The Changing Profitability of Beef Production in North Dakota

by
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Preface

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Highlights

The beef cattle cycle is very much a part of livestock production. Many factors contribute to its existence. The beef cattle cycle brings a unique set of risks to livestock production and it has substantial influence on producers' income.

Cost of production budgets were constructed at 1982 price levels for several beef production and feeding enterprises common to North Dakota. The budgets were adjusted back to 1957 using indices of prices paid by farmers for certain goods. Total production costs were divided by periods of expected output to yield an estimated break-even price. Estimated profitability of a given enterprise was calculated by subtracting the break-even price from the corresponding market price.

Results show that variation in profitability of beef production due to prices in North Dakota has increased significantly since the early 1970s. Cow-calf operations had the greatest variation of the enterprises examined. Profitability in North Dakota displayed trends similar to the cattle industry on a national level.

Analysis of vertical integration in the form of extended ownership of calves at the farm or ranch level showed that producers could potentially benefit by keeping and feeding their calves after weaning. Extending ownership of calves was beneficial in reducing profit variability. It was especially helpful in the bust years of the cattle cycle.

THE CHANGING PROFITABILITY OF BEEF PRODUCTION
IN NORTH DAKOTA

Randall D. Little and David L. Watt*

The beef cattle production-and-price cycle is a major concern to the cattle industry because it has significant influence on producers' income. The cattle cycle imposes a unique set of risks on livestock production. The objective of this study is to estimate the effects the cattle cycle might have had on a typical North Dakota cattle producer's profitability. Potential benefits of several vertical integration alternatives in the production process will also be estimated. The alternatives examined involve extending ownership of calves in a cow-calf operation beyond weaning, then feeding and selling at a later date.

The Cattle Cycle

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).

While 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 due to the decreased slaughter. As a result, 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 inventory increases decline rapidly and are followed by a period of inventory reductions. Slaughter is high relative to cattle 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. Cattle prices and returns are average. Eventually increases in demand for beef will exceed increases in supply and will drive

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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 at any given time. Many issues come into play here, for example, changes in the level of technology, price of inputs, price of substitutes, or consumer preferences, all of which affect market prices to some degree. There are many other forces within the beef industry which contribute to the existence of cattle cycles as well.

Profitability

According to Ikerd (1979), the real key to understanding the cattle cycle is 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 first year of our study, 1957, was the first 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 been built up, driving prices down and resulting in losses near the middle of that decade.

The cattle industry was generally profitable throughout the latter part of the 1960s and the early 1970s. This made the industry attractive. Many operators expanded their enterprises while others started new ones. The rapid expansion continued until cattle inventories peaked in 1975. The overabundant cattle supply resulted in sharp drops in prices and consequently on operators' profits throughout the mid-1970s. Cattle inventories were reduced by the end of the decade and prices rose. The profitability of the cattle industry at the end of the 1970s encouraged producers to expand their herds.

Cattle inventories increased steadily during the early 1980s. The cattle industry has been, for the most part, unprofitable during this period, 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 and a shift in consumer preferences away from red meat have all contributed to the losses experienced throughout the early 1980s.

Costs of Production

Profits in all segments of the cattle industry, like in all other agricultural enterprises, are contingent on production costs in addition to market prices. In this study, budgets reflecting the costs of production of several beef cattle enterprises typical to North Dakota were constructed at 1982 price levels (Appendix A). These production costs were then adjusted back over time to 1957 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 the break-even price. The break-even price in a given year was then subtracted from the corresponding market price (Appendix C) to yield an estimate of the enterprise's profit per cwt in that year. Granted, this method of deriving production costs does not give as accurate results as actual production cost and profitability data; however, the trends indicated should give a general idea of the profitability of the cattle enterprises in North Dakota over time.

The cow-calf production costs are based on a 185-cow spring calving operation. Cost estimates at 1982 levels include: feed expense, $97.55/hd; pasture rent, $40.00/hd; labor, $32.00/hd; other operating expenses (e.g., veterinarian, medical, marketing, transportation expenses), $23.38/hd; interest on operating expenses, $15.51/hd; livestock interest, $60.62/hd; land taxes, $8.17/hd; and a land charge of $76.38/hd. The total cost of production per head was an estimated $353.61 in 1982.

It is assumed that cow-calf operators replace 16 percent of their cows annually. To allow for this, they retain 18 percent of their calves, all heifers, from whom the replacement animals will be chosen. Cull cow returns were calculated by multiplying the replacement rate adjusted for death loss (assumed to be 1 percent) by the cow's market value. Cull heifer returns were calculated by subtracting the replacement rate from the retention rate and multiplying the difference (2 percent) by the heifer's market value. Cull cows and heifers were assumed to be sold at 1,000 lbs and 750 lbs, respectively. The cull cow return was $56.55 and the cull heifer return $8.51 in 1982. One final adjustment to reflect a change in the value of the cow is made to the total production costs. This is done by adding or subtracting the difference between the cow's value in the previous year and her value in the current year from the total production costs. When cow prices drop, the cow depreciates, which is an added expense. Conversely, when prices rise, the cow appreciates, which reduces production costs. The cow's value decreased from 1981 to 1982 so the adjustment to the production costs was an additional $41.00 in 1982. The adjusted total cost of production per cow is $329.55 (Table 1).

A break-even price for the cow-calf operation is 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) multiplied by the percent of steers (45 percent, or half of the 90 percent calf crop), plus the expected weaning weight of heifers (4.00 cwt), multiplied by the percent of heifers (27 percent, or half of the 90 percent calf crop less the 18 percent retention rate).

TABLE 1. COW-CALF ENTERPRISE PRODUCTION COSTS, BREAK-EVEN PRICE, AND SELLING PRICE, 1957 TO 1983

Year	Adjusted Production Costs	Cow-Calf Break-Even Price	Selling Price
	------------------------- ($/cwt) -------------------------		
1957	57.92	19.36	23.24
1958	19.97	6.67	32.19
1959	83.11	27.77	28.73
1960	93.20	31.14	24.33
1961	71.18	23.79	26.23
1962	76.44	25.55	26.54
1963	87.89	29.37	26.18
1964	101.61	33.96	20.97
1965	75.22	25.14	23.66
1966	49.95	16.69	28.04
1967	84.68	28.30	28.44
1968	81.28	27.16	28.25
1969	68.66	22.94	31.93
1970	90.80	30.34	35.02
1971	95.40	31.68	39.16
1972	59.25	19.80	47.46
1973	58.81	19.65	56.73
1974	237.60	79.40	28.35
1975	234.88	78.49	32.58
1976	140.17	46.84	36.44
1977	188.08	62.85	43.47
1978	95.79	32.01	70.58
1979	112.18	37.49	91.21
1980	302.40	101.05	78.77
1981	337.28	112.71	63.10
1982	329.55	110.13	63.25
1983	287.71	96.14	58.93

The market price, from which the break-even price is 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.

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 which involves feeding a higher protein and energy ration with less roughage. The second is a wintering program which involves lower gains and a higher roughage diet. Although the overall costs of the wintering program may be less, the cost per hundred pounds of gain in the backgrounding program should be lower. Average daily gains used in this study are 1.7 lbs and 1.0 lbs in the backgrounding and wintering programs, respectively. Calves are purchased after weaning in the fall at 425 lbs. Backgrounded calves are sold the following spring at 675 lbs and wintered calves at 575 lbs.

