The Pakistan Development Review
Vol. XXVI, No. 2 (Summer 1987)

Impact of Inflation on Fiscal Deficits in the Bangladesh Economy

MD. AKHTAR HOSSAIN*

This paper investigates the two-way relationship between fiscal deficits and inflation in Bangladesh's economy. A dynamic model containing inflation and equations concerning government revenue and development expenditures has been constructed and estimated, using quarterly data over the 1974(II)–1983(II) period. Estimates of adjustment parameters support the basic hypothesis that in Bangladesh government expenditures adjust themselves to inflation more rapidly than government revenues and increase the size of fiscal deficits during inflation. An implication of this result is that inflation-induced fiscal deficits (if financed by money creation) may generate a self-sustaining inflationary process in a developing country like Bangladesh.

1. INTRODUCTION

In the inflation literature on developing countries, fiscal deficit is considered one of the major determinants of inflation. A causal link between fiscal deficit and inflation presupposes, first, that a lack of well-developed financial institutions and capital markets forces the government to finance its fiscal deficits by creating money through borrowing from the banking system and, secondly, that there exists a causal relationship between growth of money supply and rate of inflation. Although there is little doubt about the inflationary consequences of fiscal deficits in developing countries, a unidirectional relationship between fiscal deficit and inflation has been under question in recent years. Economists like Sargent and Wallace (1973), Frenkel (1977) and Jacobs (1977) have suggested a two-way relationship between money and prices. Olivera (1967) first conceptualized the two-way causality between fiscal deficit and inflation, and later Dutton (1971) applied it for a self-generating model of inflation for Argentina. Aghevli and Khan (1978) borrowed the idea and developed their self-perpetuating model of inflation for developing countries. They argue that

*The author is a Ph.D. candidate in Economics at La Trobe University. He gratefully acknowledges the critical comments and useful suggestions received from his supervisors, Drs Robert Dixon (Melbourne University) and Bill Stent (La Trobe University) on earlier drafts of this paper. Dr Greg O'Brien (La Trobe University) and an anonymous referee of this *Review* also made constructive comments and provided valuable suggestions for an overall improvement of this paper. Any remaining errors and shortcomings are solely the author's responsibility.

one of the dynamic forces sustaining inflation in developing countries is the presence of inflation-induced fiscal deficits, which arise because government expenditures adjust themselves to inflation more rapidly than government tax and non-tax revenues during inflation. Several institutional and structural factors are believed to cause the expenditure-adjustment coefficient to exceed 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. (Aghevli and Khan, 1978, p. 391)

Such a scenario has also been reported by Sundrum (1973) and Parikh *et al.* (1985) for Indonesia and by Dutton (1971) for Argentina.

In this paper we will be primarily interested in examining the impact of inflation on fiscal deficits in Bangladesh's economy. In order to do so, we will develop a dynamic model of the government fiscal sector along with a prototype inflation equation (based on the framework of a monetary approach). The estimates of adjustment parameters of the government revenues and expenditures will provide the necessary information about the impact of inflation on fiscal deficits. The inflation equation, on the other hand, will show the effect of money supply on the rate of inflation.

This paper is organized in four sections. Section 2 formulates the model. Section 3 reports the data sources, estimates the model, and analyses the empirical results. Section 4 suggests policy implications and draws conclusions.

2. SPECIFICATION OF THE MODEL

Specification of the Inflation Equation

We assume that the rate of inflation is mainly a monetary phenomenon and any disequilibrium in the real-money market adjusts itself through changes in the price level but not instantaneously. In discrete time framework, we define (long-run) stock disequilibrium in the money market (in logarithmic form) as

$$E^s_m = (\ln M_t/P_{t-1} - \ln (M/P)^d_t) \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where M and P are, respectively, nominal-money supply and price level, and t is the time subscript.

The above specification[1] suggests that (a) if the actual real-money balances held at the beginning of the period, $\ln (M/P)_{t-1}$, differ from the money balances individuals desire to hold at the end of the period, $\ln (M/P)_t^d$, then individuals adjust their real-money balances through changes in the price level, and (b) any change in the level of money supply during the periods $t-1$ and t may also have a contemporaneous effect on changes in the price level. We then specify the equation for the rate of inflation, $\ln (P_t/P_{t-1})$, as follows:

$$\ln (P_t/P_{t-1}) = \delta (\ln M_t/P_{t-1} - \ln (M/P)_t^d) + U1_t \quad \ldots \quad \ldots \quad (2)$$

where δ is the coefficient of elasticity of adjustment and its value is expected to lie between zero and unity. The disturbance term $(U1_t)$ takes into account the effect of excluded variables on the rate of inflation.

Having specified such an inflation equation by incorporating a monetary disequilibrium term, we will now specify the desired demand for real-money balances and will substitute it into Equation (2) so that the determinants of the desired demand for real-money balances become the regressors in the inflation equation. There is voluminous literature on the desired demand for real-money balances in developing countries. A thorough examination of the literature by Hossain (1986a) suggests that real income and the expected rate of inflation are two important determinants of the desired demand for real-money balances in Bangladesh. Accordingly, we specify the desired demand for real-money balances in the following (semi-) logarithmic form:[2]

$$\ln (M/P)_t^d = a0 + a1 \ln Y_t - a2p_t^e \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

[1] Equation (1) can alternatively be written as
$E_m^* = (\ln (M_t/M_{t-1}) + \ln (M_{t-1}/P_{t-1}) - \ln (M/P)_t^d)$.
This definition of stock disequilibrium in the money market is different from its commonly used definition, $E_m^* = (\ln (M/P)_{t-1} - (M/P)_t^d)$. The latter definition is a special case of the former when $\ln (M_t/M_{t-1}) = 0$. By using the former definition we can take into account the contemporaneous effect of current money growth on the rate of inflation.

