Comparing the Profitability of Beef Production Enterprises in North Dakota

Randall D. Little and David L. Watt

Preface

Research for this report was conducted under North Dakota Agricultural Experiment Station Research Project No. 1376. Insights gained in writing "The Changing Profitability of Beef Production in North Dakota," Agricultural Economics Report No. 203, led to the development of this report, which has improved budgets and a more complete profitability analysis of cattle enterprises and retained ownership in North Dakota.

The authors would like to thank Timothy Petry and Brenda Ekstrom of the Department of Agricultural Economics and LaDon Johnson and Russell Danielson of the Department of Animal and Range Sciences for their helpful suggestions and comments throughout the development of this study. Special thanks are due to Jackie Grossman and Jody Peper for typing the manuscript.

The response of people across North Dakota encouraged work on this new publication. In particular, the authors greatly appreciated the information provided by Delbert Moore.

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Highlights

Profitability in beef production is heavily influenced by factors beyond the control of individual producers. The impact of these factors on profitability varies between beef enterprises. Cow-calf operations are shown to be especially vulnerable to the price fluctuations that characterize the cattle cycle.

Cost of production budgets were constructed at 1984 price levels for several beef production and feeding enterprises common to North Dakota. Budgets were developed for each year back to 1959 using indices of prices paid by farmers. Total production costs were divided by expected output to estimate break-even prices. Estimated profitability per production unit was derived using the break-even price and market price.

The variation in profitability of beef production due to price fluctuations in North Dakota has increased significantly since the early 1970s. The cow-calf operation had one of the lowest average profit estimates and the greatest variation of the enterprises examined.

Producers can usually increase the amount of profit generated per cow by keeping calves beyong weaning. There were several years, however, when selling weaned calves was the most profitable marketing alternative.

COMPARING THE PROFITABILITY OF BEEF PRODUCTION
ENTERPRISES IN NORTH DAKOTA

Randall D. Little and David L. Watt[*]

Cattle production is a volatile industry. Its profitability is largely determined by factors beyond the control of the individual producer because individual production and marketing decisions exert little influence on what occurs in the marketplace. These factors include cumulative beef production, competition from other meat sources, and cost of inputs. The impact of these factors on profitability varies among beef enterprises. The objective of this study is to estimate and compare the profitability of beef production enterprises typical in North Dakota. Potential benefits of several vertical integration alternatives in the production process will also be estimated. The alternatives examined involve extending ownership of calves beyond weaning in a cow-calf operation, then feeding and selling at a later date.

Description of the Situation

Beef production is a vital part of the agricultural industry in North Dakota. The sale of cattle and calves is a major source of cash farm receipts, second only to the sale of wheat in 1983. Receipts for the sale of cattle and calves accounted for 17 percent of total cash receipts for all crop and livestock products and 69 percent of total cash receipts for all livestock products in 1983 (North Dakota Agricultural Statistics 1985).

Virtually all calves produced in North Dakota are either sold at weaning, backgrounded and sold the following spring, or wintered, pastured, and sold the following fall. The number of calves sold at weaning or held for further feeding is usually determined by feed availability. A greater proportion of calves are retained beyond weaning in years of ample moisture when feed supplies are adequate and less expensive. But in years when feed is inadequate, more calves are sold at weaning in the fall. Feeder calves sold in North Dakota are generally shipped out of the state for finishing. Very few calves are fed to slaughter weight in North Dakota.

This research studies a time period from 1959 to the most recent data available. The year 1958 was one of several generally profitable years in the cattle industry. This period followed an unprofitable stretch of years that coincided with the peak in cattle numbers that occurred in 1955. By the early 1960s cattle inventories had again been built up, prices were again driven down, and losses occurred near the middle of that decade.

The cyclical nature of cattle inventories is apparent when examining changes in the number of cattle in North Dakota over time (Figure 1). The trends in cattle inventories in the state have, in general, followed those of cattle inventories in the United States (Figure 2). The exception is the sharp increase from 1962 to 1965 and subsequent decrease from 1965 to 1969 in

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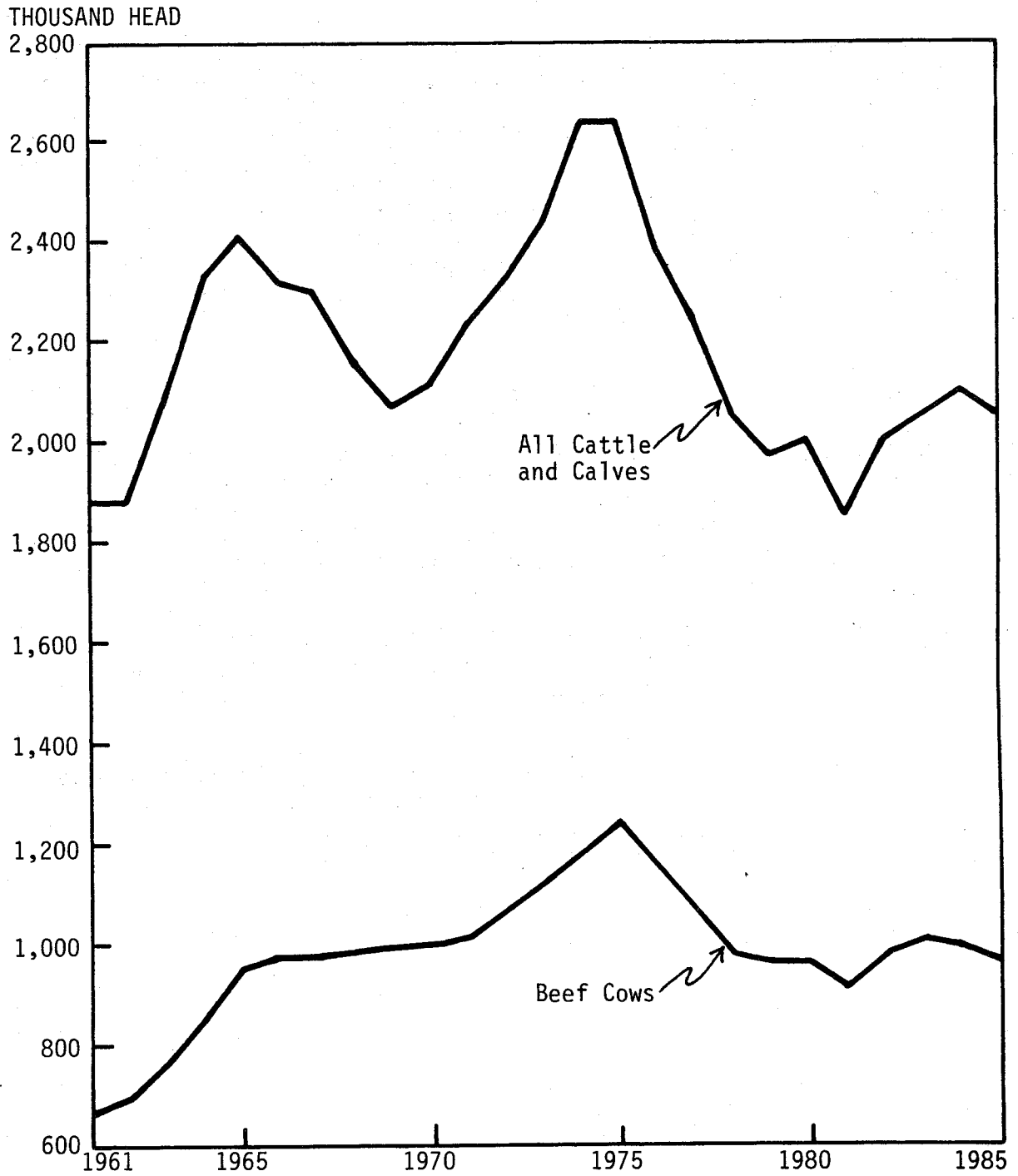

Figure 1. Inventories of Cattle and Calves and Beef Cows in North Dakota, 1961-1985

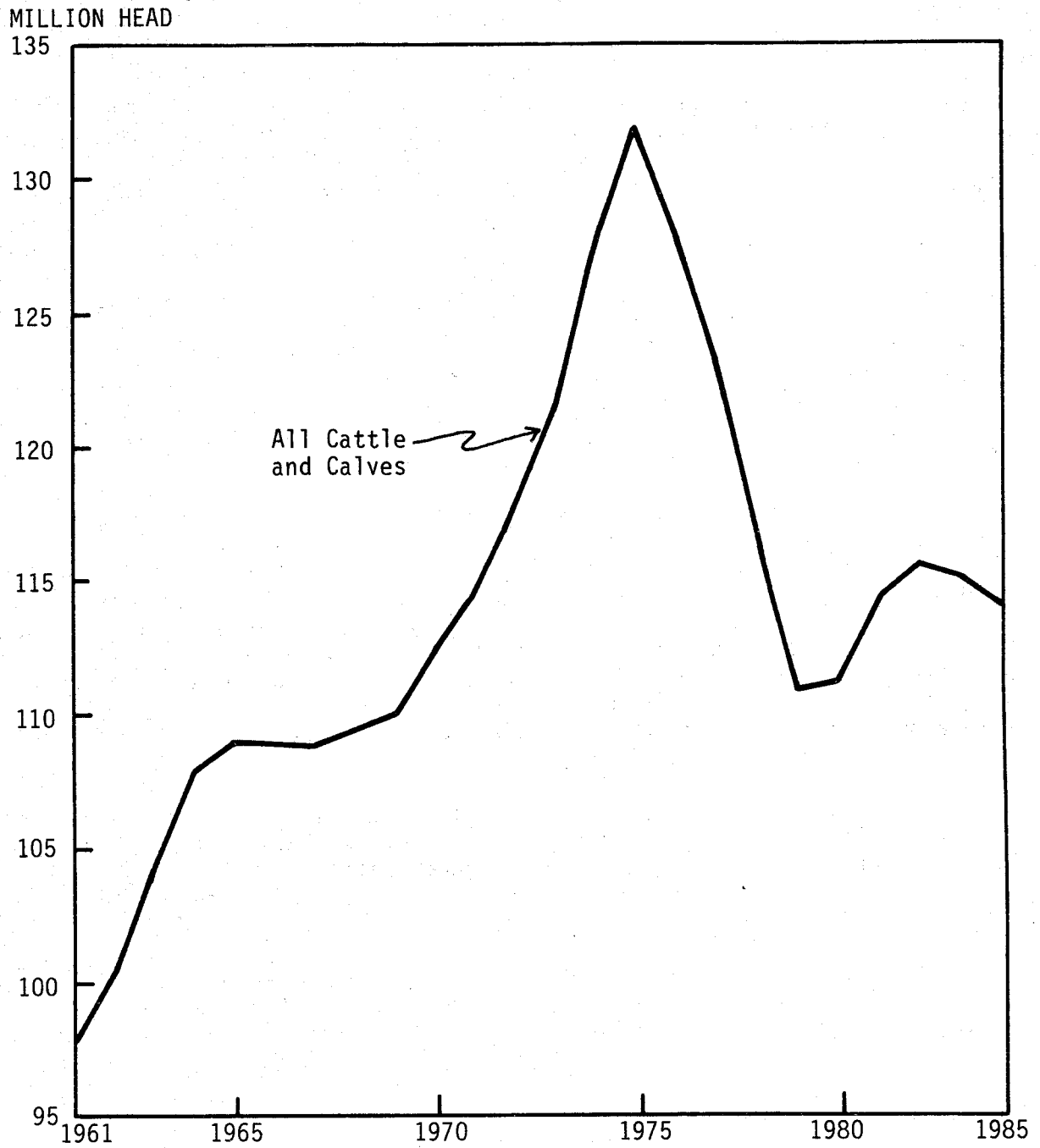SOURCE: North Dakota Agricultural Statistics.

MILLION HEAD

Figure 2. Inventory of Cattle and Calves in the United States

SOURCE: Livestock and Meat Statistics.

the number of cattle and calves in North Dakota. Inventories in the United States increased from 1961 to 1965, then stabilized until 1969. Trends in cattle inventories at both state and national levels are similar after 1969.

The cattle industry was generally profitable throughout the late 1960s and early 1970s. This made the industry attractive. The combination of a strong economy, strong consumer demand for beef, and feedlot growth and expansion increased the demand for feeder cattle, which is reflected by the rapid price increases from 1968 to 1973 (Figure 3). The industry was also relatively stable during this time. Government programs helped minimize variation in feed prices and interest rates fluctuated little. Many operators expanded their enterprises while others started new ones during this period.

Beef cow inventories increased steadily from the early to mid-1970s. Total cattle inventories in North Dakota increased over 27 percent during this five-year period. Rapid expansion continued until 1975 when cattle inventories peaked. The time lag that exists in beef production is evident here; inventories continued to increase for several years after prices bottomed out in 1974. Overabundant cattle supplies resulted in sharp price drops and, consequently, in reduced producers' profits. Although cash prices increased substantially during the late 1970s, the real prices (price adjusted for inflation) have not again attained the 1973 level.

Although prices were recovering in 1976, cattle inventories fell sharply. The impact of inflation eliminated the profit potential of these price increases. The total number of cattle in North Dakota declined over 22 percent, and the number of beef cows decreased almost 27 percent from 1976 to 1981. Although there was a slight increase in cattle inventories in 1979, in response to the sharp price increases that occurred in 1978 and 1979, inventories fell again in 1980. North Dakota's beef cow herd increased slightly from 1981 to 1983, then decreased in 1984. The inventory of all cattle and calves in North Dakota increased 13.5 percent from 1981 to 1984, then fell over 2 percent in 1985.

The cattle industry has been, for the most part, unprofitable during the early 1980s, especially for cow-calf operators. Higher feed prices in 1981 resulting from a drought in 1980, higher interest rates, as well as an abundant supply of substitutable meats have contributed to the losses experienced throughout the early 1980s.

Cattle inventories and cattle prices in North Dakota have been quite variable over time. The cyclical trends displayed by both inventories and prices have been similar to those displayed in the cattle industry as a whole, demonstrating vulnerability to the effects of the cattle cycle.

