A Policy Model for the Livestock and Poultry Sectors of Mexico

Chad Barrett and Jacinto E. Fabiosa

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Center for Agricultural and Rural Development
Iowa State University
Ames, IA 50011-1070

and

Food and Agricultural Policy Research Institute
Iowa State university
Ames, IA 50011-1070

Chad Barrett is a CARD graduate research assistant: and Jacinto Fabiosa is a CARD/FAPRI assistant scientist.

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A POLICY MODEL FOR THE LIVESTOCK AND POULTRY SECTORS OF MEXICO

Geographic, demographic, economic, and political factors help to make Mexico a potentially major player in the world livestock and poultry product markets in the next decade. Mexico has 20 percent of the population of the United States but only 6 percent of the arable land mass of the United States (Hadwiger and Lee 1994). It should be noted, however, that irrigation practices could increase Mexico's land mass by as much as 30 percent. This, combined with increasing demand for meat, particularly from the growing middle class, makes it likely that Mexico will play a major role in the international livestock and poultry markets.

Two important demographic factors contribute to strengthening Mexico's demand for meat products. First, more than 50 percent of Mexico's citizens are below 25 years of age. This fact favors Mexico's trend toward more imports because younger generations are more willing to try imported products. Second, 39 percent of the population has monthly household income of more than $500 per month. This group of more than 35 million people are considered to be potential customers for meat products. Furthermore, Mexico's participation in world markets is expected to expand as its government directs its programs and goals toward stimulating agricultural exports as a way for Mexico to acquire development capital (Hadwiger and Lee 1994). Finally, Mexico's signing of the North American Free Trade Agreement (NAFTA), which phases out and eliminates many agricultural tariffs and quotas among Canada, Mexico, and the United States, will hasten Mexico's integration into the world market.

NAFTA eliminated import duties of 25 percent for frozen beef and 20 percent for chilled beef on January 1, 1994. This agreement also phases out import tariffs by 2 percent per year for beef variety meats and all pork products, allowing free trade with NAFTA countries by 2003. Indeed, the Food and Agricultural Policy Research Institute (FAPRI) baseline projects that Mexico will be a strong importer of beef, pork, and poultry over the next decade (FAPRI 1998). FAPRI projects that Mexico will import

450 thousand metric tons of beef, 57 thousand metric tons of pork, and 288 thousand metric tons of poultry by 2007.

This report documents the development of the FAPRI model of Mexico's livestock and poultry sectors. Beef and cattle, swine and pork, and broilers are the sectors included in this model. This model is used in conjunction with the other country models in FAPRI's international livestock and poultry modeling system to analyze the impacts of agricultural policy changes.

The next section of this report provides a brief overview of Mexico's livestock and poultry sectors, followed by a description of the model's structure, specification, estimation, and validation. This document then presents some of the results from the 1998 FAPRI baseline and concludes with a comparison of the new FAPRI Mexico model to the previous FAPRI Mexico model.

Mexico's Livestock Sectors

Beef and Cattle

Beef is still considered a semiluxury commodity that is consumed mostly by the middle- and upper-income households in Mexico. Per capita consumption of beef in Mexico has remained very stable at approximately 20 or 21 kg/person on a carcass basis since 1991 (FAPRI 1998). This is considerably lower than the U.S. average of 30.5 kg/person on a retail basis over the same period (FAPRI 1998).

Pastures conducive to cattle production comprise nearly 60 percent of Mexico's total agricultural land. Beef production is evenly distributed among the northern, central, and southern regions, which produce 34, 36, and 30 percent of Mexico's beef, respectively (Bierlen and Hayes 1994). Table 1 provides inventory figures, production rates, shares of slaughter, and supply and demand figures for Mexico's cattle-beef sector for 1985 through 1997. Mexico's total cattle inventory averaged 33.62 million head between 1985 and 1990. This average inventory fell to 29.52 million head between 1991 and 1997. Mexico's other cattle inventory accounted for this decline, as its average dropped from 19.56 million head to 15.27 million head over this period. At the same time, the beef and dairy cow inventories increased only slightly to 12.15 million beef cows and 2.10 million dairy cows. Increased other cattle slaughter rates contributed to

the decline in cattle inventory. Prolonged drought and increased feed and veterinary costs also have driven down Mexican cattle inventories. Mexico's calving rate has averaged .65 calf per cow per year since 1985. This is very low compared to the U.S. calving rate of .90.

Mexico is the largest exporter of feeder cattle to the United States. In fact, Mexico supplies the United States with 75 to 90 percent of all of its feeder cattle imports (USDA/ERS 1997). Mexico's cattle producers in the northern region specialize in cow/calf production to fulfill the demand for feeder cattle in the U.S. market (USDA/FAS 1997a). After being exported to the United States, the feeder cattle are fattened on corn rations in feedlots until ready for slaughter. Mexico is also the number one export market for live cattle from the United States because many of these fattened animals are exported back to Mexico for slaughter, and also because Mexico imports many breeding animals from the United States (USDA/FAS 1997b). The cattle trade figures in Table 2 illustrate this flow of animals. In 1996, Mexico exported nearly 460,000 head of cattle to the United States and also imported nearly 186,000 head from the United States.

Mexican imports of beef from countries other than the United States are limited due to high tariffs placed on non-NAFTA countries. For example, frozen beef imports from the European Union are subject to 45.7 percent countervailing duties in addition to a 25 percent tariff (USDA/FAS 1997a). Mexico and Argentina, however, have signed a sanitary agreement and are currently negotiating to declare certain areas of Argentina as foot and mouth disease (FMD) free (USDA/FAS 1997a). This agreement will allow exports from Argentina to Mexico in the near future. Meanwhile, the United States will continue to supply the majority of beef to Mexico. Because of current trade restrictions, the United States accounted for more than 95 percent of Mexico's beef imports and exports in 1996 (Table 3).

Swine and Pork

Sixty-seven percent of Mexico's hogs are produced in the central region and 25 percent in the southern region (Bierlen and Hayes 1994). Mexico still employs a technologically mixed hog production system. Adaptation of U.S. production

technologies, however, has allowed Mexico to shift from a traditional backyard production system toward a more sophisticated production scheme (Bierlen and Hayes 1994). Traditional production for personal consumption is highly concentrated around Mexico City and in the southern region of Mexico (Bierlen and Hayes 1994). Mexico's relatively low annual pigs per sow figures reflect this mixed production system. Many countries annually produce 20 pigs per sow; however, Mexico's pig crop has averaged only 16 since 1985 (Table 4). Mexico's total swine inventory has fallen from an average of 11 million head between 1985 and 1990 to 10.8 million head between 1991 and 1997. Mexico's sow herd has averaged nearly .9 million since 1985.

Lower-income families consume most of the pork in Mexico. Mexico's per capita pork consumption has fallen steadily from 12.56 kg/person on a carcass basis in 1988 to 9.79 kg/person in 1997 (FAPRI 1998). However, aggregate pork consumption has risen from an average of 909 thousand metric tons between 1985 and 1990 to 928 thousand metric tons between 1991 and 1997. At the same time, Mexico's pork production has decreased. This has caused Mexico's pork imports to increase from an average of 10 thousand metric tons to 54 thousand metric tons over the same periods.

Two features highlight Mexico's swine and pork trade: Mexico imports nearly all of its swine and pork from the United States, and it exports nearly all of its pork to Japan (Tables 5 and 6). Because of disease problems, Mexico currently does not export any hogs to the United States. However, the United States has approved the state of Sonora as a low-risk area for hog cholera and will begin allowing imports from this region (USDA/FAS 1997a). Mexico's recognition of regions in other South American countries as being free of FMD could greatly impact the United States's share of Mexico's pork and swine trade. Argentina and Brazil could increase the competition for this market.

Broilers

One of the likely reasons for the steady decline in Mexico's per capita consumption of pork is that consumption of poultry has increased dramatically over time. Broiler consumption has increased from 11 kg/person in 1988 to 17.6 kg/person in 1997 (FAPRI 1998). Table 7 highlights this dramatic increase in broiler consumption on an aggregate basis. Mexico's aggregate consumption averaged 757 thousand metric tons

between 1985 and 1990. It increased to an average of 1.48 million metric tons between 1991 and 1997. Furthermore, the 1998 FAPRI baseline projects that per capita broiler consumption in Mexico will exceed beef and pork consumption by 2002.

Nearly 67 percent of Mexico's poultry production is located in the central region of the country (Bierlen and Hayes 1994). Technological advancements, vertical integration, improved genetics, and better management practices have bolstered Mexico's poultry production capabilities. In fact, Mexican broiler production has increased from an average of 729 thousand metric tons between 1985 and 1990 to 1.3 million tons between 1991 and 1997 (Table 7). Mexico's demand has outpaced production, however, causing Mexico's broiler imports to increase from 29 thousand metric tons to 91 thousand metric tons over the same period (Table 7).

