Private Investment in Mexico

An Empirical Analysis

Alberto R. Musalem

In 1985, Mexico shifted to a growth strategy based on private investment and exports rather than on import substitution and public sector investment. The policy implications of this study are that to increase investment, Mexico should follow policies aimed at reducing investment adjustment costs and increasing factor mobility and credibility in the program of structural reforms rather than at subsidizing investment.

Mexico's past growth strategy — based on import substitution and public sector investment — proved unsustainable in the face of the financial crisis and the drop in oil prices. Moreover, with strong linkages between public and private investment, cutbacks in one forced cutbacks in the other. The result was a magnified cost of adjustment.

To resume sustainable growth, the Mexican authorities adopted a new strategy whereby private investment and exports rather than import substitution and public sector investment would lead growth. However, in the past, investment responded extremely slowly to changes in the incentive system. This behavior may reflect high adjustment costs, uncertainties, risks, and credibility problems induced by past macroeconomic instability. Also, distortions in the factor and goods markets may have impaired the mobility of resources. Consequently, structural reform began with the 1985 trade reform, and was strengthened by the privatization of public enterprises, economic deregulation, and tax and financial sector reforms.

Further trade liberalization may be needed — removal of the remaining quantitative restrictions, particularly on imports of used capital goods — to encourage investment, both directly (through the price effect) and indirectly (as an instrument to promote trade and capacity utilization).

To the extent that trade liberalization is not accompanied by policies that facilitate real exchange rate depreciation, investment would be affected in two ways — first, profitability in the tradeables sector would be reduced in the short run, increasing adjustment costs and impairing resource mobilization. Second, expectations of real depreciation will build up as economic agents anticipate that the long-run equilibrium level of the real exchange rate consistent with import liberalization is higher. As a result, destabilizing capital outflows may increase real interest rates and reduce confidence in the government's ability to sustain trade policies.

As stabilization efforts continue, expectations of inflation will be reduced, increasing the demand for money and therefore the real interest rate. As the government continues its policy of relying less on the inflationary tax, however, favorable developments may follow:

• Financial deepening will reduce intermediation costs and spreads, increase access to financial services, and stimulate investment.

• The unanticipated risk of capital losses on holding domestic assets will decline, thereby increasing their liquidity and demand, and reducing the real interest rate.

• The improved macromanagement will make relative prices less volatile, will reduce uncertainties, risks, and adjustment costs, and will increase the short-term investment response.

<u>**PRIVATE INVESTMENT IN MEXICO:**</u>

<u>**AN EMPIRICAL ANALYSIS**</u>

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PRIVATE INVESTMENT IN MEXICO:
AN EMPIRICAL ANALYSIS

Alberto R. Musalem

Introduction

Mexico's growth rate averaged 6.6% p.a. between 1950 and 1974. Between 1978 and 1982, the economy grew at no less than an average of 8.7% p.a.; while between 1982 and 1987, Mexico did not grow at all. However, during the 1978-1982 period, the external debt tripled from US$29 to 86 billion. The ratio of external debt to GDP jumped from 28 to 52%. This period was brought to a crashing halt during the mid-1982 debt crisis. Lower investment on the one hand, and restrictive demand management on the other, induced no real growth between 1982 and 1988 and hence a severe decline in per capita income.

The analysis of Mexico's private investment explains some of the country economic performance and its determinants are examined in this paper. The findings suggest that investment responded extremely slowly to changes in the incentive system in Mexico. This result suggests that the adjustment costs of changing capital to the desired stock were relatively high --possibly due to high uncertainties and risks, and credibility problems induced by macroeconomic instability-- and also, that distortions in the factor and goods markets impaired the mobility of resources. The policy implications of this study indicate that to increase investment and, therefore resume growth, Mexico would be better off with policies aimed at reducing the cost of adjustment on attaining the desired capital stock and

increasing factor mobility, rather than providing subsidies to stimulate investment.

This analysis also demonstrates that investment is responsive to the real interest rate, the relative price of investment and the rate of capacity utilization. In addition, the relative price of investment is determined by the price of new capital equipment in the United States. Moreover, the real interest rate in Mexico responds to the behavior of the real interest rate in the United States, but in the short run it is also affected by expectations of movements in the real exchange rate, the rate of domestic credit creation, the initial ratio of money to capital, the unanticipated inflationary shocks and interest rate ceilings. A simple model for the formation of expectations about changes in the real exchange rate indicated that a real appreciation of the Mexican peso in the previous year induced expectations of a real depreciation in the current year. Also, relaxation of quantitative restrictions on imports created expectations of a deterioration in the trade balance and a depreciation of the Mexican peso in real terms.

Economic Background

The outburst of public spending in the late 1970s, the subsequent decline in oil prices and increases in real interest rates payable on the external debt caused serious public finance problems. These problems in turn triggered an increase in inflation not previously seen in Mexico's economic history. Since high and variable inflation rates go together with high relative price variability, an unpredictable macroeconomic environment increases uncertainties and risks embodied in investment decisions, thereby rising the cost of adjustments and reducing investors' responsiveness.

The fiscal adjustment after 1982 was unavoidable given the sudden lack of access to international capital markets and the series of adverse terms of trade shocks that took place over the period. As a by-product, the severe fiscal cutbacks greatly increased public sector efficiency. A divestiture program was successful in closing, selling, or transferring roughly two-thirds of the 1155 public enterprises that existed in 1982. In addition, few, if any, of the many dubious large projects of the late seventies remain in the public sector investment program. Cutting the public sector investment budget from almost 10% of GDP in 1982 down to an estimated 3.3% of GDP in 1988 clearly has had its costs; government investment has a role to play in areas that heavily complement private investment and in the social sectors. Also, private investment has not made up for the decrease in public investment. Private investment is now aproximately at its pre-oil-boom level of 11-12% of GDP (Figure 1).

Inflation, rather than slowing down, accelerated towards the end of the period. The de-facto targeting of the real exchange rate at a relatively high level during 1986-1987, together with an increase in the frequency of wage and cost adjustments, introduced an element of inherent instability into the system. This later became fully apparent towards the end of 1987. The temporary opportunity for private debt buy-backs evolving from the 1987 debt rescheduling together with the stock market plunge triggered a run on the peso. This resulted in reserve losses and eventually a 37% depreciation, fueling inflation and expectations of further exchange rate depreciations. Mexico responded with the Pacto de Solidaridad, a concerted effort to bring down inflation which had reached triple digits.

