Deficit and External Debt Effects on Money and Inflation in Brazil and Mexico: Some Evidence

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The recent economic environment has produced an immense accumulation of external debt, high rates of growth in money supply and inflation in developing countries such as Brazil and Mexico. Some economists attribute these problems to the over-expansionary policies of their governments which have forced their Central Banks to accommodation via monetary policy. The purpose of this paper is to test the monetarist view that deficits and the growth of money are the principle causes of inflation (Niskanen, 1978) when the Central Bank conducts monetary policy by controlling interest rates rather than the money supply. Some attempts have been made to test the proposition that higher deficits ultimately may cause inflation by promoting high money growth. [Barro (1978a, b), Hamburger/Zwick (1981, 1982), McMillin and Beard (1982), and Giannaros and Kolluri (1985)].

This study examines these issues for Brazil and Mexico. The section which follows offers a brief description of the model and data. Empirical results are provided in the third section which is followed by some concluding remarks.

THE MODEL AND DATA

To study the possible effects of budget deficits on monetary policy, we specify the money growth function as:

$$\dot{M} = \left(\dot{M}^e, \frac{D}{Y_{-1}}\right) \text{ where}$$

$\dot{M}$ = the rate of change of the money supply in the current year,

$\dot{M}^e$ = the rate of change of the expected money supply in the current year,

D = nominal budget deficit in the current year, and

Y = nominal GNP in the current year.

The growth rate of the money stock is assumed to depend on the growth rate of the expected money stock as predicted by lagged variables that affect the behavior of the monetary authority and the government budget deficit (Darby, 1983, p. 245). The lagged deficit variable is an explanatory variable with respect to money stock growth for two reasons. First, some lag effects of the money supply response to government deficits may occur because interest rates may take some time to adjust as demand for loanable funds increases. Second, by using the lagged deficit variable, the misspecification of the timing of deficits and money growth issues raised by Hamburger and Zwick (1982, p. 280) is avoided. The actual form of the function

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depends on the hypotheses describing M^e. Assuming linearity and

$$\dot{M}^e = F(\dot{M}_{-1}, \dot{M}_{-2})$$ as a special case we obtain

(1)
$$\dot{M} = \alpha_{11} + \alpha_{12}\dot{M}_{-1} + \alpha_{13}\dot{M}_{-2} + \alpha_{14}\frac{D}{Y_{-1}} + u_1$$

where (D/Y_{-1}) stands for the level of government deficit as a percentage of GNP lagged one year and u_1 is the error term. This specification will enable us to study the impact of the government deficit on the money supply. In addition, to examine the direct and indirect fiscal policy effects on inflation, a second model which uses the rate of change in real GNP as a proxy policy effects on inflation, a second model which uses the rate of change in real GNP as a proxy for rate of change in employment was formulated. Model (1) and Model (2) which are an approximation of Barro's initial specification (1978 a, b) employed in Hamburger and Zwick (1981) can be considered as variants of each other

(2)
$$\dot{M} = \alpha_{21} + \alpha_{22}\dot{M}_{-1} + \alpha_{23}\dot{M}_{-2} + \alpha_{24}DEF_{-1} + \alpha_{25}\left(\frac{\dot{Y}}{P}\right)_{-1} + u_2$$

$\left(\dfrac{\dot{Y}}{P}\right)_{-1}$ = the rate of change of real GNP in the prior year,

$\dot{P}_{-1}$ = the rate of change of the GNP deflator in the prior year,

DEF_{-1} = nominal government deficit divided by the GNP deflator multiplied by trend real GNP lagged one year.