Model Structure

Several features have been introduced in the FAPRI international livestock and poultry modeling system. The new model clearly differentiates between stock and flow variables. Where data allow, only flow variables are behaviorally specified and estimated. These flow variables are then aggregated in an accounting identity manner to derive the level of the stock variables. A graphic illustration of this modeling system is presented in Figures 1 through 4. The ovals denote flow variables, and the rectangles represent stock variables.

Another important feature of this model is that it estimates flow variables as rates rather than as absolute levels. This is advantageous because rates are virtually universal and easily allow for comparisons between countries and for the detection of errors. Also, based on historical data, rates are generally more stable than are their corresponding levels.

Moreover, biological or technological constraints on the rates of flow variables are accommodated with the use of logistic functional forms. This provides an upper bound for the logistic form. However, specifying purely theoretical or biological maximums as the upper bound for a logistic form generally provides poor results. Therefore, this model uses the historical maximum plus a nonnegative constant as the upper bound to allow for technological improvements.

Data and Estimation

All equations in this model were estimated in SAS using Production Supply and Distribution (PS&D) data for production and inventory figures and Organization for Economic Cooperation and Development (OECD) data for producer prices. Some constraints were imposed on the parameters to satisfy theoretical restrictions. To impose further discipline in the parameter estimation, econometric problems were addressed where possible. Significance of parameters, goodness-of-fit, and serial correlation were all considered.

The fit of the models was good as shown by their high R^2. In particular, nine equations explained more than 90 percent of the total variation in the dependent variables. Six equations explained between 80 and 90 percent of the variation, and five equations explained between 70 and 80 percent of the total variation in the dependent variables. Furthermore, most equations have Durbin-Watson statistics that do not give conclusive support for the presence of serial correlation. Specifically, 16 equations had Durbin-Watson statistics between 1.3 and 2.7. The estimates for the Mexico model are provided in Tables 8 through 31.

The specification and functional forms are presented below. The equations are grouped according to commodity. The equations within each commodity are further divided into three categories—flow variables, stock variables, and an equilibrium condition. The definitions of variables are given in Table 32.

Beef Model Equations

1. FLOW VARIABLES

1.1 BEEF DEMAND

```
EQ.MXBF1 = EXP (BD0 + BD1*LOG(BVPRFMX/CPCPIMX)
                   + BD2*LOG(POPRFMX/CPCPIMX)
                   + BD3*LOG(PYPRFMX/CPCPIMX)
                   + BD4*LOG(NAPDDMX/DEPOPMX)
                   + BD5*LOG(TRD)
                   + LOG(DEPOPMX)
                   - LOG(1000))
                   - BVUDCMX;
```

1.2 CALF CROP

```
EQ.MXBF2 = (LAG(CESBWMXE + CESMCMXE)) *(.85 / (1 + EXP( -1 * (CC0
                                  + CC1*TRD
                                  + CC2*D8485))) )
                                  - CESCVMX;
```

1.3 COW SLAUGHTER

```
EQ.MXBF3 = EXP(WS0 + WT1*LOG(BVPRFMX/CPCPIMX)
                  + WT2*LOG(MIPRFMX/CPCPIMX)
                   + WS3*LOG(TRD)
                   + WS4*D83
                   + WS5*D89
                   + LOG(LAG(CESBWMXE)
                   + LAG(CESMCMXE)) )
                   - CEKCWMX;
```

1.4 OTHER SLAUGHTER

```
EQ.MXBF4 = EXP ( OS0 + OS1*LOG(BVPRFMX/CPCPIMX)
                   + OS2*LOG(TRD)
                   + OS3*D8687
                   + OS4*D8990
                   + OS4*D85
                   + LOG(LAG(CESOTMXE)) )
                   - CEKOTMX ;
```

1.5 CALF SLAUGHTER

```
EQ.MXBF5 = EXP ( CS0 + CS1*LOG(BVPRFMX/CPCPIMX)
                     + CS2*LOG(LAG(CEKCVMX/CESCVMX))
                     + CS3*LOG(TRD)
                     + CS4*D8890
                     + LOG(CESCVMX) )
                     - CEKCVMX;
```

1.6 BEEF COW ENDING INVENTORY

```
EQ.MXBF6 = EXP ( BC0 + BC1*LOG(BVPRFMX/CPCPIMX)
                      + BC2*LOG(LAG(BVPRFMX/CPCPIMX))
                      + BC3*LOG(TRD)
                      + BC4*D8388 )
                      - CESBWMXE;
```

1.7 BEEF DEATH

```
EQ.MXBF7 = LAG(CESOTMXE+CESBWMXE+CESMCMXE)*( .06 / (1 + EXP( -1*( DT0
                     + DT1*TRD
                     + DT2*D8890))) )
                      - CEUDDMX;
```

1.8 SLAUGHTER WEIGHT

```
EQ.MXBF8 =  0.0750 + (CWW0 - 0.0750)*(CEKCWMX/CEKTNMX)
                    + (COW0 - 0.0750)*(CEKOTMX/CEKTNMX)
                    +  COW1*(CEKOTMX/CEKTNMX)*TRD
                    +  COW2*(CEKOTMX/CEKTNMX)*(BVPRFMX/CPCPIMX)
                   + D1*D82 + D3*D85
                    - BVSWTMX
```

1.9 CATTLE IMPORTS

```
EQ.MXBF9 = EXP (CM0 + CM1*LOG(BVPRFMX/BVPRFU9)
                     + CM2*LOG(TRD)
                     + CM3*D88
                     + CM4*D90 )
                     - CESMTMX;
```

1.10 CATTLE EXPORTS

```
EQ.MXBF10 = EXP (CX0 + CX1*LOG(BVPRFMX/BVPRFU9)
                      + CX2*LOG(TRD) )
                      -  CEUXTMX;
```

1.11 BEEF AND VEAL IMPORTS

```
EQ.MXBF11 = EXP (BM0 + BM1*LOG(BVPRFMX/BVPRFU9)
                    + BM2*LOG(TRD) )
                    - BVSMTMX;
```

1.12 BEEF AND VEAL EXPORTS

```
EQ.MXBF12 = EXP (BX0 + BX1*LOG(BVPRFMX/BVPRFU9)
                    + BX2*LOG(TRD) )
                    - BVUXTMX;
```

2. STOCK VARIABLES

2.1 OTHER CATTLE INVENTORY

```
EQ.MXBF13 = LAG(CESOTMXE)
          + (CESCVMX-CEKCVMX)
          + CESMTMX
          - CEKOTMX
          - ((CESBWMXE + CESMCMXE) - LAG(CESBWMXE + CESMCMXE)
                + CEKCWMX
                + CEUDDMX*LAG((CESBWMXE + CESMCMXE)/
                      (CESBWMXE+CESMCMXE+CESOTMXE)))
          - CEUDDMX*LAG((CESOTMXE)/
                (CESBWMXE+CESMCMXE+CESOTMXE))
          - CEUXTMX
          - CESOTMXE;
```

3. EQUILIBRIUM CONDITION

3.1 EQUILIBRIUM EQUATION

```
EQ.MXBF14 = LAG(BVCOTMX)
                    + (CEKCVMX+CEKCWMX+CEKOTMX)*BVSWTMX
                    + BVSMTMX
                    - BVUDCMX
                    - BVUXTMX
                    - BVCOTMX;
```

Pork Model Equations

1. FLOW VARIABLES

1.1 PORK DEMAND

```
EQ.MXP01 = EXP ( PD0 + PD1*LOG(POPRFMX/CPCPIMX)
                     + PD2*LOG(BVPRFMX/CPCPIMX)
                     + PD3*LOG(PYPRFMX/CPCPIMX)
                     + PD4*LOG(NAPDDMX/DEPOPMX)
                     + PD5*D7989
                     + PD6*D82
                     + PD7*D83
                     + LOG(DEPOPMX)
                     - LOG(1000) )
                     - POUDCMX;
```

1.2 SLAUGHTER WEIGHT

```
EQ.MXP02 = ( 0.075 / ( 1 + EXP ( -1 * ( WT0
                     + WT1*(POPRFMX/FDPRFMX)
                     + WT2*D83
                     + WT3*TRD))) )
                     - POKWTMX;
```

1.3 PORK EXPORTS

```
EQ.MXPO3 = EXP ( PX0 + PX1*LOG(POPRFMX/POPRFU9)
                     + PX2*D92
                     + PX3*LOG(LAG(POUXTMX)) )
                     - POUXTMX;
```

1.4 PORK IMPORTS

```
EQ.MXPO4 = EXP ( PM0 + PM1*LOG(POPRFMX/POPRFU9)
                     + PM2*LOG(TRD) )
                     - POSMTMX;
```

1.5 SWINE IMPORTS

```
EQ.MXPO5 = EXP ( SM0 + SM1*LOG(POPRFMX/POPRFU9)
                     + SM2*D91
                     + SM3*LOG(TRD) )
                     - HQSMTMX;
```

