12-1980

The effects of changes in petroleum based input prices on the Tennessee fed beef industry

Charles D. Keiser

To the Graduate Council:

I am submitting herewith a thesis written by Charles D. Keiser entitled "The effects of changes in petroleum based input prices on the Tennessee fed beef industry." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Irving Dubov, Major Professor

We have read this thesis and recommend its acceptance:

L.H. Keller, E.L. Rawls

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by Charles D. Keiser entitled "The Effects of Changes in Petroleum Based Input Prices on the Tennessee Fed Beef Industry." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Irving Dubov

Irving Dubov, Major Professor

We have read this thesis and recommend its acceptance:

Luther H. Keller

Emmit L. Rawls

Accepted for the Council:

L. Evans Roth

Vice Chancellor
Graduate Studies and Research

THE EFFECTS OF CHANGES IN PETROLEUM BASED INPUT PRICES ON THE TENNESSEE FED BEEF INDUSTRY

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Charles D. Keiser

December 1980

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to all persons who have made this study possible. The author is especially grateful to Dr. Irving Dubov, Committee Chairman, for his advice and guidance in the development and completion of this study. Appreciation is also extended to the other members of his committee, Dr. L. H. Keller and Dr. E. L. Rawls. The author is also indebted to John Lamb and Noel Blissard for their comments.

ABSTRACT

An analysis was made to estimate efficient adjustments the Tennessee beef industry can make to changing supply-price relations for petro-based inputs. The focus was on the economic feasibility of finishing feeder cattle produced inside the state instead of moving them to feedlots in either the Corn Belt or High Plains areas. Budgetary analysis was used to estimate costs of all vertical stages after backgrounding, including movement to feedlots, feeding, movement to slaughter points, slaughter, and movement to distribution points. The study study focused on the comparative advantage of three cattle feeding areas in Tennessee located within 100 mile radii of pricing points in Knoxville, Columbia, and Memphis relative to the Corn Belt and High Plains. Cost budgets for Tennessee were based on two feeding systems - - one silage based (silage, hay, corn, and protein supplement) and the other grain based (whole shelled corn, protein supplement). These budgets were compared with the costs of feeding cattle in the Corn Belt using the system whose costs are published in the Livestock and Meat Situation as typical for that area. Comparisons were made also with the costs of custom feeding operations in the High Plains, using the system whose costs are published in the <u>Livestock and Meat Situation</u>. Cost estimates for the Corn Belt and Great Plains areas were adjusted to take into account increased shrinkage, transportation costs, and death losses that result from moving Tennessee feeder animals for finishing in these other two areas. Once the current total costs for feeding and transporting cattle were derived, the effects of projected increases in fuel costs of 50, 100 and 200 percent were then substituted for the current prices of transportation and feed.

The results showed feeding cattle in Tennessee to be competitive with the Corn Belt and High Plains regions. Given increased fuel price situations, feeding costs in Tennessee rose less than in either the Corn Belt or the High Plains. Increased fuel costs had a much greater estimated effect on the cost of cattle feeding than on the cost of of transporting feeder steers.

Within the state, the grain system offered a lower cost ration than the silage system under all fuel cost situations. Other factors which should be considered before engaging in a beef feeding enterprise in Tennessee include; price and availability of corn, initial investment costs and managerial ability.

Other data gathered included slaughter costs for the three areas, estimated total beef consumption in Tennessee, and the potential number of feeder cattle in the state. Results indicated that there would be enough feeder cattle and slaughter capacity in Tennessee to meet the state beef consumption requirement without having to rely on out-of-state sources.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Tennessee currently is not a major beef feeding state. The Tennessee Crop Reporting Service reported only fifteen thousand cattle on feed in 1980, up from ten thousand in 1975.[1] However, Tennessee and other Southeastern states traditionally have been surplus producers of feeder cattle. Although no statistics are currently available for destinations of the outshipments of these feeder animals, the two main feeding areas for cattle from Tennessee are thought to be the Corn Belt and the High Plains areas of Texas and Oklahoma.[2]

Before being sent to the feedlot, feeder cattle usually have been through some form of backgrounding system and are in the 650 to 800 pound weight range.[3] After an initial adjustment period at the feedlot, the animals are placed on a high concentrate diet until they reach slaughter weight, about 1050 pounds depending on breed and sex.[4] The fattened

---

[1]Tennessee Farm Facts. Tennessee Crop Reporting Service, Nashville, Tennessee. February 14, 1980, p. 2.

[2]J. B. McLaren, Personal Communication, Department of Animal Science, The University of Tennessee, 1979; R. Reagen, D.V.M., Personal Communication, Tennessee State Department of Agriculture, 1979. These same locations were named as the two major destinations for Tennessee feeder cattle in a telephone survey of the cattle shippers in the state.

[3]"Feeder Cattle and Beef Cattle Futures," Chicago Mercantile Exchange, Chicago, 1974, p.8.

[4]Livestock Slaughter, a USDA publication, reported slaughter weights ranging from about 850 pounds in Arkansas to over 1200 pounds in Minnesota.

cattle are usually slaughtered at plants located near the feedlot.

A. LITERATURE REVIEW

Interregional competition in the fed beef economy has been a matter of continuing interest over the last twenty years. Much of the analysis, however, was done before the sharp increases in petroleum prices that began with the Arab oil embargo in 1973-1974.

Studies done in Oklahoma by Williams and Dietrich in the sixties suggested that because of lower costs of production, the Southern Plains area had a locational advantage in supplying the Southeastern fed beef market.[5] Their findings projected the increases in fed beef production and slaughter capacity in the Southern Plains which already have occurred. Since 1960, beef production in the Southern Plains increased 1030 percent and high volume slaughter plants were opened in the area in response to the increased availability of fed beef.[6]

Williams and Dietrich also noted that the distribution of fed beef production could shift significantly with changes in interregional advantage. In addition to transportation

---

[5] W. William and R. Dietrich, "An Interregional Analysis of the Fed Beef Economy," USDA ERS Agricultural Economic Report 88, April 1966, p. 48.

[6] E. L. Rawls, Associate Professor, Extension Agricultural Economics and Resource Development Department, University of Tennessee, Knoxville, unpublished data, June 1979.

costs; location relative to feed and feeder cattle, weather, management, wage rates, and prices of inputs used in feeding and slaughter all influence the competitive position of a region. They concluded that these factors will determine the future location of production and slaughter in the fed beef industry.

In 1964 Williams and Malone used a spatial equlibrium model to evaluate interregional competition in fed beef. Some findings indicated that fed beef production would increase in the Southeast. The authors suggested that such an increase in beef production might alter the locational advantage that Oklahoma and Texas had in supplying Southeastern fed beef markets.[7] Also during the sixties, a series of Southern Cooperative bulletins were published dealing with least cost movement of cattle and calves with special emphasis on the Southeast. Results from applying a transportation model showed that because of lower slaughter costs, the Southern slaughter industry was in a favorable position to compete with other regions of the country.[8]

In 1971 Dietrich found that portions of Kentucky and Tennessee may be in favorable competitive position for the production of fed beef. When Dietrich assumed that slaughter

---

[7]W. Williams and J. Malone, "Interregional Competition in Fed Beef," Oklahoma State Experiment Station P-473, March 1964, p. iii.

[8]L. D. Malphrus, et al., "Cattle and Calf Movement in the South," Southern Cooperative Series Bulletin 134, March 1968, p. 17.

and feeding capacities were not limiting constraints, his model showed Kentucky-Tennessee to be a major cattle feeding area, along with the Texas-Oklahoma Panhandle, Colorado, and the Eastern Corn Belt. Dietrich suggested that the potential for the Kentucky-Tennessee area was due to the locational advantages with respect to surplus feed grain supplies in the Corn Belt, surplus feeder cattle production in the region, and a large deficit bed feef market in the South.[9] Martin and Nelson in 1979 also suggested that cattle feeding in the Southeast will increase relative to the other regions of the country during this decade.[10]

Despite all the forecasts and suggestions that Tennessee could expect to expand its cattle feeding activity, no such change has occurred to any great degree. Feeder cattle are still trucked long distances to feedlots despite ever increasing fuel prices. In July 1979, the average charge per loaded mile for livestock haulers in Tennessee was $1.50.[11] For a seven hundred pound feeder steer shipped from Knoxville to Amarillo this amounts to $28.00 per head in transportation charges. Fuel prices and transportation charges have

---

[9] R. A. Dietrich, "Interregional Competition in the Cattle Beeding Economy," Texas Agricultural Experiment Station Bulletin 1115, September 1971, p. 29.

[10] R. Martin, K. Nelson, S. Querin, "Least Cost Beef Production in the 1980s," Draft of article appearing in Feedlot Management, July 1979, p.11.

[11] Obtained via telephone survey of major Tennessee cattle shippers, July 1979.

increased since July 1979, and further increases are expected in the near future

B. OBJECTIVES

The recent increases in fuel prices as well as the failure of past preductions concerning increased bef beef production in the state led to a need for research on adjustments the Tennessee beef industry can make to changing supply-price relations for petro-based inputs.

The major objective of this study was to determine the economic feasibility of finishing feeder cattle produced inside the state instead of moving them to feedlots in either the Corn Belt or the High Plains areas. The main focus was on the impact of changes in energy costs as they are reflected in transportation charges and feed prices. Another objective of the study was to determine how much beef would be required to supply the total state comsumption requirements of ground beef and other retail cuts. Third, there was a need to estimate the potential number of feeder cattle available in the state. The second and third objectives were used to determine whether Tennessee could meet its beef consumption requirement without having to rely on beef from out-of-state sources.

JUSTIFICATION

The greatest potential for energy conservation in agriculture is in the transportation and processing industries.

Together these two sectors consumed about two and one-half times as much total energy as that used in agricultural production.[12] A 33 percent reduction in the number of miles traveled by Tennessee feeder cattle haulers during 1978 would result in an estimated savings of almost 800,000 gallons of fuel annually.[13] This represents about 20,000 barrels of oil, 42 percent of which currently comes from foreign sources. The addition of beef feeding enterprise could also represent a potential income increase to many of the small farmers in the state.[14]

D. PROCEDURE

To reach objective one, current estimates of the costs of cattle feeding, transportation, and slaughter were needed. They were determined in the following manner. Seven hundred pound feeder steers were assumed to be sold from three different

---

[12]Calculated from O. C. Doering, "Agriculture and Energy Use in the Year 2000," American Journal of Agricultural Economics, December 1977, p. 1067.

[13]Calculated as follows: 644,490 feeder cattle were exported from Tennessee in 1978 according to R. W. Maxwell, Tennessee State Dept. of Agric. The average distance that feeder cattle are transported from backgrounding to finishing site is 550 miles (See Chapter IV). Assuming 60 steers per truckload and 5 miles per gallon in a livestock truck, Tennessee livestock haulers would have used 1,181,565 gallons of fuel each way or 2,363,130 including backhaul. Thirty-three percent of this amount is 779,833 gallons.

[14]J. Anderson and L. Keller, "Beef Feeding Systems and Optimum Farm Organization," Tennessee Experiment Station Bulletin 480, July 1971, p. 3.

Tennessee auction sites: Knoxville, Columbia, and Memphis. Each of these pricing points was chosen because of its geographic location and because each is the site of a relatively large cattle auction. After sale, steers were assumed (either 1) to be shipped to a representative out-of-state location in the Corn Belt (Peoria, Illinois) or the Great Plains (Amarillo, Texas), or 2) to stay in Tennessee. Steers remaining in state were assumed to be fed within one hundred miles of the auction at which they were sold. The two feeding systems for beef finishing published in The Tennessee Farm Planning Manual were used as a basis in determining feeding costs for Tennessee steers. One of the systems was silage based (Silage, Hay, corn, and protein supplment) while the other was a grain based diet (whole shelled corn and protein supplement). These budgets were compared with the costs of feeding cattle in the Corn Belt and Great Plains. Feeding bedgets for steers fed in the two out-of-state locations were based on costs published quarterly and updated monthly in the Livestock and Meat Situation.

A survey of major cattle shippers in the Tennessee area provided the current costs per loaded mile for steers being sent out of state. Costs of shrinkage and the extra death loss associated with shipping cattle were added to the mileage charges so that a more accurate cost of transportation could be obtained. Slaughter costs for cattle were obtained via a telephone survey of the major slaughter plants in the state. Since survey data from out-of-state sources were limited, costs were estimated using regional wage differentials and plant size. Data costs of moving dressed beef from Amarillo, Texas and Peoria, Illinois to distribution points in Tennessee were obtained from the Transportation Rates Section of the Tennessee Vallry Authority.

Chapters IV, V, and VI examine the current costs of the vertical stages of fed beef production after backgrounding, including transportation to the feedlot, feeding, slaughter, and transportation of processed meat. Once these costs were derived, the final chapter used data on fuel usage in crop production and transportation in conjunction with projected increases in fuel costs of 50, 100 and 200 percent to estimate the effects of rising energy prices on beef feeding and feeder cattle transportation rates.

The second objective, estimating the beef consumption requirements for Tennessee, required the use of an expenditure survey published by the Bureau of Labor Statistics. Determining the potential number of Feeder cattle in the state, the third objective, was accomplished through the use of data from the Tennessee Crop Reporting Service and with the help of state extension personnel. Objectives two and three are discussed in Chapters II and III.

CHAPTER II

ESTIMATING TENNESSEE BEEF CONSUMPTION REQUIREMENT

Estimating per capita beef consumption requirements for a specific region or state presents special problems. National consumption estimates are figured on a disappearance basis. Beginning inventories, total production and imports are added together for a total supply figure. Subtracting exports and ending inventories from the total supply gives a total consumption estimate. Since interstate movements of meat are not regularly recorded, this procedure connot be used to estimate meat consumption on a state or regional level.[1]

Surveys have been used as a means of estimating per capita beef consumption for regions of the country, but current comprehensive figures for Tennessee are not available. However, most surveys do show that the South as a whole consumes less beef per capita than other regions of the country. The University of Georgia, through the Atlanta and Griffen Consumer Panels has been estimating food consumption rates over the last twenty years. The estimates are based on the feed expenditures of a panel of one hundred households and indicate beef consumption figures lower than the national average. In 1978, for example, the report indicated that

---

[1]J. R. Ives, Livestock and Meat Economy of the United States, American Meat Institute, Ann Arbor, Michigan, 1966- p. 182.

the panel had consumed 39.7 pounds of beef per capita.[2] This was 45 percent of the national consumption estimate for that year. Similar results can be found for previous years. Another study in West Virginia indicated that the per capita consumption of beef in that state was 84 percent of the national average.[3]

The most complete report currently available for measurement of consumer expenditures on a regional basis is the 1972-1974 Consumer Expenditure Diary Survey published by the Bureau of Labor Statistics. The data, derived from reports of over 40,000 sample families, are presented by four geographic regions. Figures for the South include all Southeastern and Southcentral states including Texas, West Virginia, and Maryland.[4] Results indicate that for the two-year period, 1972 to 1974, Southern families spent about $3.19 per week on beef. Of the total expenditure, 29 percent was for hamburger while the remainder was for reasts, steaks, and other cuts. During the same period, the average American family spent $3.65 a week on beef, 27 percent of which was for hamburger. Although average family size between the

---

[2]R. Raunikar, "Summary of Feed Purchases and Prices," University of Georgia Experiment Station Research Report 337, November 1979, p. 9.

[3]J. Kuehn, "Changes in Meat Consumption and Expenditures for West Virginia 1973-1975," West Virginia Experiment Station Research Bulletin 655, March 1977, p. 15.

[4]Consumer Expenditure Dairy Survey, July 1972-June 1974, Bureau of Labor Statistics Bulletin 1959, U. S. Department of Labor, 1977, pp. 269-326.

regions was equal (2.9), the Southern families only earned about 92 percent of the national average income.

The data in the BLS study were presented in expenditure form (price times quantity). In cross sectional studies such as this, price is often treated as an exogenous variable.[5] Sales tax differences and transportation cost may result in some price differentials but these are not considered statistically significant. The expenditure amounts for the nation and the South were divided by a constant price to derive an estimate of the variation in quantity consumed between the two regions.

The average price of choice beef during the survey period was 131.25 cents per pound. The average price per pound of ground beef was 91.29 cents per pound.[6] Dividing the expenditures by the above prices shows that the South consumed about 88 percent as much beef as the national average. The calculations are shown in Table I.

Regression analysis showed that the single most important independent variable in determining beef consumption is income.[7] Per capita disposable income of Tennessee and the

---

[5]"Food Demand and Consumption Behavior," Robert Rauikar, Editor, papers presented by the S-119 Southern Regional Research Committee and the Farm Foundation, March 1977, pp. 12, 100.

[6]Estimated United States and City Retail Prices of Food, USDA, All issues from July 1972 through June 1974.

[7]R. Dietrich, "Interregional Competition in the Cattle Feeding Economy," Texas Agricultural Experiment Station B-1115, September 1971, p. 36.

TABLE I

ESTIMATED SOUTHERN BEEF CONSUMPTION
AS A PERCENTAGE OF THE U.S. AVERAGE

	South		Average Price		Pounds Consumed
Expenditure on choice cuts per week	$2.26	/	$131.25	=	1.730
Expenditure on choice cuts per week	$ .93	/	91.29	=	1.019
					2.749 (Total)

2.749 Total pounds of beef consumed weekly per capita in the South.

	Nation		Average Price		Pounds Consumed
Expenditure on choice cuts per week	$2.65	/	$131.25	=	2.019
Expenditure on choice cuts per week	1.00	/	91.29	=	1.095
					3.114 (Total)

3.114 Total pounds of beef consumed weekly per capita in the Nation.

2.749 pounds of beef consumed in the South / 3.114 pounds consumed nationwide = 88.3% (Southern consumption as a percentage of the U. S. average).

