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Private Investment in Developing Countries: An Empirical Analysis

Prepared by Joshua Greene and Delano Villanueva*

Authorized for Distribution by Mohsin S. Khan

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Abstract

This paper analyzes the effects of several policy and other macro-economic variables on the ratio of private investment to GDP in developing countries. Using data for a sample of 23 developing countries over the period 1975-87, the econometric evidence indicates that the rate of private investment is positively related to the real growth rate of GDP, public sector investment, and to a lesser extent the level of per capita GDP, while it is negatively related to domestic inflation, the debt service ratio, the debt-to-GDP ratio, and high real interest rates. There is also some indication that all but the last of these variables had a greater impact before the onset of the debt crisis in 1982, while the debt-to-GDP ratio (a measure of a country's debt overhang) has become more important since then.

JEL Classification Numbers:

O23, I21, I22

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Contents

I.	Introduction	1
II.	Recent Trends in Private Investment in Developing Countries	3
III.	Factors Affecting Private Investment Rates	5
	1. Theoretical analysis	6
	2. Preliminary evidence regarding different factors	8
IV.	Econometric Results	10
V.	Conclusions	18
	Appendix	20
	Chart 1. Average Levels of Private Investment as a Percent of GDP, 1975-87	4a
	Text Tables	
	1. Private Investment as a Percentage of GDP in Selected Developing Countries, 1975-87	4
	2. Average Levels of Major Economic Indicators in Selected Developing Countries, 1975-87	9
	3. Average Private Investment Rates over the Period 1975-87 for Countries with Selected Characteristics	11
	4. Regressions for Private Investment Rates	13
	5. Final Regressions for Private Investment Rates	16
	Appendix Table I. Nominal Interest Rates on Selected Time Deposits in 23 Countries, 1975-87	21
	References	23

I. Introduction

Since the beginning of the 1980s developing countries have experienced a pronounced slowdown in economic growth. The growth rate of real GDP, which for all developing countries averaged 5.5 percent a year during the 1971-80 period, averaged only 3.3 percent a year during 1981-89 (IMF, 1989, pp. 78-79). On a per capita basis, the average growth in real GDP fell from 3 percent a year during 1971-80 to less than 1 percent a year during 1981-89. High among the reasons for this slowdown has been a decline in investment rates, which have been shown to be positively and significantly related to real growth rates in a large sample of developing countries. 1/ Gross capital formation in developing countries declined from an average of 26.5 percent of GDP during 1981 to less than 23.5 percent during 1985-88 (IMF, 1989, p. 80). 2/

The decline in gross investment rates reflects many factors that have affected most developing countries during the 1980s. These include, inter alia, falling prices for primary commodity exports, a decline in private external financing, the presence of a large stock of foreign debt, and the implementation of adjustment programs designed to restore balance of payments viability. While there may have been an overall decline in investment, the gross investment to GDP ratio has differed substantially across countries and regions, remaining close to its 1981 level for developing countries in Asia and Europe while falling significantly in other regions. Over time, there have also been important differences among countries. For example, during the 1980s developing countries with recent debt-servicing difficulties have experienced lower rates of gross capital formation than have developing countries without such problems. Likewise, gross capital formation has, on average, been greater for developing countries specializing in manufactured exports than for countries exporting primary commodities--mostly minerals or agricultural products.

These differences in gross capital formation across countries have reflected variations in both public and private sector investment rates. The importance of public sector investment has been underscored during the 1980s, as the adoption of adjustment programs led many developing countries to reduce public sector investment activity as a way to cut fiscal deficits. Nevertheless, because public sector investment in most developing countries is effectively a policy variable, economists have focused on private sector investment as being more susceptible to extensive economic analysis. Also contributing to the interest in private investment activity is recent research suggesting that private sector investment has been more directly

1/ See IMF (1988).

2/ According to the same source, median levels of gross capital formation have fallen even more sharply during this period, from 25.3 percent of GDP during 1981 to 20.3 percent of GDP or less during 1987-89.

related to economic growth in developing countries than has public sector investment (Khan and Reinhart, 1990).

Despite the recognition that private investment plays a critical role in generating economic growth, there has been surprisingly little research on its determinants in developing countries. Stern (1989, p. 672), for example, in his recent survey of development economics, notes that "what determines investment" is very much an outstanding question in research on economic growth. Among the few recent studies on investment in developing countries is Blejer and Khan (1984), which examined the impact of government economic policy on private investment in some 24 developing countries. This study found that the level of private investment activity was related positively to the change in expected real gross domestic product (GDP), negatively to excess productive capacity (the shortfall of actual GDP from its trend value), and positively to the availability of funds for private investment (as measured by the change in bank credit for the private sector and in the level of private capital inflows). The study also found that the level of private sector investment was a positive function of the trend level of government investment, which was taken as representing investment in infrastructure, but not of deviations from that trend. This suggests that there is long-run complementarity of private to public sector investment but short-run substitutability, in the sense that short-run increases in public sector investment appear to crowd out private sector investment.

The present study is an attempt to learn more about the empirical determinants of private investment activity in developing countries during the post-1974 period. Following the approach taken in a recent study of national savings behavior (Aghevli *et al.* 1990), this paper provides a preliminary look at how various macroeconomic factors have affected private investment activity during this period in a number of developing countries. Among the factors examined are the following: (a) economic growth and per capita income level; (b) macroeconomic stability (as represented by low inflation rates); (c) the level of real interest rates; (d) the size of debt service burdens (as measured by debt service ratios and the magnitude of external debt relative to GDP); and (e) the rate of public sector investment. Because of the difficulty in identifying the theoretically correct specification and obtaining the necessary data, this paper does not attempt to build and estimate a full-scale structural model of private investment in developing countries. 1/ Rather, it is more of an exploratory data analysis. Nevertheless, the results of this study may be useful in identifying the more fundamental relationships between private sector investment and macroeconomic variables in these countries, which can then be used to develop an appropriate model of investment behavior in developing economies.

1/ Examples of possible models are contained in Blejer and Khan (1984) and Sundararajan and Thakur (1980).

The paper is organized as follows: Section II reviews recent trends in private investment activity across a group of 23 developing countries. ^{1/} Various patterns in private investment rates are identified, and these are compared with public sector investment rates in the countries. Section III then reviews a number of hypotheses that have been advanced for explaining differences in private investment rates. This section also contains a casual examination of these hypotheses, comparing average levels of the various indicators in countries with above- and below-average private investment rates. The hypotheses are then tested econometrically in Section IV. Pooled time-series, cross-section equations are estimated, relating private investment rates to a number of economic variables, both for the entire sample period and for the pre-debt crisis (1975-81) and more recent (1982-87) time periods. The concluding section (Section V) of the paper draws some implications from these findings and offers suggestions for further research. A statistical appendix describes the data sources for the paper.

