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I. INTRODUCTION

Dairy product imports in Mexico have shown extraordinary growth in past years especially in the few years preceding the NAFTA. Imports of fluid milk, cheese, and whey exhibited the fastest growth rates among dairy products, increasing by 201%, 101%, and 887% respectively, from 1990 to 1993 (Munoz and Odermatt). Imports of other products such as non-fat dry milk, butter, yogurt and ice-cream have also increased. As incomes grow, Mexico is anticipated to become a larger export market for fluid milk, butter, cheese, and yogurt. Although recently, due to the economic crisis, there has been a fall in dairy imports to Mexico, dairy product imports will remain important and is expected to grow as consumption of dairy products increase as a result of higher incomes.

In a recent paper, the authors have estimated domestic and import demand functions for four dairy products in Mexico. The results shed some light on how aggregate dairy consumption in Mexico varies with changes in incomes, prices, and policies. The results for four dairy products (fluid milk, non-fat dry milk, cheese, and butter) indicated that the demand for fluid milk was the most responsive to price changes and non-fat dry milk demand was inelastic with respect to its own price. There was no evidence of a strong substitute relationship between fluid milk and non-fat dry milk, although fluid milk demand was relatively elastic, which suggested the existence of other substitutes for fluid milk. Income elasticities showed that fluid milk, butter, and cheese are consumed more at higher income levels whereas non-fat dry milk had a lower income elasticity.

Estimation of import demand equations revealed similar trends in response to price changes, but income elasticity of imports was highest for fluid milk which suggests that

Mexico will import possibly more fluid than dry milk as per capita incomes rise. This is an important result, which indicates that as Mexico becomes wealthier, fluid milk imports might well exceed imports of non-fat dry milk. The fact that both domestic and import demand elasticities for fluid milk were elastic suggests the existence of substitutes and might lead one to hypothesize whether or not other drinks, such as Coca - Cola or other soft drinks are stronger substitutes for fluid milk than NFDM.

The purpose of this paper is to forecast dairy product imports of Mexico from 1996 to the year 2000. In light of new developments in the trade environment with the NAFTA and the GATT-URA, along with recent devaluations of the peso and lower income levels for Mexico, dairy product imports will be affected. Changes in both the U.S. and Mexico in grain and livestock sectors as a result of the NAFTA will also affect the dairy sector trade. Prices for fluid milk, cheese, and nonfat dry milk were forecasted along with real income for Mexico for the next four years. These forecast were then used to forecast import quantities for 1996-2000.

Forecasting import demand is a difficult task. Time series data are scarce, and often unreliable as it comes from various sources. There are numerous government policies that affect economic variables, and are hard to model accurately. Despite all the difficulties however, results support theory and provide a departure point for more detailed analysis.

The following two section gives overview of the dairy sector and domestic and trade policies affecting dairy products. Section III. explains the import demand model and its estimation. Section IV. gives a discussion of the forecasting model and the forecasted values for fluid milk and cheese imports. Section V. is devoted to conclusions and implications for further research.

II. OVERVIEW OF THE MEXICAN DAIRY SECTOR

The Mexican dairy sector is characterized by a long standing tradition of government intervention in the form of producer and consumer price policies and subsidies. Agricultural performance was quite favorable in the early eighties, strongly supported by subsidies as part of the Sistema Alimentario Mexicano (SAM). In 1982, following a drought, agricultural Gross Domestic Product (GDP) fell 2.9%, and fixed investment, wages, and cultivated land diminished significantly. Agricultural imports fell by 54.6% in the same year (Villa-Issa, 1990). In 1982, several government policies were instituted which influenced the dairy sector. Price controls were put in at every level of milk production and marketing (production, processing, and consumption). Retail prices were fixed despite rising production costs which led to a slow expansion in milk production, chronic production shortfalls, and increasing imports (Hallberg, et.al., 1992).

In 1992, milk and dairy products had a Nutritional Dependency Coefficient of 38% (calculated as: imports/disposable milk (imports+production)) which has been steadily increasing over the past four years. Milk and dairy products as a group were the principal food imports in 1993 with a volume of 445 thousand tons and a value of $626.3 million. This shows a tendency of increased dependency on imports in both volume and value terms (Muñoz and Odermatt, 1994).

Mexican dairy policy has tended to favor the consumer at the expense of the dairy producer. Consequently, Mexican milk production has the a relatively low producer subsidy equivalent (PSE) of -56% (Muñoz and Odermatt, 1993). This negative PSE reflects a tax on producers rather than a subsidy. The principal factor that explains the negative PSE is low producer prices. Until 1988, producers were forced to sell their milk at below market prices.

