

CATTLE-BEEF INDUSTRY PROJECTIONS TO 1980
AND DERIVED FEEDER CATTLE REQUIREMENTS

by

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INTRODUCTION

The purpose of this study is the derivation of future feeder cattle requirements in the United States. To accomplish this objective, it was necessary to make detailed beef and veal demand projections as well as to evaluate specific segments of the cattle-beef industry.

Feeder cattle requirements are important to all segments of the cattle-beef industry. Beef producers need information about future availability and potential market demand for feeder cattle. Information on beef supply sources is also essential to research endeavors concerned with evaluating the industry, and the potential beef supply response possibilities in the future.

Changes in consumer demand in conjunction with technological changes require continuous evaluation and reorganization of the cattle-beef industry. A simple look at historical trends reflect the dynamic adjustments that have been made in the past.

The variation in the rate of population growth, composition of the population, and fluctuating disposable incomes add to the complexity of evaluating a demand for beef in 1980. A void of data on average carcass weights by component as well as the complexity of maintaining a cattle inventory balance also contribute to the difficulty of evaluating the potential beef supply relative to the expected market demand.

Objectives

The objectives of this study were concerned with the various supply/demand relationships within the cattle-beef industry:

- (1) Develop a model to estimate demand for beef and veal to 1980 based on previously published research and projections.
- (2) Equate a supply of beef and veal to the projected aggregate demand by simulating cattle inventory and beef supply responses.
- (3) Derive U.S. feeder cattle requirements to 1980 based on results of the first two objectives.

CHAPTER I

METHODOLOGY

Beef and veal demand projections, if realized, will necessarily equal and be supplied by the various cattle and calf slaughterings of the cattle industry (dairy as well as beef cattle) and net imports of beef and veal. A detailed analysis of the various cattle and calf components on inventory from year to year was necessary to continually estimate future demands of beef as well as accounting for cattle in future years.

Beef and Veal Demand Projections

Projections of beef and veal demand in the United States have been estimated in this study as follows:

$$(1) \quad \hat{X}_{1t} = (X_{2t} \cdot X_{3t}) + X_{4t} - X_{5t} - X_{6t}$$

where,

\hat{X}_{1t} = Total U.S. projected aggregate domestic demand for beef and veal in period t. (Carcass weight basis)

X_{2t} = Total U.S. population in period t.

X_{3t} = Per Capita beef and veal consumption in period t.
(Carcass weight basis)

X_{4t} = Total beef and veal exports in period t. (Carcass weight basis)

X_{5t} = Total beef imports in period t. (Carcass weight basis)

X_{6t} = Total veal imports in period t. (Carcass weight basis)

Projected beef and veal demand is based on other exogenous variables for any given period t. Other studies have been utilized to obtain the

requisite population and per capita beef and veal consumption projections, i.e., variables X_{2t} and X_{3t} . Projections of exports and imports, variables X_{4t} , X_{5t} and X_{6t} have been made based on available data and are explained in a later chapter. This study has focused on cattle-beef industry projections based on the estimated demand (and supply balance) relationships. Hence, the above specifications to estimate X_{1t} has been adequate.

Cattle Inventory Balance

A general requirement for the evaluation of the cattle-beef industry is an understanding of the cattle inventory and implications of changes within this inventory.

Current inventory data available from the United States Department of Agriculture (USDA), beginning in 1970, contain the following components:

Cattle Inventory Components, January 1 Data¹

1. Beef cows and heifers that have calved
2. Milk cows and heifers that have calved
3. Heifers: Beef cow replacements 500 pounds and over
4. Heifers: Milk cow replacements 500 pounds and over
5. Heifers: Other heifers 500 pounds and over
6. Steers, 500 pounds and over
7. Bulls, 500 pounds and over
8. Steers, heifers, and bulls under 500 pounds

¹The weight specifications for each of the latter six inventory components are applicable throughout this paper in accordance with USDA procedures and data estimates. Further reference to the weight specifications is generally omitted.

In general it is useful to think of the Total Cattle Inventory (C_{1t}) as being comprised of the above components as follows:

$$(2) \quad C_{1t} = \sum_{j=1}^8 C_{1jt}$$

where,

C_{1t} = All Cattle Inventory, January 1, period t.

C_{1jt} = Cattle Inventory by component j, January 1, period t.

where, also, $j = 1, 2, 3, \dots, 8$ refers to the individual cattle inventory components as defined above.

Further development of a cattle inventory "balance" system for period t (January 1 to December 31) requires an understanding of the gains and losses during the period. Hence the beginning inventory in period t plus gains and losses during the period result in an ending inventory for period t. This ending inventory can also be defined as the beginning inventory for period (t+1) as follows:

$$(3) \quad C_{1(t+1)} = C_{1t} + C_{2t} + C_{3t} - C_{4t} - C_{5t} - C_{6t} + C_{7t} - C_{8t}$$

where, C_{it} refers to the following inventory changes:

$C_{1(t+1)}$ = All Cattle Inventory, January 1, period t+1

C_{1t} = All Cattle Inventory, January 1, period t

C_{2t} = Total Calf Crop, period t

C_{3t} = Total Cattle Imports, period t

C_{4t} = Total Cattle and Calf Slaughter, period t

C_{5t} = Total Cattle and Calf Losses, period t

C_{6t} = Total Cattle Exports, period t

C_{7t} = Rearrangement gains by component, period t

C_{8t} = Rearrangement losses by component, period t

The above specification denotes an aggregate Inventory Balance System for period t . Variables C_{2t} and C_{3t} represent gains to the inventory, while variables C_{4t} , C_{5t} , and C_{6t} represent losses. Variables C_{7t} and C_{8t} do not represent an aggregate change in total inventory, however, they do represent gains and losses of the various components which are important in maintaining an inventory balance.

In recognition of the various USDA cattle inventory components as described above, a further disaggregation of the all cattle inventory can be specified as follows:

$$(4) \quad C_{1(t+1)} = \sum_{j=1}^8 C_{1jt} + \sum_{j=1}^2 C_{2jt} + \sum_{j=1}^8 C_{3jt} - \sum_{j=1}^9 C_{4jt} - \sum_{j=1}^9 C_{5jt} - \sum_{j=1}^8 C_{6jt} + \sum_{j=1}^8 C_{7jt} - \sum_{j=1}^{5,7} C_{8jt}$$

where, C_{it} is as previously defined

where, also, $j = 1, 2, 3, \dots, 9$ refers to the individual cattle inventory components as follows:

<u>Component j</u>	<u>Description</u>
1	Beef Cows
2	Milk Cows
3	Beef Cow Replacements
4	Milk Cow Replacements
5	Other Heifers
6	Steers
7	Steers, Heifers, and Bulls
8	Bulls
9	Calves

The nine components specified in equation (4) represent a level of aggregation which is feasible to utilize in an Inventory Balance System. The first eight components represent those utilized by USDA and the additional component ($j=9$) represents calves that are born in period t . This

additional component is necessary to account for the calves born during the period even though they are present in another class at the end of period t .

Beef Supply Response Relationships

Given the above specification of aggregate U.S. beef and veal demand and the Cattle Inventory Balance System for period t , attention was turned to estimation of beef and veal supply response relationships which were equated to the demand. The beef and veal supply is reflected as $\sum_{j=1}^9 C_{4jt}$ in equation (4) of the Cattle Inventory Balance System. In other words, a given demand projection, \hat{X}_{1t} , if realized, must be equal to an estimated aggregate supply response. (Note that net export requirements are included in the above demand equation so that \hat{X}_{1t} also implies an aggregate production requirement for U.S. producers of beef and veal.

Supply (production) of beef and veal in the U.S. is composed of a variety of supply components. In outline form, the supply components of concern in this study are as shown in Figure 1. Various types of cattle and calves are produced and slaughtered to yield beef or veal. Cows and bulls of both beef cattle and dairy breed origin are involved as well as young cattle of beef, dairy or mixed breed origin. By including calf-slaughter and veal production in the Supply Responses, a balance sheet of cattle and calves in the industry may be established.

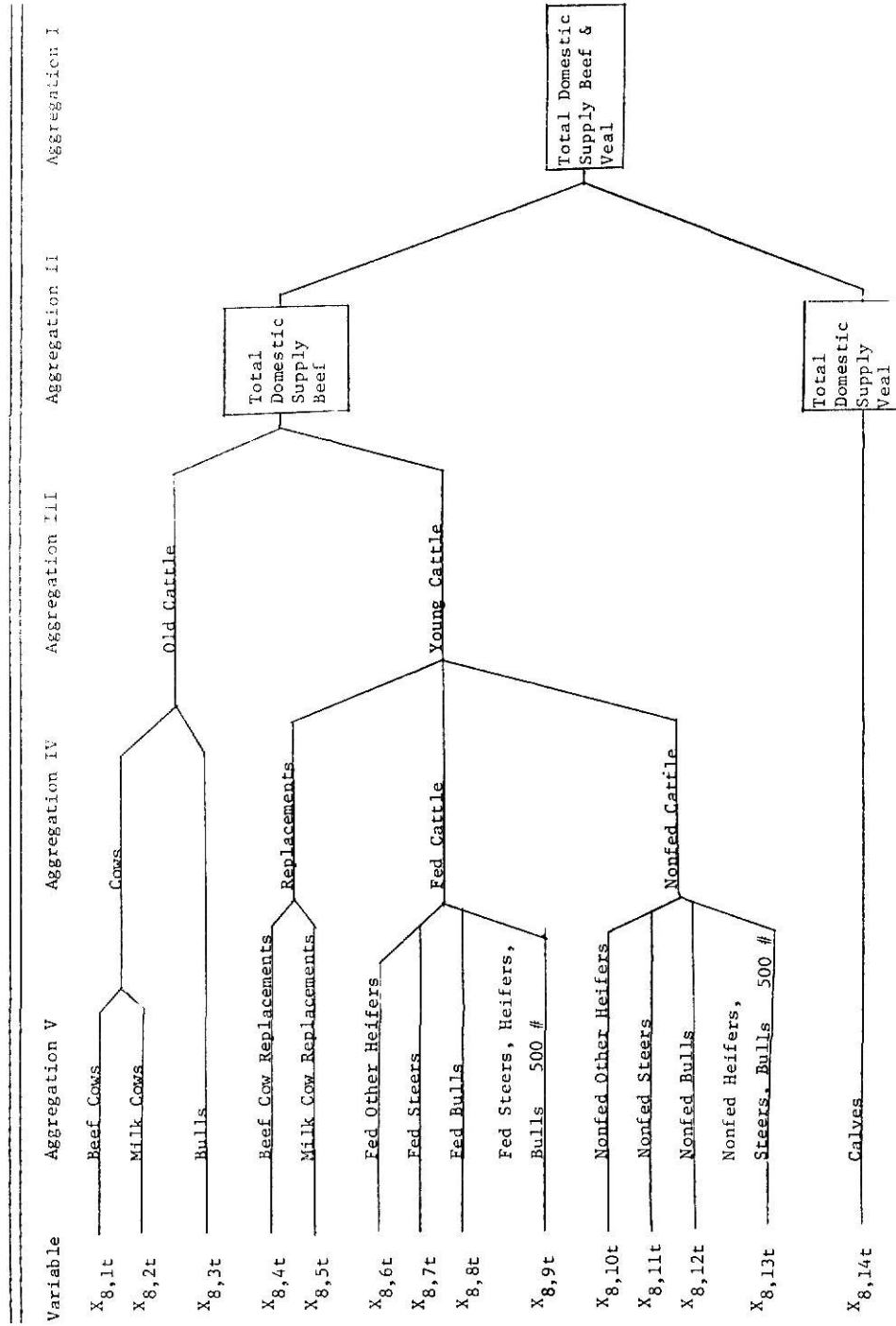
Substantial amounts of beef are supplied as 'by-products' of beef cattle or dairy cattle production enterprises. Due to aging of cattle, the basic breeding herds (both beef and dairy cattle) must be continuously replaced. However, 'beef' is produced as a result of this culling and replacement process.

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FIGURE 1
CATTLE COMPONENTS OF THE BEEF AND VEAL SUPPLY
(Five Levels of Aggregation)



Young cattle provide the bulk of beef supplies, yet a key distinction among cattle by breed is still important. Young cattle of beef breed origin are intended almost entirely for beef production. However, dairy calves are often simply a by-product of the dairy production process; and if dairy calves are not kept for replacements they become an optional beef-production input, i.e., calves may be grown-out to produce beef. Also, in some dairy herds, the dairy cows are crossed with beef cattle to produce 'mixed' breed cattle which are more suited to beef production.

A further important aspect of beef supply response relationships is fed versus nonfed production of young cattle. Fed beef production involves minimally a high energy level finish feeding of cattle, whereas nonfed beef production involves production growth to maturity at a slower rate on lower energy rations, e.g., grass feeding or other high roughage feeding programs.

The above noted aspects of 'beef and veal' production are critical in terms of an expected beef supply response because of differential carcass yields from each type of animal. Also, optional production practices among U.S. producers concerning cattle slaughter components can result in varied aggregate beef supply response from a given overall cattle herd inventory.

In recognition of various beef supply components and corresponding expected differential carcass yields, the following general beef supply response relationship is specified:¹

$$(5) \quad \hat{X}_{7t} = \left(\sum_{k=1}^{14} X_{7kt} \right) = \left(\sum_{k=1}^{14} X_{8kt} \cdot X_{9kt} \right)$$

¹Beef Supply Variables have been specified as (X_{it}) rather than Cattle Inventory Variables (C_{it}) since the Beef Supply is eventually equated to the Beef Demand Variables (X_{it}) .

where, X_{7t} = Total beef and veal supply (carcass weight equivalent)

X_{7kt} = Total beef and veal supply from k^{th} type cattle slaughtered with k^{th} type carcass weight in period t .

X_{8kt} = Number of the k^{th} type cattle slaughtered in period t .
(Figure 1)

X_{9kt} = The average (expected) carcass weight of the k^{th} type cattle slaughtered in period t , and,

where, also, $k = 1, 2, 3, \dots, 14$ refers to the individual supply components as follows:

<u>Component k</u>	<u>Description</u>
1	Beef Cows
2	Milk Cows
3	Cull Bulls
4	Beef Cow Replacements
5	Milk Cow Replacements
6	Fed Other Heifers
7	Fed Steers
8	Fed Steers, Heifers, and Bulls
9	Fed Bulls
10	Nonfed Other Heifers
11	Nonfed Steers
12	Nonfed Steers, Heifers, and Bulls
13	Nonfed Bulls
14	Calves

The fourteen components are a result of the subdivisions of the components utilized in the Cattle Inventory Balance System. The additional components have been necessary due to the differential beef supply responses described above. Therefore, the following relationship exists:

$$(6) \quad \sum_{j=1}^9 C_{4jt} = \sum_{k=1}^{14} X_{8kt}$$

The fourteen ($k=14$) components specified in equation (5) represent a selected level-of-aggregation (see Figure 1). Five levels-of-aggregation are depicted in Figure 1, with levels I, II, ..., V indicating increasing numbers of components of beef and veal supply specified.

Equation (5) above represents a level-of-aggregation of beef supply components which is believed feasible to estimate in this study. More detailed specifications of components are generally preferred, e.g., beef, dairy, or mixed breeds, from the standpoint of eventually deriving feeder cattle requirements for a future period t ; however, existing data availability has limited this area of research.

Beef supply response relationships for a given period t are necessarily conditioned and limited by developments in periods $t-1$, $t-2$...etc. Furthermore, desired beef supply response in future periods, i.e., $t+1$, $t+2$,..., etc., will also affect needed behavior in period t if such subsequent response patterns are to be realized.

Implicitly, then, it is understood that equation (5) for a given period t , is simply an accounting equation to estimate beef supply given slaughter numbers and average carcass yields. A more encompassing beef supply response system of relationships is needed in order to establish the technical and economic feasibility of any particular total beef supply yield.

Beef Demand/Supply Balance

For purposes of this study, it is assumed that a projected U.S. aggregate beef demand for period t (equation (1)) can and will be realized; and, further, that this projected demand will be obtained in general according to the supply response relationship defined (equation 5). That is, a beef demand/supply balance is assumed as follows:

$$(7) \quad \hat{X}_{1t} = \hat{X}_{7t} \text{ or, from (1) and (5)}$$

$$(X_{2t} \cdot X_{3t}) + X_{4t} - X_{5t} - X_{6t} = \left(\sum_{k=1}^{14} X_{8kt} \cdot X_{9kt} \right)$$

where, X_{jt} are as defined above.

CHAPTER II

DEMAND, DATA SOURCES AND PROJECTIONS OF EXOGENOUS VARIABLES

Population Estimates and Projections

Population is commonly estimated three different ways by the Bureau of Census: (1) Total population of the United States, which includes Armed Forces overseas; (2) Total resident population, which is obtained by subtracting an estimate of the Armed Forces overseas; and (3) Civilian resident population, which is obtained by subtracting an estimate of the total Armed Forces. Table 1 reflects the various population estimates for the period 1960-1970. Population estimates are included in this study to emphasize the differences in the types of population estimates. Traditionally, per capita consumption is derived by using civilian resident population on July 1, however, projections are available only for total population of the United States including Armed Forces overseas.

The national population projections used in this study are those derived by the United States Department of Commerce, Bureau of Census.¹ The projections were developed using a cohort component method whereby each of the components of population change (fertility, mortality, and migration) is projected separately.

¹U.S. Department of Commerce, Bureau of Census, "Projections of the Population of the United States, by Age and Sex: 1970 to 2020," Current Population Reports, Series P-25, No. 470 (Washington, D.C.: U.S. Government Printing Office, 1971).