[2] There is no clear-cut theoretical guide-line about the appropriate functional form of the money demand function. The functional form is, however, important on statistical grounds. In the case of Bangladesh, Murty and Murty (1978) carried out a log-likelihood test in order to find out an appropriate functional form of the money demand function. Their results are inconclusive. Hossain (1986a), however, used a more formal non-nested test of model specification developed by MacKinnon, White and Davidson (1983) which suggests that a log-linear form might be preferred to linear form in Bangladesh. Our equation is semi-logarithmic with respect to the expected rate of inflation. This is because, in Bangladesh, inflation rates in some quarters are negative, which prevent us from taking logarithms of this variable.

where Y_t = measured real income, p_t^e = expected rate of inflation, and the parameters $a0$, $a1$, and $a2$ are expected to have the following signs: $a0 > = < 0$, $a1 > 0$ and $a2 < 0$.
Substitute Equation (3) into Equation (2), and after rearrangement we get

$$\ln (P_t/P_{t-1}) = -\delta a0 + \delta \ln M_t/P_{t-1} - \delta a1 \ln Y_t + \delta a2\, p_t^e + U1_t \quad (4)$$

Since the expected rate of inflation is not observable, we assume that it can be approximated by a weighted average of past inflation rates such as.

$$p_t^e = \Sigma \phi i\, p_{t-i}\ , \ i = 1, 2, 3, \ldots\ldots \infty \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where ϕi represents the weight given to ith period lagged rate of inflation.[3]

Substitute Equation (5) into Equation (4), and after rearrangement we get the following estimating equation:

$$\ln (P_t/P_{t-1}) = -\delta a0 + \delta \ln M_t/P_{t-1} - \delta a1 \ln Y_t + \delta a2\, \Sigma \phi i\, p_{t-i} + U1_t \quad (6)$$

Government Domestic Budget Deficit

We define

$$GDDB_t = GDR_t - GDE_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

$$GDR_t = GTR_t + GNTR_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

$$GDE_t = GDRE_t + GDDE_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

where

$GDBD$ = government domestic budget deficit;

GDR = government domestic revenue;

GDE = government domestic expenditure;

GTR = government domestic revenue from taxes;

$GNTR$ = government domestic revenue from non-taxes;

[3]For details of such a specification, see Darrat (1985).

$GDRE$ = government domestic revenue expenditure; and

$GDDE$ = government domestic development expenditure.

All variables are expressed in nominal terms.

Revenue-Expenditure Equation

We assume that the government's desired real-revenue expenditures, $(GDRE/P)_t^d$, can be expressed as a linear function of the real national income (Y_t).[4] In logarithmic form, we specify the equation as

$$\ln (GDRE/P)_t^d = g0 + g1 \ln Y_t \qquad g1 > 0 \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

The superscript d denotes the desired amount. It is expected that the income elasticity of government revenue expenditure ($g1$) is not significantly different from unity. In the short run, there may be a discrepancy between the desired and the actual levels of revenue expenditures. We assume that if such a discrepancy arises, the actual expenditure will adjust itself to the desired level. In the event that the government does not control the price level,[5] it adjusts the real expenditures by adjusting the nominal magnitudes. We, therefore, postulate a nominal revenue-expenditure adjustment function, analogous to the demand-for-money adjustment function due to Goldfeld (1973), as

$$\ln GDRE_t - \ln GDRE_{t-1} = \gamma (\ln ((GDRE/P)_t^d P_t) - \ln GDRE_{t-1}) + U2_t \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

where γ is the coefficient of elasticity of adjustment and its value is expected to lie between zero and unity. $U2$ is the disturbance term. Introducing Equation (10) into Equation (11) and after rearrangement we get the following estimating equation:

$$\ln (GDRE/P)_t = \gamma g0 + \gamma g1 \ln Y_t + (1-\gamma) \ln (GDRE_{t-1}/P_t) + U2_t \quad \ldots \quad (12)$$

[4]In our simple model we consider the real income as exogenous. It can be argued that the government expenditures (in particular development expenditures) and real income affect each other and therefore the real income needs to be treated as an endogenous variable. We assume that it is the development expenditures (rather than the revenue expenditures) which mainly contribute to the growth of real income. In our model the development expenditures are related to resources available from foreign sources and not significantly to the level of domestic income.

[5]We assume that in Bangladesh the government does not control the price level in a significant way. It is true that the government controls the prices of some essential commodities like staple food items through public rationing system, but the impact on the general price level is minimal under normal circumstances. We have shown elsewhere (Hossain, 1986b) that in Bangladesh the government has a limited control over the money supply. It implies that the government also does not influence the price level through money supply in a significant way.

Here the lagged dependent variable is deflated by current-price level rather than by one-period lagged-price level. This specification is equivalent to the specification by Aghevli and Khan (1978) with the addition of a variable measuring the rate of inflation

$$\ln (GDRE/P)_t = \gamma g0 + \gamma g1 \ln Y_t + (1-\gamma) \ln (GDRE/P)_{t-1} - (1-\gamma) \ln (P_t/P_{t-1}) + U2_t \quad \ldots \quad \ldots \quad (13)$$

Equation (13) shows that the adjustment coefficient not only captures the speed of adjustment of actual expenditures to the desired level but it also captures the effect of the rate of inflation on the real value of actual expenditures. The effect of inflation on the real value of expenditures would be negative as long as the rate of inflation is positive. If the price level is assumed to be increasing over time, then in Aghevli and Khan's specification the estimated adjustment coefficient would be upwardly biased. Aghevli and Khan's specification is therefore a special case of our specification when the coefficient of the rate of inflation is zero. However, in using the present specification instead of Aghevli and Khan's specification we suggest a different view on how expenditures respond during inflationary situations.

Development Expenditure Equation

For simplicity we make an assumption that in Bangladesh the government adopts a long-term development-budget strategy so that the government's desired real development-expenditure depends on the real value of development resources available (from domestic revenue surplus and from foreign aid and loans). We express the relationship in the following functional form:

$$(GDDE/P)_t^d = \lambda (GDF/P)_t^\alpha \qquad \alpha > 0 \quad \ldots \quad \ldots \quad (14)$$

where

GDF = government's available development resources (from domestic revenue surplus and from foreign aid and loans);

λ = constant; and

α = elasticity of government development-expenditure with respect to available development resources. It is usually expected that α equals unity, which implies that in the long run the government development-expenditure increases proportionately with the increase of development resources.

