Impact of Inflation on Fiscal Policy in Developing Countries

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THE REALITY OF CHRONIC, and at times accelerating, inflation in the past decade has significantly complicated the policy problems of public sector decision makers. While fiscal policy presumably serves as an important element of price stabilization policy, the principal instruments of fiscal policy—government expenditure and revenue—are themselves affected by the inflationary process. Inflation raises the cost of government services and investment and increases the budgetary demands for distributional transfers while simultaneously increasing the amount of revenues collected. What is important to note is that these fiscal effects of inflation do not occur in tandem; different types of revenue and expenditure may respond at different speeds. In fact, it has recently been suggested (Aghevli and Khan, 1978) that one of the dynamic forces sustaining inflation in developing countries is inflation-induced fiscal deficits. Total government expenditure is said to adjust more rapidly than revenue to a change in the price level and in such a way that a procyclical bank-financed budgetary deficit emerges.

The Aghevli-Khan hypothesis is important for, if valid, it suggests the need for a serious re-examination of the current fiscal policy response to inflation. Beyond that hypothesis, the literature is very thin on the short-term dynamics of public revenue or expenditure growth in developing countries, particularly in response to inflation. [1]

This paper attempts to provide a theoretical and empirical analysis of the factors underlying the relative speed of adjust-

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[1] Exceptions to this are important papers by Vito Tanzi (1977 and 1978) and Aghevli and Khan (1977) in which the consequences of alternative adjustment lags of revenue to inflation are discussed. See also Heller (1975).

ment of different types of revenue and expenditure to inflation. In so doing, it provides an empirical test of the accuracy of the Aghevli-Khan hypothesis in describing the fiscal experience of developing countries over the past two decades. Section I suggests a conceptual framework for evaluating how alternative categories of revenue or expenditure are likely to respond to inflation. There are many different forms of expenditure and revenue; each is likely to respond to inflation in a particular way. With respect to expenditure, a distinction is made between the impact of inflation on the cost of providing government services and realizing the objectives of the public sector and the actual effect on the nominal level of expenditure. The government has a considerable amount of discretion in determining the magnitude of the budgetary response to such cost increases and may influence the extent of certain price increases. The reaction of total revenue or expenditure will reflect partly the initial structure of revenue and expenditure, partly the extent to which the rate of inflation has been anticipated, and partly the government's discretionary response to it. In effect, one cannot accept the Aghevli-Khan hypothesis for a country without a more detailed analysis of the country's fiscal structure and the characteristics of the inflationary situation.

Section II contains an econometric analysis of the factors influencing the rate of adjustment of revenue and expenditure to inflation. Initially, the fiscal segment of the Aghevli-Khan model for 24 developing countries is tested, and then it is demonstrated that there exists a significant degree of variability in the relative adjustment rates of total expenditure and total revenue. An attempt is made to explain this variability, and the explanation offers some support for one of the Aghevli-Khan hypotheses, viz., that the higher the mean rate of inflation, the greater the tendency for expenditure to adjust more rapidly than revenue to inflation. It also demonstrates that the Aghevli-Khan effect reflects an adjustment by decision makers to anticipated inflation; the adjustment is considerably weaker for unanticipated inflation. Also, estimates are provided of the specific adjustment properties of different categories of revenue and expenditure and of the extent to which such adjustment rates vary according to the character of the inflationary environment and according to the overall fiscal adjustment pattern. Some concluding remarks are in Section III.

I. Theoretical Issues

AGHEVLI-KHAN MODEL

In determining the actual net fiscal response to inflation, three principal questions must be answered: (1) How do government decision makers adjust the desired level of alternative categories of nominal expenditure and revenue to a change in the price level? (2) How rapidly are such adjustments reflected in actual expenditure adjustment decisions? (3) What are the constraints or factors that determine the relative rapidity of such adjustments? In the Aghevli-Khan model, only the first two questions are formally addressed. Aghevli and Khan assume that for any given real income level, a "government attempts to keep its [desired] real expenditures constant in the face of an increase in the price level" (1978, p. 389). At the same time, it will attempt to increase or decrease the level of real revenue in response to a price change according to whether the overall tax system is intended to be elastic or inelastic to nominal income. These assumptions are formalized in the following demand equations for expenditure and revenue, respectively:

$$\log (G/P)_t^D = g_0 + g_1 \log Y_t \qquad g_1 > 0 \tag{1}$$

$$\log R_t^D = t_0 + t_1 (\log Y_t + \log P_t) \qquad t_1 > 0 \tag{2}$$

where P is an index of prices, G is the nominal government expenditure level, R is the nominal revenue level, Y is the level of real income, and the subscript t refers to the time period. [2] In terms of the rapidity of adjustment, the actual level of total expenditure or revenue realized in a period will close only a portion of the gap between the desired level and the amount realized in the previous period. In the following equations, ν and τ equal the percentage of the gap that is closed for expenditure and for revenue:

[2] Note that equation (2) could be reformulated as

$$\log \left(\frac{R_t^D}{P_t^t} \right) = t_0 + t_1 \log Y_t$$

If one assumes that t_1 represents the desired (as opposed to the actual) tax elasticity, then if t_1 is more than one, an increase in the price level will cause a greater than proportional increase in the desired R level and thus an increase in the real revenue level; an elasticity of less than unity implies that an increase in the price level yields a decline in the level of desired real tax revenues.

$$\Delta \log (G/P)_t = \nu [\log (G/P)^D_t - \log (G/P)_{t-1}] \quad (3)$$

$$\Delta \log R_t = \tau (\log R^D_t - \log R_{t-1}) \quad (4)$$

where $0 < \nu < 1$ and $0 < \tau < 1$. Aghevli and Khan (1978) argue that institutional factors will lead ν, the expenditure adjustment coefficient, to exceed τ, the revenue adjustment coefficient:

> Even if governments fully recognize the need to restrain expenditures during periods of inflation, they find it difficult to reduce their commitments in real terms. On the other hand, in contrast to the situation in most developed countries, where nominal revenues often more than keep pace with price increases, in developing countries they lag substantially behind. The contrast arises both because of low nominal income elasticities of tax systems and long lags in tax collection in developing countries. . . . In any event, tax systems in developing countries depend rather heavily on indirect taxes and, in particular, on foreign trade taxes. . . . Further, indirect taxes in developing countries are often specific, and even when they are ad valorem, the adjustment of base values for some of these taxes is not frequent enough to keep pace with inflation (p. 391).

Their econometric estimates for Brazil, Colombia, the Dominican Republic, and Thailand appear to support their hypothesis.

It is clearly difficult to generalize how government decision makers formulate their "demand" for expenditure or revenue and how such demands are affected by a change in the price level. The Aghevli-Khan hypothesis on expenditure is, at first glance, reasonable. If government decision makers have gone through the process of formulating a budget and made decisions on the magnitude of government investment and consumption programs, they would presumably want to maintain the real value of such programs if, after six months, the price level had changed.

However, a closer examination of the problem suggests several qualifications. Budgetary program decisions may be set subject to a constraint determined by fiscal policy on total nominal expenditure. As prices change, fiscal policy decision makers may decide not to maintain real expenditure levels if that conflicts with other fiscal policy objectives. This was clearly demonstrated in the United Kingdom, one of the few countries that seriously attempted to formulate budgets in real terms. In the early 1970s, U. K. planners found that a deteriorating terms of trade for public sector output was rapidly escalating the nominal government expenditure level, jeopardizing their overall stabilization program. Cash limits were imposed, which effectively

meant an erosion in real expenditure levels. [3] It should be noted that this so-called adverse price effect—where the growth of the government expenditure deflator exceeds that of the gross domestic product (GDP) deflator—has characterized the industrial countries over the past three decades and the developing countries prior to 1970. Is it reasonable to assume that government decision makers will fully accommodate a sharp increase in nominal expenditure levels, relative to both GDP and tax revenues? Conversely, where a favorable price effect exists, as was the case in many developing countries in the 1970s, it is possible that government decision makers will allow budgets to rise in real terms. [4]

A similar question can be raised concerning the demand for revenue equation. From equation (2), if the elasticity exceeds one, it effectively implies that, with an increase in the price level, decision makers desire an increasing real burden, even if the real income level remains unchanged; conversely, with $t_1 < 1$, they desire a decreasing real burden if the price level increases, *ceteris paribus*. While this may be the effect of inflation on a given tax system, it is not obvious that government decision makers would claim that this result was consistent with their objectives.

In determining the rapidity of revenue and expenditure adjustments to inflation, there is also the sense from the Aghevli-Khan discussion that the response is largely nondiscretionary and mechanistic. Increasing prices are immediately recognized and taken account of as all outlays are made. However, institutional lags in tax collection and in the price responsiveness of particular tax bases suggest a lower adjustment parameter for revenue. Yet, again a closer examination of this issue suggests that the response to a sudden onset of unanticipated inflation is by no means automatic. Government decision makers are forced to exercise a considerable amount of discretion in deciding by how much and how fast to adjust the fiscal variables. The nature of their response is likely to be constrained by the particular revenue and expenditure structures and by the specific economic, legal, and political environments.

[3] R. W. R. Price (1979). In the mid-1970s, New Zealand similarly decided to absorb the impact of inflation in the form of deliberate cuts in real expenditure.

[4] A detailed discussion of the relative price effect for government services may be found in Heller (1980).

