Interregional Competition in Markets Facing Utah Livestock and Poultry Producers

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INTERREGIONAL COMPETITION IN MARKETS FACING UTAH LIVESTOCK AND POULTRY PRODUCERS

by

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Terrell O. Sorensen

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ABSTRACT

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by

Terrell O. Sorensen, Master of Science

Utah State University, 1978

Major Professor: Dr. Paul R. Grimshaw
Department: Agricultural Economics

The purpose of this thesis is to make an evaluation of the competitive position of the Utah livestock industry based on feed ingredient and transportation costs. This is done by the use of a linear programming model (MPS-360). This is on the basis of the least cost means of production to meet the quantity demanded of the livestock products. This is accomplished by dividing the United States into six regions where Utah is one of these regions to enable careful consideration of Utah's agricultural enterprises.

Beef, pork, broilers, turkeys, eggs, and milk are the agricultural products used in the model.

The feeds used for production are barley, wheat, corn, oats, milo, hay, and 44 percent soybean meal.

Mega calories of metabolizable energy were the energy units used in the model as a medium of exchange between feed inputs and livestock products as outputs.

(124 pages)

CHAPTER I

INTRODUCTION

Many of Utah's agricultural problems are concerned with the livestock industry. Livestock producers are faced with difficult problems of adjusting to changes confronting them. The changes in the industry have occurred at all stages; production, processing, marketing, and consumption.

Production in livestock has turned from many small scale operations to fewer large scale operations. The dairy industry has experienced the most changes. In Utah the average herd has increased from 13 cows per herd in 1965 to 31 in 1973, with several herds in the state having several hundred cows. At the same time the production per cow has increased greatly, in 1945 Utah had 117,000 milk cows producing 712 million pounds of milk with a per cow average of 6,070. In 1973 there were 74,000 milk cows producing 866 million pounds for a per cow average of 11,703. With increased production and larger herds the investment for each dairy farmer is increasing each year. More and more the Utah dairy farmer is going to need to know if he has an advantage over other dairymen in other regions of the country. Also he is going to need to know where his markets are and if he can compete in the market.

On the consumption side, the changes are also numerous. Consumer tastes and preferences are constantly changing. Consumers are wanting higher quality, more variety, more quantity in some products and less in other products. At the same time they want them at a reasonable price. All of these changes are related back to the livestock producer. For producers to be on top of these changes is of great importance. This thesis was designed to show in what direction the changes are heading, and what the competitive position of Utah livestock production is compared to other livestock producing areas.

Does the Utah livestock producer have a comparative advantage in the local market in selling products? What role should Utah play in the livestock and livestock product markets? These two questions will attempt to be answered by determining the competitive position of the Utah livestock producers. The violent escalation of costs of production in 1973 and 1974, and the resulting dilemma in which the livestock industry has found itself, emphasizes the need for producers to keep informed of the comparative advantages of livestock and cropping combinations. The important factors which need consideration can be divided into supply (cost) factors and demand factors. Important cost elements include management, availability and prices of feed, alternate uses of feed, transport costs, and prices and availabilities of other factors used. The problem facing producers is really an interregional one. Production in other areas must be evaluated to assess its impact on potential production for local use as well as export use. There is also a intraregional problem facing producers on what to produce. Every farmer faces problems on what to produce. A given set of resources can be used for alternative purposes on any farm.

Geographically, livestock producers in Utah would seem to be in a key position to consider expansion and/or further integration in the livestock industry. Many products are consumed in Utah in larger amounts than they are produced (Table 1). Utah producers and potential producers are faced with difficult questions on their ability to compete for out-of-state markets. It appears that the dairy and turkey producers already have developed substantial outside markets. The question remains as to whether other types of production can expand.

Are feeds available for further livestock expansion in Utah? One problem the study will attempt to solve is, can the feed be grown locally, can it be economically transported from other regions, or should the feed produced in Utah be exported?

Livestock production utilizes large quantities of intermediate products (feeds). These feeds are very bulky, so that transportation is expensive. Costs of production are highly dependent on the accessibility and prices of local forage and, to a lesser extent, other feeds. In the past, mistakes have been made in planning for livestock expansion without consideration of sources and costs of forage. With higher investment costs for each producer these decisions become even more important.

Is it possible to expand the livestock industry to keep people in the state and on the farms? Many problems of a community nature face the rural residents of Utah. A strong, viable agriculture in Utah seems to be the first requisite of viable rural communities in most parts of the state. From past studies, it is evident that livestock enterprises are the backbone of Utah's agriculture. From a community or regional standpoint, the livestock industry is expanding the size of farm units with the side effect of becoming more capital intensive

Table 1. Livestock products consumed and produced in Utah, 1972 (1).*

Products	Consumed	Produced	Surplus or deficit	Average live wt.
Beef No. of head	211,280[1]	265,500[1]	+54,220[1]	1106.0 lbs.
Pork No. of head	421,751[1]	90,100[1]	-331,651[1]	214.0 lbs.
Broilers No. of broilers	15,989,000[1]	108,000[1]	-15,881,000[1]	3.7 lbs.
Turkeys No. of turkeys	676,000[1]	3,905,000[1]	+3,229,000[1]	22.5 lbs.
Eggs 1,000 eggs	378,539	295,000	-83,539	
Milk 1,000 pounds	654,000	874,000	+220,366	

*Source: The computations were done by the author based on data obtained from Milk Production, Disposition, and Income; Layers and Egg Production; Broiler Marketing Facts; Livestock and Meat Statistics; National Food Situation; Census Report; Eggs, Chickens, and Turkeys; and Livestock Slaughter Annual Summary.

[1]In live weight or live weight equivalent.

NOTE: (1) numbers in parenthesis refer to Literature Cited section, all other enumerations refer to content footnote.

and less labor extensive. An increase in employment depends on the ability to expand livestock numbers, or on the conditions being appropriate to extend local processing of raw products.

There has been a shift in the relative importance of regions in supplying the nation's consumers with livestock and poultry products. Substantial gains can be made by timely adaptation to changes brought about by inexorable economic forces. On the other hand, untimely entry or even continuation when the forces of competition are adverse can be disastrous. This study is designed to provide a basis for decisions of the livestock and livestock-related industries of the state.

Objectives

(1) To show the relevant competing production areas in the continental United States.

(2) To calculate the food consumption of the United States based on population by regions for the products of the model.

(3) To determine a least cost way to match consumption (quantity demanded) to the production (supply) and ascertain the role Utah should play in the livestock and livestock product markets by determining the competitive position of Utah livestock producers.

(4) To determine where feed grains come from for each region.

(5) To calculate when a product is transported, where its origin and destination should be to meet the demand for the product.

(6) To determine the feed grains fed to produce each of the products for each region.

(7) To calculate the amount of each livestock product produced in each respective region.

CHAPTER II

REVIEW OF LITERATURE

With the livestock industry dominating Utah agriculture, it is important to see if the livestock industry has an advantage over other producing regions. An inter-regional competition study involves the competitive position of one area and its ability to compete with other areas in supplying livestock products. The final result will be determined in terms of a comparative advantage rather than an absolute advantage.

There have been many studies made in connection with the livestock industry in Utah. The studies have been concerned with special areas of Utah agriculture, such as crop and livestock producing enterprises, predator control, range studies, fertilizer use, machinery costs, and feed production and marketing. Many of these studies have been done in connection with a regional project for the western states with Utah being a portion of the area under study. But to the best of my knowledge, no study has been undertaken for the evaluation of inter-regional competition for the major agricultural products of the state of Utah.

There have been some inter-regional projects for certain types of livestock in certain areas carried out in the United States. The main approaches used on these projects to evaluate the competitive position of a certain area vary greatly. For this study, I will use a unique model developed by Dr. Paul Grimshaw, Associate Dean of the College of Agriculture at Utah State University. He developed this model for use in his study entitled, "Economic Considerations for Expanded Feeding of Livestock in the Pacific Northwest." This study was part of the requirements for the degree of Doctor of Philosophy at Oregon State University. This model uses energy units as a medium of exchange between feed inputs and livestock products as outputs. So this study will use Dr. Grimshaw's model for the basic background with a few modifications enabling it to be used for the study of the Utah livestock industry. The model by Dr. Grimshaw was based only on feed costs and transportation costs of feed and livestock products to meet the demand for the livestock product by region. It is a unique and well planned model to study inter-regional competition.

CHAPTER III

PROCEDURE

Regions

The United States was divided into six regions as follows: Region I is Oregon and Washington; Region II is comprised of Idaho, Montana, Wyoming, Nevada, New Mexico, Arizona, and Colorado; Region III is comprised of California; Region IV is comprised of North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri, Oklahoma, and Texas; Region V is comprised of the New England States, Middle Atlantic States, East North Central States, South Atlantic States, East South Central States, Arkansas, and Louisiana; Region VI is comprised of only Utah to enable careful consideration of its competitive position in the livestock industry (Table II). These regions should provide an interesting study of the interaction of livestock and livestock products between the regions.

Consumption of food

The objective of calculation of food consumption by regions was attained by taking the census population of each state times the national per capita consumption of each product by state to get the consumption per state. Then the states of a region are summed to get the total region consumption. The regional consumption figures were adjusted to take into account the regional variations due to differences in income and urbanization. After the consumption of a region is

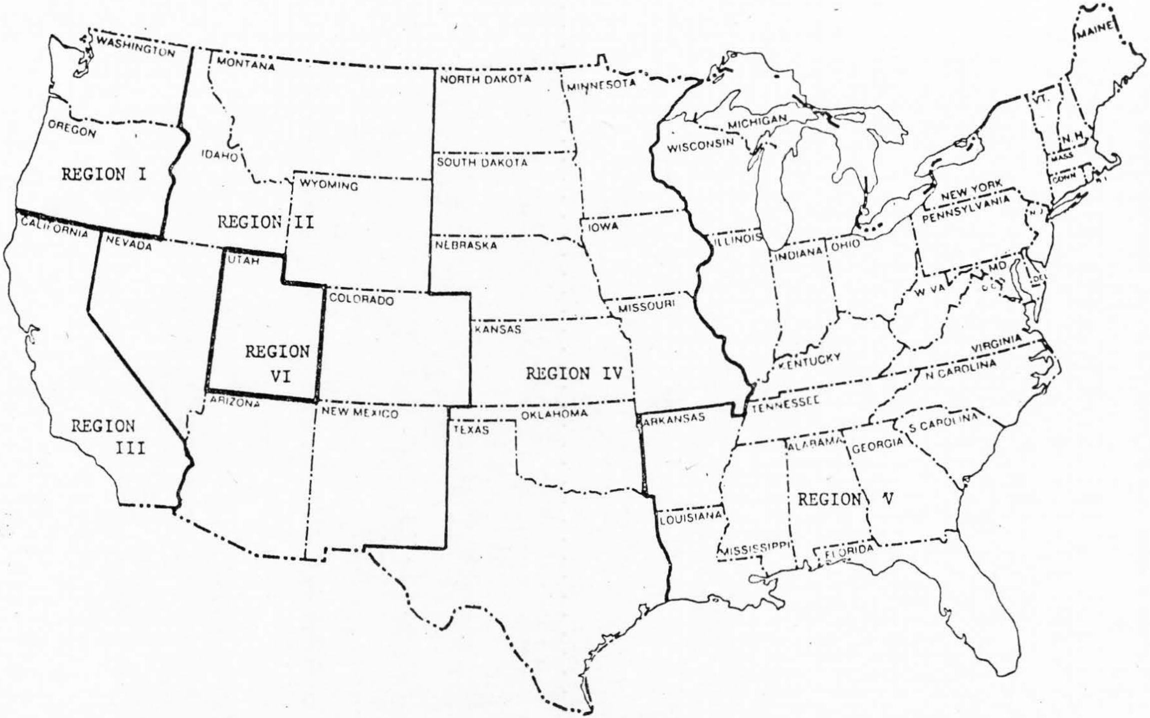

Table 2. United States breakdown into regions.

calculated, the amount of livestock products produced in each region was calculated.

The model

Determination of the least cost way to match consumption to the production was done by a linear programming model. The program was developed for and utilizes the MPS-360 Packet. A few modifications to the program enable it to be used for consideration of the Utah livestock industry.

The cost minimization property of the model makes possible the theoretical production of livestock and poultry products on a least cost basis. This is accomplished through feeding the least cost feed combination to the respective livestock to obtain the desired gain or output of product at a minimum cost. It is provided in the model that the ration fed to the livestock is a balanced ration providing the necessary protein and energy requirements for each class of livestock to enable them to produce at optimum gains.

The minimizing of the regional cost of production is accomplished by summing production of each crop for each state in the region. Production is multiplied by the average price received by farmers in each state. The value of each crop in each state is summed and total value of the product of the region is divided by the total product produced to obtain the regional weighted average price for each product. It was done the same way for livestock products to obtain the weighted average price per region.