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. The feed expense was $69.09/hd and the interest on operating expenses $3.47/hd in the backgrounding program, compared to only $36.50/hd and $2.40/hd, respectively, in the wintering program (1982 levels). Other production costs at 1982 levels include feeder cost, $280.16/hd; other operating expenses, $20.00/hd; labor $16.00/hd; interest on calves, $18.51/hd; death loss, $2.80/hd; and overhead, $10.00/hd. The estimated total costs of production of backgrounding and wintering calves in 1982 were $420.02/hd and $386.36/hd, respectively. Break-even prices for these two feeding programs were calculated by dividing the total production cost by the expected selling weights, 6.75/ cwt for a backgrounded calf and 5.75/cwt for a wintered calf. The estimated production costs, break-even prices, and market prices from 1957 to 1983 are presented for backgrounding calves in Table 2 and for wintering calves in Table 3.

Beef cattle producers usually pasture calves following a wintering program and sell calves directly to feedlots following a backgrounding program. Calves that enter a pasturing program are assumed to weigh 575 lbs when purchased in the spring and 800 lbs when sold in the fall after a 120-day grazing season. The average daily gain for pastured calves in this study is 1.9 lbs.

The total production costs, break-even prices, and market prices estimated from 1957 to 1984 for the wintering program are presented in Table 4. The costs of pasturing calves at 1982 levels include purchase costs, $382.22/hd; pasture rent, $40.00/hd; feed expense, $9.78/hd; other operating expenses, $19.00/hd; labor, $10.00/hd; interest on operating expenses, $2.08/hd; interest on calves, $20.21/hd; death loss, $3.82/hd; and overhead, $5.00/hd. The total production costs in 1982 were $492.11/hd. A break-even price for pasturing calves is derived by dividing the total production costs by the expected selling weight, 8.0 cwt.

TABLE 2. BACKGROUNDING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN PRICE, AND SELLING PRICE, 1957 TO 1983

Year	Total Production Costs	Break-Even Price	Selling Price
		($/cwt)	
1957	148.92	22.06	20.93
1958	185.61	27.50	29.63
1959	171.19	25.36	30.65
1960	152.21	22.55	27.46
1961	159.84	23.68	25.30
1962	171.89	25.47	25.30
1963	161.29	23.90	25.37
1964	138.19	20.47	21.39
1965	157.13	23.28	22.00
1966	173.95	25.78	27.24
1967	176.79	25.19	25.23
1968	175.50	26.00	27.50
1969	193.50	28.67	30.36
1970	210.55	31.18	34.25
1971	229.22	33.96	33.35
1972	269.15	39.87	39.21
1973	343.70	50.92	52.29
1974	219.15	32.47	42.10
1975	240.87	35.68	31.18
1976	261.63	38.79	42.25
1977	292.35	43.81	39.52
1978	417.57	61.86	55.13
1979	535.03	79.41	89.10
1980	491.71	72.85	71.84
1981	429.22	63.59	85.64
1982	420.02	62.23	64.43
1983	404.45	59.92	65.88

TABLE 3. WINTERING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN PRICE, AND
SELLING PRICE, 1957 TO 1983

Year	Total Production Costs	Break-Even Price	Selling Price
	----------------------	($/cwt)	--------------
1957	135.11	23.50	20.99
1958	172.14	29.94	28.58
1959	157.70	27.43	30.57
1960	139.05	24.18	27.43
1961	146.36	25.45	25.29
1962	158.41	27.55	25.30
1963	147.15	25.59	25.37
1964	124.04	21.57	21.39
1965	142.98	24.87	22.00
1966	159.14	27.68	27.24
1967	162.28	28.22	26.23
1968	161.63	26.11	27.50
1969	179.27	31.18	30.35
1970	195.67	34.03	34.25
1971	214.05	37.23	33.36
1972	253.66	44.12	41.30
1973	320.50	55.74	55.31
1974	190.55	33.14	45.74
1975	213.69	37.16	31.29
1976	233.74	40.65	44.03
1977	265.24	46.13	41.40
1978	390.97	67.99	58.24
1979	505.87	89.98	90.88
1980	457.72	79.60	76.68
1981	392.01	68.18	69.04
1982	386.36	67.19	66.47
1983	367.81	63.97	68.64

TABLE 4. PASTURING ENTERPRISE PRODUCTION COSTS, BREAK-EVEN PRICE, AND
SELLING PRICE, 1957 TO 1983

Year	Total Production Costs	Break-Even Price	Selling Price
	($/cwt)		
1957	149.72	18.72	22.62
1958	194.25	24.28	28.85
1959	206.62	25.83	26.98
1960	187.87	23.48	23.76
1961	175.46	21.93	24.71
1962	175.62	21.95	27.36
1963	176.42	22.05	24.96
1964	152.89	19.11	20.21
1965	156.97	19.62	24.19
1966	189.36	23.67	24.93
1967	183.48	22.94	24.62
1968	192.56	24.07	25.31
1969	211.82	26.48	29.52
1970	235.90	29.49	28.81
1971	231.08	28.88	33.12
1972	279.77	34.97	41.17
1973	372.48	46.56	51.02
1974	325.49	40.69	29.81
1975	242.91	30.36	38.09
1976	320.01	40.00	35.76
1977	307.56	38.45	39.76
1978	414.98	51.87	63.55
1979	625.59	78.20	78.27
1980	548.87	68.61	71.94
1981	511.19	63.90	63.09
1982	492.11	61.51	63.64
1983	500.44	62.56	57.17

Prices

The market prices used in this study were compiled from 1957 to 1983 (Appendix C). The prices used from 1963 to 1983 for steers and heifers are 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, 400-500 lb heifers, 500-600 lb steers, 600-700 lb steers, 700-800 lb steers, and 700-800 lb heifers. The equations generated in the regressions as well as the R^2 values and T-values are included in Appendix C. It should be noted that the regression results yielded high R^2 and T-values, which demonstrate a strong relationship between the cattle prices from the two sources. Cow prices are 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. The weight categories included in fall selling are 400-500 lb steers, 400-500 lb heifers, and 700-800 lb steers. Weight categories for spring selling include 500-600 lb steers and 600-700 lb steers. Cull cow and heifer values are calculated based on annual price averages of cows and 700-800 lb heifers. It is assumed that all weight categories graded choice, except cows. The cow prices are averages over all grades.

Results

The estimated profitabilities of the cattle enterprises examined are presented in Table 5. The trends in the profitability of each enterprise follow the cattle cycle closely. As might be expected, profits are greatest during the years following cattle inventory reductions, 1958, 1966, 1972, 1973, 1978, and 1979. Likewise losses are greatest in the bust years when the supply of cattle is the greatest, 1964, 1965, 1974, 1975, 1981, and 1982.

The cow-calf operation in this study had a negative profitability on the average. It also displayed considerable variability (Figure 1). This is evident in its large standard deviation and the wide range between the maximum and minimum profit per cwt values. Although the cow-calf operation is the starting point in the production process, it is the last to feel the effect of price changes. This makes cow-calf operators the most vulnerable 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 how they anticipate the market to be when they sell. For example, if a feedlot operator expects difficult times ahead, then the price he is willing to bid to purchase cattle will be adjusted down to reflect that. He also has the option not to operate at 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).