TABLE 1

POPULATION ESTIMATES OF THE UNITED STATES,
 BY TYPE OF POPULATION: 1960-1970
 (Numbers in Thousands)

<u>Year</u> ^a	<u>Civilian Resident Population Estimate</u>	<u>Total Resident Population</u>	<u>Total U.S. Population Estimate</u>	<u>Percent^b Annual Change of Total Population</u>
1960	178,136	179,175	180,667	1.7
1961	181,123	182,973	183,672	1.5
1962	183,644	185,738	186,504	1.4
1963	186,448	188,438	189,197	1.4
1964	189,085	191,085	191,833	1.3
1965	191,539	193,460	194,237	1.2
1966	193,345	195,501	196,485	1.1
1967	195,181	197,374	198,629	1.0
1968	197,026	199,312	200,619	1.0
1969	199,067	201,306	202,599	1.1
1970	201,014	203,736	204,800	1.1

^aJuly 1 Basis

^bPercent annual change based on population at beginning of the year.

Source: U.S. Department of Commerce, Bureau of Census, "Population Estimates and Projections", Current Population Reports, Series P-25, No. 460, (Washington, D.C.: U.S. Government Printing Office, 1971), p.8.

The key assumption in this method is the average number of children a cohort of women bear during their lifetime. Since fertility is the component of population change characterized by the highest degree of uncertainty, four alternative assumptions were made as to the level of cohort fertility as reflected in Table 2.

TABLE 2

LEVEL OF FERTILITY^a

<u>Projection Series</u>	<u>Ultimate Completed Cohort Fertility Rate^b</u>
Series B	3,100
Series C	2,775
Series D	2,450
Series E	2,110

^aIbid., Table E, p. 6.

^bThe "completed cohort fertility rate" is the number of children born to a cohort of 1000 women upon completion of childbearing ages. (Defined as ages 14 through 49 with a mean age of 25.8).

Series B represented a reasonable upper limit and is close to the level of cohort fertility suggested by birth expectations data from the post World War II era. Series D reflected the level of fertility experienced by the birth cohorts of women during the Depression. Series C was set midway between Series B and D. Series E was added in 1970 and is useful analytically because it represents "replacement level" fertility in the United States. The levels of fertility in the four series were about evenly spaced.

Table 3 reflects the set of age-sex specific mortality rates used for all population series. The projected mortality rates were based on projections to the year 2000 prepared in 1966 by the Division of Actuary, Social Security Administration, and presented in "United States Population Projections for OASDHI Cost Estimates." Linear interpolation was used for values between 1967 and 2000.

TABLE 3

ESTIMATED AND PROJECTED LIFE EXPECTANCY AT BIRTH BY SEX^a

<u>Sex</u>	<u>1967</u>	<u>2000</u>
Male	67.0	69.1
Female	74.2	75.3

^aU. S. Department of Commerce, Bureau of Census, "Projections of the Population of the United States, by Age and Sex: 1970 to 2020", Current Population Reports, Series P-25, No. 270 (Washington, D.C.: U.S. Government Printing Office, 1971), Table H, p. 9.

Net immigration after July 1, 1970 is assumed to be 400,000 annually, and is used for population projections.

A general assumption is that there will be no disastrous war, widespread epidemic, depression, or similar catastrophe. The projection of births are subject to more uncertainty than mortality and immigration even with the rather wide range of fertility assumptions offered. However, for the purpose of this study, the Current Population Reports by Bureau of Census are adequate and have been used.

Current population projections to 1980 are found in Table 4. Per capita consumption usually is derived by using civilian resident population

TABLE 4

PROJECTIONS OF TOTAL U.S. POPULATION (INCLUDING
ARMED FORCES OVERSEAS): 1971 to 1980
(Numbers in Thousands)

Year ^a	Series B	Percent Annual _b Change	Series C	Percent Annual _b Change	Series D	Percent Annual _b Change	Series E	Percent Annual _b Change
1971	207,800	1.2	206,989	1.1	206,939	1.1	206,886	1.0
1972	209,484	1.3	209,335	1.2	209,181	1.1	209,016	1.0
1973	212,155	1.4	211,847	1.3	211,530	1.1	211,195	1.1
1974	215,053	1.5	214,527	1.3	213,991	1.2	213,424	1.1
1975	218,177	1.5	217,375	1.4	216,561	1.2	215,703	1.1
1976	221,519	1.6	220,385	1.4	219,239	1.2	218,031	1.1
1977	225,519	1.7	223,548	1.5	222,018	1.3	220,407	1.1
1978	228,797	1.7	226,850	1.5	224,888	1.3	222,826	1.1
1979	232,692	1.7	230,274	1.5	227,839	1.3	225,282	1.1
1980	236,725	1.7	233,498	1.5	230,855	1.3	227,765	1.1

^aJuly 1 Basis.

^bPercent annual change based on population at beginning of the year.

Source: U.S. Department of Commerce, Bureau of Census, "Projections of the Population of the United States, by Age and Sex: 1970 to 2020", Current Population Reports, Series P-25, No. 470 (Washington, D.C.: U.S. Government Printing Office, 1971), Table 1, pp. 11-12

on July 1.¹ Civilian resident population has been used in the past primarily because estimates are available for domestic, civilian food consumption. Since population projections are for the total population, the assumption has been made that the Armed Forces consumption of beef and veal is the same as civilian consumption. By making this assumption, no estimate was necessary for the size of the Armed Forces or beef and veal consumed by Armed Forces during the projection period.

Series D population projections reflect growth rates commensurate with recent trends. This series reflects an annual growth rate of between 1.1 and 1.3 per cent through 1980 compared with a rate of nearly 1.6 per cent between 1950 and 1969. Series D has been used extensively as a target "predictor" in this study. Series E has also been included in this study and reflects a somewhat lower population projection approaching the "replacement level" fertility of 2.11 children per family.

Per Capita Beef and Veal Consumption

Per capita beef and veal consumption projections used were those obtained from the Outlook and Projections Section, Economic and Statistical Analysis Division, Economic Research Service (ERS), USDA. Traditionally this ERS section has been responsible for making long run projections for all agricultural commodities. The two most recent studies have been evaluated and utilized where appropriate in this study.

¹U.S. Department of Agriculture, Economic Research Service, U.S. Food Consumption - Sources of Data and Trends 1909 - 1963, Statistical Bulletin, No. 364, (Washington, D.C.: U.S. Government Printing Office, 1965), p. 2.

To effectively evaluate long range supply and demand prospects for beef, Daly found it necessary to look at the entire livestock-feed balance within agriculture.¹ Included also, were the competition of various meats, including beef, pork, mutton and poultry, as well as other economic growth factors. Specific assumptions and projections included the following:

1. Population growth was projected to increase about 1.5 per cent per year with a total population of 242 million in 1980. (This projection seems relatively high. Recently revised projections by the Bureau of Census estimate population in 1980 between 227-236 million with annual increases of 1.1 to 1.3 per cent).
2. Economic growth was projected at 4 to 4 1/2 per cent per year. Disposable personal income was projected at \$3,250 in 1980 with constant 1958 dollars.
3. Technological advances were projected to continue, however, more rapid for feed grains than for livestock products through 1980.
4. Gradually declining costs for feed grains were implied in the projection framework.
5. Based on the above projections, the following relationships were estimated for 1980; (see Table 5).
6. The target 1980 estimate made by Daly was 123 pounds of beef and veal per capita. The other estimates reflect the extreme of the likely projections.

¹Rex F. Daly, Livestock Demand Output and Prices, (Materials presented at the American National Cattleman's Association Conference, July 26-28, 1967, Denver, Colorado.)

TABLE 5
PROJECTIONS RELATED TO PER CAPITA BEEF CONSUMPTION IN 1980

Estimate Level	Exports of Feed Grains	Feed Price Corn	Farm Price of Cattle	Beef & Veal Domestic Use	Beef & Veal Per Capita Consumption	Annual Increase in Per Capita Consumption
	%	\$	\$	Mil. Lbs.	Lbs.	%
High	None	.80	20.00 ^a	33,500	137	1.7
Target	3	.90	23.40 ^a	30,255	123	1.0
Low	4 1/2	1.00	25.00 ^a	29,060	119	.8

^a Arbitrary price assumptions made by Daly as a basis for illustrating different impacts on demand.

These projections were made in 1967 and since that time more recent studies have been made by Culver and Chai.¹

Culver and Chai followed Daly's procedures, but basically revised the major demand shifters, population and income:

1. U.S. Population was assumed to rise to 235 million by 1980 rather than the 242 million used by Daly earlier. (This is still relatively high when compared to the most recent population projections by the Bureau of Census, i.e., 227-236 million).
2. Disposable income was projected to reach \$3,326 in 1980 (up from \$3,250) with constant 1958 dollars or \$5,357 in current dollars.

Projections of livestock and livestock products were derived from combining results of a livestock-feed model and individual commodity estimates by commodity specialists.² The livestock feed model, given projected feed prices and exogenous demand shifters, provides annual

¹David W. Culver and J. C. Chai, "A View of Food and Agriculture in 1980" Agricultural Economics Research, Vol. 22, No. 3, (July, 1970), with Statistical Appendix.

²A. C. Egbert and S. Rentlinger, "A Dynamic Model of the Livestock Feed Sector," Journal of Farm Economics, 47:1288-1305, December, 1965.

estimates of production and prices for livestock and prices for livestock products. Once a demand for livestock products was established, the elasticities of beef, veal, pork, and chicken were applied to derive per capita consumption estimates for each commodity based on population projections.

Accordingly, per capita beef and veal consumption was estimated to rise to 130 pounds by 1980.¹ This estimate reflects an increase of 13.4 pounds, or 11.5 per cent from the 1970 level of 116.6 pounds. Additionally, a 135 per capita beef and veal consumption estimate was utilized, based on recent trends of population, income, and anticipated demand. The 130 and 135 pounds per capita consumption estimates by 1980 provide a range of subsequent results.

Anticipated increases of per capita consumption of beef and veal are not assumed to be linear. Meat substitutes now offer little competition to beef and veal, however, by 1980 new technological developments could lead to considerably expanded use of meat extenders.² Hence, beef and veal consumption may increase at a slower rate between 1975-1980 relative to 1970-1975, for example.

Veal consumption has been dropping for many years and further declines are projected through 1980. In 1960 per capita consumption of veal was 6.1 pounds and by 1970 it had decreased 52 per cent to 2.9 pounds.³

¹David W. Culver and J. C. Chai, "A View of Feed and Agriculture in 1980," Agricultural Economics Research, Vol. 22, No. 3, (July, 1970), p. 63.

²Donald Seaborg, "Beef Cattle: The Next Ten Years", U.S. Department of Agriculture, Economic Research Service, Livestock and Meat Situation, No. 173, May, 1970, (Washington, D.C.: Government Printing Office, 1970), p. 33.

³U.S. Department of Agriculture, Agriculture; Agricultural Statistics, 1971, (Washington, D.C.: Government Printing Office, 1971), Table 525, p. 362.

Further declines in veal consumption will be due to fewer dairy calves and the tendency for more dairy heifers to be fed out in feedlots.

One of the primary assumptions has been to project per capita consumption of veal to decline linearly to 2.0 pounds in 1975 and a further decline to 1.5 pounds in 1980.¹ Based on this projection calf slaughter has been reduced accordingly as described in the Beef Supply Response Model.

1980 Beef and Veal Consumption

Given the population and per capita beef and veal consumption projections for 1980, attention was turned to projecting the United States demand for beef and veal in 1980 as specified in equation (1) earlier. Table 6 reflects demand projections for all population Series with a per capita beef and veal consumption of 130 and 135 pounds in 1980. This study has dealt specifically with population Series D as a target, with Series E also being considered in all cases.

TABLE 6

PROJECTED BEEF AND VEAL DEMAND FOR THE UNITED STATES IN 1980

U.S. Per Capita Beef and Veal Consumption (Pounds)	Population Series ^a (Numbers in Thousands)			
	Series B (236,725)	Series C (233,798)	Series D (230,855)	Series E (277,765)
	----- Million Pounds -----			
130	30,774	30,397	30,011	29,609
135	31,958	31,563	31,165	30,748

^aU.S. Department of Commerce, Bureau of Census, "Projections of the Population of the United States, by Age and Sex: 1970 to 2020," Current Population Reports, Series P-25, No. 470, (Washington, D.C.: U.S. Government Printing Office, 1971), Table 1, pp. 11-12.

¹Donald Seaborg, "Beef Cattle: The Next Ten Years", U.S. Department of Agriculture, Economic Research Service, Livestock and Meat Situation, No. 173 (May, 1970), (Washington, D.C.: Government Printing Office, 1970), p. 35.

Beef and Veal Exports and Imports

Imports of beef are likely to rise steadily through 1980. The rise is expected to approximately parallel growth in domestic production. However, the actual rate of increase will depend on both domestic programs and import restrictions as well as growth in foreign markets.

In 1969 beef imports were divided into the following classes:¹

Boneless, fresh or frozen	84 %
Bone in, fresh or frozen	1 %
Canned	10 %
Pickled, cured, other	5 %
	<hr/> 100 %

Beef imports are similar to domestic cow beef and is used similarly, mainly in hamburger and processed meat products. Australia and New Zealand are the largest suppliers and accounted for 57 per cent of the total supply in 1970.

Table 7 reflects beef import projections based primarily on trends of the 1960's. Projections for 1972-1980 are 7 per cent of the beef and veal consumption in the year t based on Series D population projections and a linear increase in beef and veal consumption to 130 pounds in 1980.

Between 1960-1970 veal imports have averaged a relatively consistent 20 million pounds yearly, and this figure has been used for veal import projections for 1972-1980 in Table 7.

Public Law 88-482, enacted in August, 1964, outlines procedures for reviewing the meat import situation and specifies conditions for proclaiming import quotas for certain meats, primarily fresh or frozen beef and mutton. The import quota is related to the level of domestic production

¹U.S. Department of Agriculture, Economic Research Service, Livestock and Meat Situation, No. 173, (May, 1970), (Washington, D.C.: Government Printing Office, 1970), p. 19.

of these meats. The law provides that if estimated imports of fresh, chilled or frozen cattle meat and meat of goats and sheep, other than lamb, equal or exceed 110 per cent of the adjusted base quota for that year, the President is required to invoke a quota of imports of these meats.

The adjusted base quota for a year is derived by adjusting the base of 725.4 million pounds specified by law (approximately the 1959-63 average annual imports of these meats) by the percentage increase or decrease since 1959-63 in domestic commercial production of these meats. The law defines the level of domestic production as a 3 year average for the year in which the quota is applied and the two preceding years.

While the quota limits imports, exporting countries seem to hold their shipments near this maximum. Unless existing regulations are repealed, it appears reasonable to expect similar behavior throughout the projection period as long as the United States maintains a favorable market for foreign supplies.¹

Beef and veal exports are typically very small because of the generally higher wholesale meat prices in the United States than in other countries. Exports between 1960-1970 were usually less than .5 per cent of the U.S. production. There are, however, large markets abroad for byproducts of the meat-packing industry but these exports do not affect this study.

¹The June, 1972 repeal, of import quotas by President Nixon, suggests that imports may be underestimated for 1972. Also, subsequent projections may be low if quotas are not reinstated.

TABLE 7

BEEF AND VEAL; EXPORTS AND IMPORTS FOR THE UNITED STATES:
 1960-1971 ACTUAL AND PROJECTIONS TO 1980
 (Carcass Weight Equivalent)

Year	Beef Imports	Veal Imports	Beef & Veal Exports	Beef & Veal Net Imports	Net Import Per Capita Consumption
	----- Million Pounds -----				-- Pounds --
1960	760	15	53	722	4.3
1961	1,021	16	58	979	5.4
1962	1,414	26	53	1,387	7.6
1963	1,651	26	54	1,623	8.7
1964	1,068	17	96	989	5.2
1965	923	19	97	845	4.4
1966	1,182	22	88	1,116	5.8
1967	1,313	15	94	1,234	6.3
1968	1,500	18	94	1,428	7.2
1969	1,615	25	87	1,553	7.8
1970	1,792	24	104	1,712	8.3
1971	1,708	20	80	1,648	8.0
<u>Projected</u>					
1972	1,747	20	80	1,687	8.1
1973	1,785	20	80	1,625	8.2
1974	1,827	20	80	1,767	8.3
1975	1,869	20	80	1,809	8.4
1976	1,912	20	80	1,852	8.4
1977	1,958	20	80	1,798	8.5
1978	2,004	20	80	1,944	8.7
1979	2,053	20	80	1,993	8.7
1980	2,100	20	80	1,940	8.8

Source: 1960-1970, U.S. Department of Agriculture, Agricultural Statistics, 1971 (Washington, D.C.: Government Printing Office, 1971), Table 526, p. 363.

1971, Preliminary

1972-1980, Projections

Notes:

1. Veal Import projections are an average of veal imports for the years 1960-1970.
2. Beef and Veal Export projections are an average of beef and veal exports for the years 1960-1971. Projected veal exports are negligible.
3. Beef Import projections are 7 per cent of beef and veal consumption in year t based on Series D. population projections and a linear increase in 1980.
4. Per Capita Consumption projections of Net Imports based on Series D. population projections.

Reflected in Table 7 are beef and veal export projections for 1972-1980 which are an average of the beef and veal exports for the years 1960-1971. Projected veal exports are a negligible part of the total beef and veal exports.

Domestic Demand for Beef 1980

The demand for domestic beef was derived from total demand for beef and veal by including export and import projections, plus veal consumption. Table 8 shows estimated domestic demand projections for all population series. Population Series D was used as a target projection with Series E also being considered.

TABLE 8

PROJECTED DEMAND OF BEEF PRODUCED IN THE UNITED STATES IN 1980

Per Capita Consumption Domestic Produced Beef	Population Series ^a (Numbers in Thousands)			
	Series B (236,725)	Series C (233,798)	Series D (230,855)	Series E (277,765)
--- Pounds ---	----- Million Pounds -----			
119.8 ¹	28,360	28,009	27,656	27,265
124.8 ²	29,543	29,178	28,811	28,425

^aU.S. Department of Commerce, Bureau of Census, "Projections of the Population of the United States, by Age and Sex: 1970 to 2020", Current Population Reports, Series P-25, No. 470, (Washington, D.C.: U.S. Government Printing Office, 1971), Table 1, pp. 11-12.

