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Abstract

Tuberculosis restrictions on animal movement have important implications for Mexican producers and consumers as well as the U.S. beef cattle industry. The restrictions cause decreased Mexican cattle exports, increased domestic fed beef production, and decreased fed beef imports. The Mexican beef industry incurs greater costs due to increased interregional cattle and meat shipments and changes in regional beef cattle production in Mexico.

Introduction

The Mexican economy has grown rapidly in the last fifteen years, with many implications not the least of which are changes in food consumption. Especially since the implementation of the North American Free Trade Agreement (NAFTA), Mexico has become increasingly modernized and urbanized. In addition to the changing laws of NAFTA, Mexicans' tastes and preferences have changed and the quantity of beef demanded has increased. In 2003, Mexicans consumed 18.13 kg of beef per person, an increase from 14.14 kg per person in 1993 (SAGARPA). These changes in demand along with NAFTA are sources of the changes in the domestic cattle industry, trade policies, and regional relationships within Mexico.

The Mexican Beef Cattle Industry

[§] Megan E. Cunningham, Graduate Research Assistant and Derrell S. Peel, Professor, Department of Agricultural Economics, Oklahoma State University. Presented as a Selected Paper for the Southern Agricultural Economics Association annual meeting, February, 2006, Orlando, Florida.

Mexico has three distinct production regions: the semiarid or arid region, the temperate region, and the tropical region. All three of these regions have very different cattle production practices due to their climate. The semiarid region is in the northern region of Mexico and is mainly desert scrubs or semi-arid grasslands. It receives an average of 7.9 to 31.5 inches of rain a year and experiences extreme temperature variations. Seventy percent of the region is used for beef production (Cockerham). Mainly European-breed crosses are produced, and exported to feedlots in the United States (Leuck and Link). The temperate region is in the central part of Mexico and has year-round warm, sunny days and cool nights. It has fertile soils and generally more than 24 inches of rain per year (Cockerham). Dual-purpose cattle farming is practiced in this area (Leuck and Link). The tropical region is located in the southern part of Mexico. This region can have as much as 141 inches of rain per year and the temperature depends upon the elevation (Cockerham). Zebu breeds and crossbreeds of cattle are predominantly raised in this area (Leuck and Link). Mexico's different regions cause producers to utilize very different types of cattle and production systems; the result is that economic factors affecting regional production and interrelationships have profound implications on trade.

Regional/International Trade and Animal Health

Regional movement of cattle within Mexico was limited before NAFTA. Traditionally, grass-fed beef was finished on pastures near cow-calf production and moved directly to slaughter and consumption in urban centers. A growing demand for fed beef means that more cattle are being moved from regions of cow-calf and stocker production to different areas for finishing in feedlots. Until recently, the central and southern regions have had little incentive to improve health status in cattle. One reason for this is that they are not a direct exporter. Another reason is that the cattle in these regions were generally grazed on pasture, slaughtered and consumed in

the same region they were born in (Leuck and Link). Recently the central and southern regions have seen incentives to move more cattle into intensive finishing systems. As income in Mexico has increased, total domestic demand for beef has increased in Mexico and preference for grain fed beef relative to grass-fed beef is growing (Peel 2003). Rapidly changing market dynamics and improved infrastructure is causing increased cattle trade between regions thereby increasing the possibility of contagious disease among herds, therefore increasing the need for implementation of health campaigns in Mexico.

NAFTA has allowed easier entry of live cattle from Mexico into the United States (Skaggs, et. al.). Herd health varies widely in the different production regions of Mexico as demonstrated by the fact that the USDA maintains different zones, which affect acceptability of cattle from different regions due to prevalence of diseases, such as tuberculosis. In general the northern region of Mexico has had a higher level of health status than the central and southern regions of Mexico. The most important disease affecting regional and international movements of feeder cattle is tuberculosis. There are basically four health status zones for tuberculosis. Zone A, which consists of the state of Sonora, is considered to be tuberculosis free. The states in Zone B, which is comprised of mostly northern states, requires that each animal moved have an individual negative tuberculosis test, a Certificate of Herd of Origin of Cattle endorsed by SAGARPA, and official identification to export to the United States. Herds in Zone C are required to have everything that Zone B's herds are required to have plus a herd of origin negative tuberculosis test, an Import Permit Application endorsed by SAGARPA, and a Lot of Origin Certificate to be exported to the United States. Those cattle in Zone D are not allowed to cross the Mexican-American border, due to the extreme levels of tuberculosis in this area (USDA, March 2002).

