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The Impact of Mexican Oil Revenues on Import Requirement of Agricultural Commodities: A Preliminary Report

WITHDRAWN
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by

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The importance of the potential tradeoff of energy for agricultural commodities is increased by the direction of the development policies for the 1980s of the Mexican government. The Mexican government has adopted a policy of expanding the industrial sector. A small proportion of the oil revenues are to be invested in the agricultural sector (Flanigan). The stated goal of the Mexican government is to expand oil production by the amount needed to pay for necessary food imports and a limited amount of industrial capital. This policy may be modified to encourage domestic production of food grains at the expense of feedstuffs.

The availability of energy from Mexico is, therefore, dependent to some degree on the growth of domestic consumption of food relative to domestic supply. Their need for imported food and feed will play an important role in the production and export of petroleum and natural gas. Simultaneously, the level and variability of imports will significantly affect U.S. commodity prices, farm income, and perhaps even, government expenditures for supply control and commodity reserve programs.

A preliminary analysis of the energy-food tradeoff is reported in this paper. The analysis has been divided into two studies. The first, a study of the domestic demand for selected agricultural commodities, provided the analysis summarized in this paper (Gonzalez). The second, an analysis of the supply side is currently underway.

Perspectives

This section of the paper provides a brief perspective of (a) the Mexican energy reserves (b) the potential export level (c) the existing U.S.-Mexican trade in agricultural commodities and (d) a brief review of Mexican economic policies. While the discussion is brief, hopefully an adequate historical perspective of the potential oil-food tradeoff will be provided.

Introduction

The analysis of the impact of Mexican oil revenues was prompted by the failure of the United States and Mexico to reach a natural gas trade and pricing agreement in late 1978. To even the most casual observer, the hardline stance of the United States in those negotiations was based on a very narrow energy perspective and did not consider many other economic factors.

The stance of the U.S. was based on protecting domestic energy sources (apparently backers of the Alaskan pipeline and refiners of Alaskan crude oil) from a highly competitive source of energy. Then Secretary of Energy Schlesinger stated:

> "We should be reluctant to contract for supplies, even from our neighbors on a take-or-pay basis, if that should be at the expense of American producers-resulting in the shutting-in of domestic capacity of diminishing the domestic incentives for drilling" (Congressional Research Service, p. VIII.)

Congress immediately requested an analysis of economic and political factors which should be considered in negotiating for Mexican energy. Resulting analysis treated the impact of the oil revenues on Mexican food consumption and U.S. - Mexican agricultural trade in, at best, a very cursory manner.

The importance of Mexican demand for U.S. agricultural commodities is exemplified by the impact of past variation in Mexican demand on U.S. farm prices. Other things held constant, Mexican imports of soybeans would have caused a 10 cent increase in U.S. soybean price in crop year 1974/75 followed by an 18 cent decline in CY 1975/76. The variation in feed grain demand would have resulted in a 15 cent per bushel decline in corn price from 1974 to 1975 and an increase of 21 cents per bushel from 1975 to 1976. Certainly, Mexico must be considered an important potential market for U.S. agricultural commodities.

Mexican Energy Reserves.

Although the exact size of Mexican petroleum resources is subject to considerable dispute, there is general agreement that the level of reserves is substantial. The Congressional Research Service (CRS) estimated proven and probable reserves of 57 billion barrels (bbs) of oil, gas equivalents and gas liquids (CRS, p. 1). In early 1979 PEMEX (the national oil company) announced proven reserves of 40.1 bbs and probable reserves of an additional 44.6 bbs. Estimates of proven and probable reserves have ranged as high as 340 bbs.

Reserves near the levels reported above place Mexico high in a ranking of nations with large petroleum resources. For example, the proven reserves of Saudi Arabia, the world's largest are approximately 250 bbs. Iraj, with the second largest, has approximately 100 bbs of proven and probable reserves.

Export Potential.