Notes:

1. 130 pounds per capita consumption includes 1.5 pounds veal and 8.8 pounds net import.

2. 135 pounds per capita consumption total which includes 1.5 pounds veal and 8.8 pounds net import.

CHAPTER III

CATTLE INVENTORY AND BEEF SUPPLY DATA AND PROJECTIONS TO 1980

Cattle Inventory Balance Data

Using the cattle inventory balance equation previously explained, gains and losses by component were derived. Estimates of the beginning inventory were made of each component, except imports and exports of live cattle which were considered to be exogenous.

The 1970 calf crop was estimated to be 93.76 per cent of beef cows and milk cows that have calved on January 1, 1970. It was assumed that the calf crop increases to 94 per cent of beef cows and milk cows in 1971 and remains constant through 1980.

Slaughter percentages, found in Table 9, are extremely important because they represent the initiation of the beef supply given the various carcass weights. Percentages for 1970 were based on meeting published 1970 USDA slaughter statistics. Attention was also paid to maintaining a balance of cattle necessary to sustain growth in livestock slaughter for future periods. Slaughter percentages for 1970 by component were as follows:

TABLE 9
ESTIMATED CATTLE INVENTORY DATA FOR THE UNITED STATES BY COMPONENT: 1970-1980

Item	Year	1970	1971	1972	1973	1973	1975	1976	1977	1978	1979	1980
<u>Beef Cow</u>												
Calving Rate		.9376	.9400	.9400	.9400	.9400	.9400	.9400	.9400	.9400	.9400	.9400
Slaughter ^{a/}		.1183	.1200	.1300	.1445	.1445	.1445	.1445	.1445	.1445	.1445	.1445
Slaughter ^{b/}		.1183	.1200	.1300	.1300	.1300	.1300	.1300	.1300	.1300	.1300	.1300
Slaughter ^{c/}		.1183	.1200	.1300	.1650	.1600	.1500	.1350	.1200	.1200	.1300	.1350
Losses		.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
<u>Milk Cow</u>												
Calving Rate		.9376	.9400	.9400	.9400	.9400	.9400	.9400	.9400	.9400	.9400	.9400
Slaughter		.1467	.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500
Losses		.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
<u>Beef Cow Replacement</u>												
Slaughter		.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350
Losses		.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150
Rearranged to Beef Cow		.9270	.9270	.9270	.9270	.9270	.9270	.9270	.9270	.9270	.9270	.9270
<u>Milk Cow Replacement</u>												
Slaughter		.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500	.1500
Losses		.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150
Rearranged to Milk Cow		.4585	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500	.4500
<u>Other Heifers</u>												
Slaughter ^{a/}		.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350
Slaughter ^{c/}		.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350	.9350
Losses		.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150
Rearranged to Beef Cow		.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200
Rearranged to Milk Cow		.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
<u>Steers</u>												
Slaughter		.9600	.9600	.9600	.9600	.9600	.9600	.9600	.9600	.9600	.9600	.9600
Losses		.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
<u>Bulls</u>												
Slaughter		.2516	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.2500
Losses		.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
<u>Steers, Heifers, and Bulls</u>												
Slaughter as Steers		.1380	.1380	.1380	.1380	.1380	.1380	.1380	.1380	.1380	.1380	.1380
Slaughter as Other Heifers		.0910	.0910	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0110	.0110
Slaughter		.0050	.0050	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100	.0100
Losses		.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200	.0200
Rearranged to Beef Cow		.1530	.1530	.1530	.1530	.1530	.1530	.1530	.1530	.1530	.1530	.1530
Replacement		.0590	.0580	.0570	.0560	.0550	.0540	.0530	.0520	.0510	.0500	.0490
Rearranged to Milk Cow		.1410	.1410	.1420	.1430	.1440	.1450	.1460	.1470	.1480	.1490	.1500
Rearranged to Other Heifers		.3540	.3540	.3540	.3540	.3540	.3540	.3540	.3540	.3540	.3540	.3540
Rearranged to Steer		.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150
Rearranged to Bull		.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150	.0150
<u>Beef Cow Calf</u>												
Losses		.0600	.0590	.0580	.0570	.0560	.0550	.0540	.0530	.0520	.0510	.0500
Rearranged to Beef Cow		.0530	.0530	.0530	.0530	.0530	.0530	.0530	.0530	.0530	.0530	.0530
Replacement		.0500	.0500	.0500	.0500	.0500	.0500	.0500	.0500	.0500	.0500	.0500
Rearranged to Other Heifers		.1170	.1170	.1170	.1170	.1170	.1170	.1170	.1170	.1170	.1170	.1170
Rearranged to Steer		.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050
Rearranged to Bull		.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050	.0050
Rearranged to Steer, Heifers, and Bull		.7100	.7100	.7100	.7100	.7100	.7100	.7100	.7100	.7100	.7100	.7100
<u>Milk Cow Calves</u>												
Losses		.0600	.0590	.0580	.0570	.0560	.0550	.0540	.0530	.0520	.0510	.0500
Rearranged to Milk Cow		.0640	.0640	.0640	.0640	.0640	.0640	.0640	.0640	.0640	.0640	.0640
Replacement		.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030
Rearranged to Other Heifer		.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350	.0350
Rearranged to Steer		.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030	.0030
Rearranged to Bull		.8350	.8350	.8350	.8350	.8350	.8350	.8350	.8350	.8350	.8350	.8350

^{a/} Coefficients used for Per Capita Consumption of 130 Pounds in 1980 with no cattle cycle.

^{b/} Coefficients used for Per Capita Consumption of 135 Pounds in 1980 with no cattle cycle.

^{c/} Coefficients used for Per Capita Consumption of 130 Pounds in 1980 with a cattle cycle.

<u>Inventory Component</u>	<u>Slaughter Percent</u>	<u>Estimates 1970 Slaughter</u>
Beef Cows	11.83	4,307
Milk Cows	14.67	1,845
Beef Cow Replacements	03.50	238
Milk Cow Replacements	15.00	596
Other Heifers	93.50	5,776
Steers	96.00	15,075
Steers, Heifers, and Bulls	00.50	149
a) Slaughtered as Steers	13.80	4,099
b) Slaughtered as Other Heifers	09.10	2,703
<u>Bulls</u>	<u>25.16</u>	<u>567</u>
Total Slaughter		35,353 ¹

Each component has a slaughter per cent independent of all other components. The per cent of 25.16 on Bulls reflects that the average bull is culled 4 years after it enters the category, i.e., $25.16 \times 4 = 100.64$. The slaughter of 11.83 for Beef Cows compared to 14.67 for Milk Cows implies that the average beef cow is in the herd longer than a milk cow. Slaughter percentages of the replacement components are estimated to be small, 3.5 and 15 per cent for Beef and Milk Cow Replacements, respectively since most of these cattle are intended to become cows.

Practically all Steers and Other Heifers on inventory January 1, period t are slaughtered prior to January 1 of period $t+1$. This is noted by 96 and 93.5 per cent slaughter respectively. Few cattle, .5 per cent, are slaughtered as Steers, Heifers, and Bulls; however, a substantial amount of these cattle, 13.8 and 9.1 per cent are grown and slaughtered as Steers and Other Heifers, respectively, during the same time period. Slaughter percentages are the same for three alternative projections discussed in Chapter V except where specifically noted otherwise.

¹U.S. Department of Agriculture, Agricultural Statistics, 1971, (Washington, D.C.: Government Printing Office, 1971), Table 462, p. 318.

Projected cattle losses have been based on death loss estimates available from USDA. In 1970, estimated death losses by USDA were 1,593,000 which represents 1.42 per cent of the 1970 beginning inventory of all cattle.¹

A further dissaggregation of death losses was necessary by component and the following death losses were used based on beginning inventory by component.

<u>Component</u>	<u>Death Loss</u> (Percent)	<u>Estimated 1970 Loss</u> (Numbers in Thousands)
Beef Cow	1.0	364
Milk Cow	1.0	127
Beef Cow Replacement	1.5	94
Milk Cow Replacement	1.5	60
Other Heifer	1.5	98
Steer	1.0	191
Bull	1.0	22
<u>Steer, Heifer, Bull</u>	<u>2.0</u>	<u>603</u>
Total Losses	1.39	1559

Utilizing the above percentages, cattle losses were estimated at 1,559,000 compared to the 1,593,000 estimate by the USDA. Throughout the projection period the losses in Table 9 were applied to the various components. No allowance was made for better management practices or advances from increased use of drugs or other medication to decrease losses.

Calf losses estimated by USDA in 1970 were 2,725,000 or 5.93 per cent of the reported calf crop for 1970.² For the projection period, a linear decrease in calf losses was utilized from 6 per cent in 1970 to 5 per cent in 1980 as show in Table 9.

¹U.S. Department of Agriculture, Agricultural Statistics, 1971, (Washington, D.C.: Government Printing Office, 1971), Table 548, p. 315.

²Ibid.

The aging or growth of cattle and calves within the various components are extremely important and referred to as rearrangements in this study. Specifically, the calf crop of period t is found in any of the components in period $t+1$, except beef cows and milk cows over two years of age.

The various rearrangements were derived by first estimating all other concurrent requirements of each component within the time period, i.e., slaughter, death losses, exports, etc. The objective was to establish a cattle inventory balance by component so that realistic projections could be made. Rearrangement percentages for all components are also found in Table 9, and they remained unchanged for the various alternative projections.

Cattle Export/Import Data and Projections

The majority of cattle imported into the United States are feeder cattle from Mexico and Canada, however, a limited number of breeding animals are also imported. Table 10 reflects actual cattle imports from 1965-1971 and projections to 1980 by the various components used in this study. The actual figures for years 1965-1971 have been adjusted to show values for each component and projections have been based on these values. Total cattle imports have been held constant at 1,047,000 head per year, which is an average of the period 1965-1971. The estimate of imports is subject to considerable error; however, it is the most realistic estimate based on the recent trends.

Cattle exports throughout the projection period have been held constant at 50,000 head per year, which is the average for the years 1965-1970. In arriving at these projections, available statistics were adjusted to show

TABLE 10
CATTLE IMPORTS FOR THE UNITED STATES: ACTUAL

Item	Beef Cow	Milk Cow	Beef Cow Replacement	Milk Cow Replacement	Other Heifers	Steers	Steers Heifers & Bulls	Bulls	Total
Actual									
1965	6,177	15,266	7,058	3,529	152,156	862,218	39,991	883	1,128,278
1966	7,607	21,472	6,550	3,775	140,026	793,482	126,494	944	1,100,350
1967	3,986	12,948	4,554	2,277	94,464	535,298	97,738	570	751,835
1968	5,210	15,783	5,976	2,983	129,158	731,898	147,396	746	1,039,150
1969	7,299	22,876	8,342	4,171	125,855	713,180	159,143	1,043	1,041,909
1970	8,668	35,178	9,904	4,952	140,818	797,971	168,933	1,238	1,167,662
1971	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
Projected									
1972	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1973	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1974	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1975	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1976	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1977	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1978	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1979	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000
1980	6,000	25,000	7,000	3,000	130,000	738,000	130,000	8,000	1,047,000

Calculated from: 1965-1970, U.S. Department of Agriculture, Economics Research Service, Livestock and Meat Statistics, 1971 (Washington, D.C.: Government Printing Office, 1971), Table 215, p. 141.

1971, Preliminary

1972-1980, Projections

- Notes:
- Reference adjusted as follows for years 1965-1971:
 - Beef Cows = .35 Breeding Cattle
 - Milk Cows = 1.00 Dairy Cows over 700 pounds
 - Beef Cow Replacements = .40 Breeding Cattle
 - Milk Cow Replacements = .20 Breeding Cattle
 - Other Heifers = .15 200 to 699 pound cattle plus other cattle
 - Steers, Heifers, and Bulls = 1.00 Cattle under 200 pounds
 - Steers = .85 200 to 699 pound cattle plus other cattle
 - Bulls = .05 Breeding Cattle
 - Projections are an average of Imports for the years 1965-1971

TABLE 11
CATTLE EXPORTS FOR THE UNITED STATES:
ACTUAL 1965-1971 AND PROJECTIONS TO 1980

Item	Beef Cow	Milk Cow	Beef Cow Replacement	Milk Cow Replacement	Other Heifers	Steers	Steers Heifers & Bulls	Bulls	Total
Actual									
1965	3,238	3,238	3,238	3,238	7,627	14,164	16,190	3,238	54,171
1966	2,695	2,695	2,695	2,695	2,930	5,441	13,473	2,694	35,317
1967	3,175	3,175	3,175	3,175	8,251	15,322	15,874	3,175	55,322
1968	3,192	3,192	3,192	3,192	1,333	2,475	15,957	3,192	35,725
1969	3,406	3,406	3,406	3,406	1,793	3,330	17,033	3,406	39,186
1970	2,632	2,632	2,632	2,632	21,600	40,114	13,163	2,632	88,037
1971	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
Projected									
1972	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1973	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1974	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1975	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1976	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1977	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1978	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1979	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000
1980	3,000	3,000	3,000	3,000	7,000	13,000	15,000	3,000	50,000

Calculated from: 1965-1970, U.S. Department of Agriculture, Economic Research Service, Livestock and Meat Statistics, 1971 (Washington, D.C.: Government Printing Office, 1971), Table 216, p. 141.

1971, Preliminary

1972-1980, Projections

- Notes:
- Reference adjusted as follows for years 1965-1971:
 - Beef Cows = .10 Cattle for Breeding
 - Milk Cows = .10 Cattle for Breeding
 - Beef Cow Replacements = .10 Cattle for Breeding
 - Milk Cow Replacements = .10 Cattle for Breeding
 - Other Heifers = .35 Other Cattle
 - Steers = .65 Other Cattle
 - Steers, Heifers, and Bulls = .50 Cattle for Breeding
 - Bulls = .10 Cattle for Breeding
 - Projections are an average of Exports for the years 1965-1971.

values for the eight cattle components used in this study. Table 11 shows cattle exports from 1965-1971 and projections to 1980.

Beef Supply Estimating Procedure

The beef supply estimating procedure was developed around the concept of equating the total cattle slaughter and beef production with the various components, and available data for 1970 and 1971.

The basic steps in the estimating procedure were as follows:

- (1) Assume the distribution of all cattle slaughtered the same as cattle slaughtered under federal inspection.

<u>All Slaughter Classes</u>	<u>Percent</u>
Steers	54.0
Heifers	27.0
Cows	17.4
<u>Bulls</u>	<u>1.6</u> ¹
All Cattle	100.0

- (2) Estimate slaughter by component based on data available in (1) above. Assume 30 per cent of the cows slaughtered were dairy.

- (3) A further important aspect in the derivation of beef supply response relationships is fed versus nonfed beef cattle production. Fed beef production involved minimally a high energy level finish-feeding of cattle which results in a relatively heavy carcass weight; whereas nonfed beef production involved growth to maturity at a slower rate with lower energy rations which result in a much lighter carcass weight.

The trend over the years has been for nonfed beef cattle marketed to decrease, while more cattle are marketed as fed beef.

¹U.S. Department of Agriculture, Agricultural Statistics, 1971, (Washington, D.C.: Government Printing Office, 1971), Table 465, p. 320.

Limited data was available for estimating fed and nonfed beef production, however, assumptions were made for 1970 as follows:

<u>Slaughter Component</u>	<u>Class</u>	
	<u>Fed</u>	<u>Nonfed</u>
	-----	Percent -----
Heifers	85	15
Steers	93	7
Steers, Heifers, and Bulls	30	70 ¹
Bulls	50	50 ¹

Table 12 shows the various fed and nonfed ratios for 1970-1980.

Throughout the projections period, estimated fed Steers and fed Other Heifers increase linearly to 98 per cent and 90 per cent respectively. Ratios of the other components remained unchanged.

(4) The estimated carcass weight of the various components is also important within the beef supply subsystem. The average carcass weight of a bull is considerably more than the average carcass weight of all cattle slaughtered. Thus, if bulls account for 1.6 per cent of the total number of cattle slaughtered it can be assumed that the amount of carcass weight derived from bulls will be larger than 1.6 per cent of the total carcass weight beef. Likewise, the average carcass weight of cows is considerably less than the average carcass weight of all cattle slaughtered.

The "cow beef" as a per cent of total carcass weight beef will be less than "cows slaughtered" as a per cent of total catter slaughtered. Also, the carcass weight of "dairy cow beef" is different than "beef cow beef" and this must be considered in the "mix" of cows.

Carcass weight data of the various components is relatively limited, and estimates were made where a void in data existed. The

¹Most Bulls (98 percent) are culled - old bulls which are considered as separate slaughter class. See Table 12.

TABLE 12
PROJECTED RATIOS OF FED AND NONFED CATTLE RELATIVE TO TOTAL SLAUGHTER, BY CLASS

Item	Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Other Heifers</u>												
Fed		.850	.855	.860	.865	.870	.875	.880	.885	.890	.895	.900
Nonfed		.150	.145	.140	.135	.130	.125	.120	.115	.110	.105	.100
<u>Steers</u>												
Fed		.930	.934	.938	.942	.946	.950	.954	.958	.962	.966	.970
Nonfed		.070	.066	.062	.058	.054	.050	.046	.042	.038	.034	.030
<u>Steers, Heifers, Bulls</u>												
Fed		.300	.300	.300	.300	.300	.300	.300	.300	.300	.300	.300
Nonfed		.700	.700	.700	.700	.700	.700	.700	.700	.700	.700	.700
<u>Bulls</u>												
Old		.980	.980	.980	.980	.980	.980	.980	.980	.980	.980	.980
Young		.020	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020
Fed		.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010
Nonfed		.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010

TABLE 13
PROJECTED CARCASS WEIGHTS BY COMPONENT

Item	Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Beef Cow		450	450	450	450	450	450	450	450	450	450	450
Milk Cow		650	650	650	650	650	650	650	650	650	650	650
Beef Cow Replacements		435	435	435	435	435	435	435	435	435	435	435
Milk Cow Replacements		435	435	435	435	435	435	435	435	435	435	435
<u>Fed Cattle</u>												
Other Heifers		587	580	586	589	592	595	598	601	604	607	610
Steers		686	680	686	689	692	695	698	701	704	707	710
Steers, Heifers, Bulls		400	400	400	400	400	400	400	400	400	400	400
Young Bulls		350	350	350	350	350	350	350	350	350	350	350
<u>Nonfed Cattle</u>												
Other Heifers		435	435	435	435	435	435	435	435	435	435	435
Steers		480	480	480	480	480	480	480	480	480	480	480
Steers, Heifers, Bulls		350	350	350	350	350	350	350	350	350	350	350
Young Bulls		300	300	300	300	300	300	300	300	300	300	300
Old Bulls		700	700	700	700	700	700	700	700	700	700	700
Calves		135.7	137	136	135	134	140	144	149	154	153	151

average carcass weight of all cattle slaughtered in 1970 was 613 pounds.¹ Certain data was available for carcass weights of Steers and Other Heifers; however, carcass weights of cows and bulls have not been published.