The Cattle Cycle

The beef cattle production-and-price cycle is a major concern of the cattle industry because it not only has significant influence on producers' incomes but also imposes a unique set of risks on livestock producers. Traditionally, a complete cattle cycle with increases and decreases in cattle numbers lasts an average of about 10 years. Peaks in cattle numbers occurred in 1890, 1904, 1918, 1934, 1945, 1955, 1965, and 1975. The last four cycles have peaked in the middle of each decade (Hasbargen et al. 1983).
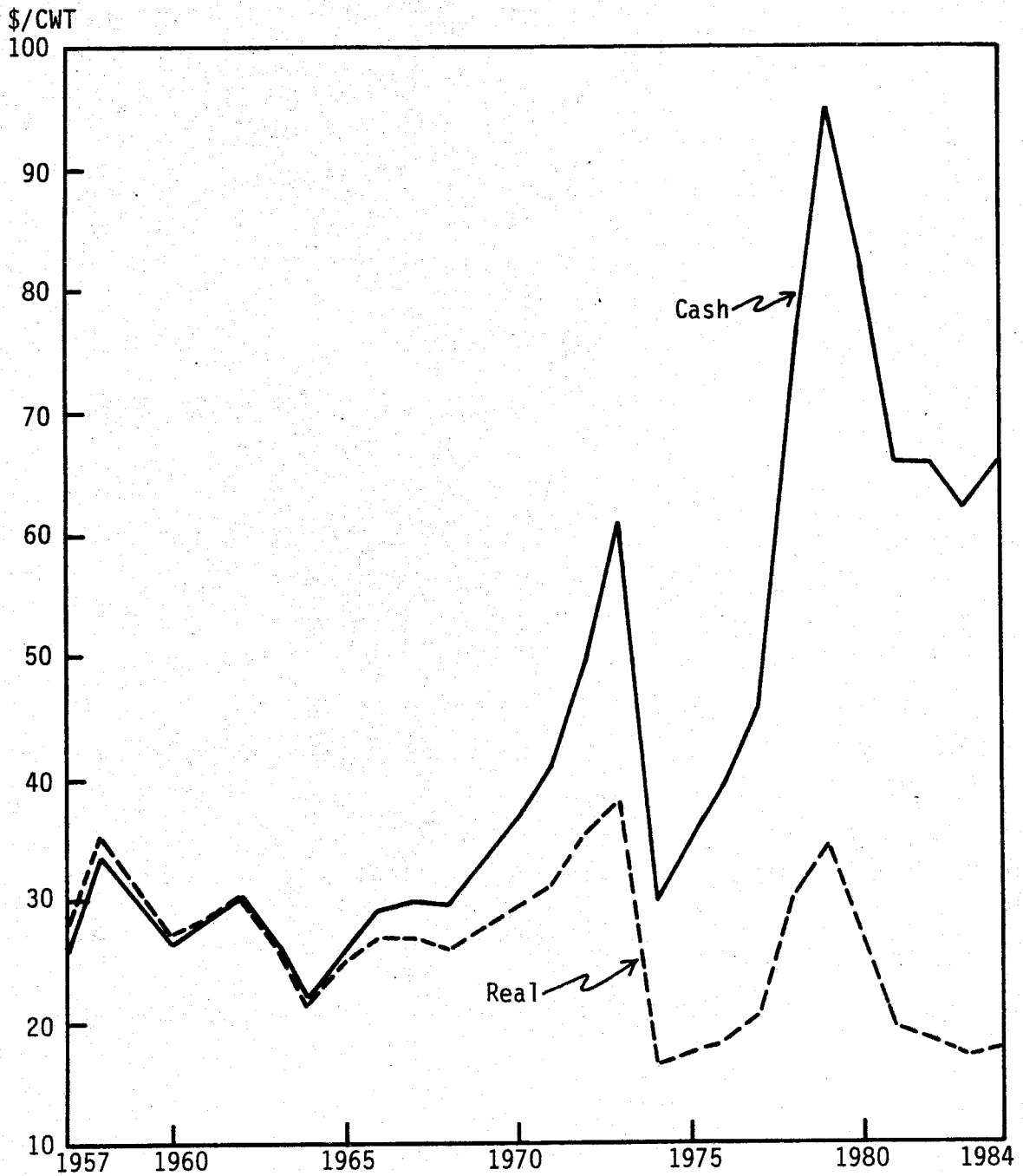
Figure 3. Cash and Real (1977=100) Market Prices for 400-500 Lb. Feeder
Steers, 1957-1984

SOURCE: Livestock Division, Market News Service, Agricultural Marketing
Service, USDA, West Fargo, North Dakota.

Although no two have been identical, past cattle cycles can be divided into three phases: expansion, liquidation, and transition. During the expansion phase, producers retain more replacement heifers and cull fewer cows than normal. As a result, cattle inventories increase while the number of slaughter animals decreases, demand for beef is high relative to supply, prices are driven up, and returns to producers are high. An expansion phase lasts several years, then as supplies increase, prices begin to drop--first for slaughter, then for feeder animals. These price decreases are usually substantial and result in large losses to some producers. Cow-calf producers now begin culling more heavily to reduce herd size. This marks the end of the expansion phase and the beginning of the liquidation phase (Craven and Hasbargen 1984).

Cattle prices and producers' returns are low in the liquidation phase. Cattle inventories increase much less rapidly and are followed by a period of inventory reductions in which slaughter is high relative to inventories. Large beef supplies, which keep prices depressed, stimulate producers to cull more heavily and retain fewer heifers. After several years, beef supplies decrease, prices recover, and the transition phase begins (Craven and Hasbargen 1984).

The cattle industry returns to normal during the transition phase. Inventories stabilize, then increase at a normal pace. Slaughter relative to inventories is normal, and cattle prices and returns are average. Eventually increases in demand for beef will exceed increases in supply and will drive prices up. This, in turn, stimulates producers to increase herd size. Thus, the cycle is completed, and producers move again into the expansion phase (Craven and Hasbargen 1984).

The existence of the cattle cycle is based on several characteristics of the beef industry. First is the profit motive, which prompts producers to make production decisions based on the current market situation. Many of these decisions are ill-timed, because producers enter the industry or expand when the outlook is favorable and prices are high, making their survival even more difficult when prices drop (Hasbargen et al. 1983). Second, a substantial period of time is required for the biological process of producing beef. This results in a lag of several years before production decisions affect the quantity of animals slaughtered. Cattle numbers usually peak in the cycle about two years after prices have peaked (Hasbargen et al. 1983). Third, the price of beef is determined in the marketplace, based on the supply and demand for beef and the condition of the economy at any given time. Many issues come into play here such as changes in the level of technology, price of inputs, price of substitutes, or consumer preferences.

The current cattle cycle has differed from past cycles considerably (Figure 4). The expansion phase, when returns to producers are generally high, lasted only three years. The liquidation phase has already extended through four years. Inventory reductions began declining in early 1982, which was three years after prices peaked in 1979.

Livestock Prices

The market prices used in this study were compiled from 1958 to 1984 (Appendix C). The prices used from 1963 to 1984 for steers and heifers are

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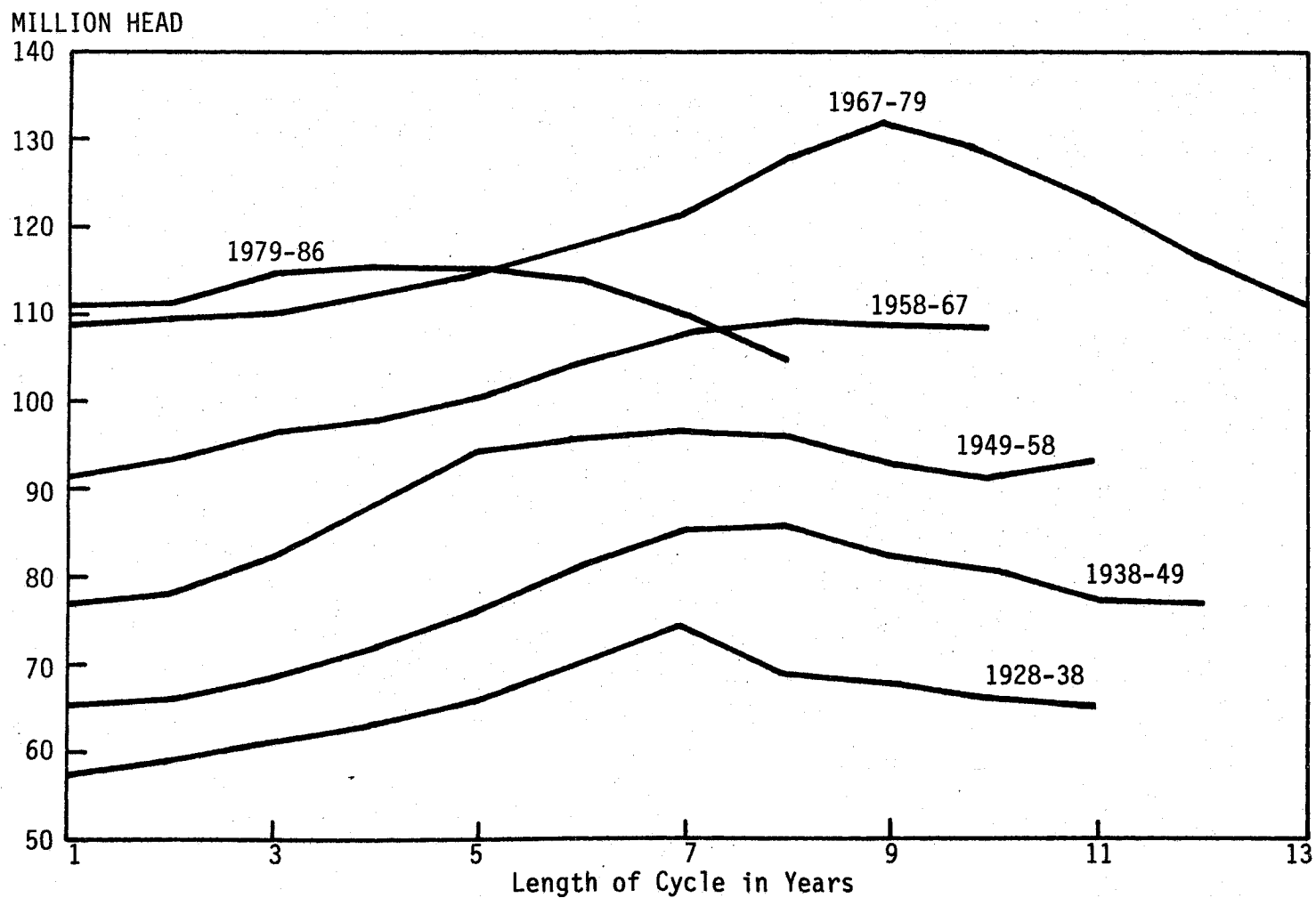
Figure 4. Cattle on Farms by Cycles, Total Inventory of 50 States

SOURCE: Tim Petry, Department of Agricultural Economics, North Dakota State University.

based on prices received at West Fargo for cattle and calves. West Fargo prices were unavailable prior to 1963 so prices received at Kansas City were adjusted and used as proxies from 1957 to 1962. Regressions were run between 10 years of prices from the two sources, with West Fargo prices as the dependent variable and Kansas City prices as the independent variable. The regressions examined the relationship between the prices at the two locations of 400-500 lb steers and heifers, 500-600 lb steers and heifers, 600-700 lb steers and heifers, and 700-800 lb steers and heifers. The equations generated in the regressions as well as the coefficients of determination (R^2) values and T-values are included in Appendix C. It should be noted that the regression results yielded fairly high R^2 and T-values, which demonstrate a strong relationship between the cattle prices from the two sources. Cow prices were based on the average prices received by farmers as reported in **North Dakota Agricultural Statistics.**

Spring and fall market prices used in this study are the averages of three months of prices in each season--March, April, and May in the spring and September, October, and November in the fall. Prices for pastured calves are the average of prices from August, September, and October. The weight categories included in fall selling are 400-500 lb steers and heifers. Weight categories for spring selling include 500-600 lb steers and heifers and 600-700 lb steers and heifers. Cull cow and heifer values were calculated based on annual price averages of cows and 700-800 lb heifers. It was assumed that the feeder cattle were all No. 1 muscle thickness and medium frame. The cow prices are averages over all grades.

Costs of Production

Budgets reflecting the costs of production of several beef cattle enterprises typical to North Dakota were constructed at 1984 price levels (Appendix A). The enterprises examined in this study include a cow-calf operation, backgrounding steers and heifers, wintering steers and heifers, pasturing steers and heifers, and wintering and pasturing steers and heifers. The approach used to construct these budgets was based on the "opportunity cost" (returns foregone in the best alternative use) of the resource. When using the opportunity cost method, inputs are valued using current market prices rather than what may have actually been paid for those inputs. Examples of resources that are valued differently using the opportunity cost method include feed, which may be cheaper when produced on the farm than if purchased; operator and family labor, which generally remains unpaid; pasture rent, which is unpaid for owned land; and interest expenses, which would not be paid when inputs were paid for at the time of purchase. The profitability derived using this method is more complete because cash and noncash expenses are considered.

The production costs were adjusted back over time to 1959 using indices of prices paid by farmers for certain goods (Appendix B). The estimated production costs were then divided by the hundredweights (cwt) of expected output per unit (e.g., cwt of calf sold per cow in a cow-calf operation) to determine a break-even price. The break-even price in a given year was subtracted from the corresponding market price (Appendix C) to yield an estimate of the enterprise's profit per cwt produced in that year. Finally, the profit per cwt was multiplied by the cwt of output per unit giving an

estimate of the enterprise's profit per production unit. No consideration is given in this study to the tax implications arising from the profitability or income sheltering through capital gains of these cattle enterprises.

There is much variation in the level of production costs among producers. Differences occur due to production practices, managerial ability, and size and type of machinery employed. This variability makes it difficult to derive an average production cost, which means that the costs individual producers incur may vary considerably from an estimate of average costs. This method of deriving production costs does not give as accurate results as actual production cost and profitability data, but the trends indicated should give a general idea of the profitability of the cattle enterprises in North Dakota over time.

Cow-Calf

The cow-calf production costs were based on an average-sized spring calving operation. Per cow cost estimates at 1984 levels include feed expense, $106.66; pasture rent, $56.00; labor, $33.60; other operating expenses (e.g., veterinarian services, medicines, supplies, fuel, and repairs), $29.50; marketing expenses (including transportation), $15.00; interest on operating expenses, $11.57; livestock interest, $43.58; and ownership costs, $21.35. The estimated total cost of production per cow was $317.26 in 1984.

It was assumed that cow-calf operators replace 16 percent of their cows annually. To allow for this, producers retain 18 percent of their calves (all heifers) from which the replacement animals are chosen. Cull cow returns were calculated by multiplying the replacement rate adjusted for death loss (16 percent minus 1 percent) by the cow's market value. Cull heifer returns were calculated by subtracting the replacement rate from the retention rate (18 percent minus 16 percent) and multiplying the difference by the heifer's market value. Cull cows and heifers were assumed to be sold at 1,000 and 750 lbs, respectively. The cull cow return was $54.30/cow and the cull heifer return $8.47/cow in 1984. A final adjustment to reflect a change in the value of the cow was made to the total production costs. This was done by adding or subtracting the difference between the cow's value in the previous year and its value in the current year from the total production costs. When cow prices drop, the cow depreciates and increases production costs. Conversely, when prices rise, the cow appreciates and reduces production costs. The cow's value decreased from 1983 to 1984, so the adjustment to the production costs was an additional $6.00. The adjusted total cost of production per cow was $260.49 in 1984 (Table 1). Adjusting for changes in the cow's value was the cause of the sharp changes in the level of adjusted production costs.

