest-bearing debt, or through monetary financing. Macroeconomic targets, such as the inflation rate, external debt, and GNP growth, however, imply restrictions on each of these financing methods. These restrictions add up to a total financeable deficit; if the actual deficit exceeds that financeable deficit, one of the nonfiscal targets will have to be abandoned or fiscal policy will need to be adjusted.

Equation 13 can be used to derive a value for the fiscal deficit consistent with a given debt strategy and whatever inflation target policymakers wish to achieve. We give an example for a particularly simple debt strategy, fixed debt-output ratios for both internal and external debt. Target values for the ratio of domestic and foreign debt to output imply that real domestic debt cannot grow faster than real output and real net foreign debt cannot grow faster than the ratio of output to the real exchange rate:

$$\text{(15a)} \qquad \dot{b} = nb, \text{ and } \overbrace{(b^* - nfa^*)\,\dot{e}} = (n - \hat{e})(b^* - nfa^*)$$

or, using tildes to indicate variables expressed as a percentage of GNP,

$$\text{(15b)} \qquad \dot{b}/y = n\tilde{b}, \text{ and } \overbrace{(b^* - nfa^*)\,\dot{e}/y} = (n - \hat{e})\overbrace{(b^* - nfa^*)}^{\sim}$$

Again, n is the growth rate of real output, y.

Using these target values in equation 13 yields the consistency condition we are after:

$$\text{(16)} \quad \tilde{d} + r\tilde{b} + \overbrace{r^*(b^* - nfa^*)\,e}^{\sim} = n\tilde{b} + \overbrace{(n - e)(b^* - nfa^*)}^{\sim} + (\hat{P} + n)\,m$$

or the noninterest deficit, d, plus real interest payments on domestic and foreign debt, cannot exceed what can be financed through debt issue at target debt-output ratios, plus the revenue from the steady-state seignorage and the inflation tax. Consistency requires that equation 16 hold with m/y evaluated at the equilibrium value $L(\ldots)/y$, where it equals demand for real balances (as a share of GNP) evaluated at the *target* inflation rate.

Several important factors will shift the relation between public deficits and inflation embedded in equation 16. For example, lower reserve requirements or the introduction of attractive liquid alternatives to domestic money, such as the foreign deposits accounts permitted in Turkey since 1984, both lower the base over which the inflation tax is levied. These changes require higher inflation rates to finance the same noninterest deficit at given income levels. A

quantitative assessment requires more detailed and empirical work on the structure of the financial sector than can be provided in this paper (this issue is discussed in more detail in van Wijnbergen, Anand, and Rocha 1988).

A second factor influencing the relation between public deficits and inflation is the government's policy on issuance of bonds. In the short run, bond issues at a rate higher than is necessary to maintain b leads to a lower required inflation tax and to potentially lower inflation. This effect will be reversed as time goes by, however, if the economy grows at a rate less than the rate of interest (that is, if $n < r$). As is indicated in equation 16, as long as $r > n$, long-run revenue requirements will increase rather than decrease, requiring some other adjustment in fiscal policy or financing. This issue is taken up in the next section.

Finally, exchange rate policy plays an important role in all this. The closed economy analysis by Sargent and Wallace (1982) on which this article draws has been extended to the open economy so as to allow discussion of exchange rate policy (see Drazen and Helpman 1987 and van Wijnbergen 1988). It is arguable that the exchange rate policy followed in many moderate- and high-inflation countries has increased the relevance of the public finance approach to inflation. Moderate and high rates of inflation have forced many countries to offset inflation differentials with trading partners by nominal devaluation to avoid disruption of real trade flows. However, such a policy eliminates the role of the exchange rate as a nominal anchor for prices, since any blip in the price level will be offset automatically by a matching exchange rate adjustment. Thus, under such an exchange rate policy, the nominal exchange rate does not provide a restraining influence on the levels of domestic prices. If the central bank also monetizes fiscal deficits, no monetary anchors are left to tie down the price level. In such circumstances the public finance approach to inflation also becomes relevant for the explanation of short-run inflation, not just for medium-run trends.

Even if a government adheres to a fixed exchange rate regime, the approach suggested here is relevant. A fixed exchange rate regime or, more generally, a predetermined exchange rate regime implies a medium-term inflation rate: foreign inflation plus the rate of nominal devaluation embedded in the exchange rate regime (which equals zero if it is a truly fixed regime). Consistency between fiscal policy and the inflation rate implied by the exchange rate policy is important. Empirical evidence shows conclusively that the absence of such consistency undermines the credibility of a fixed exchange rate regime and leads to its eventual collapse (Cumby and van Wijnbergen, forthcoming). Hence the approach suggested here can also be used to assess sustainability of a fixed exchange rate regime.

