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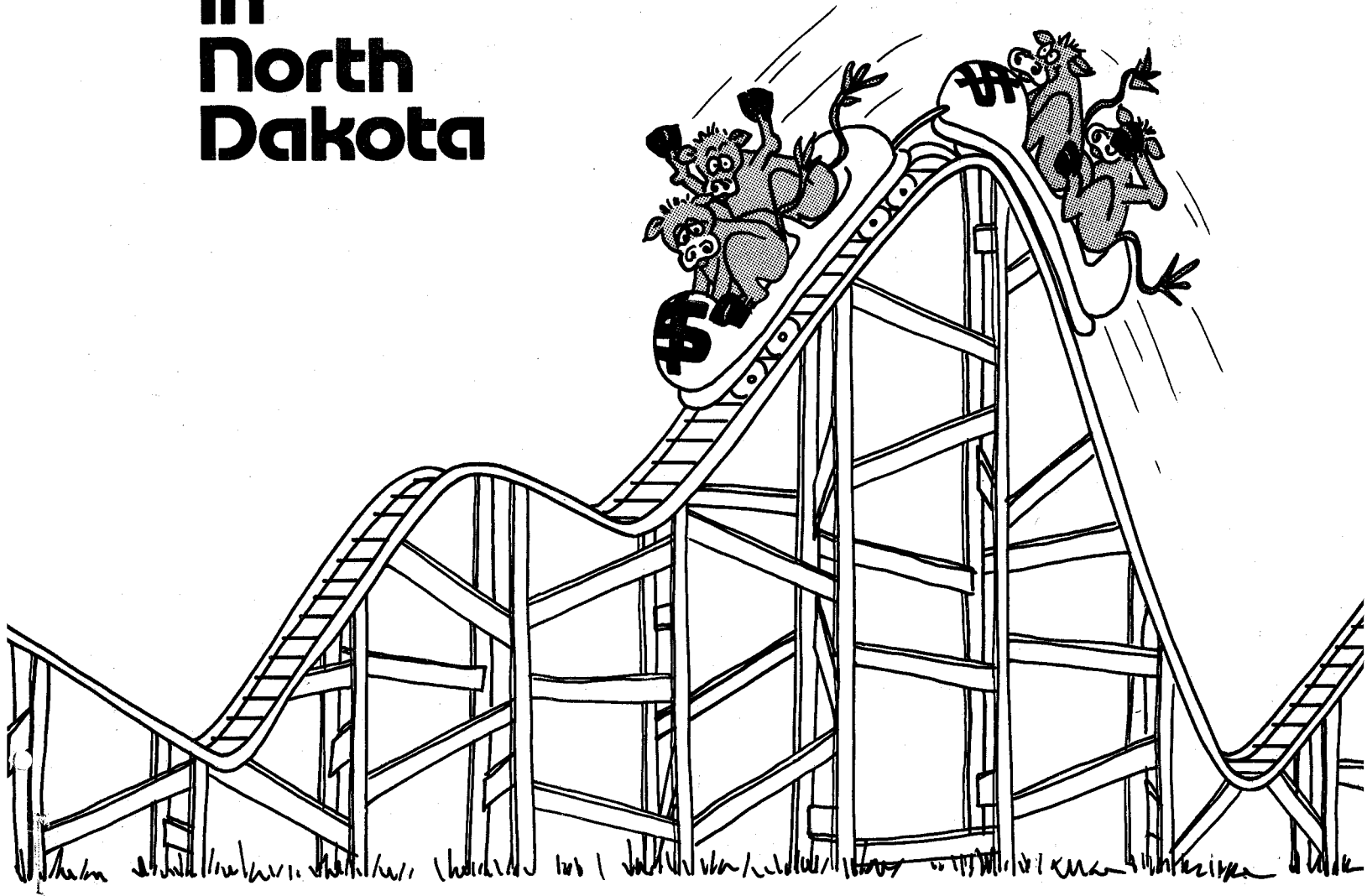
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# Feeder Cattle Basis Patterns in North Dakota



by  
Timothy A. Petry, Norman E. Toman, and Dwight G. Aakre

Department of Agricultural Economics  
Agricultural Experiment Station  
North Dakota State University  
Fargo, North Dakota 58105-5636

## PREFACE

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### Highlights

A cattle producer considering futures market hedging as a means of reducing risk from adverse price movements needs to "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 a 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 feeder cattle futures and West Fargo cash basis relationships for years 1972 through 1981 were identified. The nearby period basis was analyzed by yearly, contract month, delivery and nondelivery period, and weekly categories. In addition, the basis for the entire trading period of the April and October contracts was analyzed.

