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Collection Lags, Fiscal Revenue and Inflationary Financing: Empirical Evidence and Analysis

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Abstract

The paper provides empirical evidence on collection lags in major categories of government revenue and analyzes the estimated revenue-eroding effects of inflation within the standard model of inflationary finance. The evidence indicates a wide variation in collection lags among the categories of revenues. The estimated erosion of real fiscal revenue, although varied in the sample countries, appears to have substantially offset gains from the inflation tax, thereby severely restricting the use of this form of taxation in generating resources.

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Contents

Summary

This paper provides empirical evidence on collection lags among major categories of fiscal revenue and analyzes the revenue-eroding effects of inflation within the standard model of inflationary finance. The evidence shows wide variation in collection lags among the major categories of tax and nontax revenues. The most important collection lags are those arising from income, domestic goods and services, and imports, as well as that on the transfer of surpluses from public enterprises. Collection lags are particularly long for minor taxes.

The estimated revenue-eroding effects of inflation also varied widely among a sample of 18 developing countries. The erosion of fiscal revenue appeared to have substantially offset the gain from the inflation tax. Also, with a delay between accruals and payments of taxes generally exceeding six months in a number of countries, fiscal erosion more than offset the resources generated by the inflation tax, thereby resulting in a fall in net real revenue. These results suggest that the scope for use of inflation finance was severely limited by the harmful effects on fiscal revenues.

The results have important implications for fiscal policy and tax reform. A government that chooses the inflation tax option must take into account the possible effect of fiscal revenue erosion on the budget deficit. Otherwise, difficulties in achieving price stabilization objectives are likely to be seriously compounded. These considerations strengthen the case for the adoption of a fiscal policy that relies on increased fiscal revenue to finance any expansion in government expenditure. In this context, efforts at tax reform should concentrate on improving tax administration, which, through eliminating or reducing collection lags, can permanently raise the level of fiscal revenue and strengthen government finance.

I. Introduction

Recent empirical evidence on the effects of inflation on real fiscal revenue highlights two important consequences for developed countries of lags in the collection of taxes on government finance. 1/ First, when there are collection lags in the tax system, an increase in inflation reduces real fiscal revenue. Second, the possible widening of the fiscal deficit may lead to increased use of the inflation tax, which compounds the problem since it involves a further loss in revenues from other taxes. On both counts, because of collection lags, the adverse effects of inflation on real fiscal revenue weaken government finances.

The existence of collection lags implies that the budget is permanently falling short of real revenue regardless of the source of inflation. The reduction in real revenue varies directly with the rate of inflation and the delay between the accrual and payment of taxes. Elimination or reduction of either the rate of inflation or the collection lag will eliminate or reduce the fall in real revenue. One way of stopping such leakage from the budget is to eliminate or substantially reduce collection lags, thereby permanently raising the level of revenue.

The "average" collection lag in a tax system is the mean lapse of time between the occurrence of taxable events and the corresponding payment of tax liabilities by taxpayers. Since a revenue system (including nontax revenue) comprises numerous categories of taxes, with different rates, bases, exemptions and regulations and collection procedures, each revenue item has its own collection lag. As such, information on tax-specific collection lags is important to the design and implementation of a tax administration which eliminates or reduces the average collection lag.

This paper has two objectives. First, to provide empirical evidence on collection lags by major category of tax revenues; evidence is obtained from annual data for a sample of 18 developing countries. 2/ The second objective is to estimate the inflation-induced fall in real fiscal revenue, and to take it into account in analyzing resources generated by the inflation tax (henceforth, inflation revenue) in each of the sample countries. The analysis is carried out with a standard model of inflationary finance in order to shed light on the net effectiveness of inflation revenue in generating resources. Section II discusses the specification of collection lags and an analytical framework for estimating

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1/ The insight on collection lags and its importance for developing countries was developed by Tanzi (1977). The analysis has been further elaborated by others, including Tanzi (1978), and most recently by Choudhry (1990), who analyzes and provides empirical evidence on the revenue-eroding effects of inflation for a large number of developing countries.