II. Consistency of Fiscal Policy and Inflation Targets

In this section we apply the framework developed in the previous section to an assessment of compatibility of fiscal deficits and other macroeconomic tar-

gets in Turkey. We first derive the actual deficit in 1985 based on the change in the real value of net public liabilities, including those of the central bank. The actual deficit is then compared with the financeable deficit as implied by consistency with other macroeconomic targets. Finally we explore the consequences of delaying necessary fiscal correction measures.

Table 2 gives a breakdown of the actual deficit in 1985 by sources of financing. When corrected for inflation, the real value of net domestic liabilities as a share in GNP went down. The inflation tax, however, yielded revenues equivalent to 4.5 percent of GNP, so domestic sources of financing yielded a total of 3.9 percent of GNP.

Foreign financing was also significant: there was a large increase ($3.1 billion) in foreign debt, including net foreign liabilities of the central bank. As may be seen in table 2, most of this increase was due to an increase in real foreign debt; capital losses on the debt due to exchange rate changes were small since there was little depreciation of the real exchange rate. The total financing from all sources amounted to 6.6 percent of GNP. This number needs to be compared with the financeable deficit that we will derive from macroeconomic targets and debt strategies.

Consider first external debt targets and the restrictions on financing they imply. There is nothing magic about any given debt-output ratio. In Turkey, the ratio of external debt to GNP at the beginning of 1985 was more than twice as high as it was in the crisis year 1978. Nevertheless Turkey's creditworthiness has improved dramatically, presumably because of its much improved export performance. Due to the recent slowdown in Turkey's exports, however, further increases in the debt-output ratio may seem imprudent.

A real depreciation will, all other things being equal, increase the ratio of foreign debt to GNP and thus further restrict the room for external financing if the debt-output ratio is to be maintained at a particular level. This link, incidentally, points to a potential conflict between fiscal retrenchment and

Table 2. *Public Sector Deficit in 1985*
(percentage of GNP)

Domestic financing	
Increase in real value of all domestic liabilities	−0.6
Inflation tax	4.5
Total	3.9
Foreign financing	
Capital loss because of real exchange rate depreciation	0.2
Increase in real foreign debt at real exchange rate	2.5
Total foreign financing	2.7
Total deficit	6.6

Source: World Bank data.

increasing external competitiveness through exchange rate depreciation in the presence of a substantial foreign debt.

At the end of 1985 the external debt of central and local government and state economic enterprises (SEEs) plus foreign liabilities of the central bank minus the central bank's foreign assets was 48 percent of GNP.[1] At the 1985 real output growth rate of 5 percent, maintaining the end-of-period debt-output ratio of 48 percent allows for foreign financing of the deficit up to 2.4 percent of GNP. A 5 percent real depreciation would reduce the margin for external financing to zero, as the reduction in the debt-output ratio by a 5 percent real output growth will be offset exactly by the capital losses on external debt associated with a 5 percent real depreciation.

A more contentious question involves domestic debt issue. The real interest rate on auctioned one-year government paper was approximately 18 percent in early 1986. Issuing domestic debt at such a high real interest rate will allow lower money growth but at the cost of future increases in debt service obligations and thus future budget deterioration. The latter occurs because debt service will grow explosively at real interest rates so far above the real growth rate of the economy. A debt strategy that so clearly sacrifices future budget balance for current monetary restraint is likely to fuel inflationary expectations even if favorable external shocks allow a temporary decline in the rate of increase in prices. This in turn will keep nominal (and hence "ex-post" real) interest rates high, fueling a vicious circle of high interest rates, high public debt service, increasing budget deficits, high inflationary expectations, and back to high interest rates. (We demonstrate the negative impact of such a debt strategy on fiscal balance in tables 5 and 6 below.) Relying on further domestic debt issue should therefore be avoided, as cheaper forms of debt are still available. In what follows we will assume that the government does not allow any further *real* increase in domestic public debt.

