Determinants of Latin American External Borrowing[*]

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Given the widespread interest in the huge external debt accumulated by developing countries, most studies use non-quantitative approaches to examine the crisis. This paper establishes a quantitative relationship between the foreign borrowing of seven heavily indebted Latin American countries and some major external and internal factors during the period 1971-86. The results suggest that while the external factors play a large role in the debt accumulation, internal factors are also important, implying the domestic authorities can use fiscal and monetary policy to control the debt volume.

I. Introduction

The increase in the huge external debt accumulated by developing countries in general, and Latin American nations in particular has received much attention in recent years (Fisher (1989), Dornbusch (1985), William (1983)). The total external public debt of Latin American countries, taken together, relative to their exports increases from 155.5 percent in 1973 to 422 percent in 1987. Similarly, the share of interest payments on the external debt in total exports increases from 5.9 percent in 1973 to 22.0 percent in 1987.[1]

The debt drama is rooted in the debtor nations' policy actions, macroeconomic shocks in the world economy and other factors such as the need to recycle large liquid surpluses accumulated by the oil exporting coun-

[1] These figures are derived from *Economic and Social Progress in Latin America* and *International Financial Statistics* (IFS), various issues.

tries in the 1970s. The crisis enters a new era in 1981-82, when as a result of world recession the real cost of borrowing rises sharply, prices of primary goods tumble in international markets, banks become more reluctant to provide more loans to the debtor nations and the foreign exchange resources of the developing countries are depleted. Consequently, these nations face serious difficulties in meeting their financial obligations. Furthermore, because of the nature of the debt structure, which becomes increasingly short-term, and the unprecedented increase in the real cost of borrowing during the 1980s, interest payments absorb a large portion of their international reserves.

While a number of researchers try to analyze the external debt situation of developing nations during the past decade, the assessment of the factors listed above is generally based on more or less casual observations rather than on a more systematic empirical examination of the current crisis. Dell and Lawrence (1980), Fishlow (1982), Hope and Klein (1983), Lin and Siddique (1978), Reichman (1978), David (1981), and Enders and Mattione (1984) draw conclusions from external and internal changes that developing countries experience during the 1970s without using any empirical tests. Some studies (for example, Carvounis (1982)) argue that much of the debt and balance of payments problems of the developing countries is the result of external factors which are beyond the capacity of these countries to control or influence. There are, however, studies that develop econometric models to examine the factors responsible for the debt crisis. In a cross-section study using 43 developing countries, Heller and Frenkel (1982) identify some factors responsible for the external debt (namely; the imports, exports, gross domestic product, international reserves, and the riskiness of lending). Kwack and Leipziger (1988) examine empirically the impact of changes in the domestic assets of the monetary authority, growth rate of output, domestic inflation, cost of capital, real deposit rate and the government spending on the external borrowing of Korea. The empirical results show that the monetary factors such as the real interest rates and the domestic asset position of the monetary authorities are the main determinants of the foreign borrowing in Korea during 1972-86. Looney (1989) uses econometric models to examine the determinants of the third world mineral countries' external indebtedness. The GDP, current account, international reserves, military expenditures, and health expenditures are used in a reduced form equation. He indicates that "(t)he mineral countries... have a higher level of debt, a higher debt burden in terms of debt to GDP and a higher servicing problems..." (p. 54). These nations, however, use their loans more productively.

The purpose of this study is to go beyond these previous studies and to

develop a model that examines the influence of both demand and supply factors on the external borrowing of the heavily indebted developing countries. Because of the relative importance of the Latin American countries in total foreign borrowing, this paper focuses on seven major borrowers; Argentina, Brazil, Columbia, Chile, Mexico, Peru and Venezuela, for the period 1971-86. These countries produce almost 90 percent of all Western Hemisphere GNP and have a similar proportion of external debt. The main thesis of the paper is that both external and internal factors are responsible for the rapid rise in the external borrowing of the developing countries in general and the Latin American countries in particular.

At the outset, it is necessary to point out certain areas that the paper does not cover, even though they are closely related to the subject at hand. First, the paper does not look at the debt crisis from the banks' point of view. Therefore, it does not deal with such questions as the creditworthiness of the borrowing countries. Second, it does not address such questions as to whether the loans are made for investment purposes or for consumption uses.