In particular, one would expect the rate of fiscal adjustment to be critically influenced by the character of the inflation—its level and its rate of increase—as well as by the past history of inflation within the country. The types of institutional procedures for fiscal management that are followed when a high inflation rate is common are likely to be quite different from those adopted when inflation is generally mild. This is a factor at every level of fiscal policy and administration. In a world of high and chronic inflation, operating ministries are likely to be far more sensitive to the impact of inflation on the cost of their programs. Budget decision makers will be under considerably greater pressure to address the effects of inflation on government programs in the budget formulation and budget disbursement processes. In a mildly inflationary situation, finance ministries may deliberately avoid suggesting inflation guidelines at the time initial budget estimates are prepared; this would be impossible when inflation is chronically high. The impact of inflation on tax revenues becomes readily clear to tax policy analysts and, more important, to tax administrators. Efforts may be made to accelerate the collection of tax liabilities and ultimately steps taken to ensure that the overall tax system maintains its desired elasticity.

In effect, the government, both in its role as a tax collector and as a producer of services, eventually becomes accustomed to the effects of a given level of inflation on its fiscal tasks. The policies implemented to take account of inflation are likely to be sensitive to the rate of inflation. The higher the inflation rate, the more important it is to develop budgetary and tax administration procedures that can insulate the real resource allocation efforts of the government from the effects of inflation.

What are the effects of such efforts on ν and τ? Aghevli and Khan (1978) recognized that the relative differences between ν and τ in their four-country sample might relate to the rate of observed inflation. Might not variations in the inflation rate for industrial countries over time be equally mirrored by changes in ν or τ? Yet the answer is not obvious. For, if a given rate of inflation prevails in a country for a long enough time and in such a way that it becomes the expected rate, one might expect that the procedures developed would ensure that the real fiscal resource processes were indeed unaffected by the inflation. In such a case, the observed ν or τ in such a steady-state situation might be insensitive to the rate of inflation.

However, any significant change in the inflation rate from that steady-state level would provoke a change in the adjustment coefficients. If there were an increase in the rate of inflation, one might expect that ν or τ might lag behind their steady-state values. To the extent that such instability in inflation rates is perceived to be common in a situation of chronic inflation, there may be a tendency for ν or τ to compensate by being higher than in a situation of low inflation rates.

In the same vein, one would expect policymakers to respond more slowly to unanticipated inflation. In an economy where a mild or moderate rate of inflation has been built into the expectations or where exogenous developments clearly bode a known degree of increase in the inflation rate, the speed of adjustment is effectively a discretionary policy variable. The occurrence of an Aghevli-Khan type of rising fiscal deficit must be regarded as a consequence of deliberate policy actions by government decision makers. Clearly, if, in the preparation of the budget, the expected inflation rate will necessitate certain increases in the rate of expenditure and if it is recognized that revenue growth will lag, policymakers are faced with the choice of cutting expenditure, raising taxes, or accepting the macroeconomic consequences of a higher deficit. The more interesting question is the effect of an unanticipated change in the inflation rate on expenditure and revenue growth, and on revenue and expenditure policy decisions. Do such fiscal variables respond symmetrically with respect to comparable increases and decreases in the inflation rates? In terms of the Aghevli-Khan model, one must argue that the adjustment parameters ν or τ are determined by the character of the inflationary environment, and this should be specified in the modeling of the problem.

SPECIFIC FACTORS INFLUENCING RESPONSE OF EXPENDITURE AND REVENUE

Expenditure adjustment

The amount of latitude available to budget decision makers to respond to a change in the rate of inflation is partly a function of the particular structure of revenue and expenditure and partly of the perceived cost of such adjustments. Across expenditure categories, one can observe wide variations in the degree of exogeneity of price increases to the government and in the output cost of only partial adjustment of nominal expenditure levels to

inflation. For some types of expenditure, price increases occur exogenously to the public sector; in others, the government may attempt to limit such inflationary pressures through its control over commodity or factor prices. The combined impact of these exogenous pressures and the government's pricing decisions determine the increase in cost to the government of its output and, indirectly, the extent of any relative price effect. Government decision makers also must judge the consequences of a lack of immediate adjustment for particular categories of expenditure, although their judgments may not coincide with the reality of the impact.

With respect to the exogeneity of price changes to the decision maker, one can distinguish six categories of expenditure: wages and salaries; other current purchases of goods and services; servicing of financial obligations (interest and debt service); capital expenditure (acquisition of fixed capital assets, purchases of land, purchases of inventories, etc.); transfers and subsidies (capital and current) to individuals, enterprises, and other levels of government; and net lending.

On goods and services purchased from the private or foreign sector, whether capital or current, it can be readily assumed that increases in prices, anticipated or not, are directly and rapidly transmitted to the government. The only discretionary decision is whether to augment the budget for such categories or to effectively reduce the real level of such expenditures. (See Table 1 for the calculated share of such expenditure categories in total expenditure.)

For transfers and subsidies, the decision maker may, in principle, possess significantly more flexibility in determining the extent and timing of any adjustments to inflation. The principal exception arises when such payments are legally linked to some price index, for example, the indexation of pension or welfare payments in many developed countries. In such cases, the adjustment lag is effectively determined by a legislative formula. Among developing countries it is likely that such adjustments are found principally in social security systems, particularly in Latin America.

The government may also have little discretion concerning subsidies to public sector enterprises for the financing of operating deficits. This is particularly true when there is no significant central government control over the operating or investment decisions of the enterprise. Analogously, where the

TABLE 1. EXPENDITURE AND REVENUE CATEGORIES AS PERCENTAGE OF TOTAL EXPENDITURE AND REVENUE, SELECTED DEVELOPING COUNTRIES, 1975–78

		As Per Cent of Expenditure and Lending Minus Repayments							As Per Cent of Total Revenue							
	Year	Total expenditure and lending	Wages and salaries	Other purchases of goods and services	Interest payments	Subsidies and other current transfers	Capital expenditure	Net lending	Individual income tax	Corporate income tax	General sales tax or VAT	Selective excise taxes	Taxes on international trade	Property taxes	Social security	Employers' payroll and manpower taxes
South America																
Brazil	1975	100.0	13.8	8.9	6.0	51.1	12.4	8.7	1.2	7.3	—	29.2	5.5	0.1	32.7	6.3
Colombia	1977	100.0	...	...	...	...	37.0	−1.9	13.7	15.4	15.3	6.4	22.3	0.5	14.4	2.1
Peru	1977	100.0	←——46.8——→		11.6	12.6	20.3	8.7	3.9	11.7	28.8	14.4	24.5	5.8	—	3.3
Venezuela	1977	100.0	27.2	8.3	1.9	11.0	45.5	6.1	2.8	56.9	—	3.2	6.7	0.2	5.3	—
Central America																
Costa Rica	1977	100.0	39.8	9.7	5.8	21.5	20.6	3.1	...	...	8.1	23.1	21.7	0.7	23.0	—
El Salvador	1978	100.0	...	...	1.8	21.3	20.0	2.7	9.1	7.9	11.3	17.5	39.8	8.5	—	—
Guatemala	1977	100.0	29.6	14.5	5.1	10.7	29.6	7.3	2.4	9.8	14.1	14.3	43.2	1.8	—	—
Honduras	1976	100.0	33.7	28.1	3.7	2.7	36.0	0.5	7.6	11.3	6.5	20.0	33.6	0.7	6.0	—
Mexico	1976	100.0	27.4	13.4	8.9	...	27.8	10.4	19.9	20.3	10.4	19.2	9.6	—	16.3	1.2
Nicaragua	1976	100.0	27.6	17.9	6.6	8.1	30.3	9.6	←——14.0——→		11.1	24.9	21.3	5.5	10.9	—
Panama	1977	100.0	37.1	20.0	9.8	13.4	17.4	2.3	←——21.8——→		5.6	11.4	11.4	2.3	29.1	—
Caribbean Area																
Dominican Republic	1977	100.0	31.7	12.0	1.4	10.7	40.3	1.6	6.1	9.9	—	22.6	43.9	0.8	3.2	—
Jamaica	1976	100.0	25.6	14.8	7.3	19.3	18.7	14.4	20.1	9.5	17.8	28.0	5.6	3.2	4.4	2.6

Asia																
Indonesia	1977	100.0	17.8	12.8	2.8	14.5	44.0	8.2	2.8	58.2	8.2	5.0	10.1	1.6	—	—
Korea	1978	100.0	13.7	22.2	4.3	25.2	23.1	11.5	13.1	12.3	20.4	22.2	18.7	0.4	1.0	—
Malaysia	1977	100.0	32.8	12.3	9.4	16.6	17.7	11.8	8.7	27.1	4.9	14.5	32.5	1.0	0.8	—
Philippines	1977	100.0	27.6	23.5	4.0	9.2	12.4	9.8	9.2	13.5	16.9	16.3	24.6	0.6	—	—
Singapore	1977	100.0	26.7	27.9	12.1	3.3	16.0	14.0	←——33.4——→		—	15.1	7.9	9.4	—	1.8
Sri Lanka	1977	100.0	22.1	13.4	12.2	26.6	24.6	1.0	4.6	10.5	11.4	23.5	37.3	1.1	—	—
Thailand	1978	100.0	20.4	33.4	6.5	13.3	25.1	1.2	7.7	9.7	19.9	22.8	24.2	1.3	—	—
Africa																
Ghana	1976	100.0	26.5	21.3	6.2	11.8	23.8	7.6	9.6	13.2	6.1	21.7	36.7	0.2	—	0.3
Kenya	1977	100.0	30.5	20.3	6.2	15.1	21.5	6.1	←——35.0——→		21.3	11.7	17.2	0.2	—	—
Zambia	1977	100.0	26.6	23.2	9.1	14.8	15.1	11.0	19.5	15.3	11.5	31.7	6.2	0.1	—	2.7
Minimum share			13.7	8.3	1.4	2.7	12.4	0.5	1.2	7.3	—	3.2	5.5	—	—	—
Maximum share			39.8	33.4	12.2	51.1	45.5	14.4	20.1	58.2	28.8	31.7	43.9	9.4	32.7	6.3

Source: International Monetary Fund, *Government Finance Statistics Yearbook*, Vol. III (1979).

government remains committed (that in itself a discretionary decision) to maintaining subsidized prices for key commodities or services, such as basic public utilities or transport services, inflation will have a direct and immediate impact on the cost of such subsidies. However, in developing countries, it still appears likely that, for the bulk of subsidies and transfers, the government is under no obligation to adjust immediately to inflation.

