IMPACT OF MEAT IMPORTS ON LEAST COST U.S. BEEF PRODUCTION

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Abstract

A linear programming model of the U.S. beef industry evaluates meat import policies for a least cost optimal beef cow herd. Regional adjustments in cow numbers and corn utilization are examined. Average cost for the U.S. is estimated for different levels of cow herd size and beef production.

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Meat imports have been a source of controversy in U.S. agriculture for more than twenty years. Beef producers contend that imports unduly restrict their incomes and place the domestic livestock industry at a disadvantage. In 1964, the U.S. Congress put into legislation The Meat Import Bill (P.L. 88-482). This bill limited imports of meat to approximately 7% of domestic ~~red meat~~ beef production. Consumers subsequently complained that limitations on imports have contributed to higher beef prices. Periodic decisions to adjust quota levels occurred in 1968, 1972, and 1977 (Houck).

The Meat Import Act of 1979 (P.L. 96-177), recently passed by Congress, includes a counter-cyclical adjustment factor based on moving averages for domestic cow beef production. Previous studies have examined the effects that imports have on U.S. aggregate livestock and meat prices and supplies (Crom; Houck; and Freebairn and Rausser). Research is needed to study the impacts on the sectors with and without meat imports. The objective of this paper is to identify the net effects on the least cost U.S. beef production with and without imports.

Methodology

The analysis is based on results from an interregional linear programming (LP) model of the U.S. beef industry. Model results represent equilibrium conditions for a set of predetermined levels of the U.S. cow herd. The model minimizes the total variable plus fixed costs for new facilities at each stage of the production and marketing channels

for beef. Comparisons between total production costs and regional production organizations of the beef economy can be analyzed with and without imports of beef. The model was used to examine (1) four levels of U.S. consumption of beef and veal, and (2) four levels of a U.S. beef cow herd.