A break-even price for the cow-calf operation was calculated by dividing the adjusted production costs by the cwt of calf sold per cow. The cwt of calf sold per cow is the sum of the expected weaning weight of steers (4.25 cwt) times the percentage of steers (45 percent, half of the 90 percent calf crop), plus the expected weaning weight of heifers (4.00 cwt) times the percentage of heifers (27 percent, half of the 90 percent calf crop less the 18 percent retention rate).

TABLE 1. COW-CALF ENTERPRISE PRODUCTION COSTS, BREAK-EVEN PRICE, ADJUSTED
  SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959 TO 1984

Year	Adjusted Production Costs	Break-Even Price	Adjusted Selling Price	Estimated Profitability
	($/cow)		-($/cwt)-	
1959	73.57	24.58	29.16	4.57
1960	83.70	27.97	25.04	- 2.93
1961	60.70	20.28	26.81	6.52
1962	66.27	22.15	28.99	6.84
1963	77.44	25.88	26.18	0.30
1964	90.64	30.29	20.97	- 9.32
1965	64.72	21.63	23.66	2.03
1966	38.65	12.91	28.04	15.13
1967	74.23	24.81	28.44	3.63
1968	68.80	22.99	28.25	5.26
1969	55.41	18.52	31.93	13.41
1970	76.71	25.64	35.02	9.39
1971	81.74	27.32	39.16	11.84
1972	44.47	14.86	47.46	32.60
1973	43.53	14.55	58.73	44.19
1974	217.59	72.71	28.35	-44.36
1975	212.20	70.91	32.58	-38.33
1976	116.55	38.95	36.44	- 2.50
1977	163.31	54.57	43.47	-11.10
1978	69.67	23.28	70.59	47.31
1979	82.83	27.68	91.21	63.53
1980	272.75	91.14	78.77	-12.37
1981	305.23	102.00	63.10	-38.89
1982	298.01	99.58	63.25	-36.34
1983	255.53	85.39	58.93	-26.46
1984	260.49	87.05	62.72	-24.33

The market price, from which the break-even price was subtracted to determine profitability, is a combination of prices for both 400-500 lb steers and heifers. At weaning, 63 percent of the calves sold are steers and 37 percent are heifers. The market price is the sum of the steer price times 63 percent plus the heifer price times 37 percent.

Backgrounding and Wintering

Two winter calf-feeding programs common in North Dakota are included in the study. The first is a backgrounding program which emphasizes a higher rate of gain and requires feeding a higher protein and energy ration. The second is a wintering program which involves lower gains and a less expensive high roughage diet. Although the total production costs of the wintering program may be less, the cost per pound of gain in the backgrounding program should be

lower. Average daily gains used in this study are 1.7 and 1.0 lbs for steers and 1.5 and 0.9 lbs for heifers in the backgrounding and wintering programs, respectively. Steer and heifer calves are purchased after weaning in the fall at 425 and 400 lbs, respectively. Backgrounded steers and heifers are sold the following spring at 675 lbs and 625 lbs, respectively, and wintered steers and heifers are sold the following spring at 575 and 535 lbs, respectively.

The production costs of these two winter feeding programs are assumed to be identical, with the exception of the feed expense and the interest on operating expenses. Steer feed expense was $76.94/hd and the interest on operating expenses $2.83/hd in the backgrounding program, compared to $40.65/hd and $1.93/hd, respectively, in the wintering program (1984 levels). Other per steer production costs at 1984 levels include feeder cost, $280.63; other operating expenses, $20.72; labor, $16.80; marketing expenses, $10.00; interest on calves, $13.89; death loss, $2.81; and overhead, $10.00. The estimated total costs of production of backgrounding and wintering steers in 1984 were $434.62 and $397.43, respectively.

Heifer feed expense in 1984 was $72.64 in the backgrounding program and $38.38 in the wintering program. Interest on operating expenses was $2.73 for backgrounded heifers and $1.88 for wintered heifers. Other per heifer production costs at 1984 levels include feeder cost, $228.32; other operating expenses, $20.72; labor, $16.80; marketing expenses, $10.00; interest on calves, $11.03; death loss, $2.28; and overhead, $10.00. The estimated total costs of production of backgrounding and wintering heifers in 1984 were $374.79/hd and $339.68/hd, respectively.

Break-even prices for these two feeding programs were calculated by dividing the total production cost by the expected selling weights. Backgrounded steers and heifers are sold at 675 and 625 lbs, respectively. Wintered steers and heifers are sold at 575 and 535 lbs, respectively. Profitability of the backgrounding and wintering programs is calculated by subtracting the break-even price in a given year from the selling price in the spring of the following year. The estimated production costs, break-even prices, market prices, and profitability per cwt from 1959 to 1984 are presented for backgrounding steers and heifers in Appendix Tables D1 and D2 and for wintering steers and heifers in Appendix Tables D3 and D4.

Pasturing

Beef cattle producers often pasture calves during years of ample moisture when abundant forage is available. Steers and heifers that enter a pasturing program in this study are assumed to weigh 575 and 535 lbs, respectively, when purchased in the spring and 800 and 740 lbs, respectively, when sold in the fall after a 120-day grazing season. In this study the average daily gain is 1.9 lbs for pastured steers and 1.7 lbs for heifers.

The total production costs, break-even prices, market prices, and profitability per cwt estimated from 1959 to 1984 for the wintering steers and heifers are presented in Appendix Tables D5 and D6. The costs of pasturing steers and heifers at 1984 levels include feeder costs, $380.48/steer and $305.16/heifer; pasture rent, $40.00/hd; feed expense, $10.89/steer and $10.43/heifer; other operating expenses, $19.68/hd; labor, $10.50/hd; marketing

expenses, $10.00/hd; interest on operating expenses, $1.60/hd; interest on
calves, $15.06/steer and $12.08/heifer; death loss, $3.80/steer and
$3.05/heifer; and overhead, $5.00/hd. The total production costs in 1984 were
$497.01/steer and $417.50/heifer. A break-even price for pasturing calves is
derived by dividing the total production costs by the expected selling weight,
800 lbs for steers and 740 lbs for heifers.

Wintering and Pasturing

Producers who winter calves commonly pasture those calves following the
wintering program. Compensatory gain is greater for wintered calves than for
backgrounded calves, so their capacity for growth in a pasturing program is
greater. Total production costs in a wintering and pasturing program in this
study are equal to the total production costs of pasturing in a given year plus
the total production costs of wintering in the preceding year. The total
production costs of wintering and pasturing steers and heifers in 1984 were
$484.32 and $423.95, respectively. The estimated total production costs,
break-even prices, market prices, and profitability per cwt for pasturing and
wintering steers and heifers from 1959 to 1984 are presented in Appendix Tables
D7 and D8.

Profitability

According to Ikerd (1979), the real key to understanding the cattle
cycle is understanding the cyclical nature of profits. Profits more than
anything else spur expansion and liquidation within the cattle industry. This
is especially true with cow-calf operators, who represent the starting point in
the production process.

The estimated profitability per production unit of each cattle
enterprise examined is presented in Table 2. These estimates of profitability
are reflections of the opportunity costs of each given enterprise, with no
consideration given to tax implications or treatment. The trends in the
profitability of each enterprise follow the cattle cycle closely. As might be
expected, profits were greatest during the years following cattle inventory
reductions--1966, 1972, 1973, 1978, and 1979. Likewise, losses were greatest
in the bust years when the supply of cattle was the greatest--1964, 1974, 1975,
1981, 1982, 1983, and 1984.

The cow-calf operation in this study had an average profitability of
$2.26 per cow from 1959 to 1984. Considerable variability was also displayed
(Figure 5). This is evident in the large standard deviation and the wide range
between the maximum and minimum profit values. Although the cow-calf operation
starting point in the production process, it is the last to feel the effect of
price changes within the industry. This demonstrates the vulnerability of
cow-calf operators to the boom-and-bust periods that characterize the cattle
cycle. Slaughter plant and feedlot operators are capable, to some extent, of
passing some of their losses along in the system. Their decisions to buy and
at what price are based on anticipated market conditions at the expected time
of sale. For example, if a feedlot operator expects difficult times ahead,
then his bid price when purchasing feeders will be correspondingly adjusted
down to reflect that. Feeders also have the option to operate at less than

TABLE 2. ESTIMATED PROFITABILITY PER PRODUCTION UNIT OF SELECTED NORTH DAKOTA BEEF CATTLE ENTERPRISES, 1959-1984

Year	Cow-Calf	Backgrounding Steers	Wintering Steers	Pasturing Steers	Wintering and Pasturing Steers	Backgrounding Heifers	Wintering Heifers	Pasturing Heifers	Wintering and Pasturing Heifers
	($/cow)				-($/head)-				
1959	13.69	23.17	4.91	16.71	24.22	17.08	2.27	22.65	27.53
1960	- 8.78	15.98	0.89	- 3.29	0.24	7.11	- 6.37	20.83	17.10
1961	19.52	20.14	6.80	17.93	27.38	16.63	3.38	19.96	26.00
1962	20.48	13.24	0.03	38.05	40.75	9.05	- 4.19	19.98	18.46
1963	0.89	- 6.55	- 18.47	25.67	9.91	- 7.76	-15.78	11.06	- 2.01
1964	- 27.90	- 19.33	- 26.66	9.06	- 14.84	- 21.20	-26.01	- 1.41	- 24.66
1965	6.07	8.06	- 0.01	36.87	39.64	- 6.21	-10.25	25.34	17.87
1966	45.27	24.12	10.96	10.52	24.32	26.19	15.63	19.00	37.47
1967	10.87	0.41	- 11.10	15.20	7.05	- 6.08	-13.68	20.04	9.33
1968	15.73	5.69	- 7.29	8.03	3.77	0.29	- 8.32	15.17	9.87
1969	40.14	26.95	10.24	24.96	38.31	16.99	5.30	22.69	31.10
1970	28.09	35.07	14.77	- 5.00	13.03	21.76	8.75	9.05	21.06
1971	35.44	11.64	- 6.96	29.02	25.43	5.90	- 7.69	37.16	32.85
1972	97.55	31.78	19.85	43.15	66.56	13.01	11.04	14.96	29.57
1973	132.23	80.16	60.63	56.77	121.18	61.89	47.40	35.20	86.37
1974	-132.76	- 64.34	- 62.09	-75.62	-133.36	- 58.95	-60.13	-72.17	-127.95
1975	-114.70	- 13.42	- 15.47	43.30	32.76	- 32.02	-33.68	27.44	- 1.30
1976	- 7.49	38.59	33.90	-31.77	7.56	18.60	15.25	-31.76	- 11.07
1977	- 33.23	- 0.46	- 1.30	8.52	13.02	- 11.46	-11.12	4.03	- 1.29
1978	141.57	73.43	63.37	77.70	147.17	60.26	50.49	41.48	98.06
1979	190.12	156.63	124.80	5.77	137.15	119.46	98.84	-46.02	59.41
1980	- 37.02	- 58.33	- 72.19	22.11	- 42.58	- 69.09	-75.62	15.12	- 53.00
1981	-116.39	- 57.26	- 69.23	-11.46	- 72.27	- 56.15	-68.09	-21.96	- 81.63
1982	-108.74	- 3.24	- 18.74	21.58	11.99	- 25.33	-41.18	14.15	- 17.89
1983	- 79.18	15.10	- 1.28	-53.19	- 44.90	- 2.82	-17.05	-54.15	- 61.63
1984	- 72.81	17.69	2.96	4.35	17.07	- 7.83	-16.18	5.26	- 1.17
Average	2.26	14.42	1.67	12.88	19.25	3.43	- 6.04	6.66	5.33
Standard									
Deviation	78.75	43.66	39.71	31.32	57.63	38.22	35.74	28.07	47.19
Maximum	190.12	156.63	124.80	77.70	147.17	119.46	98.84	41.48	98.06
Minimum	-132.76	- 64.34	- 72.19	-75.62	-133.36	- 69.09	-75.62	-72.17	-127.95
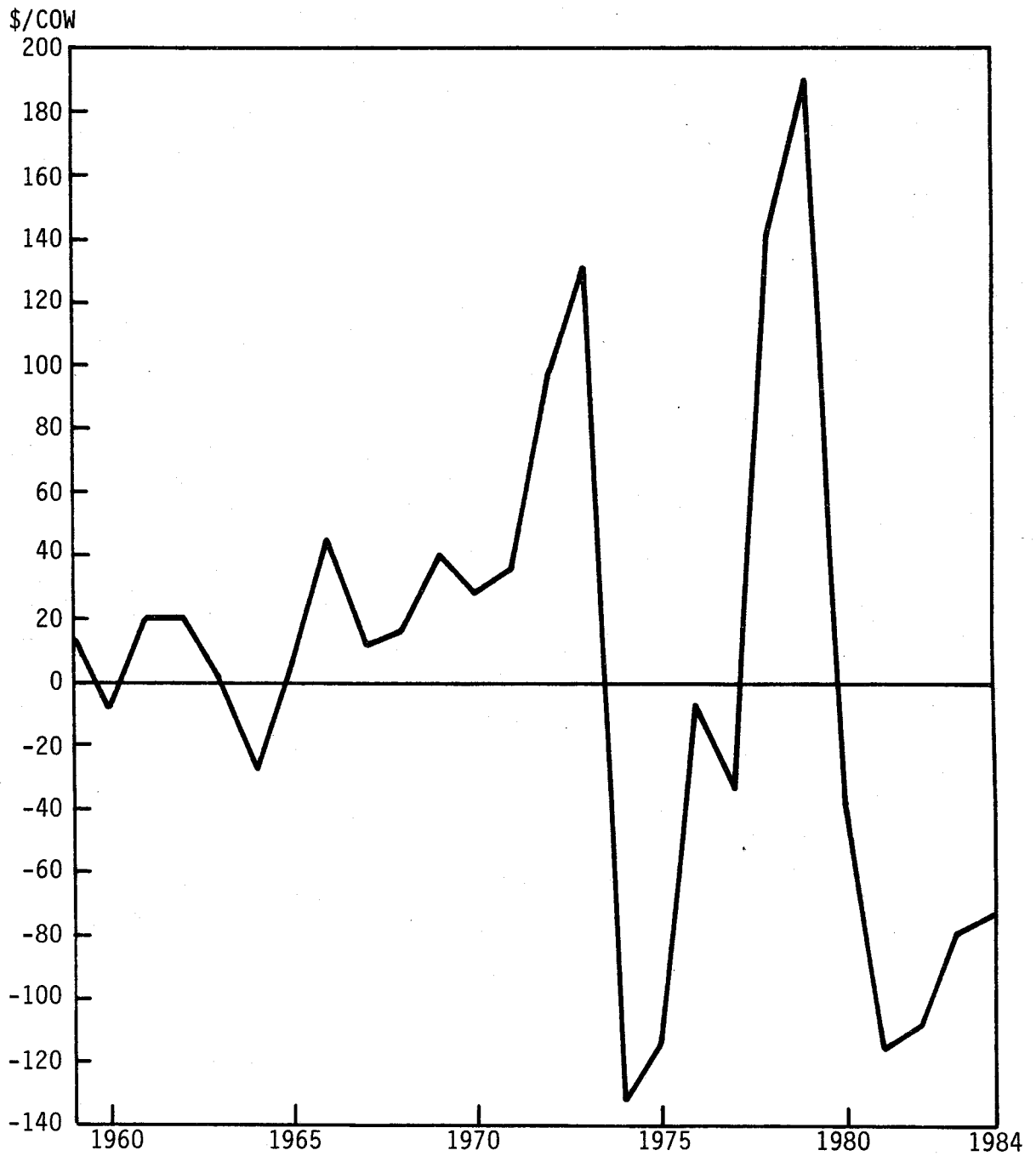
Figure 5. Estimated Profitability Per Cow on an Average North Dakota
Cow-Calf Operation (77 Cows), 1959-1984

full capacity. Cow-calf operators often have little choice but to accept the lower price. Thus, cow-calf operators receive a culmination of losses that occur as lower slaughter and feeder cattle prices and feeding losses are passed through the marketing system (Hasbargen et al. 1983).