Source: BLS Consumer Expenditure Survey, Bulletin 1959.

South have remained at a relatively constant percentage of national income since 1974, the period of the survey. The per capita personal incomes ofr the United States, the South, and Tennessee from 1974 to the latest available figures for 1978 are listed in Table II.

The figures show that Tennessee disposable per capita income is about 96 percent of the Southeastern average. In order to compensate for the difference a lower income would have on beef consumption in the state, income elasticity was used. Beef is an inelastic commodity with an income elasticity of .47.[8] This means that for each one percent increase (decrease) in income, the amount of beef demanded increases (decreases) by .47 percent. Therefore, since Tennessee income is 96 percent of the Southern average, the state beef consumption would be about 86.4 percent of the national figure.[9] Raunikar estimated Tennessee per capita beef consumption at 85.4 percent of the national average for 1975. He also projected 1980 beef consumption in the state to be 86.4 percent of the National average, the same figure derived in this study.[10]

---

[8] "Feeder Cattle and Beef Cattle Futures," Chicago Mercantile Exchange, Chicago, 1974, p. 15.

[9] Calculated as follows: 88.3% (Southern Consumption as a percentage of national consumption) - 1.88 (adjustment for lower income in Tennessee using income elasticity for beef (4 x .47) = 86.4% (Estimated Tennessee beef consumption as a percentage of the national estimate).

[10] R. Raunikar, Professor of Agricultural Economics, University of Georgia, Personal Communication, January 1979.

TABLE II

DISPOSABLE INCOME PER CAPITA
1974 THROUGH 1978

Region	1974	1975	1976	1977	1978
Tennessee	4551	4810	5293	5901	6489
Southeast	4696	5029	5531	6057	6756
United States	5448	5861	6396	7026	7810

Source: Bureau of Economic Analysis, U. S. Department of Commerce.

Per Capita beef consumption for the nation in 1979 was estimated to be 79.9 pounds retail weight.[11] This would give a state consumption estimate of 69 pounds per capita (79.9 x 86.4 percent).

In order to find total demand requirements, population estimates for 1979 were needed. The most current population figures on a per county basis are for 1978. Therefore, the Tennessee population was assumed to increase in 1979 as much as it had from 1977 to 1978.[12] This gave a total state population estimate of 4,422,000 in July 1979. Using this information, Table III shows the calculation of the Tennessee beef consumption requirement. Estimates of beef consumption requirements per county are given in Table IV. They were found by multiplying the July 1979 population figures by the 69 pound per capita beef consumption estimate.

---

[11]Retail weight does not include fat and bone not sold to consumers. It is equal to 74% if carcass weight.

[12]F. Leuthold, Professor, Department of Agricultural Economics and Rural Sociology, University of Tennessee, Knoxville, Personal Communication, January, 1980.

TABLE III

CALCULATION OF THE TENNESSEE BEEF CONSUMPTION REQUIREMENT

79.9 pounds per capita (National consumption estimate) X
86.4 (percent of the National average consumed
in Tennessee) =
69.03 pounds per capita (Estimated Tennessee beef
consumption, 1979)

69.0 pounds per capita X 4,422,000 (Estimated Tennessee
population July 1979)
= 305,120,000 (State beef requirement,
retail weight)

305,120,000 pounds / .74 (carcass weight conversion factor)=
412,320,000 pounds carcass weight

412,320,000 pounds carcass weight / .58 (dressing percentage)=
710,900,000 pounds of live weight

This would require:

748,320 cattle at a live weight of 950 pounds
710,900 cattle at a live weight of 1,000 pounds
677,000 cattle at a live weight of 1,050 pounds.

Sources: National Food Review, USDA Winter 1980, BLS Consumer Expenditure Survey, Bulletin 1959, State Population Reports, Bureau of the Census, October 1979.

TABLE IV

ESTIMATED ANNUAL TENNESSEE BEEF CONSUMPTION 1979
BY COUNTY AND SMSA

COUNTY	TOTAL POUNDS OF BEEF DEMANDED (RETAIL WEIGHT)
Bedford	1,911,300
Benton	931,500
Bledsoe	572,700
Bradley	4,459,500
Campbell	2,221,800
Cannon	641,700
Carroll	1,883.700
Chester	848,700
Claiborne	1,918,200
Clay	483,000
Cocke	1,987,200
Coffee	2,456,400
Crockett	1,007,400
Cumberland	1,952,700
Decatur	703,800
Dekalb	890,100
Dyer	2,373,600
Fayette	1,773,300
Fentress	1,021,200
Franklin	2,118,300
Gibson	3,325,800
Giles	1,600,800
Grainger	1,179,900
Greene	3,657,000
Grundy	834,900
Hamblen	3,160,200
Hancock	462,300
Hardeman	1,587,000
Hardin	1,449,000
Hawkins	2,780,700
Haywood	1,511,100
Henderson	1,393,800
Henry	1,849,200
Hickman	1,000,500
Houston	462,300
Humphreys	1,055,700
Jackson	607,200
Jefferson	2,056,200
Johnson	972,900

TABLE IV (Continued)

COUNTY	TOTAL POUNDS OF BEEF DEMANDED (RETAIL WEIGHT)
Lake	462,300
Lauderdale	1,607,700
Lawrence	2,387,400
Lewis	607,200
Lincoln	1,725,000
Loudon	2,746,200
McMinn	1,545,600
McNairy	1,545,600
Macon	1,062,600
Madison	4,899,000
Marshall	1,262,700
Maury	3,387,900
Meigs	496,800
Monroe	1,925,100
Montgomery	5,595,900
Moore	276,000
Morgan	1,124,700
Obion	2,394,300
Overton	1,235,100
Perry	441,600
Pickett	317,400
Polk	931,500
Putnam	2,918,700
Rhea	1,621,500
Scott	1,262,700
Sevier	2,642,700
Smith	1,021,200
Stewart	662,400
Trousdale	414,000
Van Buren	303,600
Warren	2,221,800
Wayne	945,300
Weakley	2,118,300
White	1,428,300
SMSA	
Chattanooga	20,920,800
Tri Cities	22,920,800
Knoxville	31,953,900
Memphis	54,910,200
Nashville	55,338,000
TOTAL STATE DEMAND FOR BEEF	305,120,000

Counties not listed separately are listed by SMSA.

CHAPTER III

ESTIMATING THE POTENTIAL NUMBER OF FEEDER CATTLE IN TENNESSEE 1979

The number of feeder cattle found on farms is a result of breeding decisions made by producers in previous time periods. The size of the cow herd is determined by previous cattle prices, the outlook for prices in the future, availability of pasturelands and the managerial ability of the producer.[1] If prices appear to be rising, the producer will tend to increase the size of the herd by holding back more heifers for breeding purposes, thus decreasing the number of feeder cattle available. When prices are falling, herds will be reduced in size through the sale of more heifers as feeder cattle rather than holding them back for breeding stock, and the sale of some of the older cows for slaughter. Grazing conditions also affect decisions concerning herd size. When pasture conditions are poor, due to long dry periods, feeder cattle will tend to enter the feedlot earlier than if grazing conditions were good.

In the context of changing herd size, an estimate was made of the potential number of feeder cattle in Tennessee during 1979. It should be emphasized that this number will change from year to year as the herd size changes.

---

[1]"Feeder Cattle and Beef Cattle Futures," Chicago Mercantile Exchange, Chicago, 1974, p. 4.

Estimating the potential number of feeder cattle available required the use of figures for the calf crop in the state. The number of calves born in 1978 divided by the number of cows that had calved in that year gave a calf crop estimate of 85 percent. The national average calf crop for 1978 was 88 percent.[2] Calf crop figures for 1978 were used because the 700 pound feeder steers in this study would have been born in that year.

Of the calves born, it was assumed that half would be heifers while the other half would end up as steers. It was also assumed that 20 percent would be used as replacements. A 4 percent death loss in calves and a 1 percent death loss in replacements were also considered.[3] State extension personnel as well as state agricultural officials agreed with these assumptions.[4]

The number of beef and milk cows in Tennessee, listed by county, were multiplied by the calf crop percentage in order to obtain the number of calves. These figures were then multiplied by 75 percent in order to give county-wide

---

[2]"Tennessee Farm Facts," Tennessee Crop Reporting Service, Nashville, February 14, 1979. The Tennessee calf crop for 1979 was 82%.

[3]"Feeder Cattle and Beef Cattle Futures," Chicago Mercantile Exchange, Chicago, 1974, p. 6.

[4]B. Gwinn, Tennessee Crop Reporting Service, Nashville, Personal communication, September 1979; H. Jamison, Animal Science Extension, University of Tennessee, Knoxville, Personal communication, June 1979.

estimates of the number of potential feeder cattle. These calculations showed that there would have been 867,000 feeder cattle available in Tennessee during 1979. County estimates are shown in Table V.

Cull cows contribute to the beef supply mainly in the form of ground beef. In 1979, there were 1,050,000 beef cows and 210,000 milk cows in Tennessee.[5] If a replacement rate of 20 percent is assumed, approximately 252,000 cows would be culled annually, 210,000 of which would be beef cattle with the remaining 42,000 being dairy breeds. The state extension service estimated that of the dairy cows on test in Tennessee, about 80 percent were Holsteins with the remainder being small breeds.[6] The Tennessee Farm Planning Manual lists the cull weight of a Holstein at 1250 pounds while the cull weight of smaller breeds is listed as 950 pounds. Using weighted averages to account for different size breeds, the live poundage supplied by cull dairy cattle in the state was calculated to be about 50,000,000 pounds.[7]

---

[5]"Tennessee County Estimates 1978-1979," Tennessee Crop Reporting Service, Nashville, March 26, 1980.

[6]J. Parsons, Extension Dairy Specialist, University of Tennessee, Knoxville, Personal communication, March 1980.

[7]Calculated as follows: Holsteins--.8 x 42,000 (total number of dairy cattle culled) x 1250 pounds (cull weight of Holstein) + Small breeds--.2 x (42,000) x 950 pounds (cull weight of small breeds = 42,000,000 (Holstein weight) + 7,980,000 (small breed weight) = 49,980,000 pounds of live weight from cull dairy cattle.

TABLE V

POTENTIAL FEEDER CATTLE AVAILABLE IN TENNESSEE BY COUNTY 1979

County	Estimated Feeder Cattle	Feeders Per Sq. Mile
Dyer	8702	16.5
Lake	255	1.5
Lauderdale	5897	12.4
Obion	10965	19.7
Shelby	9053	12.0
Tipton	7841	17.1
District 1	42713	
Carroll	9945	16.7
Chester	2805	9.8
Crockett	5833	21.7
Fayette	12176	17.3
Gibson	12304	20.3
Hardeman	8798	13.4
Haywood	7108	13.7
Henderson	7905	15.4
Henry	13069	23.0
McNairy	4877	8.6
Madison	7809	13.9
Weakley	11730	20.4
District 2	104359	
Benton	5004	12.8
Cheatham	5132	16.8
Decatur	5961	17.7
Dickson	13133	27.1
Hardon	4367	7.4
Hickman	6598	10.8
Houston	3092	15.4
Humphreys	7140	13.5
Lawrence	10359	16.3
Lewis	1721	6.0
Montgomery	14631	27.2
Perry	2837	6.9
Robertson	20241	42.5
Stewart	2582	5.5
Wayne	5769	7.8
District 3	108566	

TABLE V (Continued)

County	Estimated Feeder Cattle	Feeders Per Sq. Mile
Bedford	21898	45.5
Cannon	7586	28.0
Clay	5100	21.9
Davidson	9626	19.0
Dekalb	8288	29.8
Giles	18360	29.7
Jackson	5610	17.4
Lincoln	26552	45.8
Macon	12463	41.0
Marshall	16766	44.5
Maury	26169	42,6
Moore	5610	45.2
Rutherford	28688	46.9
Smith	13706	42.5
Sumner	16543	31.0
Trousdale	6184	54.3
Williamson	27508	46.4
Wilson	21803	38.4
District 4	278460	
Bledsoe	5196	12.9
Coffee	11858	27.3
Cumberland	6566	9.7
Fentress	5451	10.9
Franklin	11188	20.2
Grundy	5228	14.6
Marion	3570	7.0
Morgan	2008	3.7
Overton	8033	18.2
Pickett	3219	20.3
Putnam	8383	20.7
Scott	2454	4.5
Sequatchie	2263	8.3
Van Buren	2486	9.8
Warren	13037	29.7
White	11061	28.9
District 5	99131	
Anderson	4463	13.3
Blount	12017	20.9
Bradley	7905	23.7
Campbell	2869	6.4
Carter	2709	7.8
Claiborne	7714	17.4
Cocke	9786	23.1
Grainger	7778	27.6

TABLE V (Continued)

County	Estimated Feeder Cattle	Feeders Per Sq. Mile
Greene	30983	50.5
Hamblen	5514	35.7
Hamilton	5132	9.3
Hancock	3953	17.2
Hawkins	12973	27.0
Jefferson	12368	45.2
Johnson	4526	15.4
Knox	10487	20.7
Loudon	9754	41.2
McMinn	15938	36.9
Meigs	3984	20.9
Monroe	11411	17.3
Polk	2741	6.3
Rhea	4112	13.2
Roane	5196	14.8
Sevier	7841	13.1
Sullivan	10774	26.1
Unicoi	797	4.3
Washington	17244	53.3
District 6	233771	

Total number of feeder cattle in the state: 867,000

Sources: Calculated from Tennessee County Estimates Cattle 1978-1979 and Tennessee Statistical Abstract 1977.

Beef cattle cull weights are listed at 900 pounds.[8] Two hundred ten thousand cull beef cows would have a live weight of 189,000,000 pounds. Using a dressing percentage of 54 percent and the carcass weight conversion factor (.74) would give an estimate of about 95,000,000 pounds of edible beef available from cull dairy and beef sources.[9]

The estimated beef consumption derived in Chapter II was 305,120,000 pounds retail weight. Approximately 95,000,000 pounds of this requirement, or about 30 percent would be met by cull cows while 210,000,000 pounds could be supplied by fed beef. Depending on slaughter weight, this would require about 490,000 fattened cattle to supply the state beef consumption requirement.[10] Since the estimated potential number of feeder cattle in the state is about 867,000, Tennessee could be able to meet its beef consumption requirement without having to rely on

---

[8]R. Ray and H. Walch, Farm Planning Manual, Agricultural Extension Service, University of Tennessee, Knoxville, April 1978, pp. 114, 116.

[9]Calculated as follows: Beef - 210,000 cows x 900 pounds cull weight = 189,000,000 pounds live weight, 189,000,000 x .54 (dressing percentage = 102,060,000 pounds carcass weight x .74 (carcass weight conversion factor) = 75,524,400 pounds retail weight; Milk cows - 49,980,000 pounds live weight x .54 (dressing percentage)

=	75,524,400	pounds retail weight
	19,972,000	pounds retail weight
	95,496,400	pounds - total supply of beef from cull cows

[10]At a slaughter weight of 950 pounds - 515,330 fat cattle would be required, at 1,000 pounds 489,560 cattle and at a slaughter weight of 1,050 pounds, 466,250 cattle would be needed for the state requirement.

beef from out-of-state sources.

Figure I shows the areas with the greatest concentrations of feeder cattle in the state and the counties with populations of over 30,000 and therefore a beef demand of over two million pounds annually. Figure I also shows that the areas with the most feeder cattle are near the areas with the greatest demand for beef. The only exception is the Memphis area which is located in a region of relatively low feeder cattle densities.

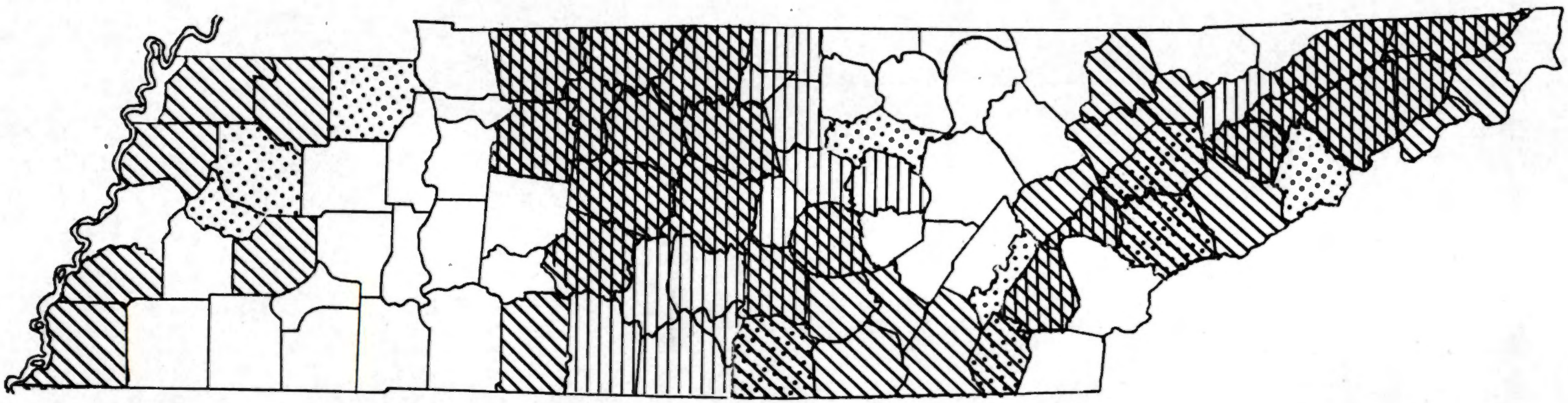

FIGURE I

CONCENTRATIONS OF FEEDER CATTLE AND THE DEMAND FOR BEEF

Counties with populations of over 30,000 and a beef requirement of over 2 million pounds annually

Counties with feeder cattle concentrations of 20 to 25 per square mile

Counties with feeder cattle concentrations of over 25 per square mile

CHAPTER IV

TRANSPORTATION OF FEEDER CATTLE

About 95 percent of the feeder cattle in the country are transported from backgrounding location to a feeding site an average of 550 miles; the other five percent requires no transportation.[1] Tennessee feeder cattle are no exception. A telephone survey of major cattle shippers in the Tennessee area conducted during July 1979 revealed that feeders had recently been sent as far away as Arizona and California. Most, However, were shipped to the Corn Belt and the High Plains areas of Texas and Oklahoma. States mentioned most often by the six cattle shippers in the survey as destinations for Tennessee cattle included Texas, Oklahoma, Iows, Nebraska, Illinois, Indiana, and Michigan. According to the survey, there is a tendency for some seasonality in feeder cattle movement. Feeders sold in the fall tend to go to the Corn Belt while those sold in the spring and summer months go to the High Plains.