In logarithmic terms, Equation (14) can be written as

$$\ln (GDDE/P)_t^d = \ln \lambda + \alpha \ln (GDF/P)_t \quad \ldots \quad \ldots \quad \ldots \quad (15)$$

Since the government usually does not control the price level, it adjusts the real expenditures by adjusting nominal magnitudes. We, therefore, define the following nominal adjustment function for development expenditures:

$$\ln GDDE_t - \ln GDDE_{t-1} = \theta (\ln ((GDDE/P)_t^d P_t) - \ln GDDE_{t-1}) + U3_t \quad \ldots \quad \ldots \quad \ldots \quad (16)$$

where θ is the coefficient of elasticity of adjustment, and its value is expected to lie between zero and unity, and $U3$ is the disturbance term. Introducing Equation (15) into Equation (16) and after rearrangement we obtain the following estimating equation:

$$\ln GDDE_t = \theta \ln \lambda + \theta\alpha \ln GDF_t + (1-\theta) \ln GDDE_{t-1} + U3_t \quad \ldots \quad (17)$$

Tax and Non-tax Revenues Equations

It is expected that the government's tax revenues are fundamentally related to the level of national income. Since in the developing countries taxes on expenditures contribute the large portion of government indirect tax revenues, we consider the level of national expenditure rather than the national income to be the more appropriate variable in the tax equation. In logarithmic form, we therefore specify the tax equation as

$$\ln GTR_t^d = t01 + t11 \ln GNE_t \qquad t11 > 0 \quad \ldots \quad \ldots \quad (18)$$

where

GTR^d = government desired tax revenue; and

GNE = gross national expenditure defined as gross national product less exports plus imports.

We assume that there is a lag in adjustment of actual tax revenues to the desired level. We then define the following adjustment function:

$$\ln GTR_t - \ln GTR_{t-1} = \partial 1 (\ln GTR_t^d - \ln GTR_{t-1}) + U4_t \quad \ldots \quad (19)$$

where ∂1 is the coefficient of elasticity of adjustment, and its value is expected to lie between zero and unity, and $U4$ is the disturbance term. Introducing Equation (18) into Equation (19) and after rearrangement we get the following estimating equation:

$$\ln GTR_t = \partial 1t01 + \partial 1t11 \ln GNE_t + (1-\partial 1) \ln GTR_{t-1} + U4_t \quad \ldots \quad (20)$$

The non-tax revenues in Bangladesh's economy originate from government property income (derived from post office, telegraph and telephone, public transport, nationalized banks and industries, and forests), fees, and miscellaneous receipts. We assume that the non-tax revenues are related to the level of national income. In logarithmic form, we specify the equation as

$$\ln GNTR_t^d = t02 + t12 \ln GNP_t \qquad t12 > 0 \quad \ldots \quad \ldots \quad (21)$$

We assume that there is a lag in adjustment of government non-tax revenue to the desired level. We then define the following adjustment function:

$$\ln GNTR_t - \ln GNTR_{t-1} = \partial 2 (\ln GNTR_t^d - \ln GNTR_{t-1}) + U5_t \qquad (22)$$

where ∂2 is the coefficient of elasticity of adjustment, and its value is expected to lie between zero and unity, and $U5$ is the disturbance term. Introducing Equation (21) into Equation (22) and after rearrangement we get the following estimating equation:

$$\ln GNTR_t = \partial 2t02 + \partial 2t12 \ln GNP_t + (1-\partial 2) \ln GNTR_{t-1} + U5_t \qquad (23)$$

Money Supply Relationship

The money supply relationship can be specified on the basis of the fraction reserve system where the money stock is an increasing function of reserve money and the money multiplier

$$M_t = mm\, RM_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (24)$$

where M = stock of money supply; mm = money multiplier; and RM = reserve money. The reserve money can be expressed in terms of its asset components as

$$RM_t = GBBB_t + GBCB_t + CBBBB_t + NF_t \quad \ldots \quad \ldots \quad (25)$$

where $GBBB$ = government's net borrowings from the Bangladesh Bank (the central bank of Bangladesh) and/or the use of its cash balances held with the Bangladesh

Bank; *GBCB* = government's net borrowings from the commercial banks where the commercial banks are assumed to replenish their reserves by borrowing from the Bangladesh Bank; *CBBBB* = commercial banks' borrowings from the Bangladesh Bank other than the amount necessary to replenish their reserves; and *NF* = net foreign assets of the banking system, and it can be defined as $NF_t = NF_{t-1} + (X-M)_t + FK_t + COB_t$ where $(X-M)_t$ = current account of the balance of payments, FK_t = net foreign-capital flows including aid and loans, and COB_t = residual item in the balance of payments (statistical discrepancy).

The direct effect of government budget on reserve money, and hence on money supply, is determined by the domestic budget deficits. The extent of reserve money created through domestic budget deficits, however, depends on the way deficits are financed. The above specified reserve-money identity suggests that if the government finances its deficits by borrowing from the central bank (and/or by using cash balances held with the central bank), by borrowing from the commercial banks (where the commercial banks replenish their reserves by borrowing from the central bank), and/or by borrowing from abroad, then there will be an equal increase in reserve money. In Bangladesh, because of the lack of well-developed financial and capital markets, the government's borrowings from the private sector are very limited. It becomes necessary for the government, then, to borrow from the banking system and foreign sources as aid and loans. An increase in domestic budget deficits is then expected to increase the reserve money and hence the money supply in Bangladesh.

