THE EFFECTS OF CHANGING ENERGY COSTS ON THE COMPETITIVE POSITION OF THE KANSAS CATTLE FEEDING INDUSTRY

by

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CHAPTER 1

INTRODUCTION

The cattle industry in Kansas has a long and colorful history. From the earliest cattle drives in the mid-1800's to the large slaughter-boxed beef operations today, the cattle industry has been a significant component of Kansas history. In addition to the folklore, the industry is a major fixture in the state's economy. Cattle marketings account for the largest subset of cash receipts from farm marketings in the state with 48.2 percent of the $5,774,358,000 total in 1980, or $2,783,240,556.

Kansas ranked fourth nationally in both cattle and calves on grain feed, January 1, 1982 and in red meat production by commercial slaughter plants. Cattle on feed numbered 1,110,000 head on January 1, 1982 representing 11.0 percent of the nation's total. Red meat production by commercial slaughter plants in 1981 for Kansas was 2,733,696,000 pounds, or 7.1 percent of the national total. In 1980, Kansas had 3,500 feedlots that finished a total of 3,015,000 head. The leading 23 cattle feeding states had a total of 113,326 feedlots and 23,183,000 head of finished cattle. The State of Kansas has 3.09 percent of the feedlots and 13.01 percent of the fed cattle in the 23 states.

Clearly, cattle feeding and meat packing are currently significant industries in both the Kansas economy and the national economy. However, Kansas has not always been a leader in this area. Grain fed cattle marketings have increased over 300 percent from 1961 to 1981. In 1961 961,000 head of grain fed cattle were marketed while in 1981 that number had grown to 2,985,000 head. The high point in cattle feeding came in 1978, when 3,471,000 head of grain fed cattle were marketed from Kansas feedlots.

Several factors have influenced the growth of cattle feeding in Kansas. Certainly the vast supplies of feedgrains available in the High Plains area is most important. This was caused by (1) the development and continued genetic improvement of hybrid corn and grain sorghum and (2) the development of irrigation in the region. The use of hybrids has increased the yields of corn and grain sorghum over the past four decades. Total corn and grain sorghum production in Kansas has increased from an average of 87,929,000 bushels in 1946-1950 to an average of 354,996,000 bushels in 1976-1980. Acres available for irrigation in Kansas have increased 413 percent from 1960 to 1980. There were 519,200 acres irrigated in 1961. In 1980, 2,145,400 acres were available for irrigation in Kansas.

Secondly, population growth in the South and Southwest has outgrown that of other regions in the United States. Kansas is closer than previous cattle feeding areas to this growing market. Land has historically been less expensive in Kansas than in the cornbelt. Transportation costs favor feeding cattle closer to the source of feedgrains rather than close to the final market. Similarly, it is less expensive to slaughter the cattle near the feedlot rather than shipping the live cattle to be slaughtered near the final market. An average steer requires 7 pounds of ration dry matter per pound of gain. Feedlot rations commonly contain 80 percent dry matter. Each pound of gain requires 8.75 pounds of feedlot ration. Also, cattle have an average dressing percentage of 60 percent. A 1,000 pound steer yields 600 pounds of wholesale product. Each pound of meat in the final market represents 1.67 pounds of live animal and that in turn represents 14.5 pounds of feedlot ration. It is obviously less expensive to ship beef than live animals or feedstuffs.

Transportation has improved with better highways and transportation equipment. The dry climate with relatively mild winters and low humidity in Kansas favors feedlot operation and is conducive to more rapid cattle gains. Current advantages for Kansas stem from the fact that the cattle feeding-beef packing industry is already in place. There is ample investment capital, managerial expertise and public support. Larger, more efficient beef packing plants have located within the state.

STATEMENT OF PROBLEM

Recently, there have been changes in the competitive position of the cattle feeding-beef packing industry in Kansas. The advantage of abundant, less expensive feedgrains has for the time disappeared. The national season average price for corn in 1981-1982 was \$2.65 per bushel. Kansas corn price was \$2.80 while corn in Iowa averaged \$2.65 per bushel. The price in Kansas was 5.7 percent above the national and Iowa price. In the period 1981-1982, seasonal average corn prices in the Southern High Plains (Kansas, Oklahoma, Texas) ranged from 5.7 to 13.2 percent above the seasonal average corn price in Iowa (USDA, 1983). The supply of corn grain has not increased sufficiently to meet the demand from cattle feeding in the region, relative to national supply/demand relationships. Reasons generally accepted for this are (1) rising energy costs make irrigated grain production more expensive and (2) falling water table levels in parts of the Ogallala Aquifer formation have made irrigation more prohibitive and in extreme cases impossible. The cost of production advantage for fed cattle in Kansas might shift to some other area if feedgrain supplies are restricted and/or more costly. This study will not examine the availability or supply of feedgrains as costs increase. Rather, it will identify the effects of higher feedgrain prices on cattle feeding.

Energy costs have risen steadily over the past 15 years. In 1968, the farm price of a gallon of diesel fuel was 17.2 cents. Prices have increased in nominal terms about 650 percent to $1.12 per gallon in 1982 with a high of $1.18 per gallon in 1981. Irrigated corn production in Kansas uses more energy inputs than corn production in the cornbelt (Pimentel, 1980). Rising energy costs will unevenly affect the cost of corn production in different growing areas. Since Kansas corn production is more energy intensive, costs will rise faster in Kansas than in the cornbelt as energy prices increase.

The major forces behind rising energy prices have been global inflation and the activity of the OPEC cartel. In addition, decontrol of crude oil and natural gas prices has been planned to take effect in this decade. Although natural gas and oil prices are determined in separate markets, both have increased in price in recent years. Because of possible natural gas deregulation and imported oil supply shocks, increasing energy prices has become an issue of concern for many, including those in the cattle feeding and beef packing industries.

The question remaining to be answered is: "What effects will changing energy prices and other critical variables have on the competitive position of the Kansas cattle feeding industry?" Energy costs have not been given as an important determinant in the past shifts in the location of cattle feeding activity. History will not serve as a guide in this case.

OBJECTIVES OF THE STUDY

The overall objective of this study is to identify the effects of changing energy prices and other selected variables on the competitive position of cattle feeding and beef packing in Kansas. The possible combinations of conditions under which Kansas has a competitive advantage will be identified. Specifically, the objectives are:

(1) Trace the growth and development of Kansas feedgrain, cattle feeding, and beef packing industries.

(2) Define the costs of currently typical cattle feeding systems in Kansas and the cornbelt.

(3) Describe the levels of energy use in these systems.

(4) Identify the markets in which Kansas slaughtered beef is currently marketed.

(5) Determine the level of energy cost increase/decrease resulting in a shift in the cost of production advantage between regions.

(6) Determine the level of energy cost increase/decrease resulting in a change in the competitive position between regions for each market identified in (4).

(7) Identify the key factors for the competitive position of the Kansas cattle feeding industry that will be important as energy costs change in the future.

CHAPTER 2

REVIEW OF LITERATURE

Previous stndies linking energy costs with regional production of given commodities agree on two points: (1) production of fresh produce will shift toward consuming regions while production of processed commodities will move to areas of lowest energy cost, (2) prices will ultimately be higher for consumers. Bielock and Dunn (1982) found that higher energy costs would concentrate domestic potato production in the Northwestern U.S. The product mix available to consumers changes from largely fresh potato products to frozen potato products as energy costs increase. The Northwestern U.S. has a competitive advantage in potato production in an increasing energy cost scenario. Tyan (1982) in a study of transportation costs found that with higher energy costs allocations of produce to markets adjacent to or within production areas are expected to increase at the expense of other consuming markets. In a study of the peach industry, Dunn and Beard (1982) conclude that in general, higher transportation costs benefit growers in importing or product deficit areas and hurt growers in exporting or product surplus regions. The significant issue is to what extent production regions could shift. While these and other studies have not investigated the cattle feeding industry, their methods and conclusions are worthy of a closer look.

Bogle (1976) used a simplified analysis to determine the impact of natural gas curtailment on Kansas agriculture. Natural gas would be eliminated from agriculture under this scenario. Using enterprise budgets for irrigated crops in Western Kansas, Bogle reported an annual increase in irrigation energy costs of $15,160,176 by switching completely from natural gas to electricity as an energy source for irrigation.

Using tbe budgets, the return to management was derived for the three major irrigated crops in Western Kansas; irrigated corn, irrigated grain sorghum and irrigated wheat. The return to management for irrigated corn was $86.58/acre, for irrigated grain sorghum was $14.08/acre, and for irrigated wheat was $40.34/acre. It was assumed that if natural gas was eliminated from agriculture, electricity would be the energy source used. A further assumption was that farmers will stop growing irrigated corn (tbe most energy use intensive of the three irrigated crops) in favor of either irrigated grain sorghum or irrigated wheat. If farmers switched from irrigated corn to irrigated grain sorghum, annual management income would fall $43,463,532 in the western tbird of Kansas. An annual loss of $27,720,742 in management income would be incurred by switching from irrigated corn to irrigated wheat. This represents an annual increase in irrigation energy costs of $15,160,176.

Tyan (1982) looked at the effect of rising transportation costs on tbe distribution of Georgia's fresh produce. The analysis used a quadratic programming model derived from the work of Takayama and Judge. The model maximizes net social payoff as a measure of welfare. A base solution was compared to the solution incorporating an increase in transportation costs.

Transportation costs were increased by 24 percent. Energy expenditures are estimated to be 24 percent of the transportation cost of fresh produce in refrigerated trucks. Thus there is an implicit 100 percent rise in energy costs. This increase only shows up in the transportation costs; production costs remain unchanged.

The results show that in general, shipments to fresh produce producing regions are contracted. Consumption of fresh produce decreases in markets further from the producing regions and increases within the production area. The implication for cattle feeding is that rising energy costs will lead to decreased shipments of beef to consuming areas not adjacent to the Kansas feedlot-meat packing area. Producers nearer large metropolitan areas might benefit from energy cost increases at the expense of producers farther from the market.

Similar results were obtained by Dunn and Beard (1982) in their study of the peach industry. The Samuelson-Enke model for spatially separated markets was solved using quadratic programming. The United States was split into eight consuming regions, each region with a destination city. Five producing regions were derived. Of these, two regions were in California, one for freestone (fresh) peaches and the other for clingstone (processing) peaches.

A fuel price index in the model was increased from 100 to levels of 200, 300, 400 and 500. Real retail prices of fresh peaches rose 69 percent in Boston, and 72 percent in Los Angeles. Farm prices in Pennsylvania rose 72 percent while California freestone (fresh) prices rose only 1 percent. Production under this scenario increases in the eastern states and decreases in California.

Dunn and Beard conclude that higher energy prices will have uneven effects on the peach industry. Higher transportation prices will benefit growers in importing or product deficit areas and hurt growers in exporting or product surplus areas. The implication for the cattle feeding-beef packing industry in Kansas is again that production will decrease. Cattle feeding and beef packing will increase in areas nearer to the consumption markets.

Beilock and Dunn (1982) had as their objective to construct an econometric model of the domestic potato industry. The model was to be useful in predicting the effects of the possible future changes in some of the exogenous variables, particularly energy variables. Emphasis was placed on examining the impacts of changes in energy costs with respect to production levels, location, and product forms.

Five supply regions were identified: Northeast, North Central, Northwest, Early Eastern, and Early Western. Fall and Early were the two seasons used. Potatoes could be used as fresh and chips, frozen, dehydrated, and miscellaneous (seed and waste). Retail demands were estimated at the national level. It was assumed that supply would always equal demand. The model provided price and quantity estimates at the farm, wholesale or processing, and retail levels.

Three energy-cost scenarios were replicated. Real energy costs increased at rates of 2, 5, and 10 percent annually to the year 2000. Total potato production remained the same under all scenarios, indicating the failure to discover an acreage-planted to fuel-cost link. If the current trend is maintained, the Northwest continues to expand production while the other regions decline. The product mix available to consumers changes drastically between the scenarios. Rapidly increasing energy costs cause a more rapid rise in production in the Northwest. Increases in fuel costs enhance the comparative advantage for processed potato products from the Northwest.

Jordan (1979) used enterprise budgets in a comparative statics approach to study the competitive position of Michigan's fresh apples and potatoes. The analysis employed a four step approach. First, per unit cost of production enterprise and transportation budgets were constructed for Michigan and Washington (for comparative purposes) apples and potatoes. Then, per unit energy budgets were constructed for the same states and commodities. The direct and indirect energy requirements were measured by type and dollar amount. The price of energy inputs was increased in the third step. Using the above two budgets, the energy price was increased to find the threshold price that changes the competitive balance between states for the two commodities. Finally, estimates were provided for market areas in which Michigan commodities can be delivered at a lower cost relative to Washington.

Washington was chosen to compare to Michigan because that state competes successfully in the fresh apple and potato markets. There are also regional differences in energy use due to different production methods. Apples and potatoes were chosen commodities for several reasons. They are sizeable industries in both states. Both states compete in these commmodities. Finally, both commodities require large fossil fuel inputs.

Jordan found that changes in the competitive position between states is related to the distance from the production site to market. The distance to market is the major determinant of the regional competitive pattern between states. Production function differences between firms in different states are not the major determinant of the regional competitive pattern. Further, it is noted that Michigan commodities will be less expensive as costs rise, relative to Washington commodities. An expansion of Michigan's fresh apple and potato markets can be expected.

Several authors have looked at the location of cattle feeding activity. They have not, however studied the impacts of energy costs upon the location of cattle feeding. Hieronymus (1982) concludes that cattle will be fed where the feedgrains are least expensive and most abundant. The major advantage for the Upper Midwest (Nebraska, Iowa, Illinois, Indiana, Minnesota, Missouri, and South Dakota) is a low-cost feed supply. Climate and an established, efficient industry are given as the Southwest's (Kansas, Texas, Oklahoma, and Colorado) advantages. Since technology and labor are free to change over time, Hieronymus sees the industry shifting from the Southwestern Plains to the Upper Midwest.

Price (1983) also looked at shifts in the location of feedlot activity. He listed three large feeding areas; the Western Cornbelt (Iowa, Minnesota, and Missouri), the Northern Great Plains (Montana, Wyoming, North Dakota, South Dakota, Nebraska, and Colorado), and the Southern Great Plains (Kansas, Oklahoma, Texas, and New Mexico). The only area exhibiting constant growth in fed cattle marketings from 1970 to 1981 was the Northern Great Plains. The regional share of marketings, as a percentage of the 23 state total, increased 3.7 percent during that time. The region's share was 25.5 percent in 1970, 27.6 percent in 1978 and 29.2 percent in 1981. The Western Corn Belt regional share fell 8.9 percent in the same period, from 24.7 percent in 1970 to 15.8 percent in 1981. The Southern Great Plains, including Kansas, increased their marketings from 23.97 percent of the 23 state total in 1970 to 35.86 percent in 1978. Marketings then fell to 34.14 percent of the 23 state total in 1981. The regional share of fed cattle marketings increased 11.89 percent from 1970 to 1978 but from 1978 to 1981 the share fell 1.72 percent. Noting this, Price concludes that cattle feeding activity will move more into the Northern Great Plains region.

CONCEPTUAL APPROACH IN THE STUDY

The purpose of the study is to find the effects of changing energy prices on the competitive position of the Kansas cattle feeding industry. Kansas has been listed in the Southwest region and in the Southern Great Plains region by Hieronymus and Price, respectively. These authors felt that cattle feeding has been moving into the Upper Midwest region and the Northern Great Plains region. Large regional differences in the production of beef exist within each area listed. To counter this, Kansas is studied as a state rather than as a member of a region. The proxy state for the traditional Cornbelt area is Iowa. Iowa is in the Upper Midwest region and the Western Cornbelt region described by Hieronymus and Price, respectively.

The conceptual approach in the study is similar to that of the other studies reviewed. There is however, a difference between the effect of rising energy costs on the transportation of fresh fruits and vegetables and the transportation of meat. The transport of fruits and vegetables is more sensitive to fuel price changes. Christensen (1980) estimated the impact of rising transportation fuel costs on the competitive position of New England agriculture. A $0.50 per gallon change in diesel fuel price changed the per hundredweight transportation cost of fresh fruits and vegetables by $1.06 per hundredweight. For meat, a $0.50 per gallon change in diesel fuel price resulted in a $0.469 per hundred weight change in transportation cost. Rising fuel prices will affect the transportation cost of meat less than that of fresh fruits and vegetables.

Another distinction between meat and fresh produce is the number of steps involved between the production phase and the consumer's table. Fresh produce is consumed after minimal processing. Produce must be harvested, cleaned, graded by size and quality, packaged and shipped to market. Beef, on the other hand, follows an assembly process. Feeder calves must be produced and shipped to the feedlot. Ration components must be grown and stored at or near the feedlot. The cattle feeding phase brings these steps together. Cattle slaughter is intuitively a more involved process than harvesting and packaging fresh fruits and vegetahles. Further processing of beef might he necessary at the retail market to satisfy local needs or customs.

The approach used in the study is to compare Kansas cattle feeding (the Southwest in general) to Iowa cattle feeding (the Cornhelt in general). As in the Jordan study, specific production hudgets will he developed for each state. Iowa cattle feeding is characterized hy farmer-feeders. These farmer-feeders utilize excess seasonal labor and farm-produced feedstuffs in the cattle feeding enterprise. Kansas cattle feeding is a two-part system. The backgrounding phase is the first part. Growing cattle are fed a primarily roughage ration. The cattle are later moved into a commercial feedyard for feeding to market weight and finish. These two cattle feeding systems are compared in the analysis.

The budgets in the Iowa (Cornbelt) system are continuous cropped corn, corn silage and cattle feeding. Center pivot irrigated corn, center pivot irrigated corn silage and cattle hackgrounding hudgets are developed for the backgrounding phase of the Kansas (Southwest) system. The feedlot phase consists of center pivot irrigated corn, center pivot irrigated alfalfa and cattle feeding hudgets.

There are also hudgets for the slaughter and transportation segments of the heef cattle industry. An important assumption in the slaughter phase is that beef is a homogenous product. Consumers cannot differentiate between beef from the Kansas cattle feeding industry and heef from the Iowa farmer-feeder system. Retailers in the market can differentiate hetween Kansas heef and Iowa heef only on the hasis of price. Consumers and retailers alike are presumed to prefer the lowest cost product.

Energy prices are changed and comparisons made between states. Two comparisons are of interest. First, at what level of energy price change, if any, does the cost of production advantage shift from one state to the other? Also, for each market in which Kansas and Iowa compete, what level of energy price change, if any, changes the source of least cost beef? The competitive position of a state (region) is thus its ability to produce and transport beef less expensively to other states (regions) as energy costs change.

In the short-run, a firm will continue to produce as long as variable costs are covered. Therefore, the minimum acceptable price for the representative firm's beef in the short-run is where marginal costs are equal to average variable costs. Studying only the average variable cost of typical cattle feeding systems is an incomplete analysis if longer term issues are of interest.

In the long-run, the representative firm needs to cover the total costs of production. As economic conditions change, the firm will adjust production levels and factor substitution including the technological change that takes place to meet this long-run requirement. This study does not consider such long-run adjustments, does not consider changes in demand for the final product or the supply of inputs to the production process. Only static economics of changing the price of a variable input with all others held constant is considered. Fixed costs as well as variable costs are considered so the procedure comprises more than a short-run analysis although it is not a dynamic long-run analysis.

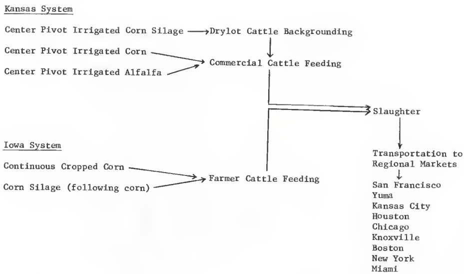
An analysis of this type although recognized as not being perfect should indicate what individual variables may lead to dynamic adjustments. If a particular variable does not have a relatively large impact on the static comparative cost of the two systems under consideration it would not likely lead to a significant adjustment under dynamic economic considerations. A static analysis can therefore indicate which of the variahles considered have the greatest potential to affect the competitive position of cattle feeding over the next several years and should prove to he useful information.

The purpose of this stndy is to quantify the effects of rising energy costs on the competitive position of the Kansas cattle feeding industry in a comparative statics framework. The approximate change in real energy prices that changes, if at all, the competitive cost position of the Kansas industry will he found.

A series of production budgets are used to determine the total cost of heef from the different cattle feeding systems. The hudget series will mimic the steps involved in the Kansas and Iowa systems. These steps are outlined in Figure 1. The Kansas cattle feeding industry starts with feedgrain and roughage production at the farm level. Cattle are backgrounded on a primarily roughage ration hy farmers. Cattle then move into a commercial feedlot for finishing to market weight and quality. The cattle are slaughtered and the heef is shipped to a regional market. The Iowa system shows the farmer-feeding producing the feedstuffs and also feeding the cattle to market weight and quality. After slaughter, the heef is shipped to the regional markets. The remainder of this chapter will discuss these steps and their respective budgets in more detail.

The cattle feeding systems presented for the High Plains and the Cornbelt are two of many possihle comhinations of feedstuffs, cattle and final market considerations. The cattle feeding industry ohviously starts with the calves produced from the cowherds in various regions in the nation. Lockeretz (1977) presents comhinations of cattle feeding systems. These systems include cow-calf production, various rations, and quality grades in the retail market.

Figure 1. Outline of Cost Components in the Kansas and Iowa Cattle Feeding Systems



This study will consider only one production system for each region, with the cow-calf phase and meat quality considerations omitted. Obviously, cattle feeding in the United States consists of many possible combinations of enterprises in an assembly process.

The format of the production budgets used in the study is shown in the example in Figure 2. These budgets contain the information from specific enterprise budgets obtained for Kansas and Iowa. The budget computes the total cost per unit produced. Total costs are divided into variable and fixed costs. Variable costs are further sub-divided into three subsets: non-energy inputs (VC 1), direct energy inpnts (VC 2), and indirect energy inputs (VC 3). The non-energy inputs do not have an energy component. It follows that as real energy prices change, the price of these inputs will remain constant. Examples of non-energy inputs include labor, insurance, interest, and marketing costs. Direct energy inputs are the second subset of variable costs. These inputs are the fuel sources (direct energy) used in the production process. As energy cost changes permit, direct energy inputs will change by an equal amount. Direct energy inputs include natural gas, diesel fuel, lp gas, and electricity.

Indirect energy inputs are the final subset of variable costs. These inpnts contain both energy components and non-energy components. For example, pesticides require direct energy, indirect energy, and non-energy inputs in the manufactnring process. The direct energy inputs include electricity and the fuels burned to provide the heat source used as a catalyst. Inputs such as the hydrocarbon seedstock used in the manufacturing process and the fuel used in transporting the final product represent the indirect energy inputs group. Labor, advertising and inert materials are non-energy inputs. Pimentel (1980) estimates that energy inputs for pesticides range from 6.3

Figure 2. Format of the Production Budgets in the Study.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.00	hours	$4.00	$12.00						
Irrigation equip. repairs				$25.56	$25.56					
Machinery repairs				$12.00	$12.00					
Miscellaneous				$3.00	$3.00					
Interest			15%	$10.50	$9.91					
				$63.06	$50.47					
VC2 Direct energy inputs										
Diesel fuel	14.40	gallons	$1.06	$15.26	$15.26	508.32	0.03003	35.3000	0.03003	$15.26
LP gas	19.00	gallons	$0.72	$13.68	$13.68	456.00	0.03000	24.0000	0.03000	$13.68
Natural gas	18.79	M cubic ft	$2.52	$47.35	$47.35	4735.00	0.01000	252.0000	0.01000	$47.35
				$76.29	$76.29	5699.40				$76.29
VC3 Indirect energy inputs										
Seed	16.67	lbs.	$1.13	$18.84	$18.84	189.04	0.03003	11.3399	0.03003	$5.68
Nitrogen	130.00	lbs. N	$0.16	$20.80	$20.80	707.62	0.01647	5.4432	0.01647	$11.66
Phosphorous	45.00	lbs. P2O5	$0.26	$11.70	$11.70	61.24	0.03003	1.3608	0.03003	$1.84
Potassium	25.00	lbs. K2O	$0.13	$3.25	$3.25	18.15	0.03003	0.7258	0.03003	$0.54
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$3.69	$3.69	30.78	0.01471	20.5207	0.01471	$0.45
(alachlor)	2.00	lbs. a.i.	$4.73	$9.46	$9.46	63.12	0.01471	31.5582	0.01471	$0.93
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$9.32	$9.32	49.03	0.01471	49.0338	0.01471	$0.72
(carbaryl)	2.00	lbs. a.i.	$3.47	$6.94	$6.94	33.05	0.01471	16.5245	0.01471	$0.49
				$84.00	$84.00	1152.01				$22.31
Fixed costs										
Equipment depreciation				$17.14						
Equipment int.,tax,ins.				$12.00	$12.00					
Irrigation equip. depr.				$53.25						
Irri. equip. int.,tax,ins.				$42.60	$42.60					
Land (cash rent equiv.)				$62.80	$62.80					
				$187.79	$117.40					
Total cost per acre				$411.14	$328.16	6851.41				$98.68
Total cost per bushel				$3.16	$2.52	52.70				$0.76
Yield (bushels per acre)				130						
Change in energy price level	0									

megacalories per pound for methyl parathion to 49.7 megacalories per pound for paraquat. The energy components of the pesticides vary according to the hydrocarbon seedstocks used and the amount of heat and electricity used in the manufacturing process.

