

Staff Paper

Estimating Import Demand in the Mexican Cheese Market

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Abstract: Mexico is the fastest growing market for US dairy exports and it is the largest market for U.S. cheese. The U.S. has always enjoyed a large share of the Mexican cheese market. However, its share growth has been less dynamic than the share of Europe, Oceania and other countries, despite advantages in proximity, shipping costs, and delivery times. We use an Almost Ideal Demand System to estimate own and cross-price elasticities in the Mexican cheese import market to assess the comparative position of the U.S. relative to other cheese market participants.

Keywords: import demand, Mexico, cheese, dairy, demand system

JEL Classification: L1.

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Estimating Import Demand in the Mexican Cheese Market

Introduction

Mexico is the largest and fastest growing market for U.S. dairy exports. This growth began even before the 1994 North American Free Trade Agreement and has been fueled by rapid population increases as well as by an expanding Mexican economy. U.S. dairy exports to Mexico were \$252 million in 2002, positioning Mexico as the largest U.S. dairy customer (United States Dairy Export Council). Since NAFTA's implementation, however, the composition of U.S. dairy exports to Mexico has changed considerably. From 1994 to 2001, U.S. suppliers made significant progress in expanding markets for value added products, primarily cheese, whey proteins, lactose and ice cream. While skim milk powder (SMP) has historically been the primary U.S. dairy export to Mexico, cheese exports have grown in importance in recent years. By 2000, Mexico had become the largest market for U.S. cheese exports with a value of \$30 million (United States Dairy Export Council). In fact, between 1996 and 2002, U.S. cheese imports in Mexico surged by 223% (Trejo and Hernandez).

Mexico's cheese market is one of the more dynamic markets in the world and the recent growth in cheese consumption is expected to continue. While cheese consumption in Mexico rose an estimated 22,000 tons from 2000 to 2002, domestic production comprised only 11,000 tons of the consumption increase (Rabobank International). As Mexican cheese import consumption has increased, the value of those cheese imports has increased at an even faster pace. This implies that Mexican consumers are not only eating more imported cheese, but that the unit value of the cheese consumed is also increasing. Indeed, Mexican middle and upper income consumers are demanding both more cheese and more varieties of cheese (AgExporter).

The U.S. has always enjoyed a large share of the Mexican cheese market. However, its share growth has been less dynamic than the share of Europe, Oceania and other countries, despite advantages in proximity,

shipping costs, and delivery times. The objective of this study is to estimate own and cross-price elasticities in the Mexican cheese import market to better understand market behavior and to assess the comparative position of the U.S. relative to other cheese market participants. We use an Linear Approximate Almost Ideal Demand System (LA/AIDS) to accomplish this task.

Market Dynamics and Characteristics

Major exporters of cheese to Mexico by region are identified as the United States, Europe (primarily France, Germany and the Netherlands) and Oceania (New Zealand and Australia). On average, cheese imports from the US were 30% of total cheese imports by Mexico, followed by the EU at 27%, Oceania at 22% and others at 20%. Though U.S. cheese exports to Mexico have increased, the U.S. market share of Mexican cheese imports has, in general, declined. The U.S. had 40% of Mexican cheese imports in 1990 but only 25% in 1999. The EU's share increased from 30% to 41% during the pre-NAFTA period of 1990 to 1994. However, by 2001, the EU's market share had declined to 22%. Interestingly, over that same time period, Oceania's share increased rapidly, jumping from 19% in 1994 to 31% in 1995. However, by 2001, Oceania's share had decreased to 18% while the U.S. share had rebounded back to 36%. Meanwhile, Other countries' market share steadily grew from 13% in 1990 to 25% in 2001. Table 1 shows the change in market share for Mexican cheese import sources, giving a sense of the dynamic nature of this market over the time period.

Oceania enjoys a production cost advantage, primarily due to New Zealand's efficiency at grassland dairy production (Robinson). Though 41% of New Zealand's cheese exports in 2000 were cheddar cheese, they have also been successful at producing and marketing high quality cheeses similar in characteristics to European cheeses (<http://www.stats.govt.nz>). These European-type cheeses such as Edam and Gouda are the primary cheeses that Oceania markets in Mexico. The E.U. enjoys the highest reputation for quality cheese, while the U.S. has reputable quality, but markets varieties that are different

from those of the E.U. and Oceania in the Mexican market. The U.S. also enjoys a natural geographical advantage in transportation costs and shipping times.