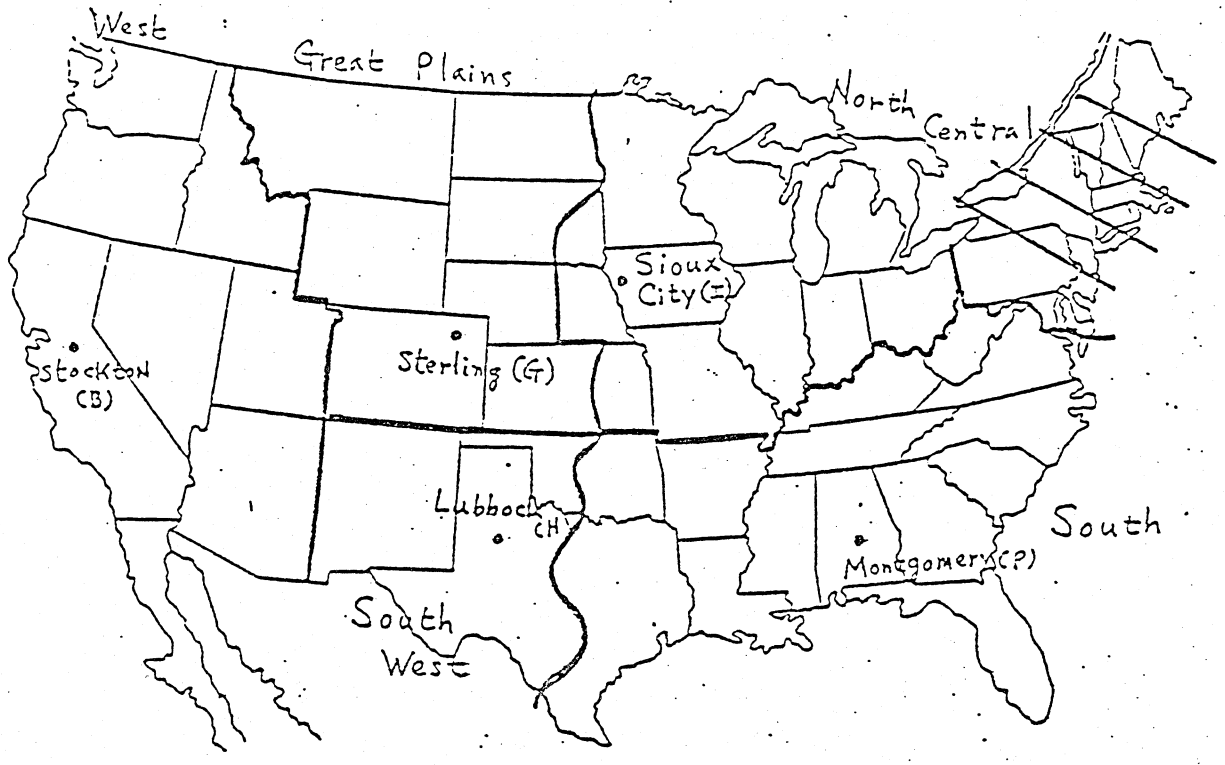
The Model

The LP model is a multistage, multiproduct, interregional competition model of beef production, processing, and distribution in the contiguous United States. Five beef production regions are represented which correspond to significant geographical, climatic, and agricultural patterns (Figure 1a).

Beef Supply Regions

There are five beef supply regions in the LP model. The Southeast Region has a long growing season, abundant moisture, and improved forage technology conducive to rapid growth in cattle populations. Beef production in the Southwest Region is important for supplying feeder cattle for large feedlots, packing, and processing plants. In the Corn Belt of the North Central Region, livestock are raised in the most productive cropping areas. The western part of this region is important for slaughter and processing plants. In the Great Plains Region, livestock production is an extensive operation. The amount of irrigated forage pasture has increased in recent years. Large custom feedlots and some large packing and processing facilities are located in the northern part of the region. In the Western Region, cattle raising and feeding have remained stable with some pressure for land to convert to nonagricultural uses. Cattle feeding has been limited because of transportation of feed grain supplies from

a. Beef Supply Regions.