For the remaining categories of expenditure, there is a qualitatively different type of pressure for immediate adjustment. For wages and salaries, the central issues are the magnitude of the differential between public sector and private sector real wages, beyond which the productivity and functioning of the government is imperiled, and the extent of pressure from public sector unions. This is a complicated question bearing on the degree of labor market immobility, the general degree of underemployment of different classes of labor, and the share of civil service employment within a given country's labor market. From an examination of the pattern of wage increases in many of the countries in the sample during the mid-1970s, it is obvious that the differential cannot get too wide, particularly with respect to public sector employees in the lower-income brackets. In part, this reflects labor market pressures, but even more, income distributional considerations. At the same time, as long as the inflation rate has not been too severe, nor too institutionalized as part of economic reality, the public sector wage adjustment has taken place with lags of one to two years and often has been only in the lower brackets of the public sector wage scale. [5]

This flexibility is also apparent from aggregate statistics on real wage and salary expenditure movements in the sample countries during the period 1972–78. While these statistics cannot distinguish shifts in public sector employment relative to wage rate changes, they indicate that it was quite common to observe a decline or slowing in the growth of real wage expenditure during one or two years of this period (Table 2). Such a decline was usually made up in the following years, but the pattern of irregular, large retroactive salary adjustments is quite common. Clearly, the more rapid the rate of inflation and/

[5] This is hardly a phenomenon restricted to developing countries. In the United States, the ceiling on the pay of senior bureaucrats has severely increased the private sector/public sector wage differential.

TABLE 2. YEAR-TO-YEAR CHANGE IN REAL PUBLIC SECTOR WAGE AND SALARY EXPENDITURE IN SELECTED COUNTRIES, 1972–73—1977–78 [1]

(In per cent)

	1972–73	1973–74	1974–75	1975–76	1976–77	1977–78
South America						
Brazil	8.9	−0.9	18.8	13.1	−7.4	12.5
Colombia	−4.8	3.5	9.2	−9.3	...	...
Peru	...	−4.4	9.1	−2.6	...	...
Venezuela	−1.2	−17.7	30.4	19.8	14.7	3.4
Central America						
Costa Rica	4.0	0.3	9.6	18.6	−0.7	33.0
El Salvador	1.7	1.1	−5.0	21.6	...	...
Guatemala	5.4	9.7	3.9	2.3	4.3	...
Honduras	−0.7	−0.5	5.8	13.4	...	...
Mexico	10.4	10.5	16.7	13.9	13.1	2.8
Nicaragua	−8.3	4.6	13.0	8.9	...	...
Panama	2.7	7.1	6.4	...	...	...
Caribbean Area						
Dominican Republic	16.4	−4.8	−5.0	5.3	−3.2	...
Jamaica	...	...	...	2.0	−0.2	...
Asia						
Indonesia	−5.0	13.7	14.9	−3.2	34.0	8.4
Korea	−10.4	1.0	21.4	31.1	47.5	−15.2
Malaysia	−10.9	8.4	14.0	65.4	18.9	0.4
Philippines	−10.8	−5.7	36.6	10.6	5.5	10.7
Singapore	−8.8	12.5	19.3	9.1	9.5	7.8
Sri Lanka	−42.7	20.9	3.8	6.5	−6.3	−4.1
Thailand	−9.1	8.2	18.9	7.1	6.9	15.6
Africa						
Ghana	−10.6	9.8	23.2	−9.0	...	...
Kenya	−5.3	−2.9	−4.5	5.9	−10.7	30.5
Zambia	0.6	−4.3	52.2	5.2	−4.5	−9.1

Sources: International Monetary Fund, *Government Finance Statistics Yearbook*, Vol. III (1979); and Fund staff estimates.

[1] Using the gross domestic product deflator.

or the longer the economy has experienced inflation, the quicker the adjustment is likely to be. This reflects both the more rapid appearance of a differential and the development of institutional procedures for wage indexation (witness Argentina—Feltenstein, Chu, and Baliño (1978)).

The effect of inflation on the annual servicing of the government's financial obligations depends on a combination of variables: (a) the impact of the inflation on interest rates, (b) the

level of the current fiscal deficit in absolute terms and as a share of the total stock of government debt, (c) the sources and costs of financing of any current deficit, and (d) the frequency of turnover of existing public debt and the interest rate at which the old debt was contracted. In cases where the capital market is not suppressed (which excludes most developing countries), the nominal interest rate should exceed the rate of inflation, ensuring a partial adjustment to inflation. Similarly, the decision maker has only marginal discretion over the rate of debt rescheduling in the short run. However, the size of the current fiscal deficit is not wholly exogenous to the decision maker; similarly, the extent and terms of central bank financing may also be under his influence. If one had to generalize, one would not expect a full adjustment to an initial increase in the rate of inflation; a more rapid adjustment would occur only if a constant rate of inflation were sustained over a long period of time.

Concerning net lending by the government, inflation will obviously have no impact on the flow of repayments; thus, the issue is whether gross loan disbursements will adjust rapidly to changes in the rate of inflation. Obviously, pressures for an increase in lending will emerge from borrowers. Where the rate of inflation is anticipated, government lending agencies will seek to maintain their real level of lending, as envisaged in the Aghevli-Khan model of demand for public expenditure. While such pressures would equally emerge with a higher than anticipated inflation rate, the policymaker has considerable discretion over whether to adjust the level of net lending for inflation immediately.

In thinking about the consequence of a lack of immediate adjustment, both in fact and as it is perceived by the policymaker, one must distinguish between different categories of expenditure. With respect to the provision of many public consumption goods and services, the potential short-run elasticity of supply relative to a moderate real reduction in an operating unit's budget may be very low. There may be inefficiency in the operation of a unit or potential for productivity growth. This was the implicit rationale of U. S. budgetary procedures in the early 1960s that deliberately avoided budgeting for anticipated mild inflation rates.[6]

[6] "Agencies should be able to offset price increases through increased productivity."—U. S. Government (1980).

Even if the nominal budget for an agency is in equilibrium, what are the consequences of only a partial adjustment to the rate of inflation? If the partial increase in the nominal budget is used principally to absorb the higher cost of purchased goods and services from the private sector, public output may decline only superficially. As long as the real wages of civil servants do not decline too sharply, it is unlikely that there will be significant mobility out of the public sector work force, despite dissatisfaction, or a significant curtailment of work effort and efficiency. Obviously, the more rapid the inflation rate, the greater the negative impact of a real wage decline on the productivity and quality of the public sector labor force. It is also likely that certain types of activity will suffer, viz., those with a long-term payoff (maintenance and repair work). However, to the extent that the budget increase does not support real levels of expenditure on operating inputs (perhaps because of political pressures to adjust nominal wage rates) there could be a more serious reduction in efficiency and productivity and a corresponding decline in the quality and quantity of publicly provided services.

In the short run, pressures for adjustment for these kinds of expenditure with respect to inflation are more likely to come from within the bureaucracy than without. In most developing countries public satisfaction with the quality of publicly provided consumption services is never high to begin with. The realization that the quality or quantity of services is deteriorating, and the ensuing political fallout, are probably slow to emerge. Obviously, there are limits to a decline in real wages or in the supply of real inputs, but, unless the initial rate of inflation is very high (above 15–20 per cent per annum), the pressures for immediate adjustment are not likely to be overwhelming. A short-run reduction in public sector consumption output, given the difficulties of its definition, can be lived with.

For public sector capital formation, physical and human, there may be greater pressures for immediate adjustment of the nominal budget in response to price changes. The opportunity cost of not adjusting may be a slower rate of construction, reduced equipment purchases, or a reduced flow of aid funds. Such costs may be politically and economically unacceptable. The perceived output loss is likely to be greater, and the discretion for deferring such losses less. Concerning the government's expenditure on distributional transfers, the output loss of a fail-

ure to adjust the value of nominal benefits is readily apparent in an economic sense; whether it is compelling in a political sense is another matter, and there is no obvious guide as to how much adjustment will occur.

Finally, how does a public decision maker value the impact of immediate adjustment of expenditure (in terms of maintaining economic growth targets, providing public consumption output, or maintaining equity goals) relative to the possible fiscal consequences in terms of an exacerbation of inflation? The issue is not whether to adjust at all, but, rather, the timing and, thus, the completeness of the adjustment. It is argued by Aghevli and Khan that, in the medium-run to long-run context, both revenue and expenditure will grow at the same pace as nominal GDP, and in this sense clearly a considerable amount of adjustment will occur. However, the speed of adjustment in the short term to an increase in the rate of inflation will have an important once-and-for-all impact on the real levels of expenditure and revenue and thus on the fiscal balance. If one accepts the Aghevli-Khan thesis, this short-term impact will be an increased deficit, with a strong likelihood that it will be financed by high-powered money, with possible inflationary consequences. Are such effects ignored by public decision makers in their preoccupation with expenditure objectives? It is not clear that the short-run losses from a failure to adjust are severe enough for this inevitably to be the case.