2/ The countries included in the sample are shown in Appendix Table 2.

both the erosion of real fiscal revenue by inflation and real net revenue from inflation at the revenue-maximizing inflation rate. Section III provides empirical evidence and analyzes the results. The implications of the empirical analysis are contained in the final section.

II. Analytical Framework

This section discusses the specification of collection lags in fiscal revenue functions. The final part of the section incorporates the erosion of real fiscal revenue in the standard model of inflationary finance in order to analyze real net revenue from inflation at the revenue-maximizing inflation rate. 1/

1. Collection lags

Assuming that real fiscal revenues depend on real income, lags in the collection of taxes can be represented by delays between the accrual and payment of taxes.

Let:

$R_i(0)$	=	the ith category of (accrued) revenue at the price level, $P(0) = 1.0$ at time $t = 0$;
$R(0)$	=	$\Sigma R_i(0)$, the real total (accrued) revenue;
n_i	=	the delay in months in the collection of ith category of tax revenue;
π	=	the annual inflation rate.

The real ith category of tax revenue collected can be written as: 2/

$$R_i(\pi) = \frac{R_i(0)}{(1 + \pi/12)^{n_i}} = R_i(0)e^{-\beta_i \pi} , \tag{1}$$

where $\beta_i = n/12$ is the lag in collection expressed in years. The real total tax revenue collected is given by:

$$R(\pi) = \Sigma R_i(\pi). \tag{2}$$

1/ See Choudhry (1990).

2/ The expression $e^{-\beta_i \pi}$ is obtained by taking the limit as π tends toward zero.

As in RHS of (1), we can express real total revenue as:

$$R(\pi) = R(0)\ e^{-\beta\pi}\ . \tag{2a}$$

The coefficient β is the average lag in collection of taxes; it is given by: 1/

$$\beta = \Sigma\ w_i\beta_i\ , \tag{3}$$

where w_i is the share of the ith category of tax revenue. Since the shares can increase, decrease, or remain stable with increases in inflation, the average lag in tax collection may vary with inflation. However, if the shares are generally stable, β can be treated as a constant. 2/

2. Revenue effects of inflation

The revenue effects of inflation involve both the erosion of real fiscal revenue by inflation and the real revenue available through financing the deficit by money creation.

For any given rate of inflation, the erosion of real fiscal revenue is given by $\delta(\pi)$:

$$\delta(\pi) = R(\pi) - R(0) = R(\pi)\ (1 - e^{\beta\pi}) \tag{4}$$

The erosion of real fiscal revenue is greater the larger is the value of the product $\beta.\pi$ and the higher the real tax ratio $R(\pi)$. Thus, even at a moderately low rate of inflation, if the average collection lag or the real tax ratio or both are relatively large, the erosion of real fiscal revenue can be quite substantial. If the real value of government spending is maintained, the erosion of real fiscal revenue generates an equal, unintended contribution to the fiscal deficit.

1/ Equation (3) is obtained by equating the derivatives of equations (2) and (2a).

2/ If w_i's vary with inflation, then the derivative of equation (3) yields

$$\frac{d\beta}{d\pi} = \beta^2 - \Sigma\ w_i\beta_i^2$$

the change in β is expected to be of second order magnitude.

Deficit financing by money creation is defined as an increase in net claims on government by the central bank, which is generally the principal determinant of the monetary base (M). For simplicity, it is assumed that the monetary base or the stock of high-powered money is given by outstanding net claims on government by the central bank. 1/ Accordingly, real inflation revenue generated by the inflation tax in the interval (t, t-1), Δm, is:

$$\Delta m = m_t - m_{t-1}, \tag{5}$$

where $m_t = \dfrac{M_t}{P_{t-1}\,(1+\pi)}$ = real monetary base (i.e., real net claim on government by the central bank).