Other examples of indirect energy inputs include fertilizers and seed used in crop production, and the ration components used in cattle feeding. Since only a portion of these inputs consists of direct energy, they will not have price changes exactly equal to the change in energy prices. The direct energy component of an indirect energy input used in cattle feeding might be 25 percent. If real energy prices were to rise by 100 percent, the input would increase in cost 25 percent. Changes in real energy prices will therefore affect the cost of indirect energy inputs proportional to the direct energy component of the inputs.

Fixed costs make up the remainder of total costs. In this study, fixed costs will not change as energy costs change. Long-run adjustments in the cattle feeding industry to changes in energy price levels would be expected. These adjustments might contain an energy component themselves. Investments in new equipment or new technology would change in cost as real energy costs change depending upon the direct energy component of the investment. However, this study will assume existing equipment and technology will remain in use during the study period.

For each variable input, the quantity, units and price of the input is listed. Costs are computed on a total and cash basis using this information. Cash costs are actual out-of-pocket expenses incurred by the farmer for the enterprise budgeted. Total costs include cash and non-cash items. The total economic cost of production is denoted by the total costs. Both cost columns are presented for comparison purposes. The production from the enterprise will be valued at the total cost of production for use in the study. It was argued earlier in this chapter that for a firm to remain profitable in the long-run, all costs must be covered. More specifically, the total cost of production must be earned for the firm to remain profitable.

Energy information is also listed for the inputs on a megacalorie (Mcal) per unit of input or content basis. The base prices are the cost per Mcal before energy prices are changed. The energy cost per Mcal will be changed for analysis purposes. This will fully affect direct energy use and only the direct energy component of the indirect energy inputs in the production process.

Transportation budgets will follow a different format. The change in per unit cost resulting from a fuel price change in the transportation budget can be estimated using a method reported by Christensen (1980). For this procedure the following information must be known:

1. Distance inputs or products are shipped
2. Fuel consumption rate in miles per gallon
3. Change in fuel price per gallon
4. Truck capacity

With this information, the following formula may be used to estimate the per unit change in the cost of transporting beef resulting from a change in fuel cost.

$$C_d = P_d \frac{\frac{D}{MPG}}{C}$$

where:

C_d = change in transportation cost per unit resulting from fuel price change

P_d = change in fuel price

D = distance shipped

C = capacity of truck

MPG = miles per gallon

The change in transportation cost per unit (C_d) must be added to the original freight rate per unit to determine the transportation cost after the fuel price change. The transportation budget format is shown in the example in Figure 3. The information needed for the previous formula is listed in the budget. The initial freight rate and the change in transportation cost are added to determine the final freight rate. This is added to the cost of beef from the respective cattle feeding system to determine the total cost of beef from Kansas and Iowa in each market. The advantage/disadvantage for the Kansas cattle feeding-meat packing industry is labeled and shown on a per hundredweight basis.

Nine regions have been identified by Bittel (1972) in which Kansas beef and Iowa beef compete. The nine regions are geographically located in the continental United States and have one city in each region serving as a market for that region. The regions and cities listed in the transportation budget are shown in Figure 4.

The same procedure outlined in this chapter is repeated to study the effects of other selected variables on the competitive position of the Kansas cattle feeding industry. The relative importance of these variables to the industry can also be determined. Specifically, the variables to be studied are farm wage rates, interest rates, feeder cattle prices, the spread in feeder cattle prices between Kansas and Iowa, the difference in slaughter costs between Kansas and Iowa, and transportation rate changes.

Figure 3. Format of the Transportation Budget in the Study.

Freight rates from Wichita, Kansas
cost of beef from Kansas is $107.20 per cwt.

City	Miles	Weight	Change	Initial Rate	Final Rate	Energy Component	Percent Of Rate	Cost of Beef		Difference $/Cwt
San Francisco	1716	42000	$0.00	$4.45	$4.45	$1.06	24%	$111.73	Advantage	$2.12
Yuma	1203	42000	$0.00	$4.45	$4.45	$0.74	17%	$111.73	Advantage	$2.12
Kansas City	197	35000	$0.00	$1.11	$1.11	$0.15	13%	$100.39	Advantage	$1.72
Houston	609	38000	$0.00	$2.35	$2.35	$0.42	18%	$109.63	Advantage	$2.10
Chicago	690	38000	$0.00	$2.54	$2.54	$0.48	19%	$103.82	Advantage	$0.53
Knoxville	874	38000	$0.00	$2.57	$2.57	$0.60	23%	$109.85	Advantage	$1.36
Boston	1595	40000	$0.00	$4.62	$4.62	$1.04	22%	$111.90	Advantage	$0.97
New York	1397	40000	$0.00	$4.41	$4.41	$0.91	21%	$111.69	Advantage	$0.92
Miami	1532	38000	$0.00	$3.89	$3.89	$1.05	27%	$111.17	Advantage	$1.72

Freight rates from Waterloo, Iowa
cost of beef from Iowa is $100.91 per cwt.

City	Miles	Weight	Change	Initial Rate	Final Rate	Energy Component	Percent Of Rate	Cost of Beef
San Francisco	1950	40000	$0.00	$4.94	$4.94	$1.27	26%	$113.85
Yuma	1699	40000	$0.00	$4.94	$4.94	$1.10	22%	$113.85
Kansas City	307	40000	$0.00	$1.20	$1.20	$0.20	17%	$110.11
Houston	1036	35000	$0.00	$2.82	$2.82	$0.77	27%	$111.73
Chicago	260	35000	$0.00	$1.44	$1.44	$0.20	14%	$110.35
Knoxville	825	38000	$0.00	$2.30	$2.30	$0.55	24%	$111.21
Boston	1226	40000	$0.00	$3.96	$3.96	$0.80	20%	$112.87
New York	1077	40000	$0.00	$3.70	$3.70	$0.70	19%	$112.61
Miami	1562	38000	$0.00	$3.98	$3.98	$1.07	27%	$112.89

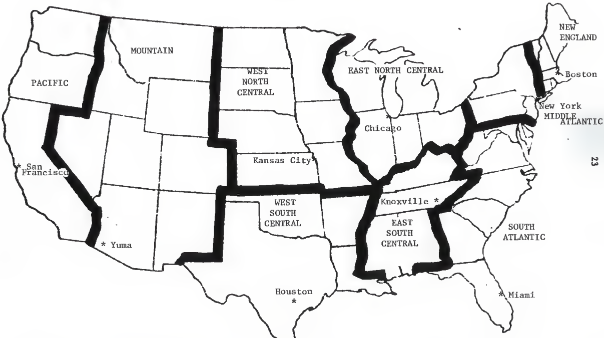
Diesel fuel price is $1.06 per gallon in 1982

Change in energy price level is 0

Diesel fuel price is now $1.06 per gallon

Change in diesel fuel price is $0.00 per gallon

Figure 4. Location of Regional Markets and Destination Cities



CHAPTER 3

DESCRIPTION OF THE KANSAS CATTLE FEEDING INDUSTRY

As was noted earlier, the cattle feeding industry in Kansas has experienced dramatic changes in the past. This section of the study will examine the Kansas cattle feeding industry in more detail. Comparisons will also be made to the national industry and to the cattle feeding industry in Iowa. The following is a brief discussion of changes in the Kansas industry. For more detail see Price (1983), Hieronymuns (1982), Reimund, Martin and Moore (1981) or McCoy and Hansman (1967). Details of farmer-feeding and the Iowa industry can be found in Van Arsdall and Nelson (1983), Futrell (1980) or Vanderflugt (1980).

One of the advantages given for cattle feeding in Kansas is the increasing supply of feedgrains. Table 1 traces the growth of feedgrain (corn and grain sorghum) production in Kansas. Several factors are behind this increase. Per acre yields have been increasing due to continually improving hybrids. Changes in the yields of corn and grain sorghum are also shown in Table 1. Government programs have also had an influence on total feedgrain production. Wheat allotment programs provided acres available for grain sorghum production. Note the dip in production in 1961 and 1962 due to a feedgrain land retirement program.

The development of irrigation has had an effect on both total feedgrain production and yield per acre. Table 2 shows the growth in irrigated acres in Kansas. Over one-half of this growth has taken place in the Southwest area of the state. In 1980 the Southwest district had 56 percent of the irrigated acres in Kansas. Phenominal growth in irrigated acres has occurred in the Northwest area of the state. However, even with irrigation, improved hybrids

Table 1. Feedgrain Yields and Total Production, Kansas 1939-82.

	YIELD		PRODUCTION		
YEAR	CORN	SORGHUM	CORN	SORGHUM	TOTAL
	(BUSHELS/ACRE)		(1000 BUSHELS)		
1982	114	62	139080	207700	346780
1981	126	67	148050	238520	386570
1980	94	43	110920	149640	260560
1979	117	69	171990	246330	418320
1978	102	52	153000	196860	349860
1977	96	60	161280	235600	396880
1976	96	43	171840	165000	336840
1975	86	42	141040	147000	288040
1974	79	40	131930	132800	264730
1973	100	56	154000	218400	372400
1972	104	62	130000	217000	347000
1971	95	54	124545	233550	358095
1970	64	41	82240	145960	228200
1969	79	56	95432	182896	278328
1968	78	47	88452	163325	251777
1967	68	46	72080	149408	221488
1966	58	49	59682	139601	199283
1965	59	46	61950	139426	201376
1964	45	33	46800	98508	145308
1963	46	39	62100	147771	209871
1962	51	44	66198	128760	194958
1961	48	40	58800	111680	170480
1960	46	39	78488	167544	246032
1959	42	34	72660	137802	210462
1958	42	34	65982	131240	197222
1957	30	21	36180	127491	163671
1956	25	15	22525	24390	46915
1955	24	12	24936	33246	58182
1954	24	15	32376	51722	84098
1953	22	16	39028	32144	71172
1952	23	14	44685	18536	63221
1951	24	22	52488	57310	109798
1950	35	23	85470	44689	130159
1949	28	22	64153	29928	94081
1948	33	22	74132	28788	102920
1947	18	15	35748	10933	46681
1946	22	14	54318	11488	65806
1945	24	15	64790	17695	82485
1944	28	22	93067	49261	142328
1943	23	15	68701	16834	85535
1942	27	17	79353	19589	98942
1941	23	17	53222	21885	75107
1940	18	13	34282	24128	58410
1939	15	10	31844	8122	39966

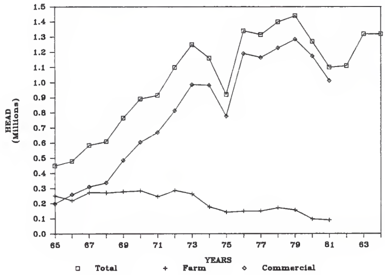
and other improved production techniques, the weather can still influence feedgrain production in Kansas. From Table 1, note the production drop in 1980, a hot and dry summer that caused severe production problems.

Table 2: Total Irrigated Acres, by Crop Reporting District 1960-80.

	Year		
District	1960	1970	1980
NW	18300	46100	240000
WC	103000	111800	269400
SW	343900	485000	1204900
NC	14500	10200	91200
CD	10400	16800	72300
SC	29100	55500	267600
Total	519200	730300	2145400

Kansas has always been a cattle state, but only recently has cattle feeding grown. National trends in cattle feeding are pronounced in Kansas, as Figure 5 shows. Commercial cattle feeding has grown greatly while farmer cattle feeding has declined in importance. (Reimund, et. al., 1981 and Van Arsdall and Nelson, 1983). Notice how this trend has shown up in Kansas cattle feeding since the mid-1960's. This corresponds to the growth in irrigated acres and the increasing feedgrain supply discussed earlier. The growth in commerical feedlots is further shown in Table 3. Feedlot numbers have fallen by 6310 lots in Kansas from 1969 to 1983. A decrease of 6383 lots has occurred in the smallest feedlot size. These small lots are primarily farmer-feeders. An increase in the number of commercial feedots has concurred with the decline in farmer-feeders. Commerical feedlots, generally larger in size, grew in number from 136 in 1964 to 209 in 1983.

Figure 5. Cattle on Feed in Farmlots and Commercial Lots, Kansas 1965-84.



Cattle feeding in Kansas is concentrated in the Southwestern section of the State. Figure 6 illustrates the location of the top ten cattle feeding counties in Kansas. This general area is also the largest irrigated area in the state and a large feedgrain supply area.

Grain fed cattle are not the only cattle in Kansas. The cow-calf and stocker industries currently account for one-fourth of total cattle marketings. Figure 7 illustrates the growth in Kansas cattle marketings. Total marketings have nearly doubled since the mid-1960's, with grain-fed marketings accounting for this growth. Reimund, Martin and Moore (1981) found that rapid growth in cattle feeding was possible in part by the supply of

Table 3. Number of Cattle Feedlots by Size Group, Kansas 1969-82.

	FEEDLOT CAPACITY (HEAD)							
YEAR	under 1000	1000-1999	2000-3999	4000-7999	8000-15999	16000-31999	over 32000	TOTAL
1983	2491	60	35	35	45	25	9	2700
1982	2668	100	24	34	44	22	8	2900
1981	2761	99	39	30	38	25	8	3000
1980	3252	102	42	33	40	24	7	3500
1979	4846	22	29	30	41	22	10	5000
1978	5331	44	26	25	44	22	8	5500
1977	5841	41	21	24	44	21	8	6000
1976	5880	9	15	38	24	26	8	6000
1975	6169	15	18	40	25	26	7	6300
1974	5960	22	27	26	35	23	7	6100
1973	6363	24	26	26	34	20	7	6500
1972	7369	36	17	26	31	16	5	7500
1971	7872	35	21	28	25	15	4	8000
1970	8868	31	35	25	21	16	4	9000
1969	8874	31	30	24	32	19	0	9010

non-fed and grass-fed cattle marketed for slaughter. Feedlots provided an alternative for these cattle, both in feeding and marketing.

Since grain-fed cattle marketings have increased, cattle slaughter has followed suit. Commerical cattle slaughter is shown in Figure 8. Again, the growth in numbers occured in the mid-1960's. Most recently, cattle slaughter has been given another boost by the addition of two large boxed-beef operations located in Southwest Kansas. A 45 percent increase in slaughter has occurred in three years from 1980 to 1982.

The beef from Kansas packing plants is distributed nationwide. Figure 9 illustrates both the distribution of beef from Kansas and how that distribution has changed. Since 1972, distribution of beef has increased in the regions adjacent to and west of the West North Central region (includes Kansas). The regions along the East Coast receive a smaller share. This follows the conclusion of Tyan (1982) that with increasing transportation

Figure 6. Cattle on Feed, Kansas, January 1, 1982. Location by 10 Largest Counties.

Top Number = Rank   Bottom Number = Cattle on Feed (head)

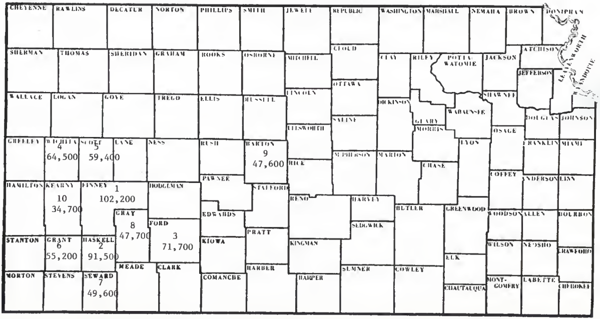


Figure 7. Total Cattle Marketings, Kansas 1965-82.

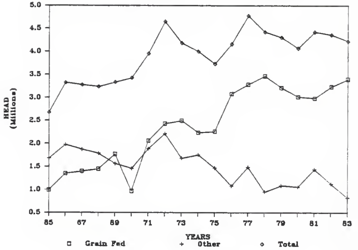


Figure 8. Total Liveweight of Commercial Cattle Slaughter, Kansas 1947-82.

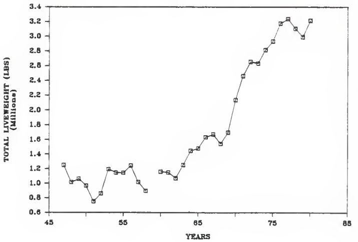
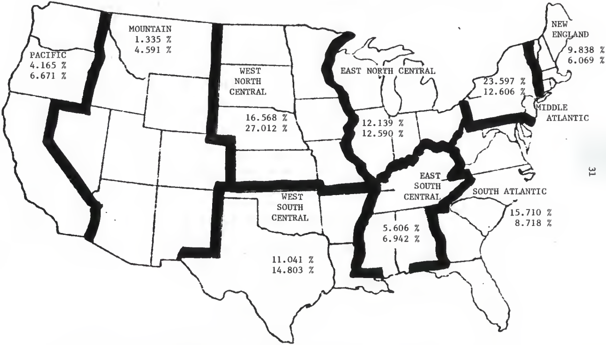


Figure 9. Federally Inspected Kansas Beef Slaughter Distribution, 1972 & 1980.

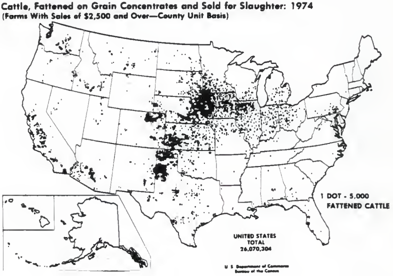


Percent of Slaughter by Region. Top = 1972. Bottom = 1980
Bittel (1972) and Unpublished Data, Dept. of Economics, KSU (1980)

costs, allocations are expected to expand in markets within or adjacent to production areas. This has already been the experience for beef in Kansas.

Price (1983) and Hieronymus (1982) have reviewed the location of cattle feeding in the United States. Figure 10 shows the location of cattle feeding nationwide. The cattle feeding areas designated in this study are easy to see. Kansas is the proxy state for the Southern High Plains area. The heaviest cattle feeding in this region is in Southwest Kansas and the Panhandles of Oklahoma and Texas. Iowa serves as the proxy state for the Midwest-Cornbelt region. Cattle feeding is most prevalent in Northern Illinois, Iowa and the area along the Missouri River.

Figure 10. Location of Cattle Feeding Activity in the United States.



The 1974 Census of Agriculture provides comparisons between Kansas, Iowa and the United States. That year, 26,070,304 head of cattle were fattened on grain in the United States. The 10 leading states fed 78 percent of the total. In Kansas, 2,558,871 head or 10 percent of the total were finished for slaughter. Iowa had 3,247,412 head or 12 percent of the national total. On a county basis, the 100 leading cattle feeding counties fed 51 percent of the total, 13,218,109 head. Kansas has 14 of those top counties while 15 of the counties are in Iowa.

While Kansas and Iowa are big cattle feeding states, there are major differences in structure and current growth of the respective cattle feeding industries. Figure 11 shows total cattle marketed from feedlots in the two states. It is evident that the Kansas cattle feeding industry is currently in a state of growth while cattle feeding is on the decline in Iowa. The Iowa industry is losing the small farmer-feeder. Cattle marketings from feedlots with less than 1000 head capacity are shown in Figure 12. Kansas has not experienced dramatic fluctuations in cattle marketings from this size feedlots, simply because there are not very many of them, compared to Iowa. On the other hand, the small farmer-feeders who make up the bulk of Iowa's cattle feeding have experienced a 63 percent decline in cattle marketings from 1970-1982. Farmer-feeders have been removing the cattle feeding enterprise from their farm businesses. Medium-size feedlots have not left the industry in either Kansas or Iowa. Figure 13 shows cattle marketings from these mid-size feedlots. Slight growth has occurred in these firms. The largest-size feedlots are also experiencing growth in Kansas. Figure 14 illustrates changes in marketings from the giant feedyards. The Iowa industry has relatively few marketings from this size group.

Figure 11. Total Cattle Marketed From Feedlots in Iowa and Kansas 1972-82.

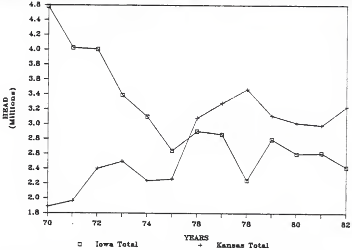


Figure 12. Number of Cattle Marketed by Feedlots with Less Than 1000 Head Capacity in Iowa and Kansas 1970-82.

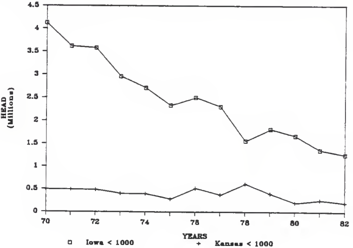


Figure 13. Number of Cattle Marketed by Feedlots by Capacity of Lot Ranging from 1,000-7,999 Head in Iowa and Kansas, 1970-82.

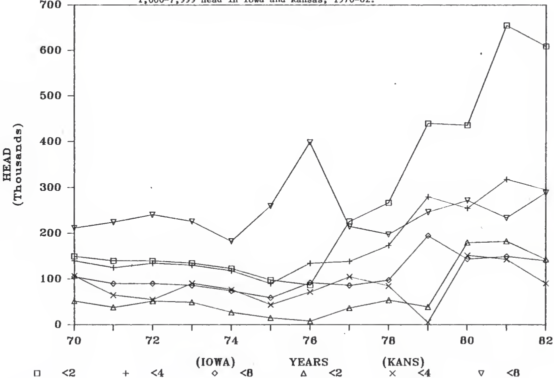
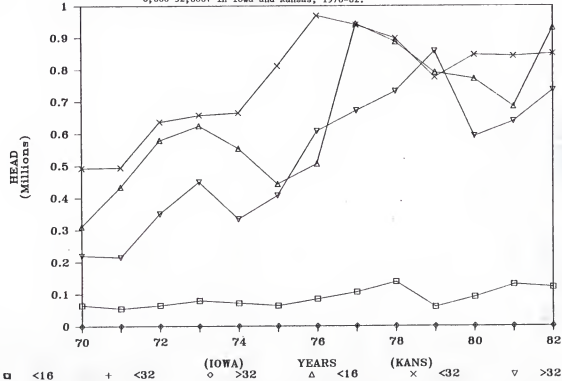


Figure 14. Number of Cattle Marketed by Feedlots by Capacity of Lot Ranging from 8,000-32,000+ in Iowa and Kansas, 1970-82.



The changing structure of cattle feeding can be seen in more detail by looking at the number of feedlots in the two states. The total number of feedlots is shown in Figure 15. Kansas and Iowa both have lost cattle feedlots. A mirror image of Figure 15 is Figure 16. The feedlots exiting the industry have been the small lots. Figure 17 and 18 show the growth in mid and large-size feedlots. The medium-size lots are increasing in Iowa while the larger lots are growing in Kansas.

Currently, the Iowa cattle feeding industry can be summarized as an industry experiencing tremendous loss of firms. Small capacity feedlots, the most numerous type in Iowa, are exiting the cattle feeding industry and as a result Iowa markets fewer head of cattle. Mid-size firms are increasing in Iowa as the smaller lots decline. There are few of the large feedlots in Iowa.

The Kansas cattle feeding industry has also experienced the loss of the small feedlots, primarily farmer-feeders. However, mid-size and larger feedlots have grown in number. Near record numbers of grain-fed cattle are currently marketed from Kansas feedlots. The growth in cattle feeding has corresponded to additional feedgrain supplies in Kansas. The increasing feedgrain supplies are the result of growth in irrigated acres and higher-yielding varieties of corn and grain sorghum. Growth in cattle feeding activity has led to subsequent growth in cattle slaughter. Kansas currently ranks third nationally with 12 percent of the national commercial cattle slaughter.