Proven reserves are converted to annual production levels using a rule of thumb of fifteen to one. Therefore, Mexico's proven reserves of 40 bbs are adequate to support a petroleum production rate of about 7 million barrels (mbs) per day. This potential greatly exceeds the current production level of about 1.8 mbs per day.

CRS estimated production levels and domestic utilization of crude petroleum and gas for the period 1980 to 1988. From these estimates the export potentials for petroleum and gas were determined. (See Table 1.) It should be noted that the estimates reflect the stated conservative development policy of the Mexican government.

In our opinion these estimates are very conservative. However, the estimates provide a ready basis of comparison. Given levels of income growth, the demand for agricultural imports and foreign exchange requirements may be determined. These requirements may be compared with that provided by oil and gas exports.

Table 1. Projected Mexican Oil and Gas Production, Demand and Export Potential

Year	Crude Petroleum Production	Crude Petroleum Utilization	Crude Petroleum Potential Exports	Natural Gas Net Production	Natural Gas Utilization	Natural Gas Potential Exports
	(million barrels/day)			(billion cubic feet/day)		
1980	2.2	1.1	1.1	2.9	1.9	1.0
1981	2.3	1.2	1.1	3.3	2.0	1.3
1982	2.4	1.3	1.1	3.7	2.1	1.6
1983	2.6	1.4	1.2	4.0	2.2	1.8
1984	2.8	1.5	1.3	4.4	2.3	2.1
1985	3.1	1.5	1.6	5.2	2.5	2.7
1986	3.3	1.6	1.7	5.8	2.6	3.2
1987	3.6	1.7	1.9	6.4	2.7	3.7
1988	3.8	1.8	2.0	6.9	2.9	4.0

Source: Congressional Research Service, p. 3.

Of special interest to the U.S., the petroleum reserves of Mexico include substantial quantities of natural gas. Production of oil necessitates some method of disposing of the gas production. The viable options include domestic utilization, flaring or exportation. The U.S. is the logical market for excess gas production.

U.S. - Mexican Agricultural Trade.

The U.S. has exported substantial quantities of wheat, sorghum and soybeans to Mexico in recent years. The U.S., in turn, has imported substantial quantities of fruits, vegetables, coffee, sugar and live beef from Mexico.

Historically, non-agricultural exports have dwarfed agricultural exports. In calendar year 1978, total exports were valued at $6.5 billion of which agricultural exports accounted for slightly less than $1 billion. The U.S. has until, very recently, maintained a positive balance of trade.

Mexican Economic Policies.

During the 1955-70 period the development strategy of the government was one of maintaining a fixed exchange rate through controlling domestic inflation at rates equal to or lower than its major trading partners. Economic policies were directed toward the growth of private savings and investment. Industrialization received great emphasis through the same policies that were adopted in the 1945-55 period. In comparison to the earlier period, however, the agricultural sector did not receive as much attention. In fact, the policy of favoring industrialization tended to deprive the agricultural sector of funds, and as a consequence, the rate of growth decreased. During earlier periods the government had been using a dual agricultural policy. Land was distributed in densely populated areas in order to increase the peasants' welfare. On the other hand, increasing amounts of public investment were channeled into irrigation projects, especially in the northwest, in order to increase output.

The proportion of total federal investment that went into irrigation projects in the 1935-39 period was 18.6 percent. This proportion decreased to only 8.2 percent in the 1960-63 period (Reynolds, p. 155). These changes were clearly reflected in agricultural production with their respective lags.

The agricultural and livestock sectors accounted for 20.6 percent of the GDP in 1953, but this proportion fell to 15.9 percent in 1967 (Solis, p. 220). Agricultural exports still provided a good part (about 45 percent of all exports in the 1956-65 period) of the foreign exchange needed to support the large imports required for the industrialization. Cotton and coffee accounted for most of the agricultural exports. However, the country had to rely increasingly on foreign exchange generated by other means. The growing tourism was a second source of foreign exchange, as were the foreign credits that became available after 1955.