The third source of financing is the issue of money. The government can raise revenue through monetary financing in two ways. First, for any given inflation rate, people will want to hold a certain amount of real money balances in relation to GNP. Thus a positive growth rate of output implies that the government can increase the real money stock in line with real output growth without undue pressure on inflation targets. This source of monetary financing is called seignorage. Its extent depends on the rate at which the output growth takes place; in Turkey a 5 percent real growth rate at a 25 percent inflation rate implies seignorage revenue of only 0.54 percent of GNP. Lower inflation increases desired money holdings in relation to output and will thus raise seignorage revenue. Growing monetization of the economy will likewise augment seignorage revenue.

1. A correction has been made for the fact that dividing debt by nominal GNP implies deflation of debt by an average rather than end-of-period price index. Turkey's central bank net foreign assets are taken from its *Quarterly Bulletin*. Other debt data were provided by the treasury.

The second source of monetary financing provides the link between fiscal deficits and inflation targets. We already saw that a particular inflation rate implies that people will want to maintain a certain ratio between real money balances and output. Since inflation reduces the ratio of real money to output, consumers increase nominal balances to offset this "inflationary erosion." This is referred to as the "inflation tax," since it forces moneyholders to reduce expenditure below income without providing any increase in real assets. At moderate inflation rates, the revenue it yields increases with the inflation rate. From the money demand estimate for Turkey, equation 14, it follows that the government can expect 2.7 percent of GNP from the inflation tax if inflation remains at 25 percent a year.

In the preceding paragraphs we outlined how much Turkish authorities can expect from the various sources of financing if prudent internal and external debt strategies are pursued and a real growth target of 5 percent and an inflation target of 25 percent are adopted. Adding up the financing these sources offer, under the constraints implied by the macroeconomic targets, yields an estimate of the financeable deficit of 5.64 percent of GNP. This is a full percentage point less than the actual deficit just derived (see table 3).

The deficit in 1985 was lower than that in 1984, largely because of expenditure cuts and higher than expected value-added tax revenues. Table 4 shows that it was just compatible with an inflation rate of 35 percent. A more moderate inflation rate of 25 percent, and certainly a further reduction to 15 percent, requires further reduction in the fiscal deficit (see table 4). A 15 percent inflation rate will slightly increase anticipated seignorage, as desired money holdings will rise; however, it will also substantially reduce the revenue from the inflation tax, down to 1.7 percent of GNP from its 1985 value of 4.5 percent. The required deficit reduction therefore increases to almost 2 percent of GNP (1.93 percent), as table 4 shows. The conclusion is clear: to maintain consistency between fiscal policy and even a moderate inflation target of 25 percent, a substantial further reduction in fiscal deficits, of 1 percentage point of GNP, is required. Current fiscal policy and inflation targets cannot simultaneously be maintained for a prolonged period of time.

Table 3. *Turkey's Actual and Financeable Deficit*
(percentage of GNP)

	Deficit	
Financing source	*Financeable*	*Actual*
Inflation tax, $\hat{P}m$	2.7	4.5
Change in domestic liabilities, $(\dot{m} + \dot{b})$	0.5	−0.6
Total foreign financing, $(\dot{b}^*e)$	2.4	2.7
Total financing	5.6	6.6

Note: The "financeable deficit" is calculated assuming growth of real output of 5 percent, an inflation rate of 25 percent, and no change in the real exchange rate or the ratio of domestic and foreign debt to output.

Table 4. *Required Fiscal Deficit Reduction for Consistency with Various Macroeconomic Targets*
(percent)

	No real depreciation; real GNP growth 5 percent			
Inflation target	15	25	35	45
Required deficit reduction	2	1	0	−0.8[a]
	No real depreciation; inflation 25 percent			
Real GNP growth target	2	5	7	
Required deficit reduction	2.7	1	0	
	Real GNP growth 5 percent; inflation 25 percent			
Real depreciation target	0	5	10	
Required deficit reduction	1	3.4	5.8	

Note: Required deficit reduction (1985) is given as a percentage of GNP.
a. A minus sign indicates that the deficit can be increased without any conflict with the other macroeconomic targets.

A higher GNP growth rate relaxes the financing constraint by increasing revenue from seignorage and by allowing more foreign debt accumulation. Hence the smaller required adjustment effort as the growth rate of GNP rises. Growth will influence not only the financeable deficit, as indicated in table 4, but also the deficit itself, through increases in production, exports, or income on which government taxes may be based. Thus some of the required adjustment might take place automatically as growth picks up, while the opposite effect takes place when growth slows down; the figures in table 4 do not account for these possible changes in the actual deficit itself.