Revenue adjustment

Tanzi (1978, pp. 423–26) has noted that the two critical parameters influencing the rapidity of adjustment of tax revenue to inflation (disregarding discretionary changes) are the elasticity of a tax and the length of the lag between the collection of revenue and the occurrence of the taxable event upon which the tax liability accrues. In any country, each tax may be characterized according to these two parameters. For example, a personal income tax usually has a high elasticity, particularly if it is progressive. However, the collection lag is a function of the share of tax withholding to total income tax revenue and the respective lags between the realization of income and the occurrence of withholding and filing. The elasticity of the corporation tax will depend primarily on the growth of the corporate sector relative

to the other sectors of the economy. Collection lags may be quite long, extending to 18 months in many developing countries.

For indirect taxes, the rapidity of adjustment to inflation will be influenced significantly by whether such taxes are ad valorem or specific and by the state of the accounting system in manufacturing and wholesale establishments. While the growth of ad valorem sales or turnover tax revenues will closely pace the rate of inflation, subject to limitations associated with collection lags, specific taxes will yield poor adjustment to inflation unless there are frequent discretionary adjustments. For taxes on international trade, the rapidity of adjustment to inflation will depend on whether changes in domestic prices, relative to price changes of trading partners, are reflected in exchange rate adjustments. If not, one might again observe slow adjustment patterns. In effect, the adjustment parameter for total tax revenue will be a function of the structure of tax revenue, the degree of development of the tax revenue administration, and the collection lags implied by the tax law. For developing countries, Tanzi notes a presumptive bias in favor of low to unitary income elasticities and long collection lags, the combination of which tends to yield a decline in real tax revenues as prices rise.

II. Empirical Analyses of Inflation Adjustment Properties of Public Sector Expenditure and Revenue

While there exists considerable room for conjecture on the extent and rapidity of fiscal adjustment to inflation, it is clearly instructive to examine empirically how countries have actually behaved in such situations. This is not easy. Tests of fiscal behavior models have always been frustrated by the unavailability of a consistent, comparable time-series data base for the relevant fiscal variables. This is particularly the case with respect to developing countries; few have applied a consistent methodology for categorizing public expenditure on a functional or economic basis for even a moderate period. This section attempts to provide such an empirical analysis, both for total revenue and expenditure and for such fiscal variables classified on a disaggregated economic basis.

Three models of fiscal behavior are tested for total expenditure and revenue: the basic Aghevli-Khan model has

been tested for a sample of 24 developing countries; the rate of fiscal adjustment has been tested for its sensitivity to the level of inflation and to its rate of increase; the sensitivity of such fiscal behavior is also analyzed according to whether the inflation was anticipated or not. The three alternative models are tested using the Fund's *International Financial Statistics (IFS)* quarterly time-series data over a period ranging from 7 to 20 years. Also, the validity of the hypotheses of Section I concerning the relative adjustment speeds of alternative categories of revenue and expenditure are tested, using the basic Aghevli-Khan model. Since few countries have long time series of disaggregated fiscal data, this analysis makes use of a cross-sectional time-series data base. [7]

ALTERNATIVE FORMULATION OF TESTS

The Aghevli-Khan model has been described in equations (1) through (4), and readily yields two basic equations for the estimation of the parameters of the model:

$$\log (G/P)_t = \nu g_0 + \nu g_1 \log Y_t + (1 - \nu) \log (G/P)_{t-1} \quad (5)$$

and

$$\log R_t = \tau t_0 + \tau t_1 (\log Y_t + \log P_t) + (1 - \tau) \log R_{t-1} \quad (6)$$

The fundamental hypothesis is that expenditure tends to adjust to its desired level more rapidly than revenue, or that $\nu > \tau$. Both adjustment parameters are assumed invariant to the economic environment. The long-term income elasticities of expenditure and revenue, g and t, respectively, are assumed close to unity.

The discussion in Section I suggests that ν and τ might vary with the rate of inflation or its rate of increase. The impact of these factors may be tested by expressing ν and τ as

$$\nu = \alpha_0 + \alpha_1 i_t + \alpha_2 \Delta i_t \quad (7)$$

and

[7] The only reasonably consistent cross-country government finance data base for developing countries is the Fund's *Government Finance Statistics Yearbook*. Since this data base contains no more than seven data points per country, cross-sectional time-series analysis is required in order to obtain an adequate number of degrees of freedom. Such analysis necessitates efforts to ensure the credibility of the assumption of homogeneous behavior for the countries within the sample.

$$\tau = \beta_0 + \beta_1 i_t + \beta_2 \Delta i_t \tag{8}$$

where $i_t = \Delta \log P_t$ = the rate of inflation in the tth quarter and Δi_t is assumed to measure the accleration or deceleration in the inflation rate since the previous quarter. Substituting equations (7) and (8) into equations (1) through (4) yields estimating equations of the form

$$\Delta \log (G/P)_t = (\alpha_0 + \alpha_1 i_t + \alpha_2 \Delta i_t)\,(g_0 + g_1 \log Y_t - \log (G/P)_{t-1}) \tag{9}$$

and

$$\Delta \log R_t = (\beta_0 + \beta_1 i_t + \beta_2 \Delta i_t)\,(t_0 + t_1 \log (Y_t P_t) - \log R_{t-1}) \tag{10}$$

A third issue is whether the speed of adjustment to inflation is determined by whether the inflation rate has been anticipated. Presumably, budget decision makers take account of their price expectations in formulating the budgetary and revenue plans for a future period. If these price expectations are accurate, the actual change in expenditure or revenue should be close to the change intended in the budget. In effect, one should observe a reasonably rapid fiscal adjustment to expected inflation. If the rate of inflation differs markedly from that anticipated, one would not expect this to be as rapidly reflected in actual revenue flows or expenditure decisions. In terms of the original model, equation (1) can be re-expressed in such a way that desired nominal expenditure in a period, G_t^D, is a function of the price level in that period, viz.,

$$\log G_t^D = \log P_t + g_0 + g_1 \log Y_t \tag{11}$$

or

$$G_t^D = G^D (P_t, Y_t) \tag{11'}$$

The expenditure desired under the expected price level P_t^e, $G^D(P_t^e)$, will clearly differ from that desired when it is apparent that the actual price level that will be realized, P_t^a, differs from P_t^e, viz., $G_t^D(P_t^a) > G_t^D(P_t^e)$ if $P^a > P^e$. The change in actual nominal expenditures between t and $t-1$ is assumed to reflect both an adjustment of ν_1 per cent of the difference between $G^D(P_t^e)$ and G_{t-1}, reflecting the response to anticipated inflation, and ν_2 per

cent of the difference between $G^D(P^a_t)$ and $G^D(P^e_t)$, reflecting the response to the unanticipated inflation during the period,

$$\Delta \log G_t = \nu_1 (\log G^D(P^e_t) - \log G_{t-1}) + \nu_2 (\log G^D(P^a_t) - \log G^D(P^e_t)) \quad (12)$$

Analogously,

$$\Delta \log R_t = \tau_1 (\log R^D(P^e_t) - \log R_{t-1}) + \tau_2 (\log R^D(P^a_t) - \log R^D(P^e_t)) \quad (13)$$

Combining equations (11) and (12) and equations (2) and (13), respectively:

$$\log G_t = \nu_1 g_0 + (1 - \nu_1) \log G_{t-1} + \nu_2 \log \left(\frac{P^a_t}{P^e_t}\right) + \nu_1 \log P^e_t + \nu_1 g_1 \log Y_t \quad (14)$$

and

$$\log R_t = \tau_1 t_0 + (1 - \tau_1) \log R_{t-1} + \tau_1 t_1 \log (Y_t P^e_t) + \tau_2 t_1 \log \left(\frac{P^a_t}{P^e_t}\right) \quad (15)$$

The expected rate of inflation [8]

$$\pi_t = \frac{P^e_t}{P_{t-1}} = \beta \Delta \log P_t + (1 - \beta) \pi_{t-1} \quad (16)$$

Both the price level and the expected rate of inflation are assumed to be exogenous to the model of fiscal behavior. While this departs from the Aghevli-Khan assumption on the endogeneity of prices, it is believed here that the fiscal posture of the government in any calendar quarter is unlikely to affect the rate of inflation until subsequent quarters. It is more reasonable to assume a recursive model wherein prices in any given period are influenced only by fiscal variables of previous periods.

In estimating the model, several important assumptions were made in the specification of the individual variables. For each country, the total revenue, total expenditure, and consumer price index variables were drawn from the *IFS* data base and

[8] Aghevli and Khan (1978). In estimating the model, β has been set equal to 0.9.

seasonally adjusted. [9] Since nominal and real GDP statistics for most countries exist only on an annual basis, it was necessary to interpolate these variables to obtain quarterly estimates. In effect, it was assumed that there was constant growth during each quarter of a given year; this will also result in a constant growth of the resulting GDP deflator during any given year.

Both the consumer price index (CPI) and the interpolated GDP deflator series were used in estimating the model. The former has the advantage that it exists on a quarterly basis and is thus a more accurate measure of the intrayear movements in prices. Despite its interpolated character, the GDP deflator has the advantage that it is likely to be a better proxy for a deflator of total government expenditure than the CPI. [10] Moreover, in the revenue equation, desired revenue is related to nominal GDP, and this suggests the appropriate price variable is the GDP deflator. Estimations have been made using each price variable, and any significant differences are noted in the text.