1.6 TOTAL SWINE SLAUGHTER

EQ.MXPO6 = EXP (TS0 + TS1*LOG(POPRFMX/FDPRFMX)
+ TS2*D7582
+ TS3*D8387
+ TS4*D8891
+ TS5*LOG(TRD)
+ LOG(HQCITMX))
- HQKTNMX;

1.7 SOW ENDING INVENTORY

EQ.MXPO7 = EXP (SE0 + SE1*LOG(POPRFMX/FDPRFMX)
+ SE2*LOG(LAG(SWCOTMX))
+ SE3*LOG(TRD)
+ SE4*D89)
- SWCOTMX;

1.8 PIG CROP

EQ.MXP8 = LAG(SWCOTMX)*(20 / (1 + EXP (-1 * (SC0
+ SC1*TRD
+ SC2*D8385
+ SC3*D92))))
- HQSPGMX;

1.9 SWINE DEATH

EQ.MXPO9 = EXP (SD0 + SD1*LOG(TRD)
+ LOG(HQSPGMX+HQCITMX))
- HQUDDMX;

2. STOCK VARIABLES

2.1 TOTAL SWINE INVENTORY

EQ.MXPO10 = LAG(HQCOTMX)
+ HQSPGMX
+ HQSMTMX
- HQKTNMX
- HQUDDMX
- HQCOTMX;

3. EQUILIBRIUM CONDITION

3.1 EQUILIBRIUM EQUATION

EQ.MXP11 = LAG(POCOTMX)
+ POKWTMX*HQKTNMX
+ POSMTMX
- POUDCMX
- POUXTMX
- POCOTMX;

Broiler Model Equations

1. FLOW VARIABLES

1.1 BROILER DEMAND

EQ.MXBR1 = EXP (RD0 + RD1*LOG(PYPRFMX/CPCPIMX)
+ RD2*LOG(BVPRFMX/CPCPIMX)
+ RD3*LOG(POPRFMX/CPCPIMX)
+ RD4*LOG(NAPDDMX/DEPOPMX)
+ RD5*LOG(TRD)
+ LOG(DEPOPMX)
- LOG(1000))
- BRUDCMX;

1.2 BROILER PRODUCTION

EQ.MXBR2 = EXP (RP0 + RP1*LOG(PYPRFMX/FDPRFMX)
+ RP2*LOG(TRD)
- BRSPRMX;

1.3 BROILER IMPORTS

EQ.MXBR3 = EXP (RM0 + RM1*LOG(PYPRFMX/(PYPRFU9*NIME_MX))
+ RM2*LOG(TRD)
+ RM3*D8891
+ RM4*D92GR)
- BRSMTMX;

2. EQUILIBRIUM CONDITION

2.1 EQUILIBRIUM EQUATION

EQ.MXBR4 = LAG(BRCOTMX)
+ BRSPRMX
+ BRSMTMX
- BRUDCMX
- BRCOTMX.

Validation

After all equations were estimated, the model was solved simultaneously in a simulation program using SAS software. This section reports several of the validation statistics generated from this in-sample simulation. Only four are highlighted in this discussion. Evaluation of the model was based on comparisons of the descriptive statistics, the statistics of fit, the Mean Squared Error (MSE) and its components, and the Theil inequality coefficients.

A well-designed model useful for projections should produce projections of endogenous variables with mean values that approach the mean values of the actual series. This also implies that the mean percentage error is close to zero. Moreover, in the decomposition of the MSE, an adequate model should produce projections that are closely correlated to the actual series (i.e., correlation coefficient approaches unity; that are without consistent bias (i.e., bias approaches zero); whose variability closely mirrors the variability of the actual series (i.e., variance approaches zero); and for which all remaining deviations of the projection from the actual are random (i.e., covariance is a large number). Also, when the predicted series is close to the actual series, both the U and U1 Theil coefficients of inequality approach zero. The validation statistics for the three sectors are shown in Tables 33 through 44.

In the beef model, the mean values of the predicted series are close to the mean of the actual series. This is also supported by the fact that all mean percentage errors for the predicted series are less than two percentage points from the mean except for beef imports, which are approximately five percentage points below the mean. All variables show high correlation with the actual series. The bias for all variables is small. However, the decomposition suggests that the variability of the actual series is not fully

captured by the variability of the predicted series because the variance is greater than .30 for five of the endogenous variables.

In the pork model, the predicted series closely follows the actual series. The mean percentage errors for all variables except pork imports and swine death are within four percentage points. Pork imports and swine death are still within an acceptable range. Furthermore, all but two endogenous variables show very strong correlation to the actual series. As is evident by the variance coefficients of three variables greater than .50, not all of the variability of the actual series is captured by the variability of the predicted series.

The validation statistics confirm that the broiler model predictions most closely followed the actual series. The mean predicted values closely follow the mean of the actual values and all mean percentage errors are less than six percentage points. All variables have low bias and variance. Also, they exhibit strong correlation and high covariance.

Trade equations for cattle and swine imports and pork exports were exogenized in the simulation to obtain more suitable validation statistics. It is difficult to accurately model Mexico's imports and exports of live animals and meat. One reason is that many of their levels have historically been very low and sporadic. For example, Mexico's pork imports were zero from 1982 to 1986, and then peaked at 80 thousand metric tons in 1994, and then dropped to 30 thousand metric tons in 1996 (USDA/PS&D). Low levels of trade also inflate percentage errors for small prediction errors. In addition, significant trade only in recent years shortens the suitable estimation period for parameters.

Projections

Using WEFA Group macroeconomic forecasts, this model was used in spreadsheet form to generate out-of-sample projections as part of the 1998 FAPRI baseline. The baseline is used to evaluate the impacts of policy changes and exogenous shocks on world trade volumes and prices. The results of the 1998 baseline are presented in Tables 48 and 49. Mexico's imports of beef, pork, and broiler meat are projected to increase by 315 thousand metric tons, 29 thousand metric tons, and 170 thousand metric tons from 1997 levels by 2007 (Table 49). Mexico's production and consumption of all

three commodities are expected to grow over the next decade. The production projections do not grow as rapidly as the consumption projections, however, causing Mexico to rely on imports to fulfill domestic demand (Table 49). Mexico's per capita broiler consumption also is expected to exceed beef per capita consumption by 2002.

Model Improvements

This new model introduced many structural improvements and refinements from the previous FAPRI Mexico model, which consisted of four main equations for each commodity: demand, production, inventory, and residual trade equations. Also, the demand equations for pork, beef, and poultry used U.S. prices and did not account for cross-price relationships. Using U.S. prices did not allow for domestic price clearing conditions. Furthermore, the previous model contained no behavioral trade equations, and therefore, net meat trade was found exogenously as a residual of the difference between domestic supply and consumption.

Improvements in the new FAPRI model structure include functional form equations and more equations for each commodity, enabling the model to estimate flow variables to capture more fully the biological processes in animal inventories, investment decisions of livestock producers, and trade dynamics within Mexico's livestock sector. Specifically, the new FAPRI Mexico livestock and poultry model contains separate slaughter equations for cows, other cattle, calves, sows, and other hogs. These equations, along with breeding herd addition and offspring equations, allow the model to capture fully the flow of specific categories of animals through the production cycle. Beneficial changes in the existing equations were also made. The demand relationships were estimated using own-price and cross-price relationships to account for substitution effects. The demand, production, and trade equations also use domestic prices. By using domestic prices, this model solves for the domestic price and satisfies domestic price clearing conditions.

Another enhancement in the new model is that it contains both live animal and meat trade equations. This change allows for behavioral decisions and refines the net trade position by dividing net trade into imports and exports.

Summary

Many economic and demographic trends along with increased free trade agreements are projected to increase Mexico's prominence in the world markets for meat products over the next 10 years. This model was designed to incorporate these factors to provide useful projections. Its structure, containing differentiated flow and stock variables and functional form equations, enables it to capture the dynamics of Mexico's livestock and meat sectors. The diagnostic statistics do not show any serious econometric problems, and the validation statistics from the simulation show that all equations tracked the actual series very closely.