Decapitalization forced many farmers out of production, especially those who produced low quality milk. Price controls on milk led to a diversification in the use of fluid milk by using milk for products whose prices were not controlled (cheese, yogurt, butter), adulteration of products by substituting up to 80% vegetable fat instead of butterfat, distribution of milk through less controlled channels, and increased vertical integration of dairy farmers. Together, these factors decreased the production of milk which led to an increase in social programs of CONASUPO (Muñoz and Odermatt, 1993).

Dairy product consumption shows distinct patterns in Mexico, where per capita consumption of fluid milk is much less when compared to the E.U. or the U.S. However, per capita consumption of NFDM, is two to three times higher than in the U.S. or EU.

Milk is not a traditional consumption item and protein source in Mexico. The high consumption of NFDM occurs because it is easy to store and transport without refrigeration and also because of government subsidies which may have affected the taste preferences of the Mexican consumers, especially the poor. So, one would expect a low price elasticity of NFDM compared to fluid milk, since fluid milk is not a staple. Fluid milk is consumed by higher income groups mainly in urban areas. Cheese is a very important item in the daily diet of the average Mexican household. It is consumed either as an appetizer or topping, or as a main dish, replacing meat or eggs. Different types of cheese are used for different purposes. However, the majority of the Mexican consumers prefer fresh cheeses to aged ones. Tastes and preferences are influenced by income levels where fresh cheeses are consumed at lower income levels and aged cheeses are consumed more at middle and high income levels (Muñoz, 1993). In 1992, 10% of total cheese consumption was made up of imports which were mostly hard or semi-hard cheeses.

Prior to 1986, the Mexican dairy sector was, like most of the rest of the Mexican economy, characterized by high tariffs, prevalent nontariff barriers, such as licensing, and extensive government involvement in import purchases. Since Mexico's entrance into GATT in 1986 and the beginnings of a more open economy, trade barriers have been lowered, and in the

case of import licensing, eliminated. In early 1992, CONASUPO began negotiating direct purchases with individual bids instead of using public tenders as it had previously (USDA/FAS). These NFDM purchases were held as stocks and in turn sold to Mexican dairy product producers. Under the NAFTA, Mexico converted its import license for NFDM to a tariff-rate-quota (TRQ) to be phased out over fifteen years. For the U.S., the first 881,840 cwt. of skim and whole milk powder will enter the Mexican market duty free. Imports over the quota level are assessed a tariff of 133.4 percent or $1136.6/mt and will gradually be phased out by the year 2008.

Concerning cheese imports from the U.S., Mexico immediately converted its import licensing regime to a tariff of 20 percent to be reduced to zero over a ten year period, except for fresh cheese which is assessed a 40 percent tariff to be phased out over ten years. All other dairy products have the current tariff levels frozen which will be phased out gradually over a ten year period.

III. IMPORT DEMAND MODEL:

Import demand functions have traditionally included a relative price variable, real income, and dummy variables to account for unusual periods such as devaluations or policy changes. The relative price measure is often the ratio of the import price to the domestic price index for the commodity adjusted for the exchange rate, which gives a measure of the

real exchange rate. (See Kahn, Boylan and Cuddy, Leamer and Stern (Chapter 1), and Nyatepe-Coo for examples of import demand functions). A lagged dependent variable was also added.

The import demand function is expressed as:

$$M_{I,t} = f(M_{i,t-1}, (P_m * e / P_d)_{I,t}, Y_t, d_t) \qquad (1)$$

Where:

$M_{I,t}$ = Imports of product I in period *t*

$M_{I,t-1}$ = Imports of product I in period *t-1*

$(P_m * e / P_d)_{I,t}$ = Import Price * Exchange rate / real domestic price for product *I* (the real exchange rate).

Y_t = real GDP at time *t*.

d_t = dummy variable for time period *t*.

Import demand will increase as real income increases. The relationship between the real exchange rate and quantity of imports is expected to be negative. In other words, as the relative price of imports increase, imports will decline.

The period of estimation was 1975-1995. Import prices were calculated from import quantity and value data from FAO Trade yearbooks, which gave the unit-value for imports. These were then converted to pesos and deflated by CPI to get real peso import prices for each year. Income is real GDP obtained from Bank of Mexico (Indicadores Economicos). Import quantities lagged one period were chosen as an explanatory variable to account for time of adjustment.