Model Considerations

The Almost Ideal Demand System (AIDS) as developed by Deaton and Muellbauer is flexible, theoretically plausible and easy to use. Here, we apply the model in the context of viewing each country's exports to Mexico as a good in the system where the complete system is Mexican cheese imports.

The AIDS model takes the form:

$$(1) \quad w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i \ln(y/P)$$

where $\ln P$ is Stone's price index defined by:

$$(2) \quad \ln P \approx \sum_{j=1}^n w_j \ln p_j$$

where α , β and γ are parameters; w is the import value share of the i th country in the Mexican cheese import market; p represents the import unit value price of the i th country's cheese, and y is the total value of cheese imports in Mexico. To avoid problems of simultaneity in the expenditure share w_i , the average share for adjacent time periods was used in calculating Stone's Index, $\ln P$ (Eales and Unnevehr). Adding up, homogeneity, and symmetry are imposed through the following restrictions, respectively:

$$(3) \quad \sum_{i=1}^n \alpha_i = 1 \quad , \quad \sum_{i=1}^n \gamma_{ij} = 0 \quad (\text{all } j) \quad , \quad \sum_{i=1}^n \beta_i = 0; \quad \sum_{j=1}^n \gamma_{ij} = 0 \quad (\text{all } i) \quad ; \quad \wedge \quad \gamma_{ij} = \gamma_{ji}$$

Here, i and j represent four import sources for the Mexican cheese market, including the United States, the European Union (15 countries), Oceania (Australia and New Zealand), and Other countries (mainly Argentina, Poland, Uruguay and other small exporters).

Data

Annual price data and cheese import quantities were obtained from the Mexican General Customs Secretariat, the U.S. Department of Agriculture (USDA) and the U.S. Dairy Export Council for 1990 through 2001. Data are reported for each import source. Quantities were given in metric ton milk equivalents and prices in US dollars per metric ton. Shares are calculated as percentage of total cheese import value.

Estimation

An LA/AIDS model was used to estimate a model of import demand in the Mexican cheese market. Three equations are estimated in the demand system, including share equations for the U.S., the E.U., and Oceania. The equation for Other is omitted from the estimation to avoid singularity of the variance-covariance matrix of disturbance terms. Adding-up, homogeneity and symmetry conditions are imposed as given in equation (3). A dummy variable is included to account for the implementation of NAFTA in 1994. The estimated system then takes the form:

$$(4) \quad w_i = \alpha_i + \lambda_i D + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i \ln(y/P)$$

where $D=0$ for 1990 to 1994 and $D=1$ for the remainder of the time period. Zellner's Seemingly Unrelated Regression (SURE) was used to estimate the system as shown in equation (4), yielding consistent and asymptotically efficient parameter estimates (Amemiya).

Results

Parameter estimates are given in Table 2. Results suggest that the implementation of NAFTA had a negative and significant impact on EU cheese imports (-0.194) and smaller, but positive, impacts on US and Oceania cheese imports (0.07 and 0.067, respectively). It is presumed that the policies associated with NAFTA made U.S. cheese relatively less expensive, thus the gain in share. Marshallian price and income elasticities are estimated at sample means and are presented in Table 3. Results are similar for compensated own- and cross-price elasticities (also estimated at sample means) given in Table 4. Expenditure elasticities are all relatively close to one, though the estimates do suggest that increases in expenditure on imported cheese in the Mexican market favor the U.S. and the E.U., with expenditure elasticities of 1.03 and 1.02, respectively, over Oceania and Other importers (0.94 and 0.99). A U.S. Dairy Export Council survey of Mexican consumers provides evidence that U.S. cheese is regarded as being high in quality. Also, the E.U. has a long history of cheese making and has historically been regarded as a high quality cheese producer. The high quality perception of cheese from these two import sources is supported by the magnitude of the expenditure elasticities.