Table 1. Cattle and Beef Historical Data

	Average 1985–1990	Average 1991–1997
Cattle		
Inventory (1000 head)	(Thousand Head)	
Total Cattle	33,625	29,523
Beef Cows	12,050	12,151
Dairy Cows	2,015	2,099
Other Cattle	19,560	15,273
Production Rates	(Percentage)	
Calf Crop	0.65	0.64
Cow Slaughter	0.13	0.12
Calf Slaughter	0.2	0.19
Other Slaughter	0.22	0.31
Death	0.03	0.03
Share of Slaughter		
Calf	0.24	0.21
Cow	0.22	0.21
Other	0.54	0.58
Beef		
Supply	(Thousand Metric Tons)	
Beginning Stocks	0	0
Production	1,571	1,744
Imports	21	102
Demand		
Ending Stocks	0	0
Domestic Consumption	1,591	1,845
Exports	2	2

Table 2. Sources and Destinations of Mexico's Cattle Trade in 1996

Trading Partner	Quantity (Head)	Percentage of Total
Exports	458,174	99.95
United States		
Others	223	0.05
Total	458,397	
Imports		
Australia	3,964	2.00
Canada	8,532	4.30
United States	185,934	93.64
Others	118	0.06
Total	198,548	

Table 3. Sources and Destinations of Mexico's Beef Trade in 1996

Trading Partner	Quantity (kg)	Percentage of Total
Exports		
United States	1,487,180	96.49
Others	54,067	3.51
Total	1,541,247	
Imports		
Australia	554,951	0.76
Canada	467,671	0.64
United States	71,998,565	98.21
Others	289,184	0.39
Total	73,310,371	

Table 4. Swine and Pork Historical Data

	Average 1985–1990	Average 1991–1997	Average 1993–1997
Swine			
Inventory		(Thousand Head)	
Total Inventory	11,040	10,816	
Sows	897	895	
Other	10,143	9,921	
Production Rates		(Percentage)	
Pig Crop	16	16	
Sow Slaughter	NA	NA	0.03
Other Slaughter	1.26	1.25	
Death	0.24	0.18	
Shares of Slaughter			
Sow	NA	NA	0.002
Other	NA	NA	0.998
Pork		(Thousand Metric Tons)	
Supply			
Beginning Stocks	0	0	
Production	899	881	
Imports	10	54	
Demand			
Ending Stocks	0	0	
Domestic Consumption	909	928	
Exports	0	7	

Table 5. Sources and Destinations of Mexico's Swine Trade in 1996

Trading Partner	Quantity (Head)	Percentage of Total
Exports		
Venezuela	626	97.81
Japan	14	2.19
Guatemala	0	0.00
Total	640	
Imports		
Canada	1,393	3.67
United States	36,158	95.22
Others	421	1.11
Total	37,972	

Table 6. Sources and Destinations of Mexico's Pork Trade in 1996

Trading Partner	Quantity (kg)	Percentage of Total
Exports		
Japan	12,535,525	95.87
Others	540,027	4.13
Total	13,075,552	
Imports		
Canada	1,123,259	3.69
United States	29,266,740	96.24
Others	20,597	0.07
Total	30,410,596	

Table 7. Broiler Historical Data

	Average 1985–1990	Average 1991–1997
Supply	(Thousand Metric Tons)	
Beginning Stocks	0	0
Production	729	1391
Import	29	91
Demand		
Ending Stocks	0	0
Domestic Consumption	757	1480
Exports	1	1

Estimation Tables

Beef Model

Table 8. Beef Demand in Mexico (BVUDCMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
BD0	Intercept	9.7933	8.2564	1.1900	0.2540
BD1	Real Beef Producer Price	-0.3500			
BD2	Real Pork Producer Price	0.1000			
BD3	Real Poultry Producer Price	0.1500			
BD4	Real Per Capita GDP	0.6265	0.7413	0.8500	0.4113
BD5	Trend	0.3271	0.1110	2.9500	0.0100
Diagnostic					
R^2		0.7204			
Adj R^2		0.6831			
DW		1.1070			

Table 9. Calf Crop in Mexico (CESPRMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
CC0	Intercept	1.0063	0.0596	16.8900	0.0001
CC1	Trend	0.0064	0.0032	1.9800	0.0628
CC2	Dummy 1984-1985	-0.1314	0.0685	-1.9200	0.0702
Diagnostic					
R^2		0.9486			
Adj R^2		0.9432			
DW		0.8790			

Table 10. Cow Slaughter In Mexico (CEKCWMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
WS0	Intercept	-0.8922	1.6671	-0.5400	0.6016
WS1	Real Beef Price	-0.2167	0.2108	-1.0300	0.3226
WS2	Real Milk Price	-0.1000			
WS3	Trend	0.0208	0.1244	0.1700	0.8697
WS4	Dummy 1983	0.3526	0.0707	4.9900	0.0002
WS5	Dummy 1989	0.5861	0.0518	11.3100	0.0001
Diagnostic					
R^2		0.9093			
Adj R^2		0.8814			
DW		1.6030			

Table 11. Other Cattle Slaughter in Mexico (CEKOTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
OS0	Intercept	-5.7646	0.2579	-22.3500	0.0001
OS1	Real Beef Price	0.1500			
OS2	Trend	1.1345	0.0824	13.7700	0.0001
OS3	Dummy 1986-1987	-0.3754	0.0514	-7.3100	0.0001
OS4	Dummy 1989-1990	0.1372	0.0281	4.8800	0.0012
OS5	Dummy 1985	0.0795	0.0528	1.5100	0.1706
Diagnostic					
R^2		0.9734			
Adj R^2		0.9601			
DW		2.4380			

Table 12. Calf Slaughter in Mexico (CEKCVMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
CS0	Intercept	-1.9980	1.4445	-1.3800	0.2159
CS1	Real Beef Price	-0.0382	0.1536	-0.2500	0.8119
CS2	Lag Calf Slaughter	0.1990	0.0798	2.4900	0.0469
CS3	Trend	0.2740	0.1709	1.6000	0.1599
CS4	Dummy 1988-1990	0.1604	0.0190	8.4400	0.0002
CS5					
Diagnostic					
R^2		0.9191			
Adj R^2		0.8652			
DW		1.4900			

Table 13. Beef Cow Inventory in Mexico (CESBWMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
BC0	Intercept	6.1991	0.7062	8.7800	0.0001
BC1	Real Beef Price	0.1351	0.0864	1.5600	0.1418
BC2	Lag Real Beef Price	0.2140	0.0827	2.5900	0.0225
BC3	Trend	0.3179	0.0447	7.1100	0.0001
BC4	Dummy 1983-1988	0.0293	0.0158	1.8600	0.0851
Diagnostic					
R^2		0.8517			
Adj R^2		0.8060			
DW		1.3960			

Table 14. Cattle Death Rate in Mexico (CEUDDMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
DT0	Intercept	-0.6332	0.4784	-1.3200	0.2222
DT1	Trend	0.0127	0.0210	0.6100	0.5606
DT2	Dummy 1988-1990	0.6364	0.1398	4.5500	0.0019
Diagnostic					
R^2		0.8331			
Adj R^2		0.7913			
DW		3.0630			

Table 15. Beef Slaughter Weight In Mexico (BVSWTMX)

Parameter	Independent		Estimate	Std Dev	"T" Ratio	Prob>|T|
CWWO			0.1479	0.0568	2.6000	0.0246
COWO			0.1219	0.0718	1.7000	0.1177
COW1			0.0039	0.0014	2.8200	0.0166
COW2		0.0001	0.0001	1.8100	0.0976	
D1			0.0128	0.0084	1.5300	0.1551
D3			-0.0198	0.0092	-2.1600	0.0537
Diagnostic						
R^2			0.9307			
Adj R^2			0.9099			
DW			1.4120			

Table 16. Cattle Imports In Mexico (CESMTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
CM0	Intercept	3.8105	2.8681	1.3300	0.2135
CM1	Mexico to World Beef Price Ratio	2.0000			
CM2	Trend	-0.4075	0.9256	-0.4400	0.6691
CM3	Dummy 1988	0.7479	0.3374	2.2200	0.0510
CM4	Dummy 1990	-0.4375	0.8969	-0.4900	0.6362
Diagnostic					
R^2		0.6168			
Adj R^2		0.5018			
DW		1.3990			

Table 17. Cattle Exports in Mexico (CEUXTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
CX0	Intercept	2.1122	0.7770	2.7200	0.0166
CX1	Mexico to World Beef Price Ratio	0.9000			
CX2	Trend	1.8980	0.2541	7.4700	0.0001
Diagnostic					
R^2		0.7760			
Adj R^2		0.7600			
DW		1.7740			

Table 18. Beef and Veal Imports in Mexico (BVSMTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
BM0	Intercept	-4.7421	2.2750	-2.0800	0.0546
BM1	Mexico to World Beef Price	1.3000			
BM2	Trend	2.3980	0.7196	3.3300	0.0045
Diagnostic					
R^2		0.7485			
Adj R^2		0.7317			
DW		0.5830			

Table 19. Beef and Veal Exports in Mexico (BVXMTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
BX0	Intercept	48.1605	15.1182	3.1900	0.0054
BX1	Mexico to World Price Ratio	-1.6000			
BX2	Trend	-19.3290	6.8732	-2.8100	0.0120
Diagnostic					
R^2		0.7909			
Adj R^2		0.7786			
DW		0.8530			