FIGURE 1: MEXICO – GROSS PRIVATE AND PUBLIC SECTOR
INVESTMENT TO GDP RATIOS

(in percent)
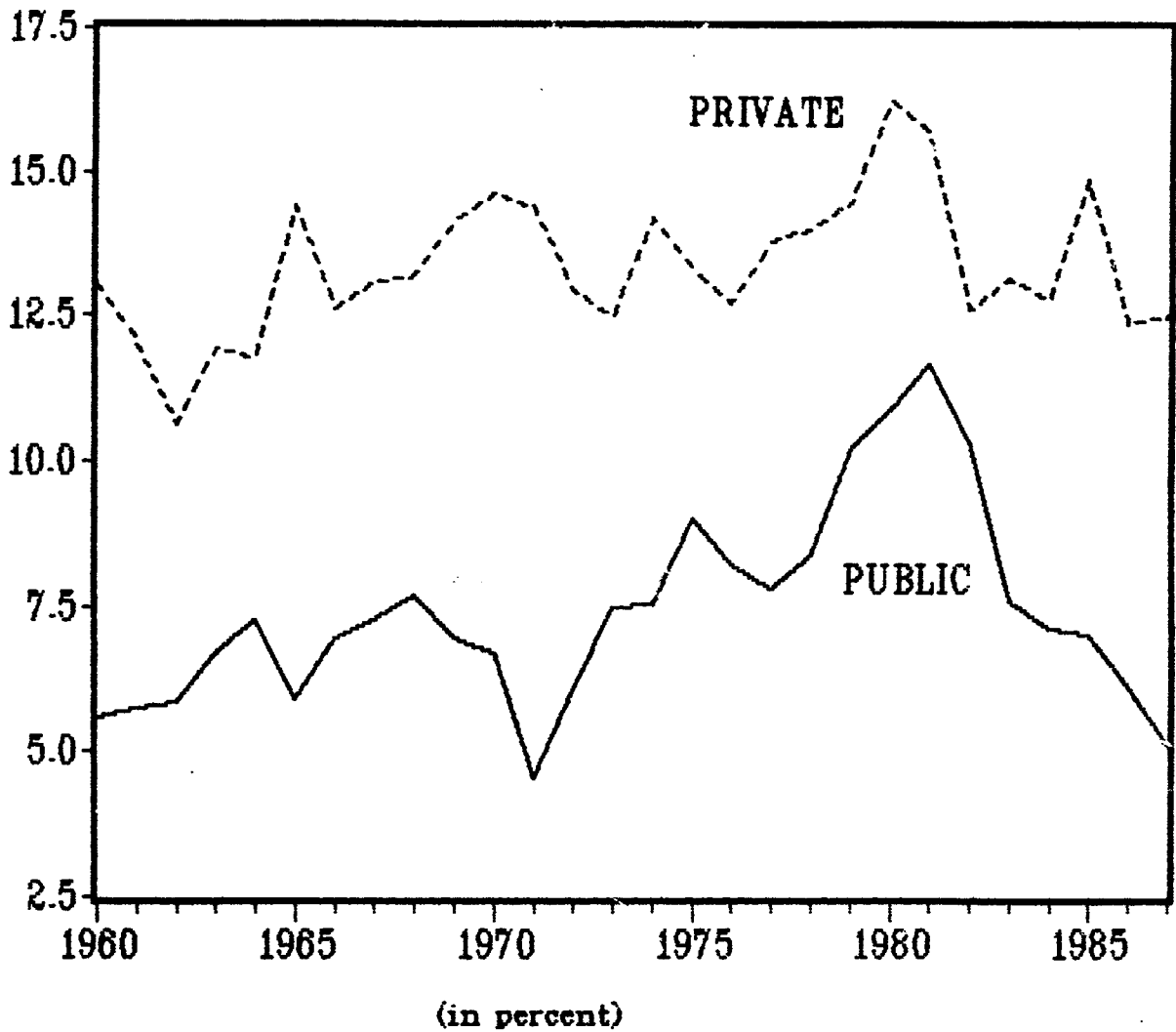
The Pacto was negotiated in December 1987 by representatives from the Government, labor, farming, and industry. The program consisted of further tightening of fiscal and monetary policy, and renewed structural reform efforts. Trade liberalization was accelerated, credit subsidies substantially reduced, and the program of public enterprise divestiture reinforced. These measures were suppl .mented by a freeze on minimum wages, public sector prices and tariffs. A corner stone of the Pacto was pegging the exchange rate to the U.S. dollar. This partial freeze was originally intended to last a couple of months but it has been extended at three month intervals throughout 1988. At the beginning of 1989, the exchange rate was set at a crawling peg at a rate of Mex$ 1 per day.

On almost every target that is under direct or indirect control of the government, performance under the Pacto has been exemplary and often has gone beyond what was initially planned. Trade reform has been accelerated, partly because of the potential efficiency gains, partly because of the hope of restraining the effect on price increases. Total governmental expenditure, net of interest payments, has fallen by about ten percentage points of GDP over the past few years, from 28% in 1982 down to an estimated 18% in 1988. The fiscal deficit is now more in line with the low inflation targets embedded in the Pacto. This effort is noteworthy given the negative budgetary impact of further drops in oil prices and increasingly high real interest rates on the foreign debt experienced towards the end of 1988.

Moreover, this has been achieved in spite of the extremely high level of domestic real interest rates. These have been at around 30% in

real terms for most of 1988, and have crept up to a compounded real rate in excess of 40% towards the end of 1988. All this occurred while real interest rates on government debt had been negative (-3%) in 1987. With the internal debt now at around 20% of GDP, such a turn around has resulted in a massive increase in real interest payments to service the domestic debt. This turn around explains how a 2 percentage point improvement in the non-interest surplus was not enough to prevent a 5.1% deterioration in the operational deficit.

High real rates probably reflect anticipations of a resurgence of inflation and exchange rate devaluation. Exchange rate uncertainty has forced the government to run very restrictive credit policies to avoid reserve losses given the fixed exchange rate. The real exchange rate with the US appreciated by 9.2% between January and August 1988, and by 5.5% since March of the same year, the first month with low inflation. The real appreciation of the dollar between March and September 1988 has added to the pressure (on a trade-weighted basis, the real exchange rate has appreciated by 7.4% between March and August). This should be set against a sharp real depreciation of 42% on a trade-weighted basis between July 1985 and December 1987. July 1985 was the month preceding a nominal devaluation of 17% and the beginning of a much more aggressive exchange rate policy. However, falling oil prices and rising foreign interest rates in the second half of 1988 may have added upward pressure on the real exchange rate. In addition, the significant policy of trade liberalization undertaken in December 1987 has also contributed to the pressures on the real exchange rate, as will be seen below.

It is clear that because of short-term problems, fiscal policy cannot be the main engine of growth, and balance of payments considerations leave no option but export-led growth. However, supply bottlenecks can be expected to develop in time, with a consequent need for additional investment. At present, gross domestic investment stands at about 16% of GDP, its lowest historical level. With fiscal tightening necessary in the face of low inflation targets and the likely negative impact of external shocks on public finance, private investment will have to lead the way. This is also more in line with the structural reforms currently underway in Mexico; these reforms seek to reduce rather than increase the role of the public sector.