The achievements of the policies pursued during this "stabilizing growth" period were many but so were the negative consequences derived from them. Real GDP grew at an average annual rate of 6.1 percent between 1956-65 (Solis, p. 90) and 6.7 percent between 1965-70 (Thompson, p. 191). The agricultural sector grew at an average annual rate of only 3.4 percent in 1956-65 (Solis) and 2.7 percent in 1965-70 (Thompson). The price level, as measured by the whole-sale price index, increased at an average annual rate of 2.9 percent during the period.

It should be noted that by 1970 Mexico neared self-sufficiency in many branches of light and medium industry. But at the same time became more dependent on capital goods imports. The general welfare of the Mexican population increased during this period.

Two important characteristics of modern Mexico were achieved during this period. Political stability was achieved through the exercise of political control by one party that was flexible enough to avoid unmanageable pressures.

Second, there was a clear definition of the economic activities in which the government and the private business would operate.

On the other hand, no direct measures to increase employment were implemented. It was believed that the growth process would take care of the problem automatically. However, as a result of the import substitution policy, the country specialized in the production of capital-intensive goods so that the unemployment and underemployment problems worsened in spite of the country's rapid economic growth. An equitable concentration of income resulted. The balance of payments current account deficit in 1956 was $35.6 million and by 1970 this deficit was $908.8 million (Looney, p. 20). This is a result of the large imports needed for industrialization and the lack of incentives to the export sector.

The public sector deficits were another concern. These deficity resulted from the increasing role of the government as a promoter of development (undertaking less profitable enterprises, providing the necessary infrastructure, and tax incentives) and as a redistributor of income (subsidizing prices of essential goods).

The 1970 administration's goals were much like the previous governments'. But the need for some sort of social reform to alleviate the problem of income distribution was stressed. It was hoped that, restructurating the Mexican economy, would redistribute income in favor of peasants and labor and greater employment opportunities would be provided. Additional goals were the improvement in the balance of payments and a reduction in Mexico's dependence on foreign capital and technology.

Nineteen seventy-one was a year of commitment to stabilization mainly because of: (a) an inherited budget prepared by the previous administration, (b) the inflationary pressures, and (c) balance of payments problems. In this year the rate of inflation was 5 percent (International Monetary Fund). But GDP increased just 3.7 percent in real terms (Anexo). During this year the government

established a new institutional basis on key areas in order to improve the long-term development prospects. A new agrarian law was passed aimed at making the ejido (communally-owned land) more productive, a new banking law strengthened the central bank's influence on private banks, and a fiscal reform was designed to reduce the income inequalities in the system.

In 1972 the government expenditures increased sharply--23 percent (Anexo)--to promote recovery with little concern for the possible inflationary consequences. The achievements were impressive. Real GDP grew 7.3 percent (Anexo) and the consumer price index rose 5 percent (International Monetary Fund). This stability was reached at the cost of increasing the current account deficit and the public foreign debt and the build up of inflationary pressures. The private sector remained critical of the new administration's economic policies and private investment declined.

In 1973 the government remained committed to expansion in order to raise the level of income and to increase the welfare of the people through social spending. Government expenditures increased 37.1 percent and the current account deficit rose to $1.2 billion (Anexo). Real GDP increased 7.6 percent (Anexo), but the consumer price index rose 12 percent (IMF) as a result of the inflationary world situation as well as internal inflationary pressures. Huge wage increases were declared by the president in 1972 and 1973. The change in attitude of the government toward the private sector contributed to further deterioration of their relationship.

The next two years were disequilibrium years characterized not only by balance of payments problems but also by inflation and unemployment. The current account deficit increased to $2.5 billion in 1974 and to $3.7 billion in 1975 (Anexo). The consumer price index rose 24 percent in 1974, but then decreased to 15.6 percent in 1975 (International Monetary Fund) as a result of the credit policies pursued by the government. Real GDP rose 5.9 percent in 1974 and 4.1

percent in 1975 (Anexo).

