FEEDER CATTLE BASIS PATTERNS IN NORTH DAKOTA

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A feeder cattle producer considering futures market hedging as a means of reducing risk from adverse price movements should "localize" the futures price so it relates more closely to a local cash market price. The method used to localize or adjust the futures market price is called "basis." Basis values are computed by subtracting a local cash price from the futures market price. When a hedge is placed and futures price "locked in," it is movement in the basis that determines the success of the hedge, rather than changes in the price level.

Chicago Mercantile Exchange (CME) feeder cattle futures and West Fargo cash daily basis relationships were identified for years 1972 to 1981. The futures prices were the daily closing price for CME feeder cattle futures published in CME Yearbooks (2). Due to a change in USDA grades for feeder cattle, the cash price used prior to September 1979 was for USDA choice, 600-700 pound feeder steers. After September 1979, the market class was USDA No. 1 muscle thickness, medium frame, 600-700 pound feeder steers. Cash prices were obtained form the USDA Livestock Market News office in West Fargo, North Dakota.

The nearby period' basis was analyzed for all contracts in the 1972 to 1981 period. From 1972 to 1977, seven contracts (March, April, May, August, September, October and November) were traded each year at the CME. In 1977, a January contract was added, with the first one maturing in 1978. From December 1977 through 1981, the January contract was added to the data. Basis values were determined only for those days for which both cash and futures prices were available.

The Overall Basis

As a starting point, the entire data set was examined. Results indicated an average basis value of $0.99 for the

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'The nearby period is defined as the month the contract matures and the month immediately preceding that month. It may be divided into the delivery period (month of contract maturity) and the nondelivery period (month prior to contract maturity).

10-year period 1972-1981, with a standard deviation of $2.41. The basis values ranged from -$5.60 to $10.12. A -$5.60 basis value indicates that the cash price exceeded the futures priceon a particular day by $5.60.

The Basis By Year

The basis was examined by year to identify changes that have occurred over the 10-year period. The basis mean (average), range, and standard deviation are presented in Table 1. In 1972 and 1975, the mean basis was negative, indicating that the cash price at West Fargo averaged above the futures price. Since 1972 was the first year of trading for feeder cattle futures contracts, there were fewer basis observations for that year. From 1973 the yearly mean basis at West Fargo declined until 1975, when it reached its lowest point. In that year, the cash price averaged $0.34 above the futures price. The yearly basis means then increased until 1977, and very little change occurred from 1978 to 1979. The average price level for feeder cattle more than doubled from 1977 to 1979. The years 1980 and 1981 were years of steadily declining prices for feeder cattle, while the basis increased markedly to $3.04 in 1981.

Table 1. Feeder Cattle Basis By Year, West Fargo, 1972-1981.

Year	Days	Mean	Low Value	High Value	Range	Standard deviation
	number	----------------------dollars per hundredweight-----------------------				
1972	86	-0.17	-2.50	1.65	4.15	0.91
1973	120	1.12	-4.50	6.25	10.75	2.48
1974	135	0.39	-5.40	6.00	11.40	2.16
1975	114	-0.34	-5.50	4.30	9.80	2.08
1976	131	0.32	-3.30	3.85	7.15	1.45
1977	109	1.18	-3.73	4.65	8.38	2.22
1978	127	1.01	-3.53	6.10	9.63	2.39
1979	139	1.01	-5.60	10.12	15.72	3.36
1980	123	1.96	-3.52	7.47	10.99	2.24
1981	131	3.04	-1.07	7.15	8.22	1.78

The variability of the basis, as measured by the standard deviation, declined steadily from 1973 through 1976. It increased approximately 50 percent from 1976 to 1977, likewise from 1978 to 1979, and then declined the last two years.

Basis Probabilities By Year

Frequency distributions were used to determine probabilities of the basis being a particular value or less for each year (Table 2). Some fluctuation in basis probabilities occurred over the 10-year period. From 1973 to 1975 the probability of the basis being a particular value or less increased consistently. From 1975 the probability of the basis being a particular value or less generally decreased except in 1979, when the probability of very low basis values was somewhat higher than the two previous years. The probability of all basis values being a particular value or less decreased markedly in 1980 and 1981.

Table 2. Feeder Cattle Basis Probabilities By Year, West Fargo, 1972-1981.