The charge per loaded mile given by most of the cattle shippers was $1.50 in July 1979. This charge had increased from $1.20 per mile the previous January. The price of diesel fuel in Tennessee in January 1979 was 53 cents per gallon, rising to 74 cents in July, an increase of 21 cents

---

[1] J. A. Barton, "Transportation Fuel Requirements in the Food and Fiber System," USDA, ESCS, Agricultural Report 444, January 1980, p. 6.

per gallon.[2]

By March 1980 the charge per loaded mile had increased ten cents to $1.60 while diesel fuel prices had increased by about 30 cents per gallon since the previous July. Assuming five miles to the gallon for diesel trucks, the cost per mile would increase ten cents if fuel prices increased 50 cents per gallon.[3] This assumes that all costs, except for fuel, remain constant for the trucking industry. One possible cause for the rather rapid increase in transportation charges in the January-July 1979 period relative to July 1979-March 1980 may be a lag effect. Since many inputs are replaced only periodically (tires, engine work, insurance, licenses), transportation rates may not adjust as rapidly as fuel prices change.

The transportation charge of $1.50 per mile was used for the base period of this study, July 1979. The distances from the three auction sites in Tennessee (Knoxville, Columbia, Memphis) to Peoria, Illinois and Amarillo, Texas via the interstate system were calculated using a highway map.[4] These distances times the mileage charge gave total transportation charges. A truckload of

---

[2]Argicultural Prices, USDA, ESCS, Issues January 1979 through August 1979.

[3]A. Moore, Tennessee Livestock Producers Assoc., Columbia, Tennessee, Personal communication, July 1979.

[4]United States Transcontinental Mileage and Driving Time, Rand McNally and Company, Chicago.

feeder cattle was assumed to weigh 42,000 pounds.[5] This would allow for sixty head of 700 pound animals. The distances and costs per head are given in Table VI. Shippers of Tennessee feeder cattle were charged $2.50 per head for transportation to any feeding location within a one hundred mile radius of the auction site.[6]

Shrinkage refers to weight loss of animals from the farm to the feedlot. Animals usually need from ten to fifteen days to recover shrinkage losses after reaching the feedlot. With improper handling before or on arrival this recovery time can increase to over thirty days with death losses exceeding 10 percent.[7] In addition to handling and loading practices, other factors which affect shrinkage include time in transit, age, and weight of the animal, and weather conditions. A longer time in transit will result in greater shrinkage. Shrinkage is at a minimum between 20 degrees and 60 degrees Farenheit.[8] Temperatures outside this range will result in greater weight loss.

---

[5]E. Rawls, et al., "Alternatives After Backgrounding," University of Tennessee, Extension Agricultural Econimics, Knoxville, Tennessee, July 1976, p. 2. This figure does not include the weight of the truck.

[6]$1.50 (charge per loaded mile) x 100 miles / 60 (number of feeders in a truckload) = $2.50 per head.

[7]J. R. Black and D. Fox, "Retaining Ownership of Calves from Birth to Slaughter," paper presented at the Interregional Extention-Industry Beef Cattle Seminar, Nashville, Tennessee, October 1974, p. 82.

[8]C O'Mary and I. Dyer, Commercial Beef Cattle Production, Lea and Febiger, Philadelphia, 1974, p. 224.

TABLE VI

SHRINKAGE AND TRANSPORTATION COST FOR FEEDER CATTLE SHIPPED FROM THREE TENNESSEE LOCATIONS TO THE CORN BELT AND HIGH PLAINS

Location	Total Miles	a/ Cost per Head ($)	b/ Shrinkage (%)	c/Shrinkage Cost /Head ($)
From:				
Knoxville, Tennessee to:				
Peoria, Illinois	570	14.25	3.4	16.66
Amarillo, Texas	1111	27.78	6.6	32.34
From:				
Columbia, Tennessee to:				
Peoria, Illinois	506	12.65	3.0	14.70
Amarillo, Texas	915	22.88	5.5	26.95
From:				
Memphis, Tennessee to:				
Peoria, Illinois	452	11.30	2.7	13.23
Amarillo, Texas	726	18.15	4.3	21.07

[a]Transportation charge is $1.50 per loaded mile. Sixty steers are carried per truckload.

[b]All steers are assumed to shrink 3 percent. An additional shrink of .6 percent for each hundred miles transported is assumed.

[c]Shrinkage cost of a seven hundred pound steer selling at 70 dollars per hundredweight.

Sources: Telephone survey of six Tennessee cattle shippers July 1979, Rand McNally Road Atlas 1977, J. R. Black and D. Fox, "Retaining Ownership of Calves from Birth to Slaughter," Paper presented at the Interregional Extention - Industry Beef Cattle Seminar. Nashville, Tennessee, October, 1974, p. 82.

Young animals tend to shrink proportionately more than older ones.

Most of the shrinkage in hauling cattle occurs during the first 25 miles. This is probably because of the excitement that occurred during loading and the greater activity among the animals during the first part of the trip. All cattle in this study were assumed to lose 3 percent of their sale weight during marketing. An additional shrinkage loss of .6 percent for each hundred miles of transportation to the feedlot was also assumed.[9] Since shrinkage is a marketing cost, it was added on to the cost of transporting the steers. Shrinkage losses for Tennessee feeders are estimated in Table VI. Death losses of 1 percent and 1.5 percent of purchase for the Corn Belt and High Plains, respectively, were assumed also to take account of increased death losses that occur when cattle are shipped long distances.[10]

The 1935 Motor Carrier Act brought all interstate motor transportation under the regulation of the Interstate Commerce Commission. Although dressed and boxed beef are covered under this act, livestock and other unmanufactured agricultural commodities are exempt. The rates for unregulated carriers are negotiated between the shipper and the livestock trucker. This exemption from regulation has

---

[9] J. R. Black and D. Fox, p. 82.

[10] Livestock and Meat Situation, USDA, ESCS, August 1979, pp. 14-15.

given cattle shippers flexibility in direction, tume, and destination of shipments. Transportation costs for livestock may be lower than for regulated products because of the large number of small exempt truckers that compete on a price basis.[11]

Operating costs per mile are only slightly lower when trucks are running empty than when they are full. Because of this, truckers try to find a commodity load for the return trip. This practice, called backhauling, increases fuel efficiency and results in greater utilization of truck capacity. However, truck design limits the backhaul opportunities for livestock carriers. In addition, for a backhaul of any other commodity except livestock, the truck must be cleaned and sometimes disinfected. The facilities for cleaning livestock trucks are not always available at the destination points of the feeder cattle shipments. Finally, there is very little livestock being shipped into the Tennessee area from the High Plains and Corn Belt. For these reasons, no backhaul opportunities were assumed in this study.

Almost all (97 percent) of feeder livestock transportation in the country is by truck, although one Tennessee cattle shipper surveyed mentioned that he had recently experimented with rail transport on a shipment of feeder

---

[11]W. Capener, et al., "Transportation of Cattle in the West," University of Wyoming, Agricultural Experiment Station Research Journal 25, January 1969, p. 8.

cattle to New Mexico.[12] Because of lowered friction and wind resistance, as well as the efficiency of large diesel engines, trains are about one-fourth as energy intensive as truck transportation.[13] Trucking operations, on the other hand, are more flexible than rail in terms of scheduling. In addition, trucks are accessible to a greater number of users and are faster than rail. This is especially important in feeder cattle transport since shrinkage is affected by time in transit. Although fuel requirements could be reduced if more livestock were shipped by rail, it is unlikely that substantial shifts will occur in the next ten to twenty years because of the existing investment in the truck transportation network.[14]

One solution to higher transportation rates suggested by Tennessee shippers was to increase the load limit to 80,000 pounds, the maximum federal highway weight standard. Tennessee is one of several Southeastern states which do not permit the maximum federal limit. The current weight limit for loaded vehicles on Tennessee

---

[12]W. Capener, et al., p. 31.

[13]The steel wheels of a train against the steel track produce less friction then rubber tires on a paved surface. A train contends with air resistance only once for its entire length, not once for each of the cars of which it may consist. "Transportation's Place in the Energy Picture," Office of Information, Association of American Railroads, Washington, D. C., August 1979, p. 6.

[14]Barton, p. 18.

highways is 73,280 pounds. An increase in the load limit would lower the cost per head since more animals could be carried. An estimated 800 million gallons of fuel could be saved annually by increasing load limits in the states with lower standards.[15] The disadvantage of increased load limits is increased damage to highways resulting in higher taxes. A General Accounting Office study has shown that a truck loaded to the 80,000 pound limit causes 10,000 times as much damage to the highway as a private automobile.[16]

---

[15] "Dealing with the Dilemma," n.a. Meat Processing, July 1979, p. 24. Estimate includes all trucked commodities, not just livestock.

[16] "Transportation's Place in the Energy Picture," p. 10.

CHAPTER V

CURRENT BEEF FINISHING COST COMPARISONS OF THREE REGIONS

The main purpose of this chapter is to compare the current costs of beef finishing among three regions of the country: The Cirb Belt, the High Plains, and three locations in Tennessee - East, West, and Middle. Attention was focused on costs that vary among regions. Expenses for which there were no inherent regional differences were assumed to be equal.

The cattle finishing systems used are typical for the region. High Plains feedlots are mainly large enterprises with over 1,000 head feeding capacities. This size of operation is known as a commercial feedlot while the smaller seasonal feeding enterprises in the Corn Belt are known as farmer feedlots. The budgets derived for Tennessee cattle feeding systems were for the farmer feedlot type of operation rather than for the commercial size of the High Plains.

I. DERIVING A CORN BELT FEEDING BUDGET

Corn Belt cattle feeders are mostly farmer feedlot operations with less than 1,000 head capacities. The cattle feeding enterprise is usually only one part of a diversified farming operation dependent on home-grown feeds.

The feedlot operator typically uses unpaid or underutilized family labor. Although there are some commercial feedlots (those with over 1,000 head feeding capacities) in the Corn Belt, they account for less than 20 percent of the cattle marketed in the region.[1]

Table VII shows the costs of feeding a 700 pound steer in the Corn Belt. The budget is based on data published quarterly and updated monthly in the *Livestock and Meat Situation*. The operation assumes a beginning six hundred pound feeder steer, and a four hundred fifty pound total gain. The *Tennessee Farm Planning Manual* calculates feed requirements based on a 700 pound steer with a 350 pound gain. Therefore, Corn Belt feed and labor requirements were reduced so that steers of the same initial weight and expected gain could be compared among regions. This assumes that steers on feed grow at a linear rate which is incorrect. However, each diet contains enough protein and metabolizable energy for the assumed daily and total gains.[2] The rate of gain used was the average figure for steers in the Corn Belt feedlots during 1976.[3]

---

[1]R. Van Arsdall, R. Gustafson, and C. Gee, "U. S. Fed Beef Production Costs, 1976-1977 and Industry Structure," USDA, ESCS, Agricultural Economic Report No. 424, June 1979, p. 5.

[2]*Nutrient Requirements of Beef Cattle*, National Research Council, Washington, D. C. 1970, p. 22.

[3]Van Arsdall, p. 10.

TABLE VII

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON CORN SILAGE BASED RATION, CORN BELT 1979[a]

Item	Quantity (per head)	Unit Price	Amount
Steer	7 cwt.	70.00	490.00
Corn[b]	35 bushels	2.16	75.60
Silage	1.32 tons	18.14	23.95
Hay[e]	.155 ton	44.50	6.92
Protein supplement 34%[b]	2.10 cwt.	10.75	22.58
Salt and minerals	12 lbs.	.15	1.80
TOTAL FEED COST			$130.85
Labor[c]			11.20
Management[c]			6.40
Veterinary expense			4.01
Interest on purchase of feeder steer 9% for 5 months			18.38
Power, equipment, fuel, shelter, and depreciation[d]			18.72
Death loss, 1% of purchase			4.90
Transportation to slaughter			2.31
Marketing expenses[f]			3.35
Miscellaneous and indirect costs[d]			8.10
TOTAL OPERATING EXPENSES			77.37
TOTAL COST			$698.21

[a]An average daily gain of 2.3 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 152 days. Steer price is based on $70 per hundred weight in Tennessee. Shrinkage and transportation costs are considered in Chapter IV.

[b]Corn and protein supplement prices are average figures for the Corn Belt for the period August 1978 - July 1979.

[c]Assumes 4 hrs. at $3.20 per hr. Management is one hour at twice the labor rate.

[d]Adjusted monthly by the index of prices paid by farmers for commodities, services, interest, taxes, and wage rates.

[e]Average price paid by farmers in Iowa and Illinois

[f]Yardage plus commission fees at midwest terminal market

Source: Livestock and Meat Situation 228, USDA, August 1979, p. 13.

The cattle were assumed to be on feed slightly over five months. This was also consistent with published estimates of length of feeding period.[4]

Prices in the budget were those published in the Livestock and Meat Situation for July 1979, except for corn and protein supplement which were average prices for the preceding year.[5] A ton of silage was valued at the price of five bushels of corn and 330 pounds of hay.[6] Labor management costs in the Corn Belt were assumed to be valued at twice the ordinary labor rate of $3.20 per hour.[7] Labor for Corn Belt feedlot operators is usually performed by the farmer or his family and therefore may be viewed as his opportunity cost or how much he could earn per hour in off-farm employment.

Interest on purchase represented the cost of borrowing money through the Production Credit Association-for the time the steer was on feed. Power, fuel, shelter, and equipment costs per head were higher for farmer feedlots than for commercial feedlot operations.[8] Since typically only one group of cattle per year were fed in Corn Belt

---

[4]Van Arsdall, p. 10.

[5]Livestock and Meat Situation, USDA, various issues, July 1978 through August 1979.

[6]Livestock and Meat Situation, USDA, LMS-228, August 1979, p. 13.

[7]Livestock and Meat Situation, p. 13.

[8]Livestock and Meat Situation, p. 13.

feedlots, the facilities were used less intensively and the costs of ownership were increased accordingly. Facilities in the Corn Belt usually included paved lots, shelters, and a feed storage system which also increased the costs of production per head. Taxes, insurance, and charges for the use of electricity, gasoline, and lubricant were also included in the operating expense category.[9]

Miscellaneous and indirect costs represented general farm overhead. A credit for manure value used on associated cropland was also included. Since the feedlot was typically one of several enterprises on Corn Belt farms, total overhead was estimated and then allocated among the enterprises.[10]

II. DERIVING A HIGH PLAINS FEEDING BUDGET

The fed beef industry in the United States has undergown major structural changes in the last two decades. From a previous situation of many small combined feedlot-grain farm operations, the industry has shifted to large scale, specialized commercial operations of more than 1,000 head capacities. In 1977, less than 2 percent of feedlots accounted for 68 percent of total fed beef production.[11] The large commercial feedlots have been better able to use

---

[9] Livestock and Meat Situation, p. 13.

[10] Van Arsdall, p. 12.

[11] L. Schertz, Another Revolution in U. S. Farming, USDA, 1979, p. 102.

specialized technology and more efficient management, marketing, and financial skills. The High Plains region has had a particularly favorable advantage in developing large commercial feedlots as a result of development of irrigation and cutbacks in acreage allotments for cotton and wheat which encouraged substitution to other grains and roughages used in cattle feeding. There were few farmer feeders in the High Plains area; so commercial operations developed to take advantage of the greatly increased feed supply and available feeder cattle. Eighty-four percent of fed beef marketed in the High Plains region are fed on large commercial feedlots.[12]

Large risks are involved in commercial operations. An adverse change in cattle or feed prices can cause serious financial losses. One practice used by many High Plains operators to reduce risk is custom feeding. In a custom operation cattle owned by someone else are fed by the feedlot owner for a fee. The owner of the cattle pays for the feed plus a yardage fee for the daily care of the animals. Arrangements are made between the cattle owner and feedlot operator concerning how cattle will be weighed, responsibility for death loss, veterinary costs, rate of gain, length of feeding period, and financing arrangements. Over four-fifths of the capital requirements for large

---

[12] Van Arsdall, p. 10.

commercial operations are for feed and feeder cattle purchases.[13] Custom feeding reduces the capital requirements for the feedlot owner and shifts most of the risk to the cattle owners.

Cattle feeding in the High Plains is based partly on large supplies of relatively low priced grains and roughages. The largest grain crop in the Texas Panhandle area is corn. In 1976, over one million acres of corn in the Amarillo area produced over 139 million bushels of corn.[14] In the same year, 850 thousand acres of irrigated sorghum (milo) and 165 thousand acres of dryland sorghum were also grown in the Amarillo area.

The costs of feeding a 700 pound steer in the High Plains are shown in Table VIII. The prices and expenses are based on figures found in the Livestock and Meat Situation. The average price of corn for the period August 1978 to July 1979 in the High Plains region was $2.75 per bushel.[15] The July price was $3.39 per bushel.[16] The average milo price for the previous year was $4.24 per hundred weight.[17] Average prices for July through August were used in the feeding budgets to obtain a value

---

[13] Van Arsdall, p. 22.