Measures were taken by mid-1975 to strengthen Mexico's balance of payments and the Mexican peso. The peso was considered by most officials to be overvaluated. However, they did not support a devaluation at that time. The overvaluation was not adversely affecting Mexican exports. And the importation of machinery and equipment was kept relatively cheap. The measures were designed to attack the problem from three different areas simultaneously: restriction of imports, promotion of exports, and promotion of capital goods import substitution. However, the measures accomplished little in controlling inflation, which was the prime contributing factor to the overvaluation of the peso.

By mid-1976 the country encountered serious economic difficulties. Inflation pressures were high. The balance of payments situation remained precarious because of an increasingly overvaluated peso. The flight of capital out of the country in anticipation of devaluation also was a contributing factor.

On August 31, 1976, the government announced the floating of the peso. Exports were not great enough to finance the imports required for development. But increasing the foreign debt just to maintain a fixed exchange rate was not in the best interests of the nation. Over the next six months the peso depreciated from 12.5 pesos per dollar to 22.8. The year ended with real GDP growing only 1.6 percent (Anexo), consumer prices increasing 15 percent (IMF), and a current account deficit of $3 billion (Anexo).

The agricultural policies that were more effective in dealing with production objectives during previous periods were directed more toward welfare objectives during this period. In order to achieve a more equal distribution of income, the government's agricultural policies were: (a) to maintain high prices for agricultural commodities through price support programs, (b) to subsidize inputs, and (c) to develop roads and agricultural infrastructure.

During this period the share of agricultural investment in total public expenditures grew from 8.8 percent in 1970 to 15.9 percent in 1975 (Looney, p. 92) without increases in output.

Few administrations inherited more political and economic problems than one inaugurated in December 1976. These problems included a country deeply divided politically, a peso that had lost half its value in six months, a considerable amount of capital that had fled the country, rumors of a military take over, world banks alarmed at foreign debt (which had increased from $4 billion in 1970 to $20 billion in 1976), and a precarious balance of payments situation.

Public expenditures increased 51 percent in nominal terms in 1977 (Anexo) reflecting a greater emphasis on growth than on monetary and fiscal stability. A very important development was the new relationship between the public and private sectors. They signed, together with the labor sector, the Alliance for Production in January 1977. The pact consisted only of general statements of intentions and was not obligatory. It was, however, indicative of the new relationship between the public and private sectors that was intended to combat inflation, increase the economic growth rate, lower the unemployment rate, and improve the balance of payments situation. Real GDP increased 3.2 percent and the current account deficit was cut in half to $1.5 billion (Anexo), but consumer prices increased almost 30 percent (IMF).

In 1978 public expenditures increased 28 percent in nominal terms (a rate lower than the 1977 inflation rate), real GDP increased 7.6 percent (Anexo) reflecting the private sector's attitude, consumer prices rose 17.5 percent (IMF), and the current account deficit amounted to $2.4 billion (Anexo). Preliminary data for 1979 show real GDP growing at almost 7 percent and consumer prices increasing at a rate close to 20 percent (IMF).

The new National Industrial Development Plan (Diario oficial) released in March 1979 describes the development policies for the 1980s. The main objective

of the plan is to solve the employment problem which is to be achieved through high rates of growth. This growth is carefully programmed and industrialization receives the greatest emphasis. Priorities are given to capital goods production, agribusiness, and export-oriented industry.

Apparently the rural underemployment will remain high. The urban unemployment will be attacked first. Once this problem is solved the modernization of the agricultural sector will provide the manpower needed for the growth of the industrial sector.