The inputs of the model and the assumptions necessary to make the model work are as follows:

(1) In this model the livestock and livestock products that were considered and used are: (1) fed beef

(2) pork

(3) broilers

(4) turkeys

(5) eggs

(6) milk

(2) The feeds that were used are:

(1) barley

(2) corn

(3) milo (sorghum grain)

(4) oats

(5) wheat

(6) alfalfa hay

(7) protein supplement (44 percent soybean meal)

(3) The transportation costs in the model are figured from a center point in each region. These locations were as follows:

Region I . . . Portland, Oregon

Region II . . Denver, Colorado

Region III . . Los Angeles, California

Region IV . . Omaha, Nebraska

Region V . . . Chicago, Illinois

Region VI . . Salina, Utah

These locations are intended to be the most feasible places from which to base the transportation charge in each of the regions. Feed grains along with livestock products can move from region to region in the model. With the transportation activities all crops or livestock products may be transported between regions if it is feasible from the price differences between the regions to compensate for the transportation charges.

Transportation costs for the model were chiefly obtained from a survey conducted by Texas A&M University. The formulas are as follows: cost of transporting feed grains by truck

$$Y = .090628326 + .00049126609X$$

Y = Transportation cost in dollars per cwt.

X = mileage

cost of transporting livestock carcasses by truck

$$Y = .85082823 + .0010969456X$$

Y = Transportation cost in dollars per cwt.

X = mileage

These figures were then increased by ten percent for 1972, an additional five percent for 1973, and an additional five percent for 1974 to update the formula to cover the increases in fuel costs, driver wages, and other costs that have increased. The transportation costs of livestock and poultry, were calculated on a carcass weight or ready-to-cook basis. These costs are then converted to live weight equivalents for model use, because in the model we use live weight in production and consumption as opposed to carcass weight.

It is assumed alfalfa hay does not move between regions.

(4) The years of 1972, 1973, and 1974 were the years for consideration.

(5) Feed grain production is set as an upper bound for each particular feed grain on a region by region basis. The United States production of any feed grain would then be the upper bound for the whole model, because import or export of feed grains is only between the regions designated in the model and this includes only the 48 states.

(6) When rations fall short on minimum protein requirements, 44 percent soybean meal was used as a protein supplement. The average price paid by farmers for protein was used so no transportation cost is necessary.

(7) As mentioned before all livestock and feed grain prices were entered in the model as weighted average prices received by farmers. Feed or livestock products can be obtained for a region by transporting from one region to another if it is feasible after the price in the region of origin is increased by the transportation cost.

(8) The quantity of each livestock product demanded for consumption is determined by consumption of that product in each state and then summing over the states of the region to determine the demand per region. This was a fixed number for each region in the model.

(9) The cost of producing a unit of livestock product was the cost of the feed required to produce that unit of product. The feed used can be either local feed or feed transported. The product was produced by the least cost method of production.

(10) Feed was converted to livestock products through the use of metabolizable energy. Feed was converted to mega calories of metabolizable energy/ton of feed (Mcal/ME/ton). Then the model used the number of Mcal ME the livestock require for maintenance and production of their respective products.* Examples are: how many Mcal ME are required to produce a ton of beef, Mcal ME required for 1,000 dozen eggs, or a 1,000 pounds of milk.

(11) Alfalfa hay was fed to only beef and milk cows in the model. Alfalfa hay fed to dairy cows is fed on a basis of four and a half tons per milk cow yearly. The feeding of alfalfa hay to fed beef was limited to 560 pounds of hay per animal. This is done to enable the rate of gain in the model to be realistic. The rate of gain is approximately 2.86 pounds per day for the fed beef. The model assumes that 400 pounds of gain is put on each beef animal. Assuming a daily rate of gain of 2.86 pounds, it takes about 140 days to put the total gain on. Assuming a 2.86 pound daily rate of gain the most hay that can be fed per head per day is approximately 4 pounds.**

(12) Beef consumption used in the model was fed beef and was obtained by assuming that 400 pounds per head is put on each animal by feeding a concentrate ration. The percentage of fed beef compared

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*Metabolizable energy is defined as food intake gross energy minus Fecal energy, minus energy in the gaseous products of digestion, minus urinary energy. Source: Biological Energy Interrelationships and Glossary of Energy Terms.

**Source: National Academy of Sciences, United States--Canadian Tables of Feed Composition.

to total beef production varies from year to year. In 1972 the percentage of fed beef to total beef production was 77.3 percent, 1973 it was 76.8 percent, and in 1974 it was 64.9 percent.* The following example might help to explain how fed beef consumption is arrived at. Total number of cattle slaughtered in a region times the percentage of fed beef times 400 pounds (amount of gain put on) equals fed beef consumption.

1,081,272 X .773 = 835.823 number of head of fed beef

835,823 X 400 = 334,329,000 pounds of fed beef available for consumption in the region used as an example.

<u>Objective function and the four constraints</u>

The objective function of the model used, can be shown by:

$$\sum_{jik}\sum\sum C\ jik\ R\ jik + \sum_{j}\sum_{kg} Y\ j(kg) + \sum_{i}\sum_{kg} Z\ i(kg)\ T\ i(kg)$$

Where the objective function is the cost function that is going to be minimized.**

C jik: The per unit cost of feeding the <u>jth</u> feed grain to the <u>ith</u> class of livestock in Region k.

R jik: The number of units (quantity) of the <u>jth</u> feed grain fed to the <u>ith</u> class of livestock in Region k.

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*Taken from the Livestock Slaughter Annual Summary, 1972, 1973, and 1974; Statistical Reporting Service, United States Department of Agriculture.

**Taken from Dr. Grimshaw's dissertation on Economic Consideration for Expanded Feeding of Livestock in the Pacific Northwest.

Therefore, $\sum_j \sum_i \sum_k C\ jik\ R\ jik$ is a representation of the total cost of feed to produce all livestock required for consumption over all the regions of production.

$Y\ j(kg)$: The unit cost of transporting the j<u>th</u> feed grain from Region k to g where k is the region of origin and g is the region of destination.

$S\ j(kg)$: Quantity of the j<u>th</u> feed grain transported between Region k and Region g where k is the region of origin and g is the region of destination.

As explained, $\sum_j \sum_{kg} Y\ j(kg)\ S\ j(kg)$ is the transportation cost of moving any feed grain from one region to any other region summed over the entire six regions.

$Z\ i(kg)$: The unit cost of transporting the i<u>th</u> livestock product from Region k to g where Region k is the region of origin and g is the region of destination.

$T\ i(kg)$: Quantity of the i<u>th</u> livestock product transported between Region k and g where k is the region of origin and g is the region of destination.

This makes the following expression: $\sum_i \sum_{kg} Z\ i(kg)\ T\ i(kg)$, the transportation cost of moving any livestock product from one region to any other region summed over the entire six regions.

The overall objective function which is:

$$\sum_i \sum_j \sum_k C\ jik\ R\ jik + \sum_j \sum_{kg} Y\ j(kg)\ S\ j(kg) + \sum_k \sum_{kg} Z\ i(kg)\ T\ i(kg)$$

can best be explained as the total cost of producing the total quantity of livestock products demanded. This is done on a cost minimizing basis where both the livestock products and feed grains can be transported from region to region by means of a transportation cost.

The constraints in the model are four in number.

(1) $Rjk \leq A\ jk + \sum_{gk} S\ j(gk) - \sum_{kg} S\ jkg.$

(2) $D\ ik = L\ ik + \sum_{gk} T\ igk - \sum_{kg} T\ ikg.$

(3) $\sum_{j} E\ jik\ R\ jk \geq F\ ik\ L\ ik$ for all i and k.

(4) $\sum_{j} N\ jik\ R\ jk \geq M\ ik\ L\ ik$ for all i and k.

R jk: Quantity of the jth feed grain available for feeding in the kth region.

A jk: Quantity of the jth feed grain produced for feeding in the kth region.

S j(kg): Quantity of the jth feed grain transported between Region k and Region g where k is the region of origin and g is the region of destination.

D ik: Quantity of the ith livestock product demanded (consumed) in the kth region.

L ik: Quantity of the ith livestock product produced in the kth region.

T i(kg): Quantity of the ith livestock product transported between region k and g where k is the region of origin and g is the region of destination.

E jik: The metabolizable energy supplied per unit of the jth feed grain when fed to the ith class of livestock in the kth region.

F ik: The metabolizable energy required per unit of product produced by the ith class of livestock in the kth region.

N jik: The digestible protein supplied per unit of the jth feed grain when fed to the ith class of livestock in the kth region.

M ik: The protein required per unit of product produced by the ith class of livestock in the kth region.

The no. 1 constraint $R\ jk = a\ jk + \sum_{gk} S\ j(gk) - \sum_{kg} S\ j(kg)$ says that the quantity of the jth feed grain in the kth region has to be less than or equal to the amount of the jth feed grain produced in Region k minus net exports of the jth feed grain from Region k.

The no. 2 constraint $D\ ik = Lik + \sum_{gk} T\ i(gk) - \sum_{kg} T\ i(kg)$ makes the quantity of the ith livestock consumed in Region k equal the amount of the ith livestock produced in Region k minus net exports of the ith livestock from Region k.

The no. 3 constraint $\sum_{j} E\ jik\ R\ jk \geq F\ ik\ L\ ik$ for all i and k says that the total amount of metabolizable energy supplied when all of the jth feeds are fed to a ith class of livestock for a particular Region k has to be greater than or equal to the amount of metabolizable energy required to produce the amount of the ith livestock product produced in the kth region.

The no. 4 constraint $\sum_{j} N\ jik\ R\ jk \geq M\ ik\ L\ ik$ for all i and k insures that the digestible protein supplied by all the jth feed grains when fed to a ith class of livestock for a particular region k is greater than or equal to the minimum protein requirement to produce the amount of the ith livestock product produced in the kth region.

In the model the values of j, i, and k are as follows:

j = 1, 2, ..., 7 where the values of j represent the following feeds:

1 - barley

2 - wheat

3 - corn

4 - oats

5 - milo (grain sorghum)

6 - alfalfa hay

7 - protein supplement (44 percent soybean meal)

i = 1, 2, ..., 6 where the values of i represent the following livestock products:

1 - fed beef

2 - pork

3 - broilers

4 - turkeys

5 - eggs

6 - milk

k = 1, 2, ..., 6 where the values of k represent the following feed-producing, livestock-product producing and consuming regions:

1 - Region I (Portland)

2 - Region II (Denver)

3 - Region III (Los Angeles)

4 - Region IV (Omaha)

5 - Region V (Chicago)

6 - Region VI (Salina)

Development of the data

The model works on the idea that feed grains and hay have a certain level of protein and metabolizable energy when fed to different classes of livestock. These values are shown in Table 3. Livestock require so much protein and metabolizable energy to produce their

Table 3. Nutrients furnished by one ton of feed in Mcal M.E. or percent D.P. when fed to various classes of livestock (7).*

Class of livestock	Variables	Barley	Wheat	Corn	Oats	Milo	Alfalfa hay	Protein supplement
Beef	Mcal M.E.	2,423	2,598	2,566	2,219	2,423	1,683	2,509
Beef	% D.P.	8.7	10.0	6.5	8.8	6.3	11.4	37.3
Hogs	Mcal M.E.	2.609	3.099	2,971	2,420	2,896	--	2,718
Hogs	% D.P.	8.2	9.9	7.0	9.9	7.9	--	39.4
Broilers	Mcal M.E.	2,400	2,800	3,100	2,300	3,000	--	2,200
Broilers	% D.P.	11.6	10.8	8.8	11.8	11.1	--	43.8
Turkeys	Mcal M.E.	2,400	2,800	3,100	2,300	3,000	--	2,200
Turkeys	% D.P.	11.6	10.8	8.8	11.8	11.1	--	43.8
Layers	Mcal M.E.	2,400	2,800	3.100	2,300	3,000	--	2,200
Layers	% D.P.	11.6	10.8	8.8	11.8	11.1	--	43.8
M. cows	Mcal M.E.	2,423	2,598	2,566	2,219	2,423	1,683	2,509
M. cows	% D.P.	8.7	8.5	6.5	8.8	11.4	11.4	37.3

*Source: Calculations based on United States-Canadian Tables of Feed Consumption. Some adjustments have been made by recommendation from Utah State University and Oregon State University staff members. These adjustments were put in as revisions by Dr. Paul Grimshaw of Utah State University, Logan, Utah.

products. These are specified in Tables 4, 5, and 6 for the various regions. Tables 4, 5, and 6 were computed by the author from Nutrient Requirements of Domestic Animals.

The metabolizable energy requirements for 1,000 pounds of product or 1,000 dozen eggs were found from the following formulas. The formulas were obtained by mathematically fitting a least square regression line through the available data in the relevant range.

<u>Beef</u> $Y = 573.4428 + 2.3715846X$

$r = .9939$

Y = Mcal of M.E.

X = Weight of beef in pounds

<u>Pork</u> $Y = -52.76 + 4.9742X$

$r = .9899$

Y = Mcal of M.E.

X = Weight of pork in pounds

<u>Broilers</u> $Y = -.893 + 3.8052X$

$r = .9899$

Y = Mcal of M.E.

X = Weight of broiler in pounds

<u>Turkeys</u> $Y = -1.396 + 4.0407X$

$r = .9797$

Y = Mcal of M.E.