[14] Amarillo Texas Chamber of Commerce, unpublished data, September 1979.

[15] Livestock and Meat Situation, p. 14.

[16] Livestock and Meat Situation, p. 14.

[17] Livestock and Meat Situation, p. 14.

TABLE VIII

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED
ON GRAIN BASED DIET IN CUSTOM LOT
HIGH PLAINS 1979

EXPENSES	QUANTITY	UNIT PRICE	AMOUNT
Steer	7 cwt.	$70.00	$490.00
Milo	10.5 cwt.	4.24	44.52
Corn	18.75 Bu.	2.75	51.56
Cottonseed Meal	2.8 cwt.	10.84	30.35
Alfalfa Hay	.28 ton	101.00	28.28
Salt and Minerals	9.5 lbs.	.15	1.43
TOTAL FEED COST			156.14
Commission			3.00
Feed Handling and Management Charge			14.70
Veterinary Medicine			3.00
Interest on Feeder and 1/2 feed 10.5%		4.2 mo.	20.82
Death Loss 1.5% of purchase			7.35
Marketing			F.O.B.
TOTAL OPERATING COST			55.17
TOTAL COST			$695.01

[a]An average daily gain of 2.8 pounds per-day is expected. Total gain is 350 pounds. The steer will be on feed for 125 days. Steer price is based on 70 dollars a hundred weight in Tennessee. Shrinkage and transportation costs are considered in Chapter IV.

[b]Corn, Milo and Cottonseed Meal are average figures for the Great Plains for the period August 1978 - July 1979.

[c]The feed handling and management charge is $10.00 per ton.

[d]Cattle are usually purchased FOB the feedlot by packer buyers.

Source: Livestock and Meat Situation, USDA, August 1979, p. 14.

representative of the region for the entire year. The remainder of the ration consisted of cottonseed meal and alfalfa hay. A feed handling and management charge of $10 per ton was assessed by the feedlot owner.

Using this ration, an expected gain of 2.8 pounds per day was assumed. This is consistent with actual rate of gain average for the region.[18] These cattle grow faster than Corn Belt feeders because of the greater amount of concentrates in the High Plains diet.

The cattle owner is usually required to dehorn, castrate, and vaccinate the cattle before they are placed on feed. Depending on the aggangements, groth stimulants, vitamins, parasite control, and antobiotics are administered at the feedlot. These items make up the $3.00 per head charge for veterinary services in the budget.

Interest on the feeder steer was valued at the rate charged by the Production Credit Association in the High Plains region for the actual time the steer was on feed. Partial payments for the feed consumed made by the cattle owner while the steers were on feed reduced the interest costs. Only half the interest on the feed was therefore added to the cost of feeding. Death losses for a predetermined time after arrival are the responsibility of the cattle owner. Any death losses occurring after that time are the

---

[18]R. Van Arsdall, p. 10.

responsibility of the cattle feeder.

Usually the feedlot operators, after consultation with the twner, sells the finished cattle F.O.B. to packer buyers who come to the feedlot. The cattle owner pays a commission charge of $3.00 per head for the selling service.

The climate in the High Plains area greatly influences cattle production. Since there is little rainfall in the region, paved lots are not required. Cropland in the High Plains region is irrigated by surface sources and underground aquifers. Between 1948 and 1976, over 60,000 new irrigation wells were dug in the Texas High Plains to irrigate 6.4 million acres.[19] Although the situation is not immediately serious in the entire region, some of the wells in the Southern Texas High Plains are actually going dry.[20]

III. CATTLE FEEDING IN TENNESSEE

Increases in beef cattle numbers in the last two decades have been greatest in the Eastern half of the country, particularly the Southeast.[21] More beef cattle

---

[19] K. Young and J. Coomer, "Effects of Natural Gas Price Increases on Texas High Plains Irrigation, 1976-2025." USDA, ESCS, Agricultural Economic Report No. 448, Februayr 1980, p. 1.

[20] L. Schertz, Another Revolution in U.S. Farming, USDA, 1979, p. 358

[21] L. Schertz, p. 85.

are now raised in the Eastern half of the United States than on the traditional range areas. Most of the Southeastern cattle are breeding cows, calves, or stockers; beef feeding is not a highly developed industry in the Southeast. The 1974 Census of Agriculture showed that there were fewer cattle on feed in Tennessee than most other states in the region. In Alabama, Kentucky, Georgia, and Virginia, separately, there were about twice as many cattle on feed as in Tennessee.[22] Since 1974, the beef feeding industry in Florida has experienced rapid expansion, and this state now is a major Southeastern cattle feeding area.[23]

Corn availability and price are two of the most important factors affecting fed beef production. This is because of the value of corn as a high energy feed in concentrate rations. Corn production in Tennessee during 1979 was estimated at 51.5 million bushels.[24] Although most of Tennessee is a corn deficit area, certain counties and bordering areas of Kentucky are surplus regions of corn. About 60 percent of the corn produced in Tennessee is for

---

[22]U.S. Census of Agriculture, 1974, U. S. Department of Commerce Part 5, pp. 90-91.

[23]J. Simpson, L. Baldwin, F. Baker, "Investment and Operating Costs for Two Types and Three Sizes of Florida Feedlots," draft for a bulletin of the Florida Agri, Exper, Sta., Inst. of Food and Agric. Sciences, University of Florida, February 1980, p. 1.

[24]Annual Crop Summary, USDA, 1979, p. 83.

on-farm use; the other 40 percent is sold on the market.[25] However, the corn sold on the market in Tennessee would be more than enough to finish all the beef needed to meet the state beef consumption requirement.[26]

Corn prices paid to farmers in five regions of Tennessee are recorded on a daily basis by the Tennessee Department of Agriculture and Extension Agricultural Economics, University of Tennessee. Using these records, an average price per bushel of corn from October 1977 to July 1979 for each of the regions of the state was calculated. The results show that corn prices vary significantly across the state with Southwest and Middle Tennessee corn prices being about 15-20 cents per bushel below Lower East Tennessee prices.[27] Average corn prices in the High Plains and Corn Belt were then compared with prices in the Tennessee regions. When data from the period July 1978 to July 1979 were examined, corn from lower Middle and South-

---

[25]C. Farmer, Associate Professor, Extension Agricultural Economics, University of Tennessee, Knoxville, personal communication, April 1980.

[26]About 480,000 fat cattle, in addition to cull cows, would be required to meet the state beef consumption requirement. If each steer were fattened on 39 bushels of corn (the amount required in the high grain diet), almost 19 million bushels would be required. This is about 37 percent of the harvest or slightly less than the estimated amount that was marketed last year.

[27]"Tennessee Market Prices," Agricultural Extension Service and Tennessee Department of Agriculture, all issues from October 1977 through July 1979.

west Tennessee was less expensive than corn in the High Plains region. This is contrary to the opinion of several of the cattle shippers in the state that corn in Tennessee was higher priced than in other regions. The results of the comparisons are given in Table IX.

Feeder steer prices vary among regions and even within the state. McLemore found that during the period 1972-1976, feeder cattle prices in West Tennessee were 21.6 cents per hundred weight below the average price for the entire state. Cattle in Middle Tennessee were 28.5 cents per hundred weight above the state average while prices of East Tennessee feeder cattle were equal to the mean price for the state.[28]

These price differentials were corrected for the higher feeder cattle prices of July 1979 relative to the prices of feeders during the study period 1972-1976. Agricultural Statistics 1977 reported that the average feeder livestock price index for 1972-1976 was 155.4 with 1967 price being equal to 100. The feeder livestock price index for July 1979 was 288. Using this information, price differentials for July 1979 feeder cattle prices were linearly extrapolated. This resulted in cattle from

---

[28]D. McLemore, "Futures Market Basis Patterns for Tennessee Feeder Cattle and Slaughter," University of Tennessee, Agricultural Experiment Station Bulletin 575, Fabruary 1978, p. 14.

TABLE IX

AVERAGE CORN PRICES PER BUSHEL PAID TO FARMERS OCTOBER 1977 TO JULY 1979, CORN BELT, HIGH PLAINS, AND LOWER EAST, LOWER MIDDLE AND SOUTHWEST TENNESSEE

	Average Corn Price Per Bushel	
	October 1977-July 1979	August 1978-July 1979
Corn Belt	$2.11	$2.16
Great Plains	2.62	2.75
Lower Middle Tennessee	2.65	2.62
Lower East Tennessee	2.80	2.87
Southwest Tennessee	2.58	2.61

Source: Federal Market News Service, Tennessee Department of Agriculture and Agricultural Extension Service, University of Tennessee.

West Tennessee being 40 cents per hundred weight below the average price for the state and Middle Tennessee cattle being 53 cents per hundred weight above average price. McLemore suggested that the intrastate price difference was due in part to the greater cattle numbers in the mi-dle part of the state which attracted more buyers resulting in a more highly developed market.[29]

Feeder cattle prices among regions of the country vary considerably. Figure II shows the average mid-month price of feeder steers for the Midwest, Southwest, and Southeast for 1979. Part of this difference in price can be explained by shrinkage losses and transportation costs that must be incurred before Southeastern feeders reach feedlot destinations. The lower costs of Southeastern feeders, in addition to the minimal transportation costs and shrinkage losses, may offer an initial cost advantage in feeding beef in Tennessee relative to other regions of the country.

A significant expansion in cattle feeding in Tennessee could not be recommended simply because the corn and feeder cattle prices in the state are currently lower than in other areas. A continuous increase in production, relative to other regions, requires a sustained basis of competitive superiority. This is because of the tendency for a relative production increase in a region to erase

---

[29] McLemore, p. 14.

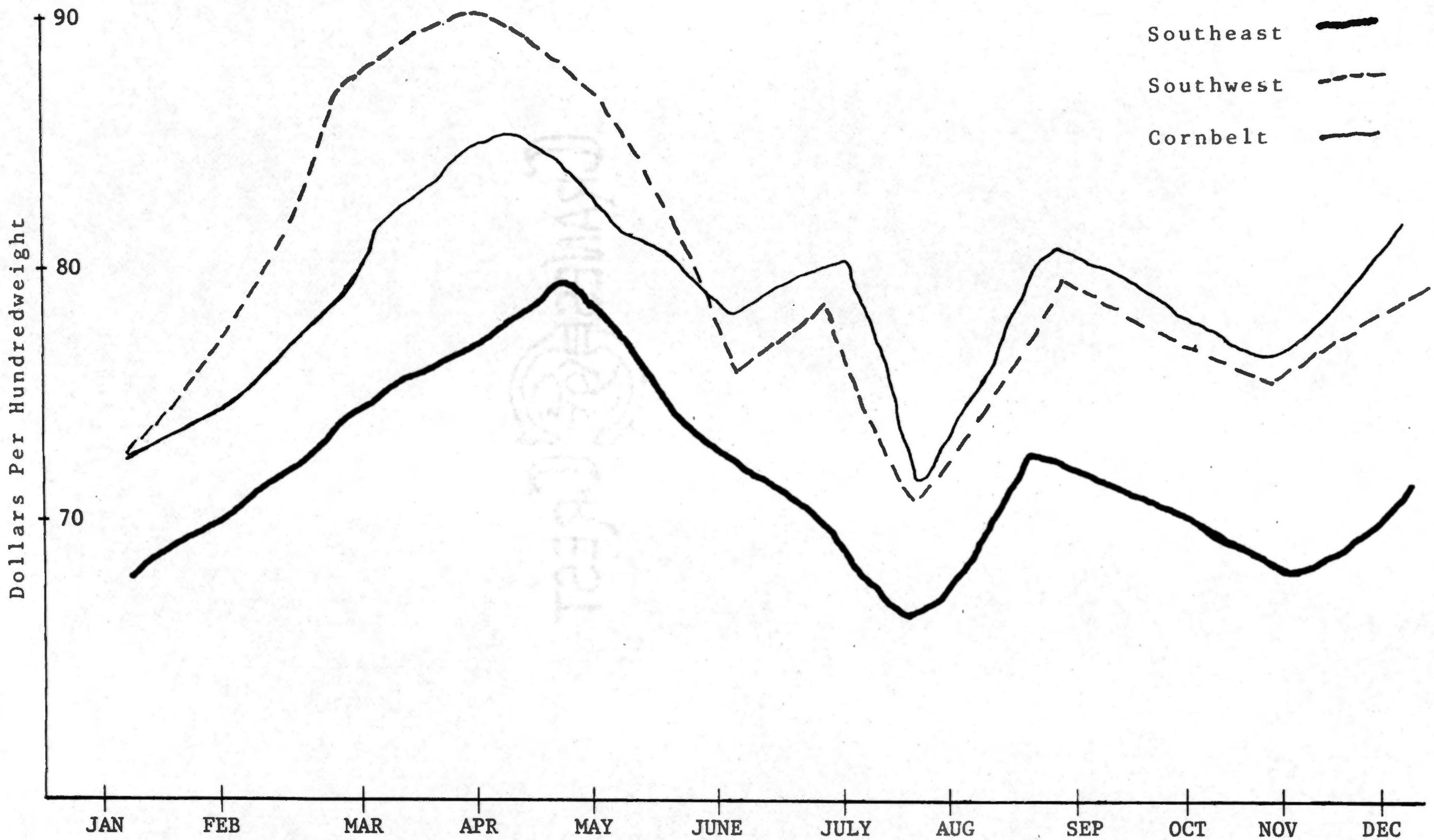

Figure 2. Feeder Cattle Prices: Southeast, Southwest, and Midwest United States. (Medium Frame, 700-800 Pounds, January-December, 1979)

Source: <u>Livestock Meat and Wool Statistics</u>, USDA, all issues from January through December 1979.

some of the competitive advantage that caused it.[30] For example, if cattle feeding were to develop on a large scale in Tennessee, corn and feeder cattle prices would probably be bid up in the state.

Other variables which affect fed cattle production are more stationary in nature. Managerial ability is a variable tht is difficult to quantify and compare among regions. The large commercial feedlots of the High Plains and farmer feedlots of the Corn Belt require specialized managerial skills, especially in changing feeders from the backgrounding ration to a heavy concentrate fattening diet. The feeding costs per head between the best managed lots and poorly run operations vary significantly.

Weather conditions can adversely affect cattle growth. The high humidity and muddy conditions found in Tennessee during certain times of the year can lower cattle growth rates and increase disease problems. Weather and mud were mentioned by several Tennessee cattle shippers as reasons for not feeding cattle in the state. To account for this variable, cement floors and loafing sheds were added to the cattle feeding facilities found in the Tennessee Farm Planning Manual. In addition to increased daily gains, paved lots tend to require less land and make manure handling

---

[30]W. Williams and R. Dietrich, "An Interregional Analysis of the Fed Beef Economy," USDA, ESCS, Agricultural Economic Report No. 88, Washington, D. C., April 1966, p. 34.

easier than dirt lots. Each steer on feed in Tennessee was allocated forty square feet of four inch thick concrete. Costs for the paved floor were obtained from local contractors and results of work done at the Florida Experiment Station.[31]

Rates of gain can be depressed also if cattle are deprived of shade and the temperature exceeds 75 degrees Farenheit. Therefore, twenty square feet of shade per animal were added to the feeding facilities for steers fed in state.[32] When privided with shade and a paved lot, Tennessee cattle could be expected to grow at a rate of gain comparable to that for cattle fed in either the Corn Belt or the High Plains.[33]

IV. DERIVING A TENNESSEE FEEDING BUDGET

Two finishing systems were used in Tennessee; one was a high grain diet while the other used silage and hay in addition to supplement and corn. The Tennessee feeding systems were for a fifty-head capacity unit with one group of cattle fed per year. This is similar to the Corn Belt

---

[31]J. Simpson, Appendix II.

[32]J. Simpson, Appendix II.

[33]J. McLaren, Professor of Animal Science, University of Tennessee, Knoxville, personal communication, September 1979; J. Butcher, Professor of Animal Science, Utah State University, Logan, personal communication, January 1980.

farmer feedlot operations. Although there are significantly lower costs per head with larger operations, current managerial ability in Tennessee would preclude any widespread development of commercial feedlots at the present time. Small feedlots also minimize environmental pollution problems. Specifications for the feedlot are found in Appendix I.

Corn used in the budgets was valued at the average price for the preceding year in each of the three regions of the state.[34] A statewide average price for 44 percent protein supplement was also used.[35] The protein supplement used in the Corn Belt feeding budget was a 34 percent protein feed so the two prices cannot be compared directly. A ton of silage was valued at the price of five bushels of corn and 330 pounds of hay. This is the same method that was used in pricing Corn Belt silage. Hay in the Tennessee budgets was assumed to be a combination grass-legume mixture and was valued at $60 per ton.[36] Requirements for salt and

---

[34]"Tennessee Market Prices," October 1977-July 1979.

[35]Agricultural Prices, USDA, Issues from July 1978 through August 1979.

[36]Tennessee Farm Planning Manual, Agricultural Extension Service, University of Tennessee, April 1978, p. 110. Hay (legume grass mixture) was valued at $50 per ton in the manual. Price indices for feeds in July 1979 were found in Agricultural Prices, 1979. An estimated price for hay in Tennessee was linearly extrapolated using the price index for July 1979 and the feed price index for April 1978 when the Farm Planning Manual was published.

minerals vary between systems since slat requirements are a function of length of time on feed and type of diet.[37]

Since both Corn Belt and Tennessee operations were farmer feedlot systems, veterinary care and marketing costs were assumed to be equal. Labor was valued at $3.00 per hour with one hour of management valued at twice the rate. Labor requirements for the two in-state systems were based on data published in the Tennessee Farm Planning Manual.