To derive average carcass weights by component, certain assumptions were made and much emphasis was placed on attaining a reliable estimate for 1970 and 1971. Specifically, a check and balance system was used to obtain carcass weights so cattle slaughter by component would be equal the total beef production. The 1970 and 1971 values in Table 13 reflect derived carcass weights that have been used throughout the projection period. Only fed steer and fed heifer carcass weights have been projected to change, and a linear increase of three pounds per year was added to estimate trends of the industry to finish fed cattle at heavier weights.

Estimations for the 1970 and 1971 Beef Supply are found in Appendix A. Table A-3 specifies slaughter classes, e.g., fed, nonfed, young and all cattle. Table A-4 specifies the estimated beef production from the various classes described in Table A-3, given the carcass weights in Table 13 for 1970 and 1971.

(5) Throughout the projection period carcass weights and fed/nonfed ratios in Tables 12 and 13 were used. In all cases, data (or estimates) for carcass weight and fed/nonfed ratios were adjusted to correspond with available data in 1970 and 1971. The essence of this research was to develop a beef supply response which incorporated these estimates plus anticipated changes for the projection

¹Calculated from: U.S. Department of Agriculture, Agricultural Statistics, 1971, (Washington, D.C.: Government Printing Office, 1971) Table 462, p. 318; Table 525, p. 362.

period. These estimates are intended to provide guidelines in the absence of aggregate data and are subject to revision as additional information becomes available.

CHAPTER IV

CATTLE INVENTORY BALANCE AND BEEF SUPPLY RESPONSE MODEL

General Description

The primary purpose for developing the Cattle Inventory Balance and the Beef Supply Response Model was to estimate the future feeder cattle requirements in the United States.¹ Implicitly, the feeder cattle requirements depend on inventory balances and beef supply response relationships. Given the latter, it was then possible to derive feeder cattle requirements.

Initial attempts to bypass a detailed analysis of inventory levels of various cattle and calf components in the cattle industry (dairy as well as beef), plus early attempts to segment the beef supply response relationships into only those involving fed cattle, repeatedly left important gaps in accountability of (1) aggregate numbers of cattle and calves on inventory from year to year, and (2) overall beef supply response levels relative to projected beef needs. Consequently, attention was focused first on the development of an inventory (number) balance and a beef supply response model.

Model Formulation and Input Requirements

The cattle inventory balance and beef supply response model was solved as a linear programming (LP) problem, and the model was therefore

¹Samuel G. Unger and Quentin C. Smith, "Specification of a Cattle Inventory Balance and a Beef Supply Response Model", Department of Economics, Kansas State University, Staff Series No. 2 (NC-106), Manhattan, Kansas, June, 1972.

described conveniently in terms of the LP matrix plus associated constraints.¹ First, all representative types of column vectors were described; and second, all types of row vectors in the cattle inventory balance and beef supply response model were explained. Similar or corresponding column and row vectors exist in the model. This specification procedure is likened to that of Input-Output analysis wherein interrelationships among the column vectors are associated via row vector specifications.

In addition to the column and row vector specifications, the basic types of constraints or assumptions involved were indicated. In general, only "equality" row constraint conditions were specified; and, therefore, the model is effectively an accounting and simulation model versus a typical linear programming-optimization model. Linear "inequality" constraints could be added readily, but for purposes of this study, such constraints were not required.

Model Procedures

The model developed is an accounting and simulation system rather than an optimization system or model. Total per capita beef and veal consumption (Series D and E) by 1980 was used as a simulation parameter during the application of the model. Alternative projections were made under constant growth rates, or with a cattle cycle embedded to stimulate growth in 1980. Target levels of 130 and 135 pounds per capita beef and veal consumption were achieved after repeated systematic simulations which converged to the desired level.

¹This LP problem was solved using the IBM Mathematical Programming System/360 application program. The model developed is a "trivial" linear programming problem in that all linear constraints specified are equalities (or neutral).

Validity of model results depend on the following assumptions or projections being realized:

- (1) Series D or E population growth.
- (2) A 1980 Per Capita beef and veal consumption of 130 or 135 pounds (with or without a cattle cycle).
- (3) Beef supply response relationships as presented.
- (4) Simulated inventory growth path.

Alternative simulations were completed using the model. The inventory growth paths and associated beef supply responses differ as a consequence. Also, as expected, the derived feeder cattle requirements projected in this study differ based on the specific simulation completed.

CHAPTER V

ALTERNATIVE CATTLE-BEEF INDUSTRY PROJECTIONS TO 1980

Given the demand/supply data and exogenous projections, attention was turned to deriving specific cattle-beef industry projections with the Cattle Inventory Balance and Beef Supply Response Model. The following assumptions were used for all projections:

- 1) Veal consumption was projected to decline to 1.5 pounds per capita consumption in 1980, while calf slaughter declined to 2,150,000 head in 1980.
- 2) Import and export projections of all cattle were as described in Tables 10 and 11 respectively.
- 3) Import and export projections of beef and veal were as described in Table 8.
- 4) Milk Cow numbers were projected to decline approximately 10 per cent over the period or about 1 per cent per year.
- 5) A calving percentage of 94 per cent was utilized throughout the projection period.
- 6) Losses, Rearrangements and Slaughter Percentages used correspond to those in Table 9. The various projections varied because of different beginning inventory values for each component and the changes shown in Table 9.

Three Alternative Projections

Three alternative projections were developed as shown in the selected summary statistics of Table 14. Specific results of each projection are shown in the following Appendixes:

Appendix A - Selected Model Results: Per Capita Consumption of 130 Pounds in 1980 Without a Cattle Cycle.

Appendix B - Selected Model Results: Per Capita Consumption of 135 Pounds in 1980 Without a Cattle Cycle.

Appendix C - Selected Model Results: Per Capita Consumption of 130 Pounds in 1980 With a Cattle Cycle.

TABLE 14
SELECTED SUMMARY STATISTICS: CATTLE-BEEF
INDUSTRY PROJECTIONS TO 1980

Item	Year	Units	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Change 1970-1980
Per Capita Consumption of 130 Pounds Beef and Veal in 1980 with No Cattle Cycle														
Beef Cow Inventory		Thousands	36,404	37,533	38,725	39,647	40,059	40,526	41,057	42,591	42,141	42,708	43,294	+16.7
Total Cow Inventory		Thousands	48,982	49,947	51,004	51,756	51,928	52,223	52,622	53,462	53,490	53,964	54,465	+11.1
Total Beginning Inventory		Thousands	112,303	114,470	117,916	120,586	122,220	123,629	124,949	126,371	127,856	129,402	130,914	+16.1
Fed Cattle Slaughter		Thousands	25,089	25,550	27,049	28,140	28,809	29,456	29,963	30,528	31,115	31,723	32,336	+28.9
Cattle Slaughter		Thousands	35,353	35,952	38,156	40,122	40,772	41,401	41,884	42,425	42,989	43,575	44,158	+24.9
Total Cattle and Calf Slaughter		Thousands	39,553	39,902	41,856	43,572	43,972	44,351	44,634	44,975	45,339	45,825	46,308	+17.1
Beef Production		Mill. Lbs.	21,600	21,815	23,186	24,405	24,904	25,395	25,794	26,235	26,694	27,171	27,650	+28.0
Beef Cow Slaughter		Percent	11.83	12.00	13.00	14.45	14.45	14.45	14.45	14.45	14.45	14.45	14.45	---
Per Capita Beef and Veal Consumption (Series D)		Pounds	116.6	116.0	121.3	123.7	126.6	127.5	127.9	128.4	129.5	129.5	130.0	+11.5
Per Capita Consumption of 135 Pounds Beef and Veal in 1980 with No Cattle Cycle														
Beef Cow Inventory		Thousands	36,404	37,533	38,725	39,647	40,635	41,601	42,596	43,616	44,664	45,738	46,842	+28.7
Total Cow Inventory		Thousands	48,982	49,947	51,004	51,756	52,504	53,298	54,161	55,076	56,042	57,052	58,107	+18.6
Total Beginning Inventory		Thousands	112,303	114,470	117,916	120,586	122,705	125,215	127,730	130,333	133,037	135,860	138,701	+23.5
Fed Cattle Slaughter		Thousands	25,090	25,550	27,050	28,140	28,809	29,625	30,456	31,320	32,206	33,133	34,075	+35.8
Cattle Slaughter		Thousands	35,353	35,952	38,156	39,543	40,266	41,141	42,035	42,964	43,918	44,914	45,926	+29.9
Total Cattle and Calf Slaughter		Thousands	39,553	39,902	41,856	42,993	43,446	44,091	44,785	45,314	46,268	47,164	48,076	+21.5
Beef Production		Mill. Lbs.	21,600	21,815	23,186	24,146	24,676	25,313	25,968	26,650	27,353	28,090	28,843	+33.5
Beef Cow Slaughter		Percent	11.83	12.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	---
Per Capita Beef and Veal Consumption (Series D)		Pounds	116.6	116.0	121.3	124.5	125.6	127.2	128.7	130.3	132.5	133.5	135.2	+16.0
Per Capita Consumption of 130 Pounds Beef and Veal in 1980 with a Cattle Cycle														
Beef Cow Inventory		Thousands	36,404	37,533	38,725	39,647	39,230	39,709	40,687	42,181	43,596	44,583	44,583	+22.5
Total Cow Inventory		Thousands	48,982	49,947	51,004	51,757	51,116	50,928	51,274	52,123	53,491	54,787	55,671	+13.7
Total Beginning Inventory		Thousands	112,303	114,470	117,916	120,587	121,406	121,309	122,034	123,575	126,304	129,688	132,782	+18.2
Fed Cattle Slaughter		Thousands	25,090	25,550	27,050	28,140	29,087	28,952	29,327	29,724	30,416	31,430	32,574	+29.8
Cattle Slaughter		Thousands	35,353	35,952	38,156	40,935	41,566	40,816	40,605	40,402	41,176	42,776	44,161	+24.9
Total Cattle and Calf Slaughter		Thousands	39,553	39,902	41,856	44,385	44,768	43,826	43,355	42,952	43,526	44,976	46,311	+17.1
Beef Production		Mill. Lbs.	21,600	21,815	23,187	24,771	25,317	25,056	25,083	25,149	25,721	26,718	27,700	+28.2
Beef Cow Slaughter		Percent	11.83	12.00	13.00	16.50	16.00	15.00	13.50	12.00	12.00	13.00	13.50	---
Other Heifer Slaughter		Percent	93.50	93.50	93.50	93.50	95.50	93.50	93.50	93.50	93.50	93.50	93.50	---
Per Capita Beef and Veal Consumption (Series D)		Pounds	116.6	116.0	121.3	127.4	128.5	126.0	124.6	123.5	123.2	127.5	130.2	+11.6

Each projection was developed utilizing the Cattle Inventory and Beef Supply Response Model. To obtain the different projections, slaughter percentages were varied on beef cows, e.g. to increase beef production over time the slaughter per cent was decreased. Figure 2 and 3 represent results of the alternative projections based on the statistics in the various Appendixes. Figure 2 shows inventory levels of the three alternative projections and Figure 3 shows the relationships of the various cattle components slaughtered.

Per Capita Beef and Veal Consumption of 130 Pounds in 1980
Without a Cattle Cycle

If a beef and veal per capita consumption of 130 pounds is realized in 1980, an increase of 11.5 per cent from 1970, then domestic beef production must increase 28 per cent while the number of cattle slaughtered increases only 24.9 per cent. The additional increase in beef production over cattle slaughter is due primarily to the assumption of fed cattle being slaughtered at heavier weights and an increasing percentage of young cattle being fed to heavier weights. Subsequent increases in beef production in the 1980's will be paralleled by increases in cattle slaughtered.

Increases in beef production by cattle component show considerably larger increases in beef from beef cows and other heifers relative to the other components. This is due to increasing numbers of beef cows compared to milk cows and the tendency for heifers to be fed out in feedlots.

The beginning inventory of beef cows increased 18.7 per cent from 1970 while milk cows decreased 10.3 per cent and the total cow inventory increased only 11.1 per cent. The total cattle inventory increased 16.4 per cent to maintain an adequate inventory for future production. The increase of 3.3

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH DIAGRAMS
THAT ARE CROOKED
COMPARED TO THE
REST OF THE
INFORMATION ON
THE PAGE.**

**THIS IS AS
RECEIVED FROM
CUSTOMER.**

FIGURE 2

CATTLE INVENTORY LEVELS: ACTUAL
1965-1971, PROJECTED 1972-1980

All Cattle
and Calves
January 1
Inventory
(Million)

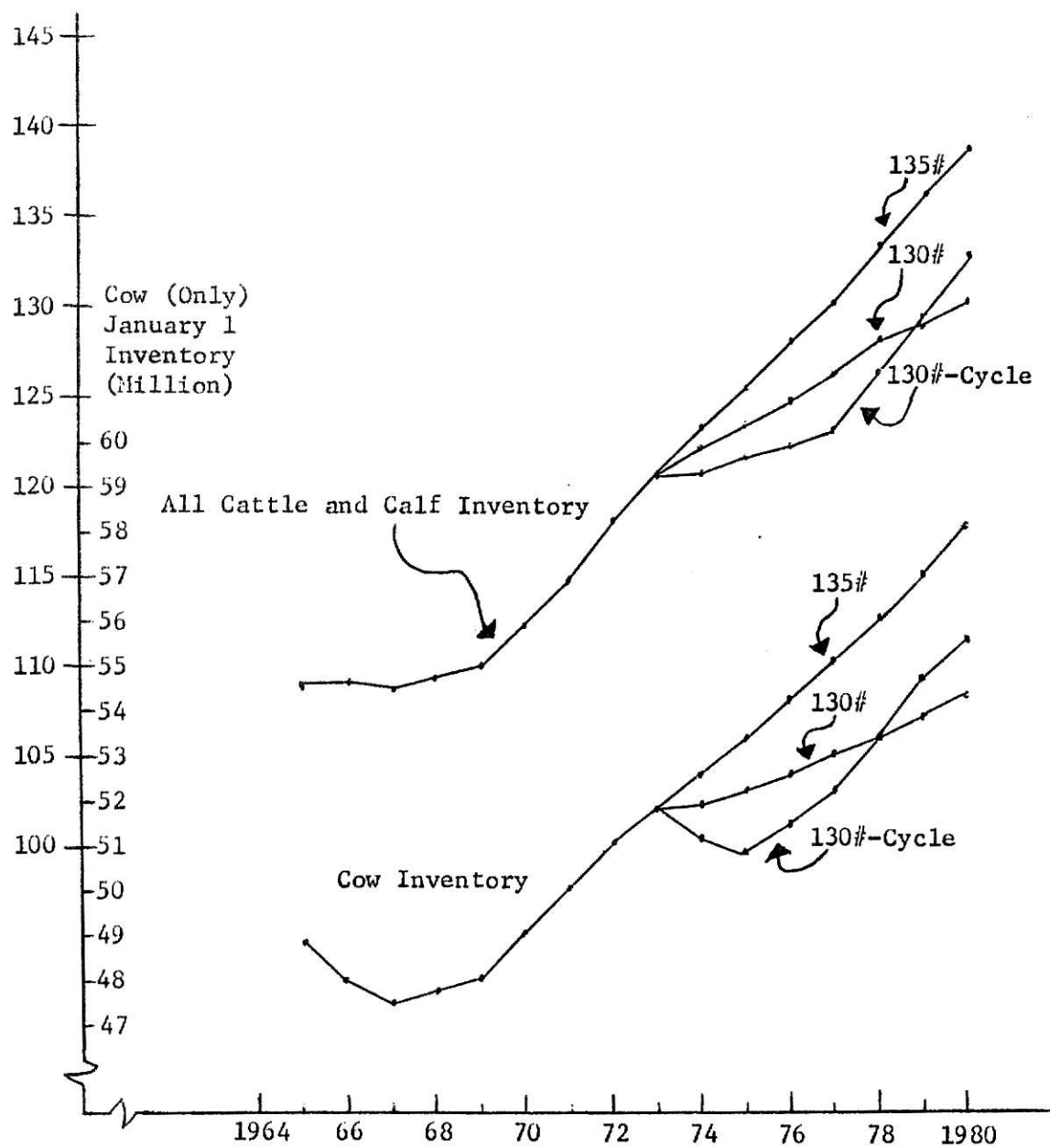
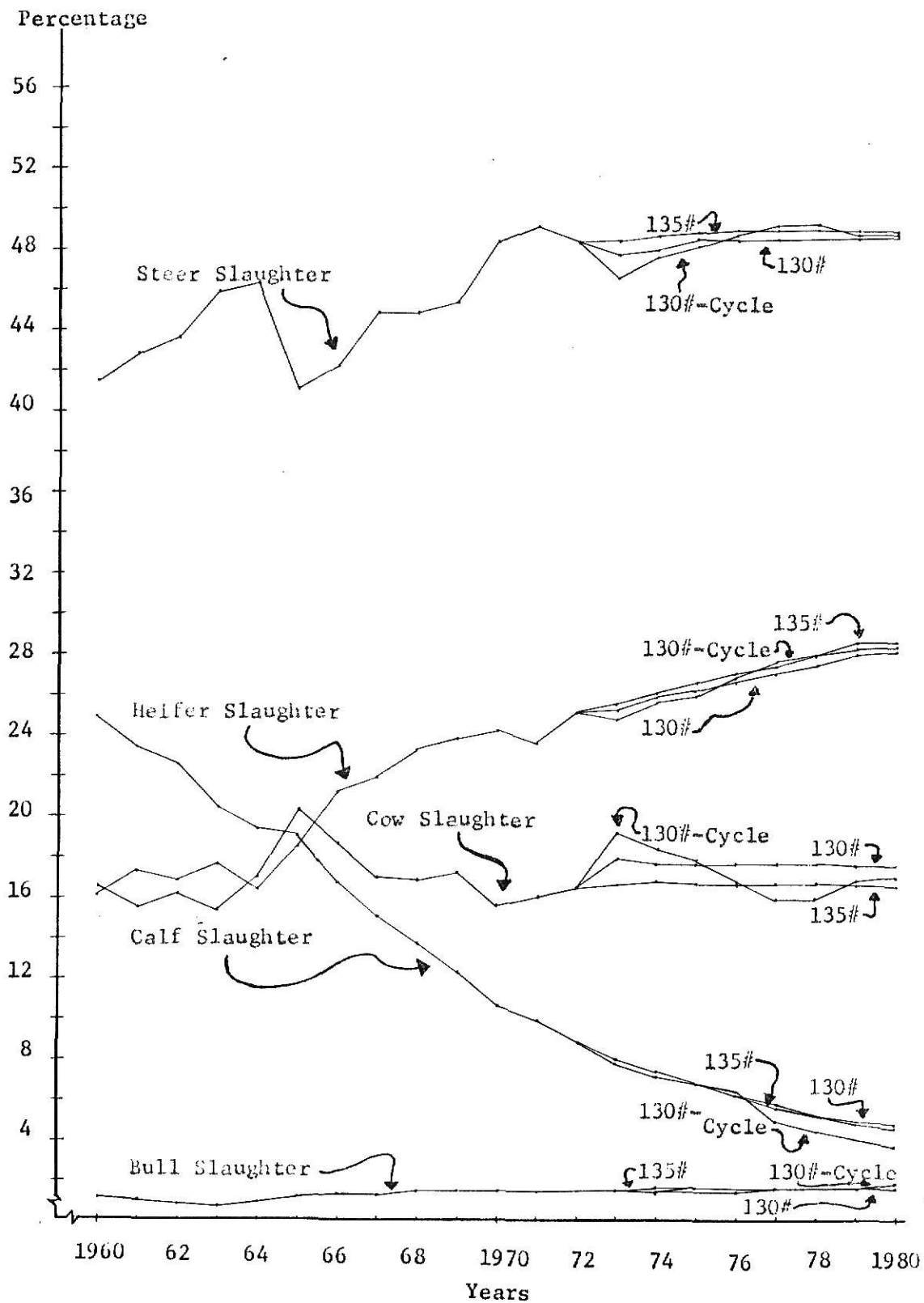