Analysis of the basis by year showed a widening trend with the sharpest increase occurring in the final two years. The fall contracts (August, September, October, November) exhibited a narrower basis than the spring contracts (March, April, May).

Analysis of basis values by week prior to maturity indicated that the basis was most favorable for lifting hedges during the fourth week prior to maturity for the March, August, September, and October contracts. Week one was the most favorable for the May contract, Week 3 for the April contract, and Week 8 for the November contract.

# Feeder Cattle Basis Patterns in North Dakota

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Timothy A. Petry, Norman E. Toman, and Dwight G. Aakre\*

## Introduction

During the past decade cattle producers have experienced increasing production costs and widely fluctuating livestock prices. Producers have expressed the need for management techniques which offer protection from adverse price movements. Forward price contracting and futures market hedging are methods of reducing price risk.

Forward price contracting during the spring and summer months of feeder cattle to be marketed in the fall has occurred in North Dakota on a somewhat limited basis for many years. Futures trading in feeder cattle began at the Chicago Mercantile Exchange (CME) in 1972. Because futures market hedging is relatively new, it is not widely understood and has been used only in isolated cases by larger feeder cattle producers in North Dakota.

In the first few years of trading, the volume of feeder cattle futures contracts traded was relatively small and offered only limited potential for hedging. More recently, volumes have increased to a point where feeder cattle producers who raise sufficient numbers of cattle can use the futures market as a risk management tool.<sup>1</sup>

Hedging is defined as taking a position in the futures market opposite to a position held in the cash market. Cash and futures market prices tend to follow a similar pattern over time. Therefore, after a hedge is placed, losses resulting from declines in one market are offset by gains resulting from the approximately equal, but opposite, position held in the other market. The futures market can be used to "lock in" or establish a price for cattle approximately one year before they actually meet CME specifications and are ready for market.

A cattle producer considering hedging as a means of transferring price risk needs to "localize" the futures price so that it relates more closely to the local cash market. The method used to localize or adjust the futures market price is called the "basis." Basis is defined as the price of a specified futures contract month minus the current cash price. When the cash price is below the futures price, the basis is positive. When the cash price is above the futures price, the basis is negative.

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\*Petry is Associate Professor, Department of Agricultural Economics, Toman is Livestock Marketing Economist, Cooperative Extension Service, and Aakre was a Graduate Research Assistant, Department of Agricultural Economics.

<sup>1</sup>The CME contract specifies a deliverable trading unit of 44,000 pounds (42,000 pounds prior to 1982) of USDA medium and large frame, number one muscle thickness beef steers. Producers raising less than 44,000 pounds or cattle not meeting CME specifications would not have a futures trading unit.



Each cash market where feeder cattle are sold has a unique basis. This basis often refers mainly to location of the cash market relative to the nearest futures market par-delivery point.<sup>2</sup> Adjustments in the basis also can be made for grade, sex, quality, and other factors such as time prior to contract maturity.

The basis is a key element in successful hedging of a commodity. Much of the potential for successful hedging rests on accurate prediction of what the basis will be on the day the hedge is lifted or closed out. This is the critical point in time for the basis value. Adjustments and changes in the basis between the time a hedge is placed and the time it is lifted are of minor concern, as long as the hedger maintains the required margin and continues to hold the hedge. Ideally, the basis on the day the hedge is lifted will be the same value as the hedger estimated when the hedge was placed. An unexpected or "windfall" gain will occur in the profitability of a short hedge<sup>3</sup> if, on the day the hedge is lifted, the actual basis is narrower or more negative than the value the hedger originally estimated. The hedger will receive lower than expected returns on a short hedge if the actual basis is wider or less negative than the estimated basis.

Basis relationships are, in theory, largely dependent upon cash price differences between futures delivery points and local markets. Cash and futures prices at par-delivery points tend to equalize due to arbitrage as the contract approaches maturity. Arbitrage is the act of buying in the lower-priced market and selling in the higher-priced market. Arbitrage at par-delivery point markets is easily accomplished. The futures price and the cash price at the par-delivery point markets are expected to converge to the point where they differ only by the costs of transferring ownership.

Differences in cash prices among markets are determined by patterns of trade among geographic locations and costs of transportation between the two markets. The futures-cash basis should, in theory, be stable and predictable if trade patterns and transfer costs are relatively stable from year to year.