b. Beef Demand Regions

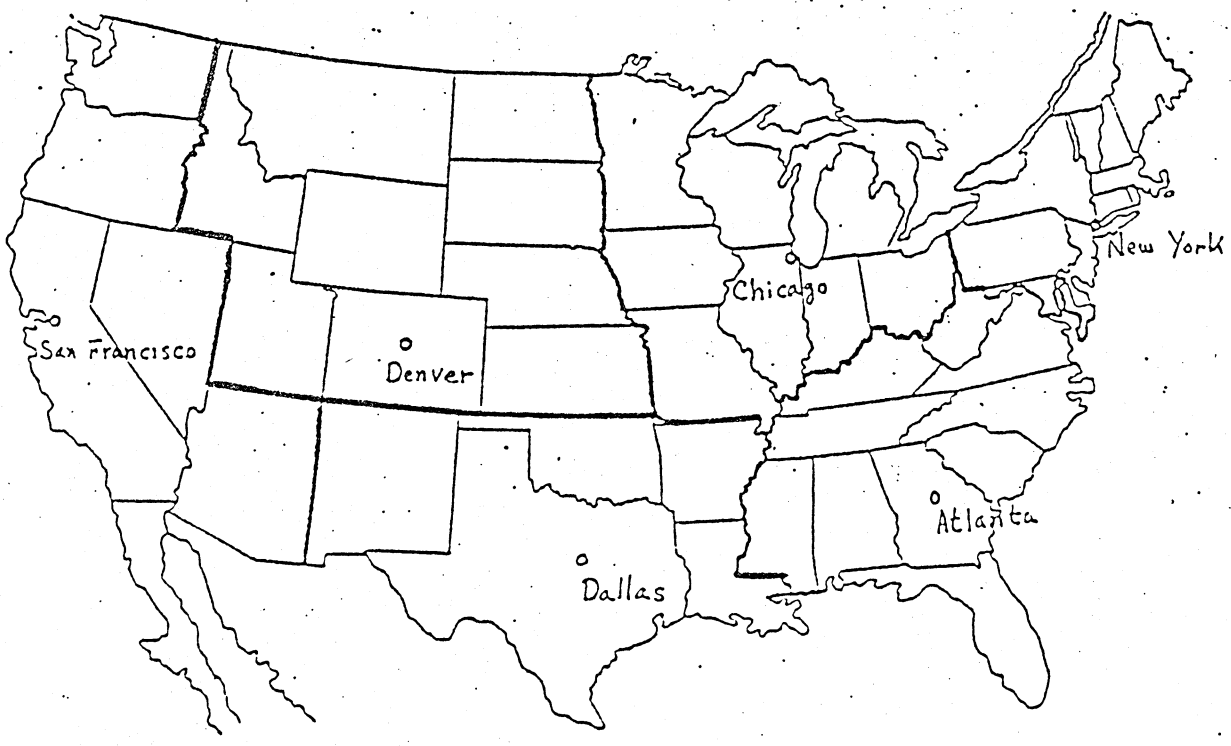


Figure 1. The supply and Demand Regions for a Model of U.S. Beef Industry.

other regions. There are a large number of small to medium size packing plants. The Northeast Region is not an important beef production area and is omitted as a supply region in the model.

Beef Production, Processing, and Distribution Stages

The model structure is identical across regions with production alternatives, technical coefficients, and related costs varying by region. Each region has available subsets of production activities for vertical linkages in the model.

The Cow-Calf Stage. One hundred seven cow-calf enterprises are typical of those found in 36 sub-regions of the five supply regions representing herd sizes from 50-1,500 cows. Allocation of cows for different budgets within a region are controlled by reasonable sub-region limitations. Production and cost coefficients are adapted from the Federal Enterprise Data System developed by ESCS regional analysts (Gustafson).

Feeders, stockers, and cull cows are intermediate outputs of the cow-calf stage. Cull beef animals with an exogeneous quantity of cull dairy cows go directly to the packer stage of the model. Dairy calves, not held for replacement, are included in feeder cattle supplies. Feeder calves of two sexes and weight-range categories can be retained in cow-stocker activities or shipped to other stocker operations or feedlots along defined transportation routes. Feeder cattle, 1-1½ years of age, can also go directly to the packer stage.

The Stocker Stage. Stocker programs involve placement of calves on pasture for 6, 12, 18, or 24 months. Regional differences in pasture and range qualities are reflected in production coefficients. All stockers up to 2 years of age can be transferred either to the feedlot stage or

packer stage as nonfed slaughter. Cattle which are 2½ years old must be shipped directly to the packer stage.

The Cattle Feeding Stage. The feedlot stage uses cattle taken from cow-calf and stocker programs. A range of 200 to 600 pounds of gain will be added based on sex, age, weight class, and feeding regime. Long (120 to 260 days) and short (40 to 95 days) feeding operations are available. Sixteen different finished weights are possible, ranging from 600 to 1,400 lb. for steers and 580 to 1,280 lb. for heifers. Gains in feeding options are identical for each region. Non-feed costs vary by region, reflecting differences in average size of lots by region (Gee). Feed costs also reflect regional differences in corn prices. Feed costs escalate as cattle are fed to higher weights, reflecting the decrease in feed conversion efficiency by older and heavier cattle.

The Packer Stage. At this stage, the dressing percentages and cutability coefficients for each carcass type produced varies according to livestock class, weight, and sex. Cost coefficients reflect typical plant size and hourly earnings in each region (Cothern, 1977a; Baker; and U.S.D.L.). By-products are sold at an average value per 1,000 lb. liveweight.