The Complete Model

(a) *Inflation Equation*

$$\ln (P_t/P_{t-1}) = -\delta a0 + \delta \ln M_t/P_{t-1} - \delta a1 \ln Y_t + \delta a2 \Sigma \phi i p_{t-i} + U1_t$$

(b) *Government Domestic Budget Deficit*

$$GDBD_t = GDR_t - GDE_t$$

(c) *Government Domestic Revenues*

$$GDR_t = GTR_t + GNTR_t$$

(d) *Government Domestic Expenditures*

$$GDE_t = GDRE_t + GDDE_t$$

(e) *Government Revenue Expenditure Equation*

$$\ln (GDRE/P)_t = \gamma g0 + \gamma g1 \ln Y_t + (1-\gamma) \ln (GDRE_{t-1}/P_t) + U2_t$$

(f) *Government Development Expenditure Equation*

$$\ln GDDE_t = \theta \ln\lambda + \theta\alpha \ln GDF_t + (1-\theta) \ln GDDE_{t-1} + U3_t$$

(g) *Government Tax Revenue Equation*

$$\ln GTR_t = \partial 1t01 + \partial 1t11 \ln GNE_t + (1-\partial 1) \ln GTR_{t-1} + U4_t$$

(h) *Government Non-tax Revenue Equation*

$$\ln GNTR_t = \partial 2t02 + \partial 2t12 \ln GNP_t + (1-\partial 2) GNTR_{t-1} + U5_t$$

(i) *Money Supply Relationship*

$$M_t = mm\, RM_t$$

(j) *Components of Reserve Money*

$$RM_t = GBBB_t + GBCB_t + CBBBB_t + NF_t$$

Our structural equation system consists of five behavioural equations and five identities. The estimating equations are (i) inflation equation, (ii) revenue-expenditure equation, (iii) development-expenditure equation, (iv) tax-revenue equation, and (v) non-tax-revenue equation. Since the expected rate of inflation is assumed to be approximated by a weighted average of past inflation rates, it is a predetermined variable in the system. Of all the behavioural equations, we are primarily interested in estimating the parameters, $g1$, α, $t11$ and $t12$ and the adjustment parameters, γ, θ, $\partial 1$ and $\partial 2$ for Bangladesh's economy. The estimates of all these parameters will provide necessary information about the impact of income and inflation on government fiscal deficits. For example, if $g1$ is greater than $t11$ and/or $t12$, an increase in income level will have a positive effect on the size of the fiscal deficits. In addition to this income-induced fiscal deficit, if the adjustment coefficients of government expenditures, γ and α, exceed the adjustment coefficients of tax and non-tax revenues, $\partial 1$ and $\partial 2$, an inflation-induced fiscal deficit will be created.

3. ESTIMATION AND RESULTS

Estimation of the Model

We estimated the model using quarterly data for Bangladesh over the 1974(II) – 1983(II) period. In the selection of the estimator, we made some compromises. We considered mainly two factors: (i) the possibility of a specification error, and (ii) the quality of the data. As far as the specification of the model is concerned, it is very difficult to rule out the possibility of any specification error. This is because it is expected that in addition to the factors considered in our model, several non-economic factors may also be important in the government's revenues and expenditures equations which we have not been able to incorporate for lack of data. Turning to data quality, the data used for the estimation of the model have been taken from both national and international sources. Quarterly interpolations from annual data were also necessary for some variables. As a result, the quality of the data is not very high. Considering these factors, we have not used the full-information maximum-likelihood (FIML) estimator which generally provides the most desirable properties when the model is correctly specified and the variables are correctly measured. In fact, FIML is extremely sensitive to both specification and measurement errors. An ordinary least-squares estimator, on the other hand, is expected to produce biased and inconsistent estimates because of the simultaneous nature of the model. As a compromise, we used the instrumental-variables approach as it performs best among the limited-information estimators and, in particular, it is less affected by the specification error. In our model, we have assumed that the real and nominal income variables are exogenous. In a more complete model, however, they should be considered as endogenous variables because government expenditure and real income are expected to affect each other. Similarly, nominal income and money stock are closely related where the causality runs from the money stock (Friedman, 1971). In order to reduce the bias and inconsistency arising from such a simultaneity, we have used instruments for real and nominal income variables. Finding an instrument for real or nominal income is not very easy. The necessary condition for selecting an instrument is that it should be contemporaneously uncorrelated with the disturbance term, while highly correlated with the variable. In the absence of any autocorrelation problem, (in our case) one-period lagged income can be used as an instrument. Preliminary estimation results suggest that the error term in each of the estimating equations is serially correlated, which prevents us from using lagged income as the instrument. So, we constructed an instrument (IY_t) for real income by adding real exports with real fixed investment, and for nominal income, ($IY_t \cdot P_t$) has been used as the instrument. The autocorrelation problem has been corrected by using the Fair (1970) method.

Basic data used in this study have been taken from several issues of *Bangladesh Statistical Yearbook, Economic Trends of Bangladesh Bank* and the *International*

Financial Statistics of International Monetary Fund. Quarterly data for revenue and development expenditures and the national income are not readily available for Bangladesh. We, therefore, quarterly interpolated the annual data using Gandolfo's (1981) methodology. Since quarterly GNP deflator is not available, the revenue expenditure has been deflated by the quarterly consumer price index. Money supply is defined as currency plus demand deposits. The rate of inflation has been approximated by the first-order logarithmic difference of consumer price index of the metropolitan Dhaka City for middle-class income group.

Analysis of the Results

The estimated results are presented below. The figures in parentheses below the coefficients are t-ratios. *SER* and *SSR* represent the standard error of regression and the sum of the squared residuals respectively. ρ stands for autocorrelation coefficient and L is the maximized value of log-likelihood function. *DM, DJ* and *DS* are the seasonal dummies (*DM* for March quarter, *DJ* for June quarter and *DS* for September quarter). The statistic R^2 is not very meaningful as a test of explanatory power when instrumental-variables approach is used for estimation. This is because the distribution of this statistic is not bounded between zero and unity; instead its value lies between $-\infty$ and unity. It is therefore not reported. Simulation results, however, may be used to provide some evidence about the goodness of fit of the model. A dynamic simulation experiment (in particular) is a more stringent goodness-of-fit test which can also be used as a test of stability of the estimated model. We conducted a dynamic simulation test of the model. The simulation results suggest that the simulated series of each of the endogenous variables are able to track the fluctuations of the corresponding actual data series very well. Because of the lack of space we have not reported the simulation results (charts and statistical measures) but these may be available from the author upon request.

