

Forecasting Mexican Live Cattle Exports to the United States

Rhonda Skaggs
Agricultural Economics & Agricultural Business
New Mexico State University
Las Cruces, NM

Diana Mitchell
USDA – APHIS
Fort Collins, CO

William Gorman
Agricultural Economics & Agricultural Business
New Mexico State University
Las Cruces, NM

Terry Crawford
Animal Products Branch
USDA – ERS
Washington, D.C.

Leland Southard
Animal Products Branch
USDA – ERS
Washington, D.C.

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Introduction

Agricultural trade between the United States and Mexico has grown steadily since implementation of the North American Free Trade Agreement (NAFTA) in 1994. At the end of 1999, U.S. agricultural exports to Mexico were 56% above pre-NAFTA levels, and U.S. agricultural imports from Mexico were up 80% (USDA-ERS). The United States currently supplies about 77% of Mexico's total agricultural imports, primarily feed grains, oilseeds, live animals, meat, and dairy products. Mexico supplies the U.S. with coffee, fresh and prepared fruits and vegetables, and live cattle, with the U.S. taking about 78% of Mexico's agricultural exports (USDA – ERS). Cattle play a major role in bilateral trade between the two countries, with breeding stock and slaughter cattle going into Mexico from the U.S., and feeder or stocker cattle (typically weighing around 300 pounds) coming from Mexico to U.S. feedlots and pastures.

Several authors have addressed the issue of beef cattle imports from Mexico, and have attempted to dispel the notion that the inflow of Mexican cattle is responsible for low U.S. prices (Brester and Marsh; Rosson). The United States International Trade Commission examined the question and concluded that there was no indication of injury to the U.S. cattle industry as a result of imports of live cattle from Mexico (USITC). Previous authors have examined annual cattle imports from Mexico, with limited discussion of the animals' areas of origin within Mexico, the locations at which they enter the United States, their destinations in the U.S. interior, and factors which influence live cattle movements from Mexico to the U.S. (Lambert; Peterson; Marsh; Leuck and Link). Recently, more detailed data and information on crossings of Mexican cattle into the U.S. were made available to the current authors by the United States Department of Agricultural Animal and Plant Health Inspection Service (USDA – APHIS), and are reported here. These data were used to develop the predictive models for the cattle crossings presented later in this article.

Background

As a result of the 1994 enactment of the NAFTA, the U.S. tariff of 2.2 cents per kilogram of beef cattle imports from Mexico was immediately eliminated. The U.S. also eliminated tariffs on fresh, chilled, and frozen beef and veal imported from Mexico. In 1994, Mexico eliminated its significantly higher import tariffs on live slaughter animals (15%), fresh or chilled beef (20%), and frozen beef (25%) (USDA - FAS). These NAFTA tariff eliminations have been credited with a 15-25% increase in U.S. live cattle exports to Mexico and increases in beef and veal exports as well (Link and Zahniser). The impact of NAFTA on U.S. imports of Mexican feeder cattle is confounded by other events in that country affecting the cattle industry (e.g., drought and currency devaluation), and thus it is difficult to estimate the true effect of NAFTA on feeder cattle trade between the two countries. NAFTA has been credited with increasing U.S. imports of beef and veal from Canada, although exemption of that country's beef from the 1979 U.S. Meat Import Law has also increased imports of Canadian beef (Link and Zahniser).

Current U.S. health regulations regarding imports of cattle from Mexico are unchanged from the pre-NAFTA period. Cattle must test negative for tuberculosis, must be healthy, and pest and disease free. Animals are dipped in insecticide before crossing into the U.S. and are inspected by the Veterinary Services unit of the U.S. Department of Agriculture's Animals and Plant Health Inspective Service (USDA – APHIS). For cattle entering the southwestern United States from northern Mexico, there are few significant disease or pest problems that regularly prohibit their border crossing. Most of the feeder cattle entering from Mexico are steers. It is possible to bring spayed heifers into the U.S. for finishing, but only a very small percentage of all the imported animals are females, due to the extra costs involved.

Rodeo stock is also regularly imported into the U.S. from Mexico. Exact numbers of rodeo animals entering from Mexico are not available, but a rough estimate is 5% of all animals (Hudgens; Machuca; Winters).

How Many Cattle Enter the United States from Mexico?