TABLE 5. ESTIMATED PROFITABILITY OF SELECTED BEEF CATTLE ENTERPRISES,
1957 TO 1983

| Year	Cow-Calf	Backgrounding	Wintering	Pasturing
	---------------------------- ($/cwt) ----------------------------			
1957	3.89			3.50
1958	25.52	6.57	5.08	4.57
1959	0.95	3.15	0.63	1.15
1960	-6.81	2.10	.00	0.28
1961	2.45	2.75	1.11	2.78
1962	3.00	1.62	-0.15	5.41
1963	-3.19	-0.10	-2.18	2.90
1964	-12.99	-2.50	-4.20	1.10
1965	-1.48	1.52	0.42	4.57
1966	11.35	3.96	2.37	1.26
1967	0.14	0.45	-1.45	1.68
1968	1.06	1.31	-0.73	1.24
1969	8.99	4.36	2.25	3.04
1970	4.68	5.59	3.08	-0.67
1971	7.28	2.17	-0.67	4.24
1972	27.66	5.25	4.07	6.20
1973	39.08	12.42	11.20	4.46
1974	-51.05	-8.82	-10.00	-10.87
1975	-45.91	-1.29	-1.85	7.73
1976	-10.40	6.57	6.87	-4.24
1977	-19.38	0.73	0.75	1.31
1978	38.58	11.62	12.11	11.68
1979	53.73	24.24	22.89	0.08
1980	-22.28	-7.57	-11.30	3.33
1981	-49.60	-7.21	-10.57	-0.61
1982	-46.88	0.84	-1.70	2.13
1983	-37.21	3.66	1.44	-5.38
Average	-2.92	2.88	1.17	1.97
Standard Deviation	26.78	6.38	6.80	4.18
Maximum	53.73	24.24	22.89	11.68
Minimum	-51.05	-8.82	-11.30	-10.87
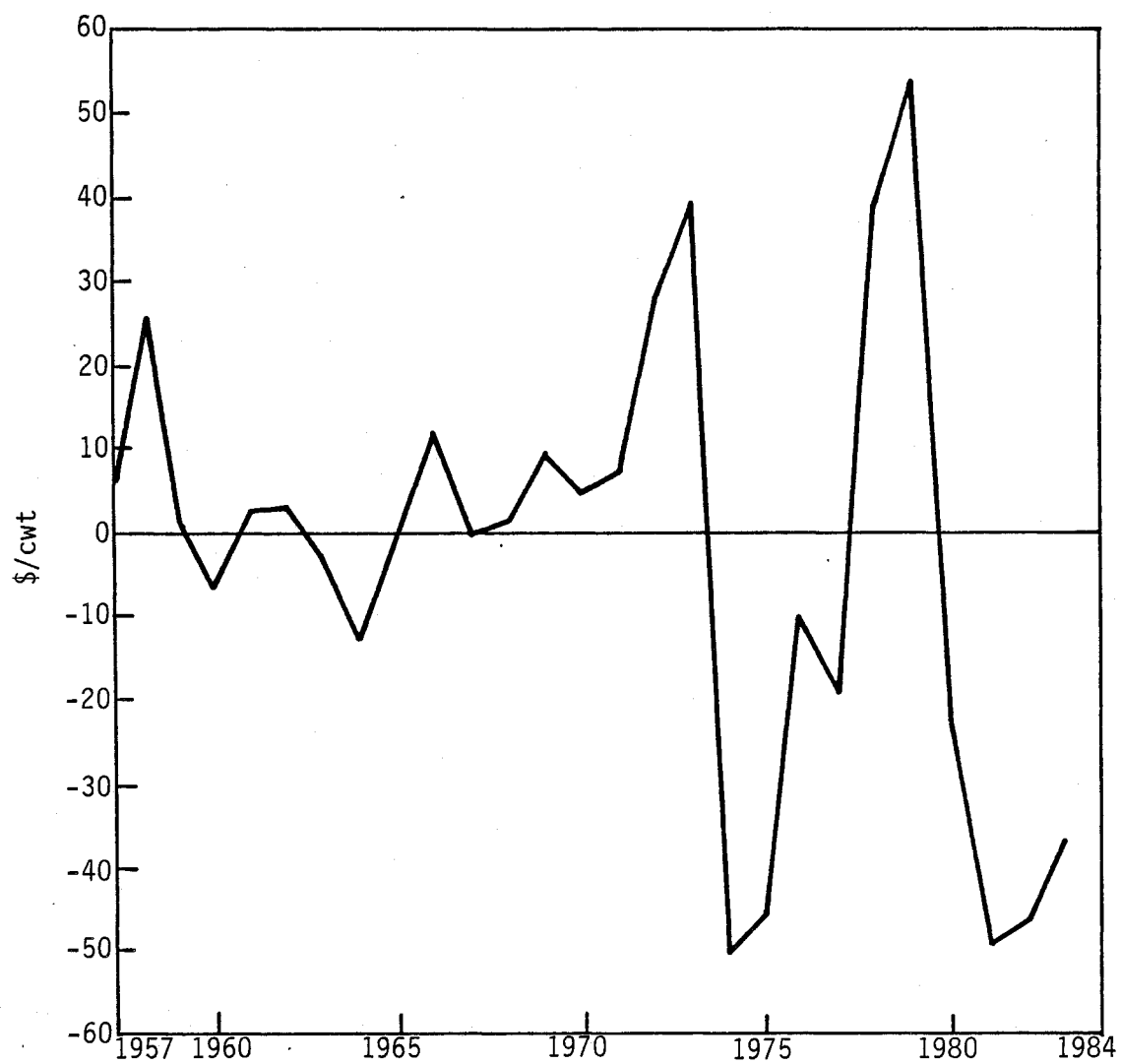
Figure 1. Cow-Calf Profitability, 1957-1983

Because the backgrounding and wintering programs are so similar in nature, they had similar profitabilities (Figures 2 and 3). The backgrounding program was shown, on the average, to be considerably more profitable than the wintering program. The wintering program's profitability displayed more variability than its counterpart. Both the standard deviation and the difference between the maximum and minimum profit per cwt values were larger.

The summer pasturing program had an average profitability of $1.97/cwt sold. The variability in this program was low relative to the other feeding programs, but so were its potential returns (Figure 4).

Vertical Integration

It has been demonstrated thus far in this study that large amounts of financial risk are 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 steps in the production process. If a producer has the flexibility, this can be a viable strategy for dealing with bust phases of the cattle cycle. In this case, cow-calf operators keep and feed their calves after weaning. Three options of extended ownership are considered: (1) backgrounding the calf and selling the following spring; (2) wintering and selling the following spring; and (3) wintering, pasturing, and selling the following fall.

Total production costs of these extended enterprises were calculated by combining the production costs of the respective enterprises included. (Purchase price of the steers was not included.) The specified production coefficients did not change. Break-even prices for the above alternatives were calculated in the same manner as for the individual enterprises. The estimated profitabilities of the vertical integration alternatives are presented in Table 6. The estimated profitability of the cow-calf operation is included for comparison. All three forms of extended ownership significantly reduced variability in the operation. The average profitability of each alternative was positive, in contrast to the negative average profitability of the cow-calf operation.

The benefits of vertical integration were the greatest during the bust years of the cattle cycle. This is especially evident in 1964 and 1974 when cow-calf operators could have experienced profits instead of losses by extending ownership of their calves and in 1975, 1981, 1982, and 1983 when losses could have been minimized.