Marshallian own-price elasticity estimates are negative as expected and are all statistically significant. Mexican consumption of imported cheese appear to be the least sensitive to changes in the price of U.S. cheese as compared to E.U., Oceania, and Other countries. The own-price elasticity for U.S. cheese is the only own-price elasticity that falls into the inelastic range at -0.942. Cheese imports from the Other category are the most sensitive to own-price changes with an own-price elasticity of -2.174, while the E.U. and Oceania also have elastic own-price elasticities at -1.151 and -1.513, respectively. Cross-price elasticities indicate that E.U. and Oceania cheese imports are gross substitutes as are cheese imports from Other and Oceania, as well as the U.S. and Other. U.S. cheese has a (gross) complementary relationship with cheese from E.U. and from Oceania. E.U. cheese and Other imported cheese are also gross complements.

Compensated own and cross-price elasticities yield results similar to the Marshallian estimates; however, statistical significance is generally lower. The U.S. and the E.U. both have compensated own price elasticity estimates that are inelastic, at $-.624$ and $-.875$, respectively. Compensated cross-price elasticities indicate the same (net) complement/substitute relationships as indicated by Marshallian elasticities.

These relationships also make intuitive sense. Both the U.S. and E.U. are regarded as producers of high quality cheese (U.S. Dairy Export Council) and that quality reputation contributes to lower own-price sensitivity. However, the two cheeses are not necessarily substitutes in their use. Traditional E.U. cheeses are similar to the soft Mexican varieties of cheese and thus are used in similar ways. Survey results show that Mexican consumers like U.S. cheese and have a positive view of its quality, but are in many ways, uneducated about uses for U.S. cheese, which tends to be a harder cheese (U.S. Dairy Export Council). As Mexican consumers choose higher quality cheese when cheese expenditures increase, they may also choose high quality cheese with different end uses, thus the complementary relationship between E.U. cheese and U.S. cheese.

Oceania produces a variety of cheeses that are quite similar to European cheese varieties and that are of respectable quality, suggesting that cheese imports from these two regions would be substitutes in the Mexican market. This is corroborated by the empirical evidence indicating that E.U. cheese and Oceania cheese are substitutes in the Mexican cheese market. It also supports the (net and gross) complementary relationship that exists between Oceania and the U.S.. In fact, Oceania and the U.S. are stronger complements, according to our elasticity estimates, than are the E.U. and the U.S..

Compensated cross-price elasticities in Table 4 are estimated as $\epsilon_{U.S., E.U.} = -0.049$ while $\epsilon_{U.S., OC} = -0.584$, indicating a rather large difference in the magnitude of the complementary relationships. Oceania prices tend to be lower than E.U. prices, at least in part due to lower production costs, and Oceania and E.U. are shown to be very strong substitutes ($\epsilon_{E.U., OC} = 1.292$). It is likely that as relative prices between E.U.

and Oceania change, the U.S. benefits as Mexican consumption shifts away from more expensive E.U. cheese toward less expensive Oceania cheese, leaving more expenditure to flow toward U.S. cheese which is distinctly different in type than E.U. and Oceania cheeses.

The Other category includes many countries and represents a wide variety of cheeses. In some cases, countries specialize in particular cheese types, while other countries produce a wide variety of cheeses. For example, Argentina produces many harder cheeses similar to those produced in the U.S., but also produces softer cheeses with characteristics similar to those of European cheese. Therefore, it is not surprising that empirical results indicate that cheese imported from Other is a substitute for U.S. and Oceania cheese and yet a complement to European cheese. It is interesting to note that, although E.U. and Oceania cheese are (net and gross) substitutes, their relationship to Other differs. A plausible explanation is that the Other category varies in its composition with respect to types of cheeses, depending on relative prices in the cheese market. The specific composition of cheese varieties by time period is not captured in the aggregation, but is influencing the measure of market relationships to other cheese import sources.

Conclusions

It is certainly plausible that the U.S. recovery in the Mexican cheese market was influenced by preferential tariffs and proximity to the market. Certainly, the E.U. and Oceania are major competitors of the U.S. in the Mexican cheese market, but the results imply that attributes of cheese play a strong role in the composition of Mexican cheese import market. Overall, the results suggest that Mexican consumers may perceive differences in the characteristics of the different cheeses and make choices accordingly and, in that sense, the Mexican market for imported cheese is not a commodity market. Since U.S. cheese and E.U. cheese are complements and are both perceived to be of high quality, this suggests that when Mexican consumers seek to increase the quality of cheese imported, they also seek to increase the varieties of cheese consumed. This is supported by both the expenditure elasticities and the cross-price elasticity estimates. Our

results lend credence to the Foreign Agricultural Service's assessment that not only are higher income Mexican consumers demanding more cheese, but that they are also demanding more variety in the cheese consumed (AgExporter). As Mexican incomes rise, we would expect this trend to continue and we would expect the U.S. to benefit from this trend.