ESTIMATES OF INFLATION EQUATION

$$\begin{aligned}
\ln(P_t/P_{t-1}) = \;& \underset{(2.354)}{1.191} + \underset{(3.359)}{0.225}\ln(M_t/P_{t-1}) - \underset{(2.987)}{0.308}\ln Y_t \\
& + \underset{(3.430)}{0.462}\ln(P_{t-1}/P_{t-2}) - \underset{(0.337)}{0.007}\, DM_t + \underset{(2.320)}{0.042}\, DJ_t \\
& + \underset{(3.548)}{0.069}\, DS_t
\end{aligned}$$

$SSR = 0.041$, $SER = 0.037$, $L = 73.49$, $\rho = 0.106$

Instruments: C, $\ln M_{t-1}/P_{t-2}$, $\ln(P_{t-2}/P_{t-3})$, $\ln(IY)_t$, DM_{t-1}, DJ_{t-1}, DS_{t-1}

Correlogram:

Coeff.	−0.030	−0.259	0.097	0.025	0.094	−0.083	−0.051	0.102
t-stat.	−0.185	−1.377	0.591	0.153	0.570	−0.505	−0.031	0.618

ESTIMATES OF NON-TAX-REVENUE EQUATION

$$\ln DNTR_t = \underset{(1.678)}{-\,1.935} + \underset{(2.413)}{0.512}\ \ln GNP_t + \underset{(5.454)}{0.643}\ \ln DNTR_{t-1} - \underset{(1.183)}{0.0450}\ DM_t + \underset{(1.437)}{0.0579}\ DJ_t + \underset{(0.167)}{0.006}\ DS_t$$

Instruments: C, $\ln IY_t + \ln P_t$, $\ln DNTR_{t-2}$, DM_{t-1}, DJ_{t-1}, DS_{t-1}

$SSR = 0.304$, $SER = 0.097$, $L = 37.60$, $\rho = 0.613$

Correlogram:

Coeff.	0.105	0.072	0.032	−0.578	0.006	−0.054
t-stat.	0.649	0.447	0.195	−1.962	0.039	−0.332

ESTIMATES OF TAX REVENUE EQUATION

$$\ln DTR_t = \underset{(0.889)}{-\,0.330} + \underset{(3.209)}{0.298}\ \ln GNE_t + \underset{(10.816)}{0.732}\ \ln DTR_{t-1} - \underset{(0.057)}{0.057}\ DM_t + \underset{(2.805)}{0.062}\ DJ_t - \underset{(0.062)}{0.001}\ DS_t$$

$SSR = 0.084$, $SER = 0.051$, $L = 62.08$, $\rho = 0.485$

Instruments: C, $\ln IY_t + \ln P_t$, $\ln DTR_{t-2}$, DM_{t-1}, DJ_{t-1}, DS_{t-1}

Correlogram:

Coeff.	0.066	0.019	−0.047	−0.506	0.089	0.029
t-stat.	0.408	0.114	−0.290	−1.430	0.553	0.181

ESTIMATES OF DEVELOPMENT EXPENDITURE EQUATION

$$\ln GDDE_t = \underset{(2.291)}{1.063} + \underset{(2.557)}{0.406}\ \ln GDF_t + \underset{(4.035)}{0.583}\ \ln GDDE_{t-1} - \underset{(2.612)}{0.052}\ DM_t + \underset{(2.101)}{0.043}\ DJ_t + \underset{(0.265)}{0.004}\ DS_t$$

$\rho = 0.776$, $SSR = 0.063$, $SER = 0.443$, $L = 67.29$

Instruments: C, $\ln IY_t + \ln P_t$, $\ln GDDE_{t-2}$, DM_{t-1}, DJ_{t-1}, DS_{t-1}

Correlogram:

Coeff.	0.112	0.018	0.098	−0.363	−0.128	−0.068
t-stat.	0.689	0.112	0.601	−1.235	−0.791	−0.417

ESTIMATES OF REVENUE EXPENDITURE EQUATION

$$\ln (GDRE/P)_t = \underset{(1.148)}{-\ 5.255} + \underset{(2.10)}{0.815}\ \ln Y_t + \underset{(2.428)}{0.526}\ \ln (GDRE_{t-1}/P_t)$$
$$- \underset{(0.625)}{0.036}\ DM_t + \underset{(0.679)}{0.120}\ DJ_t + \underset{(0.144)}{0.003}\ DS_t$$

$\rho = 0.849$, $SSR = 0.096$, $SER = 0.056$, $L = 56.95$

Instruments: C, $\ln IY_t$, $\ln (GDRE_{t-2}/P_{t-1})$, DM_{t-1}, DJ_{t-1}, DS_{t-1}

Correlogram:

Coeff.	0.145	0.175	0.444	−0.229	−0.140	−0.047
t-stat.	0.882	1.064	1.704	−1.394	−0.850	−0.286

The coefficients of all variables in the inflation equation are consistent with prior expectations and (except for the March-quarter dummy) are statistically significant at the 1-percent level. The coefficient of real money supply is positive and the value of the coefficient is 0.225. As expected, the coefficient of real income is negative and statistically highly significant. A negative coefficient of real income with a value of 0.308 suggests that a one-unit increase in real income lowers the rate of inflation by 0.308 percentage point. In the text, we have approximated the expected rate of inflation by past inflation rates, and an experimentation with past inflation rates for several periods suggests that inflation rate for only one-period lag is theoretically consistent and statistically significant. The positive and statistically significant coefficients of June and September quarters' dummies show seasonalities in the rate of inflation in Bangladesh. The prices of rice and other food products in Bangladesh usually rise during the period April to September/October, which are reflected in the positive coefficients of June and September quarters' dummies. Although the September quarter corresponds to Aus rice harvesting, very often, due to floods and other natural calamities, there are heavy crop losses during this period. Also, the level of Aus rice production is not always enough to reduce food prices.

The March-quarter dummy, on the other hand, represents the major rice-harvesting season in Bangladesh, and, as expected, the coefficient of the March-quarter dummy bears a negative sign.