FIGURE 3

RELATIONSHIPS AMONG ALL CATTLE
AND CALVES SLAUGHTERED BY CLASS:
ACTUAL 1960-1972, PROJECTED 1972-1980



per cent total cattle compared to all cows is due primarily to a decrease in calf slaughter and additional cattle being fed out. In meeting this increased demand, beef cow slaughter was held at a constant 14.45 per cent for the years 1973-1980.

Per Capita Beef and Veal Consumption of 135 Pounds in 1980
Without a Cattle Cycle

In realizing a per capita consumption of 135 pounds in 1980 beef production must increase 33.5 per cent. Increases in beef production by component are somewhat similar to those realized in attaining a per capita consumption of 130 pounds in 1980 although substantially higher for the various components.

The total number of cattle and calves slaughtered increased 21.5 per cent from 1970 while the number of cattle slaughtered increased 29.9 per cent. The difference in these percentages are a result of the decrease in calves slaughtered over the projection period.

To meet this demand for beef, the beginning beef cow inventory must increase 28.7 per cent over the ten year period or almost 3 per cent per year. This increase is consistent with increases in the beef cow industry in 1970 and 1971. Dairy Cows were projected to decline 10.4 per cent and all cows were projected to increase 18.6 per cent. The beef cow slaughter was held constant at 13 per cent between 1973-1980.

Per Capita Beef and Veal Consumption of 130 Pounds in 1980
With a Cattle Cycle

An attempt was made to simulate a cattle cycle based on current trends and projections. The Beef Cow slaughter was varied between 16.5 and 12 per cent to obtain the various growth or reduction phases similar to recent cattle

cycles. The slaughter for Other Heifers was also increased to 95.5 per cent in 1974 to reduce beginning inventory as well as increase beef production.

A per capita consumption of 130 pounds was realized in 1980, however, this alternative varied considerably from the 130 pound consumption simulation discussed earlier. Beef consumption increased relatively fast in 1973 and 1974 before leveling off and increasing slowly to 1980.

Beginning cow inventory increased 13.7 per cent and total cattle inventory increased 18.2 per cent. Production with a cattle cycle in 1980 requires 2.6 per cent more cows and cattle inventory 1.8 per cent larger than without the cattle cycle. These differences noted are due to the cyclic effects introduced that are still embedded in the system for 1980. By 1981 and 1982, for example, even further differences would be expected and beef production would be increasing relatively rapidly.

Appendixes A, B, and C provide a more detailed analysis of the alternative cattle-beef industry projections. This explanation of the three alternative projections has been adequate since the primary purpose has been to derive feeder cattle estimates as discussed in the next chapter.

CHAPTER VI

DERIVED FEEDER CATTLE REQUIREMENTS TO 1980

Given the cattle beef industry projections, attention was turned to deriving feeder cattle estimates to correspond to the various projections. Attempts to locate a "feeder cattle" definition from previously published material was not available and the following definition was developed.

Feeder cattle are defined as young cattle destined to be slaughtered at a relatively young age. The majority (90 per cent) are finished on relatively high energy rations for periods of 90 to 150 days, and referred to as fed cattle. Nonfed cattle, less than ten per cent, are finished on high roughage rations and usually slaughtered at lighter weights. Definitionally, both fed and nonfed cattle are referred to as feeder cattle if they weigh at least 500 pounds prior to slaughter. Thus, those Calves, and Steers, Heifers, and Bulls that are slaughtered at less than 500 pounds live weight, are not defined as feeder cattle in this study.

Milk cow replacements and beef cow replacements slaughtered are also not defined as feeder cattle, since they are primarily scheduled to become cows prior to slaughter. Thus, feeder cattle are young bulls, heifers, and steers to be slaughtered at over 500 pounds live weight and either fed or nonfed.

Feeder Cattle Requirements in
Relation to Slaughter

A relatively simple way of deriving feeder cattle is to utilize period t projections of the various slaughter components and add the death losses which typically occur during the production process.¹ (Specifically, Tables A-3, B-3, and C-3 of Appendixes A, B, and C respectively denote slaughter requirements of the various feeder cattle components for each of the three alternatives simulated. The addition of death losses to these figures results in feeder cattle requirements for period t slaughter.)

Table 15 summarizes feeder cattle requirements derived in the above manner. Aggregate losses for other heifers were approximately 3 per cent, while steers and young bulls were somewhat less at 2.5 per cent. Having so defined aggregate U. S. feeder cattle requirements in terms of the number of feeder cattle needed to yield beef cattle for slaughter in period t , a question still remained concerning the time-lag in production response. In other words, "feeder cattle" must exist in some time period prior to period t if the projected beef supply response, \hat{X}_{7t} , involving both fed and nonfed components, is to be realized. Thus, feeder cattle might also be derived by designating the time period in which they are born.

Feeder Cattle Requirements in Relation
to Calf Crops

The preferred method of estimating feeder cattle requirements is to account for the disposition of calf crops (in periods $t-1$, $t-2$, and $t-3$) which are eventually slaughtered (in period t) as "Other Heifers", "Steers", or young "Bulls". They may be fed or nonfed, but both classes involve young

¹The slaughter components involving feeder cattle, by definition as discussed, are: (1) Other Heifers, (2) Steers, and (3) Young Bulls.

TABLE 15
FEEDER CATTLE ESTIMATES BY PERIOD OF SLAUGHTER: 1970 to 1980

Feeder Cattle Classification	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	% Change 1970 to 1980
----- Thousands -----												
<u>Per Capita Consumption of 130 Pounds</u>												
<u>Beef and Veal in 1980 with No Cattle</u>												
Cycle												
Fed Other Heifers	7,423	7,498	8,421	8,843	9,178	9,502	9,791	10,103	10,428	10,764	11,102	+49.6
Fed Steers	18,278	18,673	19,242	19,937	20,288	20,627	20,858	21,124	21,402	21,689	21,972	+20.2
Fed Bulls	5	5	6	6	6	6	7	7	7	7	7	+40.0
Total Fed Feeder Cattle	25,706	26,176	27,669	28,786	29,472	30,135	30,656	31,234	31,837	32,460	33,081	+28.7
Nonfed Other Heifers	1,309	1,271	1,370	1,380	1,371	1,358	1,335	1,312	1,289	1,263	1,234	-05.7
Nonfed Steers	1,376	1,319	1,272	1,227	1,157	1,085	1,006	926	846	764	680	-50.7
Nonfed Bulls	3	5	6	6	6	6	7	7	7	7	7	+40.0
Total Nonfed Feeder Cattle	2,690	2,595	2,648	2,613	2,534	2,449	2,348	2,245	2,142	2,034	1,921	-28.6
Total Feeder Cattle	28,396	28,771	30,317	31,399	32,006	32,584	33,004	33,479	33,979	34,494	35,002	+23.3
<u>Per Capita Consumption of 135 Pounds</u>												
<u>Beef and Veal in 1980 with No Cattle</u>												
Cycle												
Fed Other Heifers	7,423	7,498	8,421	8,844	9,178	9,564	9,960	10,374	10,803	11,253	11,714	+57.8
Fed Steers	18,278	18,673	19,242	19,937	20,288	20,739	21,193	21,663	22,142	22,641	23,145	+26.6
Fed Bulls	5	5	6	6	6	6	7	7	7	7	7	+40.0
Total Fed Feeder Cattle	25,706	26,176	27,669	28,787	29,472	30,309	31,160	32,044	32,952	33,901	34,866	+35.6
Nonfed Other Heifers	1,309	1,271	1,371	1,380	1,372	1,367	1,359	1,348	1,335	1,320	1,302	-00.5
Nonfed Steers	1,376	1,319	1,272	1,228	1,158	1,092	1,022	950	874	796	715	-48.0
Nonfed Bulls	5	5	6	6	6	6	7	7	7	7	7	+40.0
Total Nonfed Feeder Cattle	2,690	2,595	2,649	2,614	2,536	2,465	2,388	2,305	2,216	2,123	2,024	-24.6
Total Feeder Cattle	28,396	28,771	30,318	31,401	32,008	32,774	33,548	34,349	35,168	36,024	36,890	+29.9
<u>Per Capita Consumption of 130 Pounds</u>												
<u>Beef and Veal in 1980 with a Cattle</u>												
Cycle												
Fed Other Heifers	7,423	7,498	8,421	8,854	9,303	9,298	9,575	9,831	10,192	10,669	11,192	+50.8
Fed Steers	18,278	18,673	19,242	19,937	20,448	20,316	20,423	20,574	20,921	21,483	22,132	+21.1
Fed Bulls	5	5	6	6	6	6	7	7	7	7	7	+40.0
Total Fed Feeder Cattle	25,706	26,176	27,669	28,797	29,757	30,610	30,005	30,412	31,123	32,159	33,331	+29.7
Nonfed Other Heifers	1,309	1,271	1,371	1,380	1,391	1,328	1,306	1,277	1,258	1,250	1,243	-05.0
Nonfed Steers	1,376	1,319	1,272	1,228	1,167	1,068	985	902	826	756	685	-50.2
Nonfed Bulls	5	5	6	6	6	6	7	7	7	7	7	+40.0
Total Nonfed Feeder Cattle	2,690	2,595	2,648	2,614	2,564	2,404	2,298	2,186	2,091	2,013	1,935	-19.1
Total Feeder Cattle	28,396	28,771	30,317	31,411	32,321	33,014	32,303	32,598	33,211	34,172	35,266	+24.2

cattle which would be considered as potential feeder cattle at some time prior to slaughter.

The estimated disposition of each year's calf crop, from 1970 to 1980, is summarized in Table 16 into three distinct feeder cattle classifications. The three feeder cattle classifications for each year's calf crop are defined as follows:

<u>Calf Crop/ Feeder Cattle Classification</u>	<u>Estimated Percent</u>	<u>Description</u>
Feeder Cattle I Period (t+1)	47.6	Estimated number of calves from the period t calf crop which become "feeder cattle" in period t+1. ¹
Feeder Cattle II Period (t+2)	51.0	Estimated number of calves from the period t calf crop which become "feeder cattle" in period t+2. ²
Feeder Cattle III Period (t+3)	1.4	Estimated number of calves from the period t calf crop which become "feeder cattle" in period t+3. ²

Feeder Cattle I and II are the primary classes, 98.6 per cent, of feeder cattle produced from each calf crop. However, a small percentage (1.4) or "carryover" of Feeder Cattle III is estimated to continue to 1980, which reflects those cattle two years and older which are grown to maturity at slower rates, e.g., grass fed cattle. In the cattle industry, the trend during the 1960's, was toward more rapid growth of young cattle to maturity. In the 1970's, improved breeding characteristics are probably required before young cattle can be grown to maturity at faster than current rates. Under current breeding/production practices, an estimated average age of fed cattle for slaughter is from 16 to 18 months. This average age of

¹The estimated number in period t+1 is exclusive of calf losses after birth (approximately 6 per cent which do not reach a "feeder cattle" size or age.

²The estimated number in periods t+2 and t+3 excludes calf losses, as noted above, but includes losses of young cattle, e.g. over 500 pounds.

TABLE 16

DOMESTIC FEEDER CATTLE ESTIMATES BY CALF CROP,
BASED ON DISPOSITION OF CALVES OVER TIME: 1970 to 1980

Feeder Cattle Classification	Units	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Per Capita Consumption of 130 Pounds Beef and Veal in 1980 with No Cattle Cycle</u>												
Feeder Cattle I (t+1)	Thousands	13,335	13,750	14,774	15,102	15,244	15,421	15,616	15,816	16,023	16,214	16,414
Feeder Cattle II (t+2)	Thousands	14,272	14,731	15,211	15,584	15,779	16,017	16,267	16,527	16,797	17,028	17,270
Feeder Cattle III (t+3)	Thousands	402	415	428	439	444	449	455	462	472	477	483
Total Feeder Cattle from calf crop (t)	Thousands	28,009	28,896	30,413	31,125	31,467	31,887	32,338	32,805	33,292	33,719	34,167
Calf Crop (t)	Thousands	45,925	46,950	47,943	48,651	48,813	49,089	49,465	49,860	50,280	50,727	51,197
Feeder Cattle as a percent of calf crop	Percent	61.0	61.5	63.4	64.0	64.5	65.0	65.4	65.8	66.2	66.5	66.7
<u>Per Capita Consumption of 135 Pounds Beef and Veal in 1980 with No Cattle Cycle</u>												
Feeder Cattle I (t+1)	Thousands	13,335	13,750	14,774	15,102	15,434	15,777	16,125	16,488	16,864	17,230	17,608
Feeder Cattle II (t+2)	Thousands	14,272	14,731	15,211	15,592	15,969	16,367	16,766	17,184	17,622	18,030	18,453
Feeder Cattle III (t+3)	Thousands	402	415	428	438	449	460	471	482	494	505	517
Total Feeder Cattle from calf crop (t)	Thousands	28,009	28,896	30,413	31,132	31,852	32,604	33,362	34,154	34,980	35,756	36,578
Calf Crop (t)	Thousands	45,926	46,950	47,944	48,651	48,049	47,871	48,197	48,996	50,281	51,500	52,331
Feeder Cattle as a percent of calf crop	Percent	61.0	61.5	63.4	64.0	66.3	68.1	69.2	69.7	69.6	69.4	69.9
<u>Per Capita Consumption of 130 Pounds Beef and Veal in 1980 with a Cattle Cycle</u>												
Feeder Cattle I (t+1)	Thousands	13,335	13,750	14,774	15,102	14,975	14,993	15,170	15,514	16,028	16,493	17,116
Feeder Cattle II (t+2)	Thousands	14,272	14,731	15,211	15,592	15,617	15,605	15,836	16,231	16,794	17,288	17,652
Feeder Cattle III (t+3)	Thousands	402	415	428	438	439	444	449	455	471	485	495
Total Feeder Cattle from calf crop (t)	Thousands	28,009	28,896	30,413	31,132	31,031	31,042	31,455	32,200	33,293	34,266	35,263
Calf Crop (t)	Thousands	45,926	46,950	47,944	48,651	48,049	47,871	48,197	48,996	50,281	51,500	52,331
Feeder Cattle as a percent of calf crop	Percent	61.0	61.5	63.4	64.0	64.6	64.8	65.3	65.7	66.2	66.5	67.4

slaughter was not projected to change and thus, percentages of feeder cattle I, II, III from each calf crop stayed relatively stable throughout the projection period.

The above summary and Table 16 indicates feeder cattle derivations relative to a given calf crop, i.e. period t calf crop. However, feeder cattle estimates (from domestic production) can now be derived for a given slaughter period t in the manner shown in Table 17.