The functional form chosen was double-log-linear. This form is generally used in

import demand estimation (Leamer, p.17 gives a discussion on functional form), for its ease of interpretation, as coefficients of the log-linear equation are elasticities. The estimated equations are defined as:

$$\ln M_t = \alpha_0 + \alpha_1 \ln(P_m/P_d) + \alpha_3 lnY_t + \alpha_4 lnM_{t-1} + \alpha_5 d_t \qquad (2)$$

Results of the estimation for fluid milk and cheese imports are given in Table 3.

Table 3. Estimated import demand equations

			Variables							
Commodity	**Constant**	**(P_m/P_d)**	**Y_t**	**M_{t-1}**	**d80**	**d83**	**d84**	**d88**	**R^2**	**DW**
Fluid Milk	-11.61	-1.20	1.66	0.317	-2.55	-2.15				
	(-1.49)	(-3.38)	(1.27)	(2.12)	(-7.29)	(-6.31)			0.957	1.966
Cheese	-9.08	-0.85	1.53	0.48			-1.32	-1.96		
	(-1.28)	(-1.88)	(1.24)	(2.77)			(-1.88)	(-2.82)	0.89	2.05

The Durbin-h statistic was calculated because of the inclusion of the lagged dependent variable. Durbin-h is the appropriate measure to test for the existence of serial correlation. The Durbin-h for the fluid milk equation was 0.85. Therefore, the null hypothesis of no serial correlation could not be rejected. For the cheese equation, the Durbin-h was 0.32 which also ruled out the existence of serial correlation (see Pindyck and Rubenfeld on calculation of Durbin-h)

Results indicate a very strong relationship between income and both fluid milk and cheese imports. Income elasticities for fluid milk and cheese were 1.66 and 1.53 respectively for the given study period. This indicates imports of both of these products will increase more as incomes increase. It should be noted here that this response will differ among different income levels (for a recent study, see Nicholson). Expenditure elasticities calculated by Nicholson (p. 36), show that for lower income deciles, elasticity is higher . For fluid milk, he calculates the

expenditure elasticiy to be 3.56 at the lowest income decile compared to 0.48 at the highest income decile.

The real exchange rate is also significant, although the elasticity is much lower than the income elasticity. Imports of the previous period were significant for both fluid milk and cheese. Elasticities for the real exchange rates are -1.20 and -0.85 for fluid milk and cheese respectively.

IV. FORECASTING

Import demand for the period 1996 - 200 was forecasted for fluid milk and cheese using forecasted prices and income. The new series created by these forecasts was used to forecast import demand quantities. The following is a discussion of the forecasting models for prices and income.

i. Forecasting the Real Import Price (real exchange rate) for Fluid Milk:

The price variable in the import equation is a real exchange rate for milk. The unit value of imports is multiplied by the exchange rate and divided by the Consumer Price Index for fluid milk. The model is as follows:

$$P_t = \alpha_0 + \alpha_1 P_{t-1} + \alpha_2 P_{t-2} + \alpha_3 P_{t-3} + d_{82} + d_{86} + d_{94} + d_{95} \qquad (3)$$

Where:

P_t = Price of fluid milk at time period *t*

P_{t-1} = Price of fluid milk at time period *t-1*

P_{t-2} = Price of fluid milk at time period *t-2*

P_{t-3} = Price of fluid milk at time period *t-3*

$d_{82,86,94,95}$ = dummy variables

The equation was estimated using OLS, and the dummies were added to account for major devaluations that affected exchange rates. As seen in Figure 1, real exchange rates have had very sharp increases in 1982, 1986, and the most recently in 1994 and 1995. Real exchange rate behavior has been an important factor in imports. Periods following increased real exchange rates
are marked by lower imports. Real exchange rates for cheese were forecasted using the following
model:

$$P_t = \beta_0 + \beta_1 (P_{t-1} - P_{t-2}) + \beta_2 d_{82} + \beta_3 d_{87} + \beta_4 d_{93} \qquad (4)$$

Where (P_{t-1}- P_{t-2}) is the price difference between year t-1 and t-2.

ii. Forecasting Real Income for Mexico:

Real GDP for Mexico was forecasted according to the following model:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 d_{94} + \beta_3 d_{95} + \beta_4 d_{80} + \beta_5 d_{86} \qquad (5)$$

Where Y_t is real GDP in period t and Y_{t-2} is real GDP in period t-1, and *d*'s represent dummy variables.

iii. Fluid Milk Imports 1996-2000:

Using income and price forecasts, fluid milk imports were forecasted according to the import demand model explained above. Results are shown in Table 4.