Real total revenue from taxation and inflation, $TR(\pi)$, is defined as:

$$TR(\pi) = R(\pi) + \Delta m. \tag{6}$$

Equation (6) can also be expressed in terms of R(0) from equation (4) as:

$$TR(\pi) = R(0) + \delta(\pi) + \Delta m. \tag{7}$$

Taking into account the erosion of real fiscal revenue, real net inflation revenue, $v(\pi)$, can be defined as:

$$v(\pi) = \delta(\pi) + \Delta m\ . \tag{8}$$

As seen, it is possible that real total revenue can be less than real fiscal revenue, R(0), if the erosion of real fiscal revenue more than offsets real inflation revenue.

The erosion of real fiscal revenue can also be incorporated within the standard model of inflationary finance, in which real inflation revenue, $f(\pi^e)$ is:

$$f(\pi^e) = \mu m(\pi^e) = \mu m(0)e^{-\alpha\pi^e}, \tag{9}$$

where:

μ = rate of growth of the real monetary base,
π^e = the expected rate of inflation,

1/ This assumption is only for expositional purposes.

$m(\pi^e)$ = the real monetary base ratio when all adjustments associated with price expectations have been made,

$m(0)$ = the real monetary base (henceforth, real balance ratio) when the rate of inflation is zero.

Assuming that the expected rate of inflation is equal to the actual rate of inflation, we may rewrite real total revenue from taxation and inflation in equation (6) as:

$$TR(\pi) = R(\pi) + \Delta m = R(\pi) + f(\pi). \tag{10}$$

In a steady state, the rate of inflation is equal to the rate of growth of the real monetary base (abstracting from the rate of population growth). Hence, the maximum amount of real total revenue is given by the inflation rate, π^*, where: 1/

$$\pi^* = \frac{1}{\alpha + \dfrac{\beta R(\pi^*)}{f(\pi^*)}} \tag{11}$$

Equation (10) shows that the revenue maximizing inflation rate is not only determined from real balance holdings (i.e. net claims on government by central banks), but also from the level of real fiscal revenue and the extent of fiscal erosion. Specifically, the higher the initial ratio of real fiscal revenue to real balance holdings, the lower would be the revenue maximizing rate. Also, the higher the coefficients of collection lag (β) and expected inflation (α), the lower is the value of π^*. Based on a configuration of these values, it is possible that the revenue-maximizing rate can be nonpositive. In such a case there is no scope for inflationary financing, as fiscal erosion more than offsets gains from the inflation tax.

The revenue-maximizing rate can be useful in either an assessment or design of the extent of inflationary financing. At this rate, real net inflation revenue $\nu(\pi^*) = \delta(\pi^*) + f(\pi^*)$ must be positive or at least, non-negative. Otherwise, the use of the inflation tax reduces real total revenue below what it would have been in the absence of inflation, i.e., $TR(\pi)$ would be less than $R(0)$. Hence, for a given inflation rate, whether actual or targeted, and if π is greater than π^*, then $\upsilon(\pi)$ is negative and the real total revenue is less than real fiscal revenue, $R(0)$, implying that the loss in other revenue more than offsets the gain from the inflation revenue. As such, the extent of inflationary financing should be reduced to a level which makes $\nu(\pi)$ non-negative; inflation cannot exceed the revenue-

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1/ Ibid., pp. 3-6, for a discussion of the revenue-maximizing inflation rate in the context of collection lags.

maximizing rate. The extent of reduction in inflationary financing is greater when domestic inflation is also influenced by external or internal factors.

III. Empirical Evidence and Analysis

This section provides empirical evidence on collection lags by major category of taxes, and analyzes the estimated effects of the erosion of real fiscal revenue by inflation and real net inflation revenue for the sample countries. The estimates of collection lags and revenue effects were obtained by econometric techniques, while the revenue-maximizing inflation rates were simulated by using the result of a study on the demand for money by Khan (1980).

1. Estimation of collection lags

Empirical evidence on collection lags for major categories of fiscal revenues was obtained by estimating a variant of equation (1) using pooled time-series cross-section data for a sample of 18 developing countries. 1/ Allowances were made for cross-country differences in the constant term by adding 17 dummy variables to the right hand side of the equation. However, it was assumed that the buoyancy of real revenue for each category of taxes with respect to real income and tax-specific collection lags was the same across countries. 2/ The choice of country was dictated by data availability. Wide variation in the rates of real income growth, fiscal revenue ratios, and inflation was found among the countries. For instance, the fiscal revenue ratios ranged from 9 percent to about 53 percent, while annual inflation averaged as low as 5 percent to as high as 48 percent.

