BEHAVIORAL AND PREDICTIVE MODEL OF THE BEEF CYCLE

By

KENDELL WAYNE KEITH

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OF THE BEEF CYCLE

Thesis Approval:

Wayne D Purcell
Thesis Advisor

David L. Kletke

Paul D. Hummer

N D Durham
Dean of the Graduate College

PREFACE

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The Current Situation

The cattle industry has faced several unique situations over the past two years. The price of beef moved up after the beginning of 1972 to a point some producers thought impossible. With this increase came government price controls on beef at the retail counter. Such price controls had never been implemented during peacetime.

Beef consumption has increased relative to other meat consumption since World War II. Beef consumed per person has doubled in the past twenty years, and this has paralleled a remarkable expansion in the cattle industry.[1] The increase in per capita beef consumption from 1952 to 1974 is shown in Figure 1. A recent exception to the upward trend occurred in 1973, when cattle slaughter fell, as producers held mature animals off the slaughter market. The high prices experienced during the government price controls began to decline when the freeze was lifted. By mid-1974 prices had fallen to such low levels that all cattlemen holding cattle during the period sustained large losses. These developments have caused policy-makers as well as those related directly to the industry to take a careful look at what other changes might be expected in the near future.

It has long been recognized that annual cattle inventories display

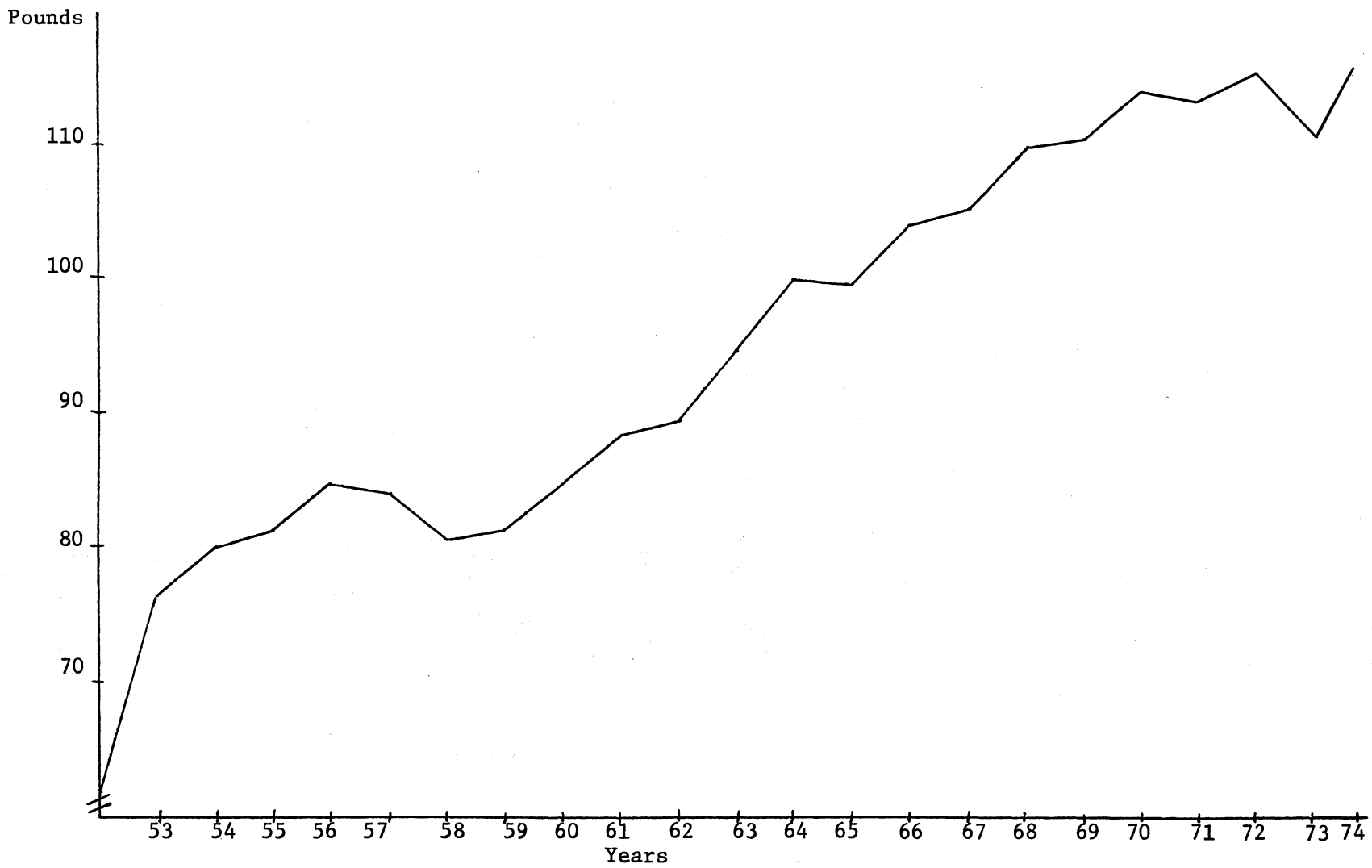

Figure 1. U.S. Per Capita Consumption of Beef, Pounds, 1952- 1974

a cyclical pattern. Although there is disagreement on what factors cause this cycle (external versus internal), few disagree with the existence of the cycle. Periods of low production and high prices, tracing the normal pattern, have been followed by shorter periods of high production at low prices. The pattern is possibly caused by the biological nature of beef production since a longer time is required to build up production as opposed to liquidation of existing herds.

Most of those who have studied the cattle cycle subscribe to the belief it is internally generated. There have been times when factors other than rapid price declines have caused producers to sell cow herds. During the 1930's drought caused feed supplies to fall below normal and this resulted in liquidation.[2] But on most of the occasions cattle numbers have dipped, the decreased number were related to depressed prices. With the low prices comes slaughter of cow herds previously used in production. This cow slaughter, along with the higher than normal slaughter of fed animals, causes prices to be driven down even further until slaughter finally dips below equilibrium levels due to shortages of feeder animals. With these shortages comes increases in prices which are eventually forced even higher by producers holding heifers off the feeder market for production purposes. The higher prices will ultimately again fall from overproduction as the cycle is repeated.

The cattle industry has been subject to three distinct cycles since 1940. During each of these cycles the downswing in numbers has required a shorter time period than the upswing.[3] The cycles have not exhibited regular length or amplitude. External forces, of which weather is the most influential, have some effect in lengthening or

shortening the cycle. However, the cycles have shown enough similarity of pattern to make analysis and comparisons possible.

The cycle of the mid-1950's was characterized by marked herd liquidation. By the early 1960's, the cow herd was in the expansion phase of the cycle and numbers were high. Following a normal pattern, cattle numbers should have dipped in 1965. However, prices were supported by a rapidly increasing demand and did not fall as dramatically as during past cycles. This situation resulted in little liquidation of cow herds.

Since the cattle numbers did not fall during the mid-1960's as was expected, cattlemen have not faced a situation of forced liquidation since the mid-1950's. Current price conditions indicate that a reduction in cattle numbers would protect the financial position of cattlemen, but no over-all industry liquidation of cows has begun. January inventory reports for 1975 show a 5.6 percent increase in beef cow numbers.[4] Such a large increase in the production base, given the low prices experienced during 1974, indicate possibly false optimism within the industry that depressed prices may recover quickly.

With the continued build-up in the beef cow herd and a slowing of the growth in population, substantial increases in per capita consumption of beef will be needed. While per capita production continues at high levels, prices will likely remain depressed, causing problems for the cattle feeder, cow-calf man, and others connected with the industry.

The Problem

The beef industry in 1975 is most concerned about low cattle prices and uncertainty as to when these prices are expected to recover. To deal with the situation requires knowledge of what slaughter numbers are likely for 1975 and 1976. Slaughter level projections, however, depend largely on individual cattlemen's behavior and decision-making. There is little information available concerning this phase of the cattle cycle. More definitive knowledge of relationships which must exist before herd liquidation begins could provide a base for policy recommendations, marketing decisions, and outlook.

Review of Literature

Literature available on the cattle cycle was surprisingly somewhat limited, but several recent studies were of benefit in developing a workable format for this project.

Trierweiler and Erickson[5] made a study of supply response of the cow-calf operation in 23 homogeneous regions of production in the United States. Structural economic models for the different regions were utilized. They emphasized a need for more thorough knowledge of supply response on a small regional breakdown of the cattle industry. Such information, they argued, should be available to producers, policy makers, and administrators.

A study by Franzmann[6] made use of a trend model of the cattle price cycle. This model's greatest use was in predicting turning points of the cycle, one of which was a projected cyclical low in 1974. Unlike some other authors, Franzmann contended that the price cycle displayed a remarkably uniform pattern.

Gruber and Heady[7] divided the cycle into three separate cycles: (1) inventory, (2) price and income, and (3) slaughter and import. They developed macroeconomic models explaining the magnitude of important variables relating to the cattle cycle. This study further emphasized the need for more quantitative information on factors relating to the cycle.

In a diversion from the technical models, Crom[8] used a behavioral model to make economic projections in the beef and pork industries to 1980. This model utilized human behavior as a variable in projections of levels of consumption, production, and resulting prices. In making human behavior a variable, operating rules were placed in the model such that when certain variables exceeded specified levels, subsequent changes were automatically implemented.

In a 1965 work by Walters[9] several models were built which separated the cattle inventory into separate classes. Walters indicated that build-up periods of the cattle cycle have normally taken six years. This article drew special interest for this project as it occurred during the sixth year of a build-up phase which began in 1959. Thus, at the time the article was written, the author apparently felt the liquidation phase of another cycle was near.

Objectives

The main objective of this study is to develop a beef production model and predict the occurrence of significant behavioral reactions which are involved in the current beef cycle. Sub-objectives include:

1. Isolate and identify key elements in behavior of the cow-calf sector of the beef industry during past cyclical disturbances.

2. Estimate quarterly per capita availability of beef over the 1975-76 period.

3. Estimate the average quarterly market-clearing price of slaughter and feeder steers, 1975-76, given the estimates of per capita availability.

4. Infer behavioral reactions within the cow-calf sector of the beef industry to the estimated average prices for feeder steers.

Procedure

As a means of outlining the behavioral dimension of the cattle cycle, two analyses were conducted. First, a questionnaire was prepared for the cow-calf man and was directed toward a better understanding of likely occurrences in the near future for the industry. Second, an accounting approach was used to derive slaughter numbers from inventory numbers. The purpose was perception of behavioral influences throughout the beef cycle.

Since the time horizon for the per capita production predictions was only two years, single-equation models were used. First, an equation predicting quarterly slaughter numbers over all classes was developed. Next, average weights and slaughter percentages of the various classes were estimated from analysis of recent trends and past comparable periods. Combining the slaughter equation's projections with the estimates of weight and breakdown of slaughter, quarterly per capita production predictions were generated for 1975-76.

To predict quarterly average price for 1975-76, a slaughter steer price model was adopted which used the beef production estimates as an explanatory variable. Using prices generated by this model and

estimates of feeding costs over the period, quarterly average feeder steer prices were generated. Inferences were then drawn as to the future situation and outlook for the industry at the cow-calf level of production.

FOOTNOTES

[1]U.S. Department of Agriculture, Livestock and Meat Statistics, Statistical Bulletin 522 (Washington, July, 1973), p.206.

[2]James H. Lorie, "Causes of Annual Fluctuations in the Production of Livestock and Livestock Products," Journal of Business, Vol. 17, No. 1, Part 2 (April, 1947), pp.43-62.

[3]Forrest Walters, "Predicting the Beef Cattle Inventory," Agricultural Economics Research, Vol. 17, No. 1 (January, 1965), p. 10.

[4]U.S. Department of Agriculture, Livestock Meat Wool, Agricultural Marketing Service, Vol. 43, No. 6 (February, 1975), p.142.

[5]John E. Trierweiler and Donald B. Erickson, Structural Relationships for National and Regional Beef Cattle Production, South Dakota Agricultural Experiment Station, Technical Bulletin 25 (Brookings, June, 1965).

[6]John R. Franzmann, "Cattle Cycles Revisited," Southern Journal of Agricultural Economics, Vol. III, No. 1 (December, 1971), pp. 69-76.

[7]Josef Gruber and Earl O. Heady, Econometric Analysis of the Cattle Cycle in the U.S., Iowa Agricultural Experiment Station, Research Bulletin 564 (Ames, July, 1968).

[8]Richard J. Crom, "Economic Projections Using a Behavioral Model," Agricultural Economics Research, Vol. 24, No. 1 (January, 1972), pp. 9-15.

[9]Forrest Walters, pp. 10-18.

CHAPTER II

THEORETICAL DIMENSIONS OF THE CATTLE CYCLE

In conventional economic theory, the basic price-determining relationship is that of a supply schedule for producers and a demand schedule for consumers. Figure 2 shows an upward sloping supply curve, demonstrating producers' willingness to supply more of a good at a higher price. The downward sloping demand curve displays consumers' willingness to purchase more of a good at a lower price. The common point between the two schedules represents an equilibrium price and quantity satisfying both participants in the market.

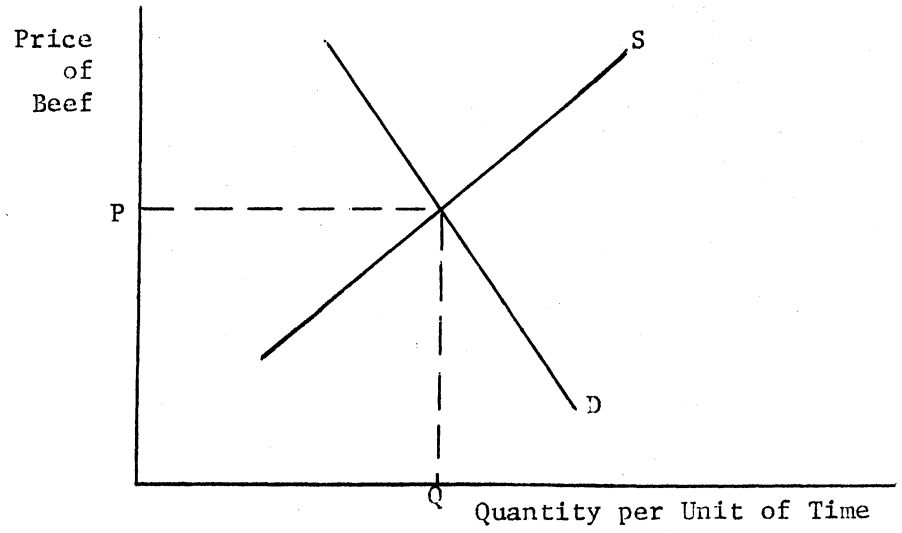

Figure 2. Basic Supply, Demand and Equilibrium Price Concepts

To achieve and maintain an equilibrium price and quantity within a market, producers and consumers would be required to make instantaneous adjustments to external influences affecting the value or availability of the product. In a real-world market place, full adjustment in quantity supplied or demanded may be delayed by characteristics of the market or the product. Changes in quantity demanded to given changes in conditions determining demand are often slowed by imperfect knowledge within the market. Changes in quantity supplied in response to a change in price are less than instantaneous in many cases because of the nature of the production process.

Lagged response in supply to price changes forms the theoretical basis for production cycles. Since production of a commodity such as beef requires a period of time determined by the biological process, supply in one period is largely governed by prices in some previous period. Demand for beef is best reflected by price in the current period. These functional relationships might be stated in simplistic terms as follows:

Beef Supply = f (lagged beef price)

Beef Demand = f (current beef price)

Since supply must equal demand at the market-clearing price, one would not expect the short-run market-clearing price to be the long-run equilibrium price unless current price and lagged price are equal. Figure 3 shows an initial available quantity of Q_1, which is less than the equilibrium quantity Q_0. The shortage might have been caused by drought or a previous reaction to reduced prices on the part of cow-calf men.

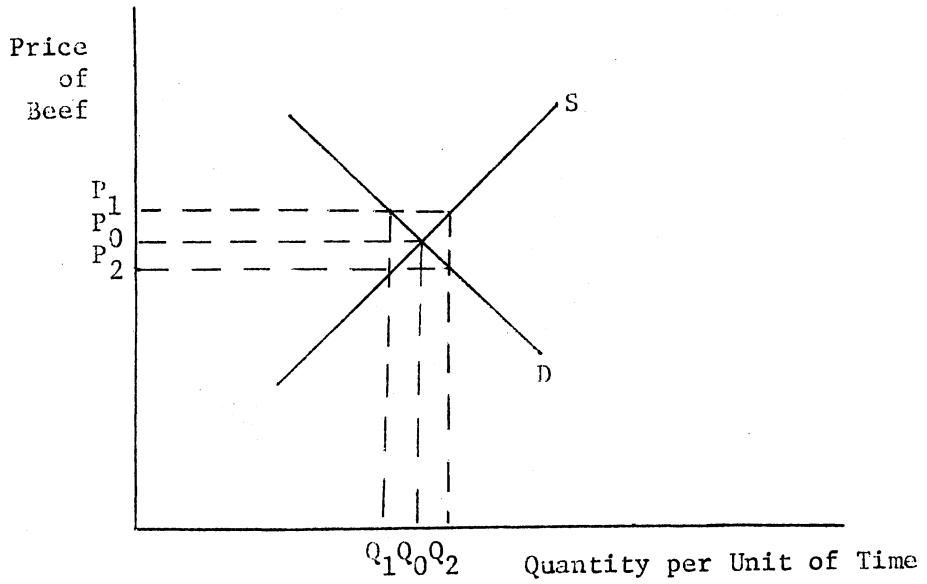

Figure 3. Cobweb Theory of Production Cycles

With Q_1 available, consumers are willing to pay P_1 for the beef. As cattlemen see the price rise to P_1, they begin to produce more. At the market price of P_1, cattlemen are willing to supply quantity Q_2. As this production level is reached, however, consumers are willing to pay only P_2 for the increased quantity. As cattlemen begin to receive lower prices for beef, production levels are lowered. Therefore, the reaction of cattlemen in terms of quantity supplied to current prices is seem in some later period.