Fluid milk imports are forecast to begin rising streadily from 1996 through 2000, averaging about 13 percent growth per year. This forecast import growth depends on average annual income growth of 1 per cent per year, which is reasonable given recent developments in Mexico's economy.

Cheese imports are forecast to decline and average of 5.6 percent through the year 2000. This occurs primarily due to the lower income elasticity for imports of cheese. The rate of decline does slow down after 1980 and imports stabilize near 10,000 metric tons.

Table 4. Forecasted Values for Cheese and Fluid Milk Imports for Mexico:(Metric tons)

	Fluid Milk	**Cheese**
1995	15000	18000
1996	16565	12647
1997	21469	11046
1998	27495	10552
1999	36048	10410
2000	43338	10413

V. CONCLUSIONS

Dairy imports to Mexico are expected to grow, albeit at a slower rate. After recovering from the present economic crisis, fluid milk imports are predicted to rise by 10 to 15 thousand metric tons a year through 2000. Cheese imports on the other hand, will not show the extraordinary growth of the early 1990's but will stabilize around 10000 metric tons (see figures 1 and 2).

The primary purpose of this study was not just predicting future import quantities, but estimating the elasticities of income and the real exhange rate for fluid milk and cheese that enable sound analysis of these markets. The response to changes in the real exchange rate can be different depending on the degree of elasticity of demand. Fluid milk imports are more responsive to changes in price compared to cheese , but income elasticities for both goods are

similar. Taking into account the economic crisis of 1994-1995, fluid milk import demand will rise again to 1993 level by the year 2000..

Future work in this area will greatly be enhanced by more accurate data on prices, especially in differentiated products at both consumer and producer levels. Another important consideration is the incorporation of actual policy instruments, and analysis of policy variables. Most important may be the determination of trade transition measures, such as Mexico's tariff-rate quota on non fat dry milk on fluid milk imports.

Figure 1.

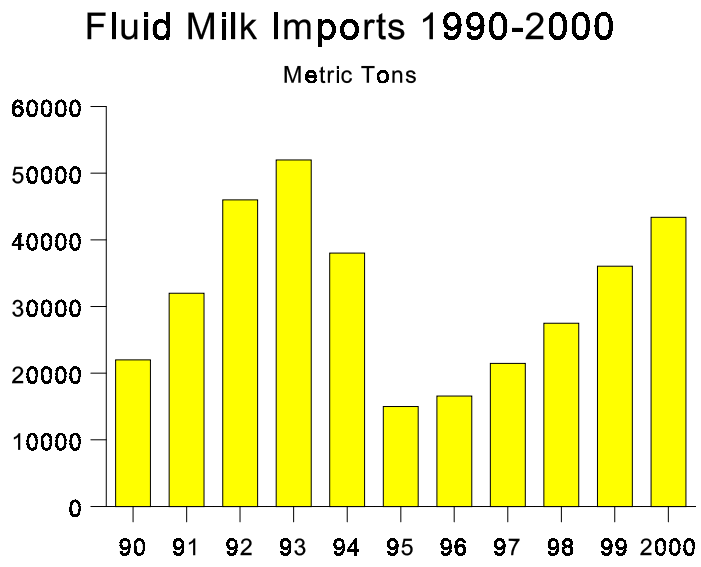
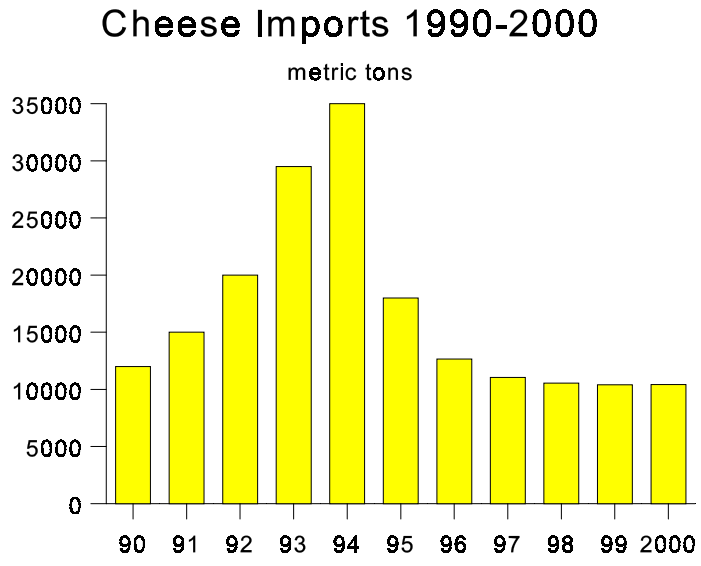


Figure 2.



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