In terms of estimation technique, equations (5), (6), and (15) are estimated using ordinary least squares. Equations (9), (10), and (14) involve nonlinear terms and require constraints on the individual parameters. As a result, a minimum-distance, nonlinear estimation technique was used. [11]

RESULTS

Examining the results of the estimation of the basic Aghevli-Khan model in Table 3 and of its extension in Table 4, several observations can be drawn. First, it is clear that the basic Aghevli-Khan hypothesis, while characteristic of a majority of the countries in the sample, is not universally valid. Depending on the deflator used, $\nu > \tau$ in only 12 or 13 of the 24 countries in the sample, with $\tau > \nu$ in the remaining 9 or 10 countries. The hypothesis is verified most clearly in the Latin American region,

[9] The seasonal adjustment procedure uses the X-11 variant of the Census Method II seasonal adjustment program as modified by the Federal Reserve System.

[10] Beck (1979) has shown that there has been a marked difference in the growth rate of the GDP deflator and the CPI relative to the government consumption deflator. If, however, one takes account of both government transfers and investment, the overall deflator for total expenditure does not diverge substantially from the GDP deflator. See Heller (1980).

[11] The algorithm used was developed by Amemiya and was extended and implemented by Berndt, Hall, and Hausman. It is described in Vol. 2 of the Fund's *RAL Statistical Routines* (November 1976), pp. 9.151–9.172.

with an opposite tendency in Africa and Asia. When the model is specified as in equations (9) and (10), the tendency for the basic expenditure adjustment coefficient to be larger emerges more strongly; α_0 exceeds β_0 in almost two thirds of the countries, but with a clear and consistently opposite relationship in the remaining ones. Although there is some varability in the expenditure adjustment coefficient, depending on whether the GDP or the CPI deflator was used, there is a reasonable consistency in the relative size of ν and τ (or α_0 and β_0) regardless of the choice of deflator. [12]

Second, the value of ν and τ is generally below unity. From Table 3, $\nu > 0.9$ in only a few countries; the median expenditure coefficient is approximately 0.8 in the estimations using the GDP deflator and slightly below 0.7 in the estimations using the CPI. The median revenue coefficient is slightly lower. It is worth noting, however, that one effect of the more elaborate specification of the model is to raise the basic ν_0 coefficient and lower the basic τ_0 coefficient. However, this simply reflects offsetting effects in the impact of the i and Δi variables.

Third, while the coefficients of elasticity are of a reasonable magnitude, they are not structural coefficients of elasticity but, rather, of buoyancy. The demand coefficient for expenditure, g_1, significantly exceeds unity and clearly reflects the increase over time in the overall share of real expenditure in total output in these economies.

Fourth, the results in Table 4 suggest that, in some countries, the inflationary process gives rise to more complicated dynamic fiscal effects than would be implied by the basic Aghevli-Khan model. In the expenditure equations, neither the inflation rate, i, nor the variables measuring the increase in inflation, Δi, are significant in all cases. The coefficient for the former, α_1, tends to be either significantly negative (in 10 of 24 countries) or statistically insignificant. The acceleration rate coefficient, α_2, tends to be positive, but is significant in only 7 countries. In the revenue equations, the inflation level coefficient, β_1, is either significantly positive (in 8 countries) or insignificant, whereas the coefficient reflecting the rate of increase, β_2, proves slightly more significant—negative in 8 countries and positive in 5 countries.

[12] In only 4 of the countries—Brazil, Kenya, Malaysia, and Mexico—does the choice of the deflator affect the relative size of the adjustment coefficients.

TABLE 3. PARAMETERS IMPLIED BY ORIGINAL AGHEVLI-KHAN MODEL FOR ADJUSTMENT OF REVENUE AND EXPENDITURE TO INFLATION IN SELECTED DEVELOPING COUNTRIES

	Period (Years/ Quarters)	Expenditure Adjustment Parameter (ν) Using		Revenue Adjustment Parameter (τ)	Expenditure Elasticity Parameter (g_1) Using		Revenue Parameter (t_1)	Quarterly Mean Inflation Rate	Standard Deviation of Quarterly Inflation Rate
		CPI deflator[1]	GDP deflator		CPI deflator	GDP deflator			
South America									
Brazil	1964/II - 1977/IV	0.66	1.02	0.57	1.09	1.07	1.07	7.1	3.6
Colombia	1959/II - 1977/IV	0.59	0.61	0.44	1.25	1.13	1.09	3.4	3.7
Peru	1971/I - 1978/IV	0.82	0.77	0.82	1.13	1.04	1.00	6.0	5.0
Venezuela	1957/I - 1977/IV	0.21	0.42	0.58	1.67	1.26	1.22	0.8	1.4
Central America									
Costa Rica	1970/II - 1978/IV	0.54	0.84	0.67	1.33	1.30	1.04	3.2	3.1
El Salvador	1969/II - 1978/IV	0.95	1.14	0.60	1.72	1.71	1.32	2.1	2.2
Guatemala	1965/II - 1977/IV	0.88	0.94	0.82	1.20	1.05	1.12	1.5	3.2
Honduras	1960/II - 1978/IV	0.48	0.52	0.94	1.50	1.11	1.27	1.0	1.9
Mexico	1971/II - 1977/IV	0.86	0.86	0.52	2.86	2.74	1.34	4.1	2.8
Nicaragua	1961/II - 1976/IV	0.95	0.99	0.59	—	1.58	1.12	1.0	1.3
Panama	1965/II - 1978/III	0.99	0.95	0.72	1.92	1.68	1.11	1.0	1.3
Caribbean Area									
Dominican Republic	1957/II - 1977/IV	0.60	0.62	0.49	0.60	0.76	0.94	1.1	2.7
Haiti	1967/I - 1977/IV	0.31	0.40	0.25	2.00	1.68	1.16	1.7	4.1
Jamaica	1961/I - 1977/IV	0.14	0.18	0.76	2.30	2.01	1.25	1.9	2.0
Asia									
Indonesia	1969/III - 1977/IV	0.89	0.87	0.88	1.84	1.87	1.32	4.2	4.3
Korea	1957/II - 1978/IV	0.39	0.34	0.20	1.56	1.25	1.25	2.9	3.5
Malaysia	1967/II - 1978/III	0.78	0.82	0.74	1.47	1.38	1.20	1.6	1.7
Philippines	1959/II - 1978/IV	0.28	0.31	0.35	1.53	1.45	1.18	2.0	2.6
Singapore	1969/II - 1978/IV	0.72	0.81	0.87	0.83	1.07	1.04	1.5	2.8
Sri Lanka	1957/II - 1977/IV	0.82	0.94	1.00	1.10	0.98	1.00	0.9	1.2
Thailand	1959/II - 1978/IV	0.23	0.33	0.63	1.04	1.18	1.02	1.3	3.4
Africa									
Ghana	1968/II - 1975/IV	0.47	0.59	0.81	0.60	0.44	0.78	3.5	4.7
Kenya	1969/III - 1978/IV	1.14	1.10	0.98	1.60	1.82	1.18	2.7	2.2
Zambia	1967/IV - 1978/III	0.52	0.37	0.78	...	0.97	0.90	2.3	1.9

[1] Seasonally deflated consumer price index series.

TABLE 4. PARAMETERS REFLECTING RESPONSE OF ADJUSTMENT COEFFICIENT TO RATE OF INFLATION [1] AND RATE OF INCREASE OF INFLATION IN SELECTED DEVELOPING COUNTRIES [2]

	Expenditure Adjustment Parameters					Revenue Adjustment Parameters				
	Base parameter (α_0)	Response to rate of inflation in quarter (α_1)	Response to rate of increase of inflation (α_2)	Expenditure elasticity to real GDP (g_1)	Constant (g_0)	Base parameter (β_0)	Response to rate of inflation in quarter (β_1)	Response to rate of increase of inflation (β_2)	Revenue elasticity to nominal GDP (t_1)	Constant (t_0)
South America										
Brazil	1.49**	−9.50**	18.12**	1.19**	−9.27**	0.55**	1.65	−2.10	1.06**	−3.00
Colombia	0.13	9.00**	−3.28	1.22**	−9.57**	0.53**	−2.60	−2.65	1.13**	−3.80
Peru	1.06**	−3.74	−8.02	1.50**	−12.30**	0.18	5.36*	−1.16	0.97**	−1.52
Venezuela	−0.05**	23.44	−0.60	1.73**	−13.27**	0.41**	12.90	−13.40**	1.27**	−4.10
Central America										
Costa Rica	0.88**	−11.10**	3.35	1.22**	−8.15**	0.37**	12.30*	−4.78	1.04**	−2.29
El Salvador	0.69**	−1.79	−1.90	1.75**	−11.76**	0.37	7.14	−4.97	1.28**	−4.00
Guatemala	1.09**	−9.06	−4.85	1.21**	−3.70**	0.77**	3.84	6.96**	1.13**	−3.26
Honduras	0.53**	−0.01	2.08	1.71**	−11.00**	0.67**	29.30*	−13.08**	1.28**	−3.81
Mexico	1.14**	−11.08	3.77	2.64**	−26.90**	0.34*	4.40*	−1.70	1.35**	−6.53
Nicaragua	0.87** [3]	9.97** [3]	0.73 [3]	1.69** [3]		0.34**	17.20**	−12.31**	1.10**	
Panama	1.17**	−8.15	−9.96	1.91**	−11.73**	0.46**	13.70*	12.75	1.03**	−2.07
Caribbean Area										
Dominican Republic	0.62**	−1.36	0.36	0.59**	−3.69**	0.50**	3.40	−9.90**	0.92**	−1.30
Haiti	0.43**	−7.65	3.85**	2.14**	−14.60**	0.33**	1.04	−7.74**	1.09**	−2.80
Jamaica	0.28* [3]	−4.74 [3]	−6.43* [3]	1.58** [1]	5.87**	0.92*	−4.87	6.56*	1.25*	−3.14