Mexico's regional health campaigns tend to duplicate those set by the USDA, because of the desire for the northern states to export cattle to the United States. This desire has caused the northern region to have more economic incentives to maintain higher levels of health status than the southern and central regions (Hayes). As a result of increased disease concern in the U.S., health requirements to export cattle to the U.S. have become stricter. Increased understanding in all these issues will be beneficial to producers, industry leaders, and policy makers in both the United States and Mexico. To begin to address the problem of disease risk due to regional cattle trade within Mexico one needs to understand the trading patterns.

Most of the grain production and cattle feedlot industry is in Mexico's northern region. As demand grows for grain-fed beef, northern feedlots are feeding more southern cattle for the growing domestic market, increasing interregional cattle movement. Increased movement of cattle from the central and southern regions into the northern region jeopardizes the bovine health status of the northern region and its ability to export. More stringent regional trade restrictions may reduce the ability of Mexico to meet domestic demand for fed beef and raise the cost of producing and feeding cattle in regions less optimal for these activities.

Objective and Procedures

GANAMEX, a regional linear programming model of the Mexican beef and cattle industry will be used to analyze regional restrictions on animal movement and exports (Peel 2001). The model will be used to represent the structure of the current cattle and beef industry in a benchmark scenario which can then be compared to an alternative scenario which represents animal source restrictions due to different animal health status in certain regions.

Linear programming was chosen for its ability to represent different production systems in detail, to understand the impacts of resource limitations and how they are affected by changing

market conditions, to represent regional differences, to analyze impacts of changes in isolation of specific factors, to analyze scenarios of hypothetical situations, and to overcome limitations in data availability or quality.

The objective function minimizes the cost of providing a quantity of beef consumption in the Mexican market. It sums of all activities and multiplies them by the cost per unit associated with the activity. Then it chooses the level of the activities that minimizes the cost from the possible alternatives. The activities include production, processing, transportation, and trade activities. When the objective function is minimized the activities contain the solution for the model given a set of circumstances.

This model is disaggregated into nine production regions (P1-P9), ten feedlot regions (F1 – F10), and seven beef consumption regions (C1-C7). The appendix table includes the regional composition of production, feedlots and consumption. There are four types of cattle, which the model can choose to produce: Northern Cattle, Semi-Intensive, Traditional, and Criollo. Weaned calves are grown in either an extensive or intensive grazing (stocker) program and then either finished in the feedlot or finished with supplementation on pasture to produce fed beef, or finished on pasture to produce grass-fed beef. The finishing program used determines the type of meat produced. The model includes four different types of meat including: M1 meat, which is highly finished and is equivalent to American fed beef; M2 meat, a less finished fed beef; M3, grass-fed beef; and M4 meat, which is meat from cull cows and bulls. The model includes trade activities including exports of calves and feeder cattle; exports of rodeo cattle; imports of M1 and M2 fed beef; imports of cull cows for slaughter; exports of cull cow beef; imports of Central American calves and feeder cattle.

The constraints represent the capacity or availability of resources and how the market activities are linked. There are two types of constraints in the GANAMEX model: inequality constraints whose right-hand-side values represent resource capacity and availability and equality constraints whose right-hand-side values equal zero. Those that represent resource capacity are for forage availability and feedlot capacity. Constraints that equal zero are balance equations, which enforce linkages in related production and processing activities, and to track flows of product between regions.

Activities and constraints are linked by technical coefficients that represent the productivity and input requirements of the production activities. A complete list of activities, constraints, and parameters included in the GANAMEX model are in the appendix.

The data used in the GANAMEX model comes from official governmental data and publications, scientific literature, and industry information. Governmental sources are from Mexican federal and state sources, the USDA and other governmental sources. The Mexican Government data sources used are the Department of Agriculture (SAGARPA), The Bureau of Statistics (INEGI), The Secretary of Natural Resources (SEMARNAT), and The Mexican Import/Export Bank (BANCOMEXT).