The Model

The model assumes that Mexico is a price taker in international markets. That is, the foreign real interest rate and the foreign currency denominated prices of tradeable goods are given; among them, the price of new capital equipment. Moreover, Mexican wealth-holders can decide on the composition of their portfolio between holdings of three assets: domestic real assets (a composite asset including installed capital goods or equity and domestic real bonds which are perfect substitutes), money and foreign real bonds based on the real yield of each asset. The model assumes that domestic assets are non-tradeable, that assets are gross substitutes and that the monetary authority has a passive role with respect to wealth-holders' decisions of changing their portfolio composition between domestic and foreign assets by allowing accumulation or de-accumulation of foreign reserves. In other words, the nominal exchange rate is a policy instrument. Therefore, asset demand depends on rates of return and wealth:

(1) $m = M/P = a_m (r, r^f + De^e, (-DP/P)^e) w$

(2) $p_x(r) x = (P_k K/P) + (B/r P) = k + b = a_x (r, r^f + De^e, (-DP/P)^e) w$

(3) $f = (E F/r^f P) = a_f (r, r^f + De^e, (-DP/P)^e) w$

where r is the real interest rate on domestic real assets (x); $r^f + De^e$ is the real expected return on foreign real bonds (f), since r^f is the real interest rate and De^e is the expected rate of change in the real exchange rate; $(-DP/P)^e$ is the expected rate of inflation (the negative yield of real money, m); P_k is the market price of capital; K is the number of units of capital; P is the price level; B is the number of units of domestic real bonds yielding a constant value Mexican peso at perpetuity; p_x is the market price of the composite domestic real asset, which is inversely related with the real interest rate; E is the nominal exchange rate defined in units of Mexican pesos per US dollar; and F is the number of units of foreign real bonds yielding a constant value US dollar at perpetuity. Finally, real wealth (w) equals the real value of asset holdings:

(4) $w = m + p_x(r) x + f$

The system (1)-(4) boils down to only one equilibrium condition, the domestic real asset market condition, x, since we assume that: the nominal exchange rate (E), the US real interest rate (r^f), the expected rate of change in the real exchange rate (De^e), and the rate of expected inflation $((DP/P)^e)$, are exogenous. Equation 1 and 3 collapsed into one based on the assumption on monetary policy, and due to Walras' Law can be ignored.

Equation 2 will determine the equilibrium real interest rate. The assumption that domestic real bonds and capital are perfect substitutes implies that the price of capital relative to the price of real bonds is nearly constant. However, the rate of return on capital may be different than the real interest rate on domestic financial assets due to a constant risk and liquidity premiums. The analysis will first study investment and then the determination of the real interest rate.

Private Investment

Gross fixed private investment in Mexico fluctuated between 10.5 and 16.5% of GDP from 1960 to 1987 (Figure 1). A model of gross fixed private investment incorporates three effects: (i) the replacement of depreciation; (ii) the adjustment of the actual level of the capital stock to the desired level; and (iii) the capacity utilization of the actual capital stock. A low rate of capacity utilization will render much of the existing capital stock redundant, hence lowering investment. The proxy variable used for capacity utilization is the output-capital ratio. Thus,

$$PRIV_t = d\ k_{t-1} + v_0\ (k^*_t - k_{t-1}) + v_1\ (Y/K)_t$$

$$(5) \qquad PRIV_t = (d-v_0)\ k_{t-1} + v_0\ k^*_t + v_1\ (Y/K)_t$$

where:

PRIV   is the annual rate of gross fixed private investment in billions of Mex\$ at 1980 prices;

k_{t-1} is the stock of capital at the beginning of the year in billions of Mex\$ at 1980 prices;

d   is the annual rate of depreciation of the capital stock (d > 0);

v_0 is the coefficient of adjustment of the desired capital stock (v_0 > 0);

v_1 is the coefficient of investment response to the rate of capacity utilization of the actual capital stock (v_1 > 0);

(Y/K)   is the ratio of output to capital stock lagged one year, as a percentage; and

k*   is the desired capital stock.

The desired capital stock is derived from the long run equilibrium condition where the value marginal product of capital (VMP$_k$) is equal to the rental cost of capital. We assume that the production function is linearly homogeneous in labor and capital. Thus,

(6) $VMP_k = MP_k (K, L, PUI, t) P = (r+d) P_I$; and MP_{kk}, $MP_{LL} < 0$.

Hence,

(7) $K^* = K^* (r, p, PUI, L, t, d)$

where MP$_k$ is the marginal product of capital; L stands for labor; PUI is the public sector investment; p is the relative price of investment (P_I/P); and t stands for the unincorporated technological change.

An increase in the real interest rate on domestic real assets or in the relative price of investment will require an increase in the MP$_k$ to maintain the equilibrium condition of Equation 6. This can be attained by a decline in the desired capital-labor ratio, which for a given quantity of labor, will be obtained through a fall in the desired stock of capital.

Moreover, public sector investment is seen as affecting private sector investment. Public investment in infrastructure could increase the MP$_k$ if they are complementary. However, in Mexico a restrictive regulatory

framework which has linked private sector production to public enterprise (PE) activities in both the goods and factor markets has prevailed. As a result public sector investments have become a determining factor in private sector investment, far exceeding the usual complementarity between public infrastructure and private undertakings. More specifically, an expansion in the PEs' capacity to produce industrial inputs (e.g., basic petrochemical can only be produced by PEMEX) was a precondition for the complementary private sector downstream investments (e.g., secondary and tertiary petrochemicals). Conversely, an increase in PEs' demand resulting from capacity expansion has fostered some private sector investment undertaken for the purpose of satisfying this additional demand (e.g., capital goods sector expansion to satisfy PEMEX's and other PEs demand). Moreover, this complementary relationship may have been encouraged through the granting of selective incentives for directing private investment to fulfill the desired policy goals. Figure 1 shows a predominantly positive relationship between public and private investment as shares of GDP. However, the relationship between both variables seems to have changed after 1982.

Accordingly, the equation for the desired capital stock and the gross fixed private investment can be written as:

(8) $k^* = k_0 + k_1 r + k_2 p + k_3 PUI$, and

(9) $PRIV_t = v_0 k_0 + v_0 k_1 r_t + v_0 k_2 p_t + v_0 k_3 PUI_t + v_1 (Y/K)_t + (d-v_0) k_{t-1}$,

where: k_0 incorporate the effects of L, t and d on the desired capital stock, discussed in Equation 7; k_1, $k_2 < 0$; and (complements) $0 < k_3 < 0$ (substitutes). In addition,

r   is the _ex-post_ after tax average real interest rate on banking instruments, as a percentage;

p   is a relative price index as a percentage, defined as the ratio between the gross investment implicit price deflator and the GDP deflator; and

PUI   is the public sector gross fixed investment in billions of Mex\$ at 1980 prices.

A simple OLS estimate of Equation 9 for private investment on an annual basis during the period 1962-1987, yields the following results:

(10) $PRIV_t = -339 - 2.87 \, r_{t-1} - 2.3 \, p_t + .6 \, PUI_t + 12.4 \, (Y/K)_t + .036 \, k_{t-1}$

       (-1.3)   (-2.1)   (-1.8)   (5.7)   (3.5)   (5.6)

   $R^2 = 96.3\%$ $\bar{R}^2 = 95.1\%$ DW = 2.07   RHO = .04 (.86)   F = 81.4

where the values in parenthesis correspond to the t-statistics.

The results indicate that: (i) the capital replacement effect dominated the stock adjustment effect, the latter being too small (possibly, no higher than 2% p.a.);[1] (ii) public sector investment strongly complemented private investment; (iii) private investment was negatively related to the relative price of investment; (iv) private investment responded negatively to the one-year lagged real interest rate, possibly

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[1] From the Equation 9, the coefficient of the lagged capital stock is equal to $d-v_0$. The estimated value of this coefficient is 3.6%. Hence, an overall rate of depreciation of 5.6% (higher than that reported in the National Accounts) will be needed to obtain a coefficient of adjustment of 2% p.a.

because investors form their expectations on the real interest rate based on its level of the previous year; and (v) private investment was positively related to capacity utilization.