Asia										
Indonesia	1.03**	−3.49	−3.26	1.81**	−18.44**	0.66**	4.98*	−6.83**	1.32**	−6.62
Korea	0.48**	−6.10**	4.93*	1.52**	−13.79**	0.31**	−2.59*	1.86**	1.23**	−4.80
Malaysia	1.40**	−27.40**	18.29	1.51**	−10.24**	1.02**	−10.07*	−15.12*	1.16**	−2.88
Philippines	0.33**	−2.01	−2.10	1.60**	−12.58**	0.32**	0.09	−1.61	1.20**	−3.80
Singapore	0.60**	−9.30**	25.41**	0.85**	−5.18**	0.67**	−1.39	−16.18**	1.04**	−1.75
Sri Lanka	0.73**	11.66	−10.02	1.04**	−6.25**	0.96**	12.10*	−33.71**	0.99**	−1.45
Thailand	0.20**	−4.37**	−0.38	1.24**	−8.74**	0.63**	−0.27	8.17**	1.02**	−2.15
Africa										
Ghana	1.13**	−16.33**	3.86**	1.50**	−9.80**	0.27*	15.85**	1.70	0.99**	−1.91
Kenya	1.33**	−12.75**	25.90**	1.36**	−9.19**	1.10**	−5.04	16.49*	1.16**	−3.04
Zambia	0.44	0.16	7.66	−0.12	0.97**	0.76**	−0.07	13.57	0.93**	−0.93

*Significant at 80 per cent level.
**Significant at 90 per cent level.
[1] Using the consumer price index deflator.
[2] Estimated from equations (9) and (10).
[3] Using the gross domestic product deflator.

Such results suggest that a country that moves to a higher inflation rate period will ultimately have a slightly lower expenditure adjustment coefficient than it did in the lower inflation rate period. However, the tendency toward a positive coefficient for Δi suggests that there will be an offsetting tendency for a more rapid expenditure adjustment during the period in which the inflation rate is accelerating. This pattern appears more common in the African and Asian countries than in the South American or Central American countries of the sample. Conversely, revenues tend to adjust somewhat more quickly in a period of higher inflation rates, but there is also a clear tendency for there to be a lag in adjustment during the period in which the inflation rate is increasing. In this sense, there is some tendency for the type of fiscal disequilibria that exists in the early phase of an inflationary process, as described by Aghevli and Khan, to be lessened as the inflation rate stabilizes at a higher level.

The pattern of convergence of ν and τ in a higher, steady-state inflation rate period is apparent if one examines the joint effect of the coefficients for α_0, α_1, β_0, and β_1 in the revenue and expenditure estimations. The value of $\alpha_0 + \alpha_1 i$ tends to move closer to the value of $\beta_0 + \beta_1 i$ at higher inflation levels. The implication of the results of the acceleration rate coefficients, α_2 and β_2, is the tendency for a lag in any such convergence. Positive values for α_2 and negative values for β_2 imply that the relative values of overall ν and τ do not converge while the increase in inflation is occurring, but, rather, that they converge only after the rate has begun to stabilize at a higher level.

These results are clearly not consistent with the general notion that there is an increase in the rate of adjustment of expenditure and a corresponding decrease in adjustment for revenues as the rate of inflation stabilizes at a higher level in a given country. It suggests that the fiscal policy pressures that emerge in a higher inflation rate world may lead to discretionary policies that counteract the tendencies generally assumed.

The above discussion effectively focuses on how the adjustment pattern of an individual country varies with the rate of inflation. Based on the cross-country experience embodied in Table 4, the question also remains as to whether countries that have experienced a higher mean inflation rate over the period tend to have higher expenditure or lower revenue adjustment coefficients than countries that have experienced a low inflation rate. What factors explain the considerable variation in the reve-

nue and expenditure parameters of Table 4? For expenditure, several types of explanatory variable are plausible, such as (a) the economic or functional structure of a country's expenditure basket, (b) the average rate of inflation experienced by the country during the period of observation, (c) the corresponding standard deviation in the rate of inflation experienced, and (d) the length of time over which fiscal behavior is measured. The higher the share of wages and salaries, the less rapid the adjustment; a lower mean rate of inflation would have a similar result. A high standard deviation for the quarterly inflation rate might be associated with a lower adjustment rate, in that it is less likely that fiscal decision makers would become fully adapted to a particular institutional response to inflation. The longer the period under observation, the lower the coefficient of adjustment, if only because one is likely to be incorporating the pre-1974 period with a significantly lower rate of inflation. For total revenue, it is plausible that the overall revenue adjustment parameter would be sensitive to the share in total tax revenues of particular tax categories, as well as to other variables reflecting the character of the economic environment.

These hypotheses were tested on a cross-sectional data base, where the adjustment parameters α_0, α_1, β_0, and β_1 estimated in Table 4 serve as the dependent variables. Measures of revenue and expenditure structures for the period 1975–78 are easily obtained from the Fund's *Government Finance Statistics Yearbook*. The results in Table 5 are illuminating. They clearly indicate that the basic adjustment parameter for expenditure, α_0, is higher in high inflation rate periods, with each percentage point increase in the quarterly inflation rate raising α_0 by 0.13 percentage point. The parameter is also lower for countries where the original sample period is long, for example, extending back into the late 1950s or early 1960s. It is not affected by the basic structure of expenditure in terms of object categories. The parameter α_1, reflecting the impact of the level of inflation on the rate of adjustment, is not affected by the rate of inflation but is, not surprisingly, reduced where there is a high standard deviation in the quarterly inflation rate. In other words, where there is considerable variability in the overall inflation rate, there is a smaller adjustment of total expenditure to changes in the overall inflation rate. The results also suggest that countries with a high fraction of capital to total expenditure are more likely to raise their expenditure adjustment coefficients in periods of high infla-

TABLE 5. DETERMINANTS OF TIME-SERIES ADJUSTMENT PARAMETERS ESTIMATED IN TABLE 4

Dependent Variable / Independent Variable	Base Parameter (α_0)	t Statistic	Adjustment Parameter Indicating Response of Expenditure to Rate of Inflation in Quarter (α_1)	t Statistic	Base Parameter (β_0)	t Statistic	Adjustment Parameter Indicating Response of Revenues to Rate of Inflation in Quarter (β_1)	t Statistic
Mean quarterly inflation rate over sample period	0.13	2.19	0.84	0.67	−0.01	−0.26	0.72	0.40
Standard deviation of quarterly inflation rate over sample period	−0.01	0.84	−5.70	−2.77	−0.09	−1.38	−2.02	−0.80
Number of years in sample	−0.04	−3.42	0.79	2.58	−0.01	−0.54	−0.09	0.21
Fraction of wages in total expenditure in 1977	0.01	0.85	−0.28	−1.47				
Fraction of other purchases of goods and services in total expenditure in 1977	0.01	0.84	−0.28	−1.37				
Fraction of capital expenditure in total expenditure in 1977			0.41	2.37				
Fraction of corporate income tax revenue in total tax revenue in 1977					0.04	1.12	−0.05	−0.41
Fraction of personal income tax revenue in total tax revenue in 1977					0.11	0.14	−0.28	−0.89
Fraction of international tax revenue in total tax revenue in 1977					0.16	0.39	0.13	0.85
Constant	0.94	1.79	0.95	0.08	0.83	3.20	7.78	0.81
R^2	0.60		0.71		0.26		0.13	
(N)	24		24		24		24	

Sources: Table 4; International Monetary Fund, *Government Finance Statistics Yearbook*, Vol. III (1979).

tion. The estimations do not readily explain cross-country variations in the revenue parameters β_0 and β_1. Surprisingly, these results do not indicate any sensitivity in the revenue adjustment parameter to the composition of the revenue.

Finally, the results in Table 6 clearly indicate that the rate of fiscal adjustment varies according to whether or not the change in the inflation rate was anticipated. They suggest that, in 90 per cent of the countries, expenditures adjust more rapidly than revenue in response to anticipated inflation. Equally striking, in 65 per cent of the countries the opposite adjustment pattern occurs with respect to unanticipated inflation, viz., that revenues adjust more rapidly than expenditure to unanticipated changes in prices. In fact, one startling result is that ν_2, the expenditure adjustment parameter of expenditure to unanticipated inflation, is often less than zero, suggesting that unanticipated inflation leads to a slower growth in expenditure than would have occurred if actual and expected price changes were equal. This may reflect an asymmetry in behavior. While the result appears implausible for cases of $P_t^a > P_t^e$, one can more easily imagine reasons for a negative adjustment parameter when $P_t^e > P_t^a$. In a specification as simple as equation (12), there could be many factors underlying a larger than anticipated growth in expenditure despite a lower than anticipated rate of inflation. If anything, these results suggest that the phenomenon under discussion is as much a policy outcome as the unintended consequences of inflation on revenue or expenditure performance.