The cow-calf wintering and pasturing option (alternative 3) had the smallest standard deviation, signifying that it had the least variability. That option also had the least potential payoff; its maximum profit was the lowest. The cow-calf wintering option (alternative 2), on the other hand, had the greatest variability and the largest potential payoff. Its standard deviation and maximum profit were the largest. The cow-calf backgrounding option (alternative 1) ranked in the middle. The estimated profitabilities of these three vertical integration alternatives are illustrated in Figures 5, 6, and 7.
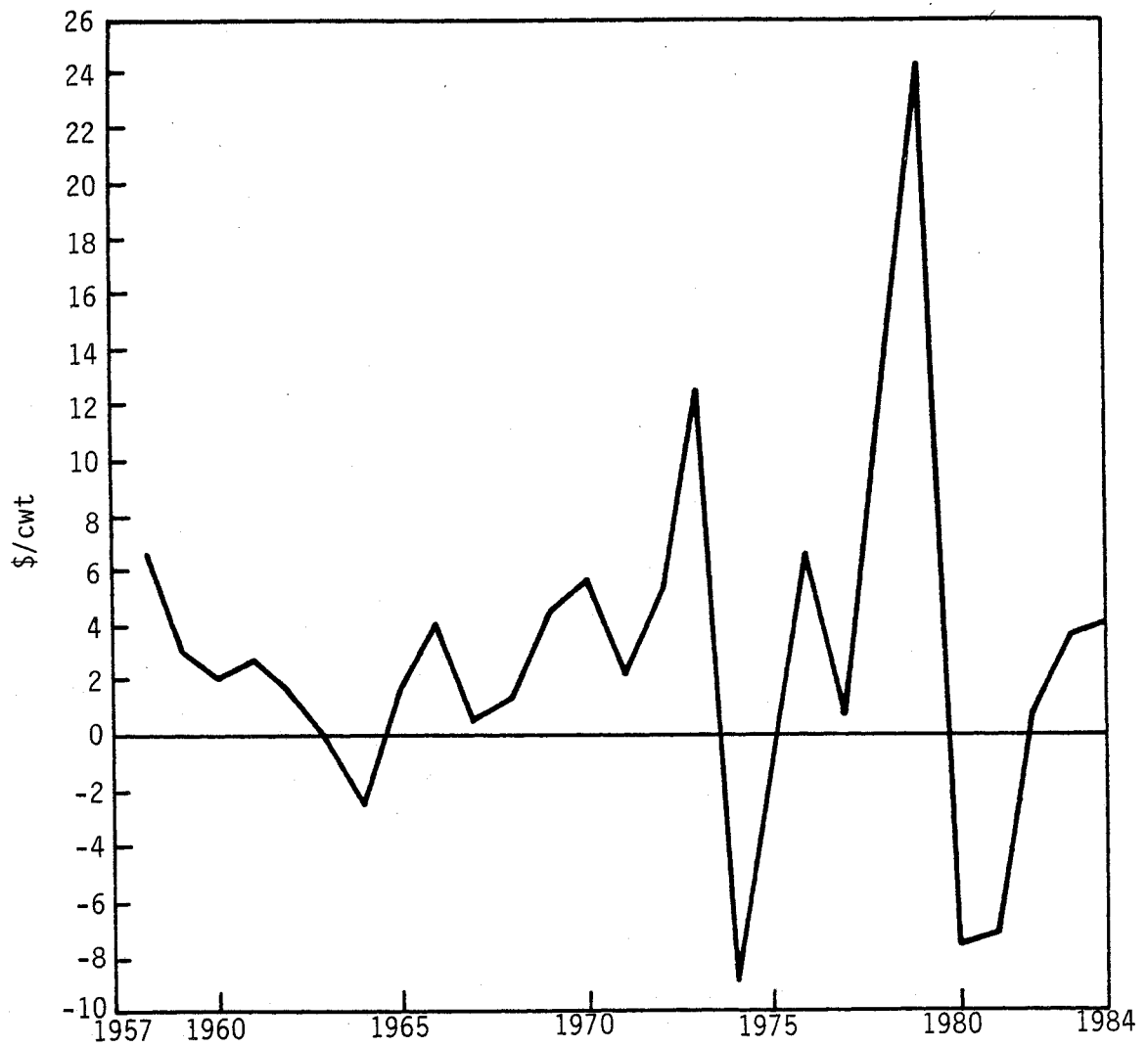
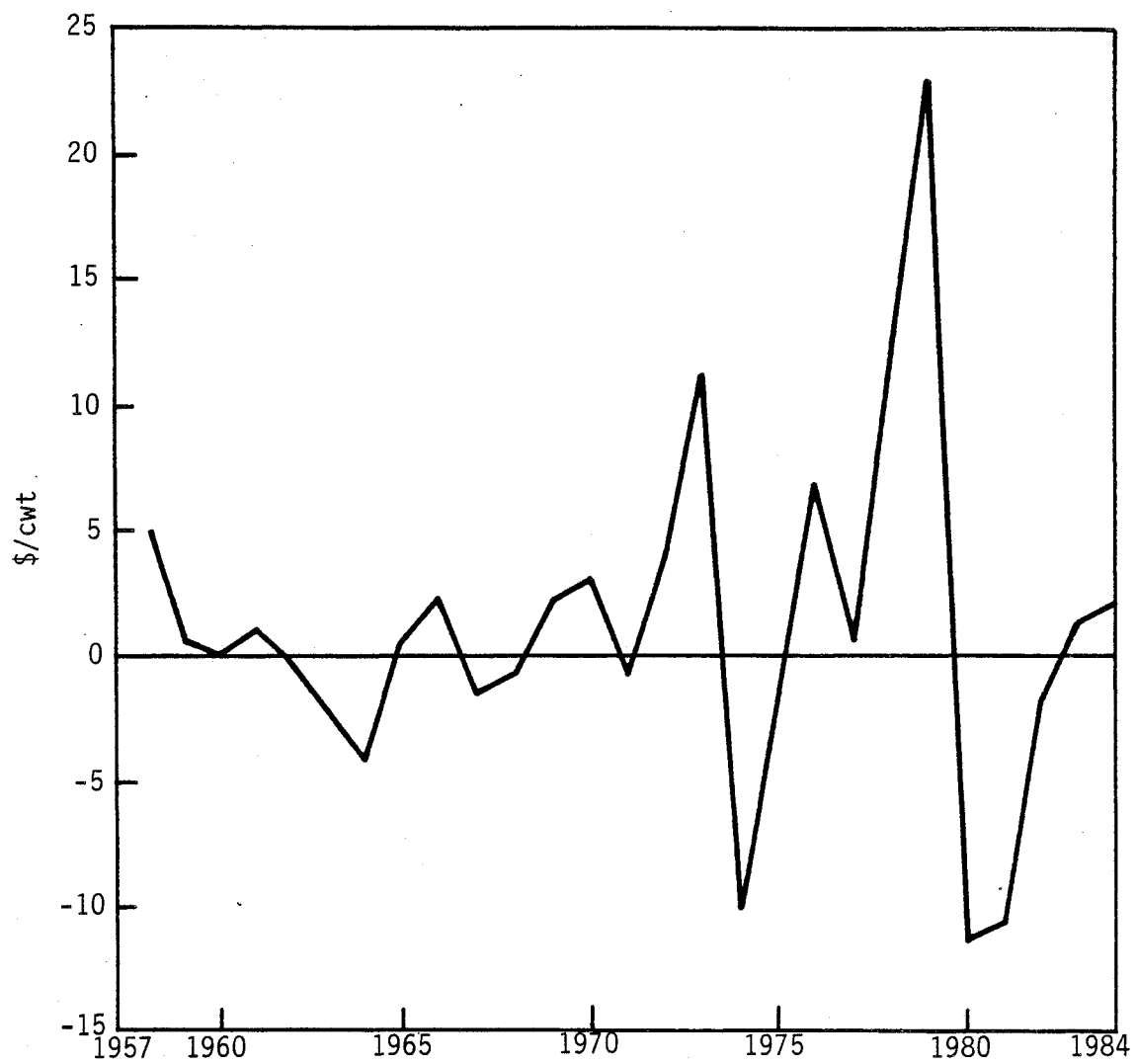Figure 2. Backgrounding Profitability, 1957-1983
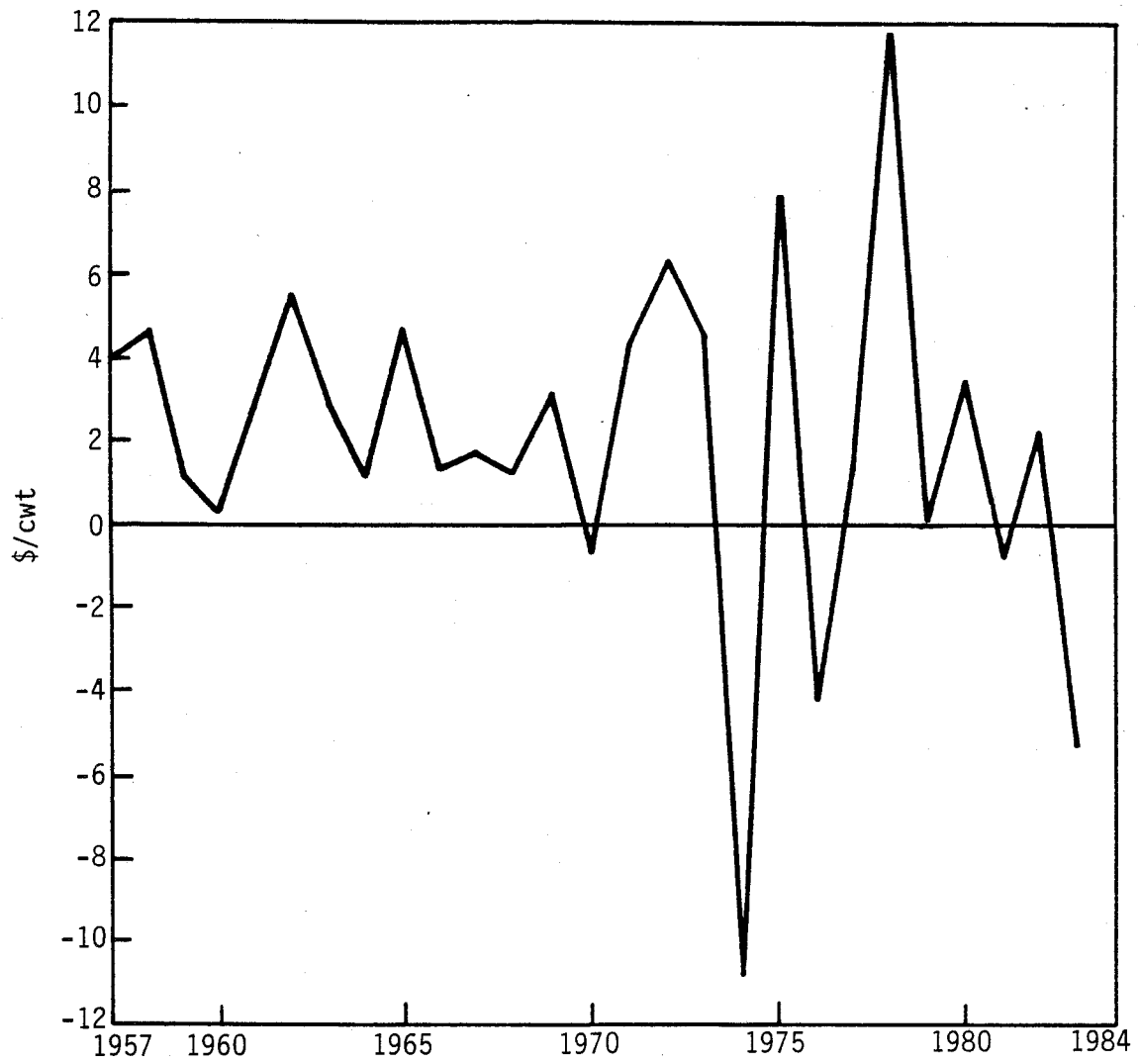
Figure 3. Wintering Profitability, 1957-1983

