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THE ECONOMY OF MEXICO

A BASIC REPORT

(in Six Volumes)

VOLUME VI

TECHNICAL APPENDIX

June 27, 1973

Latin America and the Caribbean Department

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CURRENCY EQUIVALENTS

US\$1 = Mex\$12.5  
Mex\$1 = US\$0.08  
Mex\$1 million = US\$80,000

FISCAL YEAR

January 1 - December 31

THE ECONOMY OF MEXICO:

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TECHNICAL NOTE # 1

(see Volume II, para. 44)

Classification of Mexican Federal Government Budgetary  
Expenditure by Type of Emphasis

Economic Expenditure

Commerce and Industry (including National Economy and Statistics)  
Communications and Public Works  
Agriculture, Livestock and Forestry (Fomento)  
Agricultural Credit  
Agrarian Department  
Hydraulic Resources and Irrigation  
Tourism  
Investment in trust funds, stocks, bonds, railways, electrical industry,  
etc.  
Economic Share of Unclassified Category:  
Transfers to industry and commerce, price supports (Compania Nacional  
de Subsistencias Populares, etc.), subsidies to decentralized agencies  
(Puertos Libres Mexicanos, Comision Nacional de Valores, railways, etc.).

Social Expenditure

Education and Physical Education  
Indian Affairs  
Public Health, Welfare and Assistance  
Potable Water and Sewage Disposal  
Labor  
Social Share of Unclassified Category:  
National Housing Institute and Social Security Institute  
Social and Cultural Aids (including agricultural insurance, Banco  
National Hipotecario Urbano y de Obras Publicas, S.A., and Patrimonio  
Indigena del Valle de Mezquital).  
Payments to government employee medical services  
Military and civilian insurance programs

Administrative Expenditure

Public Debt (including redemption, interest and costs)  
Military (including army, navy, and military industry)  
Legislative  
Executive  
Judicial  
Foreign Relations  
Interior (Gobernacion)  
Attorney-General  
Treasury (including Accounting Department)  
General Expenses:  
Department of General Supply (1919-1924)  
Department of Press and Publicity (1937-1939)  
National Resources (1947-present)

Administrative Share of Unclassified Category:

General Services (including interest and contingency funds)

Transfers (including subsidies to states and territories), government pensions and administration of pensions.

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Source: Mexico, Secretaria de Hacienda y Credito Publico, Presupuesto General de Egresos de la Federacion (cited as Presupuesto) and Cuenta Publica by year. For the Leyes de Secretarias y Departamentos de Estado, from 1821 to the present, consult the Revista de Administracion Publica (Mexico City) 10 (1958) 49-165 and 11-40.

## TECHNICAL NOTE # 2

(see Volume II, para. 50)

### National Accounts

#### General

1. The GDP estimates for 1900-1950 contained in the Statistical Appendix were obtained by extrapolating and aggregating the 1950 sectoral estimates presented in Cuentas Nacionales y Acervos de Capital, 1950-67 by the sectoral growth rates estimated by Leopold Solis.
2. Since the estimates contained in the latter source were calculated using 1950 as a base year, while the figures for 1950 contained in Cuentas Nacionales (op.cit.) were revised using the 1960 input-output matrix, the resulting series presents a slightly altered sectoral distribution than that presented by Solis. This linking procedure was adopted in order to benefit both from the sectoral growth rates estimated by Solis while still maintaining consistency regarding absolute levels with data for later years.
3. For the period 1950-60, with the exception of breakdowns between public and private investment (see below), all data was taken as presented in Cuentas Nacionales. Furthermore, estimates for changes in stocks and capital consumption for later years were based on the relationships between GDP and these expenditure items in the 1950-60 period. The exceptions are the estimates on consumption expenditures (residual) and foreign transactions, presented in the Statistical Appendix, since the latter were made to agree with the balance of payments data. It should be pointed out that in all expenditure data produced by the Banco de Mexico, consumption is estimated as a residual.
4. Although the Cuentas Nacionales contains data for the period 1960-67, these have, since its publication, been substituted by more recent information. For 1961-71 therefore, the data presented on GDP by sector of origin is that published in the Informe Anual, 1971 of the Banco de Mexico, while that on expenditure is based on unpublished information supplied to the mission by the Banco de Mexico. As in the period 1950-60, consumption has been re-estimated as a residual after substituting the data on the foreign sector by the balance of payments estimates contained in the Statistical Appendix. Moreover, estimates of changes in stocks are also broken down from the residual consumption data presented to the mission.

#### Changes in Inventories

5. Although the GDP estimates since 1960 have been revised after the publication of Cuentas Nacionales, the more recent data are not as complete, lacking data on specific indicators, namely changes in inventories and capital consumption. To estimate these items, the 1950-60 period was used as a sample of observations from which the relation between GDP, related data, and these indicators could be used for estimation purposes.

6. For estimating inventories, the economy was divided into four sectors - agriculture, livestock, industry and commerce, and other - based on examination of the data for the 1950s. The data used was in constant terms. The estimates resulting from the equations below were then applied to 1960 end of year inventories, thus obtaining a series for 1960-72 end of year. These were then deflated into current prices, using for 1960-67 the deflator for stocks in each of these sectors from Cuentas Nacionales. For more recent years, the price index used was extrapolated from 1967 using the sectoral deflator from the revised series on GDP by origin.

7. The equations used are:

$$\text{Industry: } S_D = -486.4 + 0.3163 (M_P) + 0.28018 (Y_M) + 0.54368 (Y_{mi})$$

$$\text{Livestock: } S_D = 1708.6 + 1.303 (Y_L) - 3.882 (X_L)$$

$$\text{Agriculture: } \Delta S = -750.1 + 0.104 (Y_{AG}) - 0.612 (S_J) - 0.6295 (X_{CR}) \\ + 4.947 (P_{CR})$$

$$\text{Commerce and Other: } S_D = 6901.2 + 0.4478 (M) + 0.15262 (Y_G - \Delta S_G - Y_R)$$

where:

$S_D$  = inventories at end of year

$\Delta S$  = changes in inventories

$M_P$  = imports of producer goods

$Y_m$  = GDP in manufacturing

$Y_{mi}$  = GDP in manufacture of producer goods

$Y_l$  = GDP in livestock

$X_L$  = exports of livestock

$Y_{AG}$  = GDP in agriculture

$S_J$  = stocks at beginning of year

$X_{CT}$  = cotton exports

$P_{CT}$  = cotton production

$M$  = imports

$Y_G$  = GDP in goods producing sectors

$\Delta S_G$  = increases in inventories of goods producing sectors

$Y_R$  = GDP in trade

For each of the regressions an  $\bar{R}^2$  of over 0.9 was obtained with T-statistics over 2 for all independent variables.

### Capital Consumption

8. As with changes in inventories, the data for 1950-60 presented in Cuentas Nacionales were used as a basis for regression. The equation used was:

$$DEPR_t = -629.1 + 0.0411 (GDP_t) + 0.0055 (K_{t-1})$$

starting from capital stock (K) in 1960, depreciation was computed for each subsequent year and together with Gross Fixed Investment in that year was used

to update the capital stocks. The figures used were in current prices. The  $R^2$  obtained for this regression was 0.9956 with T-statistics of 3.64 for GDP and of 1.20 for lagged capital stock.

Other Estimates

9. For 1960-67 indirect taxes and subsidies were taken from Cuentas Nacionales. For 1968-70, the estimates are based on data on indirect taxes collected by the Federal Government and state tax revenues published in the Anuario Estadístico. Data on subsidies were obtained from Cuentas Publicas. For 1971 and 1972 the data are rough estimates.

10. Public Fixed Investment was obtained from Inversion Publica Federal for the Federal Government and Federal District and from rough estimates based on State and municipal data from the Anuario Estadístico. In the former case the concept used was "autorizado", and therefore understates actual investment. However, it is the only concept for which data is available for the entire period. For State and municipalities, the Anuario Estadístico has published for certain years data on public works expenditures. For others, when only total expenditures were available, the share of public works expenditures in total expenditures of the benchmark years were used as proxies for the actual share.



TECHNICAL NOTE # 3

(see Volume II, para. 51)

MEAN AND STANDARD DEVIATION OF INFLATION  
INDEXES FOR MEXICO, 1940 - 1969

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	<u>1940-54</u>		<u>1955-69</u>	
Wholesale prices of 210 articles in Mexico City	11.9	9.0	3.4	3.1
Food cost at retail prices of 16 articles	12.2	13.5	4.4	4.4
Workers' cost of living	13.0	10.0	4.8	4.2
GNP implicit price deflator	10.5	10.4	4.7	2.5

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Source: Bank of Mexico, Informe Anual

TECHNICAL NOTE # 4

(see Volume II, paras. 96 and 140)

The Gini Coefficient

The Gini coefficient is a global indicator of distributive inequality. Its value fluctuates from zero when equality is perfect, to one - at an extreme level of inequality.