U.S. imports of feeder cattle from Mexico are shown in Figure 1 for 1961 through 2000. Imports exhibited no trend from 1961 until the mid-1980s. Since that time, there has been a steep increase in the number of Mexican cattle entering the U.S., continuing until 1995 when the number dropped. Differences in these three periods are evident from a review of average imports for 1961 – 2000. For the period 1961 – 1985, the annual average was 561,000 animals, the 1986-1995 annual average was 1.1 million animals, and the 1996 – 2000 annual average was 800,000 animals.

Stabilization of the Mexican cattle industry, continued disease control efforts and herd improvement in Mexico supported increased U.S. imports from 1985-1995. In the mid-1990s, producers in northern Mexico faced extreme drought conditions, as well as macro-economic instability and a dramatic devaluation of the peso. These factors contributed to the record high levels of Mexican feeder cattle (1.6 million) sold in the U.S. in 1995. Following that year's herd liquidation, the numbers of Mexican animals entering the U.S. decreased 72% to 456,000 in 1996. Imports have gradually recovered since 1995, and in 2000 reached 1,230,616 animals.

Even though the numbers quoted above may seem large, they represent a small portion of the total U.S. beef and feeder animal markets. When feeder animal imports from Mexico were converted to carcass weight equivalent, they were estimated to represent approximately 1% of total U.S. beef supplies in 1998 (Brester and Marsh). By comparison, the carcass weight equivalent of beef and cattle imports from Canada comprised 6.5% of the total U.S. beef supply, and all imports of beef and cattle accounted for 14% of total U.S. beef supplies in the same year (Brester and Marsh). It has also been estimated that Mexico typically repurchases about half of the meat and all of the hides that result from the feeder animals shipped to the U.S. (Melton and Huffman). Mexico also annually purchases 100,000 – 125,000 tons of beef offal from the U.S., sold chiefly through taco restaurants (Secretaria de Agricultural, Ganaderia y Desarrollo

Rural). Offal items in demand by the Mexican market include livers, hearts, kidneys, tongues, stomach, and heads.

Relative to the total 2000 U.S. inventory of calves weighing less than 500 pounds, feeder cattle originating in Mexico were 7.3% of almost 16.8 million animals (USDA-NASS). When using total U.S. cattle and calves on feed as a base of comparison, Mexican feeder cattle are 8.8% of the 2000 total of 14 million animals (USDA-NASS). Annual Mexican feeder cattle exports to the United States typically vary from 3-5% of the total Mexican cattle inventory (Leuck and Link). According to the Mexican government, the size of the feeder cattle exports depend on rainfall, related forage supplies, the Mexican cattle cycle, U.S. cattle market prices, and the overall condition of the Mexican economy (Secretaria de Agricultura, Ganaderia y Desarrollo Rural 1998).

Where Do Mexican Feeder Cattle Enter the United States?

Mexican feeder cattle currently enter the United States through ten ports-of-entry along the U.S.-Mexico border. These locations are San Luis, Nogales, and Douglas (in Arizona); Columbus and Santa Teresa in New Mexico; and Presidio, Del Rio, Eagle Pass, Hidalgo, and Laredo (Texas).

The ports-of-entry range greatly in the size and complexity of cattle crossing facilities. With the exception of Santa Teresa, NM, the ports tend to be characterized by limited and/or older cattle handling facilities. The modern 10,000 head capacity Santa Teresa facility is considered to be "state-of-the-art" by the regional cattle industry. Prior to 1999, all live cattle crossings in the far western region of Texas took place at a facility located in the El Paso, TX metropolitan area. All live animal crossings are now handled at a relatively uncongested and undeveloped area of New Mexico, located a few miles west of El Paso. A new highway is under construction in the State of Chihuahua that will completely bypass the Ciudad Juarez metropolitan area south of El Paso, and further facilitate truck traffic from the Mexican interior through the Santa Teresa port-of-entry. This highway is expected to be open in mid-2001, and will facilitate livestock movement between the United States and Mexico, as well as other trade and travel between the two countries.

Cattle crossing facilities, regardless of level of complexity, are supported and maintained by Mexican cattle producers, under the auspices of a regional *Union Ganadera*. A statewide *Union* membership consists of smaller groups of cattlegrowers within the same state. These organizations have many of the same functions as state-level cattlegrowers' associations in the United States (e.g., industry advocacy, political activity, cattle marketing, etcetera). However, they also have many functions of traditional agricultural cooperatives, including operation of border crossing facilities, and group marketing and education, feed manufacturing, purchase of vaccines and other supplies in bulk for sales to members.