There are relatively wide variations in the day-to-day basis. The basis may vary with changes in relative supply and demand, changes in production costs among regions, changes in transportation costs, changing government programs, or short-run shortages or surpluses at specific markets. Understanding and being aware of these sources of variation may assist the hedger in successfully completing the hedge. Basis can, however, usually be predicted with more accuracy than future cash market prices. Even though variations exist in the basis, price uncertainty can be reduced by hedging.

Hedging establishes a price within some range rather than an exact forward price, since the basis is not precisely predictable and basis variations do occur. Once the hedge has been placed, it is the variation in

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<sup>2</sup>Par-delivery points refer to locations where the commodity defined in the futures contract may be delivered at the price specified in the futures contract.

<sup>3</sup>A short hedge is a hedge in which a futures contract is first sold and then bought back or delivered upon at a later date.

basis, rather than the movement of price levels, which determines the realized net price.

The hedger should begin to monitor carefully the day-to-day variations in the basis as the time approaches to complete or lift the hedge. It may be advantageous for the hedger in a short hedge position to offset the hedge earlier than originally planned if the basis at that time is more favorable (narrower or more negative).

Basis relationships in feeder cattle consist of several components, with the major components being temporal (time) and spatial (distance). Other factors affecting the basis are related to differences in quality between futures contract specifications and the actual cattle.

The theory of basis relationships for feeder cattle and other nonstorable commodities has not been fully developed. Much of the existing theory has been adapted from theories developed for grains and other storable commodities. However, basis relationships for nonstorable commodities, such as feeder cattle, differ from storable commodities, such as wheat. The basis for storable commodities is a market-determined price for carrying charges related to the time value of money. The carrying charge is also related to inventory demand and seasonality of production, since the commodity does not change form over time. The cash price for storable commodities is often derived by discounting this market-determined basis from the market-determined futures price. The basis for nonstorable commodities is not so closely related to the time value of money. Nonstorable commodities are continuously produced and consumed and cannot be stored for any length of time, so there is no long-term inventory demand.

Leuthold (4: p. 48) hypothesized that the basis in live cattle is merely the difference between a futures price derived from anticipated future supply and anticipated future demand and a cash price derived from current supply and demand conditions. This differs from the pricing relationships in storable commodities such as wheat, where the cash price is the residual of the futures price minus some market-determined basis value.

#### Methodology of Basis Calculations

The traditional approach for calculating the basis (futures price minus cash price) was used. The cash market was the West Fargo terminal market, the only market in North Dakota for which an adequate record of USDA daily feeder cattle prices was available.

The nearby period<sup>4</sup> basis was analyzed for all contracts in the 1972 through 1981 period. From 1972 through 1977, seven contracts (March, April, May, August, September, October, and November) were traded each year at the Chicago Mercantile Exchange (CME). In 1977, a January contract was added,

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<sup>4</sup>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).

with the first one maturing in 1978. From December 1977 through 1981, the January contract was added to the data. However, the January contract was excluded from much of the statistical analysis because of the smaller number of observations available.

In addition to analysis of the nearby basis for all contracts, two contracts were analyzed for their entire life. Since the contract months are grouped together in spring and fall sequencing, one contract from each group was used. The April and October contracts were selected due to their high level of trading activity. Basis observations were collected from the beginning of each contract until the contract matured. In most cases, this period was approximately 12 months.

The source for cash prices at the West Fargo terminal market was USDA Market News Reports. USDA reports quotations only for days when actual trading takes place and a quotable price range is established. This normally was only two or three days per week. Basis values were determined only for those days for which both cash and futures prices were available. Cash prices were obtained for the class of livestock that would meet the futures contract specifications. Therefore, it was assumed that the basis did not include discounts for animals not meeting the requirements of a par-delivery unit.

Both the cash and futures markets fluctuate widely from day to day. The futures market, however, is limited to moves of no more than \$1.50 per hundredweight above or below the previous day's close, while the cash market has no limit. Thus, the basis can change considerably from one day to the next. Daily observations were used in the analysis to reflect the situation faced by producers.

A par-delivery unit for a futures contract calls for feeder steers averaging between 550 and 650 pounds. This does not match identically with the weight classifications reported by USDA, as USDA reports prices for even 100-pound classes. The cash price used prior to September 1979 was for choice, 600-700 pound feeder steers. After September 1979, the class used was No. 1 muscle thickness, medium frame, 600-700 pound feeder steers. USDA quotes a range of prices for each class. The mid-point of this range was used for the basis calculation.