Figure 15. Number of Total Feedlots in Iowa and Kansas 1970-82.

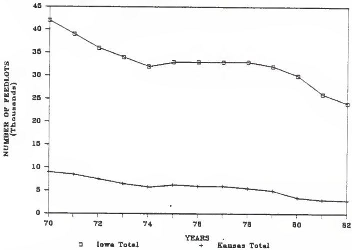


Figure 16. Number of Feedlots of Less Than 1000 Head Capacity in Iowa and Kansas 1970-82.

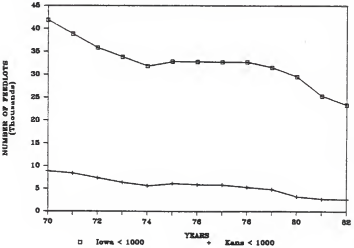


Figure 17. Number of Feedlots by Capacity of Lot Ranging from 1,000-7,999 Head in Iowa and Kansas, 1970-82.

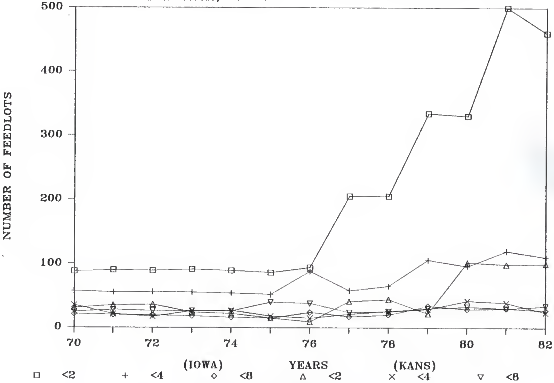
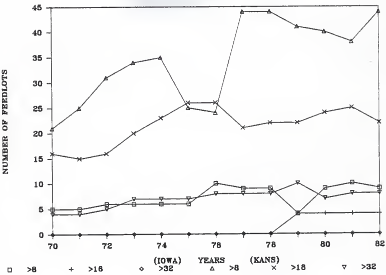


Figure 18. Number of Feedlots by Capacity of Lot Ranging from

8,000 - 32,000+ in Iowa and Kansas 1970-82.



CHAPTER 4

DESCRIPTION OF BUDGETS AND ASSUMPTIONS

The analysis of the Kansas and Iowa cattle feeding systems requires detailed information on costs, cattle performance and energy use in the respective systems. This section of the study develops the necessary information in three steps. The basic data of input costs, direct and indirect energy components of the inputs are assembled. Budgets are constructed for the various stages in the cattle feeding systems using the input information previously developed. Finally, each stage in the two cattle feeding systems are linked together, with the cattle feeding systems themselves linked to the final market.

Variable costs in each budget are grouped into subsets according to the energy component of the input. This grouping was discussed earlier in the study. The inputs and their respective prices in Kansas and Iowa are shown in Tahle 4. The first group of inputs are the non-energy inputs. Only one input (feeder cattle) is common between Kansas and Iowa in the table of base prices. The second suh-set is the direct energy inputs, the fuels in the cattle feeding systems. The largest group is the indirect energy inputs. Included in this subset are: seeds, fertilizers, herbicides, insecticides and feedstuffs. Only a portion of these inputs consists of direct energy.

The energy component of the inputs is presented in Table 5. Non-energy inputs are not a part of this table, their energy component is obviously zero. Direct and indirect energy inputs and their energy components are a part of the table. The energy components are given in Megacalories (Mcal) per unit terms. A megacalorie is 1,000,000 calories. One calorie is the energy required to raise one gram of water one degree centigrade. Thus, one

Table 4. Base Prices used in the Enterprise Budgets, 1982.

Input	Units	Price Per Unit Kansas	Iowa
Non-energy inputs			
Feeder Cattle	cwt.	$ 61.90	$ 60.40
Direct Energy Inputs			
Fuel: Diesel fuel	gallon	$ 1.06	$ 1.06
LP gas	gallon	$ 0.72	$ 0.72
Natural gas	1000 cu. ft.	$ 2.52	N/A
Electricity	kwh	$ 0.07	$ 0.05
Indirect Energy Inputs			
Seed: Alfalfa	cwt.	$190.00	N/A
Corn (hybrid)	bushel	$ 64.00	$ 65.00
Fertilizer: Anhydrous ammonia	ton	$247.00	$253.00
Superphosphate	ton	$233.00	$227.00
Muriate of potash	ton	$159.00	$154.00
Agricultural limestone	ton	N/A	$ 11.45
Herbicide: Atrazine	5 lb. (80 W)	$ 10.10	$ 10.00
Alachlor	5 gal. (4 EC)	$ 94.80	$ 92.20
Trifluralin	5 gal. (4 EC)	$171.00	N/A
Insecticide: Carbofuran	50 lb. (10 G)	$ 46.30	$ 46.70
Carbaryl	10 lb. (80 W)	$ 28.30	N/A
Feedstuffs: Soybean meal	cwt.	$ 12.17	$ 12.50
Wheat midds	cwt.	$ 8.17	N/A

N/A = not applicable

USDA (1983) and USDOE (1982)

Table 5. Energy Component of the Inputs used in Cattle Feeding.

Input	Units	Mcal/Unit	Source
Direct Energy Inputs			
Fuel: Diesel fuel	gallon	35.3000	2
LP gas	gallon	24.0000	2
Natural gas	1000 cu. ft.	252.0000	2
Electricity	kwh	0.8600	2
Indirect Energy Inputs			
Seed: Alfalfa	cwt.	28.1230	1
Corn (hybrid)	bushel	11.3399	1
Fertilizer: Anhydrous ammonia	lb. N	5.4432	1
Superphosphate	lb. P_2O_5	1.3608	1
Muriate of potash	lb. K_2O	0.7258	1
Agricultural limestone	ton	286.1744	1
Herbicide: Atrazine	lb. a.i.	20.5207	1
Alachlor	lb. a.i.	31.5582	2
Trifluralin	lb. a.i.	15.9320	1
Insecticide: Carbofuran	lb. a.i.	49.0338	1
Carbaryl	lb. a.i.	16.5245	1
Feedstuffs: Soybean meal (Kansas)	cwt.	38.3814	3
Soybean meal (Iowa)	cwt.	37.2545	3
Wheat midds	cwt.	48.4208	3

1. Pimentel (1980)
2. Lockeretz (1977)
3. Calculated from enterprise budgets in Pimentel (1980)

megacalorie is the energy needed to raise one metric ton (1,000,000 grams) of water one degree centigrade. One megacolorie will raise 10,000 grams of water from freezing (0°C) to boiling (100°C). To put this in terms of the inpnts, one gallon of diesel fuel contains 35.3 Mcals, enough energy to raise 353,000 grams (about 778 pounds) of water from freezing to boiling.

Converting the cost of the inputs from a per unit basis to a per megacalorie (Mcal) basis is a more complex procedure. The indirect-energy inputs contain several of the direct energy inputs, as the example in Chapter 2 pointed out. Energy cost conversions for the indirect energy inputs are shown in Table 6. All the direct energy sources used in the manufacture and distribution of the indirect energy inputs are listed. For each energy source, the units, megacalories (energy) per unit, number of units and cost per unit are shown. The energy per unit for the direct energy inputs is from the previous table or Pimentel (1980). Prices for the inputs are national average

Table 6. Energy Cost Conversions.

Energy Source	Units	Factor	# Units	Total	Price	$/Mcal
Gasoline	Mcal/gal	31	1	31	1.25	0.0403226
Diesel	Mcal/gal	35.3	1	35.3	'$1.06	0.0300283
Propane	Mcal/gal	24	1	24	$0.72	0.03
Electricty	Mcal/kwh	0.86	1	0.86	$0.05	0.0575581
Natural Gas	Mcal/100ft3	25.2	10	252	$3.72	0.0147619
Coal	Mcal/BTU	0.000248	1000000	248	$1.65	0.0066411
Labor	Mcal/hr	0.18		0		
Machinery	Mcal/lb	9.3		0		
Nitrogen Fertilizer	Mcal/lb	5.8		0		
Phosphate Fertilizer	Mcal/lb	1.3607787	1	1.3607787		0.0300283
Fuel Oil	Mcal/BTU	0.000248	6287000	1559.176	$28.86	0.0185098

Weighted Cost	$/Mcal
Pesticide	0.01471186
Nitrogen Fert	0.01647375

prices per unit. The goal is to derive the weighted cost of the direct energy component in the direct inputs.

The cost ($) per Mcal is computed by dividing the price per unit by the total energy (Mcal) per unit. For example, the cost per Mcal for diesel is $1.06 per gallon/35.3 Mcal per gallon = $0.03 per Mcal. Nitrogen fertilizer and pesticides use a more involved formula to derive the cost per Mcal. The energy component of nitrogen fertilizer is 96 percent natural gas and 4 percent electricity. The weighted energy cost per Mcal is therefore: 0.96 ($0.01) + 0.04 ($0.06) = $0.02 per Mcal. Pesticides have a direct energy component of 42 percent fuel oil, 38 percent natural gas and 20 percent coal. The weighted energy cost calculation is 0.42 ($0.02) + 0.38 ($0.01) + 0.20 ($0.01) = $0.01 per Mcal. The direct energy components of nitrogen fertilizer and pesticides are found in Pimentel (1980).

The production of other indirect energy inputs involves only one direct energy component. For these indirect energy inputs, the energy cost of that component is used as the energy cost for the input. A summary of the energy costs for the various inputs used in the budgets appears in Table 7.

The information used to prepare the production budgets comes from the Cooperative Extension Services of Kansas and Iowa. Crop production and cattle backgrounding budgets in Kansas are based on KSU Farm Management Guides and also Kansas Farm Management Association data for cooperating farms in 1982. Iowa State University Extension publications on Estimated Costs of Crop Production and Beef Cattle Feeding provide information on the Iowa cattle feeding system. The specific publications used are listed in the bibliography. For use in this study, these budgets are adapted to the format presented in Chapter 2.

Table 7. Energy Cost of the Inputs used in Cattle Feeding.

Input	Energy Cost ($/Mcal)
Direct Energy Inputs	
Fuel: Diesel fuel	0.03003
LP gas	0.03000
Natural gas	0.01000
Electricity (Kansas price)	0.08023
Electricity (Iowa price)	0.05400
Indirect Energy Inputs	
Seed: Alfalfa	0.03003
Corn (hybrid)	0.03003
Fertilizer: Anhydrous ammonia	0.01647
Superphosphate	0.03003
Muriate of potash	0.03003
Agricultural limestone	0.03003
Herbicide: Atrazine	0.01471
Alachlor	0.01471
Trifluralin	0.01471
Insecticide: Carbofuran	0.01471
Carbaryl	0.01471
Feedstuffs: Soybean meal	0.03003
Wheat midds	0.03003

Center Pivot Irrigated Corn is the first budget in the Kansas cattle feeding system. The inputs and their use in the budget are listed below, the budget is Figure 19.

Labor: 3 hours of operator labor @ $4.00 = $12.00

Irrigation equipment repairs: 6 percent of irrigation investment per acre. 6 percent of $426 per acre = $25.56

Machinery repairs: estimated as 10 percent of machinery investment per acre. 10 percent of $120.00 per acre = $12.00

Miscellaneous: $3.00

Interest: 1/2 of variable costs per acre @ 15 percent for 240 days ($10.50)

Diesel fuel: 14.4 gallons per acre @ $1.06 per gallon = $15.26

LP gas: (0.15 gallons dries 1 bushel) 0.13 gallon @ $0.72 per gallon for 130 bushels = 19 gallons @ $0.72 per gallon = $13.68

Natural gas: 18,790 cubic feet @ $2.52 per 1000 cubic feet = $47.35

Seed: 16.67 lbs. @ $1.13 per lb. = $18.84 (about 25,000 seeds per acre)

Nitrogen: 130 lbs. of N @ $0.16 = $20.80

Phosphorous: 45 lbs. of P_2O_5 @ $0.26 = $11.70

Potassium: 25 lbs of K_2O @ $0.13 = $3.25

Herbicides: atrazine and alachlor tank mix is common
atrazine: 1.5 lbs. active ingredient per acre @ $2.46 = $3.69
alachlor: 2.0 lbs active ingredient per acre @ $4.73 = $9.46

Insecticides: corn rootworm insecticide + cornborer spray is common
carbofuran: 1.0 lbs. active ingredient per acre @ $9.32 = $9.32
carbaryl: 2.0 lbs. active ingredient per acre @ $3.47 = $6.94

Equipment depreciation: $120.00 per acre investment/7 years = $17.14

Equipment interest, taxes, insurance: 10% of investment per acre $120.00 per acre @ 10 percent = $12.00 per acre

Irrigation equipment depreciation: $426.00 per acre investment/8 years = $53.25 per acre

Irrigation equipment interest, taxes, insurance: 10 percent of investment per acre. 10 percent of $426.00 per acre = $46.20 per acre

Land cost (cash rent equivalent): $62.80 per acre

Figure 19. Center Pivot Irrigated Corn Budget for Kansas, 1982.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.00	hours	$4.00	$12.00						
Irrigation equip. repairs				$25.56	$25.56					
Machinery repairs				$12.00	$12.00					
Miscellaneous				$3.00	$3.00					
Interest			15%	$10.50	$9.91					
				$63.06	$50.47					
VC2 Direct energy inputs										
Diesel fuel	14.40	gallons	$1.06	$15.26	$15.26	508.32	0.03003	35.3000	0.03003	$15.26
LP gas	19.00	gallons	$0.72	$13.68	$13.68	456.00	0.03000	24.0000	0.03000	$13.68
Natural gas	18.79	M cubic ft	$2.52	$47.35	$47.35	4735.08	0.01000	252.0000	0.01000	$47.35
				$76.29	$76.29	5699.40				$76.29
VC3 Indirect energy inputs										
Seed	16.67	lbs.	$1.13	$18.84	$18.84	189.04	0.03003	11.3399	0.03003	$5.68
Nitrogen	130.00	lbs. N	$0.16	$20.00	$20.00	707.62	0.01647	5.4432	0.01647	$11.66
Phosphorous	45.00	lbs. P2O5	$0.26	$11.70	$11.70	61.24	0.03003	1.3608	0.03003	$1.84
Potassium	25.00	lbs. K2O	$0.13	$3.25	$3.25	18.15	0.03003	0.7258	0.03003	$0.54
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$3.69	$3.69	30.78	0.01471	20.5207	0.01471	$0.45
(alachlor)	2.00	lbs. a.i.	$4.73	$9.46	$9.46	63.12	0.01471	31.5582	0.01471	$0.93
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$9.32	$9.32	49.03	0.01471	49.0338	0.01471	$0.72
(carbaryl)	2.60	lbs. a.i.	$3.47	$6.94	$6.94	33.05	0.01471	16.5245	0.01471	$0.49
				$84.00	$84.00	1152.01				$22.31
Fixed costs										
Equipment depreciation				$17.14						
Equipment int.,tax,ins.				$12.00	$12.00					
Irrigation equip. depr.				$53.25						
Irri. equip. int.,tax,ins.				$42.60	$42.60					
Land (cash rent equiv.)				$62.80	$62.80					
				$187.79	$117.40					
Total cost per acre				$411.14	$328.16	6851.41				$98.60
Total cost per bushel				$3.16	$2.52	52.70				$0.76
Yield (bushels per acre)				130						
Change in energy price level	0									

Under the base case assumptions, the total cost per bushel of corn produced in Kansas is $3.16. Cash costs are $2.52 per bushel. Energy required to produce the corn crop is 52.70 Mcal per bushel. The direct energy share of total costs is $0.76 per bushel.

The inputs and costs in Center Pivot Irrigated Corn Silage are summarized here. Figure 20 contains the Center Pivot Irrigated Corn Silage budget.

Labor: 3 hours of operator labor @ $4.00 per hour = $12.00

Irrigation equipment repairs: 6 percent of irrigation investment per acre
6 percent of $426 = $25.56 per acre

Machinery repairs: 10 percent of machinery investment per acre.
10 percent of $120.00 = $12.00

Miscellaneous: $3.00

Interest: 1/2 of variable costs per acre @ 15 percent for 240 days ($9.93)

Diesel fuel: 16.4 gallons @ $1.06 = $17.38

Natural gas: 18,790 cubic feet @ $2.52 per 1000 cubic feet = $47.35

Seed: 16.67 lbs. seed @ $1.13 per lb. = $18.84 (about 25,000 seeds per acre)

Nitrogen: 130 lbs. of N @ $0.16 = $20.80 per acre

Phosphorous: 45 lbs. of P_2O_5 @ $0.26 = $11.70 per acre

Potassium: 25 lbs. of K_2O @ $0.13 = $3.25 per acre

Herbicides: atrazine and alachlor tank mix is common
atrazine: 1.5 lbs. active ingredient @ $2.46 = $3.69
alachlor: 2.0 lbs. active ingredient @ $4.73 = $9.46

Insecticdes: corn rootworm treatment + cornborer spray
carbofuran: 1.0 lb. active ingredient per acre @ $9.32 = $9.32
carbaryl: 2.0 lbs. active ingredient per acre @ $3.47 = $6.94

Equipment depreciation: $120.00 per acre investment/7 years = $17.14

Equipment interest, taxes, insurance: 10 percent of investment per acre
$120.00 per acre @ 10 percent = $12.00 per acre

Irrigation equipment depreciation: $426.00 per acre investment/8 years =
$53.25 per acre

Irrigation equipment interest, taxes, insurance: 10 percent of investment per acre. 10 percent of $426.00 per acre = $42.60 per acre

Figure 20. Center Pivot Irrigated Corn Silage Budget for Kansas, 1982.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.00	hours	$4.00	$12.00						
Irrigation equip.repairs				$25.56	$25.56					
Machinery repairs				$12.00	$12.00					
Miscellaneous				$3.00	$3.00					
Interest			15%	$9.93	$9.33					
				$62.49	$49.89					
VC2 Direct energy inputs										
Diesel fuel	16.40	gallons	$1.06	$17.38	$17.38	578.92	0.03003	35.3000	0.03003	$17.38
Natural gas	18.79	M cubic ft	$2.52	$47.35	$47.35	4735.00	0.01000	252.0000	0.01000	$47.35
				$64.73	$64.73	5314.00				$64.73
VC3 Indirect energy inputs										
Seed	16.67	lbs.	$1.13	$18.84	$18.84	189.04	0.03003	11.3399	0.03003	$5.60
Nitrogen	130.00	lbs. N	$0.16	$20.80	$20.80	707.62	0.01647	5.4432	0.01647	$11.66
Phosphorous	45.00	lbs. P2O5	$0.26	$11.70	$11.70	61.24	0.03003	1.3600	0.03003	$1.84
Potassium	25.00	lbs. K2O	$0.13	$3.25	$3.25	18.15	0.03003	0.7258	0.03003	$0.54
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$3.69	$3.69	30.78	0.01471	20.5207	0.01471	$0.45
(alachlor)	2.00	lbs. a.i.	$4.73	$9.46	$9.46	63.12	0.01471	31.5582	0.01471	$0.93
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$9.32	$9.32	49.03	0.01471	49.0338	0.01471	$0.72
(carbaryl)	2.00	lbs. a.i.	$3.47	$6.94	$6.94	33.05	0.01471	16.5245	0.01471	$0.49
				$84.00	$84.00	1152.01				$22.31
Fixed costs										
Equipment depreciation				$17.14						
Equipment int.,tax,ins.				$12.00	$12.00					
Irrigation equip.depr.				$53.25						
Irri. equip. int.,tax,ins				$42.60	$42.60					
Land (cash rent equiv.)				$62.00	$62.00					
				$187.79	$117.40					
Total cost per acre				$399.01	$316.03	6466.0134				$87.04
Total cost per ton				$18.14	$14.36	293.9097				$3.96
Yield (tons/acre)				22						
Change in energy price level	0									

Land cost (cash rent equivalent): $62.80 per acre

Center pivot irrigated corn silage costs $18.14 per ton. Cash costs per ton are $14.36. The cost of direct energy in corn silage is $3.96 per ton. The amount of direct energy needed to grow one ton of silage is 293.91 Mcal.

The final crop production budget in the Kansas system is Center Pivot Irrigated Alfalfa. The breakdown of this budget is listed below, with the budget in Figure 21.

Labor: 1.75 hours of operator labor per ton (6 tons per acre) = 10.5 hours 10.5 hours @ $4.00 = $42.00 per acre

Irrigation equipment repairs: 6 percent of irrigation equipment investment per acre. 6 percent of $426.00 per acre = $25.56

Machinery repairs: estimated as 10 percent of investment per acre 10 percent of $150.00 per acre = $15.00 per acre

Miscellaneous: $3.00 per acre

Interest: 1/2 of variable costs per acre @ 15 percent for 240 days = $9.35

Diesel fuel: Tillage and planting (annual costs) and fertilizer/chemical application requires 4.3 gallons per acre. Harvest uses 2.1 gallons per ton (12.6 gallons per acre @ 6 tons). Total = 16.9 gallons per acre @ $1.06 per gallon = $17.91

Natural gas: 18,790 cubic feet @ $2.52 cubic feet = $47.35

Seed annual cost: 15 lbs. of seed per acre/5 years = 3 lbs. of seed per acre @ $1.97 per lb = $5.91

Phosphorous: 45 lbs of P_2O_5 @ $0.26 = $11.70

Potassium: 25 lbs. of K_2O @ $0.13 = $3.25

Herbicide: trifluran: 1.0 lb of active ingredient per acre @ 8.55 per lb. active ingredient = $8.55

Insecticide: carbofuran: 1.0 lb. of active ingredient per acre @ $9.32 = $9.32 per acre

Equipment depreciation: equipment investment $150.00 per acre/7 years = $21.43 per acre

Equipment interest, taxes, insurance: 10 percent of machinery investment per acre. $150.00 per acre @ 10 percent = $15.00 per acre

Figure 21. Center Pivot Irrigated Alfalfa Budget for Kansas, 1982.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	10.50	hours	$4.00	$42.00						
Irrigation equip. repairs				$25.56	$25.56					
Machinery repairs				$15.00	$15.00					
Miscellaneous				$3.00	$3.00					
Interest			15%	$9.35	$7.28					
				$94.91	$50.84					
VC2 Direct energy inputs										
Diesel fuel	16.90	gallons	$1.06	$17.91	$17.91	596.57	0.03003	35.3000	0.03003	$17.91
Natural gas	18.79	M cubic ft	$2.52	$47.35	$47.35	4735.08	0.01000	252.0000	0.01000	$47.35
				$65.26	$65.26	5331.65				$65.26
VC3 Indirect energy inputs										
Seed (annual cost)	3.00	lbs.	$1.97	$5.91	$5.91	84.37	0.03003	28.1230	0.03003	$2.53
Phosphorous	45.00	lbs. P2O5	$0.26	$11.70	$11.70	61.24	0.03003	1.3608	0.03003	$1.84
Potassium	25.00	lbs. K2O	$0.13	$3.25	$3.25	18.15	0.03003	0.7258	0.03003	$0.54
Herbicides (trifluralin)	1.00	lbs. a.i.	$0.55	$0.55	$0.55	15.93	0.01471	15.9320	0.01471	$0.23
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$9.32	$9.32	49.03	0.01471	49.0330	0.01471	$0.72
				$30.73	$30.73	228.72				$5.07
Fixed costs										
Equipment depreciation				$21.43						
Equipment int.,tax,ins.				$15.00	$15.00					
Irrigation equip. depr.				$53.25						
Irri. equip. int.,tau,ins.				$42.60	$42.60					
Land (cash rent equiv.)				$62.00	$62.00					
				$195.08	$120.40					
Total cost per acre				$393.98	$275.23	5560.37				$71.14
Total cost per ton				$65.66	$45.87	926.73				$11.86
Yield (tons per acre)				6						
Change in energy price level	0									

Irrigation equipment depreciation: $426.00 per acre investment/8 years = $53.25 per acre

Irrigation equipment interest, taxes, insurance: 10 percent of $426.00 per acre investment = $42.60 per acre

Land charge (cash rent equivalent): $62.80 per acre

Total costs of center pivot irrigated alfalfa are $65.66 per ton. Cash costs per ton are $47.87. The energy used to produce one ton of alfalfa equals 926.73 Mcal. Per ton energy costs are $11.86.