At every port, all inspection activities of the U.S. Veterinary Services are located on the Mexican side of the border, also in facilities owned and operated by the Mexican

cattlegrowers' associations. U.S. Veterinary Services receives payment for their inspection activities from cattlebrokers who in turn charge the fee back to the Mexican cattle producers. When cattle are sold into the United States, there may be five or more fees associated with the transaction, including payments to Mexican customs brokers or inspectors, Mexican cattlebrokers, the *Union Ganadera* (for expenses incurred by the cattle at the crossing facility), U.S. customs brokers or inspectors, and a U.S. cattlebroker. The Mexican ranchers are also deducted \$1 per head for the U.S. beef checkoff program. The fees collected by Veterinary Services goes into a general fund, which allocates monies across the ports. Thus, each port does not keep all fees collected there. The activities of the Veterinary Services agency are also subsidized through federal appropriations.

The Santa Teresa cattle crossing facility handles the largest volume of Mexican animals entering the United States (Figure 2). Because it is also the most modern, its activities will be described in greater detail here. At Santa Teresa, Mexican cattle spend approximately 24 hours at the port-of-entry before they enter New Mexico. While at the port, they are fed, watered, and inspected by U.S. Veterinary Services personnel. Paper documentation for the animals is also reviewed, specifically results of tuberculosis tests which are performed at their point of origin in Mexico, at least 10 days prior to crossing. Some animals are quarantined for further examination, and a small number are refused entry. The typical basis for refused entry is failure to comply with U.S. or Mexican paperwork or regulations (e.g., eartags and records are not consistent, dipping certificates are not in order, cattle are not properly branded, cattle are suspected of being stolen in Mexico). Occasionally, cattle are refused entry due to open wounds or recurrent tick infestations. Approximately 3,000-4,000 head of cattle are refused entry annually at the Santa Teresa, NM port (Hudgens).

If the animals pass the basic inspection, which is visual, tactile, and includes manual verification of castration, they are divided into small lots (usually about 20-25 animals) and sent swimming through dipping vats approximately 60 feet in length. A small number of animals, usually lightweight ones, drown or swallow enough insecticide that they do not survive the dipping process. The dipped, inspected animals are sent to holding areas closer to the actual border, and then are released into an area that spans both the Mexican and U.S. borders (i.e., "no-man's land"). They next enter pens on the U.S. side of the border. They may spend some time in the facility, but it is more likely that the animals have already been purchased on the U.S. side, and immediately will be loaded onto cattle trailers destined for U.S. pastures or feedlots.

Inside the office of the Santa Teresa facility, several Mexican sellers, U.S. buyers, cattle brokers have permanent offices, where they and other interested parties conduct their business dealings. Unlike the other cattle ports-of-entry on the U.S.-Mexico border, the Santa Teresa facility is open and crosses cattle most weekdays throughout the year.

At the ports-of-entry, the cattle are priced at whatever the U.S. market is paying; however, a formula pricing mechanism is applied. The prices are set for a 300 pound animal, and the Mexican sellers are penalized \$0.01 for every 10 pounds over the 300

pound baseline. If the offer price for steers entering from Mexico is \$1.13/pound, a 400 pound animal would be sold at \$1.03/pound. This may create an incentive for Mexican producers to export their animals earlier than would be optimal given local forage conditions.

The cattle are usually crossed and sold in lots of 20-25 animals. The Mexican sellers group the animals in uniform lots, with an average weight of 300 pounds or lower, so as to avoid the formula pricing penalty for heavier animals.

How Do the Ports-of-Entry Differ in Numbers of Cattle Imported?

Cattle crossings by port-of-entry are shown in Figure 2. Almost 50% of all the cattle imported from Mexico enter the U.S. through two ports: Santa Teresa, NM and Presidio, TX. Cattle were last imported through Sasabe, AZ and Brownsville, TX in 1994.

When Do Mexican Feeder Cattle Enter the United States?

There is a distinct seasonal pattern with respect to the timing of Mexican cattle entering the United States. Monthly data since 1972 exhibit strong seasonality in cattle imports from Mexico (Figure 3). Figure 3 also illustrates the overall increase in import volume that occurred between 1985 and 1995, and the subsequent reduced (but increasing) volume. Cattle imports by month for 2000 are presented in Figure 4, where it is shown that 85% of cattle were crossed October through May. Cattle imports from Mexico into the United States are lowest in the summer because Mexican ranchers typically graze their animals through the spring and summer months until the first fall frost. Within one month after the first frost, feeder animals will begin going to market, and thus enter the United States during the winter and spring months. As the cooler weather moves south through northern Mexico's cattle production regions, animals there enter the flow of feeder calves to the U.S. market. This marketing pattern takes advantage of the warm-season grasses that characterize rangelands in northern Mexico and the U.S. Southwest.