The plan calls for high rates of growth in real GDP (greater than 7 percent in the first years and about 10 percent from 1982 to 1990). In order to achieve these rates of growth, the government will rely heavily on the private sector. A series of stimuli including (a) fiscal incentives, (b) cheap energy, and (c) abundant credits will be given to insure strong private investment.

Large imports of agricultural products will be necessary to feed the growing Mexican population. Prices will probably be subsidized. A large proportion of the oil revenues will be spent for these agricultural imports. The stated policy of the government is to export only as much oil as is necessary for these imports and for a proportion of the industrialization.

Methodology

A simplistic, aggregated approach was adopted. The format for an individual cereal includes the following equations:

(1) $q_h = q_h\ (P_1, \ldots, P_n, \ldots, P_m, \text{CPI}, \text{Income})$ (per capita demand)

(2) $Q_n = (\text{population}_{1978} \cdot e^{1.029}) \cdot q_h$ (total human consumption)

(3) $Q_f = Q_f\ (\text{meat production})$ (total feed demand)

(4) $TD = Q_h + Q_f$ (aggregate demand)

(5) $S = e^{a+r \cdot \text{time}}$ (supply)

(6) $M = TD - S + \text{Exports} + \Delta\ \text{Stocks}$ (import demand)

Endogenous variables include human consumption, feed demand, supply (as a trend), imports (as a residual). (Estimated equations are included in the appendix.)

The model reflects the supply and consumption policies of the Mexican government. Both production and consumption are subsidized. Prices are established by government policy. Therefore, imports may be derived as a residual. Import demand is perfectly inelastic with respect to world market (U.S. prices).

Projections for 1985 and 1990 are based on the following assumptions:

(1) population will increase at a rate of 2.9

(2) inflation and the nominal prices of individual commodities will increase at a rate equal to the average of the most recent seven years.

Given these assumptions, levels of consumption, supply, and imports were projected conditioned on alternative rates of income growth.

RESULTS

This section summarizes the most important findings obtained in the study and reaches some conclusions based on the results. The estimated elasticity coefficients are summarized. A summary of the projection results in per capita and total terms followed by the repercussions in terms of import demand.

Estimated Elasticity Coefficients

The elasticity coefficients derived from the estimated human demand equations are summarized in Table 2. The demand elasticities were estimated subject to the homogeneity condition. The corn, wheat, and beef demand functions are represented by semi logarithmic functions but the pork demand function is represented by a double logarithmic function. In general, all of the estimated equations are very inelastic with respect to prices and income.

Table 2. Estimated Human Demand Elasticity Coefficients

Variable	Product			
	Corn[a]	Wheat[a]	Beef[a]	Pork[b]
Retail price of corn	-.287	-	.110	-.082
Wholesale price of corn	-	.082	-	-
Retail price of bread	.387	-	.110	-.082
Wholesale price of wheat	-	-.321	-	-
Retail price of beef w/bone	.144	.409	-	-
Retail price of beef (high quality)	-	-	-.295	.889
Retail price of pork	-	-	.373	-.956
Consumer price index	-.745	-.422	-.570	-.381
Nominal per capita income	.501	.252	.382	.530
Real per capita income	-.244	-.170	-.188	.149

[a]1976 elasticity values (semi log function)

[b]Constant elasticities (double log function)

Feed demand equations were estimated for coarse grains (corn and sorghum) and soybean meal. The estimated elasticities are summarized in Table 3.

Table 3. Estimated Feed Demand Elasticity Coefficients

Variable	Product	
	Coarse Grains[a]	Soybean Meal[a]
Cotton meal consumption	-	-.790
U.S. price of meal in pesos	-	-.237
Meat production	.744	-
Beef production	-	1.920
Pork production	-	.027

[a]1977 elasticity values

Projection Results

Projection results are, necessarily, conditioned on the assumed values of the exogenous variables. Particularly, prices are assumed to increase at an annual rate equal to the average annual rate of growth experienced during the last seven years. Three different real per capita income growth alternatives are considered. The results in terms of per capita human consumption are summarized in Table 4.

