Economic Feasibility of Specialized Beef Processing in Louisiana

by

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Introduction

Louisiana has traditionally exported weaned calves to other regions of the country for grain finishing and processing. Then, it imports the higher valued processed product back into the state for consumption. Given the shift in consumer preferences for leaner red meats and the abundant supply of forage in the state, Louisiana may be able to develop a specialized beef processing industry. The successful development of this type of industry will depend on several factors. These factors range from having profitable cow/calf and stocker operations up to the strategic location and scale of cattle slaughtering and processing facilities within the state.

One means of producing leaner beef is to use a forage or silage-based feed ration, with a reduced grain-finishing period. This type of production is particularly well suited to the high rainfall/forage-producing areas in Louisiana. However, this system will produce beef products which typically grade less than choice. The targeting of leaner beef production, coupled with in-state processing, could provide an additional value-added industry to the existing oil-dependent economy.

The purpose of this research project was to examine the economic feasibility of establishing a beef processing industry in the state. Economic feasibility must consider beef production and processing costs, transportation costs of both inputs and products, regionalized product supply and demand conditions, processing efficiency and constraints, and the price of imported product. The products considered in this study include ground and boxed boneless lean beef.

Procedures

A regionalized Integer Program Model was developed to address the issue of the economic feasibility of lean beef processing in Louisiana. The state was divided into seven producing regions, also referred to as assembly points. Figure 1 displays the parishes associated with each region. Beef production supply and cost estimate, as well as forage/silage availability, were estimated for each area. On the demand side, results from a 1987 survey of lean beef users--restaurants, meat markets, grocers, etc. (Schupp)--by region was used to establish product demand levels at four demand centers. Product demand consists of both boxed boneless lean beef and ground beef.

The following represents the mathematical programming formulation of the feasibility model. The objective of this model is the minimization of total cost, subject to a series of supply and demand constraints and integer conditions. Specifically:

$$\text{Min } C = \sum_{i=1}^{7} \sum_{j=1}^{7} \sum_{g=1}^{2} (T_{ij} + P_{ig}) * N_{ijg}$$

$$+ \sum_{i=1}^{7} \sum_{K=1}^{4} \sum_{L=1}^{2} T_{iKL} * PR_{iKL}$$

$$+ \sum_{m=1}^{2} \sum_{i=1}^{7} FC_{im} * E_{im}$$

$$+ \sum_{L=1}^{2} \sum_{K=1}^{4} IP_{LK} * IM_{LK}$$

ST:

$$\sum_{i=1}^{7} \sum_{g=1}^{2} N_{ijg} \leq N_j$$

$$\sum_{j=1}^{7} PR_{iKL} + IM_{LK} = D_{LK}$$

$$\Sigma N_{ij} \leq CAP * E_{im}$$

$$\Sigma N_{ij} \geq .7345 * CAP * E_{im}$$

$$\sum_{j=1}^{7} PR_{jKL} = PRD_{iKL}$$

E_{im} is a zero *or* a positive integer

Where:

T_{ij} =	Transportation cost to ship cut of live animal from *i* to *j*.
P_{ig} =	Processing + cost per cwt of live animal from *i*, type *g*.
N_{ijg} =	Number of live animals from *i*, to *j* of type *g*.
T_{iKL} =	Transportation cost to ship product *L*, from *j* to *k*.
PR_{iKL} =	Amount of product produced of type *L*, for location *k*.
PRD_{jKL} =	Amount of product shipped of type *L* from *j* to *k*.
FC_{im} =	Fixed cost of the processing plant at *i* of size *m*.
E_{im} =	Integer variable of plant existence.
IP_{LK} =	Imported product price type *L* for demand *k*.
IM_{LK} =	Quantity of product *L* imported to demand *k*.
i =	region of origin.
j =	region of processing plant.
g =	type of animal (silage or forage).