Where Do the Cattle Come From in Mexico?

Chihuahua, Coahuila, Durango, Nuevo Leon, and Tamaulipas are the most common states of origin for Mexican cattle entering the United States. Cattle coming from Chihuahua, Coahuila, and Durango predominate at the New Mexico and West Texas ports. Coahuila, Nuevo Leon, and Tamaulipas are the primary sources of cattle entering at the Central and East Texas ports. Sonora is assumed to be the primary state of origin for cattle entering through the Arizona ports.

Across all the ports, the cattle are primarily English (Hereford and Angus), mixed English or other mixed European breeds, with some Brahma and English crosses (such as Brangus). Cattle buyers at the Santa Teresa port have found that the English crossbreeds are best able to acclimate to U.S. pastures and feedlots (Hudgens). The European breed animals are also able to withstand the hot and dry conditions, as well as extreme daily temperature variations that characterize the desert regions in Northern Mexico. These

animals are well suited for grain finishing in the United States, and produce beef that grades Select or better. Many of the Mexican feeder animals are the result of herd improvement programs using bulls and heifers (both registered and commercial) imported from the United States. For example, since the mid-1980s, over 9,000 animals for reproductive purposes have been exported from 52 New Mexico livestock breeders into Mexico (Telles; Segovia). The purebred animals have been primarily Charolais, but include Hereford, Red Angus, Black Angus, Limousin, Brangus, and other breeds.

The USDA-APHIS (specifically Veterinary Services) has the responsibility for collecting data at the border crossings for cattle by state of origin in Mexico. However, in past years the agency has not consistently gathered these data. The quality of data on Mexican state of origin also varies between ports. For instance, monthly data for 1994 – 1998 for the three functioning ports in Arizona (i.e., Nogales, Douglas, and San Luis) all report “unknown” for state of origin. Origin data have been more consistently maintained at the other ports.

In some cases (or lots of cattle destined for the United States), the recorded state of origin may be more accurately characterized as an area of concentration. Feeder cattle throughout the marketing regions in northern Mexico may be gathered by cattle buyers from several small producers, and exported to the U.S. in larger lots.

One other issue has been raised with respect to the origin of cattle crossing into the U.S. from Mexico. The Texas Animal Health Commission has been concerned with foreign cattle, not originating in Mexico, entering the United States through Mexico and being sold as Mexican cattle (Associated Press). These foreign cattle bring health risks not present in cattle of Mexican origin. In 1999, 5,000 head of Australian cattle bound for Texas and New Mexico feedlots were stopped at the Mexico-U.S. border and not allowed to enter the U.S. because they had not met quarantine requirements.

Where Do the Cattle Go Once Inside the United States?

In the early 1990s, some Mexican animals entered the U.S. for in-bond feeding in southern New Mexico or southwest Texas. This feeding arrangement required that the animals be returned to Mexico for slaughter. The in-bond animals were usually heifers because at that time they were not allowed to move beyond the bonded feedlot. At the current time, in-bond cattle feeding arrangements have almost disappeared (Telles).

No U.S. federal or state records are kept at the ports-of-entry as to the Mexican animals' final U.S. destinations. The Mexican cattlegrowers' associations that manage the livestock ports-of-entry keep copies of bills of lading for the cattle shipped from their facilities, but their data are not compiled and not generally available to the public. However, the states and areas most commonly mentioned by individuals familiar with cattle marketing at the New Mexico ports are the Texas Panhandle, northern Colorado, Oklahoma, northeastern New Mexico, Kansas, and California's Imperial Valley. Individuals working in or near the Texas ports-of-entry report Texas, Nebraska, southeastern Colorado, the Imperial Valley, Oklahoma, New Mexico, Kansas, and

Arizona as destinations for the imported cattle. Informants familiar with Arizona ports indicate that many of the cattle crossing at Nogales and San Luis remain in Arizona for feeding, but that cattle also go to California, West and Central Texas, and Oklahoma for feeding. These individuals also reported that cattle crossing into Arizona are sometimes destined for Idaho, South Dakota, and possibly Canada.