The irrigated crop budgets in Kansas have used natural gas as an energy source with a center pivot irrigation system. The energy cost information is from Williams, Manges and Smith (1983). An interactive computer program is used to determine fuel cost for operation. Assumptions entered in the model are:

1. Center pivot irrigation system (130 acres) with 65 pounds per square inch pressure.
2. 24 inches of water are irrigated per season.
3. Lift is 200 feet.
4. Flow rate is 750 gallons per minute.
5. The pump efficiency is 65 percent.
6. Natural gas price is $2.52 per 1000 cubic feet.
7. 1000 cubic feet of natural gas contains 925 BTUs.

The total fuel cost for operating the center pivot system is $6158.62 for 130 acres. This is $47.37 per acre, with 18,790 cubic feet of natural gas per acre used as fuel.

The center pivot irrigated enterprise budgets represent the most energy intensive crop production in Western Kansas (the High Plains region in general). Flood irrigation is also used in the area. Variations on these systems, such as surge irrigation or limited irrigation, are in use to improve the water-use efficiency of irrigation. Since technology is not allowed to change in this study, these techniques will not he analyzed; hut in the long run these techniques may contrihute to an improved economic position for cattle feeding in Kansas.

Cattle feeding in Kansas is a two-stage process. Backgrounding the cattle is the first stage. The following list shows the inputs in the cattle backgrounding hudget, with the budget in Figure 22.

Stocker calf: 4.5 cwt @ $61.90 per cwt = $278.55 per head

Lahor: 3 hours of operator labor @ $4.00 per hour = $12.00 per head

Vet and drugs: $7.00 per head

Death loss: 2 percent of purchase cost = 2 percent of $278.55 = $5.57 per head

Repairs: $6.25 per head

Miscellaneous: $4.50 per head

Interest: stocker calf + 1/2 of variahle costs per head @ 15 percent for 180 days = $15.37 per head

Diesel fuel: 1.65 gallons @ $1.06 = $1.75 per head

Electricity: 20.6 kwh @ $0.07 = $1.42

Corn silage: 4.5 tons per head @ $18.14 per ton = $81.62 per head

Supplement: soyhean meal @ 1 lb. per head per day for 180 days = 180 lhs per head @ $12.80 = $23.04 per head

Depreciation: $125 investment per head/20 years = $6.25 per head

Interest: $125 investment per head @ 7 percent = $8.75 per head.

Taxes and Insurance: $125 investment per head @ 1 percent = $1.25 per head

The total cost of the feeder steer coming out of the backgrounding phase is $60.44 per cwt, or $55.60 per cwt in terms of cash costs. Energy costs of this animal are $23.05 per head. This represents 489.21 Mcals of direct

Figure 22. Cattle Backgrounding Budget for Kansas, 1982.

	Inputs			Cost		Energy					
	Quantity	Units	Price	Total	Cash	Mcal/head	$/Mcal	Mcal/Unit	Base Prices	Energy Share	
VC1 Non-energy inputs											
Stocker calf	4.5	cwt.	$61.90	$278.55	$278.55						
Labor	3.00	hours	$4.00	$12.00							
Vet&drugs				$7.00	$7.00						
Death loss	2%			$5.57	$5.57						
Repairs				$6.25	6.25						
Miscellaneous				$4.50	$4.50						
Interest			15%	$15.37	$14.29						
				$329.24	$316.17						
VC2 Direct energy inputs											
Diesel fuel	1.65	gallons	$1.06	$1.75	$1.75	58.25	0.03003	35.3000	0.03003	$1.75	
Electricity	20.6	kwh	$0.07	$1.42	$1.42	17.72	0.08023	0.8600	0.08023	$1.42	
				$3.17	$3.17	75.96				$3.17	
VC3 Indirect energy inputs											
Corn Silage	4.5	tons	$18.14	$81.62	$64.64	1322.59		293.9097		$17.00	$3.96
Supplement(SBM)	1.0	cwt	$12.00	$23.04	$23.04	69.09	0.03003	38.3814	0.03003	$2.07	
				$104.66	$87.68	1391.68				$19.08	
Fixed costs											
Depreciation				$6.25							
Interest				$8.75	$8.75						
Taxes&Insurance				$1.25	$1.25						
				$16.25	$10.00						
Total cost per head				$453.31	$417.02	1467.6412				$23.05	
Breakeven price per cwt.				$60.44	$55.60	489.21372		(Energy Cost of Gain) 1)			$7.68
Market weight (cwt)				7.5							
Change in energy price level	0										

++

Cash Cost Corn Silage (ton)		$14.36

energy per cwt. The energy cost of gain for the 300 pounds of gain in the backgrounding phase is $7.68 per cwt.

The final stage in Kansas cattle feeding is the finishing phase, most often in a commercial feedyard. Data for the feedlot phase is from interviews with managers of four commercial feedlots in Kansas. The data presented is a weighted average of the four feedlots, based on the capacity of the feedlots. The data obtained from the interviews is located in Appendix A. Information used for the commercial feedlot budget is shown below. Figure 23 shows the cattle feeding budget.

Feeder steer: 750 lbs. @ $60.44 per cwt = $453.31

Labor: 1.64 hours @ $6.75 per hour = $11.07

Yardage: 100 days @ $0.05 per day = $5.00

Death loss: 0.3 percent of the value of the feeder steer. $453.31 @ 0.3 per cent = $1.36

Miscellaneous: $4.99 per head

Interest: 1/2 of variable costs plus feeder steer @ 15 percent for 100 days = $22.10 per head

Diesel fuel: 0.73 gallons @ $1.06 = $0.77

Natural gas: 350 cubic feet @ $2.52 per 1000 cubic feet = $0.88

Electricity: 33.30 kwh @ $0.07 per kwh = $2.30

Alfalfa hay: 0.0945 tons @ $65.66 per ton = $6.21

Flaked corn: 25.8750 bushels @ $3.16 per bushel = $81.83

Soybean meal: 199.5 lbs. @ $12.17 per cwt = $24.28

Wheat mids: 262.5 lbs. @ $8.17 per cwt = $21.45

Depreciation: $2.58 (average)

Other fixed costs: $6.81 (average)

The total cost per cwt of the finished steer is $62.25. There are no cash costs in this budget. The feedlot firm is a distinct entity, separate from the farmer's business. All costs incurred at the feedlot are included in

Figure 23. Cattle Feeding Budget for Kansas, 1982.

	Inputs			Total	Energy			Base	Energy	
	Quantity	Units	Price	Cost	Mcal/head	$/Mcal	Mcal/unit	Prices	Share	
VC 1 Non-energy inputs										
Feeder steer	7.50	cwt.	$60.44	$453.31	1467.64				$23.05	
Labor	1.64	hours	$6.75	$11.07						
Yardage	100.00	days	$0.05	$5.00						
Vet. & drugs				$0.65						
Death loss			0.300%	$1.36						
Miscellaneous				$4.99						
Interest			15.00%	$22.10						
				$506.48	1467.64				$23.05	
VC 2 Direct energy inputs										
Diesel fuel	0.73	gallons	$1.06	$0.77	25.77	0.03003	35.3000	0.03003	$0.77	
Natural gas	0.35	M cubic ft	$2.52	$0.88	88.20	0.01000	252.0000	0.01000	$0.88	
Electricity	33.30	kwh.	$0.07	$2.30	28.64	0.08000	0.8600	0.08000	$2.29	
				$3.95	142.61				$3.95	
VC 3 Indirect energy inputs										
Alfalfa hay	0.0945	tons	$65.66	$6.21	87.58		926.7276		$1.12	$11.86
Flaked corn	25.0750	bushels	$3.16	$81.03	1363.69		52.7032		$19.63	$0.76
Soybean meal	1.9950	cwt.	$12.17	$24.20	76.57	0.03003	38.3814	0.03003	$2.30	
Wheat mids	2.6250	cwt.	$8.17	$21.45	127.10	0.03003	48.4200	0.03003	$3.82	
				$133.76	1527.84				$26.86	
Fixed costs										
Depreciation				$2.58						
Other fixed costs				$6.81						
				$9.39						
Total cost per head				$653.59	3138.09				$53.86	
Breakeven price per cwt.				$62.25	523.01		(Energy Cost of Gain))))			$0.98
Market weight (cwt.)				10.5						
Change in energy price level	0									

the cost of the animal. Energy required in the feedlot phase is 523.01 Mcal per cwt, or a cost of $53.86 per head. The energy cost of gain in the feedlot phase is $8.98 per cwt. Including the backgrounding phase, the total energy cost of gain is $73.91 per head, or $12.32 per cwt. gain.

A favorable climate with relatively open winters and low humidity is given as an advantage for Kansas cattle feeding. Cattle need minimal protection from the elements in Kansas. The low humidity and low rainfall allow the use of bunker or pit silos for storage of silages and high-moisture grains. Hay can be left in unprotected stacks without serious deterioration. The per head investment in facilities is therefore relatively low in Kansas.

The Iowa cattle feeding system begins with the production of feedstuffs. The information used in the continuous cropped corn budget shown in Figure 24, appears below.

Labor: 3.6 hours of operator labor @ $6.00 = $21.60

Crop Insurance: 115 bushel per acre proven yield = $4.50

Machinery repairs: (variable cost of preharvest + harvest machinery = $35.40) - (fuel cost) = $12.00 per acre

Miscellaneous: $3.20

Interest: 1/2 of total variable costs for 8 months @ 15 percent = $7.55

Diesel fuel: conventionally cropped corn requires 6.85 gallons of diesel fuel @ $1.06 per gallon = $7.26

LP gas: 1 gallon of propane dries 6 bushels of corn (115 bushel per acre/6 bushels per gallon = 19.00 gallons) @ $0.72 = $13.68

Seed: 18.04 lbs. @ $1.13 per lb. = $20.39 (about 23,000 seeds per acre)

Nitrogen: 140 lbs. of N @ $0.16 per lb. = $22.40

Phosphate: 60 lbs. of P_2O_5 @ $0.24 per lb. = $14.40

Potash: 60 lbs. of K_2O @ $0.13 per lb. = $7.80

Lime: (1 ton per acre every three years). annual cost = 0.3 ton @ $11.45 per ton = $3.44

Figure 24. Continuous Cropped Corn Budget for Iowa, 1982.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.60	hours	$6.00	$21.60						
Crop insurance				$4.50	$4.50					
Machinery repaire				$12.00	$12.00					
Miscellaneous				$3.20	$3.20					
Interest			15%	$7.55	$6.49					
				$48.85	$26.19					
VC2 Direct energy inputs										
Diesel fuel	6.85	gallons	$1.06	$7.26	$7.26	241.01	0.03003	35.3000	0.03003	$7.26
LP gas	19.00	gallons	$0.72	$13.68	$13.68	456.00	0.03000	24.0000	0.03000	$13.68
				$20.94	$20.94	697.01				$20.94
VC3 Indirect energy inputs										
Seed	18.04	lbs.	$1.13	$20.39	$20.39	204.57	0.03003	11.3399	0.03003	$6.14
Nitrogen	140.00	lbs. N	$0.16	$22.40	$22.40	762.05	0.01647	5.0432	0.01647	$12.55
Phosphorous	60.00	lbs. P2O5	$0.24	$14.40	$14.40	81.65	0.03003	1.3608	0.03003	$2.45
Potassium	60.00	lbs. K2O	$0.13	$7.80	$7.80	43.55	0.03003	0.7258	0.03003	$1.31
Lime (annual cost)	0.30	tons	$11.45	$3.44	$3.44	85.85	0.03003	286.1744	0.03003	$2.58
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$3.69	$3.69	30.78	0.01471	20.5207	0.01471	$0.45
(alachlor)	2.00	lbs. a.i.	$4.73	$9.46	$9.46	63.12	0.01471	31.5582	0.01471	$0.93
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$9.32	$9.32	49.03	0.01471	49.0330	0.01471	$0.72
				$90.89	$90.89	1320.68				$27.14
Fixed costs										
Equipment depreciation				$31.02						
Equipment int.,tax,ins.				$20.68	$20.68					
Land (cash rent equiv.)				$122.00	$122.00					
				$173.70	$142.68					
Total cost per acre				$334.38	$280.70	2018.40				$48.08
Total cost per bushel				$2.91	$2.44	17.55				$0.42
Yield (bushels per acre)				115						
Change in energy price level	0									

Herbicides: usually an atrazine + alachlor tank mix
atrazine: 1.5 lbs of active ingredient per acre @ \$2.46 = \$3.69
alachlor: 2.0 lbs of active ingredient per acre @ \$4.73 = \$9.46

Insecticide: carbofuran: 1.0 lb of active ingredient per acre @ \$9.32 = \$9.32
Fixed cost of equipment: \$51.70

Depreciation is assumed to be 60 percent of fixed costs per acre. 60 percent of \$51.70 = \$31.02

Interest, Taxes, Insurance: \$51.70 - \$31.02 = \$20.68

Land cost: cash rent equivalent = \$122 per acre

The total cost of a bushel of corn produced in Iowa is \$2.91. Cash costs are \$2.44 per bushel. One bushel of corn requires 17.55 Mcals of energy input. The energy share of the total cost per bushel is \$0.42.

Corn silage is the other farm-produced feedstuff used by Iowa farmer-feeders. The following list contains the costs and inputs used in corn silage production. Figure 25 shows the production budget.

Labor: 5.5 hours @ \$6.00 = \$33.00

Crop Insurance: 115 bushel equivalent = \$4.50 per acre

Machinery repairs: (variable cost of preharvest + harvest machinery = \$30.80) - (fuel cost = \$10.25) = \$20.55

Miscellaneous: \$3.20

Interest: 1/2 of variable costs for 8 months @ 15 percent = \$9.37

Diesel fuel: corn silage requires 8.65 gallons @ \$1.06 per gallon = \$9.17

Seed: 18.04 lbs. @ \$1.13 per lb. = \$20.39 (about 23,000 seeds per acre)

Nitrogen: 180 lbs. of N @ \$0.16 per lb. = \$28.80

Phosphate: 80 lbs. of P_2O_5 @ \$0.24 per lb. = \$19.20

Potash: 180 lbs. of K_2O @ \$0.13 per lb. = \$23.40

Lime: (1 ton per acre every three years). annual cost = 0.3 ton @ \$11.45 per ton = \$3.44

Herbicides: usually an atrazine + alachlor tank mix
atrazine: 1.5 lbs of active ingredient per acre @ \$2.46 = \$3.69
alachlor: 2.0 lbs of active ingredient per acre @ \$4.73 = \$9.46

Figure 25. Corn Silage (following Corn) Budget for Iowa, 1982.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	5.50	hours	$6.00	$33.00						
Crop insurance				$4.50	$4.50					
Machinery repairs				$22.50	$22.50					
Miscellaneous				$3.20	$3.20					
Interest			15%	$9.37	$7.75					
				$72.57	$37.95					
VC2 Direct energy inputs										
Diesel fuel	8.65	gallons	$1.06	$9.17	$9.17	305.35	0.03003	35.3000	0.03003	$9.17
				$9.17	$9.17	305.35				$9.17
VC3 Indirect energy inputs										
Seed	18.04	lbs.	$1.13	$20.39	$20.39	204.57	0.03003	11.3399	0.03003	$6.14
Nitrogen	180.00	lbs. N	$0.16	$28.80	$28.80	979.78	0.01647	5.4432	0.01647	$16.14
Phosphorous	80.00	lbs. P2O5	$0.24	$19.20	$19.20	108.86	0.03003	1.3608	0.03003	$3.27
Potassium	180.00	lbs. K2O	$0.13	$23.40	$23.40	130.64	0.03003	0.7258	0.03003	$3.92
Lime (annual cost)	0.30	tons	$11.45	$3.44	$3.44	85.85	0.03003	286.1744	0.03003	$2.58
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$3.69	$3.69	30.78	0.01471	20.5207	0.01471	$0.45
(alachlor)	2.00	lbs. a.i.	$4.73	$9.46	$9.46	63.12	0.01471	31.5582	0.01471	$0.93
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$9.32	$9.32	49.03	0.01471	49.0338	0.01471	$0.72
				$117.69	$117.69	1652.64				$34.16
Fixed costs										
Equipment depreciation				$27.96						
Equipment int.,tax,ins.				$10.64	$10.64					
Land (cash rent equiv.)				$122.00	$122.00					
				$160.60	$140.64					
Total cost per acre				$360.03	$305.44	1957.98				$43.33
Total cost per ton				$23.00	$19.09	122.37				$2.71
Yield (tons per acre)				16						
Change in energy price level	0									

Insecticide: carbofuran: 1.0 lb of active ingredient per acre @ $9.32 = $9.32

Fixed cost of equipment: $46.60

Depreciation is assumed to be 60 percent of fixed costs per acre. 60 percent of $46.60 = $27.96

Interest, Taxes, Insurance: $46.60 - $27.96 = $18.64

Land cost: cash rent equivalent = $122 per acre

Total costs per ton of corn silage are $23.00. Cash costs of producing corn silage are $19.09 per ton. The energy used in producing one ton of corn silage is 122.37 Mcals. Energy costs are $2.71 per ton.

Corn and corn silage are the major feedstuffs in Iowa cattle feeding. All the inputs for cattle feeding are listed below, with the budget appearing in Figure 26.

Feeder calf: 450 lbs @ $60.40 per cwt = $271.80

Labor: 5 hours @ $6.00 = $30.00 (operator labor)

Vet and drugs: $6.50

Death loss: 2 percent of purchase value = $5.44

Miscellaneous: $3.20

Interest: Feeder calf + 1/2 of variable costs @ 15% for 286 days = $50.61

Diesel fuel: 2.2 gallons @ $1.06 = $2.33

Electricity: 8.32 kwh @ $0.05 = $0.39

Corn silage: 2.6 tons @ $23.00 = $59.81

Shelled corn: 61 bushels @ $2.91 = $177.37

Supplement: 2.85 cwt @ $12.49 = $35.60

Fixed costs computation is as follows:

Figure 26. Cattle Feeding Budget for Iowa, 1982.

	Inputs			Cost		Energy					
	Quantity	Units	Price	Total	Cash	Mcal/head	$/Mcal	Mcal/Unit	Base Prices	Energy Share	Energy Cost/Unit
VC1 Non-energy inputs											
Feeder calf	4.50	cwt.	$60.40	$271.00	$271.00						
Labor	5.00	hours	$6.00	$30.00							
Vet. & drugs				$6.50	$6.50						
Death loss			2%	$5.44	$5.44						
Miscellaneous				$3.20	$3.20						
Interest			15%	$50.61	$46.59						
				$367.55	$333.53						
VC2 Direct energy inputs											
Diesel fuel	2.20	gallons	$1.06	$2.33	$2.33	77.66	0.03003	35.3000	0.03003	$2.33	
Electricity	0.32	kwh.	$0.05	$0.39	$0.39	46.51	0.05400	0.8600	0.05400	$2.51	
				$2.72	$2.72	124.17				$4.84	
VC3 Indirect energy inputs											
Corn silage	2.60	tons	$23.00	$59.81	$49.63	318.17		122.3740		$7.04	$2.71
Shelled corn	61.00	bushels	$2.91	$177.37	$140.09	1070.63		17.5513		$25.50	$0.42
Supplement (SBM)	2.85	cwt.	$12.43	$35.60	$35.60	106.10	0.03003	37.2545	0.03003	$3.19	$1.12
				$272.77	$234.12	1494.90				$35.73	
Fixed costs											
Depreciation				$23.80							
Interest				$16.55	$16.55						
Repairs, taxes, insurance				$13.17	$13.17						
				$53.52	$29.72						
Total cost per head				$696.55	$600.09	1619.15				$40.57	
Breakeven price per cwt.				$63.32	$54.55	147.20		(Energy Cost of Gain) 11)			$6.24
Market weight (lbs.)				11.0							
Charge in energy price level	0										

++

Cash Cost of Corn Grain (bu) $2.44
Cash Cost of Corn Silage (ton) $13.03

Ownership costs of facilities as a percentage of initial investment:

Item	Lot & Shelter	Manure & Feed Handling	Feed Storage
Interest	5%	5.0%	5.0%
Depreciation	6.67%	10.0%	5.0%
Rep. Tax Ins.	4.33%	5.0%	2.0%
Total annual own. costs	16.0%	20.0%	12.0%

Initial investment for a 300 head lot:

Lot and shelter		$49,626
Manure and feed handling		$26,940
Manure handling equipment	$ 9,940	
Feed handling equipment	$17,000	
Feed storage		$22,729
Total investment		$99,294

Per Head Ownership Cost of Facilities (300 head lot)

Item	Lot & Shelter	Manure & Feed Handling	Feed Storage	Total
Interest	$ 8.27	$4.49	$3.79	$16.55
Depreciation	11.03	8.98	3.79	23.80
Rep. Tax Ins.	7.16	4.49	1.52	13.17
Total	$26.46	$17.96	$9.10	$53.52

Cattle fed in the Iowa system cost $63.32 per cwt to produce. Cash costs per cwt are $54.55. Total energy costs per head are $40.57. Energy required to produce the finished animal is 147.20 Mcal per cwt. The energy cost of gain is $6.24 per cwt. The comparable energy cost of gain from the Kansas cattle feeding systsem is $12.32 per cwt.

In addition to the variable and fixed costs of cattle feeding in Iowa, the noise, odor and animal wastes from a farm feedlot operation add to the total costs of Iowa cattle feeding. The population density in Iowa is nearly twice that of Kansas. Odor and noise can become a problem for Iowa cattle feeders, especially nearer metropolitan areas. Higher rainfall and more rolling topography cause increased waste runoff problems in Iowa, compared to Kansas. The Iowa Department of Environmental Quality (DEQ), formed in 1969, has dealt with these problems. The actions of the DEQ have caused some farmers to terminate their cattle feeding enterprises (Vanderflugt, 1981).

The budget for the slaughter phase of the beef cattle industry is an abbreviated form of the production budgets. Data concerning slaughter costs is very difficult to obtain, even for those associated with meat packers (Meat Industry, May 1981). The slaughter budget used is the result of a cost synthesis study by Cothern, Peard and Weeks (1978). Their objectives were to develop costs for each stage of operation in six plant sizes and to aggregate these costs to determine the economies or diseconomies of scale for each size of plant. The largest plant size, 2,250 head slaughtered per day, is used for this study. This size is typical of the slaughter plants in Kansas. No information is available on cost or size differences between packing plants in Kansas and those in Iowa.

The slaughter budget is shown in Figure 27. Inputs for slaughter plant operation are listed in the same fashion as the production budgets. Both the total annual cost and the per head capacity cost are listed for these inputs. The update column will reflect changes in the cost of the direct energy inputs. All other costs remain fixed as energy costs change. The total cost of slaughter is $22.28 per head. This is consistent with anonymus estimates from meat packers reported in Meat Industry (May, 1981). The slaughter cost figure will be used for both Kansas and Iowa beef.

Figure 27. Cattle Slaughter Budget, 1982.

	Base Cost		Update	
	Total	Per Head	Total	Per Head
VC1 Non-energy inputs				
Repairs & Maintenance	$543575.00	$0.97	$543575.00	$0.97
Labor (direct)	$5240000.00	$9.32	$5240000.00	$9.32
(foreman)	$459000.00	$0.82	$459000.00	$0.82
Fringe Benefits	$1196790.00	$2.13	$1196790.00	$2.13
Sewage	$600.00	$0.00	$600.00	$0.00
Sanitation	$123000.00	$0.22	$123000.00	$0.22
Miscellaneous	$1848735.00	$3.29	$1848735.00	$3.29
Feed Expense	$33069.00	$0.06	$33069.00	$0.06
Direct Supplies	$325000.00	$0.58	$325000.00	$0.58
	$9769769.00	$17.37	$9769769.00	$17.37
VC2 Direct energy inputs				
Gas	$90000.00	$0.16	$90000.00	$0.16
Fuel (trucking)	$506650.00	$0.90	$506650.00	$0.90
Electricity (lights)	$330513.34	$0.59	$330513.34	$0.59
(refrigeration)	$81202.35	$0.14	$81202.35	$0.14
	$1008365.69	$1.79	$1008365.69	$1.79
Fixed costs				
Depreciation	$685980.53	$1.22	$685980.53	$1.22
Interest	$638604.38	$1.14	$638604.38	$1.14
Taxes	$188941.39	$0.34	$188941.39	$0.34
Insurance	$201094.91	$0.36	$201094.91	$0.36
Installation	$32063.66	$0.06	$32063.66	$0.06
Land	$8259.52	$0.01	$8259.52	$0.01
	$1754944.39	$3.12	$1754944.39	$3.12
Total cost	$12533079.00	$22.28	$12533079.00	$22.28

Change in energy price level 0

	Kansas	Iowa
Value of animal	$653.59	$696.55
Slaughter Cost (head)	$22.28	$22.28
Subtotal	$675.87	$718.84
Dressing percent	60%	60%
Animal weight (cwt.)	10.50	11.00
Carcass weight (cwt.)	6.30	6.60
Cost per cwt.	$107.28	$108.91

The remainder of the slaughter budget asigns the slaughter cost to the cost of beef cattle from Kansas and Iowa. The dressing percentages are the same for both states, data on average dressing percentages by states is unavailable. The total cost of beef at a Kansas packing plant is $107.28 per cwt. Beef from the Iowa cattle feeding system costs $108.91 per cwt. at the packing plant.