The outline of the paper is as follows. Section II summarizes the sources of the current debt crisis. In Section III an empirical model is developed and estimated using pooled cross-section time-series data. The empirical results are presented and discussed in Section IV. In Section V, specification and stability tests are conducted. Concluding remarks are presented in Section VI.

II. The Sources of the Current Debt Crisis

The major determinants of the volume of borrowing seem to be divisible into external and internal factors. This distinction is made in oder to gain a better appreciation of the role that these factors have played and might play in the future. Among the external factors one can list: (1) The deterioration in terms of trade, due to the sharp increases in oil prices and reductions in prices of raw material, (2) the slow-down of economic activity in the industrial countries following the rises in oil prices, (3) the sharp increase in the availability of funds due to surpluses accumulated by OPEC nations and the remarkable increases in the banks' capacity to expand their international lending operations during the 1970s. The international money market was eagerly encouraging the developing countries to borrow. This caused a sharp decrease in the real cost of borrowing for the debtor nations. At the same time, the internal factors such as (1) a growth rate in real output substantially higher than their major trading partners, and (2) inflationary demand management policies combined

with rigid exchange rate policies result in domestic demand pressures and a deterioration in balance of payments in many developing countries. This leads to substantial imports and encourage outflow of capital. Reluctant to take deflationary domestic measures to correct balance of payments deficits, and frustrated with International Monetary Fund's loan package requirements, these countries borrow in the international credit market as a source of loans (Cline (1983), Weintraub (1983), Khan and Knight (1983), Weisner (1985), and Kwack (1988)).

The deterioration in the overall terms of trade of all Western Hemisphere countries, taken together, between 1974 and 1986 represents a distinct change from the previous decade.[2] A considerable part of the deterioration can be the fourfold in the price of oil in 1973-74 and the further substantial increase in 1979-80. This in turn increases the prices of those manufactured goods that require energy as a major input. At the same time prices of most other primary goods register a downward trend. Chu and Morrison (1984) show that the 1970s and 1980s are marked with significant cyclical fluctuations in the non-oil commodity prices, whereas during the two preceding decades they enjoy a high degree of stability. Over the last three decades, the largest annual decline in the prices of primary goods (excluding gold and petroleum) occurs in the 1975 recession, when prices decline by 19 percent. The recession in the early 1980s depresses the prices of non-oil primary goods even further. The decline in prices by 15 percent in 1981 and 12 percent in 1982 result in a cumulative two-year decline of 25 percent which is the largest and the longest in more than three decades. In 1983 they increase by only 6 percent. In 1985 and 1986 they again decline by 13 and 1 percent, respectively.[3]

A second important factor is the gap between the real output growth rate of Latin American countries and those of industrial nations. During the period 1971-80, their real gross domestic product, taken together, grows at an annual average rate of 5.5 percent while that of the developed nations grows at an annual average of 3.38 percent. The worldwide recession of the early 1980s lowers the average economic growth rate in both Latin American and industrial nations to 2.01 and 2.33 percent, respectively, for the period 1981-86. Therefore, as far as the influence of real income on demand for imports is concerned, Latin American coun-

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[2] During 1962-72, the terms of trade register an average annual increase of about 1.7 percent while during 1973-79, they deteriorate with an average annual rate of 1.9 percent. During the 1980-86, the terms of trade deteriorate even further at an average annual rate of 2.6 percent, obtained from *World Economic Outlook* and *Statistical Abstract of Latin America,* various issues.

[3] These figures are derived from *World Economic Outlook,* various issues.

tries import more than they export to the industrial nations, particularly during the 1970s. The growing balance of payments deficits resulting from the above changes does not encourage these countries to take necessary measures to adjust to these developments. Instead, they maintain their rapid economic growth by importing the required capital goods from abroad (discussed below). This in turn leads to more demand for foreign goods and services and further deterioration in the balance of payments.