The coefficients of all the variables in the revenue expenditure equation are consistent with prior expectations and (except the seasonal dummies) are statistically significant. The short-run income elasticity of government revenue expenditure is 0.815, while the long-run income elasticity[6] is around 1.75. It suggests that in the long run government revenue expenditure increases more than proportionately with the increase in real income. In the developing countries, such a phenomenon of higher income elasticity of government expenditure has been suggested by many, and particularly by Martin and Lewis (1956) and Williamson (1961). A hypothesis (sometimes called "Wagner's Law") put forward by the nineteenth century economist Adolph Wagner (1893) holds that as a society progresses, government involvement in fiscal-budgetary matters rises even faster (this implies an income elasticity in excess of one). In a recent study, Aghevli and Khan (1978) found that (even) the short-run income elasticity of government expenditure exceeds unity for countries like Colombia and Thailand. While Aghevli and Khan did not mention any reason behind such a result, Martin & Lewis and Williamson suggested several possible interpretations. Martin & Lewis and Williamson were mainly interested in establishing an economic relationship between public expenditure and income level, much like Engel's Law of consumption function. Their results suggest that government expenditure can be treated as a luxury good with income elasticity greater than unity. Martin and Lewis referred to a stagnation thesis which supports the existence of an elasticity greater than unity. They are of the view that with the historical process of development, there is a shrinking of investment opportunities; therefore, in order to support a Keynesian full-employment level of income, an increasing amount of government expenditure is necessary to compensate for the dearth in private investment outlays. It reflects a more than proportionate increase in public expenditure with an increase in real income. Although this argument may be relevant for development expenditure but, in our case, since we are concerned with income elasticity of revenue expenditures, Clark's (1951) study on sectoral productivity may be more useful in analysing the results. The Clark study suggests that, given that the revenue expenditures are in the form of public service, the rate of productivity increase in the services industries is less than for manufactures and even less than that in agriculture. Then, if public services are a function of output, a greater share of government expenditure would result with an increase in income. Since the government sector is characteristically extremely labour-intensive and labour becomes more

[6]The reader should recall that by "long run" in this context is meant, not the steady state of an equilibrium growth model, but merely the situation in which expected and realized values of the dependent variable (government real revenue expenditure) are constant.

expensive with the development process, government expenditure may increase more than proportionately with an increase in income. Furthermore, Williamson suggests various other reasons which may increase public service expenditures more than proportionately with an increase in income. With the process of development, urbanization and industrialization encourage rural-urban migration. This influx of population in urban areas requires formal additional security measures, social services, education, health, transport, etc., which support an increasing share of government expenditures to GDP. A correlation between welfarism and level of income can therefore be postulated during the process of development and such a relationship becomes obvious due to the demonstration effect in adapting many welfare expenditures found in developed countries. All the same, an implication[7] for a steady-state solution of an income elasticity greater than one is that eventually government expenditures will be larger than total GDP! This would suggest caution in using the estimated coefficient for the solution of long-run, by which we mean in this context a position of steady-state equilibrium, growth. To ensure sensible steady-state properties, the coefficient should be equal to one. However, it is possible over "short" to "medium" term (and perhaps even lengthy periods) of calendar time for the income elasticity of government revenue expenditure to exceed unity.[8] Indeed, the ratio of government revenue expenditure to GDP in Bangladesh has steadily risen over the period of our study. The coefficient of the elasticity of adjustment in the revenue expenditure is 0.474. A close examination of different types of public expenditures suggests that the public decision-makers have some discretionary power in deciding the extent and timing of adjustment of different types of revenue expenditures during inflation. The public decision-makers are quite aware of the impact of increased expenditures (usually financed through bank credit) on inflation and are not in a hurry (unless under extreme pressure) to adjust various types of revenue expenditures (like wages and salaries of public employees, transfer payments etc.). A delay in adjusting these expenditures is therefore to be expected during inflationary situations.

In the development expenditure equation, the short-run elasticity of development expenditure with respect to resources is 0.406. The coefficient of the elasticity of adjustment is 0.42, which suggests a long-run elasticity of government expenditure with respect to resources not significantly different from unity. These results suggest

[7]I am grateful to an anonymous referee of this *Review* who reminded me of such an implication. Borcherding (1985, p. 365) suggests that in one sense it is possible that spending at some point would exceed national income, since transfers can be taxed away and redistributed. However, he qualified his argument by saying that in a more fundamental sense net transfers plus public spendings cannot indefinitely rise faster than national income.

[8]It is possible that an estimate of high income elasticity of government revenue expenditure is biased because of the presence of a stochastic lagged dependent variable combined with a higher-order autocorrelation problem.

that in the long run the government has a tendency to spend proportionately with the increase in development resources which is consistent with prior expectations. The adjustment coefficients of revenue and development expenditures suggest that compared with the revenue expenditure, the development expenditure adjusts at a relatively slow speed. Since most of the development projects in Bangladesh are financed by either aid donor countries or international financial institutions, the adjustment of development expenditures during inflation is expected to be relatively slower (compared with that of the revenue expenditures) mainly because of the fact that all these expenditures come through several bureaucratic stages of the foreign and domestic administrations. On the other hand, many revenue expenditures, directly and indirectly, benefit either the bureaucrats or many politically sensitive pressure groups. So there remains always a pressure to adjust revenue expenditures during inflation, although not instantaneously. However, the adjustment coefficients of both revenue and development expenditures are significantly lower than the expected value of unity, as found by Aghevli and Khan for several other developing countries. It suggests that during inflation neither revenue nor development expenditure in Bangladesh adjusts instantaneously. By disaggregating the total expenditures into revenue and development expenditures, we have therefore been able to examine the rates of adjustment of both types of expenditures. Heller (1980), in particular, emphasized how different types of expenditures adjust differently with the changes of price level. He found 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" (p. 742).

We estimated the tax- and non-tax-revenues equations separately to find out whether there is any significant difference between the speed of adjustment of these two types of revenues during inflation. In both the tax- and non-tax-revenues equations, the estimated coefficients of all the variables are consistent with prior expectations and are statistically highly significant. In the tax-revenue equation, the long-run expenditure elasticity[9] is not significantly different from unity. The adjustment coefficient is, however, less than unity. It is also much lower than the adjustment coefficient in the revenue or development expenditure equation. The long-run income elasticity of non-tax revenue exceeds unity. As expected, the adjustment coefficient of non-tax revenue is lower than those of the expenditures equations. It is, however, relatively higher than the adjustment coefficient of tax revenue equation. Since the non-tax revenue comes from various types of fees and incomes

[9]We also estimated the equation using national income as the explanatory variable. The estimated income-elasticity is not significantly different from the expenditure elasticity.

from public service sectors like the post office, telegraph and telephone, railway, etc., the authority finds it more convenient (because of its greater administrative control and less political implications) to adjust its revenues from these sources at a relatively high speed than revenues originating from tax sources during inflation.