The establishment of a feedlot requires a relatively large capital investment. The investment and operating costs category in the budget takes these expenses into account and also includes allowances for grain and supplement storage facilities, a water trough and pipes, fencing, excavation and land charges, a cement floor and feeding bunk, cattle working facilities and shade for the animals. The derivation and explanation of these charges are found in Appendix I. The depreciation and operating costs for a 34 HP tractor, bases on figures given in the Farm Planning Manual were also included. These figures were extrapolated by means of price indices so that they would reflect the prices of July 1979.[38] Repairs were assumed to be 1

---

[37] B. Miller, "Empty Lots," Article in Successful Farming, May 1979, p. b-25.

[38] Agricultural Prices, August 1979.

percent of the new cost of selected facilities and machinery. Miscellaneous and indirect costs are assumed to be the same in Tennessee as they are in the Corn Belt since no inherent regional differences in these costs are apparent. The transportation to slaughter charge for Tennessee is higher than the figure for the Corn Belt or High Plains since there are fewer slaughter plants in the state.[39] The costs of feeding a 700 pound steer in three locations in Tennessee using two different feeding systems are found in Chapter V.

V. RESULTS

The results showed that the grain system had a cost advantage over the silage bases system. The high concentrate diet eliminated the need for certain facilities, (silo, silage wagon), reduced the use of others, and had a lower labor requirement per head. The higher average daily gain shortened the length of time on feed and reduced the interest charge on the feeder steer.

The silage system, on the other hand, required less managerial ability since the steers would be less likely to

---

[39]Calculated as follows: This assumes a 42,000 pound load of fattened steers each weighing 1,050 pounds, or fourty animals per truckload. The mileage charge in July 1979 was \$1.50 per loaded mile. Steers are assumed to be slaughtered within 100 miles. \$1.50 x 100 miles / 40 steers = \$3.75 per head.

go off feed with a silage diet.[40] Although silage may be readily available to the farmer, it usually has few alternative uses and has no estiblished market price. Therefore, the price of silage may not be a true market price but more of an inputed value. Silage cost is the major difference between the two Tennessee systems.

The Corn Belt had a feed cost advantage over all the Tennessee feeding systems. Although the Tennessee grain budget was the lowest cost system, when Corn Belt prices were substituted for the ingredients in the Tennessee diet, the results showed that feed costs would be lower in the Corn Belt. The cost of the Tennessee grain system using Corn Belt feed prices is $97.20. For example, if a Corn Belt farmer were to use the Tennessee grain system, his ration cost would be $97.20. The lowest cost grain ration in Tennessee was $117.14, a difference of $20.

The lowest corn prices ($/bu.) in West and Middle Tennessee were 31 and 37 cents above the lowest price per bushel during the year in the Corn Belt. The average difference in price between the Corn Belt and West Tennessee was 46 cents. This larger average difference was caused

---

[40]Going off feed refers to a refusal of cattle to eat their rations. It is partly caused by a buildup of lactic acid due to the high carbohydrate levels in the grain. Care would also need to be exercised in changing the cattle from a mainly grass ration of a backgrounding ration to the full feed grain ration.

TABLE X

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON CORN SILAGE BASED RATION, MIDDLE TENNESSEE 1979

Item	Quantity (per head)	Unit Price ($)	Amount ($)
Steer, 700 lbs.[a]	7 cwt.	70.53	493.71
Corn[b]	21.2 Bu.	2.62	55.54
Supplement, 44% pritein[c]	2.1 Cwt.	12.96	27.22
Corn Silage	2.4 tons	23.00	55.20
Hay, Grass-Legume mixture	.25 ton	60.00	15.00
Salt and minerals	12 lbs.	.15	1.80
TOTAL FEED COST			$154.76
Veterinary expense			4.01
Marketing expense			3.35
Investment and operating costs[d]			17.23
Repairs			1.78
Tractor, 34 HP_PTO[e]			4.90
Interest on purchase of feeder steer, 9% for 5.6 months			20.74
Death loss, 5% of purchase			2.47
Labor[f]			20.10
Transportation to slaughter[g]			3.75
Miscellaneous and indirect costs			8.10
TOTAL OPERATING EXPENSES			86.43
TOTAL COSTS			$734.95

[a]An average dialy gain of 2.1 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 167 days. Steer price is based on 70 dollars per hundred weight with a price differential for Middle Tennessee.

[b]This is the average corn price paid to farmers in Middle Tennessee during the period August 1978 - July 1979. If corn must be purchased, an extra 30 cents per bushel marketing charge should be added to the feed cost.

[c]Protein supplement, 44% was valued at the average price in Tennessee during the period August 1978-July 1979.

TABLE X (Continued)

[d]See Appendix I for the derivation and explanation of the items in this category. Repair charges are also explained in Appendix.

[e]Tractor use and depreciation are both included in this category. Variable expenses for the tractor are 2.65 per head while the fixed costs are $2.25 per animal. See Appendix I.

[f]Labor assumes 4.7 hours per head plus one hour of manatement which is valued at twice the labor rate of $3.00 per hour.

[g]This assumes a 42,000 pound load of fattened steers weighing 1050 pounds, or forty animals per truckload. The mileage charge in July was $1.50 per loaded mile. Steers are assumed to be slaughtered within 100 miles. $1.50 x 100 miles / 40 steers = $3.75 (per head).

Sources: Tennessee Farm Planning Manual, 1978, University of Tennessee, Agricultural Extension Service, p. 110; Livestock and Meat Situation, USDA, August 1979, p. 13.

TABLE XI

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON CORN SILAGE BASED RATION, EAST TENNESSEE 1979

Item	Quantity (per head)	Unit Price ($)	Amount ($)
Steer[a]	7 cwt.	70.00	490.00
Corn[b]	21.2 bu.	2.87	60.84
Supplement, 44% protein	2.1 cwt.	12.96	27.22
Corn Silage	2.4 tons	24.25	58.20
Hay, grass-legume mixture	.25 ton	60.00	15.00
Salt and minerals	12 lbs.	.15	1.80
TOTAL FEED COST			$163.06
Veterinary expense			4.01
Marketing expense			3.35
Investment and operating costs[d]			17.23
Repairs			1.78
Tractor, 34 HP-PTO[e]			4.90
Interest on Purchase of feeder steer, 9% for 5.5 months			20.58
Transportation to slaughter[g]			3.75
Labor, 6.7 hrs.		3.00	20.10
Death loss, .5% of purchase			2.45
TOTAL OPERATING EXPENSES			86.25
TOTAL COSTS			$739.31

[a]An average daily gain of 2.1 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 167 days. Steer price is based on 70 dollars per hundred weight with no price differential for East Tennessee

[b]This is the average corn price paid to farmers in East Tennessee during the period July 1978 - July 1979. If corn must be purchased, an extra 30 cents per bushel marketing charge should be added to the feed cost.

[c]See Table X.

[d]See Appendix I.

[e]See Table X.

TABLE XI (Continued)

[f]See Table X.

[g]See Table X.

Sources: Tennessee Farm Planning Manual, 1978, University of Tennessee, Agri, Extension Service, p. 110; Livestock and Meat Situation, USDA, August 1979, p. 13.

TABLE XII

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON CORN SILAGE BASED RATION, WEST TENNESSEE 1979

Item	Quantity (per head)	Unit Price ($)	Amount ($)
Steer[a]	7 cwt.	69.60	487.20
Corn[b]	21.2 bu.	2.61	55.33
Supplement, 44% protein[c]	2.1 cwt.	12.96	27.22
Silage	2.4 tons	22.95	55.08
Hay, Grass-Legume mixture	.25 ton	60.00	15.00
Salt and minerals	12 pounds	.15	1.80
TOTAL FEED COST			$154.43
Veterinary expense			4.01
Marketing expense			3.35
Investment and operating costs[d]			17.23
Repairs			1.78
Tractor, HP-PTO[e]			4.85
Interest on purchase, 9% for 5.6 months			20.46
Death loss, .5% of purchase			2.44
Labor[f]			20.10
Transportation to slaughter[g]			3.75
Miscellaneous and indirect costs			8.10
TOTAL OPERATING EXPENSES			86.12
TOTAL COSTS			727.75

[a]An average daily gain of 2.1 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 167 days. Steer price is based on 70 dollars per hundred weight with a price differential for West Tennessee.

[b]This is the average corn price paid to farmers in Southwest Tennessee during the period August 1978 - July 1979. If corn must be purchased, an extra 30 cents per bushel marketing charge should be added to the feed cost.

[c]See Table X.

[d]See Appendix I.

TABLE XII (Continued)

[e]See Table X.

[f]See Table X.

[g]See Table X.

Sources: Tennessee Farm Planning Manual, 1978, University of Tennessee, Agricultural Extension Service, p. 110; Livestock and Meat Situation, USDA, August 1979, p. 13.

TABLE XIII

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON GRAIN BASED RATION, MIDDLE TENNESSEE 1979

Item	Quantity (per head)	Unit Price ($)	Amount ($)
Steer[a]	7 cwt.	70.53	493.71
Shelled corn[b]	39 bu.	2.62	102.18
Protein supplement, 44%[c]	1.08 cwt.	12.96	14.00
Salt and minerals	9.5 lbs.	.15	1.43
TOTAL FEED COST			117.61
Veterinary expense			4.01
Marketing expense			3.35
Investment and operating costs[d]			13.20
Repairs			1.29
Tractor[e]			4.08
Interest on purchase of feeder steer, 9% for 4.2 months			15.55
Death loss, .5% of purchase			2.47
Labor[f]			14.40
Transportation to slaughter[g]			3.75
Miscellaneous and indirect costs			8.10
TOTAL OPERATING EXPENSES			70.20
TOTAL COSTS			681.52

[a]An average daily gain of 2.8 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 125 days. Steer price is based on 70 dollars per hundred weight with a price differential for Middle Tennessee.

[b]This is the average price paid to farmers in Middle Tennessee during the period August 1978-July 1979. If coen must be purchased, an extra 30 cents per bushel marketing charge should be added to the feed cost.

[c]Protein supplement, 44%, was valued at the average price in Tennessee during the period August 1978-July 1979. Source: Agricultural Price, USDA Annual Summary 1979.

[d]See Appendix I for the derivation and explanation of these costs. Repair charges are also explained in Appendix I.

TABLE XIII (Continued)

[e]Tractor use and depreciation are both included in this category. Variable expenses for the tractor are $2.57 per head while the fixed costs are $1.51 per animal. See Appendix I.

[f]Labor assumes 2.8 hours per head at $3.00 per hour plus one hour of management at twice the labor rate.

[g]This assumes a 42,000 pound load of fattened steers each weighing 1050 pounds, or forty animals per truckload. The mileage charge in July 1979 was $1.50 per loaded mile. Steers are assumed to be slaughtered within 100 miles of the feeding location. $1.50 x 100 miles / 40 steers = $3.75.

Sources: Tennessee Farm Planning Manual, 1978, University of Tennessee, Agricultural Extension Service, p. 112; Livestock and Meat Situation, USDA, August 1979, p.13.

TABLE XIV

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON GRAIN BASED RATION, EAST TENNESSEE 1979

Item	Quantity (per head)	Unit Price ($)	Amount ($)
Steer[a]	7 cwt.	70.00	490.00
Shelled corn[b]	39 bu.	2.87	111.93
Protein supplement, 44%[c]	1.08 cwt.	12.96	14.00
Salt and minerals	9.5 pounds	.15	1.43
TOTAL FEED COST			127.39
Veterinary expense			4.01
Marketing expense			3.35
Investment and operating costs[d]			13.20
Repairs			1.29
Tractor[e]			4.08
Interest on purchase, 9% for 4.2 months			15.44
Death loss, .5% of purchase			2.45
Labor[f]			14.40
Transportation to slaughter[g]			3.75
Miscellaneous and indirect costs			8.10
TOTAL OPERATING EXPENSES			70.07
TOTAL COSTS			687.46

[a]An average daily gain of 2.8 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 125 days. Steer price is based on 70 dollars per hundred weight. East Tennessee price differential is equal to zero.

[b]This is the average price paid to farmers in East Tennessee during the period August 1978-July 1979. If corn must be purchased, an extra 30 cents per bushel marketing charge should be added to the feed cost.

[c]See Table XIII.

[d]See Appendix I.

[e]See Table XIII.

[f]See Table XIII.

TABLE XIV (Continued)

[g]See Table XIII.

Sources: Tennessee Farm Planning Manual, 1978, University of Tennessee, Agricultural Extension Service, p.112; Livestock and Meat Situation, USDA, August 1979, p.13.

TABLE XV

ESTIMATED EXPENSES PER HEAD FOR STEER FINISHED ON GRAIN BASED RATION, WEST TENNESSEE 1979

Item	Quantity (per head)	Unit Price ($)	Amount ($)
Steer[a]	7 cwt.	60.60	487.20
Shelled corn[b]	39 bu.	2.61	101.79
Protein supplement, 44%[c]	1.08 cwt.	12.96	14.00
Salt and minerals	9.5 lbs.	.15	1.35
TOTAL FEED COST			117.14
Veterinary expense			4.01
Marketing expense			3.35
Investment and operating costs[d]			13.20
Death loss, .5% of purchase			2.44
Tractor[e]			4.08
Repairs			1.29
Interest on purchase, 9% for 4.2 months			15.35
Labor[f]			14.40
Transportation to slaughter[g]			3.75
Miscellaneous and indirect costs			8.10
TOTAL OPERATING COST			69.97
TOTAL COSTS			674.31

[a]An average daily gain of 2.8 pounds is expected. Total gain is 350 pounds. The steer will be on feed for 125 days. Steer price is based on 70 dollars per hundred weight with a price differential for West Tennessee.

[b]This is the average price paid to farmers in West Tennessee during the period August 1978-July 1979. If corn must be purchased, an extra 30 cents per bushel marketing charge should be added to the feed cost.

[c]See Table XIII.

[d]See Appendix I.

[e]See Table XIII.

[f]See Table XIII.

TABLE XV (Continued)

[g]See Table XIII.

Sources: Tennessee Farm Planning Manual, 1978, University of Tennessee, Agricultural Extension Service, p.112; Livestock and Meat Situation, USDA, August 1979, p.13.

by greater variation in Tennessee corn prices. Some of the feeding cost differential between West Tennessee and the Corn Belt would be offset if farmers bought low priced corn and stored it. Storage facility costs were included in the budget.

The feed costs in the High Plains were greater than the Tennessee grain system and less than the silage diet. The advantage of the High Plains was in the large scale custom feeding operations which reduced many of the investment and operating costs per head for the cattle owner.

Each region had advantages in feeding Tennessee steers. The Corn Belt had the lowest feed costs, the High Plains had lower operating costs per head, while steers fed within Tennessee are not subject to large transportation costs and high shrinkage losses. Chapter VII on page 19 analyzes the effects of 50, 100, and 200 percent increases in fuel prices on the direct production costs of the crops involved in the feeding budgets and on the feeder transportation charges.

CHAPTER VI

COSTS OF SLAUGHTER AND TRANSPORTATION OF PROCESSED BEEF

Slaughter cost and capacity are two variables which affect the location of beef production. If beef were to be fed in Tennessee, it is important that there be a readily available market for the cattle feeder. Over the past two decades, slaughter facilities have tended to locate near the sources of cattle feeding rather than close to areas of high consumer demand. As a result, the meatpacking industry has become geographically concentrated. In 1979, six states accounted for 62 percent of the cattle slaughtered in the United States .[1] In the same year, ten Southeastern states slaughtered 6 percent of the National total.[2] Tennessee ranked third, closely behind Georgia and Florida, in number of cattle slaughtered in the Southeast during 1979. Four Tennessee packers are among the top one hundred meat firms in the country ranked by collar sales volume.[3] However, several large plants in Tennessee have closed down during the past few years.

A confidential telephone survey was conducted during July 1979 of seven major meat packing plants in the

---

[1]Livestock Slaughter, Annual Summary, 1979, United States Department of Agriculture, March 1980, p.21.

[2]Calculated from Livestock Slaughter, p.21

[3]"The Top One Hundred," Meat Processing, October 1979, pp. 44-48.

state. The main objective was to determine if slaughter costs in Tennessee were comparable to those in the Great Plains and Corn Belt regions. Another objective of the survey was to obtain an estimate of the slaughter capacity of the state. The results are shown in Table XVI. The range in slaughter costs among the seven plants was from $18.90 to $23.50 per head. This figure included all costs (labor, depreciation, power, and so forth) from slaughter to meat shipment. (This includes any cooler costs but excludes transportation charges to wholesale outlets.) Slaughter costs obtained from two large plants in the Amarillo area are also shown in Table XVI.

Packers were reluctant to disclose slaughter cost data because of the need to keep trade secrets from competitors. For this reason, regional slaughter costs were estimated using regional wage data and size of plant. Direct labor is the largest single operating cost item in the meatpacking industry. Wages and benefits paid to meatpacking workers may vary because of union contracts and regional wage differences, but still account for about 52 percent of packer operating expenses.[4] The average wages paid to meatplant workers in seven regions of the country during 1974 are shown in Table XVII.

---

[4]Annual Financial Review of the Meatpacking Industry, American Meat Institute, Washington, D. C. August, 1979, p. 4.

TABLE XVI

SLAUGHTER COST AND CAPACITY IN TENNESSEE, 1979

Plants	Slaughter Cost Per Head ($)	Capacity Per Day (Steers)
A	18.90	250
B	23.50	250
C	20.00	240
D	N/A	240
E	21.50	240
F	20 -22	400
G	22.00	100
Texas Plants		
A	15.39	4000
B	22.29	950

Sources: Confidential telephone survey of major Tennessee packing plants, July 1979, and Amarillo Chamber of Commerce, Personal communication, September 1979.

TABLE XVII

AVERAGE HOURLY EARNINGS IN THREE SIZES OF MEAT PACKING PLANTS IN SELECTED REGIONS, 1974

Region	Total Number of Plants[a]	Slaughter Capacity: Under 5 Head per Hour	Slaughter Capacity: 5- 30 Head per Hour	Slaughter Capacity: Over 30 Head per Hour	Average Hourly Wage For All Plants ($)
Southeast	126	81	38	7	3.58
Northcentral	265	166	50	49	5.50
Southwest	92	35	36	21	4.18
Mountain and Plains States	155	81	26	48	4.40

[a]Total number of federally inspected meat plants in the region.