Year	$.00 or less	$0.50 or less	$1.00 or less	2.00 or less	3.00 or less	4.00 or less	5.00 or less
				percent			
1972	57.0	81.4	93.0	100.0	--	--	--
1973	33.0	40.9	48.7	67.0	78.3	84.3	92.2
1974	43.7	52.6	65.9	78.5	88.1	95.5	100.0
1975	54.4	64.0	71.1	86.0	97.4	100.0	--
1976	35.9	50.4	65.6	90.1	98.5	100.0	--
1977	37.4	41.7	42.6	51.3	68.7	92.2	100.0
1978	33.6	38.0	43.0	62.8	73.7	83.9	89.8
1979	41.1	47.3	50.7	67.8	78.1	84.9	89.7
1980	19.0	27.0	36.5	52.6	67.9	79.6	89.1
1981	5.1	9.6	15.4	29.4	48.5	70.6	86.0

The years 1972 and 1981 were extremes. In 1972, the probability of the basis being zero or negative was 57 percent compared to 5.1 percent in 1981. Similarly, the probablity for a $2.00 or less basis was 100 percent in 1972 and only 29.4 percent in 1981. Results from 1972 may be affected by the reduced number of observations for that year, and also because it was the first year of trading in feeder cattle futures.

The Basis By Contract Month

The basis for the nearby period was analyzed by contract month. The mean basis, by contract month, exhibited a distinct seasonal pattern. Except for January, the contracts were grouped into spring and fall contracts. The basis means for spring contracts were significantly higher than for fall contracts. The mean basis was highest in April, declined steadily until reaching is lowest value in October, then increased in November.

To determine if the seasonal pattern was continuous throughout the study period, the data were divided into three three-year groups: 1973-1975, 1976-1978 and 1979-1981. The January contract was not included because it did not begin trading until 1978. The mean basis was determined, by contract month, for each three-year period. A similar pattern existed in all subgroups, indicating seasonal factors affecting the basis remained relatively consistent during the 10-year period (Figure 1).
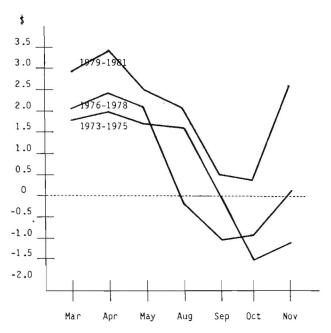

Figure 1. Feeder Cattle Basis by Contract Month at West Fargo, 1973-1975, 1976-1978, and 1979-1981.

All three groups reached the highest mean basis value in April. The lowest mean basis occurred in October for two of the three groups and in September for the 1976-1978 period. The most noticeable change in the seasonal pattern was that the November contract displayed an increasing trend. Over time, the November contract basis increased relative to other contracts so that during the 1979-1981 period the November basis was in the range of the spring contracts rather than other fall contracts. While seasonal patterns remained relatively constant throughout the 10-year period, the price level increased, causing an increase in the basis level for all contracts.

The basis mean, standard deviation, and range statistics by contract month for the 1972-1981 period are presented in Table 3. Both the September and October contracts had negative mean basis values, indicating strong prices at West Fargo relative to the futures market during these months. Standard deviations among contract months did not differ substantially. However, as a group, the spring contracts had a smaller standard deviation than fall contracts.

Table 3. Feeder Cattle Basis by Contract Month, West Fargo, 1972-1981.

Contract Month	Days	Mean	Low Value	High Value	Range	Standard Deviation
	number			dollars per hundredweight		
January*	60	2.52	-3.75	8.63	12.38	2.70
March	170	2.15	-3.30	10.12	13.42	2.17
April	188	2.53	-0.53	9.40	9.93	1.93
May	187	1.87	-2.00	7.47	9.47	1.76
August	149	0.58	-4.88	7.35	12.23	2.32
September	163	-0.29	-5.00	5.70	10.70	2.17
October	168	-0.73	-5.60	5.50	11.10	2.07
November	167	0.44	-5.50	6.95	12.45	2.39

*January contract for years 1978-1981 only.