Under the 6 percent real per capita income growth alternative, for instance, the projected per capita consumption of corn increases at an average annual rate of .45 percent during the 1980-90 period. This rate is about one-half that of the historical period 1960-78 (.77 percent). Also, the rate of increase decreases as income increases because of the functional form used to describe consumption. In Kg/capita terms, the per capita consumption of corn increases from the 1976-78 average of 167.05 Kg/capita to a level of 170.88 Kg/capita in 1985 and to a level of 174.77 Kg/capita in 1990.

On the other hand, the projected per capita consumption of wheat increases at an average annual rate of 2.2 percent during the 1980-90 period. This rate is slightly higher than the one experienced during the historical period 1960-78 (1.9 percent). In per capita terms, the consumption of wheat increases from the 1976-78 average of 47.4 Kg/capita to a level of 55.93 Kg/capita in 1985 and to a level of 61.99 Kg/capita in 1990. Therefore, the projections indicate increasing per capita levels of consumption for both corn and wheat. However, a much higher rate of increase in wheat consumption than in corn consumption is projected.

The per capita corn consumption results contradict the results of other two Mexican studies (Secretaria de Agricultura y Ganadenia and FAO). Both studies were published in the 1960s and predicted declining levels of per capita corn consumption for the 1970s. The data used for the present study reveals increas-

Table 4. Projected Per Capita Consumptions

Product	Year	Real Per Capita Income Growth 6%	8%	10%
		Kg/capita	Kg/capita	Kg/capita
Corn:				
	Average 76-78	----------	167.05	----------
	1985	170.88	181.67	192.30
	1990	174.77	192.31	209.57
Wheat:				
	Average 76-78	----------	47.40	----------
	1985	55.93	57.47	58.99
	1990	61.99	64.49	66.96
Pork:				
	Average 76-78	----------	6.57	----------
	1985	7.42	7.95	8.50
	1990	8.28	9.25	10.31
Beef:				
	Average 76-78	----------	15.30	----------
	1985	19.02	19.78	20.52
	1990	21.25	22.48	23.69

ing levels of per capita corn consumption during the 1970s and this tendency is reflected in the projection results.

Per capita pork consumption under the same circumstances increases during the projection period at an annual rate of 2.2 percent. This rate is just about equal to the average annual growth of per capita pork consumption during the 1961-78 historical period (2.5 percent). Per capita consumption of pork increases from the 1976-78 average of 6.57 Kg/capita to a level of 7.42 Kg/capita in 1985 and to a level of 8.28 Kg/capita in 1990. Per capita beef consumption, increases at an average annual rate of 2.4 percent during the projection period. This rate is again lower than the average annual rate of growth experienced during the 1961-78 historical period (3.1 percent). In Kg/capita terms, the per capita consumption of beef increases from the 1976-78 average of 15.3 Kg/capita to a level of 19.02 Kg/capita in 1985 to a level of 21.25 Kg/capita in 1990.

All of the per capita projection results are fairly consistent with the historical tendencies. No dramatic departures from the historical tendencies are foreseen provided the assumptions. All these results confirm the initial belief the sizable increases in the consumptions of the selected commodities are to be expected in the future.

Coarse grains demand is the sum of corn and sorghum demand. Feed demand for coarse grains is not a function of income. Therefore, the differentials between the different income growth alternatives are the result only of changes in human demand for corn. Coarse grains demand is the sum of the human consumption of corn, feed demand, and human demand for sorghum (assumed to be constant during the projection period at the last year's available level). Under the 6 percent real per capita income growth alternative, total demand for coarse grains increases at an average annual rate of 3.68 percent from 1980 to 1990. The average annual rate of growth during the 1960-79 historical period was 5.4 percent. However, this rate was much lower for the 1970-79 period (3.74 percent). The total demand

for coarse grains increases from 1977-79 average of 15,228.0 thousand metric tons to 20,108.36 thousand metric tons in 1985 and to 23,895.98 thousand metric tons in 1990.