Pork-Swine Model

Table 20. Pork Demand in Mexico (POUDCMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
PD0	Intercept	6.3182	0.0215	293.5000	0.0001
PD1	Real Pork Producer Price	-0.2500			
PD2	Real Beef Producer Price	0.1300			
PD3	Real Poultry Producer Price	0.0800			
PD4	Real Per Capita GDP	0.3300			
PD5	Dummy 1979-1989	0.1587	0.0313	5.0700	0.0004
PD6	Dummy 1982	0.1634	0.0560	2.9200	0.0140
PD7	Dummy 1983	0.2251	0.0508	4.4300	0.0010
Diagnostic					
R^2		0.6469			
Adj R^2		0.5506			
DW		1.8850			

Table 21. Swine Slaughter Weight in Mexico (POKWTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
WT0	Intercept	2.6044	0.4223	6.17	0.0001
WT1	Pork to Feed Price Ratio	0.7409	0.3372	2.2	0.0503
WT2	Dummy 1983	-0.9292	0.1490	-6.24	0.0001
WT3	Trend	-0.0104	0.0127	-0.82	0.4286
Diagnostic					
R^2		0.8769			
Adj R^2		0.8434			
DW		1.5110			

Table 22. Pork Exports in Mexico (POUXTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
PX0	Intercept	2.6846	0.0935	28.7000	0.0001
PX1	Mexico to World Pork Price Ratio	1.3500			
PX2	Dummy1992	0.7783	0.1937	4.0200	0.0277
PX3	Lag Pork Exports	0.5000			
Diagnostic					
R^2		0.7344			
Adj R^2		0.6459			
DW		1.4950			

Table 23. Pork Imports in Mexico (POSMTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
PM0	Intercept	-4.7922	3.6187	-1.3200	0.2270
PM1	Mexico to World Pork Price Ratio	1.5000			
PM2	Trend	2.0026	1.1393	1.7600	0.1222
Diagnostic					
R^2		0.6132			
Adj R^2		0.5579			
DW		1.8370			

Table 24. Swine Imports in Mexico (HQSMTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
SM0	Intercept	0.6534	3.3904	0.1900	0.8548
SM1	Mexico to World Pork Price Ratio	1.4500			
SM2	Dummy 1991	1.4100	0.1750	8.0600	0.0005
SM3	Trend	0.4713	1.0944	0.4300	0.6846
Diagnostic					
R^2		0.8965			
Adj R^2		0.8344			
DW		2.0670			

Table 25. Swine Slaughter in Mexico (HQKTNMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
TS0	Intercept	-1.2997	0.3418	-3.8000	0.0016
TS1	Pork to Feed Price Ratio	0.2000			
TS2	Dummy 1975-1982	-0.1543	0.1073	-1.4400	0.1698
TS3	Dummy 1983-1987	0.1030	0.0647	1.5900	0.1309
TS4	Dummy 1988-1991	0.1020	0.0535	1.9100	0.0748
TS5	Trend	0.1690	0.1063	1.5900	0.1313
Diagnostic					
R^2		0.8128			
Adj R^2		0.7660			
DW		1.7440			

Table 26. Sow Ending Inventory in Mexico (SWCOTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
SE0	Intercept	5.7280	1.4545	3.9400	0.0028
SE1	Pork to Feed Price Ratio	0.1254	0.0497	2.5200	0.0303
SE2	Lag Sow Ending Inventory	0.2143	0.1987	1.0800	0.3061
SE3	Trend	-0.1278	0.0476	-2.6800	0.0229
SE4	Dummy 1989	-0.1176	0.0392	-3.0000	0.0134
Diagnostic					
R^2		0.8021			
Adj R^2		0.7229			
DW		1.5410			

Table 27. Pig Crop in Mexico (HGSPGMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
SC0	Intercept	1.1423	0.0277	41.2100	0.0001
SC1	Trend	0.0122	0.0016	7.8200	0.0001
SC2	Dummy 1983-1985	0.3341	0.0276	12.1200	0.0001
SC3	Dummy 1992	-0.2087	0.0367	-5.6900	0.0001
Diagnostic					
R^2		0.9895			
Adj R^2		0.9876			
DW		1.1350			

Table 28. Swine Death in Mexico (HQUDDMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
SD0	Intercept	-1.5795	0.2709	-5.8300	0.0001
SD1	Trend	-0.2719	0.0960	-2.8300	0.0126
Diagnostic					
R^2		0.7607			
Adj R^2		0.7447			
DW		0.6600			

Broiler Model

Table 29. Broiler Demand in Mexico (BRUDCMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
RD0	Intercept	9.5802	0.3157	30.3500	0.0001
RD1	Real Broiler Producer Price	-0.4000			
RD2	Real Beef Producer Price	0.2000			
RD3	Real Pork Producer Price	0.1500			
RD4	Real Per Capita GDP	0.9500			
RD5	Trend	1.3001	0.1013	12.8400	0.0001
Diagnostic					
R^2		0.9677			
Adj R^2		0.9657			
DW		0.8690			

Table 30. Broiler Production in Mexico (BRSPRMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
RP0	Intercept	0.7177	0.4596	1.5600	0.1379
RP1	Broiler to Feed Price Ratio	0.3000			
RP2	Trend	2.0305	0.1476	13.7500	0.0001
Diagnostic					
R^2		0.9391			
Adj R^2		0.9353			
DW		1.4590			

Table 31. Broiler Imports In Mexico (BRSMTMX)

Parameter	Independent	Estimate	Std Dev	"T" Ratio	Prob>|T|
RM0	Intercept	-7.6292	2.4238	-3.1500	0.0104
RM1	Mexico to World Broiler Price Ratio	0.9500			
RM2	Trend	3.2975	0.8629	3.8200	0.0034
RM3	D8891	0.2078	0.4128	0.5000	0.6256
RM4	D92GR	0.5298	0.5046	1.0500	0.3185
Diagnostic					
R^2		0.9359			
Adj R^2		0.9103			
DW		2.0830			

Table 32. Definitions of Variables

Code	Description	Units
HQCITMX	Swine; Stocks, Beginning; Mexico	Thousand Head
HQCOTMX	Swine; Stocks, Ending; Mexico	Thousand Head
HQKOTMX	Swine; Slaughter, Other; Mexico	Thousand Head
HQKTNMX	Swine; Slaughtered; Mexico	Thousand Head
HQSMTMX	Swine; Imports; Mexico	Thousand Head
HQSPGMX	Swine; Pigs, Born; Mexico	Thousand Head
SWCOTMX	Swine; Sows; Mexico (Ending)	Thousand Head
HQSSWMX	Swine; Sows; Mexico (Beginning)	Thousand Head
HQUDDMX	Swine; Deaths; Mexico	Thousand Head
POSMTMX	Pork; Imports; Mexico	Thousand Metric Ton
POSPRMX	Pork; Production, MT; Mexico	Thousand Metric Ton
POUDCMX	Pork; Consumption; Mexico	Thousand Metric Ton
POUXTMX	Pork; Exports; Mexico	Thousand Metric Ton
POKWTMX	Pork; Slaughter Weight; Mexico	Thousand Metric Ton
BRSMTMX	Broilers, Live and Meat; Imports; Mexico	Thousand Metric Ton
BRSPRMX	Broilers, Live and Meat; Production, Mt; Mexico	Thousand Metric Ton
BRUDCMX	Broilers, Live and Meat; Consumption; Mexico	Thousand Metric Ton
CECOTMX	Cattle; Stocks, Ending; Mexico	Thousand Head
CEKCVMX	Cattle; Calves, Slaughtered; Mexico	Thousand Head
CEKCWMX	Cattle; Cows, Slaughtered; Mexico	Thousand Head
CEKOTMX	Cattle; Slaughter, Other; Mexico	Thousand Head
CEKTNMX	Cattle; Slaughtered; Mexico	Thousand Head
CESBWMXE	Cattle; Cows, Beef; Mexico, ≥ 2 Years December (End)	Thousand Head
CESCVMX	Cattle; Calves, Born; Mexico	Thousand Head
CESMCMXE	Cattle; Milking Animals, Head; Mexico, ≥ 2 Years Dec.	Thousand Head
CESMTMX	Cattle; Imports; Mexico	Thousand Head
CEUDDMX	Cattle; Deaths; Mexico	Thousand Head
CEUXTMX	Cattle; Exports; Mexico	Thousand Head
BVSMTMX	Meat, Beef and Veal; Imports; Mexico	Thousand Metric Ton
BVSPRMX	Meat, Beef and Veal; Production, Mt; Mexico	Thousand Metric Ton
BVUDCMX	Meat, Beef and Veal; Consumption; Mexico	Thousand Metric Ton
BVUXTMX	Meat, Beef and Veal; Exports; Mexico	Thousand Metric Ton
BVSWTMX	Cattle; Slaughter Weight; Mexico	Thousand Metric Ton
NAPDDMX	Gross Domestic Product Index 1990=1	Index
DEPOPMX	Population, MidNAyear Estimates	Thousand
CPCPIMX	Consumer Price Index 1990=1	Index
NIME_MX	Exchange Rate, Spot	Peso/US $
BVPRFMX	Beef and Veal Producer Price	Peso/100 kg
MIPRFMX	Milk Producer Price	Peso/100 kg

POPRFMX	Pork Producer Price	Peso/100 kg
PYPRFMX	Poultry Producer Price	Peso/100 kg
FDPRFMX	Feed Cost Index	Peso/100 kg
BVPRFU9	Nebraska Direct Steers (1100NA1300 lbs.)	$/cwt.
POPRFU9	IANASoNA MN 230NA250 lbs. Barrows and Gilts	$/cwt.
PYPRFU9	12NACity Wholesale	c/lbs.