Transporting beef to the regional market is the final step in the cattle feeding-beef packing industry. The transportation budget is shown in Figure 28. The destination cities for the nine regional markets identified in Chapter 2 are listed for Kansas and Iowa beef. The initial freight rates shown are from Kansas State University Department of Economics research (1982). Mileage and truck capacities are shown for the cities. This information, along with the fuel price change and the average fuel consumption for the trucks, is needed to estimate the change in transportation cost per unit resulting from a fuel price increase. Barton (1980) found that refrigerated trucks averaged 4.0043 miles per gallon. This study will use that rate of fuel use. The procedure reported by Christensen (1980), described in Chapter 2, is used to determine the change in transportation cost. Summing the initial freight rate, change in per unit transportation cost and the cost of beef at the packing plant gives the cost of beef in the regional market from the respective cattle feeding system. The advantage/disadvantage for the Kansas system is highlighted in the transportation budget. Initially, Kansas beef is lower in cost than Iowa beef in all nine regional markets.

The individual steps in the cattle feeding systems in Kansas and Iowa are outlined in Chapter 2. This section of the study has defined the costs and energy use in each of those steps. The budgets for these steps are linked

Figure 28. Beef Transportation Budget, 1982.

Freight rates from Wichita, Kansas
cost of beef from Kansas is $107.28 per cwt.

City	Miles	Weight	Change	Initial Rate	Final Rate	Energy Component	Percent Of Rate	Cost of Beef		Difference $/Cwt
San Francisco	1716	42000	$0.00	$4.45	$4.45	$1.06	24%	$111.73	Advantage	$2.12
Yuma	1203	42000	$0.00	$4.45	$4.45	$0.74	17%	$111.73	Advantage	$2.12
Kansas City	197	35000	$0.00	$1.11	$1.11	$0.15	13%	$108.39	Advantage	$1.72
Houston	609	38000	$0.00	$2.35	$2.35	$0.42	18%	$109.63	Advantage	$2.10
Chicago	698	38000	$0.00	$2.54	$2.54	$0.48	19%	$109.82	Advantage	$0.53
Knoxville	874	38000	$0.00	$2.57	$2.57	$0.60	23%	$109.85	Advantage	$1.36
Boston	1595	40000	$0.00	$4.62	$4.62	$1.04	22%	$111.90	Advantage	$0.97
New York	1397	40000	$0.00	$4.41	$4.41	$0.91	21%	$111.69	Advantage	$0.92
Miami	1532	38000	$0.00	$3.09	$3.09	$1.85	27%	$111.17	Advantage	$1.72

Freight rates from Waterloo, Iowa
cost of beef from Iowa is $108.91 per cwt.

City	Miles	Weight	Change	Initial Rate	Final Rate	Energy Component	Percent Of Rate	Cost of Beef
San Francisco	1958	40000	$0.00	$4.94	$4.94	$1.27	26%	$113.85
Yuma	1699	40000	$0.00	$4.94	$4.94	$1.10	22%	$113.85
Kansas City	307	40000	$0.00	$1.20	$1.20	$0.20	17%	$110.11
Houston	1036	35000	$0.00	$2.82	$2.82	$0.77	27%	$111.73
Chicago	268	35000	$0.00	$1.44	$1.44	$0.20	14%	$110.35
Knoxville	805	38000	$0.00	$2.30	$2.30	$0.55	24%	$111.21
Boston	1226	40000	$0.00	$3.96	$3.96	$0.80	20%	$112.87
New York	1077	40000	$0.00	$3.70	$3.70	$0.70	19%	$112.61
Miami	1562	30000	$0.00	$3.98	$3.98	$1.07	27%	$112.89

Diesel fuel price is $1.06 per gallon in 1982

Change in energy price level is 0

Diesel fuel price is now $1.06 per gallon

Change in diesel fuel price is $0.00 per gallon

together so that the entire cattle feeding system in each state is completely modeled. The next section of the study will deal with the effects of changing energy costs on the cattle feeding industries of Kansas and Iowa.

CHAPTER 5

EFFECTS OF CHANGING ENERGY COSTS ON THE COMPETITIVE POSITION OF THE KANSAS CATTLE FEEDING INDUSTRY.

This section of the study analyzes the base case and energy cost scenarios to determine the effect, if any, on the competitive position of the cattle feeding industries in both Kansas and Iowa. Recall that Kansas is a proxy for the High Plains area and Iowa serves as a proxy for the Cornbelt area in their respective cattle feeding systems. Specifically, the energy cost component of both cattle feeding systems is determined. Differences in the two systems are highlighted, especially the degree of energy intensity involved. Transportation costs are added to the costs of production to determine their effect on the competitive position between both systems. Finally, a "breakeven" point is found for that energy cost increase (decrease) that results in a change in the competitive position between systems in terms of cost of production. Transportation costs are added in to determine the energy cost increase (decrease) that changes the source of least cost beef for each market identified in the previous chapter.

An analysis of the base case presents support for statements made earlier in the study regarding differences in cattle feeding between Kansas and Iowa. It also provides insight into the effects that changing energy costs have upon the cattle feeding systems. Generally, the commercial feedlot system typical in Kansas provides a lower cost product at the feedlot, packing plant, and delivered to the final market. However, the product from Iowa requires less energy to produce when compared to Kansas cattle.

Different cost ratios illustrate the degree of energy use in cattle feeding. Feedgrain production in Kansas is more costly and more energy intensive than feedgrain production in Iowa as shown in Table 8. The total cost per acre of corn production in Iowa is $344.38 compared to $411.14 per acre for irrigated corn production in Kansas. The total cost per acre in Iowa is 81.3 percent of that in Kansas. A difference in the yield per acre (130 bushels per acre in Kansas vs. 115 bushels per acre in Iowa) results in a total cost per bushel in Iowa 92.1 percent of that in Kansas. A slightly higher irrigated yield in Kansas partially compensates for the cost per acre differences.

From Table 8, the energy costs per acre of corn production in Kansas is more than double the energy cost per acre in Iowa. Energy costs are a larger portion of both variable and total costs per acre in Kansas. The relative

Table 8. Cost Comparisons for Corn Grain

	Source of Corn (grain)	
Cost Category	Kansas	Iowa
TC of production per acre	$411.14	$334.38
VC of production per acre	$223.35	$160.68
VC as a percent of TC	54.3%	48.1%
Relative TC per acre	123.0%	81.3%
Yield per acre (bushels)	130	115
TC of production per bushel	$ 3.16	$ 2.91
VC of production per bushel	$ 1.72	$ 1.40
VC as a percent of TC	54.4%	48.1%
Relative TC per bushel	108.6%	92.1%
Energy cost per acre	$ 98.60	$ 48.08
Energy cost as a percent of VC per acre	44.1%	29.9%
Energy cost as a percent of TC per acre	24.0%	14.4%
EC per bushel	$ 0.76	$ 0.42
EC as a percent of VC per bushel	44.2%	30.0%
EC as a percent of TC per bushel	24.1%	14.4%
Relative EC per acre	205.1%	44.0%
Relative EC per bushel	181.0%	55.3%

energy cost per acre in Kansas is 205.1 percent of that in Iowa. Again, the higher yield from irrigated corn production in Kansas compensates slightly for this difference. The relative energy cost per bushel in Kansas is 181.0 percent of that in Iowa. Earlier in the study it was noted that the advantage of abundant, low-cost feedgrains in Kansas had changed. It is evident from the base case analysis that feedgrain production is currently (1) relatively less expensive in Iowa than Kansas and (2) much more energy intensive in Kansas based on relative energy cost comparisons.

Cost comparisons for the cattle feeding budgets from each area in the base case are presented in Table 9. Kansas has a slight cost of production advantage over Iowa in cattle feeding. The relative total cost per head in Kansas is 93.8% of that in Iowa. Variable costs are 98.6% of the total cost per head in Kansas. The economies of size in the larger feedlots result in a very low per head fixed cost. Farmer-feeders in the cornbelt traditionally feed cattle to a heavier market weight than do the larger commercial feedlots. This heavier weight compensates for a portion of the relative cost per head advantage in Kansas. The relative cost per cwt in Kansas is 98.3% of that in Iowa.

Energy cost per head in Kansas is $53.86 while in Iowa the cost per head is $40.57. The relative energy cost per head in Kansas is 132.8 percent of that in Iowa. Recall that farmer-feeders market a heavier animal than do commercial feedyards. This makes the relative cost per cwt of cattle fed in Kansas 139.0% of that in Iowa. A general statement was made earlier that cattle feeding is less expensive in Kansas but is more energy intensive. Specifically, the total cost per cwt of cattle fed in Kansas is 98.3 percent of the total cost per cwt of cattle fed in Iowa while the energy cost per cwt of those cattle fed in Kansas is 139.0 percent of those fed in Iowa.

It was stated in the previous chapter that a simplified budget would be used for the slaughter phase in the cattle feeding industry. Much valuable information comes from this budget, however. The total cost per cwt of beef produced and slaughtered in Kansas is 98.5 percent of that produced and slaughtered in Iowa as shown in Table 10. Energy costs are a small percentage of the total cost per cwt of beef. However, the beef from the Kansas cattle

Table 9. Cost Comparisons for Cattle Feeding

	Source of Cattle	
Cost Category	Kansas	Iowa
TC of production per head	$653.59	$696.55
VC of production per head	$644.20	$643.04
VC as a percent of TC	98.6%	92.3%
Relative TC per head	93.8%	106.6%
Market weight (cwt)	10.5	11.0
TC of production per cwt	$ 62.25	$ 63.32
TC of production per cwt	$ 61.35	$ 58.46
VC as a percent of TC	98.6%	92.3%
Relative TC per cwt	98.3%	101.7%
Energy cost per head	$ 53.86	$ 40.57
Energy cost as a percent of VC per head	8.4%	6.3%
Energy cost as a percent of TC per head	8.2%	5.8%
EC per cwt	$ 5.13	$ 3.69
EC as a percent of VC per cwt	8.4%	6.3%
EC as a percent of TC per cwt	8.2%	5.8%
Relative EC per head	132.8%	75.3%
Relative EC per head	139.0%	71.9%

feeding system has a relative energy cost per cwt of 139.0 percent of the energy cost per cwt of the beef from the Iowa system.

Finally, the transportation phase of the cattle feeding industry is added to the production and slaughter phases. Cost comparisons for total costs and energy costs for the nine markets in the study are shown in Table 11. Beef from Kansas is lower in cost relative to Iowa in all nine of the markets.

Table 10. Cost Comparisons for Beef

Cost Component	Source of Beef Kansas	Iowa
Relative cost per cwt	98.5%	101.5%
Energy cost per cwt	$ 8.55	$ 6.15
Energy cost as a percent of TC per cwt	8.0%	5.6%
Relative EC per cwt	139.0%	71.9%

Notice the total energy costs per cwt. This includes the energy costs in the production and slaughter phases as well as the energy component of the transportation phase. In each of the nine markets, Kansas beef has a higher energy cost per cwt relative to beef from Iowa. The base case analysis shows that beef from Kansas is less expensive on a per cwt basis relative to beef from Iowa. This includes all costs in the production, slaughter and transport sectors of each state's respective cattle feeding system. The base case analysis also shows that beef from the Kansas system has a higher relative energy cost per cwt in all nine markets than beef from the Iowa system.

The transportation phase merits more detailed study. Energy cost comparisons are given in Table 12. For each state, the energy cost in the production and slaughter phases is added to the energy cost in the transportation phase. The energy cost per cwt in the transportation phase, in most instances, is a lower percentage of the total energy costs per cwt for Kansas relative to Iowa. Energy cost increases (decreases) in different phases of the cattle feeding systems will have a different effect than a general energy cost increase (decrease) does.

The base case analysis shows the different total costs and energy costs between cattle feeding systems. How will changes in the energy price level

Table 11. Cost Comparsions of Beef from Kansas and Iowa at Selected Markets

	per cwt				per cwt			
	Cost of Beef		Relative Cost		Energy Cost		Relative EC	
City (markets)	Kansas	Iowa	Kansas	Iowa	Kansas	Iowa	Kansas	Iowa
San Francisco	$111.73	$113.85	98.1%	101.9%	$9.61	$7.42	129.5%	77.2%
Yuma	$111.73	$113.85	98.1%	101.9%	$9.29	$7.24	128.1%	78.0%
Kansas City	$108.39	$110.11	98.4%	101.6	$8.70	$6.35	137.0%	73.0%
Houston	$109.63	$111.73	98.1%	101.9%	$8.97	$6.92	129.6%	77.1%
Chicago	$109.82	$110.35	99.5%	100.7%	$9.03	$6.35	142.2%	70.3%
Knoxville	$109.85	$111.21	98.8%	101.2%	$9.15	$6.70	136.6%	73.2%
Boston	$111.90	$112.87	93.3%	100.9%	$9.59	$6.95	138.0%	72.5%
New York	$111.69	$112.61	99.2%	100.8%	$9.46	$6.85	138.1%	72.4%
Miami	$111.17	$112.89	98.5%	101.5%	$9.60	$7.22	133.0%	75.2%

Table 12. Energy Cost Comparisons

	Kansas				Iowa			
	Energy Cost per cwt				Energy Cost per cwt			
City	of Beef	of Transport	Total	Transport EC as a % of Total EC	of Beef	of Transport	Total	Transport EC as a % of Total EC
San Francisco	$8.55	$1.06	$9.61	11.0%	$6.15	$1.27	$7.42	17.1%
Yuma	$8.55	$0.74	$9.29	8.0%	$6.15	$1.10	$7.25	15.2%
Kansas City	$8.55	$0.15	$8.71	1.7%	$6.15	$0.27	$6.35	3.1%
Houston	$8.55	$0.42	$8.97	4.7%	$6.15	$0.77	$6.92	11.1%
Chicago	$8.55	$0.48	$9.03	5.3%	$6.15	$0.27	$6.35	3.1%
Knoxville	$8.55	$0.60	$9.15	6.6%	$6.15	$0.55	$6.75	8.2%
Boston	$8.55	$1.04	$9.59	10.8%	$6.15	$0.80	$6.95	11.5%
New York	$8.55	$0.91	$9.46	9.6%	$6.15	$0.70	$6.85	10.2%
Miami	$8.55	$1.05	$9.60	10.9%	$6.15	$1.07	$7.22	14.8%

affect the competitive position between Kansas and Iowa? Energy cost scenarios are imposed upon the base case to provide a basis for answering this question.

Four changing price scenarios were selected for use in estimating energy input expenditures over the period of analysis. The lower bound scenario uses a 3 percent real decrease in energy prices per year. The upper bound scenario uses a 6 percent real increase annually. Medium range price increase scenarios include a 3 percent real increase and a 0 percent real increase in energy prices annually.

Two separate time frames were arbitrarily selected to use with the price change scenarios. The years 1985 and 1990 were selected to compare to the base year of 1982. This provides the analysis with planning horizons of three and eight years. The annual price change scenarios and the time frames combined give the percent increase in real energy prices shown in Table 13.

The three percent real price increase per annum appears intuitively correct if the own price elasticity of aggregate energy demand is considered in relation to the necessary reduction in energy use over the period of 1980-1990. According to Sawhill (1979) some studies such as Pindyck (1979) have estimated the own price elasticity of aggregate energy demand in the residential sector to be approximately -1.0. Therefore, a one percent

Table 13. Percent Change in Real Energy Prices (Base year = 1982)

Annual Scenario	Year 1985	1990
-3%	-9.3%	-26.7%
0%	0.0%	0.0%
+3%	+9.3%	-26.7%
+6%	+19.1%	+59.4%

increase in the real price of energy would result in a one percent decline in consumption. Inversely, a one percent decline in the supply available for consumption would result in a one percent rise in the real energy price. A recent study by Exxon (1980) reports that domestic production of oil will decline from about 10.0 million barrels per day in 1980 to 6.0 million barrels per day in 1990. Imports are also expected to decline. The Carter administration strategy called for imports to fall from the current level of approximately 8.0 million barrels per day to 4.5 million barrels per day in 1990. These figures point to a 40 percent reduction in the liquid energy supply during the 10 year period 1980-1990. Therefore an average annual four percent reduction of supply from 1980-1990 may cause the real price of liquid fuel to rise approximately four percent annually. However, Exxon predicted total production including exports would decline at an average annual rate of only 1.4 percent. This would cause an increase in real energy prices of 1.4 percent. These figures fall well within the range of increasing energy cost scenarios used in this study.

A more recent study by Drabenstott, Duncan, and Borowski (1984) outlines the current decreasing real energy cost situation. Two events make this scenario possible. There is currently a reduction in the growth of worldwide energy demand. Also, higher energy prices in recent years have led to increased energy production in the United States and other non-OPEC nations. Total oil supplies are expected to remain fairly large for the next five years. While there may be slight increases in oil prices in nominal terms, real energy prices are expected to decline over the next five years.

Cost comparisons for the -3 percent, 3 percent and 6 percent real increase in energy cost scenarios for 1985 are shown in Tables 14 - 16. As real energy prices are increased at a higher rate, the total cost of

Table 14. Cost Comparisons for Cattle Feeding and Beef, 1985
3% Annual Decrease in Real Energy Prices (Base Year = 1982)

	Cattle Feeding System	
Cost Category	Kansas	Iowa
TC of production per head	$648.88	$692.61
Relative TC per head percent	93.7%	106.7%
TC of production per cwt	$61.80	$62.96
Relative TC of production per cwt	98.2%	101.9%
Energy cost per head	$48.85	$36.80
Relative EC per head	132.7%	75.3%
Energy cost as a percent of TC per head	7.5%	5.3%
Energy cost per cwt	$4.65	$3.35
Relative EC per cwt	138.8%	72.0%
	Source of Beef	
Total cost per cwt	$106.51	$108.29
Relative TC per cwt	98.4%	101.7%
Energy cost per cwt	$7.75	$5.58
EC as a percent of TC per cwt	7.3%	5.2%
Relative EC per cwt	138.9%	72.0%

Table 15. Cost Comparisons for Cattle Feeding and Beef, 1985

3% Annual Increase in Real Energy Prices (Base Year = 1982)

	Cattle Feeding System	
Cost Category	Kansas	Iowa
TC of production per head	$658.29	$700.50
Relative TC of production per head	94.0%	106.4%
TC of production per cwt	$62.69	$63.80
Relative TC of production per cwt	98.3%	101.8%
Energy cost per head	$58.87	$44.35
Relative EC per head	132.7%	75.3%
Energy cost as a percent of TC per head	8.9%	6.5%
Energy cost per cwt	$5.61	$4.03
Relative EC per cwt	139.2%	71.8%
	Source of Beef	
Total cost per cwt	$108.51	$109.54
Relative TC per cwt	99.1%	101.0%
Energy cost per cwt	$9.34	$6.72
EC as a percent of TC per cwt	8.6%	6.3%
Relative EC per cwt	139.0%	71.9%

Table 16. Cost Comparisons for Cattle Feeding and Beef, 1985
6% Annual Increase in Real Energy Prices (Base Year = 1982)

	Cattle Feeding System	
Cost Component	Kansas	Iowa
TC of production per head	$663.26	$704.65
Relative TC of production per head	94.1%	106.2%
TC of production per cwt	$63.17	$64.06
Relative TC of production per cwt	98.6%	101.4%
Energy cost per head	$63.17	$48.32
Relative EC per head	130.7%	76.5%
Energy cost as a percent of TC per head	9.5%	6.9%
Energy cost per cwt	$6.02	$4.39
Relative EC per cwt	137.1%	72.9%
	Source of Beef	
Total cost per cwt	$108.87	$110.19
Relative TC per cwt	99.8%	101.2%
Energy cost per cwt	$10.03	$7.32
EC as a percent of TC per cwt	9.2%	6.6%
Relative EC per cwt	137.0%	73.0%

production per head in Kansas and Iowa come closer together. Under the 3 percent annual decrease scenario the total cost per head in Kansas is 93.7 percent relative to that in Iowa. The relative total cost in Kansas was increased to 94.1 percent of Iowa when real energy prices are increased at an annual rate of 6 percent. The relative total cost on a cwt basis in Kansas ranges from 98.2 percent of Iowa to 98.6 percent of Iowa's total cost under the respective scenarios.

Energy costs show more interesting movement as real energy prices are changed. When real energy prices fall 3 percent annually, energy costs are 7.5 percent of the total costs on a per head basis. Energy costs are 9.5 percent of the total cost when energy prices increase at the 6 percent annual rate. During the three year planning horizon, technology is not allowed to change in the cattle feeding systems. Relative energy costs remain the same between Kansas and Iowa under all energy price increase scenarios.

The scenarios nnder the 1990 time frame show more dramatically the difference in energy use between cattle feeding systems in Kansas and Iowa. Cost comparisons for these energy price changes are contained in Tahles 17 - 19. The cost of cattle per head from Kansas ranges from $640.07 to $683.66 under the respective real energy price changes. Kansas cattle are 93.4 percent of the price of Iowa cattle when energy prices decline 3 percent annually. The relative cost changes to 94.7 percent for the 6 percent increase per year from 1982 to 1990. The energy cost of these cattle continues to increase as well. Under the 6 percent yearly real energy price increase, energy costs are 12.6 percent of the total cost of the animal. This contrasts to 6.2 percent for the 3 percent annual decrease in real energy prices.

Table 17. Cost Comparisons for Cattle Feeding and Beef, 1990

3% Annual Decrease in Real Energy Prices (Base Year = 1982)

	Cattle Feeding System	
Cost Category	Kansas	Iowa
TC of production per head	$640.07	$685.23
Relative TC per head percent	93.4%	107.1%
TC of production per cwt	$60.96	$62.29
Relative TC of production per cwt	97.9%	102.2%
Energy cost per head	$39.48	$29.74
Relative EC per head	132.8%	75.3%
Energy cost as a percent of TC per head	6.2%	4.3%
Energy cost per cwt	$3.76	$2.70
Relative EC per cwt	134.3%	71.8%
	Source of Beef	
Total cost per cwt	$105.06	$107.13
Relative TC per cwt	98.1%	102.0%
Energy cost per cwt	$6.27	$4.51
EC as a percent of TC per cwt	6.0%	4.2%
Relative EC per cwt	139.0%	71.9%

Table 18. Cost Comparisons for Cattle Feeding and Beef, 1990
3% Annual Increase in Real Energy Prices (Base Year = 1982)

	Cattle Feeding System	
Cost Category	Kansas	Iowa
TC of production per head	$667.10	$707.88
Relative TC of production per head	94.2%	106.1%
TC of production per cwt	$63.53	$64.35
Relative TC of production per cwt	98.7%	101.3%
Energy cost per head	$68.24	$51.41
Relative EC per head	132.7%	75.3%
Energy cost as a percent of TC per head	10.2%	7.3%
Energy cost per cwt	$6.50	$4.67
Relative EC per cwt	139.2%	71.8%
	Source of Beef	
Total cost per cwt	$109.50	$110.70
Relative TC per cwt	98.9%	101.1%
Energy cost per cwt	$10.83	$7.79
EC as a percent of TC per cwt	9.9%	7.0%
Relative EC per cwt	139.0%	71.9%

Table 19. Cost Comparisons for Cattle Feeding and Beef, 1990

6% Annual Increase in Real Energy Prices (Base Year = 1982)

	Cattle Feeding System	
Cost Category	Kansas	Iowa
TC of production per head	$683.66	$721.74
Relative TC of production per head	94.7%	105.6%
TC of production per cwt	$65.11	$65.61
Relative TC of production per cwt	99.2%	100.8%
Energy cost per head	$85.85	$64.68
Relative EC per head	132.7%	75.3%
Energy cost as a percent of TC per head	12.6%	9.0%
Energy cost per cwt	$8.18	$5.88
Relative EC per cwt	139.1%	71.9%
	Source of Beef	
Total cost per cwt	$112.22	$112.89
Relative TC per cwt	99.4%	100.6%
Energy cost per cwt	$13.63	$9.82
EC as a percent of TC per cwt	11.2%	8.7%
Relative EC per cwt	139.1%	71.9%

The total cost of beef also increases as energy costs are increased from 1982-1990. When real energy prices decline 3 percent per annum the per cwt cost of beef from Kansas is $105.06. This increases to $112.22 per cwt for the 6 percent annual increase scenario. The relative price for Kansas beef rises from 98.1 percent of Iowa beef to 99.4 percent. As with the live cattle, the energy cost per cwt increases in Kansas beef from $6.27 per cwt to $13.63 per cwt.