Figure 4. Pasturing Profitability, 1957-1983

TABLE 6. ESTIMATED PROFITABILITY OF VERTICAL INTEGRATION, 1957 to 1983

|		Profitability--Vertical Integration		
Year	Cow-Calf	Cow-Calf and Backgrounding	Cow-Calf and Wintering	Cow-Calf, Wintering and Pasturing
		($/cwt)		
1957	3.89			
1958	25.52	13.41	13.12	14.00
1959	0.96	21.02	21.60	16.68
1960	-6.81	8.42	7.43	5.62
1961	2.45	4.97	3.71	5.44
1962	3.00	8.07	7.42	10.74
1963	-3.19	7.29	6.49	7.57
1964	-12.99	1.43	0.42	1.40
1965	-1.48	0.10	-1.24	3.67
1966	11.35	9.09	8.39	7.30
1967	0.14	11.39	11.40	9.87
1968	1.08	7.56	6.61	5.99
1969	8.99	10.94	9.98	10.22
1970	4.68	16.27	15.62	10.55
1971	7.28	11.72	10.55	11.81
1972	27.66	16.73	17.55	18.82
1973	39.08	34.78	37.45	31.38
1974	-51.05	21.08	25.09	7.16
1975	-45.91	-17.81	-21.24	-7.54
1976	-10.40	-6.29	-8.23	-10.16
1977	-19.38	4.49	5.17	5.03
1978	38.58	12.85	13.32	21.26
1979	53.73	56.07	60.26	43.39
1980	-22.28	35.89	39.71	31.88
1981	-49.60	-0.13	-2.26	-2.43
1982	-46.88	-7.66	-11.69	-6.27
1983	-37.21	-3.66	-7.15	-10.52
Average	-2.92	10.32	9.71	9.34
Standard Deviation	26.78	14.57	16.47	12.52
Maximum	53.73	56.07	60.26	43.39
Minimum	-51.05	-17.81	-21.24	-10.52
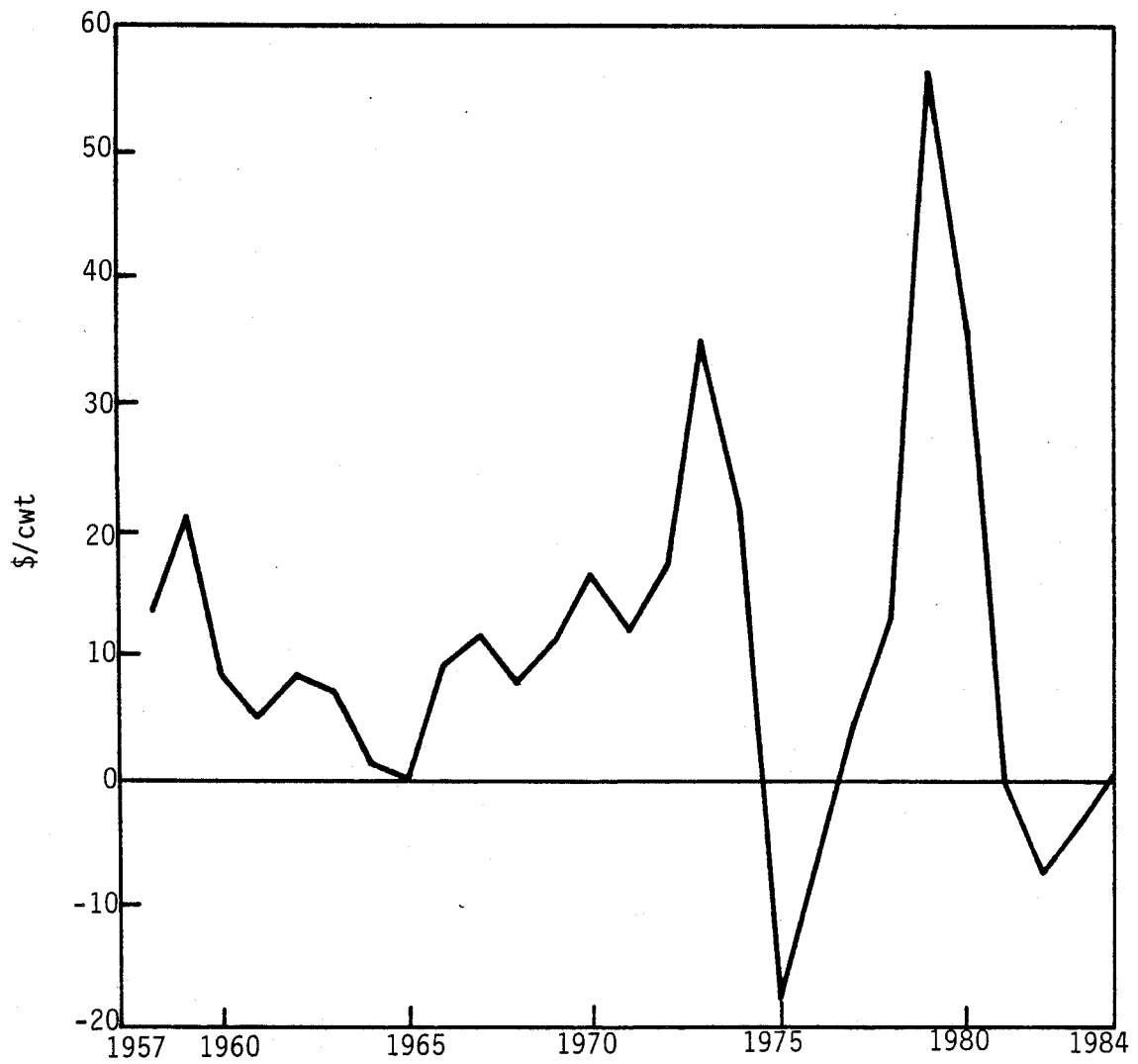
Figure 5. Cow-Calf and Backgrounding Profitability, 1957-1983
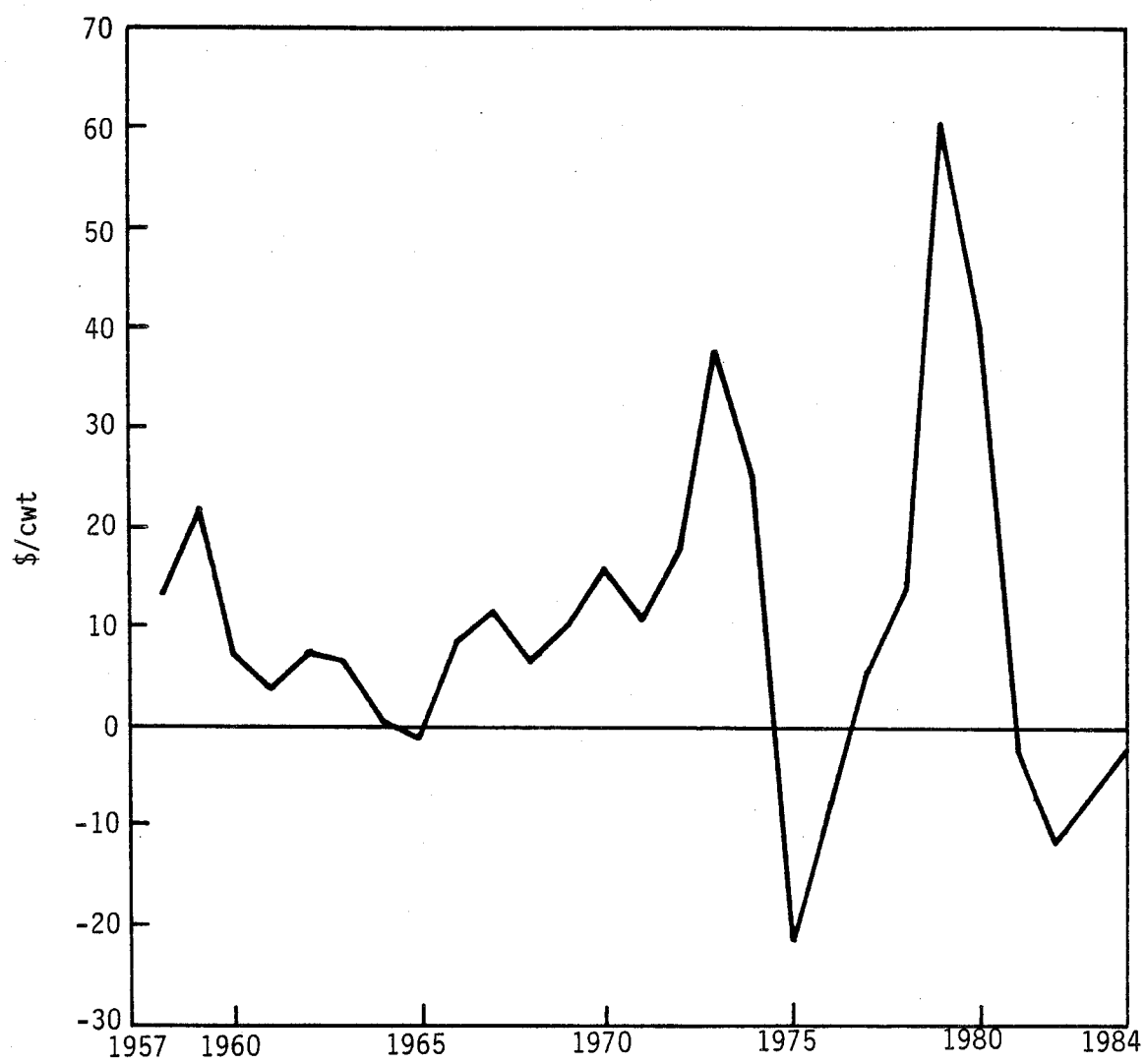
Figure 6. Cow-Calf and Wintering Profitability, 1957-1983
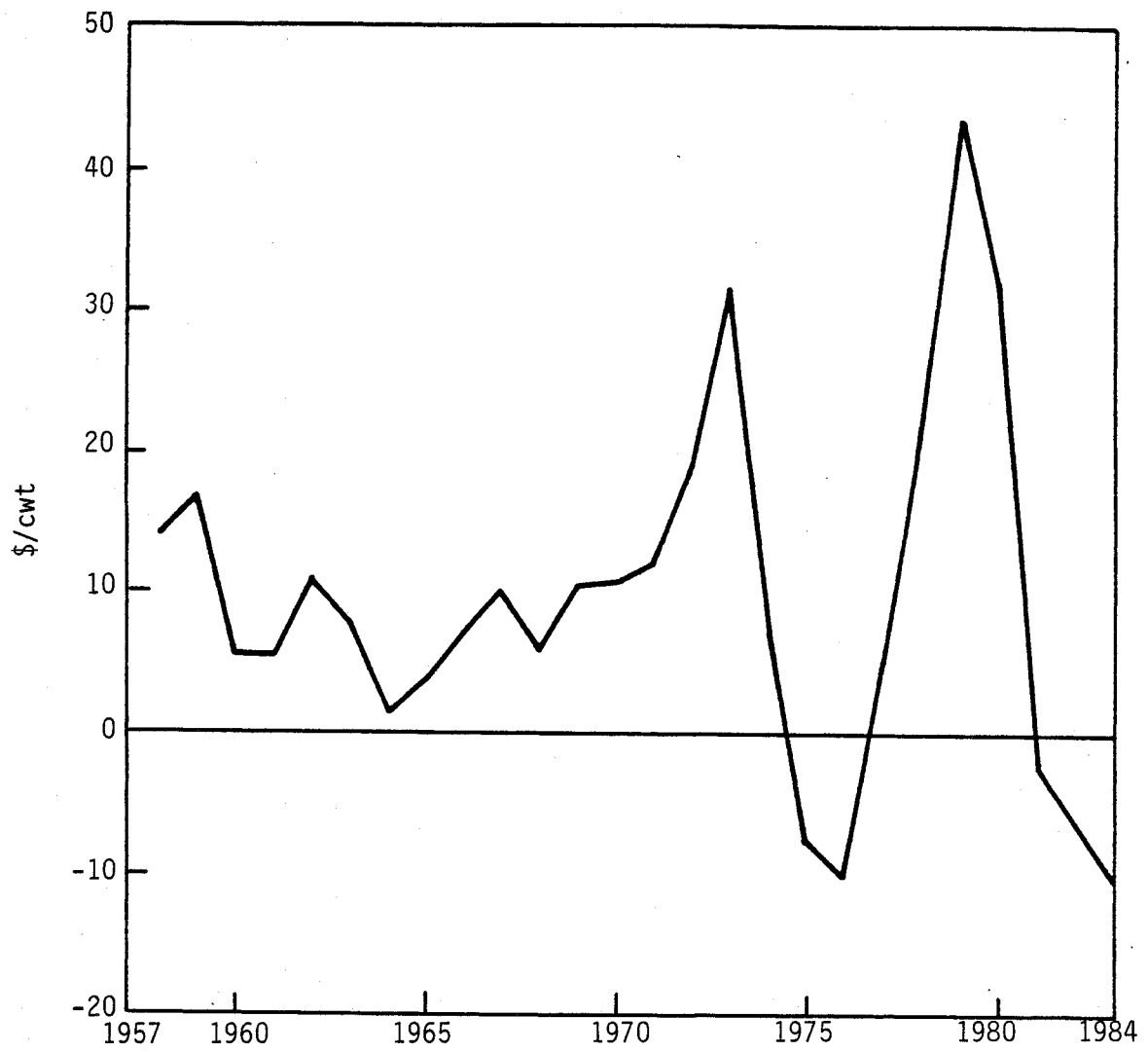
Figure 7. Cow-Calf, Wintering, and Pasturing Profitability, 1957-1983