Validation Tables

Beef Model

Table 33. Descriptive Statistics

Variable	Description	Actual Mean	Actual Std	Predicted Mean	Predicted Std
BVPRFMX	Beef Producer Price	826.5744	139.9091	816.4308	167.3692
BVUDCMX	Beef and Veal Consumption	1821.0000	75.2666	1824.0000	81.9798
CESBWMXE	Beef Cow Inventory (End)	12343.0000	558.4502	12289.0000	243.0405
CESCVMX	Calf Crop	9395.0000	366.9478	9396.0000	362.3681
CEKCWMX	Cow Slaughter	1663.0000	67.4290	1670.0000	104.1072
CESOTMXE	Other Cattle Inventory (End)	15502.0000	495.3132	15503.0000	662.9902
CEKOTMX	Other Slaughter	4707.0000	395.1034	4747.0000	365.9472
CEKCVMX	Calf Slaughter	1742.0000	78.5918	1749.0000	79.7691
CEUDDMX	Cattle Death	800.0000	100.6062	814.8036	130.7297
BVSWTMX	Slaughter Weight	0.2137	0.0047	0.2142	0.0039
CEUXTMX	Cattle Exports	1217.0000	247.9987	1203.0000	299.9026
BVSMTMX	Beef and Veal Imports	89.6667	33.8802	77.6969	22.9747

Table 34. Statistics of Fit

Variable	Description	Mean Error	Mean % Error	Mean Abs Error	Mean Abs % Error
BVPRFMX	Beef Producer Price	-10.1436	-1.7604	33.2874	4.6172
BVUDCMX	Beef and Veal Consumption	3.2532	0.1802	26.7069	1.4777
CESBWMXE	Beef Cow Inventory (End)	-53.9548	-0.3272	295.3749	2.3946
CESCVMX	Calf Crop	0.9814	0.0361	178.4898	1.8974
CEKCWMX	Cow Slaughter	6.3040	0.5769	114.6715	6.8703
CESOTMXE	Other Cattle Inventory (End)	0.9665	-0.0162	190.7046	1.2516
CEKOTMX	Other Slaughter	40.4094	0.9404	96.8537	2.0885
CEKCVMX	Calf Slaughter	7.7091	0.4667	33.4271	1.9322
CEUDDMX	Cattle Death	14.8036	1.6309	35.2556	4.1874
BVSWTMX	Slaughter Weight	0.0005	0.2373	0.0022	1.0537
CEUXTMX	Cattle Exports	-14.4231	-1.4258	97.2191	7.9424
BVSMTMX	Beef and Veal Imports	-11.9697	-4.4231	27.3211	33.2332

Table 35. MSE Decomposition Proportions Inequality Coefficients

Variable	Description	MSE	Corr (R)	Bias (UM)	Var (US)	Covar (UC)
BVPRFMX	Beef Producer Price	2064	0.9660	0.0500	0.3040	0.6460
BVUDCMX	Beef and Veal Consumption	919	0.9150	0.0120	0.0410	0.9480
CESBWMXE	Beef Cow Inventory (End)	125331	0.8250	0.0230	0.6610	0.3150
CESCVMX	Calf Crop	41829	0.8110	0.0000	0.0000	1.0000
CEKCWMX	Cow Slaughter	16532	-0.3140	0.0020	0.0680	0.9300
CESOTMXE	Other Cattle Inventory (End)	61229	0.9310	0.0000	0.3830	0.6170
CEKOTMX	Other Slaughter	13342	0.9540	0.1220	0.0530	0.8250
CEKCVMX	Calf Slaughter	1738	0.8390	0.0340	0.0010	0.9650
CEUDDMX	Cattle Death	2034	0.9520	0.1080	0.3720	0.5210
BVSWTMX	Slaughter Weight	0	0.7230	0.0240	0.0580	0.9170
CEUXTMX	Cattle Exports	12053	0.9230	0.0170	0.1860	0.7960
BVSMTMX	Beef and Veal Imports	978	0.4330	0.1460	0.1010	0.7520

Table 36. Theil Forecast Error Statistics

Variable	Description	U1	U
BVPRFMX	Beef Producer Price	0.0543	0.0273
BVUDCMX	Beef and Veal Consumption	0.0166	0.0083
CESBWMXE	Beef Cow Inventory (End)	0.0287	0.0144
CESCVMX	Calf Crop	0.0218	0.0109
CEKCWMX	Cow Slaughter	0.0772	0.0385
CESOTMXE	Other Cattle Inventory (End)	0.0160	0.0080
CEKOTMX	Other Slaughter	0.0245	0.0122
CEKCVMX	Calf Slaughter	0.0239	0.0119
CEUDDMX	Cattle Death	0.0560	0.0277
BVSWTMX	Slaughter Weight	0.0142	0.0071
CEUXTMX	Cattle Exports	0.0887	0.0444
BVSMTMX	Beef and Veal Imports	0.3297	0.1784

Pork Model

Table 37. Descriptive Statistics

Variable	Description	Actual Mean	Actual Std	Predicted Mean	Predicted Std
POPRFMX	Pork Producer Price	947.7617	343.3296	936.6919	416.2188
POUDCMX	Pork Consumption	949.0000	38.2535	931.3232	28.7098
POKWTMX	Pork Slaughter Weight	0.0716	0.0008	0.0718	0.0002
POSMTMX	Pork Imports	49.0000	22.3010	47.3418	6.7324
HQSPGMX	Pig Crop	14300.0000	617.7918	14345.0000	561.2777
HQKTNMX	Swine Slaughter	12615.0000	622.8162	12365.0000	368.6468
SWCOTMX	Sow Ending Inventory	657.5000	439.5737	873.0341	18.2254
HQUDDMX	Swine Death	2000.0000	0.0000	2231.0000	101.1303
HQCOTMX	Swine Ending Inventory	11483.0000	1025.0000	11548.0000	624.3557

Table 38. Statistics of Fit

Variable	Description	Mean Error	Mean % Error	Mean Abs Error	Mean Abs % Error
POPRFMX	Pork Producer Price	-11.0698	-3.2277	58.2693	6.7106
POUDCMX	Pork Consumption	-17.6768	-1.7788	21.8377	2.2326
POKWTMX	Pork Slaughter Weight	0.0001	0.1850	0.0006	0.8245
POSMTMX	Pork Imports	-1.6582	11.3215	15.2361	33.2691
HQSPGMX	Pig Crop	44.8508	0.3271	46.6913	0.3394
HQKTNMX	Swine Slaughter	-250.3141	-1.8182	546.0085	4.2300
SWCOTMX	Sow Ending Inventory	215.5341	.	231.7976	.
HQUDDMX	Swine Death	230.6352	11.5318	230.6352	11.5318
HQCOTMX	Swine Ending Inventory	64.5297	0.9253	649.5612	5.6802

Table 39. MSE Decomposition Proportions Inequality Coefficients

Variable	Description	MSE	Corr (R)	Bias (UM)	Var (US)	Covar (UC)
POPRFMX	Pork Producer Price	4200	1.0000	0.0290	0.9490	0.0220
POUDCMX	Pork Consumption	1393	0.3860	0.2240	0.0490	0.7270
POKWTMX	Pork Slaughter Weight	0	0.5360	0.0410	0.6070	0.3520
POSMTMX	Pork Imports	405	0.0210	0.0070	0.4490	0.5440
HQSPGMX	Pig Crop	4437	1.0000	0.4530	0.5400	0.0070
HQKTNMX	Swine Slaughter	427253	0.0820	0.1470	0.1130	0.7400
SWCOTMX	Sow Ending Inventory	187246	0.3640	0.2480	0.7110	0.0410
HQUDDMX	Swine Death	60863	.	.	.	.
HQCOTMX	Swine Ending Inventory	458433	0.6530	0.0090	0.2630	0.7280

Table 40. Theil Forecast Error Statistics

Variable	Description	U1	U
POPRFMX	Pork Producer Price	0.0652	0.0325
POUDCMX	Pork Consumption	0.0393	0.0198
POKWTMX	Pork Slaughter Weight	0.0087	0.0044
POSMTMX	Pork Imports	0.3821	0.2005
HQSPGMX	Pig Crop	0.0047	0.0023
HQKTNMX	Swine Slaughter	0.0518	0.0262
SWCOTMX	Sow Ending Inventory	0.5696	0.2650
HQUDDMX	Swine Death	.	.
HQCOTMX	Swine Ending Inventory	0.0588	0.0293