Because the backgrounding and wintering programs are so similar in nature, they have similar trends in profitability (Figures 6A, 6B, 7A, and 7B). The backgrounding program was shown, on the average, to be considerably more profitable than the wintering program, especially when feeding steers. However, the profitability of backgrounding both steers and heifers displayed more variability than its counterpart. Both the standard deviation and the difference between the maximum and minimum profit per head were larger in the backgrounding programs.

The summer pasturing program had an average profitability of $12.88/steer and $6.66/heifer. The variability in this program was low relative to the other cattle feeding enterprises, but so were potential returns (Figures 8A and 8B).

Producers could have increased their average profitability per head considerably by pasturing calves following a wintering program (Figures 9A and 9B). Profitability per steer would have jumped from $1.67 to $19.25, while profitability per heifer would have increased from -$6.04 to $5.33. However, variation in profitability would also have increased substantially, as is evidenced by the larger standard deviations for wintering and pasturing steers and heifers.

Vertical Integration

It has been demonstrated thus far in this study that substantial financial risk is involved in operating a cow-calf enterprise. The purpose of this section is to estimate any benefits a producer might have received by vertically integrating during the study period. Vertical integration is the combination of successive steps in the production and marketing process within one firm. In this case, cow-calf operators keep and feed their calves after weaning. If a producer has the flexibility, this can be a viable strategy for dealing with bust phases of the cattle cycle. Three options of retained ownership following weaning are considered: (1) background the calf and sell in the spring, (2) winter the calf and sell in the spring, and (3) winter and pasture the calf and sell in the fall.

Total production costs of these extended enterprises were calculated by combining the production costs of the respective enterprises included (Table 3). (Purchase price of the calves was not included.) The specified production coefficients did not change. It was assumed that sufficient pasture was available for rent so no adjustments in the size of the cow herd were required in Option 3. Because the wintering and pasturing option requires more than one year, the cow-calf and wintering production costs in a given year were added to the pasturing production costs in the following year to ensure continuity through time. Break-even prices and estimated profit per cwt produced for the above alternatives were calculated in the same manner as for the cow-calf enterprise and are presented in Appendix Tables D9 and D10.

$/HEAD
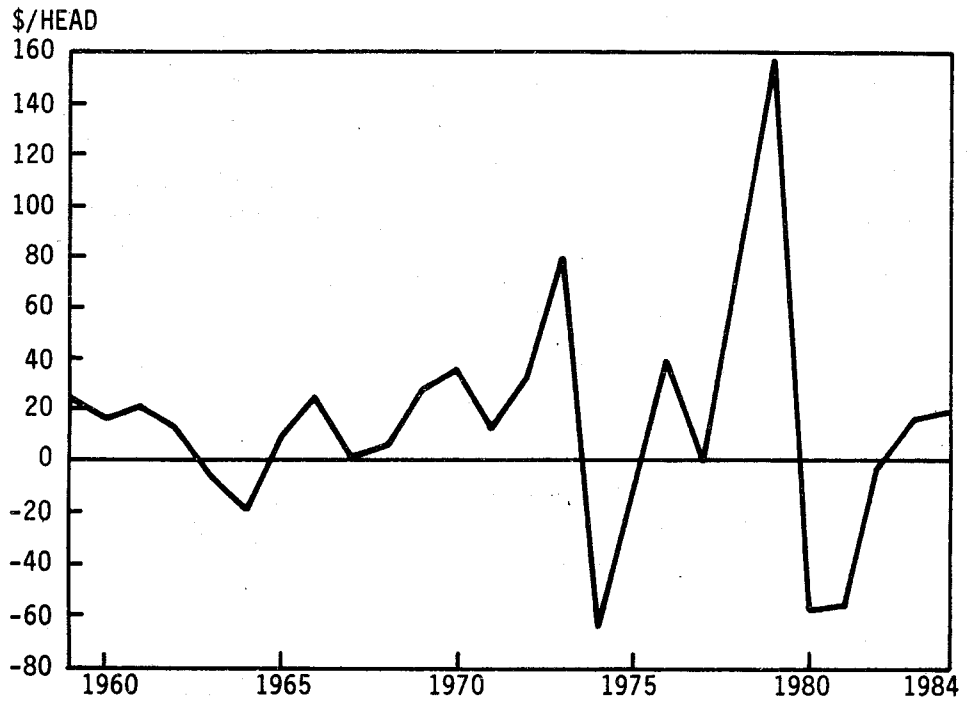
Figure 6A. Estimated Profitability of Backgrounding Steers in
North Dakota, 1959-1984

$/HEAD
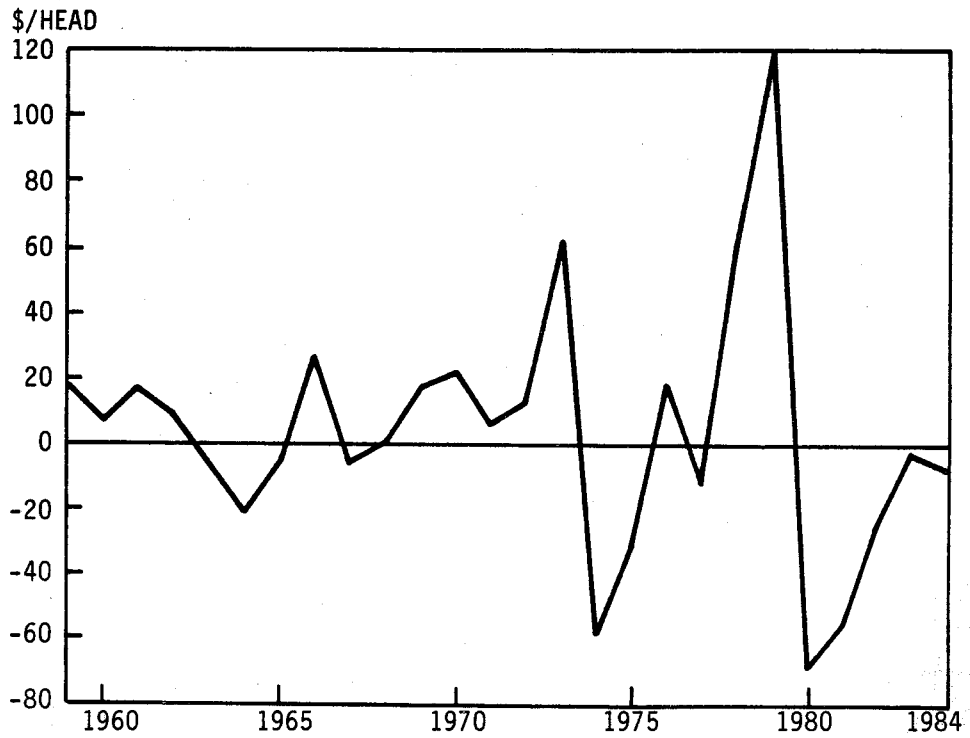
Figure 6B. Estimated Profitability of Backgrounding Heifers in
North Dakota, 1959-1984

$/HEAD
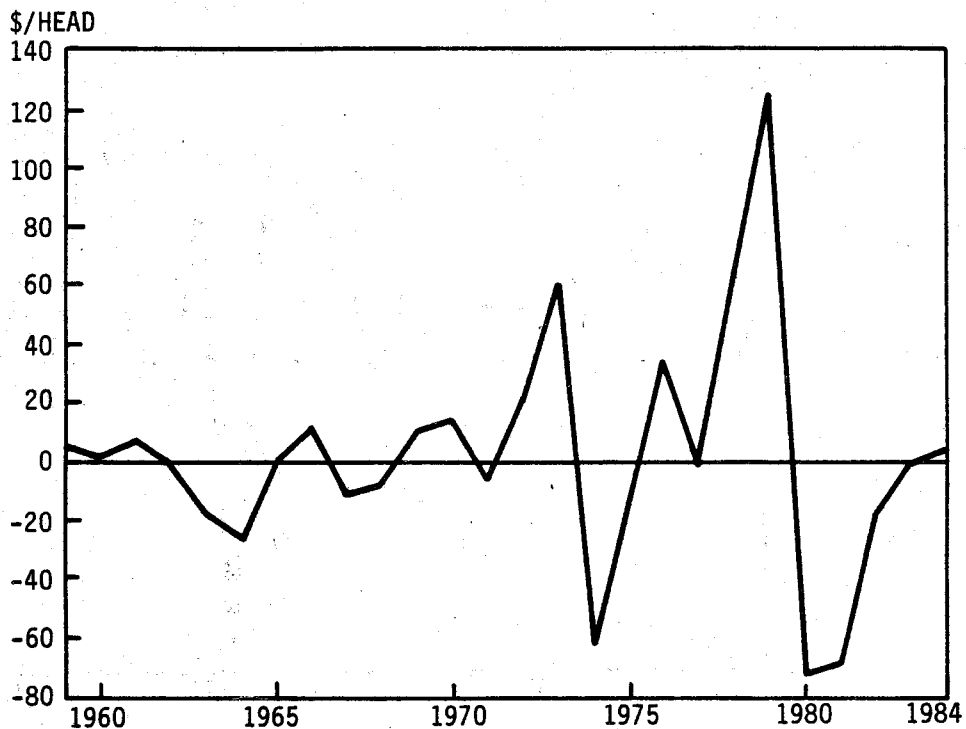
Figure 7A. Estimated Profitability of Wintering Steers in North Dakota, 1959-1984

$/HEAD
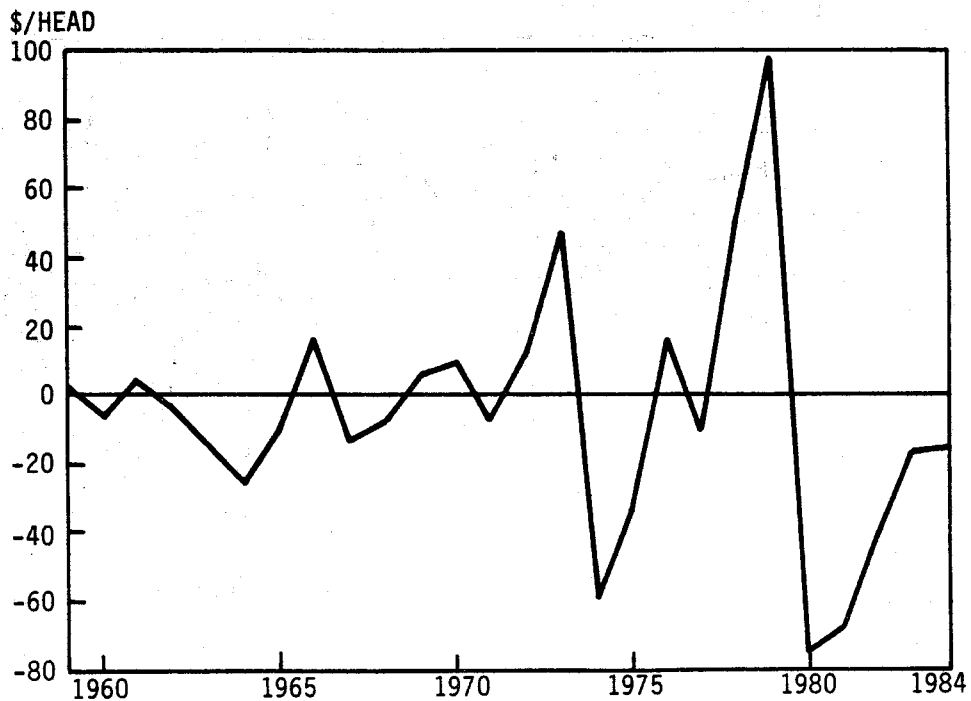
Figure 7B. Estimated Profitability of Wintering Heifers in North Dakota, 1959-1984

$/HEAD
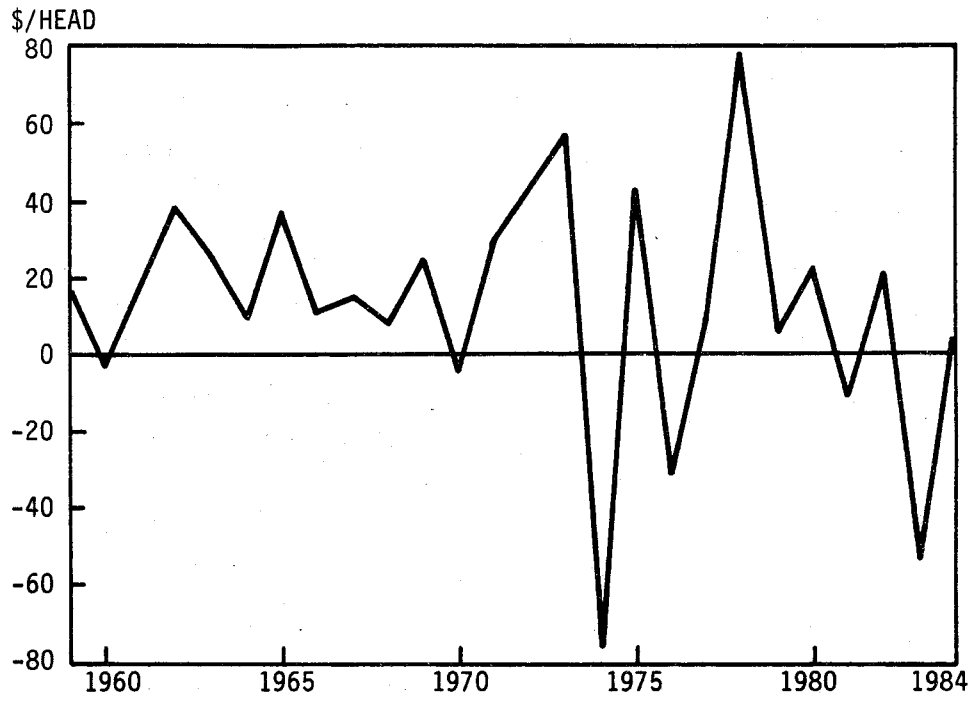
Figure 8A. Estimated Profitability of Pasturing Steers in North
Dakota, 1959-1984