The third major external factor is the sharp increase in the availability and the decline in real cost of borrowing from the international capital market. The rapid expansion in the Eurocurrency market, chiefly because of the inflow of petrodollars to European markets, and the eagerness of the banks to recycle these petrodollars lead to a reduction in the real cost of borrowing.[4]

During the 1960s the bulk of investment in Latin America is financed domestically. From 1965 to 1970 net capital inflow accounts for only 8.8 percent of total investment. But in the next decade, massive capital inflow occurs, equal to 20.1 percent of the total investment.[5]

This recourse to foreign borrowing does not result solely from initiatives in the borrowing countries. Rather it occurs through major shifts on the supply side. To banks, anxious to invest OPEC surpluses, Latin America seem underborrowed. As a result, the real cost of borrowing falls to unusually low levels during the 1970s.

While these external factors play an important role, domestic demand pressures are also important in determining foreign borrowing. Khan and Knight (1983) indicate that in most developing countries inflationary demand management policies combined with overvalued domestic currencies fuel domestic demand. This in turn, has a strong negative effect on the balance of payments and the demand for foreign exchange. The current account balance of all Western Hemisphere countries as a percentage of their exports deteriorates from −13.1 in 1973 to −23.6 in 1980. The world recession of the early 1980s causes this ratio to deteriorate even further to −31.3 and −34.9 in 1981 and 1982, respectively. The external disequilibrium adjustments achieved in most of these countries during 1982-84 improve, to some extent, their external balance position in 1984.

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[4] The real interest rates, defined in the Appendix 1, for all Latin America countries, taken together, are negative in 5 out of 7 years during the period 1974-80. But it is positive and increasing during the period 1981-86, derived from *International Financial Statistics* and *World Economic Outlook*, various issues.

[5] IDB, *Economic and Social Progress in Latin America: 1982 Reports*, p. 35.

Their current account as a proportion of exports improves to −1.9 in 1984 but it then deteriorates to −3.8 and −15.1 in 1985 and 1986, respectively.[6]

When economic growth slows down in industrial nations during the 1970s, Latin American nations unable or unwilling to take the necessary adjustment measures, continue ambitious government investment projects and borrow from international financial markets to finance their massive budget deficits. As a result, the rate of inflation increases markedly in the last four years of the 1970s. It reaches to an annual rate of 128 percent in all Latin American countries taken together. The domestic inflation generates increasingly overvalued exchange rates which give incentives to businessmen to borrow abroad rather than at home. The result is a further rise in external borrowing. The performance of inflation becomes even worse in the 1980s. It continues to increase during the first half of the 1980s and reaches to 143.2 percent in 1985. The year 1986 marks a sudden reduction in the rate of inflation to 88.4 percent. But it again increases to 177.5 percent in 1987.[7] Th net result is a larger overvaluation of the domestic currency.

The last important factor, resulting from both internal and external forces, is the growing outstanding stock of foreign debt. The total external public debt of all Latin American countries increases from $37.389 billion in 1973 to $380.0 billion in 1987. In order to service the outstanding debt as well as due portion of the principle they refer to foreign credit markets to obtain loans. Interest payments on the external public debt of all Latin American countries increase from $1.423 billion in 1973 to $19.844 billion in 1987.[8]

III. The Theoretical and the Empirical Model

Consider the following simple model that stipulates foreign borrowing of the ith country at time t (B_{it}) is related to its current account balance (CA_{it}) and its international reserves (RES_{it}):

$$(1) \qquad B_{it} = f(CA_{it}, RES_{it})$$

In this equation, the current account balance can be viewed as the main determinant of demand for external borrowing and, following Heller and

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6 These figures are derived from *World Economic Outlook*, various issues.

7 These figures are derived from *World Economic Outlook*, various issues.

8 These figures are derived from *Economic and Social Progress in Latin America*, various issues.

Frenkel (1982), the international reserves position can be viewed as the main supply factor. Equation (1) can thus be interpreted as a reduced form.

Khan and Knight (1983) show that the current account balance of developing nations is influenced by the terms of trade, the foreign real interest rates, the economic growth of industrial nations, the real effective exchange rate and the government fiscal budget. There are, however, two other variables missing in their model: the growth in the real GDP of the home country (Doroodian, 1985) and the size of the nation's outstanding debt. Thus,

$$(2) \qquad CA_{it} = f(TOT_{it}, REER_{it}, BUD_{it}, RINT_{it}, YDIF_{it}, OUTDEBT_{it})$$

where
- TOT = Terms of trade based on 1980 prices;
- $REER$ = Effective real exchange rate based on 1980 prices;
- BUD = Government budget surplus (revenues minus expenditures), in millions of domestic currency;[9]
- $RINT$ = Foreign real interest rate;
- $YDIF$ = Real GDP growth rate differential between the home country, and the seven major industrial nations taken together;
- $OUTDEBT$ = Outstanding stock of foreign public debt of the home country, in millions of U.S. dollars;