Essentially, feeder cattle required to "produce" animals for slaughter in period t must come from calf crops from three immediately preceding years; $t-1$, $t-2$, and $t-3$. The estimated number are "Feeder Cattle I" from period $t-1$, "Feeder Cattle II" from period $t-2$, and "Feeder Cattle III" from period $t-3$. These numbers for the simulations of this study are those presented in Table 17.

The percentages of the feeder cattle obtained out of the three separate lagged periods relative to the estimated total feeder cattle estimates so derived remained relatively stable throughout the projection period.

The feeder cattle requirements as derived in Table 17 are comparable to the first described feeder cattle projection in Table 15, i.e., the slaughter plus losses projections. The latter projections are believed most valid, however. The advantages are the relationships which can be made to preceding calf crops, and the implicit lagged-response associations, which are necessary in the cattle industry if future period projections are to be realized.

TABLE 17

FEEDER CATTLE ESTIMATES BY PERIOD OF SLAUGHTER,
DERIVED FROM THE DISPOSITION OF PRIOR CALF CROPS: 1970 to 1980

Feeder Cattle Classification	Period	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
----- Thousands -----												
<u>Per Capita Consumption of 130 Pounds</u>												
<u>Beef and Veal in 1980 with No Cattle</u>												
Cycle												
Feeder Cattle I (calf crop)	t-1	13,335	13,751	14,774	15,102	15,244	15,421	15,616	15,816	16,023	16,214	16,414
Feeder Cattle II (calf crop)	t-2	13,824	14,272	14,732	15,202	15,584	15,779	16,017	16,267	16,527	16,797	17,028
Feeder Cattle III (calf crop)	t-3	370	384	402	415	428	439	444	449	455	462	472
Domestic Feeder Cattle	t	27,529	28,407	29,908	30,719	31,256	31,639	32,177	32,732	33,005	33,473	33,914
Net Imports of Feeder Cattle	t	877	848	848	848	848	848	848	848	848	848	848
Total Feeder Cattle	t	28,406	29,255	30,756	31,667	32,104	32,487	33,025	33,580	33,853	34,321	34,762
<u>Per Capita Consumption of 135 Pounds</u>												
<u>Beef and Veal in 1980 with No Cattle</u>												
Cycle												
Feeder Cattle I (calf crop)	t-1	13,335	13,751	14,774	15,102	15,434	15,777	16,125	16,488	16,864	17,230	17,608
Feeder Cattle II (calf crop)	t-2	13,824	14,272	14,732	15,211	15,592	15,969	16,367	16,766	17,184	17,622	18,030
Feeder Cattle III (calf crop)	t-3	370	384	402	415	428	438	449	460	471	482	494
Domestic Period t Feeder Cattle	t	27,529	28,407	29,908	30,728	31,454	32,184	32,941	33,714	34,519	35,334	36,132
Net Imports of Feeder Cattle	t	877	848	848	848	848	848	848	848	848	848	848
Total Feeder Cattle	t	28,406	29,225	30,756	31,576	32,302	33,032	33,789	34,562	35,367	36,182	36,980
<u>Per Capita Consumption of 130 Pounds</u>												
<u>Beef and Veal in 1980 with a Cattle</u>												
Cycle												
Feeder Cattle I (calf crop)	t-1	13,335	13,751	14,774	15,102	14,975	14,993	15,170	15,514	16,028	16,493	17,116
Feeder Cattle II (calf crop)	t-2	13,824	14,272	14,732	15,211	15,592	15,617	15,605	15,834	16,231	16,794	17,288
Feeder Cattle III (calf crop)	t-3	370	384	402	415	428	438	439	444	449	455	471
Domestic Feeder Cattle	t	27,529	28,407	29,908	30,728	30,995	31,048	31,214	31,792	32,708	33,742	34,875
Net Imports of Feeder Cattle	t	877	848	848	848	848	848	848	848	848	848	848
Total Feeder Cattle	t	28,406	29,255	30,756	31,576	31,843	31,896	32,062	32,640	33,556	34,590	35,725

CHAPTER VII

SUMMARY

The purpose of the study reported herein was to develop feeder cattle requirements for the United States in 1980 based on projections of beef demand.

The variables necessary to develop beef demand projections were namely population and per capita consumption of beef. Per capita consumption projections were taken from previously published research by the U.S. Department of Agriculture. Data on population projections were developed from U.S. Bureau of Census sources.

A Cattle Inventory Balance and Beef Supply Response Model was developed to account for (1) overall beef supply sources relative to the projected beef demand. (2) aggregate numbers of cattle and calves on inventory from year to year.

Three specific projections were made to 1980. Primary emphasis was placed on estimating feeder cattle requirements to achieve 130 pounds per capita beef and veal consumption by 1980, both with and without a cattle cycle. Secondly, projections were made for feeder cattle based on a per capita consumption of 135 pounds in 1980 without a cattle cycle.

Based on the available information and estimating procedures employed, feeder cattle requirements will be 34,762 thousand head in 1980 if per capita consumption is 130 pounds and 36,132 thousand head if a per capita consumption of 135 pounds exists in 1980.

Additionally if a 130 pounds per capita beef and veal consumption is realized, an increase of 11.5 per cent from 1970, total beef consumption will increase 27.4 per cent and the total beef production will increase 28.0 per cent from 1970. If a 135 pound per capita beef and veal consumption is attained, an increase of 16.0 per cent, total beef consumption will increase 32.5 per cent and beef production will increase 33.5 per cent from 1970.

Estimates of 130 pounds per capita beef and veal reflect an increase in cattle numbers of 16.4 per cent from 1970 compared to an increase of 23.5 per cent for an estimate of 135 pounds per capita beef and veal in 1980.

Results of this study are subject to the limitations of the data, functional relations and procedures. However, the study does provide guidelines for future growth in the cattle-beef industry, including derived feeder cattle requirements.

SELECTED BIBLIOGRAPHY

Government Documents

United States Department of Agriculture, Agricultural Statistics, 1971
Washington, D.C.: Government Printing Office, 1971.

_____. Economic Research Service, U.S. Food Consumption - Sources of Data and Trends 1909-1963, Statistical Bulletin, No. 364,
Washington, D.C.: Government Printing Office, 1965.

_____. Economic Research Service, Livestock and Meat Statistics 1971.
Washington, D.C.: Government Printing Office, 1971.

_____. Economic Research Service, Livestock and Meat Situation 1970.
Washington, D.C.: Government Printing Office, 1970.

United States Department of Commerce, Bureau of Census, "Population Estimate and Projections," Current Population Reports, Series P-25, No. 460, Washington D.C.: Government Printing Office, 1971.

_____. Bureau of Census, "Projections of the Population of the United States, by Age and Sex: 1970 to 2020." Current Population Reports, Series P-25, No. 270, Washington, D.C.: Government Printing Office, 1971.

Articles

Culver, David W., and J.C. Chai, "A View of Food and Agriculture in 1980." Agricultural Economics Research, Vol. 22, No. 3, (July, 1970), pp. 61-68.

Daly, R.E., and A.C. Egbert, "A Look Ahead for Food and Agriculture," Agricultural Economics Research, Vol. 18, No. 1 (January, 1966) pp. 1-9.

Egbert, A.C. and S. Rentlinger, "A Dynamic Model of the Livestock Feed Sector," Journal of Farm Economics, Vol. 47, (December, 1965), pp. 1288-1305

Larsen, John T., "Potential Feeder Cattle Supply," Livestock and Meat Situation, No. 171, (February, 1970), pp. 27-29.

Rizek, Robert L., and John T. Larsen, "Our Beef Producing Potential," Livestock and Meat Situation, No. 169, (October, 1969), pp. 19-21.

Seaburg, Donald, "Beef Cattle: The Next Ten Years," Livestock and Meat Situation, No. 173, (May, 1970), pp. 32-35.

Unpublished Material

Daly, Rex R., "Livestock Demand Output and Prices." Paper presented at the American National Cattleman's Association Conference, Denver, Colorado, July 26-28, 1962, (Mimeographed).

Dunn, Terry, "Comments on the Long Run Cattle Situation." Speech presented to the annual meeting of the Advisory Committee, Western Livestock Marketing Information Project, Denver, Colorado, March 18-19, 1971, (Mimeographed).

Unger, Samuel G., and Quentin C. Smith, "Specification of a Cattle Inventory Balance and a Beef Supply Response Model." Department of Economics, Kansas State University, Staff Series No. 2 (NC-106) Manhattan, Kansas, June, 1972.

APPENDIX A

SELECTED MODEL RESULTS: PER CAPITA CONSUMPTION OF 130 POUNDS BEEF AND VEAL WITHOUT A CATTLE CYCLE.

Table	Title	Page
A-1	Summary of Cattle-Beef Industry Projections, 1970-1980 ..	59
A-2	Summary of Cattle Inventory Projections, 1970-1980	59
A-3	Cattle Slaughter Projections, 1970-1980	60
A-4	Beef and Veal Production / Consumption Projections, 1970-1980	61
A-5	Per Capita Beef and Veal Projections, 1970-1980	62

Notes:

- (1) Source: Kansas State University Computing Center, Job 684, June 14, 1972.
- (2) Numbers may not add in all cases due to rounding.

TABLE A-1

SUMMARY OF CATTLE-BEEF INDUSTRY PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
.....(Numbers in Thousands).....											
<u>Beginning Inventory</u>											
Beef Cows	36404	37533	38725	39647	40059	40526	41057	41591	42141	42708	43294
Milk Cows	12578	12414	12279	12109	11869	11697	11565	11451	11349	11256	11171
Total Cows	48982	49947	51004	51756	51928	52223	52622	53042	53490	53964	54465
All Cattle and Calves	112303	114470	117916	120586	122220	123629	124949	126371	127856	129402	130914
<u>Changes in Inventory</u>											
+ Calf Crop	45925	46950	47943	48651	48813	49089	49465	49860	50280	50727	51197
+ Net Imports	1079	997	997	997	997	997	997	997	997	997	997
- Cattle Slaughter	35353	35952	38156	40122	40772	41401	41884	42425	42989	43575	44158
- Calf Slaughter	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
- Cattle Losses	1558	1582	1633	1668	1695	1715	1734	1755	1777	1780	1821
- Calf Losses	2755	2770	2780	2773	2733	2700	2671	2642	2615	2587	2560
<u>Ending Inventory</u>											
All Cattle and Calves	115441	118162	120586	122220	123629	124949	126371	127856	129402	130914	132418
.....(Million Pounds).....											
<u>Beef and Veal Production</u>											
Beef Production	21600	21815	23186	24405	24904	25393	25794	26235	26694	27171	27650
Veal Production	570	541	503	466	429	413	396	380	362	344	325
Total Production	22170	22356	23689	24871	25333	25808	26190	26615	27056	27515	27975

TABLE A-2

SUMMARY OF CATTLE LEADERSHIP PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
(Numbers in Thousands)											
<u>Beginning Inventory</u>											
Beef Cows	36404	37533	38725	39647	40059	40526	41057	41591	42141	42708	43294
Milk Cows	12578	12414	12279	12109	11869	11697	11565	11451	11349	11256	11171
Total Cows	48982	49947	51004	51756	51928	52223	52622	53042	53490	53964	54465
Beef Cow Replacements	6253	6475	6840	7050	7176	7324	7416	7521	7633	7747	7866
Milk Cow Replacements	3974	3941	3942	4127	4186	4208	4197	4179	4159	4141	4123
Other Heifers	6065	6046	6331	6727	6973	7249	7470	7711	7962	8220	8487
Steers	15080	15375	15711	16308	16481	16696	16781	16898	17024	17153	17290
Bulls	2245	2305	2365	2447	2518	2584	2641	2692	2739	2785	2829
Steers, Heifers, Bulls	29704	30381	31723	32169	32956	33344	33822	34327	34849	35391	35814
Total Beginning	112303	114470	117916	120586	122220	123629	124949	126371	127856	129402	130914
<u>Changes</u>											
+ Calf Crop	45925	46950	47943	48651	48813	49089	49465	49860	50280	50727	51197
- Cattle Slaughter	35353	35952	38156	40122	40772	41401	41884	42425	42989	43575	44158
- Calf Slaughter	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
- Cattle Losses	1558	1582	1633	1668	1695	1715	1734	1755	1777	1780	1821
- Calf Losses	2755	2770	2780	2773	2733	2700	2671	2642	2615	2587	2560
+ Imports	1167	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047
- Exports	88	50	50	50	50	50	50	50	50	50	50
- Unexplained Residual	971	246	0	0	0	0	0	0	0	0	0
<u>Ending Inventory</u>											
Total Ending	115441	118162	120586	122220	123629	124949	126371	127856	129402	130914	132418

TABLE A-3

CATTLE SLAUGHTER PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>All Cattle Slaughter</u>	(Numbers in Thousands)										
Beef Cows	4306	4504	5034	5729	5788	5856	5932	6009	6089	6171	6256
Milk Cows	1845	1862	1841	1998	1958	1930	1908	1889	1873	1857	1843
Beef Cow Replacements	237	246	259	268	273	278	282	286	290	294	299
Milk Cow Replacements	596	591	591	619	628	631	629	627	624	621	618
Other Heifers	8479	8515	9506	9926	10242	10543	10802	11084	11375	11676	11977
Steers	19174	19506	20013	20649	20923	21183	21330	21513	21705	21905	22099
Bulls	564	576	591	612	629	646	660	673	685	696	707
Steers, Heifers, Bulls	<u>148</u>	<u>152</u>	<u>317</u>	<u>321</u>	<u>329</u>	<u>333</u>	<u>338</u>	<u>343</u>	<u>348</u>	<u>354</u>	<u>359</u>
Total Cattle	35353	35952	38156	40122	40772	41401	41884	42425	42989	43575	44158
<u>Fed Cattle Slaughter</u>	7207	7280	8176	8586	8911	9225	9506	9809	10124	10450	10779
Fed Other Heifers	17832	18218	18773	19451	19793	20124	20349	20609	20880	21160	21436
Fed Steers	5	5	6	6	6	6	7	7	7	7	7
Fed Bulls	<u>44</u>	<u>45</u>	<u>95</u>	<u>96</u>	<u>99</u>	<u>100</u>	<u>101</u>	<u>103</u>	<u>104</u>	<u>106</u>	<u>108</u>
Fed Steers, Heifers, Bulls	25089	25550	27049	28139	28809	29456	29963	30528	31115	31723	32330
<u>Nonfed Cattle Slaughter</u>	1271	1234	1330	1340	1331	1318	1296	1274	1251	1226	1198
Nonfed Heifers	1342	1287	1240	1197	1129	1059	981	903	825	745	663
Nonfed Steers	5	5	6	6	6	6	7	7	7	7	7
Nonfed Bulls	<u>103</u>	<u>106</u>	<u>222</u>	<u>225</u>	<u>231</u>	<u>233</u>	<u>236</u>	<u>240</u>	<u>243</u>	<u>247</u>	<u>250</u>
Nonfed Steers, Heifers, Bulls	2723	2634	2799	2768	2698	2617	2520	2425	2326	2225	2118
<u>Young Cattle Slaughter</u>	25089	25550	27049	28140	28809	29456	29963	30528	31115	31723	32330
Fed Cattle	2723	2634	2799	2768	2698	2617	2520	2425	2326	2225	2118
Nonfed Cattle	237	246	259	267	272	278	281	286	290	294	299
Beef Cow Replacements	<u>596</u>	<u>591</u>	<u>591</u>	<u>619</u>	<u>627</u>	<u>631</u>	<u>629</u>	<u>627</u>	<u>624</u>	<u>621</u>	<u>618</u>
Milk Cow Replacements	28647	29021	30700	31795	32408	32982	33396	33866	34356	34864	35366
Total Young Cattle	28647	29021	30700	31795	32408	32982	33396	33866	34356	34864	35366
<u>All Cattle Slaughter</u>	6151	6366	6876	7727	7747	7786	7841	7899	7962	8029	8099
Total Young Cattle	<u>553</u>	<u>564</u>	<u>579</u>	<u>600</u>	<u>617</u>	<u>633</u>	<u>647</u>	<u>660</u>	<u>671</u>	<u>682</u>	<u>693</u>
Cows	35353	35952	38156	40122	40772	41401	41884	42425	42989	43575	44158
Bulls	28647	29021	30700	31795	32408	32982	33396	33866	34356	34864	35366
Total Cattle	6151	6366	6876	7727	7747	7786	7841	7899	7962	8029	8099
<u>All Cattle and Calf Slaughter</u>	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
Total Cattle and Calves	39553	39902	41856	43572	43972	44351	44634	44975	45339	45825	46308

BEEF AND VEAL PRODUCTION/CONSUMPTION PROJECTIONS, 1970-1980
(Carcass Weight Equivalent)