The final row in table 4 shows the fiscal implications of an export strategy that relies on real exchange rate depreciation to maintain export growth. Real depreciation raises the cost of servicing foreign debt and so reduces room for fiscal policy. The required cuts are substantial, because external public debt stood at 48 percent (1985). A 5 percent real depreciation would thus have *increased* the required adjustment by 2.4 percent to bring it to 3.4 percent of GNP, assuming 5 percent real output growth and 25 percent inflation. Similarly, a 10 percent real depreciation would require a fiscal adjustment of 5.8 percent to restore fiscal policy consistency.

Next, consider the consequences of an alternative financing method—domestic issue of government securities. With domestic real interest rates so far above the real growth rate, financing deficits through domestic bond sales will lead to explosive debt growth and increasing future fiscal deficits because of higher real interest payments. This is demonstrated in table 5 where we assume a restrictive monetary policy aiming at 15 percent inflation, and the same basic noninterest deficit as in 1985. However, we assume that the fiscal cuts required to sustain a monetary policy geared for 15 percent inflation are not undertaken. Instead, deficits are covered by issuing domestic debt at a real interest rate of 18 percent, which is approximately the real interest rate on auctioned government securities at the beginning of 1986. Each year, the interest on debt so issued is added to the deficit to be financed. The numbers in table 5 show the

Table 5. *Required Fiscal Deficit Reduction Due to Domestic Debt Financing of the Fiscal Deficit*
(percentage of GNP)

Macroeconomic assumptions	*Years following debt issue* 1	2	3	4	5	6	*Change in domestic debt/output*
Real GNP growth = 0 RER depreciation = 0[a] External debt / GNP = constant	2.0	2.4	2.8	3.3	3.9	4.6	18.9
Real GNP growth = 5 percent RER depreciation = 0 External debt / GNP = constant	2.0	2.2	2.5	2.8	3.2	3.6	16.4
Real GNP growth = 5 percent RER depreciation = 5 percent External debt / GNP = constant	4.4	4.9	5.6	6.2	7.0	7.9	36.1
Real GNP growth = 5 percent RER depreciation = 5 percent Nominal value of external debt = constant	6.8	7.6	8.6	9.7	10.8	12.2	55.7

Note: The required reductions are calculated assuming 15 percent inflation and an 18 percent real interest rate.

a. RER is the real exchange rate.

required adjustment in six successive years if fiscal consistency were to be attained in that year.

The table demonstrates that while bond sales make it possible to sustain restrictive monetary policy, they do so at the cost of ever larger fiscal cuts if consistency is to be restored. The reason for this is that the real interest rate on internal debt substantially exceeds the growth rate of the economy. That becomes clear when comparing the first two rows in table 5. Row two shows the effects of such a debt management policy at a 5 percent growth rate of real output. In this scenario, the required fiscal deficit reduction rises from 2 percent to 3.6 percent of GNP in six years. At lower growth, this increase is much bigger; row one shows that at zero real growth, the required cut increases to 4.6 percent in six years.

The situation is actually worse than is shown: a lower growth rate for a given real interest rate not only influences the dynamics of the process but would also increase required deficit reduction in the base year (see table 4). This is ignored in row one of table 5 to bring out the dynamic complications more clearly.

Table 5 also shows the effects of various changes in the assumptions on exchange rate policy and external debt management. The 5 percent real depreciation per year adds to the cost of external finance, and has implications for external debt accumulation. The exercise has been set up under the assumption

of a constant external debt-output ratio. At a 5 percent real rate of depreciation and 5 percent real growth rate of GNP, that implies no real increase (in terms of foreign goods) in external debt. In other words, to meet the external debt target, nominal debt can only go up at the foreign rate of inflation under this scenario. This clearly adds to the pressure on domestic finance, as table 5 shows; the total of internal debt to GNP increases by 36 percentage points over the six years shown. Compound interest on internal debt also makes for a rapid deterioration of the fiscal situation: the required adjustment rises from 4.4 percent to 7.9 percent in six years under the pressure of the increasing cost of servicing the growing internal debt.

The final row assumes a stricter target on external account: no increase in the dollar value of external debt. This means that a 5 percent rate of world inflation would imply an approximate 5 percent real decline in the value of the debt. This adds a further 2.4 percent of GNP to domestic financing requirements if no matching expenditure cuts or tax increase takes place. Table 5 shows that under this scenario the fiscal situation will deteriorate very rapidly because of the large interest differential between internal and external debt.