Source: A. J. Baker, Federally Inspected Livestock Slaughter by Size and Type of Plant. USDA - ERS Statistical Bulletin 549, May 1976, p. 27.

Another variable which affects slaughter cost is plant size. Significant cost reductions are achieved as plant size and volume increase. In 1973, 6 percent of Southeastern slaughter plants had capacities of over 30 head per hour. In the North Central region, 18 percent of plants had slaughter capacities of over 30 per hour, while 23 percent of the Southwestern federal inspected meat packing firms slaughtered over 30 head per hour.[5] Most Southeastern plants are relatively small operations. Of the 126 federal inspected slaughter plants in the Southeast, 64 percent slaughtered less than five head per hour. Regional slaughter plant size data are given in Table XVII. Using plant size and regional wage figures, Nelson estimated slaughter costs for five regions of the country which are given in Table XVIII. The results show that for the Southeast, some of the cost disadvantage due to small scale operations was offset by the lower regional wage. Slaughter cost figures given by Tennessee meat packers were consistant with these estimates. The lower slaughter cost figure for the Southwest reflects the advantege of large scale plant size.

The largest slaughter plant in the state had a capacity of 400 head of cattle per day. The capacities

---

[5]A. J. Baker, Federally Inspected Livestock Slaughter by Size and Type of Plant, USDA-ERS Statistical Bulletin 549, May 1976, p. 27.

TABLE XVIII

REGIONAL SLAUGHTER COST ESTIMATES, STEERS AND CULL BEEF, 1979

Region	Variable Cost Per Head ($)	Fixed Cost Per Head ($)	Total Cost Per Head ($)
	1000 Pound Steers		
West	22.24	3.10	25.34
Great Plains	18.28	2.73	21.01
Southwest	14.69	2.73	17.42
Northcentral	20.33	2.89	23.22
Southeast	18.94	2.88	21.82
	Cull Beef		
West (900 lb.)	20.67	2.88	23.55
Great Plains (950)	17.36	2.59	19.95
Southwest (900)	13.66	2.54	16.20
Northcentral (1000)	19.72	2.81	22.53
Southeast (1000)	18.37	2.79	21.16

Source: K. Nelson, Draft Bulletin on Regional Allocation Model of Livestock Sector USDA, ESCS Urbana, Ill. March 1980, n.p.

obtained during the telephone survey for the seven plants totaled 1720 head per day. Davis and Melton estimated that each of four SMSAs in the state would have enough capacity to slaughter an additional 250 head per day in smaller operations.[6] Considering only the seven larger plants and the smaller plants located near the SMSAs, the slaughter capacity for the state would be 2720 head per day. Davis and Melton estimated the total state slaughter capacity to be about 4000 head per day. Assuming 252 working days per year, annual capacity in the state would be between 685,000 and 1,008,000 head.[7] The annual capacity in the Amarillo area is 5,148,710 head.[8] One Amarillo plant has a yearly slaughter capacity of 1,300,000 head or more than the capacity of all the slaughter plants in Tennessee combined.

The _Livestock Annual Slaughter Summary_ shows that 254,000 head of cattle were slaughtered in the state last year.[9] This was about 37 percent of the low estimate of

---

[6]G. David, Assistant Professor, Department of Food Science and Technology, University of Tennessee, Knoxville; C. Melton, Associate Professor, Department of Food Science and Technology, University of Tennessee, Knoxville, personal communication, September, 1979.

[7]Calculated as follows: 252 working days x 2720 head = 685,440 head annually, 252 working days x 4000 = 1,008,000 (Head slaughtered annually)

[8]"1979 Fed Cattle Production." Southwestern Public Service Commission, Amarillo, Texas. March 1979, p.2.

[9]_Livestock Slaughter_, p. 21.

slaughter capacity. Amarillo plants slaughtered 4,525,000 cattle last year or 88 percent. In Chapter II, it was estimated that 700,000 (cull and fed beef) would be needed to meet the state beef consumption requirement. Given current capacity, slaughter plants in the state could probably supply most, if not all, in-state beef consumption.

None of the meat packing plants surveyed obtained more than 50 percent of their cattle from in-state sources. Most plants reported that about 30 percent of their cattle came from Tennessee, with the remainder coming from Kentucky, Alabama, Virginia, and other states in and out of the region. Although meat packers could reduce their costs by obtaining cattle nearer to the plant and using their facilities at rates closer to capacity, sources for small groups of fat cattle from individual operators may be discounted. The packer-buyer may view the farmer feeder as an irregular and perhaps unreliable supplier. Because of the relatively small number of slaughter plants in the state, the farmer feeder may have few alternative locations at which to market his fattened steers. This may also explain relatively low prices offered by packer-buyers.

A. TRANSPORTATION OF PROCESSED BEEF

One reason for the trend in locating packing plants closer to the sources of slaughter animals is the reduced expense involved in transporting live animals. Additional breaking-down of beef carcasses by packers has increased significantly in recent years. In the late sixties several meat packers began curring beef carcasses into subprimal cuts, vacuum packing the meat and boxing it for sale. This product is known as boxed beef. Over 66 percent of steer and heifer beef currently marketed in the Southeast is shipped as boxed beef.[10] Only 20 percent of all beef now is transported in carcass form. In addition to reducing shrinkage losses and maintaining flavor, boxed beef shipment reduces freight costs by eliminating the need to transport waste fat and bone. One ton of carcass beef requires 106 cubic feet of storage space, while a ton of frozen boxed beef requires only 50 cubic feet of space.[11]

Table XIX shows the cost of shipping fresh and frozen beef from Peoria, Illinois and Amarillo,-Texas to five different Tennessee cities by rail and truck. These shipping rates are regulated by the Interstate Commerce Commission. Rail appears to have an advantage when quantities of beef over 75,000 pounds are shipped from Peoria to Tennessee and on shipments from the Amarillo ares. The costs of shipping the retail cuts from a one thousand

---

[10]"Carcass Beef Down, Boxed Beef Up," <u>Meat Processing</u>, n.a. July, 1979, p. 28.

[11]J. R. Romans and P. T. Zieglar, <u>The Meat We Eat</u>, Interstate Publishing Company, Danville, Illinois, 1977, p. 145.

TABLE XIX

TRUCKLOAD AND RAIL CHARGES FOR PROCESSED BEEF FROM PEORIA, ILLINOIS AND AMARILLO, TEXAS TO FIVE TENNESSEE LOCATIONS[c] 1979

FROM: Peoria, Illinois

TO: Tennessee		Rail Carload Rates ($)		Truck Rates ($)[a]	
Minimum Weight (pounds)		35,000[b]	75,000[b]	35,000	38,000
Chattanooga	Non-Frozen	10.83	8.08	8.17	7.99
	Frozen	-----	8.44	----	----
Knoxville	Non-Frozen	10.83	8.08	8.44	8.21
	Frozen	-----	8.79	----	----
Memphis	Non-Frozen	9.24	6.93	7.19	7.02
	Frozen	-----	7.10	----	----
Johnson City	Non-Frozen	10.35	7.73	9.28	8.92
	Frozen	-----	----	----	----

FROM: Amarillo, Texas

TO: Tennessee		Rail Carload Rates ($)	Truck Rates ($)
Minimum Weight (pounds)		40,000[b]	24,000
Chattanooga	Frozen	19.44	24.15
Knoxville	Frozen	21.02	25.75
Nashville	Frozen	18.33	23.13
Memphis	Frozen	17.41	22.82
Johnson City	Frozen	22.34	27.21

[a]Truck rates for fresh and frozen meat are the same.

[b]Rates are applicable on first 35,000, 40,000, or 75,000 pounds loaded in car. Excess charges are added on to these rates for heavier loads.

TABLE XIX (Continued)

[c]Charges are based on the costs of shipping the retain cuts of a 1000 pound steer. If the steer dresses at 60% and a carcass weight conversion factor of .74 is assumed, then there will be 444 pounds of retail cuts per steer. This figure was multiplied by the transportation rate per hundred pounds to give the charges shown.

Source: Tennessee Valley Authority Rates and Tariffs Division, August 1979.

pound steer from the Corn Belt to Tennessee are about nine dollars. Shipping costs from Amarillo, Texas to Tennessee are about twenty-two dollars. These return shipping charges should be considered in the costs of finishing beef in state relative to out of state finishing costs.

Although significant cost reductions are involved with large scale plants located near sources of slaughter animals, the situation is complicated when population centers and supplies of slaughter animals are scattered. Kuehn has suggested that the cost savings of large firms located close to live animal supplies may be offset by smaller more centrally located firms which do not incur the large transportation costs of shiping meat to isolated demand centers.[12] His study showed that the small plants in West Virginia, with capacities of 25 head per day, may be more efficient than larger Western plants when the greater transportation costs are considered.[13]

CHAPTER VII

THE EFFECTS OF CHANGES IN FUEL PRICES ON CATTLE FEED PRODUCTION AND TRANSPORTATION COSTS

Since the sharp increases in petroleum prices in the early 1970s, there has been much concern regarding their impact on food costs. This has also been associated with increased needs for more efficient energy use in agriculture. Production agriculture accounts for only about 3 percent of total United States direct energy consumption; however production, processing, and distribution of agricultural products account for nearly 20 percent of total national energy use.[1]

The main objective of this chapter is to assess direct cost impacts of fuel price increases on the fed beef industry. As fuel prices increase, the costs of transporting cattle as well as cattle feed production cost would be expected to increase. The effects of changes in fuel costs vary among regions and for different crops. This is because the amount of fuel used per bushel or ton of feed varies according to regional climate, water supply. fertilizer requirements, and tillage methods.

---

[1]R. K. Conway and J. F. Yanagida, "Impact of Rising Energy Prices on Livestock Prices and Production," Paper presented at the Southern Region Agricultural Economics Association Meeting, Hot Springs, Arkansas, Feb. 1980, p.1.

In 1974, the Department of Agriculture, in cooperation with the Department of Energy, estimated energy use by states for direct crop production.[2] This included energy used in field operations, irrigation, and crop drying. Using the data from this study, estimates of energy use were made for each of the crops in the feeding budgets for the High Plains, the Corn Belt, and Tennessee. Gasoline, LP gas, and natural gas were all converted to diesel fuel equivalents by use of BTU values.[3] Yield and fuel usage data were from 1974. Fuel costs were from 1979. An assumption was made therefore that increases in yield from 1974 to 1979 would also be accompanied by increased fuel usage. This assumption has validity in that liberal use of petrochemical materials has been the single most important factor responsible for increased American agricultural productivity.[4] As fuel costs rise, farmers would be expected to change their enterprise combinations to less energy intensive crops. However, Heady and Dvoskin showed that a doubling of 1974 level energy prices resulted in only a 5 percent reduction in energy

---

[2]Energy and Agriculture: 1974 Data Base. Vol 1, Federal Energy Commission and USDA, FEA/D-76 459, September 1976. pp. 120, 78, 83, 88, 144, 6, 222, 188, 217.

[3]See Appendix II for conversion values

[4]D. Pimental *et al.*, "Food Production and the Energy Crisis," *Science* Vol. 182, November 2, 1973. pp. 443-449.

used in agricultural production.[5] The fuel costs per bushel obtained in this study as a percentage of product value, are similar to results found in other work.[6] The results are shown in Table XX.

The fuel cost excluding natural gas reflects the amount of irrigation and fertilizer used in each region. Natural gas cost makes up a significant part of the total fuel cost per bushel for Texas and Okalhoma. This is because of the High Plains dependence on irrigation which is mainly fueled by natural gas.

Table XXI shows estimated feed costs given 50, 100, and 200 percent increases in fuel prices. The fuel costs per bushel derived in Table XX were increased by 50, 100, and 200 percent and were then added to the feed costs estimated for the base period, July 1979. It was assumed that all petrochemical fuel prices rose at the same rate. Only the direct fuel costs were increased; all other costs were held constant. In addition, indirect energy costs such as those for soybean processing or fuel used in machinery production were not taken into account. This is because of the difficulty in making interregional comparisons of indirect energy use.

---

[5]C. D. Baird and R. C. Fluck, Agricultural Energetics, AVI Publishing Company, Westport, Connecticut, 1980. p. 77.

[6]Baird and Fluck, p. 74.

TABLE XX

FUEL COST PER BUSHEL (OR TON) FOR CROPS USED IN BEEF CATTLE FEEDING: THREE REGIONS
TENNESSEE, CORN BELT, HIGH PLAINS, 1979

Region and Crop	Gasoline per acre (gallons)	Diesel per acre (gallons)	LP Gas per acre (gallons)	Nat. Gas per acre (gallons)	Total gallons per acre	Yield per acre	Price of Diesel (gallon)	Fuel Cost: per bushel or ton	Fuel Cost excluding Nat. gas
TENNESSEE									
Corn	7.47	9.69	2.0	.98	20.14	61.0 bu.	.74	.24	.23
Soybeans	4.70	8.62	.36	.03	13.71	21.0 bu.		.48	.48
Alfalfa	26.50	.65	3.55	21.13	51.83	2.5 tons		15.34	9.09
Silage	9.64	10.37	.54	.0	20.55	13.5 tons		1.13	1.13
Grass Hay	2.11	.02	.50	.0	2.63	1.4 tons		1.39	1.39
GREAT PLAINS									
Texas									
Milo	7.78	8.92	2.01	25.74	44.45	52.0 bu	.71	.61	.26
Corn	9.09	9.61	3.12	46.69	68.51	92.0 bu.		.53	.17
Cottonseed Meal	4.56	9.4	1.50	18.00	34.36(4.68)	166.5 lbs.		2.00 cwt	.98
Alfalfa Hay	14.25	5.39	3.75	59.67	83.06	4.3 tons		13.71	3.86
Oklahoma									
Milo	5.28	7.91	3.93	18.05	35.17	38.0 bu	.78	.72	.35
Corn	9.43	13.14	10.20	47.22	79.99	88.0		.71	.29
Cottonseed Meal	5.05	10.18	1.22	6.09	23.31(3.16)	168.37 lbs.		1.46	1.07
Alfalfa Hay	13.72	7.80	3.12	14.09	38.73	2.9 tons		10.42	6.63
CORN BELT									
Illinois									
Corn	11.07	4.89	7.80	.11	23.86	83. bu.	.77	.22	.22
Silage	10.33	13.14	.70	.0	24.17	11.5 tons		1.62	1.62
Alfalfa	26.19	.93	3.37	1.13	31.62	3.1 tons		7.85	7.57
Other Hay	2.25	.01	.50	.0	2.76	2.1 tons		1.01	1.01

TABLE XX (Continued)

Region and Crop	Gasoline per acre (gallons)	Diesel per acre (gallons)	LP Gas per acre (gallons)	Nat. gas per acre (gallons)	Total gallons per acre	Yield per acre	Price of Diesel (gallon)	Fuel Cost per bushel or ton	Fuel Cost excluding Nat. gas
								- dollars -	
CORN BELT (Continued)									
Iowa							.75		
Corn	10.7	5.16	5.73	.16	21.76	80. bu.		.20	.20
Silage	10.65	13.70	.74	.0	25.09	11.5 tons		1.64	1.64
Soybeans	7.18	5.71	.44	.08	13.42	28. bu.		.36	.35
Alfalfa	24.40	.93	.37	1.02	26.72	3 tons		6.68	6.43
Other Hay	3.46	.0	.60	.0	4.06	2.1 tons		1.45	1.45
Indiana							.70		
Corn	10.56	4.53	7.37	.08	22.54	71. bu.		.22	.22
Silage	10.21	13.08	.48	.0	23.77	11.5 tons		1.45	1.45
Soybeans	6.95	5.61	.42	.07	13.11	25. bu.		.37	.37
Alfalfa	21.41	1.34	2.73	.97	26.45	2.7 tons		6.86	6.62
Other Hay	2.19	.0	.50	.0	2.69	1.9 tons		.99	.99
Michigan							.76		
Corn	9.28	4.86	4.48	.13	18.75	61. bu.		.23	.23
Silage	9.52	11.58	.62	.0	21.72	9.5 tons		1.74	1.74
Soybeans	6.59	5.28	.39	.07	12.33	21. bu.		.45	.45
Alfalfa	16.42	.17	.60	.0	4.23	1.9 tons		1.69	1.69
Nebraska							.74		
Corn	7.52	18.33	13.04	5.99	44.88	68. bu.		.49	.42
Silage	6.47	22.23	3.63	2.49	34.82	7.5 tons		3.44	3.20
Soybeans	5.02	6.12	1.06	.48	12.68	24. bu.		.39	.38
Alfalfa	3.08	20.08	2.95	29.95	56.06	2.6 tons		15.96	7.44
Other Hay	3.81	1.50	1.91	.84	8.06	.9 tons		6.63	5.94

TABLE XX (Continued)

Region and Crop	Gasoline per acre (gallons)	Diesel per acre (gallons)	LP gas per acre (gallons)	Nat. gas per acre (gallons)	Total gallons per acre	Yield per acre	Price of Diesel (gallon)	Fuel Cost per bushel or ton	Fuel Cost excluding Nat. gas
								- dollars -	
UNITED STATES							.72		
Corn	9.35	7.39	6.11	3.04	25.72	71.3		.26	.23
Silage	8.16	13.82	.94	2.76	25.68	10.4 tons		1.78	.59
Soybeans	6.43	6.40	.48	.27	13.58	23.5 bu.		.42	.41
Alfalfa	12.60	5.00	1.83	7.85	27.28	2.8 tons		7.01	4.99
Other Hay	3.16	.29	.72	.40	4.57	1.6 tons		2.06	1.88

[a]Gasoline, LP gas and Natural gas were converted to diesel equivalents by using BTU values for each. See Appendix II for conversion factors.