X = Weight of turkeys in pounds

<u>Eggs</u> $Y = 28.32 + 11.145\,(X_1) + .1829\,(X_2)$

$r = .9884$

Y = Mcal of M.E.

X_1 = Weight of chicken in pounds

X_2 = Number of eggs per year

Table 4. Nutrient requirements per 1,000 pounds of product or per 1,000 dozen eggs produced by regions, 1972.

Regions	Variables	Beef	Pork	Broilers	Turkeys	Eggs	Milk
I	Mcal M.E.	10,331	4,746	3,573	3,965	6.089	1,012
I	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
II	Mcal M.E.	10,220	4.749	3,570	3,977	6,302	1,020
II	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
III	Mcal M.E.	10,014	4,742	3,592	3,966	6,264	926
III	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
IV	Mcal M.E.	10,069	4,758	3,567	3,965	6,356	1,056
IV	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
V	Mcal M.E.	10,141	4,750	3,570	3,965	6,600	1,072
V	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
VI	Mcal M.E.	10,655	4,728	3,570	3,979	6,185	1,004
VI	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0

*Source: Calculated by author based on nutrient requirements for the different classes of livestock.

Mcal M.E. designates mega calories of metabolizable energy.

% D.P. means percent digestible protein.

Table 5. Nutrient requirements per 1,000 pounds of product or per 1,000 dozen eggs produced by regions, 1973.

Regions	Variables	Beef	Pork	Broilers	Turkeys	Eggs	Milk
I	Mcal M.E.	10,639	4,746	3,573	3,960	6,207	1,003
I	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
II	Mcal M.E.	10,259	4,751	3,570	3,973	6,209	1,025
II	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
III	Mcal M.E.	10,069	4,750	3,587	3,965	6,302	936
III	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
IV	Mcal M.E.	10,125	4,759	3,567	3,964	6,392	1,057
IV	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
V	Mcal M.E.	10,165	4,753	3,565	3.965	6,580	1,085
V	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
VI	Mcal M.E.	10,686	4,729	3,570	3.979	6,064	989
VI	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0

*Source: Calculated by author based on nutrient requirements for the different classes of livestock.

Mcal M.E. designates mega calories of metabolizable energy.

% D.P. means percent digestible protein.

Table 6. Nutrient requirements per 1,000 pounds of product or per 1,000 dozen eggs produced by regions, 1974.

Regions	Variables	Beef	Pork	Broilers	Turkeys	Eggs	Milk
I	Mcal M.E.	10,323	4,759	3,582	3,970	6,105	1,000
I	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
II	Mcal M.E.	10,330	4,747	3,570	3.975	6,246	1,015
II	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
III	Mcal M.E.	10,212	4,750	3,592	3.975	6,246	928
III	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
IV	Mcal M.E.	10,149	4,756	3,567	3,963	6,356	1,045
IV	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
V	Mcal M.E.	9,935	4,756	3,570	3.965	6,506	1,075
V	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
VI	Mcal M.E.	10,544	4,725	3,570	3.978	6,096	982
VI	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0

*Source: Calculated by author based on nutrient requirements for the different classes of livestock.

Mcal M.E. designates mega calories of metabolizable energy.

% D.P. means percent digestible protein.

<u>Milk</u> $Y = 1082.34 + 3.608X$

Y = Mcal M.E. needed for maintenance of the cow

X = Weight of cow in pounds

For the total Mcal M.E. needed for the cow for maintenance and production, you take the average B.F. content and average milk production and look up in the tables of Nutrient Requirements of Dairy Cattle. This will show you the Mcal M.E. needed for production. Add this value to the Mcal M.E. needed for maintenance to get the Mcal M.E. needed for production and maintenance.

Based on these requirements the model was able to calculate the quantity of each product produced.

The percentage of digestible protein in the feeds was obtained from the United States--Canadian Tables of Feed Composition.

Quantity demanded for consumption was calculated in the following manner: Take the population of each state and multiply by national per capita consumption indexes as published in the National Food Situation; this is done for each class of livestock and poultry. This gives us the carcass weight consumed for each state for each class of livestock. These figures are then multiplied by an index number to take into account the regional variations due to differences in income and utilization. This is then converted to average live weight by a factor multiplication for each of the classes of livestock; it is then converted to number of head per state by dividing the live weight totals per state by average live weight per animal per state. Total number of head is summed and compared to the actual total head slaughtered in the 48 states taking into account exports and imports. In making this comparison we were within 2 to 3 percent for each of the various classes of livestock. Which shows that the procedure is very reasonable. This procedure allows a breakdown of the total consumption of the livestock products on a state basis. Summing state consumption for all the states in the region gives us a regional consumption figure. These regional consumption figures were put into the model as fixed values. The model then determined how the regional consumption requirements are met. The model did this on a least cost basis. It allows transportation of both product and feed grains, so consumption requirements were met from the region of least cost after the cost of transportation has been added.

A word of caution about the model is necessary; this model only includes feed costs and transportation costs. It does not take into account other costs such as the costs of land, labor, taxes, feeder cattle, and other operational expenses. In some cases these expenses could vary and the results could be different. It is assumed that feed costs and transportation costs are the biggest costs of livestock production, and that non feed costs are comparable from region to region.

Source of data

Data for the model were taken from many secondary sources. Sources include the United States Department of Agriculture, National Academy of Sciences, and other minor sources.

Data from the United States Department of Agriculture included such things as livestock, poultry, and crop prices that farmers received. The per capita consumption of livestock and poultry products, actual slaughter of livestock and poultry, imports and exports of livestock products, percent of carcass weight of the average live animals used in the model, and the production figures for the different classes of livestock and poultry were taken from the Department of Agriculture sources.

The nutrient requirements for the various classes of livestock and poultry were derived, with the aid of the National Academy of Sciences publications. The energy requirements were taken from these sources.

All energy requirements are expressed in Mcal M.E. All feed is converted to Mcal M.E. for all the livestock and poultry classes from the National Academy of Sciences publications.

Other minor sources include the Texas A&M Transportation formula, and the Ph.D. dissertation by Harry G. Witt for calculation of transportation rates. United States Population reports were used for population data. Also some help was received from various Utah State University Extension staff members.

Considerable data about the model and how it works comes from Dr. Paul Grimshaw's dissertation, "Economic Considerations for Expanded Feeding of Livestock in the Pacific Northwest."

CHAPTER IV

MODEL ANALYSIS--1972

In some of the following analyses of the model, comparisons are made between what the regions actually produced of a product and what the model would have had the regions producing. The reader should be aware of this and not think that the model is the source of all the production figures.

Pork

Actual pork production in 1972 was centered in two regions, Region IV and Region V. Region V produced 10,000 million pounds, followed closely by Region IV with 9,300 million pounds. Some pork was produced in each of the other four regions. As indicated in Table 7, the model suggests a few changes in pork production. The main changes would be that Region I, Region II, and Region III would not produce any pork. Their consumption needs would be met from pork produced in Region IV and transported out to the respective regions. Also, Region V would increase its pork production to meet all its own consumption needs, along with Region VI (Utah) doing the same. The feeds to produce the pork are located in Table 8.

The next 1,000 pounds of pork in Region IV can be produced by feeding a ration of corn and protein supplement for a cost of $90.04. Corn would make up 81.5 percent of the ration, with protein supplement making up 18.5 percent to meet the minimum protein requirement for

Table 7. Model specifications of pork production and consumption, 1972.

	Consumption (1,000 pounds)	Production (1,000 pounds) Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	489,304	--	--	--	489,304	--	--
Region II	683,958	--	--	--	683,304	--	--
Region III	1,781,825	--	--	--	1,781,825	--	--
Region IV	3,018,879	--	--	--	3,018,879	--	--
Region V	14,495,336	--	--	--	--	14,495,336	--
Region VI	98,473	--	--	--	--	--	98,473
TOTAL	20,567,775	--	--	--	5,973,966	14,495,336	98,473

Table 8. Model specifications of the utilization of feed grains to produce pork, 1972.

	Production of pork (1,000 pounds)	Produced by feeding the following grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	--	--	--	--	--	--	--
Region IV	5,973,966	--	--	7,893,759	--	--	1,794,036
Region V	14,495,336	--	6,851,670	12,627,537	--	--	3,674,447
Region VI	98,473	--	136,611	--	--	--	16,041

producing hogs. To produce 1,000 pounds of pork in Region III (California) using the previously mentioned ration for Region IV, it would cost more than $108.63; which is the feed cost of 1,000 pounds pork in Region IV ($90.04) plus the transportation cost from Omaha to Los Angeles ($18.59 per ton). It would require 1.624 tons of the above ration in California to produce 1,000 pounds of pork. This would mean feeding 646 pounds of protein (44 percent soybean meal) to each 2,602 pounds of corn to produce the 1,000 pounds of pork. The cost of the protein was $130.46 per ton in Region III. The price of the corn was $59.07 per ton. This makes the average cost of producing 1,000 pounds of pork in Region III $118.99. So, it would cost $10.36 more per 1,000 pounds of pork to produce it in Region III than it would to have it shipped in from Region IV. Region IV would have a distinct advantage from the feed costs in supplying pork to California. Region IV will have a similar advantage in Region I and Region II.

Region V produced its pork by feeding wheat, corn, and protein supplement. Region V could produce another thousand pounds of pork at a cost of $96.25. Utah (Region VI) could produce another thousand pounds of pork for $99.68 using wheat and protein supplement for the feed.

According to the model, Utah should produce all of its pork for consumption. In actuality, Utah produced only 19.6 percent or 19,280 thousand pounds of its own pork. There are probably two main reasons Utah doesn't raise more pork.

(1) Many sellers and few buyers.

(2) Few hog slaughter plants, killing a small volume of hogs.

Many sellers and few buyers. Many sellers and few buyers makes it a buyer's market rather than a seller's market. With the reduced competition in the buying market, Utah hog producers have a difficult time getting a fair price for their product. Also, most hog producers in Utah are small producers. The average hog farm in Utah for 1972 only produced 22 pigs per farm (8).* This further diminishes the producer's bargaining power for the price. The producers sell many of their hogs through the local auction a few at a time, which results in very little bargaining power.

Also, with the hog farms being so small, the diseconomies of scale come into the picture. The producers are not able to bargain effectively for either the price of their feeds or the price of the hogs.

Few hog slaughter plants and a small volume. Presently, there are only two major plants which slaughter hogs in the state of Utah, Tri-Miller and Ogden Dressed Meats. Tri-Miller is mainly set up to slaughter beef. Between them, they only slaughter approximately 250-300 pigs per day. These two plants would need a much larger slaughter rate to operate on an efficient scale.

The price farmers receive for their pork is affected by how efficient the hogs are slaughtered and distributed to the consumer. With the small volume slaughter facilities in Utah, it costs more

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*Source: 1972 Census of Agriculture, Utah.

per pig than for a larger, more efficient operation. The pork coming out of these small slaughter houses will have a higher cost for the consumer unless the slaughter houses pay less for the pigs they slaughter. This helps lead to the depressed hog market for Utah hog producers in comparison to other regions.

Broilers

Broiler production like pork production was mainly centered in Regions IV and V. The model also had Region II and Region VI raising broilers. The production totals are shown in Table 9. Broilers were produced according to the analysis, by feeding the feed grains, on a regional basis as indicated in Table 10.

In all cases where broilers were grown, protein supplement (44 percent soybean meal) was necessary in the rations to meet the minimum protein requirements. Table 10 shows the amounts of feed grains and protein supplement required by the model to produce the broilers. Region VI imported the milo from Region IV to feed their broilers.

Region VI had barley that was unused for livestock production. If Region VI would have used its own barley for broiler production rather than transporting milo in, it would have cost $793,322 more. Using the milo from Region IV, it cost Utah $88.92 per 1,000 pounds of broilers. By feeding barley, it would have cost $102.33 per 1,000 pounds of broilers. A difference of $13.41 per 1,000 pounds of broilers.

The price of milo in Region IV was $43.54 per ton. If you add in the cost of transportation from Region IV to Region VI, which is $12.13 per ton, you get the cost of milo in Utah of $55.67 per ton.

Table 9. Model specifications of broiler production and consumption, 1972.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	293,320	--	--	--	293,320	--	--
Region II	466,119	--	466,119	--	--	--	--
Region III	1,071,391	--	--	--	1,071,391	--	--
Region IV	1,581,235	--	--	--	1,581,235	--	--
Region V	7,695,809	--	--	--	--	7,695,809	--
Region VI	59,159	--	--	--	--	--	59,159
TOTAL	11,167,033	--	466,119	--	2,945,946	7,695,809	59,159

Table 10. Model specifications of the utilization of feed grains to produce broilers, 1972.

	Production of broilers (1,000 pounds)	Produced by feeding following grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	466,119	--	--	--	--	463,733	124,021
Region III	--	--	--	--	--	--	--
Region IV	2,945,946	--	--	--	--	2,928,400	783,177
Region V	7,695,809	--	--	7,072,742	--	--	2,522,063
Region VI	59,159	--	--	--	--	58,856	15,740

A ration of 21.1 percent protein and 78.9 percent milo had to be fed. By feeding the above ration, it would take 1.28 tons of feed to produce 1,000 pounds of broilers in Utah. It would require 685 pounds of protein supplement and 1,878 pounds of milo to produce each 1,000 pounds of broilers.