There is an alternative way of presenting these intertemporal tradeoffs which may be more realistic. In table 5, we assumed that fiscal adjustment would be postponed but would take place eventually. The table suggests at which intertemporal terms adjustment today can be traded for adjustment tomorrow. Since real interest rates exceed the growth rate of real GNP, those terms are unfavorable, as the table shows. But what if, in the future, fiscal adjustment does not take place, and monetization becomes the residual source of finance? What happens if monetization is reduced through increased bond finance, in an attempt to restrain inflation, only to see renewed monetization later when debt service escalates too much?

Table 6 shows the tradeoffs involved when fiscal adjustment does not take place. Column one shows which inflation rate is required to yield sufficient

Table 6. *Intertemporal Inflation Tradeoffs through Temporary Bond Financing*
(percent)

	Years following debt issue				
Macroeconomic assumptions	*1*	*2*	*3*	*4*	. . . *6*
Real GNP growth = 5 percent RER depreciation = 0[a] External debt / GNP = constant	35	38	41	45	55
Real GNP growth = 5 percent RER depreciation = 5 percent External debt / GNP = constant	67	75	88	102	**

** Indicates there is no inflation rate at which the financing gap can be covered.

Note: Inflation rates shown after year 1 are those required to finance the fiscal deficit when bond financing is used in the intervening years.

a. RER is the real exchange rate.

inflation tax revenue to cover the entire gap under zero and 5 percent rates of real exchange rate depreciation. Column two shows what is needed in year two if in the intervening year bond finance is used. Once again, since real interest rates exceed the growth rate of real GNP, the debt service burden will have increased and more inflation is needed to restore balance. Column three shows the corresponding entry for year three if bond finance has been relied upon for the intervening two years, and so on.

For a 5 percent growth rate of real output and a constant real exchange rate target, the financing gap equals 2.2 percent of GNP, as we saw before. To finance this through the inflation tax requires 35 percent inflation. Postponing adjustment through bond issue at the 18 percent real interest rate prevailing at the end of 1985 clearly compounds the problem: after three years, the inflation rate necessary to fill the gap has increased to 45 percent and two years later, to 55 percent. In addition, the cost of the policy increases as the inflation rate rises; the second 10 percent increase took only half as much time as the first 10 percent increase. This is due to the fact that the marginal revenue from inflation tax falls as higher inflation pushes money demand in a more price-elastic range.

The second row in the table goes through the same exercise, but asssuming a 5 percent real depreciation each year. This erodes the fiscal deficit through increased capital losses on foreign debt and hence requires higher inflation tax revenues and thus higher inflation rates. In the first year, 67 percent inflation is required to fill the financing gap. This rapidly escalates to just over 100 percent in the fourth year, after which the financing gap becomes too large to be covered through the inflation tax.

III. Conclusion

In this article we present a framework to assess the consistency of fiscal deficits with macroeconomic targets such as inflation, output growth, and real exchange rate developments. The framework's usefulness is demonstrated in an analysis of the consistency between macroeconomic targets and current fiscal deficits in Turkey. The analysis suggests that, if 1985 is taken as a benchmark, a substantial reduction in the fiscal deficit is necessary: an inflation target of 15 percent is shown to require, for consistency, a cut of 2 percentage points of GNP in the total public deficit. It should be emphasized that this measure includes the entire public sector—the central government (inclusive of extra-budgetary funds), local governments, state economic enterprises (SEEs), and the central bank.

The example demonstrates how taking a more restricted definition of the public sector may yield misleading results. While including SEEs, local government, and off-budget agencies is by now accepted practice, our inclusion of the central bank in the public sector accounts is not. We show how such an integrated view is necessary for a consistent link between deficits, money creation, and debt. This link is crucial for any assessment of sustainability, and, as

a corollary, so is the inclusion of the central bank accounts into those of the public sector.

We also highlight a number of interactions between different macroeconomic instruments and targets that often receive insufficient attention. First, pursuing current restrictive money growth targets by relying on debt finance rather than cuts in the noninterest deficit sacrifices future budget balance if real interest rates exceed the real growth rate of the economy. In this sense there is an intertemporal tradeoff between current and future inflation when bond issues rather than fiscal correction are used to support tight money. We demonstrate quantitatively that in Turkey this tradeoff takes place at highly unfavorable terms in the year considered in this example.