To study the effects of government deficits on inflation, the following monetarist price change equation is used:

$$\dot{P} = \beta_{11} + \beta_{12}\dot{M} + \beta_{13}\dot{M}_{-1} + \beta_{14}\dot{M}_{-2} + u_3$$

in which $\dot{P}$ is the rate of change in the GNP deflator. Accordingly, the current inflation depends on the current and lagged rates of money growth. This model may be modified to consider the possible direct response of inflation to deficits:

(3)
$$\dot{P} = \beta_{11} + \beta_{12}\dot{M} + \beta_{13}\dot{M}_{-1} + \beta_{14}\dot{M}_{-2} + \beta_{15}\left(\frac{D}{Y_{-1}}\right) + u_5$$

in which (D/Y_{-1}) is the government deficit in the current year as a percentage of the GNP in the prior year. This response may occur from the demand side and/or through its impact on inflationary expectations, rather than through variations in money supply. Our inflation equation (3) can be considered as a close approximation of the following equation specified by Niskanen:

(4)
$$\dot{P} = \beta_{21} + \beta_{22}\dot{M}_{-1} + \beta_{23}\dot{M}_{-2} + \beta_{24}\dot{P}_{-1} + \beta_{25}\left(\frac{D}{Y_{-1}}\right) + u_6$$

Monetarist propositions can be tested by using the money and price equations (1) and (3). Equations (2) and (4) are also estimated for purposes of comparison. The slope coefficients, as implied by the stated propositions, are expected to be positive.

Unlike the case of the highly developed economies, most of the less developed nations have recently been plagued by huge external debt. This phenomenon is especially true for Brazil and Mexico. To study the direct and indirect effects of the external debt on inflation our basic money and price equations (1) and (3) are replaced by $(XDEBT/Y)$ which represents external

debt as a percentage of GNP. It is assumed that the Central Bank, as a response to an increase in external debt, intervenes by increasing the money supply in order to prevent the local currency from appreciating. Thus, the effect of external debt on money supply and/or inflation is considered to be positive.

The Data Sources

The annual time series data on all the variables, except on debt for Brazil and Mexico, have been collected from the *International Financial Statistics* and its supplements published by the International Monetary Fund. The most current and revised data on total debt outstanding (disbursed only) for the years 1972–82 for Brazil and for the years 1965–76 for Mexico, were supplied by the World Bank, Washington, D.C. In the case of the debt figures for the years 1956–71 we used data supplied by World Bank and those published in the *World Debt Tables—External Public Debt of LDC's, IBRD*. The sample period is 1950–81 for Brazil and 1965–81 for Mexico for data relating to deficits. For equations in which debt is used as an explanatory variable, the estimates are for the sample period 1967–81 for Brazil and 1965–76 for Mexico. In the case of Mexico GDP has been used in place of GNP. Money stock is measured by M1 and all variables are measured in billions of the local currencies. The data on budget deficits are based on the national income accounts with a reversed sign for interpretation convenience of the results.

The parameters of the model are estimated using the annual time series data for Brazil and Mexico. Because the initial Ordinary-Least Squares regressions, based on Durbin-Watson statistics, indicated some serial correlation in the residuals, the Maximum Likelihood procedure assuming first order serial correlation in the disturbance term was employed.

EMPIRICAL RESULTS WITH DEFICIT AS THE PRIMARY DETERMINANT

Results with Deficit as the Primary Determinant

The money growth equation is estimated using two different hypotheses. First, in Equation 1 money growth is explained by the last year's budget deficit relative to GNP and the lagged money growth. Equation 2 follows Barro's specification [as modified by Hamburger and Zwick] in which budget deficit is a determinant of money growth among other things.

Contrary to the conventional belief, the estimates presented in Table I reveal that the budget deficit is not statistically significant as a determinant of the money supply in either Brazil or Mexico. It seems to be marginally significant in one of the estimated equations for Brazil. However, in this specific case (Equation 1) the other summary statistics are not at satisfactory levels. Thus, the empirical results do not support the thesis that higher government deficits contribute to a rapidly increasing money supply. This is consistent with the findings reported for industrialized nations (Giannaros and Kolluri, 1985). This may suggest lack of coordination between fiscal and monetary policies.