Production costs in the other regions were less. The reason being they used their own feed instead of transporting feed into their regions. Region IV had the cheapest cost of producing broilers. It was $74.52 per 1,000 pounds of broilers. With this cost of production, Region IV produced the broilers for Region I and Region III. Region V had a cost of $82.00 per 1,000 pounds produced, and Region II a cost of $85.88 per 1,000 pounds of broilers produced.

Turkeys

Turkey production was nearly the same as the production of broilers, except Region II did not produce any turkeys and had them transported in from Region IV. Region V was the largest producer of turkey (see Table 11). The turkeys in Region V were produced by feeding corn and protein supplement (44 percent soybean meal) to the turkeys at a cost of $99.82 per 1,000 pounds of turkey. Protein supplement made up 32.3 percent of the ration with corn making up the other 67.7 percent (see Table 12). Region IV could have supplied turkey to Region V at a cost of $103.21 per 1,000 pounds of turkey. The difference of $3.39 makes a slight comparative advantage for Region V in producing their own turkey.

Table 11. Model specifications of turkey production and consumption, 1972.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	62,026	--	--	--	62,026	--	--
Region II	85,857	--	--	--	85,857	--	--
Region III	225,987	--	--	--	225,987	--	--
Region IV	330,231	--	--	--	330,231	--	--
Region V	1,618,720	--	--	--	--	1,618,720	--
Region VI	15,210	--	--	--	--	--	15,210
TOTAL	2,338,031	--	--	--	704,101	1,618,720	15,210

Table 12. Model specifications of the utilization of feed grains to produce turkeys, 1972.

	Production of turkeys (1,000 pounds)	Produced by feeding the following grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	--	--	--	--	--	--	--
Region IV	704,101	--	--	--	--	727,101	276,412
Region V	1,618,720	--	--	1,546,953	--	--	737,577
Region VI	15,210	--	--	--	--	15,779	5,992

In Regions I, II, and III a comparative advantage is held by Region IV in supplying turkey for their consumption needs. The cost of turkey production in Region I would be $132.31 by feeding the turkeys milo and protein supplement. Milo would cost Region I $63.81 per ton transported in from Region IV. Protein supplement (44 percent soybean meal) would cost $142.65 per ton. It would take a ration of 27.5 percent protein supplement and 72.5 percent milo to make a balanced ration. With a ration of this kind, it would take 1,459 pounds of feed to produce 1,000 pounds of turkey, or 995 pounds of protein supplement and 1,923 pounds of milo. This ration would make the above cost of production for 1,000 pounds of turkey $132.31. Region IV could have supplied turkey to Region I for $112.93 per 1,000 pounds of turkey. Making a difference of $19.38 per 1,000 pounds of turkey between the two regions. It would be cheaper to transport the turkey to Region I than the milo to feed the turkeys there. Region I could have used corn from its own region to produce turkeys, but it would have cost $136.07 per 1,000 pounds of turkey. This cost is even higher than by transporting milo into the region to feed the turkeys.

Region II could produce turkey at a cost of $114.24 per 1,000 pounds. This is by feeding milo and protein supplement in the ration fed to the turkeys. Region IV could supply turkey to Region II for $103.83 per 1,000 pounds of turkey. Thus, Region IV has a slight comparative advantage in raising turkeys for Region II.

Region III did not raise any turkeys according to the model. In the real world, California is a large turkey producer. The model shows by the feed and transportation costs that Region IV could supply turkey to Region III for $114.66 per 1,000 pounds of turkey. This is transporting the turkey from Omaha to Los Angeles. Region III could have grown its own turkey for $128.61 per 1,000 pounds. It would have to transport milo in from Region II or use barley from its own region. Other feed grains were used for producing other livestock and poultry products. By using the milo it would cost $66.70 per ton for the milo, and $130.46 per ton for the protein supplement. This would make the above feed cost $114.66 for 1,000 pounds of turkey. Feeding barley would even make a higher cost of production. Region IV could supply it for $13.95 per 1,000 pounds of turkey cheaper than California could raise it.

According to the model, Utah could raise 15 million pounds of turkey, enough to meet its own consumption needs. The turkeys were fed milo and protein supplement. Milo was transported in from Region IV. Cost of producing 1,000 pounds of turkey in Utah was $107.41.

Utah actually produced just under 88 million pounds of turkey in 1972. There are a number of reasons for the wide difference between the model's turkey production and the actual production. Most turkeys in the state of Utah are grown around Moroni, with the growers being members of the Moroni Feed Cooperative. This cooperative has a number of outstanding characteristics that enable them to produce turkey and be able to compete with other turkey producing regions. They are:

(1) They have an almost completely vertically integrated setup.

(a) They own their own feed plant and large storage facilities that enable them to buy feed grains in large quantities.

(b) They mix their own rations and keep the rations on a least cost basis while maintaining an excellent growth rate.

(c) They have their own slaughter plant and storage facilities through which they process over 2 million turkeys annually.

(d) They have their own turkey hatchery.

(e) They have most of their marketing associated with Norbest Turkey Cooperative.

(2) They are very capable and able managers and producers.

Eggs

Eggs were produced in every region (see Table 13). Each region produced a quantity sufficient to meet the quantity demanded in that region. High transportation costs in transporting fresh eggs was the main factor. In some cases, the comparative advantage of producing their own eggs was slim.

According to the model, eggs were produced by feeding different feed grains in different regions (see Table 14). The main feed was milo and protein supplement. However, Region I produced their eggs with barley and protein supplement. Region I grows very little milo and it would be cheaper to feed their own barley rather than transporting milo in to be fed to the layers. Region III and Region V also fed corn along with the milo and protein supplement to form their feed rations.

By feeding barley, Region I saved $1,413,029 in feed costs. The barley and protein supplement ration cost $152.15 per 1,000 dozen eggs

Table 13. Model specifications of egg production and consumption, 1972.

	Consumption (1,000 dozen)	Production (1,000 dozen)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	156,829	156,829	--	--	--	--	--
Region II	217,008	--	217,008	--	--	--	--
Region III	571,308	--	--	571,308	--	--	--
Region IV	867,175	--	--	--	867,175	--	--
Region V	3,699,769	--	--	--	--	3,699,769	--
Region VI	31,545	--	--	--	--	--	31,545
TOTAL	5,543,634	156,829	217,008	571,308	867,175	3,699,769	31,545

Table 14. Model specifications of the utilization of feed grains to produce eggs, 1972.

	Production of eggs (1,000 dozen)	Produced by feeding the following grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	156,829	359,034	--	--	--	--	42,386
Region II	217,008	--	--	--	--	414,681	56,155
Region III	571,308	--	--	252,197	--	811,852	164,231
Region IV	867,175	--	--	--	--	1,671,287	226,321
Region V	3,699,769	--	--	6,109,721	--	783,740	1,421,419
Region VI	31,545	--	--	--	--	59,160	8,011

produced. A milo and protein supplement would cost more. The milo would cost Region I $63.81 per ton. This cost is the cost of milo in Region IV plus the transportation cost from Region IV to Region I. Layers would require 2.118 tons of milo and protein supplement to produce 1,000 dozen eggs. With the cost of milo at $63.81 per ton and $142.65 per ton for protein supplement, it would cost $161.16 per 1,000 dozen eggs. In feeding their own barley, they saved $9.01 per 1,000 dozen eggs.

Region III fed corn, milo, and protein supplement to produce the eggs in their region. They would have first fed the available corn with protein supplement. By feeding corn, they could achieve the least cost ration. The cost of producing eggs by feeding the corn available in Region III would be $152.64 per 1,000 dozen eggs. Protein supplement would need to be fed at the rate of 751.7 pounds protein supplement to every 3,507.8 pounds of corn to meet the 15 percent protein requirements of laying hens. With the ration, it would take 2.1298 tons of feed to produce 1,000 dozen eggs. Most of the corn raised in California was used in milk production. Egg producers used about 41.9 percent of the corn grown in California. After the corn supply ran out, egg producers would have switched to milo grown in the region. Feeding milo and protein supplement, it would cost $154.31 per 1,000 dozen eggs. Region III would feed all the available milo raised in the region to laying hens to produce eggs. After the corn and milo in the region had been fed up, Region III would have had to import milo from Region IV to produce the rest of the eggs needed to meet its consumption needs. Feeding the imported milo from Region IV, the cost of producing 1,000 dozen eggs rose to $157.33. The average cost of producing 1,000 dozen eggs in Region III was $154.15.

Actual egg production varied very little from the model's theoretical egg production. Regions IV and V were the closest. The model had Region V producing 3,699,769 thousand dozen eggs, and in real life, Region V produced 3,821,082 thousand dozen eggs. Region IV actually produced 1,003,083 thousand dozen eggs, and the model had them producing 867,175 thousand dozen eggs.

Utah produced eggs at an average cost of $136.47 per 1,000 dozen eggs. This cost gives Utah a clear comparative advantage in producing its own eggs. Utah produced the eggs by feeding milo and protein supplement. The milo was transported in from Region IV.

Milk

Milk production was much the same as egg production for 1972, in that each region produced milk. Each region produced the amount of milk needed to meet the quantity of milk demanded in each region (Table 15). No milk products were transported in the model analysis. Fluid milk is very expensive to transport from region to region.

The biggest producer of milk in the model, and in real life, is Region V. In 1972, Region V actually produced 73,699 million pounds. The model had Region V producing 79,834 million pounds. Region V produced 62 percent of all the milk actually produced in the United States for 1972. Milk in Region V was produced by feeding barley, corn, hay, and protein supplement (44 percent soybean meal) as shown in Table 16. Feeding these feeds, Region V had an average cost of milk production of $26.96 per 1,000 pounds of milk.

Table 15. Model specifications of milk production and consumption, 1972.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	3,250,000	3,250,000	--	--	--	--	--
Region II	4,507,000	--	4,507,000	--	--	--	--
Region III	11,838,000	--	--	11,838,000	--	--	--
Region IV	18,364,000	--	--	--	18,364,000	--	--
Region V	79,834,000	--	--	--	--	79,834,000	--
Region VI	654,000	--	--	--	--	--	654,000
TOTAL	118,447,000	3,250,000	4,507,000	11,838,000	18,364,000	79,834,000	654,000

Table 16. Model specifications of the utilization of hay and feed grains to produce milk, 1972.

	Production of milk (1,000 pounds)	Produced by feeding the following hay and feed grains (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	3,250,000	185,958	--	--	--	--	1,490,000	131,827
Region II	4,507,000	519,588	--	--	--	--	1,867,000	78,125
Region III	11,838,000	193,250	747,609	349,803	--	--	3,854,000	465,356
Region IV	18,364,000	--	--	--	--	--	9,879,082	1,102,387
Region V	79,834,000	723,460	--	3,379,333	--	--	36,687,000	5,346,160
Region VI	654,000	--	--	28,299	--	--	347,000	--

Protein supplement is fed only to balance the ration. A milk cow requires a ration containing 14 percent digestible protein, and if this is not met, a milk cow will not produce to its capability. Protein is fed in every region except Utah. Alfalfa hay in Utah is of very high quality and has a high protein content. No protein supplement is necessary to have a balanced ration, and this cuts the cost of the ration down considerably. This is one of Utah's main advantages in being able to supply milk at a lower cost than some of the other regions. Regions I and II produced milk feeding barley, hay, and protein supplement. Region I had an average cost of producing 1,000 pounds of milk at $27.74, and Region II had an average cost of $26.03 per 1,000 pounds of milk. In actuality, Region I and II produced 3,312 million pounds and 4,121 million pounds, respectively. The model had them producing almost the same amounts. Region I would have produced 3,250 million pounds and Region II 4,507 million pounds. So, there would be very little change, if any, according to the model analysis.

Region III had the highest cost of producing milk. It cost Region III an average of $27.96 per 1,000 pounds of milk. This comes from the high feed costs. Region III fed barley, wheat, corn, hay, and protein supplement to produce the milk. Barley and wheat were transported in from Utah to help meet the feed requirements. It was a little cheaper for California to transport in barley than feed their own barley. Utah could have produced and transported fluid milk to California for a price of $39.33 per ton. So, for fluid milk, California has a definite comparative advantage. However, the model doesn't include a number of other considerations that should be mentioned. Milk products, other than fluid milk, such as cheese, dried skim milk or powdered milk, could be transported for considerably less than fluid milk.

Utah produced all of their milk by feeding corn and hay. Corn was imported in from Region IV. Corn in this case was cheaper to feed than barley or other feeds that were available in the region.

Fed beef

Fed beef refers to beef animals that had weight put on by feeding them concentrates and a limited quantity of hay. Table 17 shows that all fed beef was produced in Region IV. It was cheaper for all the beef to be produced in Region IV and transported to the other reqions to meet their consumption needs. Omaha is used as a centerpoint of transportation for Region IV.