The Mexican feeder cattle are destined primarily for small grain pastures and backgrounding. The formula pricing mechanism at the border creates the incentive to bring the animals into the U.S. at weights suitable for pasturing or backgrounding. The heavier animals (weighing at least 500 pounds) go directly to feedlots. Winter small grain pasture conditions throughout the Great Plains region create a pull factor for the cattle imports, and when plentiful supplies of this forage are available, there is increased demand at the border for the lightest weight Mexican animals (i.e., 200-300 pounds).

Dissatisfaction with traditional marketing practices for their cattle sold at the U.S. border is leading several Mexican ranchers to explore alternatives. Some are electing to bring their smaller cattle into the U.S., retain ownership, and pay grazing fees themselves. Others are taking heavier cattle directly to U.S. feedlots, and either retaining ownership or selling the animals to the feedlots. Some of the regional *Uniones* are encouraging members to send their cattle at auctions in the U.S. and thus bypass cattle buyers working at the ports-of-entry. The *Union Ganadera de Chihuahua* is constructing an auction facility of its own on the U.S. side at the Santa Teresa, NM port. They plan to develop video or satellite marketing when their auction facility is completed. The Mexicans taking these steps are seeking to create more transparent marketing conditions and liquidity than currently exist. The formula pricing mechanism described above is a source of dissatisfaction for the Mexican cattlegrowers. The Mexicans also seek to reduce traditional market discrimination against their cattle based on the animals' "Mexican" origin. Given the inflow of U.S. breeding stock to Mexico in recent years, and the improvements in livestock quality there, many Mexican cattlegrowers are currently producing animals that are genetically of U.S. origin.

Factors Influencing Movements of Cattle from Mexico to the United States

An evaluation of the factors influencing the movement of feeder cattle from Mexico to the United States was recently undertaken upon the request of USDA-APHIS for the purpose of forecasting number of head imported by port several months in advance. The Veterinary Services agency of APHIS is examining cattle inspection services along the U.S.-Mexico border. The agency is currently seeking to improve the allocation of inspection services and personnel at the various ports-of-entry where cattle enter the United States. Any changes in the inspection system also will be carried out under limited budget conditions.

In 1999 APHIS requested a study of monthly live cattle imports from Mexico by port-of-entry, for the purpose of planning and allocation of resources. Simple econometric models were developed for the nine highest volume ports. The dependent variable in each model was number of animals imported monthly at each port for the period 1994 -

1999, with selection of independent variables based on individual port-of-entry characteristics, economic theory, and statistical significance. Results for each model are reported in Table 1.

The reported models were estimated over the period 1994 – 1998, with a 12-month lag in rainfall variables that reduced the data set used in estimation to the 1995 – 1998 post-NAFTA period. For each port model, relatively few explanatory variables were needed to achieve acceptable R^2 values. The ratio of nominal U.S. cattle prices to nominal Mexican cattle prices, both in dollars per hundredweight, was useful in seven of the nine models. The U.S. price used was monthly average medium #1 500-550 lbs Amarillo feeder steer price and the Mexico City slaughter price (in pesos). The dollar/peso exchange rate was incorporated into the explanatory variable with the transformation of the Mexico City price.

Rainfall variables were incorporated into the models relative to the most likely sources of cattle crossing into the U.S. at each port. Because pasture condition data are not available for Mexico, the rainfall variables functioned as proxy variables for grazing conditions. The rainfall variables used in each model were 12-months cumulative, and lagged. For example, the rainfall observation for January 1995 was the sum of rainfall over the period January 1994 through December 1994; while the rainfall observation for February 1995 was the sum of rainfall over the period February 1994 through January 1995. A linear trend variable was useful as an explanatory factor in several of the models, and was negative in every case. Monthly dummy variables were established for each model such that low volume months were set to be zeros, while higher volume months were coded as ones. The dummy variables served as intercept shifters.

As shown in Table 1, the final models were able to explain a relatively high degree of the variability in U.S. imports of Mexican feeder cattle at the nine ports-of-entry. R^2 values ranged from .73 to .91. The influence of relative cattle prices between the U.S. and Mexico is demonstrated, as is the influence of rainfall and seasonal patterns of cattle movements.

The effect of the relative U.S. and Mexican cattle prices is consistently positive, indicating that as U.S. prices increase relative Mexican prices (or Mexican prices decrease relative to U.S. prices), cattle crossings increase. Results for the precipitation variables were not consistently negative or positive. For instance, as rainfall in Chihuahua decreases, cattle crossings at both New Mexico ports (Columbus and Santa Teresa) increase (vice versa). This result reflects the common practice among Mexican cattle producers of herd liquidation in the face of drought conditions, and reduced cattle marketings when grazing conditions are better.

