An Economic Analysis of the United States Fed Beef Industry

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AN ECONOMIC ANALYSIS OF THE
UNITED STATES FED BEEF INDUSTRY

by

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SUMMARY AND IMPLICATIONS

This report presents the results of a regional and interregional analysis of the U.S. fed beef industry. A computerized model was used to estimate relations among important economic variables affecting the cattle feeding industry in nine regions of the U.S. Values of these variables are projected to 1975.

The number of cattle fed in the U.S. is projected to increase by 50 percent from 1968 to 1975, for an average annual growth rate of about 6 percent. The Pacific Northwest is estimated to increase its fed cattle marketings at a rate of about 6 percent per year. The greatest _percentage_ increase is expected in the Southern Plains: about 15 percent per year. The largest _absolute_ growth in fed cattle numbers is projected in the Northern Plains region: a rise of 4.2 million head from 1968 to 1975. The Corn Belt is expected to continue as the largest cattle feeding region--11.2 million head in 1975--but that area's annual growth rate of about 4 percent

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is lower than several other regions. Fed cattle marketings in the Arizona - California region are projected to grow at a rate of about 1.4 percent per year.

The nation's feeder cattle supply is not expected to grow as rapidly as fed cattle production. Consequently, it will be necessary to feed a larger proportion of all cattle suitable as feeders, rather than slaughter- ing them as nonfed beef or carrying them over in stocker operations. The Pacific Northwest feeder cattle supply will grow more slowly than cattle feeding in that region, reducing the number of feeder cattle shipped from the Pacific Northwest to other regions. The Southern Plains is projected to have the largest regional increase in feeder cattle supplies: one million head or a 17 percent increase from 1968 to 1975.

Beef cow numbers in the U.S. are projected to grow by about 3 percent per year to 1975. This increase is larger than estimated growth in feeder cattle supply, and may be too high. The Pacific Northwest growth rate is slightly above the national average: 3.1 percent annually. Corn Belt cow numbers are estimated to climb by 3.3 percent per year from 1968 to 1975.

Projections of total fed beef supplies are similar to fed cattle num- bers, with small deviations explained by changes in carcass weights. U.S. produced nonfed beef supply is projected to grow by 1.3 billion pounds (2 percent per year) from 1968 to 1975.

Average U.S. fed cattle prices are projected to rise by about 2.5 per- cent from 1968 to 1975. No significant changes in fed cattle prices are projected for the Pacific Northwest. However, Pacific Northwest feeder

cattle prices are estimated to rise at a rate of 2.1 percent per year from 1968 to 1975, as the demand for feeder cattle continues to expand. Wholesale U.S. beef prices are projected to move parallel to fed cattle prices, with a 2.1 percent increase in the former from 1968 to 1975. Wholesale beef prices are expected to drop slightly in the Pacific Northwest, bringing wholesale-feedlot margins more closely in line with other regions.

Feed grain prices were increased to assess the impact of a possible corn crop decline on the above projections. Corn prices were increased by 20 percent, and other feed grain prices were raised by 15 percent over normal expectations. The projected number of cattle fed in 1975 declined by about 1 percent for the entire U.S. Regional fed cattle estimates declined where corn was the primary feed grain, and increased in regions where other feed grains were more important. An exception was the Southern Plains, which showed no significant change in numbers of cattle fed as a result of the grain price increases. The model's other variables did not change as much as cattle feeding levels in response to higher feed grain prices. If the lower prices experienced for corn and other feed grains after the record 1971 harvest had been fed into the model, the variables would be expected to change in the opposite directions.

Interregional shipments of fed beef were also estimated for 1968 and projected for 1975. The 1968 analysis showed three regions deficit in fed beef: the Eastern U.S., California-Arizona, and Utah-Nevada.[1] To meet

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[1] Although Oregon and Washington were both fed beef deficit states in 1968, Idaho's surplus resulted in a net surplus for the three-state region.

California's deficit, fed beef was shipped from three regions: the Pacific
Northwest, Montana-Wyoming, and Colorado. Colorado and the Pacific North-
west both shipped fed beef to the Utah-Nevada region to meet its deficit.
All surplus-producing regions except the Pacific Northwest shipped fed beef
to the Eastern U.S., according to the model's estimates for 1968.

Regional projections of cattle feeding and live and carcass prices
from the first computerized analysis were used to estimate interregional fed
beef shipments in 1975. The same three regions (Eastern U.S., California-
Arizona, and Utah-Nevada) were fed beef deficit in 1975. California was pro-
jected to receive beef from four regions: Colorado, Pacific Northwest,
Southern Plains, and Corn Belt. The Southern Plains and Montana-Wyoming re-
gions are estimated to ship fed beef to Utah-Nevada in 1975. The Eastern
states' fed beef requirements would be met by shipments from the Northern
Plains, the Southern Plains, and the Corn Belt regions, according to the
results of the analysis.

Almost 10 billion pounds of fed beef is projected to enter interregional
trade in 1975, compared with an estimated 5.9 billion pounds traded in 1968.
Virtually all fed beef will move between regions in carcass form via trucks,
according to our 1975 estimates.

Implications for the Pacific Northwest Beef Industry

This analysis indicates that the fed beef industry will continue a sub-
stantial growth rate in both the U.S. and the Pacific Northwest through 1975.
These findings have implications for several industry sectors.

Cattle Feeders and Meat Processors

Pacific Northwest fed cattle marketings are expected to grow slightly faster during the first half of the 1970's (6.3 percent per year) than they did in the 1960's (5.7 percent per year). Competition will remain keen within the region and from other regions for a supply of feeder cattle that will increase more slowly than fed cattle marketings. Consequently, increased feeder cattle prices are expected. Fed beef prices (both live and carcass) are not expected to increase substantially from now until 1975. Therefore, maintaining or increasing cattle feeding profits will require lower costs per pound of gain in the feedlot. Lower feed grain prices (both absolutely and relative to other regions) hold considerable potential for decreasing feedlot costs. Since competition from California for Northwest-produced feed grains now appears to be increasing, increased feed grain production will be necessary to keep Pacific Northwest beef feeders competitive. Lower nonfeed costs of fattening cattle are another potential area for cost reduction. The establishment of more feedlots of economically optimal sizes will help keep the Pacific Northwest competitive with other regions in cattle feeding.

Markets for Pacific Northwest fed beef in 1975 are projected to include consumers within this region and shipments to California. Since most of the movement will be in the form of carcasses, it will be necessary to maintain an efficient, competitive meat packing and processing industry in the Pacific Northwest. Otherwise, these projected fed beef sales in California could be lost to other regions.

Feeder Cattle Producers

This study's projections for 1975 indicate the demand for Pacific Northwest feeder cattle will continue to expand from within the region and from other regions. As a result, feeder cattle prices are expected to strengthen from 1968 to 1975. The supply of feeder cattle in the Pacific Northwest is also expected to grow by about 13 percent during this seven-year period. Thus, the 1970's appear to be a relatively favorable period for feeder cattle producers. The major challenge facing this sector of the industry will be to develop efficient feeder cattle production units. Ranches will need to be economically viable with feeder cattle prices about 15 percent above 1968 levels, which are near the price levels prevailing in 1971. Increasing cattle feeding activity will provide Pacific Northwest producers with more opportunities to have their own cattle custom fed, when that is an economically attractive alternative.

Consumers

Based on the projections made in this study, U.S. consumers can expect an expanding supply of fed beef at prices only slightly (about 2 percent) above 1968 levels in 1975.[2] This conclusion is based upon our projections of wholesale and fed beef prices, assuming no significant changes in whole-sale-retail marketing margins for fed beef. Thus, it appears that fed beef will be available in quantities and at prices which should allow it to remain an important part of the American consumer's diet.

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[2] This estimate implies that consumer demand for fed beef will grow slightly faster than fed beef supply.

The reader undoubtedly will draw additional conclusions and implications of his own as he reads the remainder of this report.

INTRODUCTION

The beef cattle feeding industry in the United States has undergone a tremendous expansion since World War II. The total number of fed cattle marketed increased from about 13 million head in 1960 to 23 million head in 1968, an increase of about 75 percent during this nine-year period. The North Central (Corn Belt) region has been and is still the leading cattle feeding area of the nation. The 8 million head fed in this 12-state region in 1960 constituted about 64 percent of the nation's total production that year. In 1968 this region fed about 14 million cattle, accounting for 62 percent of the U.S. total. Historically most of the cattle feeding in the North Central region has been done by relatively small farmer-feeders.

Cattle feeding activity increased very rapidly in the Southern Plains (Oklahoma, Texas, New Mexico) during the 1960's. These states made the largest proportionate gain of any region during the 1960-68 period. Cattle fed in Texas feedlots increased from 477,000 head in 1960 to 1,970,000 head in 1968, an increase of more than 400 percent.

The Pacific Northwest (Oregon, Washington, Idaho) also showed an increase in cattle feeding during the 1960's, but its relative share of total U.S. output declined slightly (from 4.25 percent to 4 percent). This region experienced a 67 percent increase in fed cattle marketings during the decade,

with the three individual states showing the following percentage growth:
Idaho, 88 percent; Washington, 58 percent; and Oregon, 40 percent.

The state of California fed about 12 percent of the U.S. total in
1960, but in 1968 it accounted for less than 9 percent of all fed cattle
marketings. Wyoming, Utah, and North Dakota showed a decline in relative
as well as absolute numbers of cattle fed.