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## TECHNICAL NOTE # 5

(see Volume II, para. 140)

### Adjustments of Income Distribution Data

1. Income distribution data may be adjusted<sup>1/</sup> on the following assumptions: that (a) only those income groups with roughly equal income and expenditure levels accurately reported income; (b) income groups which reported a deficit between income and expenditure, underreported incomes in kind and fringe benefits, and (c) income groups which reported a surplus of income over expenditure underreported money income - the higher the income level, the greater the degree of underreporting. (Table TN5-1). Application of this adjustment implies a progressive deterioration in income distribution over time, and implies that the income levels of the poorest 20 percent of the population would have fallen from 6.1 percent to 3.9 percent between 1950 and 1969, whilst the income share of the 20 percent with the highest income levels would have increased from 59.8 percent to 62.4 percent. The income of an average family in the latter category would have been 9.8 times that of an average family among the poorest 20 percent in 1950. By 1969 that figure would have been 16 times.
2. Such a deterioration would not have implied an absolute decline in the real income of the lowest income groups, but rather a deterioration of income status relative to that of the highest income groups. Absolute income would thus have risen at both ends of the income scale, but much faster at the top. The absolute increases at the bottom of the scale were small, whereas those at the top were substantial. The fact that the 1950 census reported only 72 percent of total income, the 1958 survey only 62 percent and the 1963 and 1969 surveys also reported only 73 percent of total income may imply that results based on adjusted data are not conclusive.

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<sup>1/</sup> Following Ifigenia de Navarrete: "La Distribucion del Ingresos", op.cit.

Table TN5-1: ESTIMATE OF THE REAL FAMILY INCOME IN MEXICO, 1969-1970

Monthly Income Brackets (in pesos)	% of Families	Ttl income (in thousand pesos)	% of Ttl income	Corrective Factor		Adj. Ttl Income (in thousand pesos)	% of Adj. Income
				Specie Income	% of Under Reporting		
Less than 500	21.0	639,953.7	4.0	153	-	979,639	4.1
501 - 750	12.1	691,569.2	4.4	132	-	912,871	5.8
751 - 1,000	15.3	1,211,492.8	7.6	115	-	1,393,217	5.8
1,000 - 2,000	27.7	3,617,614.3	22.8	110	2	4,172,728	17.5
2,000 - 3,000	10.6	2,367,818.9	14.9	100	31	3,098,057	13.0
3,000 Plus	13.2	7,317,137.5	46.2	100	82	13,306,488	55.8
	100.0	15,845,486.5	100.0	-	-	23,862,000	100.0

Source: IBRD Estimates. The correction coefficients are derived from the methodology used for 1963 by Ifigenia de Navarrete in El Perfil de Mexico en 1960, La Distribucion del Ingreso en Mexico, Mexico (1970).

## TECHNICAL NOTE # 6

(See Volume III para. 16, and Volume IV para. 62)

### Mexican Projection Model

1. The model used to project the Mexican economy is essentially the same type of model that has been used in past IBRD Economic Reports on Mexico, the difference lying mainly in the length of the projection period, which in this case is to the year 2000. In actual use however the model has two phases, the projection for medium term analysis to 1980 and the longer run analysis to the year 2000. 1/

2. The model is a target model which selects a rate (or rates) of growth and asks what will happen, particularly to the balance of payments aggregates. Three rates are selected. The basic equation is

$$1) Y_t = Y_{t-1}(1 + g)$$

where Y is GDP and g is the growth rate of GDP. For the base or standard run the value of g averages out to be 6.3% between 1970 and 2000. In terms of specific periods we have projected a rate of growth of 6.5% between 1972 and 1976, with an acceleration to 7% by 1980 (reflecting the maturity of the export boom). The rate then falls to 6% by 1990 (reflecting a waning of the export drive and an increasing burden of petroleum imports) and remains at that level until the year 2000.

3. Allied to this basic equation we have made calculations of the probable sector outputs for 9 sectors. These have been done simply on the basis of sectoral elasticities applied to the overall GDP/growth rate. These are used mainly to derive sectoral shares and play no part in determining other parts of the model, although they would of course be a good base for future sections on employment. The elasticities used are estimated from the period 1960-72 and as such are additive only at the mean of the time period involved. In the projections no attention is given to the additivity constraint, but it is violated only by 0.2% in 1980, 2.2% in 1990 and 8.5% in 2000. As the projections play no vital part in the model at this point we did not force additivity; the dominant sectors are manufacturing, electricity, construction, and commerce.

4. As the model is a target model, and as the model is assumed to have a dominant import constraint, the investment function only concerns the use of resources and plays no key role in the determination of the behavior of the model. Thus we have used a very simple investment equation:

$$2) I = kgY$$

Where I is gross domestic investment and k is the incremental capital to output ratio. The value of k is set at 3.0 which is fairly close to the historical value. Consumption then becomes a residual and

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1/ For medium-term projections see Appendix Tables 2.12 (National Accounts) and 3.24 (Balance of Payments)

is also a user of resources:

$$3) C = Y + M - X - I$$

Where X and M are exports and imports of goods and non-factor services.

In a similar vein, savings is also a residual:

$$4) S = I - M + X - TT$$

Where S is gross domestic savings and TT is the adjustment due to changes in the terms of trade (see below).

5. The concentration of the model is on the balance of payments side of the economy. We begin with the export equations. Current price exports of goods and non factor services are composed of five main categories:

$$5) X_{cur} = X_g + X_t + X_f + X_a + X_o$$

Where  $X_g$  is exports of merchandise,  $X_t$  is tourism,  $X_f$  is frontier transactions,  $X_a$  is exports of gold and silver, and  $X_o$  is other exports (mainly non-factor services). For the purposes of the projection model  $X_a$  is kept constant at \$50 million. This clearly could be better modelled, but it is fairly minor in the overall total and thus we have left it at its recent level.  $X_o$  is allowed to grow at 8.5% per annum, the recent growth rate; currently this item amounts to about \$150 million. Frontier transactions are defined to include only the goods exported from the border zones; the earnings of workers are included under factor payments. The border exports were worth \$687 million in 1972 and for the purposes of the model we have projected them at their recent growth rate of 8.3% per annum. Tourism, currently worth about \$700 million should grow by at least 10.4% per annum.

6. In runs involving higher growth rates of GDP (8 and 10%) we have allowed tourism to accelerate to 14% by 1980 and then fall back to 10% by 2000. Thus in the basic run tourism earns \$11.2 billion in the terminal year of 2000 while in the higher growth rate version it earns \$16.7 billion. The qualitative implications of figures of this magnitude are substantial. However, these estimates are considered conservative by the Mexican authorities and it should be remembered that these are current price estimates over 27 years. Given the assumed international inflators, the two figures are 9 and 13 times the current real levels, while real GDP itself is projected variously at 6, 8 and 13 times current levels.

7. Thus we have the following equations:

$$6) X_a = 50$$

$$7) X_{ot} = X_{ot-1} (1.085)$$

$$8) X_{ft} = X_{ft-1} (1.083)$$

$$9) X_{tt} = X_{tt-1} (1 + g_t), g_t = .104; = \text{variable averaging } .120, 1972-2000$$

Exports of merchandise are divided into seven categories:

$$10) X_g = X_{ag} + X_{liv} + X_{min} + X_{mfg} + X_{chm} + X_{otm} + X_{unc}$$

agriculture, livestock, mining, manufacturing, chemicals, other manufacturing, and unclassified. In this breakdown manufacturing includes processed foods, textiles and leather products while other manufacturing includes mineral based products such as steel, glass, and ceramics as well as items such as books. (See Table 3.4 in Statistical Appendix). An analysis of the 48 different items in this classification is presented in Table 3.23 of the Statistical Appendix. This refers to the volume trends in the period 1961-72, recent price trends, the outlook for prices to 1976 and the prospects in terms of volume to that year. Using the average of 1970-72 as the base year (centered on 1971), growth rates of earnings for the seven major categories were calculated; these are also shown in table 3.23, the overall growth rate being 12.3% per annum. A separate calculation was made of the implicit price index over the same period. This figure was 2.95% per annum, thus the real growth rate of merchandise exports is projected at 9.1%. In current prices, we therefore have the following equations:

$$11) X_{agt} = X_{agt-1} (1 + g_{ag})$$

$$12) X_{livt} = X_{livt-1} (1 + g_{liv})$$

$$13) X_{mint} = X_{mint-1} (1 + g_{min})$$

$$14) X_{mfgt} = X_{mfgt-1} (1 + g_{mfg})$$

$$15) X_{chmt} = X_{chmt-1} (1 + g_{chm})$$

$$16) X_{otmt} = X_{otmt-1} (1 + g_{otm})$$

$$17) X_{unct} = X_{unct-1} (1 + g_{unc})$$

The seven growth rates are variable over time and also with respect to the target growth rate. In fact, with the 8% and 10% GDP projections, the exports are adjusted so as to answer the question "what growth in exports is needed in order to support a given growth rate of GDP?".