II. Recent Trends in Private Investment in Developing Countries

Data on private investment rates for 23 developing countries over the period 1975-87 have recently been assembled in the World Bank Group. ^{2/} These data, summarized in Table 1, reveal several interesting patterns. First, there is a wide discrepancy in private investment rates across countries. A few countries, in particular the newly-industrializing and rapidly-growing Asian countries, exhibit very high rates of private investment, often exceeding 20 percent of GDP. At the other extreme, less-affluent and more slowly-growing countries, such as Bolivia and Peru, have experienced much lower rates of private investment, sometimes falling to less than 10 percent of GDP. For most countries in the sample, private investment averaged between 10 and 15 percent of GDP during most of the 1975-87 period.

The data in Table 1 also indicate a significant decline in private investment activity between the first part of the observation period, 1975-81, and the 1982-87 sub-period, which has been characterized by recurring debt crises in a number of developing countries. For the 23 countries in the sample, the average level of private investment activity decreased from 13.2 percent of GDP during 1975-81 to 11.0 percent in 1982-87. This trend is illustrated in Chart 1, which shows a significant decline in average investment rates after 1981. Although private investment rates in a few developing countries, notably Korea and Singapore, increased during the 1980s, for most countries in the sample private investment rates decreased. In several cases the decline was precipitous. In Argentina,

^{1/} The 23 countries are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, India, Kenya, Korea, Mexico, Pakistan, Peru, the Philippines, Singapore, Sri Lanka, Thailand, Tunisia, Turkey, Uruguay, Venezuela, and Zimbabwe.

^{2/} See Pfefferman and Madarassy (1989).

Table 1. Private Investment as a Percentage of GDP in Selected Developing Countries, 1975-87

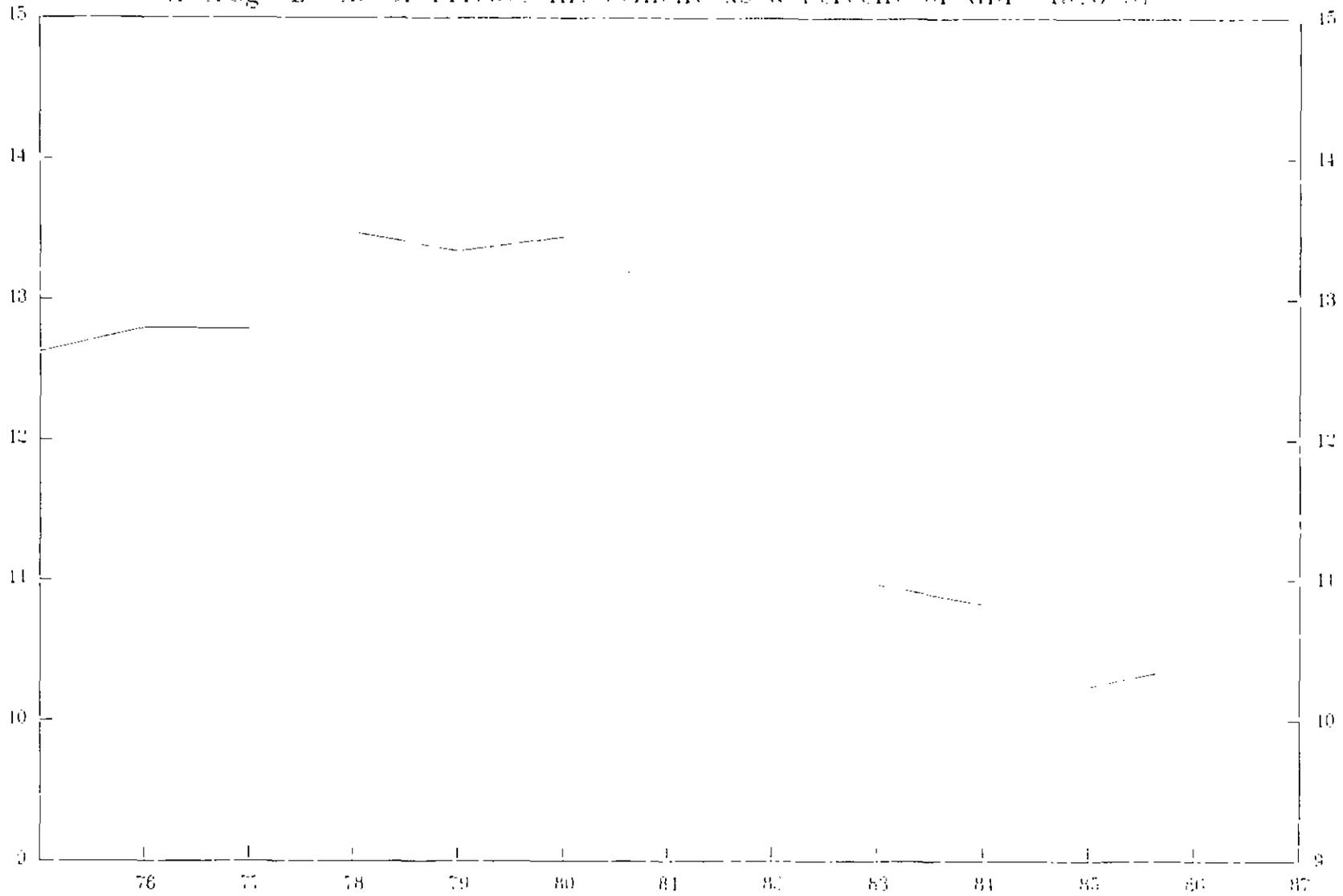
	Mean Public Debt																	Sector	Service	Mean Investment Difficulties
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1987-87	1975-81	1982-87	1975-87			
Argentina	17.1	13.9	14.4	12.5	12.5	13.0	9.4	9.9	7.9	6.9	5.5	5.0	6.8	10.4	13.3	7.0	9.4	Yes		
Bolivia	10.3	8.4	9.3	6.9	6.9	7.3	3.9	5.0	2.0	1.6	3.6	4.9	4.9	5.6	7.3	3.7	7.4	Yes		
Brazil	20.9	16.1	15.7	13.6	7.7	14.5	12.0	11.7	9.7	9.5	10.5	12.3	12.8	12.8	14.4	11.1	8.6	Yes		
Chile	3.2	4.8	7.6	11.4	12.6	15.6	17.5	6.5	4.9	7.3	6.8	7.0	10.0	9.9	10.4	7.1	6.5	Yes		
Colombia	11.9	12.1	9.6	11.5	12.3	11.4	12.0	11.1	11.0	10.0	9.4	9.3	11.1	11.0	11.5	10.2	7.9	No		
Costa Rica	14.5	15.1	14.2	15.6	17.3	14.7	15.2	13.1	11.6	13.7	12.3	12.9	15.1	14.2	15.4	13.1	7.1	Yes		
Ecuador	12.1	14.0	13.4	16.8	14.5	14.1	11.7	13.0	8.6	9.0	9.5	9.8	14.6	12.5	14.0	10.8	8.8	Yes		
Guatemala	12.1	14.0	13.0	14.4	12.4	9.8	8.4	8.8	5.9	5.8	8.3	8.1	9.5	10.0	12.0	7.7	5.0	Yes		
India	9.6	10.3	10.3	10.6	10.7	10.5	10.7	10.6	9.7	9.4	9.4	10.4	11.0	10.2	10.4	10.1	3.1	No		
Kenya	11.7	11.6	12.1	15.6	12.8	12.9	13.4	10.6	11.8	10.7	10.9	11.9	12.6	12.2	12.9	11.4	8.8	No		
Korea	19.3	19.8	20.7	24.5	25.8	23.4	19.8	21.7	23.5	23.3	21.8	22.4	23.0	22.2	21.9	22.6	5.9	No		
Mexico	12.4	12.8	11.9	12.5	13.6	13.9	14.7	12.7	10.0	10.8	12.2	13.3	13.5	12.7	13.1	12.1	5.4	Yes		
Pakistan	4.5	5.9	6.2	5.9	5.9	6.4	6.1	5.6	5.0	6.1	6.2	6.1	6.3	5.9	5.4	5.1	10.3	No		
Faru	9.2	9.7	9.3	6.4	8.5	9.7	11.5	11.5	7.9	6.9	5.9	9.3	10.6	9.0	9.2	9.9	7.5	Yes		
Philippines	18.6	17.7	16.6	16.8	18.0	18.4	18.5	19.1	18.8	14.5	11.4	9.7	10.6	16.0	17.8	13.9	6.0	Yes		
Singapore	26.5	23.6	21.6	22.4	25.0	26.7	30.4	11.9	30.7	31.3	26.7	21.9	23.4	26.3	25.2	27.7	12.4	No		
Sri Lanka	8.2	7.3	7.2	7.9	13.0	12.3	12.7	13.3	14.3	11.9	10.7	10.6	10.9	10.3	10.0	12.0	12.5	No		
Thailand	17.7	16.1	18.6	17.5	18.0	16.3	15.8	15.3	15.9	16.1	14.6	14.1	17.3	16.4	17.2	15.6	12.1	No		
Tunisia	12.3	11.6	10.7	11.7	12.0	13.3	14.8	15.4	14.2	13.6	12.3	10.5	9.0	12.4	12.4	12.2	15.2	No		
Turkey	11.7	10.2	11.2	12.4	10.7	9.5	8.1	8.1	8.3	8.3	8.4	9.9	11.3	10.2	11.3	9.0	11.5	No		
Uruguay	9.7	9.0	8.2	8.0	9.7	11.4	10.7	7.8	6.3	5.2	4.5	4.4	5.2	7.7	9.4	5.7	5.2	Yes		
Venezuela	15.8	19.6	23.6	24.5	19.1	13.0	9.8	7.7	4.5	6.6	6.5	6.8	6.6	12.5	17.6	6.5	12.9	Yes		
Zimbabwe	10.7	11.2	10.1	9.4	9.2	10.5	13.4	10.1	6.4	10.6	7.3	7.8	7.2	9.8	10.9	8.6	5.1	No		
Mean (Unweighted)	13.2	12.9	13.4	13.1	13.3	13.4	13.4	12.1	11.0	10.9	10.2	10.4	11.2	12.2	13.2	11.2	11.2	3.1		