Although the cobweb theory assumes static demand and supply schedules, which may be in conflict with real-world conditions, it can be used to explain the occurrence of commodity production cycles.[1] The length of time involved in moving from one period of low prices through a period of high prices and back to low is

determined by the time necessary to change the quantity of the commodity produced. The production process and factors which may increase or decrease the time involved are unique within each commodity group. In the cattle industry, history presents evidence of about a ten-year cycle.[2] In Figure 3 this ten-year cycle follows a path beginning with a price of P_1 to a low price of P_2 and back again to a cyclical high. Figure 3 is general representation displaying the common characteristics of all cycles, but there are some special considerations within the production cycle of each commodity.

Slaughter steers and heifers are generally 18 to 20 months old when they reach the packing plant. This time lag, however, does not accurately depict the time required to increase production levels. Heifers must be held approximately two years before reaching calving age. This would indicate a 3 1/2 to 4-year production lag. Given this length of time for production, there appears to be a conflict between the cobweb theory and the cattle cycle as it occurs in reality. The conflict can be largely resolved by noting the differences between price movements implied in the cobweb model and price movements occurring in an actual market.

Figure 4 will be utilized to incorporate some behavioral dimensions and realistic price movements over time into a theoretical framework explaining the length of the cattle cycle. With the supply and demand schedules shown in Figure 4, the quantity initially being supplied, Q_1, is less than the equilibrium quantity Q_0. At the initial price level, P_1, producers would be willing to supply quantity Q_3. To achieve this production level, producers must begin by holding heifers and cows off the slaughter market for breeding purposes. Therefore, the quantity of

beef supplied while producers are increasing their production base may actually decrease to some level designated by a short-run supply curve, S_2, with coordinates including Q_2, P_2. The price increases further due to the reduced supply resulting from decreased female slaughter. Cattlemen are induced to produce more at this still higher price level, and more heifers are held back to continue the increase in production herd numbers. Given adequate time, the progeny of the new brood cows reach slaughter age and the quantity supplied begins to increase. After the quantity of beef available increases, prices start a gradual decline as the short-run supply schedules shift outward to the right.

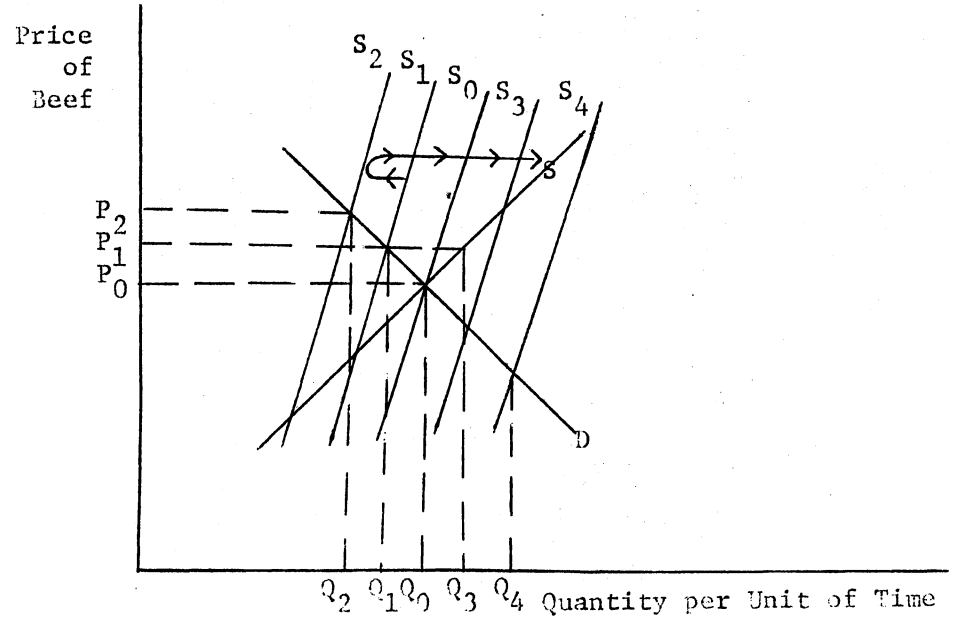

Figure 4. Cobweb Theory Explaining Dynamics of the Cattle Cycle

The build-up of the production herd through the aforementioned process has generally taken six to eight years. After prices have fallen from their peak and continue a downward trend, the supply curve shifts further to the right as cattlemen make decisions with regard to the size of their herd.

The length of time involved in cattlemen's decision process to slaughter excess cow numbers directly affects the amplitude of the cycle. Since the rapidity of liquidation of herds also determines the duration of the low price phase, the speed at which the supply curve shifts also directly affects the length of the cycle.

All the applied theory discussed in this chapter begins with the assumption of a market out of equilibrium. Shortages of cattle may be forced by drought, but in recent history droughts have not played a big role in causing production declines. During the two decades of the 1950's and 1960's, there is evidence that the demand schedule for beef was shifting outward.[3] This factor has probably been more instrumental in causing relative beef shortages than any external force. A shifting demand with increasing production would tend to lengthen the time required to build numbers from a cyclical low to a peak. Demand shifts would also dampen price drops as low points in cycles are approached.

Figure 4 demonstrates a characteristic of the cattle cycle which should be important to everyone connected with the beef industry. Once the production herd has been built to a level so that prices begin to fall, unless demand is increasing rapidly, prices will continue to fall forcing increased cow slaughter. Producers' strategies and actions in attempting to handle the depressed price situation are the major

elements governing the span of time dominated by low prices. The importance of determining when cattle prices will begin to recover has become quite obvious to cattlemen involved in the present price situation.

In projecting a length of time one could reasonably expect cattle prices to remain low, predicting behavioral reactions of producers becomes a necessity. The next chapter is devoted to examining the behavioral aspects of the cattle cycle in a framework which may aid in projecting producers' possible responses to faltering cattle prices.

FOOTNOTES

[1]James M. Henderson and Richard E. Quandt, Microeconomic Theory, 2nd ed. (New York, 1971), pp. 142-150.

[2]John R. Franzmann, "Cattle Cycles Revisited," Southern Journal of Agricultural Economics, Vol. III, No. 1 (December, 1971), pp. 69-76.

[3]J.W. Goodwin, R. Andorn, and J.E. Martin, The Irreversible Demand Function for Beef, Oklahoma Agricultural Experiment Station Technical Bulletin T-127 (Stillwater, June, 1968).

CHAPTER III

ELEMENTS OF THE CATTLE CYCLE

The Producer's Role in the Cycle

The length and amplitude of each recurring cattle cycle is largely dependent on how the individual producer responds to the price cycle. The shorter the time interval needed to reduce production levels in reaction to low prices, the more quickly prices will recover. A survey was conducted in an effort to determine the production plans of cow-calf men for the near future. The survey also attempted to measure producers' awareness of recent developments which preceded the falling prices in 1973 and 1974.

Method and Purpose of Sampling

The mailed questionnaire survey was sent in August, 1974, to 925 cow-calf men in Oklahoma, Texas, and Kansas. The sample of those persons questioned in the survey was taken from the Statistical Reporting Service's mailing list of producers.[1] Nearly all the counties in Oklahoma were represented plus several counties in Texas and Kansas on Oklahoma's border. The percentage breakdown of respondents by cow herd size was as follows: 31 percent had 1-25 cows; 43 percent had 26-100 cows; and 26 percent had a herd containing greater than 100 brood cows.

Questions asked of the cow-calf men were directed toward a better understanding of four main points:

1. The level of growth experienced over the last five years and estimated growth for the next three years in the cow-calf operations included in the survey;
2. Cow-calf men's understanding of causal factors involved in the current depressed price situation;
3. Cow-calf men's expectations for the near future in the cattle industry; and
4. Given their expectations, the producers' plans or strategies to handle the situation.

Although response to the questionnaire was only 15 percent of the number mailed, some insight into the situation from a real-world viewpoint were acquired.

Questionnaire Results

For the cow-calf men surveyed, Table I indicates growth of herds in the past five years as well as planned growth for the near future.

The summation of results in Table I demonstrates substantial herd growth over the last five years, with the greatest part of the increase coming in the last three years. The pattern and timing of the growth conforms well with published data on national growth in the beef cow herd.[2] The percentage growth for the five year period, however, is considerably larger than that of total U.S. beef cow numbers.

TABLE I

PAST GROWTH AND ESTIMATED FUTURE GROWTH
IN COW HERDS OF RESPONDENTS

Survey Item	Head Number
Cows and Replacement Heifers in Herd in 1969	7,437
Cows and Replacement Heifers in Herd in 1971	8,071
Current Number of Cows in Herd (August, 1974)	8,239
Current Number of Replacement Heifers in Herd	1,681
Total Current Number of Cows and Replacement Heifers	9,970
Estimated Number of Cows and Replacement Heifers in 1977	10,308

The number of replacement heifers currently in the herds of reporting cattlemen constitutes some 20 percent of the number of cows. There could be two interpretations of this high percentage: (1) The heifers held back for replacement when prices were rising are still being held in hopes of a better market in which to sell later; and (2) with the market price down, cow-calf men have decided that old or unproductive cows can be replaced at lower cost.

In another part of the survey, cow-calf men were questioned on their knowledge of beef cow numbers in the U.S., and whether the total has increased or decreased from 1969 to 1974. Seven choices were

suggested as possible answers. Results from this question, displayed in Table II, were tabulated according to the herd size of the reporting cow-calf men.

TABLE II

PERCENTAGE CHANGE IN U.S. BEEF COW NUMBERS, 1969-1974, (AS ESTIMATED BY REPORTING COW-CALF MEN)

Change in Cow Numbers	Size of Respondent's Operation (no. cows) 1-25	26-100	>100	Total	% of Total
Decreased More than 20%	2	1	0	3	2.7
Decreased 20%	1	1	0	2	1.8
Decreased 10%	2	5	0	7	6.2
No Change	3	1	1	5	4.4
Increased 10%	16	25	15	56	49.6
Increased 20%	7	12	8	27	23.9
Increased more than 20%	4	4	5	13	11.5

Actual data show beef cow numbers increasing some 20.8 percent during the five year period.[3] Of those questioned, 85.0 percent knew numbers had increased over the period, but only 35.4 percent (sum of last two rows) were familiar with the magnitude of the increase. Table II also seems to show that cow-calf men with larger operations are

better informed with regard to the industry's situation. NOne of those questioned who had herds larger than 100 brood cows thought there had been a decrease in U.S. beef cow numbers.

One of the survey questions was explicitly directed toward determination of the factors cow-calf men felt have had the greatest impact in depressing cattle prices during 1974. Six choices were listed, and respondents were requested to rank the alternatives (1 - most important, 2 - next most important, etc.) according to relative importance. After the questionnaires were returned, an oversight in the suggested factors became obvious. Another choice which should have been offered was high grain prices. A large percentage listed grain prices under the choice of 'other', indicating the cow-calf men thought it was an extremely important factor. Table III indicates factors the cow-calf men perceived as having the greatest depressing influence on cattle prices in 1974.

The cow-calf men envision the price freeze instituted by the government in the fall of 1973 as having the greatest impact on cattle prices. Factors listed next in importance are high beef imports and heavier slaughter weights. Most likely, had the high grain prices been a choice, it would have been given more emphasis.

The most interesting statistic from Table III is the number of times 'too much beef produced' was selected. According to traditional economic theory, increased supply or decreased demand will cause decreased prices. 'Too much beef produced' is the choice offered in this question which points most directly toward an excess supply. According to cow-calf men, however, it ranks fourth out of the possible factors depressing current cattle prices.

TABLE III

FACTORS LISTED BY RESPONDENTS AS CAUSING
LOW CATTLE PRICES IN 1974

Rankings	High Beef Imports	Seasonal Price Variation	Too Much Beef Produced	Last Summer's Price Freeze	Heavier Slaughter Weights	High Grain Prices	Consumer Resistance	Other
one's	34	2	25	42	8	12	3	4
two's	27	2	10	29	34	5	4	2
three's	14	3	11	15	18	3	3	1
four's	10	4	10	5	12	0	2	0
five's	2	18	8	3	2	0	1	0
six's	2	6	1	0	0	1	0	3
Simple Total	89	35	65	94	74	21	13	10

Another question attempted to measure expectations which cow-calf operators have for the developing industry situation in the next three to five years. Five possible alternatives were offered in this question. Table IV shows developments the cow-calf men questioned deemed as the most likely ones.

TABLE IV

COW-CALF MEN'S OPINION OF MOST PROBABLE DEVELOPMENTS IN CATTLE INDUSTRY, NEXT 3-5 YEARS

Possibilities	Number of Producers Responding	Percent of Total
Prices should recover by late 1974 to early 1975	24	19.7
Prices to remain stable for 1 1/2 years and recover late 1975	59	48.4
High production will cause prices to remain at present levels 2-3 years	31	25.4
Prices will spiral downward for the next 3-5 years	3	2.5
Other	5	4.1

Admittedly, the choices for answers were limited in their scope, but it was hoped that an approximation could be made on the length of time cattlemen expected market prices to be down. From a summation of the percentage choosing the first two possibilities, 68.1 percent of

those polled felt recovery of prices would come no later than the end of 1975. Very few operators chose the extremely pessimistic view of prices falling further for 3-5 years more.

With higher grain prices putting downward pressure on the feeder market from a sagging slaughter cattle market, cow-calf enterprises have become marginal at best. These events form the basis for another question asking cow-calf operators to choose a feeder cattle price for choice 400-500 lb. steer calves which would force them to seriously consider reducing their production herd size.

Thirty-two percent of cow-calf men reporting chose a price above $26 per hundred-weight. Forty-one percent selected prices below $26 per hundred-weight for feeder calves before they would consider reducing herd size. Twenty percent stated they intended to keep their herd sizes constant, indicating indifference with regard to low prices. Seven percent listed weather or pasture conditions as being of more importance to them than price in decisions of decreasing herd size.

The final two questions on the survey asked the cow-calf men for an opinion of the cattle industry's future for the next three to five years and for their plans or strategies as producers to handle situations which they felt were probable. Unlike the others, the last two were open end questions, such that those responding could freely express their thoughts or feelings.

As was expected, answers to these questions varied widely. The responses were narrowed down into four main areas that were mentioned most often. Tables V, VI, VII and VIII indicate producers' outlooks in each of the four respective areas.

TABLE V

QUESTIONNAIRE RESPONDENTS' OUTLOOK ON PRODUCTION
FOR THE NEXT 3 TO 5 YEARS

Possibilities	Number Responding
Less grain-fed cattle	13
Moderate increases in production	4
Lighter average slaughter weights	3
Moderate decreases in production	3
Beef shortage sometime during period	3

TABLE VI

QUESTIONNAIRE RESPONDENTS' OUTLOOK
ON U.S. BEEF COW NUMBERS
FOR THE NEXT 3-5 YEARS

Possibilities	Number Responding
Numbers will decrease by less than 10%	37
Numbers will be constant	11
Numbers will decrease by more than 10%	5
Numbers will increase	3

TABLE VII

QUESTIONNAIRE RESPONDENTS' PLANS FOR THEIR OWN COW HERD SIZE

Possibilities	Number Responding
Herd size will remain constant	32
Will cull more cows	20
Will sell all cows if production costs and/or prices don't improve	11
Plan to slowly build herd size	5

The results given in Table V indicate the respondents did expect some changes in the cattle industry in the near future, but the only point in this area on which many of the producers appeared to agree was a decrease in the grain feeding of cattle. Tables VI and VII seem to denote a conflict in the producers' opinions of changing cow numbers for the next 3-5 years. Only 3 of 56 respondents expected increased U.S. beef cow numbers during the period. However, 37 of 68 respondents stated plans of at least keeping a constant herd size. Other production plans listed by respondents and shown in Table VIII included cutting production costs, retaining a smaller cow herd for grazing only, and switching from a cow-calf to a stocker operation.