On the demand side, national per capita consumption of fed beef in-
creased from 45.5 pounds in 1960 to 71.3 pounds in 1968, an increase of
56 percent. Per capita consumption also varies among regions. The Cal-
ifornia-Arizona region was estimated to have the highest per capita consump-
tion (85.5 pounds) in 1968, while the lowest consumption per person (62 pounds)
was found in the Texas-Oklahoma-New Mexico area. Also, there have been dif-
ferential rates of population growth in different areas of the nation,
changing total demand levels for fed beef in most regions.

The differential growth of demand for fed beef, along with differential
increases in supply, have affected the activities of various components of
the fed beef industry. The production, marketing, slaughtering, processing,
distribution, and consumption of fed beef have all been affected. Since
production and consumption levels differ within regions, fed beef shipments
among regions become necessary to equalize supply and demand.

Information on economic relations among various sectors of the fed beef
economy and among geographic regions is germaine to a wide range of industry

decision-makers. Cattle feeders are interested in relative prices and costs of inputs they buy and products they sell because these factors determine their economic viability and profitability. Long-range trends and projections of numbers of cattle fed and feeding margins provide the cattle feeder with valuable planning information. Decisions on rates of feedlot expansion, sources of feeder cattle and feed supplies, and marketing alternatives can be aided by this information.

Products tend to bring the lowest prices in areas where they are in surplus (where supply exceeds demand). For example, in Oregon, where more feeder cattle are produced than are fed, ranchers historically have received lower prices for their feeders than in areas where cattle are fed on a larger scale (the Midwest, Colorado, California, etc.). Therefore, feeder cattle producers are concerned about the competitive position of cattle feeding in their marketing area, since it affects the prices they can expect to receive for their cattle. Custom feedlots create a marketing alternative for feeder cattle producers--retaining ownership of their cattle through the feeding process--that may be economically attractive under certain conditions.

The size and location of beef packing plants are now influenced more by the availability of a dependable (fed and nonfed) cattle supply than by any other single factor. Therefore, decision-makers in the meat processing industry are vitally interested in the number, location, and size of viable feedlots.

Other industry participants who can utilize information on levels of cattle feeding and interregional competition include financial institutions, feed producers and processors, and meat marketing institutions. Consumers also have a stake (and a steak) in the industry. An efficient, well-organized fed beef economy will supply high-quality products to them at economical prices, resulting in a high level of consumer satisfaction.

The purpose of this report is to provide information on factors affecting regional production, consumption, and interregional flows of fed beef. More specifically, the report describes relationships among economically important variables in the U.S. beef cattle industry; projects cattle feeding levels by regions to 1975; and provides a framework for explaining the shipment of fed beef among surplus-producing and deficit-producing regions.

METHODS OF ANALYSIS[3]

Regional Demarcation

One of the first steps necessary in conducting an interregional analysis is to specify the geographical regions to be studied. A wide range of criteria can be used to partition the U.S. into regions. Two very practical considerations in making this decision are the availablity of data for given geographical areas, and the availability of resources to conduct the study

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[3] For a more detailed and technical treatment of the information contained in the remainder of this report, see "An Economic Analysis of Cattle Feeding and Interregional Flows of Live and Carcass Beef," by Gobind S. Bhagia, Ph.D. dissertation, Oregon State University, Department of Agricultural Economics, June 1971.

(the greater the number of regions analyzed, the higher the cost). In addition to these factors, two other criteria were weighted heavily in partitioning the U.S. into regions:

(1) homogeneity of cattle production: An attempt was made to specify areas where cattle production costs, technology, and types of inputs were comparable throughout the geographical region.

(2) primary emphasis on the Western States: We were most interested in developing detailed analysis and research results for the western U.S., since this is the location and immediate competitive area of our industry clienteles. At the same time, those regions outside the West which are expected to compete for western markets and inputs were defined on the basis of (1).

The nine regions demarcated for the purposes of this study are:

Region 1 - California and Arizona

Region 2 - Pacific Northwest States (Oregon, Washington, and Idaho)

Region 3 - Montana and Wyoming

Region 4 - Colorado

Region 5 - Nevada and Utah

Region 6 - Northern Plains States (North Dakota, South Dakota, Nebraska, and Kansas)

Region 7 - Southern Plains States (Texas, Oklahoma, and New Mexico)

Region 8 - Corn Belt States (Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, and Ohio)

Region 9 - Remainder of the continental U.S. (23 states)

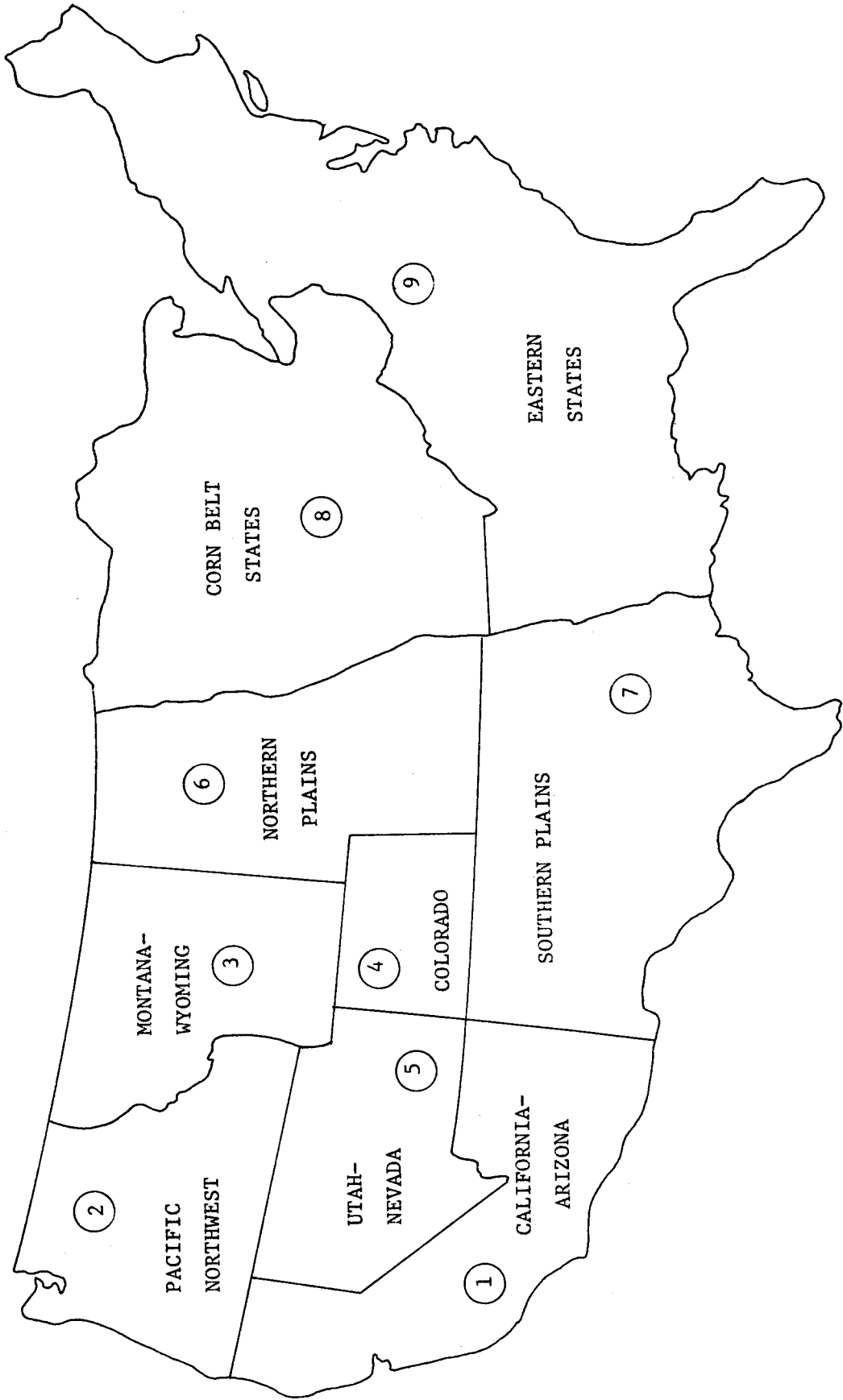Figure 1 outlines the geographical configuration of these regions.

Figure 1. Regional Demarcation of the United States

Relations Among Industry Variables

A primary objective of this study is to explain and project levels
of cattle feeding (and related variables) in each of the nine regions
identified above. The relationships among a number of physical and econ-
omic variables form a complex model that depicts the industry. To aid
the reader in understanding this model, a flow diagram is presented as
Figure 2. The variables in rectangles are the ones whose values are
considered as given for the purposes of this study, and as such they
are not determined in the analysis. The variables in circles are those
whose values are calculated in the analysis. The arrows show the direct-
ion of influence among variables.

The superscript above a variable refers to the region or area under
consideration: i refers to the individual region, N refers to a national
value, C refers to a Chicago figure, and K refers to a Kansas City figure.
The subscript below a variable denotes a one-year time period: for ex-
ample, if t stands for 1968, t+1 is 1969, t-1 is 1967, and t-2 is 1966.

The units of measurement and a description of the variables are given
in Table 1. The various components of the model are described in more
detail below.