Substituting equation (2) into equation (1) and writing it in a linear form, we get:[10]

$$(3) \qquad B_{it} = a + b\ TOT_{it} + c\ REER_{it} + d\ BUD_{it} + e\ RINT_{it}$$
$$+ f\ YDIF_{it} + g\ OUTDEBT_{it} + h\ RES_{it} + U_{it}$$

The relevant variables in equation (3) must be scaled to make them comparable across the nations before estimating the line. The nominal exports (X) is used to normalize the variables B, OUTDEBT and RES and the

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[9] A positive value means a surplus in the government budget and a negative value implies a deficit in the budget. Thus, there will be both negative and positive values in the series.

[10] Since some variables are negative (e.g., the government budget), equation (3) cannot be written and estimated in a log-linear form.

nominal GNP is used to normalize the variable BUD.[11] As a result, the empirical model can be written as:

$$(4) \quad (B/X)_{it} = a + b \ TOT_{it} + c \ REER_{it} + d \ (BUD/GNP)_{it} + e \ RINT_{it}$$
$$+ f \ YDIF_{it} + g \ (OUTDEBT/X)_{it} + h \ (RES/X)_{it} + U_{it}$$

where B = Net external public borrowing during the year, in millions of U.S. dollars;

X = Nominal exports of goods, in millions of U.S. dollars;

GNP = Nominal GNP of the home country, in millions of domestic currency;

U = Error term.

Based on the discussion in Section II, one would expect an improvement in the terms of trade, an increase in the ratio of government budget surplus to GNP, or an increase in the real cost of borrowing to result in a decline in the ratio of foreign borrowing to exports, while an increase in the real effective exchange rate, an increase in the outstanding stock of foreign debt as a proportion of exports, or an increase in the growth rate differential would tend to increase the foreign borrowing relative to exports. As Heller and Frenkel (1982) explain, the relationship between the borrowing and foreign reserves is not straightforward. On the one hand, as international reserves increase, there would be less need to borrow from abroad. On the other hand, using the portfolio model the relationship is expected to be positive, because both assets and liabilities tend to increase as the international reserves increase. See the Appendix 1 for the construction and sources of data.

Pooled cross-section time-series annual data for the sample of seven countries over the period of 1971-86 are used to estimate equation (4) under different specifications.[12] In all cases, we allow for contemporaneous correlation and first-order autocorrelation through the use of Parks (1967) generalized least squares method. This procedure and tests related to it are presented in Appendix 2.

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[11] To avoid problems associated with exchange rate conversions, the nominal exports rather than the nominal GNP are used to scale the variables. However, since the government budget surplus is expressed in terms of the domestic currency, the nominal GNP is used to normalize it.

[12] The main reason to pool the data is to gain sufficient degrees of freedom.

IV. Empirical Results

Three versions of equation (4) are estimated using a panel data for seven Latin American countries over the period 1971-86. The purpose of using different specifications is to examine if the results are robust. Equation (4.1) is the basic equation containing both external and internal variables. To construct the other specifications, the real GDP growth rate differential (YDIF) is split into its components; the real GDP growth rate in the home country (CYLC) and the real GDP growth rate in industrial countries taken together (CYDC). The former variable (CYLC) is then added to equation (4.2), where only internal factors are included and the latter variable (CYDC) is added to equation (4.3), where only external factors are included. Furthermore, two dummy variables, D74 and D79, were added to the above models to capture the first and the second oil shocks of the 1970s, but they turned out to be statistically insignificant. Thus, they were omitted from the estimation procedure. To check for multicollinearity, the correlation coefficients for the variables in each function were estimated. The highest correlation coefficient obtained was 0.37 between the international reserves and the outstanding debt variables.[13]

The regression estimates are reported in Table 1.