Basis Probabilities By Contract Month

Probabilities of the basis being a particular value or less for each contract month were calculated from frequency distribution tables. Probabilities of low or negative basis values are greater for the fall contracts than for the spring contracts (Table 4). The nearby basis was zero or negative for the spring contracts less than 15 percent of the time, while August and November basis values were zero or negative 44.3 and 45.5 percent of the time, respectively. October had the highest probability of a zero or negative basis with 69.6 percent, followed by September with 60.7 percent.

Table 4. Feeder Cattle Basis Probabilities by Contract Month, West Fargo, 1972-1981.

Contract Month	$.00 or less	$0.50 or less	$1.00 or less	$2.00 or less	$3.00 or less	$4.00 or less	$5.00 or less
				percent			
January	18.3	20.0	20.0	45.0	56.7	73.3	83.3
March	14.7	23.5	31.8	52.4	70.0	82.9	91.2
April	9.0	17.6	24.5	40.4	64.9	80.3	89.4
May	13.9	19.8	30.5	57.8	74.3	88.8	96.8
August	44.3	53.0	66.4	78.5	85.9	89.9	94.0
September	60.7	70.6	76.7	86.5	90.2	95.7	98.2
October	69.6	77.8	82.8	90.5	94.6	97.6	99.4
November	45.5	59.3	67.7	78.4	83.8	89.8	94.6

The probability of a $2.00 basis or less was high for all fall contracts. Probabilities range from 78 percent for the August and November contracts to 90 percent for the October contract. Spring contracts, including the January contract, had a much lower probability of a $2.00 or less basis. The range was from 40 percent for the April contract to 57 percent for the May contract. The January contract was most variable with approximately 17 percent probability that the basis would be greater than $5.00. At each basis value shown in Table 4, the October contract had the highest probability of occurrance.

If a producer hedged feeder cattle to be marketed in the fall, especially during September and October, a relatively narrower basis could be estimated with less risk of loss on the basis. However, for the spring months a producer would need to allow for a wider basis in order to limit the risk of a loss due to the basis value.

The Basis By Week For Each Contract

Individual contracts were examined by week prior to maturity. Contracts mature on the twentieth, or the last trading day prior to the twentieth, of each contract month. The first week was the calendar week in which trading on the contract terminated. Week 2 was the week prior to Week 1, etc. Week 1 had somewhat fewer observations than Weeks 2-7, because it was not always a full week of trading. Week 8 had considerably fewer observations than all other weeks because the data collected began on the first trading day of the month prior to delivery.

The March contract basis was narrowest during the fourth week prior to maturity and then widened during the delivery month (Table 5). The standard deviation was smallest during the fifth week and increased considerably during the delivery month.

Table 5. Feeder Cattle Basis by Week Prior to Contract Maturity for the March Contract, West Fargo, 1972-1981.

Week Prior	Obser-vations	Mean	Low Value	High Value	Standard Deviation
	number		dollars per hundredweight		
1	18	2.14	-1.00	6.75	2.19
2	27	2.60	-1.28	9.00	2.42
3	29	2.23	-1.65	10.12	3.20
4	23	1.68	-3.30	5.35	1.87
5	18	2.12	-0.50	4.60	1.40
6	28	2.18	-1.35	7.15	1.81
7	25	2.00	-0.43	6.00	1.58
8	2	1.79	1.07	2.50	1.01

The mean basis narrowed from the seventh week to the third week prior to maturity for the April contract, and then widened the last two weeks of trading (Table 6). The standard deviation became smaller from the seventh week through the final week of trading. There was very little difference in the standard deviation during any of the three weeks in the delivery month. The eighth week had the narrowest basis and the smallest standard deviation, but was based on a smaller number of observations and is not comparable.

Table 6. Feeder Cattle Basis by Week Prior to Contract Maturity for the April Contract, West Fargo, 1972-1981.

Week Prior	Obser-vations	Mean	Low Value	High Value	Standard Deviation
	number		dollars per hundredweight		
1	21	2.79	0.25	6.40	1.49
2	24	2.59	-0.17	6.45	1.54
3	25	1.94	-0.53	4.97	1.53
4	26	2.35	-0.48	6.25	1.87
5	26	2.10	-0.53	6.00	1.72
6	27	2.82	-0.10	8.60	2.26
7	29	3.33	-0.30	9.40	2.59
8	10	1.74	-0.45	4.02	1.45

The May contract reached its narrowest basis mean during the final week of trading, however there was very little difference during any of the last four weeks of trading (Table 7). The mean basis values for Weeks 5 through 8 were similar, but about $1.00 wider than Weeks 1 through 4. The standard deviation decreased from the seventh week through the third week, and then increased during the final two weeks of trading.