Table 1 shows the short- and long-run effects on private investment due to changes in the level of its determinants, assuming that the adjustment coefficient is 2% p.a. This small value may imply relatively high adjustment costs, thus resulting in large differences between short and long term effects. In fact, the high cost of adjustment may be a reflection of the relative instability of the macroeconomic environment that characterized the period under study. This may have increased the uncertainties and the risks of investment decisions, thereby, fostering an extremely cautious response of Mexican investors. Moreover, the small coefficient of adjustment may also reflect imperfections and immobilities in the goods and factor markets, as well as, problems of credibility in the structural reforms adopted in the past.

Table 1. MEXICO: Short- and Long-Run Effects on Private Investment

(Billions of 1980 Mex$)

	Short-Run	Long-Run
Increase of one percentage point in r	-2.87	-143.5
Increase of one percentage point in p	-2.3	-115.5
Increase of 1 billion in PUI	.6	30.0
Increase of one percentage point in Y/K	12.4	620.0

These results suggest that the greatest stimulus to private investment will come from policies directed at reducing the cost of adjustment, and increasing factor mobility and credibility on the ongoing policies of structural reform. That is, improved macromanagement inducing greater stability in the real exchange rate, real interest rate, and relative prices in general should provide a supportive macroenvironment for a faster investment response. Also a review of the regulatory framework and policies, aimed at improving competition and mobility in the goods and factor markets should improve credibility and the opportunities for a quicker adjustment in response to changes in the system of economic incentives.

To confirm the slow adjustment result, however, further research would still be needed. At this time, our analysis continue studying investment behavior by estimating equations for the relative price of investment and the real interest rate.

The Relative Price of Investment

Since the price of investment includes new capital equipment which is a tradeable, these prices reflect those in the United States. Also, changes in QRs on total imports may have affected domestic prices of new capital goods to the extent that QRs on new capital goods also changed. Moreover, an improved net foreign asset position may have facilitated import licensing approvals, in particular, those of new capital goods. Consequently, the relative price of investment may be negatively related to the level of net foreign assets. Finally, there is a lagged response in actual prices (p) to the equilibrium prices (p~), thus:

(11) $p_t = p_{t-1} + z (p^\sim_t - p_{t-1})$

         $p_t = (1-z) p_{t-1} + zp^\sim_t$,   and

(12) $p^\sim_t = b_0 + b_1 p^f_t + b_2 QR_t + b_3 a_t$, hence

(13) $p_t = zb_0 + zb_1 p^f_t + zb_2 QR_t + zb_3 a_t + (1-z) p_{t-1}$

where: $b_1, b_2 > 0$ and $b_3 < 0$;

p^f is the domestic currency price of the U.S. producer price
         for capital equipment relative to Mexican GDP deflator, as a
         percentage (i.e., the real exchange rate for capital goods);

QR   is an index of quantity restrictions on imports as a
         percentage; and

a   is net foreign assets of the consolidated banking system in
         billions of 1980 Mex$.

The OLS estimate of Equation 13 for the behavior of the relative

price of investment on an annual basis during the period 1962-1987 yields

the following results:

(14) $p_t = 20.0 + .19 p^f_t + .104 QR_t - .024 a_t + .50 p_{t-1}$

              (1.19)   (3.1)   (1.29)   (-2.8)   (3.8)

         $R^2 = 81.9\%$ $\bar{R}^2 = 78.4\%$ Durbin h = -.12 $F = 23.7$

where the values in parenthesis correspond to the t-statistics.

The results indicate that: (i) there is a lagged response of

actual prices to the equilibrium level; (ii) the domestic price of

investment is related to the behavior of the real exchange rate for new

capital equipment; (iii) quantity restrictions on total imports are

marginally binding; and (iv) the level of net foreign assets is negatively

related to the relative price of investment, indicating that licensing of

imports of new capital goods depended on the level of net foreign reserves.

Table 2 shows the short and long-run effects of changes in the

level of the explanatory variables on the relative price of investment.

Table 2. MEXICO: Short- and Long-Run Effects on the Relative
Price of Investment

(in Percentage Points)

	Short-Run	Long-Run
Increase of one percentage point in pf	.19	.38
Increase of one percentage point in QRs	.104	.21
Increase of 1 billion 1980 Mex$ in a	-.024	-.05

Figure 2 indicates that the relative price index of investment in
Mexico has always been below the U.S. relative price of new capital goods
in Mexican pesos. This explains that capital equipment is indeed a
component in the implicit cost of investment, albeit an important one.
Accordingly, a possible incentive for investment could come by further
liberalizing trade policy, that is to reduce the cost of a major component,
namely, capital equipment. Although QRs for new capital goods have been
abolished, QRs still remain for used capital goods. Moreover, Rule 8 of
the Tariff Code allows imports of parts for assembling new capital goods
with ad valorem tariffs ranging from 0 to 10%, instead of the simple
average nominal tariff on imports of new capital goods of 13.5% (12.6%
weighted). To improve efficiency in the allocation of resources, a more
neutral tariff treatment for imports of new capital goods would be
desirable.

On the other hand, imports of used durable goods (e.g. used
capital goods) under Rule 10 are subject to the same tariffs as imports of
new capital goods, but with a depreciation schedule that discriminates
against imports of used capital goods. A more realistic depreciation
schedule for imports of used capital goods would provide Mexican investors
with access to cheaper capital goods, and possibly with a wider variety of