NUMBER OF CATTLE FED

The number of cattle fed in a region during a year is a function of
three variables: profits made by feedlot operators from cattle feeding
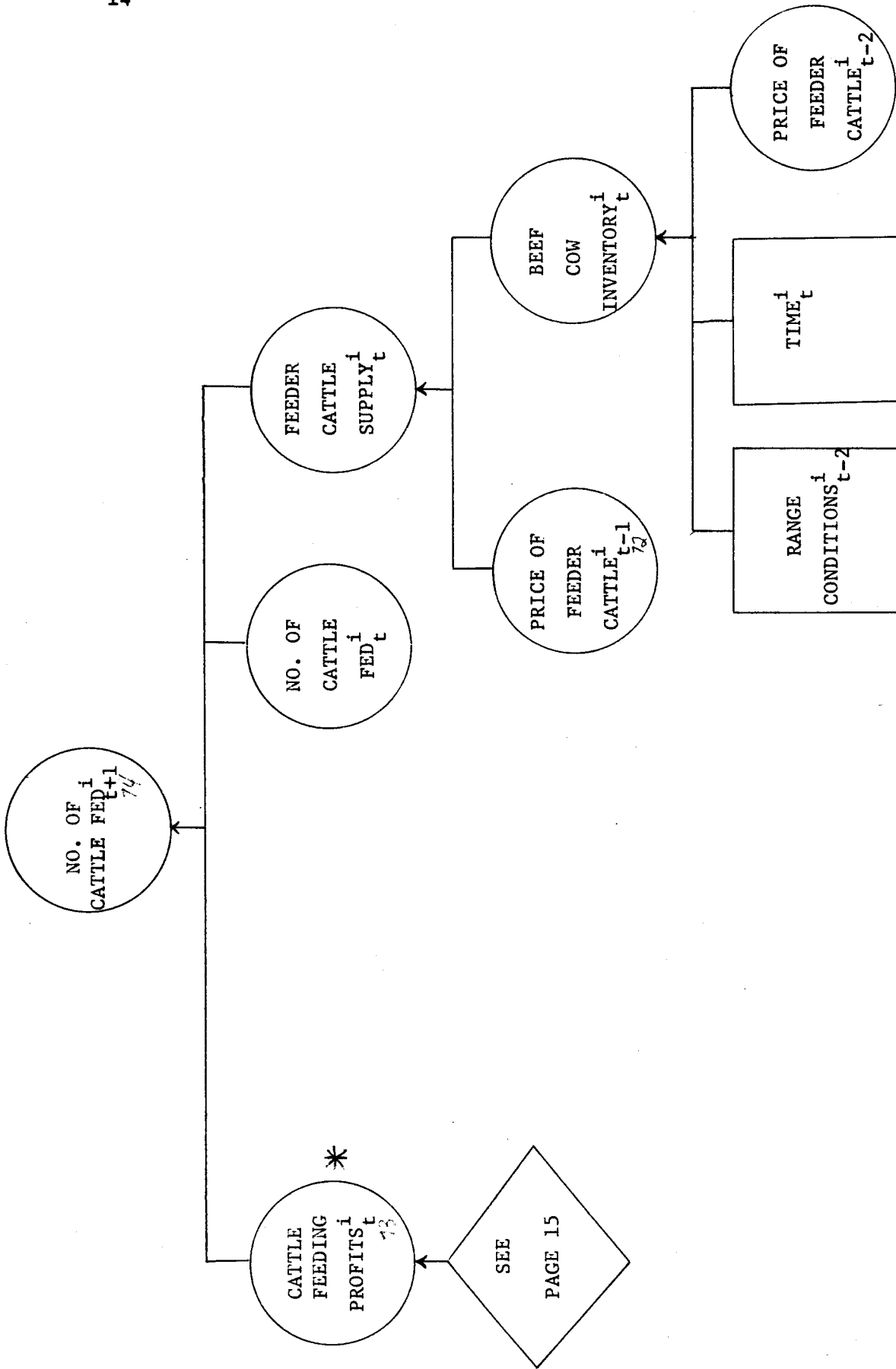
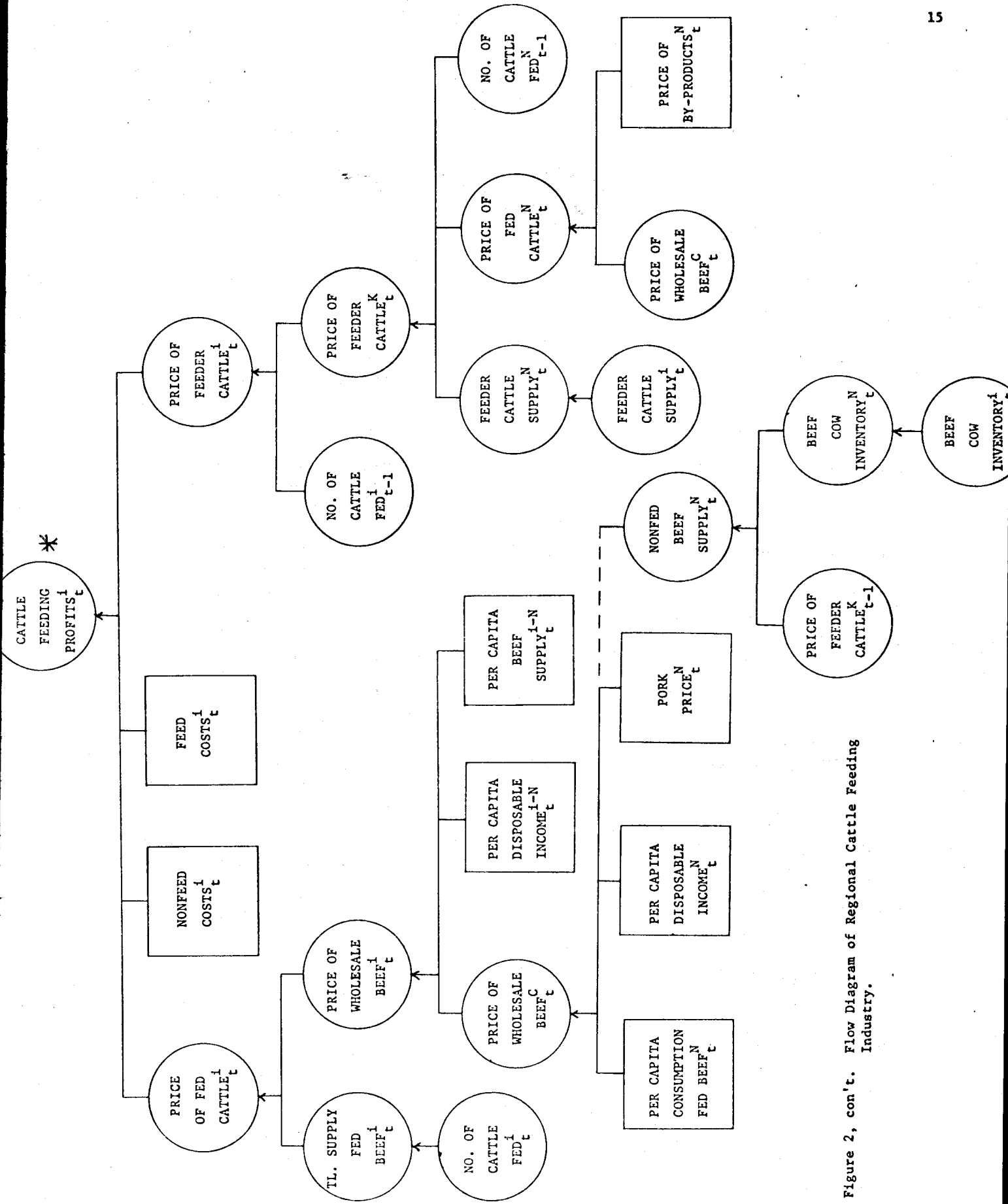Figure 2. Flow Diagram of Regional Cattle Feeding Industry

Figure 2, con't. Flow Diagram of Regional Cattle Feeding Industry.

Table 1. Description of Variables, Beef Industry Model (Figure 2)

Variable	Unit of Measurement	Description
NO. OF CATTLE FED	head	Number of fed cattle marketed from feedlots
CATTLE FEEDING PROFITS	dollars	Feedlot profits per steer fed
FEEDER CATTLE SUPPLY	head	Number of feeder cattle available to be fed (80 percent of calves born)
PRICE OF FEEDER CATTLE	dollars	Price per cwt., choice steers, 500-800 pounds, relevant market
BEEF COW INVENTORY	head	Cows, 2 years and older (other than kept for milk) on farms, January 1
RANGE CONDITIONS	percent	Range conditions in a given region for a given year
TIME	number	A trend variable (1959 = 1, 1960 = 2, ...)
PRICE OF FED CATTLE	dollars	Price per cwt., choice steers, 900-1,100 pounds, relevant market
NONFEED COSTS	dollars	Nonfeed costs for 425 pounds of gain in the feedlot
FEED COSTS	dollars	Feed costs for 425 pounds of gain in the feedlot
TOTAL SUPPLY FED BEEF	1,000 pounds	Total quantity of fed beef produced (carcass weight)
PRICE OF WHOLESALE BEEF	dollars	Price per cwt. of wholesale carcass beef.
PER CAPITA DISPOSABLE INCOME	dollars	Disposable income per capita, regional or national

(Continued following page)

Table 1. Description of Variables, Beef Industry Model (Figure 2)
(Continued)

Variable	Unit of Measurement	Description
PER CAPITA BEEF SUPPLY	pounds	Total beef supply per capita, regional or national
PER CAPITA CONSUMPTION FED BEEF	pounds	National per capita consumption of fed beef
PORK PRICE	dollars	Pork price per cwt., Chicago
NONFED BEEF SUPPLY	1,000 pounds	National supply of nonfed beef
PRICE OF BY-PRODUCTS	dollars	National price per cwt., by-products

during the previous year, supply of feeder cattle in that region during the previous year, and the number of cattle fed in that region the previous year. A one-year lag was introduced for profits because feedlot operators are expected to adjust their operations as a result of the profits they expect to earn "this year," and the main basis for their expectations are the profits they earned "last year." Feeder cattle supply is lagged one year because it takes that long for "calves born" to become available as 500-800 pound feeders. A one-year lag in cattle fed introduces both a trend factor and a constraint on the growth of cattle feeding, which should result in more reasonable projections.