The basis was analyzed by segregating the data into groups based on time. These groups were yearly, contract month, delivery and nondelivery period, and weekly. First, the total data set was analyzed by year to identify any changes in patterns that had occurred over the 10-year period. The data then were analyzed by contract months in order to identify significant differences among the contracts, and involved only the nearby period for all contract months.

The nearby period was further analyzed by the month of delivery and the month prior to delivery. The analysis identified changes in the mean and variability as the contract reached maturity.

The nearby period also was analyzed by individual weeks prior to delivery. The first week was the calendar week in which trading on a contract terminated. Week 2 was the calendar week prior to Week 1, etc.

Finally, the April and October contracts were analyzed individually by examining the basis over the entire life of these two contracts. This was done to identify changes that occur in the basis from the beginning of trading until the contract matured.

Mean values (averages) were used for analyzing the data, according to groups. Initial procedures included analysis of variance (ANOVA) and probabilities calculated from frequency distributions. Those means which were shown by ANOVA to be significantly different were further analyzed by the Duncan Multiple Range test and Scheffe's test of significant differences (3:37).

### The Overall Basis

Initially the entire data set was examined without regard to classes. Results indicated a mean basis value of \$0.99 for the 10-year period, 1972-1981 with a standard deviation of \$2.41. The basis values ranged from -5.60 to \$10.12.

### The Basis By Year

The basis was examined by year to identify changes that have occurred over the 10-year period. The yearly basis means are shown in Figure 1. Considerable change occurred over the 10-year period. Some fluctuation occurred, but in general, a rising trend existed in the yearly mean basis at West Fargo.

The basis mean, 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. The yearly mean basis at West Fargo declined from 1973 to 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 feeder cattle prices, while the basis increased markedly to \$3.04 in 1981.

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.

ANOVA indicated that the basis means among years were significantly different at the 1 percent level. The yearly basis means were then tested using both Scheffe's test of differences and Duncan's Multiple Range test to determine which years were significantly different from each other. Results of the Duncan's Multiple Range test are presented in Table 2. The years 1980 and 1981 were significantly different from all other years. Scheffe's test of significant differences yielded identical results.