Total demand for wheat is the sum of human and feed demand (which is assumed to remain constant during the projection period). Under the 6 percent real per capita income growth alternative, the projected total demand for wheat increases at an average annual rate of 5 percent during the 1980-90 period. Total wheat consumption increased at an average annual rate of 5.7 percent during the 1960-79 historical period. The projected results in total demand terms indicate an increase from the 1977-79 average of 3,336.0 thousand metric tons to 4,690.95 thousand metric tons in 1985 and to 5,956.12 thousand metric tons in 1990.

Total soybean meal demand is projected to increase at an average annual rate of 8.97 percent during the 1980-90 period. This represents an increase in total soybean meal consumption from the 1974-76 average of 568.66 thousand metric tons to a level of 1,237.77 thousand metric tons in 1985 and to a level of 1,853.96 thousand metric tons in 1990.

Under the 6 percent real per capita income growth alternative, the projected total demand for beef increases at an average annual rate of 5.4 percent during the 1980-90 period. This rate compares to the average annual rate of 6.5 percent experienced during the 1961-78 historical period. In metric ton terms, the total demand for beef increases from the 1976-78 average of 988.1 thousand metric tons to 1,544.51 thousand metric tons in 1985 and to 1,990.53 thousand metric tons in 1990.

Under the 6 percent real per capita income growth alternative, the projected total demand for pork increases at an annual rate of 5.16 percent during the 1980-90 period. This rate compares to the average annual rate of 5.7 percent experienced

Table 5. Projected Total Demand for the Selected Commodities

Product	Year	Real Per Capita Income Growth 6%	8%	10%
		(1,000 Metric Tons)		
Coarse Grains				
	Average 77-79	----------	15228.0	----------
	1985	20108.36	20984.72	21847.31
	1990	23895.98	25538.87	27155.95
Wheat				
	Average 77-79	----------	3336.0	----------
	1985	4690.95	4816.23	4939.53
	1990	5956.12	6190.97	6422.13
Soybean Meal				
	Average 76-76	----------	568.66	----------
	1985	----------	1237.77	----------
	1990	----------	1853.96	----------
Beef				
	Average 76-78	----------	988.1	----------
	1985	1544.51	1605.86	1666.25
	1990	1990.53	2105.55	2218.76
Pork				
	Average 76-78	----------	424.8	----------
	1985	603.14	645.48	690.05
	1990	775.76	866.17	965.45

during the 1961-78 historical period. The projected results in total demand terms indicate an increase in total pork consumption from the 1976-78 average of 424.8 thousand metric tons to 603.14 thousand metric tons in 1985 and to 775.76 thousand metric tons in 1990.

Import Demand

An attempt was made to translate the total demand projections into import demand terms. Time trend supply equations were used except in the cases that unrealistic rates of growth derived from them. Assumptions about the growth of supply were made in these cases. The necessary identities were constructed to form a recursive model that is solved in terms of imports. The results of these models are summarized in Table 6. The findings for beef and pork are not included since the simulation of these models results in increasing levels of exports and the study is only concerned with import demand.

These results are preliminary. A closer look at the production side is necessary to improve the accuracy of the models. However, these results indicate that if the historical tendency in production remains the same and the assumptions regarding prices, population, and income are appropriate, the import demand for coarse grains, wheat, and soybean meal will increase substantially during the studied period.