The exact form of the equation used to estimate each major category of fiscal revenue was: 3/

1/ Annual data covering country-specific intervals in the period 1970-1988 were obtained for the following countries listed according to regions: in Central America, Costa Rica, Guatemala; in Asia, Bangladesh, Myanmar, India, Pakistan, Philippines, Singapore, and Sri Lanka; in Africa, Botswana, Ethiopia, Ghana, and Zaire; in the Middle East, Egypt, Iran, Jordan, Syrian Arab Republic, and Yemen Arab Republic. All data used in this study were taken from the International Monetary Fund's data bases, Government Finance Statistics and International Financial Statistics.

2/ Nontax revenue, which comprises profit transfers, rent and income from various government undertakings, is included in fiscal revenue in line with the classification in Government Finance Statistics.

3/ The constant and the aforementioned 17 dummies are omitted from this presentation and that of the estimated revenue equations in Appendix Table 1, as they indicate country-specific differences in the level of revenue in the pooled regression.

$$\log R_{it} = \gamma_i \log y_t - \beta_i \Delta \log CPI_t + u_{it} , \qquad (12)$$

where: R_i = the ith category of fiscal revenue divided by the gross domestic product deflator.

y = real gross domestic product, and

$\Delta \log CPI$ = annual rate of change in the consumer price index (1985 = 1.0) 1/

Equation (12) was estimated by pooling the country-specific data over the period 1970-1988. Given constant real income and the assumption that the buoyancy of real government revenue to changes in real income is unity, equation (12) becomes equivalent to equation (2a). The estimated equations are listed in Appendix Table 1. The estimated equation for real current revenue (R) is reproduced below:

$$\log R_t = \underset{(17.37)}{1.113} \log y_t - \underset{(-5.90)}{0.545} \pi_t \qquad (12a)$$

$$R^2 = 0.972$$

As expected, empirical evidence strongly supports the existence and importance of collection lags. The value of 0.55 for the parameter β translates to an average collection lag of six and a half months. 2/ This size of average lag for a given level of real income, suggests that a 3 percentage point increase in the inflation rate can reduce real fiscal revenue by about 1.5 percent. However, the country-specific values of β show wide variation (Appendix Table 2), ranging from 0.3 to 0.7. These results indicated an average collection lag varying from 3.6 months to 8.4 months in a majority of the sample countries, reflecting considerable differences in the structures of taxation, production, and the pattern of demand. The values of β on either side of the above spectrum were found in a few countries--those which generally suffered from either a reduction or

1/ For Yemen Arab Republic, the CPI was based on 1980 = 1.0 because of nonavailability of data beyond 1984.

2/ In Choudhry (1990), the average collection lag was estimated at four months. This is probably because the earlier study had some high inflation countries where indexation was the dominant form of changes in taxation.

slack in domestic production and/or demand for traditional exports, or else the countries had benefitted from sharp increases in oil revenues. 1/

Information on the size of collection lags in major and subcategories of fiscal revenues is provided in Table 1. The distribution of the size of collection lags is revealing. The average collection lag of current revenue is closer to that of tax revenue than to that of nontax revenue, generally accounting for about 80 percent of current revenue. The size of collection lags of the four major categories of tax revenue varies widely. However, in individual income tax, excises and import duties, the lag is around 7-8 months. The size of the lag in excises and import duties, which in developing countries are among the most important sources of revenue, is unexpectedly large since these taxes are paid at the time of delivery or on release of goods from factory premises or from customs warehouses. A possible reason could be that the bases of these taxes did not keep pace with inflation so that what appears to be a lag in collection essentially reflects erosion of the tax base. 2/ Taxes grouped under "other" in each of the major categories appear to exert relatively less influence on the size of the lags of respective major categories, indicating the small share of "other" in revenues. The size of collection lags of nontax revenue from public enterprises is surprisingly large. It is possible that public enterprises have a tendency to delay profit transfers or that their surpluses do not keep pace with inflation possibly because of pricing and investment policies.