TABLE VIII

QUESTIONNAIRE RESPONDENTS' OTHER PRODUCTION PLANS

Possibilities	Number Responding
Cut feeding and other production costs	14
Keep only the amount of cows land will pasture	11
Switch from cow-calf to stocker operation	10
Hold calves on grass and pasture to heavier wgts	7
Breed for less fat, earlier maturing	4
Stay financially liquid in case of further price drop	3

Summary of Results

Level of Growth in Past and Planned Future Growth. The cow-calf men responding to the survey have increased their herd size an average of 34 percent over the past five years. Thus, these cattlemen have reacted to increasing prices much like cattlemen, across the country. A few of those polled stated they had already sold their herd or had decreased its size, but the majority still had herds the same size as in the fall or 1973. Thus, the bulk of those questioned have been hurt financially, much like the whole cattle industry.

Concerning future growth, these cow-calf men, on the average, anticipated a small growth in their herd size in the next three years. However, within this average are growth estimates which vary from complete liquidation of herd to a doubling of herd size. The relation of heifer replacement numbers to present cow herd size (20.3 percent) shows prospects of further growth for 1974 and 1975 in the production base. Continued growth, given prices which producers now face in the feeder cattle market, seems difficult to justify on economic grounds.

Understanding of Factors Causing Low Prices. Most of the cow-calf men were aware that beef cow herds have been increasing for the past five years. However, only slightly more than one-third were knowledgeable of the magnitude of the increase.

Even though the majority knew cattle numbers had been increasing to a degree, they felt that two exogenous influences, imports and the price freeze, have had more impact on prices than overproduction. That is, they thought there were two factors outside of the industry's control which had been more detrimental than any factors such as overproduction or heavy weights controllable within the industry. The producers were reluctant to admit that the recent rapid growth in cattle numbers was the major influence forcing prices downward.

Expectations Regarding Next 3-5 Years. At the time the questionnaire was mailed (August, 1974), prices of cattle had been 'down' for only some six to seven months. The majority of the producers stated prices should recover by the end of 1975 at the latest. This estimate could be interpreted as optimistic given present cattle numbers on hand. However, cattle prices have been favorable for seven to eight years

previous to 1974. With this fact in mind, there is little need to attempt any reasoning as to why producers tend to be optimistic about the industry's future.

Other points mentioned with regard to the near future were less grain feeding and lighter slaughter weights. Producers listing these two ideas may be correct in their thinking. In past cyclical downturns in price, lighter slaughter weights have followed. These lighter weights resulted from the industry trying to rid itself of excess numbers by slaughtering cattle at earlier ages, slaughtering more cows, and because the decreased profitability of grain feeding cattle to heavy weights in a faltering market. Less grain feeding in the present situation will also be forced by historically high grain prices as well as the falling cattle prices.

Plans or Strategies to Handle Expected Situation. The majority of the producers responding indicated their herd size would at least remain constant. Heavier culling of cows was noted likely by some 29 percent of the producers. Another 16 percent declared they would not make a decision on reducing or increasing their herd of cows until they were convinced production costs and cattle prices would not change for the better. Therefore, very few producers were considering any large scale herd reduction even though losses from cow-calf operations appeared likely for the next year.

Other strategies mentioned by the cow-calf men reflected attempts to cut production costs by pasturing as much as possible and little feeding. Producers also declared they would hold calves to heavier weights in hopes of a larger profit from grazing and a possible price rise.

Relationship Between the Inventory and Slaughter Cycles

Predicting Slaughter Numbers from Inventories

In simplistic terms, commercial beef production is determined by the numbers of cattle slaughtered and the average weights of slaughter animals. Both head numbers slaughtered and the average weights are affected by price movements, but physical limits such as maximum weight and age cause commercial production to be largely predetermined over the short-run regardless of price. That is, with a given brood cow herd, a certain number of slaughter animals may be expected in slaughter markets over a two-year period. To keep computational problems to a minimum in this section, beef production will be considered completely inelastic with respect to price over the two-year period, 1975-76.

For the slaughter number predictions, an accounting procedure was developed from logical reasoning and known physical relationships. The beginning point for the procedure was January 1 cow inventory numbers. From this outset, slaughter numbers of cows, steers, and heifers were generated for the following year. Cow numbers were separated into beef cows and milk cows, since replacement rates for the two categories appeared to be quite different.[4]

Several assumptions had to be made to generate the slaughter numbers from inventories. Normal replacement rates for zero herd growth were calculated from published data during the 1965-1973 period. Before 1965 no data was available on heifers kept for replacement purposes. Death rates of 1.4 percent per year for cows and 1.0 percent for steers and heifers 600 pounds and over were assumed constant

throughout the period. Another critical assumption involved the percentages of calf slaughter made up by heifers, steers, and bulls.

Equation 1 was used to calculate milk cow slaughter from the existing milk cow herd.

$$\text{Milk Cow Slaughter}_t = \left[\frac{\frac{MCH_{t+1} - MCH_t}{MCH_t}}{2} + .2935 \right] \cdot MCH_t - .014 \cdot MCH_t \quad (1)$$

Where:

MCH_t = Milk cow herd in year t

The fractional expression within the first bracket measures the percent change in milk cow numbers during year t. Making the assumption of increases (decreases) in inventory of cows being caused by equal proportions of decreased (increased) cow slaughter and increased (decreased) holdings of replacement heifers, the change is divided by two to measure the change in inventory attributable to changing cow slaughter. The change in inventory due to cow slaughter is then added to .2935 which is estimated to be the replacement rate for constant inventory numbers. This sum is the percent of the milk cow herd which was slaughtered or died during the year. Actual 'slaughter plus death' figures come from the multiplication of herd size by this percentage. An annual death loss of 1.4 percent is subtracted to obtain milk cow slaughter for the year.

$$\text{Beef Cow Slaughter}_t = \left[\frac{\frac{BCH_{t+1} - BCH_t}{BCH_t}}{2} + .1611 \right] \cdot BCH_t - .014 \cdot BCH_t \quad (2)$$

Where:

BCH_t = Beef cow herd in year t

Equation 2, estimating beef cow slaughter in year t, is the same

as equation 1 with two exceptions. The replacement rate used for beef cows was .1611, and the beef cow slaughter plus deaths (first brackets) was not allowed to fall below a minimum of .11 during peak growth periods. The .11 was admittedly an estimate, but it established a minimum culling rate for older cows.[5]

$$\text{Heifer Slaughter}_{t+1} = [(.50 \cdot \text{calving rate}_t \cdot CH_t) - (\text{replacement heifers}_t) - (\text{heifer calf slaughter}_t + \text{heifer calf deaths}_t)]. \quad .99 \tag{3}$$

Where:

CH_t = Cow herd in year t

Slaughter heifer numbers from both beef and dairy herds were projected in the same manner. Numbers of replacement heifers were calculated from cow slaughter and death figures (replacement heifers = cow slaughter and deaths + change in cow inventory). Heifer calf slaughter and deaths were obtained by multiplying total calf slaughter by the percentage of total available calves which were heifers. The total figure in brackets in equation 3 represents the number of mature heifers available for slaughter or death. Death loss for mature animals (1.0 percent) was removed by multiplying by the constant .99 to obtain slaughter heifer numbers.

$$\text{Steer Slaughter}_{t+1} = [(.50 \cdot \text{calving rate}_t \cdot CH_t) - (\text{steer calf deaths}_t + \text{steer calf slaughter}_t)] \cdot .99 \tag{4}$$

Steer slaughter numbers were obtained in about the same manner as heifer slaughter. However, no replacement rate for bulls (as compared to replacement heifers) was calculated. Bull slaughter is relatively insignificant when compared to the head numbers from the other categories, so it was lumped with steer slaughter. Of course, placing the classes together implicitly assumes the same average lags in production for each,

but the smallness of bull numbers causes any error in prediction to be small.

Comparison of Actual and Predicted Slaughter

Equations 1-4 were utilized to transform January 1 cow inventories of the period 1948-73 into slaughter estimates for each class. Hypothetically, annual steer and heifer slaughter numbers generated in this manner assume a uniform time lag in the production process.

Although the average production period for slaughter animals may be declining slowly throughout the twenty-five year interval, an assumption of uniform time lags has validity because of biological limitations. Possibly the most critical supposition was that of the normal replacement rate for the beef and milk cow herds. Estimates for the 1965-1973 period were used throughout the period, because previous data was lacking. If the rates have changed much during the period, heifer and cow slaughter may be distorted.

As a comparison for the estimates of slaughter with uniform time lags, total commercial slaughter was plotted along with the sum of annual calculated slaughter over all classes in Figure 5. Actual total commercial slaughter in the graphic presentation shows wider fluctuation than commercial slaughter developed from inventory numbers. In relation to the upward trend line, when slaughter numbers were low, calculated slaughter consistently overestimated actual, and when slaughter numbers were high, calculated slaughter consistently underestimated actual. The uniformity of the differences between the two annual slaughter lines may offer some insight into what the slaughter numbers generated from inventory numbers actually depict. It may also

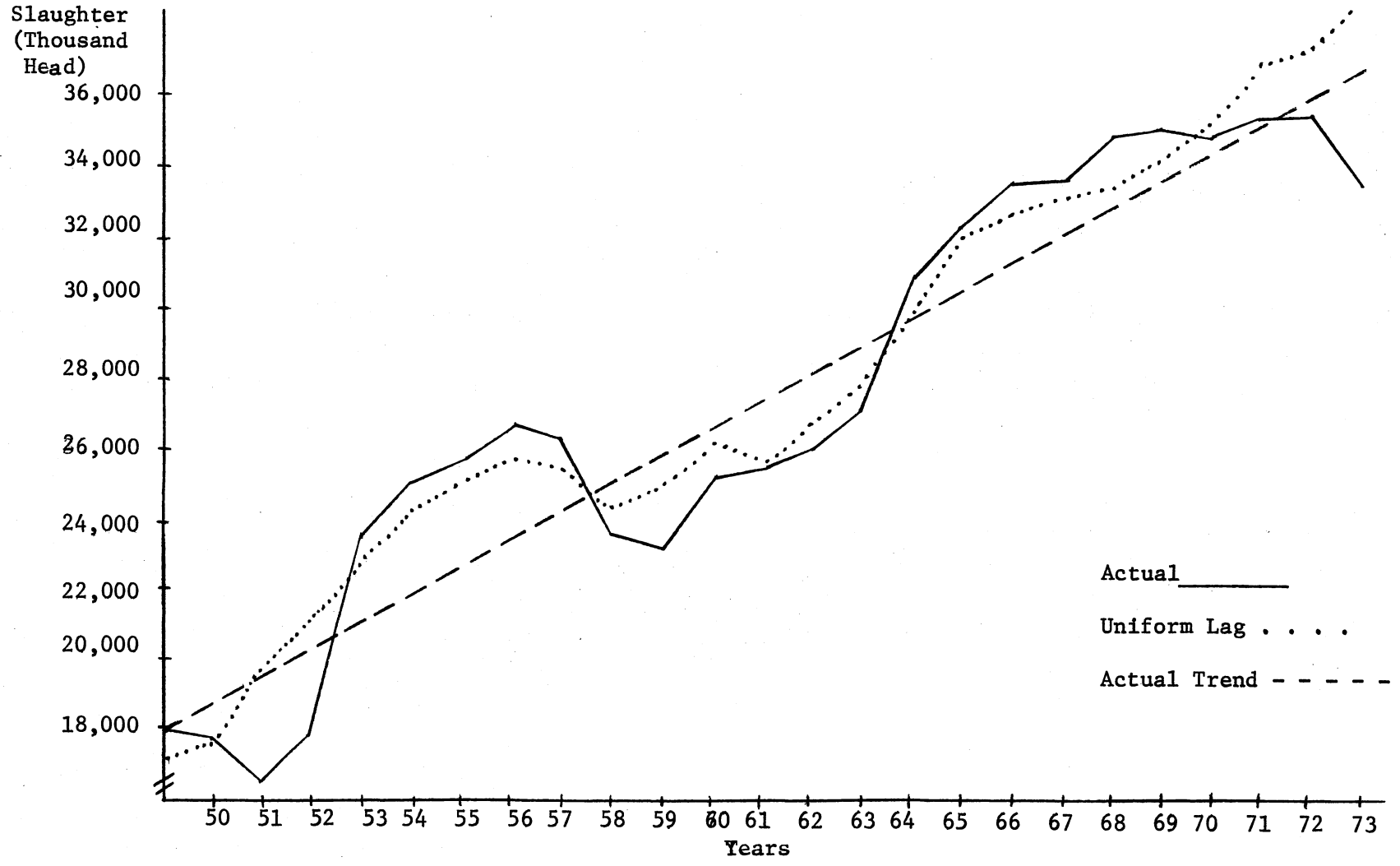

Figure 5. Comparison of Actual Commercial Cattle Slaughter and Slaughter with a Uniform Production Lag, 1949-1973

help to explain the cycle in cattle slaughter numbers.

As previously stated, the slaughter derived from inventory data assumed uniformity in average production periods of slaughter steers and heifers. Figure 5 indicates the average production period may lengthen considerably during periods of low slaughter levels and shorten to some extent during periods of high slaughter levels. The dotted line, therefore, becomes an estimate of expected slaughter for any given year. Deviations in actual slaughter from this expected slaughter are caused by differences in production periods.

If one views the dotted line as annual available slaughter, a partial explanation can be given for the production cycle. For example, during 1951-52 slaughter was below what normally would be anticipated given the production base of brood cows. In the following five years, 1953-57, expected slaughter was below the actual. Steers and heifers available for slaughter were built up during the 1951-52 period of favorable prices and were marketed as actual slaughter for five years as prices fell to lower levels. Over-reaction of the industry to price in terms of slaughter numbers is clearly shown. This behavioral response of the industry results in larger price declines during heavy slaughter periods than should actually occur had normal marketing and production patterns not been interrupted.

If this explanation of the cycle is reasonable, favorable prices are the inducement which causes a surplus of available slaughter. Seemingly, once this surplus is built to some level, it must be liquidated and a break in the price level logically follows. The time at which the surplus is slaughtered may depend on several factors: surplus of each class, time period involved in build-up, volume of total

surplus and available slaughter facilities.

Annual commercial slaughter of cows, heifers, steers and bulls are not published as three separate series, but only as a total.[6] Data for federally inspected slaughter, therefore, became the primary source of information on actual slaughter for the separate classes. Because cow slaughter apparently constitutes a very large proportion of non-federally inspected slaughter, actual commercial steer slaughter for the 1949-1973 period was the only class series which could be generated with reasonable accuracy for comparison with the uniform lag estimates.[7]

Figure 6 shows estimates of calculated actual annual steer slaughter and predicted steer slaughter using inventory numbers and uniform time lags in production. The differences in estimates roughly depict the same relations as the total series displayed in Figure 5. Because of the assumptions made in generating slaughter cow numbers from equations 1 and 2, actual cow slaughter and the generated uniform lag cow slaughter must necessarily be equal. The larger differences between the uniform lag and actual series shown in Figure 5 relative to those shown in Figure 6 must, therefore, be due to the added differences in the heifer slaughter predictions.

Trend lines for the actual slaughter series were calculated by a simple regression on time so that the cycle in each series could be visualized as it relates to long term growth. The trend lines indicate hypothetical slaughter numbers given a constant growth in brood cow numbers and uniform production lags. Therefore, deviations of actual slaughter around the trend lines show not only deviations due to lags in marketing slaughter animals, but also due to differences in growth patterns of the industry at the cow-calf level.