The rates used in the model are shown in Table TN6 -1. It should be noted that for mining and unclassified the rates are constant over time<sup>1/</sup>, the former because of basic pessimism about the industry, the latter because of lack of information. In agriculture, livestock and chemicals the rates increase as the target growth rates increase, while in the two categories of manufacturing the strategy appears to differ between 8% and 10%. This is mainly ad hoc selection on the part of the model builder and has little or no policy implication.

8. As indicated above, the calculations for exports are in current prices. This is appropriate for analysis of the balance of payments, but for use in the national accounts equations (3 and 4), the values must be in constant prices. Thus:

$$18) X_{\text{cons}} = X_{\text{cur}} / P_x$$

where  $P_x$  is the export price index, 1967-69 average = 1.00.<sup>2/</sup>  
As mentioned above,

$$19) P_{xt} = P_{xt-1} (1 + g_{pe}), \text{ where } g_{pe} = .0295 \text{ to } 1976 \text{ and then falls to } .02 \text{ by } 1980.$$

Similarly, the import price index;

$$20) P_{mt} = P_{mt-1} (1 + g_{pm}), \text{ where } g_{pm} = .04 \text{ until } 1976 \text{ and then falls to } .02 \text{ by } 1980.$$

where we use a rough estimate of future import price increases of 4% per annum in the short run falling to 2% by 1980. The index of the terms of trade is simply the ratio of the two;

$$21) TIN = P_x / P_m$$

and the adjustment due to changes in the terms of trade is;

$$22) TT = X_{\text{cur}} / P_m - X_{\text{cur}} / P_x \quad 3/$$

Moving now to the imports of goods and non-factor services we have;

$$23) M_{\text{cur}} = M_g + M_f + M_t + M_o + M_a$$

where the categories and the notation are identical to the export equations; goods, frontier transactions, tourism, other imports and gold and silver. As before, the gold and silver account is small and constant,

<sup>1/</sup> Also with respect to different growth rates.

<sup>2/</sup> The national account variables are calculated in constant prices average of 1967-69.

<sup>3/</sup> In exact technical terms, the service component of exports is deflated by the import price index, not the export price index. We have simplified the treatment above for clarity of presentation.

$$24) M_a = 15$$

Tourism by Mexicans going abroad is currently \$200 million and is projected to grow at its recent rate of 14.3% per annum. Frontier transactions are about \$650 million and are growing at 10.2% while other transactions are \$180 million growing at 5.4%. Thus:

$$25) M_{tt} = M_{tt-1} (1.143)$$

$$26) M_{ft} = M_{ft-1} (1.102)$$

$$27) M_{ot} = M_{ot-1} (1.054)$$

Imports of goods are classified into four categories, consumer, intermediate, capital, and petroleum;

$$28) M_g = M_c + M_i + M_k + M_p$$

Consumer goods are based on consumption. We use a regression line through the data from 1959 to 1972;

$$29) M_c = -98.33 + 0.029 C$$

In like fashion, raw materials are related to GDP and the equation is based on data for a similar period;

$$30) M_i = -380.27 + 0.034Y$$

In the case of capital goods, we have used the same equation (but re-estimated) which was employed in the last IBRD Report on Mexico. Capital goods imports are related to the previous years imports of these goods and also the change in investment between the two years;

$$31) M_{kt} = 383.75 + 0.877M_{kt-1} + 0.023(I_t - I_{t-1})$$

With the relationships for petroleum imports we come to a sector that has never been treated explicitly before in our projections and which now is clearly seen to have serious implications for the long run growth and balance of payments of Mexico. Whereas such imports were only \$93 million in 1972, they are conservatively expected to be at least \$12 billion in the year 2000. In the model we have simply incorporated the detailed relationships 1/. We begin with the volume price identity;

$$32) M_p = P_v \cdot P_p \quad \text{where the subscripts are volume and price.}$$

The prices are supplied exogenously to the model and can be found in Table 8.21 of the Statistical Appendix. Currently \$3 per barrel, they are projected at \$9.07 per barrel in the year 2000. Petroleum

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1/ See Volume III, para. 248; Volume IV, para. 55.

import volume is expressed in millions of barrels, but in order to treat the problem in the terms of petroleum economics, these values must be converted into the daily rate of usage (barrels per day).

$$33) P_v = 0.356 \text{ BBL}$$

and barrels per day is the difference between supply and demand;

$$34) \text{BBL} = \text{PD} - \text{PS}$$

Supply is expected to grow through the 1980's and then to taper off;

$$35) \text{PS}_t = \text{PS}_{t-1} (1 + g_p), \quad g_p = .05 \text{ to } 1980, .045 \text{ to } 1985, \\ -.025 \text{ to } 1990, \text{ and } -.035 \text{ to } 2000$$

while demand, which continues to grow must be related to the demand for hydrocarbons, less the supply of gas;

$$36) \text{PD} = \text{HD} - \text{GAS}$$

$$37) \text{GAS}_t = \text{GAS}_{t-1} (1 + g_G), \quad g_G = .048 \text{ to } 1976, .044 \text{ to } 1980, \\ .015 \text{ to } 1990, \text{ and } -.025 \text{ to } 2000.$$

Hydrocarbon demand is related to total energy demand by a factor which is currently 84% and which is expected to rise to 86% during the 1980's and then to fall back to 83% by 2000;

$$38) \text{HD}_t = f_t \cdot \text{EDEM}_t, \text{ where } f_t \text{ is the factor of relation.}$$

Finally, energy demand is related to GDP through an elasticity coefficient;

$$39) \text{EDEM}_t = \text{EDEM}_{t-1} (1 + g_e) \text{ where } g \text{ is the growth of}$$

GDP and  $e$  is the elasticity of energy demand. This elasticity is currently 1.2 and is projected to fall to 1.17 in 1977 and 1.1 in 1991. The detailed formulation of the petroleum imports allows the model to automatically adjust to changes in the growth rate of GDP and at the same time provides scope for experimentation with the various parameters of the projection. This part of the model has only been used in a limited fashion for this report, but has substantial potential for further analysis.

9. Having now arrived at an estimate of the resource gap;

$$40) F = M_{\text{cur}} - X_{\text{cur}}$$

we proceed to describe the parts of the model that relate to the financing of this gap. First let us treat the equations for direct foreign investment. Total direct foreign investment is expected to continue to grow at its recent average;

$$41) \text{DFI}_t = \text{DFI}_{t-1} (1.125)$$

In looking at the payments on this investment we tried a number of different functions and came to the conclusion that the most sensible alternative was to relate it to the foreign capital stock in Mexico. Estimates of this stock are not very reliable but we do have data on direct investment and on the payments. If we hypothesize a constant profit rate and a constant depreciation rate, we find a "best fit" with a stock of \$2.5 billion in 1970 and a depreciation rate of 2.5%. The stock figure is in the range of the various estimates and the depreciation rate, although seemingly low, is in fact the same rate as is implied in the national accounts for domestic capital stock. Thus the function for stock:

$$42) KF_t = 0.975 KF_{t-1} + DFI_t$$

and for profits;

$$43) \pi F_t = -83.12 + 0.225 KF_t$$

In terms of strict balance of payments accounting we have all the necessary variables for foreign direct investment. However, the Mexican authorities present their balance of payments on a non-standard, net basis, i.e. they report the actual flows in and out rather than the potential. Thus we need to calculate retained profits (that part of profits which is reinvested). An analysis of the data indicates that these are fairly well related to direct foreign investment, and that the proportion is increasing;

$$44) RI = -16.44 + 0.468 DFI$$

the coefficients being taken from a regression of the data over the period 1960-72. In addition to payments on direct foreign investment, factor income payments also include interest paid and earned and remittances of workers. The former we treat below in the discussion of the debt portion of the model. Payments to workers mainly represent the earnings of workers in the border zones who cross to the U.S.A. to work and return on a daily or weekly basis. The earnings from the braceros program, to the extent it still exists, are classified under transfers. Workers remittances are currently at a level of \$380 million and are expected to grow at a rate of 12% per annum;

$$45) WR_t = WR_{t-1} (1.12)$$

Completing the balance on current account we have transfers which are currently \$50 million and are not expected to change;

$$46) TRN = 50$$

The balance on current account is thus defined:

$$47) BOCA = -F - \pi F + WR - INT + TRN$$

where INT is net interest paid on all types of borrowing, long and short term.

10. Moving to the financing of the capital account we first look at reserve changes. In recent years the ratio of reserves to imports has risen to a level which is equivalent to about 5 months imports. The authorities do not intend that this level should persist over the long run; the policy would appear to be that reserves should represent about 2 months imports. Thus:

$$48) \text{ CRES} = 0.167 (M_t - M_{t-1})$$

where CRES is the change in reserves.