[b]Yield per acre 1974

[c]Price of diesel used on farms July 1979.

[d]Cottonseed is valued at 14 percent of the value of seed cotton. Cottonseed meal is about 43 percent of cottonseed.

Sources: Energy and Agriculture, Summary by Commodity 1974, USDA, Conversion Factors and Weights and Measures USDA Bulletin No. 616, Guide to Energy Savings for the Livestock Producer USDA Federal Energy Administration, June 1977, Agricultural Prices, USDA August 1979.

TABLE XX (Continued)

Region and Crop	Gasoline per acre (gallons)	Diesel per acre (gallons)	LP gas per acre (gallons)	Nat. gas per acre (gallons)	Total gallons per acre	Yield per acre	Price of Diesel (gallon)	Fuel Cost per bushel or ton	Fuel Cost excluding Nat. gas
								- dollars -	
UNITED STATES							.72		
Corn	9.35	7.39	6.11	3.04	25.72	71.3		.26	.23
Silage	8.16	13.82	.94	2.76	25.68	10.4 tons		1.78	.59
Soybeans	6.43	6.40	.48	.27	13.58	23.5 bu.		.42	.41
Alfalfa	12.60	5.00	1.83	7.85	27.28	2.8 tons		7.01	4.99
Other Hay	3.16	.29	.72	.40	4.57	1.6 tons		2.06	1.88

[a]Gasoline, LP gas and Natural gas were converted to diesel equivalents by using BTU values for each. See Appendix II for conversion factors.

[b]Yield per acre 1974

[c]Price of diesel used on farms July 1979.

[d]Cottonseed is valued at 14% of the value of seed cotton. Cottonseed meal is about 43% of cottonseed.

Sources: Energy and Agriculture, Summary by Commodity 1974, USDA, Conversion Factors and Weights and Measures USDA Bulletin No. 616, Guide to Energy Savings for the Livestock Producer USDA Federal Energy Administration, June 1977, Agricultural Prices, USDA August 1979.

TABLE XXI

ESTIMATED FEED COSTS GIVEN 50, 100, AND 200 PERCENT INCREASES IN FUEL PRICES
TENNESSEE, CORN BELT AND HIGH PLAINS AREAS

Region and Crop	Fuel Cost per unit	Unit Feed Cost, Base Period	Unit Feed Cost, 50% Fuel Price Increase	Unit Feed Cost, 100% Fuel Price Increase	Unit Feed Cost, 200% Fuel Price Increase
TENNESSEE					
Middle Tennessee					
Corn	.24 bu.	2.62	2.74	2.86	3.10
Silage	1.13	23.00	23.57	24.13	25.26
Protein Supplement[a]	1.03	12.96	13.48	13.99	15.02
Hay	8.37	60.00	64.19	68.37	76.74
East Tennessee					
Corn	.24 bu.	2.87	2.99	3.11	3.35
Silage	1.13 cwt.	24.25	24.82	25.38	26.51
Protein Supplement[a]	1.03 cwt.	12.96	13.48	13.99	15.02
Hay	8.37 ton	60.00	64.19	68.37	76.74
West Tennessee					
Corn	.24 cwt.	2.61	2.73	2.85	3.09
Silage	1.13 ton	22.95	23.52	24.08	25.21
Protein Supplement[a]	1.03 cwt.	12.96	13.48	13.99	15.02
Hay	8.37 ton	60.00	64.19	68.37	76.74
CORN BELT					
Corn	.25 bu.	2.16	2.29	2.41	2.64
Protein Supplement[a]	.80 cwt.	10.75	11.18	11.61	12.47
Silage	2.09 ton	18.14	19.19	20.23	22.32
Hay	6.37 ton	44.50	47.69	50.87	57.24
HIGH PLAINS					
Corn	.55 bu.	2.75	3.03	3.30	3.85
Milo	1.16 cwt.	4.24	4.82	5.40	6.56
Cottonseed Meal[b]	4.54 cwt.	10.84	13.11	15.38	19.92
Alfalfa Hay	11.67 ton	101.0	106.84	112.67	124.34

[a]Soybean meal is about 78 percent of soybeans. One hundred pounds of soybean meal requires 128 lbs. of soybeans. The fuel cost for a hundred weight of soybean meal is 2.14 times the cost per bushel. 128.2 (pounds of soybeans) / 60 (pounds of soybeans per bushel) = 2.14.

[b]Cottonseed meal is about 43 percent of cottonseed. Two hundred thirty-three pounds of cottonseed would be required to produce 100 pounds of cottonseed meal. Fuel cost is therefore 2.3 times the fuel cost of producing cottonseed.

Sources: Livestock and Meat Situation, USDA, August 1979, pp. 13, 14; Tennessee Farm Planning Manual, University of Tennessee Agricultural Extension Service, April 1978, p. 110; Tennessee Market News, Tennessee Department of Agriculture and Agricultural Extension Service. All issues from October 1977 through July 1979.

The feed cost figures for the Corn Belt and High Plains represent average figures for the regions. Corn Belt energy use was calculated from estimates for Illinois, Iowa, Indiana, Nebraska, and Michigan while the figures for the High Plains were an average of Texas and Oklahoma estimates.[7] The yield per acre times the number of acres harvested in each Corn Belt state for each crop used in the feeding budgets were aggregated to determine weighted average fuel costs for the region. Texas and Oklahoma estimates were added together in the same method to give figures for High Plains crops. For example, Texas produced about 90 percent of the corn in the High Plains while Oklahoma produced 10 percent. The weighted average fuel cost for the region was therefore; .9 x .53 (Texas fuel cost per bushel of corn) + .1 x .71 (Oklahoma fuel cost per bushel of corn) = .55 (corn fuel cost for the region).

Table XXII uses the projected fuel costs to estimate the ration costs for the budgets presented in Chapter V. Table XXII shows that as fuel prices increase, the cost of corn increases relative to the cost of silage. Although corn grain is valuable as a livestock feed, one fourth of all energy used in farming is for corn production.[8] Lockeritz has shown that silage is the least energy

---

[7] Energy and U. S. Agriculture, pp. 188, 217, 83.

[8] Farm Index, United States Department of Agriculture, January-February 1979, p. 14.

TABLE XXII

ESTIMATED RATION COST FOR 700 POUND STEER GIVEN 50, 100, AND 200 PERCENT INCREASES IN FUEL PRICES TENNESSEE, CORN BELT, AND HIGH PLAINS REGIONS, 350 POUND TOTAL GAIN

Region and Crop	Ration Cost Base Period	Ration Cost 50% Fuel Price Increase	Ration Cost 100% Fuel Price Increase	Ration Cost 200% Fuel Price Increase	Percent Change from Base Period
TENNESSEE (SILAGE SYSTEM)			- dollars -		
Middle Tennessee					
Corn	55.54	58.09	60.63	65.72	18
Silage	55.20	56.57	57.91	60.62	10
Protein Supplement	27.22	28.31	29.38	31.54	16
Hay	15.00	16.05	17.09	19.19	28
East Tennessee					
Corn	60.84	63.39	65.93	71.02	17
Silage	58.20	59.57	60.91	63.62	9
Protein Supplement	27.22	28.31	29.38	31.54	16
Hay	15.00	16.05	17.09	19.19	28
West Tennessee					
Corn	55.33	57.88	60.42	65.51	18
Silage	55.08	56.45	57.79	60.50	10
Protein Supplement	27.22	28.31	29.38	31.54	16
Hay	15.00	16.05	17.09	19.19	28
CORN BELT					
Corn	75.60	80.15	84.35	93.10	23
Protein Supplement	22.58	23.48	24.38	26.19	16
Silage	23.95	25.33	26.71	28.13	17
Hay	6.92	7.42	7.91	8.90	29
HIGH PLAINS					
Milo	44.52	50.61	56.70	68.88	54
Corn	51.56	56.81	61.88	72.18	40
Cottonseed Meal	30.35	36.71	43.06	55.78	84
Hay	28.28	29.92	31.55	34.82	23

TABLE XXII (Continued)

Region and Crop	Ration Cost Base Period	Ration Cost 50% Fuel Price Increase	Ration Cost 100% Fuel Price Increase	Ration Cost 200% Fuel Price Increase	Percent Change from Base Period
TENNESSEE GRAIN SYSTEM					
Middle Tennessee					
Corn	102.18	106.86	111.54	120.90	18
Protein Supplement	14.00	14.56	15.11	16.22	16
East Tennessee	111.93	116.61	121.29	130.65	17
Protein Supplement	14.00	14.56	15.11	16.22	16
West Tennessee					
Corn	101.79	106.47	111.15	120.51	18
Protein Supplement	14.00	14.56	15.11	16.22	16

Source: Rations developed for feeding 700 pound steers, found in Chapter V.

consumptive crop for feeding cattle under feedlot conditions in terms of beef production response.[9] This is consistant with the results found in this study.

The large estimated cost increases in milo and cottonseed meal in the High Plains are due partly to the reliance of production of these crops on natural gas. Young and Coomer have shown that a tripling of 1976 level natual gas prices would result in a 70 percent decrease in grain sorghum production and a cotton production decrease of 33 percent.[10] This is especially relevant to cattle producers because of heavy reliance on milo and cottonseed meal by High Plains cattle feeders. Data from the Amarillo Chamber of Commerce show that unirrigated sorghum produces only about 42 percent of the average irrigated sorghum yield.[11] Thus, other factors held constant, any large fuel price increase would result either in a decrease of available sorghum for cattle feed or an increase in the cost of cattle feeding in the region if sorghum production continued under irrigation.

---

[9] W. Lockeretz, Agriculture and Energy, Proceedings of a conference at Washington University, St. Louis, June 1976. Academic Press, New York 1977. p. 409.

[10] K. B. Young and J. M. Coomer, "Effects of Natural Gas Price Increase on Texas High Plains Irrigation, 1976-2025." USDA-ESCS, Agricultural Economic Reprot No. 448, February 1980, p. 28.

[11] Kirie Smith, Unpublished Data, Amarillo Chamber of Commerce, Texas.

As a region, the Corn Belt fuel costs increased relative to Tennessee. However, the fuel costs per bushel of some of the indivudual Corn Belt states are lower than those in Tennessee. This means that for certain states such as Iowa and Indiana feeding costs would decrease slightly relative to Tennessee costs as fuel prices increase. Nebraska cattle feed costs would increase significantly relative to costs in this state although Nebraska is currently second in the nation in number of cattle on feed.

Table XXIII shows the estimated total ration costs for the High Plains, Corn Belt, and the two Tennessee systems with increasing fuel prices. The total cost of the Tennessee grain system under each projected energy price increase is lower than that of the silage ration even though the cost of the silage ration increases less than the cost of the grain ration. Although the High Plains ration is initially about the same cost as the Tennessee silage rations, greater fuel usage causes the cost of the High Plains ration to increase incrementaly more than twice as much as the cost increase of any other region.

Transportation costs would also be expected to increase as fuel prices rise. If trucks are assumed to average five miles to a gallon of diesel, then a price increase of fifty cents per gallon would increase the

TABLE XXIII

ESTIMATED TOTAL RATION COST GIVEN 50, 100 AND 200 PERCENT INCREASES IN FUEL PRICES TENNESSEE, CORN BELT AND HIGH PLAINS

Region	Total Ration Cost, Base Period	Total Ration Cost, 50% Fuel Price Increase	Total Ration Cost, 100% Fuel Price Increase	Total Ration Cost, 200% Fuel Price Increase	Percent Change from Base Period
		- dollars -			
TENNESSEE SILAGE SYSTEM					
Middle Tennessee	152.96	.59.02	165.01	177.07	16
East Tennessee	161.26	167.32	173.31	185.37	15
West Tennessee	152.63	158.69	164.68	176.74	16
CORN BELT	129.05	136.87	143.35	156.32	21
HIGH PLAINS	154.71	174.05	193.19	231.66	49
TENNESSEE GRAIN SYSTEM					
Middle Tennessee	116.18	121.42	126.65	137.12	18
East Tennessee	125.93	131.17	136.40	146.87	17
West Tennessee	115.79	121.03	126.26	136.73	18

charge per loaded mile by twenty cents.[12] All costs except those for fuel were held constant. Using these assumptions, and a base fuel price of 74 cents per gallon, transportation rates were estimated given 50, 100, and 200 percent increases in fuel prices.[13] The transportation rate, which was $1.50 per loaded mile in the base period, was increased twenty cents for each fifty cent increase in the price of a gallon of fuel. Because transportation charges of unregulated shippers are usually not given in odd penny rates, the estimates were rounded to the nearest five cents. Taxes were not included in the fuel price so that only effects of changes in fuel costs would be assessed.

Table XXIV shows the estimated cost of transporting sixty steers from the three Tennessee locations given in Chapter IV to Amarillo, Texas and Peoria, Illinois under four different fuel price situations. Table XXV uses the same information to give a transportation cost per head. An increase in fuel prices of 200 percent would increase

---

[12]Although the charge is $1.50 per loaded mile, twice the number of miles from the origin to the destination must be driven since there is a return trip. The return trip also requires fuel. No backhaul opportunities were assumed (See Chapter IV). Therefore a 50 cent increase in fuel price for a truck averaging five miles per gallon would increase the rate by 10 cents each way or 20 cents in total per <u>loaded</u> mile.

[13]Diesel Fuel would then cost $1.11, $1.48, and $2.22 per gallon exclusive of tax. The charges per loaded mile would be $1.65, $1.80, and $2.10

TABLE XXIV

ESTIMATED TRANSPORTATION COSTS OF FEEDER STEERS GIVEN 50, 100, AND 200 PERCENT INCREASES IN FUEL PRICES EAST, WEST, AND MIDDLE TENNESSEE TO PEORIA, ILLINOIS AND AMARILLO, TEXAS
TOTAL COST

Region	Base Period Cost (4)	50% Fuel Price Increase ($)	100% Fuel Price Increase ($)	200% Fuel Price Increase ($)
	($1.50/mile)	($1.65/mile)	($1.80/mile)	(2.10/mile)
From <u>Columbia</u>, <u>Tennessee</u> to:				
Amarillo, Texas	1,372.50	1,509.75	1,647.00	1,921.5
Peoria, Illinois	759.0	834.9	910.8	1,062.6
From <u>Knoxville</u>, <u>Tennessee</u> to:				
Amarillo, Texas	1,666.5	1,833.15	1,999.8	2.333.10
Peoria, Illinois	855.0	940.5	1,026.0	1,197.0
From <u>Memphis</u>, <u>Tennessee</u> to:				
Amarillo, Texas	1,089.0	1,197.9	1,306.8	1,524.6
Peoria, Illinois	678.0	745.8	813.6	949.2

TABLE XXV

ESTIMATED TRANSPORTATION COSTS OF FEEDER STEERS GIVEN 50, 100, AND 200 PERCENT INCREASES IN FUEL PRICES EAST, WEST, AND MIDDLE TENNESSEE TO PEORIA, ILLINOIS AND AMARILLO, TEXAS COST PER HEAD

Region	Base Period Cost ($)	50% Fuel Price Increase ($)	100% Fuel Price Increase ($)	200% Fuel Price Increase ($)
From <u>Columbia</u>, <u>Tennessee</u> to:				
Amarillo, Texas	22.88	25.16	27.45	32.03
Peoria, Illinois	12.65	13.92	15.18	17.71
From <u>Knoxville</u>, <u>Tennessee</u> to:				
Amarillo, Texas	27.78	30.55	33.33	38.89
Peoria, Illinois	14.25	15.68	17.10	19.95
From <u>Memphis</u>, <u>Tennessee</u> to:				
Amarillo, Texas	18.15	19.97	21.78	25.41
Peoria, Illinois	11.30	12.43	13.56	15.82

the cost of transporting a 700 pound steer from Knoxville, Tennessee to Amarillo, Texas by $11.11, or an increase of 40 percent over the base period.

Although this appears to be a significant cost increase, a rise in the interest rate may affect cattle feeding costs more than a rise in the transportation charges. If money were borrowed at 9 percent for six months, the interest charge on a 700 pound steer selling at $70.00 per hundred weight would be $22.05. If money to finance the steer was borrowed at 13.75 percent for six months, the interest charge would be $33.69. Therefore, a 4.75 percentage point rise in the interest rate would increase in feeding cost than that which would result from a 200 percent increase in fuel prices on an 1100 mile shipment of feeder steers.

Table XXVI shows the total feed costs plus transportation charges per head for steers fed in three Tennessee locations, the High Plains, and the Corn Belt. As fuel prices increase, the cost of finishing cattle in the High Plains rose relative to costs in other regions. The Tennessee grain system was less expensive than either the silage system or Corn Belt finishing costs. However, if the Tennessee grain ration were fed in the Corn Belt, the cost would be $117.21 per head when fuel prices were increased 200 percent. This is compared to a cost of $136.50 per head in Southwest Tennessee when fuel prices were increased

TABLE XXVI

ESTIMATED TOTAL RATION COSTS PLUS TRANSPORTATION CHARGES A COMPARISON OF COSTS PER HEAD AMONG THREE TENNESSEE LOCATIONS, THE CORN BELT, AND THE HIGH PLAINS GIVEN INCREASING FUEL PRICES

	Fed in Amarillo, Texas (High Plains)				Fed in Peoria, Illinois (Corn Belt)			
Percent Fuel Price Increase	Base	50	100	200	Base	50	100	200
				($)				
From:								
Columbia, Tennessee	178.	199.	221.	263.	142.	151.	159.	174.
Knoxville, Tennessee	182.	205.	227.	271.	143.	153.	160.	176.
Memphis, Tennessee	173.	194.	215.	257.	140.	149.	157.	172.