$/HEAD
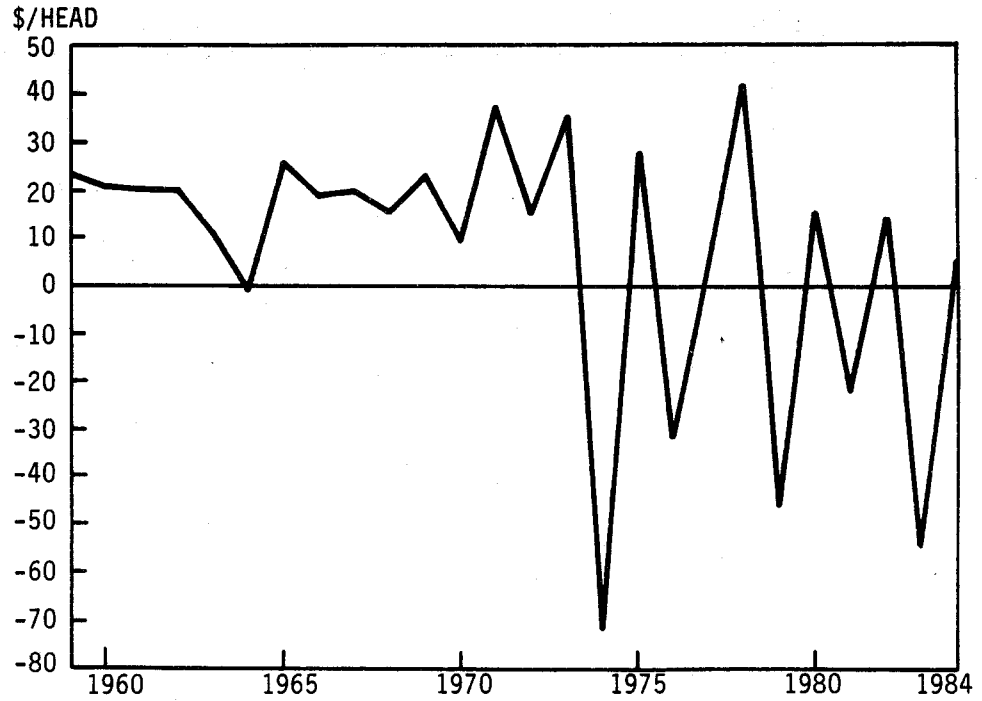
Figure 8B. Estimated Profitability of Pasturing Heifers in North
Dakota, 1959-1984

$/HEAD
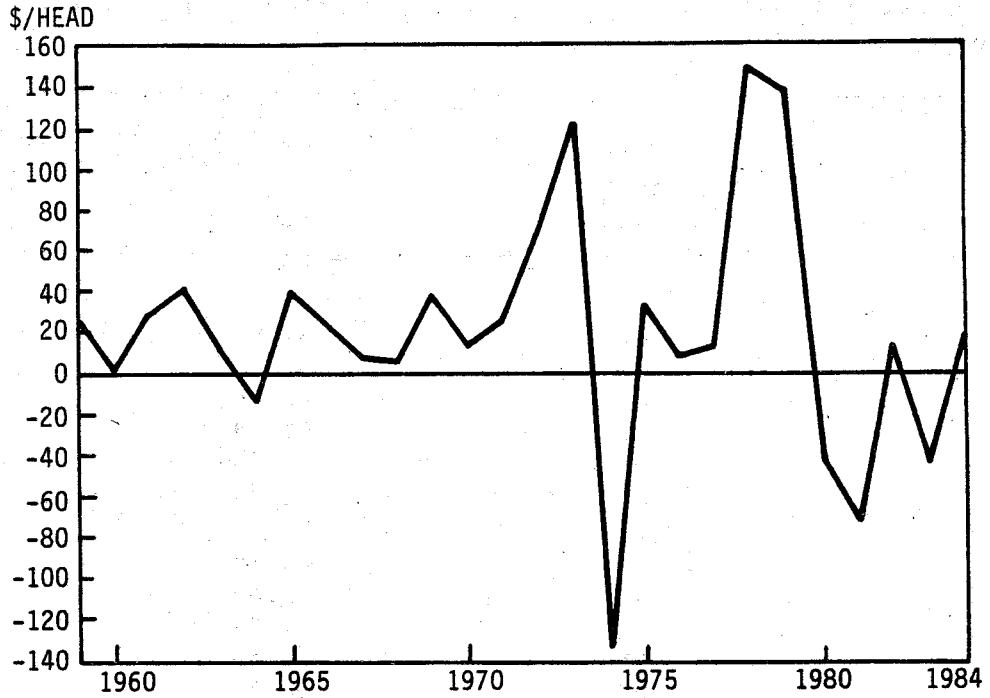
Figure 9A. Estimated Profitability of Wintering and Pasturing Steers
in North Dakota, 1959-1984

$/HEAD
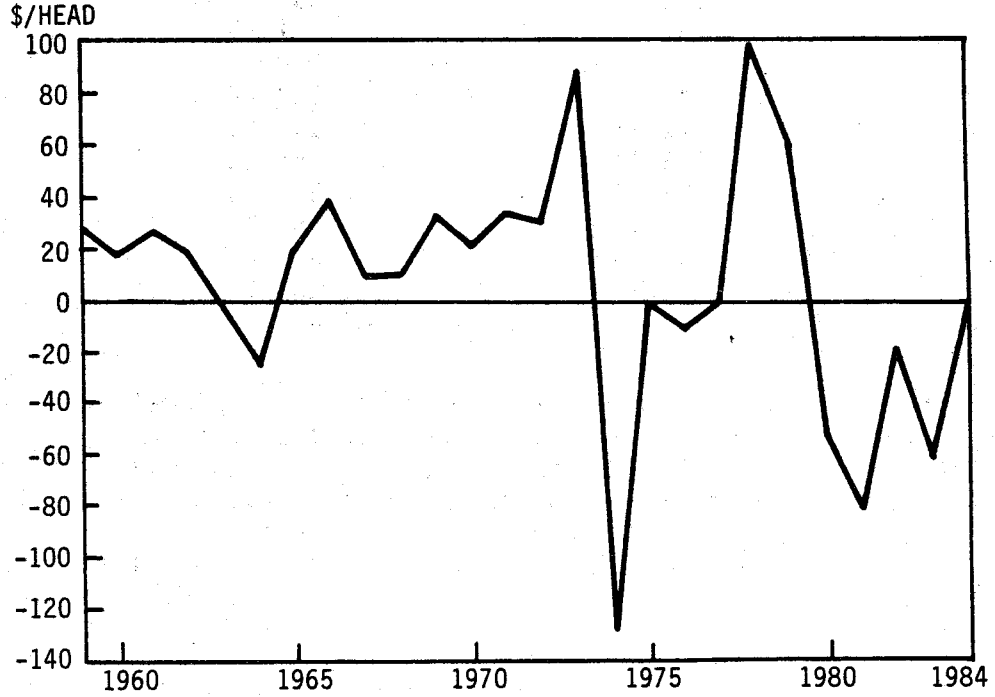
Figure 9B. Estimated Profitability of Wintering and Pasturing Heifers
in North Dakota, 1959-1984

TABLE 3. ESTIMATED PRODUCTION COSTS OF THE RETAINED OWNERSHIP ALTERNATIVES, 1959-1984

Year	Cow-Calf and Backgrounding	Cow-Calf and Wintering	Cow-Calf, Wintering and Pasturing
		-($/cow)-	
1959	104.41	94.88	52.76
1960	113.65	104.36	116.41
1961	91.05	81.66	125.72
1962	97.11	87.63	103.16
1963	109.05	99.13	109.21
1964	121.61	111.79	120.27
1965	96.54	86.61	133.43
1966	72.51	62.14	109.78
1967	108.11	97.88	85.47
1968	102.01	92.39	122.26
1969	90.69	80.85	118.89
1970	113.86	103.45	108.29
1971	119.90	109.15	131.41
1972	84.21	73.37	139.36
1973	100.32	83.81	112.32
1974	280.86	260.81	128.52
1975	275.36	256.10	305.62
1976	181.52	161.88	303.74
1977	229.36	210.19	211.35
1978	142.30	123.42	267.16
1979	170.81	149.53	196.33
1980	368.49	344.42	226.17
1981	405.95	379.74	425.25
1982	392.12	368.39	457.32
1983	349.69	323.88	443.30
1984	357.33	331.12	399.63

The estimated profitability per cow of the vertical integration alternatives is presented in Table 4 and illustrated in Figures 10, 11, and 12. The estimated profitability of the cow-calf operation is included for comparison. No profitability is listed for the retained ownership options in 1958, the first year of the study. This is because calves from the first year of the study had not entered the feeding program at that time. Because calves from the 1958 calf crop entered the feeding programs that year, the first year in which profitability could be calculated is 1959.

All three forms of retained ownership have greater variability than the cow-calf operation. There is, however, greater potential payoff in retaining ownership, as evidenced by the significantly larger maximum profitability values. All three retained ownership alternatives improved the profitability of the cow-calf operation. The average profitability per cow of the cow-calf

TABLE 4. ESTIMATED PROFITABILITY PER COW OF A TYPICAL NORTH DAKOTA COW-CALF
OPERATION AND THE RETAINED OWNERSHIP ALTERNATIVES, 1959-1984

Year	Cow-Calf	Cow-Calf and Backgrounding	Cow-Calf and Wintering	Cow-Calf, Wintering and Pasturing
		($/cow)		
1958	87.18	--	--	--
1959	13.69	105.29	93.10	108.69
1960	- 8.78	25.88	15.46	21.74
1961	19.52	7.93	- 1.65	13.76
1962	20.48	31.09	21.57	45.87
1963	0.89	18.67	11.17	27.55
1964	- 27.90	- 10.24	- 14.82	- 9.21
1965	6.07	- 22.75	- 27.43	- 2.08
1966	45.27	27.40	18.65	30.66
1967	10.87	47.30	40.10	54.55
1968	15.73	17.08	8.95	18.93
1969	40.14	36.09	25.45	45.06
1970	28.09	65.60	53.01	55.70
1971	35.44	38.92	26.92	52.56
1972	97.55	57.37	51.56	77.34
1973	132.23	154.72	142.07	179.67
1974	-132.76	92.55	93.23	42.83
1975	-114.70	-141.70	-143.06	-112.73
1976	- 7.49	- 85.99	- 88.98	-107.96
1977	- 33.23	- 3.98	- 4.23	4.84
1978	141.57	23.31	16.14	66.42
1979	190.12	251.96	232.16	226.59
1980	- 37.02	154.02	146.09	165.48
1981	-116.39	- 67.91	- 76.52	- 81.64
1982	-108.74	-113.94	-125.19	-105.12
1983	- 79.18	- 91.39	-102.58	-134.26
1984	- 72.81	- 61.89	- 70.70	- 60.27
Average	2.26	21.36	13.09	24.04
Standard Deviation	78.75	86.18	84.29	87.61
Maximum	190.12	251.96	232.16	226.59
Minimum	-132.76	-141.70	-143.06	-134.26

and backgrounding option was $21.36; the wintering option, $13.09; and the
cow-calf wintering and pasturing option, $24.04. The cow-calf operation
generated a positive profitability in 16 of the 27 years examined. Retaining
ownership in a wintering and pasturing program resulted in 18 of 26 years of
positive profitability; the backgrounding program, 17 years; and the wintering
program, 16 years.