The price change equation is estimated by using two different hypotheses. First, specification (3) is the traditional monetarist proposition that inflation is a function of the current and the lagged money growth variables and the budget deficit. Second, Niskanen's specification (4) describes inflation as a function of money growth, lagged inflation and the budget deficit. These alternative price equations are used for comparative purposes. Either of these specifications can be used to study the inflationary effects of budget deficits.

Examination of the results of Equations (3) and (4) in Table II reveal that the deficit

TABLE I

ESTIMATED COEFFICIENTS FOR THE MONEY SUPPLY EQUATIONS

Country	Constant	$\dot{M}_{-1}$	$\dot{M}_{-2}$	$(D/Y)_{-1}$	DEF_{-1}	$(Y/P)_{-1}$	$(XDEBT/Y)$	R^2	D.W.	F-Ratio	Rho-Value
BRAZIL											
Eq. 1	0.297	0.031 (0.16)	0.155 (0.83)	5.369** (1.88)				.11	1.97	0.95	0.51
Eq. 2	0.174	0.575* (2.82)	0.104 (0.50)		0.117 (0.30)	-0.314 (0.75)		.36	1.97	3.43*	0.05
Eq. 1A	-0.037	0.244 (1.22)	0.078 (0.54)				1.598* (3.05)	.66	1.74	5.85*	0.22
Eq. 1B	-0.007	0.2143 (1.13)					1.669 (3.32)*	.64	1.70	10.58*	0.26
MEXICO											
Eq. 1	0.020	0.597* (2.40)	0.224 (1.00)	1.232 (0.96)				.83	2.04	19.91*	0.02
Eq. 2	0.0473	0.669* (2.61)	0.187 (0.80)		0.990 (0.720)	-0.411 (0.60)		.84	2.06	10.72	0.04
Eq. 1A	0.045	0.197 (0.56)	-0.012 (0.04)				3.071** (1.83)	.52	1.75	2.15	0.27
Eq. 1B	0.044	0.198 (0.61)					3.046** (2.12)	.52	1.75	4.13*	0.27

Values in parentheses are t-values
* Significant at the 0.05 level
** Significant at the 0.10 level

TABLE II

ESTIMATED COEFFICIENTS FOR THE CHANGE OF PRICE EQUATIONS

Country	Constant	$\dot{M}$	$\dot{M}_{-1}$	$\dot{M}_{-2}$	(D/Y_{-1})	$\dot{P}_{-1}$	$(XDEBT/Y)$	R^2	D.W.	F-Ratio	Rho-Value
BRAZIL											
Eq. 3	-0.123	0.431* (2.66)	0.478* (3.07)	0.386* (2.47)	-0.004 (0.01)			.51	1.74	6.33*	0.57
Eq. 4	-0.007		0.419* (2.14)	0.3071 (1.53)	1.305 (0.73)	0.266 (1.18)		0.42	1.83	4.38*	0.53
Eq. 3A	-0.569	0.057 (0.21)	0.878* (4.60)	0.533* (4.07)			1.609* (2.47)	.90	1.52	17.73*	0.26
Eq. 3B	-0.411	0.229 (0.55)	0.718* (2.43)				1.837** (1.91)	.79	1.50	11.15*	0.10
MEXICO											
Eq. 3	-0.728	-0.027 (0.08)	0.666* (2.11)	0.127 (0.52)	1.886** (1.95)			.91	2.22	19.24*	0.28
Eq. 4	-0.072		0.649* (2.60)	-0.115 (0.37)	1.825* (2.22)	0.009 (0.03)		.91	2.22	19.26*	0.28
Eq. 3A	-0.112	0.404 (1.63)	0.805* (3.21)	0.512** (2.24)			-1.475 (1.06)	.90	1.99	9.26*	0.09
Eq. 3B	-0.0851	0.360 (1.19)	0.899 (2.88)				-0.240 (0.16)	.85	1.82	10.99*	0.19

Values in parentheses are t-values
* Significant at the 0.05 level
** Significant at the 0.10 level

variable is only statistically significant in the case of Mexico. The estimated coefficients have the expected positive signs and the other summary statistics are at acceptable levels. The regression coefficients of the deficit variable indicate that a unit increase in deficit relative to GNP in the prior year causes an approximate 1.8% increase in the rate of money growth. This seems to confirm the direct impact of deficit spending on inflation in Mexico.