Reasons for the large fed beef production in Region IV are mainly due to the large amounts of feed grain grown there, and the cheaper price of the feed grains. Corn is the main feed grain used accounting for 84 percent of the total grain fed to beef. Barley accounts for 9 percent and oats account for about 7 percent of the grains fed (see Table 18).

Fed beef in Region IV was produced at an average of $168.09 for 1,000 pounds of fed beef. Region IV could transport fed beef from Omaha (Region IV transportation center) to Chicago (Region V transportation center) for $8.80 per 1,000 pounds. Adding the $8.80 and the $168.09 gives you $176.89, which is the cost that Region IV could supply fed beef to Region V.

Table 17. Model specifications of fed beef production and consumption, 1972.

	Consumption (1,000 pounds)	Production (1,000 pounds) Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	334,329	--	--	--	334,329	--	--
Region II	483,854	--	--	--	483,854	--	--
Region III	1,276,646	--	--	--	1,276,646	--	--
Region IV	7,866,109	--	--	--	1,999,398	--	--
Region V	7,866,109	--	--	--	7,866,109	--	--
Region VI	65,328	--	--	--	65,328	--	--
TOTAL	12,025,644	--	--	--	12,025,664	--	--

Table 18. Model specifications of the utilization of hay and feed grains to produce fed beef, 1972.

	Production of fed beef (1,000 pounds)	Produced by feeding the following grains and hay (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	--	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--	--
Region III	--	--	--	--	--	--	--	--
Region IV	12,025,664	4,246,580	--	38,723,853	3,215,399	--	2,551,606	--
Region V	--	--	--	--	--	--	--	--
Region VI	--	--	--	--	--	--	--	--

Region V could produce their own fed beef for $174.38 per 1,000 pounds. This would be by using the same ration Region IV fed. It would take 2.849 tons of corn, 1,400 pounds of hay, .324 tons of barley, and .275 tons of oats to produce the 1,000 pounds of fed beef. Looking at these costs of production, one could say that Region V should have produced fed beef. But, Region V used all their barley in the production of milk, so they would have to substitute another grain for barley. Substituting oats for barley, the cost for 1,000 pounds of fed beef would rise to $177.96. With the oat, corn, and hay ration fed in Region V, Region IV would have an advantage of $1.07 per 1,000 pounds of fed beef. This is a very slight advantage for Region IV. Region V could have very easily produced fed beef.

Region IV could transport fed beef from Omaha to Salina (Region VI transportation center) at a cost of $12.05 per 1,000 pounds. So, the total cost of fed beef delivered from Region IV to Region VI is $180.14. If this same 1,000 pounds of beef were produced in Region VI by feeding barley and alfalfa hay, the price would have been $205.56, which is an increase of $25.42 per 1,000 pounds. This puts Utah at a large comparative disadvantage in trying to produce fed beef with Region IV, when looking at the feed and transportation costs.

However, one important factor needs to be considered in the least cost method of meeting Utah's consumer demand for fed beef. Each year, Region VI exports around 245,000 feeder cattle (9).* This enables Utah to be in a better competitive position than previous analysis would

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*Source: Feasibility of Expanding the Livestock Feeding and Meat Packing Industry in Utah. Taylor et al., page 28.

indicate to supply some fed beef for consumption in Utah. Region IV would need to import the feeder cattle from Utah and then transport the finished product back to Utah for consumption. This would decrease the advantage Region IV would have over Region VI.

CHAPTER V

MODEL ANALYSIS--1973

Livestock and poultry production in 1973 experienced the biggest price fluctuations for feed grains and protein supplement in American agricultural history. In 1972, protein supplement (44 percent soybean meal) averaged around $120-$140 per ton for the various regions. Protein supplement in 1973 averaged around $240-$260 per ton for the various regions. Feed grains did almost the same thing, having a price increase of almost 100 percent. At the same time the prices for livestock and poultry products raised, but not as rapidly or as high as feed grain prices. The result was that a lot of livestock and poultry producers found themselves in a difficult price-cost squeeze.

Pork

Production of pork in 1973 as compared to 1972, showed some major changes. In 1973, pork was produced in Region III, while in 1972 the model did not produce any pork for that region. Also another major change is that Region VI did not produce any pork, while in 1972 Region VI produced enough pork to meet its own pork consumption needs. Table 19 shows the quantities of pork the model produced in each region.

Table 20 shows the various quantities and kinds of feed grains and protein supplement used to produce the pork.

Region III produced pork to meet its own consumption needs and also supplied pork to Region I. Region IV supplied pork to Region I in 1972. In 1973, Region IV could have supplied pork to Region I

Table 19. Model specifications of pork production and consumption, 1973.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	457,468	--	--	457,468	--	--	--
Region II	651,788	--	--	--	651,788	--	--
Region III	1,672,143	--	--	1,672,143	--	--	--
Region IV	3,146,978	--	--	--	3,146,978	--	--
Region V	13,054,178	--	--	--	--	13,054,178	--
Region VI	93,112	--	--	--	93,112	--	--
TOTAL	19,075,667	--	--	2,129,611	3,891,878	13,054,178	--

Table 20. Model specifications of the utilization of feed grains to produce pork, 1973.

	Production of pork (1,000 pounds)	Produced by feeding the following grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	2,129,611	--	--	2,818,730	--	--	640,620
Region IV	3,891,878	--	--	--	2,466,488	3,439,085	953,994
Region V	13,054,178	--	--	17,289,279	--	--	3,929,382
Region VI	--	--	--	--	--	--	--

at a cost of $187.97 for 1,000 pounds of pork. Region III transported pork to Region I for a cost of $186.39 per 1,000 pounds. This gave Region III a comparative advantage of $1.58 per 1,000 pounds of pork over Region IV in supplying pork to Region I. Two factors caused this change in production. Transportation costs rose 94 cents per 1,000 pounds of pork between Region IV and Region I. The price of protein supplement in Region IV rose $118.86 per ton, while the price of protein supplement in Region III rose only $114.54 per ton. These changes caused the change in production.

Region VI did not produce any pork according to the model in 1973. All of the pork to meet the quantity demanded for consumption was imported from Region IV. In 1972, Region VI produced hogs by feeding wheat and protein supplement. With the increase in wheat prices in Region VI from $56.67 per ton in 1972 to $158.33 per ton in 1973, pork production in Utah became economically infeasible.

Broilers

Table 21 shows the production of broilers in the respective regions. Each region except Region I produced broilers. Region I imported broilers from Region IV to meet its demand for broilers. The only change in regional production from 1972, occurred in Region III. In 1972, Region III imported all of its broilers from Region IV. Region III, in 1973, raised all of their own broilers to meet consumption needs.

Milo and protein supplement were fed to broilers in 1973, with some corn being fed in Region III (see Table 22). Region V went from feeding corn and protein supplement in 1972, to feeding milo and protein

Table 21. Model specifications of broiler production and consumption, 1973.

	Consumption (1,000 pounds)	Production (1,000 pounds) Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	287,279	--	--	--	287,279	--	--
Region II	410,386	--	410,386	--	--	--	--
Region III	1,052,827	--	--	1,052,827	--	--	--
Region IV	1,555,937	--	--	--	1,555,937	--	--
Region V	7,479,901	--	--	--	--	7,479,901	--
Region VI	58,630	--	--	--	--	--	58,630
TOTAL	10,844,880	--	410,386	1,052,827	1,843,216	7,479,901	58,630

Table 22. Model specifications of the utilization of feed grains to produce broilers, 1973.

	Production of broilers (1,000 pounds)	Produced by feeding the following feed grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	410,386	--	--	--	--	408,285	109,192
Region III	1,052,827	--	--	972,196	--	--	346,674
Region IV	1,843,216	--	--	--	--	1,832,238	490,017
Region V	7,479,901	--	--	--	--	7,431,182	1,987,409
Region VI	58,630	--	--	--	--	58,330	15,600

supplement in 1973. The milo was transported in from Region IV. It was less expensive for Region V to transport milo from Region IV rather than feed their own corn. The price of corn in Region V went from $44.05 per ton in 1972 to $76.10 per ton in 1973. Milo in Region IV increased $31.30 per ton. The slight difference between the price increase of corn and milo, plus the fact that milo is higher in protein which permits feeding less protein supplement, would enable Region V to produce broilers at a lower cost by feeding milo than corn.

Region III would have produced broilers by feeding corn and protein supplement. It would have used corn transported in from Region IV.

Broiler production in Utah for 1973 was almost the same as production in 1972. Utah fed the broilers milo and protein supplement. The milo was transported in from Region IV.

Turkeys

No turkeys should have been grown in Region I and Region II in 1973 according to the model. Regions III, IV, V, and VI would produce the turkey for consumption in their regions, plus Region IV would produce turkey for Region I and Region II. This differs from the year 1972 in which turkey for Region III was produced in Region IV. Other than that change, the years 1972 and 1973 for turkey production were very nearly the same (see Table 23).

Feed grains fed to the turkeys in 1973 changed in a similar way to the feed grains fed to broilers (Table 24). Region V went from feeding corn in 1972 to feeding milo in 1973. The reasons for doing this would be the same reasons for switching from corn to milo for

Table 23. Model specifications of turkey production and consumption, 1973.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	61,109	--	--	--	61,109	--	--
Region II	98,633	--	--	--	98,633	--	--
Region III	236,164	--	--	236,164	--	--	--
Region IV	331,505	--	--	--	331,505	--	--
Region V	1,628,629	--	--	--	--	1,628,629	--
Region VI	13,140	--	--	--	--	--	13,140
TOTAL	2,369,180	--	--	236,164	491,247	1,628,629	13,140

Table 24. Model specifications of the utilization of feed grains to produce turkeys, 1973.

	Production of turkeys (1,000 pounds)	Produced by feeding the following feed grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	236,164	--	--	225,694	--	--	107,609
Region IV	491,247	--	--	--	--	507,713	192,802
Region V	1,628,629	--	--	--	--	1,683,642	639,358
Region VI	13,140	--	--	--	--	13,632	5,177

feeding broilers. Also Region IV had a large increase in milo production from 1972 to 1973, it went from 20,297,930 tons to 23,679,490 tons of milo, this increase would help make more milo available for Region V.

Utah fed milo and protein supplement to produce turkeys. The milo was imported from Region IV. Utah turkey production for 1973 was similar to Utah's turkey production for 1972.

Eggs

Egg production in 1973 was similar to 1972 production, except in Region I. Region I did not produce any eggs in 1973, they transported eggs in from Region VI. Region VI could have transported eggs to Region I for a cost of $247.43 for 1,000 dozen eggs. Table 25 shows the quantity of eggs produced in each region.

Eggs were produced by feeding milo and protein supplement, with the exception of Region III, which fed corn and protein supplement (Table 26). The corn fed in Region III was transported in from Region IV.

Laying hens were fed barley and protein supplement to produce eggs in Region I in 1972. But from 1972 to 1973 barley prices rose $36.60 per ton in Region I. Protein supplement rose $116.53 per ton in 1973 for Region I. If barley and protein supplement were used in 1973, it would have cost $262.57 for 1,000 dozen eggs. Utah could produce the eggs for $15.14 per 1,000 dozen less than Region I could produce the eggs.

Table 25. Model specifications of egg production and consumption, 1973.

	Consumption (1,000 dozen)	Production (1,000 dozen)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	144,628	--	--	--	--	--	144,628
Region II	206,063	--	206,063	--	--	--	--
Region III	528,647	--	--	528,647	--	--	--
Region IV	772,580	--	--	--	772,580	--	--
Region V	3,402,110	--	--	--	--	3,402,110	--
Region VI	29,438	--	--	--	--	--	29,438
TOTAL	5,083,466	--	206,063	528,647	772,580	3,402,110	174,066

Table 26. Model specifications of the utilization of feed grains and protein to produce eggs, 1973.

	Production of eggs (1,000 dozen)	Produced by feeding the following grains and protein (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	--	--	--	--	--	--	--	--
Region II	206,063	--	--	--	--	387,956	--	52,536
Region III	528,647	--	--	932,260	--	--	--	200,695
Region IV	772,580	--	--	--	--	1,497,409	--	202,774
Region V	3,402,110	--	--	--	--	6,787,886	--	919,193
Region VI	174,066	--	--	--	--	320,062	--	43,342

Utah produced the eggs for Region I and for its own consumption needs by feeding the laying hens milo and protein supplement. The milo came from Region IV.

Milk

Milk production by the model in 1973 was similar to the production patterns exhibited in 1972. Milk was produced in the regions of consumption, except for Region V, which imported some milk from Region IV. Table 27 shows the production of milk according to the model.

The quantity of milk produced, predicted by the model, is relatively close to the actual production in all the regions. The greatest variation from the real world occurs in Region IV (10).*

Table 28 shows the feed grains, alfalfa hay, and protein supplement used to produce the milk. Alfalfa hay and protein supplement were fed in 1973 very much the same as they were in 1972. Region I, II, and V fed the same grains in 1973 as in 1972. Region I and Region II fed barley, hay, and protein supplement, with Region V feeding barley, corn, hay, and protein supplement. Regions III and VI changed feed grains between the two years. Region III in 1972 fed a great deal of wheat, but with wheat in California going from $60.00 per ton in 1972 to $108.00 per ton in 1973, the feeding of wheat became too expensive. Barley became too expensive as a feed, so Region III fed all corn in 1973 instead of barley, wheat, and corn.