TESTS OF BEHAVIOR OF ALTERNATIVE TYPES OF REVENUE AND EXPENDITURE

A principal deficiency in the above results and in those of earlier studies is their lack of specificity as to the components of revenue or expenditure that adjust more or less rapidly to inflation. The failure to do such analyses arises principally from lack of data. Time series on expenditure in particular are rarely long enough or in sufficiently comparable form to undertake a reasonable analysis. This section presents results on inflation adjustment parameters for specific categories of revenue and expenditure, using the basic Aghevli-Khan model for revenue and expenditure, respectively. A cross-sectional time-series estimation procedure has been used, where the fiscal base is drawn from Volume III of the Fund's *Government Finance Sta-*

TABLE 6. PARAMETERS REFLECTING ADJUSTMENT OF REVENUE AND EXPENDITURE TO ANTICIPATED AND UNANTICIPATED INFLATION IN SELECTED DEVELOPING COUNTRIES [1]

	Revenue Parameters				Expenditure Parameters			
	Adjustment parameters				Adjustment parameters			
	Anticipated inflation (τ_1)	Unanticipated inflation (τ_2)	t_0	Nominal income elasticity (t_1)	Anticipated inflation (ν_1)	Unanticipated inflation (ν_2)	g_0	Real income elasticity (g_1)
South America								
Brazil	0.69	2.50	−8.40	1.08	0.95	4.09	−8.56	1.12
Colombia	0.50	−0.41	−9.29	1.15	0.59	−1.26	−10.90	1.35
Peru	0.84	2.32	−5.80	0.95	0.86	−0.21	−11.50	1.41
Venezuela	0.19	2.14	−17.14	1.74	0.30	13.50	−9.00	1.25
Central America								
Costa Rica	0.55	0.58	−6.90	1.03	0.56	−1.07	−9.13	1.34
El Salvador	0.40	1.45	−9.60	1.27	0.93	−1.00	−12.10	1.81
Guatemala	0.82	−0.29	−8.65	1.15	0.87	0.44	−8.40	1.23
Honduras	0.80	0.41	−10.48	1.35	0.47	−0.84	−10.90	1.71
Mexico	0.30	0.28	−14.20	1.44	0.84	0.09	−30.30	2.92
Panama	0.75	1.30	−0.92	1.12	1.02	4.60	−11.40	1.86
Caribbean Area								
Dominican Republic	0.54	0.12	−4.81	0.86	0.60	1.72	−3.60	0.58
Haiti	0.24	0.05	−9.61	1.26	0.33	−0.60	−14.80	2.17
Jamaica	0.80	−0.50	−10.50	1.40	0.12	−0.38	−18.10	2.95
Asia								
Indonesia	0.64	1.20	−13.30	1.35	0.95	−0.12	−19.40	1.88
Korea	0.26	0.23	−20.60	1.40	0.40	0.03	−14.40	1.56
Malaysia	0.91	−0.55	−9.50	1.26	1.11	−10.67	−9.90	1.48
Philippines	0.30	0.08	−9.96	1.25	0.45	−1.41	−3.81	0.43
Singapore	0.84	−1.42	−5.08	0.93	0.83	−2.82	−5.20	0.87
Sri Lanka	0.85	0.51	−6.28	1.01	0.88	−4.08	−7.13	1.15
Thailand	0.39	1.01	−5.40	0.93	0.24	−0.46	−7.40	1.10
Africa								
Ghana	0.82	−3.75	−5.02	0.88	0.50	−1.23	−6.11	1.00
Kenya	1.09	2.33	−7.43	1.09	1.14	2.42	−11.00	1.57
Zambia	0.63	−0.08	−0.34	0.48	0.52	1.18	0.76	−0.08

[1] For the time period, see Table 3.

tistics Yearbook. This ensures maximum comparability in the definition of revenue and expenditure variables. Expenditure has been broken down on both a functional and an economic basis and revenue on an economic classification basis. [13] For any one country, four to eight observations are used over the period 1972–78. For any estimation, countries are grouped according to criteria described below, with from 7 to 15 countries in a group.

Countries have been grouped so as to classify them in a way that maximizes the intragroup homogeneity in behavior with respect to inflation. Two alternative groupings suggest themselves. First, the results in Table 3 suggest that countries can be ranked according to their relative speeds of expenditure and revenue adjustment to inflation. In these estimations, countries are grouped according to whether the ν parameter in the initial Aghevli-Khan model estimations are above or below 0.75. The underlying behavioral assumption is that countries that rapidly adjust expenditure to inflation will exhibit common patterns of adjustment with respect to specific components of expenditure. This may not be a valid assumption; countries that adjust rapidly to inflation may nevertheless differ sharply in the specific types of expenditure that exhibit this rapid adjustment behavior. If this were the case, the estimated coefficients would reflect averages of the different behavior patterns. [14] If one accepts the underlying assumption, the results will indicate how specific types of expenditure or revenue differ in their adjustment with respect to inflation.

A second grouping is according to the mean rate of inflation experienced by a country during the period under consideration. Three groups of countries have been distinguished: countries with mean inflation rates (a) below 10 per cent per annum, (b) from 10 to 20 per cent per annum, and (c) above 20 per cent per annum. Again, the underlying assumption is that specific types

[13] The estimation procedure used is a simple error-components model, where additive dummies are used to estimate country-specific intercept terms. The model was also estimated with multiplicative dummy terms in order to take account of possible country-specific variations in the specific adjustment parameters. However, the multiplicative dummies proved significant in only a few cases. The estimations reported in Table 6 relate only to the estimations with additive dummy terms.

[14] It is precisely for this reason that separate estimations were made with multiplicative dummy terms for country-specific variations in the adjustment parameter. As has been noted, there were only a few countries where such coefficients proved significant.

of expenditure or revenue will exhibit similar adjustment properties for countries experiencing common inflationary regimes.

EXPENDITURE

The results emerging from the groupings described above appear instructive on the complexity of the adjustment process (Table 7). Focusing on the contrast in behavior between the high-adjustment countries and the low-adjustment countries, it is comforting to note a basic tendency for the adjustment parameters of the specific expenditure categories of the high-adjustment countries to exceed those of the low-adjustment countries. On an economic classification basis, the principal exceptions relate to subsidies and net lending, which reveal lower adjustment parameters in the high-adjustment countries.

Several other aspects of the results can be noted. First, in both groups, the adjustment rate of purchases of other goods and services is clearly higher than that for wages; this is a result that occurs in both groupings of countries, bearing out the hypothesis in Section I. Equally interesting, as one moves from the low-adjustment to the high-adjustment countries, the increase in the adjustment parameter for other goods and services considerably exceeds the increase in the wage adjustment parameter. If anything, the latter type of expenditure tends to restrain the overall degree of fiscal adjustment to inflation. Second, certain other categories of expenditure appear to adjust rapidly to the impact of inflation, regardless of the overall level of adjustment in total expenditure. This relates primarily to interest payments, capital transfers, and net lending. Also, expenditure on wages and on the acquisition of fixed assets appears to adjust relatively slowly. Third, one should perhaps stress the obvious result that adjustment rates do, in fact, differ across expenditure categories. Fiscal decision makers, confronted by the impact of inflation, are forced to make decisions on which categories of expenditure to increase or decrease in real terms. This inevitably casts doubts on the usefulness of the aggregative expenditure model specification.

Classifying expenditure on a functional basis, it is apparent that high-adjustment countries generally have higher adjustment parameters for most functional expenditure types, compared with low-adjustment countries (with the principal exception being expenditure on social services and welfare). However,

TABLE 7. PATTERN OF EXPENDITURE ADJUSTMENT CLASSIFIED BY ECONOMIC AND FUNCTIONAL TYPE OF EXPENDITURE: SAMPLES STRATIFIED ACCORDING TO RELATIVE ADJUSTMENT RATE AND RATE OF INFLATION, 1972–78

	Sample of High-Adjustment Countries [1]		Sample of Low-Adjustment Countries [2]		Sample of Countries Experiencing Annual Inflation Rates					
					In excess of 20 per cent per annum [3]		From 10 to 20 per cent per annum [4]		Below 10 per cent per annum [5]	
	ν	g_1	ν	g_1	ν	g_1	ν	g_1	ν	g_1
Current expenditure	0.90	1.43	0.71	1.38	0.83	1.20	0.63	1.22	0.65	1.29
Goods and services	0.89	1.51	0.44	1.75	1.06	1.27	0.54	1.48	0.31	2.74
Wages	0.66	2.02	0.49	1.67	0.98	1.50	0.40	1.60	0.33	2.58
Other	1.20	0.86	0.72	1.84	1.13	1.12	0.76	1.48	0.44	1.95
Interest	1.03	1.20	0.72	2.83	1.00	2.24	0.57	2.21	0.18	5.60
Subsidies	0.77	0.47	0.96	1.42	0.68	0.94	0.68	0.68	0.92	1.10
Capital expenditure	0.94	2.88	0.80	2.11	0.98	2.56	0.69	0.68	0.69	3.47
Acquisition of fixed capital assets	0.55	2.45	0.45	0.48	1.12	2.60	0.41	1.76	0.63	2.98
Capital transfers	1.07	0.86	0.95	2.64	0.97	1.04	1.33	0.09	0.84	1.94
Total lending and repayments	0.92	1.48	1.17	1.68	0.93	3.20	1.04	2.50	1.28	0.83
Expenditure on										
General public services	0.64	1.55	0.56	1.98	1.06	1.01	0.33	2.82	0.62	2.25
Defense	0.97	2.27	0.74	2.24	1.12	1.65	0.54	2.90		
Education	0.69	0.86	0.64	1.78	1.09	1.52	0.31	2.22	0.70	1.60
Health	1.04	1.49	0.69	2.73	0.98	2.04	0.40	1.55	0.65	2.26
Social services and welfare	0.34	0.15	1.37	0.88	0.54	2.61	0.28	2.61	0.77	1.05
Housing and community amenities	1.12	−2.18	0.99	2.03	0.40	−1.00	0.86	2.76	0.87	
Other community services	1.03	0.78	0.50	0.94	0.44	0.47	0.66	0.88	0.21	2.19
Economic services	1.16	2.11	0.72	1.42	1.14	1.18	0.77	2.06	0.88	2.48