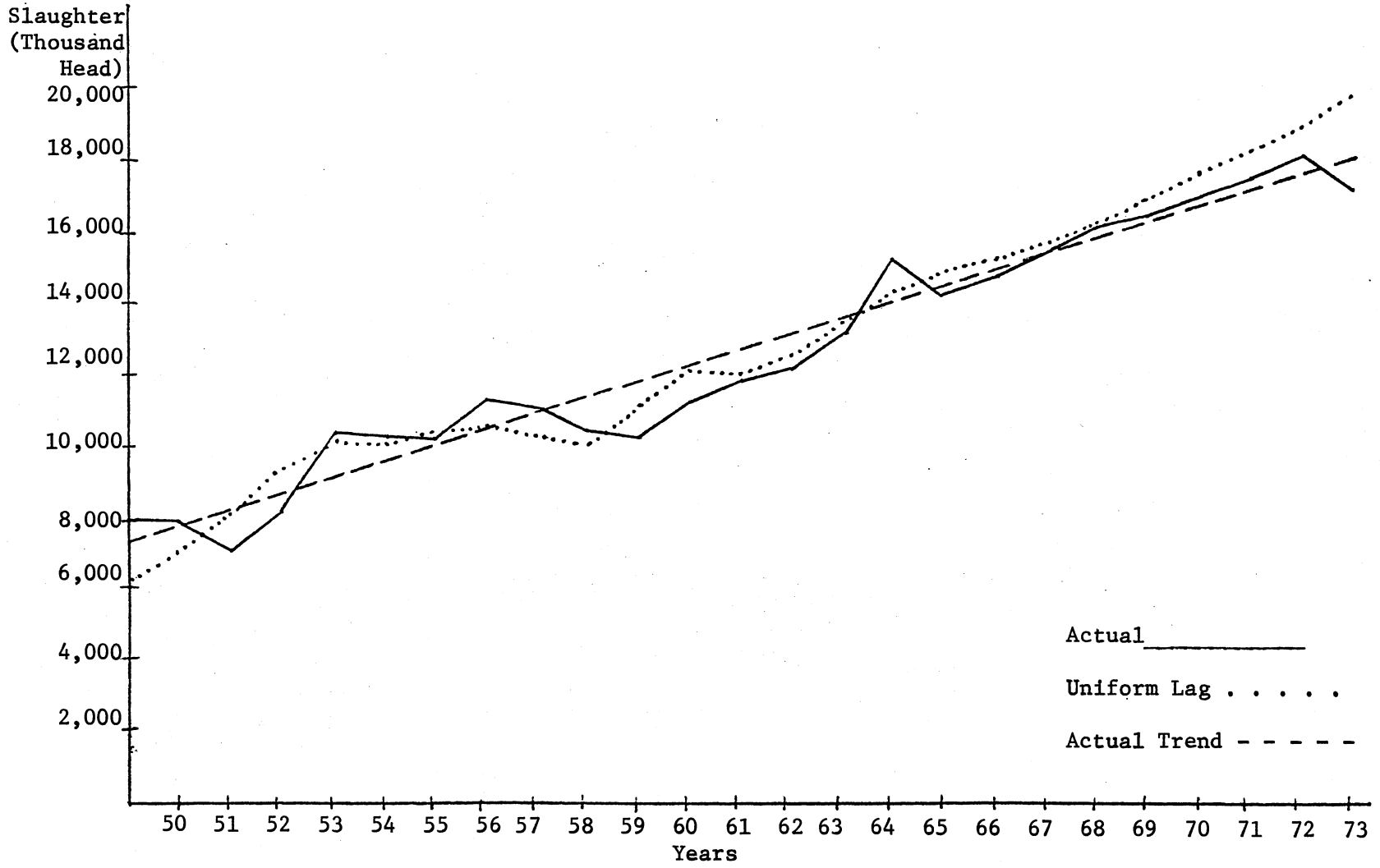

Figure 6. Comparison of Actual Commercial Steer Slaughter and Steer Slaughter with a Uniform Production Lag, 1949-1973

There is one significant conclusion which might be drawn from the accounting approach of deriving slaughter numbers. Because of the changing lags in the production of slaughter animals, the cycle in slaughter numbers is subject to wider variation than the inventory cycle in cow numbers. Hypothetically, if production lags remained constant throughout the cattle cycle, excess production would not result in such extreme price declines.

Behavioral Dimensions of Cattle Cycle

In this section, results of the questionnaire and the derivation of slaughter estimates from inventory numbers are combined to outline some behavioral elements in the cattle cycle. Evidence from statistics supporting the hypothesized relations is offered where appropriate and/or available.

The Nature of Cyclical Growth in the Cow Herd

As cattle prices begin a cyclical upswing, cow and heifer slaughter declines, causing an increase in the cow inventory. This fact has long been recognized as a major component of the cattle cycle. The building of cow numbers has generally displayed slow growth the first few years following a cyclical low in prices. As prices continue to improve, growth rate of cow numbers increases. As prices peak and begin to decline, the growth rate begins to decrease. However, cow numbers continue increasing after the initial major decline in prices. Depending on the amount prices fall and the absolute level of prices after the decrease, cow inventories may or may not decrease.

Table IX shows reactions of cow-calf men which increase production potential with price increases. The period beginning in 1965 is also an example of cow numbers increasing at increasing rates as prices continue to increase. Average price of feeder steers at Kansas City for 1974 was approximately $39.00 with the January 1, 1975 inventory of beef cows showing a 2.4 million head increase over 1973. Thus, continued increases in cow numbers with a cyclical fall in prices seems to be occurring again.

Changes in Production Lags during Cyclical Herd Growth

During cyclical price increases, slaughter steers and heifers are held for longer periods as cattlemen begin to expect further price improvement. The most recent example of cattlemen detaining cattle from the slaughter market during an increasing price phase is shown in Table X. Total slaughter in year t as a percentage of beef cow numbers in year t-1 is used as a measure of the willingness of cattlemen to market available slaughter age stock. During the period illustrated in Table X, slaughter numbers with respect to the size of the cow herd decreased as cattle prices were in a cyclical upswing. There were cattle during this period which were not being slaughtered, because cattlemen expected further profit by holding for higher prices.

TABLE IX

RELATIONSHIP BETWEEN AVERAGE PRICE OF CALVES AND COW INVENTORIES THE FOLLOWING YEAR

Year	K.C. Feeder Price[a]	Year	January 1 Beef Cow Inventory
1964	22.57	1965	33,400,000
1965	23.70	1966	33,500,000
1966	28.38	1967	33,770,000
1967	28.00	1968	34,470,000
1968	29.10	1969	35,490,000
1969	32.89	1970	36,689,000
1970	36.73	1971	37,877,000
1971	36.84	1972	38,807,000
1972	46.54	1973	40,918,000
1973	59.73	1974	43,008,000
1974	39.00	1975	45,421,000

[a]Average annual price per 100 pounds for good and choice feeder steer calves, Kansas City.

After prices have peaked and begin a cyclical downswing, a variety of behavioral reactions by producers are possible. The next five behavioral aspects of the cattle cycle will probably occur during a falling price phase. However, their incidence and the time lag involved in their completion are both dependent on several factors.

TABLE X

RELATIONSHIP BETWEEN AVERAGE PRICE OF FEEDER CALVES AND SLAUGHTER AS A PERCENTAGE OF PRODUCTION BASE, 1967-1973

Year	$\frac{\text{Total Slaughter}_t}{\text{Beef Cow Herd}_{t-1}}$	Kansas City Feeder Price
1967	.808	28.00
1968	.825	29.10
1969	.817	32.89
1970	.795	36.73
1971	.779	36.84
1972	.760	46.54
1973	.697	59.73

Initial Response to Falling Prices

Immediate reaction of cow-calf operators to a declining cattle market is one of cutting production costs to a minimum level. As noted by the variety of future plans producers listed in the questionnaire responses, the initial fall in prices places cattlemen in a perplexing situation. Uncertainty as to the future profitability of their operation leads many cow-calf men to keep their entire herd of cows until prices drop to such low levels that eventual losses become all too evident.

Figures 7 and 8 are graphic illustrations of this lag involved between the price drop and increased cow and heifer slaughter. In both

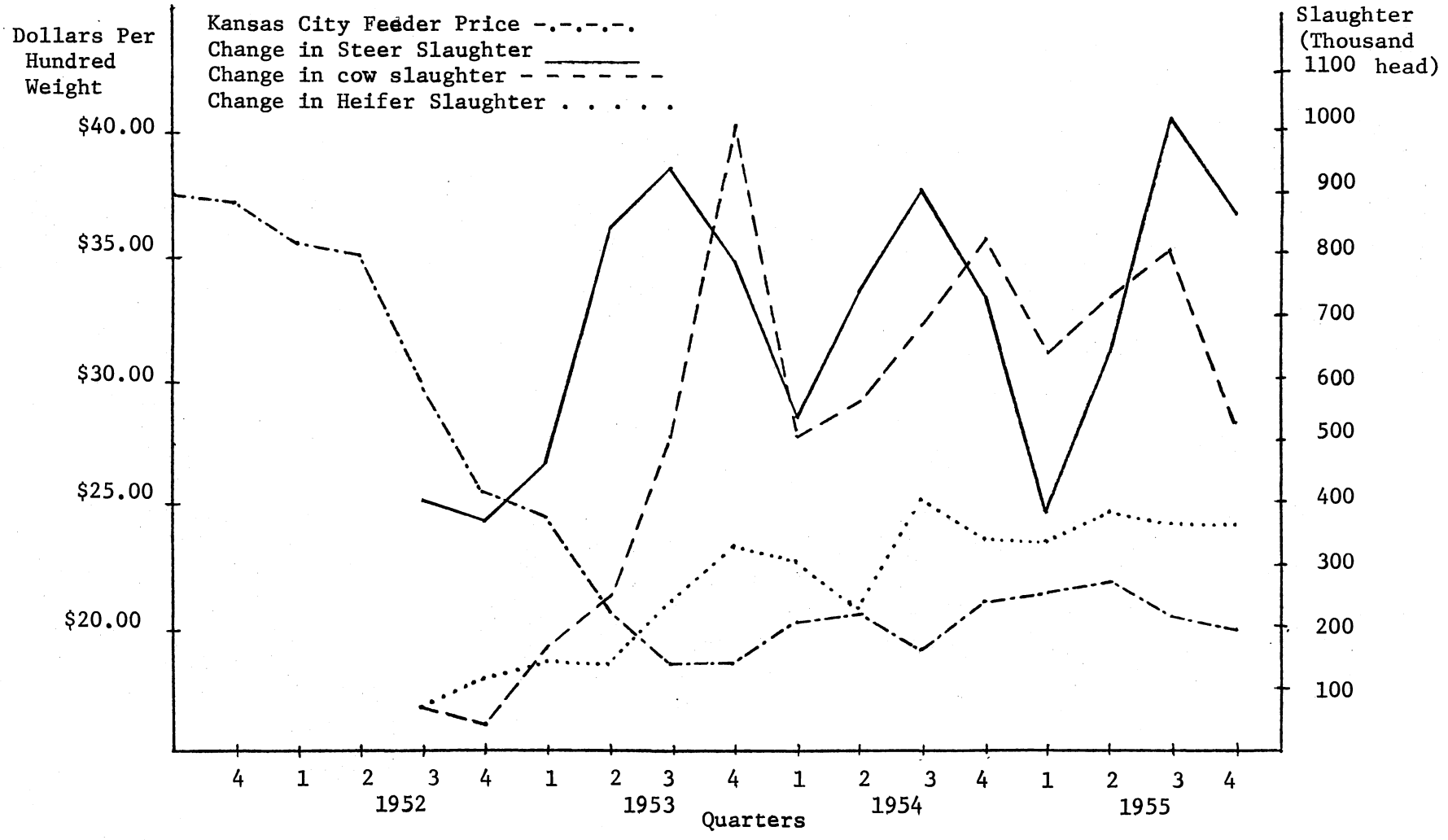

Figure 7. Quarterly Change in Slaughter Numbers of Each Class Following a Cyclical Price Decline, 1951-1955

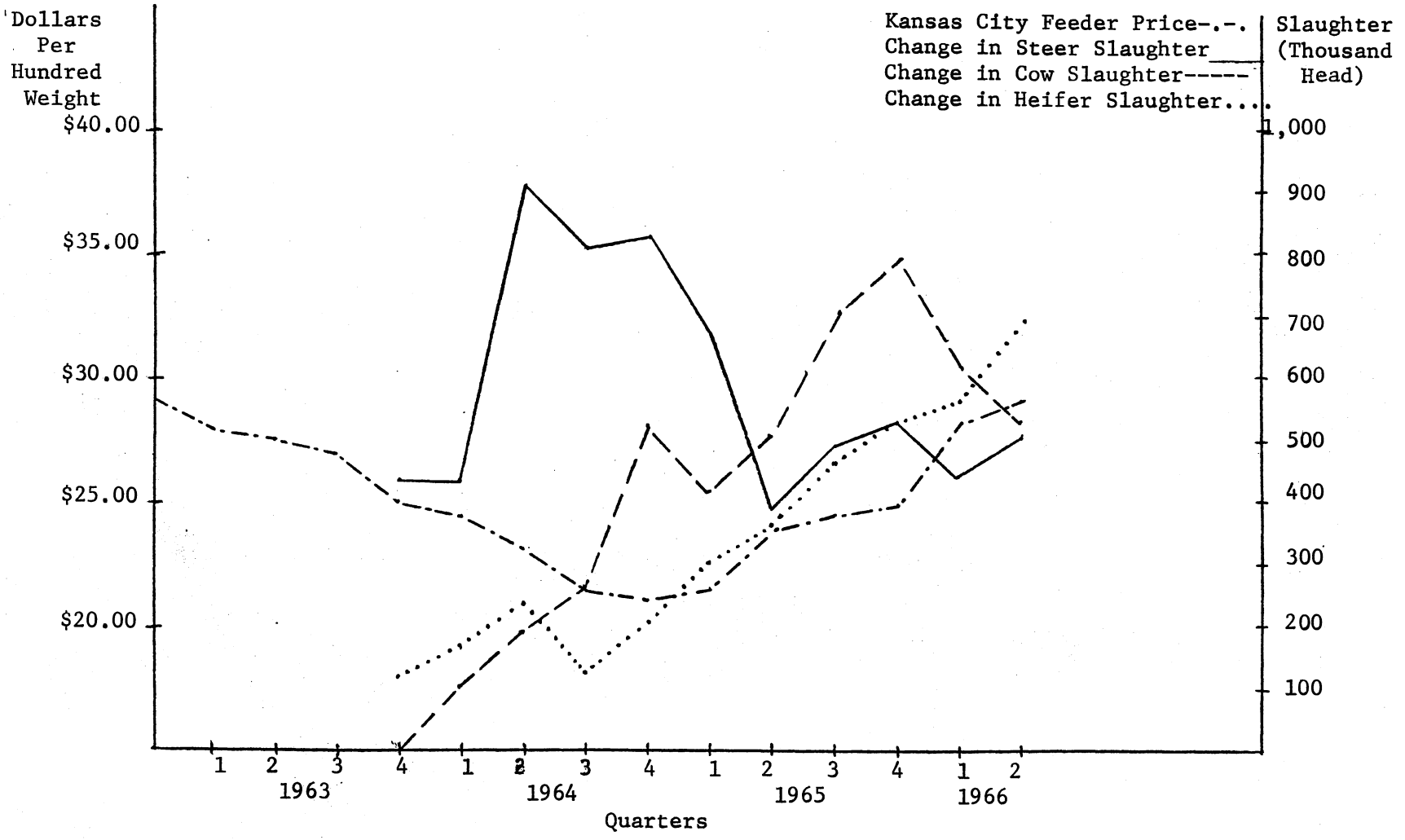

Figure 8. Quarterly Change in Slaughter Numbers of Each Class Following a Cyclical Price Decline, 1963-1966

figures the change in slaughter of each class for respective quarters has been calculated by subtracting the total slaughter of each class in the quarter from the total slaughtered in the comparable quarter after the price drop. Therefore, the lines show changes in slaughter after the price drop as compared to the period of slaughter at high prices.

In the 1950's period shown in Figure 7, feeder calf price dropped almost $10.00 per hundred-weight or some 27 percent in the third and fourth quarters of 1952. Cow and heifer slaughter remained low for some six months, and did not peak until a year later. In the 1960's period shown in Figure 8, prices did not fall by as much or as quickly as in 1952, but the lag between the price decline and increased heifer and cow slaughter is clearly evident.

Falling Prices: Slower Growth Versus Liquidation

As is also indicated by Figures 7 and 8, falling prices eventually force cow-calf operators to sell at least some cows and possible replacement heifers. The extent to which cows and heifers are sold for slaughter purposes determines whether cow numbers are only retarded in their growth or are actually diminished.

The 1950's period is an example of a reaction to a price drop leading to an eventual fall in inventory figures. The falling prices forced only a slowdown in growth of brood cow numbers in the 1960's. Obviously, the magnitude of the price drop played some role in determining the final consequences of each fall in price. However, the absolute level of prices after the decline is the most important factor in determining the profitability in continuing a cow-calf operation. Although the amount of decrease and absolute level of prices are influential, the

rapid recovery of prices in the 1960's is probably the factor responsible for saving cattlemen from forced liquidation of herds during that period.

Delayed Marketing of Slaughter Steers

As previously noted, when prices are increasing, cattlemen hold steers and heifers destined for slaughter for longer periods in anticipation of further price boosts. After prices drop, cattlemen are reluctant to sell their calves at prices resulting in financial losses. Cattlemen hold their cattle with intentions to sell at some later date when prices might be improved. Understandably, there is some maximum length of time in which cattle can be reasonably detained from slaughter.

This reaction by cattlemen results in a glut of slaughter steers at some point in the price downswing. The last three quarters of 1953 and 1964 in Figures 7 and 8 clearly indicate an extremely large number of slaughter steers being marketed.

Changes in Production Lags during Cyclical Decreases in Numbers

As prices continue to fall, feeding cattle to heavy weights becomes more and more costly. Cattle are slaughtered at earlier ages to shorten the average production period. Calf slaughter is also likely to increase as the industry endeavors to slaughter excess numbers.

The 1952-1957 period, as illustrated in Table XI, best exemplifies increasing slaughter numbers relative to the production base during price cycle declines. Increased slaughter of calves and younger cattle along with fewer heifers held back as replacements are the major

influences causing the proportion to increase.