Broiler Model

Table 41. Descriptive Statistics

Variable	Description	Predicted Mean	Std	Actual Mean	Std
PYPRFMX	Poultry Producer Price	544.3217	252.1597	536.0383	289.1194
BRUDCMX	Broiler Consumption	1154.0000	363.9067	1147.0000	323.9168
BRSPRMX	Broiler Production	1095.0000	333.9261	1096.0000	313.0810
BRSMTMX	Broiler Imports	61.4545	31.9198	50.7569	14.2677

Table 42. Statistics of Fit

Variable	Description	Mean Error	Mean % Error	Mean Abs Error	Mean Abs % Error
PYPRFMX	Poultry Producer Price	-8.2835	-2.9550	70.7852	12.1074
BRUDCMX	Broiler Consumption	-7.2443	1.7576	77.9552	8.5201
BRSPRMX	Broiler Production	1.9079	2.1626	74.0822	8.4538
BRSMTMX	Broiler Imports	-10.6976	5.4975	21.1924	41.4729

Table 43. MSE Decomposition Proportions Inequality Coefficients

Variable	Description	MSE	Corr (R)	Bias (UM)	Var (US)	Cov (UC)
PYPRFMX	Poultry Producer Price	7797	0.9510	0.0090	0.1590	0.8320
BRUDCMX	Broiler Consumption	8775	0.9660	0.0060	0.1660	0.8280
BRSPRMX	Broiler Production	8051	0.9600	0.0000	0.0490	0.9500
BRSMTMX	Broiler Imports	653	0.6910	0.1750	0.4340	0.3910

Table 44. Theil Forecast Error Statistics

Variable	Description	U1	U
PYPRFMX	Poultry Producer Price	0.1484	0.0737
BRUDCMX	Broiler Consumption	0.0777	0.0391
BRSPRMX	Broiler Production	0.0787	0.0394
BRSMTMX	Broiler Imports	0.3727	0.2110

Elasticity Tables

Table 45. Meat Demand Elasticity in Mexico

	Price Elasticity			Income
	Beef	Pork	Broiler	Elasticity
Beef	-0.3500	0.1000	0.1500	0.6265
Pork	0.1300	-0.2500	0.0800	0.3300
Broiler	0.2000	0.1500	-0.4000	1.0000

Table 46. Meat Supply Elasticity in Mexico

Dependent Variables	Price/Feed Price Ratio	Real Beef Price	Real Milk Price	Lag Dependent
Cattle-Beef Model				
Cow Slaughter		-0.2167	-0.1000	
Other Cattle Slaughter		0.1500		
Calf Slaughter		-0.0382		0.2740
Beef Cow Inventory		0.1351		
		0.2140		
Swine-Pork Model				
Slaughter Weight	0.7409			
Swine Slaughter	0.2000			
Sow Ending Inventory	0.1254			0.2143
Broiler Model				
Broiler Production	0.3000			

Table 47. Trade Elasticity in Mexico

	Independent Variables	
Dependent Variables	Price Ratio	Lag Dependent Variable
Cattle-Beef Model		
Cattle Imports	2.0000	
Cattle Exports	-0.9000	
Beef Import	1.3000	
Beef Export	-1.6000	
Swine-Pork Model		
Pork Export	-1.3500	0.5000
Pork Import	1.5000	
Swine Imports	1.4500	
Poultry Model		
Broiler Import	0.9500	

Table 48. FAPRI Baseline Projections for Mexico (1988-1997)

	Mexican Meat Supply and Utilization									
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	(Million Head)									
Cattle Inventories (Beg.)	35.38	35	31.75	29.85	30.23	30.65	30.7	30.19	28.14	26.9
Hog Inventories (Beg.)	10.88	9	8.56	8.59	9.93	11.3	12.08	12.51	11.1	10.2
Net Trade (Live Animals)	(Thousand Head)									
Cattle	609	744	1198	815	713	1197	943	1633	260	350
Hog	-84	-80	-50	-265	-120	-35	-130	-5	-38	-40
Beef and Veal	(Thousand Metric Tons)									
Production	1754	2140	1790	1580	1660	1710	1810	1850	1800	1800
Consumption	1769	2176	1845	1696	1789	1805	1899	1890	1898	1935
Net Trade	-15	-36	-55	-116	-129	-95	-89	-40	-98	-135
Pork										
Production	964	910	792	820	830	870	900	954	895	900
Consumption	980	937	809	859	881	917	978	1011	923	928
Net Trade	-16	-27	-17	-39	-51	-47	-78	-57	-28	-28
Broiler										
Production	808	873	945	1178	1346	1364	1383	1435	1478	1550
Consumption	858	916	979	1233	1415	1451	1485	1529	1581	1668
Net Trade	-50	-43	-34	-55	-69	-87	-102	-94	-103	-118
Producer Prices	(Peso Per 100 kg)									
Beef and Veal	441.96	505.45	619.52	794.55	839.37	835	813	1058	1459.40	1678.30
Pork	444.31	445.94	557.74	652.12	620.05	730	670	965	1426.10	1611.40
Poultry	417	542	626	647	522	597	602	717	1031.50	1010.90
Per Capita Consumption										
Mexico	(Kilogram, Carcass Weight Basis)									
Beef	22.68	27.37	22.71	20.38	21.07	20.84	21.48	20.74	20.40	20.42
Pork	12.56	11.79	9.96	10.32	10.38	10.59	11.06	11.10	9.92	9.79
Broiler	11.00	11.52	12.05	14.82	16.67	16.75	16.80	16.78	16.99	17.60
Total	46.24	50.68	44.71	45.53	48.11	48.18	49.34	48.62	47.32	47.81

Table 49. FAPRI Baseline Projections for Mexico (1998-2007)

Mexican Meat Supply and Utilization										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	(Million Head)									
Cattle Inventories (Beg.)	25.63	25.85	25.63	25.3	24.99	24.82	24.49	24.04	23.58	23.12
Hog Inventories (Beg.)	9.97	9.81	9.81	9.82	9.94	9.97	9.87	9.74	9.65	9.52
Net Trade (Live Animals)	(Thousand Head)									
Cattle	124	543	711	673	556	564	570	518	486	450
Hog	-56	-52	-51	-55	-61	-62	-66	-75	-85	-90
Beef and Veal	(Thousand Metric Tons)									
Production	1780	1802	1800	1788	1772	1783	1783	1769	1752	1733
Consumption	1949	1970	1980	1996	2013	2058	2099	2137	2159	2183
Net Trade	-169	-167	-180	-208	-241	-275	-316	-368	-406	-450
Pork										
Production	930	981	1027	1055	1083	1115	1148	1180	1217	1260
Consumption	950	986	1026	1060	1097	1129	1165	1212	1267	1317
Net Trade	-20	-5	1	-5	-14	-14	-17	-32	-50	-57
Broiler										
Production	1620	1664	1717	1742	1811	1867	1933	2008	2102	2216
Consumption	1745	1814	1886	1933	2020	2086	2166	2256	2370	2504
Net Trade	-125	-150	-169	-190	-208	-219	-233	-248	-267	-288
Producer Prices	(Peso Per 100 kg)									
Beef and Veal	1887.9	2044.5	2349.1	2538	2741.2	2943.1	3206.9	3506.7	3938	4468.7
Pork	1759	1829.7	2008.4	2105.9	2245.2	2470.5	2752.6	3041.6	3409.6	3926.8
Poultry	1152.9	1176.9	1277.9	1331.4	1354.2	1429.4	1519.5	1612.6	1725.3	1862.4
Per Capita Consumption										
Mexico	(Kilogram, Carcass Weight Basis)									
Beef	20.2	20.05	19.8	19.63	19.47	19.58	19.66	19.7	19.6	19.53
Pork	9.84	10.03	10.26	10.42	10.61	10.74	10.91	11.18	11.51	11.79
Broiler	18.08	18.46	18.87	19.01	19.53	19.85	20.28	20.8	21.52	22.4
Total	48.12	48.55	48.94	49.06	49.61	50.17	50.85	51.67	52.62	53.72