Benchmark Model

As a benchmark, the GANAMEX model is configured and validated to approximately represent the situation in 2005. In particular, international trade values for cattle and meat reflect market values in 2005. The GANAMEX model depends critically on specified levels of beef consumption in Mexico. An overall national average level of beef consumption of 16.75 kilograms per capita is specified. The profile of beef consumption is specified as 44.8 percent fed beef (consisting of 12.1 percent M1 and 32.7 percent M2), 35.4 percent grass-fed beef and

19.8 percent cull beef. Both total beef quantity and the profile of meat consumption vary across consumption regions in the GANAMEX model. For example, specified total per capita beef consumption varies from 20.93 kilograms in the C3 region (Monterrey) to 11.73 kilograms in the C6 region (Veracruz). Selected results from the benchmark model are found in Tables 1 – 8.

Scenario: Tuberculosis Restriction on Domestic and International Movement of Feeder Cattle

This paper presents the results of initial analysis of the economic impacts of TB related restrictions on animal movements in Mexico. Although, USDA and the Mexican Government recognize several zones of TB health status, this preliminary analysis designates each of the nine production regions in Mexico as either TB-unrestricted or TB-restricted. TB-restricted regions are not permitted to ship calves or stocker animals into TB-unrestricted regions nor are they permitted to export calves or feeder cattle. TB-unrestricted regions can ship to other TB-unrestricted regions as well as to TB-restricted regions. All exported calves or feeder cattle must originate in TB-unrestricted regions. The TB-restricted zones are permitted to ship feeder cattle to all Mexican feedlot regions as it is assumed that those animals will proceed directly to slaughter without commingling with pasture animals in TB-unrestricted regions. Results presented in Tables 1-8 for the TB-restricted scenario are based on TB-unrestricted designations for regions P1NO and P2NE. This area includes all of the Mexican states that border the U.S. (see Appendix Table). Production regions P3 – P9 are treated as TB-restricted. It should be remembered that the TB scenario assumes no changes in domestic beef consumption by quantity or quality. Thus the scenario model provides consumers with exactly the same quantities of meat for each quality type. All production and trade changes in the model therefore either represent the direct impact of the TB restrictions or the indirect impacts of changes needed to minimize the cost of providing the same level of consumption as in the benchmark model.

Results

The TB restrictions produce a variety of direct and indirect impacts on domestic beef production and Mexican cattle and beef trade (Tables 1-8). In general, the direct impacts of the restrictions are relatively small and limited to specific regions. However, the indirect effects are much more widespread in terms of magnitude and regional impacts. It should be remembered that linear programming solutions have a tendency to overstate impacts and therefore results should be viewed as tendencies and in the case of the GANAMEX model, must be interpreted as long run impacts after the industry has sufficient time to adjust production systems in response to changes caused by the scenario.

National and Regional Production and Trade Impacts

Table 1 presents national aggregate impacts due to the scenario. The most dramatic impacts apparent in Table 1 are a significant reduction in cattle exports and a significant increase in Mexican feedlot production of fed beef, which leads to reduced Mexican beef imports. One of the most significant direct impacts of the TB-restrictions is decreased calf exports. In the benchmark model, total calf exports were 1.2 million head of which 353,000 head originated in the P3 region, which includes the states of Durango, Zacatecas, and San Luis Potosi. Moreover, calves and stocker cattle were not allowed to move from region P3 into regions P1 and P2 in the scenario, which represents an additional direct impact of the TB restrictions (Table 4). This caused regions P1 and P2 to attempt to make up for the loss of those exports with limited increases in exports, but they could not fully make up for the loss and total cattle exports decreased by 29 percent. Reduced cattle exports in the TB scenario means that more cattle are available for domestic meat production. Domestic production of M2 fed beef increased by 20

percent as a result of the 19 percent increase in feedlot production. Total domestic meat production in Mexico increased by 5 percent in the scenario (Table 1).

Total cow numbers decreased slightly in the TB scenario, while stocker numbers increased by 6 percent and cattle finished on grass increased nearly one percent. The total calf crop decreased by almost 2 percent, more than the decrease in cow numbers. Because the model minimizes total cost, the model will utilize lower quality cows, which are less costly but less productive, whenever possible. Since consumption has remained the same, the reduced calf crop is an indication that lower quality cattle are being produced, which produce less meat per head and requires more head of cattle to meet consumption requirements. The decrease in calf crop is the result of the model choosing lower quality cows since there is less emphasis on high quality cattle for export. The number of animals finished on grass increased slightly for the same reason; because it takes more of the smaller lower-quality animals to produce the same quantity of grass-fed beef. Regional shifts in cow, stocker and grass-finished animal production are more dramatic than the national totals. Table 3 shows that all regions except the Yucatan have changes in cow inventory ranging from an increase of 42 percent in region P4 to a decrease of 25 percent in region P3.

