

**THE NAFTA AND MEXICAN IMPORT DEMAND FOR DAIRY**

**PRODUCTS**

**Ayşen Tanyeri-Abur and Parr Rosson**

**NAFTA and Agriculture Symposium**

**San Antonio, Texas  
November 1-2, 1996**

## **THE NAFTA AND MEXICAN IMPORT DEMAND FOR DAIRY PRODUCTS**

### **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:  $\text{imports}/\text{disposable milk (imports+production)}$ ) 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:

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

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:

$$\ln M_t = \alpha_0 + \alpha_1 \ln(P_m/P_d) + \alpha_3 \ln Y_t + \alpha_4 \ln M_{t-1} + \alpha_5 d_t \quad (2)$$

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

**Table 3. Estimated import demand equations**

Commodity	Variables										R <sup>2</sup>	DW
	Constant	(P <sub>m</sub> /P <sub>d</sub> )	Y <sub>t</sub>	M <sub>t-1</sub>	d80	d83	d94	d95	d84			
<b>Fluid Milk</b>	-30.859 (-4.94)	-0.888 (-2.65)	4.863 (4.23)	0.503 (5.65)	-3.034 (-5.67)	-1.947 (-3.87)	-0.822 (-1.49)	0.679 (1.28)			0.957	1.966
<b>Cheese</b>		-13.222 (-2.29)	-0.779 (2.10)	1.998 (5.29)	0.669						-1.102	
											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 0.0975. Therefore, the null hypothesis of no serial correlation could not be rejected. For the cheese equation, the Durbin-h was 0.43 which also ruled out the existence of serial correlation (see Pindyck and Rubinfeld 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 4.863 and 1.998 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). Fluid milk and cheese are food items that are consumed more at higher income levels, and expenditure elasticities calculated by Nicholson (p. 36), show that for higher income deciles, elasticity is also higher. For fluid milk, he calculates the expenditure elasticity to be 3.56 at the highest income decile compared to 0.48 at the lowest 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 -0.888 and -0.78 for fluid milk and cheese respectively.

#### IV. FORECASTING

Import demand for the period 1996 - 2000 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:

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

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:

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

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:

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

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.

Dummies were added to account for sharp changes in income due to devaluation or other policies. Figure 3 shows real income from 1975 to 1995. The year 1980 was a turning point followed by falling real incomes, and 1986 and 1994 mark devaluations.

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 steadily 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 13,700 metric tons.

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

	<b>Fluid Milk</b>	<b>Cheese</b>
1995	80000	25360
1996	61645	19131
1997	62816	16176
1998	71059	14708
1999	86601	13997
2000	102541	13698

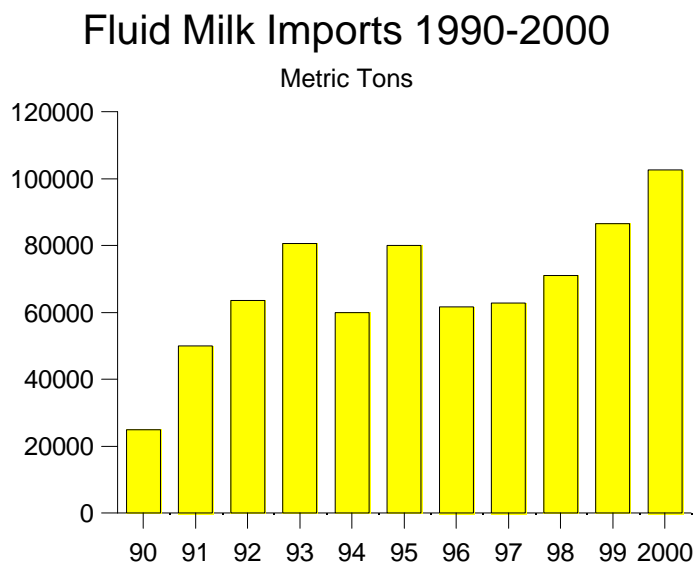
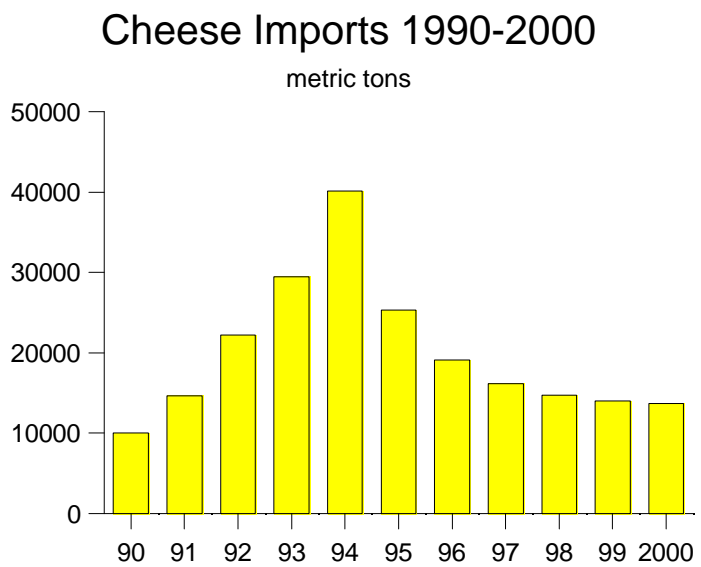
## V. CONCLUSIONS

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 14000 metric tons (see figures 1 and 2).