The Fabrications Stage. Fabrication activities are formulated to reduce carcasses to subprimals. Technical coefficients are consistent with the carcass type, whether it is a cull cow, nonfed, or short or long fed steer and heifer. Six classes of fabricated beef are outputs including table cuts and fat trim. Lean trim (15%) and medium trim (50%) can go into hamburger production. Fat (100%) is sold as a by-product. Beef imports enter a region as 15% lean trim. Carcass fabrication occurs in conjunction with the packer stage either at central processing faci-

lities or at retail levels. Cost by regions reflect typical plant sizes and hourly earnings (Baker; Cothern, 1977b; U.S.D.L.).

The Hamburger Stage. Hamburger activities represent all processing uses of trimmings of beef. The model uses 15% and 50% fat trimmings and table cuts to produce hamburger which contains no less than 20%, but no more than 30% fat. Hamburger production can occur at the packer, fabricator, and retail demand stages. Production capacity is unlimited at any stage.

The Retail Stage. This stage reflects average final distribution costs and is not divided into hotel-restaurant-institutional (HRI) and food store components (Tribe).

The Transportation Activities and Demand for Beef

Transportation activities make up a significant proportion of the model (1845 activities). These include transportation of feeder cattle, slaughter cattle, carcass and boxed beef among 5 supply regions and 6 demand regions. Of the 25 possible transfer routes among supply regions, 20 routes are selected for the model (15 inter-regional and 5 intra-regional). Freight costs, death loss, and shrink are included in the shipment coefficients. All inter-regional shipments are between supply points (Figure 1a) and demand destinations (Figure 1b). All transportation activities terminate at each of the six designated regional cities. National beef consumption is set at four levels exogeneously and regionalized among the demand regions. National beef consumption was set at 25.8, 26.5, 27.2, and 27.5 billion lb. carcass weight, which is 117, 120, 124, and 127 lb. per capita, respectively. Demand by regions was determined from previous research by Rauniker, et al.

Results

Optimal Least Cost Production

For the optimal solution, the model is constrained to the production of 27,200 million lb. carcass weight of beef output, which assumed 124 lb. per capita beef consumption (U.S. population of 232.9 million), and net meat imports of 1,803 million lb. A corn price of $2.37 per bu. (U.S. average price in 1976 dollars) is used in the sensitivity analysis. This base beef production and corn price is used to estimate the optimal (least cost) national cow herd.

With imports, the optimal U.S. beef cow herd is estimated at 53.95 million head (Table 1). This is a long term optimal herd size. Over the next two cattle cycles this optimum level could gradually be approached if per capita consumption is 124 lb. If all imports are curtailed and the level of per capita consumption is unchanged, the optimal U.S. cow herd increases 8% to 58.222 million head. The restriction in imports is equally offset by an increase in cow numbers to replace the imported meat.

With available imports, corn (equivalents) used in cattle feeding in the U.S. is 1,389.0 million bu. (Table 1). The impact of restricting imports requires an increase in corn utilization to 1,547.2 billion bu., an increase of 11%. The additional corn is used to carry cattle on feed to heavier weights to meet the shortfall in meat imports. With likely future deficits in world demand for food grains, restricting U.S. meat imports will affect the U.S. position in international trade in corn.

Regional Impact on Cattle Raising and Feeding. In the optimal solution, the impact of meat import policies on regional livestock production

Table 1. The Effect of Import Policies on Regional Distribution of Beef Cows and Corn Utilization with the Least Cost Optimal U.S. Cow Herd