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*The actual amounts produced per region in 1973 are: Region I--3,346 million pounds. Region II--4,128 million pounds. Region III--10,348 million pounds. Region IV--26,465 million pounds. Region V--70,311 million pounds. Region VI--866 million pounds.

Table 27. Model specifications of milk production and consumption, 1973.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	3,157,000	3,157,000	--	--	--	--	--
Region II	4,497,000	--	4,497,000	--	--	--	--
Region III	11,538,000	--	--	11,538,000	--	--	--
Region IV	17,783,000	--	--	--	17,783,000	--	--
Region V	77,213,000	--	--	--	5,148,699	72,064,301	--
Region VI	642,000	--	--	--	--	--	642,000
TOTAL	114,830,000	3,157,000	4,497,000	11,538,000	22,931,699	72,064,301	642,000

Table 28. Model specifications of the utilization of feed grains and hay to produce milk, 1973.

	Production of milk (1,000 pounds)	Produced by feeding the following hay and grains (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	3,157,000	296,937.52	--	--	--	--	1,242,000	142,170
Region II	4,497,000	614,027.99	--	--	--	--	1,701,000	103,169
Region III	11,538,000	--	--	1,332,199	--	--	3,564,000	551,189
Region IV	22,931,699	--	--	--	--	--	12,348,000	1,377,888
Region V	72,064,301	672,720	--	4,154,937	--	--	31,665,552	5,023,943
Region VI	642,000	39,776	--	--	--	--	320,000	--

Milk production in Utah for 1973 was almost identical to 1972 according to the model. The milk cows were fed barley instead of corn. The barley fed was barley grown in Utah.

Fed beef

Fed beef production in 1973 was quite different, than production of fed beef in 1972 by the model. Production in 1972 was done entirely in Region IV. In 1973 the biggest percent was once again produced in Region IV, but Region III and Region V also produced fed beef. Table 29 shows the production the model would have recommended for a least cost situation.

Table 30 shows the grain, hay, and protein supplement utilized to produce the fed beef per region.

The main reason for the changes in location of production of fed beef from 1972 to 1973 is the relative prices of the feed grains and hay from region to region. Corn in Region IV increased $33.13 per ton in 1973, while corn in Region V increased $32.05 per ton in 1973. Hay prices increased $5.50 per ton more in Region IV than in Region V in 1973. These two price changes enabled Region V to be able to be competitive in production of part of their own fed beef. Another reason is the slight increase in transportation rates from 1972 to 1973.

According to the model Utah was not competitive in 1973 in producing fed beef. All of the state's beef supply was produced by Region IV and shipped to Region VI.

Table 29. Model specifications of beef production and consumption of fed beef, 1973.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	308,335	--	--	--	308,335	--	--
Region II	465,677	--	--	--	465,677	--	--
Region III	1,205,040	--	--	1,205,040	--	--	--
Region IV	1,872,640	--	--	--	1,872,640	--	--
Region V	7,337,576	--	--	--	6,321,704	1,015,872	--
Region VI	62,387	--	--	--	62,387	--	--
TOTAL	11,251,655	--	--	1,205,040	9,030,743	1,015,872	--

Table 30. Model specifications of the utilization of hay and feed grains to produce fed beef, 1973.

	Production of fed beef (1,000 pounds)	Produced by feeding the following grains and hay (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	--	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--	--
Region III	1,205,040	--	--	4,461,073	--	--	394,537	8,939
Region IV	9,030,743	4,340,620	--	29,861,496	--	--	2,551,606	--
Region V	1,015,872	--	--	3,686,875	--	--	514,448	--
Region VI	--	--	--	--	--	--	--	--

CHAPTER VI

MODEL ANALYSIS--1974

Livestock and poultry producers had big problems in 1974. Feed grains and hay prices continued to increase, while some of the prices for livestock and poultry products took sharp decreases. The price of beef and turkeys took the biggest drop. Beef prices averaged about \$6.00 to \$8.00 per cwt. lower, and turkey prices averaged about \$9.00 to \$14.00 per cwt. lower than the previous year. It is essential to minimize feed costs with these circumstances to permit the livestock and poultry industries to survive.

Pork

Table 31 describes the production of pork region by region to meet the quantity demanded.

Table 32 shows the feed grains and protein supplement utilized to produce the pork.

The table shows that pork production in 1974 should occur in the same regions as in 1973. However, quantities produced in each region vary between the two years. Region IV would produce the pork for Region I and also part of the requirements for Region III. Region III produced all of its own pork and all of the pork for Region I in 1973. Region III produced 2,129,611 thousand pounds of pork in 1973 and dropped to producing 21,766 thousand pounds in 1974. This large drop occurred because of the increase in corn prices in Region IV. Region III produced

Table 31. Model specifications of pork production and consumption, 1974.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	497,434	--	--	--	497,434	--	--
Region II	713,578	--	--	--	713,434	--	--
Region III	1.811,187	--	--	21,766	1,789,421	--	--
Region IV	3,068,517	--	--	--	3,068,517	--	--
Region V	14,314,063	--	--	--	--	14,314,063	--
Region VI	101,619	--	--	--	101,619	--	--
TOTAL	20,506,398	--	--	21,766	6,170,569	14,314,063	--

Table 32. Model specifications of the utilization of feed grains to produce pork, 1974.

	Production of pork (1,000 pounds)	Produced by feeding the following feed grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	21,766	--	30,247	--	--	--	3,552
Region IV	6,170,569	--	--	8,177,614	--	--	1,858,549
Region V	14,314,063	--	--	18,969,868	--	--	4,311,334
Region VI	--	--	--	--	--	--	--

the pork in 1973 by feeding corn transported in from Region IV. Region III produced pork in 1974 by feeding wheat and protein supplement.

Utah pork producers were not competitive in pork production in 1974 on an interregional basis. All of Utah's pork was produced and transported from Region IV.

Broilers

According to the model, broiler production in 1974 was very different than broiler production in 1973 and 1972. In 1974, broilers would have been produced entirely in Region IV and Region V. In 1973, every region except Region I produced broilers.

Table 34 shows the feed grains and the amount of protein supplement utilized to produce the broilers.

Table 33 describes the production of broilers in the respective regions and what regions produced broilers to transport to other regions.

Region V produced all of their own broilers for consumption, as they did in 1972 and 1973. The feed grains fed to the broilers did change though. In 1973, Region V fed milo and protein supplement to produce the broilers. In 1974, corn made up 44 percent of the ration. The reason corn use increased is that Region V did not grow enough milo to meet its needs and to feed more milo they would have had to import the milo from Region IV. All of Region IV's milo supply was used up, thus Region V could only obtain so much milo before they had to switch to another feed source, which was corn.

Region VI was not in a competitive position to produce broilers. The increased prices of the feed grains would have restricted Region

Table 33. Model specifications of broiler production and consumption, 1974.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	290,388	--	--	--	290,388	--	--
Region II	407,503	--	--	--	407,503	--	--
Region III	1,062,264	--	--	--	1,062,264	--	--
Region IV	1,560,259	--	--	--	1,560,259	--	--
Region V	7,633,901	--	--	--	--	7,633,901	--
Region VI	62,732	--	--	--	62,732	--	--
TOTAL	11,017,047	--	--	--	3,383,146	7,633,901	--

Table 34. Model specifications of the utilization of feed grains to produce broilers, 1974.

	Production of broilers (1,000 pounds)	Produced by feeding the following feed grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	--	--	--	--	--	--	--
Region IV	3,383,146	--	--	--	--	3,362,996	899,406
Region V	7,633,901	--	--	4,209,846	--	3,037,560	2,313,556
Region VI	--	--	--	--	--	--	--

VI from growing broilers. All of the broilers consumed in Region VI were produced in Region IV and transported to Region VI.

Turkeys

Turkey and broiler production are very similar in 1974. Region IV and Region V produced all the turkeys to meet the quantity demanded of the regions. Table 35 shows the production from the model in the various regions.

Feed grains fed to turkeys were also very similar to feed grains fed to broilers. Table 36 shows the feed grains and protein supplement utilized to feed the turkeys. Region V fed corn and protein supplement. The year before, Region V fed milo and protein supplement. As mentioned for broilers, the milo that had been fed to the turkeys was transported in from Region IV, but the milo from Region IV had been used in other livestock and poultry production, leaving none to feed in Region V to turkeys. Milo production in Region IV amounted to 23,679,490 tons in 1973, and dropped to 15,698,590 tons of milo in 1974. This drop in production brought the use of other feed grains into play.

Utah had been feeding turkeys milo transported from Region IV. But with the milo supply becoming tight and the price of milo increasing, Utah was not able to compete in the production of turkeys. All the turkey consumption in Utah was met by transporting in turkey from Region IV.

Table 35. Model specifications of turkey production and consumption, 1974.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	64,537	--	--	--	64,537	--	--
Region II	100,774	--	--	--	100,774	--	--
Region III	281,474	--	--	--	281,474	--	--
Region IV	327,186	--	--	--	327,186	--	--
Region V	1,630,336	--	--	--	--	1,630,336	--
Region VI	13,475	--	--	--	13,475	--	--
TOTAL	2,417,782	--	--	--	787,446	1,630,336	--

Table 36. Model specifications of the utilization of feed grains to produce turkeys, 1974.

	Production of turkeys (1,000 pounds)	Produced by feeding the following feed grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--
Region III	--	--	--	--	--	--	--
Region IV	787,446	--	--	--	--	813,634	308,975
Region V	1,630,336	--	--	1,558,054	--	--	742,870
Region VI	--	--	--	--	--	--	--

Eggs

Egg production was found in every region for 1974, according to the model. Table 37 shows the amounts produced in each region. Looking at the table it can be seen Region VI supplied a large quantity of eggs to California to help California meet its egg consumption needs.

Table 38 shows the feed grains that were utilized to feed the laying hens. Milo and protein supplement were the feeds fed in every region. Region IV shipped milo to Regions I, V, and VI to meet the milo needs of the regions. Region II used its own milo to produce eggs. In Region III, they used the entire milo supply produced in Region III to feed the laying hens. After the milo in Region III was fed, Utah could supply eggs to Region III cheaper than Region III could use other feeds or transport milo from other regions to produce their own eggs. Region III can produce eggs by feeding their own milo for $298.68 per 1,000 dozen eggs. After their own milo supply is used up, it would cost Region III more than $300.49 per 1,000 dozen eggs. The $300.49 per 1,000 dozen eggs is the cost Region VI could produce eggs and transport them to California. So Utah supplied some eggs to California, according to the model.

Utah produced the eggs by feeding milo and protein supplement. The milo was transported in from Region IV.

Milk

Table 39 shows where the milk was produced and in what amounts for each region.

Table 37. Model specifications of egg production and consumption, 1974.

	Consumption (1,000 dozen)	Production (1,000 dozen)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	146,982	146,982	--	--	--	--	--
Region II	210,848	--	210,848	--	--	--	--
Region III	535,169	--	--	218,214	--	--	316,955
Region IV	780,390	--	--	--	780,390	--	--
Region V	3,419,745	--	--	--	--	3,419,745	--
Region VI	30,021	--	--	--	--	--	30,021
TOTAL	5,123,155	146,982	210,848	218,214	780,390	3,419,745	346,976

Table 38. Model specifications of the utilization of feed grains to produce eggs, 1974.

	Production of eggs (1,000 dozen)	Produced by feeding the following feed grains (tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	146,982	--	--	--	--	272,088	36,845
Region II	210,848	--	--	--	--	399,330	54,076
Region III	218,214	--	--	--	--	413,280	55,965
Region IV	780,390	--	--	--	--	1,504,028	203,670
Region V	3,419,745	--	--	--	--	6,746,338	913,567
Region VI	346,976	--	--	--	--	641,365	86,851

Table 39. Model specifications of milk production and consumption, 1974.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	3,160,000	3,160,000	--	--	--	--	--
Region II	4,534,000	--	4,534,000	--	--	--	--
Region III	11,507,000	--	--	11,507,000	--	--	--
Region IV	17,707,000	--	--	--	17,707,000	--	--
Region V	76,371,000	--	--	--	4,945,899	71,425,101	--
Region VI	633,000	--	--	--	--	--	633,000
TOTAL	113,912,000	3,160,000	4,534,000	11,507,000	22,652,893	71,425,101	633,000

Table 40 shows the feeds fed to the milk cows to get the milk production.

Milk production in 1973 and 1974 was almost identical in the regions for the two years. The model had Region IV producing the milk to meet its consumption needs and exporting approximately 5,000 million pounds to Region V.

The feeds fed to produce the milk in 1974 varied from 1972 and 1973. Much less barley was fed in 1974 than in the other two years. Region V fed barley, hay, and corn with protein supplement in 1972 and 1973, but with the higher prices for corn and barley, Region V fed a great deal of oats in 1974. Corn and barley was still fed, but in smaller quantities.

Region VI fed corn and hay to produce the milk in 1974. The corn was transported in from Region IV.