CATTLE FEEDING PROFITS

Feedlot profits per head of cattle fed are calculated as the price received by the feedlot operator for the fed cattle he sells minus the price paid for feeder cattle and feed and nonfeed costs of fattening the feeder steer. It is assumed in this study that a feeder steer is purchased when it weighs 600 pounds and is fed until it weighs 1,025 pounds. As a result, feed costs and nonfeed costs are calculated for a feedlot gain of 425 pounds per head. The variables which determine the prices in feeder cattle and fed cattle markets are discussed below.

PRICE OF FEEDER CATTLE

The price of feeder cattle in a region is estimated by the number of cattle fed in the previous time period and the national price of feeder

cattle, based on the Kansas City market. Three variables determine prices of feeder cattle in the national market: (1) the total supply of feeder cattle in the United States (the sum of feeder cattle supplies in the various regions); (2) price of fed cattle in the national market; and (3) the number of cattle fed in the U.S. in the previous time period.

PRICE OF FED CATTLE

The price of fed cattle marketed in a region is estimated from the total supply of fed beef produced in the region and the regional price of wholesale beef. The regional supply of fed beef is calculated from the number of cattle fed in the region. The national fed cattle price (used to estimate national and regional feeder cattle prices) is derived by using national (Chicago) wholesale beef prices and prices of by-products.

PRICE OF WHOLESALE BEEF

Price of wholesale beef in a region is determined by the national (Chicago) price of wholesale beef; the difference between regional and national beef supply per capita disposable income; and the difference between regional and national beef supply per capita. The national price of wholesale beef is estimated by three variables: per capita consumption of fed beef in the nation; U.S. per capita disposable income; and the national pork price.

FEEDER CATTLE SUPPLY

The supply of feeder cattle in a region is determined from cow inventories in the region in the same year and the market price of feeder cattle in the region one year previously. This relationship was so constructed

because feeder cattle producers are expected to base this year's marketing decisions on last year's prices, the most recent information available to them.

BEEF COW INVENTORY AND NONFED BEEF SUPPLY

Regional beef cow inventory is estimated as a function of range conditions two years before, a trend variable, and feeder cattle prices two years previously. The two-year lags are used because that is the approximate time period between a producer's decision to expand his herd by raising heifers and these heifers' maturity to calf-bearing cows. National beef cow inventory (a summation of the regional values) and national feeder cattle prices lagged one year are used to estimate domestically-produced nonfed beef supplies.

Data Collection and Interpretation

Historical information on many of the model variables was available from publications from the Statistical Reporting Service, U.S.D.A. In some instances it was necessary to revise the raw data to fit the model's requirements.

The individual feedlot's cost structure depends on numerous variables, including type of feeding rations, costs of feed ingredients, type of feed mill utilized, capital investment, and labor costs. Feedlot costs can be divided into two categories: feed costs and nonfeed costs. Feed costs are a function of the prices and proportions of grain, supplements, roughages, and by-products in the feeding ration. Nonfeed costs are all other costs incurred

in cattle feeding: wages and salaries, taxes, interest, insurance, repairs, depreciation, veterinary expense, etc.

Nonfeed costs were obtained from various states' Agricultural Experiment Station bulletins. Since the reported costs were not all for the same year, these data were updated by using national indices for four categories: production items, labor wage rates, interest on capital, and taxes payable.

Feed costs vary among regions due to differences in feed ingredients, prices of ingredients, and sizes of feedlots. The type of ration fed to cattle differs from region to region. Corn is the most widely-used grain in U.S. cattle feeding. In the Northern Plains and the Corn Belt regions, corn accounts for more than one-half of the total feed costs. Sorghum grains are the main feed ingredient in the Southern Plains region (Texas-Oklahoma-New Mexico), accounting for about 70 percent of feed costs in that region. Barley is the most important feed grain in the Mountain region and the Pacific Northwest. Another important item in feedlot rations is corn silage.

Using feedlot rations for different states compiled in a Southern regional study and applying prices of the inputs in each state, feed costs were calculated for a "representative"[4] feedlot in each region. Table 2 compares the per head feed costs of 425 pounds of feedlot gain in each region in 1965. These costs vary (both absolutely and relatively) from year to year as the costs of feed ingredients change.

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[4] Refers to a typical feedlot size and feeding program in each region.

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Table 2. Feed Costs Per Head for 425 Pounds of Feedlot Gain, Beef
Cattle, by Region, 1965

Region	Feed Costs (dollars)
California-Arizona	97.00
Pacific Northwest	78.20
Montana-Wyoming	72.03
Colorado	86.27
Utah-Nevada	80.91
Northern Plains	77.57
Southern Plains	64.99
Corn Belt	79.00
Eastern U.S.	64.19

Since reliable price series are not kept for feeder cattle and fed
cattle at the state and regional levels, it was necessary to specify cer-
tain livestock markets as representative of prices in each region. While
discounts and premiums exist at locations removed from these markets, this
approach seems reasonable. The following markets' feeder and fed cattle
price reports are used to represent the regions:

Region	Market(s)
California-Arizona	Los Angeles (California) Phoenix (Arizona)
Pacific Northwest	Portland (Oregon)
Montana-Wyoming	Billings (Montana)
Colorado	Denver (Colorado)
Utah-Nevada	Ogden (Utah)

Region	Market(s)
Northern Plains	Omaha (Nebraska)
Southern Plains	Amarillo (Texas), Oklahoma City (Oklahoma), Clovis (New Mexico)
Corn Belt	St. Paul (Minnesota), Kansas City (Missouri), Indianapolis (Indiana), Sioux City (Iowa)
Eastern U.S.	Nashville (Tennessee), Thomasville (Georgia), Baltimore (Maryland)

Where more than one market is used to represent prices in a region, a simple average price was calculated for the (two to four) market prices.

Where national prices are needed in the analysis, Kansas City prices were utilized for fed cattle and feeder cattle, and Chicago market prices were used for wholesale fed (carcass) beef. Chicago also represents the national pork price in the model. Since hides represent about 34 percent of the value of beef slaughter by-products, Chicago hide prices were used as a proxy for national by-product prices.

RESULTS OF THE ANALYSIS

The complex relations among industry variables are evident in Figure 2. Since one of these models must be quantified for each region, the solution and verification of the system by hand would be a formidable task. Its computational speed and potential for programmed logic make the computer a valuable research tool for analyzing such a model. First, the behavioral relationships among the system's variables were estimated. Data for the 1956-67 period were utilized to estimate these relations. The statistical

significance of the relations was also tested.[5/] Then these individual

relations (equations) were ordered to form a computerized simulation

model. Initial conditions were fed into the model. Results from the

first year's run (iteration) became input for the next year's run.

Operating rules were introduced into the system to minimize error build-

up through time, and to improve the model's estimates. That is, limits

were imposed on certain variables in order to improve early-period esti-

mates, thereby minimizing the compounding of estimation errors.[6/]

<div align="center">PROJECTIONS TO 1975</div>

The values of those variables determined by the model were projected

for 1975. Table 3 summarizes those projections, and the following sections

discuss the important variables.

NUMBER OF CATTLE FED

The total number of cattle fed in the U.S. is projected to increase

from about 23 million head in 1968 to almost 35 million head in 1975, an

average annual growth rate of about 6 percent. Although the estimated

number of cattle fed showed an increase in each of the nine regions, this

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[5/] For an explanation of the technical coefficients and their statistical significance, see Bhagia, Gobind S., "An Economic Analysis of Cattle Feeding and Interregional Flows of Live and Carcass Beef," Ph.D. dissertation, Oregon State University, Department of Agricultural Economics, June 1971.

[6/] For a more detailed discussion of the nature and use of these rules, see Bhagia, Gobind S., ibid.