Table 1

REGRESSION RESULTS FOR SEVEN HEAVILY INDEBTED
LATIN AMERICAN NATIONS

	Equation (4.1)	Equation (4.2)	Equation (4.3)
Intercept	−20.391	−30.662	2.639
	(−2.97)***	(−5.15)***	(0.51)
Terms of Trade	−0.084		−0.085
(TOT)	(−2.07)**		(−2.03)**
Foreign Real Interest Rates	−0.182		−0.187
(RINT)	(−2.73)***		(−2.82)***
Growth in Industrial Nations			−1.213
(CYDC)			(−1.78)**
Growth in the Home Country		0.422	
(CYLC)		(1.60)*	

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13 The correlation matrix is available from the author upon request.

Growth Differential (YDIF)	0.482 (1.76)**		
Real Effective Exchange Rate (REER)	0.061 (2.37)***	0.049 (1.85)**	
Fiscal Position (BUD/GNP)	−0.505 (−3.17)***	−0.507 (−2.69)***	
Intl. Reserves of the Home Country (RES/X)	0.115 (2.54)***	0.140 (2.98)***	
Stock of Foreign Debt of the Home Country (OUTDEBT)	0.212 (15.18)***	0.215 (14.71)***	0.197 (15.58)***
Pearson Correlation	0.72***	0.70 ***	0.70 ***
Degrees of Freedom	104	106	107

Note: Dependent variable is the ratio of foreign borrowing to nominal exports. T values
are in parentheses. Parks procedure does not produce the R-Squared and beta coef-
ficients. Since the signs are *a priori* determined, t tests are one-tailed.
  * Significant at 10 percent level
 ** Significant at 5 percent level
*** Significant at 1 percent level

The findings are robust with different specifications. All estimates are
statistically significant at the 10 percent level or better. The estimated
coefficient for each explanatory variable is very close, in absolute value, to
the corresponding estimate in other specifications. In fact, each estimate is
within one standard deviation of the corresponding parameter in other
models. Since the R-squared has not been developed for the Parks pro-
cedure, to get some impression about the correlation between the depen-
dent and the independent variables, taken together, the correlation coeffi-
cient is calculated for each regression. These estimate as reported in Table
1, are fairly high for a cross-section time-series data. The t-test rejects the
null hypothesis that the correlation in the population is zero at the 1 per-
cent level. For analytical purposes, in the following we discuss the results
for the basic equation (4.1).

The results for equation (4.1) provide empirical confirmation for the
view that both external and internal factors explain the foreign borrowing
of Latin American countries. According to these results, the foreign real
interest rates, the real effective exchange rate, the fiscal position, the ratio
of international reserves to exports, and the stock of foreign debt as a pro-
portion of the home country's exports are statistically significant at a 1

percent level. The terms of trade and the growth rate differential are statistically significant at the 5 percent level. All variables have the expected sign. A deterioration in the terms of trade, a rise in the ratio of outstanding debt to exports, and an increase in the real effective exchange rate would increase the borrowing as a proportion of exports. Moreover, a decrease in the ratio of government budget surplus to GNP, a positive growth rate differential or a reduction in the real interest rates would cause the ratio of foreign borrowing to exports to increase. The positive sign on the coefficient of the ratio of international reserves to exports is consistent with the prediction of the portfolio model.

Given the units in which the variables are expressed, the estimates suggest that a deterioration of 1 percent in the terms of trade would lead to an increase of 0.08 percentage point in the ratio of foreign borrowing to exports, while a reduction of 1 percent in the foreign real interest rate or an appreciation of 1 percent in the real effective exchange rate in a typical Latin American country would cause the borrowing as a ratio of exports to increase by about 0.18 and 0.06 percentage point, respectively. An increase of 1 percent in the growth rate differential, or a decline of 1 percentage point in the ratio of government budget surplus to GNP; or an increase of 1 percentage point in the ratio of international reserves to exports would cause the external borrowing as a proportion of exports to increase by 0.48, 0.51, and 0.12 percentage points, respectively. And finally, an increase of 1 percentage point in the debt outstanding as a proportion of exports would lead to 0.21 percentage point increase in the ratio of foreign borrowing to exports.