Implications

The purpose of this paper has been to determine the profitability of several North Dakota beef production enterprises over time. According to the results generated, there is considerable financial risk involved in the beef industry, especially cow-calf operations. The variability in profits has been increasing over time (Table 7). The standard deviation of the profitability of each enterprise from 1971 to 1983 was significantly higher than that from 1957 to 1960. The average profit increased in the backgrounding and wintering programs, but dropped in the pasturing program. The average profit in the cow-calf operation dropped over $10.00/cwt sold, resulting in an average loss from 1971 to 1983. These results demonstrate clearly that the risks involved in cattle production have been increasing rapidly since 1971.

TABLE 7. AVERAGE AND STANDARD DEVIATION OF ESTIMATED PROFIT FOR NORTH DAKOTA CATTLE ENTERPRISES, 1957 to 1970, 1971 to 1983

	Cow-Calf	Backgrounding	Wintering	Pasturing
1957-1970				
Average ($/cwt)	2.68	2.35	0.40	2.37
Standard Deviation	8.63	2.25	2.25	1.73
1971-1983				
Average ($/cwt)	-8.95	3.44	2.01	1.53
Standard Deviation	36.60	8.85	9.45	5.72

What does this imply for North Dakota cattle producers? The importance of becoming educated about the beef cattle cycle, its causes and effects, and indicators that give clues to the cattle cycle's current stage should be fairly obvious. 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 are not well-informed about inventory changes or new developments in the industry on a national scale. That study also concluded that most cow-calf operators are reluctant to acknowledge that it is the collective impact of their individual decisions to increase production that is the major cause of the cyclically lower prices. They instead blame the condition of the industry on the government, the weather, imports, etc. (Hasbargen et al. 1983).

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

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 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 nunmbers 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. 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.

Maintaining flexibility in an operation is one way that variability caused by cattle cycles can be reduced. It was shown that cow-calf operators could potentially benefit by vertically integrating in the form of extended ownership of their calves. Production flexibility is especially beneficial in the bust years by enabling producers to at least minimize losses to some extent. 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.

One possible option available to producers with sufficient flexibility is reduction or expansion of the cow herd depending on the current market situation. This would entail careful monitoring of the status of the cattle industry as a whole by the indicators listed and by other means. The objective of such a program would be to reduce the cow herd prior to the unprofitable phase of the cycle, then rebuild to full capacity in time to capitalize on the improved market during profitable years.

Summary

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, there is hope for the prudent cow-calf operator. The potential exists for the cow-calf operator to profit from cattle cycles by staying abreast of developments in the beef industry as a whole, by remaining flexible in his production and marketing, and by making decisions based on current market trends.

APPENDIX A

COW-CALF BUDGET (1982)

	(Per Cow)
Feed Expense	$ 97.55
Pasture Rent	40.00
Labor	32.00
Other Operating Expenses	23.38
Interest on Operating Expenses[1]	15.51
Livestock Interest[2]	60.62
Land Taxes	8.17
Land Charge	76.38
Total Production Costs	$353.61

Adjustments
Cull Cow Return[3]	$-56.55
Cull Heifer Return[4]	- 8.51
$\pm\Delta$ in Value of Cow[5]	41.00
Adjusted Production Costs	$329.55

Breakeven Price: 4.25 cwt x .45 = 1.9125
                4.00 cwt x .27 = 1.0800 $\dfrac{\$329.55}{2.9925 \text{ cwt}}$ = $110.13/cwt
                                   2.9925

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

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

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

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

[5] Change in cow's value = $V_t - V_{t-1}$

SOURCE: USDA, ERS, Feeder Cattle Budgets, Beef Cow Enterprise, 100-499 Cows, Northeast Plains, 1984.