11. Short term capital is much less well understood in Mexico than it would ideally be. It seems fairly clear that there is a substantial amount of autonomous capital flowing into the financieras from abroad to take advantage of the combination of high interest rates and a stable currency. We have made a rough estimate that this type of flow was about \$200 million net in 1972 and that it would be reasonable to expect it to grow by 6% per annum, thus:

$$49) \text{ STC}_t = \text{STC}_{t-1} (1.06)$$

In addition there is also a more clearly defined category of short term capital inflow. This has ranged up to \$200 million in the past few years. For the purposes of projection we have allowed it to be a gap filler up to a limit of \$400 million in any one year and with the provision that such borrowing costs 8% per annum. Likewise, if the availability of capital is such that this item is an outflow, then 8% would be earned. Thus:

$$50) \text{ OSTC} = -(\text{BOCA} + \text{NPB} = \text{STC} + \text{CRES} + \text{DFI})$$

where NPB is net borrowing by the public sector on long term, and where CRES is defined so that an increase in reserves has a negative sign. However;

$$51) \text{ if } \text{OSTC} > 400; \text{ then } \text{NPB} = 400 - \text{OSTC}, \text{ and } \text{OSTC} = 400$$

12. Finally we look at the system describing net borrowing by the public sector. The largest part of this borrowing is defined from commitment patterns representing our best estimates of the likely levels of lending from various multilateral and bilateral sources. These are translated with the use of profiles into disbursement patterns. The committed debt leads to a fixed amortization schedule and once disbursed to a fixed interest schedule. 1/ Thus the model has sufficient information to calculate, for each year, the interest and the amortization to be paid;

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1/ There are a few types of loans that have a fixed equal payment instead.

$$52) \text{ INT} = \sum \text{INT}_i \quad \text{and}$$

53)  $\text{AM} = \sum \text{AM}_i$  where the subscript refers to the source of the loan. Also;

$$54) \text{ NPB} = \text{DISB} - \text{AM} \quad \text{and}$$

$$55) \text{ DISB} = \sum \text{DISB}_i$$

Each disbursement is related to a commitment;

$$56) \text{ DISB}_i = f(\text{COM}_i) \quad \text{and}$$

$$57) \text{ AM}_i = f(\text{COM}_i)$$

$$58) \text{ INT}_i = f(\text{DISB}_i)$$

These functions are mechanical, depend on the source of the loan and are too detailed to be presented in this Note. In the case of suppliers credits, the commitments must be related to the imports of capital goods. Examination of recent data showed great variability, but a reasonably good function was as follows:

$$59) \text{ COM}_{sc} = 0.132 (M_k)$$

where the disbursement profile is such as to disburse immediately. Equation 51 is set up so that if short term capital is greater than \$400 million, then the excess must be borrowed from official public long term sources. In the model, this residual financing source is assumed to be financial institutions, and this source is assumed to have an immediate disbursement profile. If this constraint is not binding then this source of funds grows by 6% per annum.

13. This completes the balance of payments part of the model. The accompanying Tables show the national account and balance of payments aggregates for the three cases tried; 6.3%, 8%, and 10% growth of GDP.

TECHNICAL NOTE # 6

Table TN 6-1: Mexico - merchandise export growth rates (%)

GDP growth: a = 6.3%, b = 8.0%, c = 10.0%

		<u>1972-76</u>	<u>1977-80</u>	<u>1981-85</u>	<u>1986-90</u>	<u>1991-95</u>	<u>1996-2000</u>
1. $g_{ag}$	a.	7.8	6.0	5.0	5.0	5.0	6.0
	b.	7.8	7.0	6.5	6.5	6.5	6.5
	c.	7.8	7.0	7.0	7.0	7.0	7.0
2. $g_{liv}$	a.	13.9	8.0	6.0	5.0	4.0	4.0
	b.	13.9	8.0	6.0	6.0	6.0	6.0
	c.	13.9	8.0	8.0	8.0	8.0	8.0
3. $g_{min}$	a.	3.4	3.4	3.4	3.4	3.4	3.4
	b.	3.4	3.4	3.4	3.4	3.4	3.4
	c.	3.4	3.4	3.4	3.4	3.4	3.4
4. $g_{mfg}$	a.	9.6	9.6	9.6	9.6	9.6	9.6
	b.	9.6	9.6	9.6	12.0	15.0	20.0
	c.	9.6	9.6	9.6	9.6	9.6	9.6
5. $g_{oth}$	a.	19.0	12.0	9.0	9.0	9.0	9.0
	b.	19.0	16.0	10.0	9.0	12.0	12.0
	c.	19.0	16.0	16.0	16.0	16.0	16.0
6. $g_{chm}$	a.	24.3	15.0	10.0	10.0	9.0	9.0
	b.	24.3	18.0	15.0	15.0	15.0	15.0
	c.	24.3	18.0	18.0	18.0	18.0	18.0
7. $g_{unc}$	a.	8.0	8.0	8.0	8.0	8.0	8.0
	b.	8.0	8.0	8.0	8.0	8.0	8.0
	c.	8.0	8.0	8.0	8.0	8.0	8.0

TECHNICAL NOTE #6

Table TN 6-2 : MEXICO : BALANCE OF PAYMENTS PROJECTIONS  
TERMS OF BORROWING

	Interest	Maturity	Grace
IBRD	7-1/4	20	5
IDB	7	20	5
Governments	6-1/2	20	5
Suppliers - Medium	7	10	3
Suppliers - Hard	7	6	2
Banks and F.I. <u>1/</u>	(8)	(20)	(5)
Bonds	8	10	3

1/ Both types of money are included in the model.

Table TN 6-3 (a) : MEXICO : NATIONAL ACCOUNTS PROJECTIONS  
 (millions of 1967-69 US\$, percentages and average annual rates of growth)  
 6.3 percent growth alternative

	1960	1965	1970	1980	1990	2000
Resource Use	16,013	22,297	31,723	57,932	108,544	196,357
Consumption	12,766	17,852	25,007	46,041	89,226	161,761
Investment	3,247	4,446	6,717	11,891	19,318	34,596
Resource Gap (Unadj.)	253	65	666	488	1,220	4,157
Exports	1,657	2,061	2,572	5,146	9,358	17,387
Imports	1,910	2,126	3,238	5,634	10,578	21,544
GDP	15,760	22,232	31,057	57,445	107,324	192,200
Terms of Trade Adj.	26	-61	4	-110	-185	-316
GDY	15,786	22,171	31,061	57,335	107,139	191,885
Net Factor Income	-114	-185	-370	-865	-2107	-5,988
GNY	15,672	21,986	30,691	56,470	105,032	185,896
(Net Transfers)	41	9	53	34	28	23
Gross National Saving	2,947	4,143	5,737	10,463	15,834	24,159
<u>Selected Relationships (%)</u>						
Consumption/GDY	80.9	80.5	80.5	80.3	83.3	84.3
Investment/GDY	20.6	20.1	21.6	20.7	18.0	18.0
Savings/GDY	18.7	18.7	18.5	18.2	14.8	12.6
ICOR	2.71	3.00	2.8	3.0	3.0	3.0
	<u>1960-65</u>	<u>1965-70</u>	<u>1960-70</u>	<u>1970-80</u>	<u>1980-90</u>	<u>1990-2000</u>
GDP	7.1	6.9	7.0	6.3	6.4	6.0
Exports	4.4	4.5	4.5	7.2	6.2	6.4
Imports	2.2	8.8	5.4	5.7	6.5	7.4
Investment	6.5	8.6	7.5	5.9	5.0	6.0
Savings	7.0	6.7	6.9	6.2	4.2	4.3

Source: IBRD Mission Estimates.

Table TN 6-3(b) : MEXICO : BALANCE OF PAYMENTS PROJECTIONS  
(current US\$)  
6.3 percent growth alternative

	1965	1970	1980	1990	2000
Goods and non-factor services (net)	-123	-697	-867	-2486	-9638
Exports	1954	2710	7304	16216	36791
Imports	2078	3408	8171	18702	46429
Net Factor Payments	-181	-389	-1254	-3725	-12905
Interest (net)	-103	-218	-810	-2220	- 7619
Public M & L Term	- 87	-217	-525	-1615	- 6694
Other (net)	- 16	- 1	-285	-605	-925
Investment Income	-236	-474	-1385	-4427	-14362
Workers Remittances	158	302	941	2922	9076
Net Goods and Services	-304	-1087	-2121	-6211	-22543
Current Transfers	9	56	50	50	50
Current Account Balance	-295	-1031	-2071	-6161	-22493
Direct Investment (net)	181	306	808	2625	8523
M & L Term Capital (net)	-8	308	621	2779	13146
Disbursements	388	781	1574	4664	17860
Amortization (-)	396	474	952	1885	4715
Short-term Capital	-16	43	400	400	400
Other Capital, n.i.e.	117	476	338	605	1084
Changes in Reserves (increase -)	21	-102	-96	-248	-659

Source: IBRD Mission Estimates.