Table 3. The Estimated Values of Selected Economic Variables, U.S. Beef Industry, 1968 and 1975, and Percent Changes during 1968-75

VARIABLE	PERIOD	REGION									
		California-Arizona	Pacific Northwest	Montana-Wyoming	Colorado	Utah-Nevada	Northern Plains	Southern Plains	Corn Belt	Eastern U.S.	National
NO. OF CATTLE FED (1,000 head)	1968	2,907	903	236	1,476	172	6,066	2,071	8,525	684	22,946
	1975	3,191	1,384	261	2,208	181	10,291	5,510	11,246	709	34,871
	% change 1968-75	9.74	53.26	10.41	49.57	5.68	69.64	166.0	32.09	3.69	51.96
	Yearly % change	1.35	6.30	1.45	5.90	0.70	7.85	15.00	4.05	0.50	6.15
FEEDER CATTLE SUPPLY (1,000 head)	1968	1,659	1,581	1,685	844	503	5,662	6,317	8,484	9,457	36,192
	1975	1,755	1,785	1,956	978	534	6,450	7,396	8,023	9,521	38,402
	% change 1968-75	5.79	12.95	16.03	15.91	6.12	13.91	17.07	-5.44	0.67	6.10
	Yearly % change	0.80	1.75	2.15	2.15	0.85	1.85	2.30	-0.80	0.09	0.85
BEEF COW INVENTORY (1,000 head)	1968	1,431	1,657	2,194	998	616	6,465	8,523	5,564	8,853	36,301
	1975	1,583	2,053	2,571	1,196	664	7,948	10,644	6,999	10,862	44,525
	% change 1968-75	10.63	23.90	17.18	19.75	7.84	22.93	24.88	25.80	22.69	22.65
	Yearly % change	1.45	3.10	2.30	2.60	1.10	3.00	3.20	3.30	2.95	2.95

Table 3. Continued

| VARIABLE | PERIOD | REGION | | | | | | | | | |
		California-Arizona	Pacific Northwest	Montana-Wyoming	Colorado	Utah-Nevada	Northern Plains	Southern Plains	Corn Belt	Eastern U.S.	National
TL. SUPPLY FED BEEF (1,000 pounds)	1968	1,260,995	360,647	106,869	708,393	76,410	2,911,326	930,410	3,516,697	273,989	10,145,736
	1975	1,391,403	586,100	118,918	1,067,343	80,782	4,980,931	2,490,991	4,430,122	280,543	15,427,130
	% change 1968-75	11.03	62.51	11.27	52.39	5.72	71.08	167.73	25.97	2.39	53.56
	Yearly % change	1.40	7.20	1.55	6.00	0.80	8.00	15.10	3.35	0.30	6.20
PRICE OF FED CATTLE (dollars)	1968	26.24	26.05	21.37	27.04	27.18	27.04	26.49	27.79	25.59	27.02
	1975	26.83	26.07	19.76	27.93	28.50	28.81	28.71	27.78	25.38	27.69
	% change 1968-75	2.2	0	-7.5	3.3	4.7	6.6	8.3	0	-0.7	2.47
	Yearly % change	0.30	0	-1.05	0.50	0.65	0.90	1.15	0	-0.10	0.35
PRICE OF FEEDER CATTLE (dollars)	1968	25.46	26.76	26.96	27.42	26.69	28.56	26.51	27.52	24.73	26.89
	1975	28.82	30.91	30.91	30.21	30.93	32.17	29.59	30.54	28.03	31.01
	% change 1968-75	13.30	15.7	14.0	10.2	16.1	12.0	11.0	10.9	13.3	15.32
	Yearly % change	1.80	2.10	1.90	1.40	2.10	1.70	1.60	1.50	1.80	2.10

Table 3. Continued

VARIABLE	PERIOD	REGION									
		California-Arizona	Pacific Northwest	Montana-Wyoming	Colorado	Utah-Nevada	Northern Plains	Southern Plains	Corn Belt	Eastern U.S.	National
PRICE OF WHOLESALE BEEF (dollars)	1968	44.64	42.25	35.70	41.48	43.41	41.41	41.40	43.18	43.07	45.17
	1975	44.99	41.46	32.83	41.10	45.20	41.61	40.13	41.78	42.68	46.12
	% change 1968-75	0.7	-1.8	-8.0	-0.9	4.1	0.48	-3.0	-3.24	-0.90	2.10
	Yearly % change	0.10	-0.25	-1.10	-0.10	0.6	0.05	-0.45	-0.50	-0.10	0.30
NONFED BEEF SUPPLY (1,000 pounds)	1968										8,623,057
	1975										9,891,412
	% change 1968-75										14.70
	Yearly % change										2.00

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growth was not divided equally among all regions. The Pacific Northwest region is projected to increase its fed cattle marketings by an average of 6.3 percent per year from 1968 to 1975 (in absolute terms, from 903,000 head in 1968 to 1,384,000 head in 1975). This projected growth rate is slightly higher than the 5.3 percent annual growth rate in this region from 1960 to 1970.

The California-Arizona region's fed cattle marketings are expected to grow by about 10 percent from 1968 to 1975, or at a yearly rate of about 1.4 percent. Montana-Wyoming's growth rate is similar: 1.5 percent annually, resulting in a 25,000-head increase from 1968 to 1975. Colorado's fed cattle growth rate is projected as slightly below the Pacific Northwest: about 6 percent per annum. However, in absolute terms this increase is about 730,000 head over the seven-year period in Colorado. Utah-Nevada's seven-year growth is estimated at about 6 percent (9,000 head).

The Northern Plains region is projected to show the greatest absolute growth in numbers of cattle fed: about 4.2 million head. This increase amounts to about 8 percent per year from 1968 to 1975. Fed cattle marketings in the Southern Plains states are estimated at 5.5 million head in 1975, an increase of 3.4 million head over 1968. That region's percentage increase is projected as the highest of any region: about 15 percent per year.

The Corn Belt states fed the most cattle of any region in 1968, and this situation is expected to continue in 1975, when fed cattle marketings are projected at 11.2 million head. The Northern Plains region is expected

to be only one million head behind the Corn Belt region by 1975, however. A yearly growth rate of 4 percent is projected for the Corn Belt. Combined, the Northern Plains and Corn Belt regions are projected to feed nearly 22 million head, or about 62 percent of the U.S. total, in 1975.

The 23 states comprising the Eastern U.S. region are estimated to continue their relatively small numbers of cattle fed, with a projected growth rate of 0.5 percent per year resulting in about 709,000 head fed in 1975. This is the smallest percentage increase of any region.

FEEDER CATTLE SUPPLY

While the projected U.S. fed cattle marketings are increasing by 12 million head from 1968 to 1975, the supply of cattle available for feeding is estimated to rise by 2.2 million head: from 36.2 million to 38.4 million. Consequently, the percentage of feeder cattle available which are actually fed must rise to about 90 percent in 1975 (from about 63 percent in 1968). This change will occur as a result of (1) fewer calves being slaughtered and (2) more calves going directly into feedlots after weaning rather than into stocker and feeder operations, to be fed as yearlings. Both of these trends are now evident in the industry.

Feeder cattle numbers are projected to increase by 200,000 head (13 percent) in the Pacific Northwest from 1968 to 1975. With a 57 percent increase in numbers of cattle fed, the surplus of feeder cattle produced in this region (relative to cattle fed) will decline. However, Table 3 still shows a projected 500,000-head feeder cattle surplus in the Pacific Northwest in 1975.

Feeder cattle supplies are expected to increase in all other regions except the Corn Belt, where a 5.4 percent decrease is projected for the seven-year period. The Southern Plains show the largest absolute and percentage increases (1 million head and 17 percent) in feeder cattle supplies. Montana-Wyoming and Colorado's increases are projected at about 16 percent, while in the Northern Plains feeder cattle numbers are expected to increase by about 800,000 head. Feeder cattle supplies in the Eastern U.S. are projected to be fairly stable through 1975.

BEEF COW INVENTORY

Numbers of beef cows on farms January 1 were projected to increase by 23 percent in the U.S. from 1968 to 1975. The model's estimate is probably too high here, since U.S. feeder cattle numbers are projected to increase by only 6 percent. A 3 percent annual growth rate would probably be difficult to achieve over this seven-year period. The Pacific Northwest's beef cow inventory is projected to expand by 3.1 percent per year, slightly above the national average. Other regions with high-growth projections in beef cow numbers are the Corn Belt (3.3 percent), the Southern Plains (3.2 percent), and the Eastern U.S. (3.0 percent). At the low end of the cow inventory projections were Utah-Nevada with an annual increase of 1.1 percent and California-Arizona at 1.5 percent.

TOTAL SUPPLY FED BEEF

Projections of total quantities of fed beef produced (on a carcass weight basis) closely follow the fed cattle estimates discussed above. The minor

differences which exist are a result of changes in the carcass weights of fed slaughter steers. Total U.S. fed beef production is expected to increase at a rate of 6.20 percent per year, compared with a 6.15 percent growth rate in fed cattle numbers. This small difference suggests slightly heavier carcasses in 1975 than in 1968. Carcasses are projected to be lighter in the Corn Belt and Eastern states, the same average weight in Utah-Nevada, and slightly heavier in the other six regions. As was the case for numbers of cattle fed, the greatest absolute growth was projected in the Northern Plains region: a 2-billion-pound increase from 1968 to 1975. The Southern Plains have the greatest percentage growth estimate—15 percent per year—and the second largest absolute fed beef tonnage increase.

NONFED BEEF SUPPLY

The supply of domestically-produced nonfed beef was estimated at the national level only. It is projected to increase at a rate of 2 percent per year, or a total of 1.3 billion pounds from 1968 to 1975.

PRICE OF FED CATTLE

Average U.S. prices of fed cattle are projected to increase by about 2.5 percent from 1968 to 1975. Regional price estimates for fed cattle vary from a 1.2 percent yearly increase in the Southern Plains to a 1.1 percent annual decrease in the Montana-Wyoming region. An increase in slaughter demand for fed cattle in the Southwest may account for this trend. Conversely, a decrease in slaughter demand in the Montana-Wyoming area, as well as in- creased transportation costs for live cattle and carcass beef to major markets,

may cause this unexpected estimate by the model. Fed cattle prices in the Pacific Northwest are projected to show no significant changes from 1968 to 1975. Since prices have risen significantly from 1968 to 1971, the "cattle price cycle" would have to turn down by 1975 for this projection to materialize.