Item	Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
(Numbers in Million lbs.)												
<u>All Beef Production</u>												
Beef Cows		1937	2026	2265	2578	2604	2635	2669	2704	2740	2777	2815
Milk Cows		1199	1210	1197	1298	1272	1254	1240	1228	1217	1207	1198
Beef Cow Replacements		103	107	113	116	118	121	122	124	126	128	130
Milk Cow Replacements		259	257	257	269	273	274	273	273	271	270	269
Other Heifers		4784	4759	5369	5639	5854	6062	6248	6450	6659	6876	7096
Steers		12877	13006	13473	13976	14239	14492	14675	14881	15096	15317	15538
Bulls		391	399	410	424	437	448	457	467	475	483	491
Steers, Heifers, Bulls		46	48	100	101	104	105	106	108	110	111	113
Total Beef Production		21600	21815	23186	24405	24904	25395	25794	26235	26694	27171	27650
<u>Fed Beef Production</u>												
Fed Heifers		4230	4222	4791	5057	5275	5489	5685	5895	6115	6343	6575
Fed Steers		12232	12388	12878	13401	13697	13986	14204	14447	14700	14960	15220
Fed Bulls		2	2	2	2	2	3	3	3	3	3	3
Fed Steers, Heifers, Bulls		15	16	33	34	35	35	35	36	36	37	37
Total Fed Production		16481	16629	17704	18495	19009	19513	19927	20381	20854	21343	21835
<u>Nonfed Beef Production</u>												
Nonfed Heifers		553	537	579	583	579	573	564	554	544	533	521
Nonfed Steers		644	617	595	574	542	508	471	434	396	358	318
Nonfed Bulls		2	2	2	2	2	2	2	2	2	2	2
Nonfed Steers, Heifers, Bulls		31	32	66	67	69	70	71	72	73	74	75
Total Nonfed Production		1230	1188	1243	1227	1192	1154	1108	1062	1015	967	916
<u>Young Cattle Beef Production</u>												
Fed Beef		16481	16629	17704	18495	19009	19513	19927	20381	20854	21343	21835
Nonfed Beef		1230	1188	1243	1227	1192	1154	1108	1062	1015	967	916
Beef Cow Replacements		103	107	113	116	118	121	122	124	126	128	130
Milk Cow Replacements		259	257	257	269	273	274	273	273	271	270	269
Total Young		18074	18182	19318	20108	20594	21062	21431	21841	22267	22709	23151
<u>All Beef Production</u>												
Total Young		18074	18182	19318	20108	20594	21062	21431	21841	22267	22709	23151
Cows		3137	3237	3462	3876	3878	3890	3910	3933	3957	3984	4013
Bulls		387	395	405	419	432	443	453	461	470	478	485
Total Beef Production		21600	21815	23186	24405	24904	25395	25794	26235	26694	27171	27650
<u>Domestic Production</u>												
Total Beef		21600	21815	23186	24405	24904	25395	25794	26235	26694	27171	27650
Veal		570	541	503	466	429	413	396	380	362	344	325
Total Beef and Veal		22170	22356	23689	24871	25333	25808	26190	26615	27056	27515	27975
<u>Imports / Exports</u>												
+ Beef Imports		1792	1708	1747	1785	1827	1869	1912	1958	2004	2053	2100
+ Veal Imports		24	20	20	20	20	20	20	20	20	20	20
- Beef and Veal Exports		104	80	80	80	80	80	80	80	80	80	80
<u>Supply</u>												
Total Beef and Veal Supply		23881	24004	25376	26596	27100	27617	28042	28513	29000	29508	30015
<u>Domestic Consumption</u>												
Beef Consumption		23287	23443	24853	26110	26651	27184	27627	28113	28618	29144	29670
Veal Consumption		594	561	523	485	448	433	416	400	382	364	345
Total Beef and Veal Consumption		23881	24004	25376	26596	27100	27617	28042	28513	29000	29508	30015

TABLE A-5

PER CAPITA BEEF AND VEAL PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Population Series D</u>											
Domestic Beef Supply Per Capita	105.5	105.4	110.9	115.4	116.4	117.3	117.6	118.2	119.2	119.3	119.8
Domestic Veal Supply Per Capita	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>
Total Domestic Beef and Veal Supply	108.3	108.0	113.3	117.6	118.4	119.2	119.4	119.9	120.8	120.8	121.2
Net Beef and Veal Imports Per Capita	8.3	8.0	8.1	8.2	8.3	8.4	8.4	8.5	8.7	8.7	8.8
Total Beef Consumption Per Capita	113.7	113.3	118.8	123.4	124.5	125.5	126.0	126.6	127.8	127.9	128.5
Total Veal Consumption Per Capita	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>
Total Beef and Veal Consumption Per Capita	116.6	116.0	121.3	123.7	126.6	127.5	127.9	128.4	129.5	129.5	130.0
<u>Population Series E</u>											
Domestic Beef Supply Per Capita	105.5	105.4	110.9	115.6	116.7	117.7	118.3	119.0	119.8	120.6	121.4
Domestic Veal Supply Per Capita	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>
Total Domestic Beef and Veal Supply	108.3	108.0	113.3	117.8	118.7	119.6	120.1	120.7	121.4	122.1	122.8
Net Beef and Veal Imports Per Capita	8.3	8.0	8.0	8.1	8.3	8.4	8.5	8.6	8.7	8.8	9.0
Total Beef Consumption Per Capita	113.7	113.3	118.9	123.6	124.9	126.0	126.7	127.5	128.4	129.4	130.3
Total Veal Consumption Per Capita	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>
Total Beef and Veal Consumption Per Capita	116.6	116.0	121.4	125.9	127.0	128.0	128.6	129.3	130.1	131.0	131.8

APPENDIX B

SELECTED MODEL RESULTS: PER CAPITA CONSUMPTION OF 135 POUNDS BEEF AND VEAL WITHOUT A CATTLE CYCLE.

Table	Title	Page
B-1	Summary of Cattle-Beef Industry Projections, 1970-1980 ..	64
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B-4	Beef and Veal Production / Consumption Projections, 1970-1980	66
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Notes:

- (1) Source: Kansas State University Computing Center, Job 23, June 13, 1972.
- (2) Numbers may not add in all cases due to rounding.

TABLE B-1

SUMMARY OF CATTLE-BEEF INDUSTRY PROJECTION, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Beginning Inventory</u>	(Numbers in Thousands)										
Beef Cow	36404	37533	38725	39647	40635	41601	42596	43616	44664	45738	46842
Milk Cows	<u>12578</u>	<u>12414</u>	<u>12279</u>	<u>12109</u>	<u>11869</u>	<u>11697</u>	<u>11565</u>	<u>11460</u>	<u>11378</u>	<u>11314</u>	<u>11265</u>
Total Cows	48982	49947	51004	51756	52504	53298	54161	55076	56042	57052	58107
All Cattle and Calves	112303	114470	117916	120586	122795	125215	127730	130333	133037	135860	138701
<u>Changes in Inventory</u>											
+ Calf Crop	45925	46950	47943	48651	49354	50100	50911	51772	52679	53628	54621
+ Net Imports	1079	997	997	997	997	997	997	997	997	997	997
- Cattle Slaughter	35353	35952	38156	39548	40266	41141	42035	42964	43918	44914	45926
- Calf Slaughter	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
- Cattle Losses	1558	1582	1633	1668	1700	1735	1770	1807	1846	1885	1925
- Calf Losses	<u>2755</u>	<u>2770</u>	<u>2781</u>	<u>2773</u>	<u>2763</u>	<u>2755</u>	<u>2749</u>	<u>2743</u>	<u>2739</u>	<u>2735</u>	<u>2731</u>
<u>Ending Inventory</u>											
All Cattle and Calves	115441	118162	120586	122795	125215	127730	130333	133037	135860	138700	141585
<u>Beef and Veal Production</u>											
Beef Production	21600	21815	23186	24146	24676	25313	25968	26650	27353	28090	28843
Veal Production	<u>570</u>	<u>541</u>	<u>503</u>	<u>465</u>	<u>428</u>	<u>413</u>	<u>396</u>	<u>380</u>	<u>362</u>	<u>344</u>	<u>325</u>
Total Production	22170	22356	23689	24612	25104	25726	26364	27030	27715	28434	29168

TABLE B-2

SUMMARY OF CATTLE INVENTORY PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Beginning Inventory</u>	(Numbers in Thousands)										
Beef Cows	36404	37533	38725	39647	40635	41601	42596	43616	44664	45738	46842
Milk Cows	<u>12578</u>	<u>12414</u>	<u>12279</u>	<u>12109</u>	<u>11869</u>	<u>11697</u>	<u>11565</u>	<u>11460</u>	<u>11378</u>	<u>11314</u>	<u>11265</u>
Total Cows	48982	49947	51004	51756	52504	53298	54161	55076	56042	57052	58107
Beef Cow Replacements	6253	6475	6840	7050	7176	7353	7530	7714	7901	8095	8297
Milk Cow Replacements	3974	3941	3942	4128	4186	4208	4218	4227	4235	4245	4257
Other Heifers	6065	6046	6331	6728	6973	7276	7584	7906	8237	8583	8944
Steers	15080	15375	15711	16308	16481	16760	17033	17320	17606	17805	18216
Bulls	2245	2305	2365	2447	2519	2587	2654	2719	2785	2951	2919
Steers, Heifers, Bulls	<u>29704</u>	<u>30381</u>	<u>31723</u>	<u>32169</u>	<u>32956</u>	<u>33733</u>	<u>34550</u>	<u>35371</u>	<u>36231</u>	<u>37129</u>	<u>37961</u>
Total Beginning	112303	114470	117916	120586	122795	125215	127730	130333	133037	135860	138701
<u>Changes</u>											
+ Calf Crop	45925	46950	47943	48651	49353	50100	50911	51772	52679	53628	54620
- Cattle Slaughter	35353	35952	38156	39548	40266	41141	42035	42964	43917	44914	45926
- Calf Slaughter	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
- Cattle Losses	1558	1582	1633	1668	1700	1735	1771	1808	1845	1885	1925
- Calf Losses	<u>2755</u>	<u>2770</u>	<u>2780</u>	<u>2773</u>	<u>2763</u>	<u>2756</u>	<u>2749</u>	<u>2744</u>	<u>2739</u>	<u>2735</u>	<u>2731</u>
+ Imports	1167	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047
- Exports	88	50	50	50	50	50	50	50	50	50	50
- Unexplained Residual	<u>971</u>	<u>246</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
<u>Ending Inventory</u>	115441	118162	120586	122795	125215	127730	130333	133037	135860	138700	141585

TABLE B-3

CATTLE SLAUGHTER PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
(Numbers in Thousands)											
<u>All Cattle Slaughter</u>											
Beef Cows	4307	4504	5034	5154	5283	5408	5538	5670	5806	5946	6089
Milk Cows	1845	1862	1842	1998	1958	1930	1908	1891	1878	1867	1859
Beef Cow Replacements	238	246	260	268	273	279	286	293	300	307	315
Milk Cow Replacements	596	591	591	619	628	631	633	634	635	637	638
Other Heifers	8479	8515	9507	9926	10242	10611	10989	11380	11785	12207	12636
Steers	19174	19506	20014	20649	20923	21298	21673	22062	22456	22866	23279
Bulls	565	576	591	612	630	647	663	680	696	713	730
Steers, Heifers, Bulls	<u>149</u>	<u>152</u>	<u>317</u>	<u>322</u>	<u>329</u>	<u>337</u>	<u>345</u>	<u>354</u>	<u>362</u>	<u>371</u>	<u>380</u>
Total Cattle	35353	35952	38156	39548	40266	41141	42035	42964	43918	44914	45926
<u>Fed Cattle Slaughter</u>											
Fed Other Heifers	7208	7280	8176	8586	8911	9285	9670	10072	10488	10925	11373
Fed Steers	17832	18219	18773	19451	19793	20233	20676	21135	21602	22089	22581
Fed Bulls	5	5	6	6	6	6	7	7	7	7	7
Fed Steers, Heifers, Bulls	<u>44</u>	<u>46</u>	<u>95</u>	<u>97</u>	<u>99</u>	<u>101</u>	<u>103</u>	<u>106</u>	<u>109</u>	<u>112</u>	<u>114</u>
Total Fed	25090	25550	27050	28140	28809	29625	30456	31320	32206	33133	34075
<u>Nonfed Cattle Slaughter</u>											
Nonfed Heifers	1272	1235	1331	1340	1332	1327	1319	1309	1296	1282	1264
Nonfed Steers	1342	1288	1241	1198	1130	1065	997	927	853	777	698
Nonfed Bulls	5	5	6	6	6	6	6	7	7	7	7
Nonfed Steers, Heifers, Bulls	<u>104</u>	<u>106</u>	<u>222</u>	<u>225</u>	<u>230</u>	<u>236</u>	<u>242</u>	<u>247</u>	<u>255</u>	<u>260</u>	<u>266</u>
Total Nonfed	2723	2634	2800	2769	2698	2634	2564	2490	2411	2326	2235
<u>Young Cattle Slaughter</u>											
Fed Cattle	25090	25550	27050	28140	28809	29625	30456	31320	32206	33133	34075
Nonfed Cattle	2723	2634	2800	2769	2698	2634	2564	2490	2411	2326	2235
Beef Cow Replacements	238	246	260	268	273	279	286	293	300	307	315
Milk Cow Replacements	<u>596</u>	<u>591</u>	<u>591</u>	<u>619</u>	<u>628</u>	<u>631</u>	<u>633</u>	<u>634</u>	<u>635</u>	<u>637</u>	<u>638</u>
Total Young Cattle	28647	29021	30701	31796	32408	33169	33939	34737	35552	36403	37263
<u>All Cattle Slaughter</u>											
Total Young Cattle	28647	29021	30701	31796	32408	33169	33939	34737	35552	36403	37263
Cows	6152	6366	6876	7152	7241	7338	7446	7561	7684	7813	7948
Bulls	<u>553</u>	<u>565</u>	<u>579</u>	<u>600</u>	<u>617</u>	<u>634</u>	<u>650</u>	<u>666</u>	<u>682</u>	<u>698</u>	<u>715</u>
Total Cattle	35352	35952	38156	39548	40266	41141	42035	42964	43918	44914	45926
<u>All Cattle and Calf Slaughter</u>											
Total Cattle	35353	35952	38156	39548	40266	41141	42035	42964	43918	44914	45926
Calves	<u>4200</u>	<u>3950</u>	<u>3700</u>	<u>3450</u>	<u>3200</u>	<u>2950</u>	<u>2750</u>	<u>2550</u>	<u>2350</u>	<u>2250</u>	<u>2150</u>
Total Cattle and Calves	39553	39902	41856	42998	43466	44091	44785	45514	46268	47164	48076

TABLE B-4

BEEF AND VEAL PRODUCTION/CONSUMPTION PROJECTIONS, 1970-1980
(Carcase Weight Equivalent)

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>All Beef Production</u>				(carcasses in million lbs.)							
Beef Cows	1938	2027	2265	2319	2377	2434	2492	2552	2613	2676	2740
Milk Cows	1199	1210	1197	1299	1273	1254	1240	1229	1220	1213	1208
Beef Cow Replacements	103	107	113	117	119	122	125	128	131	134	137
Milk Cow Replacements	259	257	257	269	273	275	275	276	276	277	278
Other Heifers	4784	4760	5370	5640	5854	6101	6356	6622	6899	7189	7487
Steers	12877	13007	13424	13977	14239	14573	14910	15260	15618	15990	16368
Bulls	392	399	410	424	437	448	460	472	482	494	506
Steers, Heifers, Bulls	47	48	100	101	104	106	109	111	114	117	119
Total Beef Production	21600	21815	23186	24146	24676	25313	25967	26650	27353	28090	28843
<u>Fed Beef Production</u>											
Fed Heifers	4231	4223	4791	5057	5275	5524	5783	6053	6335	6632	6937
Fed Steers	12233	12389	12878	13402	13697	14062	14432	14816	15208	15617	16032
Fed Bulls	2	2	2	2	3	3	3	3	3	3	3
Fed Steers, Heifers, Bulls	16	16	33	34	34	35	36	37	38	39	40
Total Fed Production	16482	16630	17704	18495	19009	19624	20254	20909	21584	22291	23012
<u>Nonfed Beef Production</u>											
Nonfed Heifers	553	537	579	583	579	577	574	569	564	558	550
Nonfed Steers	644	618	596	575	543	511	478	445	410	373	335
Nonfed Bulls	2	2	2	2	2	2	2	2	2	2	2
Nonfed Steers, Heifers, Bulls	31	32	66	67	69	71	73	74	76	78	80
Total Nonfed Production	1230	1189	1243	1227	1193	1161	1127	1090	1052	1011	967
<u>Young Cattle Beef Production</u>											
Fed Beef	16482	16630	17704	18495	19009	19624	20254	20909	21584	22291	23012
Nonfed Beef	1230	1189	1243	1227	1193	1161	1127	1090	1052	1011	967
Beef Cow Replacements	103	107	113	117	119	122	125	128	131	134	137
Milk Cow Replacements	259	257	257	269	273	275	275	276	276	277	278
Total Young	18074	18183	19317	20108	20594	21182	21781	22403	23043	23712	24394
<u>All Beef Production</u>											
Total Young	18074	18183	19317	20108	20594	21182	21781	22403	23043	23712	24394
Cows	3138	3237	3463	3618	3650	3688	3732	3781	3833	3889	3948
Bulls	388	395	406	420	432	443	455	466	477	489	501
Total Beef Production	21600	21815	23186	24146	24676	25313	25968	26650	27353	28090	28843
<u>Domestic Production</u>											
Total Beef	21600	21815	23186	24146	24676	25313	25968	26650	27353	28090	28843
Veal	570	541	503	466	428	413	396	380	362	344	325
Total Beef and Veal	22170	22356	23689	24612	25104	25726	26364	27030	27715	28434	29168
<u>Imports / Exports</u>											
+ Beef Imports	1792	1708	1747	1785	1827	1869	1912	1958	2004	2053	2100
+ Veal Imports	24	20	20	20	20	20	20	20	20	20	20
- Beef and Veal Exports	104	80	80	80	80	80	80	80	80	80	80
<u>Supply</u>											
Total Beef and Veal Supply	23882	24004	25377	26337	26871	27535	28216	28928	29659	30427	31208
<u>Domestic Consumption</u>											
Beef Consumption	23288	23443	24854	25852	26423	27102	27800	28528	29277	30063	30863
Veal Consumption	594	561	523	485	448	433	416	400	382	364	345
Total Beef and Veal Consumption	23882	24004	25377	26337	26871	27535	28216	28928	29659	30427	31208

TABLE B-5

PER CAPITA BEEF AND VEAL PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Population Series D</u>											
Domestic Beef Supply Per Capita	105.5	105.4	110.8	114.1	115.3	116.9	118.4	120.0	122.2	123.3	125.0
Domestic Veal Supply Per Capita	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>
Total Domestic Beef and Veal Supply	108.3	108.0	113.2	116.3	117.3	118.8	120.2	121.7	123.8	124.8	126.4
Net Beef and Veal Imports Per Capita	8.3	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.7	8.8
Total Beef Consumption Per Capita	113.7	113.3	118.8	122.2	123.5	125.2	126.8	128.5	130.8	131.9	133.7
Total Veal Consumption Per Capita	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>
Total Beef and Veal Consumption Per Capita	116.6	116.0	121.3	124.5	125.6	127.2	128.7	130.3	132.5	133.5	135.2
<u>Population Series E</u>											
Domestic Beef Supply Per Capita	105.5	105.4	110.9	114.3	115.6	117.4	119.1	120.9	122.8	124.7	126.6
Domestic Veal Supply Per Capita	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>
Total Domestic Beef and Veal Supply	108.3	108.0	113.3	116.5	117.6	119.3	120.9	122.6	124.4	126.2	128.0
Net Beef and Veal Imports Per Capita	8.3	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.9	9.0
Total Beef Consumption Per Capita	113.7	113.3	118.9	122.4	123.8	125.7	127.5	129.4	131.4	133.5	135.5
Total Veal Consumption Per Capita	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>
Total Beef and Veal Consumption Per Capita	116.6	116.0	121.4	124.7	125.9	127.7	129.4	131.2	133.1	135.1	137.0

APPENDIX C

SELECTED MODEL RESULTS: PER CAPITA CONSUMPTION OF 130 POUNDS BEEF AND VEAL WITH A CATTLE CYCLE.