**Table TN 6-4(a) : MEXICO : NATIONAL ACCOUNTS PROJECTIONS**  
(millions of 1967-69 US\$, percentages and average annual rates of growth)  
8 percent growth alternative 1/

	1960	1965	1970	1980	1990	2000
Resource Use	16,013	22,297	31,723	60,514	130,821	282,599
Consumption	12,766	17,852	25,007	46,043	99,579	215,149
Investment	3,247	4,446	6,717	14,471	31,242	67,400
Resource Gap (unadj.)	253	65	666	218	644	1,558
Exports	1,657	2,061	2,572	5,510	11,477	26,396
Imports	1,910	2,126	3,238	5,728	12,121	27,954
GDP	15,760	22,232	31,057	60,297	130,177	281,041
Terms of Trade Adj.	26	-61	4	-118	-227	-556
GDY	15,786	22,171	31,061	60,178	129,950	280,485
Net Factor Income	-114	-185	-370	-826	-1,692	-4,262
GNY	15,672	21,986	30,691	59,353	128,258	276,223
(Net Transfers)	41	9	53	34	28	23
Gross National Saving	2,947	4,143	5,737	13,344	28,707	61,097
Consumption/GDY	80.9	80.5	80.5	76.5	76.6	76.7
Investment/GDY	20.6	20.1	21.6	24.0	24.0	24.0
Savings/GDY	18.7	18.7	18.5	22.2	22.1	21.8
ICOR	2.71	3.00	2.8	3.0	3.0	3.0
	<u>1960-65</u>	<u>1965-70</u>	<u>1960-70</u>	<u>1970-80</u>	<u>1980-90</u>	<u>1990-2000</u>
GDP	7.1	6.9	7.0	6.9	8.0	8.0
Exports	4.4	4.5	4.5	7.9	7.6	8.0
Imports	2.2	8.8	5.4	5.9	7.8	8.7
Investment	6.5	8.6	7.5	8.0	8.0	8.0
Savings	7.0	6.7	6.9	8.8	8.0	7.8

1/ 8 percent growth rate from 1977.

Source: IBRD Mission Estimates.

**Table TN 6-4(b) : MEXICO : BALANCE OF PAYMENTS PROJECTIONS**  
**8 percent Growth Alternative 1/**  
**(current US\$)**

	1965	1970	1980	1990	2000
Goods and Non-factor Services (net)	-123	-697	-487	-1,541	-4,555
Exports	1,954	2,710	7,820	19,889	55,687
Imports	2,078	3,408	8,307	21,430	60,242
Net Factor Payments	-181	-389	-1,197	-2,991	-9,185
Interest (net)	-103	-218	-753	-1,486	-3,899
Public M&L Term <u>2/</u>	-87	-217	-540	-1,277	-3,610
Other (net)	-16	-1	-213	-209	-289
Investment Income	-236	-474	-1,385	-4,427	-14,361
Workers Remittances	158	302	941	2,922	9,076
Net Goods and Services	-304	-1,087	-1,684	-4,531	-13,740
Current Transfers	9	56	50	50	50
Current Account Balance	-295	-1,031	-1,634	-4,481	-13,690
Direct Investment (net) <u>3/</u>	181	306	808	2,624	8,523
M&L Term Capital (net) <u>1/</u>	-8	308	640	1,478	4,935
Disbursements	388	781	1,596	3,319	8,506
Amortization	396	474	955	1,840	3,570
Short-term Capital	-16	43	-51	100	100
Other Capital, n.i.e.	117	476	338	605	1,084
Changes in Reserves (increase -)	21	-102	-101	-326	-952

1/ 8 percent growth from 1978.

2/ As reported to External Debt Reporting System and not comparable to figures presented in Tables 3.2 and 3.3. Discrepancies on interest payments are included with "other interest" and discrepancies in disbursements and repayments are included with "other capital, n.i.e.".

3/ New investments and reinvestments only.

Source: IBRD Mission Estimates.

**Table TN-6.5(a) : MEXICO : NATIONAL ACCOUNTS PROJECTIONS**  
(millions of 1967-69 US\$, percentages and average annual rates of growth)  
10 percent growth alternative 1/

	1960	1965	1970	1980	1990	2000
Resource Use	16,013	22,297	31,723	65,280	169,249	438,533
Consumption	12,766	17,852	25,007	45,813	118,758	307,570
Investment	3,247	4,446	6,717	19,467	50,492	130,962
Resource Gap (unadj.)	253	65	666	391	944	1,992
Exports	1,657	2,061	2,572	5,510	13,814	37,596
Imports	1,910	2,126	3,238	5,901	14,758	39,588
GDP	15,760	22,232	31,057	64,889	168,305	436,541
Terms of Trade Adj.	26	-61	4	-118	-314	-973
GDY	15,786	22,171	31,061	64,771	167,992	435,567
Net Factor Income	-114	-185	-370	-847	-2,152	-5,883
GNY	15,672	21,986	30,691	63,924	165,839	429,684
(Net Transfers)	41	9	53	34	28	23
Gross National Saving	2,947	4,143	5,737	18,145	47,110	122,137
Consumption/GDY	80.9	80.5	80.5	70.7	70.7	70.6
Investment/GDY	20.6	20.1	21.6	30.1	30.1	30.1
Savings/GDY	18.7	18.7	18.5	28.0	28.0	28.0
ICOR	2.71	3.00	2.8	3.0	3.0	3.0
	<u>1960-65</u>	<u>1965-70</u>	<u>1960-70</u>	<u>1970-80</u>	<u>1980-90</u>	<u>1990-2000</u>
GDP	7.1	6.9	7.0	7.7	10.0	10.0
Exports	4.4	4.5	4.5	7.9	9.6	10.5
Imports	2.2	8.8	5.4	6.2	9.6	10.4
Investment	6.5	8.6	7.5	11.3	10.0	10.0
Savings	7.0	6.7	6.9	12.2	10.0	10.0

1/ 10 percent growth rate from 1977

Source: IBRD Mission Estimates

Table TN 6-5(b) : MEXICO : BALANCE OF PAYMENTS PROJECTIONS  
10 percent growth alternative 1/  
(current US\$)

	1965	1970	1980	1990	2000
Goods and non-Factor Services (net)	-123	-697	-739	-2,223	-6,391
Exports	1,954	2,710	7,820	23,868	78,925
Imports	2,078	3,408	8,559	26,091	85,315
Net Factor Payments	-181	-389	-1,228	-3,805	-12,679
Interest (net)	-103	-218	-784	-2,301	-7,393
Public M & L Term <u>2/</u>	- 87	-217	-568	-2,005	-7,017
Other (net)	- 16	- 1	-216	-296	-376
Investment Income	-236	-474	-1,385	-4,427	-14,362
Workers Remittances	158	302	941	2,922	9,076
Net Goods and Services	-304	-1,087	-1,967	-6,029	-19,071
Current Transfers	9	56	50	50	50
Current Account Balance	-295	-1,031	-1,917	-5,979	-19,021
Direct Investment (net) <u>3/</u>	181	306	808	2,625	8,523
M & L Term Capital (net) <u>2/</u>	- 8	308	783	3,104	10,839
Disbursements	388	781	1,743	5,224	16,137
Amortization (-)	396	474	960	2,120	5,299
Short-Term Capital	- 16	43	100	100	100
Other Capital, n.i.e.	117	476	338	605	1,084
Changes in Reserves (increase - )	21	-102	-112	-455	-1,525

1/ 10 percent growth from 1977.

2/ As reported to External Debt Reporting System and not comparable to figures presented in Tables 3.2 and 3.3. Discrepancies on interest payments are included with "other interest" and discrepancies in disbursements and repayments are included with "other capital, n.i.e.".

3/ New investments and reinvestments only.

Source: IBRD Mission Estimates.



TECHNICAL NOTE # 7

(see Volume III, para. 65)

The Demand for Liquid Assets in Mexico

1. Asset-choice theory<sup>1/</sup> specifies the demand for assets as a function of income (or wealth); the expected return on the particular asset, *i*; the return on the *j*th asset and all other assets which are substitutes for the *i*th asset; the riskiness of the *i*th, *j*th and *n*th assets, and possibly other factors. The general demand function:

$$(1) \quad A_i = F [\bar{Y}; r_i, r_j, \dots, r_n; S_i, S_j, \dots, S_n, \\ \text{cov}(r_i, r_j), \text{cov}(r_i, r_m), \dots, \text{cov}(r_i, r_n)]$$

where  $A_i$  = Amount of asset *i* demanded at any time *t*

$\bar{Y}$  = concept of "permanent" income or wealth

$r_i, r_j, \dots, r_n$  = expected rates of return on the *i*th, *j*th, ..., and *n*th assets

$S_i, S_j, \dots, S_n$  = standard deviation of expected returns, or any other suitable measure of individual asset risk

$\text{cov}(r_i, r_j)$ , etc. = covariance of expected returns, or any other suitable measure of common movement of asset returns

derives from some utility of wealth (or income, depending on the particular transformation<sup>2/</sup>) function.