The effect of rising real energy prices on the competitive position of Kansas cattle feeding is shown. Several questions remain unanswered, however. What level of energy price increase results in beef from both cattle feeding systems at the same cost? Also, for each market in which Kansas beef and Iowa beef compete, what level of energy price increase results in that market receiving beef from either system at the same cost? The remainder of this section of the study will answer these questions.

Figure 29 shows the cost of beef before transport for a range of energy price changes. For each level of change the cost of beef at the packing plant is given for Kansas and for Iowa. As energy costs increase, Kansas beef becomes more expensive relative to Iowa beef. At an energy price increase of 100 percent, both systems supply beef at the same cost. This breakeven cost is $115.62 per cwt. A 100 percent increase in real energy prices translates into a 26 percent annual increase for the three year time frame 1982-1985. For the 8 year scenario this is a 9 percent annual increase in real energy prices.

The Chicago market is represented in Figure 30. The breakeven in that market is approximately a 29 percent increase in real energy prices. This is a 9 percent increase and a 3 percent annual increase for the 1985 and 1990 projections, respectively. The 3 percent annual increase falls in the range

Figure 29. Cost of Beef Before Transport

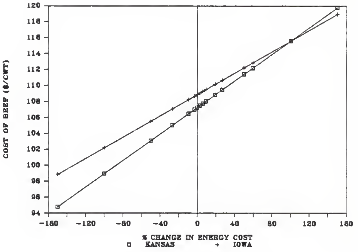
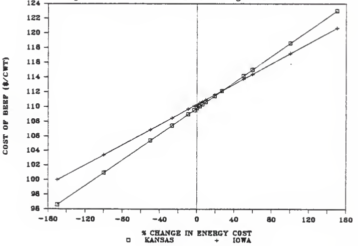


Figure 30. Cost of Beef to Chicago Market



of possible annual real energy price increases developed earlier in the chapter. It is therefore conceivable that, under the assumptions presented in this study, Kansas beef will be relatively more expensive than Iowa beef in the Chicago market by 1990.

Figures 31 - 38 show cost of beef comparisons between Kansas and Iowa to the remaining markets. Beef from Kansas eventually becomes relatively more expensive than Iowa beef over the range of scenarios. The breakeven energy cost increases are summarized in Table 20. Kansas beef loses its competitive position in terms of cost of production in only three of the markets within the scenarios studied. By 1990, it is possible for Kansas beef to be relatively more expensive in Chicago, New York and Boston. Annual real energy cost increases of three, five and six percent respectively would be required to bring about this change. In all other markets, under the conditions in the scenarios, Kansas beef remains relatively less expensive compared to Iowa beef.

Figure 31. Cost of Beef to San Francisco Market.

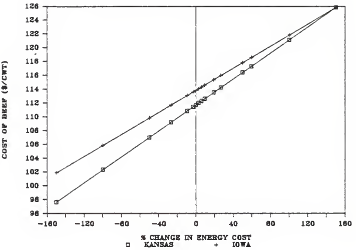


Figure 32. Cost of Beef to Yuma Market

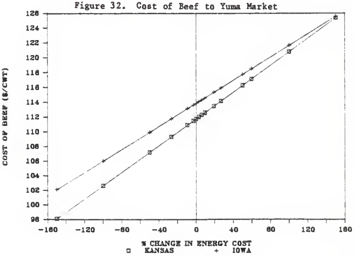


Figure 33. Cost of Beef to Kansas City Market.

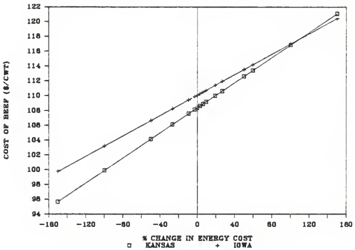


Figure 34. Cost of Beef to Houston Market.

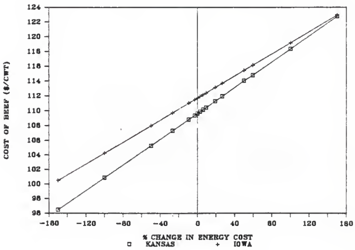


Figure 35. Cost of Beef to Knoxville Market.

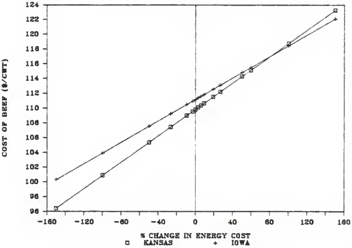


Figure 36. Cost of Beef to Boston Market.

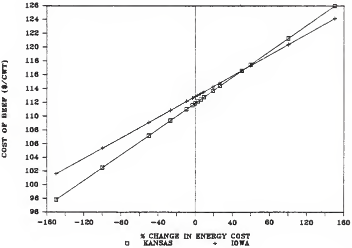


Figure 37. Cost of Beef to New York Market.

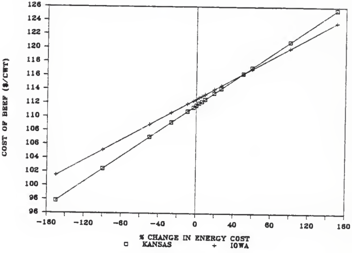


Figure 38. Cost of Beef to Miami Market.

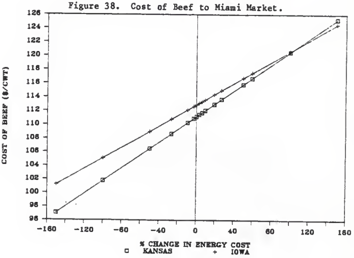


Table 20. Breakeven Energy Cost Increases

Market	Breakeven Price	Energy Cost Increase	Annual Increase To The Year: 1985	1990
Before transport	$115.60	100%	26%	9%
San Francisco	$125.83	150%	36%	12%
Yuma	$125.58	150%	36%	12%
Kansas City	$117.94	113%	29%	10%
Houston	$112.95	150%	36%	12%
Chicago	$112.37	29%	9%	3%
Knoxville	$116.99	80%	22%	8%
Boston	$117.03	55%	16%	6%
New York	$116.32	50%	14%	5%
Miami	$121.31	108%	28%	10%

CHAPTER 6

SENSITIVITY OF OTHER SELECTED VARIABLES ON THE COMPETITIVE POSITION OF THE KANSAS CATTLE FEEDING INDUSTRY

The framework used to study the effects of changing energy costs on Kansas cattle feeding is useful to analyze the effects of other variables on the cattle feeding industry. The same general procedure, changing the variable of interest while holding all others constant, is ideal for further analysis of the competitive position of Kansas cattle feeding and beef packing. Specifically, the variables of interest are: equal farm wage rates, interest rates, feeder cattle prices, the spread in feeder cattle prices between Kansas and Iowa, slaughter cost differences between Kansas and Iowa, freight rates and combinations of energy cost changes.

The wage rates for the enterprise budgets are taken from the respective Cooperative Extension Service enterprise budgets. Kansas reported a farm wage rate of $4.00 per hour while the rate reported in Iowa is $6.00 per hour for 1982. How is the Kansas industry affected by an equal farm wage rate, that is $6.00 per hour? The cost of beef before transport in Kansas is $108.79 per cwt while the cost of beef in Iowa is $108.91. Kansas retains a slight cost of production advantage under this scenario. Since the wage rates are equal, it follows that the Iowa cattle feeding system uses slightly more labor at the farm level. Beef from Kansas is obviously more expensive with increased farm wages. This increase in cost is enough to make Kansas beef more expensive than Iowa beef in Chicago, Knoxville, Boston and New York markets.

Wages have increased over the past years as inflation pushed up the price level in the United States. If farm wage rates were to increase at the current level of inflation, what would be the effect on the Kansas cattle feeding industry? Using an annual rate of increase of four percent, the farm wage rates will climb 12.5 percent by 1985 and 36.9 percent by 1990 with a base year of 1982. The cost of beef before transport under these situations is shown in Table 21.

Table 21. Effect of Farm Wage Rate Changes.

	Cost of Beef Before Transport ($/cwt)		Relative Cost	
Change in Wage Rate	Kansas	Iowa	Kansas	Iowa
0%	$108.28	$108.97	98.5	101.5
12.5%	$108.08	$110.06	98.2	101.8
36.9%	$109.65	$112.30	97.6	102.4

As farm wage rates increase in the future, the cost of production advantage for Kansas beef widens. Part of this advantage is due to slightly higher labor use in the Iowa system. The larger portion of the Kansas advantage comes from the lower base wage rate at the farm level in Kansas. Under an increasing wage rate situation, Kansas beef becomes relatively less expensive to produce and also relatively less expensive in all nine regional markets. For every one percent change in farm wage rates, Kansas beef increases 6.4 cents per cwt in cost. Iowa beef increases 9.2 cents per cwt in cost for every one percent increase in farm wage rates.

Interest rates are an important variable to study in the cattle feeding industry. The farm press currently contains many stories, letters and editorials on the level of interest rates. How does the level of interest rates affect the competitive position of the Kansas cattle feeding industry? The interest rate to be studied is the rate on operating loans at the farm level. A one-year time period will be used since that is the commonly accepted term of an operating loan. Interest rates on fixed costs (investment in facilities) will not change in this analysis.

The interest rate on variable costs (operating loan) will vary around the base case rate of 15 percent. The levels to be studied are 16, 15, 14, 12, and 10 percent. Table 22 illustrates the effect of these levels of interest rates on the comparative cost of beef.

Table 22. Effect of Interest Rate Levels.

	Cost of Beef Before Transport ($/cwt)		Relative Cost	
Interest Rate (%)	Kansas	Iowa	Kansas	Iowa
10%	$105.04	$106.07	99.0	101.0
12%	$105.93	$107.21	98.8	101.2
14%	$106.83	$108.34	98.6	101.4
15%	$107.25	$108.91	98.5	101.5
16%	$107.73	$109.49	98.4	101.6

It is evident that the cattle feeding system in Iowa requires larger amounts of operating funds than does the Kansas system. As interest rates increase, two things happen. First, beef from both systems becomes more expensive. Second, and most important for the Kansas cattle feeder, beef from Kansas becomes less expensive relative to Iowa beef. A one percentage point change in the interest rate on operating loans results in a $0.45 per cwt. change in the cost of Kansas beef before transport. Iowa beef changes $0.58 per cwt in cost before transport as interest rates change one percentage point. This difference is accounted for by higher operating loan requirements in Iowa and also a feeding period six days longer in Iowa than in Kansas. At the 10 percent interest rate level, Iowa beef becomes relatively less expensive than Kansas beef in the Chicago market. Further decreases in the level of interest rates will be advantageous for Iowa beef while increasing interests rates enhance the competitive position of Kansas beef.

The most expensive input in the cattle feeding budgets of both systems is the feeder calf. Which state is affected the most by changes in feeder calf prices? The base price for the feeder calf in Kansas is $61.90 per cwt. For Iowa, the feeder calf base price is $60.40 per cwt. These prices are increasesd at an annual rate of two percent. By 1985, feeder cattle prices will have increased or decreased by 6.1 percent. A 17.2 percent increase or decrease will have occurred in the year 1990. The change in feeder cattle prices and the corresponding cost comparisons are shown in Table 23.

Table 23. Effect of Changes in Feeder Cattle Prices.

	Cost of Beef Before Transport ($/cwt)		Relative Cost	
Change in Feeder Cattle Prices	Kansas	Iowa	Kansas	Iowa
-17.2%	$ 98.88	$100.85	98.0	102.0
-6.1%	$104.30	$106.06	98.3	101.7
0.0%	$107.28	$108.91	98.6	101.4
6.1%	$110.26	$111.77	98.6	101.4
17.2%	$115.68	$116.98	98.9	101.1

As feeder cattle prices increase, beef before transport from Kansas becomes more expensive at a faster rate than does Iowa-produced beef. A one percentage point increase in feeder cattle prices causes a $0.49 cwt increase in the cost of beef from Kansas. Iowa beef rises $0.47 per cwt in cost as feeder cattle prices increase one percent. In Iowa, the value of the feeder calf is 39 percent of the total cost of the finished animal. For Kansas, the stocker calf going into the backgrounding phase is 43 percent of the value of the finished animal from the feedlot. The Kansas cattle feeding system is slightly more sensitive to increases in feeder cattle prices, relative to the farmer-feeder cattle feeding system in Iowa. However, under the two percent annual increase in feeder cattle prices, Kansas beef remains relatively less expensive than Iowa beef in all nine regional markets.

Changing prices is not the only analysis of feeder cattle costs. Analysis shows that Kansas is more sensitive to increasing feeder cattle prices. How does the difference in feeder cattle prices between Kansas and Iowa affect the competitive position of Kansas cattle feeding? The base case price in Iowa will be used as the base price here, that is $60.40 per cwt. Kansas feeder cattle prices will be increased/decreased $1.00, $3.00 and $5.00 per cwt from the base price. Cost comparisons for these scenarios are shown in Table 24.

Table 24. Effect of Differences in Feeder Cattle Prices.

Feeder Cattle Price		Cost of Beef Before Transport ($/cwt)		Relative Cost of Beef	
Kansas	Iowa	Kansas	Iowa	Kansas	Iowa
$55.40	$60.40	$102.15	$108.91	93.8	106.6
$57.40	$60.40	$103.73	$108.91	95.2	105.0
$59.40	$60.40	$105.31	$108.91	96.7	103.4
$60.40	$60.40	$106.10	$108.91	97.4	102.6
$61.40	$60.40	$106.89	$108.91	98.1	101.9
$63.40	$60.40	$108.46	$108.91	99.6	100.4
$65.40	$60.40	$110.04	$108.91	101.0	99.0

Table 24 shows that, as feeder cattle prices in Kansas rise while those in Iowa remain constant, Kansas beef becomes more expensive relative to beef from the Iowa cattle feeding system. For every one dollar rise in Kansas feeder cattle prices, Kansas beef before transport becomes $0.79 per cwt more expensive. When Kansas feeder cattle are priced $3.00 per cwt more than Iowa's, Kansas beef is more expensive in the Chicago, Boston and New York markets. Under the $5.00 per cwt feeder cattle prices difference, Kansas beef is more expensive than Iowa beef in all nine regional markets.

Historically, the difference in feeder cattle prices between the High Plains and the Cornbelt has been due to type of cattle rather than an in institutional supply/demand relationship. The price of a feeder calf depends more upon its breeding, color, conformation and weight rather than the available supply of or demand for calves. Futrell (1980) summarized this concept from a farmer-feeder bias. "Pricewise, cattle feeders in the Central and Southern Plains may have an advantage over some midwest feeders in the purchase of feeder cattle, although this does not appear to be a major factor. Feeder attitudes regarding quality and breeding of feeder cattle may be a more important aspect of the comparative costs of cattle fed by some farmer/feeders versus those fed in large commercial lots. Thus, there may be a greater tendancy for farmer/feeders to purchase higher grading cattle and to incur additional costs as a result." If this is true, the cost of feeder cattle will be greater for farmer-feeders in the Cornbelt regions compared to feeder cattle going into commerical feedyards in the High Plains region. The analysis shows that this situation will enhance the competitive position of Kansas beef.

One of the advantages given for cattle feeding in Kansas is the recent completion of two extremely large boxed beef packing plants in the southwestern area of the state. Iowa Beef Processors, a subsidiary of Occidental Petroleum, and Excel Corp, owned by Cargill, operate slaughter-boxed beef plants completed since 1980. These plants are located at

Holcomb and Dodge City, Kansas, respectively. The combined capacity of these two operations is 2.4 million head annually. Although definite evidence is not available, it is assumed these plants are more efficient than the older beef packing plants in Iowa. If this is so, what effect do lower slaughter costs have on the Kansas cattle feeding industry? Useful data on the slaughter phase is unavailable. For analysis purposes, arbitrary levels of lower slaughter costs are assigned to the Kansas beef packing budget. Specific levels are 3, 5, 10, 15 and 20 percent lower slaughter costs. The cost comparisons for these scenarios are in Table 25.

Table 25. Effect of Differences in Slaughter Costs.

	Cost of Beef Before Transport ($/cwt)		Relative Cost	
Differences in Slaughter Costs Between Kansas and Iowa	Kansas	Iowa	Kansas	Iowa
-20%	$106.57	$108.91	97.6	102.2
-15%	$106.75	$108.91	98.0	102.0
-10%	$106.93	$108.91	98.2	101.9
-5%	$107.10	$108.91	98.3	101.7
-3%	$107.17	$108.91	98.4	101.6
0%	$107.28	$108.91	98.5	101.5

Intuitively, as slaughter costs in Kansas decrease beef from Kansas becomes less expensive relative to Iowa beef. However, slaughter costs do not have a very significant effect on the cost of beef. Every one percent decrease in Kansas slaughter costs decreases the cost of Kansas beef before transport only 3.5 cents per cwt.

The final phase in the cattle feeding industry is the transportation phase. Energy costs in the transportation phase are analyzed in another section of the study. However, the transportation rate was not analyzed. What effect will changes in transportation rates have on the competitive position of the Kansas cattle feeding industry? Freight rates are increased at annual rates of 3, 5 and 10 percent from the base year of 1982 to 1985 and 1990 to analyze their effect on the Kansas position.

Under the 5 and 10 percent annual freight rate increases from 1982 to 1990, Kansas beef becomes more expensive than Iowa beef in only the Chicago market. Chicago is the closest market to the Iowa production area. Obviously, changes in freight rates have a small effect on the cost of beef given their current structure with inflation rates applied directly to them. In the Chicago market, the cost of a one percent increase in freight rates increases Kansas beef 0.4 cents per cwt for every 100 miles shipping distance. Iowa beef increases 0.5 cents per cwt for every 100 miles shipped under this assumption. Freight rates, like slaughter costs, are a relatively small portion of the cost of beef from both Kansas and Iowa.

It has been shown that the Kansas cattle feeding industry is more energy intensive than the Iowa system. What kind of direct energy inputs have the greatest effect on Kansas cattle feeding? Several combinations of energy cost assumptions answer this question. Prices of selected direct energy inputs are changed independently of other direct energy inputs. First, natural gas and LP gas prices are doubled while all others are held constant. Kansas beef becomes more expensive to produce than Iowa beef. In addition, Kansas beef is more expensive in all nine regional markets. A brief look at energy use in the cattle feeding systems shows why this happens. Corn production in Iowa uses 19 gallons of LP gas for drying corn grain after harvest. Kansas corn production uses 19 gallons of LP gas for drying grain and also 18,790 cubic feet of natural gas as an energy source for irrigation. The corn grain used in Kansas cattle feeding requires more energy inputs to produce than corn in Iowa. Cost comparisons in Chapter 5 showed that the relative energy cost of Kansas corn is 181 percent of Iowa corn. The cattle feeding operation in Iowa does not use natural gas or LP gas, while cattle feeding in Kansas requires 350 cubic feet of natural gas per head. Natural gas is the energy source used in the steam-flake processing of corn prior to feeding. This extra energy use along with the more energy-intensive corn results in cattle with a relative energy cost per head 133 percent of the energy cost of Iowa cattle.

Second, all diesel fuel prices are doubled. Under this situation, Kansas beef retains its competitive advantage, in terms of lower cost, in all regional markets. Cost comparisons between Kansas and Iowa reveal that the advantage for Kansas beef increases. The relative costs are in Table 26, with the base case compared to the situation in which all diesel fuel prices are doubled.

Table 26. Cost Comparisons between Base Case and Diesel Fuel Prices Doubled

	Relative Cost of Beef from Kansas (%)	
City (Market)	Base Case	Diesel Fuel Price Doubled
San Francisco	98.1	97.7
Yuma	98.1	97.6
Kansas City	98.4	98.1
Houston	98.1	98.0
Chicago	99.5	99.4
Knoxville	98.8	98.5
Boston	99.1	99.0
New York	99.2	99.1
Miami	98.5	98.2

Since Kansas beef becomes even less expensive relative to Iowa beef, the later cattle feeding system must use more diesel fuel compared to the Kansas system. In a situation where diesel fuel prices are doubled, Kansas beef will not lose the competitive advantage in terms of a relatively lower cost product.

Alternatively, diesel fuel prices are doubled at the farm level, but not in the transportation phase of the cattle feeding industry. Again, Kansas beef is less expensive than Iowa beef in all nine markets. Under the conditions of the base case, the cost of Kansas beef relative to Iowa is 98.5 percent. When farm level diesel fuel prices are doubled the relative cost of Kansas beef is 98.2 percent of the cost in Iowa. Again, the Iowa farmer-feeder system uses more diesel fuel to produce beef than the commercial feedlot system in Kansas does.

Finally, electricity prices are doubled, holding all other prices constant. Kansas beef rises faster in cost than beef from Iowa. Electric energy use is greater in Kansas than Iowa. The backgrounding phase of the Kansas system needs 20.6 kilowatt-hours of electricity while the feedlot phase takes 33.3 kilowatt-hours. Total electricity use in the Kansas system is 53.9 kilowatt-hours, compared to 8.32 kilowatt-hours of electricity used in the Iowa farmer-feeder system. The cost of Kansas beef relative to iowa beef under the base case conditions is 98.5 percent. With electricity rates doubled, the relative cost of Kansas beef is 98.9 percent, compared to Iowa.

Ranking the variables in the order of their effect of Kansas cattle feeding is difficult. A side by side comparison serves as a useful summary. The various scenarios in the study are listed below, with their effect on the cost of Kansas beef. A one percent change in energy costs results in an $0.08 per cwt change in the cost of Kansas beef. A one percent increase in farm wage rates results in a $0.06 per cwt increase in the cost of Kansas beef. A one percentage point change in the interest rate on operating loans changes the cost of Kansas beef $0.45 per cwt. A one percent change in feeder cattle cost results in a $0.49 per cwt change in the cost of Kansas beef. Every $1.00 increase in the difference in feeder cattle prices between Kansas and Iowa increases the cost of Kansas beef $0.79 per cwt. A one percent decrease in the difference in slaughter costs between Kansas and Iowa results in a $0.035 per cwt decrease in the cost of Kansas beef. Transportation cost increases do not result in a dramatic change in the competitive position of the Kansas cattle feeding industry. Eventually, with large enough increases in freight rates, Kansas beef will be relatively more expensive in the markets nearer to Iowa. There are the Chicago, Knoxville, Boston and New York markets.

Table 27. Sensitivity of Variables on the Kansas and Iowa Cattle Feeding Systems.

Variable	Change	KS Effect	IA Effect	Effect on Position of Kansas Industry
Energy costs	1%	$0.08	$0.07	-
Farm wage Rates	1%	$0.06	$0.09	+
Interest rates	1 pct. point	$0.45	$0.58	+
Feeder cattle price	1%	$0.49	$0.47	-
Difference in feeder cattle prices	-$1.00	-$0.79	-	+
Slaughter cost difference	-1%	-$0.035	-	+
Freight rates (per 100 miles)	1%	$0.04	$0.05	+ if closer than or - if farther than Iowa to market

These variables are summarized in Table 27. The effect on the Kansas industry, positive or negative, is noted. Situations that will enhance the competitive position of Kansas cattle feeding are: rising farm wage rates, increased interest rates on operating loans, a lower feeder cattle price than in Iowa, lower slaughter costs and increasing freight rates if the destination is closer to Kansas than Iowa. The competitive position of the Kansas cattle feeding system will be hindered if: energy costs increase, feeder cattle prices increase or freight rates increase, if Iowa is closer to the market than Kansas.