Sources: Pfefferman and Madarassy (1983), IMF (1989); and estimates by the authors.

1. Ratio of public sector investment to GDP

Chart 1

Average Levels of Private Investment as a Percent of GDP 1975-87



for example, private investment as a share of GDP declined from an average of 13.3 percent in 1975-81 to 7.0 percent in 1982-87. In Venezuela, the figures were 17.6 percent in 1975-81 and 6.4 percent in 1982-87. On balance, the difference in investment rates between the two periods was smaller for countries such as Colombia and India that did not undergo rescheduling or incur debt service arrears during the 1980s than was true for countries such as Argentina and Bolivia that did have difficulties in meeting scheduled debt service obligations during this period. At the same time, investment rates also declined noticeably for several countries such as Kenya and Zimbabwe that experienced higher debt service obligations during the 1980s, but were able to meet them without rescheduling.

It is interesting to observe that the range of public sector investment rates for the countries in the sample is smaller than that for private investment. As shown in Table 1, public sector investment averaged between 5 and 13 percent of GDP during 1975-87 in all of the 23 countries except Tunisia, with the average for all countries being 9 percent. There is no obvious correlation between high rates of private and public sector investment. For example, public sector investment rates in Singapore and Thailand, two of the countries with the highest private investment rates, were double those in Korea and the Philippines, two other countries with relatively high levels of private investment activity. Indeed, public investment rates in Korea and the Philippines were lower than in many countries with smaller rates of private sector investment. This no doubt reflects the different emphasis accorded public and private sector activity in different countries. Nevertheless, public sector investment commanded a smaller percentage of GDP than did private sector investment in all but five countries in the sample (Bolivia, Pakistan, Sri Lanka, Tunisia, and Turkey).

III. Factors Affecting Private Investment Rates

A number of hypotheses have been advanced to explain the variations in private investment activity observed in developing countries. ^{1/} This variety to some extent reflects uncertainty about the form of the private investment function for these countries. The neoclassical flexible accelerator model has been the most widely-accepted general theory of investment behavior, and empirical tests of the model using data from several industrial countries have been quite successful (see, for example, Bischoff, 1969, 1971; Hines and Catephoros, 1970; Jorgenson, 1967, 1971; and Clark 1979). However, it has generally been hard to test this model in developing countries, because key assumptions (such as perfect capital markets and little or no government investment) are inapplicable, and data for certain variables (capital stock, real wages, and real financing rates for debt and equity) are normally either unavailable or inadequate. Accordingly, research has proceeded in several directions, in the process

^{1/} For a more comprehensive analytical overview of private investment theory and the impact of macroeconomic policies on private investment in developing countries, see Serven and Solimano (1989).

identifying a number of economic variables that might be expected to affect private investment in developing countries. These efforts, however, have not yet produced a full-fledged model of investment behavior in developing countries.