2. The demand for money may be analyzed from this basic microeconomic approach. In this framework, the demand for money is usually construed as behavior against risk<sup>3/</sup> provided that the analysis abstracts from inflation. The demand for other liquid assets - various types of bank savings instruments, bonds, stocks, and physical capital, relates to various means of investing wealth in the expectation of some future return, subject to the individual and common riskiness of realizing these returns. On the macroeconomic level, the demand for these assets may represent the aggregation of these individual demands. But the utility choices are definitely not as clear as they would be in the microeconomic level. Moreover, in the aggregate, policy questions surround these asset choices - specially in the demand for money - and the relationship between the quantity of money and the level of economic activity becomes the relevant consideration.

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<sup>1/</sup> See Sharpe [11], Tobin [13], Hamada and Royama [12], for representative expositions of the theory.

<sup>2/</sup> This is a common transformation. See, for instance, Hamada and Royama [12].

<sup>3/</sup> Tobin [13] is the seminal article.

3. The theory of the demand for money has a long, involved and controversial history. This is not the place to recount the various formulations; Laidler [9] provides a sufficient discussion. Fundamentally, we are analyzing here the demand for banking system liabilities by the surplus units in Mexico, and assuming that the funds raised in this manner are used by the banking system for their lending activities. Therefore, we assume that ceteris paribus, the derivative of total lending with respect to total demand for (or more appropriately, total stock of) liquid assets, equals unity. We could not directly introduce the effects of Bank of Mexico reserve requirements and portfolio composition directives on the demand for banking system liabilities (including quasi-money and bank bonds) due to the partial equilibrium approach that we had to take. To incorporate all the policy influences and constraints requires a general equilibrium model: not only must we explain the behavior of the private sector, but also that of the banking system, particularly its demand for reserves, and come up with a model of the supply of money. We are not prepared to attack the problem on this broad level, at this point.

Demand for Money Function in Mexico

4. Given the structure of the Mexican financial system and the significant role played by the Bank of Mexico in demand management, we hypothesized that the classical theory of money demand would be a reasonable approach. This is usually represented by the Cambridge equation:

$$(2) \quad \bar{R}^2 M = kPY$$

where M = quantity of money in nominal terms

k = inverse of income velocity

P = price level

Y = national income in real terms.

Using published data<sup>1/</sup> for the period 1951 to 1971, we approximated this theoretical formulation with the following estimated equation:

$$(3) \quad \log \left( \frac{M_1}{P} \right)_t = -2.035 + 0.981 \log GDP_t + 7.126 D_{1t} \\ \quad \quad \quad (8.168) \quad (47.761) \quad (2.293) \\ \quad \quad \quad - 0.613 (\log GDP_t * D_{1t}) \\ \quad \quad \quad (2.271)$$

$\bar{R}^2 = 0.994$   $D_{1t} = (1, 1951-54$   
 S.E. = 0.003  $(0, 1955-71$   
 D.W. = 2.056  
 No. of obs. = 21; estimation period: 1951-71

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<sup>1/</sup> From Bank of Mexico Annual Reports, 1951-1971, inclusive.

Here, the variables are:

$M_1$  = annual average (mean of 12 end-of-month figures)  
quantity of money, defined as the sum of coins and  
currency in circulation plus demand deposits

GDP = real gross domestic product

P = implicit GDP deflator, 1960 = 1.00

$D_1$  = dummy variable for devaluation

5. This nearly statistically perfect equation bears out the hypothesis that in Mexico, the demand for money in real terms is proportional to the real level of national income. The value of the coefficient, 0.981, is very plausible and is consistent with the theoretical foundations of the monetarist position. The high t-value of the coefficient for log GDP further supports the hypothesis, and there can be no question that money "matters" in Mexico. The dummy variable,  $D_1$ , was introduced to account for the effects of the 1954 devaluation on the constant term. Its coefficient is significant at the 5 percent level. Since the 1954 devaluation was a major economic dislocation, it was very likely that it affected the slope of the regression line as well. The multiplicative dummy,  $\text{Log GDP}_t \cdot D_{it}$ , was introduced for this purpose, and its coefficient is significant at the 5 percent level.

6. Other relevant statistics show the remarkable stability of the estimated relationship. The correlation coefficient adjusted for degrees of freedom is very high, the standard error (S.E.) of 0.003 is quite low, and the Durbin-Watson d-statistic of 2.056 allows us to decisively reject the hypothesis that the error terms are positively serially correlated. The latter statistic is important, because it indicates that the equation is properly specified and that no variables relevant to the analysis have been omitted. It is regrettable that the regression program used in our calculations did not provide F-statistics for the one-way analysis of variance to determine the independent effects of the included variables. However, the values of the available statistics allow us to safely infer that the inclusion of other variables (possibly those for stock adjustment and the level of "the" interest rate) would not have increased the value of the F-statistic, i.e., added to the explanatory power of the equation.

7. This equation was used to forecast the demand for money in Mexico from 1972 to 1976, assuming that real GDP grows at an annual rate of 7 percent and that inflation is to be maintained at an annual rate of 4 percent. In general, our calculations show that the money supply may be expanded at a rate of 12 percent annually without disrupting the stability that characterizes the Mexican economy. We also used the equation as a price-determining relationship to calculate theoretical prices for the period 1951-71. These prices were compared with actual prices for the same period, and the results further support our hypothesis concerning the close relationship of money, prices and economic activity in Mexico.

Demand for Quasi-Money Function

8. We defined quasi-money,  $QM_t$ , in our analysis as:

$$QM_t = \text{Total assets - capital and reserves} \\ - \text{monetary liabilities - bank bonds.}$$

Consequently,  $QM_t$  includes not only all the classical savings instruments: time and saving deposits, but other time deposits denominated in pesos and dollars (pagares), as well. Between dollar pagares and the rest of the quasi-money liabilities, we can expect some substitution to occur for two reasons: (a) dollar-denominational pagares were utilized by savers who desired a hedge against any risk of peso-devaluation; and (b) the Bank of Mexico, from 1959 to 1969 had actively promoted peso-denominated pagares and bank bonds to compete directly with dollar-pagares and minimize the holdings of these assets to the private sector.

9. The estimated equation for real  $QM_t$  balances, a variant of the general demand function (1) above, reflects this possible substitution within the  $QM_t$ -asset category:

$$(4) \quad \log \frac{QM}{P} = -10.990 + 1.389 \log GDP_t + \frac{3.435D_{2t}}{(4.301)} - \frac{1.959 \log r_t}{(5.319)} \\ + \frac{1.560(\log r_t * D_{2t})}{(5.013)}$$

$$\bar{R}^2 = 0.994 \quad (0, 1954-58) \\ \text{S.E.} = 0.005 \quad D_{2t} = (1, 1959-69) \\ \text{D.W.} = 1.847 \quad (0, 1970 \text{ onwards}) \\ \text{No. of obs.} = 18, \text{ estimation period, } 1954-71.$$

It is only this hypothesis of substitution among  $QM_t$ -category assets that may explain the negative sign of the coefficient of the interest rate variable,  $r_t$ . Unfortunately, only the series for dollar pagares interest rates was available to us at the time that we were estimating the equations, and we could not use more appropriate variables. Furthermore, the shortening of the estimation period from 1951 to 1971, to 1954 to 1971, resulted from the absence of any interest rate data prior to 1954.<sup>1/</sup>

10. We could not find evidence of statistical biases, specifically multi-collinearity, to account for the negative sign of  $r_t$ . Since all the included variables had "correct", i.e., anticipated signs, and were highly significant at the one percent level, we could only speculate that important variables were omitted from the equation. There is little doubt that these variables are interest rates of other quasi-money liabilities. We introduced the dummy variable,  $D_{2t}$ , and the multiplicative dummy,  $\log r_t \cdot D_{2t}$ , to account for the influence of Bank of Mexico policies regarding dollar pagares referred to above, on the constant term and on the slope of the regression line, respectively.

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<sup>1/</sup> Caso-Bercht [1].

11. In general, despite the reasonable values of  $\bar{R}^2$ , SE and the Durbin-Watson d-statistic, it is difficult for us to be as confident about equation (4) as we are with equation (3). The perverse negative sign of  $r_t$ 's coefficient indicates specification problems that we cannot solve at the present time due to data limitations.

Demand for Bank Bonds Function

12. In our analysis, bank bonds had to be treated separately from quasi-money because of the high liquidity and high yields that tend to distinguish them from other non-money bank liabilities. In addition, policy-makers in the Bank of Mexico working in conjunction with those in the Ministry of Finance selected financiera bonds as the primary instruments to compete against dollar pagares in their domestic resource mobilization efforts.