CHAPTER 7

SUMMARY, CONCLUSIONS AND FURTHER RESEARCH NEEDS

The cattle industry is a major fixture in the Kansas economy. Trail drives, cow-calf production and stocker operations were the basis of the industry. In the mid-1960's cattle feeding and meat packing started growing at phenominal rates. Grain fed cattle marketings have increased over 300 percent from 1961 to 1981. Kansas currently ranks fourth nationally in cattle and calves on grain feed with 1,100,000 head on feed January 1, 1982. Commercial cattle slaughter has more than doubled in that same time period. More recently, the total liveweight of commercial cattle slaughter has increased 45 percent in the three year period 1980 to 1982.

Kansas, and the High Plains area in general, has several advantages that have fueled the growth in cattle feeding and slaughter. Certainly the vast supply of feedgrains available in the High Plains area is most important. This was caused by (1) the development and continued genetic improvement of hybrid corn and grain sorghum and (2) the development of irrigation in the region. Population growth in the South and Southwest has outgrown that of other regions in the United States. Kansas is closer than previous cattle feeding areas to this growing market. Land has historically been less expensive in Kansas than in the cornbelt. Tranportation costs favor feeding cattle closer to the source of feedgrains rather than close to the final market. Similarily, it is less expensive to slaughter the cattle near the feedlot rather than shipping the live animal to be slaughtered near the final market. Transportation has improved with better highways and transportation equipment. The dry climate and relatively mild winters and low humidity in Kansas favors feedlot operation and is conducive to more rapid cattle gains.

The Kansas cattle feeding-beef packing industry is firmly in place, with ample investment capital, managerial expertise and public support.

Recently, there have been changes in the competitive position of the cattle feeding-beef packing industry in Kansas. The advantage of abundant, less expensive feedgrains has for the time disappeared. Corn prices in Kansas were higher than the national average price during the 1981-1982 marketing year. The supply of corn grain has not increased sufficiently to meet the demand from cattle feeding in the region, relative to national supply/demand relationships. Reasons generally accepted for this are (1) rising energy costs make irrigated grain production more expensive and (2) falling water table levels in the parts of the Ogallala Aquifer formation have made irrigation prohibitive and in extreme cases impossible. Energy costs have risen steadily over the past 15 years. The farm price of a gallon of diesel fuel has increased in nominal terms about 650 percent during that time. Since Kansas corn production is more energy intensive, costs will rise faster in Kansas than in previous cattle feeding areas as energy prices increase. The cost of production advantage for fed cattle in Kansas might shift to some other area if feedgrain supplies are restricted and/or more costly.

The purpose of the study is to identify the effect of changing energy prices and other selected variables on the competitive position of cattle feeding and beef packing in Kansas. Specifically, the objectives are: (1) Trace the growth and development of Kansas feedgrain, cattle feeding, and beef packing industries, (2) Define the costs of currently typical cattle feeding systems in both Kansas and the cornbelt, (3) Describe the levels of energy use in these systems, (4) Identify the markets in which Kansas slaughtered beef is currently marketed, (5) Determine the level of the energy cost change resulting in a shift in the cost of production advantage between regions, (6) Determine the level of energy cost change resulting in a change in the competitive position between regions for each market previously identified, (7) Identify the key factors for the competitive position of the Kansas cattle feeding industry that will be important as energy costs change in the future.

Kansas has heen listed in the Southwest region and in the Southern Great Plains region by Hieronymns (1982) and Price (1983), respectively. The cornhelt region has been the traditional cattle feeding area. Large differences in the production of heef exist both between these areas and also within each area. To counter this, Kansas is studied as a state rather than as a memher of a region. The proxy state for the traditional cornbelt area is Iowa. The approach used in the stndy is to compare Kansas cattle feeding to Iowa cattle feeding.

A series of production budgets are used to determine the total cost of heef from the different cattle feeding systems. Information used to prepare the production budgets comes from the Cooperative Extension Services of Kansas and Iowa. Crop production and cattle backgrounding hudgets in Kansas are hased on KSU Farm Management Guides and also Kansas Farm Management Association data for cooperating farms in 1982. Iowa State University Extension publications on Estimated Costs of Crop Production and Beef Cattle Feeding provide information on the Iowa cattle feeding system. The budget series mimics the steps involved in the respective systems. Steps in the Kansas system are: (1) irrigated feedgrain and roughage production, (2) cattle backgrounding, (3) cattle feeding in a commercial feedlot. Iowa cattle feeding consists of: (1) feedgrain and roughage production, (2) cattle feeding hy the farmer-feeder.

The cattle feeding systems are joined at the slaughter phase. A simplified hudget common to hoth states is used due to the absence of slaughter cost data. Beef from each state leaves the slaughter budget for transportation to one of nine regional markets in the United States. Energy costs are changed in the transportation phase with a method by Christensen (1980).

Costs in the budgets are separated into non-energy inputs, direct energy inputs, and indirect energy inputs. Non-energy inputs have no direct energy component. Direct energy inputs are the fuels used in the budgets. Examples are: diesel fuel, lp gas, natural gas and electicity. Indirect energy inpnts have a direct energy component, an indirect energy component, and a non-energy component. Pesticides are a good illustration of indirect energy inputs. The direct energy component consists of electricity and the fuels burned to provide the heat source used as a catalyst. Inputs snch as the hydrocarbon seedstock used in the manufacturing process and the fuel used to transport the final product are the indirect energy component. Lahor, advertising and inert materials are non-energy inputs. Examples of indirect energy inputs in cattle feeding are: fertilizers, seeds, pesticides, feedstuffs and supplements. By increasing only the direct energy component of the two cattle feeding systems, the effect of changing energy costs can he identified.

An analysis of the hase case presents support for statements made earlier in the study regarding differences in cattle feeding hetween Kansas and Iowa. Generally, the commercial feedlot system typical in Kansas provides a lower cost product at the feedlot, packing plant, and delivered to the final market. However, the product from Iowa requires less energy to produce when compared to Kansas cattle. Specifically, the total cost per cwt of cattle fed in Kansas is 98.3 percent of the total cost per cwt of cattle fed in Iowa. Energy costs of those cattle fed in Kansas are 139 percent of those fed in Iowa. Although more energy-intensive, Kansas heef is relatively less expensive in all nine regional markets previously identified.

Energy price change scenarios are developed based on information from several studies regarding future real energy price changes. Real energy prices are changed at rates of -3 percent, +3 percent and +6 percent annually to the years 1985 and 1990. This translates into energy price changes of -26.7, -9.3, +9.3, +19.1, +26.7 and +59.4 percent. The energy cost change resulting in a change in the source of least cost beef can be determined.

From the base case, Kansas beef before transport is cheaper than Iowa beef. A real energy price increase of 100 percent changes the cost of production advantage from Kansas to Iowa. This occurs at a beef price of $115.60 per hundredweight. The energy cost increase necessary to change the competitive advantage from Kansas to Iowa in each of the nine regional markets ranges from 29 to 150 percent. For the 1985 projection, these are annual increases of 9 to 35 percent. Under the 1990 time frame, these are annual real energy price increases of 3 to 12 percent. Based on the information used to develop the energy cost scenarios, it is possible for Kansas beef to become relatively more expensive than Iowa beef in some markets by 1990. These markets are generally closer to Iowa than Kansas, specifically the Chicago, New York and Boston markets.

The comparative statics framework used to study the effects of changing energy costs on Kansas cattle feeding is useful to analyze the effects of other variables on the cattle feeding industry. The same general procedure, changing the variable of interest while holding all others constant, is ideal for further analysis of the competitive position of Kansas cattle feeding and beef packing. Specifically, the variables of interest are: farm wage rates, interest rates, feeder cattle prices, the spread in feeder cattle prices between Kansas and Iowa, slaughter cost differences between the states, freight rates and combinations of energy cost changes.

Ranking the variables in the order of their effect on Kansas cattle feeding is difficult. A side by side comparison serves as a useful summary. The various scenarios in the study are listed below, with their effect on the cost of Kansas beef. A one percent change in energy costs results in an $0.08 per cwt change in the cost of Kansas beef. A one percent increase in farm wage rates results in a $0.06 per cwt increase in the cost of Kansas beef. A one percentage point change in the interest rate on operating loans changes the cost of Kansas beef $0.45 per cwt. A one percent change in feeder cattle cost results in a $0.49 per cwt change in the cost of Kansas beef. Every $1.00 increase in the difference in feeder cattle prices between Kansas and Iowa increases the cost of Kansas beef $0.79 per cwt. A one percent decrease in the difference in slaughter costs betwen Kansas and Iowa results in a $0.035 per cwt decrease in the cost of Kansas beef. Transportation cost increases do not result in a dramatic change in the competitive position of the Kansas cattle feeding industry. Eventually, with large enough increases in freight rates, Kansas beef will be relatively more expensive in the markets nearer to Iowa. These are the Chicago, Knoxville, Boston and New York markets.

Situations that will enhance the competitive position of Kansas cattle feeding are: rising farm wage rates, increased interest rates on operating loans, a lower feeder cattle price than in Iowa, lower slaughter costs and increasing freight rates if the destination is closer to Kansas than Iowa. The competitive position of the Kansas cattle feeding system will diminish if: feeder cattle prices increase, freight rates increase if Iowa is closer to the market than Kansas or finally, if energy costs increase.

FURTHER RESEARCH NEEDS

This study defines the comparative costs in currently typical cattle feeding systems in Kansas (the High Plains region) and Iowa (the Cornbelt region). Notations are made throughout the study where the analysis uses simplifying assumptions or examines a sector of the system rather than the total industry. Results of the analysis imply areas of additional stndy. The conclusions derived from this analysis are useful in suggesting hypotheses for these further research needs.

Land costs remained fixed during the period of analysis. As comparative costs changed between Kansas and Iowa, the land value stayed at the base case level. The land value is related to the productive earnings from the land. As prodnction costs increase, with commodity prices constant thereby lowering earnings, land values should decrease. With increasing energy costs, the comparative cost of production advantage in cattle feeding gradually shifts from Kansas to Iowa. Land values would be expected to decline in Kansas and increase in Iowa under this scenario; lowering total costs of production in Kansas and raising them in Iowa as a result. Additional work on these long-run relationships would be of interest.

The study looked at a limited section of the cattle feeding industry. Both the Iowa farmer and the Kansas cattlemen purchased calves for feeding to market weight and finish. The origin of these feeder calves, especially the distance from the feedlot, is an important issue. As energy costs increase, the cost of production of the feeder calf and the transportation cost to the feedlot would increase. It was noted earlier that the farmer-feeder incurs an additional expense by purchasing feeder calves of a higher quality. Generally, these are British-breed calves or their crosses. Cattle feeding in

Kansas requires inshipments of calves, mostly from the states south and southeast of Kansas. Also, the backgrounding phase adds to the distance these animals travel before going on feed in a Kansas feedlot. With this information, it appears feeder calves in the Kansas system have a higher total transportation cost before entering the feedlot, compared to the Iowa system. Therefore, when adding the cowherd and feeder calf production to the typical cattle feeding systems outlined, rising energy costs could have an even greater impact on the Kansas cattle feeding system.

Feedgrain production is assumed to take place at or near the feedlot location. This is almost always true for the farmer-feeder, but is rare for the commercial feedlot operation. Shipment of feedgrains, both locally and long-distance, has been left out of the Kansas cattle feeding system in this analysis. Adding feedgrain transportation to the system will increase the cost of cattle fed in the Kansas industry. Also, as energy costs increase, the cost of feeding cattle in Kansas will increase even more.

A comment was made early in the study that cattle feeding in Kansas (the High Plains area) is actually an assembly process. Cattle feeding has recently grown in the High Plains area because the assembly process can be done less expensively here, relative to other possible assembly areas in the nation. As energy costs change, and the costs of other significant variables in the cattle feeding system change, the assembly process might shift in location to some other region. Price (1983) and Hieronymus (1982) mention the Upper Missouri River region as a growth area. Further research needs to examine the possibility of cattle feeding and meat packing locating in this area, particularly under different assumptions about export demand for feedgrains.

The impact of the cattle feeding industry on the environment has been given as a problem in Iowa and a benefit for Kansas. Kansas is more sparsely populated than Iowa, specifically the western third of Kansas where the cattle feeding industry is located. There is little objection to the noise and odor from a commercial feedlot, especially when a feedlot provides a market for feedstuffs, feeder cattle and labor. The additional regulation in Iowa, on the other hand, is a deterrent to expansion of the cattle feeding-beef packing industy. Environmental concerns and regulations appear to be a limiting factor in the development of a cattle feeding industry. Any future expansion or relocation of cattle feeding and meat packing activity will occur in an area with public support and minimal environmental regulations or concerns.

The study used a simplified slaughter budget common to both Kansas and Iowa due to the absence of useable slaughter cost information. Newer and more efficient packing plants, such as those located in Southwest Kansas, should enhance the competitive cost advantage of a region. Cattle procurement should be cheaper in Kansas. The variability in quantity and quality of finished cattle from many small farmer-feeders will present additional costs for the Iowa beef packer. A large feedlot, with larger marketable lots of cattle, will present more uniform finished animals due to reduced variability in the rations fed to many head of cattle over a period of time. Packer procurement costs must be less in this situation.

Labor costs are lower in Kansas than in Iowa. The absence of labor union activity in the new packing plants leads to lower labor costs. There is also very little alternative use for industrial labor in Western Kansas. Other costs are lower for these packing plants. Less stringent environmental regulations were mentioned before. Land costs are lower in Kansas than in Iowa. This not only saves construction costs, taxes are lower on this property. There is widespread public support for packing plants. They provide a market for the cattle fed in the area, a market for labor, and an increase in local tax revenues. These factors were not considered in the competitive cost analysis of Kansas cattle feeding. If included, they should enhance the competitive position for the Kansas industry in the long-run in comparison with Iowa.

Additionally, comparative statics is a useful approach to determine the effect of a shock, such as energy costs, upon a model, such as the Kansas and Iowa cattle feeding industries. The limitations of this method suggest fnrther research needs to be done in several areas.

First is the study of Kansas cattle feeding in the framework of the six-state High Plains Ogallala Aquifer Study. The study projected conditions in the High Plains area to the year 2020. Four management strategies were tested. The baseline used currently available technology and forecasts of market conditions affecting the supply and demand of commodities. Strategy one looked at the impact of volnntary water use incentives. Strategy two added water policy reducing the available water along with the incentives in strategy one. Constant commodity prices were also imposed on the baseline to test the effect of lower commodity prices. These scenarios would be useful to determine the effect of future policies and economic conditions on cattle feeding in the High Plains area.

Using a linear programming framework in the study of Kansas cattle feeding would allow the determination of an optimal solution. Economic relationships in the cattle feeding-meat packing industry involve demand for livestock products, production functions for the feedstuff and cattle feeding enterprises, the availability of factors of production, and transfer cost functions for products at all levels in the industry. This would allow feedgrains to be substituted, technology to be changed, and demand to be analyzed.

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APPENDIX A

KANSAS FEEDLOT DATA

The following data was collected from four cooperating feedlots in 1983 concerning their operations in fiscal 1982. The procedure involved was to interview the feedlot manager, review the financial statements made available, and to tour the feedlot facilities. Using the enterprise budget format, the financial data collected from each feedlot is presented in this appendix.

Different accounting procedures were used between the feedlots. Also, the fiscal years for which data was collected differed between the four businesses. For these and other reasons, comparisons between the feedlots presented should not be made.

"Average" Feedlot - Select Cost Components

Responses	Item	Quantity	Units	Price	Cost/Head
4	Labor	1.64	hours	$6.75	11.07
1	Yardage	100.00	days	$0.05	5.00
3	Vet and drugs				8.65
4	Death loss	.3% of value of feeder steer			1.38
3	Miscellaneous				4.99
4	Diesel fuel	.73	gallons	$1.06	0.77
3	Natural gas	.35	1000 cu.ft.	$2.52	0.88
4	Electricity	33.30	kwh	$0.07	2.30
4	Depreciation				2.58
4	Other fixed costs				6.81

Feedlot Finishing Rations - Kansas 1982

Firm A (3/83)

Ingredient	% As Is	Cost/Cwt	
Hay	10%	5.10	0.51
Flaked Corn	31%	6.33	1.96
Wet Corn	50%	5.63	2.82
Mollasses	4%	4.45	0.18
Protein	5%	9.66	0.48
	100%		$5.95/cwt

$119.80 per ton (includes markup)

Firm B (3/83)

Ingredient	% As Is	Cost/Cwt	
Flaked Corn	63%	5.45	3.43
Hay	9%	3.90	0.35
Finisher Supp.	3%	7.00	0.21
Steepwater Blend	3%	3.48	0.10
Fat	2%	13.38	0.27
Bovatec	0.012%	668.00	0.08
Water	1.988%	0.01	0.00
Wheat Midds	18%	5.33	0.96
	100%		$5.40/cwt

$108.00 per ton (excludes markup)

$123.40 per ton (includes markup)

Firm C (6/82)

Ingredient	% As Is	Cost/Cwt	
Silage	10%	1.60	0.16
Hay	5.5%	3.20	0.18
Straw	2.5%	3.20	0.08
Milo	46%	4.25	1.96
Wheat Midds	15%	5.00	0.75
Hominy	12%	5.65	0.68
Molasses	5%	4.86	0.24
Supplement	4%	7.38	0.30
	100%		$4.35/cwt

$87.00 per ton (no markup information is available)

Firm D (12/82)

Ingredient	% As Is	Cost/Cwt
Hay	10%	
Flaked Corn	41%	
Wet Corn	40%	
Molasses	4%	
Supplement	5%	

$145.22 per ton (includes markup)

Note: no cost data was available for Firm D

Firm A

VC1:	Labor		10.15	298,186.62
	Yardage	0.05/HD/Day	5.65	
	Vet & Medicine		5.99	
	Death Loss	0.5%		
	Miscellaneous		2.56	75,229.48
	Interest	113 Days @ %		
			$24.35	$373,416.10
VC2:	Gasoline & Oil		0.47	13,791.02
	Diesel		0.40	11,643.61
	Natural Gas		0.77	22,648.64
	LP Gas		0.06	1,621.70
	Electricity		1.72	50,549.39
			$ 3.42	$100,254.36
VC3:	Feed	1.50255 Tons @ $119.00/Ton	$178.80	
			$178.80	
Fixed Costs:				
	Depreciation		2.55	75,000.00
	Interest		3.01	88,403.57
	Repairs		2.74	80,809.92
	Taxes		0.42	12,363.57
	Insurance		0.68	19,913.63
			$ 9.40	$276,490.69
Total Cost			$215.97	
CWT Gain			3.71	
Cost/CWT			$ 58.21	
Feedlot Operating Expenses				$750,161.15

Additional Information

Data collected for 9/01/82 to 1/31/83
Number of head closed out: 29,370 (68% steers, 32% heifers)
Average days on feed: 113 days
Average gain 371 pounds (adg 3.3)
Average beginning weight: 715 pounds
Average finished weight: 1,086 pounds
Average death loss: 0.5%
Average conversion: 8.1 pounds of feed per pounds gained

Lot built in 1961
480 acres
Capacity: 30,000 head

Firm B

VC1:	Labor		10.58	1,133,818.27
	Vet		10.09	
	Death Loss	0.2%		
	Miscellaneous			833,056.08
	Interest	15% for 132 days		
			$20.67	$1,966,874.35
VC2:	Diesel Fuel			
	Gasoline & Oil		0.54	58,332.67
	Natural Gas		0.74	79,209.01
	Electricity		2.65	283,842.39
			$3.93	$ 421,384.07
VC3:	Feed	1.28865 Tons @ $123.40/Ton $159.02	$159.02	
Fixed Costs:				
	Depreciation		2.10	225,535.33
	Interest		1.02	109,384.16
	Repairs		5.90	632,455.91
	Taxes		0.20	21,139.23
	Insurance		0.23	1,013,476.48
			$ 9.45	$1,013,476.48
Total Cost			$193.07	
CWT Gain			3.63	
Cost/CWT			$ 53.19	
Feedlot Operating Expenses				$3,401,734.90

Additional Information

Data collected for 4/01/82 to 12/31/82
Number of head closed out: 107,199 (71% steers, 29% heifers)
Average days on feed: 132 days
Average gain 363 pounds
Average beginning weight: 688 pounds
Average finished weight: 1,051 pounds
Average conversion 7.1
Average death loss: 0.2%
Average conversion: 8.1 pounds of feed per pounds gained

Lot built in 1973
Unknown acres
Capacity: 55,000 head

Firm C

VC1:	Labor		13.79	$304,097.91
	Vet & Medicine		5.22	
	Death Loss	0.9%		
	Miscellaneous		9.97	219,855.00
	Interest	143 Days @ %		
			$28.98	$523,952.91
VC2:	Auto & Eqnipment Expense		0.73	16,179.00
	Electricity	25.2hrs @ $0.66	1.67	37,751.00
	LP Gas	7.957 gal. @ $0.458	3.64	80,308.00
			$ 6.04	$133,238.00
VC3:	Finishing Ration	1.5075 T @ $87.00	$131.15	
			$131.15	
Fixed Costs				
	Depreciation		3.05	67,263.00
	Interest		2.32	51,207.00
	Repairs		1.73	38,060.00
	Taxes		1.08	23,843.00
	Insurance		1.46	32,298.00
			$ 9.64	$212,671.00
Total Cost			$175.81	
CWT Gain			4.02	
Cost/CWT			$ 43.73	
Feedlot Operating Expenses				$869,861.91

Additional Information

Data collected for 8/01/81 to 7/31/82
Number of head closed out: 22,050 (75%steers, 25% heifers)
Average days on feed: 143 days
Average gain 402 pounds (ADG 2.8 pounds)
Average beginning weight: 661 pounds
Average finished weight: 1,063 pounds
Average death loss: 0.9%
Average conversion: 7.5 pounds of feed per pounds gained

Lot built in 1970
400 acres (Includes runoff lagoon)
Capacity: 13,500 head - winter time
11,000 head - summer time

Firm D

VC1:	Labor		11.55	323,104.63
	Death Loss	0.2%		
	Miscellaneous		3.63	101,521.01
	Interest	115 days @ %		
			$15.18	$424,625.64
VC2:	Diesel Fuel		0.88	24,569.43
	Gasoline & Oil		0.63	17,590.85
	Natural Gas		1.54	42,998.94
	Electricity		2.05	57,358.21
			$5.10	$142,517.43
VC3:	Ration	1.1377 Tons @ $145.22/Ton	$165.22	
Fixed Costs:				
	Depreciation		4.10	114,637.12
	Interest		2.16	60,527.30
	Repairs		1.89	52,830.24
	Taxes		0.26	7,288.98
	Insurance		0.85	23,850.05
			$9.26	$259,850.05
Total Cost			$194.76	
CWT Gain			3.67	
Cost/CWT			$ 53.07	
Feedlot Operating Expenses				$826,276.76

Additional Information

Data collected for 4/01/82 to 12/31/82
Number of head closed out: 27,977 (75% steers, 25% heifers)
Average days on feed: 115 days (ADG 3.2)
Average gain: 367 pounds
Average beginning weight: 712 pounds
Average finished weight: 1,079 pounds
Average conversion: 6.2
Average death loss: 0.2%

Lot built in 1972
130 acres
Capacity: 18,000 head

APPENDIX B

ENERGY INCREASE BUDGETS

This appendix contains a complete series of budgets when real energy prices are increased 100 percent. Comparing the base case budgets in Chapter 4 to these budgets illustrates the effect of an energy price increase on the Kansas and Iowa cattle feeding systems.