2. Estimation of the revenue effects of inflation

The revenue effects of inflation for the sample countries are provided in Table 2. These effects are estimated by using country-specific values of the parameter β, average inflation rates and real fiscal revenue ratios in equation (4). 3/ Real net inflation revenue is determined by netting

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1/ Although the focus is not on the buoyancy of government revenue, the estimated value of the parameter $\gamma = 1.113$, is in line with evidence for developing countries. When the tax system is progressive or discretionary measures are taken to bolster revenue, and buoyancy is likely to be higher than unity. Like the parameter β, the country-specific values of γ show wide variation, indicating differences in tax structures and the type and frequency of discretionary tax measures taken by the countries.

2/ Excises are levied on quantity or volume while the valuation basis for import taxes is cost and freight, quoted in foreign currency at the time of shipment. As such, these tax bases may not keep pace with interim inflation and/or exchange rate depreciation. In contrast, "other" taxes from international trade and transactions, comprised of taxes on exports and exchange profits, show negative collection lags because exchange rate depreciation increases the bases for such taxes.

3/ Since the real fiscal revenue ratio, $R(\pi)$, is an average over the sample period, the estimated revenue erosion by inflation takes into account automatic and discretionary revenue effects.

Table 1. Estimated Distribution of Collection Lags
By Major Revenue Categories, 1970-88 1/

(In months)

	Collection Lag
Current revenue	6.5
Tax revenue	6.0
Taxes on income, profits and capital gains	6.3
Individual	(7.2)
Other	(13.7) 2/
Domestic taxes on goods and services	9.9
General sales, turnover or value added	(5.4)
Excises	(8.3)
Other	(17.7)
Taxes on international trade and transactions	4.0
Import duties	(8.0)
Other	(-5.0) 3/
Other taxes on goods and services	3.9
Nontax revenue	11.7
Nonfinancial public enterprises and financial public institutions	(11.6)
Other	(18.2)

1/ Computed from the coefficient of inflation in the revenue equations as provided in Appendix Table 1.

2/ Estimated on fewer than 19 annual observations, because the breakdown of taxes on income, profits, and capital gains, were uneven among the sample countries.

3/ Negative means lead time, reflecting gains in real revenue as inflation raises the tax base.

fiscal revenue erosion from the average actual central bank financing ratio as shown in equation (6).

Several interesting points emerge from the information in Table 2. First, the revenue-eroding effects of inflation varied widely among the sample countries. Second, the erosion of real fiscal revenue as a proportion of real income was 1 percent or more in almost two thirds of the sample countries. It was as high as 10-11 percent of real income in some countries where two or all three of the revenue-eroding factors--collection lag, inflation rate and the real fiscal revenue ratio--were high. Third, real inflation revenue, as measured by the real amount of central bank financing, was positive in two thirds of the countries, ranging from an average annual rate of 0.2 percent of real income to about 2-2.5 percent. Fourth, real inflation revenue was negative in five countries and zero in one, indicating that governments improved or maintained their net liability position with the central bank. Fifth, real net inflation revenue was positive in some countries and negative in others, indicating that fiscal erosion more than offset the gain from central bank financing. Finally, in a few instances where real net inflation revenue was positive, it was less than or equal to 0.6 percent of real income.

The simulated revenue-maximizing inflation rates were obtained as solutions of equation (10) using the estimated country-specific values of the parameter β and the ratios of fiscal revenue and net claims on government by central banks (m). A value of 2 for the coefficient of expected inflation (α) was taken, as mentioned earlier from Khan (1980, Table 4, p. 273), who found this value to be representative in the sample countries chosen in his study. 1/ Country-specific solutions yielding a

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1/ A value of 2 for the coefficient of expected inflation, indicating that an increase in expected inflation reduces the stock of real money balances, may be roughly compared with one that is derived from changes in the velocity of money (v). To see this, consider a linear velocity equation:

$$v = y/m(\pi) = v_o + v_1\pi ,$$

where $v_o = y/m(0)$ can be regarded as the initial velocity when inflation is zero. Then taking the limit as π tends to zero, we obtain:

$$m(\pi) = m(0)\ e^{-(v_1/v_o)\pi}$$

so that $\alpha = v_1/v_o$.