PRICE OF FEEDER CATTLE

Feeder cattle prices are projected to increase more than fed cattle prices during the period analyzed. For this projection to occur, cattle feeding costs and/or margins would have to decline. National average feeder cattle prices are estimated to increase by 15.3 percent, or 2.1 percent per year, from 1968 to 1975. Regional price increases are fairly uniform: Colorado is low on a percentage basis with 1.4 percent per year; the Pacific Northwest and Utah-Nevada are high with a 2.1 percent annual growth rate. Increases in feeder cattle demand are projected to exceed growth in feeder cattle supply, resulting in higher market prices. On an absolute basis, 1975 projections are highest for the Northern Plains ($32.17 per cwt.) followed by Utah-Nevada ($30.93), the Pacific Northwest ($30.91) and Montana-Wyoming ($30.91). The Eastern U.S. shows the lowest feeder cattle price in the 1975 projections.

PRICE OF WHOLESALE BEEF

The 1975 projected U.S. wholesale beef price increased slightly less than the fed cattle price: 2.1 percent for wholesale beef and 2.5 percent for fed cattle. Very small yearly changes were projected for regional wholesale beef prices. In fact, the percentage changes were all less for wholesale beef than fed cattle. In six of the nine regions wholesale beef prices

are projected to decline. This suggests that feedlot-wholesale marketing margins will narrow slightly from 1968 to 1975. In the Pacific Northwest wholesale beef prices are estimated to decline .25 percent annually over this period, while fed cattle prices are showing no significant changes.

IMPACTS OF CHANGES IN FEED GRAIN PRICES

Once the model has been constructed and projections have been made, it is possible to change certain conditions on which the model is based, and examine changes which occur in the projections. Changes were made in feed grain prices, and the impacts on number of cattle fed in each region and other important variables were analyzed. Corn prices were increased 20 percent over the original estimates used in the 1970-75 projections, and the prices of all other feed grains (barley, milo, wheat, oats) were increased by 15 percent over previous estimates for the same period. These changes were made to assess the impact of the Southern leaf blight on the 1970 corn crop, which resulted in an increase of about 20 percent in corn prices. In 1970 it was believed that this disease could reduce corn supplies in subsequent years. However, the large 1971 corn crop alloyed most fears of a corn shortage in the foreseeable future.

Since feed costs are one important determinant of cattle feeding profitability, an increase in feed grain prices decreases the profitability of feedlot operations (assuming all other prices and costs remain at the same levels). The number of cattle fed is determined by cattle feeding profits the previous year (see Figure 2). For example, a change in feedlot profits

in 1970 affects the number of cattle fed, fed cattle prices, and total
supply of fed beef in 1971. In turn these variables influence national and
regional feeder cattle prices in 1972; feeder cattle and nonfed beef supplies
in 1973; and beef cow inventories in 1974. This example illustrates the
lagged effect of changes in economic variables on the beef cattle industry.

Changes in 1975 projections based on these higher feed grain prices are
summarized in Table 4. Both the absolute and the percentage differences be-
tween original 1975 estimates and the revised estimates with higher feed grain
prices are presented. For example, numbers of cattle fed in the U.S. are
almost 1 percent (324,000 head) lower under the revised estimates. Re-
gional changes follow an expected pattern: most regions dependent on corn
as their main feed grain (e.g., Colorado, Northern Plains) show lower
numbers of cattle fed. The Corn Belt is a notable (unexplained) exception.
On the other hand, those regions relying on other feed grains whose prices
did not increase as much (e.g., California-Arizona, Pacific Northwest)
were projected to feed more cattle by 1975. Apparently increases in South-
ern Plains cattle feeding is more dependent on factors other than relative
and absolute prices of feed grains.

As expected, other variables did not change as much as number of cat-
tle fed in response to the higher feed grain prices. National feeder cat-
tle supplies were slightly higher and feeder cattle prices were slightly
lower. It is surprising that fed cattle prices did not increase with this
1 percent decrease in fed cattle marketings; smaller decreases in total
fed beef supplies may explain some of this unresponsiveness. National

Table 4. Changes in 1975 Estimated Values of Selected Economic Variables With Increases of 20 Percent in Corn Prices and 15 Percent in Other Feed Grain Prices

VARIABLE	REGION									
	California–Arizona	Pacific Northwest	Montana–Wyoming	Colorado	Utah–Nevada	Northern Plains	Southern Plains	Corn Belt	Eastern U.S.	National
NO. OF CATTLE FED										
Absolute Change (head)	27,700	39,000	-1,900	-67,800	-200	-320,700	0	15,200	600	-323,600
Percent Change	0.86	2.80	-0.73	-3.06	-0.13	-3.11	0	0.13	0.08	-0.92
FEEDER CATTLE SUPPLY										
Absolute Change (head)	400	0	100	0	100	300	-300	3,300	2,900	6,800
Percent Change	0.02	0	0	0	0.01	0	0	0.04	0.03	0.02
TL. SUPPLY FED BEEF										
Absolute Change (000 pounds)	12,700	11,500	-900	-33,200	-100	-157,100	0	118,800	700	-47,600
Percent Change	0.90	1.96	-0.78	-3.11	-0.13	-3.15	0	2.68	0.25	-0.31
PRICE OF FED CATTLE										
Absolute Change ($/cwt.)	0.04	0.03	-0.04	-0.11	0	-0.13	0	0.13	0	0
Percent Change	0.15	0.10	-0.20	-0.04	0	-0.45	0	0.46	0	0
PRICE OF FEEDER CATTLE										
Absolute Change ($/cwt.)	-0.08	-0.03	-0.01	0.04	-0.03	-0.01	-0.03	-0.04	-0.03	-0.03
Percent Change	-0.27	-0.09	-0.03	0.12	-0.09	-0.03	-0.09	-0.12	-0.10	-0.09
NONFED BEEF SUPPLY										
Absolute Change (000 pounds)										12,200
Percent Change										0.12

nonfed beef supply increased slightly to meet some of the unfilled demand resulting from lower fed beef supplies.

A similar analysis could be conducted with the model to assess the impacts of the large 1971 corn crop and accompanying lower prices on the U.S. fed cattle industry. In general, the results would be the opposite of those presented in this section. The absolute changes in projections would probably be greater than those shown in Table 4, since corn prices have fallen more than 20 percent from 1970 to 1971.

INTERREGIONAL SHIPMENTS OF FED BEEF

Each of the regions defined above is not "self-sufficient" in the production and consumption of fed beef. Some regions are "surplus" and others are "deficit" in fed beef. A surplus region is one in which the number of cattle fed, transformed into carcass weight, exceeds the amount of fed beef consumed in that region. A deficit region exists when the carcass weight equivalent of fed cattle production is less than fed beef consumption in that area.

Prices of live and carcass beef are the basic determinants of trade among regions. Trade is expected to occur until price levels between deficit and surplus regions differ only by the costs of transportation between the regions. Then it is no longer profitable for seller to ship (live or carcass) beef to other regions. When all pairs of exporting and importing regions, considered simultaneously, have reached this condition, the entire national fed beef economy has reached an "equilibrium."

The purpose of this section of the report is to incorporate these trade principles into a model which indicates the likely directions and magnitudes of interregional fed beef shipments. Unfortunately, data on trade are not available (as they were in the previous analysis) to test the reliability of the model's projections. However, its sound economic basis and casual observation of actual trade patterns should enable us to assess the validity of the model's results. First the methods utilized in the analysis will be described, followed by a presentation of the resulting estimated interregional trade flows for 1968 and 1975.

Method of Analysis

The wholesale prices of fed beef were calculated for each region defined in Figure 1. These prices were compared between regions, and the differences in prices packers can get selling in their own region relative to that in other regions were calculated. The costs of transporting carcass beef from one region to another was then deducted from these price differences to calculate the net price advantage of shipping carcass beef between regions. The maximum price advantage was selected from these regional comparisons. The maximum price advantage of shipping live cattle among regions was calculated in a manner similar to that described above for carcass beef shipments.

The two maximum price advantages (one in the case of carcass beef shipments and the other for live cattle shipments) were then compared. Carcass beef was shipped if the price advantage of shipping it were greater

than that of shipping live fed beef. Conversely, live cattle were shipped if the net margin[7] from shipping them were greater than that from shipping carcass beef.

Any potential shipments (calculated on the basis of the net margin advantages) from exporting regions to importing regions were required to meet certain restrictions before they were allowed to occur. The surplus regions were not allowed to be net importers of live and carcass beef, and the deficit regions were not allowed to be net exporters. The net importers were considered to be ones whose imports exceeded exports, and the net exporters were the ones whose exports exceeded imports. Some surplus regions found it advantageous to sell to other surplus regions who, in turn, could sell to a deficit region advantageously. This was allowed to occur, provided the surplus region did not become a net importer of fed beef in live or carcass form.

The slaughter capacity of a region was one of the limitations imposed on the number of cattle a region could slaughter. A deficit region was not allowed to import live beef in excess of the slaughter capacity minus the number of cattle already slaughtered in that region. If the imports of fed cattle from other regions exceeded the remaining slaughter capacity after consideration had been given to their own cattle, then this restriction indicated that the last flow of imports of live cattle to that region was void.

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[7] As used here, "net margin" is the price difference between two regions minus the costs of transporting carcass or live beef between the regions.

The sizes of interregional fed beef shipments depended upon the extent of the net margin advantage to the shipping region. After one round of trades was completed and a surplus region had shipped fed beef in live or carcass form to a deficit region, the production-consumption balances were calculated again for each region. The whole process was repeated a number of times until no fed beef surplus or deficit remained in any region, and no price margins existed in shipping fed beef among regions. The regions were then considered to have reached an equilibrium.