In the Mexican cheese market, it appears that Oceania competes more directly with the E.U. than with the U.S.. Oceania's cheese exporters entered the Mexican market with soft-cheese varieties that Mexican consumers have shown a strong preference for such as Gouda and Edam. Additionally, they have entered the market at lower relative prices than their European counterparts due to their milk production cost advantage (Rabobank).

The own-price inelasticity of U.S. cheese relative to other suppliers to the Mexican cheese market indicates that Mexican consumers are relatively less price-sensitive about U.S. cheese. In fact, USDEC's sponsored U.S. cheese image study in Mexico reveals that price of cheese is second to quality in the decision criteria related to cheese purchases. Additionally, U.S. cheese does benefit from some "brand power" since Mexican consumers are familiar with U.S. brands. This opens the possibility of export strategies alternative to simple price competition. The USDEC study also reports that the product mix of U.S. dairy exports to Mexico has shifted towards a value-added one rather than to a commodity-based one. Consumer education and promotional programs, such as "Quesolutions", enlightening Mexican consumers on U.S. cheese quality, varieties and uses will likely play a crucial role in the U.S.'s presence in the Mexican cheese market (Trejo and Hernandez).

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Table 1. Change in Market Share of Mexican Cheese Import Sources

	U.S.	EU	Oceania	Others
Average Share 1991-2000	0.31	0.27	0.22	0.21
1991	-0.15	0.08	-0.14	0.20
1992	0.01	0.02	0.11	-0.14
1993	0.02	-0.03	0.05	0.03
1994	-0.04	0.03	0.00	0.00
1995	0.13	-0.16	0.12	-0.09
1996	-0.04	-0.09	0.03	0.10
1997	-0.05	0.03	0.00	0.02
1998	0.01	0.01	-0.08	0.06
1999	-0.04	0.02	-0.02	0.04
2000	0.10	-0.02	-0.02	-0.06
2001	0.01	0.03	0.05	0.01

Table 2. Parameter Estimates and Goodness of Fit Statistics for Mexican Cheese Import Demand System Using LA/AIDS

Exporter	D_i	α_i	γ_{i,U.S.}	γ_{i,EU}	γ_{i,OC}	β_i	R²
United States	0.07 (.036)	0.196 (.036)	0.021 (.896)	-0.097 (.371)	-.247 (.054)	0.010 (.764)	.65
European Union	-0.194 (.000)	0.442 (.000)	---	-0.038 (.757)	.287 (.006)	0.005 (.862)	.92
Oceania	0.066 (.048)	0.163 (.133)	---	---	-0.114 (.516)	-.014 (.728)	.66

Note: p-values in parentheses.

Table 3. Marshallian Own- and Cross-Price Elasticity Estimates for Mexican Cheese Import Demand System Using LA/AIDS

Exporter	U.S.	E.U.	Oceania	Other	Expenditure Elasticity
U.S.	-0.942 (.069)	-0.332 (.326)	-0.808 (.016)	1.039 (.124)	1.03 (.000)
E.U.	-0.370 (.226)	-1.151 (.021)	1.071 (.009)	-0.575 (.327)	1.02 (.000)
Oceania	-1.125 (.117)	1.364 (.107)	-1.513 (.059)	0.362 (.584)	0.94 (.002)
Other	1.547 (.249)	-0.726 (.648)	0.355 (.772)	-2.174 (.080)	0.99 (.080)

Note: p-values in parentheses.

Table 4. Compensated Own- and Cross-Price Elasticity Estimates for Mexican Cheese Import Demand System Using LA/AIDS

Exporter	U.S.	E.U.	Oceania	Other
U.S.	-0.624 (.265)	-0.049 (.326)	-0.584 (.015)	1.257 (.124)
E.U.	-0.056 (.226)	-0.875 (.097)	1.292 (.009)	-0.361 (.326)
Oceania	-0.835 (.117)	1.596 (.108)	-1.314 (.152)	0.553 (.584)
Other	1.855 (.249)	-0.460 (.648)	0.570 (.772)	-1.965 (.729)

Note: p-values in parentheses.