Overall, production region P3 has the most significant changes and is the only region directly affected by the TB restrictions. In this region cow production decreased by 25 percent, while stocker production increased by 96 percent and grass-finished production increased by 213 percent, causing a 15 percent total increase in cattle production. The 25 percent decrease in cow production is caused by the inability for region P3 to export calves and ship calves and stocker cattle to regions P1 and P2. Regions P1 and P2 are producing more cattle in order to export to the United States. Cow production in region P4 increased by 42 percent along with a 61 percent

increase in stocker production but grass-finishing decreased to zero in the region (Table 3).

Region P9 was unaffected by the imposed restriction, which can be explained because it is the most southern region and does not produce cattle for export.

Interregional Mexican Cattle Shipments for Stocker and Grass-fed Production

The GANAMEX model specifically tracks shipments of calves and stocker cattle between production regions and the TB restrictions pertain directly to limitation in these shipments. Table 4 shows total shipments of calves and stocker cattle between production regions. Implementation of TB restrictions causes P3 to decrease cattle shipments to other regions by 49 percent. Shipments ceased to region P2 because cattle are not allowed to be shipped into production regions P1 and P2 from other Mexican regions. However, region P3 begins shipping significant numbers of feeder cattle to region P5 as a result of the TB restrictions. Region P1 increased shipments to region P2 by 32 percent. Region P7 increased shipments to region P6 by 26 percent while region P8 decreased shipments to region P6 by 32 percent.

Feeder Cattle Shipments to Feedlots

The TB restrictions have significant impact on the quantity of feedlot production, regional location of feedlot production and shipments of feedlot cattle despite the fact that the restrictions do not directly affect feedlot production at all. Total feedlot production increased by 20 percent and cattle feeding shifts from feedlot region F1 to feedlot region F4 (Table 2). Feedlot production in region F1 is decreased by 18 percent with TB restrictions. Region P1 ceased to ship cattle to region F2 and reduced shipments to region F1 by 18 percent. Region P2 increased shipments to region F2 by 35 percent, and stopped shipping cattle to region F6 while continuing to supply region F2. Region P4 began shipments to region F4 and increased

shipments to region F5 by 36 percent. Region P5 greatly increased feedlot shipments to region F4 by over 253,000 head. Production region F8 increases shipments to feedlot region F9 by 15 percent.

Fed Beef Shipments

Changes in total feedlot production quantity and location also impact shipments of fed beef in the TB scenario. All fed beef in the GANAMEX model is assumed to be processed in federally inspected (TIF) slaughter plants and can be shipped to any consumption region. These shipments are reported in Table 6. Feedlot region F1 is producing less meat and shipping less meat to consumption region C1, which means that C1 has to get it from somewhere else. Feedlot region F4 is sending 532 percent more meat to consumption region C1, which makes sense because F4 becomes the main producing feedlot region in the TB scenario. Feedlot region F3 started to send all of its meat to consumption region C5 and ceased shipments to consumption region C6. Region C6 began receiving meat from feedlot region F9, which is producing 16 percent more M2 meat to satisfy consumption in region C6. Feedlot region F5 is sending the majority of its meat to consumption region F5 and reduced shipments to consumption region F4 by 82 percent, forcing consumption region C4 to get meat from feedlot region F4. Consumption region C5 has increased consumption of domestically produced M2 meat by 52 percent, causing M2 meat imports to this region to decrease by 61percent.

Grass-Fed and Cull Beef TIF Shipments

Grass-fed (M3) and cull cow beef (M4) are grazing based and are produced in production regions. The GANAMEX model includes two slaughter types that can be utilized with M3 and M4 meat. If the meat is consumed in the region of production as local consumption, the model can utilize local slaughter, which is cheaper than federally inspected slaughter (TIF). However,

if the meat must be shipped to other consumption regions, the meat must be processed in a TIF (federally inspected) plant. TIF slaughter is more expensive because of the additional regulatory requirements and use of refrigerated storage and meat shipment technology. This section discusses only TIF production and shipment of M3 and M4 meat (Table 7) and all other M3 and M4 consumption is assumed to occur as local consumption. In the benchmark model 94 percent of M3 meat and 72 percent of M4 meat is consumed as local production. M3 and M4 meat shipments to consumption region C3 increased by 62 percent, which was spurred by the decline in local M3 and M4 production. Shipments to consumption region C5 declined by 41 percent, which was the result of an increase in local M3 and M4 production causing demand for shipments of this type of meat to decline. Production region P8 reduced shipments by 47 percent and local M3 and M4 meat production is remaining constant, which indicates that more cattle are being sent to feedlots or shipped to other regions as stockers or to feedlots. Production region P9 is shipping 81 percent less M3 and M4 meats to consumption region C5 and started shipping to consumption region C3, resulting in a 70 percent decrease in total M3 and M4 shipments from the region.