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% steers sold (45 steers/72 hd sold)

   37% heifers sold (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

	(Per Head)
Feeder Cost	$280.15
Feed Expense	69.09
Other Operating Expenses	20.00
Labor	16.00
Interest on Operating Expenses[1]	3.47
Interest on Calves[2]	18.51
Death Loss[3]	2.80
Overhead	10.00
Total Production Costs	$420.02

Breakeven Price: $\dfrac{\$420.02}{6.75 \text{ cwt}} = \underline{\$62.22/\text{cwt}}$

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

[2]Interest on calves = feeder cost x interest rate x % of year on feed

[3]Death loss = feeder cost x .01

Backgrounding Production Coefficients

a. Purchase in the fall at 425 lbs
    Sell in the spring at 675 lbs

b. 1.7 lb average daily gain

c. 150-day feeding period

d. 1% death loss

SOURCE: Toman, Norman and Wallace Eide, "Breakeven Prices for Backgrounding Calves," Cooperative Extension Service, North Dakota State University, Bulletin EC-783, September 1983.

WINTERING (1982)

	(Per Head)
Feeder Cost	$280.15
Feed Expense	36.50
Other Operating Expenses	20.00
Labor	16.00
Interest on Operating Expenses[1]	2.40
Interest on Calves[1]	18.57
Death Loss[1]	2.80
Overhead	10.00
Total Production Costs	$386.36

Breakeven Price: $\dfrac{\$386.36}{5.75 \text{ cwt}} = \underline{\$67.19/\text{cwt}}$

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[1]Refer to Backgrounding Budget

Wintering Production Coefficients

a. Purchase in the fall at 425 lbs
    Sell in the spring at 575 lbs

b. 1.0 lb average daily gain

c. 150-day feeding period

d. 1% death loss

SOURCE: Toman, Norman and Wallace Eide, "Breakeven Prices for Backgrounding Calves," Cooperative Extension Service, North Dakota State University, Bulletin EC-783, September 1983.

PASTURING (1982)

	(Per Head)
Feeder Cost	$382.22
Pasture Rent	40.00
Feed Expense	9.78
Other Operating Expenses	19.00
Labor	10.00
Interest on Operating Expenses[1]	2.08
Interest on Calves[1]	20.21
Death Loss[1]	3.82
Overhead	5.00
	$492.11

Breakeven Price: $\dfrac{\$492.11}{8.0 \text{ cwt}} = \underline{\$61.51/\text{cwt}}$

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[1]Refer to Backgrounding Budget.

Pasturing Production Coefficients

a. Purchase in the spring at 575 lbs
    Sell in the fall at 800 lbs

b. 1.9 lb. average daily gain

c. 120-day grazing period

d. 1% death loss

SOURCE: Toman, Norman and Billy Rice, "Breakeven Prices for Pasturing Calves," Cooperative Extension Service, North Dakota State University, Bulletin EC-829, April 1984.

APPENDIX B

APPENDIX TABLE B1. INDEX OF PRICES PAID BY FARMERS (ADJUSTED TO 1982)

Year	Feed Index	Agricultural Production Items Index	Labor Index	Land Index	Land Tax Index	Interest Rates
1953	47.00	30.00	19.00	28.00	16.00	3.25
1954	47.00	30.00	19.00	28.00	17.00	3.00
1955	44.00	29.00	19.00	28.00	18.00	3.38
1956	43.00	29.00	20.00	30.00	19.00	3.88
1957	42.00	30.00	21.00	31.00	21.00	4.50
1958	41.00	31.00	22.00	31.00	22.00	3.83
1959	41.00	31.00	23.00	31.00	24.00	4.75
1960	40.00	31.00	23.00	31.00	26.00	4.50
1961	41.00	31.00	24.00	31.00	28.00	4.50
1962	41.00	31.00	25.00	31.00	29.00	4.50
1963	43.00	32.00	25.00	31.00	31.00	4.50
1964	43.00	31.00	26.00	31.00	32.00	4.50
1965	43.00	32.00	27.00	31.00	35.00	5.00
1966	45.00	33.00	29.00	32.00	38.00	5.75
1967	44.00	33.00	31.00	32.00	40.00	5.71
1968	42.00	34.00	34.00	34.00	44.00	6.38
1969	43.00	35.00	37.00	36.00	48.00	7.67
1970	45.00	36.00	40.00	37.00	52.00	7.30
1971	46.00	38.00	42.00	39.00	55.00	5.67
1972	47.00	40.00	44.00	42.00	57.00	5.32
1973	70.00	49.00	48.00	47.00	59.00	8.23
1974	86.00	55.00	55.00	58.00	62.00	9.99
1975	82.00	50.00	60.00	67.00	66.00	8.27
1976	85.00	64.00	65.00	69.00	72.00	6.81
1977	82.00	66.00	70.00	74.00	76.00	7.13
1978	80.00	72.00	75.00	80.00	76.00	9.78
1979	90.00	84.00	82.00	88.00	82.00	13.78
1980	101.00	92.00	89.00	94.00	88.00	15.92
1981	110.00	99.00	96.00	99.00	94.00	18.50
1982	100.00	100.00	100.00	100.00	100.00	16.08
1983	110.00	102.00	103.00	102.00	104.00	10.83

APPENDIX C

APPENDIX TABLE C1.   CATTLE PRICES

Year	400-500# Steers Fall	400-500# Heifers Fall	500-600# Steers Spring	600-700# Steers Spring	700-800# Steers Fall	700-800# Heifers Annual Average	Cow Prices
				($/cwt)			
1957	24.50	21.10	20.99	20.93	22.62	20.08	11.50
1958	33.07	30.70	28.58	28.63	28.85	26.18	16.60
1959	29.60	27.26	30.57	30.65	26.98	26.84	15.70
1960	25.45	22.42	27.43	27.46	23.76	23.50	13.90
1961	27.00	24.93	25.29	25.30	24.71	23.37	14.40
1962	29.72	26.54	25.30	25.30	27.36	24.32	14.40
1963	26.93	24.89	25.37	25.37	24.96	22.92	13.60
1964	21.65	19.80	21.39	21.39	20.21	19.22	11.70
1965	25.84	19.93	22.00	22.00	24.19	20.33	12.50
1966	29.13	26.20	27.24	27.24	24.93	24.08	16.00
1967	29.86	26.02	26.23	26.23	24.62	24.10	16.00
1968	29.59	25.95	27.50	27.50	25.31	24.76	16.60
1969	33.12	29.90	30.36	30.36	29.52	27.55	19.00
1970	36.54	32.44	34.25	34.25	28.81	30.18	19.50
1971	40.69	36.56	33.36	33.36	33.12	31.63	19.60
1972	49.46	44.04	41.30	39.21	41.17	34.73	23.40
1973	81.32	54.32	55.31	52.29	51.02	44.73	30.70
1974	29.66	26.10	45.74	42.10	29.81	32.41	24.60
1975	34.84	28.74	31.29	31.18	38.09	28.72	19.60
1976	38.96	32.16	44.03	42.25	35.76	32.89	24.10
1977	45.89	39.34	41.40	39.52	39.76	34.15	24.40
1978	73.10	66.32	58.24	55.13	63.55	50.75	34.80
1979	95.41	84.06	50.88	86.10	78.27	69.77	47.40
1980	82.38	72.63	76.68	71.84	71.94	64.15	44.60
1981	65.85	58.43	69.04	65.64	63.09	53.26	41.80
1982	65.92	58.70	66.47	64.43	63.64	56.74	37.70
1983	62.22	53.33	68.64	65.88	57.17	55.73	36.80

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

<center>Regression Equations</center>

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

600-700# Steers

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

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 = .5080279 + (.9720322 x Kansas City Price)
R^2 = .994
T-Value = 35.844

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