TABLE XI

RELATIONSHIP BETWEEN AVERAGE PRICE OF FEEDER CALVES AND SLAUGHTER AS A PERCENTAGE OF PRODUCTION BASE, 1952-1957

Year	$\frac{\text{Total Slaughter}_t}{\text{Beef Cow Herd}_{t-1}}$	Kansas City Feeder Price
1952	.636	31.58
1953	.751	20.55
1954	.795	20.21
1955	.797	21.04
1956	.808	19.57
1957	.813	23.36

Cyclical Slaughter Weights

Because of shorter production periods during low prices and longer production periods during high prices, average weights of slaughter cattle will likely be affected by price fluctuations. During low price periods when cow, heifer and calf slaughter increase relative to steer slaughter, slaughter weights tend to diminish. Likewise, when prices are high, cow, heifer and calf slaughter decrease relative to

steer slaughter, pushing average slaughter weights higher. Both of these forces tend to dampen price fluctuations due to variations in slaughter numbers, but their effect is limited.

Summary

This chapter has attempted to uncover some of the underlying components and causal factors of the slaughter cycle of cattle. The cycle as it exists is basically the result of the beef industry's effort to adjust beef production levels in accordance with changes in beef demand. The beginning of production level changes, of course, must start at the cow-calf level. The questionnaire presented results indicating the average producer had somewhat limited knowledge concerning the forces behind the recently experienced falling cattle prices. This apparent lack of knowledge on the part of the cow-calf sector helped to explain the long lags in production responses to price level changes in past cycles.

Although changes in beef production must originate at the cow-calf level, adjustments to changing cattle prices are made throughout the industry. The projections of slaughter from cow inventories separated the slaughter cycle into two basic parts: (1) Changes in slaughter numbers due to changes in the production herd base; and (2) changes in slaughter numbers due to differences in production periods of slaughter animals. By making this division, variation in slaughter numbers attributable to behavior of the cow-calf production level and variations in slaughter caused by behavior of the entire industry were isolated.

From the questionnaire results and the projection of slaughter numbers from inventories, some behavioral dimensions of the cattle

cycle were hypothesized. The relationships depicted outlined not only the behavioral aspects at the cow-calf level, but also behavioral reactions of the total industry throughout the cycle. Efforts were made in this section to show that the slaughter cycle is the logical outgrowth of each level of the beef industry attempting to maximize profits over the short-run.

FOOTNOTES

[1]The Statistical Reporting Service, Oklahoma City provided a confidential mailing list of cow-calf men in Oklahoma and some surrounding states.

[2]U.S. Department of Agriculture, Livestock and Meat Statistics, Statistical Bulletin 522 (Washington, June, 1974), p.2.

[3]Ibid.

[4]Replacement rates calculated for the two categories during the 1965-1973 period indicated the replacement rate required to maintain a constant herd size for dairy herds was almost double that of beef herds.

[5]To calculate annual total cow slaughter from equations 1 and 2, cow inventories for the beginning and end of the year are required. Thus, slaughter cow numbers generated in this manner are not projections but should be considered approximations of actual, because of the assumptions made in developing the equation. Since actual total commercial cow slaughter is not available in published data, there is no basis for testing the accuracy of the assumptions used.

[6]The Economic Research Service of the U.S.D.A. presently reports only federally inspected slaughter numbers for the separate classes.

[7](total replacement heifers) - (cow herd growth) - (estimated cow deaths) - (federally inspected cow slaughter) = non-federally inspected cow slaughter.

Using this equation, non-federally inspected commercial cow slaughter was calculated to be 12,705,000 for the period 1970-1973. Total non-federally inspected commercial slaughter for the period was 25,880,000. Cow slaughter from these calculations averaged 49 percent of the total for the period. This compares to approximately 17.6 percent of federally inspected slaughter consisting of cows for the same years.

CHAPTER IV

QUARTERLY PROJECTIONS OF BEEF PRODUCTION, 1975-76

The basic forecasting method used in this section was developed using regression analysis.[1] An equation was postulated and regressions on time series data were then run as a means of estimating parameters of the equation. In selecting variables to form the equations, consideration was given to economic significance, time lags, and data availability.

Quarterly Slaughter Projection, 1975-76

Equation 1 in this section was used to predict quarterly slaughter numbers over all classes for 1975-76. The time series data used to estimate coefficients for equation 1 ran from 1949 to 1974 inclusive.[2]

$$\underset{t}{SLATR} = \underset{(6.46)}{5027.44} + \underset{(38.42)}{.2581}\ \underset{t}{HSB} - \underset{(3.09)}{.1586}\ \underset{t}{TOTH} - \underset{(5.32)}{40.3330}\ \underset{t-4}{STFI} \qquad (1)$$
$$\underset{(8.97)}{-83.2280}\ \underset{t-4}{CPRC} + \underset{(4.50)}{57.9502}\ \underset{t-8}{SLST}$$

$R^2 = .9582$ $\qquad$ $S = 334.92$

Where:

$SLATR_t$ = Total commercial cattle slaughter in quarter t (thousand head)

HSB_t = January 1 inventory of heifers, steers and bulls under 500 pounds (thousand head) of the year for which slaughter is being estimated.

$TOTH_t$ = January 1 inventory of total heifers (thousand head)

$STFI_{t-4}$ = Percent of total federally inspected cattle slaughter consisting of steers in quarter t-4

$CPRC_{t-4}$ = Average utility grade cow price per hundred-weight in Omaha for quarter t-4

$SLST_{t-8}$ = Average choice grade (900-1100 pounds) slaughter steer price per hundred-weight in Omaha for quarter t-8

( ) = Calculated t test statistic

R^2 = Coefficient of determination

S = Standard error of estimator

Quarterly seasonal indices were used to transform the inventory variables, HSB and TOTH, into variables for quarterly estimates. That is, the January 1 inventory numbers were multiplied by the seasonal pattern of slaughter numbers for 1949 to 1974. The effect of this transformation was much the same as that obtained by using seasonal dummies in the regression analysis. Seasonal multipliers used for transformation were .97528, .98782, 1.02803 and 1.00888 for the first through fourth quarters, respectively.

Heifers, steers and bulls under 500 pounds on hand January 1 were a rough approximation of stock available at some future time for slaughter. Although an inventory variable such as steers over 500 pounds could have been better justified as a proxy for potential slaughter age animals for the year, the HSB variable displayed far greater statistical significance in explaining slaughter variations.

The other inventory variable, total heifers, helped to differentiate between building periods as opposed to reduction periods within the cycle. The negative sign was appropriate in that increasing total heifer numbers indicated a building period in the cycle, leading to a reduction in slaughter in the short run.

The percentage of slaughter consisting of steers also explained some cyclical variation in slaughter numbers. During the building phase of the cycle, steer slaughter was a large percentage of the total as heifers and cows were held back for breeding.

The Omaha utility cow price reflected the value placed on herd building as well as the availability of low quality beef. Slaughter steer price was indicative of available fed beef supplies. The positive sign on the slaughter steer price probably was the result of the eight-quarter lag stretching over two calf crops.

Observations on explanatory variables for 1975 estimates were available by February, 1975. But to use the same model to project 1976 slaughter required estimation of January 1, 1976 inventories for the two inventory variables plus projection of the federally inspected steer slaughter percentage and Omaha utility cow price by quarters for 1975.

To project TOTH and HSB for 1976, two models were constructed. Equations 2 and 3 are mathematical representations of the models for inventory projections with coefficients estimated from annual data, 1949-1974.[3]

$$TOTH_{t+1} = \underset{(29.23)}{12784.64} + \underset{(9.52)}{96.3917}\ KCF_{t-1} + \underset{(7.79)}{.2778}\ \Delta HSB3_t \qquad (2)$$

$$- \underset{(3.51)}{.0737}\ CS_{t-1} + \underset{(1.6884)}{32.7750}\ SLST_{t-2}$$

$R^2 = .917$ $\qquad$ $S = 277.07$

$$HSB500_{t+1} = \underset{(1.37)}{1707.05} + \underset{(40.06)}{.9528}\ HSB500_t + \underset{(1.98)}{.1512}\ \Delta HSB3_t \qquad (3)$$

$$+ \underset{(2.94)}{205.398}\ CPRC_{t-1} - \underset{(1.80)}{129.465}\ SLST_{t-1}$$

$R^2 = .993$ $\qquad$ $S = 556.26$

Where:

$TOTH_{t+1}$ = Total heifer inventory January 1, year t+1 (thousand head)

KCF_{t-1} = Average price per hundred-weight of good and choice feeder steers in Kansas City for the last 6 months of year t-1

$\Delta HSB3_t$ = Change in the number of heifers, steers and bulls under 500 pounds over the last three years.

$SLST_{t-2}$ = Average price per hundred-weight of choice grade (900-1100 pounds) slaughter steers in Omaha for the last 6 months of year t-2

$HSB500_{t+1}$ = Total heifers, steers and bulls under 500 pounds January 1, year t+1 (thousand head)

$CPRC_{t-1}$ = Average price per hundred-weight of utility grade cows in Omaha for the last 6 months of year t-1

CS_{t-1} = Calf slaughter in year t-1 (thousand head)

During past cyclical lows cow prices did not fluctuate to any great extent once the low point was reached. Assuming cow prices would reach the cyclical bottom sometime during 1975, quarterly average prices were estimated by projecting the 1975 average price and adjusting this average price according to the seasonal price pattern of recent years.[4]

As cattle prices fall over a significant time interval, one normally would expect the percent of steer slaughter relative to total slaughter to decline as more heifers and cows are marketed. The steer slaughter percentage has also shown a seasonal pattern, usually reaching a high in the second quarter and a low in the fourth. Federally inspected steer slaughter was estimated from past observations on both cyclical and seasonal influences during the price declines of the 1950's and 1960's.[5]

Data for the quarterly slaughter steer price ($SLST_{t-8}$) were available by February, 1975, so that with estimates of the other four

explanatory variables in equation 1, projections for quarterly slaughter in 1976 were possible. Table XII lists estimates of the two inventory variables (multiplied by the seasonal indices), cow prices and federally inspected steer slaughter percentage used in calculation of total commercial slaughter for 1976. The last two columns of Table XII list projections of quarterly slaughter for 1975-76.

Of the models tested, equation 1 used in projection of both 1975 and 1976 total commercial slaughter was not the equation with the best statistical fit (highest R^2). There were several variables not included in the model which displayed significant explanatory power. Among these variables were cost of gain and feeder steer price. Both of these factors were economically relevant and would have seemed to fit well in a slaughter model, but during 1973 and 1974 the wide swings in values for these two factors distorted estimates considerably.

As result of not using some apparently important explanatory variables, equation 1 tended to underestimate slaughter during peak periods and overestimate slaughter during bottoms. The pattern of residuals for equation 1 estimates, however, did not show much consistency in following these tendencies during 1973-74. This was probably due to the unusual circumstances surrounding the beef industry during that period. Therefore, projections listed in Table XII were the final ones used in beef production estimation.

TABLE XII

ESTIMATED EXPLANATORY VARIABLES AND QUARTERLY CATTLE SLAUGHTER PROJECTIONS, 1975-76

Quarter	HSB_t (head)	$TOTH_t$ (head)	$STFI_{t-4}$ (percent)	$CPRC_{t-4}$ (dollars)	Slaughter 1975 (head)	Slaughter 1976 (head)
1st	35,007,000	17,948,000	50.8	16.50	9,735,000	11,358,000
2nd	35,457,000	18,179,000	52.3	17.50	10,147,000	10,967,000
3rd	36,910,000	18,919,000	48.3	17.00	11,246,000	11,737,000
4th	36,213,000	18,565,000	45.8	15.50	11,185,000	11,576,000
					42,313,000	45,638,000

Quarterly Average Dressed Weight Projections, 1975-76

Variations in average dressed weights of slaughter cattle are dependent on several factors. The weights of slaughter steers, heifers and bulls change as the cost of feeding changes. The prices of slaughter and feeder animals may also affect average weights for the three classes. Cow weights, although probably affected less than the other classes by feeding costs and price change, vary cyclically and seasonally. Along with numerous factors influencing weights in each class, the changing mix of slaughter within the cycle will also cause average weights to vary.

For average dressed weight predictions by quarters during 1975 and 1976, the analysis was divided into two sections. The first of these was estimating average weights for the separate classes. The second process involved projection the slaughter mix by quarters for the two years. These two components determining average weights were assumed independent so that each could be estimated separately.

Average Dressed Weights of Slaughter Steers, Heifers, Cows and Bulls, 1975-76

The method used for projecting average dressed weights of each class was one of first predicting weights of the largest class, steers. Average dressed weights of heifers, cows and bulls were then estimated as functions of steer weight estimates. Although some of the factors affecting weights of the different classes are not the same, relationships between classes were assumed to remain constant during comparable cyclical periods.

The two factors deemed most important in determining dressed slaughter steer weights were feeding costs and slaughter steer prices. During past cyclical declines in slaughter cattle prices, weights and prices have shown a negative short-run relationship. This basically was the result of feeders holding cattle longer as prices declined, while hoping for price improvement before selling. However, once prices neared a cyclical bottom, no definite relationship between the two was apparent.

Because feeding costs have become so extremely high, there are no truly comparable periods to use as means of estimation. During the cyclical bottom in the 1950's cattle feeding was not a common practice as it was during the 1960's.[6] For this reason, the 1960's period was utilized as an approximation of what might occur in the near future.

The beef steer-corn price ratio, Omaha basis, was used as a proxy for feeders' willingness to feed slaughter stock to heavy weights. Figure 9 shows that during the interval from the fourth quarter of 1962 to the second quarter of 1964, the steer-corn price ratio dropped from 24.4 to 16.1, a decrease of some 34 percent. These increased feeding costs did not precipitate downward trending slaughter weights until the second quarter of 1964. Weights continued to decline until the third quarter of 1965. This length of lag was not considered realistic with feeding periods for cattle rarely extending beyond seven months. Thus, there was likely some critical value for the steer-corn ratio for which feeders were no longer willing to feed cattle to the previous heavier weights. This critical value seemed to be in the 17.0 to 20.0 range. Once weights began to decline, the low was reached after six quarters of declining weights at 93.7 percent of the previous high.

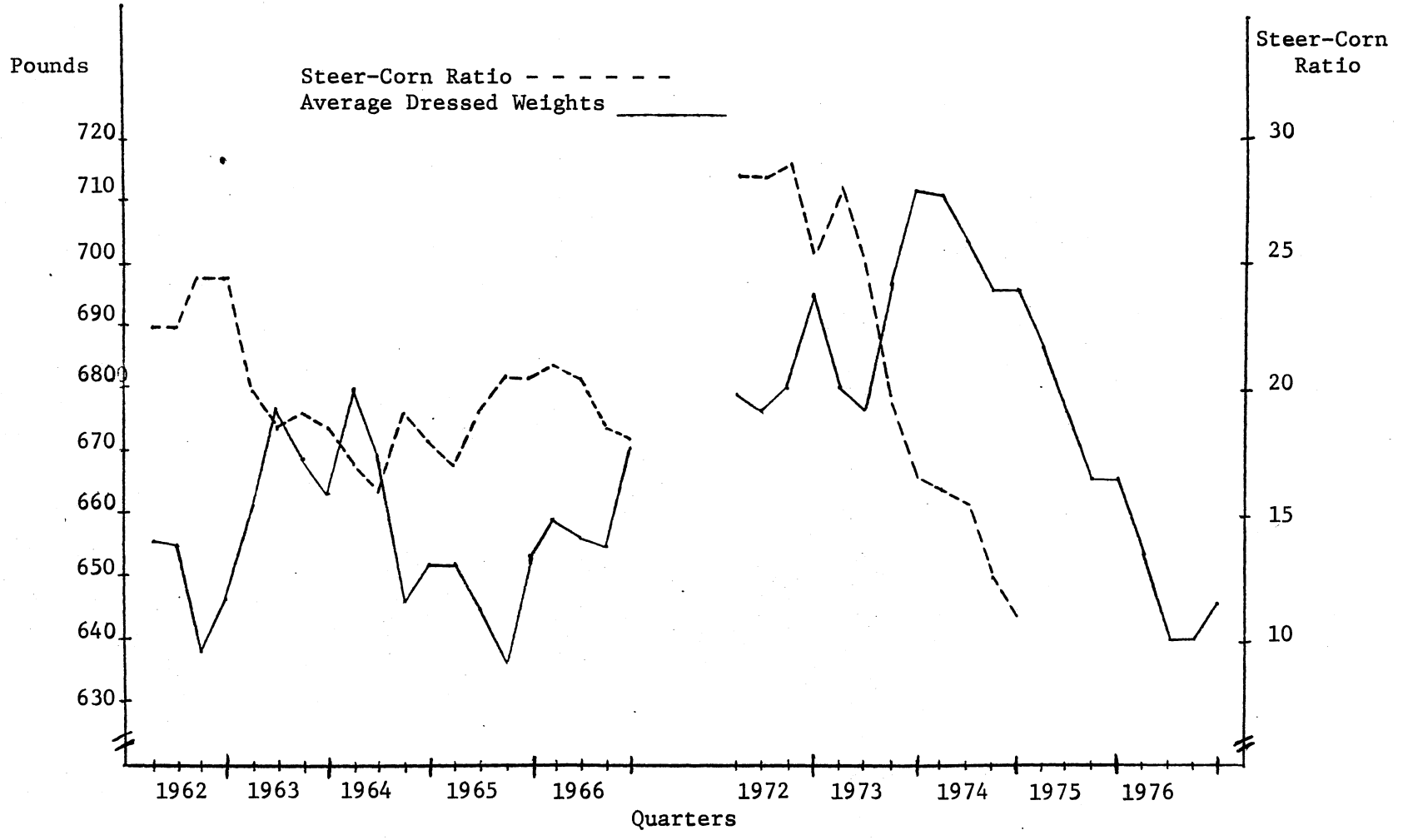

Figure 9. Comparison of Beef Steer-Corn Price Ratio, Omaha Basis, and Average Dressed Weights of Slaughter Steers, 1962-1966 and 1972-1974 with Estimates for 1975-76

If the current cycle were to follow the pattern set during the 1960's, the low point in slaughter weights would be reached the third quarter of 1975 at a level of 666 pounds (.937 X 712). After the low was reached, weights would begin improvement. But there are other factors which merit consideration. Feeding costs could remain high throughout 1975 and early 1976. The Western Livestock Round-Up states that feed grain prices will likely stay high during at least the first six months of 1975.[7] There is also the possibility of proposed changes in grading standards being instituted.[8] Another consideration is the declining placements of cattle on feed. All of these factors would place downward pressure on slaughter weights and give indication that weights could fall to a greater extent than during the 1960's. If the new grading standards are instituted and cattle on feed continue to decline, the cyclical low in weights of slaughter steers will likely be reached at some later point than the third quarter of 1975.