Fed beef

Analysis of data for the 1974 year shows that all of the fed beef should have been produced in Region IV. Table 41 describes the production of fed beef region by region to meet the quantity demanded.

The main reason for the different locations of production between 1973 and 1974 is the price increases for corn. Corn increased $27.09 per ton from 1973 to 1974 in Region IV. While Region V had a price increase of $31.04 per ton for the same period of time. Also with the increases in corn prices, Region III could not afford to transport corn in from Region IV to produce fed beef. It was less expensive for Region IV to produce the beef and transport it to Region III.

Table 40. Model specifications of the utilization of hay and feed grains to produce milk, 1974.

	Production of milk (1,000 pounds)	Produced by feeding the following feed grains and hay (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	3,160,000	305,802	--	--	--	--	1,224,000	143,105
Region II	4,534,000	--	--	553,309	--	--	1,679,000	142,074
Region III	11,507,000	--	1,139,573	--	--	--	3,981,000	405,685
Region IV	22,652,893	--	--	--	--	--	12,059,394	1,345,683
Region V	71,425,101	748,420	--	607,582	3,799,940	--	31,550,000	4,734,471
Region VI	633,000	--	--	22,526	--	--	335,000	--

Table 41. Model specifications of fed beef production and consumption, 1974.

	Consumption (1,000 pounds)	Production (1,000 pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	388,213	--	--	--	388,213	--	--
Region II	568,776	--	--	--	568,776	--	--
Region III	1,427,816	--	--	--	1,427,816	--	--
Region IV	2,266,456	--	--	--	2,266,456	--	--
Region V	9,030,272	--	--	--	9,030,272	--	--
Region VI	75,517	--	--	--	75,517	--	--
TOTAL	13,757,050	--	--	--	13,757,050	--	--

Table 42 shows the feeds utilized in producing fed beef for 1974.

As in 1972 and 1973, Utah was not in a position to compete with the other regions for fed beef production. All of Utah's fed beef for consumption was imported from Region IV.

Table 42. Model specifications of the utilization of hay and feed grains to produce fed beef, 1974.

	Production of fed beef (1,000 pounds)	Produced by feeding the following grains and hay (tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	--	--	--	--	--	--	--	--
Region II	--	--	--	--	--	--	--	--
Region III	--	--	--	--	--	--	--	--
Region IV	13,757,050	--	--	47,576,828	5,671,360	--	2,551,606	262,678
Region V	--	--	--	--	--	--	--	--
Region VI	--	--	--	--	--	--	--	--

CHAPTER VII

SUMMARY

As can be observed from the data, large production shifts occurred from one year to another year. The reason is the rapidly changing feed grain prices for the years considered. Never before have feed grain prices fluctuated so much and so widely in United States agricultural history. The model helps bring out the importance of the relative feed costs and how it affects livestock and poultry producers.

Livestock and poultry producers cannot go into and out of production on a year to year basis as the model does. It takes years to get the necessary capital and know how to run a livestock or poultry operation effectively. So the important question is whether the livestock and poultry producer can succeed in the long run. The short run is important to the producer, but as long as the livestock producer is making enough to cover his variable costs in the short run, he will continue to operate. The critical question is can the producer make a profit in the long run?

The model's analysis sheds some light on the direction producers should turn. This is done by showing the competitive advantage offered by lower feed costs and market locations. In a lot of cases this comparative advantage is slim.

Another area that livestock and poultry producers should be aware of is how the exports of feed grains to other countries affect their production costs and markets. With the strong export market for feed grains, livestock producers have even more problems to face. The United States livestock producer could become even more involved in competition with other countries.

Production conclusions

The model was set up mainly to consider Utah's livestock industry. Utah has a comparative advantage to produce all of its own eggs, milk, and part of its beef, pork, broilers, and turkeys for the years 1972, 1973, and 1974.

There is some possibility for increased pork production in Utah, but the increase would have to be limited to supplying the state's demand for pork. For the years analyzed there is little evidence that Utah could produce pork for other regions. Regions IV and V are located closer to the population centers and have the feed available to produce the hogs.

According to the model, in 1972, Utah would have produced enough pork to meet the consumptive needs of the state's population. However, in 1973 and 1974 Utah did not produce any pork. The pork was imported in from Region IV. The change in production between the years occurred because of the drastic price rise in wheat and protein supplement. In 1972, wheat and protein supplement were fed to produce the hogs. With the price changes Utah could have transported pork in at a lower cost than producing its own.

Turkey production in Utah far exceeds the state's demand for turkeys. Each year large quantities of turkeys are exported to other regions of the United States. The model had Utah producing turkeys in 1972 and 1973, but none in 1974. Also the model had Utah producing only enough turkeys to meet the state's consumption requirements. The reason Utah has developed a large turkey industry is due, at least in part, to the Moroni Feed Cooperative. With the Cooperative the producers are able to buy feed in bulk quantities, which is one big reason they can compete with the other regions in turkey production.

Broilers were produced in Utah during 1972 and 1973. In 1974, broilers were not produced in Utah, the broilers were imported in from Region IV. In the real world comparatively few broilers are produced in Utah. For broilers to be produced in Utah, they would need to be grown under similar conditions to those experienced by turkey producers.

All of the eggs consumed in Utah could be produced in the state. According to the model, egg production in Utah also had a competitive market with surrounding regions. The model had Utah producing eggs for Region I in 1973, and eggs for Region III in 1974. In some cases, this comparative advantage was small. The relative prices of feeds between these regions determines whether the egg producer in Utah will have a comparative advantage in supplying eggs to outside regions.

Milk production, according to the model, would be one of the better enterprises for the state of Utah. Utah has one of the least cost milk production capabilities in the United States. This is due to the alfalfa hay grown in the state. It is high in protein content and quality.

Fed beef production in Utah is more costly than in other regions. In most cases fed beef can be imported from other regions at less cost than it can be produced in Utah. This is according to the model.

There is some fed beef production currently done in the state of Utah. This is made possible by the large number of feeder cattle produced in the state. Utah was able to produce some fed beef, but on a limited basis.

This thesis helps to point out the important relative feed costs, availability of feeds, location of markets, and where the location of markets are in deciding where products should be produced.

BIBLIOGRAPHY

1. U.S. Department of Agriculture. Economic Research Service. National Food Situation. U.S. Government Printing Office, Washington, D.C., May, 1975.

1-a. U.S. Department of Commerce. Bureau of the Census. Estimates of the Population of States. U.S. Government Printing Office, Washington, D.C., July 1, 1975.

2. Dietrich, Raymond A., Assistant Professor. Department of Agricultural Economics and Sociology, Texas A&M University, College Station, Texas.

3. National Academy of Sciences. National Research Council, Biological Energy Interrelationships and Glossary of Energy Terms. (Revised 1966.) Washington, D.C., 1966, pp. 35.

4. National Academy of Sciences, United States--Canadian Tables of Feed Composition. Washington, D.C., 1969, pp. 22.

5. U.S. Department of Agriculture. Statistical Reporting Service. Livestock Slaughter, 1972, 1973, 1974, Annual Summary. U.S. Government Printing Office, Washington, D.C.

6. Grimshaw, Paul R. Economic Considerations for Expanded Feeding of Livestock in the Pacific Northwest, Ph.D. dissertation, Oregon State University, Corvallis, Oregon, 1972, pp. 148.

7. National Academy of Sciences. National Research Council. Nutrient Requirements of Domestic Animals. Washington, D.C.

8. U.S. Department of Agriculture. Statistical Reporting Service. 1972 Utah Agricultural Statistics. Utah Crop and Livestock Reporting Services. pp. 128.

9. Taylor, Morris H., Lynn H. Davis, and Darwin B. Nielsen. Feasibility of Expanding the Livestock Feeding and Meat Packing Industry in Utah. Logan, 1970, pp. 238, Utah State University Extension Service.

10. U.S. Department of Agriculture. Statistical Reporting Service. U.S. Government Printing Office, Washington, D.C. Milk Production, Disposition, and Income, 1972-1974.

11. U.S. Department of Agriculture. Statistical Reporting Service. Agricultural Prices, 1972 Annual Summary. U.S. Government Printing Office, Washington, D.C., June, 1973, page 170.

BIBLIOGRAPHY (Continued)

12. U.S. Department of Agriculture. Statistical Reporting Service. Agricultural Prices, 1973 Annual Summary. U.S. Government Printing Office, Washington, D.C., June, 1974, 167 p.

13. U.S. Department of Agriculture. Statistical Reporting Service. Agricultural Prices, 1974 Annual Summary. U.S. Government Printing Office, Washington, D.C., June, 1975, 167 p.

14. Witt, Harry G. Broilers, Dairy Cattle, Fed Beef Cattle, Layers, and Swine: differences between actual production and production with "optimum" economic utilization of feed in eleven regions of the United States, 1965. Ph.D. dissertation, University of Florida, Gainesville, Florida, 1970, 182 p.

APPENDIX

Table 43. Regional weighted average feed prices received by farmers, 1972.*

Regions	Barley	Wheat	Corn	Oats	Milo	Hay	Protein
				(Dollars per ton)			
I	49.62	72.95	60.71	57.25	--	33.25	142.65
II	46.67	59.24	52.40	46.65	52.45	32.25	130.69
III	61.67	60.00	59.07	58.75	60.80	36.00	130.46
IV	40.55	58.56	41.44	41.00	43.54	23.50	117.49
V	42.98	49.47	44.05	49.58	42.27	30.50	126.69
VI	50.41	56.67	--	62.50	--	35.00	127.03

*Source: Agricultural Prices, 1972 Annual Summary, United States Department of Agriculture.

Table 44. Regional weighted average feed prices received by farmers, 1973.*

Regions	Barley	Wheat	Corn	Oats	Milo	Hay	Protein
	(Dollars per ton)						
I	83.82	161.89	95.66	92.73	--	52.00	259.17
II	75.97	136.91	90.33	80.75	89.07	43.50	249.22
III	87.36	108.33	93.14	87.50	100.00	50.00	245.00
IV	65.08	132.68	74.57	69.07	74.84	33.00	236.35
V	65.76	109.43	76.10	95.15	73.92	34.50	238.32
VI	78.85	158.33	--	109.38	--	40.00	239.00

*Source: Agricultural Prices, 1973 Annual Summary, United States Department of Agriculture.

Table 45. Regional weighted average feed prices received by farmers, 1974.*

Regions	Barley	Wheat	Corn	Oats	Milo	Hay	Protein
				(Dollars per ton)			
I	113.87	140.00	124.70	113.10	--	65.70	246.75
II	110.47	130.59	107.45	104.29	110.46	51.50	236.75
III	119.90	125.33	125.00	118.75	125.33	67.00	239.09
IV	110.37	136.68	101.66	90.85	98.45	49.50	206.30
V	88.06	126.87	108.06	78.03	98.79	40.50	207.37
VI	116.67	132.33	--	118.75	--	47.00	218.33

*Source: Agricultural Prices, 1974 Annual Summary, United States Department of Agriculture.

Table 46. Regional weighted average prices received by farmers, 1972.*

Regions	Beef	Pork	Broilers	Turkey	Eggs**	Milk
	(Dollars per cwt.)					
I	32.70	25.40	18.04	21.80	27.50	6.18
II	35.60	24.70	17.70	24.90	33.30	6.05
III	33.50	25.30	17.50	21.80	28.10	5.60
IV	34.20	25.10	14.12	21.20	24.80	5.62
V	30.40	24.84	13.90	23.00	33.00	6.73
VI	32.00	22.90	17.80	21.50	27.80	5.83

*Source: Agricultural Prices, 1972 Annual Summary, United States Department of Agriculture.

**Dollars per one hundred dozen eggs.

Table 47. Regional weighted average prices received by farmers, 1973.*

Regions	Beef	Pork	Broilers	Turkeys	Eggs**	Milk
	(Dollars per cwt.)					
I	41.50	36.40	25.90	46.10	51.60	7.11
II	44.80	37.80	24.00	43.00	55.90	7.06
III	42.90	37.70	24.70	38.40	50.60	6.47
IV	43.30	38.50	22.90	38.70	46.10	6.72
V	38.40	37.90	23.90	36.40	54.20	7.37
VI	40.30	35.90	24.00	43.00	48.90	6.97

*Source: Agricultural Prices, 1973 Annual Summary, United States Department of Agriculture.

**Dollars per one hundred dozen eggs.

Table 48. Regional weighted averages prices received by farmers, 1974.*

Regions	Beef	Pork	Broilers	Turkeys	Eggs**	Milk
	(Dollars per cwt.)					
I	35.20	35.30	27.30	33.10	48.70	8.25
II	38.90	33.80	21.50	26.10	54.60	8.27
III	39.40	34.00	25.70	27.60	47.90	8.20
IV	36.00	34.10	21.22	27.60	46.50	7.67
V	32.80	34.60	21.23	28.50	55.80	9.19
VI	31.20	33.20	21.50	29.00	46.30	8.10

*Source: Agricultural Prices, 1974 Annual Summary, United States Department of Agriculture.