$/COW
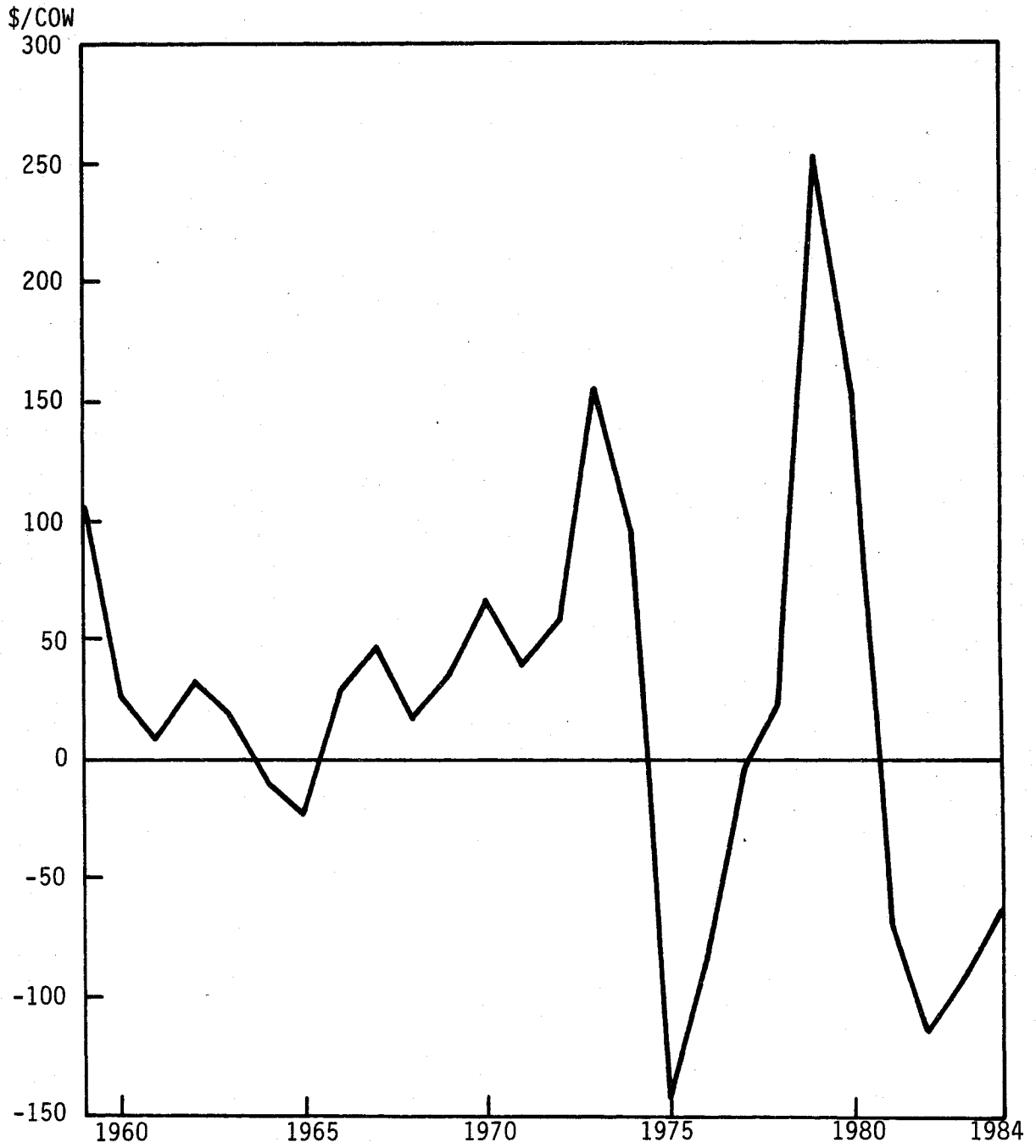
Figure 10. Estimated Profitability Per Cow on a Cow-Calf With Backgrounding
    Operation, 1959-1984
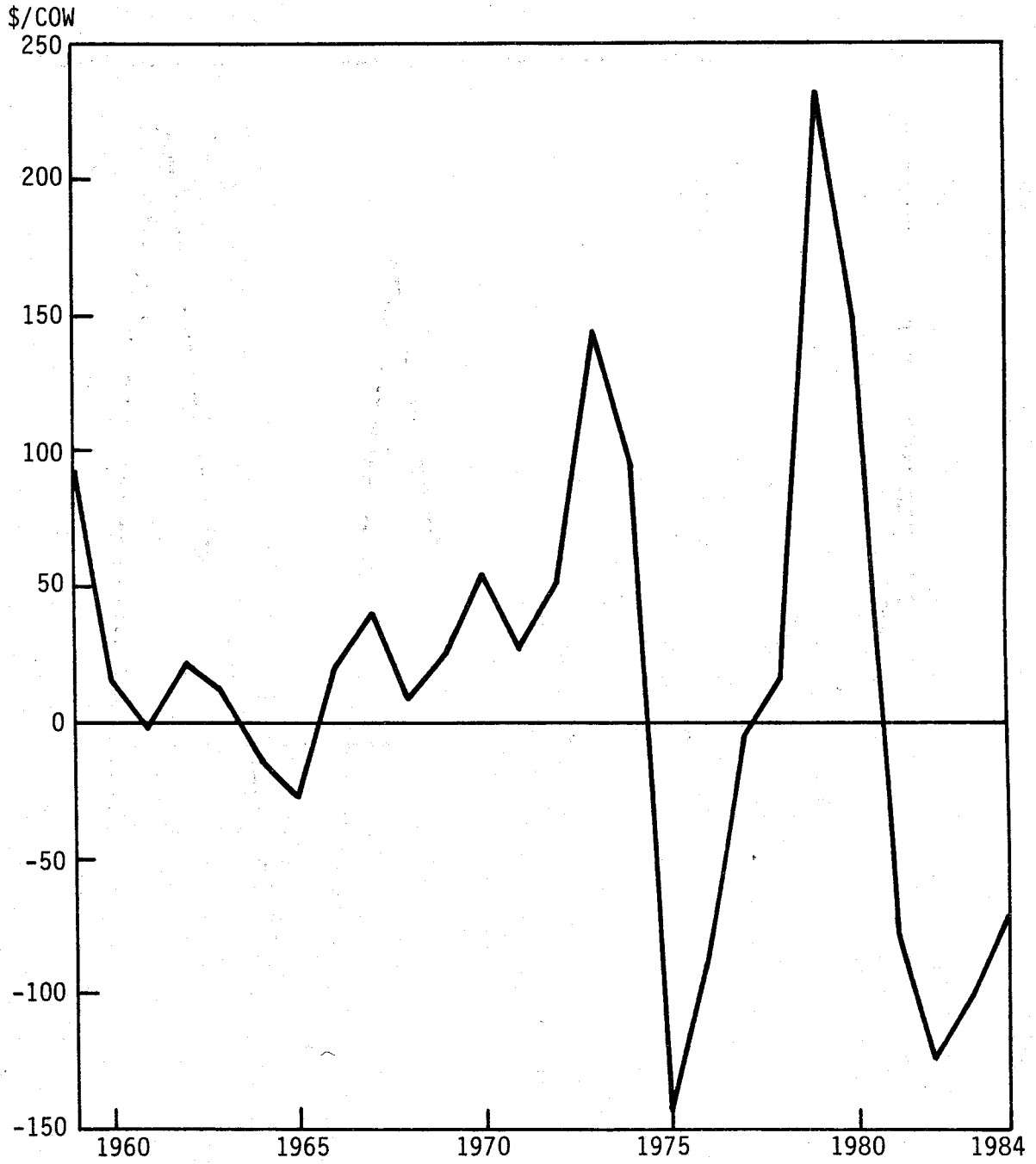
Figure 11. Estimated Profitability Per Cow on a Cow-Calf With Wintering
   Operation, 1959-1984
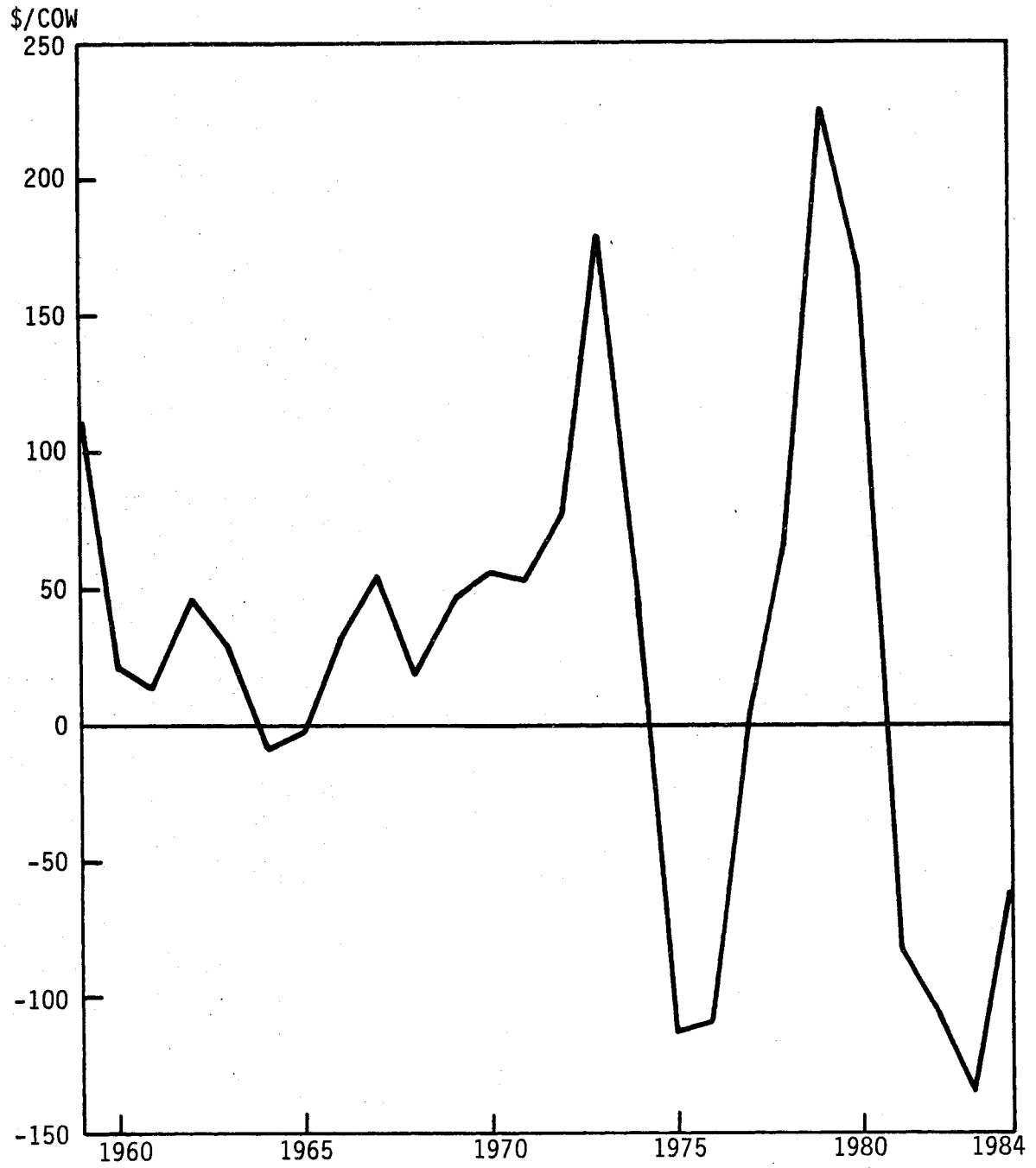
Figure 12. Estimated Profitability Per Cow on a Cow-Calf With Wintering and Pasturing Operation, 1959-1984

The best method of evaluating the cow-calf operation and the retained ownership alternatives is by comparing profitabilities when calves from a given calf crop are sold. Calves in a cow-calf operation are sold after weaning in the fall. Producers who retain ownership beyond weaning sell calves the following year. It is possible to determine which production choice would have been optimal by comparing the profitability of a cow-calf operation in a given year with the profitability of the retained ownership alternatives in the following year.

The cow-calf, wintering, and pasturing option improved the profitability per cow over the cow-calf option in 20 of the 26 years studied; the cow-calf and backgrounding option, 20 years; and the cow-calf and wintering option in 17 years. Producers could have realized greatest benefits by retaining ownership of their calves in 1958, 1960, 1965, 1968, 1969, 1971, 1972, 1977, and 1978. The cow-calf producer would have been better off selling his calves at weaning in the remaining years. The profitability per cow was reduced the most by retaining ownership in 1963, 1973, 1974, 1979, and 1980.

Implications

The purpose of this project was to determine the profitability of several North Dakota beef production enterprises over time. The results support the generally held view that there is considerable financial risk in producing beef, especially in cow-calf operations. Variability in profits has been increasing over time (Table 5). The standard deviation of the profitability of each enterprise from 1972 to 1984 was significantly higher than that from 1959 to 1971. The average profit of feeding steers increased in the backgrounding and wintering programs but decreased in the pasturing program, while the average profit of feeding heifers decreased in all three feeding programs. The average profit in the cow-calf operation dropped over $55.00/cow. The average profit per cow in the operations that retained ownership also dropped from the first period to the second, but not to the extent of the cow-calf operation. Variability, as measured by the standard deviation, increased more in the cow-calf operation than in the operations that retained ownership. These results demonstrate clearly that the risks involved in cattle production have been increasing rapidly since 1972.

What does this imply for North Dakota cattle producers? Producers and lenders must develop a working knowledge of the beef cattle cycle, its causes and effects, and indicators that give clues to the current stage of the cattle cycle. Operators cannot simply produce and expect to survive without considering the market situation. A 1974 survey of Oklahoma ranchers concluded that most cow-calf operators were not well-informed about inventory changes or new developments in the industry on a national scale. The study also concluded that most cow-calf operators were reluctant to acknowledge that the collective impact of individual decisions to increase production is the major cause of the cyclically lower prices. They instead blamed the condition of the industry on the government, the weather, imports, etc. (Keith and Purcell 1976).

In these days of rising production costs and increasing price variability (and consequently profit variability), knowledge of the cattle cycle and how to use it can assist in the survival of many operations. Hasbargen et al. (1983) list seven indicators which, when used together, can

TABLE 5. AVERAGE AND STANDARD DEVIATION OF ESTIMATED PROFIT OF NORTH DAKOTA CATTLE ENTERPRISES AND
RETAINED OWNERSHIP ALTERNATIVES, 1959-1971, 1972-1984

| | Backgrounding | | Wintering | | Pasturing | | Wintering and Pasturing | |
	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers
1959-1971								
Average ($/head)	12.20	6.13	- 1.68	- 4.38	17.21	18.58	18.40	17.07
Standard Deviation	14.21	13.24	11.62	10.81	13.02	8.75	16.23	15.90
1972-1984								
Average ($/head)	16.64	0.74	5.02	- 7.69	8.56	- 5.26	20.10	- 6.42
Standard Deviation	60.00	52.27	54.73	49.32	41.89	34.86	79.86	62.65

	Cow-Calf	Cow-Calf and Backgrounding	Cow-Calf and Wintering	Cow-Calf, Wintering, and Pasturing
1959-1971				
Average ($/cow)	15.35	29.87	20.81	35.67
Standard Deviation	19.39	31.08	29.17	29.16
1972-1984				
Average ($/cow)	- 10.83	12.86	5.38	12.40
Standard Deviation	108.10	117.23	115.06	119.29

enable a producer to track progress of the cattle cycle. Even though no two cycles are identical, the basic trends are similar and these indicators reflect those trends. The indicators are as follows: (1) year of cattle cycle, (2) percentage of annual expansion in all cattle numbers, (3) percentage of annual expansion in all cow numbers, (4) ratio of annual cattle and calf slaughter to January 1 inventory, (5) ratio of annual cattle and calf slaughter to previous year's calf crop, (6) ratio of annual cow slaughter to January 1 inventory of all cows, and (7) ratio of cow and heifer slaughter to steer slaughter. The use of indicators, as explained by Hasbargen et al., is discussed below.

The year of the cattle cycle merely tracks the years from one low point in cattle numbers to the next. Cattle numbers in every cycle thus far in the twentieth century have taken from six to eight years to go from the low point to the high point. Large price breaks can usually be expected during the fifth to the seventh year of expansion because cattle prices drop one to two years before inventories begin to decrease.

The percentage of annual expansion in all cattle numbers reflects growth in the industry as a whole. Historically, beef demand has increased about 2 percent per year as a result of increased per capita income and population growth. Therefore, when expansion in the cattle industry was below 2 percent, higher prices could be expected. Conversely, when the growth rate exceeded 2 percent, an excessive supply depressed prices during the following years. The annual increase in demand of 2 percent is not a hard and fast figure. It is subject to change based on the condition of the general economy, rate of population growth, and changes in consumer preferences.

The percentage of annual expansion in all cow numbers is a reflection of the production capacity of the nation's cow herd. If herd growth exceeds 2 percent annually for several years, inventories will increase faster than demand and overproduction will occur.

The ratio of annual cattle and calf slaughter numbers to the January 1 cattle and calf inventory numbers provides a measure of how rapidly the nation's cattle herd is changing in size. The normal rate of kill should be about 37 percent of inventory. If the ratio is less than 37 percent, the cattle herd is increasing too fast.

The ratio of annual cattle and calf slaughter numbers to the size of the previous year's calf crop is another measure of changing herd size. A ratio below 88 percent indicates the cattle herd is building too rapidly, and a ratio greater than 88 percent indicates reductions in herd size.