Through a somewhat subjective analysis, the factors mentioned above were combined to produce weight projections for average slaughter steer weights in Figure 9. The 666 pounds estimate for the third quarter of 1975 was taken from the previous estimate. Seasonal factors were used in predicting the temporary halt in weight decline for the fourth quarter of 1975. The lowest point for weights during 1976 will depend mostly on the 1975 corn crop and consumer acceptance of non-fed beef. Although the choice of 640 pounds was rather arbitrary and possibly too high considering all the factors against heavy slaughter weights, this weight would be the lowest quarterly average since the third quarter of 1965. The upturn in weights predicted for the fourth quarter of 1976 was based on prospective lower feed grain prices and some possible

strengthening in cattle prices from diminishing cow slaughter.

Table XIII displays projected average dressed weights for slaughter steers derived in Figure 9.

TABLE XIII

QUARTERLY PROJECTIONS OF AVERAGE DRESSED WEIGHTS OF SLAUGHTER STEERS, 1975-76

Year	1	2	3	4	Annual Average
1975	686	676	666	666	673.5
1976	653	640	640	646	644.7

Once the estimates of average dressed steer weights were obtained, average weights of the other three classes were derived as functions of these estimates. Attempts to establish relationships among the weights of the various classes during past cycles proved futile. Thus, reliance on recent trends in average slaughter weights and some economic judgement to predict 1975-76 slaughter weights became a necessity.

In Figure 10 three weight ratios were plotted. The heifer-steer weight ratio ramained fairly steady throughout the three years with no discernible seasonal pattern. Heifer weights did fall more relative to steer weights during the final two quarters of 1974. Two factors may have caused this to happen: (1) Heifers originally held back for replacement were being sent to slaughter, bypassing any feeding period;

Figure 10. Quarterly Average Dressed Weight Ratios of Heifers/Steers, Cows/Steers, and Bulls/Steers, 1972-74, with Estimates for 1975-76

and (2) Heifers' feed conversion from grain to beef is less efficient than that of steers, so that feeding of heifers may decrease more with higher costs of grain. With the expectation of feeding costs remaining at a high level and more slaughter coming from the production base, heifer weights will likely decline more than steer weights. Predictions for the heifer-steer weight ratio for 1975-76 are indicated in Figure 10.

The cow-steer weight ratio displayed a general decline during 1972-74 with a marked seasonal pattern. The decrease in the ratio for 1972, 1973 and the first half of 1974 was likely due to the much heavier weights of slaughter steers coming from feedlots. During the last two quarters of 1974, the ratio continued to decline as slaughter steer weights also fell. Some of this decrease was attributed to the larger proportion of cow slaughter being beef cows in contrast to heavier dairy cows.[9] These two factors in 1975 and 1976 will push the cow-steer weight ratio in opposite directions. Falling steer weights should force the ratio upward. More slaughter of beef cows relative to dairy cows should push the ratio downward. The sharply falling steer weights will likely dominate, leading to a slight upward trend over 1975 and 1976. Considering seasonal influences along with this upward trend, cow-steer weight ratio predictions were obtained and are shown in Figure 10.

Accurate estimation of average bull weights was not as important as for the other classes since bull slaughter averages only two percent of total slaughter. Consequently, projections for the bull-steer weight ratio were based on the level of expected steer weights alone. From 1972 to 1974 average steer weights were upward trending and the bull-steer weight ratio was downward trending. With steer weights expected to fall in the 1975-76 period the bull-steer weight ratio will probably

rise as indicated by projections in Figure 10.

Ratios of weights for the four classes developed in Figure 10 are listed in Table XIV. By multiplying each ratio by the same quarter's estimate of average dressed steer weight, average dressed weights for each class were obtained and listed in Table XIV.

Federally Inspected Slaughter Percentages by Classes

To predict the composition of slaughter for 1975 and 1976 by quarters required observing past cyclical variation and the established seasonal patterns for each class. Possible observation periods on the peak and liquidation phases of the cycle occurred during the 1951-1955 and 1962-1966 intervals. The liquidation period of the 1950's was one resulting in decreased beef cow inventories. Prices in the 1960's did not fall to the extent nor remain low for as long as during the 1950's. Consequently, beef cow inventories during the 1960's did not display an actual decrease but only a reduced growth rate. To choose between these two periods for comparison to the current situation would seem to entail some estimation of average cattle prices during 1975 and 1976. If cattle prices continue a slight downward trend or remain low throughout the 1975-76 period, the more analagous period would be the 1950's. If prices begin recovery at some point in the next two years, the better comparison period would likely be the 1960's.

Because dairy cattle in the 1950's composed such a large portion of total cattle numbers, cow slaughter percentage was extremely high and heifer slaughter was extremely low in comparison to the percentages in the current period. Therefore, the 1960's period was chosen for

TABLE XIV

QUARTERLY PROJECTIONS OF DRESSED WEIGHT RATIOS AND AVERAGE DRESSED WEIGHTS FOR SLAUGHTER STEERS, COWS, HEIFERS AND BULLS, 1975-76

	Year	1	2	3	4
Ave. Dressed Heifer Weight/ Ave. Dressed Steer Weight	75	.820	.820	.820	.820
	76	.820	.820	.820	.820
Ave. Dressed Cow Weight/ Ave. Dressed Steer Weight	75	.730	.720	.710	.700
	76	.750	.740	.720	.710
Ave. Dressed Bull Weight/ Ave. Dressed Steer Weight	75	1.08	1.06	1.04	1.02
	76	1.14	1.11	1.08	1.06
Ave. Dressed Slaughter Steer Weight	75	686	676	666	666
	76	653	640	640	646
Ave. Dressed Slaughter Heifer Weight	75	563	554	546	546
	76	535	525	525	530
Ave. Dressed Slaughter Cow Weight	75	501	487	473	466
	76	490	474	461	459
Ave. Dressed Slaughter Bull Weight	75	741	717	693	679
	76	782	710	691	685

comparison, even though the financial strain of the current situation is probably more comparable to the 1950's.

Slaughter of bulls has displayed little cyclical variety in the past. Recently, bull slaughter under federal inspection has remained around the two percent level. For these reasons, slaughter of this class for 1975-76 was assumed to remain at a constant two percent of total slaughter.

Heifer and cow slaughter percentages for the two comparable periods are shown in Table XV. The price of slaughter steers began falling in mid-1963. Cow slaughter increased almost two percent the following year. Cow slaughter increased about two percent in 1974 as well, but still remained at a relatively low absolute level. Therefore, a larger increase in cow slaughter was projected for 1975. With cow slaughter continuing at low levels during 1974, cow-calf men displayed reluctance to sell their production herds. This resistance should ease some in 1975, but if total slaughter numbers reach previously projected levels, slaughter cow numbers would need to increase phenomenally to force the percentage upward more than that predicted.

Changes in percentage of heifers slaughtered during 1962-1964 closely approximate changes occurring from 1972-1974. Heifer slaughter is expected to increase in 1975-76 much like the 1965-66 period, but because of the large projected increases in slaughter numbers in all classes, the heifer slaughter percentage in 1975-76 is not predicted to increase as much as during 1965-66.

Given predictions of the percentage of total slaughter consisting of heifers, cows and bulls, the percentage of steer slaughter was left as a residual. Projections for the percentage of each class are listed in Table XVI. Estimates take into account changes occurring from cyclical influences as well as a seasonal weighting from recent quarterly seasonal patterns.

TABLE XV

FEDERALLY INSPECTED PERCENTAGE OF SLAUGHTER HEIFERS AND COWS, 1962-1966 AND 1972-1974

	Year	Quarters				Year's
		1st	2nd	3rd	4th	Average
Cows	1962	19.4	18.0	21.6	24.2	20.9
	1963	19.1	16.5	19.2	21.8	19.2
	1964	18.7	17.1	21.8	26.4	21.1
	1965	21.7	22.1	26.4	29.0	25.0
	1966	24.1	21.0	21.3	23.3	22.4
	1972	17.5	16.3	16.4	16.9	16.7
	1973	18.4	17.6	19.2	19.1	18.5
	1974	19.8	15.8	20.5	24.6	20.2
Heifers	1962	21.2	19.9	22.6	23.2	21.7
	1963	22.3	21.2	22.0	23.2	22.2
	1964	21.4	19.5	20.1	20.7	20.4
	1965	21.2	21.7	23.6	24.3	22.8
	1966	24.4	24.9	26.4	25.7	25.4
	1972	25.0	25.1	28.1	27.3	26.5
	1973	24.2	23.7	25.8	26.2	25.1
	1974	23.3	23.2	24.7	24.4	23.9

TABLE XVI

PROJECTIONS OF FEDERALLY INSPECTED SLAUGHTER PERCENTAGE BY CLASS, 1975-76

Class	Year	1	2	3	4
Steers	1975	50.8	52.3	48.3	45.8
	1976	48.8	50.2	47.3	44.9
Heifers	1975	24.8	24.7	26.2	25.9
	1976	26.8	26.7	28.2	27.9
Cows	1975	22.4	21.0	23.5	26.3
	1976	22.4	21.1	25.5	25.2
Bulls	1975	2.0	2.0	2.0	2.0
	1976	2.0	2.0	2.0	2.0

Per Capita Beef Consumption

(Carcass Weight), 1975-76

Given the slaughter number estimates from Table XII, average dressed weight estimates from Table XIV, and federally inspected slaughter percentage projections for each class from Table XVI, total domestic beef production estimates for the period were calculated.[10] Since beef which is produced during any period must be largely consumed during that same period, little other data was required to project per capita consumption.

Per capita consumption is affected by two other factors besides

total domestic production. These are population changes and beef imports. The government has indicated a desire to hold beef imports for 1975 to 1,150 million pounds.[11] This figure was used for total projected imports during 1975. For lack of information on possible import developments in 1976, the same amount was also used for the second year projections. Imports have relatively little seasonal pattern, so quarterly estimates were calculated by dividing the annual figure equally into the four quarters for both 1975 and 1976.

Estimates of population changes were derived from a trend of constant absolute growth over the two year period. Growth in the U.S. resident population averaged approximately 400,000 persons each quarter for 1973 and 1974.[12] Population estimates using this as the average increase over the eight quarters in 1975 and 1976 are shown in Table XVII.

Calculated total beef production, projected imports, and subsequent predictions for per capita consumption of beef during 1975 and 1976 are listed in Table XVII.

TABLE XVII

ESTIMATED QUARTERLY DOMESTIC BEEF PRODUCTION, IMPORTS AND PER CAPITA CONSUMPTION, 1975-76

Item	Year	Quarters				Total
		1	2	3	4	
Domestic Beef Production (million lbs.)	1975	5,988	6,159	6,632	6,516	25,295
	1976	6,672	6,313	6,670	6,567	26,222
Imports (million lbs.)	1975	287	287	287	287	1,150
	1976	287	287	287	287	1,150
Population Estimates	1975	212.4	212.8	213.4	213.6	
	1976	214.0	214.4	214.8	215.2	
Per Capita Beef Consumption	1975	29.5	30.3	32.5	31.8	124.1
	1976	32.5	30.8	32.4	31.8	127.5

FOOTNOTES

[1]J. Johnston, Econometric Methods, 2nd ed. (New York, 1972), pp. 121-168.

[2]Time series data used in parameter estimation was obtained from various publications of the Economic Research Service of the U.S. Department of Agriculture. The most recent data used was derived from Livestock and Meat Situation. Data existing prior to 1974 was derived from Livestock and Meat Statistics.

[3]Ibid.

[4]Seasonality of cow prices was given the largest weight in 1975 projections for the variable. Monthly seasonal indices used were calculated by a moving average of data between 1961-1966 inclusive.

[5]Federally inspected steer slaughter percentage was left as residual after estimating average percentages for bull, cows and heifers (Table XVI) projected average weight.

[6]Ronald A. Gustafson and Roy N. Van Arsdall, Cattle Feeding in the United States, Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report No. 186 (Washington, October, 1970), pp. iii-iv.

[7]U.S. Department of Agriculture, Western Livestock Round-Up, Extension Service (Washington, March, 1975), p.4.

[8]U.S. Department of Agriculture, Livestock and Meat Situation, Economic Research Service (Washington, December, 1974).

[9]Weights of slaughter dairy cows were assumed to average considerably more than slaughter beef cows. This conclusion was arrived at through a discussion between the author and Dr. Don Gill of the Animal Science Department, Oklahoma State University. From Dr. Gills' experience and knowledge of slaughter cow weights in Oklahoma, the live weight of dairy cows were estimated to average 1200-1400 pounds as compared to 800-900 pounds for beef cows.

[10]Total domestic beef production $=(\Sigma XiZi)$ X Total slaughter
Where: Xi represent the federally inspected slaughter percentage of the form slaughter classes, divided by 100. Zi represents projected average weights of the four respective classes.

[11]U.S. Department of Agriculture, Livestock and Meat Situation, Economic Research Service (Washington, February, 1975), p. 16.

[12]U.S. Department of Commerce, Population Estimates and Projections, Social and Economic Statistics Administration (Washington, December, 1974).

CHAPTER V

PREDICTIONS OF SLAUGHTER AND FEEDER STEER PRICES

The demand for live cattle is often described as a derived demand, with the initial demand for beef coming from the consumer at the retail counter. The strength or weakness of consumer demand is reflected throughout the marketing chain of the beef production industry. With available supplies of beef largely predetermined in the short-run, consumer demand is the primary factor governing retail beef prices. Live cattle prices are, given time for adjustments, derived from retail beef prices as operating margins for all middlemen are effectively deducted from retail prices.

Quarterly Slaughter Steer Price Projections, 1975-76

Given the close relationship of slaughter cattle price and retail beef price, an equation utilizing determinants of retail price to estimate slaughter cattle price was postulated.[1] Explanatory variables in the equation reflect basic supply and demand for beef. Deflated per capita disposable personal income was employed as the primary demand shifter. Per capita supply of beef was divided into two classifications: (1) cow, bull and import beef; and (2) steer and heifer beef. This division approximates supplies of beef in the form they are marketed at retail. Three dummy variables were used to account for seasonal

variation between quarters not explained by the supply and demand variables. Selection of the Consumer Price Index, used for deflation, was based on its appropriateness for the income variable. The two variables composing quarterly per capita supplies were transformed to an annual basis, and all the data were converted into logarithms so the coefficients could be compared to those estimated in a previous study.[2]

Regressions were run on quarterly time series data for the period 1959 to 1974 to estimate the parameters given in equation 1.

(1)

$$\begin{aligned} \text{LOG (SLST)} = &-.9629 - \underset{(4.71)}{1.7935}\ \text{LOG (SHPROD)} - \underset{(5.29)}{.2857}\ \text{LOG (BCPROD)} \\ &+ \underset{(14.76)}{1.8089}\ \text{LOG (DPI)} - \underset{(3.14)}{.0137}\ \text{DM1} + \underset{(6.89)}{.0304}\ \text{DM3} - \underset{(3.44)}{.0158}\ \text{DM4} \end{aligned}$$

$R^2 = .810$ $\qquad$ $S = .0193$

Where:

SLST = Average quarterly price per hundred-weight of choice steers, by CPI (1967 = 100)

SHPROD = (Per capita quarterly supplies of steer and heifer beef) X 4

BCPROD = (Per capita quarterly supplies of cow, bull and import beef) X 4

DPI = Per capita disposable income (annual basis), deflated by CPI (1967 - 100)

DM1 = Dummy variable (0 in second, third and fourth quarters; 1 in first quarter)

DM3 = Dummy variable (0 in first, second and fourth quarters; 1 in third quarter)

DM4 = Dummy variable (0 in first, second and third quarters; 1 in fourth quarter)

( ) = Calculated t test statistic

Equation 1 was used to estimate quarterly average slaughter steer prices for the eight quarters in 1975-76. Projections of per capita disposable income and expected changes in the Consumer Price Index for the period were based on an econometric study of the national economy.[3] The forecasts of the study were adjusted according to more recent information on income and price observations which indicated the current recession might continue until mid-1975.[4] Projections for the last two quarters of 1976, not estimated by the econometric study, were extrapolated from the adjusted projections for the first two quarters of 1976.