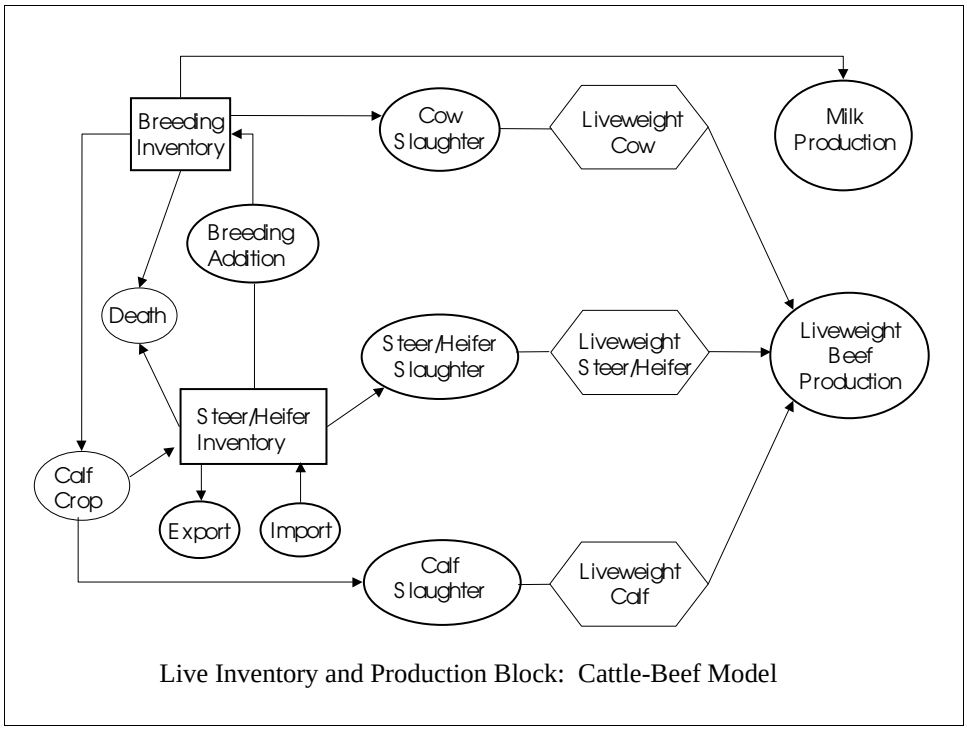

Figure 1. Cattle-Beef Model Illustration

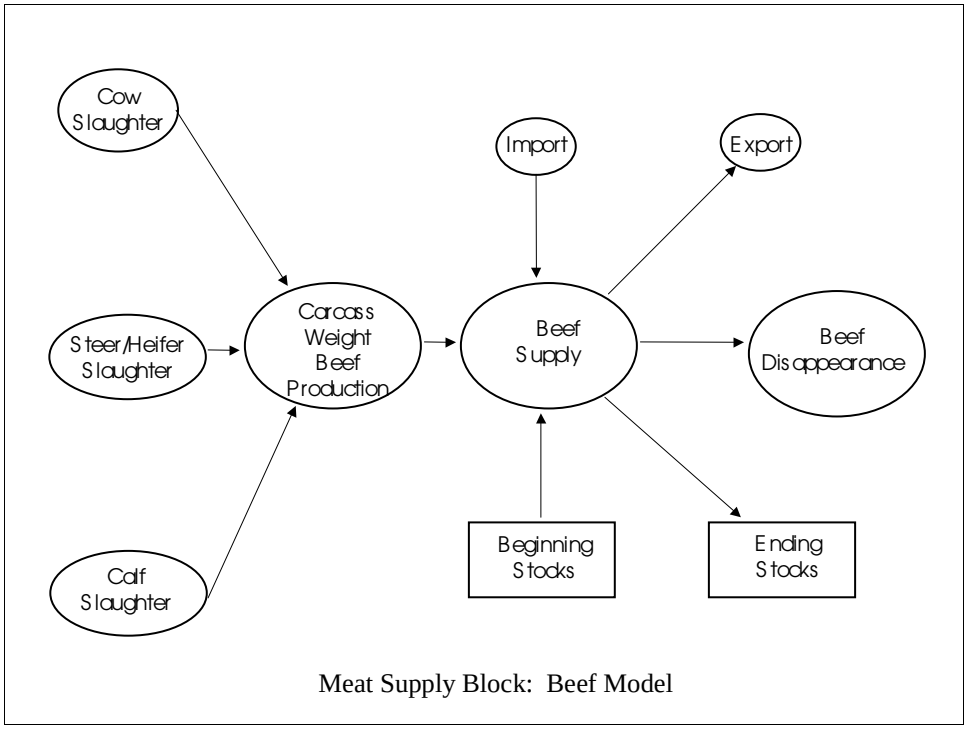

Figure 2. Beef Model Illustration

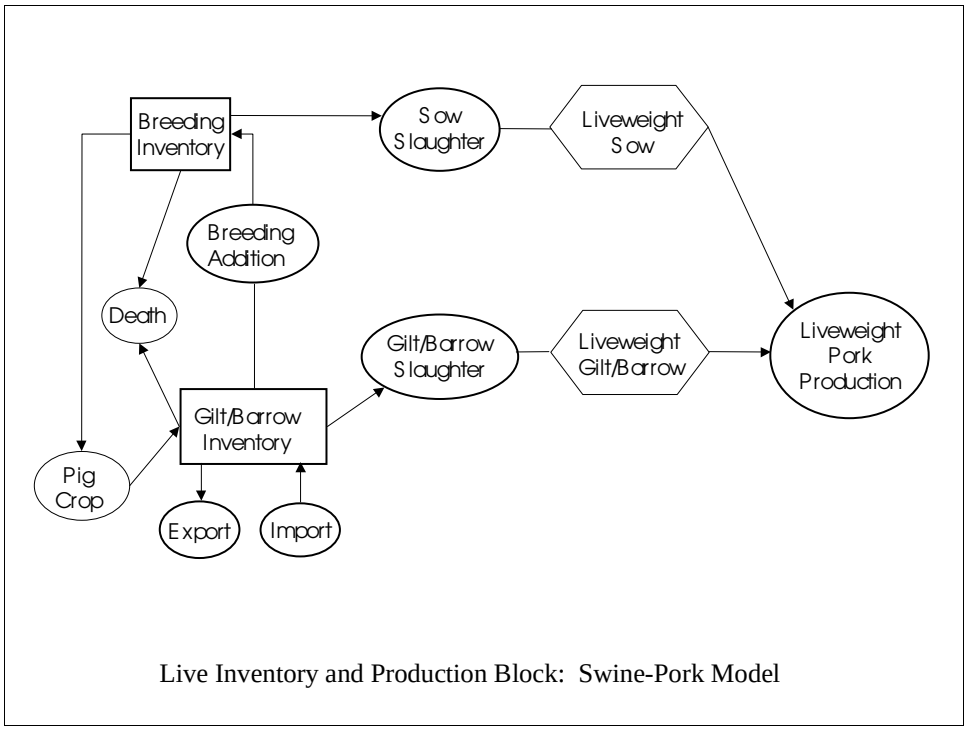

Figure 3. Swine-Pork Model Illustration

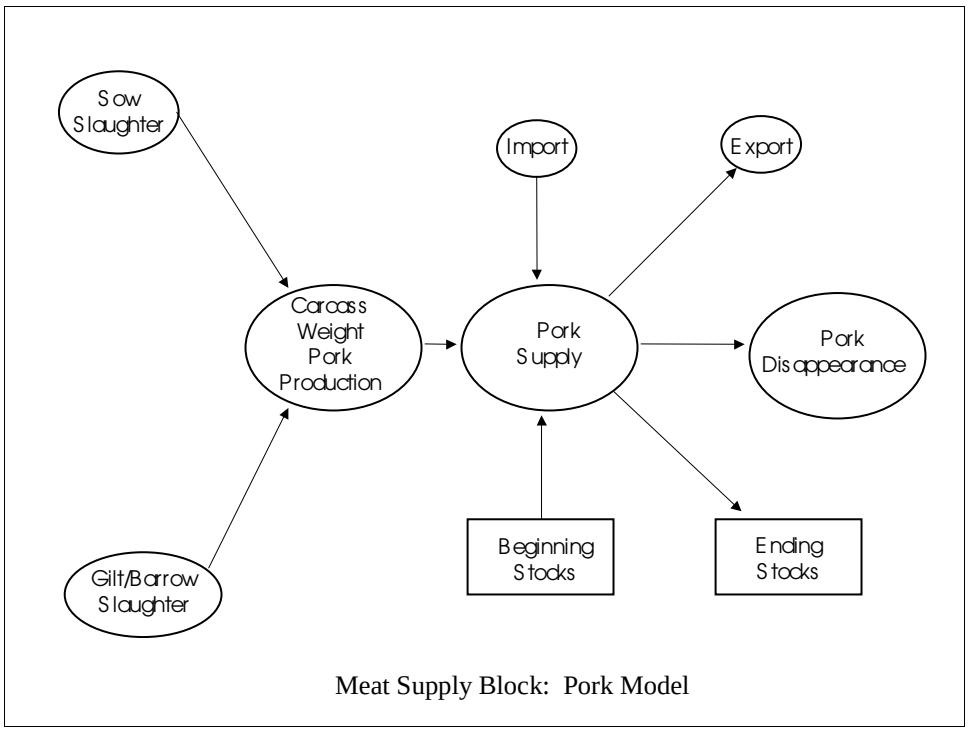

Figure 4. Pork Model Illustration

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