Meat Imports

Total Mexican imports of fed beef change as an indirect result of the TB restriction due to the induced changes in domestic beef production in Mexico. Both the level of imports and the pattern of imports by the various consumption regions is impacted by the TB scenario (Table 8). M1 meat imports are unaffected by the TB restrictions, this is because M1 meat consumption has not changed, and all of the M1 meat was being imported to begin with. M2 meat imports decreased by 25 percent indicating that there is more M2 domestic production because of the new restrictions. Decreased M2 imports represents a 13 percent decrease in total (M1 + M2) fed

beef imports. Most of the regional impact is a 35 percent reduction in M2 beef imports into the C5 region. This region covers the central part of Mexico, including Mexico City, and represents over 47 percent of total beef consumption in the GANAMEX model. Table 8 also indicates a 21 percent increase in fed beef imports in the C6 region.

Implications for Further Work

This results presented here are preliminary. The tuberculosis zones need to be modified into several different zones, and production regions may be altered slightly in the future.

Additional scenarios will be considered, which restrict different regions of Mexico and release restrictions on others in order to further understand regional trade and the effects of restrictions on production. Tuberculosis is only one health concern in Mexico; there are other diseases of concern including reproductive illnesses like brucellosis. Various regionalization scenarios may be considered with respect to other health issues. This approach could be applied to other illnesses with alteration of the infected and uninfected zones. Another issue that will be addressed in future research includes restrictions on shipments to feedlots or other production related health impacts. In all cases, international trade will be considered, to see how regional trade restrictions affect international trade.

Summary

The results presented here confirm that animal health related restrictions on animal movement have important implications for Mexican producers and Mexican consumers as well as the U.S. beef cattle industry and Mexico's other international cattle and beef trading partners. The TB restrictions considered here result in a 29 percent decrease in Mexican cattle exports, which obviously represent considerable lost value to Mexican producers. Limited access to international markets results in an increase in domestic beef production in Mexico. Mexican fed

beef production increases by 20 percent, which represents a 5 percent increase in total domestic beef production. As a result of increased domestic fed beef production, Mexican imports of fed beef decrease by 14 percent, reducing Mexico's reliance on imported meat from 26.6 percent of total beef consumption to 23 percent of total beef consumption. The U.S. (and likely Canada) would be impacted by this loss of beef exports to Mexico.

The Mexican beef industry becomes less efficient and thus incurs more costs as a result of the TB restrictions. This is indicated by the fact that total cattle and total meat shipments increase although shipments of M3 and M4 meat decrease as production is shifted to permit more local production of those meat types. However, because the TB restrictions effectively reduce Mexico's ability to participate in international cattle markets, the overall cost of meat production in Mexico is reduced. In other words, because Mexican producers lose the value of exports and make more cattle available to the domestic market, the overall cost of meeting the consumption requirements in Mexico is reduced in the TB scenario. Likewise, the Mexican cattle feeding industry, which has to compete with the U.S. market for feeder cattle, benefits from the TB restrictions and the result is a significant increase in feedlot production in Mexico. Moreover, the results indicate that the TB restrictions imply a wide variety of relatively subtle changes in the level and types of beef cattle production in many regions in Mexico.

Table 1. National GANAMEX Model Results.

	Benchmark	TB Restricted	% Change
Cows ¹	8596958	8563307	-0.39
Stockers ¹	4210673	4479064	+6.37
Grass-Finish ¹	2856633	2873380	+0.59
Feedlot ¹	1253754	1497044	+19.40
Calf Crop ¹	5190255	5104782	-1.65
Calf Crop %	60.4	59.6	
Total Slaughter ¹	5394360	5665888	+5.03
Fed Beef ²	305658	366952	+20.05
Grass-Fed Beef ²	594302	594302	0.0
Cull Beef ²	332738	332738	0.0
Total Domestic Beef Production ²	1232698	1293992	+4.97
Total Beef Consumption ²	1679733	1679733	0.0
Beef Imports ²	447035	385742	-13.71
Imports as % of Total Consumption	26.6	23.0	
Cattle Exports ¹	1156822	826034	-28.59
Total Harvest ³	6551182	6491922	-0.90

¹Head

²Metric Tons

³Slaughter + Cattle Exports, Head

Table 2. GANAMEX Model Feedlot Production, Head.