The results of this study are quite interesting. These findings do not confirm the general belief that much of the borrowing problem is the result of external factors beyond the control of Latin American nations. They suggest that these countries can use an appropriate combination of demand management and exchange rate policy to adjust to external exogenous shocks. For example, the estimates suggest that, *ceteris paribus,* it would require a real devaluation of 1.38 percent of the domestic currency to keep the ratio of external borrowing to exports unchanged for each 1 percent deterioration in the terms of trade, or a reduction of 0.38 percent in the ratio of government budget surplus to GNP can counter each 1 percent reduction in the foreign real interest rate.

It should, however, be mentioned that devaluation of the domestic currency to counter the adverse effects of external changes may not be feasible for some of these countries. Brazil, for example, uses regular indexation. Moreover, domestic factor prices tend to respond immediately following the devaluation and would tend to leave the real effective ex-

change rate unchanged. Finally, the authorities may not be able — for political reasons — to devalue the domestic currency. But there are other variables under the control of government. The suggestion here is that, the size of the external borrowing would have been much smaller if the authorities had not adopted inflationary fiscal policies to overheat the economy or had stimulated the growth in the real output beyond that of their trading partners. For example, if a typical Latin American government had reduced the share of its budget surplus in GNP by an annual rate of 1 percentage point after the first oil shock and had adopted an economic growth rate comparable to those of the major trading partners, the foreign borrowing as a proportion of exports, *ceteris paribus,* would have been reduced by that 6.57 percentage point at the end of the period under review. Finally, a more flexible exchange rate would seem clearly to have been helpful.

V. Specification and the Stability Tests of the Model

Since the price of money is the interest rate, one might argue that the real interest rate should not be exogenously given to the model. To examine if this is the case, the Hausman specification test (1978) is conducted under the null hypothesis that the covariance between the foreign real interest rate and the error terms in equation (4.1) is zero. The instrumental variables used for the foreign real interest rate are the balance of payments surplus of the oil exporting countries as a supply factor and the government budget surplus of all industrial nations, taken together, relative to their combined nominal GNP, as a demand factor.[14] The former is chosen as an instrument because the petrodollars recycled in Eurocurrency markets significantly influence the interest rates in these markets. The latter instrumental variable is chosen because these nations, partiularly the U.S., resort to the foreign credit markets to finance their budget deficits. The demand generated by these governments influences the interest rates.

The Hausman test involves the calculation of a Chi-square statistic. The test fails to reject the null hypothesis, implying that the real interest rate is exogenous in the model.[15] One possible explanation for this result is that the borrowing of these seven Latin American countries compared to

[14] A positive value means a surplus and a negative value means a deficit for these two variables. Therefore, there are both positive and negative values in each series.
[15] The calculated Chi-squared is 1.246, while the critical Chi-squared at 10 percent level is 2.706.

the supply of international liquidity is relatively small.[16]

The second test conducted is a test for structural shifts in the model. It is quite plausible to argue that after the rises in oil prices the estimated coefficients change significantly during the 1980s compared to those of the 1970s. To test if a structural shift is taking place, the period under study is split into two parts; 1971-1979 and 1980-1986. The whole period and the two subperiods are used to obtain three different sets of estimates, one for each data set, using equation (4.1). The Chow test fails to reject the null hypothesis, suggesting that the model is stable throughout the period under study.[17]

Alternatively, one may argue that there is no strong prior belief that the data should be split at 1980. To examine if the estimates are stable throughout the period of study, the Farely and Hinich (1970) test is conducted under the null hypothesis that the model is stable. One can conduct this test for any single coefficient that is thought to be unstable, or for some subset of coefficients, or for all coefficients in the function. In each case we assume that the unstable coefficient is a linear function of time. Since we have no *a priori* knowledge as to which coefficient is unstable, we conduct the test for all coefficients in equation (4.1). The virtue of the Farely and Hinich (1970) test is that it does not require the data to be split into parts; in both restricted and unrestricted models all observations are used. The appropriate test is an F-test. The results fail to reject the null hypothesis, suggesting that the model is stable.[18]

VI. Concluding Remarks

This paper attempts to further the discussion of external borrowing by investigating the quantitative relationship between the volume of borrowing and a set of closely related factors. Pooled cross-section time-series analysis is used for seven major borrowers in Latin America during the period 1971-86. The empirical results suggest that while the external factors (the deterioration in terms of trade, the slow-down in the economic activity in industrial countries, a decrease in the real cost of borrowing) plays a large role in foreign borrowing, internal factors (inflationary

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[16] The ratio of the Latin America external public debt to the deposit banks' foreign assets varies between 8 percent to 11 percent throughout the period 1973-86, derived from the *Economic and Social Progress in Latin America* and *International Financial Statistics*, various issues.