[1] Brazil, Costa Rica, El Salvador, Guatemala, Indonesia, Kenya, Malaysia, Peru, Singapore, and Uruguay.
[2] Dominican Republic, Ghana, Honduras, Korea, the Philippines, Thailand, Venezuela, and Zambia.
[3] Brazil, Indonesia, Israel, Korea, Peru, Turkey, and Uruguay.
[4] The Republic of China, Costa Rica, the Dominican Republic, El Salvador, Fiji, The Gambia, Guatemala, Kenya, Malawi, Mauritania, Morocco, Pakistan, the Philippines, Sudan, and Venezuela.
[5] Cyprus, Ethiopia, Honduras, Malaysia, Paraguay, Singapore, Thailand, Tunisia, and Zambia.

across functional expenditure types, it is apparent that some tend to adjust more slowly (this is particularly true for general public services and education); others tend to dominate in their relative speeds of adjustment, notably economic services, housing and community amenities, health, and defense.

Turning to the adjustment patterns of countries experiencing different inflation rates, certain trends in the parameters can be discerned. As one moves toward higher inflation rates, the rate of adjustment of wages, other purchases of goods and services, and interest payments clearly accelerates; conversely, the rate of adjustment for subsidies and total net lending declines. For capital transfers and the acquisition of fixed capital assets, one can only note that the rate of inflation experienced clearly matters in terms of the rate of adjustment, but there is no uniform relationship that is apparent. This suggests the character of the pressures placed on expenditure decisions in an inflationary situation and the types of public objective that are likely to suffer in terms of their relative share of expenditure. No obvious trends emerge in the results on expenditure classified on a functional basis.

REVENUE

With respect to revenue (Table 8), corporate income taxes appear to adjust to inflation more rapidly than taxes on personal income, regardless of the average rate of inflation. Second, the rate of adjustment of both individual and corporate income taxes appears to have a U-shaped relationship with respect to the rate of inflation. The adjustment parameter rises as the mean inflation rate rises from below 10 per cent to from 10 to 20 per cent. As the inflation rate rises above 20 per cent, the adjustment parameter falls. This suggests that, as inflation increases, the high elasticity of income taxes overwhelms the effect of collection lags, thus increasing the rate of adjustment of such taxes to inflation; however, once inflation exceeds a certain rate, the relationship reverses itself, leading to a fall in the rapidity of adjustment.

Third, when the inflation rate is below 20 per cent, the adjustment rate of income taxes to inflation appears to dominate that of domestic taxes on goods and services; above 20 per cent inflation, the opposite holds. This reflects the afore-mentioned movement in the income tax parameter and the steady increase in the

TABLE 8. PATTERN OF REVENUE ADJUSTMENT CLASSIFIED BY TYPE OF REVENUE: SAMPLES STRATIFIED ACCORDING TO RELATIVE ADJUSTMENT RATE AND RATE OF INFLATION, 1972–78

	Sample of Countries Experiencing Annual Inflation Rates					
	In excess of 20 per cent per annum		From 10 to 20 per cent per annum		Below 10 per cent per annum	
	τ	t_1	τ	t_1	τ	t_1
Total revenues	0.78	1.09	0.83	0.51	0.88	1.23
Tax revenues	0.71	1.13	0.84	1.04	0.87	1.06
Taxes on income and profits	0.49	0.94	0.85	1.20	0.60 [1]	1.41
Individual	0.46	0.89	0.72	1.49	0.28	1.42
Corporate	0.57	1.03	0.95	1.10	0.42	1.25
Social security contributions	...	...	...	...	0.55	1.56
Taxes on property	0.40 [1]	0.74	0.84 [1]	1.06	0.79 [1]	1.37
Immovable property (recurrent)	0.70	0.65	...	...	...	...
Estate, inheritance, and gift	0.67	0.91	0.61	0.76	...	...
Financial and capital transactions	0.63	0.91	...	...	0.05	4.74
Domestic taxes on goods and services	0.84	1.14	0.78	1.05	0.43	1.17
General, turnover, and value-added	0.80	1.37	0.95	1.24	0.74	1.35
Excises	0.99	1.00	0.31	0.83	0.52	0.92
Specific services	0.26	0.82	0.90	0.95	0.20	2.67
Taxes on international trade and transactions	0.87 [1]	0.95	0.72 [1]	1.19	1.00 [1]	1.20
Import duties	0.34	1.14	0.52	1.12	0.95	1.20
Customs duties	0.22	1.23	0.28	1.40	0.91	1.20
Export duties	0.37	−0.77	0.35	—	0.83	1.35
Nontax revenue	0.81	0.96	0.84	0.98	0.97	1.30
Grants	0.96	0.07	0.85	2.02	0.45	−0.80

[1] The adjustment parameters associated with a subaggregate of industrial taxes may not correspond to the weighted averages of the parameters of the component taxes, as indicated in the table. This problem arises because country samples or time periods for the particular estimations may differ.

adjustment parameter of domestic taxes on goods and services with respect to increases in the inflation rate. However, the latter pattern masks divergent intragroup movements. General sales taxes appear to have a uniformly high adjustment pattern, regardless of the inflation rate (although the adjustment seems to be highest for a 10 to 20 per cent inflation rate). Excise taxes reveal a relatively low adjustment rate for inflation rates under 20 per cent, rising sharply thereafter.

Fourth, the results on the adjustment of taxes on international trade transactions are ambiguous. Total tax revenues from international trade adjust rapidly, although there is a tendency for the adjustment rate to fall as the inflation rate increases. This pattern is also clear as one focuses on the component taxes of this grouping. The adjustment parameter for import duties falls from 0.95 to 0.34; that for export duties from 0.83 to 0.37. Thus, inflation clearly has a negative impact on the rate of adjustment of such taxes. What is unclear is why the aggregate adjustment parameter for such taxes is higher than the parameters for the principal constituent taxes in this grouping. Two plausible explanations exist. First, the sample of countries on which the parameters have been estimated are not the same for each of the tax groupings (reflecting the absence of export duties in some of the countries). Second, equations were not estimated for some of the minor taxes on international trade and transactions.

III. Conclusion

The empirical results of Section II can be briefly summarized. While the Aghevli-Khan hypothesis that public expenditure adjusts more rapidly than revenue in response to inflation appears valid for approximately 60 per cent of the countries in the sample, the opposite result holds for a significant minority of the countries. More important, the fiscal response to inflation for any given country varies according to the stage of the inflationary process. In the process of movement to a higher inflation rate, there appears to be an accelerated response of expenditure and a lagged response of revenue; once the inflation rate appears stabilized at a higher steady-state level, the expenditure and revenue adjustment coefficients tend to converge to a lower level than in the low inflation rate period. The results also suggest that expenditures adjust more rapidly than revenues to anticipated

inflation; the opposite result emerges with respect to unanticipated inflation.

Between countries, there is evidence that countries experiencing periods of high mean inflation rates have higher overall adjustment coefficients than countries in low mean inflation rate periods. Cross-sectional analysis also suggests considerable variability in the response to inflation of particular categories of revenue and expenditure. Public expenditure on goods and services tends to adjust more rapidly than expenditure on wages and salaries or public investment. Corporate income taxes tend to adjust more rapidly than personal income taxes. At high inflation rates, domestic sales tax revenues adjust more rapidly than income taxes, with the converse result at low inflation rates.

These results confirm the principal assertion that the impact of inflation on the net fiscal position of the public sector is not a priori predictable. The ultimate reaction of total government expenditure and revenue to a change in price level will be shaped by the discretionary response of budget decision makers, as constrained by a country's particular structure of revenue and expenditure. The character of the inflationary environment, past, present, and future, will also influence these budgetary decisions. In other words, while one can make inferences as to the inflation adjustment propensities that are likely to be inherent in a country with a particular fiscal structure, the ultimate response is by no means automatic or mechanistic. Government decision makers have considerable discretion in the way in which they respond to the pressures of inflation on the government budget. If inflation leads to a higher deficit, it is not wholly unplanned.

This paper has called attention to the difficult problems for budget planners created by an uncertain inflationary world. In formulating a budget, what is the expected inflation rate? Should the budget be based on the expected inflation rate, or, if there is considerable uncertainty, should it be set at a more conservative lower bound? What are the likely sources of inflation? In a world where inflation may derive from externally generated shocks that imply a fundamental decline in a country's terms of trade, the implications on expenditure and revenue may differ sharply from cases of domestically generated inflation. Furthermore, how should the decision maker adjust the budget when it

appears, early in the budget year, that the actual inflation rate will markedly exceed the original rate assumed in the budget? This may give rise to substantive problems of overall fiscal policy, real resource allocation, and practical institutional problems of budget authorization and execution. Much more work is clearly needed to help the beleaguered budgetary decision maker cope with the implications of an uncertain inflationary environment.

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