Under the 6 percent real per capita income alternative, the projected level of coarse grains imports increases at an average annual rate of 8.4 percent during the 1980-90 period, reaching a level of almost four and a half million tons by 1990. Wheat imports increase at an average annual rate of 9.1 percent during the 1980-90 period, reaching a level of 2,116.79 thousand metric tons by 1990. This represents more than a double in the level of imports from the 1977-79 average imports. Soybean meal imports increase even more dramatically. The projection results indicate soybean meal imports increasing at an average annual rate of 16

Table 6. Projected Level of Imports of Coarse Grains, Wheat and Soybean Meal

Product	Year	Real Per Capita Income Growth 6%	8%	10%
		(1,000 Metric Tons)		
Coarse Grains				
	Average 77-79		2364.0	
	1985	3214.21	4090.56	4953.14
	1990	4421.21	6064.10	7681.18
Wheat				
	Average 77-79		956.66	
	1985	1437.83	1563.11	1686.41
	1990	2116.79	2351.64	2582.90
Soybean Meal				
	Average 74-76		185.66	
	1985		620.38	
	1990		1120.69	

in the level of total consumption of food commodities could be expected. It would be very interesting to look at the effect of different income distribution policies on the levels of total consumption of the selected commodities.

Another interesting point to look at is the differences in the projection results derived from the use of alternative functional forms to represent the demand functions. The use of different techniques to project consumption would probably yield different results which would be of interest.

A better estimate of the Mexican import demand for the selected commodities will be obtained when the second part of this project is completed. This part, as mentioned before, deals with the production side of the model, and it will substitute the time trend production equations used in the recursive model of this paper.

Appendix

Table A1 Estimated Demand for Livestock Feed
Selected Commodities, 1960-1977.

Coarse Grains (Semi-Log)[a/]

Restricted Regression Intercept	Log (Beef pd.-- Hog pd.)	Hog Prod.	R^2	DW
-22780.9	1386.2	2984.0	.984	1.96
-	(0.681)[b/]	(15.7)		

Computed Equation

Intercept	Production of Beef	Production of Pork
-11780.9	1386.24	1597.8

Soybean Meal (Linear)

Restricted Regression Intercept	Meal Price	Cotton Meal Consumption	(Beef-Pork)	Pork	R^2	DW
-267.85	-.043	-.890	1.231	1.26	.87	3.03
-	(-.78)[b/]	(-1.3)	(4.57)	(2.22)		
	[-.24]	[-.79]	-	-		

[a/] The dependent variable is (corn consumption +.9 sorghum consumption)

[b/] Estimated t-statistic

Table A2 Estimated Per Capita Demand Equations, Selected Commodities, 1960-1977.

	Intercept	Corn	Wheat	Beef	Pork	CPI	Income	R^2	D.W.
Corn (Semi-log)									
	-90.86	-48.25	64.95[c]	24.26	--	-125.29	84.33	.89	1.96
	-	(-2.93)[a]	--	(1.67)	--	(-4.09)	(5.01)		
	-	[-.29[b]]	[.39]	[.14]	--	[-.75]	[.50]		
Wheat (Semi-log)									
	42.84	3.91[c]	-15.37	19.59		-20.19	12.06	.93	0.98
	-	--	(-3.78)	(3.52)	--	(-2.27)	(3.81)		
	-	[.08]	[-.32]	[.41]		[-.42]	[.25]		
Pork (Log-Log)									
	-.73	-0.08[d]	-0.08[d]	0.97[c]	-0.96	-0.38	0.53	.91	1.74
		(1.46)	(-1.46)	--	(-1.38)	(-0.92)	(2.11)		
		[-.08]	[-.08]	[.97]	[-.96]	[-.38]	[.53]		
Beef (Semi-log)									
	-4.13	1.71[c,d]	1.71[c,d]	-4.56	-5.77[e]	-8.82	-5.90[e]	.99	1.74
	-	-	-	(-2.06)	-	(3.35)	-		
		[.11]	[.11]	[-.30]	[.37]	[-.57]	[.38]		

[a] estimated t-statistic

[b] estimated elasticity evaluated at means

[c] coeficient calculated as a residual to enforce homogeneity condition

[d] coeficients forced to be equal

[e] coeficients restricted to these values to approximate the Slutski condition between pork and beef.

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