The most important findings of this study are not just predicting future import quantities, but the elasticities of income and the real exchange rate 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. In the case of fluid milk and cheese, the real exchange elasticities are similar, being slightly less than one. In the case of fluid milk though, the income elasticity is very high indicating that fluid milk demand will increase at an increasing rate with higher incomes. Taking into account the economic crisis of 1994-1995, fluid milk import demand will rise well above 1993 levels.

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.**

### References

Banco de Mexico. Indices de Precios, 1975-1992. Mexico City, Mexico.

Boylan and Cuddy, “Elasticities of Import Demand and Economic Development: The Irish Experience”, *Journal of Development Economics*, 1987, p. 301-309.

Food and Agriculture Organization, Trade Yearbooks, 1976-1993. FAO, Rome.

Gudmunds, Karl, and Alan Webb, "PS&D View '91" electronic database, U.S. Dept. of Agri., Econ. Res. Serv., November 1991.

Officios de la Direccion General de Precios (SECOFI), 1986-1992.

Hallberg, Milton C., James R. Cranney, Stephen M. Smith, and Constanza M. Valdés. (1992) *The Mexican Dairy Economy and Potentials of Liberalized Trade For the U.S. Dairy Industry*. Agricultural Economics and Rural Sociology Department, A.E. & R.S. No. 236, The Pennsylvania State University, University Park, Pennsylvania.

INEGI, 1992. *Estadísticas Históricas de México*, Tomo II., Aguascalientes, Mexico.

International Monetary Fund, Annual Reports, 1975-1992

Kahn, Mohsin, “The Structure and Behavior of Imports of Venezuela”, *Review of Economics and Statistics*, May 1975, p. 221-24.

Leamer, Edward and Robert Stern. “Quantitative International Economics”, Allyn and Bacon, Boston, 1970.

López, Patricia Marín. Personal Communication, 1995.

Luna, Gerardo. Personal communication, 1995.

Knutson, Ron, C. Parr Rosson III, Joe Outlaw, Amy Angel, and John Miller (1993). *NAFTA and the U.S. Dairy Industry*. AFPC Policy Working Paper 93-3, Dept. Of Agricultural Economics, Texas A&M University, College Station, Texas.

Muñoz, Manrubio (1993). *El Mercado de Lácteos en Mexico*. Working Paper, Universidad Autónoma Chapingo, Chapingo, Mexico.

Muñoz, Manrubio and P. Odermatt (1993). “El Sistema Leche de Mexico en el Tratado

Trilateral de Libre Comercio (TLC), In: Juan Pablos (Editor), *La Agricultura Mexicana Frente al Tratado Trilateral de Libre Comercio*, 2nd edition, Universidad Autónoma Chapingo,, S.A., Mexico.

Muñoz Rodriguez, Manrubio, Odermatt P., and Cárdenas Altamirano J.R., (1994). *Retos y Oportunidades del Sistema-Leche ante el TLC*, Working Paper, Universidad Autónoma Chapingo, CIESTAAM, Chapingo, Mexico.

McClain, Emily A., and Harold M. Harris, Jr. (1992) *A U.S.-Mexico Free Trade Agreement: Potential Impacts and Implications for the U.S. Dairy Industry*. American Farm Bureau Research Foundation, 1992.

Nicholson, Charles F. "Mexico's Dairy Sector in the 1990's: A descriptive Analysis", Publication #R.B.95-05 of the Cornell Program on Dairy Markets and Policy, November 1995.

Nyatepe-Coo, Akorlie "Dutch Disease, Government Policy and Import Demand in Nigeria", *Applied Economics*, 1994, Vol 26, 327-336.

Salinas, Gortari, *Sexto Informe de Gobierno*, 1993.

Tanyeri-Abur, Aysen and C. Parr Rosson III. "Demand for Dairy Products in Mexico", *Forthcoming in Agricultural Economics*.

U.S. Dept. of Agriculture. *Foreign Agricultural Trade of the United States (USDA/FATUS)*, Calendar Year Supplement, Econ. Res. Serv., various issues.

Villa-Issa, Manuel, (1990). *Performance of Mexican Agriculture: the Effects of Economic and Agricultural Policies.*", *American Journal of Agricultural Economics*. 72(3):774-748.