However, in the case of the Presidio port-of-entry, cattle crossings were found to be positively related to rainfall in Coahuila. The same result was found for rainfall in Sinaloa and Nogales. Increased rainfall is positively associated with increased cattle exports to the United States. This likely occurs due to larger calf crops and increased production as a result of improved forage availability. It is not known the extent to which

cattle producers in these states may import cattle from other parts of Mexico to take advantage of local forage resources, however, this may also be a factor in explaining the positive relationship between precipitation and increased cattle exports from the region.

For the San Luis and Douglas ports (both in Arizona), the price ratio variable was not useful in explaining imports of Mexican cattle. This result may reflect long-standing market relationships between buyers in the U.S. and Mexican cattle producers or brokers, or could be related to the geographic isolation (relative to large Mexican markets) of some Sinaloan and Sonoran producers.

As discussed above, the models reported here had good explanatory power, especially given the parsimonious nature of the models. The models were kept relatively simple because of the limited number of observations available, and because some explanatory factors which could be helpful are not available (e.g., pasture condition or drought indices). The signs of all estimated coefficients were consistent with economic theory, and/or not inconsistent with beef cattle production practices in northern Mexico. As a final verification of the models' goodness of fit, the sum of imports through all ports-of-entry was not greater than the total amount of imports during the estimation period.

The forecasting research aided in formalizing commonly held notions about the factors that influence imports of live cattle from Mexico into the United States. The research also provides a tool to predict and plan for future cattle movements, and for associated inspection and processing services at the ports-of-entry. The models were reestimated using data over the period 1994 – 1999, to forecast for 2000, and over the period 1994 – 2000 to forecast for 2001. The reestimated models were relatively stable and did not require significant redevelopment.

Concluding Remarks

The movement of feeder cattle from Mexico to the United States occurred in the pre-NAFTA period at magnitudes not notably different from those of the post-NAFTA years. There are long-established business relationships between cattle producers in Mexico, cattle brokers in the border region, and cattle buyers in the United States. In the course of this research, many instances were identified where the individuals involved in transborder cattle marketing have dual nationalities, or for whom the identification as a U.S. or Mexican national is an arbitrary classification. The cattle industry in the border region has experienced several generations of relatively free movement of people and animals across the international boundary.

Production conditions and practices in the border region's cattle industry are very similar between U.S. and Mexican ranchers. Some cattlegrowers (or their extended families) produce cattle in both countries. The cattle industry in northern Mexico has strong linkages to the U.S. beef and cattle sector – linkages that existed long before the advent of NAFTA, and which have endured political and economic upheaval, droughts, and impediments to export from both the U.S. and Mexican governments. Mexican feeder cattle will continue to enter the U.S. market, and the Mexican cattlegrowers will become

increasingly sophisticated in their production and marketing practices. However, Mexican cattle imports are unlikely to vary much from the patterns shown in Figures 1 - 4. The movement of feeder cattle from Mexico can be characterized as relatively steady, but affected by cyclical and seasonal events related to economic and climatological factors. Economic recovery and growth in Mexico could result in fewer exports of feeder animals and increased beef imports if consumption of beef in Mexico grows in concert with increasing affluence. Periodic economic turmoil in Mexico will continue to result in dramatic spikes in cattle crossings into the United States, such as that which occurred in 1995. Long-run uncertainty about the Mexican economy and limited local beef consumption will continue to preserve the position of the U.S. Southwest as the market of choice for cattle producers in Northern Mexico.

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Figure 1. Annual U.S. Live Cattle Imports from Mexico (1961 – 2000).