The August contract basis was narrowest during the fourth week, when cash prices averaged $0.10 above the futures price (Table 8). The basis during the delivery month widened considerably. The variability of the basis generally increased as the August contract matured. The smallest standard deviation occurred during Weeks 6 and 7.

Table 7. Feeder Cattle Basis by Week Prior to Contract Maturity for the May Contract, West Fargo, 1972-1981.

Week Prior	Observations	Mean	Low Value	High Value	Standard Deviation
	number	------------dollars per hundredweight-------------			
1	19	1.33	-2.00	5.05	1.89
2	29	1.38	-1.70	5.75	1.86
3	26	1.44	-1.60	3.30	1.43
4	30	1.50	-1.80	5.05	1.58
5	25	2.40	-1.00	5.15	1.50
6	26	2.55	-0.60	7.35	1.81
7	23	2.41	-0.52	7.47	2.06
8	9	2.30	0.38	4.47	1.14

Table 8. Feeder Cattle Basis by Week Prior to Contract Maturity for the August Contract, West Fargo, 1972-1981.

Week Prior	Observations	Mean	Low Value	High Value	Standard Deviation
	number	------------dollars per hundredweight-------------			
1	17	0.98	-3.13	6.75	2.80
2	24	1.28	-2.83	6.20	2.42
3	24	0.78	-3.25	6.45	3.08
4	15	-0.10	-4.88	7.35	2.75
5	24	0.36	-2.25	4.75	2.08
6	21	0.37	-2.75	2.40	1.36
7	18	0.27	-2.50	2.97	1.38
8	6	-0.04	-2.38	1.45	1.54

The September contract basis was most favorable during Week 4 with a basis of $0.86 (Table 9). The basis was negative during the last five weeks of trading. The standard deviation followed a similar pattern, decreasing to Week 4, and then increasing during the delivery month.

Table 9. Feeder Cattle Basis by Week Prior to Contract Maturity for the September Contract, West Fargo, 1972-1981.

Week Prior	Observations	Mean	Low Value	High Value	Standard Deviation
	number	------------dollars per hundredweight-------------			
1	17	-0.66	-5.00	1.95	1.91
2	24	-0.16	-3.50	4.00	1.86
3	20	-0.56	-3.33	2.75	1.66
4	23	-0.86	-3.30	3.07	1.58
5	24	-0.79	-3.28	4.20	1.92
6	26	0.47	-3.73	5.70	2.65
7	20	0.19	-4.40	4.70	2.76
8	20	0.19	-4.40	2.94	

Except for the final week of trading, the October contract had negative basis means throughout the nearby period. Week 4 had the largest negative basis means and would have been the most favorable for lifting a short hedge. The standard deviation was also most favorable (smallest) during this week. Results of the weekly analysis for the October contract are shown in Table 10.

Table 10. Feeder Cattle Basis by Week Prior to Contract Maturity for the October Contract, West Fargo, 1972-1981.

Week Prior	Observations	Mean	Low Value	High Value	Standard Deviation
	number	------------dollars per hundredweight-------------			
1	21	0.70	-2.50	5.50	2.27
2	21	-0.01	-3.80	4.85	2.16
3	24	-1.35	-3.80	2.30	1.64
4	27	-1.58	-4.50	1.07	1.46
5	25	-1.18	-5.60	2.45	1.95
6	24	-0.63	-5.13	3.75	2.37
7	22	-0.72	-4.20	2.75	2.05
8	4	-0.48	-1.10	1.00	1.00

The mean basis for the November contract was negative, and therefore most favorable during Weeks 7 and 8 prior to maturity. The basis was positive the last six weeks of trading, reaching its greatest value during the final week of trading. The standard deviation was smallest during Weeks 1 and 8. However, both weeks had fewer observations than the remaining weeks (Table 11).

Table 11. Feeder Cattle Basis by Week Prior to Contract Maturity for the November Contract, West Fargo, 1972-1981.