13. The estimated equation for bond demand is given below:

$$(5) \quad \log \frac{B}{P}_t - \rho \log \frac{B}{P}_{t-1} = -9.521 + 1.677 [\log GDP_t - \rho \log GDP_{t-1}] + 0.115D_{2t} \\ (15.1403) \qquad \qquad \qquad (3.200)$$

$$\begin{aligned} R^2 &= 0.970; \rho = 0.7 & + 1.118 [\log GDP_{t-1} - \rho \log GDP_{t-2}] \\ S.E. &= 0.007 & + 0.559 [\log GDP_{t-2} - \rho \log GDP_{t-3}] \\ D.W. &= 1.580 & (19.29) \\ \text{No. of obs.} &= 18 \end{aligned}$$

All coefficients of the explanatory variables are significant at the one percent level. The first-order autoregressive scheme and the distributed lag structure (Almon Lag) were used to minimize positive serial correlation of the error terms. The value of the Durbin-Watson d-statistic allows us to reject - but barely - the hypothesis of positive autocorrelation of the residuals.

14. Autocorrelation in the unadjusted equation would be caused by our inability to introduce variables for the rapid development of financial intermediation in Mexico and the strong response to the financial authorities' policy of encouraging issue and ownership of bank bonds. Thus, without any adjustments, we would have consistent underestimates of the real stock of bank bonds.

Projected Liquid Asset Demand in Mexico, 1972-76

15. Using these equations and assuming that the Mexican economy were to grow at a real annual rate of 7 percent from 1972 to 1976, and that inflation is to be held at the tolerable level of 4 percent annually, we have the following projections (amounts in current billion pesos):

	<u>M<sub>1</sub></u>	+	<u>QM</u>	+	<u>B</u>	=	<u>TL = Total</u> <u>Lending</u>	<u>%</u> <u>Increase</u>
1971 (actual)	45.6		92.8		69.0		207.4	
1972	52.0		133.5		81.8		267.3	28.9
1973	57.8		152.7		100.5		311.0	16.3
1974	64.3		174.6		127.3		366.2	17.7
1975	71.4		199.3		162.8		433.5	18.4
1976	79.4		227.6		209.4		516.4	19.1

The big increase from 1971 to 1972 reflects the depressed state of economic activity in 1971.

16. As a final note, it is important to consider that these projections depend on the assumption that the financial system - fiscal and monetary - in Mexico will not change. If a major fiscal effort were undertaken, such that the Federal Government will not have to rely on the Bank of Mexico for investible funds to the extent it has done in the past, then the increase in total lending of the system will be curtailed, and necessarily, the increase in total liabilities or equivalently, the demand for bank liabilities by the private sector, will also be curtailed.

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TECHNICAL NOTE # 8

(see Volume III, para. 111)

ICOR Projection

For the years 1973-78 the ICOR was imputed using the following procedure:

- (a) in the absence of any change in public revenues, it was assumed that private investment (including inventories) would remain at 13.1 percent of GDP;
- (b) from Tables III-II-22 the net increase in public savings needed for an accelerated public investment program was obtained and its relation to the GDP projection estimates (Appendix Table 2.12) computed;
- (c) the estimates for required increases in public savings were converted into 1967-69 U.S. dollars using the ratio to GDP obtained in (b) and the GDP projections in U.S. dollars based on the same growth rates as those stated in Table III-II-22.
- (d) it was assumed that 50 percent of the required increase in public savings would be financed out of private investment so that 50 percent of the net increase in public savings (see (c)) was subtracted from 13.1 percent of GDP in order to obtain private investment;
- (e) the ratio of public investment to GDP obtained from Table III-II-22 was applied to projected GDP in 1967-69 U.S. dollars to obtain public investment;
- (f) total investment was obtained from private and public investment;
- (g) the ICOR was computed by dividing the ratio of total investment to GDP in the preceding year by the growth rate of GDP.

## TECHNICAL NOTE # 9

(see Volume III, para. 191)

### Agricultural Demand Projection

A straightforward regression analysis with time series data and three tested functions was used for the projection. <sup>1/</sup> The fits were fairly good with all except three coefficients of determination above 0.5. To make the projections consistent, the demand for feedgrains was derived via technical coefficients. <sup>2/</sup> The projections are based on a GDP growth rate of 7 percent p.a. and clearly rest on the assumption of a stable income distribution, which may be somewhat restrictive considering the planned substantial resource transfer to the rural areas. In addition, the possible increase in consumption through non-marketed production is only partially accounted for.

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<sup>1/</sup> Tested functions: (1)  $y = a+bt$ ; (2)  $y = at^b$ ; (3)  $y = ay^b$  where  $y$  = apparent consumption;  $Y$  = GDP per capita;  $t$  = years; and,  $a, b$  = coefficients. Except for two cases, the elasticity coefficient function -  $\frac{d(lu)}{d(lu)} = \frac{1}{y} \cdot \frac{dy}{dY}$ .  $Y = EyY = b$  - gave the best fit.

<sup>2/</sup> Technical coefficients: (a) beef breeding operations are expected to continue on natural and improved pastures; (b) 7 kg. of green matter/liter milk; 28 percent are alfalfa and rest maize, sorghum, barley, pasture, clover, nopal, etc.; (c) 0.3 kg. balanced food/1 kg. pork meat; 3.5 kg. balanced food/1 kg. pork on the hoof, 2.7 kg. on the hoof/1 kg. meat; (d) 2.5 kg. balanced food per 1 kg. of broiler; (e) 2.8 kg. balanced food per 1 kg. of eggs: 18 eggs per kilo, 220 eggs p.a. per chicken, 45 kg. balanced food p.a. per chicken; (f) composition of 1 ton balanced food: 850 kg. sorghum or maize and 150 kg. of soybeans or sesame. Composition depends on relative prices. A ratio of 4:1 between sorghum and maize and 5:4 between soybeans and sesame/safflower was applied for 1976. Protein content of safflower assumed about half of soybean and sesame. Barley, oats and wheat used in manufactured feed volumes are not significant compared to sorghum and maize and neglected for sake of simplicity.

## TECHNICAL NOTE # 10

(see Volume III, para. 398)

### Balance of Payments

#### Introduction

1. The Mexican Balance of Payments is compiled regularly by the Departamento de Estudios Economicos (DEE) of the Banco de Mexico. For this purpose, statistical information is obtained from other institutions in the public sector (e.g., Aduana, Oficina de Estadisticas) and supplemented with surveys carried out by the DEE itself (e.g., Tourism Survey in 1969). The Balance of Payments has been published regularly in the Anuario Estadistico since 1949. Furthermore, the IBRD-Banco de Mexico Working Party published balance of payments data from 1939-1950 although using slightly different concepts, namely, including border transactions with the other headings. Over the years, however, changes in statistical coverage and definitions have decreased the comparability of the published data. Consequently, the current account presented in Tables 3.1 and 3.2 of this appendix and all statistics such as net foreign capital inflow, which have been derived from them, differ from previously published data due to the re-estimations and adjustments described below. Certainly, the methods used are deficient in many ways. Nevertheless, it was felt that the absolute levels of the data available since 1949 were superior to that previously used for earlier years and that for historical comparison purposes it would be advantageous to have a long term series estimated on a consistent basis. Of course, the methods used were limited by the availability of statistical information. The alternatives would be to use the original figures, known to be of limited comparability over time.

#### Improved Statistical Information

2. In 1969 the Banco de Mexico undertook a survey which considerably altered the data base used for estimating tourism receipts and expenditures. The data published in the Informe Anual for 1969-72 reflect this improved coverage but data for previous years were not revised. In order to increase comparability over time these series were re-estimated using the procedure described below.

3. Tourism receipts were divided into those accruing from tourists arriving by airplane, automobile and other, a residual item including Mexican citizens residing abroad. The procedure for estimating receipts from tourists arriving by air was:

- (a) considering only tourists staying less than 25 days, a regression of average expenditure per day against length of stay yielded the following equation:

$$\text{avg daily exp.} = \$73.01 - 2.43 (\text{length of stay})$$

- (b) the yearly percent change in numbers of airplane tourists leaving obtained from the Anuario Estadistico (Secretaria de Industria y Comercio, various issues) was applied to the total of tourists obtained from the survey for 1969.

- (c) the absolute change in the average number of days spent by airplane tourists obtained from Anuario Estadístico (op.cit.), was applied to the average stay obtained from the survey.
- (d) the adjusted series for length of stay described in (c) was used with the equation in (a) to obtain an average expenditure per day per tourist; this sum was then multiplied by the adjusted series of tourists leaving described in (b) to obtain an estimate for total receipts of tourists travelling by air.

4. The receipts from tourists travelling by private automobile were estimated using the same procedure described above for tourists arriving by air, but using the equation:

$$\text{avg. daily exp.} = \$37.91 - 1.04 (\text{length of stay})$$

also derived from the 1969 survey.