**Dollars per one hundred dozen eggs.

Table 49. Truck feed grain transportation rates for 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per ton)			
I	--	15.807	12.474	20.273	24.816	12.155
II	15.807	--	14.245	7.832	12.980	7.348
III	12.474	14.245	--	19.954	24.629	8.470
IV	20.273	7.832	19.954	--	7.139	12.133
V	24.816	12.980	24.629	7.139	--	17.281
VI	12.155	7.348	8.470	12.133	17.281	--

*Derived from the Texas A & M Formula: Transporting feed grain by truck:

$$Y = .090628326 + .00049126609X$$

X = mileage

Y = transportation cost in dollars per cwt.

Each Y was then increased by ten percent to update the formula to cover the increases in fuel costs, driver wages, and other transportation costs that have increased.

Table 50. Truck feed grain transportation rates for 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per ton)			
I	--	16.60	13.10	21.287	26.057	12.763
II	16.60	--	14.957	8.224	13.629	7.715
III	13.19	14.957	--	20.952	25.860	8.894
IV	21.287	8.224	20.952	--	7.50	12.740
V	26.058	13.629	25.860	7.50	--	18.145
VI	12.763	7.715	8.894	12.74	18.145	--

*Derived from the Texas A & M Formula: Transporting feed grain by truck:

$Y = .090628326 + .00049126609$
$X = \text{mileage}$
$Y = \text{transportation cost in dollars per ton}$

Each Y was then increased by ten percent for 1972, plus five percent for 1973 to update the formula to cover the increases in fuel costs, driver wages, and other transportation costs that have increased.

Table 51. Truck feed grain transportation rates for 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per ton)			
I	--	17.430	13.755	22.350	27.36	13.738
II	17.43	--	15.70	8.635	14.310	8.10
III	13.755	15.70	--	22.00	27.150	9.34
IV	22.35	8.635	22.00	--	7.875	13.377
V	27.36	14.31	27.15	7.875	--	19.052
VI	13.738	8.10	9.34	13.377	19.052	--

*Derived from the Texas A & M Formula: Transporting feed grain by truck:

$Y = .090628326 + .00049126609$
X = mileage
Y = transportation cost in dollars per cwt.

Each Y was then increased by ten percent for 1972, plus five percent for 1973, plus five percent for 1974 to update the formula to cover the increases in fuel costs, driver wages, and other transportation costs that have increased.

Table 52. Truck transportation costs for whole milk, 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Gallons per cwt.)			
I	--	2.453	1.925	3.443	3.894	2.970
II	2.453	--	2.20	1.276	1.98	1.595
III	1.925	2.20	--	3.00	3.894	1.837
IV	3.443	1.276	3.00	--	1.10	2.61
V	3.894	1.98	3.894	1.10	--	3.531
VI	2.97	1.595	1.837	2.61	3.531	--

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970. The transportation costs were raised ten percent to cover the increased costs of transportation since 1970.

Table 53. Truck transportation costs for whole milk, 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	2.576	2.02	3.615	4.089	3.12
II	2.576	--	2.31	1.34	2.079	1.675
III	2.02	2.31	--	3.15	4.089	1.93
IV	3.615	1.34	3.15	--	1.155	2.741
V	4.089	2.079	4.089	1.155	--	3.708
VI	3.12	1.675	1.93	2.741	3.708	--

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970. The transportation costs were raised ten percent for 1972, plus five percent for 1973 to cover the increased costs of transportation since 1970.

Table 54. Truck transportation costs for whole milk, 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	(Dollars per cwt.)					
I	--	2.705	2.121	3.80	4.293	3.28
II	2.705	--	2.43	1.41	2.18	1.759
III	2.121	2.43	--	3.308	4.293	2.027
IV	3.80	1.41	3.308	--	1.213	2.88
V	4.293	2.18	4.293	1.213	--	3.893
VI	3.28	1.759	2.027	2.88	3.894	--

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970. The transportation costs were raised ten percent for 1972, plus five percent for 1973, and five percent for 1974 to cover the increased costs of transportation.

Table 55. Rail transportation costs for fresh eggs, 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Cents per dozen)			
I	--	6.325	2.915	6.809	6.974	2.486
II	2.629	--	2.629	3.146	4.235	2.233
III	2.915	6.325	--	6.809	6.974	2.332
IV	6.809	2.629	6.809	--	2.607	5.247
V	3.058	4.235	3.058	2.607	--	6.721
VI	2.486	2.233	2.332	5.247	6.721	--

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970.

Table 56. Rail transportation costs for fresh eggs, 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Cents per dozen)			
I	--	6.64	3.06	7.15	7.323	2.61
II	2.76	--	2.76	3.303	4.447	2.345
III	3.06	6.97	--	7.149	7.323	2.449
IV	7.15	2.76	7.149	--	2.737	5.51
V	3.211	4.447	3.211	2.737	--	7.057
VI	2.61	2.345	2.449	5.51	7.057	--

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970.

Table 57. Rail transportation costs for fresh eggs, 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Cents per dozen)			
I	--	6.97	3.214	7.507	7.689	2.741
II	2.898	--	2.898	3.468	4.669	2.462
III	3.214	6.97	--	7.507	7.689	2.571
IV	7.507	2.898	7.507	--	2.874	5.785
V	3.371	4.669	3.371	2.874	--	7.41
VI	2.741	2.462	2.571	5.785	7.41	--

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970.

Table 58. Cost of transporting turkey ready to cook in live weight equivalents, 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	(Dollars per cwt.)					
I	--	1.982	1.684	2.380	2.787	1.656
II	1.982	--	1.844	1.270	1.729	1.227
III	1.684	1.844	--	2.353	2.918	1.326
IV	2.380	1.270	2.353	--	1.208	1.654
V	2.787	1.729	2.918	1.208	--	2.114
VI	1.656	1.227	1.326	1.654	2.114	--

*Source: Texas A & M Formula: Y = .85082823 + .0010969456X
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from ready to cook to live weight equivalent is live weight equivalent = (ready to cook) weight * .80.

Table 59. Cost of transporting turkey ready to cook in live weight equivalents, 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	2.08	1.768	2.50	2.927	1.739
II	2.08	--	1.936	1.33	1.815	1.288
III	1.768	1.936	--	2.476	3.064	1.392
IV	2.50	1.333	2.476	--	1.268	1.737
V	2.927	1.815	3.064	1.268	--	2.220
VI	1.739	1.288	1.392	1.737	2.220	--

*Source: Texas A & M Formula: $Y = .85082823 + .0010969456X$
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from ready to cook to live weight equivalent is live weight equivalent = (ready to cook) weight + .80.

Table 60. Cost of transporting turkey ready to cook in live weight equivalents, 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	2.185	1.857	2.625	3.073	1.826
II	2.185	--	2.032	1.40	1.906	1.352
III	1.857	2.032	--	2.60	3.217	1.462
IV	2.625	1.40	2.60	--	1.331	2.331
V	3.073	1.906	3.217	1.331	--	2.331
VI	1.826	1.352	1.462	1.824	2.331	--

*Source: Texas A & M Formula: $Y = .85082823 + .0010969456X$
X = milage
Y = transporation costs in dollars per cwt.

Conversion factor from ready to cook to live weight equivalent is live weight equivalent = (ready to cook) weight + .80.

Table 61. Cost of transporting beef carcasses in live weight equivalents by truck, 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.445	1.228	1.735	2.031	1.207
II	1.445	--	1.343	0.926	1.26	0.894
III	1.228	1.343	--	1.715	2.126	0.967
IV	1.735	0.926	1.715	--	0.880	1.205
V	2.031	1.260	2.126	0.88	--	1.54
VI	1.207	0.894	0.967	1.205	1.540	--

*Source: Texas A & M Formula: $Y = .85082823 + .0010969456$
X = milage
Y = transportation cost in dollars per cwt.

The conversion factor from carcass to live weight equivalents is carcass wt. + .583 = live weight equivalent. This figure was then increased by ten percent to update the formula to cover the increases in fuel costs, driver wages, and other increased transportation costs.

Table 62. Cost of transporting beef carcasses in live weight equivalents by truck, 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.517	1.289	1.822	2.133	1.267
II	1.517	--	1.41	0.972	1.323	0.939
III	1.289	1.410	--	1.80	2.232	1.015
IV	1.822	0.972	1.80	--	0.924	1.265
V	2.133	1.323	2.232	0.924	--	1.617
VI	1.267	0.939	1.015	1.265	1.617	--

*Source: Texas A & M Formula: $Y = .85082823 + .0010969456$
X = milage
Y = transportation cost in dollars per cwt.

The conversion factor from carcass to live weight equivalents is carcass wt. + .583 = live weight equivalent. This figure was then increased by ten percent for 1972, plus five percent for 1973 to update the formula to cover the increases in fuel costs, driver wages, and other increased transportation costs.

Table 63. Cost of transporting beef carcasses in live weight equivalents by truck, 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.593	1.353	1.913	2.24	1.33
II	1.593	--	1.48	1.021	1.389	0.986
III	1.353	1.48	--	1.890	2.344	1.066
IV	1.913	1.021	1.890	--	0.970	1.328
V	2.24	1.389	2.344	0.970	--	1.698
VI	1.33	0.986	1.066	1.328	1.698	--

*Source: Texas A & M Formula: Y = .85082823 + .0010969456
X = milage
Y = transportation cost in dollars per cwt.

The conversion factor from carcass to live weight equivalents is carcass wt. + .583 = live weight equivalent. This figure was then increased by ten percent for 1972, plus five percent for 1973, and five percent for 1974 to update the formula to cover the increases in fuel costs, driver wages, and other increased transportation costs.

Table 64. Cost of transporting pork carcasses in live weight equivalents, 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.566	1.331	1.881	2.202	1.308
II	1.566	--	1.456	1.003	1.366	0.969
III	1.331	1.456	--	1.859	2.305	1.048
IV	1.881	1.003	1.859	--	0.954	1.307
V	2.202	1.366	2.305	0.954	--	1.67
VI	1.308	0.969	1.048	1.307	1.67	--

*Source: Texas A & M Formula: $Y = .85082823 + .0010969456X$
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from carcass to live weight equivalent is live weight = carcass weight ÷ .632.

Table 65. Cost of transporting pork carcasses in live weight equivalents, 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.644	1.398	1.975	2.312	1.373
II	1.644	--	1.529	1.053	1.434	1.017
III	1.398	1.529	--	1.952	2.42	1.10
IV	1.975	1.053	1.952	--	1.002	1.372
V	2.312	1.434	2.420	1.002	--	1.754
VI	1.373	1.017	1.10	1.372	1.754	--

*Source: Texas A & M Formula: Y = .85082823 + .0010969456X
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from carcass to live weight equivalent is live weight = carcass weight + .632.

Table 66. Cost of transporting pork carcasses in live weight equivalents, 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.726	1.468	2.074	2.428	1.442
II	1.726	--	1.605	1.106	1.506	1.068
III	1.468	1.605	--	2.05	2.541	1.155
IV	2.074	1.106	2.05	--	1.052	1.441
V	2.428	1.506	2.541	1.052	--	1.842
VI	1.442	1.068	1.155	1.441	1.842	--

*Source: Texas A & M Formula: Y = .85082823 + .0010969456X
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from carcass to live weight equivalent is live weight = carcass weight + .632.

Table 67. Cost of transporting broilers ready to cook in live weight equivalents, 1972.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	(Dollars per cwt.)					
I	--	1.784	1.517	2.143	2.509	1.491
II	1.784	--	1.659	1.143	1.557	1.104
III	1.517	1.659	--	2.118	2.626	1.194
IV	2.143	1.143	2.118	--	1.087	1.488
V	2.509	1.557	2.626	1.087	--	1.902
VI	1.491	1.104	1.194	1.488	1.902	--

*Source: Texas A & M Formula: $Y = .85082823 + .0010969456X$
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from ready to cook to live weight equivalent is live weight equivalent = (ready to cook) weight + .720.

Table 68. Cost of transporting broilers ready to cook in live weight equivalents, 1973.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.873	1.593	2.250	2.634	1.566
II	1.873	--	1.742	1.20	1.635	1.159
III	1.593	1.742	--	2.224	2.757	1.254
IV	2.250	1.20	2.224	--	1.248	1.562
V	2.634	1.635	2.757	1.248	--	1.997
VI	1.566	1.159	1.254	1.562	1.997	--

*Source: Texas A & M Formula: Y = .85082823 + .0010969456X
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from ready to cook to live weight equivalent is live weight equivalent = (ready to cook) weight + .720.

Table 69. Cost of transporting broilers ready to cook in live weight equivalents, 1974.*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
			(Dollars per cwt.)			
I	--	1.967	1.673	2.363	2.766	1.644
II	1.967	--	1.829	1.260	1.717	1.217
III	1.673	1.829	--	2.335	2.895	1.317
IV	2.363	1.26	2.335	--	1.310	1.640
V	2.766	1.717	2.895	1.310	--	2.097
VI	1.644	1.217	1.317	1.64	2.097	--

*Source: Texas A & M Formula: Y = .85082823 + .0010969456X
X = milage
Y = transportation costs in dollars per cwt.

Conversion factor from ready to cook to live weight equivalent is live weight equivalent = (ready to cook) weight + .720.