	Fed in Tennessee							
	Silage System				Grain System			
Percent Fuel Price Increase	Base	50	100	200	Base	50	100	200
				($)				
From:								
Columbia, Tennessee	155.	162.	168.	181.	119.	124.	130.	141.
Knoxville, Tennessee	164.	170.	176.	189.	128.	134.	139.	150.
Memphis, Tennessee	155.	161.	168.	180.	118.	124.	129.	140.

[a]Tennessee transportation rates within one hundred miles are $2.50 per head in the base period (see Chapter IV), $2.75 per head with a 50 percent fuel price increase, $3.00 and $3.50 per head with 100 and 200 percent price increases.

200 percent. When transportation charges and shrinkage losses from West Tennessee to the Corn Belt are included, West Tennessee has a six dollar advantage in cattle finishing costs over the Corn Belt given a 200 percent increase in fuel prices.[14]

No estimated increases in fuel prices for shipment of pricessed beef were calculated because the rates are controlled by the Interstate Commerce Commission. Since electricity is the major energy source used in packing plants, slaughter costs under projected fuel price increases were not estimated either.

A. OTHER CONSIDERATIONS

Cattle could probably be fed in certain areas of Tennessee at a lower cost than in the High Plains or the Corn Belt. This is shown in Tables XXIII and XXVI. However, several other factors should be considered before engaging in a cattle feeding enterprise in this state. One of the

---

[14]The transportation charge from Memphis to Peoria, Illinois would be $15.82 per head. Shrinkage losses for a seven hundred pound steer selling at $40.00 per hundred weight would be: 450 (miles from Memphis to Peoria) x .6% (See Chapter IV) = 2.7% shrinkage. 2.7% x 490. (cost of steer) = $13.23 (Shirnkage cost). The actual transportation cost is therefore $15.82+ $13.23 = $29.05. When this cost is added to the feeding cost in the Corn Belt ($117.21), the total cost is six dollars more than the cost of feeding a local steer in West Tennessee given price increases of 200%.

most important is the availability of corn. The cost of transporting corn plus marketing charges make it desirable for a farmer to have his own or a nearby supply of grain. The high conversion rate in fattening beef (over nine pounds of feed per pound of gain) maked transporting large amounts of corn to feed cattle more expensive than transferring feeder steers to corn surplus areas. Second, beef cattle would have to compete with poultry, hogs, and dairy cattle for the available corn supply. These animals convert corn into meat or milk more efficiently than does fattening beef and so would have an advantage in competing for limited corn supplies if beef prices did not reflect the lower conversion ratio.

Managerial ability and investment costs should also be considered in planning a cattle feeding operation. Although the grain diet is less expensive than the silage system, there is a higher possibility that under poor management conditions the cattle would go "off-feed" on a high grain diet.[15] This would result in little weight gain and serious financial losses. Appendix I shows the initial investment costs for a farmer feedlot. Even though a small farmer may minimize some of these costs by using existing facilities, many of the expenses such as paved floors and feeding equipment must still be assumed.

---

[15]"Off-feed" refers to a condition when fattening cattle refuse to eat the ration. It is caused primarily by a high level of carbohydrate in the diet.

B. CONCLUSIONS

This study has shown that there probably would be a surplus of feeder cattle in the state to meet the state beef consumption requirement. Currently most feeder cattle are sent out of state to be fattened in the Corn Belt or the High Plains. Transportation rates for cattle were $1.50 per loaded mile or about $28.00 per head on a trip between Knoxville and Amarillo, Texas. In addition to the actual transportation rate, shrinkage costs, which may amount to nine percent of the animal weight, must be considered in calculating the true cost of shipping feeder steers. When these costs are included, feeding cattle in parts of Tennessee (West, Middle and Lower East) becomes less expensive than feeding in the High Plains or the Corn Belt. In Tennessee, the grain system offers a lower cost ration than the silage system if corn supplies are available. Slaughter capacity in the state is probably sufficient to kill enough cattle to meet the state beef consumption requirement. Although Tennessee packing plants are smaller in capacity than facilities in other regions of the country, lower wage rates in the South may offset some of the cost advantage of large scale plants.

When projected fuel price increases are considered, the High Plains became more expensive as a cattle feeding location relative to the other regions. The current advantage of the High Plains, low operating costs per head, would be offset by increased feed cost caused by high fuel usage in crop production. The cost of feeding in the Corn Belt as a region increases relative to the cost of feeding in this state as fuel prices rise. Although true for the region, individual states such as Indiana and Iowa have lower fuel costs per bushel and may have slightly lower feeding costs relative to Tennessee as fuel prices increase. This slight advantage would be offset by the increased cost of shipping cattle plus shrinkage losses to the Corn Belt region. Although transportation rates go up with increased fuel costs, the increased feed ration prices would have more of an effect on the cost of fed beef production.

Individual cattle feeding operations in Tennessee could probably be successful at current fuel prices. Before any recommendations for the development of a cattle feedign industry in Tennessee were made, more research would be needed. This needed study should center around the availability and price of corn in different regions of the state. The effects of competing uses for corn and corn land, such as poultry, hogs, dairy cattle, and other crops should also be considered.

This study reaches no simple conclusions as to whether or not cattle should be fed in Tennessee. Several factors which determine the location of fed beef production are examined, both at current prices and projected prices given increasing petrochemical fuel costs. But the decision to develop a cattle feeding industry in this state is a complex question which requires consideration of several interrelated issues.

BIBLIOGRAPHY

BIBLIOGRAPHY

Anderson, J. M. and L. H. Keller. Beef Feeding Systems and Optimum Farm Organization. Tennessee Agricultural Experiment Station Bulletin 480. July 1971.

Association of American Railroads. Office of Information. Transportations Place in the Energy Picture. Washington, D. C., August 1979.

Baird, C. D. and R. C. Fluck, Agricultural Energetics. AVI Publishing Co., Westport, Connecticut, 1980.

Baker, A. J. Federally Inspected Livestock Slaughter by Size and Type of Plant. United States Department of Agriculture, Economics, Statistics and Cooperatives Service Bulletin 549, May 1976.

Barton, J.A. Transportation Fuel Requirements in the Food and Fiber System. United States Department of Agriculture, Economics, Statistics and Cooperatives Service, Agricultural Economics Report Number 444. January 1980.

Black, J. R. and Daniel Fox. Retaining Ownership of Calves from Birth to Slaughter. Paper presented at the Interregional Extension Industry Beef Cattle Seminar. Nashville, Tennessee, October 1974.

Capener, William. Transportation of Cattle in the West. University of Wyoming Agricultural Experiment Station Research Journal 25. January 1969.

Chicago Mercantile Exchange. Feeder Cattle and Beef Cattle Futures. Chicago. 1974.

Conway, R. K. and J. F. Yanagida. Impact of Rising Energy Prices on Livestock Prices and Production. Paper presented at the Southern Regional Agricultural Economics Association Meeting, Hot Springs, Arkansas. February, 1980.

Dietrich, Richard, Interregional Competition in Fed Beef. Texas Agricultural Experiment Station Bulletin 1115. September 1971.

Doering, O. C. Agriculture and Energy Use in the Year 2000. American Journal of Agricultural Economics, December 1977. pp. 1067-1078.

Durst, Ronald and John Kuehn. The Feasibility of Establishing Low Volume Beef Slaughtering and Processing Plants in West Virginia. Bulletin 666, West Virginia Agricultural Experiment Station. May 1979.

Farmer, Charles. Associate Professor Extension, Department of Agricultural Economics, University of Tennessee. Personal Communication. April 1980.

Gwinn, Bud. Tennesee Crop Reporting Service, Nashville Tennessee. Personal Communication. September 1979.

Ives, J. R. Livestock and Meat Economy of the United States. American Meat Institute, Ann Arbor, Michigan. 1966

Jamison, H. M. Professor Department of Animal Science Extention, University of Tennessee, Knoxville. Personal Communication. September 1979.

Kuehn, John. Changes in Meat Consumption and Expenditures for West Virginia 1973-1975. West Virginia Experiment Station Research Bulletin 655. March 1977.

Leuthold, Frank. Professor Department of Agricultural Economics and Rural Sociology. University of Tennessee, Knoxville. Personal Communication. January 1980.

Lockeretz, William editor. Agriculture and Energy. Proceedings of a Conference at Washington University, St. Louis, Missouri, June 1976. Academic Press, New York. 1977.

Malphrus, I. D. Cattle and Calf Movement in the South. Southern Cooperative Series Bulletin 134. March 1968.

Martin, Robert, Kenneth Nelson, Scott Querin. Least Cost Beef Production in the 1980s. Draft of an article appearing in Feedlot Management. July 1979.

McLaren, J. B. Professor Department of Animal Science, University of Tennessee, Knoxville. Personal Communication. September 1979.

McLemore, Daniel. Futures Market Basis Patterns for Tennessee Feeder Cattle and Slaughter. University of Tennessee Agricultural Experiment Station Bulletin 575. February 1978.

Meat Processing. "The Top One Hundred." October 1979 pp. 44-48.

Meat Processing. "Carcass Beef Down, Boxed Beef Up." July 1979. pp. 28-32.

Moore, Alvin. Tennessee Livestock Producers. Columbia, Tennessee. Personal Communication. July 1979.

National Research Council. Nutrient Requirements of Beef Cattle. Washington, D. C. 1970.

O'Mary, C. C. and Irwin Dyer. Commercial Beef Cattle Production. Lea and Febiger. Philadelphia. 1974.

Parsons, Joseph. Extension Dairy Specialist. University of Tennessee, Knoxville, Personal Communication. March 1980.

Pimental, D., L. E. Hurd, A. C. Bellotti, M. J. Forester, I. N. Oka, O. D. Sholes, and R. J. Whitman. "Food Production and the Energy Crisis." Science. Volume 182. November 1973. pp. 443-449

Raunikar, Robert. Editor. Food Demand and Consumption Behavior. Papers Presented by the S-119 Southern Regional Research Committee and the Farm Foundation. March 1977.

Raunikar, Robert. Summary of Food Purchases and Prices. University of Georgia Experiment Station Research Report 337. November 1979.

Rawls, E. L. et al. Alternatives After Backgrounding. University of Tennessee Agricultural Extionsion Service, Knoxvillé, July 1976.

Ray, Robert and Herbert Walch, Tennessee Farm Planning Manual. University of Tennessee Agricultural Extension Service. April 1978.

Romans, J. R. and P. T. Zieglar. The Meat We Eat. Interstate Publishing Company. Danville, Illinois. 1977

Schertz, L. P. Another Revolution in U. S. Farming? United States Department of Agriculture, Washington, D. C. 1979.

Simpson, James, L. Baldwin, and F. S. Baker. Investment and Operating Cost for Two Types and Three Sizes of Florida Feedlots. Draft for a bulletin of the Florida Agricultural Experiment Station, Institute of Food and Agricultural Sciences, University of Florida, February 1980.

Southwestern Public Service Commission. Fed Cattle Production. Amarillo Texas. March 1979.

Smith, Kirie. Unpublished Data. Amarillo Chamber of Commerce. January 1980.

Tennessee Crop Reporting Service. Tennessee Agricultural Statistics Annual Bulletin 1979. Nashville, Tennessee. 1979.

Tennessee Crop Reporting Service. Tennessee County Estimates: Cattle 1978-1979. Nashville, Tennessee. 1979.

Tennessee Crop Reporting Service. Tennessee Farm Facts. Nashville Tennessee. February 14, 1979.

Tennessee Department of Agriculture and University of Tennessee Agricultural Extension Service. Tennessee Market Prices. All issues from October 1977 through July 1979.

United States Department of Agriculture. Annual Crop Summary. Washington, D. C. 1979.

United States Department of Agriculture. Estimated United States and City Retail Prices of Food. Washington D. c. All issues from July 1972 - June 1974.

United States Department of Agriculture. Farm Index. Washington D. C. January - February 1979.

United States Department of Agriculture. Livestock and Meat Situation. Washington D. C. LMS 228. August 1979.

United States Department of Agriculture. National Food Review. Washington D. C. Winter 1980.

United States Department of Agriculture and the Federal Energy Commission. Energy and Agriculture: 1974 Data Base. Vol. I. FEA/D-76/459. September 1976.

United States Department of Commerce. United States Census of Agriculture 1974. Bureau of the Cenuss. Part Five Livestock and Poultry. Washington D. C. 1976.

United States Department of Labor. Consumer Expenditure Diary Survey, July 1972 - June 1974. Bureau of Labor Statistics Bulletin 1959. Washington D. C. 1977.

Van Arsdall, Robert, R. Gustafson and C. Gee. _U. S. Fed Beef Production Costs, 1976-1977 and Industry Structure_. United States Department of Agriculture, Agricultural Economic Report No. 424. June 1979.

Williams, Willard and Richard Dietrich. _An Interregional Analysis of the Fed Beef Economy_. USDA Economic Research Service Agricultural Economic Report 88. April 1966.

Williams, Willard and Joseph Malone. _Interregional Competition in Fed Beef_. Oklahoma State Experiment Station Bulletin P-473. March 1964.

Young, Kenneth and Joseph Coomer. _Effects of Natural Gas Price Increases on Texas High Plains Irrigation, 1976-2025_. United States Department of Agriculture, Economics, Statistics, and Cooperatives Service Agricultural Economic Report Number 448. February 1980.

APPENDICES

APPENDIX I

FEEDLOT INVESTMENT AND OPERATING COSTS, REPAIR CHARGES, AND SPECIFICATIONS.

AREA

50 steers x 40 square feet = 2000 sq. feet
50 feet width x 40 feet depth.

Facilities	Expected Life (Years)	Quantity	Unit Price ($)	Cost Per Head ($)	Initial Total Cost ($)
Feed bunks, Concrete with cable 24" width, 12" bunk space/head	15	50 ft	9.15/ft.	.61	457.5
Galvanized Corn bin, 2381 bu. capacity[b]	15	1		2.04	1530.4
Supplement Storage Bin, 3 ton capacity[b]	15	3 ton	208 ton	.83	625.0
Heating element for grain bin[a]	15	1		1.67	1250.0
Auger for transport of grain, .5 ton feed per hour (6" x 11')[b]	10	1		.40	200.0
Water trough, stainless steel[a]	15	1		.30	225.0
Water Pike (1 1/2) PVC & Connections for washdown[d]	10	300 ft.	29 ft.	.19	97.0
Paved floor, Includes labor, materials, and concrete. 26 cu. yds. (25 cu. yds. for cattle & adjacent 9'x 9'4'' area for manure storate).[abe]	20	26cu.yds.	39.32	1.02	1022.32 NR

Facilities	Expected Life (Years)	Quantity	Unit Price ($)	Cost Per Head ($)	Initial Total Cost ($)	
Excavation[a]		26cu.yds.	1.20	.03	31.20	NR
Land Charge 10%, $1000 per acre		.15 acre	150.0	.30	150.00	NR
Fence & gate barb wire, 3 strands Woven wire treated line and corner posts[c]	5	180 ft.		.56	139.40	
Security light[a]	2	1		.35	35.00	
Saran shade, installed, metal posts, 60 ft apart, 20 sq. ft. of shade/head.[a]	10	1000sq.ft.	1.75	3.50	1750.0	
Items found in <u>Farm Planning Manual</u> Loading chute Squeeze shute Salt & mineral feeder Sorting pen	20			1.40	1402.00	
TOTAL COST (GRAIN SYSTEM)				13.20	6463.20	
REPAIRS (GRAIN SYSTEM)				1.29	64.62	
THE SILAGE SYSTEM ALSO INCLUDES THE FOLLOWING FACILITIES:						
Trench silo, 130 ton capacity	20			1.59	1590.00	
Silage wagon (1/4 of value)	10			1.76	880.00	
Silage cover	1			.68	34.00	
TOTAL COST (SILAGE SYSTEM)				17.23	9031.82	
REPAIRS (SILAGE SYSTEM)				1.78	89.32	

[a]Calculated from Investment and Operating Costs for Two Types and Three Sizes of Florida Feedlots, J. Simpson, L. Baldwin, and F. Baker, University of Florida, January 1980. Appendix II, m.p.

[b]Knox County Farmers CO-OP. Personal Communication, April 1980.

[c]Fence costs are as follows: Barb wire, $18/1320 foot roll, Woven wire $60.00/330 feet. Treated line posts (every 12 feet) @ $3 = $36. Four corner posts @ $10.00 plus two for the gate = $60.00.

[d]Water pipe charge includes $10.00 for connections for washdown system. Enough pipe is provided to go from the well or the water system three hundred feet to the water trough.

[e]All items for which there was no repair charge considered are marked NR, otherwise repairs are calculated as 1% of new cost.

APPENDIX II

BTU CONVERSION FACTORS

FUEL	BRITISH THERMAL UNITS PER GALLON
Gasoline	124,000
Diesel Fuel	140,000
LP Gas	92,000
Natural Gas	1,067.5
Fuel Oil	138,500

Source: A Guide to Energy Savings for the Livestock Producer, United States Department of Agriculture and Federal Energy Administration. Washington, D. C. 1977. p. 78.

VITA

Charles D. Keiser was born in January 3, 1952 in Butler, Pennsylvania. He graduated from Butler Senior High School in 1970. He attended Utah State University in the fall of that year on a track scholarship. In June 1971, he entered the United States Army and spent two years overseas as a medical corpsman. After another year at Utah State, he served two years as a Peace Corps volunteer on Kapamarangi Atoll in the South Pacific. Mr. Keiser graduated cum laude from Utah State in June 1978 with a B. S. in International Agriculture.

In fall 1978 Mr. Keiser began a Master's program in Agricultural Economics at The University of Tennessee, Knoxville. He completed his studies in July 1980 and was employed as a farm manager in Changuinola, Panama by United Brands Corporation.

He is married to the former Marcianna Magadi of Kapamarangi Atoll. They have one child, Juanita.