FIGURE 2: MEXICO – RELATIVE PRICE OF NEW CAPITAL GOODS
(in percent, 1960=100)
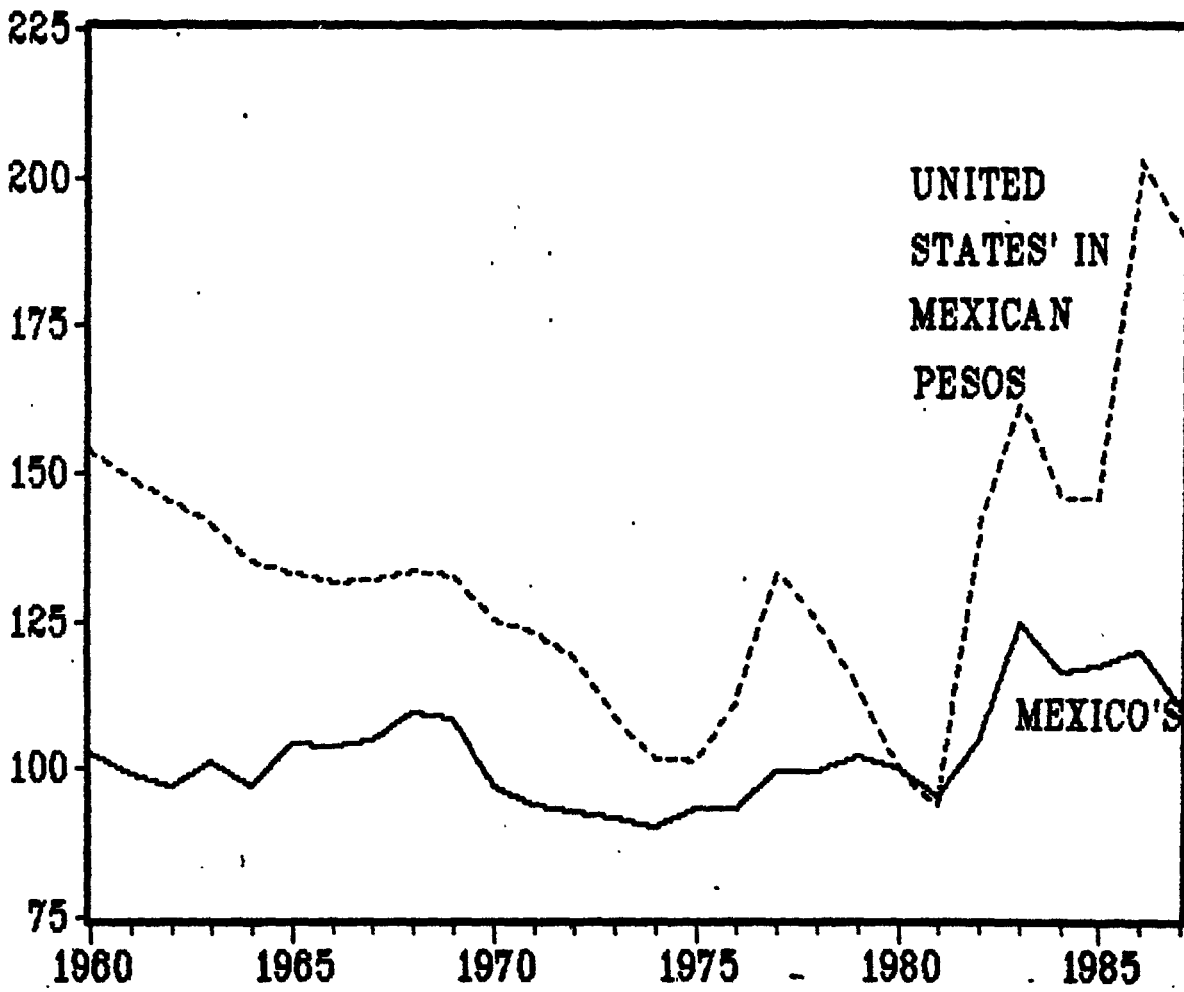
incorporated technology. Mexico has not had a good experience with imports of used capital goods in the past. This was due, in part, to the fact that a non-competitive and protected market offered opportunities for imports of obsolete capital goods. However, under present more competitive markets, there is little room left for imports of capital goods that are inefficient to operate in competitive foreign markets.

The Real Interest Rate

As assumed above, Mexican wealth-holders, besides having to decide between holding the composite asset integrated by domestic real financial assets and productive capital, also have the opportunity to hold foreign real bonds. The last possibility creates the linkage between domestic and foreign real interest rates. Figure 3 shows that there was a close relationship between the real interest rate in Mexico and that of the United States up until the mid- 1970s. However, since 1976, Mexico's real interest rate has been systematically negative and significantly smaller than the one in the United States. Hence, there are other factors that have played a role in the determination of the real interest rate in Mexico.

The arbitrage process will also take into account macroeconomic conditions; in particular, expectations of changes in the real exchange rate. Thus expectation of a real appreciation of the Mexican peso will increase the expected income stream of domestic real assets in terms of foreign currency; hence, increasing the demand for Mexican real assets in general and, thereby, reducing the real interest rate.

The policy of interest rate controls has had some responsability for the outcome of negative real interest rates in the face of accelerating inflation (Figure 4). Moreover, changes in the rate of domestic credit creation induce flow disequilibium in the asset markets and changes in the expectations of inflation thus fostering a portfolio shift between money and real assets and changes in the domestic real interest rate. Also, unanticipated inflationary shocks such as those that have taken place since 1982, have helped generate negative ex-post real interest rates.

Ultimately, the level of equilibrium of the domestic real interest rate will result when all asset markets clear. Therefore, wealth holders' decisions on the composition of their portfolio will affect the equilibrium real interest rate. The ratio of money to the composite domestic real asset will be a key variable in the determination of the real interest rate. Accordingly, a higher initial ratio of money to real domestic assets creates an excess supply of money and an excess demand for real domestic assets, which can only be resolved by an increase in the composite price of the real domestic assets, that is, a decline in the real interest rate.

Consequently, the equation for the real interest rate is written as:

15) $\quad r_t = g_0 + g_1 r^f_t + g_2 De^e_t + g_3 c_t + g_4 (M/K)_{t-1} + g_5 du$

where: $g_1, g_2 > 0$ and $g_3, g_4, g_5 < 0$;

$\quad\quad r^f \quad\quad$ is the ex-post real interest rate on U.S. Federal Funds as a percentage;

$\quad\quad De^e \quad\quad$ is the expected annual rate of change in the real exchange rate as a percentage ($De^e > 0$ means a expected real depreciation of the Mexican peso). D is the first-difference operator and e is the log of the real exchange rate;

c	is the annual rate of change in domestic credit creation as a percentage;
$(M/K)_{t-1}$	is the ratio of the stock of money and quasi-money to the stock of capital as a percentage measured at the beginning of the year. This variable is a proxy for the more appropiate ratio of money to real domestic assets discussed above; and
du	is a dummy variable to capture the unanticipated inflationary shocks experienced since 1982. It adopts a zero value for each of the previous years, and a unit value for 1982 and thereafter.

To complete the analysis, we need to specify a model for the formation of expectations of changes in the real exchange rate. We first postulate that the expected real exchange rate in year t is a weighted average of the actual real exchange rate in the previous two years and a function of the contemporaneous structural policies affecting the trade balance, in particular, trade policy. Due to the availability of data, the only trade policy variable that will be considered is the degree of quantitative restrictions on imports. Thus, an increase in QRs will induce expectations of an immediate improvement in the trade balance, hence an appreciation of the Mexican peso in real terms. Accordingly, the equation for expectations of the real exchange rate can be expressed as follows:

16) $e^e_t = (1-h_0) e_{t-1} + h_0 e_{t-2} + h_1 QR_t$

where: $0 < h_0 < 1$ and $h_1 < 0$. Hence, the expectation of changes in the real exchange rate becomes:

17) $De^e_t = e^e_t - e_{t-1} = -h_0 (e_{t-1} - e_{t-2}) + h_1 QR = -h_0 De_{t-1} + h_1 QR_t$

That is, an appreciation in the Mexican peso in real terms in the previous year generates expectations of a depreciation in the current year. Replacing the results of Equation (17) into (15), we can finally express the equation for the real interest rate as:

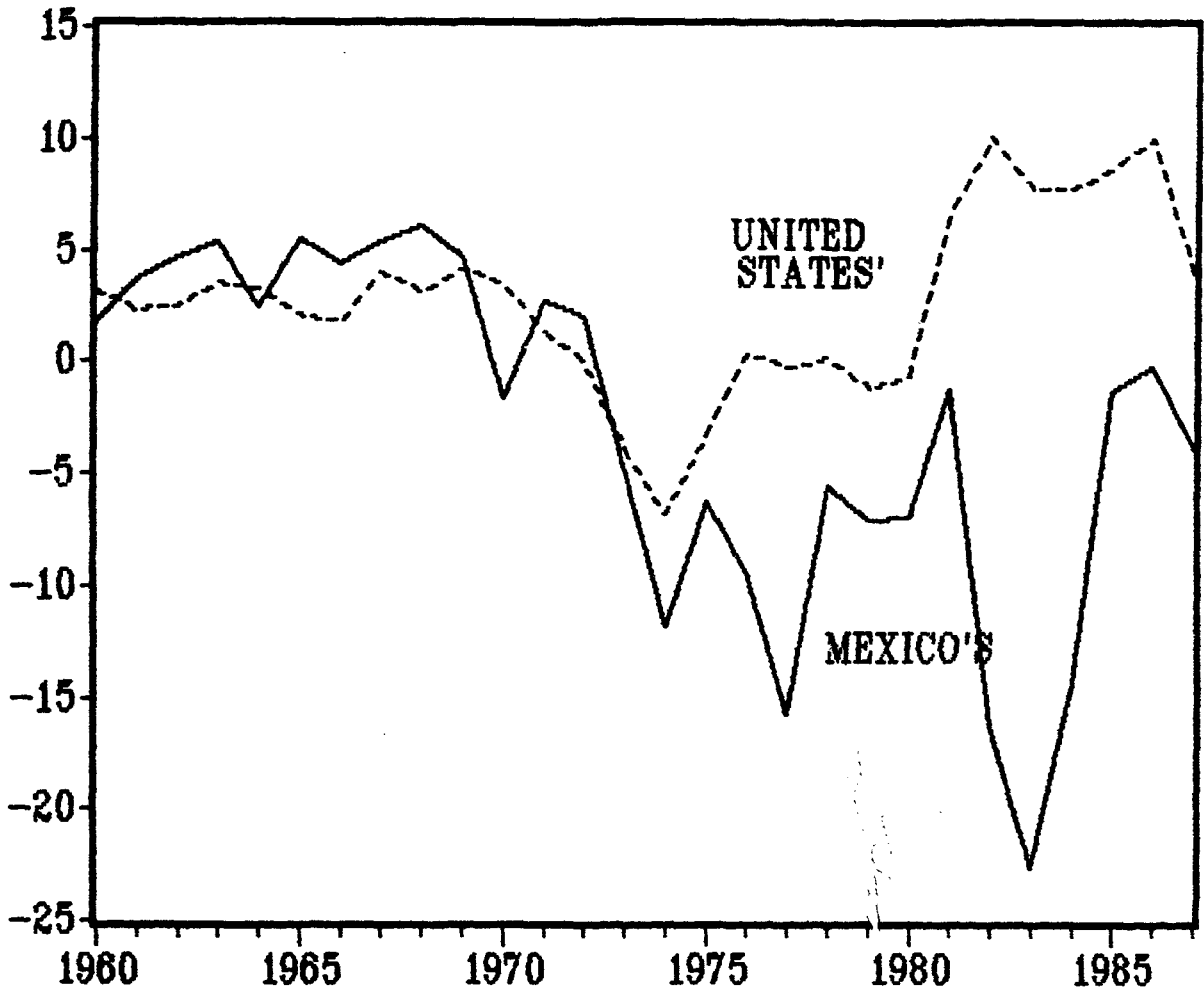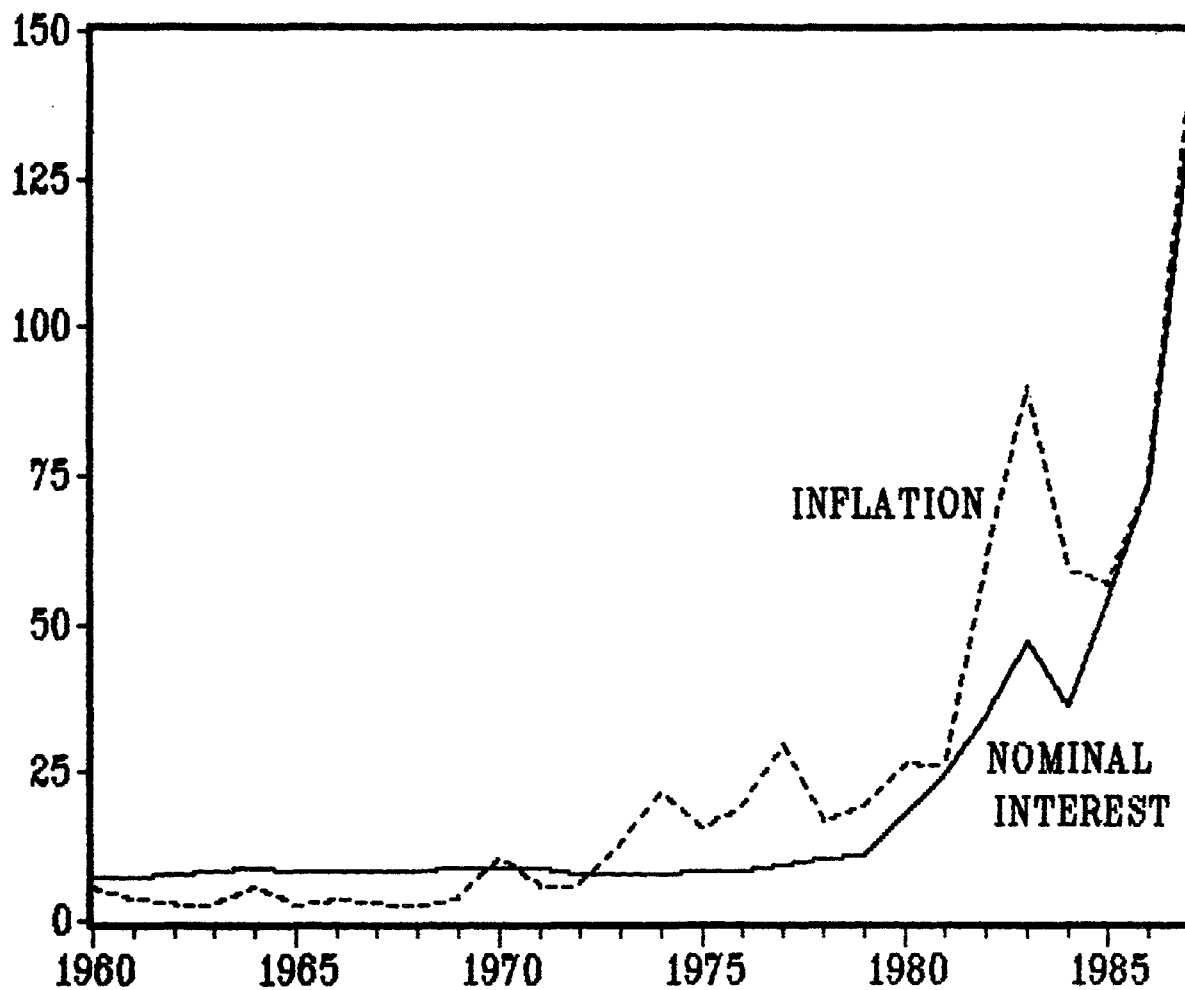## FIGURE 3: MEXICO – EX–POST REAL INTEREST RATES
(in percent)

FIGURE 4: MEXICO – NOMINAL INTEREST RATE AND INFLATION
(annual, in percent)

18) $r_t = s_0 + s_1 r^f_t - s_2 h_0 De_{t-1} + s_2 h_1 QR_t + s_3 c_t + s_4 (M/K)_{t-1} + s_5 du$

The OLS estimate of Equation 18 for the annual real interest rate for the period 1963-1987 yields the following results:

19) $r_t = 23.5 + .76 r^f_t - .13 De_{t-1} - .26 QR_t - .12 c_t - .58 (M/Y)_{t-1} - 11 du$

    (11)   (5)   (-3.1)   (-8.8)   (-6.2)   (-3)   (-5.6)

$R^2 = 94.5\%$ $\bar{R}^2 = 92.3\%$ $DW = 2.03$ $RHO = -.13 (-.52)$ $F = 41.9$

where the values in parenthesis correspond to the t-statistics.