Feedlot Region	Benchmark	TB Restricted	% Change
F01NW	327176	270975	-17.18
F02LA	150000	150000	0.0
F03NE	312500	312500	0.0
F04PA	17512	313569	+1690.60
F05CO	300000	300000	0.0
F06HA	87500	87500	0.0
F07ME	0	0	0.0
F08VE	25000	25000	0.0
F09TB	21567	25000	+15.92
F10YU	12500	12500	0.0
Total	1253755	1497044	+19.40

Table 3. GANAMEX Model Regional Cattle Production, Head.

Region	Cows	Stockers	Grass-Finished	Total
P1NO	B 1807097 R 1848535 +2.29 %	B 500801 R 416564 -16.82 %	B 142454 R 156748 +10.03 %	B 2450352 R 2421847 -1.16 %
P2NE	B 575616 R 597277 +3.76 %	B 520716 R 520209 -0.10 %	B 69948 R 47305 -32.37 %	B 1166280 R 1164791 -0.13 %
P3ME	B 1065348 R 794548 -25.42 %	B 213857 R 418978 +95.92 %	B 129961 R 406910 +213.10 %	B 1409166 R 1620436 +14.99 %
P4CO	B 887779 R 943923 +6.32 %	B 945826 R 972568 +2.83 %	B 700145 R 603800 -13.76 %	B 2533750 R 2520291 -0.53 %
P5PA	B 323113 R 457584 +41.62 %	B 171773 R 276307 +60.86 %	B 150826 R 0 -100.00 %	B 645712 R 733891 +13.66 %
P6SS	B 193137 R 186416 -3.48 %	B 323468 R 323468 0.0 %	B 984138 R 979456 -0.48 %	B 1500743 R 1489340 -0.76 %
P7VE	B 1550324 R 1584808 +2.22 %	B 672129 R 601127 -10.56 %	B 0 R 0 0.0 %	B 2222453 R 2185935 -1.64 %
P8SU	B 1409276 R 1364947 -3.15 %	B 541529 R 629268 +16.20 %	B 382710 R 382710 0.0 %	B 2333515 R 2376925 +1.86 %
P9YU	B 785267 R 785267 0.0 %	B 320574 R 320574 0.0 %	B 296451 R 296451 0.0 %	B 1402292 R 1402292 0.0 %
Total	B 8596957 R 8563305 -0.39 %	B 4210673 R 4479063 +6.37 %	B 2856633 R 2873380 +0.59 %	

B = Benchmark, R=TB Restricted

Table 4. GANAMEX Model Feeder Cattle Shipments Between Production Regions, Head.

Source	Destination	Benchmark	TB Restricted	% Change
P1NO	P2NE	496052	655124	+32.07
P3ME	P2NE	167986	0	-100.00*
P3ME	P5PA	0	84993	
P7VE	P6SS	553101	695934	+25.82
P8SU	P6SS	438535	297742	-32.11
Total	Total	1655674	1733793	+4.72

*Shipments directly limited by TB restrictions.

Table 5. GANAMEX Model Feeder Cattle Shipments From Production to Feedlot, Head.

Source	Destination	Benchmark	TB Restricted	% Change
P1NO	F01NW	307176	250975	-18.30
P1NO	F02LA	39463	0	-100.00
P2NE	F02LA	110537	150000	+35.70
P2NE	F03NE	312500	312500	0.0
P2NE	F06HA	17316	0	-100.00
P3ME	F05CO	79386	0	-100.00
P4CO	F04PA	0	42788	
P4CO	F05CO	220614	300000	+35.98
P5PA	F04PA	17512	270781	+1446.26
P7VE	F06HA	70184	87500	+24.67
P7VE	F08VE	25000	25000	0.0
P8SU	F09TB	21567	25000	+15.92
P9YU	F10YU	12500	12500	0.0
Total	Total	1233755	1477044	+19.72

Table 6. GANAMEX Model Fed Beef Shipments from Feedlot to Consumption Regions, Metric Tons.*