Table	Title	Page
C-1	Summary of Cattle-Beef Industry Projections, 1970-1980 ..	69
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C-3	Cattle Slaughter Projections, 1970-1980	70
C-4	Beef and Veal Production / Consumption Projections, 1970-1980	71
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Notes:

- (1) Source: Kansas State University Computing Center, Job 793, June 15, 1972.
- (2) Numbers may not add in all cases due to rounding.

TABLE C-1

SUMMARY OF CATTLE-BEEF INDUSTRY PROJECTION, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Beginning Inventory</u>	(Numbers in thousands)										
Beef Cows	36404	37533	38725	39647	39247	39230	29709	40687	42181	43596	44583
Milk Cows	12578	12414	12279	12110	11869	11698	11565	11436	11310	11191	11088
Total Cows	48982	49947	51004	51757	51116	50928	51274	52123	53491	54787	55671
All Cattle and Calves	112303	114470	117916	120587	121408	121309	122034	123575	126304	129688	132782
<u>Changes in Inventory</u>											
+ Calf Crop	45926	46950	47944	48651	48049	47871	48197	48996	50281	51500	52331
+ Net Imports	1079	997	997	997	997	997	997	997	997	997	997
- Cattle Slaughter	35353	35952	38156	40935	41568	40876	40605	40402	41176	42726	44161
- Calf Slaughter	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
- Cattle Losses	1159	1582	1633	1668	1687	1685	1695	1716	1753	1801	1846
- Calf Losses	2756	2770	2780	2773	2691	2633	2603	2597	2615	2626	2617
<u>Ending Inventory</u>											
All Cattle and Calves	115441	118162	120587	121408	121309	122034	123575	126304	129688	132782	135336
<u>Beef and Veal Production</u>											
Beef Production	21600	21815	23187	24771	25317	25056	25083	25149	25721	26718	27700
Veal Production	570	541	503	466	429	413	396	380	362	344	325
Total Production	22170	22356	23690	25237	25746	25469	25479	25529	26083	27062	28025

TABLE C-2

SUMMARY OF CATTLE INVENTORY PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Beginning Inventory</u>	(Numbers in thousands)										
Beef Cows	36404	37533	38725	39647	39247	39230	39709	40687	42181	43596	44583
Milk Cows	12578	12414	12279	12110	11869	11698	11565	11436	11310	11191	11088
Total Cows	48982	49947	51004	51757	51116	50928	51274	52123	53491	54787	55671
Beef Cow Replacements	6253	6475	6840	7051	7177	7285	7263	7314	7439	7645	7905
Milk Cow Replacements	3974	3941	3942	4128	4186	4208	4165	4119	4086	4076	4093
Other Heifers	6065	6046	6331	6727	6973	7071	7317	7500	7760	8109	8526
Steers	15080	15375	15711	16308	16481	16442	16445	16445	16606	16938	17377
Bulls	2245	2305	2365	2447	2519	2580	2624	2660	2698	2745	2803
Steers, Heifers, Bulls	29704	30381	31723	32169	32956	32795	32946	33413	34224	35388	36407
Total Beginning	112303	114470	117916	120587	121408	121309	122034	123575	126304	129688	132782
<u>Changes</u>											
+ Calf Crop	45926	46950	47944	48651	48049	47871	48197	48996	50281	51500	52331
- Cattle Slaughter	35353	35952	38156	40935	41568	40876	40605	40402	41176	42726	44161
- Calf Slaughter	4200	3950	3700	3450	3200	2950	2750	2550	2350	2250	2150
- Cattle Losses	1159	1582	1633	1668	1687	1685	1695	1716	1753	1801	1846
- Calf Losses	2756	2770	2780	2773	2691	2633	2603	2597	2615	2626	2617
+ Imports	1167	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047
- Exports	88	50	50	50	50	50	50	50	50	50	50
- Unexplained Residual	971	246	0	0	0	0	0	0	0	0	0
<u>Ending Inventory</u>											
All Cattle and Calves	115441	118162	120587	121408	121309	122034	123575	126304	129688	132782	135336

TABLE C-3

CATTLE SLAUGHTER PROJECTIONS, 1970-1980

Item \ Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>All Cattle Slaughter</u>	(numbers in thousands)										
Beef Cows	4307	4504	5034	6542	6279	5885	5361	4883	5062	5668	6019
Milk Cows	1845	1862	1842	1998	1958	1930	1908	1887	1866	1846	1830
Beef Cow Replacements	278	246	260	267	273	277	276	278	283	291	300
Milk Cow Replacements	596	591	591	619	628	631	625	618	613	611	614
Other Heifers	8479	8515	9507	9926	10382	10316	10563	10786	11118	11572	12073
Steers	19174	19506	20014	20649	21088	20864	20887	20952	21218	21697	22260
Bulls	565	576	591	612	630	645	656	665	674	687	771
Steers, Heifers, Bulls	<u>149</u>	<u>152</u>	<u>317</u>	<u>322</u>	<u>330</u>	<u>328</u>	<u>329</u>	<u>334</u>	<u>342</u>	<u>354</u>	<u>364</u>
Total Cattle	35353	35952	38156	40935	41568	40876	40605	40402	41176	42726	44161
<u>Fed Cattle Slaughter</u>											
Fed Other Heifers	7208	7280	8176	8586	9032	9027	9296	9545	9895	10358	10866
Fed Steers	17832	18219	18773	19451	19949	19820	19925	20072	20411	20959	21592
Fed Bulls	5	5	6	6	6	6	7	7	7	7	7
Fed Steers, Heifers, Bulls	<u>45</u>	<u>46</u>	<u>95</u>	<u>97</u>	<u>98</u>	<u>99</u>	<u>99</u>	<u>100</u>	<u>103</u>	<u>106</u>	<u>109</u>
Total Fed	25090	25550	27050	28140	29087	28952	29327	29724	30416	31430	32574
<u>Nonfed Cattle Slaughter</u>											
Nonfed Heifers	1272	1235	1331	1340	1350	1290	1268	1240	1221	1214	1207
Nonfed Steers	1342	1288	1241	1198	1139	1043	961	880	806	738	668
Nonfed Bulls	5	5	6	6	6	6	6	7	7	7	7
Nonfed Steers, Heifers, Bulls	<u>104</u>	<u>106</u>	<u>222</u>	<u>225</u>	<u>230</u>	<u>230</u>	<u>231</u>	<u>234</u>	<u>240</u>	<u>248</u>	<u>255</u>
Total Nonfed	2723	2634	2800	2769	2725	2569	2466	2361	2276	2207	2137
<u>Young Cattle Slaughter</u>											
Fed Cattle	25090	25550	27050	28140	29087	28952	29327	29724	30416	31430	32574
Nonfed Cattle	2723	2634	2800	2769	2725	2569	2466	2361	2276	2207	2137
Beef Cow Replacements	278	246	260	267	273	277	276	278	283	291	300
Milk Cow Replacements	<u>596</u>	<u>591</u>	<u>591</u>	<u>619</u>	<u>628</u>	<u>631</u>	<u>625</u>	<u>618</u>	<u>613</u>	<u>611</u>	<u>614</u>
Total Young Cattle	28647	29021	30701	31795	32713	32429	32694	32981	33587	34539	35626
<u>All Cattle Slaughter</u>											
Total Young Cattle	28647	29021	30701	31795	32713	32429	32694	32981	33587	34539	35626
Cows	6152	6366	6876	8540	8238	7815	7269	6769	6928	7514	7848
Bulls	<u>554</u>	<u>565</u>	<u>579</u>	<u>600</u>	<u>617</u>	<u>632</u>	<u>642</u>	<u>652</u>	<u>661</u>	<u>673</u>	<u>687</u>
Total Cattle	35353	35952	38156	40935	41568	40876	40605	40402	41176	42726	44161
<u>All Cattle and Calf Slaughter</u>											
Total Cattle	35353	35952	38156	40935	41568	40876	40605	40402	41176	42726	44161
Calves	<u>4200</u>	<u>3950</u>	<u>3700</u>	<u>3450</u>	<u>3200</u>	<u>2950</u>	<u>2750</u>	<u>2550</u>	<u>2350</u>	<u>2250</u>	<u>2150</u>
Total Cattle and Calves	39553	39902	41856	44385	44768	43826	43355	42952	43526	44976	46311

BEEF AND VEAL PRODUCTION/CONSUMPTION PROJECTIONS, 1970-1980
(Carcass Weight Equivalent)

Item	Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
(Numbers in Million Pounds)												
<u>All Beef Production</u>												
Beef Cows		1938	2027	2266	2944	2826	2648	2412	2197	2278	2551	2708
Milk Cows		1199	1210	1197	1299	1273	1255	1240	1227	1213	1200	1189
Beef Cow Replacements		103	107	113	117	119	120	120	121	123	126	131
Milk Cow Replacements		259	257	257	269	273	275	272	269	267	266	267
Other Heifers		4784	4760	5370	5640	5934	5932	6110	6276	6509	6815	7153
Steers		12877	13007	13474	13977	14351	14276	14370	14493	14757	15173	15651
Bulls		392	399	410	424	437	447	455	461	467	476	486
Steers, Heifers, Bulls		47	48	100	101	104	103	104	105	107	111	115
Total Beef Production		21600	21815	23187	24771	25317	25056	25083	25149	25721	26718	27700
<u>Fed Beef Production</u>												
Fed Heifers		4231	4223	4791	5057	5347	5371	5559	5737	5976	6287	6628
Fed Steers		12233	12389	12879	13402	13805	13775	13908	14070	14370	14818	15331
Fed Bulls		2	2	2	2	3	3	3	3	3	3	3
Fed Steers, Heifers, Bulls		16	16	33	34	34	34	34	35	36	37	38
Total Fed Production		16482	16630	17705	18495	19189	19183	19504	19845	20385	21145	22000
<u>Nonfed Beef Production</u>												
Nonfed Heifers		553	537	579	583	587	561	552	540	532	529	525
Nonfed Steers		644	618	595	575	547	501	461	422	387	354	321
Nonfed Bulls		2	2	2	2	2	2	2	2	2	2	2
Nonfed Steers, Heifers, Bulls		31	32	67	67	69	69	69	70	72	74	76
Total Nonfed Production		1230	1189	1243	1227	1205	1133	1084	1034	993	959	924
<u>Young Cattle Beef Production</u>												
Fed Beef		16482	16630	17705	18495	19189	19183	19504	19845	20385	21145	22000
Nonfed Beef		1230	1189	1243	1227	1205	1133	1084	1034	993	959	924
Beef Cow Replacements		103	107	113	117	119	120	120	121	123	126	131
Milk Cow Replacements		259	257	257	269	273	275	272	269	267	266	267
Total Young		18074	18183	19318	20108	20786	20711	20980	21269	21768	22496	23322
<u>All Beef Production</u>												
Total Young		18074	18183	19318	20108	20786	20711	20980	21269	21768	22496	23322
Cows		3138	3237	3463	4243	4099	3903	3653	3424	3490	3751	3898
Bulls		388	395	406	420	432	442	450	456	463	471	480
Total Beef Production		21600	21815	23187	24771	25317	25056	25083	25149	25721	26721	27700
<u>Domestic Production</u>												
Total Beef		21600	21815	23187	24771	25317	25056	25083	25149	25721	26718	27700
Veal		570	541	503	466	429	413	396	380	362	344	325
Total Beef and Veal		22170	22356	23690	25237	25746	25469	25479	25529	26083	27062	28025
<u>Imports / Exports</u>												
+ Beef Imports		1792	1708	1747	1785	1827	1869	1912	1958	2004	2053	2100
+ Veal Imports		24	20	20	20	20	20	20	20	20	20	20
- Beef and Veal Exports		104	80	80	80	80	80	80	80	80	80	80
<u>Supply</u>												
Total Beef and Veal Supply		23882	24004	25377	26962	27513	27278	27331	27427	28027	29055	30065
<u>Domestic Consumption</u>												
Beef Consumption		23288	23443	24854	26476	27064	26845	26915	27027	27645	28691	29720
Veal Consumption		594	561	523	486	449	433	416	400	382	364	345
Total Beef and Veal Consumption		23882	24004	25377	26962	27513	27278	27331	27427	28027	29055	30065

TABLE C-5

PER CAPITA BEEF AND VEAL PROJECTIONS, 1970-1980

Item	Year										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
<u>Population Series D</u>											
Domestic Beef Supply Per Capita	105.5	105.4	110.9	117.1	118.3	115.7	114.4	113.3	114.9	117.3	120.0
Domestic Veal Supply Per Capita	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>
Total Domestic Beef and Veal Supply	108.3	108.0	113.3	119.3	120.3	117.6	116.2	115.0	116.5	118.8	121.4
Net Beef and Veal Imports Per Capita	8.3	8.0	8.0	8.1	8.3	8.4	8.4	8.5	8.7	8.7	8.8
Total Beef Consumption Per Capita	113.7	113.3	118.8	125.2	126.5	124.0	122.7	121.7	123.5	125.9	128.7
Total Veal Consumption Per Capita	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.2</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>
Total Beef and Veal Consumption Per Capita	116.6	116.0	121.3	127.4	128.6	126.0	124.6	123.5	125.2	127.5	130.2
<u>Population Series E</u>											
Domestic Beef Supply Per Capita	105.5	105.4	110.9	117.3	118.6	116.2	115.0	114.1	115.5	118.6	121.6
Domestic Veal Supply Per Capita	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>
Total Domestic Beef and Veal Supply	108.3	108.0	113.3	119.5	120.6	118.1	116.8	115.8	117.1	120.1	123.0
Net Beef and Veal Imports Per Capita	8.3	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.9	9.0
Total Beef Consumption Per Capita	113.7	113.3	118.9	125.4	126.8	124.5	123.4	122.6	124.1	127.4	130.5
Total Veal Consumption Per Capita	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>
Total Beef and Veal Consumption Per Capita	116.6	116.0	121.4	127.7	128.9	126.5	125.3	124.4	125.8	129.0	132.0

CATTLE-BEEF INDUSTRY PROJECTIONS TO 1980
AND DERIVED FEEDER CATTLE REQUIREMENTS

by

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B.S., Ohio State University, 1967

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ABSTRACT

This study involves the derivation of future feeder cattle requirements in the United States to 1980. In accomplishing this task, it was necessary to evaluate specific segments of the cattle-beef industry, as well as detailed demand projections for beef and veal. Total U.S. beef and veal demand projections were developed utilizing previously published studies on per capita consumption by the U.S. Department of Agriculture, and population projections as were developed by U.S. Department of Commerce, Bureau of Census. Projections were made for exports and imports of live cattle, beef and veal. A total demand was then established for domestically produced beef and veal in 1980; and attention was directed to an analysis of cattle-beef industry for possible ways in which this domestic demand could be achieved.

Initial attempts to bypass a detailed analysis of inventory levels of all components of the cattle industry, plus early attempts to segment various beef supply response relationships with limited inventory data, repeatedly left important gaps in accountability of (1) aggregate numbers of cattle and calves on inventory from year to year, and (2) overall beef supply response levels from cattle slaughtered relative to projected beef needs. Subsequently a Cattle Inventory Balance and Beef Supply Response Model was developed to resolve these discrepancies.

Three alternative simulations of the cattle-beef industry were made to 1980 as follows: (1) Per capita consumption of 130 pounds (beef and veal) by 1980, without a cattle cycle; (2) Per capita consumption of

135 pounds by 1980, without a cattle cycle; and (3) Per capita consumption of 130 pounds by 1980, with a cattle cycle. Inventory growth paths and associated beef supply responses differ in each case. Also, cattle inventory levels in 1980 varied considerably due to the different beef supply responses and cattle cycle effects where applicable.

Based on available information and the estimating procedures employed, feeder cattle requirements in 1980 will be between 34,762 and 36,980 thousand head. These estimates represent increases of 22.8 and 30.2 per cent respectively over the 1970 estimate of 28,406 thousand head of feeder cattle. Included in these estimates are 848 thousand head of imported feeder cattle.

Other results of the analysis involve various segments of the cattle-beef industry. For the three primary simulations indicated, the following summary statistics were projected:

Year	Per Capita Beef & Veal Consumption		Beginning Inventory of All Cattle		Beef Production		Feeder Cattle Requirements	
	% Δ		% Δ		Mil.		% Δ	
	lbs.	1970-80	Thous.	1970-80	lbs.	1970-80	Thous.	1970-80
1970	116.6	----	112,303	----	21,600	----	28,406	----
1980	130.0 ^a	11.5	130,914	+16.1	27,650	+28.0	34,762	+22.8
1980	135.2 ^b	16.0	138,701	+23.5	28,843	+33.5	36,980	+30.2
1980	130.2 ^b	11.5	132,782	+18.2	27,700	+28.2	35,725	+25.8

^aWithout a cattle cycle.

^bWith a cattle cycle.