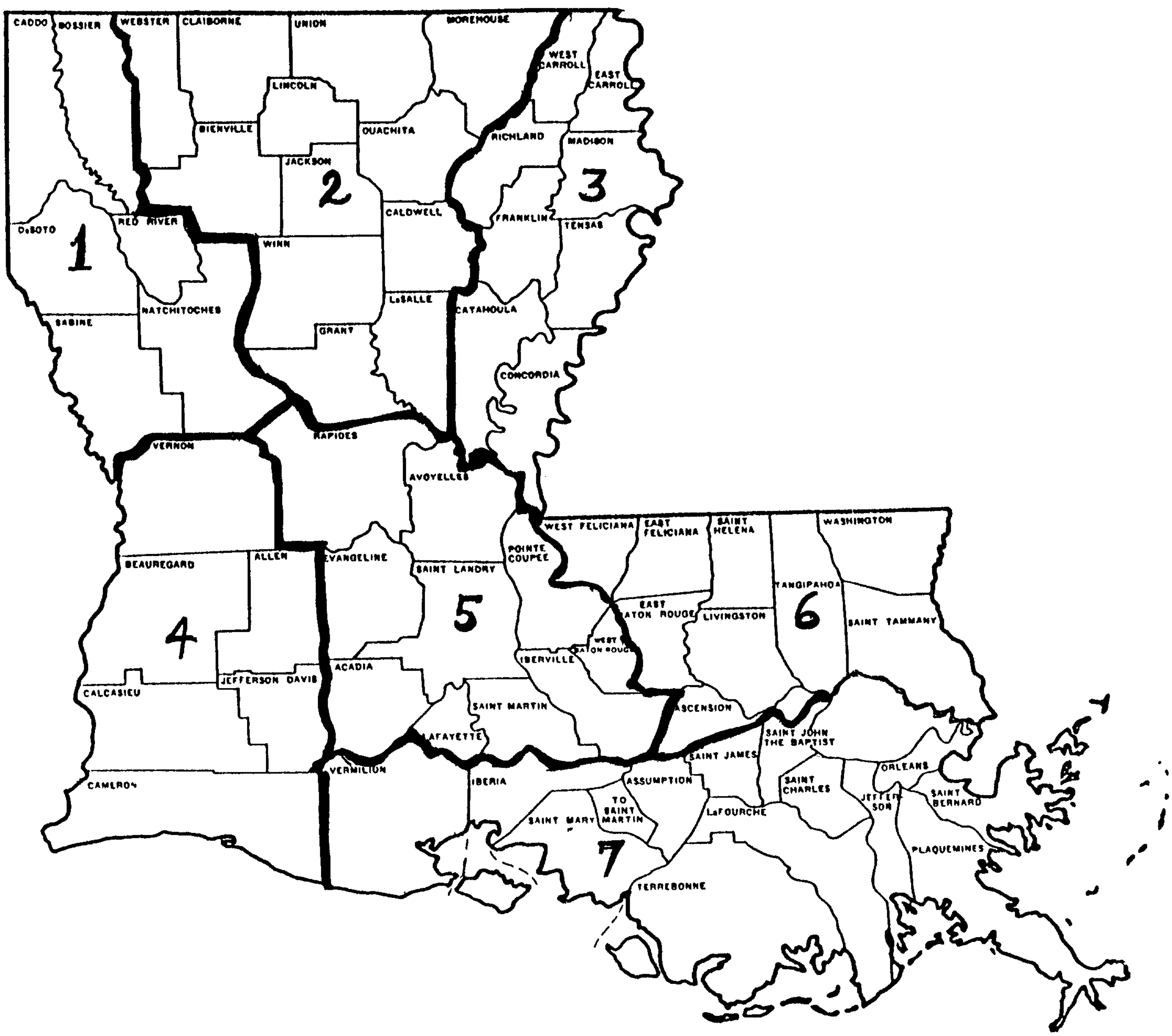

Figure 1. Producing Areas and Assembly Points Within the State

$K =$ demand center.
$L =$ Product type (Boxed or Ground Beef).
$m =$ Plant size (Small or Medium).