Source	Destination	Benchmark	TB Restricted	% Change
F01NW	C1NW	76808	63615	-17.18
F02LA	C5CE	38095	39124	+2.70
F03NE	C5CE	79051	81508	+3.11
F03NE	C6GO	2457	0	-100.00
F04PA	C1NW	2478	15672	+532.38
F04PA	C4TP	1633	59578	+3548.85
F05CO	C4TP	70428	12483	-82.28
F05CO	C5CE	0	57945	
F06HA	C6GO	20841	20542	+1.44
F08VE	C6GO	5869	6179	+5.28
F09TB	C6GO	0	806	
F09TB	C7YU	5063	5063	0.0
F10YU	C7YU	2935	2935	0.0
Total	Total	305658	365448	+19.56

All shipments of fed beef are TIF (federally graded).

Table 7. GANAMEX Model Combined Grass-fed and Cull Beef Shipments from Production Regions to Consumption Regions, Metric tons.*

Source	Destination	Benchmark	TB Restricted	% Change
P1NO	C3NE	7781	7221	-7.19
P1NO	C4TP	35411	37041	+4.60
P7VE	C5CE	39499	41923	+6.14
P8SU	C5CE	2637	1407	-46.65
P9YU	C3NE	0	5416	
P9YU	C5YU	45311	8346	-81.58
Total	Total	130638	101353	-22.42

*Shipments of TIF (federally graded) meat only. Does not include local production.

Table 8. GANAMEX Model Mexican Fed Beef Imports by Consumption Region, Metric Tons.

Consumption Region	Benchmark	TB Restricted	% Change
C1NW	28543	28543	0.0
C2NC	75269	75269	0.0
C3NE	139694	139694	0.0
C4TP	13345	13345	0.0
C5CE	178066	116636	-34.50
C6GO	7675	9315	+21.37
C7YU	4443	4443	0.0
Total	447035	387245	-13.37

Appendix Table: GANAMEX Model Production, Feedlot, and Consumption Regions

PRODUCTION REGIONS Designation:Name (Key City)	FEEDLOT REGIONS Designation:Name (Key City)	CONSUMPTION REGIONS Designation:Name (Key City)
P1NO: NORTH (Chihuahua) Baja Cal., Baja Cal. Sur, Sonora, Chihuahua	F01NW: NORTHWEST (Mexicali)	C1NW: NORTHWEST (Hermosillo) Baja Cal., Baja Cal. Sur, Sonora, Sinaloa
P2NE: NORTHEAST (Monterrey) Nuevo Leon, Tamaulipas	F02LA: LA LAGUNA (Torreon)	C2NC: NORTH CENTRAL (Chihuahua) Chihuahua, Durango, La Laguna Region
P3ME: MESA (Zacatecas) Durango, Zacatecas, San Luis Potosi, Aguascalientes	F03NE: NORTHEAST (Monterrey)	C3NE: NORTHEAST (Monterrey) Nuevo Leon, Tamaulipas, Coahuila
P4CO: CORDILLERA (Guadalajara) Queretero, Hidalgo, Puebla, Tlaxcala, Mexico, Morelos, Guanajuato, Jalisco, Michoacan	F04PA: PACIFIC (Culiacan)	C4TP: TAPATIO (Guadalajara) Nayarit, Jalisco, Aguascalientes, Colima, Guanajuato, Zacatecas
P5PA: PACIFIC (Culiacan) Sinaloa, Nayarit	F05CO: CORDILLERA (Guadalajara)	C5CE: CENTRAL (Mexico City) San Luis Potosi, Queretero, Hidalgo, Puebla, Mexico, Michoacan, Tlaxcala, Guerrero, Oaxaca, DF
P6SS:SOUTHERN SIERRA (Oaxaca) Colima, Guerrero, Oaxaca	F06HA: HUASTECA (Tampico)	C6GO: GULF (Veracruz) Veracruz, Tabasco, Chiapas
P7VE: VERACRUZ (Veracruz) Veracruz	F07ME: MESA (San Luis Potosi)	C7YU: YUCATAN (Merida) Campeche, Yucatan, Quintana Roo
P8SU: SOUTH (Villahermosa) Chiapas, Tabasco	F08VE: VERACRUZ (Veracruz)	
P9YU: YUCATAN (Merida) Campeche, Yucatan, Quintana Roo	F09TB: TABASCO (Villahermosa)	
	F10YU: YUCATAN (Merida)	

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