The results accept the hypothesis that the real interest rate in Mexico is proportionally adjusted to changes in the US real interest rate. This result suggests that domestic and U.S. real bonds are close substitutes. Moreover, the real interest rate incorporates expectations of changes in the real exchange rate. The model accepts that both, a real appreciation of the Mexican peso in the previous year and a contemporaneous policy of trade liberalization induce expectations of a real depreciation in the current year. This will foster a change in portfolio composition favoring holdings of foreign real assets at the expense of domestic real and monetary assets, therefore, increasing Mexico's real interest rate. These results may provide some of the explanation for the high level of the real interest rate during 1988 and 1989. However, these are some of the reasons for generating a differential between the domestic and foreign real interest rates.

In addition, the level of the Mexican real interest rate responds to conditions in domestic asset markets. In particular, a high initial ratio of cash balances to capital creates an excess supply of money and an excess demand for domestic real assets. Equilibrium will be restored through capital flight and an increase in the price of real assets -- i.e.,

a fall in the real interest rate. Moreover, an acceleration in the rate of
domestic credit creation will create a flow excess supply of money and
excess demand for real assets -- the liquidity effect. This effect will be
reinforced by a fall in the demand for money due to expectations of rising
inflation stemming from the acceleration in the rate of credit expansion,
which, in turn, induces a fall in the desired ratio of money to real assets
in wealth holders' portfolios. Ultimately, equilibrium will be restored
through capital flight and a fall in the real interest rate. However, this
model is a short run model of real interest rate determination. In the
long run, the real interest rate cannot be affected by monetary policy, it
will have to reflect either consumers' rate of time preference, or the
level of foreign real interest rates, which are independent of monetary
variables.

Finally, estimates confirm that unanticipated inflationary shocks
have negatively affected the ex-post real interest rate. The capital
losses that this implies, in turn, may have forced a significant increase
in the ex-ante real interest rate to cover for the higher risk of holdings
of domestic financial assets.

Concluding Remarks

Mexico's past growth strategy based on import substitution and
public sector investment proved to be unsustainable as expansionary fiscal
policies came to an end with the financial crisis and drop in oil prices in
the 1980s. Moreover, complementary links between public and private
investment, necessarily implied that the cutbacks in the former also forced
contraction in the latter. The result was a magnified cost of adjustment,
particularly where linkages were high (e.g., capital goods).

To resume sustainable growth, the Mexican authorities adopted a new strategy whereby expansion in aggregate demand would have to come primarily from exports rather than from import substitution and fiscal deficits. Accordingly, the structural reform process began with the trade reforms in 1985. Table 1 shows that the greatest effect on investment corresponds to the rate of capacity utilization. At present, there is no other sustainable source for increased capacity utilization than through increasing non-oil exports. Also, the trade reform has reduced distortions in the price of capital goods, thereby stimulating investment.

However, to the extent that trade liberalization is not accompanied by a supportive macroeconomic environment, particularly by an improvement in the Government budget or a simultaneous devaluation in the Mexican peso to offset the deteriorating balance of trade effect stemming from the trade liberalization policies, expectations of depreciation of the Mexican peso in real terms will develop. This, in turn, will induce a portfolio shift against holdings of domestic assets in favor of foreign assets, thereby increasing the real interest rate. Accordingly, investment may be discouraged, a consequence of an ill fated trade liberalization policy due to a lack of consistent macroeconomic policies.

Further trade liberalization measures may still be needed, especially the removal of the remaining QRs, in particular, those on imports of used capital goods. This would encourage investment, both directly through the price effect, and indirectly as an instrument to promote trade. To obtain these benefits, it is necessary to review Rule 10 of the Tariff Code on the method for assessing the value of used durable goods, and replace it with a market determined system of depreciation.

As the stabilization efforts continue, the rate of domestic credit creation should be reduced. This policy, as in the past, may induce a reduction in the expectations of inflation. This, in turn, could increase the ratio of money to real assets in wealth holders' portfolios, thereby increasing the real interest rate thus discouraging investment. However, this is a short run effect since monetary policy cannot change the long run real interest rate. As the Government continues its policy of reducing reliance on the inflationary tax as a source of finance, more important and favorable developments will occur. First, financial deepening will reduce intermediation costs and spreads and increase access to financial services and thereby stimulate investment. This effect is being strengthened by the ongoing economic deregulation in the financial sector. Second, the unanticipated risk of capital losses on holding domestic assets will decline, thereby, increasing their liquidity and demand and reducing the real interest rate. Third, incentives for managing the exchange rate to repress inflationary pressures (thus inducing appreciation of the Mexican peso in real terms and expectations of depreciation and a higher real interest rate) will greatly be reduced. But more important of all, improved macromanagement will reduce the volatility in relative prices in general and therefore uncertainties, risks and adjustment costs, and will increase credibility and the short run response of investment to the gap between the desired and actual stocks of capital.

In addition, the Government has recognized the need for reforming the regulatory framework in order to foster a more competitive market structure and to unleash private sector decision making from public sector performance. These reforms are expanding private sector opportunities to

new areas of activities while improving factor mobility and the supply response to the change in the incentive system, hence stimulating private investment.

Data

The definition and sources of the data used in the estimates are discussed below while the data is shown in Table 3.

Real Money and Quasi-Money. It is defined as the aggregate of money and quasi-money of the consolidated banking system deflated by the GDP deflator. The source was the monetary survey in IFS, IMF.

Net Foreign Assets. It is defined as net international reserves of the consolidated banking system less long-term foreign liabilities and deflated by the GDP deflator. The source was the monetary survey in IFS, IMF, Yearbook, 1987 and August 1988.

Capital Stock. The data was obtained from a survey done by the Bank of Mexico for the period 1960-1985. Villalpando Hernandez, L.H. and Fernandez Moran, J., "La Encuesta de Acervos, Depreciacion y Formacion de Capital del Banco de Mexico 1975-1985," Subdireccion de Investigaciones Economica, Banco de Mexico, October 1986. The capital stock for 1986 and 1987 was obtained by adding net investment from the National Accounts, INEGI, to the previous years' capital stock figures.

The U.S. Real Interest Rate. Is the ex-post real interest rate calculated as the ratio between one plus the Federal Funds rate and one plus the U.S. producer price inflation rate. The source was IFS, IMF.

Gross Fixed Private and Public Sector Investment. These series were obtained from National Accounts, INEGI.

Implicit Price Deflators. Both the implicit price deflator for investment and GDP were obtained from the National Accounts, INEGI.