Center Pivot Irrigated Corn Budget for Kansas,
100 percent Energy Price Increase.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.00	hours	$4.00	$12.00						
Irrigation equip. repairs				$25.56	$25.56					
Machinery repairs				$12.00	$12.00					
Miscellaneous				$3.00	*$3.00					
Interest			15%	$15.36	$14.77					
				$67.92	$55.33					
VC2 Direct energy inputs										
Diesel fuel	14.40	gallons	$2.12	$30.53	$30.53	508.32	0.06006	35.3000	0.03003	$30.53
LP gas	19.00	gallons	$1.44	$27.36	$27.36	456.00	0.06000	24.0000	0.03000	$27.36
Natural gas	18.79	M cubic ft	$5.04	$94.70	$94.70	4735.08	0.02000	252.0000	0.01000	$94.70
				$152.59	$152.59	5699.40				$152.59
VC3 Indirect energy inputs										
Seed	16.67	lbs.	$1.13	$24.51	$24.51	109.04	0.06006	11.3399	0.03003	$11.35
Nitrogen	130.00	lbs. N	$0.16	$32.46	$32.46	707.62	0.03295	5.4432	0.01647	$23.31
Phosphorous	45.00	lbs. P2O5	$0.26	$13.54	$13.54	61.24	0.06006	1.3600	0.03003	$3.68
Potassium	25.00	lbs. K2O	$0.13	$3.79	$3.79	10.15	0.06006	0.7250	0.03003	$1.09
Herbicides (atrazine)	1.50	lbs. a.t.	$2.46	$4.14	$4.14	30.78	0.02942	20.5207	0.01471	$0.91
(alachlor)	2.00	lbs. a.t.	$4.73	$10.39	$10.39	63.12	0.02942	31.5582	0.01471	$1.86
Insecticide (carbofuran)	1.00	lbs. a.t.	$9.32	$10.04	$10.04	49.03	0.02942	49.0338	0.01471	$1.44
(carbaryl)	2.00	lbs. a.i.	$3.47	$7.43	$7.43	33.05	0.02942	16.5245	0.01471	$0.97
				$106.30	$106.30	1152.01				$44.61
Fixed costs										
Equipment depreciation				$17.14						
Equipment int.,tax,ins.				$12.00	$12.00					
Irrigation equip. depr.				$53.25						
Irri. equip. int.,tax,ins.				$42.60	$42.60					
Land (cash rent equiv.)				$62.00	$62.00					
				$187.79	$117.40					
Total cost per acre				$514.60	$431.62	6851.41				$197.20
Total cost per bushel				$3.96	$3.32	52.70				$1.52
Yield (bushels per acre)				130						
Change in energy price level	1									

Center Pivot Irrigated Corn Silage Budget for Kansas,
100 percent Energy Price Increase.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.00	hours	$4.00	$12.00						
Irrigation equip.repairs				$25.56	$25.56					
Machinery repairs				$12.00	$12.00					
Miscellaneous				$3.00	$3.00					
Interest			15%	$14.22	$13.63					
				$66.78	$54.19					
VC2 Direct energy inputs										
Diesel fuel	16.40	gallons	$2.12	$34.77	$34.77	578.92	0.06006	35.3000	0.03003	$34.77
Natural gas	18.79	M cubic ft	$5.04	$94.70	$94.70	4735.00	0.02000	252.0000	0.01000	$94.70
				$129.47	$129.47	5314.00				$129.47
VC3 Indirect energy inputs										
Seed	16.67	lbs.	$1.13	$24.51	$24.51	189.04	0.06006	11.3399	0.03003	$11.35
Nitrogen	130.00	lbs. N	$0.16	$32.46	$32.46	707.62	0.03295	5.4432	0.01647	$23.31
Phosphorous	45.00	lbs. P2O5	$0.26	$13.54	$13.54	61.24	0.06006	1.3608	0.03003	$3.68
Potassium	25.00	lbs. K2O	$0.13	$3.79	$3.79	18.15	0.06006	0.7258	0.03003	$1.09
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$4.14	$4.14	30.78	0.02942	20.5207	0.01471	$0.91
(alachlor)	2.00	lbs. a.i.	$4.73	$10.39	$10.39	63.12	0.02942	31.5582	0.01471	$1.86
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$10.04	$10.04	49.03	0.02942	49.0338	0.01471	$1.44
(carbaryl)	2.00	lbs. a.i.	$3.47	$7.43	$7.43	33.05	0.02942	16.5245	0.01471	$0.97
				$106.30	$106.30	1152.01				$44.61
Fixed costs										
Equipment depreciation				$17.14						
Equipment int.,tax,ins.				$12.00	$12.00					
Irrigation equip.depr.				$53.25						
Irri. equip. int.,tax,ins				$42.60	$42.60					
Land (cash rent equiv.)				$62.00	$62.00					
				$187.79	$117.40					
Total cost per acre				$490.34	$407.36	6466.0134				$174.00
Total cost per ton				$22.29	$18.52	293.9097				$7.91
Yield (tons/acre)				22						
Change in energy price level	1									

Center Pivot Irrigated Alfalfa Budget for Kansas,
100 percent Energy Price Increase.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	10.50	hours	$4.00	$42.00						
Irrigation equip. repairs				$25.56	$25.56					
Machinery repairs				$15.00	$15.00					
Miscellaneous				$3.00	$3.00					
Interest			15%	$12.86	$10.70					
				$98.42	$54.34					
VC2 Direct energy inputs										
Diusel fuel	16.90	gallons	$2.12	$35.83	$35.83	596.57	0.06006	35.3000	0.03003	$35.83
Natural gas	10.79	M cubic ft	$5.04	$94.70	$94.70	4735.00	0.02000	252.0000	0.01000	$94.70
				$130.53	$130.53	5331.65				$130.53
VC3 Indirect energy inputs										
Seed (annual cost)	3.00	lbs.	$1.97	$8.44	$8.44	84.37	0.06006	28.1230	0.03003	$5.07
Phosphorous	45.00	lbs. P2O5	$0.26	$13.54	$13.54	61.24	0.06006	1.3608	0.03003	$3.68
Potassium	25.00	lbs. K2O	$0.13	$3.79	$3.79	18.15	0.06006	0.7258	0.03003	$1.09
Herbicides (trifluralin)	1.00	lbs. a.i.	$8.55	$8.70	$8.70	15.93	0.02942	15.9320	0.01471	$0.47
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$10.04	$10.04	49.03	0.02942	49.0330	0.01471	$1.44
				$44.60	$44.60	228.72				$11.75
Fixed costs										
Equipment depreciation				$21.43						
Equipment int., tax, ins.				$15.00	$15.00					
Irrigation equip. depr.				$53.25						
Irri. equip. int., tax, ins.				$42.60	$42.60					
Land (cash rent equiv.)				$62.80	$62.80					
				$195.08	$120.40					
Total cost per acre				$460.63	$349.88	5560.37				$142.28
Total cost per ton				$78.10	$58.31	926.73				$23.71
Yield (tons per acre)				6						
Change in energy price level	1									

Cattle Backgrounding Budget for Kansas,
100 percent Energy Price Increase.

	Inputs			Cost		Energy					
	Quantity	Units	Price	Total	Cash	Mcal/head	$/Mcal	Mcal/Unit	Base Prices	Energy Share	
VC1 Non-energy inputs											
Stocker calf	4.5	cwt.	$61.90	$278.55	$278.55						
Labor	3.00	hours	$4.00	$12.00							
Vet&drugs				$7.00	$7.00						
Death loss	2%			$5.57	$5.57						
Repairs				$6.25	6.25						
Miscellaneous				$4.50	$4.50						
Interest			15%	$16.20	$15.13						
				$330.07	$317.00						
VC2 Direct energy inputs											
Diesel fuel	1.65	gallons	$2.12	$3.50	$3.50	58.25	0.06006	35.3000	0.03003	$3.50	
Electricity	20.6	kwh	$0.07	$1.42	$1.42	17.72	0.16047	0.8600	0.08023	$2.84	
				$4.92	$4.92	75.96				$6.34	
VC3 Indirect energy inputs											
Corn Silage	4.5	tons	$22.29	$100.30	$83.32	1322.59		293.9097		$35.61	$7.91
Supplement(SBM)	1.0	cwt	$12.00	$25.11	$25.11	69.09	0.06006	38.3814	0.03003	$4.15	
				$125.41	$108.44	1391.68				$39.76	
Fixed costs											
Depreciation				$6.25							
Interest				$8.75	$8.75						
Taxes&Insurance				$1.25	$1.25						
				$16.25	$10.00						
Total cost per head				$476.65	$440.36	1467.6412				$46.10	
Breakeven price per cwt.				$63.55	$58.71	489.21372		(Energy Cost of Gain)	!!!		$15.37
Market weight (cwt)				7.5							
Change in energy price level	1										

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Cash Cost Corn Silage (ton) $10.52

Cattle Feeding Budget for Kansas,
100 percent Energy Price Increase.

	Inputs			Total	Energy			Base	Energy	
	Quantity	Units	Price	Cost	Mcal/head	$/Mcal	Mcal/unit	Prices	Share	
VC 1 Non-energy inputs										
Feeder steer	7.50	cwt.	$63.55	$476.65	1467.64				$46.10	
Labor	1.64	hours	$6.75	$11.07						
Yardage	100.00	days	$0.05	$5.00						
Vet. & drugs				$8.65						
Death loss			0.300%	$1.43						
Miscellaneous				$4.99						
Interest			15.00%	$23.59						
				$531.38	1467.64				$46.10	
VC 2 Direct energy inputs										
Diesel fuel	0.73	gallons	$2.12	$1.55	25.77	0.06006	35.3000	0.03003	$1.55	
Natural gas	0.35	M cubic ft	$5.04	$1.76	88.20	0.02000	252.0000	0.01000	$1.76	
Electricity	33.38	kwh.	$0.07	$2.38	28.64	0.16000	0.8600	0.08000	$4.58	
				$5.61	142.61				$7.89	
VC 3 Indirect energy inputs										
Alfalfa hay	0.0945	tons	$78.10	$7.38	87.58		926.7276		$2.24	$23.71
Flaked corn	25.8750	bushels	$3.96	$102.43	1363.69		52.7032		$39.25	$1.52
Soybean meal	1.9950	cwt.	$12.17	$26.58	76.57	0.06006	38.3814	0.03003	$4.60	
Wheat mids	2.6250	cwt.	$8.17	$21.45	127.10	0.06006	48.4200	0.03003	$7.63	
				$157.83	1527.84				$53.72	
Fixed costs										
Depreciation				$2.58						
Other fixed costs				$6.81						
				$9.39						
Total cost per head				$704.21	3138.09				$107.71	
Breakeven price per cwt.				$67.07	523.01		(Energy Cost of Gain) !!!			$17.95
Market weight (cwt.)				10.5						
Change in energy price level	1									

Continuous Cropped Corn Budget for Iowa,
100 percent Energy Price Increase.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	3.60	hours	$6.00	$21.60						
Crop insurance				$4.50	$4.50					
Machinery repairs				$12.00	$12.00					
Miscellaneous				$3.20	$3.20					
Interest			15%	$9.92	$8.86					
				$51.22	$28.56					
VC2 Direct energy inputs										
Diesel fuel	6.85	gallons	$2.12	$14.52	$14.52	241.01	0.06006	35.3800	0.03003	$14.52
LP gas	19.00	gallons	$1.44	$27.36	$27.36	456.00	0.06000	24.0000	0.03000	$27.36
				$41.88	$41.88	697.01				$41.88
VC3 Indirect energy inputs										
Seed	18.04	lbs.	$1.13	$26.53	$26.53	204.57	0.06006	11.3399	0.03003	$12.29
Nitrogen	140.00	lbs. N	$0.16	$34.95	$34.95	762.05	0.03295	5.4432	0.01647	$25.11
Phosphorous	60.00	lbs. P2O5	$0.24	$16.85	$16.85	81.65	0.06006	1.3608	0.03003	$4.90
Potassium	60.00	lbs. K2O	$0.13	$9.11	$9.11	43.55	0.06006	0.7258	0.03003	$2.62
Lime (annual cost)·	0.30	tons	$11.45	$6.01	$6.01	85.85	0.06006	286.1744	0.03003	$5.16
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$4.14	$4.14	30.78	0.02942	20.5207	0.01471	$0.91
(alachlor)	2.00	lbs. a.i.	$4.73	$10.39	$10.39	63.12	0.02942	31.5582	0.01471	$1.86
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$10.04	$10.04	49.03	0.02942	49.0338	0.01471	$1.44
				$118.03	$118.03	1320.60				$54.27
Fixed costs										
Equipment depreciation				$31.02						
Equipment int.,tax,ins.				$20.60	$20.60					
Land (cash rent equiv.)				$122.00	$122.00					
				$173.70	$142.60					
Total cost per acre				$384.83	$331.15	2018.40				$96.16
Total cost per bushel				$3.35	$2.88	17.55				$0.84
Yield (bushels per acre)				115						
Change in energy price level	1									

Corn Silage (following Corn) Budget for Iowa,
100 percent Energy Price Increase.

	Inputs			Cost		Energy				
	Quantity	Units	Price	Total	Cash	Mcal/acre	$/Mcal	Mcal/Unit	Base Prices	Energy Share
VC1 Non-energy inputs										
Labor	5.50	hours	$6.00	$33.00						
Crop insurance				$4.50	$4.50					
Machinery repairs				$22.50	$22.50					
Miscellaneous				$3.20	$3.20					
Interest			15%	$11.51	$9.88					
				$74.71	$40.08					
VC2 Direct energy inputs										
Diesel fuel	8.65	gallons	$2.12	$18.34	$18.34	305.35	0.06006	35.3000	0.03003	$18.34
				$18.34	$18.34	305.35				$18.34
VC3 Indirect energy inputs										
Seed	18.04	lbs.	$1.13	$26.53	$26.53	204.57	0.06006	11.3399	0.03003	$12.29
Nitrogen	180.00	lbs. N	$0.16	$44.94	$44.94	979.78	0.03295	5.4432	0.01647	$32.28
Phosphorous	80.00	lbs. P2O5	$0.24	$22.47	$22.47	108.86	0.06006	1.3608	0.03003	$6.54
Potassium	180.00	lbs. K2O	$0.13	$27.32	$27.32	130.64	0.06006	0.7258	0.03003	$7.85
Lime (annual cost)	0.30	tons	$11.45	$6.01	$6.01	85.85	0.06006	286.1744	0.03003	$5.16
Herbicides (atrazine)	1.50	lbs. a.i.	$2.46	$4.14	$4.14	30.78	0.02942	20.5207	0.01471	$0.91
(alachlor)	2.00	lbs. a.i.	$4.73	$10.39	$10.39	63.12	0.02942	31.5582	0.01471	$1.86
Insecticide (carbofuran)	1.00	lbs. a.i.	$9.32	$10.04	$10.04	49.03	0.02942	49.0338	0.01471	$1.44
				$151.85	$151.85	1652.64				$68.31
Fixed costs										
Equipment depreciation				$27.96						
Equipment int., tax, ins.				$10.64	$18.64					
Land (cash rent equiv.)				$122.00	$122.00					
				$160.60	$140.64					
Total cost per acre				$413.49	$350.91	1957.98				$86.65
Total cost per ton				$25.84	$21.93	122.37				$5.42
Yield (tons per acre)				16						
Change in energy price level	1									

Cattle Feeding Budget for Iowa,
100 percent Energy Price Increase.

	Inputs			Cost		Energy					
	Quantity	Units	Price	Total	Cash	Mcal/head	$/Mcal	Mcal/Unit	Base Prices	Energy Share	Energy Cost/Unit
VC1 Non-energy inputs											
Feeder calf	4.50	cwt.	$60.40	$271.80	$271.80						
Labor	5.00	hours	$6.00	$30.00							
Vet. $ drugs				$6.50	$6.50						
Death loss			2%	$5.44	$5.44						
Miscellaneous				$3.20	$3.20						
Interest			15%	$52.96	$48.75						
				$369.89	$335.69						
VC2 Direct energy inputs											
Diesel fuel	2.20	gallons	$2.12	$4.66	$4.66	77.66	0.06006	35.3000	0.03003	$4.66	
Electricity	0.32	kwh.	$0.89	$0.77	$0.77	46.51	0.10800	0.8600	0.05400	$5.02	
				$5.44	$5.44	124.17				$9.69	
VC3 Indirect energy inputs											
Corn silage	2.60	tons	$25.84	$67.19	$57.02	318.17		122.3740		$14.08	$5.42
Shelled corn	61.00	bushels	$3.35	$204.13	$175.65	1070.63		17.5513		$51.00	$0.84
Supplement (SBM)	2.85	cwt.	$12.49	$38.78	$35.60	106.10	0.06006	37.2545	0.03003	$6.38	$2.24
				$310.11	$268.27	1494.98				$71.46	
Fixed costs											
Depreciation				$23.80							
Interest				$16.55	$16.55						
Repairs, taxes, insurance				$13.17	$13.17						
				$53.52	$29.72						
Total cost per head				$738.95	$639.11	1619.15				$81.15	
Breakeven price per cwt.				$67.18	$58.10	147.20		(Energy Cost of Gain))))			$12.48
Market weight (lbs.)				11.0							
Change in energy price level	1										

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Cash Cost of Corn Grain (bu)	$2.00
Cash Cost of Corn Silage (ton)	$21.93

Cattle Slaughter Budget,
100 percent Energy Price Increase.

	Base Cost		Update	
	Total	Per Head	Total	Per Head
VC1 Non-energy inputs				
Repairs $ Maintenance	$543575.00	$0.97	$543575.00	$0.97
Labor (direct)	$5240000.00	$9.32	$5240000.00	$9.32
(foreman)	$459000.00	$0.82	$459000.00	$0.82
Fringe Benefits	$1196790.00	$2.13	$1196790.00	$2.13
Sewage	$600.00	$0.00	$600.00	$0.00
Sanitation	$123000.00	$0.22	$123000.00	$0.22
Miscellaneous	$1840735.00	$3.29	$1840735.00	$3.29
Feed Expense	$33069.00	$0.06	$33069.00	$0.06
Direct Supplies	$325000.00	$0.58	$325000.00	$0.58
	$9769769.00	$17.37	$9769769.00	$17.37
VC2 Direct energy inputs				
Gas	$90000.00	$0.16	$180000.00	$0.32
Fuel (trucking)	$506650.00	$0.90	$1013300.00	$1.80
Electricity (lights)	$330513.34	$0.59	$661026.68	$1.18
(refrigeration)	$81202.35	$0.14	$162404.70	$0.29
	$1008365.69	$1.79	$2016731.38	$3.59
Fixed costs				
Depreciation	$685980.53	$1.22	$685980.53	$1.22
Interest	$630604.38	$1.14	$630604.38	$1.14
Taxes	$188941.39	$0.34	$188941.39	$0.34
Insurance	$201094.91	$0.36	$201094.91	$0.36
Installation	$32063.66	$0.06	$32063.66	$0.06
Land	$8259.52	$0.01	$8259.52	$0.01
	$1754944.39	$3.12	$1754944.39	$3.12
Total cost	$12533079.00	$22.28	$13541444.77	$24.07

Change in energy price level 1

	Kansas	Iowa
Value of animal	$704.21	$738.95
Slaughter Cost (head)	$24.07	$24.07
Subtotal	$728.28	$763.03
Dressing percent	60%	60%
Animal weight (cwt.)	10.50	11.00
Carcass weight (cwt.)	6.30	6.60
Cost per cwt.	$115.60	$115.61

Beef Transportation Budget,
100 percent Energy Price Increase.

Freight rates from Wichita, Kansas
cost of beef from Kansas is $115.60 per cwt.

City	Miles	Weight	Change	Initial Rate	Final Rate	Energy Component	Percent Of Rate	Cost of Beef		Difference $/Cwt
San Francisco	1716	42000	$1.08	$4.45	$5.53	$2.12	38%	$121.13	Advantage	$0.71
Yuma	1203	42000	$0.76	$4.45	$5.21	$1.49	29%	$120.01	Advantage	$0.07
Kansas City	197	35000	$0.15	$1.11	$1.26	$0.29	23%	$116.06	Advantage	$0.15
Houston	609	38000	$0.42	$2.35	$2.77	$0.83	30%	$118.37	Advantage	$0.04
Chicago	698	38000	$0.49	$2.54	$3.03	$0.95	32%	$118.63	Disadvantage	($1.37)
Knoxville	874	38000	$0.61	$2.57	$3.18	$1.19	30%	$118.78	Disadvantage	($0.31)
Boston	1595	40000	$1.06	$4.62	$5.68	$2.07	36%	$121.20	Disadvantage	($0.09)
New York	1397	40000	$0.92	$4.41	$5.33	$1.81	34%	$120.93	Disadvantage	($0.91)
Miami	1532	38000	$1.07	$3.89	$4.96	$2.09	42%	$120.56	Advantage	$0.12

Freight rates from Waterloo, Iowa
cost of beef from Iowa is $115.61 per cwt.

City	Miles	Weight	Change	Initial Rate	Final Rate	Energy Component	Percent Of Rate	Cost of Beef
San Francisco	1950	40000	$1.29	$4.94	$6.23	$2.53	41%	$121.84
Yuma	1699	40000	$1.12	$4.94	$6.06	$2.21	36%	$121.67
Kansas City	307	40000	$0.20	$1.20	$1.40	$0.40	28%	$117.01
Houston	1036	35000	$0.78	$2.82	$3.60	$1.54	43%	$119.21
Chicago	268	35000	$0.20	$1.44	$1.64	$0.40	24%	$117.25
Knoxville	805	38000	$0.56	$2.30	$2.86	$1.10	38%	$118.47
Boston	1226	40000	$0.81	$3.96	$4.77	$1.59	33%	$120.38
New York	1077	40000	$0.71	$3.70	$4.41	$1.40	32%	$120.02
Miami	1562	38000	$1.09	$3.98	$5.07	$2.13	42%	$120.68

Diesel fuel price is $1.06 per gallon in 1982

Change in energy price level is 1

Diesel fuel price is now $2.12 per gallon

Change in diesel fuel price is $1.06 per gallon

THE EFFECTS OF CHANGING ENERGY COSTS ON THE COMPETITIVE POSITION OF THE KANSAS CATTLE FEEDING INDUSTRY

by

MARK CHARLES WARD

B.S., Kansas State University

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

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MASTER OF SCIENCE

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Kansas currently ranks fourth nationally in cattle and calves on grain feed with 1,100,000 head on feed January 1, 1982. Commercial cattle slaughter in Kansas accounts for 12 percent of the national total, a rank of third place. A combination of factors has made this possible. Recently, rising energy prices and a falling water table in the Ogallala Aquifer have made irrigated feedgrain production more costly. The overall objective of the study is to identify the effects of changing energy prices and other selected variables on the competitive position of cattle feeding and beef packing in Kansas.

The study uses a comparative statics approach to analyze the competitive position of Kansas cattle feeding and beef packing. Kansas cattle feeding (the Southwest in general) is compared to Iowa (the proxy state for the Cornbelt) cattle feeding. Enterprise budgets are developed for each step in the cattle feeding system: feedgrain production, cattle feeding, slaughter and transportation to the final market. Cooperative Extension Service bulletins provide the basic information on inputs and costs in the two cattle feeding systems.

Energy composition of the inputs is related through the budgets. Inputs are separated into two groups, variable costs and fixed costs. Variable costs are sub-divided into non-energy, direct energy and indirect energy inputs. This separation is made on the basis of the direct energy component of each input. As real energy prices are changed, only the direct energy component of the inputs will change in cost. This technique is replicated over a range of changing real energy price scenarios to determine the effect on the Kansas system.

The base case analysis shows that beef from the Kansas cattle feeding system is relatively less expensive than beef from Iowa. The total cost per hundredweight of cattle fed in Kansas is 98.3 percent of the total cost of Iowa beef. Kansas cattle production is much more energy intensive. Energy costs per hundredweight for Kansas beef are 139.0 percent of Iowa-produced beef.

Energy costs are changed at rates of -3, 3, and 6 percent annually from 1982 to 1985 and 1990. As energy costs increase, Kansas beef becomes more expensive relative to Iowa beef. At a real energy price increase of 100 percent, both systems supply beef at the same cost. The cost of beef is $115.62 per hundredweight. Kansas beef loses its competitive position in terms of lower costs of production in only three markets within the scenarios studied. By 1990, it is possible for Kansas beef to be relatively more expensive in the Chicago, New York and Boston markets.

The framework used to study the effects of changing energy costs on Kansas cattle feeding is useful to analyze the effects of the other variables on the cattle feeding industry. Generally, situations that will enhance the competitive position of Kansas cattle feeding relative to Cornbelt cattle feeding are: rising farm wage rates, increased interest rates on operating loans, a lower feeder cattle price than in Iowa, lower slaughter costs and increasing freight rates if the destination is closer to Kansas than Iowa. The competitive position of the Kansas cattle feeding system will diminish relative to the Cornbelt cattle feeding system if: feeder cattle prices increase, freight rates increase if Iowa is closer to the market than Kansas or finally, if energy costs increase.