Week Prior	Observations	Mean	Low Value	High Value	Standard Deviation
	number	------------dollars per hundredweight-------------			
1	15	1.08	-1.47	5.27	1.99
2	24	0.56	-3.52	6.47	2.53
3	20	0.83	-3.00	5.40	2.39
4	23	0.42	-3.35	4.75	2.30
5	25	0.74	-4.15	6.95	2.75
6	23	0.51	-5.50	5.45	2.65
7	22	-0.21	-4.30	3.42	2.22
8	15	-0.49	-3.85	2.12	1.86

Analysis of basis means by week prior to maturity by contract month, indicated the most favorable basis did not occur during the same week for all contract months. The most favorable basis was the largest negative basis value or the smallest positive basis if negative values did not occur. The fourth week prior to maturity of the contract was most favorable for March, August, September and October contracts. The most favorable mean basis occurred during Week 1 for the May contract, Week 3 for the April contract, and Week 8 for the November contract.

Summary

Much of the potential for the successful hedging of feeder cattle rests on accurate prediction of what the basis will be on the day the hedge is lifted. Research showed that relatively wide variations existed in the day-to-day feeder cattle basis and that prediction of basis values for a particular day is difficult. However, analysis indicated that particular basis patterns do exist,

and probably can be predicted more accurately than cash market prices. Therefore, futures market hedging during periods of adverse price movements can be an effective method of reducing price risk.

REFERENCES

1. Aakre, Dwight G., **Basis Determination For Feeder Cattle in North Dakota and Related Hedging Strategies,** Fargo: North Dakota State University, Unpublished M.S. Thesis, June 1983, 101 pages.

2. Chicago Mercantile Exchange, Market News Department, **Chicago Mercantile Exchange Yearbook,** Chicago: 1972-1981.

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ern and western states, has been especially evident at North Dakota State University. Historically, agriculture has been perhaps the single most competitive enterprise in this country. Faced with the intensely competitive demands of their professions, farmers and ranchers were quick to recognize the resource represented by the concentration of highly trained professionals comprising the faculties and staffs of the land-grant colleges and universities. The demands placed on the land-grant universities and the support given them by the agricultural community have been instrumental in building the land-grant system into what it is today.

That special relationship between the farmer and rancher and the land-grant university has never been more important. Both are facing what is, historically, perhaps their most difficult period. The intensely competitive nature of agriculture requires that crop varieties and livestock breeds be developed or enhanced to match the specific ecological and climatological conditions of an area such as North Dakota. Weed and pest control procedures must be equally specific. If reliance is placed upon research in other parts of the country, it will not always fit the conditions here, and our farmers and ranchers will fall behind the competition. In today's intensely competitive market, the loss of that edge could prove fatal. Any dilution in the focus of resources toward the problems of North Dakota agriculture, in the education of our young people who will take positions in or in support of agriculture, in the research into the solution of problems facing the state, or in the service communicating the latest techniques to solve problems, would have serious consequences. North Dakota agriculture simply cannot afford to drop behind the rest of the nation. The result of any diminution of competitive posture would have serious ramifications for all sectors of the state and its economy.

The national press often refers to the "subway alumni" of Notre Dame. These are city dwellers who have not graduated from that institution, and who may have never even seen it, but who have adopted its athletic teams with all the fervor of alumni. In an even more basic sense, everyone associated with agriculture in the state of North Dakota is a "tractor alumnus" of North Dakota State University. If you are associated with ranching or farming, even if you graduated from some other university, or never went to one, if you support some other football team or even if you dislike the Bison mascot, you are still a tractor alumnus of NDSU. And, we need from you all the contributions usually expected from a dedicated alumnus if NDSU is to do the job that you, the agricultural community, must have from the University.

North Dakota State University needs from its tractor alumnus support, advice, and, most importantly of all, involvement. If the University is to continue to strengthen and nurture this very special concept of service to North Dakota and to North Dakota's agricultural community, the involvement by agriculture in the University and its functions is essential. That involvement may take a variety of forms, from service on formal advisory bodies, to membership in the **President's Ag Club,** to assistance in determining research and service priorities, to encouraging support for the University's needs over coffee with a local legislator. But, for the sake of both the University and agriculture in North Dakota, that involvement on the part of agricultural practitioners is essential. We hope everyone associated with agriculture in North Dakota will become active tractor alumni of North Dakota State University.