Quarterly supplies of beef per person were separated into two categories in equation 1. Projections of steer and heifer beef and cow, bull and import beef were derived from quarterly total projections (Table XVII), estimated average slaughter percentages (Table XVI), and average dressed slaughter weights (Table XIV).[5] Estimated explanatory variables and projected slaughter steer prices by quarters for 1975-76 are listed in Table XVIII.

Average price of choice grade slaughter steers in Omaha for January and February of 1975 was approximately 35.50 per hundred-weight.[6] With present market conditions and price movements in the first two weeks of March, 1975, there is little reason to believe the actual first quarter average price will be above 36.00 per hundred-weight. Given this recent data, the projection of 39.44 listed in Table XVIII will likely be too high by 3.50-4.00 per hundred-weight.

There are three possible sources of error when using a model such as equation 1 to predict price. Supply of beef could be underestimated; demand for beef could be overestimated; and/or some factors not included in the model might be affecting price.

TABLE XVIII

ESTIMATED EXPLANATORY VARIABLES AND CALCULATED SLAUGHTER STEER PRICES BY QUARTERS, 1975-76

	Year	1	2	3	4	Yearly Average
Consumer Price Index (1967=100)	1975	1.570	1.596	1.621	1.647	1.609
	1976	1.676	1.705	1.735	1.766	1.721
Real Per Capita Disposable Income	1975	3059	3062	3067	3085	3068
	1976	3107	3118	3132	3147	3126
Per Capita Steer and Heifer Beef	1975	93.3	97.6	102.1	97.7	97.7
	1976	102.0	98.5	102.8	98.5	100.5
Per Capita Cow, Bull and Import Beef	1975	24.3	23.2	27.5	29.9	26.2
	1976	27.6	24.3	26.8	29.1	27.0
Average Slaughter Steer Price, Omaha	1975	39.44	38.74	37.22	36.27	37.92
	1976	35.58	41.46	41.05	40.00	39.52

Beef production data for the first two months of 1975 do not give indication that supply was underestimated. Real per capita income (the demand factor) will not be reported for several months, but the apparent large error in the first quarter's estimate is unlikely to be caused by this component. With the current price level, for each ten dollar increment real disposable income is overestimated, current dollar slaughter price will be overestimated approximately .25 per hundredweight given the estimated parameters in the equation. Because real disposable income per person has long displayed moderate stability, overestimated demand must be discounted as a source of large error.

The third potential error source in the estimates, relevant factors not included as explanatory variables, is the most likely source of the

error. To attempt identification of all elements not in the model which might affect price is not within the scope of this study. There is, however, a point worth noting with regard to the error in estimates caused by exogenous factors. The residuals of the regression displayed a pattern during the cyclical downturn and bottom in price of the 1960's period which appears to be occurring again with the current falling prices.

Figure 11 illustrates two comparable periods of a one year build-up to a price cycle peak followed by a decreasing price phase. The plot of price is the quarterly average of actual slaughter steer price, as deflated by the Consumer Price Index. The correlation between price and residuals in the 1960's period is obvious. In the 1970's the two series are at many points moving in opposite directions. The only common characteristic between the two relationships is that of a downward trend in both instances.

To note the similarity of the two periods, each plotted series is divided into three sections by vertical segmented lines. In the first section prices are high and still rising, and the residuals are consistently positive. In the second section, while prices are fluctuating around a downward trend, the residuals are fluctuating around a zero level. In the third section of the 1960's period, prices reach the cyclical bottom, and the residuals are consistently negative.

Given the likelihood of the large negative residual for the first quarter of 1975, there is reason to believe the pattern of residuals and prices from equation 1 for 1975-76 will display a pattern similar to that during 1964-65. With a price bottom chosen by equation 1 for the first quarter of 1976, the average residuals for the two year period

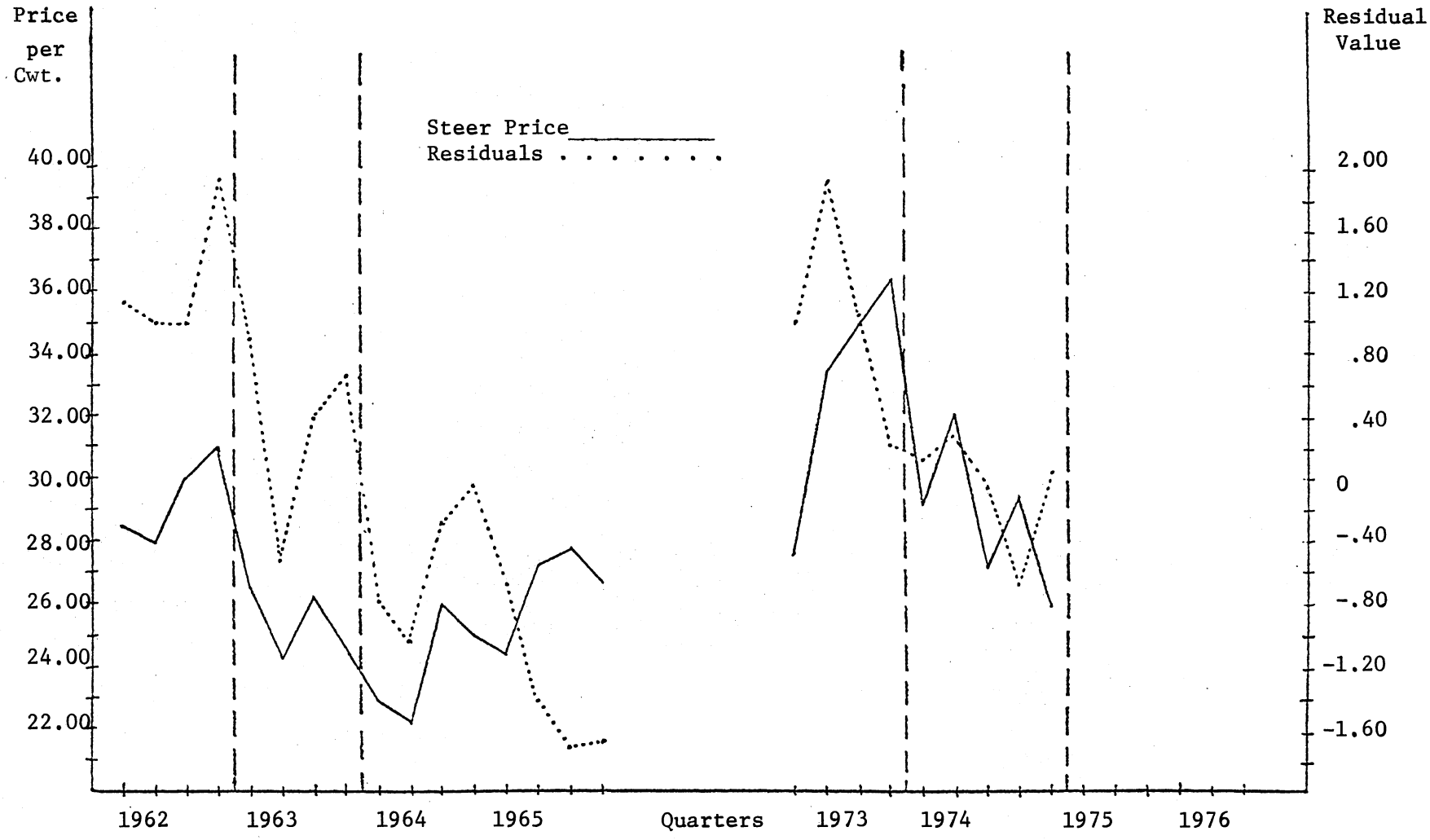

Figure 11. Comparison of a Two-Quarter Moving Average of Residuals for Equation 1 and Deflated Choice Slaughter Steer Price, Omaha, 1962-65 and 1973-74

will probably be negative. The average residual for the 1964-65 interval was -1.07 per hundred-weight. This average residual was employed to revise the original quarterly price estimates. Table XIX displays the original slaughter steer price forecasts, estimated by equation 1, and calculated adjusted price estimates for 1975-76.

TABLE XIX

SLAUGHTER STEER PRICE PROJECTIONS, 1975-76

	Year	1	2	3	4	Yearly Average
Estimates from Equation 1	1975	39.44	38.74	37.22	36.27	37.92
	1976	35.58	41.46	41.05	40.00	39.52
Adjusted Estimates	1975	37.76	37.03	35.48	34.50	36.19
	1976	33.78	39.64	39.19	38.11	37.68

Quarterly Feeder Steer Price Projections, 1975-76

Given the assumption that the demand for cattle is derived from the basic consumer demand for beef at retail, average quarterly feeder steer prices for 1975-76 were calculated from the projected slaughter steer prices. If price differentials between the segments of the marketing chain depict the costs involved with each step of production, a slaughter steer's value less the cattle feeder's input costs per steer should approximate the feeder steer's value.

The cattle feeder's input costs for a slaughter steer are composed of the costs of various feeds, non-feed costs, and the price of the original feeder animal. Non-feed costs per steer remained fairly stable during 1973-74 with a range of 58.43 to 63.98 and an average of 60.60.[7] Most of the variation in this item was due to changing interest rates over the period, with a small increase over the period due to price increases in transportion, medicinal, and marketing expenses. For quarterly estimates of non-feed costs during 1975-76, interest rates were assumed to remain constant. Estimated averages of 60.00 in 1975 and 61.00 in 1976 for non-feed costs were made on the basis of an expected small rise in costs due to inflation.

Various components in the feeder's mix were subject to wide variation in price during 1973-74. The largest single cost in the mix was grain, which rose and fell in price over the period from low yields, exports and decreased feeding. Other feeds in the mix (silage, hay and protein supplement) fluctuated in price but did not affect total input costs as much as grain price because of their lower usage levels.

In projecting average feed costs per animal, grain price was the only feed variable allowed to change. Other feed costs were estimated at a constant 65.00 per animal over 1975-76. Assuming an average slaughter steer weight of 1050 pounds and an average feeder steer weight of 600 pounds, average quarterly prices of feeder steers were calculated for 1975-76. Projections are listed in Table XX.

Estimates of corn prices used to calculate feeder steer prices in Table XX were projected average prices paid to farmers in the U.S. Since the price of corn had generally been declining during March, 1975, the average price for the first quarter of 1975 was estimated to be

slightly lower than the average price during January and February. Other estimates for the two years were based on favorable export prospects and expectations of normal production levels for the reported planting intentions.[8]

TABLE XX

DERIVATION OF QUARTERLY FEEDER STEER PRICES FROM SLAUGHTER STEER PRICES, 1975-76

Prices and Costs	Year	Quarter 1	2	3	4
Choice Slaughter Steer Value	1975	396.48	388.82	372.54	362.25
	1976	354.69	416.22	411.50	400.16
Average non-feed costs	1975	60.00	60.00	60.00	60.00
	1976	61.00	61.00	61.00	61.00
Average cost of corn	1975	128.25	121.50	114.75	108.00
	1976	108.00	112.50	112.50	108.00
Average feed costs other than corn	1975	65.00	65.00	65.00	65.00
	1976	65.00	65.00	65.00	65.00
Feeder Steer Price	1975	23.87	23.72	22.13	21.54
	1976	20.12	29.62	28.83	27.69

The theoretical framework employed in calculating the feeder steer prices in Table XX assumes two relationships which may not be valid

over the next two years. One of these is that of unchanging weights. The average weight difference of 450 pounds between feeder and slaughter steers may be narrowing as slaughter weights fall and feeder weights rise. There would be obvious reductions in feeding costs with the lower weight difference, resulting in higher prices per hundred-weight for steers going into the feedlot.

Another assumption, and probably the most critical one considering the current situation, is the implicit assumption that cattle feeders are the only demand outlet for non-fed steers. Slaughter of non-fed steers and heifers was five times greater in 1974 than in 1973.[9] Thus, considerable numbers of feeder animals are by-passing feedlots and going directly from grazing to slaughter. With non-fed slaughter increasing, packers become an important demand outlet for grass-fed steers and heifers.

The difference between the meat value and grain-feeding value of feeder steers and heifers is dependent on several facors. Cost of feeding, slaughter costs and the level of cattle marketings in both fed and non-fed categories are among the more important variables affecting the difference in value placed on feeder animals for their two alternative uses. When feeding costs per pound of gain are higher than the price per pound of grain-fed cattle, the average price per pound of feeder animals must be below the average price per pound of grain-fed cattle if feeders are to realize a profit. If, however, packers are unable to obtain enough slaughter animals from feedlots, they must look to other sources of cattle to process. Feeders would like for the difference in price between feeder and slaughter steers to reflect at least

the cost of gain in the feedlot. But at some level of price, grass-fed cattle become a profitable purchase for packers.

Whether packers set the maximum price difference between grain-fed and grass-fed cattle during 1975 and 1976 depends mostly on the magnitude of the flow of cattle marketings from pasture and grass. If weather remains favorable and grass plentiful so that feeder cattle may be marketed in an orderly flow, the maximum price difference between the non-fed and fed cattle will likely be supported by the meat packers. If, however, pasture conditions worsen to the point of forcing larger cattle marketings than meat packers are able to slaughter, the maximum price differences may exceed the difference in value to packing operations.

To estimate the difference in value of non-fed and fed cattle to the packer would entail estimating costs involved in slaughter as well as the benefits gained from more cattle moving through the packing plant. A somewhat easier method for deriving an estimate for the value difference is to observe price differences between the two categories over recent months. Figure 12 displays the average weekly price difference between choice slaughter steers in Omaha and choice feeder steers in Kansas City over an eight-month period. Feeding costs per animal rose from $225.04 in July, 1974 to $275.76 in September, 1974, which resulted in a widening price difference.[10] Feeding costs in October, 1974 were $290.70, but this increase in feeding costs did not induce a wider price spread. The value difference for meat packers between the two categories as seen in Figure 12 appears to be somewhere in the $10-11.00 range.

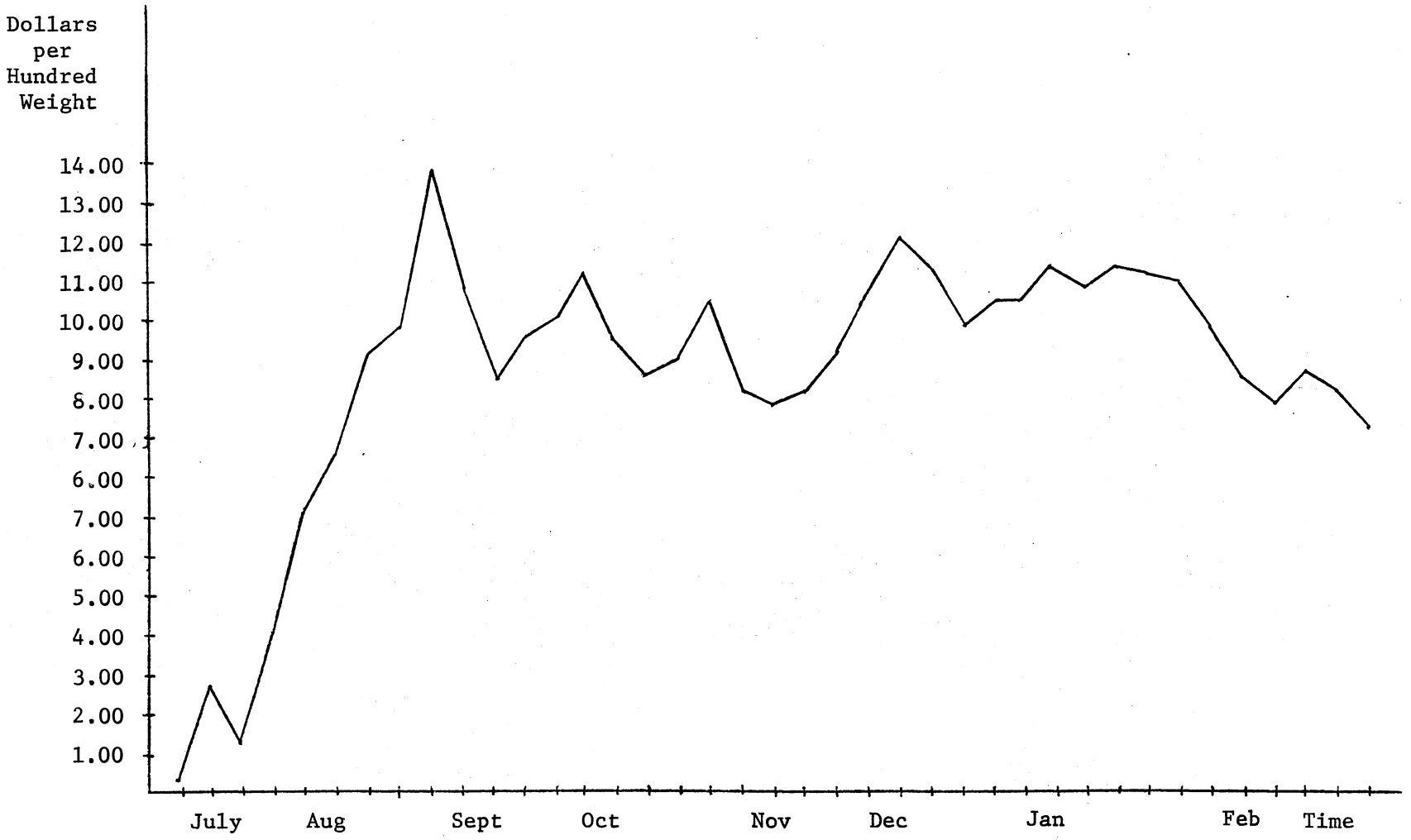

Figure 12. Average Weekly Difference in Price Between Choice Slaughter Steers, Omaha, and Choice Feeder Steers, Kansas City, June, 1974, through February, 1975

Assuming feeding costs will stay high during 1975-76, meat packers and feeders will be bidding against each other for grass-fed cattle. From the relationship shown in Figure 12, feeder steer prices will probably not fall below their meat value to packers. Using the mean of the estimated range of $10-11.00, the maximum value difference for 1975-76 was predicted to be $10.50 per hundred-weight. Given these developments, projected feeder steer prices shown in Table XX were adjusted using a maximum allowable price difference of $10.50 per hundred-weight between feeder and slaughter steers. The final quarterly feeder steer price estimates for 1975-76 are listed in Table XXI.