Regions	Cattle Raising: Beef Cow Production				Cattle Feeding: Corn Utilization		
	Lower Limit	With Imports	Without Imports	Δ	With Imports	Without Imports	Δ
	(million hd)			(%)	(million bu)		(%)
Western	3.033	5.349	6.038	+13	149.60	151.10	+ 1
Great Plains	6.687	12.730	14.646	+15	346.04	347.50	+.4
Southwest	2.724	6.043	6.043	--	212.98	252.20	+18
North Central	7.239	15.979	17.472	+ 9	530.56	644.60	+21
Southeast	13.207	13.207	13.379	+ 1	149.00	151.80	+ 2
Northeast	--	.642	.642	--	--	--	--
Nation		53.950	58.222	+ 8	1389.00	1547.20	+11

is examined (Table 1). Because only a certain amount of adjustments can be made, lower limits on cow production are set for each region. With meat imports, the North Central Region produces the greatest number of beef cows, 15.979 million head, followed by the Southeast Region with 13.207 million head. The Southeast Region produces its lower limit, implying cow-calf operations will continue in the region though it is not at least cost. Without meat imports, beef cow herds increase the greatest in the Great Plains (15%), Western (13%), and North Central (9%) because of lower total variable costs in these regions.

In the cattle feeding stage, corn utilization with meat imports is highest in the North Central Region with 530.56 million bu., 38% of the total. With the curtailment of all imports, corn usage increases by 21% in this region and 18% in the Southwest. Cattle feeding increases very little in the other three regions. The North Central and Great Plains Regions remain the highest demand regions for corn for cattle feeding.

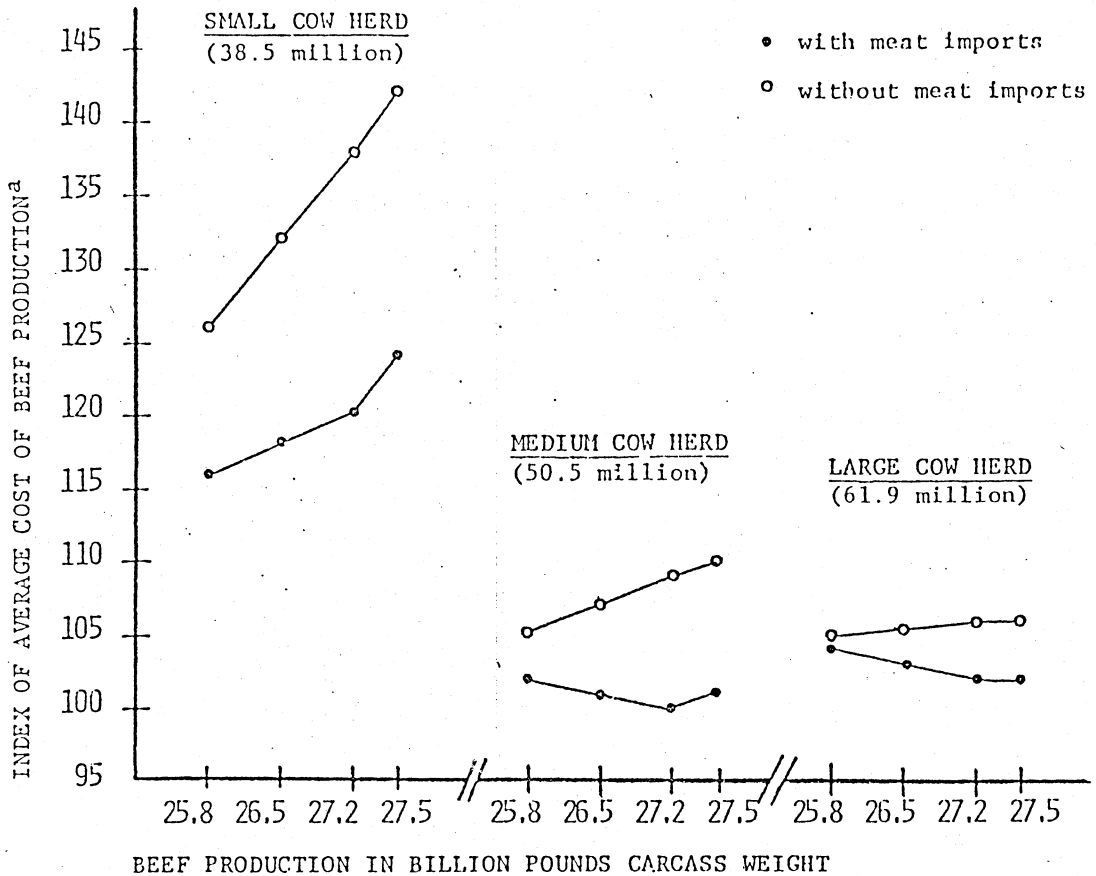
The Retail Meat Stage. Meat imports with the optimum cow herd affects the types of cattle processed into retail meats. More non-fed and cull cows are used as table cuts for home consumption and HRI. A lesser amount of fed cattle are used as table cuts. Imported meat, as 85% beef trim, is processed as hamburger and processed meat. The impact of no imports causes non-fed and cull cows to go for processing into hamburger to replace imported beef trim. In addition, cattle are fed a longer period in feedlots to produce more beef. The increased number of fed cattle go for table cuts and for fat trim to make hamburger.