Transportation costs between all pairs of regions, beef slaughter costs in each region, and the slaughter capacity available in each region were estimated. Since most live and carcass fed beef is shipped by truck rather than by rail, it is assumed in this analysis that all fed beef is shipped by truck. The truck rates used are based upon minimum loads required by trucking companies, and on current trucking tariffs and rates. The points of outshipments and inshipments in the various regions were selected from important market centers in each region. These points are given below.[8]

Region	Shipping Point
California-Arizona	Fresno (California)
Pacific Northwest	Portland (Oregon)
Montana-Wyoming	Billings (Montana)
Colorado	Denver (Colorado)
Utah-Nevada	Salt Lake City (Utah)
Northern Plains	Omaha (Nebraska)
Southern Plains	Fort Worth (Texas)
Corn Belt	Chicago (Illinois)
Eastern U.S.	Nashville (Tennessee)

[8] While the reader may question the selection of these shipping points, the authors believe that designating other points would not significantly change the results of this interregional analysis.

For the purposes of this study, transportation rates are assumed to depend upon the distance the load is hauled, with no allowance made for direction of shipments.

RESULTS OF THE ANALYSIS

A comparison of production and consumption of fed beef in each region indicated that from 1962 to 1966 only the Eastern U.S. was a deficit producing area. Although some states in other regions were deficit producers of fed beef when considered individually, when these states are aggregated into the regions used in this study, most areas do not show a deficit. California-Arizona and Utah-Nevada were also deficit-producing regions in 1967 and 1968. The fed beef production-consumption balances in each region for 1968 are shown in Table 5.

The Pacific Northwest region consists of Oregon, Washington, and Idaho. Although Oregon and Washington are deficit producers of fed beef, the inclusion of Idaho in the region made the Pacific Northwest a surplus producer of fed beef by about 113,000 head in 1968. Oregon's deficit has increased consistently throughout the 1962-68 period. In 1962 Oregon's fed beef production was about 91 million pounds (carcass weight basis), while the total consumption of fed beef during the same year was estimated at slightly more than 103 million pounds. Thus, Oregon had a deficit of about 12 million pounds in 1962. In the same year, Washington showed a deficit of about 9 million pounds of fed beef. The Pacific Northwest in that year had a surplus of 74 million pounds. In 1968, Oregon and Washington had a deficit of 56 and

TABLE 5. Fed Beef Production - Consumption Balances, by Region, 1968

REGION	1 Per Capita Consumption Pounds	2 Population Number	3 Total Consumption Pounds	4 Cattle Fed Head	5 Total Production (Carcass Weight) Pounds	Production - Consumption Balance [1] Pounds	Production - Consumption Balance [1] Head
California	85.52	19,221,000	1,643,779,000	2,068,000	1,271,820,000	-371,959,000	-604,811
Arizona	85.52	1,670,000	142,818,000	703,000	432,345,000	289,527,000	470,775
(1) California & Arizona	85.52	20,891,000	1,786,598,000	2,771,000	1,704,165,000	-82,433,000	-134,037
Oregon	83.39	2,008,000	167,447,000	181,000	111,315,000	-56,132,000	-91,271
Washington	83.39	3,276,000	273,185,000	332,000	204,180,000	-69,005,000	-112,203
Idaho	83.39	705,000	58,789,000	412,000	253,380,000	194,591,000	316,408
(2) Pacific Northwest	83.39	5,989,000	499,422,000	925,000	568,875,000	69,453,000	112,931
(3) Montana & Wyoming	76.97	1,008,000	77,585,000	226,000	138,990,000	61,405,000	99,845
(4) Colorado	76.97	2,048,000	157,634,000	1,431,000	880,065,000	722,431,000	1,174,684
(5) Utah & Nevada	76.97	1,487,000	114,454,000	160,000	98,400,000	-16,054,000	-26,104
(6) Northern Plains	77.68	5,022,000	390,109,000	5,562,000	3,420,630,000	3,030,521,000	4,927,676
(7) Southern Plains	62.00	14,505,000	899,310,000	2,705,000	1,663,575,000	764,265,000	1,242,707
(8) Corn Belt States	79.11	50,606,000	4,003,441,000	8,628,000	5,306,220,000	1,302,779,000	2,118,339
(9) Eastern States	64.14	97,248,000	6,237,487,000	631,000	388,065,000	-5,849,422,000	-9,511,255
NATIONAL	71.27	198,804,000	14,168,985,000	23,039,000	14,168,985,000	0	0

[1] Column 5 minus Column 3. Negative numbers indicate a deficit, while positive numbers show a surplus.

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69 million pounds of fed beef, respectively, but the Pacific Northwest showed a surplus of 69 million pounds. This shows that Idaho's increases in fed beef production during the 1960's about kept pace with Oregon and Washington's growing deficits.

Expected interregional fed beef shipments to reach the equilibrium conditions described above were calculated for 1968. Then spatial fed beef movements were estimated for 1975, using the cattle feeding projections presented earlier in this report. The 1968 and 1975 estimates are presented in the following two sections.

Estimated 1968 Fed Beef Shipments

The 1968 estimated fed beef shipments are summarized in tabular form in Table 6 and on a map in Figure 3. During 1968 the California-Arizona region had a deficit of 82 million pounds of fed beef. The estimated whole-sale carcass price in that region was $46.45 per hundred pounds. On the basis of net margin advantages, the analysis shows that three regions had a financial incentive to ship fed beef to California-Arizona. These three regions were the Pacific Northwest, Montana-Wyoming, and Colorado. The model's results show the Pacific Northwest shipping 13 million pounds; Montana-Wyoming shipping 42 million pounds; and Colorado shipping 26 million pounds to California.[9] With these shipments, fed beef consumption in the California-Arizona region was equal to total (produced plus imported) supply of fed beef.

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[9] Since Arizona was a surplus fed beef state in 1968 (Table 5), it is assumed that all of these shipments went to California.

Table 6. Estimated Interregional Shipments of Live and Carcass Fed Beef, 1968 (thousand pounds dressed weight)

| ORIGIN	Destination									
	California–Arizona	Pacific Northwest	Montana–Wyoming	Colorado	Utah–Nevada	Northern Plains	Southern Plains	Corn Belt	Eastern U.S.	Total
California – Arizona	-	-	-	-	-	-	-	-	-	-
Pacific Northwest	12,937	-	-	-	5,266	-	-	-	-	18,203
Montana – Wyoming	42,350	-	-	-	-	-	-	-	18,002	60,352
Colorado	26,131	-	-	-	10,145	-	-	-	686,155	722,431
Utah – Nevada										
Northern Plains	-	-	-	-	-	-	-	-	3,030,521	3,030,521
Southern Plains	-	-	-	-	-	-	-	-	764,237	764,237
Corn Belt	-	-	-	-	-	-	-	-	1,301,208	1,301,208
Eastern U.S.	-	-	-	-	-	-	-	-	-	-
TOTAL	81,418				15,411				5,800,123	5,896,952

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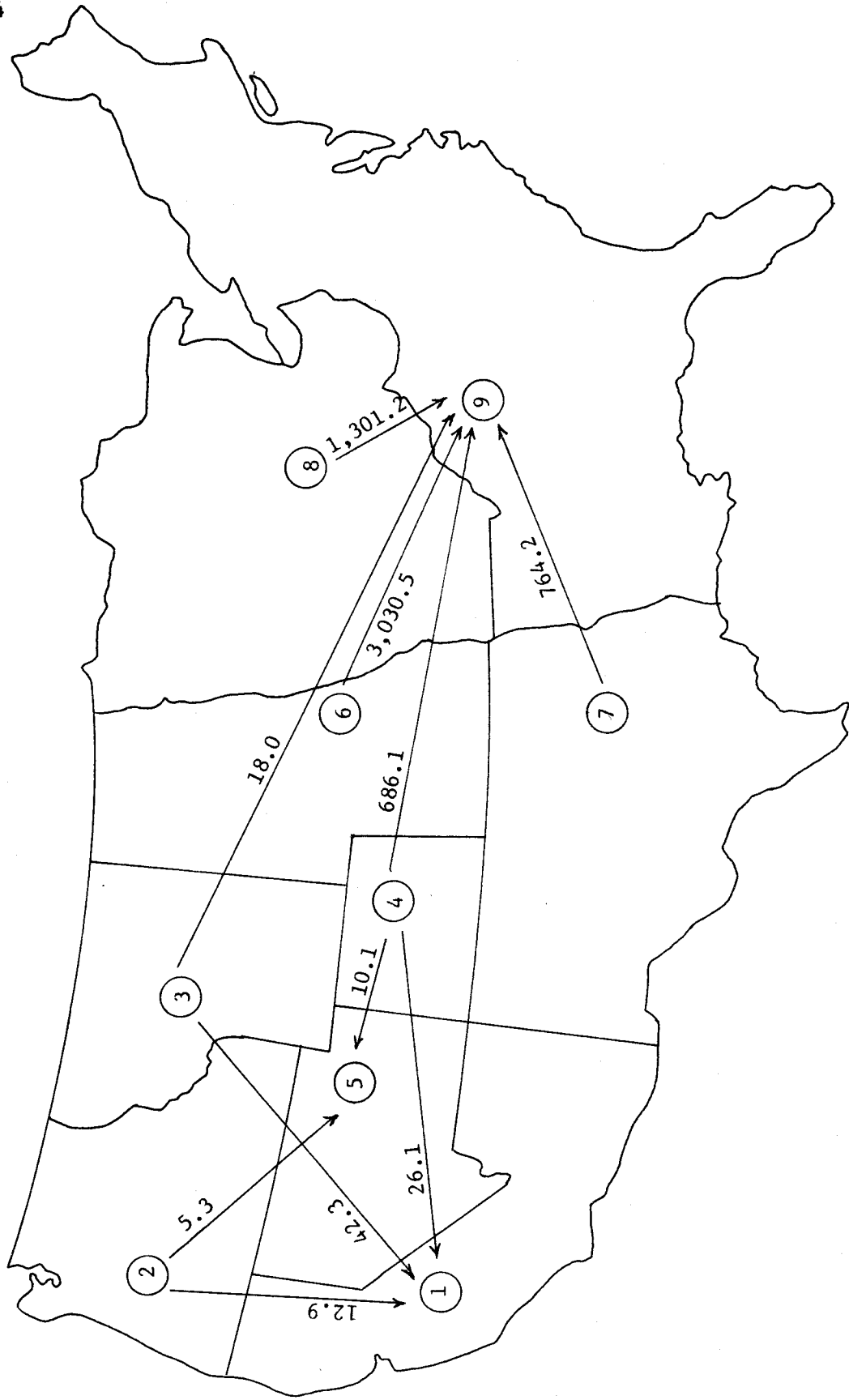
Figure 3. Estimated Shipments of Live and Carcass Fed Beef, 1968 (million pounds dressed weight).