TABLE XXI

ADJUSTED QUARTERLY PROJECTIONS FOR AVERAGE PRICE OF FEEDER STEERS, KANSAS CITY, 1975-76

Year	1	2	3	4	Yearly Average
			(dollars per cwt.)		
1975	27.26	26.53	24.98	24.00	25.69
1976	23.28	29.62	28.83	27.69	27.36

Effects of Projected Feeder Steer Prices on the Cow-Calf Sector

Given the projected average prices of choice feeder steers for 1975-76, the cow-calf sector of the beef industry will be under considerable financial pressure to reduce beef cow numbers. According to a 1973 study, the average price of choice feeder steers required to

encourage a stable number of beef cows in the United States ranges from 30.00 to 34.00 per hundred-weight, depending on geographical area.[11] Assuming this estimate is reasonable, the average price of 26.50 per hundred-weight predicted for the 1975-76 period indicates cow-calf production will be generally unprofitable for the period.

With the prevailing situation indicating financial losses in calf production, one might expect cow numbers to be reduced by January, 1976. Adjustments in the cattle industry, however, are not instantaneous. Following the cyclical price drop in 1952-53, cow slaughter increased, but cow inventories did not display an absolute decrease until 1956. Reasons for the extended period required to make adjustments are contained in the variables each cow-calf man must consider in making production decisions. Expected price for calves is the one most important factor in the cow-calf man's decision to increase, maintain or reduce herd size. Part of the long lag in production level decreases is due to the time required to change price expectations. The cow-calf sector must become convinced that prices will not recover until cow numbers are reduced. The difficulty of shifting resources from the production of beef into the production of alternative commodities also tends to increase the lag in production level decreases.

Given the predicted average choice feeder steer price of $26.50 per hundred-weight, adjustments will be made throughout the cattle industry. Lower average slaughter weights are expected for the period, and if non-fed slaughter and lower weights in fed slaughter force average weights to decline more rapidly than predicted, average feeder steer prices would be supported at a higher level than anticipated. This short-run adjustment, however, is not expected to materialize to

the extent needed to make calf production a profitable venture for the 1975-76 period.

Assuming cow-calf operations will confront losses through the 1975-76 period, occurrences within the sector were projected by comparison to a similar cyclical interval. Because of the magnitude of the recent decline in cattle prices, the eventualities following the price drop in 1952-53 were considered the most accurate approximation of probable developments in 1975-76.

Average feeder steer prices reached a cyclical peak in the fourth quarter of 1951 and prices continued at high levels through mid-1952. The sharply falling prices began in the third quarter of 1952 and persisted until the cyclical low was attained the third quarter of 1953. The low in prices represented a fifty percent decline from the high established in 1951. In 1973 feeder steer prices reached a cyclical peak in the third quarter. Prices began a rapid decline in 1974 and are predicted to reach the cyclical bottom in late 1975. The percentage decline from the high to the low in prices for the current period should be in excess of that experienced during the 1950's.

The absolute level of prices expected for 1975-76 is also probably lower in real terms than those experienced during the two-year period of low prices in the 1950's. Over the two-year interval, mid-1953 through mid-1955, average price for good and choice feeder steer calves, Kansas City, averaged $20.16 per hundred-weight. The estimate of $26.50 for 1975-76 is considerably under this average price after accounting for general price increases over the twenty year span.

Cow and heifer slaughter started increasing in 1953 with the largest numbers being marketed in the third and fourth quarters after

summer grass and pasture were depleted (Figure 7., Chapter III). Given that the cow-calf sector is facing a financial outlook seemingly more ominous than that of 1953, larger relative increases in cow and heifer slaughter for the last half of 1975 are likely.

Whether increased cow and heifer slaughter continue after 1975, eventually leading to decreased beef cow inventories, depends upon the ability of the beef industry to adjust to conditions. If average slaughter weights for 1976 continue at the current level, prices will remain low and cow slaughter will remain at high levels with a marked seasonal pattern at least through 1976. Under these circumstances, beef cow inventories would probably display near zero growth in January 1, 1977 inventories. If average slaughter weights decline over the period, depending on the relative fall in weights, cow numbers might continue to grow through 1977 at a diminishing rate.

Summary

At the outset of this chapter, an assumption of the demand for cattle being a derived demand formed the basis in projecting initial estimates of slaughter steer prices. An equation containing supply and demand variables was estimated using regression analysis on time series data. Price estimates were then adjusted according to residuals of projected values during a similar interval in the cattle cycle during the 1960's.

Feeder steer prices, again applying the derived demand concept, were then estimated from the slaughter steer prices by subtracting projected feeding costs. Because meat packers have recently exihibited significant influence on the price of non-fed steers and heifers, these

prices were revised to reflect the meat value of feeder animals.

The foundation for the projections of prices for 1975-76, time series regression and the assumption of cattle prices determined largely by derived demand, could be termed as traditional price analysis. The methods employed in the revision of the initial estimates were rather unconventional techniques. No effort will be made in this instance to justify the statistical procedure utilized to revise the estimates. Explanation as to why adjustments were required to arrive at price estimates considered more accurate must come from current conditions surrounding the industry. The environment of the cattle industry presently includes many factors and and relationships which did not exist prior to 1974. Increased non-fed beef slaughter, changing of grade quality standards, and a national economic recession are but a few of the factors contributing to problems in projections based on conventional price analysis with time series data.

FOOTNOTES

[1]Some ideas for the variables used in equation 1 were taken from an annual price model developed by John Ferris in Staff Paper #74-2, Department of Agricultural Economics, Michigan State University, January, 1974.

[2]Ibid.

[3]Saul H. Hymans and Harold T. Shapiro, "An Econometric Model Forecast of 1975," Economic Outlook U.S.A., Vol. 2, No. 1 (Winter, 1975), pp. 1-5.

[4]William B. Franklin, "Business Outlook," Business Week (March 10, 1975) pp. 17-18.

[5]Total production of steer and heifer beef =

$$\left(\frac{\text{Heifer Slaughter \%}}{100} \times \text{Average Dressed Heifer Weight}\right) + \left(\frac{\text{Steer Slaughter \%}}{100} \times \text{Average Dressed Steer Weight}\right);$$

Total cow, bull and import beef = (Total beef production and imports) - (total production of steer and heifer beef).

[6]U.S. Department of Agriculture, Livestock Meat Wool, Vol. 43, Nos. 1-9 (January 7 - March 4, 1975).

[7]U.S. Department of Agriculture, Livestock and Meat Situation, Economic Research Service (Washington, February issues, 1974 and 1975).

[8]U.S. Department of Agriculture, Feed Situation, Economic Research Service (Washington, February, 1975), pp. 5-7.

[9]American National Cattlemen's Association, Guidelines, Vol. 1 (Denver, February, 1975).

[10]U.S. Department of Agriculture, Livestock and Meat Situation, Economic Research Service (Washington, February, 1975), p. 11.

[11]Roy N. Van Arsdall and Melvin D. Skold, Cattle Raising in the United States, Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report No. 235 (Washington, January, 1973), p. 67.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The fundamental problem of this study is as follows: Given the cattle industry is currently confronting a period of depressed prices caused by the recurrence of the cattle cycle, the span of time required for cattle prices to recover is mainly dependent on how quickly the industry rids itself of excess cattle numbers. The time necessary for slaughter numbers to increase, reducing supplies and producing the desired eventuality of increased prices, relies on individual cattlemen's behavior and decision-making, particularly in the 1975-76 period. The overall objective was, therefore, to isolate the significant behavioral reactions involved in the current beef cycle, and given projected prices, to infer behavioral reactions of the cow-calf sector for the 1975-76 period.

To determine the outlook and future intentions of the cow-calf sector, a mailed survey of cow-calf men was conducted. An accounting procedure which derived expected slaughter numbers from beginning cow inventories was also developed. From these two endeavors, conclusions were inferred and enumerated as the behavioral dimensions of the cattle cycle.

Behavioral Dimensions

When cattle prices begin an upward movement out of a cyclical bottom, cattlemen begin holding all classes of cattle for longer periods. Cows and heifers are held back to build production herds. In general, the largest relative increases in the production base occur as prices near a cyclical peak. Slaughter steers and heifers are also held for longer periods as cattlemen attempt to benefit from more weight gain and price improvement before marketing slaughter animals. Reduced slaughter of cows and heifers and the feeding of slaughter steers and heifers for longer periods result in average slaughter weights moving upward with the price cycle.

When cattle prices begin a downward movement from a cyclical peak, cattlemen initially cut production costs in an effort to avoid selling cattle in a faltering market. Steers and heifers are retained in herds and feedlots for longer periods causing the peak in average slaughter weights to lag behind the peak in price. Because of the large financial investment in a calving operation, cattlemen retain cows from slaughter for the longest periods. The reluctance of cow-calf men to sell cows during the first stages of the decreasing price phase of the cycle results in continued build-up in the production base for several years following the initial price decline.

As cattle prices approach a cyclical bottom, cow and heifer slaughter increase, causing either decreased inventories or reduced growth. Slaughter steers and heifers are held for shorter periods as cattlemen anticipate downward movements in price. These two relationships cause the average slaughter weights of cattle to move downward with the price cycle.

Production and Price Projections

Quarterly levels of cattle slaughter were projected for 1975 by using a single-equation model containing five explanatory variables. By estimating 1975 values for the explanatory variables in the equation, quarterly cattle slaughter for 1976 was also predicted. Total estimated cattle slaughter for 1975 and 1976 in relation to slaughter in 1974 were 115.0 and 124.0 percent, respectively.

Quarterly average dressed weights and federally inspected slaughter percentages were estimated from past observations within cyclical fluctuations. By multiplying slaughter percentages (divided by 100) by estimated average dressed weights for each class and summing, an average slaughter weight could be obtained. Computations from this procedure yielded average slaughter weights for 1975 and 1976 showing 5.1 and 8.9 percent respective decreases from 1974 average dressed weights of 631 pounds.

By multiplying expected slaughter weights by estimated slaughter numbers, quarterly total domestic beef production in pounds was projected for 1975-76. Using government import projections and population estimates which assumed a constant growth rate over the period, quarterly per capita beef consumption for 1975-76 was predicted. Beef consumption in the U.S. in 1974 averaged 116.3 pounds per person. Estimates for per capita consumption in 1975 and 1976 of 124.1 and 127.5 pounds depict relative increases of 6.7 and 9.6 percent, respectively.

To estimate quarterly average choice slaughter steer prices for the 1975-76 period, a single-equation price model was adopted. The model employed projected beef production as a supply variable and real per capita disposable income as a demand variable. Assuming annual

inflation rates of nine percent for 1975 and seven percent for 1976, average annual choice slaughter steer prices for 1975-1976 were projected at $36.19 and $37.68 per hundred-weight, respectively. These price estimates compare with average prices of $44.60 and $42.28 per hundred-weight in 1973-1974.

To arrive at estimates for average quarterly feeder steer prices, and assumption of the demand for live cattle being a derived demand was made. Given the estimated slaughter steer prices, average feeder steer prices were calculated by subtracting estimated feed and non-feed costs by quarters through 1976. Because the meat value of feeder steers has currently become an important price-determining factor with high costs of gain and fewer animals marketed from feedlots, a maximum price spread of $10.50 per hundred-weight between the feeder and slaughter steer prices was used. Projected average annual choice feeder steer prices for 1975 and 1976 using this procedure were $25.69 and $27.36 per hundred-weight. These prices compare with average annual prices in 1973 and 1974 of $59.74 and $44.64, respectively.

Implications of Projected Feeder Prices on the Cow-Calf Sector

Given the recent sharp decline in prices experienced by the cow-calf sector and projected low prices for 1975, significant adjustments at the production level of the beef marketing system are probable. Behavioral reactions immediately following a cyclical price fall normally include a lack of willingness to sell brood cows in a falling market. Once prices fall below the level needed to make calf production a profitable enterprise, female slaughter begins to rise rapidly. Given an

estimated required price range of $30.00 - $34.00 per hundred-weight for choice feeder steers to maintain stable cow numbers in the U.S., current and estimated average prices for 1975 will obviously result in financial losses for the sector.

Cow slaughter has historically displayed a very pronounced seasonal pattern with most cows being marketed in the fall and early winter months after the summer pasture period. Cow slaughter in 1975 will likely increase very rapidly during September, October and November. Cow slaughter will probably remain high during the winter months until the spring and summer of 1976 when grazing again becomes plentiful.

In determining the span of time in which the cattle industry will be required to endure low prices and large cow slaughter, several factors must be considered. The largest increases in inventory figures for January, 1975, were in beef cow numbers, calves under 500 pounds and replacement heifers. Large increases in these three categories indicate much potential growth in future numbers.

The absolute level of prices is another factor affecting how quickly excess head numbers of cattle are slaughtered. The amount of loss faced by cow-calf men attempting to keep their cow herd in tact must be an important determining factor of the rate of increasing cow slaughter. Although difficult to assign an appropriate index to deflate cattle prices, the 1975 average projected price of $25.69 per hundred-weight for choice feeder steers is probably lower in real terms than the 1953 average price of $20.55. This might indicate larger relative increases in cow slaughter in the current situation as compared to the 1950's.

Another variable to contemplate is the adaptability of resources in a calving operation. Pasture land often has no other practical use

besides cattle raising. With these conditions existing, the cattlemen have no alternative enterprises for which to use their resources and will continue raising calves at extremely low market price levels.

One other important element which may play a role in regulating the length of time cattle prices remain at low levels is the current financial situation of producers at the cow-calf level. Many producers have diversified farming interests and will be able to rely on other enterprises to subsidize their losses in the cattle market for a period of time. Also, net income from farming during 1973-74 average 32.9 billion dollars annually. This figure represents more than a 100 percent increase over average annual net farm income during 1971-72. Thus, farmers, many of whom are also cattlemen, are probably in a financial position to further complicate the situation by refusing to market their cows at low price levels.

Describing probable occurrences in the cattle industry beyond 1975 is a difficult task. In appraising the general financial situation of farmers and the recent large inventory increases in cows and replacement heifers, the low price phase of the present cycle may continue for several years. The length of time covered by depressed prices depends mainly on the time necessary for cow-calf men to recognize the industry's problem, and the time involved in taking action to reduce excess cattle numbers.

One significant variable, although presently unpredictable, which may be the ultimate deciding factor as to when surplus cattle are marketed is the feed situation. If 1975 and 1976 are high production years for feed grain crops, the price of calves and feeders should show relative improvement. This situation would tend to lengthen the time

necessary for liquidation. If, however, a drouth condition were to develop, depleting summer pasture and grassland, the current phase of the cattle cycle would be much shorter but very painful economically to the cow-calf sector.

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VITA

Kendell Wayne Keith

Candidate for the Degree of

Master of Science

Thesis: BEHAVIORAL AND PREDICTIVE MODEL OF THE BEEF CYCLE

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Hollis, Oklahoma, September 9, 1951, the son of Mr. and Mrs. W. J. Keith.

Education: Graduated from Hollis High School, Hollis, Oklahoma in May, 1969; received the Bachelor of Science degree from Oklahoma State University with a major in Agricultural Economics in May, 1973; completed requirements for the Master of Science degree in May, 1975.

Professional Experience: Graduate research assistant, Oklahoma State University, September, 1973 to May, 1975.