Output from a Geographic Information System (G.I.S.) was used to derive transportation distances from the various supply points to potential processing plants and on to the different demand centers. Therefore, the model considers both the transportation cost of live animals within and across regions and the transportation cost of the product from the processing plant to the demand centers. Processing costs per cwt of product, fixed cost and plant capacity were estimated for two sizes of processing plants. In this study, the optimal processing plant/size combination in a region was assumed to an integer (0, 1, 2, etc.).

Given the above model formulation, economic feasibility of beef processing in Louisiana was determined by parametricizing the cost of imported boxed and ground product. While it is clearly recognized that regional lean beef demand is a function of product price, existing survey demands provide a measure of the potential volume at each demand center for prices close to traditional levels. For this analysis, the model was solved on an IBM-based personal computer, using GAMS (General Algebraic Modeling System)/Zoom integer programming package (Marsten).

Results

Displayed in Figure 2 are the estimated levels of product processing relative to product price. Given the overall model objective of minimizing total cost, estimated in-state processing of lean beef products does not appear feasible for prices less than $2.50 per pound. At a price of $2.50, two small processing plants enter the optimal solution. One small processing plant is located in area 1 and supplies demand center 1 with boxed beef exclusively. The second small plant is located in area 7 and supplies demand center 3 with both boxed and ground beef. As product price is increased above $2.50/lb., the optimal size plant increases to the medium size and the location of single plants shifts to areas 2, 4 and 5.

Figure 3 illustrates total imports of ground and boxed beef relative to the product price. What is interesting in this case is that total imports of both products remain positive for prices in excess of $3.00 per pound. This situation occurs because the current supply of live animals for slaughter in the state is not sufficient to meet all estimated regionalized demand.

Figure 4 displays the mix of processing output by region (assembly point) in live animal units, given a product price of $2.75/lb. The majority of animals processed are allocated to the boxed beef product as opposed to ground. This result may have occurred because the cost of producing ground beef from these "leaner" animals could be slightly greater than the relative cost of processing boxed beef.

Illustrated in Figure 5 is the combined product distribution by demand center. Transportation costs play a major role in plant location and distribution decisions. In this figure, area 2 provides all product to demand center 1, area 5 provides demand center 2, and area 4 provides demand center 3. All three processing plants provide some supply of both products to demand center 4 (New Orleans).

Given the current average retail price of boxed beef of $2.75 per pound minus the retail margin, the current product price is about $2.00-$2.10 per pound. Application of the integer programming model for Louisiana production and processing revealed a minimum feasible price of $2.50 per pound. While current conditions indicate that lean beef processing is uneconomical, changes in product supply and demand, costs of production and/or processing, and transportation costs may make lean beef processing feasible in the future.

Conclusions

The integer math programming model formulation proposed in this study can be easily extended to consider other products, regions, demand centers, and plant location/size issues. While the model can be extended, numeric solution is limited on existing micro-computers. The