1. Theoretical analysis

Because of the problems inherent in applying the standard neoclassical model to developing countries, one line of research, pursued notably by McKinnon (1973) and Shaw (1973), has abandoned this model, advancing instead the hypothesis that private investment in developing countries is positively related to the accumulation of domestic real money balances. Underlying this hypothesis is the assumption that private investors in these countries must accumulate money balances before undertaking investment projects, because of their limited access to credit and equity markets. Because real money balances are directly influenced by real deposit interest rates, there should be a positive relationship between private investment and real interest rates in these countries. This approach accordingly disregards the negative effect of higher real rates on investment via increases in the user cost of capital that normally follows from the neoclassical investment model.

Another line of research has attempted to retain the neoclassical model, but address the analytical and data problems involved in its application to developing countries, in particular the lack of data and the resource constraints facing private investors in developing countries (see, for example, Sundararajan and Thakur, 1980; Tun Wai and Wong, 1982; and Blejer and Khan, 1984.) Applying the neoclassical model leads to the conclusion that the private investment rate should be negatively related to the real interest rate as a measure of the user cost of capital. ^{1/} These studies also suggest that the rate of growth of real output (real GDP) per capita should be positively related to the private investment rate, as is common in industrial countries. ^{2/}

In addition to the real interest rate and real per capita growth rate, the application of the neoclassical model to developing countries has led to identifying the public investment rate (the ratio of public investment to GDP) as a factor affecting the rate of private investment in these countries (Blejer and Khan, 1984). However, at the theoretical level the effect of public sector investment is ambiguous. On the one hand, public investment activity may be complementary to and thus support private investment, particularly where public investment involves useful infrastructure--

^{1/} The real interest rate is closer to the spirit of the neoclassical model than are measures of the availability of financing, which some studies have used in the absence of interest rate data.

^{2/} This can be readily derived from a flexible-accelerator model with a fixed relationship between the desired capital stock and the level of real output.

transportation systems, schools, water and sewage systems, and the like. Projects in these areas tend to raise the expected rate of return on private investment. On the other hand, public sector investment may detract from private investment activity to the extent that it substitutes for or crowds out private investment. This may occur when the investment involves parastatal enterprises producing goods that compete with the private sector, or when heavy spending for public capital projects leads to high interest rates, severe credit rationing, or a heavier current or future tax burden (Aschauer, 1989).

Besides the factors derived from the neoclassical investment model, the domestic inflation rate has also been proposed as affecting private investment rates in developing countries, where inflation is less often correlated with a rise in economic output than in industrial countries (Dornbusch and Reynoso, 1989). High rates of inflation adversely affect private investment by increasing the riskiness of longer-term investment projects, reducing the average maturity of commercial lending, and distorting the information content of relative prices. In addition, high inflation rates are often considered an indicator of macroeconomic instability and a country's inability to control macroeconomic policy, both of which contribute to an adverse investment climate. Thus, the domestic inflation rate should be negatively related to the rate of private investment.

Besides the above hypotheses, private investment activity has been hypothesized as a positive function of income per capita because of the greater ability of higher income countries to devote resources to saving. This ability is particularly important given the imperfection of capital markets, since it appears that most investment projects must be financed, at least in substantial part, through domestic savings.

Finally, the presence of large external debt burdens has also been suggested as a factor reducing investment activity in three ways. First, the higher debt service payments associated with a large external debt reduce the funds available for investment. Second, the existence of a large debt overhang, in the form of a high ratio of external debt to GDP, can reduce the incentives for investment, because much of the forthcoming returns from investment must be used to repay existing debt and therefore acts as a tax on domestic investment (Borensztein, 1989; and Froot and Frugman, 1990). Third, if substantial external debt leads to difficulties in meeting debt service obligations, relations with external creditors may deteriorate, thus reducing the amount of trade financing a country can obtain. This in turn may make it harder or more costly to finance private investment, because imports play a major role in most developing country investment projects, and the preponderance of all developing country imports are investment-related (Mirakhor and Montiel, 1987).

2. Preliminary evidence regarding different factors

As a first look at the evidence regarding the various factors discussed in the previous subsection, it is interesting to compare the average values of the various economic variables in countries with above- and below-average private investment rates, and vice-versa. This type of analysis is hardly definitive, because other variables are not held constant in the real world and an apparent relationship between one factor and private investment rates may in fact result from movements in a common underlying variable. Still, the information does offer a preliminary look at whether countries with high (equal to or greater than 12 percent of GDP) and low (less than 12 percent of GDP) private investment rates also differ in other economic respects.

Table 2, which reports the average levels for a number of economic indicators in the sample of 23 countries during the 1975-87 period, provides support for many of the hypotheses outlined earlier. The data suggest, for example, that interest rates may indeed affect private investment activity through their role in mobilizing domestic savings. As shown in Table 2, the average real deposit rate on mid-term (6 to 24 month) deposits in countries with higher levels of private investment was -0.9 percent, implying an average nominal deposit rate just less than the mean rate of inflation. For the countries with lower private investment rates, however, the average real deposit rate was -5.7 percent. The data also suggest that the rate of real GDP growth per capita was greater in the countries with higher private investment rates, averaging 2.1 per cent a year, more than twice the average for countries with lower private investment rates. In addition, public investment in these countries may on balance be complementary to private sector investment, as the average rate of public sector investment in the countries with higher private investment activity (9.8 percent of GDP) was slightly larger than that for the countries with smaller private investment rates (8.3 percent of GDP).

The data in Table 2 support the view that high inflation rates may be inimical to strong private investment activity, as the average inflation rate in countries with higher private investment rates, about 25 percent a year, was far below the average of 137 percent for countries with lower private investment rates. The data also indicate that average per capita GDP for the eleven countries with mean private investment rates above the sample median of 12 percent of GDP was, at US\$1,818, nearly 70 per cent larger than the average for the twelve countries with smaller private investment rates. As for external debt, although countries with higher private investment rates experienced somewhat higher external debt to GDP ratios, these countries also had somewhat smaller average debt service ratios (29 versus 32 percent of exports of goods and services), perhaps suggesting an ability to use borrowed funds more efficiently.