The velocity equation was estimated using the pooled cross-section annual data for the 18 sample countries covering the same intervals of the 1970-88 period. The estimated equation was:

(continued...)

negative revenue-maximizing inflation rate were inadmissible. As such, negative solution values are regarded as zero. The latter along with positive solution values of revenue-maximizing rates, are reported in Table 2.

A comparison of actual inflation and simulated revenue-maximizing rates and real net inflation revenue bring out the critical influence of fiscal erosion on the scope of inflationary financing. The results of this comparison are summarized in Table 3. In those instances where actual inflation was less than the simulated revenue-maximizing rates, real net inflation revenue was positive, in line with theory. This indicates that inflationary financing, although limited by fiscal erosion, generated resources. 1/ In a majority of instances, however, actual inflation was found to be greater than the simulated revenue-maximizing rates. In all such instances, real net inflation revenue was negative, including those instances where real net inflation revenue was reinforced by negative central bank financing. The latter is of interest as it shows that inflation can persist even without using the inflation tax.

The above analysis suggests that real net inflation revenue was more often than not negative and that inflation persisted even in countries that did not generally resort to inflationary financing. On both counts, the harmful effects of fiscal erosion severely limited the scope of inflationary financing in many of the sample countries. Moreover, in countries where the simulated revenue-maximizing rate is nonpositive, the scope of inflationary financing appears to have been nonexistent.

IV. Conclusion

This paper has provided empirical evidence on collection lags in major categories of fiscal revenue and analyzed the revenue effects of inflation. Except for Tanzi (1977), information on the major sources of collection lags are nonexistent in the literature. Evidence shows wide variation in the size of collection lags in the different categories of revenues. Taxes on

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1/ (...continued)

$$v = \underset{(23.14)}{2.823} + \underset{(5.13)}{3.315}\,\pi .$$

$$R^2 = 0.10; \quad SEE = 1.38 .$$

These coefficients yield a value of 1.2 for the coefficient of expected inflation. As Khan's study employed a more elaborate model of monetary adjustments to expected inflation, a value of 2 for the coefficient of inflation is considered appropriate.

1/ In view of the moderately high rate of inflation and the small size of real inflation revenue, a question may arise about whether inflationary financing was not inappropriate altogether in a number of these countries.

Table 2. Estimated Revenue Effects of Inflation, 1970-88

	Average collection lag parameter β	Average inflation rate (π)	Fiscal revenue ratio $R(\pi)$	Ratio of net claims on government by central banks m	Fiscal revenue erosion $\delta(\pi)$	Actual average central bank financing Δm	Net inflation revenue $\upsilon(\pi)$	Revenue maximizing inflation rate 1/
Costa Rica	0.142	20.0	17.0	4.9	-0.5	0.2	-0.3	16.0
Guatemala	0.084	12.0	9.2	4.9	-0.1	0.2	0.1	34.4
Bangladesh	0.782	13.2	9.8	4.4	-1.1	-0.2	-1.3	0.0
Myanmar	1.174	9.1	14.6	1.0	-1.7	-2.5	-4.2	0.0
India	0.502	7.0	12.7	12.5	-0.5	1.1	0.6	16.3
Pakistan	0.285	9.9	15.0	12.7	-0.4	0.7	0.3	23.9
Philippines	0.582	14.8	13.3	3.2	-1.2	-0.2	-1.4	0.0
Singapore	0.571	5.0	26.3	* 2/	-0.8	-0.3	-1.1	* 3/
Sri Lanka	0.309	10.5	18.7	15.1	-0.6	1.2	0.6	21.5
Botswana	1.762	11.1	52.7	* 2/	-11.4	-9.7	-21.1	* 3/
Ethiopia	0.883	8.3	22.1	11.3	-1.7	0.9	-0.8	0.0
Ghana	0.609	47.6	14.4	18.6	-4.8	0.0	-4.8	12.6
Zaire	0.843	47.7	22.4	20.7	-11.1	1.5	-9.6	0.0
Egypt	0.019	15.0	41.3	43.3	-0.1	2.2	2.1	47.7
Islamic Republic of Iran	0.613	14.0	28.3	5.1	-2.5	1.1	-1.4	0.0
Jordan	0.814	7.4	21.6	8.9	-1.3	1.3	0.0	0.0
Syrian Arab Republic	1.652	16.7	31.2	34.6	-9.9	2.1	-7.8	0.0
Yemen Arab Republic	0.456	13.2	20.1	26.8	-1.2	9.8	8.6	23.8