Our empirical findings in a precise form are presented in Table 1.

Table 1

Parameter Estimates and the Average Time Lags (in quarters) in the Adjustment of Government Expenditures and the Revenues for the Bangladesh Economy

1	2	3	4
	REVENUE EXPENDITURE		
$\gamma g1 = 0.815$	$g1 = 1.720$	$\gamma = 0.474$	$(1-\gamma)/\gamma = 1.11$
	DEVELOPMENT EXPENDITURE		
$\theta\alpha = 0.406$	$\alpha = 0.970$	$\theta = 0.417$	$(1-\theta)/\theta = 1.40$
	TAX REVENUE		
$\partial 1 t11 = 0.298$	$t11 = 1.110$	$\partial 1 = 0.268$	$(1-\partial 1)/\partial 1$ - 2.73
	NON-TAX REVENUE		
$\partial 2 t12 = 0.572$	$t12 = 1.490$	$\partial 2 = 0.359$	$(1-\partial 2)/\partial 2 = 1.80$

The table shows the estimates of both short- and long-run elasticities, coefficients of the elasticities of adjustment, and the average time lags in the adjustment of government expenditures and revenues of the Bangladesh economy. From Column 1 we can see that the short-run income elasticity of government revenue expenditure exceeds the income elasticity of tax or non-tax revenues. This implies that in the short run the size of the government fiscal deficit will increase with an increase in the level of income. From Column 2 we can see (for similar reasons) that even in the long run the size of the government fiscal deficit will increase with an increase in the level of income. This suggests that the Bangladesh economy is prone to both short- and long-run income-induced fiscal deficits. Column 3 shows that the adjustment coefficients of both government revenue and development expenditures are significantly higher than the adjustment coefficients of both tax and non-tax revenues. This implies that the government expenditures adjust at a higher speed than government revenues and increase the size of the fiscal deficits with the increase of price level.

The overall results therefore suggest that the Bangladesh economy is prone to both income- and inflation-induced fiscal deficits. The results also show that the average lags in the adjustment of revenue and development expenditures are 1.11 and 1.40 quarters, whereas the average lags in the adjustment of government tax and non-tax revenues are 2.73 and 1.80 quarters, respectively. This suggests that the main reason behind the two-way causality between fiscal deficit and inflation in the Bangladesh economy results from a relatively slower adjustment of government tax and non-tax revenues (compared with government expenditures) during inflation.

4. POLICY IMPLICATIONS AND CONCLUSIONS

In this paper we have been particularly interested in examining the impact of inflation on fiscal deficits in the Bangladesh economy. The empirical results support the hypothesis that the government expenditures (both revenue expenditure and development expenditure) adjust more rapidly than government domestic revenues (from tax and non-tax sources) and increase the size of the fiscal deficits during inflation. We also found that the income elasticity of government revenue expenditure exceeds the income elasticity of government taxes (these contribute about 4/5th of government total domestic revenues) in the short run as well as in the long run. This implies that Bangladesh has a tendency to experience income-induced fiscal deficits both in the short run and long run. Furthermore, the empirical results reveal some important policy implications for a developing country like Bangladesh. It is now widely accepted that fiscal deficits-oriented development policy cannot generate a sustainable economic growth except in the short run. The costs of such a policy are a self-perpetuating (but unpredictable) inflationary situation which hampers long-term investment, changes the pattern of investment and reduces the long-term economic growth (for details see Hossain, 1984). As a precondition for sustained economic growth, the government therefore needs to maintain some fiscal discipline with appropriate corrections of its budgetary policies. A relatively high rate of income elasticity of government expenditure compared with that of government revenue is self-destabilizing (in the sense that a budget deficit resulting out of it may be inflationary if financed by money creation). The appropriate policy goal of the fiscal authority therefore must be a reduction of income elasticity of government expenditure in conjunction with an increase in the income elasticity of government revenues. Given the existing socio-economic and political considerations, a reduction of the income elasticity of government expenditure may be very difficult, but for a politically courageous government that is not impossible. In doing so, as a first step the government needs to contain its expenditures arising from short-run political considerations. Transitory export boom-induced current-expenditures (which are usually permanent in nature) should also be kept at a minimum level. An increase of the income elasticity of government revenues requires a thorough reform of the outdated and complicated tax system and administration. By tax reform we mean, in particular, the simplification of the tax structure, the broadening of tax base, the computerization of tax information system, the depersonalization and streamlining of tax administration and a drastic reduction in discretionary authority in the hands of tax officials. Furthermore, the major goal of tax system needs to be the raising of revenues rather than to serve several non-revenue goals such as promoting exports, regional development etc. which, like in many developing countries, have complicated the Bangladesh tax system, created anomalies, and also provided enough discretionary power to the tax administration (which in the end have resulted in organized corruption). Gillies (1985, p. 246), in this context for Indonesia comments that "after 12 years of intermittent studies of Indonesian tax incentives by various analysts, there was abundant evidence indicating that few if any of the incentives in the system has yielded the desired results. Rather, the principal impact of incentives was massive hemorrhages from the treasury". It is true that a drastic tax reform requires considerable time and resources but its necessity and urgency are beyond doubt. Even a casual pressure, presumably during fiscal crises, to tax administration in many countries, yielded significant results. As, for example, Cole (1976) remarked that in Korea, the ratio of government revenues to GNP was raised from 6.5 percent in 1964 to 12 percent in 1967 without any significant change in the tax laws. The administrative apparatus was reorganized and a very tough administrator was put in charge with a clear mandate from the president to raise revenues. Similarly, in Indonesia the ratio of revenues to GNP went from 4.2 percent in 1966 to 10 percent in 1967, mainly because of increased pressure on the administration. He also made an important suggestion to the fiscal authority that the policy-makers should not be "unduly cowed by the firm upper limits of estimated tax revenues presented by the tax authorities" (p. 166). This is because tax administration in developing countries usually put forward a very conservative estimate of potential revenues which makes their lives very easy. Furthermore, since in most developing countries a significant portion of the tax assessment is arrived at through negotiation (which bears little or no relation to the original tax declaration), a conservative tax estimate enables the tax officials to waive or reduce taxes for bribing and/or for other personal interests. The fiscal authority should also strive to maintain the real value of tax receipts during inflation. Aghevli and Khan (1978) suggests of indexing the nominal value of certain taxes, particularly personal and corporate income taxes and property taxes which tend to have the longest lags. Such a policy has also been suggested by Kalfa (1967) for Brazil and Tanzi (1977) for Argentina and Chile. Indexation of taxes with the inflation rate may lessen the temptation to delay taxes by the tax payers. Indeed, in order to increase the elasticity of taxes with respect to the rate of inflation, it may be important to replace all specific or unit taxes with *ad valorem* taxes. Above all, it is necessary that there be an efficient and honest tax administration free from political interference and subjected to tough anti-corruption laws.