Second, there is a conflict between fiscal retrenchment and increasing external competitiveness through exchange rate depreciation in the presence of a substantial foreign debt. This is because of the impact of a real depreciation on the real cost of foreign debt service. Thus, an export strategy that relies on real depreciation to maintain export growth requires more stringent fiscal policy to an extent quantified in the preceding section.

Finally, there is a link between stabilization policy and growth: a higher GNP growth rate relaxes the financing constraint by increasing revenue from seignorage and by allowing more foreign debt accumulation within the constraint of a given debt-output ratio. Hence the smaller required fiscal adjustment effort as the growth rate of GNP rises.

Appendix. Revenue from Monetization and the Structure of the Financial Sector

In the article we argued that the appropriate money concept to use is net central bank liabilities to the private sector or base money. It is clearly important to understand how demand for base money responds to changes in financial sector regulation, interest rates, and so on. The money demand function used in the example of section II is too simple to incorporate the impact of changes in reserve requirements, for example. Incorporating such shift factors in the money demand function creates a practical problem in that central bank has liabilities of different agents in the economy. It is unlikely therefore that an aggregate money demand function would adequately capture the sensitivity of reserve money demand with respect to changes in the inflation rate, financial structure, and interest rates.

In what follows we outline an approach that explicitly incorporates the structure of the financial sector, and we enter separate behavioral equations for different actors (for an application, see van Wijnbergen, Anand, and Rocha 1988). Underlying the approach is a model describing private portfolio choice as a function of inflation, output growth, and interest rates, which gives the amount of currency, demand deposits, and time deposits the private sector is willing to hold. This is coupled with a simple financial sector model incorpo-

rating reserve requirements and other bank regulatory policies to derive the demand for reserves by commercial banks. The demand for reserves is then added to the demand for currency already derived to get an estimate of the total demand for base money. This is used to calculate revenue from monetization for different inflation rates, output growth rates, and interest rates, and for different regulatory policies.

This indirect, structural approach has a number of advantages. It allows explicit calculation of the effects of changes in financial sector regulation on the financeable deficit through the impact of such regulation on the aggregate demand for base money. For the same reason, this approach is more likely to be stable across changes in financial sector regulation. Below we give an example for a simple fractional reserve banking system (that is, a system where banks are required to hold a fraction of their deposits as reserves). More complicated regulatory systems can easily be incorporated (see Rocha and van Wijnbergen 1988 for more extensive discussion).

To analyze the determinants of the demand for the primary components of reserve money entering into such a financial sector model, consider first a simple portfolio approach to private asset demand:

$$(Cu/\text{GNP}) = f_C(\hat{P}, i_{DD}, i_{TD}) \tag{A-1}$$

$$(DD/\text{GNP}) = f_{DD}(\hat{P}, i_{DD}, i_{TD}) \tag{A-2}$$

$$(TD/\text{GNP}) = f_{TD}(\hat{P}, i_{DD}, i_{TD}) \tag{A-3}$$

Demand for currency Cu, demand deposits, DD, and time deposits, TD, each as a share of nominal GNP, depend on inflation and the interest rates paid on demand and time deposits, i_{DD} and i_{TD}.

More sophisticated financial structures would introduce additional factors. For example, with foreign exchange deposits available one would expect exchange rate depreciation and foreign interest rates to influence demand for domestic assets. The time period since the introduction of foreign exchange deposits in Turkey, however, has been too short to allow econometric analysis of the influence of such factors.

Under a fractional reserve system, with reserve requirement ratios, RR_{DD} and RR_{TD} against demand and time deposits respectively, demand for base money M is:

$$\begin{aligned} M/(\text{GNP}) &= Cu/(\text{GNP}) + RR_{DD}(DD/\text{GNP}) + RR_{TD}(TD/\text{GNP}) \\ &= f_C(\hat{P}, i_{DD}, i_{TD}) + RR_{DD} f_{DD}(\hat{P}, i_{DD}, i_{TD}) \\ &\quad + RR_{TD} f_{TD}(\hat{P}, i_{DD}, i_{TD}) \end{aligned} \tag{A-4}$$

Equation A-4 can be used to derive the impact of changes in inflation, interest rates, and financial sector regulation on base money demand (as a share of GNP; the inverse, GNP/M, is often referred to as velocity) and their likely impact on the revenue the public sector can expect from monetization. Com-

bining this information with equation 13 of section I allows assessment of the fiscal consequences of financial sector reforms affecting, for example, reserve requirements or the interest rates paid on various types of deposits in commercial banks.

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