A second way of looking at the different hypotheses is to compare private investment rates for groups of countries with higher or lower levels

Table 2. Average Levels of Major Economic Indicators in Selected Developing Countries, 1975-87

	Private Investment Rate	Real Deposit Rate	Real Per Capita GDP Growth Rate	Public Sector Investment Rate <u>1/</u>	Inflation Rate	Per Capita GDP (in US dollars)	Debt Service Ratio	External Debt to GDP Ratio
Singapore	26.3	3.6	5.57	12.4	2.8	5129.17	1.6	16.5
Korea	22.2	2.3	6.84	6.9	11.9	1615.43	19.3	43.1
Thailand	16.4	4.0	4.56	12.1	6.4	662.36	18.6	27.9
Philippines	16.0	-0.3	0.71	6.0	13.9	590.02	29.9	56.1
Costa Rica	14.2	-2.4	0.48	7.1	21.1	2502.51	31.9	43.6
Brazil	12.8	-1.5	1.60	8.6	112.4	2027.17	53.5	27.8
Mexico	12.7	-5.6	0.81	8.4	50.2	1920.99	56.6	42.9
Ecuador	12.5	-7.4	0.67	8.8	20.4	982.82	41.8	58.1
Venezuela	12.5	-2.2	-0.96	12.9	12.5	3105.61	26.0	55.6
Tunisia	12.4	-3.1	2.07	16.3	8.2	1138.78	17.9	46.5
Kenya	12.2	-2.7	0.54	8.8	12.3	328.18	19.6	37.0
Colombia	11.0	2.2 <u>2/</u>	1.97	7.9	23.3	1009.72	27.3	32.1
Sri Lanka	10.9	2.0	3.14	12.2	11.4	297.42	25.3	42.8
Argentina	10.4	-21.0	-1.53	9.4	259.3	2876.73	50.8	34.4
India	10.2	0.8	2.86	9.1	7.1	232.65	19.5	14.7
Turkey	10.2	-4.7	2.79	11.5	41.3	1186.33	32.7	31.8
Guatemala	10.0	-2.0	-0.37	5.0	12.4	1058.50	17.3	17.3
Zimbabwe	9.8	-3.7	-1.29	8.1	12.2	934.18	16.5	15.8
Peru	9.0	-21.2	-0.28	7.6	74.5	1064.28	54.3	56.0
Chile	8.9	4.9	1.08	6.6	71.6	1634.70	45.9	67.6
Uruguay	7.7	-0.3	1.49	5.2	56.5	1709.04	27.8	43.8
Pakistan	5.9	1.2	2.87	0.3	8.4	270.04	29.3	38.9
Bolivia	5.6	-26.7	-2.08	7.4	155.7 <u>3/</u>	728.46	34.1	62.9
High Private Invest. Cos. <u>4/</u>	15.4	-0.9	2.1	9.8	24.7	1818.5	28.8	41.4
Low Private Invest. Cos. <u>5/</u>	9.1	-5.7	0.9	8.3	61.1	1083.5	31.7	38.2

Sources: Pfefferman and Madarassy (1989); and IMF (1989).

1/ As a percentage of GDP.2/ Based on the effective yield on a 90-day certificate of deposit.3/ Geometric average.4/ First eleven countries in the table.5/ Last twelve countries in the table.

of the relevant economic variables. This is done in Table 3, using average levels of private investment for each country weighted by the country's GDP. ^{1/} The figures in Table 3 indicate that countries with nonnegative real interest rates, higher average real GDP growth rates, and lower average inflation and public investment rates also have higher average rates of private investment. The same is true for countries with higher average real levels of GDP per capita, and lower debt service (but not lower debt-to-GDP) ratios. These results are generally consistent with theoretical expectations. Except for the findings regarding countries with higher- and lower public investment rates, they are also consistent with the data in Table 2.

IV. Econometric Results

To examine more rigorously the various hypotheses outlined above, equations for the private investment rate were estimated for the 23 countries in the sample, using a pooled time-series, cross-section approach. A detailed list of the variables and data sources appears in the statistical appendix to this paper. Because the current values of the real per capita growth rate, the per capita GDP level, and the debt service ratio may be affected by the private investment rate, lagged values of these variables were used to reduce the possibility of simultaneous equations bias in the coefficient estimates. In addition, the lagged value of the external debt to GDP ratio was employed, because the information is usually available only for the end of the year and is therefore generally known retrospectively. To capture the effects of country-specific factors, a dummy variable for each country was included in the specifications. Thus, the equations took the following form:

$$IP/Y = f[RI, GR_{-1}, IPUB/GDP, CPI, INC_{-1}, (DS/XGS)_{-1}, (DEBT/GDP)_{-1}, Z],$$

where

- IP/Y = the ratio of private sector investment to GDP,
- RI = the real deposit interest rate, as measured by the ratio $(1+NINT)/(1+ECPI)$, where NINT is the nominal interest rate and ECPI is the expected inflation rate,
- GR₋₁ = the lagged percentage change in real GDP per capita,
- IPUB/GDP = the ratio of public sector investment to GDP,
- CPI = the percentage change in the country's consumer price index,

^{1/} As in IMF (1989), weights were calculated on the basis of each country's average GDP in U.S. dollars during the previous three years.

Table 3. Average Private Investment Rates over the Period 1975-87
For Countries with Selected Characteristics 1/
(In Percent of GDP)

Non-negative Real Interest Rate	13.0
Negative Real Interest Rate	11.7
High Growth <u>2/</u>	12.8
Low Growth	11.9
High Public Investment Rate <u>3/</u>	12.0
Low Public Investment Rate	14.7
High Inflation <u>4/</u>	11.8
Low Inflation	13.6
High Income <u>5/</u>	13.2
Low Income	11.1
High Debt Service Ratio <u>6/</u>	11.9
Low Debt Service Ratio	13.5
High Debt to GDP Ratio <u>7/</u>	14.0
Low Debt to GDP Ratio	11.7

Sources: Pfefferman and Madarassy (1989); and IMF (1989).

1/ Averages for countries in designated groups, with individual country observations weighted by 3-year average of country GDPs.

2/ Average growth rate of real GDP above 1.4 percent per year.

3/ Average ratio of public sector investment to GDP greater than 8.4 percent.

4/ Average annual rate of increase in consumer price index above 20 percent.

5/ Average per capita GDP (1975-87) above US\$1100.

6/ Average debt service ratio greater than 29 percent of exports of goods and services.

7/ Average external debt to GDP ratio greater than 40 percent.

- INC₋₁ = the lagged level of per capita GDP in current U.S. dollars,
- (DS/XGS)₋₁ = the lagged ratio of external debt service payments to exports of goods and services,
- (DEBT/GDP)₋₁ = the lagged ratio of the country's stock of external debt to its nominal gross domestic product, and
- Z = a vector of country dummy variables, one for each country in the sample, with the value of each variable set equal to 1 whenever observations for that country were entered, and 0 otherwise.

For the real interest rate, three different variants were tried: one using the current period value of the percentage change in the consumer price index as the expected inflation rate; one using the previous year's value; and one using the value of the year ahead, which is conceptually the correct specification. 1/ The best results came from using the value of the consumer price change one period ahead, i.e., CPI₊₁, to generate the real interest rate, in line with the correct specification. Because CPI and CPI₊₁ may both be affected by the rate of private investment, instrumental variables were used for the real interest rate and the current period's inflation rate, CPI. 2/

This equation was estimated over the entire 1975-87 time period. In addition, separate equations were estimated for the two sub-periods 1975-81 and 1982-87, to test for the effect of the post-1981 debt crisis on the results. The results of all three equations are summarized in Table 4. This table omits the results for the country dummy variables, all of which were statistically significant at the 1 percent level. As indicated, the overall fit of all three equations was fairly good, with R-squared statistics adjusted for degrees of freedom in the 0.7-0.9 range.