Regarding the second monetarist proposition concerning the direct effect of the change in money supply on inflation we observe that the growth of money in the prior year is consistently significant in explaining current inflation in both models. A one percent increase in the rate of growth of money lagged one year increases the rate of inflation by about one half of a percent and by about six tenths of a percent in Brazil and Mexico respectively. Therefore, we can conclude that there is some evidence in favor of this proposition.

Results with External Debt as the Primary Determinant

Thus far, the direct and indirect effects of deficits on money and inflation have been tested. What remains to be tested is the proposition that the Central Banks responds to the accumulation of external debt relative to national income by expanding the money supply. This is accomplished by modifying the basic money model (Equation 1) using external debt as primary determinant.

The results presented in Table I [Equations (1A) and (1B)] consistently indicate a strong positive relationship between debt and money growth. The coefficient of determination (R^2) indicates that fifty to sixty percent of the variation in the money growth is attributable to the variation of the external debt. It is interesting to note that, in general, the overall summary statistics support a stronger relationship between debt and monetary expansion in Brazil than in Mexico. This may be attributable to differences in the structure of their financial and political institutions. However, given the sample size limitations in both countries, one must view these conclusions cautiously.

To study the direct and indirect effects of external debt on inflation, the basic price [Equation (3)] model is modified to include the ratio of external debt to national income as a primary factor. We submit that overexpansionary fiscal policy actions financed by excessive foreign borrowing is bound to increase inflationary pressures. The estimated results presented in Table II [Equations (3A) and (3B)] enable us to test this proposition.

Examination of the estimates indicates a significant direct relationship between external debt and the rate of inflation only in Brazil. We also observe a strong positive significant relationship between money growth and the rate of inflation in both Brazil and Mexico. The same phenomenon has been established with deficit as the primary explanatory variable. These results which are consistent with Barbarosa's findings (1983) seem to confirm the traditional monetarist proposition on the effects of money growth on inflation. The estimated coefficients in Table II, in general, gave the expected signs and the summary statistics are at satisfactory levels. The coefficient of determination (R^2) indicates that about eighty to ninety percent of the variation in the rate of inflation has been accounted for by our model. Based on these results, we conclude, that in Brazil, external debt has had direct and indirect effects on the rate of inflation while in Mexico there has only been an indirect effect (through money growth).

CONCLUDING COMMENTS

The overall results of testing the impact of deficits and debt on money supply growth and inflation are consistent with the following concluding remarks:

1. Contrary to the conventional belief, the federal budget deficit has been insignificant as a determinant of money growth in Brazil and Mexico. This is consistent with the findings reported earlier for some of the industrialized countries, the U.S. being the exception.
2. There seems to be some evidence of a direct effect of deficit spending on the rate of inflation, in the case of Mexico. However, such a relationship is not observed in Brazil.
3. The results regarding the second monetarist proposition concerning the direct effect of the change in money supply on the rate of inflation has some validity in both Brazil and Mexico. This is consistent with the basic monetarist view on the effects of money supply on inflation.
4. External debt is found to be a significant factor of money growth in both Brazil and Mexico, as has been proposed, suggesting a possible indirect effect on the rate of inflation. On the other hand, the results are not conclusive regarding the direct effect of external borrowing on the rate of inflation.

Based on these conclusions, it seems reasonable to conclude that expansionary fiscal policy can be inflationary via its effect on the monetary policy of the Central Bank. However, given the sample size limitations of this study these results are to be interpreted cautiously.

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