The Utah-Nevada region had a total fed beef deficit of 15.4 million pounds in 1968. According to the model, Colorado should have shipped about 10.1 million pounds and the Pacific Northwest about 5.3 million pounds to Utah and Nevada.

All surplus-producing regions except the Pacific Northwest shipped fed beef to the Eastern region. The analysis showed that about 3 billion pounds of fed beef in carcass form were shipped to the Eastern region from the Northern Plains. The Southern Plains shipped 764 million pounds of fed beef to that region. Colorado provided the Eastern states with another 700 million pounds. Thus, Colorado provided fed beef to all deficit-producing regions. The Montana-Wyoming region shipped 29,000 head of fed cattle to the Eastern states.

Projected 1975 Fed Beef Shipments

Using the projected 1975 regional levels of cattle feeding and live and carcass prices presented in Table 3, interregional fed beef movements were estimated for 1975. The direction and magnitude of these estimates are summarized in Table 7 and Figure 4.

The same three regions were found to be fed beef deficient in 1975: California-Arizona, Utah-Nevada, and the Eastern states. The California-Arizona region is projected to receive fed beef from four regions. Colorado is estimated to be the main supplier to that region, shipping 722 million pounds of fed beef west. The Pacific Northwest is projected to

Table 7. Estimated Interregional Shipments of Live and Carcass Fed Beef, 1975 (thousand pounds dressed weight)

| ORIGIN	Destination									
	California-Arizona	Pacific Northwest	Montana-Wyoming	Colorado	Utah-Nevada	Northern Plains	Southern Plains	Corn Belt	Eastern U.S.	Total
California - Arizona										
Pacific Northwest	46,544	-	-	-	16,772	-	-	-	-	63,316
Montana - Wyoming	-	-	-	-	42,591	-	-	-	-	42,591
Colorado	721,688	-	-	-	-	-	-	-	-	721,688
Utah - Nevada										
Northern Plains	-	-	-	-	-	-	-	-	5,769,138	5,769,138
Southern Plains	291,673	-	-	-	7,859	-	-	-	1,716,142	2,015,674
Corn Belt	24,837	-	-	-	-	-	-	-	1,076,568	1,101,405
Eastern U.S.										
TOTAL	1,084,742				67,222				8,561,848	9,713,812
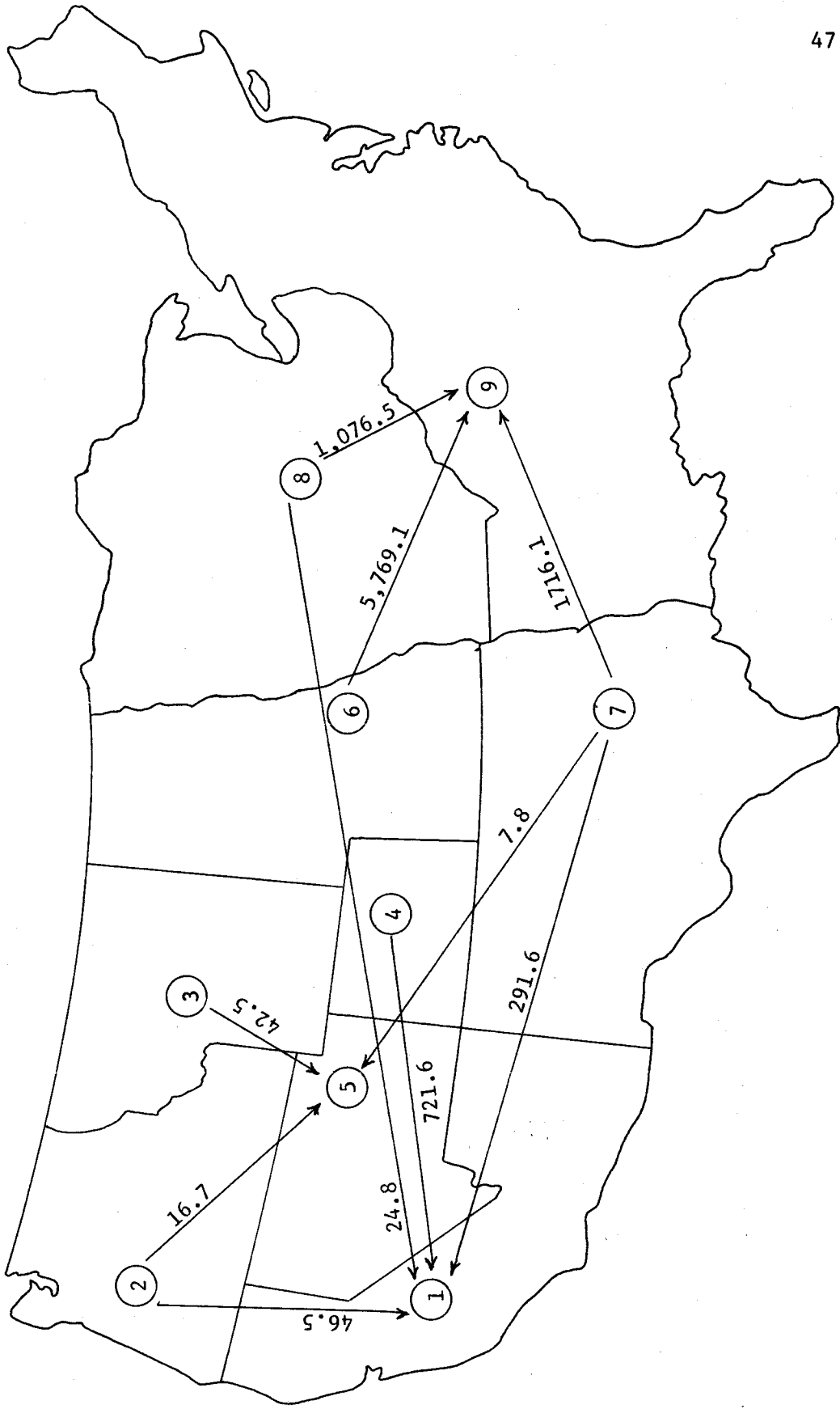
Figure 4. Estimated Interregional Shipments of Live and Carcass Fed Beef, 1975 (million pounds dressed weight).

supply about 47 million pounds; the Southern Plains 292 million pounds; and the Corn Belt area about 25 million pounds to the California-Arizona region.

The Southern Plains and the Montana-Wyoming regions are projected to ship about 13,000 and 69,000 head of fed cattle, respectively, to the Utah-Nevada region. The Pacific Northwest would ship both live fed cattle and dressed fed beef to Utah and Nevada. Total shipments of 67 million pounds (dressed weight equivalent) of fed beef would be received by Utah and Nevada from these three sources.

The Northern Plains, the Southern Plains, and the Corn Belt regions are projected to ship fed beef to fill the large deficit in the Eastern states in 1975. A total of about 8.6 billion pounds of fed beef would be shipped to the Eastern region. The Northern Plains would supply 5.8 billion pounds; the Southern Plains would supply 1.7 billion pounds; and the Corn Belt area would supply about 1.1 billion pounds of fed beef to the Eastern states.

The total amount of fed beef projected to enter interregional trade in 1975 is nearly 10 billion pounds; this compares with 5.9 billion pounds traded in 1968. The Northern Plains region is expected to supply about 60 percent (5.8 billion pounds) of the 1975 beef shipments. Also, the Southern Plains is projected to ship fed beef to all deficit regions in 1975. About 87 thousand head of fed cattle are expected to enter the interregional trade. This is less than 1 percent of the total fed beef shipments in 1975.

LIMITATIONS OF RESULTS

Two factors limit the accuracy of any economic model in explaining and projecting an industry's economic structure with acceptable precision. One limitation is the specification of the model itself. Judgments must be made on the variables to include in the analysis and their relations to each other; to the extent that these judgments are imperfect, the model's ability to explain and project is limited. In addition, changes in the basic industry structure between the period used for model verification and the period over which projections are made can lead to discrepancies between estimated and realized results.

The quantities and qualities of available data also place limitations on this study's results. Numbers of fed cattle marketed were not reported by U.S.D.A. before 1960. Therefore, only eight years of observations were used for this important model variable. While it can be argued that changes in industry structure would make it unwise to use earlier data, the relatively short time period limits the study's statistical reliability. The accuracy of the data used (mostly from U.S.D.A. publications) also is open to conjecture.

Notwithstanding these limitations, the authors believe the study should enhance the reader's understanding of the U.S. fed cattle industry.