The ratio of annual cow slaughter numbers to the January 1 inventory of all cows is an excellent measure of changing herd size. During the past two cycles, a ratio below 14 percent indicated expansion and a ratio below 13 percent indicated overexpansion because too many cows were being kept in production. The danger level of this indicator has been moving lower as the proportion of beef cows in the total cow herd increases.

Finally, the ratio of cow and heifer slaughter to steer slaughter provides another measure of changing herd size. A ratio of 90 percent or less indicates that too many heifers are being retained in the herd for expansion.

The use of these indicators enables producers to make timely production and marketing decisions. The numbers necessary for the computation of these ratios are available in publications from the USDA Statistical Reporting Service and Economic Research Service, some of these are; **Livestock and Meat Statistics; Meat Animals Production, Disposition, and Income; Livestock Slaughter; Livestock and Poultry Outlook and Situation Report,** and the **Cattle on Feed Report.** It should be noted that the development of these indicators was based on performance in past cattle cycles. While they should reflect trends occurring in the current cattle cycle, the accuracy of these indicators may be affected by unforeseen developments that influence the industry. For example, the whole herd dairy buy-out program will increase the supply of beef and change the constitution of the total cow herd drastically, which may distort the information provided by the indicators. In addition, Hilker et al. (1985) indicate that the demand for beef has declined significantly in recent years. This may affect the relevant values of these indicators.

Maintaining flexibility in an operation is an important method of reducing variability caused by cattle cycles. Production flexibility is especially beneficial in the bust years by enabling producers to at least reduce losses to some extent. It was shown that cow-calf operators could have potentially benefited in most years by vertically integrating in the form of extended ownership of their calves. Cow-calf operations generally remain unprofitable for several years after a price break while feeder operations rebound more quickly in the early expansion phases of the cattle cycle. There were other years, however, when selling calves at weaning was the most profitable alternative.

One possible option available to producers with sufficient flexibility is adjustment in the constitution of the cow herd based on future expectations of market performance. During periods of low prices, producers could cull and sell a larger number of cows and hold a larger number of replacement heifers. The difference between cow and heifer prices would be minimal in a depressed market, so more income would be generated by selling cows. By retaining more replacement heifers, the producer rebuilds a younger cow herd and is prepared to capitalize on price improvements.

Summary

The profitability of several beef cattle enterprises typical to North Dakota was estimated from 1959 to 1984 using cost of production budgets constructed to reflect the opportunity costs of the inputs used. The enterprises examined include cow-calf, backgrounding, wintering, and wintering and pasturing operations. Benefits of retaining ownership of calves by cow-calf operators were also considered as a means of increasing profitability per cow. The retained ownership alternatives included cow-calf and backgrounding; cow-calf and wintering; and cow-calf, wintering, and pasturing.

The beef cattle cycle, complete with the risks it imposes on raising cattle, is very much a part of livestock production. The results of this study support this fact. They have indicated that beef production in North Dakota has been very risky, especially in recent years. The cow-calf operation has the greatest amount of risk due to its position in the production and marketing process. It receives a culmination of losses that

are passed through the marketing system during bad years. However, by
maintaining production and marketing flexibility, cow-calf producers have the
potential of reducing risk and improving the profitability of their
operations.

APPENDIX A

COW-CALF BUDGET (1984)

	(Per Cow)
Feed Expense	$106.66
Pasture Rent 7 AUM @ $8/AUM	56.00
Labor 8 hrs @ $4.20/hr	33.60
Other Operating Expenses	29.50
Marketing Expenses	15.00
Interest on Operating Expenses[1]	11.57
Livestock Interest[2]	43.58
Ownership Costs[3]	21.35
Total Production Costs	$317.26

Adjustments

Cull Cow Return[4]	$-54.30
Cull Heifer Return[5]	- 8.47
$\pm\Delta$ in Value of Cow[6]	-(-6.00)
Adjusted Production Costs	$260.49

Break-Even Price: 4.25 cwt x .45 = 1.9125
              4.00 cwt x .27 = 1.0800 $260.49   = $ 87.05/cwt
                               2.9925   2.9925 cwt

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[1]Interest on operating expenses = (feed expense + pasture rent + other operating expenses) x interest rate x .5

[2]Livestock interest = (cow value x interest rate)

[3]Excluding livestock interest

[4]Cull cow return = (replacement rate - death rate) x cow value

[5]Cull heifer return = (retention rate - replacement rate) x heifer value

[6]Change in cow's value = $V_t - V_{t-1}$ where t = current year

COW-CALF PRODUCTION COEFFICIENTS

a. Weaned steers weigh 425 lbs

   Weaned heifers weigh 400 lbs

   Cull heifers weigh 750 lbs

   Cull cows weigh 1,000 lbs

b. 16% cow replacement rate

   18% heifer retention rate

c. 90% calf crop (45% steers + 45% heifers)

d. 63% calves sold steers (45 steers/72 hd sold)

   100% calves sold heifers (27 heifers/72 hd sold)

e. 299.25 lbs calf wt sold per cow per year

   425 lbs steer x .45 = 191.25
   400 lbs heifer x .27 = 108.00

                          299.25

BACKGROUNDING (1984)

	Steers (Per Head)	Heifers (Per Head)
Feeder Cost	$280.63	$228.32
Feed Expense	76.94	72.64
Other Operating Expenses	20.72	20.72
Labor	16.80	16.80
Marketing Expenses	10.00	10.00
Interest on Operating Expenses[1]	2.83	2.73
Interest on Calves[2]	13.89	11.30
Death Loss[3]	2.81	2.28
Overhead	10.00	10.00
Total Production Costs	$434.62	$374.79

Breakeven Price: Steers $\dfrac{\$434.62}{6.75\ cwt}$ = $64.39/cwt Heifers $\dfrac{\$374.79}{6.25\ cwt}$ = $59.97/cwt

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[1](Feed expense + operating expense + labor) x (interest rate x .5) x % of year on feed.

[2]Feeder cost x interest rate x % of year on feed.

[3]Feeder cost x .01.

Production Coefficients

		Steers	Heifers
a.	Purchase weight in lbs	425	400
	Selling weight in lbs	675	625
b.	Average daily gain in lbs	1.7	1.5
c.	Feeding period in days	150	150
d.	Death loss in percent	1	1

WINTERING (1984)

	Steers (Per Head)	Heifers (Per Head)
Feeder Cost	$280.63	$228.32
Feed Expense	40.65	38.38
Other Operating Expenses	20.72	20.72
Labor	16.80	16.80
Marketing Expenses	10.00	10.00
Interest on Operating Expenses[1]	1.93	1.88
Interest on Calves[1]	13.89	11.30
Death Loss[1]	2.81	2.28
Overhead	10.00	10.00
Total Production Costs	$397.43	$339.68

Breakeven Price: Steers $\frac{\$397.43}{5.75 \text{ cwt}}$ = $69.12/cwt   Heifers $\frac{\$339.68}{5.35 \text{ cwt}}$ = $63.49/cwt

_____

[1]Refer to Custom Backgrounding Budget.

Production Coefficients

		Steers	Heifers
a.	Purchase weight in lbs	425	400
	Selling weight in lbs	575	535
b.	Average daily gain in lbs	1.0	.9
c.	Feeding period in days	150	150
d.	Death loss in percent	1	1

PASTURING (1984)

	Steers (Per Head)	Heifers (Per Head)
Feeder Cost	$380.48	$305.16
Pasture Rent	40.00	40.00
Feed Expense	10.89	10.43
Other Operating Expenses	19.68	19.68
Labor	10.50	10.50
Marketing Expenses	10.00	10.00
Interest on Operating Expenses[1]	1.60	1.60
Interest on Calves[2]	15.06	12.08
Death Loss[2]	3.80	3.05
Overhead	5.00	5.00
Total Production Costs	$497.01	$417.50

Breakeven Price: Steers $\dfrac{\$497.01}{8.0 \text{ cwt}} = \$62.13/\text{cwt}$ Heifers $\dfrac{\$417.50}{7.40 \text{ cwt}} = \$56.42/\text{cwt}$

---

[1](Pasture rent + feeder expense + other operating expenses + labor) x .5 x interest rate x percent of year on feed.

[2]Refer to Custom Backgrounding Budget.

Production Coefficients

		Steers	Heifers
a.	Purchase weight in lbs	575	535
	Selling weight in lbs	800	740
b.	Average daily gain in lbs	1.9	1.7
c.	Feeding period in days	120	120
d.	Death loss in percent	1	1

APPENDIX B

APPENDIX B.   INDEX OF PRICES PAID BY FARMERS (ADJUSTED TO 1984)

Year	Feed Index	Labor Index	Production Item Index	Land Index	Transportation Index	Marketing Index	Interest Rate
1957	37.29	19.50	28.93	30.04	26.72	25.40	4.50
1958	36.73	20.10	29.87	30.20	27.59	26.02	3.83
1959	36.92	21.28	29.85	30.82	28.75	26.37	4.75
1960	35.99	21.87	29.87	30.82	28.75	26.55	4.50
1961	36.36	22.46	29.85	30.67	29.07	26.73	4.50
1962	36.73	23.05	30.21	30.59	29.68	27.17	4.50
1963	38.40	23.64	30.53	30.51	29.84	27.61	4.50
1964	38.03	24.23	30.21	30.43	30.25	27.70	4.50
1965	38.40	25.38	30.92	30.67	30.77	28.41	5.00
1966	40.07	27.37	32.25	31.25	31.18	29.56	5.75
1967	39.52	29.53	32.37	31.76	32.08	30.27	5.71
1968	37.11	32.04	32.37	33.73	33.11	31.09	6.38
1969	37.85	35.25	33.71	35.84	34.39	32.60	7.67
1970	40.07	37.76	34.93	35.92	36.16	33.81	7.30
1971	41.56	39.71	36.61	38.51	38.05	35.62	5.67
1972	41.93	42.02	39.17	41.57	38.47	37.73	5.32
1973	63.45	45.82	47.32	46.59	39.72	43.47	8.23
1974	76.81	52.51	53.68	57.49	44.18	49.39	9.99
1975	74.03	56.73	58.93	65.49	48.32	54.27	8.27
1976	75.70	62.10	62.39	68.31	53.10	57.93	6.81
1977	73.84	66.77	64.62	72.78	56.85	60.98	7.13
1978	72.36	71.58	70.09	78.51	59.51	65.85	9.78
1979	80.89	78.17	80.36	86.20	68.01	75.00	13.78
1980	91.09	84.41	89.06	92.94	80.11	84.15	15.92
1981	98.70	91.60	95.42	97.33	89.83	91.46	18.50
1982	89.80	96.23	96.54	98.35	93.52	95.73	16.08
1983	98.70	98.88	98.55	100.47	95.73	97.56	10.83
1984	100.00	100.00	100.00	100.00	100.00	100.00	12.04

APPENDIX C

APPENDIX TABLE C1. WEST FARGO CATTLE PRICES

Year	Steers 400-500# Fall	Heifers 400-500# Fall	Steers 500-600# Spring	Heifers 500-600# Spring	Steers 600-700# Spring	Heifers 600-700# Spring	Steers 700-800# Fall	Heifers 700-800# Fall
1957	25.45	21.10	22.30	-	22.30	-	23.34	-
1958	33.73	30.13	29.75	26.96	29.75	27.36	29.58	26.77
1959	30.38	27.07	31.70	29.04	31.70	29.26	29.06	28.47
1960	26.37	22.77	28.62	25.23	28.62	25.80	24.27	25.38
1961	27.86	25.01	26.52	23.68	26.52	24.38	25.38	24.12
1962	30.49	26.43	26.53	24.03	26.53	24.70	27.92	24.40
1963	26.93	24.89	25.37	23.03	25.37	23.03	25.56	22.50
1964	21.65	19.80	21.39	20.09	21.39	20.09	20.55	18.63
1965	25.84	19.93	22.00	19.10	22.00	19.10	24.56	21.60
1966	29.13	26.20	27.24	24.18	27.24	24.52	25.31	24.70
1967	29.86	26.02	26.23	23.87	26.23	23.87	25.21	24.67
1968	29.59	25.96	27.50	24.79	27.50	24.79	25.42	24.87
1969	33.12	29.90	30.36	27.30	30.36	27.30	29.98	28.10
1970	36.54	32.44	34.25	31.41	34.25	31.07	29.22	29.42
1971	40.69	36.56	33.36	30.59	33.36	30.59	32.93	32.75
1972	49.46	44.04	41.30	37.41	39.21	34.64	40.82	35.12
1973	61.32	54.32	55.31	50.23	52.29	47.64	54.19	48.71
1974	29.66	26.10	45.74	40.79	42.10	38.64	31.83	28.53
1975	34.84	28.74	31.29	25.64	31.18	26.51	36.39	31.16
1976	38.96	32.16	44.03	37.06	42.25	36.38	36.72	31.99
1977	45.89	39.34	41.40	35.18	39.52	34.26	40.23	35.87
1978	73.10	66.32	58.24	52.55	55.13	50.65	62.35	54.89
1979	95.41	84.06	90.88	83.61	86.10	78.91	79.74	68.42
1980	82.38	72.63	76.68	67.60	71.84	63.47	72.37	65.86
1981	65.85	58.43	69.04	62.03	65.64	60.16	63.51	57.76
1982	65.92	58.70	66.47	57.45	64.43	57.33	65.33	58.81
1983	62.22	53.33	68.64	61.31	65.88	59.84	57.05	52.06
1984	66.03	57.08	66.17	57.04	63.98	55.69	62.67	57.13

APPENDIX TABLE C2. EQUATIONS USED TO ADJUST KANSAS CITY PRICES TO WEST FARGO PRICES

Regression Equations

400-500# Steers
West Fargo Price = -1.8201946 + (1.0343523 x Kansas City Price)
R^2 = .978
T-Value = 35.155

400-500# Heifers
West Fargo Price = -3.2100313 + (1.1254112 x Kansas City Price)
R^2 = .972
T-Value = 31.107

500-600# Steers
West Fargo Price = -1.7479408 + (1.0194804 x Kansas City Price)
R^2 = .988
T-Value = 48.229

500-600# Heifers
West Fargo Price = -1.0131856 + (1.03754 x Kansas City Price)
R^2 = .990
T-Value = 61.98

600-700# Steers
West Fargo Price = -2.1280667 + (1.0340014 x Kansas City Price)
R^2 = .984
T-Value = 41.624

600-700# Hiefers
West Fargo Price = 1.9244081 + (.9436183 x Kansas City Price)
R^2 = .773
T-Value = 11.68

700-800# Steers
West Fargo Price = -.5434368 + (.9881594 x Kansas City Price)
R^2 = .987
T-Value = 45.332

700-800# Heifers
West Fargo Price = 4.1015440 + (.8410749 x Kansas City Price)
R^2 = .766
T-Value = 11.31