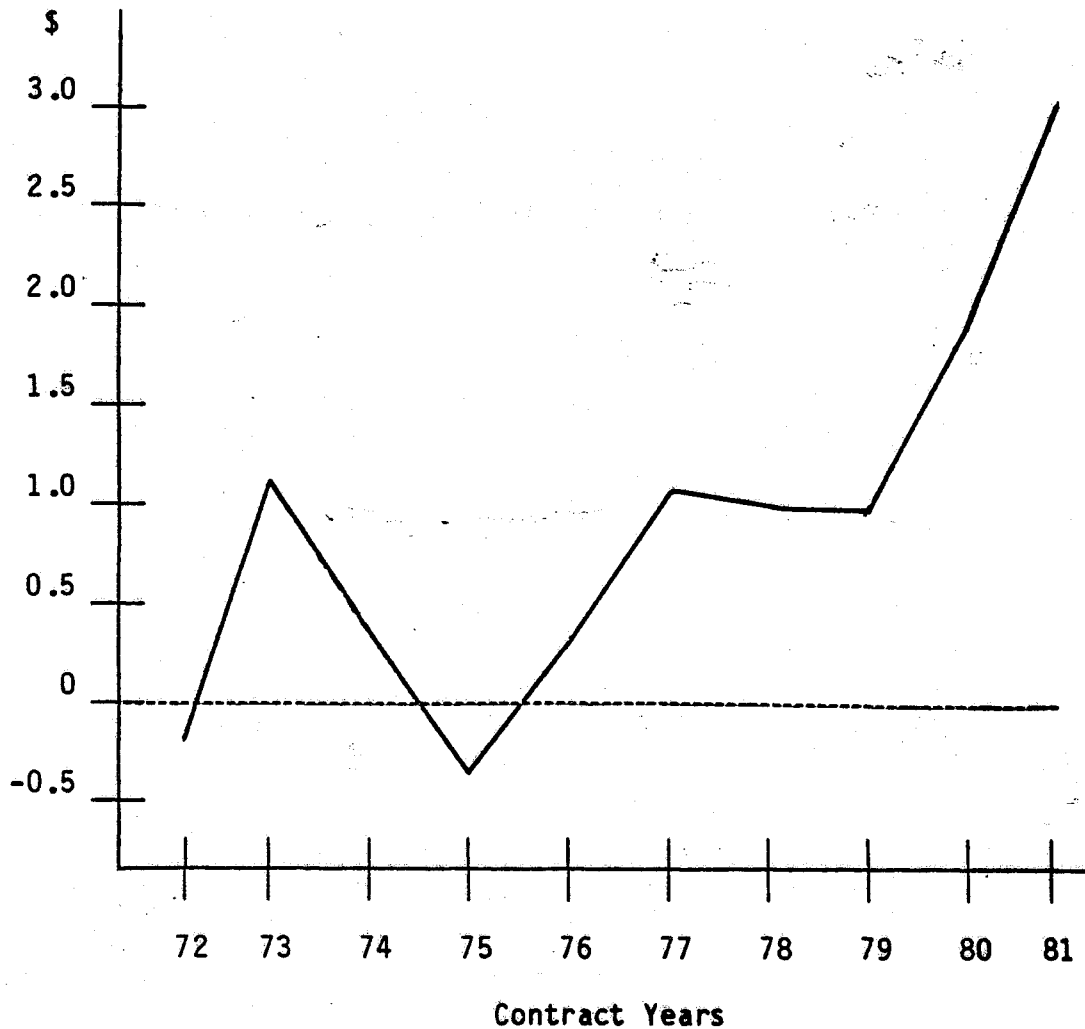


Figure 1. Feeder Cattle Basis Means by Year, West Fargo, 1972-1981

Basis Probabilities By Year

Frequency distributions were used to determine probabilities of the basis being a particular value or less for each year (Table 3). 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. A notable exception was 1979. In that year 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 1. FEEDER CATTLE BASIS BY YEAR, WEST FARGO, 1972-1981

Year	Days number	Mean	Low Value	High Value	Range	Standard Deviation
-----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

TABLE 2. DUNCAN'S MULTIPLE RANGE TEST OF SIGNIFICANT DIFFERENCES AMONG YEARLY BASIS MEANS FOR FEEDER CATTLE AT WEST FARGO, 1972-1981

Year	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1972		X				X	X	X	X	X
1973	X		X	X	X				X	X
1974		X		X		X	X	X	X	X
1975		X	X		X	X	X	X	X	X
1976		X		X		X	X	X	X	X
1977	X		X	X	X				X	X
1978	X		X	X	X				X	X
1979	X		X	X	X				X	X
1980	X	X	X	X	X	X	X	X		X
1981	X	X	X	X	X	X	X	X	X	

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 probability 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.

#### Deflated Yearly Basis Means

The mean yearly basis values were deflated to determine if the rising trend in basis values over the years was due to cattle price level inflation.

TABLE 3. 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 deflator used was an index of futures prices for feeder cattle. CME feeder cattle contract prices were used to develop this index. The base year selected was 1972. Prices of subsequent years were divided by the base year price to obtain the index used to deflate the basis. This index was used because it reflects price level changes in feeder cattle alone. The Index of Prices Received by Farmers (PRF) for meat animals includes all meat animals without regard to market class. The relationship of feeder cattle prices to other cattle prices, or to the prices of other meat animals, may not have remained constant over this time period. Therefore, the PRF would not have been an accurate indicator of change in feeder cattle prices. The deflated yearly basis means are presented in Table 4.

TABLE 4. YEARLY FEEDER CATTLE BASIS MEANS, DEFLATED BY FEEDER CATTLE PRICE INDEX (1972 = 100), WEST FARGO, 1972-1981

Year	Deflated Basis Mean
1972	-0.17
1973	0.82
1974	0.43
1975	0.42
1976	0.33
1977	1.17
1978	0.68
1979	0.49
1980	1.05
1981	1.82

The upward trend in the feeder cattle basis was still evident after adjustment for feeder cattle price level inflation. Regression analysis of the deflated basis means yielded the following regression equation:

$$Y = -0.0107 + 0.1299X$$

where: Y = estimated basis

X = year, 1-10 (1972-1981)

The regression equation resulting from analysis of the actual basis means without deflating was:

$$Y = -0.0502 + 0.2632X$$

The deflated basis increased by about \$0.13 per year, while the actual basis increased by about \$0.26 per year. Therefore, approximately half of the increase in the basis was due to feeder cattle price changes. The trend lines of the two regression equations are shown in Figure 2.