1/ The reason is that the real rate of return on an investment during the current period equals (1+the nominal interest rate) deflated by the ratio of the next period's price level to this period's, or

$$\frac{(1+NINT)}{P_{t+1}/P_t} = \frac{(1+NINT)P_t}{P_{t+1}} = \frac{(1+NINT)}{(1+CPI_{t+1})}$$

Here, both NINT and CPI have been divided by 100, i.e., a 10 percent nominal interest rate is written as NINT = 0.10.

2/ The instrumental variables included all the country dummy variables, the current value of the public investment rate, and one year lags of all the other variables.

Table 4. Regressions for Private Investment Rates 1/

	RI	GR ₋₁	IPUB/GDP	GPI	INC ₋₁	(DS/XGS) ₋₁	(DEBT/GDP) ₋₁	N	R ²	S.E.E.
<u>Entire Sample Period (1975-87)</u>										
(1)	-8.285** (-3.06)	0.249*** (6.50)	0.080*** (2.03)	-0.004*** (-4.02)	0.084 (0.32)	-0.031*** (-2.55)	-0.033*** (-2.99)	294	0.81	2.38
<u>Pre-Debt Crisis Period (1975-81)</u>										
(2)	-7.844 (-1.62)	0.210*** (3.01)	0.359*** (3.17)	-0.024** (-2.62)	0.870* (1.34)	-0.043** (-1.73)	-0.041* (-1.40)	156	0.79	2.34
<u>Debt Crisis Period (1982-87)</u>										
(3)	-1.851 (-1.03)	0.209*** (5.67)	0.061** (2.05)	-0.001*** (-3.02)	-1.560*** (-2.87)	-0.003 (-0.21)	-0.052*** (2.82)	138	0.92	1.56

1/ Dependent variable is the ratio of private investment to GDP, in percent. Figures in parentheses are estimated t-statistics. N is the number of observations. R-squared statistic is the adjusted R squared. S.E.E. is the standard error of estimate. The coefficients of the country dummy variables have been omitted from the table; they were all statistically significant at the 0.01 level.

* Statistically significant at the 10 percent level.

** Statistically significant at the 5 percent level.

*** Statistically significant at the 1 percent level.

The results for equation (1) in Table 4, which reflects the entire sample period equation, supported most of the hypotheses outlined earlier. The estimated coefficient for the ratio of public sector investment to GDP (IPUB/GDP) was positive and significant, suggesting that in this sample public sector investment was on balance complementary to private sector investment activity. In addition, the lagged per capita real GDP growth rate (GR₁) was positive and highly significant, while the coefficients for the lagged debt service ratio, (DS/XGS)₁, and the lagged debt stock, (DEBT/GDP)₁, were both negative and statistically significant at the 1 percent level. ^{1/} In addition, the estimated coefficient for the inflation rate (CPI) was negative and highly significant, implying that a higher inflation rate, other things equal, had a negative impact on the private investment rate on countries in the sample. However, the estimated coefficient for the lagged value of GDP per capita (INC₁) was positive but insignificant. Interestingly, the estimated coefficient for the real interest rate (RI) was negative and statistically significant. This finding is more consistent with the neoclassical investment model than with the McKinnon-Shaw hypothesis, as it would suggest that high real interest rates serve more to deter investment by raising the user cost of capital than to promote investment by increasing the volume of financial saving. Supporting this view is the recent finding in Haque, Lahiri, and Montiel (1990) that the interest rate appears to be negatively and highly significantly related to domestic investment rates in a multi-equation macroeconomic model estimated over 31 developing countries for much of the post-World War II period. At the same time, these results should not be taken to suggest that negative real interest rates are a good thing. In view of the earlier observations about interest rate levels in countries with above- and below-average private investment rates, they suggest that high (above the market-clearing level) and positive real interest rates--such as those observed in some Latin American countries during part of 1970s--would tend to reduce the private investment rate.

The results of equations (2) and (3) in Table 4, which are estimated over the 1975-81 and 1982-87 periods, respectively, suggest that the findings reported in equation (1) mask rather different effects of certain macroeconomic variables during the two sub-periods. This is confirmed by a simple F test comparing the results in the two sub-periods, which yields an F value of 4.4 compared to the critical value of F(30,234) = 1.86 to establish a significant difference in the estimated coefficients between sample periods. In equation (2), for example, the estimated coefficients for the public sector investment rate, inflation rate, and the lagged debt service ratio had the same sign and were larger in absolute value than in equation (1). Indeed, compared to their values in equation (1) the coefficient for the domestic inflation rate was more than five times its absolute value in the previous equation. This result would suggest that

^{1/} The significance levels reported here are for one-tailed tests, except for the public investment rate and the real interest rate, which are two-tailed tests.

higher inflation rates had decidedly more negative effects on private investment rates during the 1975-81 period. In addition, the estimated coefficient on the lagged value of GDP per capita was considerably larger than in equation (1) and became statistically significant at the 10 percent level. By comparison, the estimated coefficient for the lagged ratio of external debt to GDP, though still negative, was now significant at only the 10 percent level. This may reflect the generally low and stable debt-to-GDP ratios among developing countries during the pre-1982 years, as compared with the ratios observed after 1981. It may also indicate high collinearity between this variable and the lagged debt service ratio.

In equation (3), which covers the 1982-87 period, most of the variables that were significant in equations (1) and (2) either had smaller estimated coefficients or were no longer statistically significant. For example, the coefficient for the real interest rate was barely one-fifth of its absolute value in equation (2) and was now statistically insignificant. The estimated coefficient for the domestic inflation rate was considerably smaller in absolute value than in equation (1), although still significant at the 1 percent level. The estimated coefficient for the public sector investment rate, though still positive and statistically significant, was smaller than in the previous two equations, although the coefficient for the lagged GDP growth rate was virtually the same as in equation (2). In addition, the estimated coefficient for the lagged debt service ratio was considerably smaller in absolute value than in the other equations and was no longer statistically significant. However, the estimated coefficient for the lagged ratio of external debt to GDP increased in absolute value and was now significant at the 1 percent level. This suggests that the role of a country's debt overhang became more important during the 1982-87 period, which may reflect the increasing gap during this period between actual debt service payments, as reflected in the debt service ratio, and contractual payments. The estimated coefficient for lagged per capita GDP, which was positive and marginally significant for the 1975-81 period, was now negative and significant at the 1 percent level, contrary to expectations. This may reflect the sharp decline in private investment rates in higher-income Latin American countries after 1981.