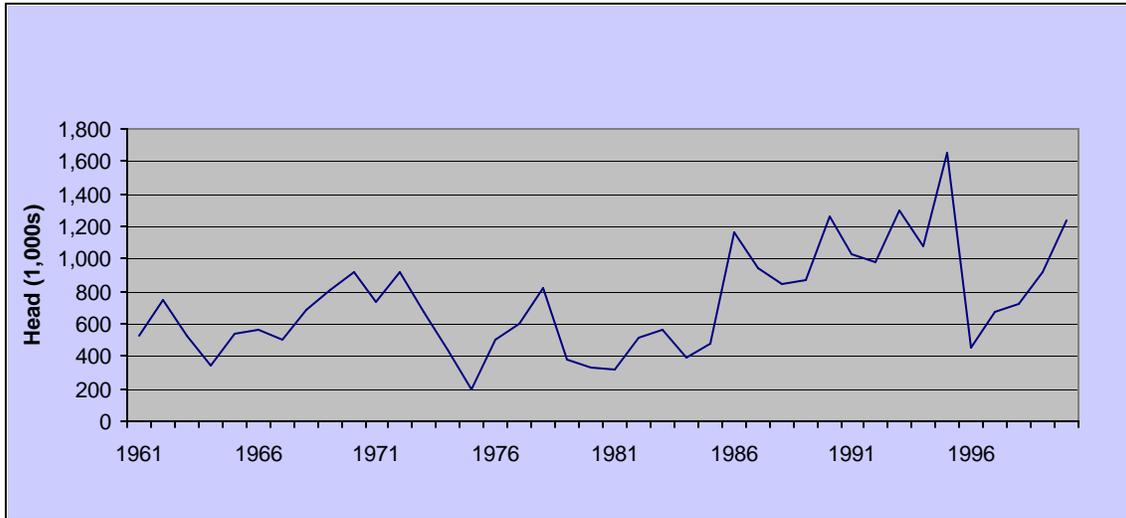


Figure 2. Cattle crossings by port – 2000.

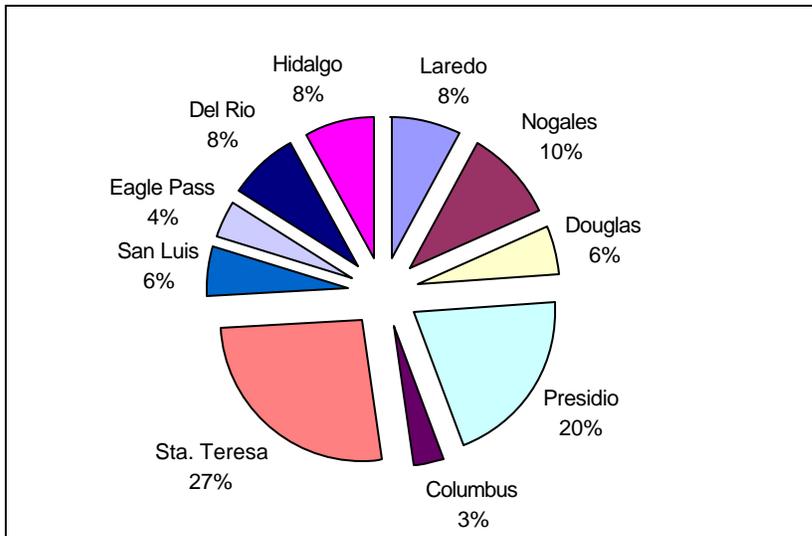


Figure 3. Monthly U.S. Live Cattle Imports from Mexico (1972 – 2000).

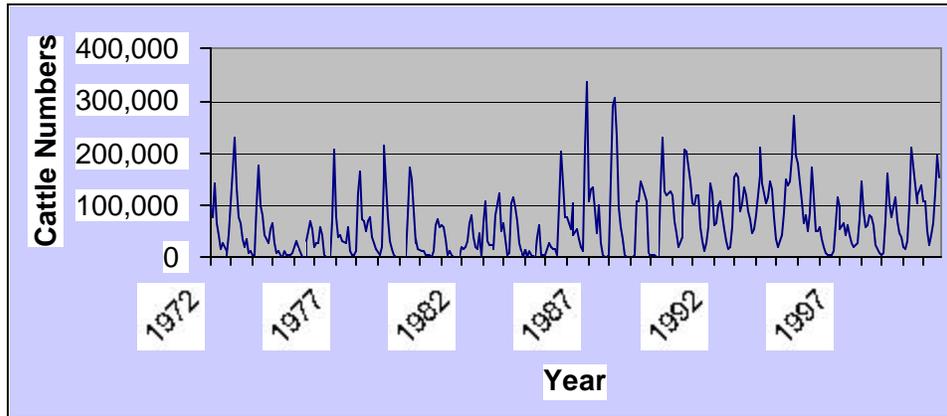


Figure 4. Cattle crossings by month – 2000.