Output-Capital Ratio. It is the ratio of GDP and capital stock lagged one year. The data on GDP was obtained from National Accounts, INEGI.

The Real Interest Rate. Is the ex-post real interest rate calculated as the ratio between one plus the nominal interest rate and one plus the inflation rate in the implicit GDP deflator. The nominal interest rate is a weighted average of after tax yields of banks instruments. The source was: Gil Diaz F., "Mexico: Macroeconomic Policies Adjustments and Growth in the Long-Run", 1988, Table A56.

The Real Exchange Rate. It is a trade-weighted real exchange rate. World Bank staff estimates.

The Index of Quantity Restrictions on Imports. It reflects the percentage of imports subject to quantity restrictions out of total imports. The source was: Gil Diaz F., Ibidem.

The Rate of Net Domestic Credit Creation. Net domestic credit is obtained from the consolidated banking system balance sheet. Its rate of change is obtained as the annual change in the nominal stock of net credit divided by the nominal stock of monetary assets at the beginning of the year. The source was IFS, IMF.

The Relative Price of US Capital Goods in Mex$. It is obtained as the product of the US producer price index for capital equipment and the index of the annual average of the controlled exchange rate, divided by the GDP deflator. The source for both components of the numerator was IFS, IMF.

TABLE 3: MEXICO: Data Used In Estimating the Regressions

(In Percent)

obs	p	pf	Y/K	QRs
1960	102.9630	154.1193	43.43353	37.80000
1961	99.28571	149.0040	42.73182	53.30000
1962	97.22222	145.2433	44.09813	52.50000
1963	101.3513	141.6858	48.76482	63.50000
1964	96.81529	134.9514	49.17985	65.50000
1965	104.3478	133.2900	49.13813	60.00000
1966	103.5928	131.7626	50.38022	62.00000
1967	104.6512	132.0489	50.48351	65.20000
1968	109.6591	133.6898	51.53908	64.40000
1969	108.7432	132.7428	51.08719	65.10000
1970	97.04434	125.2992	50.97790	68.30000
1971	93.95349	123.1190	51.74186	67.70000
1972	92.98246	118.9657	52.74241	66.30000
1973	91.86047	108.7214	53.39858	69.60000
1974	90.15873	101.6703	48.90191	82.00000
1975	93.13187	101.4508	47.96574	86.50000
1976	93.33333	111.7171	47.94003	90.40000
1977	99.64602	134.0266	43.19328	67.70000
1978	99.69698	124.9216	46.96928	64.20000
1979	102.2814	113.7006	47.80382	60.00000
1980	100.0000	100.0000	47.38810	76.00000
1981	95.63492	93.44348	46.32153	82.80000
1982	104.8817	141.1739	41.34202	78.30000
1983	124.7540	162.4675	30.65258	80.10000
1984	116.5826	145.8740	32.50785	78.40000
1985	117.6855	145.6892	32.12053	35.10000
1986	119.8642	202.7307	28.49463	17.90000
1987	110.8495	189.9779	24.07883	13.60000

TABLE 3: MEXICO: Data Used In Estimating

the Regressions

(In Percent)

obs	r	rf	c	(M/K)	De
1960	1.731315	3.103034	NA	6.112343	NA
1961	3.718571	2.278718	8.333333	6.031656	-0.711747
1962	4.650061	2.476155	12.00000	6.954368	-1.523295
1963	5.354871	3.502887	10.34483	7.181367	0.636940
1964	2.480528	3.264979	8.823529	6.905303	-2.983721
1965	5.541052	2.042472	13.51351	7.118165	-0.745576
1966	4.396333	1.750047	7.317073	7.111777	2.253523
1967	5.398923	3.995866	-2.222222	6.519766	-2.571169
1968	6.101330	3.092682	6.666667	6.458545	-0.848258
1969	4.632873	4.166810	32.65306	7.673700	0.950570
1970	-1.641672	3.420218	7.692308	7.355075	-1.506590
1971	2.677368	1.279894	2.816901	6.968513	0.000000
1972	1.951872	0.020779	25.00000	7.937831	3.250480
1973	-4.799815	-3.898387	28.57143	7.849524	-0.277781
1974	-11.80785	-7.001092	36.22047	8.180079	-2.228407
1975	-6.290481	-3.128493	24.13793	8.490438	-1.994308
1976	-9.473949	0.373911	19.26605	7.425216	4.941866
1977	-15.83482	-0.269532	129.5019	12.70240	10.71099
1978	-5.499469	0.139519	32.07907	13.28170	-4.920769
1979	-7.128217	-1.186579	35.16193	13.74147	-4.385965
1980	-6.897067	-0.673965	39.20993	13.20168	-8.256881
1981	-1.268714	6.643455	44.15266	13.12755	-9.300003
1982	-16.29402	10.04162	83.44542	9.974231	48.07057
1983	-22.61354	7.735204	65.30278	8.678700	2.382723
1984	-14.30395	7.670287	64.34782	8.852296	-17.09091
1985	-1.410914	8.617634	56.74508	7.470602	-2.017547
1986	-0.254954	10.00894	95.04859	6.371425	30.61772
1987	-3.908425	3.884043	85.11198	6.456861	3.769706

TABLE 3: MEXICO: Data Used In Estimating

the Regressions

(In Billions of 1980 Mex$)

obs	PRIV	k	PUI	a	m
1960	151.0791	2908.505	64.74820	44.44444	177.7778
1961	151.0792	2960.570	71.94245	35.71429	178.5714
1962	142.8572	2895.862	78.57143	41.66667	201.3889
1963	166.6667	3198.969	93.33334	54.05405	229.7297
1964	190.7894	3412.867	118.4211	50.95541	235.6688
1965	232.1429	3577.585	95.23810	43.47826	254.6584
1966	219.6532	3788.942	121.3873	47.90419	269.4611
1967	238.8889	4012.842	133.3333	52.32558	261.6279
1968	248.7047	4310.642	145.0777	56.81818	278.4091
1969	286.4322	4628.684	140.7035	54.64481	355.1913
1970	355.3300	4755.270	162.4365	54.18720	349.7537
1971	376.2376	5072.652	118.8119	65.11628	353.4884
1972	372.6415	5414.887	174.5283	74.56141	429.8246
1973	392.4051	6271.057	236.2869	69.76744	492.2481
1974	482.3944	6752.759	257.0423	60.31746	552.3810
1975	463.1268	7053.831	312.6844	57.69231	598.9011
1976	460.5911	8080.573	298.0296	50.57471	600.0000
1977	483.1262	8035.553	273.5346	-0.530972	1020.708
1978	530.3951	8630.012	316.1094	-8.333333	1146.212
1979	583.6431	9432.747	411.4003	-6.717368	1296.198
1980	727.0000	10499.42	487.0000	-42.89999	1386.100
1981	797.5102	11686.32	595.0208	-85.71429	1534.127
1982	580.6299	15103.02	474.3771	-295.3649	1506.410
1983	487.9618	14753.65	282.0673	-182.2890	1280.425
1984	524.8465	15316.92	292.1552	-81.20423	1355.899
1985	622.3652	16582.56	292.6184	-168.4484	1238.817
1986	487.5311	19905.28	240.4868	-214.6600	1268.250
1987	540.4833	19981.49	220.5079	235.8072	1290.177

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