1/ Estimated by solving equation (10), in which the value of $\alpha = 2.0$ was from Khan (1980) and the values of β, π, $R(\pi)$, and m are those shown in columns 1-4.
2/ These instance reflect negative net claims on government by central bank.
3/ Solution not possible because of negative net claims on government by central bank.

Table 3. Comparison of Actual Inflation and Simulated Revenue-Maximizing Rates and Real Net Inflation Revenue

(Number of countries)

	Actual Inflation Less Than Simulated Revenue Maximizing Rates	Actual Inflation Greater Than Simulated Revenue Maximizing Rates	Total Number of Countries
Real net inflation revenue (positive)	6	0	6
Real net inflation revenue (negative)	0	10 1/	10
Total number of countries	6	10	16

Source: Based on Table 2.

1/ For five of these cases, central bank financing was negative and in a sixth, real net inflation revenue was close to zero.

income, domestic goods and services and imports as well as transfers from public enterprises exhibited long collection lags.

The estimated revenue effects of inflation provide insight into the harm that can be caused by collection lags. The erosion of real fiscal revenue was found to be significant. In countries where collection lags generally exceeded six months, the resources acquired by means of inflationary financing appeared to have been substantially offset by the erosion in real fiscal revenue. The persistence of inflation, even in countries that did not resort to inflationary financing methods, appeared to have caused substantial fiscal erosion. Indeed, taking into account the fiscal erosion, real gains from the inflation tax were negative in many countries. These results indicate that the scope of inflationary financing was severely curtailed by the harmful revenue effects of collection lags.

The above results have important implications for fiscal policy and tax reform. A government intending to resort to deficit financing by money creation must take into account the possible effect of fiscal erosion on the fiscal deficit. This is of particular significance when domestic rigidities or external factors contribute importantly to inflation. In general, the use of the inflation tax can seriously threaten the price stabilization objectives of fiscal policy. These considerations strengthen the case for tax reform in the adoption of a fiscal adjustment policy. Identification of the major sources of collection lags can be of much help in the design and implementation of tax reform, which through an improvement in legal codes, regulation and administration of taxes, can substantially reduce collection lags. Such a reduction can permanently raise the level of taxation, thereby strengthening government finances to accommodate an expansion in government expenditure, rather than to rely on generating revenue through inflation.

Appendix Table 1. Pooled Estimates of Categories of Real Revenue Equations for 18 Selected Countries, 1970-88

	Coefficients of:		R^2	SEE
	Real income	Inflation		
Current revenue	1.113	-0.545	0.972	0.161
	(17.37)	(-5.50)		
Tax revenue	1.052	-0.498	0.975	0.153
	(17.43)	(-5.65)		
Taxes on income, profits and capital gains			0.938	0.254
	1.375	-0.528		
Individual income	(13.72)	(-3.59)	0.931	0.270
	0.765	-0.604		
	(4.50)	(-3.84)		
Other 1/	2.013	-1.139	0.874	0.360
	(6.97)	(-3.00)		
Domestic taxes on goods and services	1.082	-0.828	0.978	0.174
	(15.90)	(-7.98)		
General sales, turnover or value added taxes	1.379	-0.446	0.691	0.388
	(5.15)	(-1.93)		
Exercises	0.549	-0.688	0.937	0.270
	(4.08)	(-4.43)		
Other	0.654	-1.474	0.865	0.484
	(3.40)	(-4.93)		
Taxes on international trade and transactions	0.640	-0.336	0.933	0.274
	(6.02)	(-2.05)		
Import duties	1.000	-0.666	0.932	0.250
	(10.20)	(-4.56)		
Other	-1.475	0.414	0.805	0.831
	(-3.97)	(0.77)		
Other taxes	1.388	-0.327	0.889	0.483
	(6.15)	(-0.81)		
Nontax revenue	1.535	-0.973	0.917	0.314
	(12.45)	(-5.29)		
Nonfinancial public enterprises and other financial institutions	1.533	-0.966	0.829	0.776
	(5.25)	(-1.73)		
Other	1.462	-1.520	0.899	0.360
	(10.39)	(-6.12)		