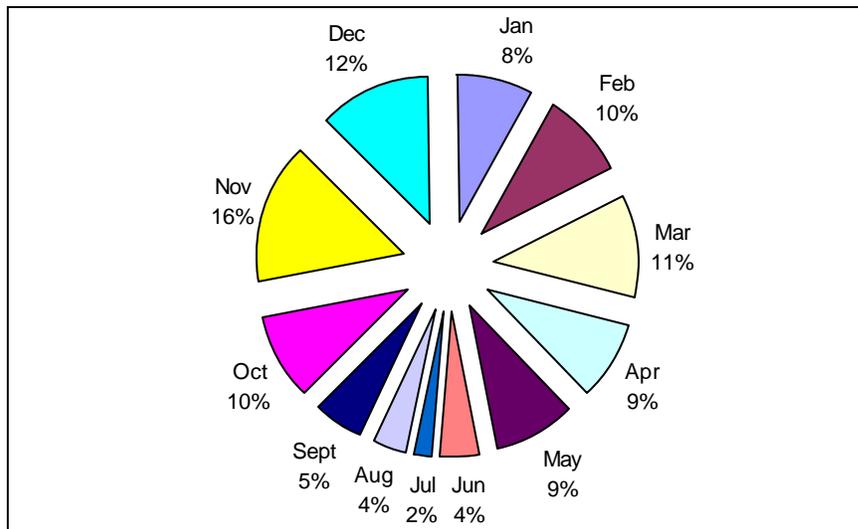


Table 1. Regression Model Results for U.S. Ports-of-Entry: Estimated Coefficients, *t*-statistics, and *R*² values.

	Columbus, NM		Del Rio, TX		Douglas, AZ		Eagle Pass, TX		Santa Teresa, NM		Laredo, TX		Nogales, AZ		Presidio, TX		San Luis, AZ	
Independent Variable	Estimated Coefficient	<i>t</i> -statistic																
Intercept	-3,440.80	-1.98	-13,824.00	-3.95	161.32	0.09	-10,644.00	-2.77	-37,083.00	-5.26	-20,804.00	-7.62	-10,505.00	-3.35	-35,529.00	-5.30	-2,455.19	-1.30
Price Ratio (US/Mex)	7,161.79	5.57	22,813.00	13.12	***	***	16,060.00	8.85	43,033.00	8.26	25,047.00	12.98	6,366.24	2.54	-35,529.00	6.91	***	***
Rain - Chihuahua	-11.79	-2.57	***	***	***	***			-27.59	-1.50	***	***	***	***	***	***	***	***
Rain - Coahuila	***	***	***	***	***	***	-10.83	-1.71	***	***	***	***	***	***	22.37	1.69	***	***
Rain - Durango	***	***	-11.33	-2.25	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Rain - Sinaloa	***	***	***	***	***	***	***	***	***	***	***	***	11.88	1.86	***	***	***	***
Rain - Sonora	***	***	***	***	10.55	3.18	***	***	***	***	***	***	***	***	***	***	14.09	-1.30
Trend	***	***	-165.53	-5.49	-91.15	-4.04	-100.01	-3.21	***	***	-170.42	-6.93	-71.31	-2.27	***	***	-52.74	-2.36
January	***	***	***	***	3,440.76	3.15	***	***	***	***	***	***	8,999.51	6.24	9,345.48	3.06	3,746.70	3.47
February	***	***	***	***	2,552.54	2.35	2,127.83	1.49	13,472.00	3.53	***	***	8,442.24	5.84	10,337.00	3.38	3,372.21	3.13
March	***	***	***	***	4,291.73	3.96	2,824.59	1.97	15,442.00	4.03	2,658.48	1.71	14,571.00	10.04	10,076.00	3.29	4,015.04	3.74
April	***	***	***	***	5,225.98	4.83	2,865.88	2.01	8,557.15	2.25	3,648.34	2.37	11,569.00	8.08	6,593.00	2.17	4,724.69	4.41
May	***	***	***	***	3,282.48	3.04	***	***	6,295.06	1.66	3,398.38	2.21	9,089.20	6.36	***	***	3,891.01	3.64
June	***	***	***	***	***	***	***	***	***	***	***	***	2,871.37	2.01	***	***	***	***
July	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
August	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
September	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
October	***	***	***	***	3,496.72	3.24	***	***	13,153.00	3.45	***	***	4,722.31	3.29	8,297.79	2.17	1,969.58	1.84
November	15,970.00	17.39	2,084.49	1.53	10,864.00	10.05	3,829.10	2.68	47,419.00	12.41	***	***	17,940.00	12.55	20,818.00	6.85	6,422.26	6.00
December	3,571.84	3.86	4,121.09	2.99	6,982.75	6.44	3,609.48	2.51	22,518.00	5.85	***	***	13,647.00	9.54	10,097.00	3.31	5,720.73	5.33
<i>R</i> ²	0.88		0.89		0.81		0.81		0.87		0.84		0.91		0.75		0.73	