5. The estimates for the residual item "other tourists" was then estimated by:

- (a) Subtracting from total tourism receipts for 1969 published by the Banco de Mexico the totals for air and automobile tourism for 1969 obtained by the above procedure, thus obtaining a residual;
- (b) the yearly percentage change of foreign tourists not arriving by air or automobile obtained from Anuario Estadístico was used to extrapolate the figure obtained from the 1969 survey for this class of tourist; to this series was added the number of Mexican citizens visiting Mexico, also from Anuario Estadístico;
- (c) for 1969 an estimate of expenditure per capita was obtained by dividing the value obtained in (a) above by the number of visitors in (b); an average expenditure per capita per day was then computed using the average length of stay in 1969 of tourists not arriving by air or automobile from the Anuario Estadístico;
- (d) using the series of number of visitors obtained in (b) above, the series on average length of stay of tourists not arriving by air or automobile presented in Anuario Estadístico and the per diem expenditure calculated in (c) above, total expenditures in Mexico of this class of tourist were then obtained.

6. The series on tourism receipts thus obtained being a function of number of tourists, reflected constant 1969 prices. In order to inflate the series into current prices an index was calculated from the Statistical Abstract of the U.S. reflecting average expenditures of U.S. tourists per day. Although this index is based on expenditures in areas other than Mexico, it reflects prices of international tourism and the changing economic status of tourism originating in the U.S., by far the largest source of Mexico's earnings from tourism.

7. Mexican tourism expenditures abroad were re-estimated for the years before 1969 as follows:

- (a) the expenditures published by the Banco de Mexico for 1969 were divided by the average length of stay abroad and number of Mexicans travelling abroad from the series in Anuario Estadistico to obtain an estimate of per diem expenditures;
- (b) the per diem expenditures were then multiplied by the average length of stay abroad and number of travellers for each year, from the series in Anuario Estadistico to obtain total expenditures in 1969 prices;
- (c) the series in constant 1969 prices was inflated to current prices using the U.S. GNP deflator.

8. The data on other services, namely re-insurance and non-merchandise transport which has been published since 1969 is also not comparable to that published for previous years. In order to make the series on reinsurance for 1950-60 consistent with later years, the 1969 figure published by the Banco de Mexico was extrapolated using an index derived from statistics on premium payments, income and expenditures related to reinsurance operations presented in the Anuario Estadistico. Similarly, the figure for receipts and expenditures related to non-merchandise transport published by the Banco de Mexico for 1969 was extrapolated by a series on passenger-kilometers flown by national and foreign airlines published in the Anuario Estadistico. Moreover, specific data on these balance of payments headings were only available for 1960-71. For 1950-69 these items were previously included under the general heading "other services". Consequently for the years prior to 1960, the difference between the re-estimated figure and the original figure for 1960 was calculated for reinsurance and non-merchandise transport. This difference was then extrapolated back to 1950 using the series described above. The differences obtained in this manner for each year was then added to the original figures for "other services".

9. The data for current account prior to 1950 was taken directly from IBRD (Combined Mexican Working Party) "The Economic Development of Mexico". Exceptions are receipts and expenditures related to tourism which were extrapolated by the number of tourists entering Mexico and the number of Mexicans travelling abroad, respectively.

#### Reclassification

10. As against what had been used until recently, the following definitions were used to distinguish factor services, non-factor services and transfers:

- (a) receipts from Mexican agricultural workers (braceros) are classified as current transfers from abroad; previously these were considered factor services;

- (b) payments and receipts for rental of freight cars, films, etc., are classified as non-factor services; previously these were considered factor services;
- (c) wages received by Mexican citizens, residing in Mexico but working in the U.S., are considered factor services; previously these were included in the general heading "Border transactions".

This classification is consistent with that currently used by the Banco de Mexico and with the data on National Product.

TECHNICAL NOTE # 11

(see Volume IV, para. 10)

Economically Active Population (EAP)

1. Although the Economically Active Population is sometimes defined in terms of age limits at 15 and 65 years, 8.1 percent of the EAP of Mexico in 1970 was outside these limits. 340 thousand people were under 15 years of age and 707 thousand were 65 years and older. The EAP represented only about 27 percent of total population; the work of one person thus had to sustain 2.72 other persons.

2. In order to estimate the size of the economically active population over the next 30 years, a projection was made of labor supply, assuming that the population who desire work will be between the ages of 15 and 65 and that participation rates for age groups between 15 and 65 will remain as in 1970.

3. Table TN11-1 shows the working age population (WAP) and Table TN11-2 the economically active population (EAP) in the light of population projections. Thus, in the case of Projection #2:

(a) Assuming that participation rates remained as in 1970, the exclusion of persons aged under 15 or over 65 would indicate that the WAP would rise from 24.9 million in 1970 to 73.1 million in 2,000 - a growth rate of 3.6 percent.

(b) Assuming that participation rates remained as in 1970 and the WAP were defined as the population of 10 years and over, the WAP would rise from 32.7 million to 94.6 million from 1970 to 2,000 - a growth rate of 3.5 percent.

(c) Assuming that participation rates remained as in 1970 and that the EAP was defined as the population between 15 and 65, the EAP would grow from 12.3 million in 1970 to 36.8 million in 2,000 - a growth rate of 3.6 percent.

(d) Assuming that participation rates remained as in 1970, if the EAP is defined as the population aged 12 and over, the EAP would rise from 13.4 million to 40.0 million between 1970 and 2,000 - a growth rate of 3.6 percent.

4. Age and sex considerations might however modify the EAP. Table TN 11-2 shows the economically active population according to sex and three specific age groups which are now part of the EAP. It is likely that as socio-economic conditions improve, a higher proportion of children under 15 would attend school, and better conditions would be achieved for retirement. The participation rates of groups under 15 and over 65 would thus tend to

be reduced. Moreover, better education for women and greater equality in job opportunities would tend to increase the participation of women in the national economy, although it is difficult to predict how quickly and to what extent this would happen. However, taking account of greater female participation between the ages of 15 and 64 and of the fact ~~that~~ this would be compensated by decreased participation for both sexes before the age of 15 and after 65, it is assumed that the EAP would grow to about 40.0 million by the year 2,000.

Table TN 11-1: Mexico: Population in Working Ages According to Three Alternative Projections for Selected Years<sup>1/</sup>

(in thousands)

Age and Projection	YEARS						
	1970	1975	1980	1985	1990	1995	2000
<u>10-14</u>							
Projection I	6,375	7,600	8,944	10,701	12,987	15,849	19,249
Projection II	6,375	7,600	8,944	10,591	12,535	14,928	17,398
Projection III	6,375	7,600	8,944	10,481	12,020	13,337	14,457
<u>15-64</u>							
Projection I	24,909	29,757	35,704	42,762	51,242	61,668	74,603
Projection II	24,909	29,757	35,704	42,762	51,132	61,109	73,119
Projection III	24,909	29,757	35,704	42,762	51,023	60,488	70,927
<u>64 and over</u>							
All Projections	1,454	1,743	2,017	2,359	2,830	3,403	4,049

<sup>1/</sup> Population as of January 1 of each year.

Table TN 11-2: Mexico: Economically Active Population by Age and Sex  
Groups According to Three Different Projections of Population  
for Selected Year

(in thousands)

Sex and Age	All Projections				Projection I				Projection II				Projection III			
	1970	1975	1980	1985	1990	1995	2000	1985	1990	1995	2000	1985	1990	1995	2000	
<u>Males</u>																
10-14	419	493	581	696	848	1,038	1,261	689	819	977	1,140	682	785	873	947	
15-64	9,995	11,972	14,440	17,407	20,967	25,320	30,710	17,407	20,439	25,162	30,212	17,407	20,912	24,987	29,583	
65 and over	482	577	653	754	904	1,085	1,288	754	904	1,085	1,288	754	904	1,085	1,288	
Sub-Total	10,896	13,042	15,674	18,857	22,719	27,443	33,259	18,850	22,662	27,224	32,640	18,843	22,601	26,945	31,818	
<u>Females</u>																
10-14	158	191	224	268	324	395	479	265	313	371	433	263	300	332	360	
15-64	2,310	2,755	3,300	3,937	4,696	5,633	6,795	3,937	4,685	5,574	6,639	3,937	4,673	5,509	6,409	
65 and over	88	105	122	145	175	211	249	145	175	211	249	145	175	211	249	
Sub-Total	2,556	3,051	3,646	4,350	5,195	6,239	7,523	4,347	5,173	6,156	7,321	4,345	5,148	6,052	7,018	
<u>Both Sexes</u>																
10-14	577	684	805	964	1,172	1,433	1,740	954	1,132	1,348	1,573	945	1,085	1,205	1,307	
15-64	12,305	14,727	17,740	21,344	25,663	30,953	37,505	21,344	25,624	30,736	36,851	21,344	25,585	30,496	35,992	
65 and over	570	682	775	899	1,079	1,296	1,537	899	1,079	1,296	1,537	899	1,079	1,296	1,537	
TOTAL	13,452	16,093	19,320	23,207	27,914	33,682	40,782	23,197	27,835	33,380	39,961	23,188	27,749	32,997	38,836	