Impact of Imports with the Cattle Cycle

Projections of cow numbers into the 1980's and beyond are based on beef cow numbers over the last two cattle cycles. Peak to peak changes applied to the 1975 cow herd indicate a high of 61.9 million beef cows. A small increase in trough to trough applied to 1979 cow numbers project a low of 38.5 million cows in middle or late 1980's. The middle range herd size is the average of the high and low, 50.2 million cows. Average cost of production (1976 dollars) for each level of the U.S. cow herd is compared as an index to the least cost optimum herd size of 53.95 million cows with meat imports and the optimum herd of 58.222 million cows without meat imports (Figure 2).

With Meat Imports. The medium level cow herd of 50.2 million cows is the least cost level with meat imports for all levels of U.S. beef production. Average cost was slightly above the cost for the optimum U.S. cow herd. As U.S. beef production increases from 25.8 billion lb. to 27.5 billion lb., index of average costs falls slightly from 102% to 100% and then increases again slightly. With the larger U.S. cow herd of 61.9 million, the index of average cost falls slightly from 104% to 102% with increases in U.S. beef production. When the U.S. cow herd is at the lower level of 38.5 million, increases in beef production cause average costs to rise more rapidly from 116% to 124% because of feeding corn to cattle over a longer period of time to meet domestic beef production requirements.

Without Meat Imports. With no imports, minimum average cost is now lower with the larger herd size of 61.9 million cows except at 25.8 billion lbs. of U.S. beef production where average cost with 50.2 million



[a] Average cost in 1976 dollars of optimal beef cow herd, a corn price $2.37 per bu. and 27.2 billion lbs. carcass weight production = 100

Figure 2. Index of Average Cost of Beef Production With and Without Meat Imports for Specified Beef Cow Herds and Beef Production Levels, United States

cows is identical. With increases in total beef production, average cost increases slightly from 105% to 106%. With the medium herd size of 50.2 million cows, average cost increases from 105% to 110% with increases in U.S. beef production. Average cost increased at a faster rate than with meat imports. The smaller cow herd causes an even more drastic increase in the magnitude of average costs with increases in U.S. beef production. Without meat imports, higher average costs are incurred because the smaller size of the U.S. cow herd must then be fed over a longer period of time.

Conclusion

Results should be interpreted to indicate direction, order of magnitude, and general areas of economic impacts--not predictions of actual future outcomes. With the current 1980 U.S. beef cow herd of 36.9 million (USDA), the cattle industry is not at the least cost optimum size. The current high price of beef coincides with a need for an addition of cows to the U.S. inventory. The buildup of the national cow herd to the optimum level will be slower in the future because of uncertainty in the economy.

Restricting meat imports requires a larger U.S. cow herd (8%) and greater utilization of corn (11%) in cattle feeding above the optimum herd size. More resources have to be put into livestock production resulting in higher average costs of production. The role of meat imports helps the cattle industry approach the least cost optimum herd size.

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