In view of the significantly different results from equations (2) and (3), it seemed useful to estimate a new equation for the entire sample period that would allow the values of the coefficients for the various macroeconomic variables to differ across time periods. This was done by creating from each of the variables in the specification two variables, one containing only those observations for the 1975-81 period and the other holding only those observations for the years 1982-87. The equation was then estimated using this expanded set of explanatory variables, with the country dummies left unchanged over the two sub-periods. ^{1/} The results of this equation are summarized in Table 5.

^{1/} This essentially means assuming that country-specific factors remain invariant over time.

Table 5. Final Regressions for Private Investment Rates 1/

	Estimated Coefficient	Estimated t-statistic	Beta Coefficient
RI:			
1975-81	-8.240***	-2.99	-0.751
1982-87	-7.738***	-2.90	-0.700
GR₋₁:			
1975-81	0.227***	4.30	0.128
1982-87	0.236***	4.86	0.142
IPUB/GDP:			
1975-81	0.139*	1.87	0.132
1982-87	0.063	1.56	0.069
CPI:			
1975-81	-0.006***	-3.90	-0.156
1982-87	-0.003***	-3.60	-0.170
INC₋₁:			
1975-81	1.875***	3.80	0.289
1982-87	0.683**	2.22	0.162
(DS/XGS)₋₁:			
1975-81	-0.035***	-2.36	-0.125
1982-87	-0.026**	-1.86	-0.102
(DEBT/GDP)₋₁:			
1975-81	-0.028*	-1.37	-0.090
1982-87	-0.023*	-1.59	-0.119
Equation statistics: <u>2/</u> N = 294		R ² = 0.82	S.E.E. = 2.29

1/ Dependent variable is the ratio of private investment to GDP, in percent.

2/ N is the number of observations, R-squared statistic is the adjusted R squared, and S.E.E. is the standard error of the estimate.

* Statistically significant at the 0.10 level.

** Statistically significant at the 0.05 level.

*** Statistically significant at the 0.01 level.

The figures reported in Table 5 confirm most of the results in equations (2) and (3) of Table 4. The estimated coefficients for the real interest rate, lagged per capita growth rate, and domestic inflation rate all had the same sign as before and were statistically significant at the 1 percent level or better. However, the coefficient for the public sector investment rate during the 1975-81 period was now much smaller than before and significant at only the 10 percent level, while the coefficient of this variable for the 1982-87 period was no longer statistically significant. The estimated coefficient for the lagged debt service ratio was again larger during the 1975-81 period, although significant during both periods. By comparison, the coefficients for the lagged debt-to-GDP ratio were uniformly smaller than in the previous equations and were significant at only the 10 percent level. Interestingly, the estimated coefficient for the lagged real GDP level was now positive and quite significant for both the 1975-81 and 1982-87 periods, although much larger during the earlier period. These results are more consistent with the hypothesized relationship between income level and investment rate, while taking into account the falloff in private investment rates in many higher-income Latin American countries after 1981. Another interesting finding reported in Table 5 is that for several variables the differences in estimated coefficients between the two subperiods are smaller than suggested from equations (2) and (3). For example, the estimated coefficients for the lagged debt service ratio and lagged debt-to-GDP ratio in the two subperiods became virtually the same, while the differences between the coefficients for the real interest rate and the domestic inflation rate fell substantially. On the whole, these results suggest that most of the macroeconomic variables affected private investment rates in both the 1975-81 and 1982-87 subperiods.

As a further indication of the relative importance of different variables on private investment rates, Table 5 also reports the beta coefficients for the macroeconomic variables in the final estimating equation. These coefficients are unit free and measure the relative impact of different explanatory variables on the private investment rate. The beta coefficients indicate that changes in the real interest rate had by far the largest relative impact on private investment rates, about three times that of any other variable. The next largest effect came from the lagged GDP per capita level during the 1975-81 period. The beta coefficients for most other variables fell in a fairly narrow range, with those for lagged GDP per capita, the domestic inflation rate, lagged growth rate, and the public investment rate during 1975-81 being slightly larger than those for the public investment rate in 1982-87, the lagged debt service ratio, or the lagged debt-to-GDP ratio. Overall, these results suggest that the impact on private investment rates of these other variables was roughly equal, with the effects of lagged GDP per capita, the domestic inflation rate, lagged growth rate, and the public investment rate for 1975-81 being somewhat greater than that of the rest. Also noteworthy is the increase in the beta coefficient for the lagged debt-to-GDP ratio, suggesting that the debt overhang has become more important since the onset of the debt crisis in 1982.

V. Conclusions

The results of this study provide some support for the hypothesis that private investment rates in developing countries are affected by important macroeconomic variables. The econometric tests undertaken support the view that real interest and economic growth rates, the domestic inflation rate, external debt burdens (either in the form of high debt service ratios or, following 1981, a high debt-to-GDP ratio), and, to a lesser extent, the public investment rate have all been significant determinants of private investment rates in these countries during the post-1974 period. Of these variables the domestic inflation rate and the external debt burden appear to have had a negative impact on private investment rates, while economic growth rates, the public investment rate, and, for 1975-81, the GDP per capita level have had a positive effect. These results suggest that public sector investment has been complementary to private investment in these countries. There is also evidence that, in accordance with standard theory, high real interest rates have had a negative effect on private investment rates. At the same time countries with less negative real interest rates have, on balance, experienced higher rates of private investment.

There is some evidence that a few variables, particularly the domestic inflation rate and public investment rate, as well as per capita GDP level, had a greater impact on private investment rates during 1975-81 than afterwards. In addition, it appears that the way in which external debt burdens reduced private investment changed between the 1975-81 and 1982-87 subperiods. During the former period, when most countries remained current on their external debt service payments, the debt service payments ratio was a more significant determinant of private investment rates. During the second subperiod, when rescheduling and external arrears became more common, the ratio of the external debt stock to GDP became equally if not more significant. On balance, these results provide some support for the view that countries with higher growth rates and income levels, more stable macroeconomic policies (in the form of lower inflation rates), smaller debt burdens, and higher rates of public investment have higher levels of private investment relative to GDP. For the reasons mentioned earlier, however, these findings should be considered suggestive, rather than providing strong evidence for the various hypotheses discussed in the paper.

Because of the close links among saving, private investment, and economic growth, it would seem useful to go beyond the partial equilibrium framework of the present study and examine the interactions among investment, saving, and growth in a general equilibrium model. This could be done by applying a savings model (such as the one described in Aghevli *et al.* 1990) and appropriate growth models (see., e.g., Otani and Villanueva, 1990) to develop a general equilibrium framework in which separate equations for savings, private investment, and growth are estimated simultaneously. Such a project would greatly strengthen the current understanding of causal relationships among these phenomena in developing countries. It might also

make it possible to develop more effective policy measures to strengthen private savings and investment activity, and thereby raise the long-term rate of economic growth.