Note: In the estimated equations t-values are reported in parentheses; R^2 and SEE, respectively, are the coefficient of determination and the standard error of estimated equations.

1/ Estimated on fewer annual observations as a breakdown of taxes on income, profits and capital gains were unavailable for many countries in the sample.

Appendix Table 2. Estimates of Real Current Revenue Equations for 18 Selected Countries

Countries	Period	Constant	Coefficient of: Real income	Coefficient of: Inflation	R^2	SEE	D-W
Costa Rica	1972-86	-15.404 (-2.55)	2.131 (4.31)	-0.142 (-0.94)	0.843	0.066	1.635
Guatemala	1972-87	-5.473 (-2.64)	1.334 (5.93)	-0.084 (0.189)	0.731	0.123	1.255
Bangladesh	1973-88	1.890 (-0.58)	0.973 (3.84)	-0.782 (-1.74)	0.771	0.156	0.871
Myanmar	1973-87	-1.627 (0.231)	0.976 (1.504)	-1.174 (-3.30)	0.572	0.099	1.676
India	1974-88	-7.448 (-7.11)	1.370 (19.10)	-0.502 (-2.19)	0.969	0.058	1.460
Pakistan	1973-86	-7.173 (-7.30)	1.414 (18.72)	-0.285 (-0.94)	0.986	0.042	1.909
Philippines	1972-87	4.888 (1.88)	0.486 (2.48)	-0.582 (-3.00)	0.591	0.076	1.570
Singapore	1970-87	-4.036 (-4.52)	1.264 (14.55)	-0.571 (-2.52)	0.946	0.055	1.825
Sri Lanka	1970-87	-5.409 (-1.14)	1.312 (3.28)	0.309 (0.46)	0.487	0.146	1.341
Botswana	1975-87	-5.039 (-6.94)	1.637 (18.50)	-1.762 (-1.01)	0.980	0.114	1.358
Ethiopia	1972-87	1.997 (0.50)	0.637 (1.49)	-0.883 (-5.23)	0.712	0.059	1.732
Ghana	1972-88	6.100 (0.38)	0.361 (0.29)	-0.609 (-2.17)	0.699	0.298	1.15
Zaire	1971-87	-14.175 1/ (-0.80)	2.104 (1.49)	-0.8429 (-2.87)	0.764	0.230	1.650
Egypt	1975-88	8.719 (1.41)	0.065 (0.11)	-0.019 (-0.002)	0.669	0.123	1.654
Iran	1970-86	-13.414 (-1.14)	1.725 (2.45)	-0.613 (-0.55)	0.832	0.284	1.245
Jordan	1974-87	-0.630 (-0.72)	0.884 (7.79)	-0.814 (-1.11)	0.969	0.067	1.708
Syrian Arab Republic	1972-83	2.146 (0.52)	0.725 (1.90)	-1.652 (-2.49)	0.432	0.218	2.00
Yemen Arab Republic	1974-84	-12.257 (-1.76)	2.134 (2.91)	-0.456 (-0.54)	0.815	0.178	1.415

Note: In the estimated equations t-values are reported in parentheses; R^2, SEE, and D-W are respectively, the coefficient of determination, the standard error of the estimated equation, and the Denbair-Watson statistic.

1/ Owing to large discretionary tax measures, a dummy variable was used for the period 1976-83. The coefficient of the dummy was -0.464 with a t-value of -3.10.

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