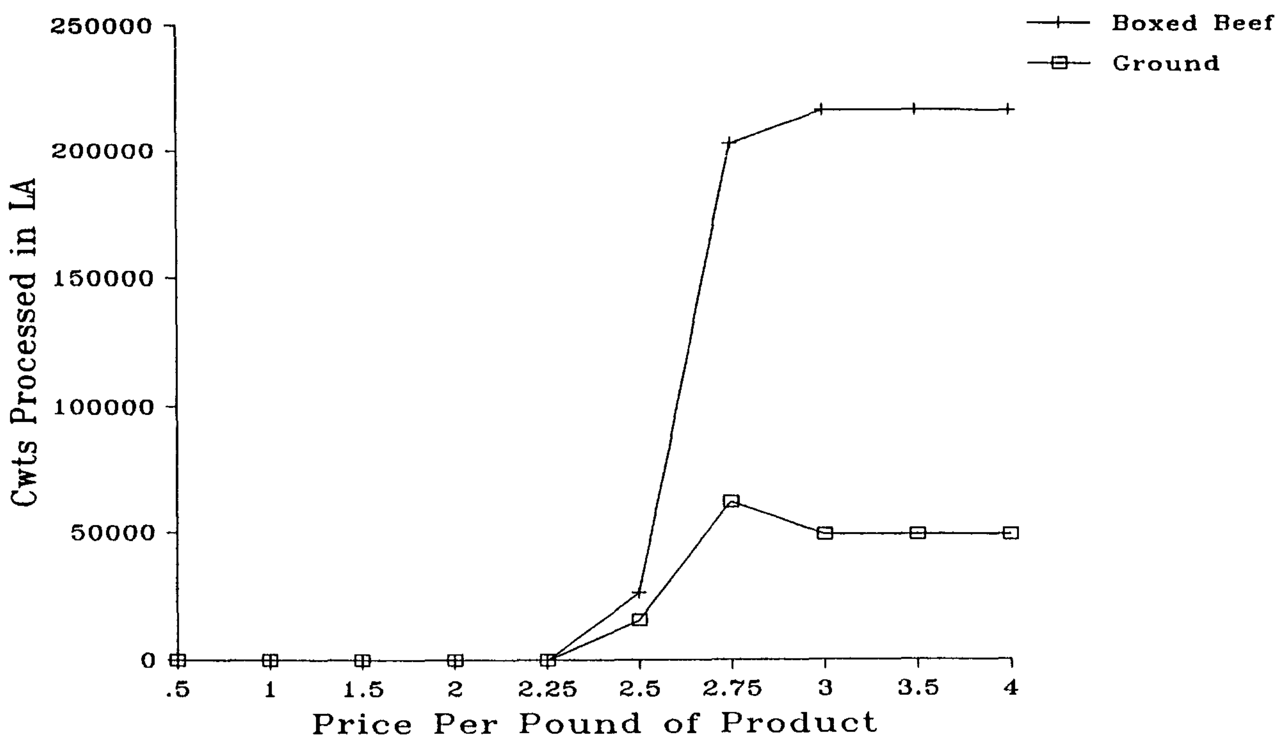

Figure 2. Quantity of Product Produced in the State by Price Level

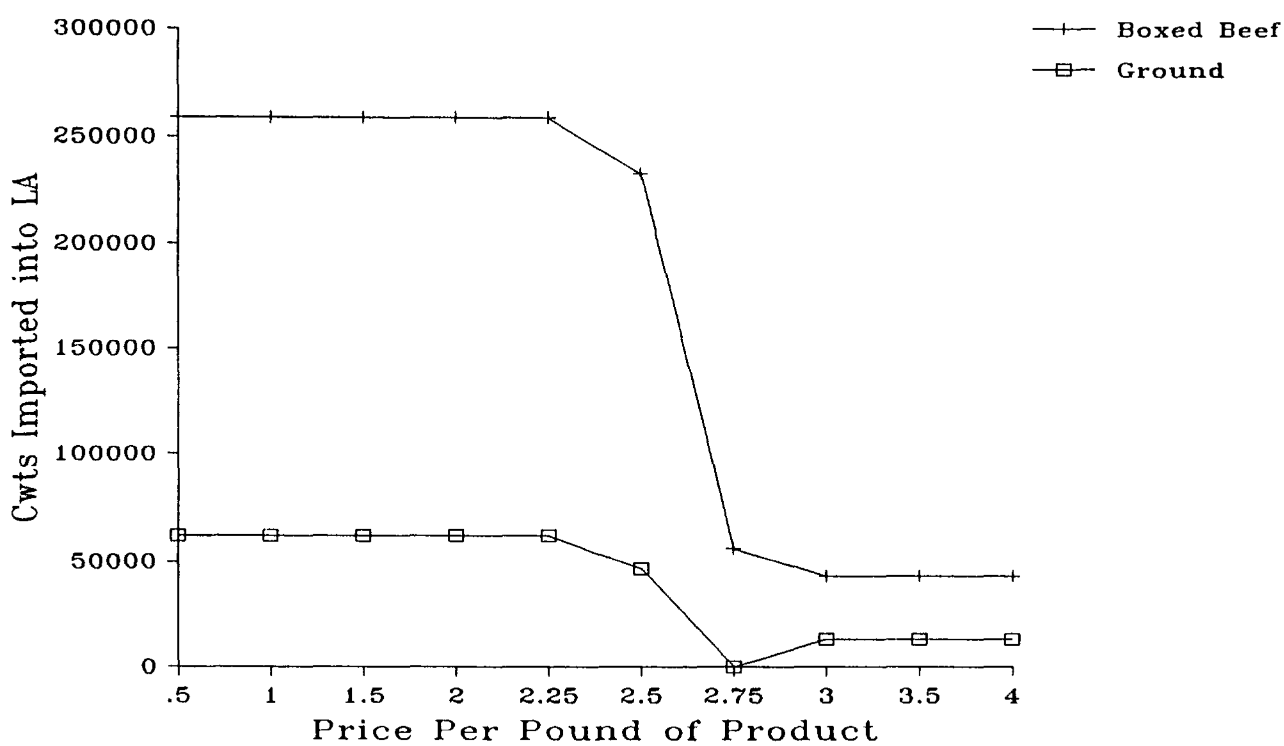

Figure 3. Imports of Product into the State by Price Level

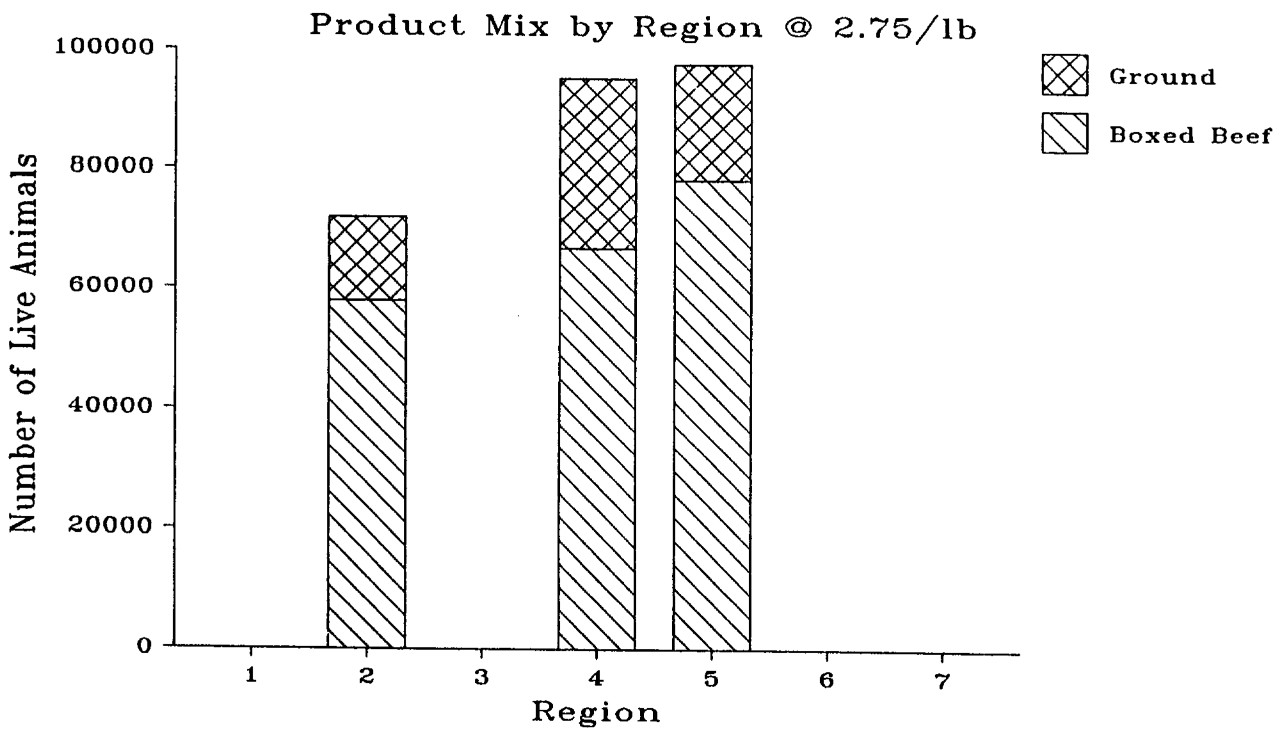

Figure 4. Distribution of Product by Region and Number of Head

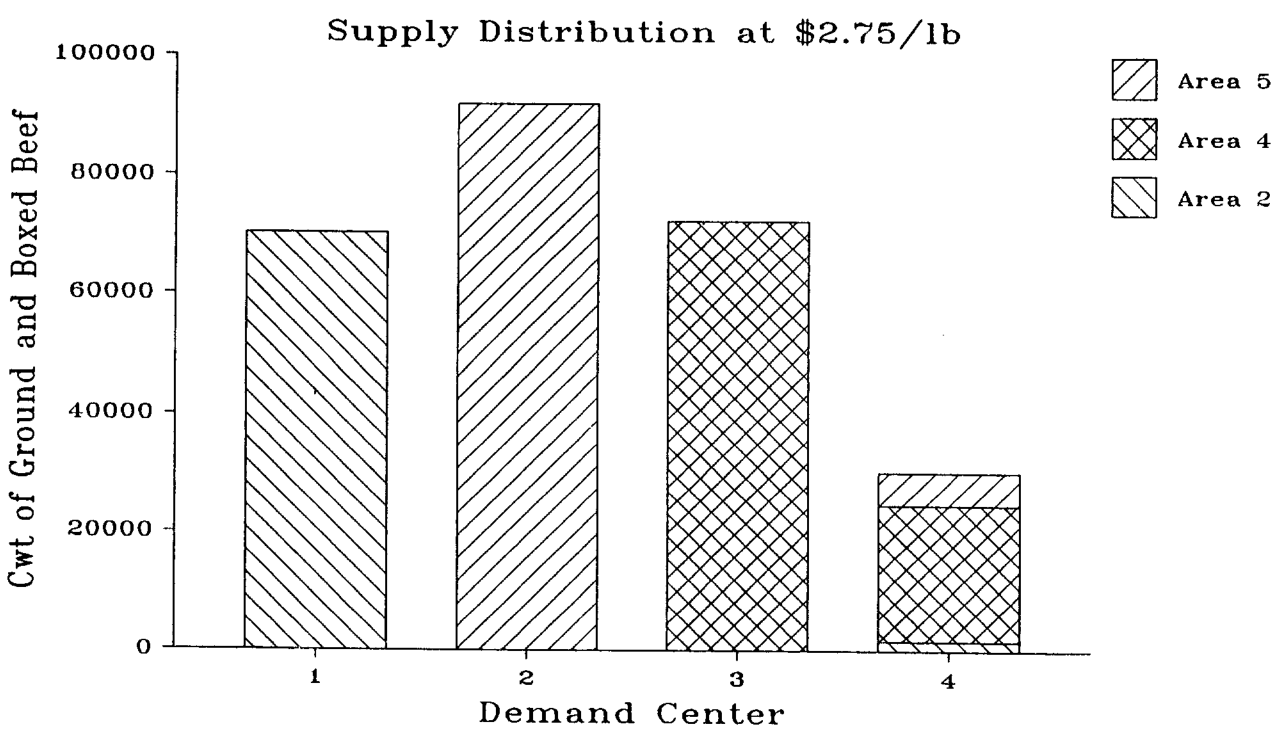

Figure 5. Distribution of Total Product by Producing Area to Demand Center

constraint is a limitation of the disk-operating system (DOS), not the solution algorithm GAMS.

Specific to lean beef processing in Louisiana, cost and price relationships indicate that, at the current product price of about $2.10 per pound, it is not feasible to establish processing plants in the state. Even if product price increased above $2.50 per pound, product imports would be required to meet existing in-state demands. It should be noted that product demands in the model are assumed to be constant. An obvious extension to this analysis would involve endogenizing regional product demands in the model formulation.