Data Sources for Variables in the Study

The data used in this study come primarily from three sources: Guy Pffefferman and Andrea Madarassy, Trends in Private Investment in Thirty Developing Countries (Washington: The World Bank, 1989); International Monetary Fund, International Financial Statistics data file; and International Monetary Fund, World Economic Outlook. The first of these sources provided the data on private and public investment rates for the 23 countries in the sample. Except for data on interest rates, all remaining data came from the Fund's International Financial Statistics and World Economic Outlook data files.

Data on interest rates were compiled from national sources. To focus on the effect of real interest rates on private savings interest rates on time deposits of 6-24 month maturities at commercial banks were selected *wherever possible, with the specific maturity depending on the country*. The data selected appear in Appendix Table I. Wherever possible, the maturities chosen were those in Hanson and Neal (1986). Following are the precise definitions of interest rates used:

- Argentina -- 1975-76: maximum rates on annual savings deposits; 1977-87 interest rates on 30-day certificates of deposit;
- Bolivia -- minimum rate on peso-denominated 1-year time deposits;
- Brazil -- 1975-82: interest paid on bills of exchange at finance companies; 1983-86: annualized interest rates on savings deposits; 1987: annual rates on time deposits;
- Chile -- 1975-87: annualized interest rates on 30-day time deposits;
- Colombia -- annualized rates on 90-day certificates of deposit;
- Costa Rica -- (data missing for 1975-77) 1978-87: "basic rate" on savings deposits at commercial banks;
- Ecuador -- 1975-85: interest rate on time deposits at commercial banks and non-bank financial institutions; 1986-87: rate on 90-day savings accounts (NB: rates for 1975-79 taken as the same as in 1980);
- Guatemala -- maximum rate on savings deposits at commercial banks;
- India -- lowest ceiling rate on 1-2 year deposits at commercial banks;
- Kenya -- interest rate on 9-12 month deposits at commercial banks;

Table 1. Nominal Interest Rates on Selected Time Deposits
in 23 Countries, 1975-97 ¹

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Argentina	40.0	55.0	149.8	132.2	117.3	79.2	154.4	125.0	273.9	381.8	234.1	59.9	144.2
Bolivia	11.8	11.8	11.8	11.8	12.1	17.2	28.0	30.3	33.2	106.4	68.8	62.4	29.1
Brazil	26.5	39.0	44.4	47.8	48.8	60.3	101.4	112.5	157.5	242.3	249.8	75.5	401.0
Chile	277.3	202.1	93.9	57.4	45.1	37.4	40.8	47.8	27.9	26.1	31.6	13.0	25.2
Colombia	25.6	25.6	25.6	22.0	23.0	35.8	37.4	38.0	33.7	34.8	35.3	31.2	31.1
Costa Rica	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.8	23.1	22.0	20.0	18.0	17.5
Ecuador	0.0	0.0	0.0	0.0	0.0	9.0	9.0	13.0	15.0	22.0	22.0	24.8	32.0
Guatemala	9.0	9.0	9.0	9.0	9.0	9.0	10.0	12.3	9.0	9.0	9.0	10.3	11.0
India	8.0	8.0	6.0	5.0	7.0	7.5	8.0	8.0	8.0	8.0	8.5	8.5	9.0
Kenya	5.6	5.6	5.6	5.6	5.6	5.0	10.4	13.0	14.1	12.0	12.0	12.0	10.0
Korea	15.0	16.2	14.4	18.6	18.6	23.3	19.0	10.3	8.0	10.0	10.0	10.0	10.0
Mexico	10.0	9.6	12.4	13.0	13.8	21.2	30.9	56.5	53.4	44.4	70.7	35.7	96.0
Pakistan	8.1	8.5	9.1	9.5	9.5	9.5	10.9	10.6	9.5	10.9	9.8	8.8	8.9
Peru	7.0	9.0	14.0	28.8	31.5	31.5	52.0	55.0	57.5	60.0	32.8	41.9	29.5
Philippines	9.5	10.0	10.0	10.0	12.0	14.0	13.0	13.9	14.2	17.4	19.8	11.5	10.0
Singapore	6.2	5.5	5.3	5.7	6.9	9.2	10.7	7.9	6.7	7.2	5.5	4.1	3.5
Sri Lanka	7.5	7.5	10.0	15.0	15.0	20.0	20.0	15.0	15.0	14.0	12.0	8.5	8.5
Thailand	8.0	8.0	8.0	8.7	9.0	12.0	12.5	13.0	13.0	13.0	13.0	9.5	9.5
Tunisia	3.0	3.0	4.0	4.0	4.0	4.0	4.8	5.0	5.0	5.0	5.7	6.8	8.2
Turkey	9.0	9.0	9.0	11.3	17.4	26.6	49.2	50.0	42.5	45.0	50.2	52.0	45.7
Uruguay	21.0	44.0	48.9	53.1	43.0	51.5	46.9	50.6	66.1	71.1	84.1	61.2	62.8
Venezuela	6.0	6.0	6.0	6.0	6.0	11.3	14.9	14.8	13.9	12.5	10.5	8.9	8.9
Zimbabwe	5.0	4.8	4.6	4.3	4.3	4.4	12.0	10.5	14.2	10.5	10.5	10.3	10.2

¹/ For definitions and sources of interest rate series, see text in Appendix.

- Korea -- rate on commercial bank deposits of more than 1 year;
- Mexico -- interest rate on 6 month deposits at commercial banks;
- Pakistan -- 1975-80: weighted average of interest rates on 6-12 month deposits; 1981-87: interest rates paid on profit/loss-sharing accounts;
- Peru -- 1975-86: interest rates on 6-12 month time deposits at commercial banks with head offices in Lima; 1987: rates on 91-180 day certificates of deposit at commercial banks;
- Philippines-- rates on 6-12 month deposits at commercial banks;
- Singapore -- interest rate on 1-year deposits at commercial banks;
- Sri Lanka -- actual or minimum interest rates on 1-year deposits at commercial banks;
- Thailand -- rate on 1-2 year deposits (1985-87: ceiling rate);
- Tunisia -- 1975-81: maximum rate on 6-12 month deposits; 1982-87: rate on 3-6 month deposits;
- Turkey -- interest rates on 12-24 month deposits;
- Uruguay -- average interest rates on deposits of 6 months or more;
- Venezuela -- rates on time deposits of 6-12 months (1979: rate on 6 month deposits); and
- Zimbabwe -- interest rate on deposits of 12 months or more, from Reserve Bank of Zimbabwe, Quarterly Economic and Statistical Review, December 1988.

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