[17] The calculated F value is 1.45, while the critical F at 5 percent is 2.07.

[18] The calculated F is 1.8, while the critical F at 5 percent level is 2.10.

domestic management policies combined with rigid exchange rates) as well as the size of debt outstanding are also important in determining the volume of external borrowing in Latin America. This implies that the domestic authorities can reduce the rapid rise in the external borrowing by adopting appropriate domestic policy.

Viewed from this vantage point, some of the factors that cause excessive borrowing may be under the control of domestic government. A more flexible exchange rate seems called for, supplemented by the application of a broad range of management policies that are more consistent with the rate of growth in real output of their major trading partners.

Appendix 1
Data Definitions and Sources

B   = Net external public borrowing during the year, in millions of U.S. dollars, various issues of *World Tables*, published by World Bank and *Economic and Social Progress in Latin America*, published by Inter-American Development Bank;

X   = Nominal value of exports of goods by the home country, in millions of U.S. dollars, *International Financial Statistics* (IFS), published by International Monetary Fund;

TOT = Terms of trade based on 1980 prices, various issues of *Statistical Yearbook for Latin America*, published by United Nation.

REER = Real effective exchange rate based on 1980 prices. For the purpose of this study, it is defined as the ratio of the home country's CPI to an import-weighted average of the CPI in the major trading partners, adjusted for the nominal exchange rate, various issues of *IFS*. Note that the REER must also include tariffs, subsidies and others. Unfortunately, data on these variables are not available;

BUD = Government budget surplus (revenues minus expenditures); millions of domestic currency, various issues of *IFS*;

GNP = Nominal GNP of the home country, in millions of domestic currency, various issues of *IFS*;

RINT = Real interest rate. Following Khan and Knight (1983), it is defined as the nominal Eurodollar rate in London

minus percentage change in the home country's export price index, various issues of *IFS;*

OUTDEBT = Outstanding stock of public debt of the home country, in millions of U.S. dollars, various issues of *World Tables* and *Economic and Social Progress in Latin America;*

YDIF = Difference in the rate of real GDP growth in the home country and the developed nations as a whole, various issues of *IFS.*

CYLC = Growth rate in the real GDP of the home country, 1980 prices, various issues of *IFS;*

CYDC = Growth rate in the real GDP of the seven largest industrial countries taken together: The U.S., Japan, Canada, West Germany, the U.K., France and Italy, various issues of *IFS;*

RES = International reserves including gold, millions of U.S dollars, various issues of *IFS.*

Appendix 2
The Parks Procedure

The Parks (1967) procedure assumes that the error terms have the following characteristics:

The error terms $U_{ij} = 1, 2, \ldots, N;$ and $t = 1, 2, \ldots, T,$ have the structure

$$E(U^2_{ii}) = \sigma_{ii} \qquad E(U_{it}\, U_{jt}) = \sigma_{ij} \qquad U_{it} = \rho U_{i\ t-1} + e_{it}$$

If cross-sectional independence does not exist then σ_{ij} would have a non-zero value (contemporaneous correlation). If it does, then σ_{ij} would be zero. In either case the estimates are efficient and consistent. However, a test is conducted for the existence of contemporaneous correlation in equations (4.1) through (4.3). The correlation coefficients between the various countries' error terms are not statistically significant at 10 percent level in over 90 percent of the cases in all models, suggesting cross sectional independence. The existence of autocorrelation in equations (4.1) through (4.3) is tested by directly estimating the autocorrelation coefficient. This estimate is found to be statistically significant at 1 percent level in all models, implying autocorrelation in the equations. Thus, the Parks procedure is appropriate. The procedure, however, does

not produce the R-squared because of the complexity of the error structure.

The Parks (1967) procedure consists of three steps. First, single equation regressions are used to estimate the autoregression parameters. Second, single equation regressions on the transformed equations (from step 1) are used to estimate the contemporaneous covariances. Third, the estimated contemporaneous covariance matrix is used to form the generalized least squares estimator.

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