REFERENCES

Aghevli, B: and M. Khan (1978). "Government Deficits and the Inflationary Process in Developing Countries". *IMF Staff Papers*. Vol. 25. pp. 383–415.

Borcherding, T. (1985). "The Causes of Government Expenditure Growth: A Survey of the U.S. Evidence". *Journal of Public Economics*. Vol. 28, No. 3. pp. 359–382.

Clark, C. (1951). *The Conditions of Economic Progress*. Macmillan and Company Ltd.

Cole, D. (1976). "Concepts, Causes and Cures of Instability in Less Developed Countries". In R. Mckinnon (ed.), *Money and Finance in Economic Growth and Development*. New York: Marcel Dekker. pp. 143–171.

Darrat, A. (1985). "The Demand for Money in a Developing Economy: The Case of Kenya". *World Development*. Vol. 13, No. 10/11. pp. 1163–1170.

Dutton, D. (1971). "A Model of Self-Generating Inflation". *Journal of Money, Credit and Banking*. Vol. 3. pp. 245–262.

Fair, R. (1970). "The Estimation of Simultaneous Equation Models with Lagged Endogenous Variables and First Order Serially Correlated Errors". *Econometrica*. Vol. 38, No. 3. pp. 507–516.

Frenkel, J. (1977). "The Forward Exchange Rate, Expectations and the Demand for Money: The German Hyperinflation". *American Economic Review*. Vol. 67. pp. 653–670.

Friedman, M. (1971). "A Monetary Theory of Nominal Income". In C. Clayton, J. Gilbert and Sedwick (eds.), *Monetary Theory and Monetary Policy in the 1970s*. London: Oxford University Press.

Gandolfo, G. (1981). *Quantitative Analysis and Econometric Estimation of Continuous Time Dynamics*. Amsterdam: North-Holland Publishing Company.

Gillies, M. (1985). "Micro and Macroeconomics of Tax Reform". *Journal of Development Economics*. Vol. 19, No. 3. pp. 221–254.

Goldfeld, S. (1973). "The Demand for Money: Revisited". *Brookings Papers on Economic Activity*. Vol. 3. pp. 577–638.

Heller, P. (1980). "Impact of Inflation on Fiscal Policy in Developing Countries". *IMF Staff Papers*. Vol. 27. pp. 712–748.

Hossain, Md. Akhtar (1984). "Price Instability, Inflation and the Economic Growth: Some Theoretical and Empirical Analysis of Selected Developed and Developing

ESCAP Countries". Research Paper No. 117. Department of Economics, Melbourne University. Australia.

Hossain, Md. Akhtar (1986a). "The Short Run Demand for Real Money Balances in the Bangladesh Economy". Discussion Paper No. 6/86. School of Economics, La Trobe University, Australia.

Hossain, Md. Akhtar (1986b). "The Ability of the Monetary Authority to Control the Stock of Money Supply in a Developing Economy like Bangladesh". Discussion Paper No. 18/86. School of Economics, La Trobe University, Australia.

Jacobs, R. (1977). "Hyperinflation and the Supply of Money". *Journal of Money, Credit and Banking.* Vol. 9. pp. 287–303.

Kalfa, A. (1967). "The Brazilian Stabilization Programme". *The Journal of Political Economy.* Vol. 75. pp. 596–631.

MacKinnon, J., H. White and R. Davidson (1983). "Tests for Model Specification in the Presence of Alternative Hypotheses: Some Further Results". *Journal of Econometrics.* Vol. 21. pp. 53–70.

Martin, A., and A. Lewis (1956). "Patterns of Public Revenue and Expenditure". *The Manchester School.* pp. 303–339.

Murty, G., and S. Murty (1978). "The Functional Form of the Demand for Money in Bangladesh". *Bangladesh Development Studies.* pp. 443–460.

Olivera, J. (1967). "Money, Prices and Fiscal Lags: A Note on the Dynamics of Inflation". *Banca Nazionale del Lavoro Quarterly Review.* Vol. 20. pp. 258–267.

Parikh, A., A. Booth and R. Sundrum (1985). "An Econometric Model of the Monetary Sector in Indonesia". *Journal of Development Studies.* Vol. 21. pp. 406–421.

Sargent, J., and N. Wallace (1973). "Rational Expectations and the Dynamics of Hyperinflation". *International Economic Review.* Vol. 2. pp. 328–350.

Sundrum, R. (1973). "Money Supply and Prices – A Reinterpretation". *Bulletin of Indonesian Economic Studies.* November.

Tanzi, V. (1977). "Inflation, Lags in Collection and the Real Value of Tax Review". *IMF Staff Papers.* Vol. 24. pp. 154–167.

Wagner, A. (1893). *Grundlegung der politschen Oekonomie.* 3rd ed. Leipzig, Cited by Borcherding (1985).

Williamson, J. (1961). "Public Expenditure and Revenue: An International Comparison". *Manchester School.* Vol. 29, No. 1. pp. 43–56.