700-800# Heifers (Annual Average)
West Fargo Price = .5080279 + (.9720322 x Kansas City Price)
R^2 = .994
T-Value = 35.844

APPENDIX D

APPENDIX TABLE D1. STEER BACKGROUNDING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)	- - - - - - - - -($/cwt)- - - - - - - - - -		
1959	177.18	26.25	31.70	3.43
1960	158.89	23.54	28.62	2.37
1961	165.82	24.57	26.52	2.98
1962	177.80	26.34	26.53	1.96
1963	163.74	24.26	25.37	- 0.97
1964	140.42	20.80	21.39	- 2.86
1965	159.73	23.66	22.00	1.19
1966	176.64	26.17	27.24	3.57
1967	179.91	26.65	26.23	0.06
1968	177.95	26.36	27.50	0.84
1969	196.14	29.06	30.36	3.99
1970	213.54	31.64	34.25	5.20
1971	232.86	34.50	33.36	1.72
1972	272.80	40.42	39.21	4.71
1973	348.49	51.63	52.29	11.87
1974	223.86	33.16	42.10	- 9.53
1975	246.60	36.53	31.18	- 1.99
1976	267.22	39.59	42.25	5.72
1977	298.70	44.25	39.52	- 0.07
1978	424.56	62.90	55.13	10.88
1979	543.27	80.48	86.10	23.21
1980	500.33	74.12	71.84	- 8.64
1981	438.14	64.91	65.64	- 8.48
1982	429.61	63.65	64.43	- 0.48
1983	414.15	61.36	65.88	2.24
1984	434.62	64.39	63.98	2.62

APPENDIX TABLE D2. HEIFER BACKGROUNDING ENTERPRISE PRODUCTION COSTS,
BREAK-EVEN PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)		-($/cwt)-	
1959	154.14	24.66	29.26	2.73
1960	135.77	21.72	25.80	1.14
1961	145.32	23.25	24.38	2.66
1962	151.67	24.27	24.70	1.45
1963	146.77	23.48	23.03	- 1.24
1964	125.56	20.09	20.09	- 3.39
1965	127.04	20.33	19.10	- 0.99
1966	155.27	24.84	24.52	4.19
1967	154.63	24.74	23.87	- 0.97
1968	153.66	24.58	24.79	0.05
1969	172.45	27.59	27.30	2.72
1970	185.27	29.64	31.07	3.48
1971	203.49	32.56	30.59	0.94
1972	235.84	37.73	34.64	2.08
1973	300.48	48.08	47.64	9.90
1974	197.73	31.64	38.64	- 9.43
1975	208.79	33.41	26.51	- 5.12
1976	225.61	36.10	36.38	2.98
1977	256.32	41.01	34.26	- 1.83
1978	373.75	59.80	50.65	9.64
1979	465.80	74.53	78.91	19.11
1980	432.18	69.15	63.47	-11.05
1981	383.62	61.38	60.16	- 8.98
1982	376.82	60.29	57.33	- 4.05
1983	355.90	56.94	59.84	- 0.45
1984	374.79	59.97	55.69	- 1.25

APPENDIX TABLE D3. STEER WINTERING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN
PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)		-($/cwt)-	
1959	163.66	28.46	31.70	0.85
1960	145.71	25.34	28.62	0.15
1961	152.50	26.52	26.52	1.18
1962	164.35	28.58	26.53	0.00
1963	149.67	26.03	25.37	- 3.21
1964	126.49	22.00	21.39	- 4.64
1965	145.65	25.33	22.00	0.00
1966	161.93	28.16	27.24	1.91
1967	165.40	28.76	26.23	- 1.93
1968	164.31	28.58	27.50	- 1.27
1969	182.19	31.68	30.36	1.78
1970	198.78	34.57	34.25	2.57
1971	217.60	37.84	33.36	- 1.21
1972	257.42	44.77	41.30	3.45
1973	325.08	56.54	55.31	10.54
1974	195.41	33.98	45.74	-10.80
1975	219.27	38.13	31.29	- 2.69
1976	239.37	41.63	44.03	5.90
1977	271.51	47.22	41.40	- 0.23
1978	397.78	69.18	58.24	11.02
1979	513.08	89.23	90.88	21.70
1980	466.19	81.08	76.68	-12.56
1981	400.96	69.73	69.04	-12.04
1982	395.94	68.86	66.47	- 3.26
1983	377.54	65.66	68.64	- 0.22
1984	397.43	69.12	66.17	0.51

APPENDIX TABLE D4. HEIFER WINTERING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN
PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)		-($/cwt)-	
1959	141.37	26.42	29.04	0.42
1960	123.32	23.05	25.23	- 1.19
1961	132.75	24.81	23.68	0.63
1962	138.97	25.98	24.03	- 0.78
1963	133.49	24.95	23.03	- 2.95
1964	112.41	21.01	20.09	- 4.86
1965	113.75	21.26	19.10	- 1.92
1966	141.38	26.43	24.18	2.92
1967	140.93	26.34	23.87	- 2.56
1968	140.77	26.31	24.79	- 1.56
1969	159.28	29.77	27.30	0.99
1970	171.33	32.02	31.41	1.64
1971	189.08	35.34	30.59	- 1.44
1972	221.31	41.37	37.41	2.06
1973	278.37	52.03	50.23	8.86
1974	170.87	31.94	40.79	-11.24
1975	183.00	34.21	25.64	- 6.30
1976	199.31	37.25	37.06	2.85
1977	230.66	43.11	35.18	- 2.08
1978	348.46	65.13	52.55	9.44
1979	437.30	81.74	83.61	18.47
1980	399.95	74.76	67.60	-14.14
1981	348.52	65.14	62.03	-12.73
1982	345.04	64.49	57.45	- 7.70
1983	321.33	60.06	61.31	- 3.19
1984	339.68	63.49	57.04	- 3.03

APPENDIX TABLE D5. STEER PASTURING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN
    PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)	- - - - - - - - - -($/cwt)- - - - - - - - - -		
1959	215.77	26.97	29.06	2.09
1960	197.42	24.68	24.27	- 0.41
1961	185.14	23.14	25.38	2.24
1962	185.34	23.17	27.92	4.76
1963	178.84	22.36	25.56	3.21
1964	155.34	19.42	20.55	1.13
1965	159.61	19.95	24.56	4.61
1966	191.99	24.00	25.31	1.31
1967	186.50	23.31	25.21	1.90
1968	195.35	24.42	25.42	1.00
1969	214.91	26.86	29.98	3.12
1970	238.76	29.84	29.22	- 0.62
1971	234.40	29.30	32.93	3.63
1972	283.44	35.43	40.82	5.39
1973	376.72	47.09	54.19	7.10
1974	330.28	41.29	31.83	- 9.45
1975	247.85	30.98	36.39	5.41
1976	325.56	40.69	36.72	- 3.97
1977	313.32	39.16	40.23	1.07
1978	421.07	52.63	62.35	9.71
1979	632.13	79.02	79.74	0.72
1980	556.85	69.61	72.37	2.76
1981	519.54	64.94	63.51	- 1.43
1982	501.03	62.63	65.33	2.70
1983	509.59	63.70	57.05	- 6.65
1984	497.01	62.13	62.67	0.54

APPENDIX TABLE D6. HEIFER PASTURING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN
PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY, 1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)	- - - - - - - - - -($/cwt)- - - - - - - - - -		
1959	188.00	25.41	28.47	3.06
1960	166.98	22.56	25.38	2.82
1961	158.53	21.42	24.12	2.70
1962	160.61	21.70	24.40	2.70
1963	155.42	21.00	22.50	1.49
1964	139.25	18.82	18.63	- 0.19
1965	134.47	18.17	21.60	3.42
1966	163.78	22.13	24.70	2.57
1967	162.54	21.96	24.67	2.71
1968	168.89	22.82	24.87	2.05
1969	185.25	25.03	28.10	3.07
1970	208.65	28.20	29.42	1.22
1971	205.22	27.73	32.75	5.02
1972	244.89	33.09	35.12	2.02
1973	325.26	43.95	48.71	4.76
1974	283.27	38.28	28.53	- 9.75
1975	203.17	27.45	31.16	3.71
1976	268.51	36.28	31.99	- 4.29
1977	261.43	35.33	35.87	0.54
1978	364.73	49.29	54.89	5.60
1979	552.30	74.63	68.42	- 6.22
1980	472.27	63.82	65.86	2.04
1981	449.36	60.72	57.76	- 2.97
1982	421.02	56.89	58.81	1.91
1983	439.42	59.38	52.06	- 7.32
1984	417.50	56.42	57.13	0.71

APPENDIX TABLE D7.   STEER WINTERING AND PASTURING ENTERPRISE PRODUCTION
   COSTS, BREAK-EVEN PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY,
   1959-1984

Year	Total Production Costs ($/head)	Break-Even Price	Selling Price	Estimated Profitability
		- - - - - - - - - -($/cwt)- - - - - - - - - -		
1959	208.26	26.03	29.06	3.03
1960	193.90	24.24	24.27	0.03
1961	175.68	21.96	25.38	3.42
1962	182.64	22.83	27.92	5.09
1963	194.59	24.32	25.56	1.24
1964	179.24	22.40	20.55	- 1.85
1965	156.84	19.61	24.56	4.95
1966	178.18	22.27	25.31	3.04
1967	194.65	24.33	25.21	0.88
1968	199.62	24.95	25.42	0.47
1969	201.56	25.19	29.98	4.79
1970	220.73	27.59	29.22	1.63
1971	237.98	29.75	32.93	3.18
1972	260.03	32.50	40.82	8.32
1973	312.32	39.04	54.19	15.15
1974	388.03	48.50	31.83	-16.67
1975	258.38	32.30	36.39	4.10
1976	286.23	35.78	36.72	0.94
1977	308.82	38.60	40.23	1.63
1978	351.61	43.95	62.35	18.40
1979	500.74	62.59	79.74	17.14
1980	621.54	77.69	72.37	- 5.32
1981	580.35	72.54	63.51	- 9.03
1982	510.62	63.83	65.33	1.50
1983	501.30	62.66	57.05	- 5.61
1984	484.32	60.54	62.67	2.13

APPENDIX TABLE D8. HEIFER WINTERING AND PASTURING ENTERPRISE PRODUCTION
   COSTS, BREAK-EVEN PRICE, SELLING PRICE, AND ESTIMATED PROFITABILITY,
   1959-1984

Year	Total Production Costs	Break-Even Price	Selling Price	Estimated Profitability
	($/head)	- - - - - - - - - -($/cwt)- - - - - - - - - -		
1959	183.13	24.75	28.47	3.72
1960	170.71	23.07	25.38	2.31
1961	152.49	20.61	24.12	3.51
1962	162.13	21.91	24.40	2.49
1963	168.48	22.77	22.50	- 0.27
1964	162.49	21.96	18.63	- 3.33
1965	141.95	19.18	21.60	2.41
1966	145.31	19.64	24.70	5.06
1967	173.26	23.41	24.67	1.26
1968	174.19	23.54	24.87	1.33
1969	176.84	23.90	28.10	4.20
1970	196.64	26.57	29.42	2.85
1971	209.53	28.31	32.75	4.44
1972	230.29	31.12	35.12	4.00
1973	274.08	37.04	48.71	11.67
1974	339.05	45.82	28.53	-17.29
1975	231.91	31.34	31.16	- 0.18
1976	247.82	33.49	31.99	- 1.50
1977	266.75	36.05	35.87	- 0.17
1978	308.15	41.64	54.89	13.25
1979	446.87	60.39	68.42	8.03
1980	540.39	73.03	65.86	- 7.16
1981	509.03	68.79	57.76	-11.03
1982	453.05	61.22	58.81	- 2.42
1983	446.89	60.39	52.06	- 8.33
1984	423.91	57.29	57.13	- 0.16

APPENDIX TABLE D9.   BREAK-EVEN PRICES FOR THE RETAINED OWNERSHIP
  ALTERNATIVES, 1959-1984

Year	Cow-Calf and Backgrounding	Cow-Calf and Wintering	Cow-Calf, Wintering and Pasturing
	- - - - - - - - - - - -($/cwt)- - - - - - - - - - - -
1959	22.10	23.53	9.43
1960	24.05	25.88	20.79
1961	19.27	20.25	22.46
1962	20.55	21.73	18.43
1963	23.08	24.59	19.51
1964	25.74	27.73	21.48
1965	20.43	21.48	23.83
1966	15.35	15.41	19.61
1967	22.88	24.28	15.27
1968	21.59	22.91	21.84
1969	19.19	20.05	21.24
1970	24.10	25.66	19.34
1971	25.38	27.07	23.47
1972	17.82	18.20	24.89
1973	21.23	20.79	20.06
1974	59.44	64.68	22.96
1975	58.28	63.52	54.60
1976	38.42	40.15	54.26
1977	48.54	52.13	37.75
1978	30.12	30.61	47.72
1979	36.15	37.09	35.07
1980	77.99	85.42	40.40
1981	85.92	94.18	75.96
1982	82.99	91.37	81.69
1983	74.01	80.33	79.19
1984	75.63	82.12	71.39

APPENDIX TABLE D10. ESTIMATED PROFITABILITY FOR THE RETAINED OWNERSHIP
ALTERNATIVES, 1958-1984

Year	Cow-Calf	Cow-Calf and Backgrounding	Cow-Calf and Wintering	Cow-Calf, Wintering and Pasturing
		- - - - - - - - - - - -($/cwt)- - - - - - - - - - - - - -		
1958	29.13	--	--	--
1959	4.57	22.28	23.09	19.42
1960	- 2.93	5.48	3.83	3.88
1961	6.52	1.68	- 0.41	2.46
1962	6.84	6.58	5.35	8.19
1963	0.30	3.95	2.77	4.92
1964	- 9.32	- 2.17	- 3.68	- 1.65
1965	2.03	- 4.81	- 6.80	- 0.37
1966	15.13	5.80	4.63	5.48
1967	3.63	10.01	9.95	9.75
1968	5.26	3.61	2.22	3.38
1969	13.41	7.64	6.31	8.05
1970	9.39	13.88	13.15	9.95
1971	11.84	8.24	6.68	9.39
1972	32.60	12.14	12.79	13.82
1973	44.19	32.75	35.23	32.10
1974	-44.36	19.59	23.12	7.65
1975	-38.33	-29.99	-35.48	-20.14
1976	- 2.50	-18.20	-22.07	-19.29
1977	-11.10	- 0.84	- 1.05	0.86
1978	47.31	4.93	4.00	11.87
1979	63.53	53.33	57.58	40.48
1980	-12.37	32.60	36.23	29.56
1981	-38.89	-14.37	-18.98	-14.58
1982	-36.34	-24.11	-31.05	-18.78
1983	-26.46	-19.34	-25.44	-23.98
1984	-24.33	-13.10	-17.53	-10.77

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