#### 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 (Figure 3). 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 its 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 3-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 3-year period. A similar pattern existed in all subgroups, indicating seasonal factors affecting the basis remained relatively consistent during the 10-year period (Figure 4).

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.



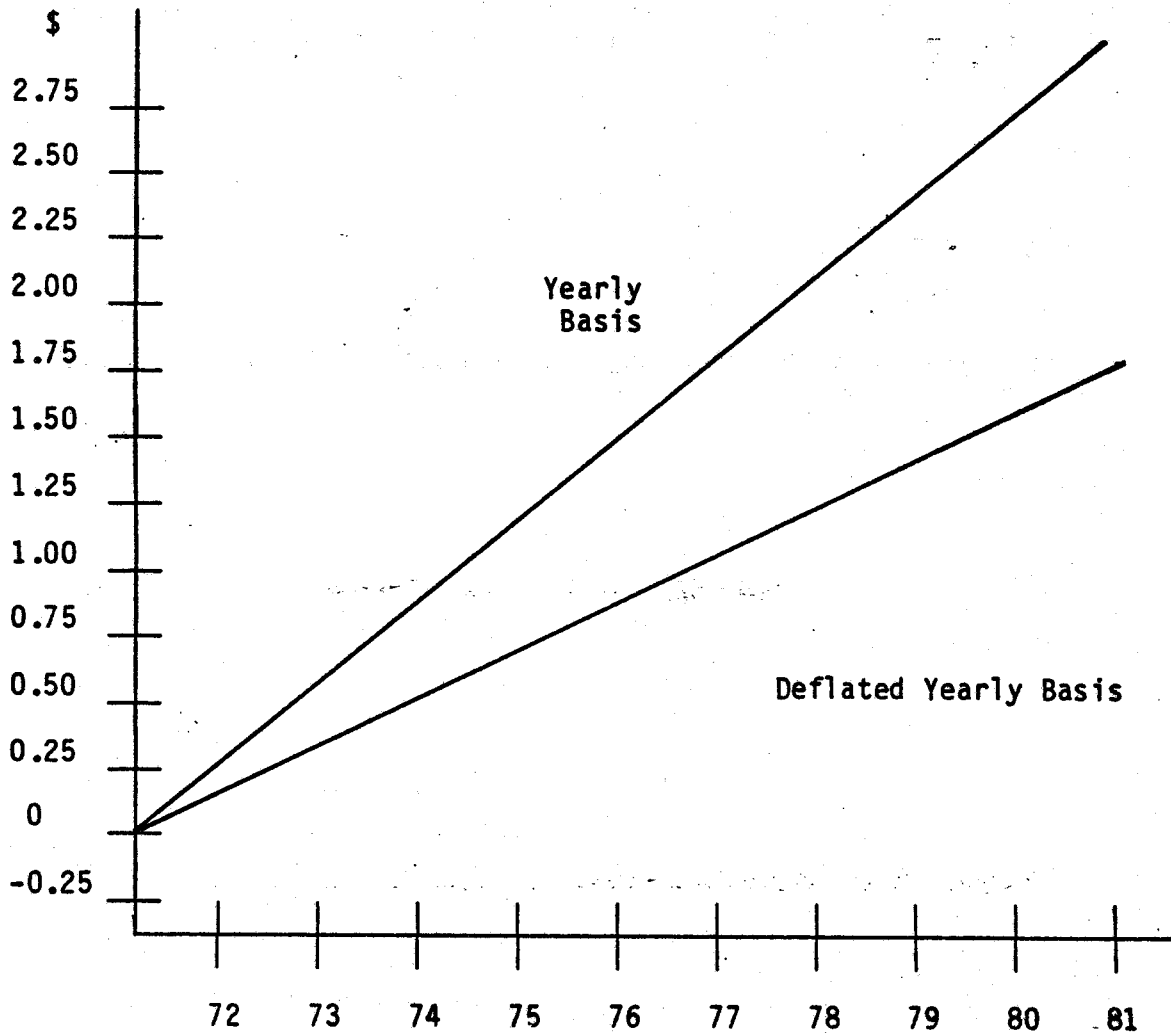


Figure 2. Regression Trend Lines for Yearly Feeder Cattle Basis Means and Deflated Yearly Basis Means, West Fargo, 1972-1981

The basis mean, standard deviation, and range statistics by contract month for the 1972-1981 period are presented in Table 5. 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.

#### The January Contract

The January contract was added in 1978, resulting in only four years of observations, compared to 10 years for all other contracts. These data were

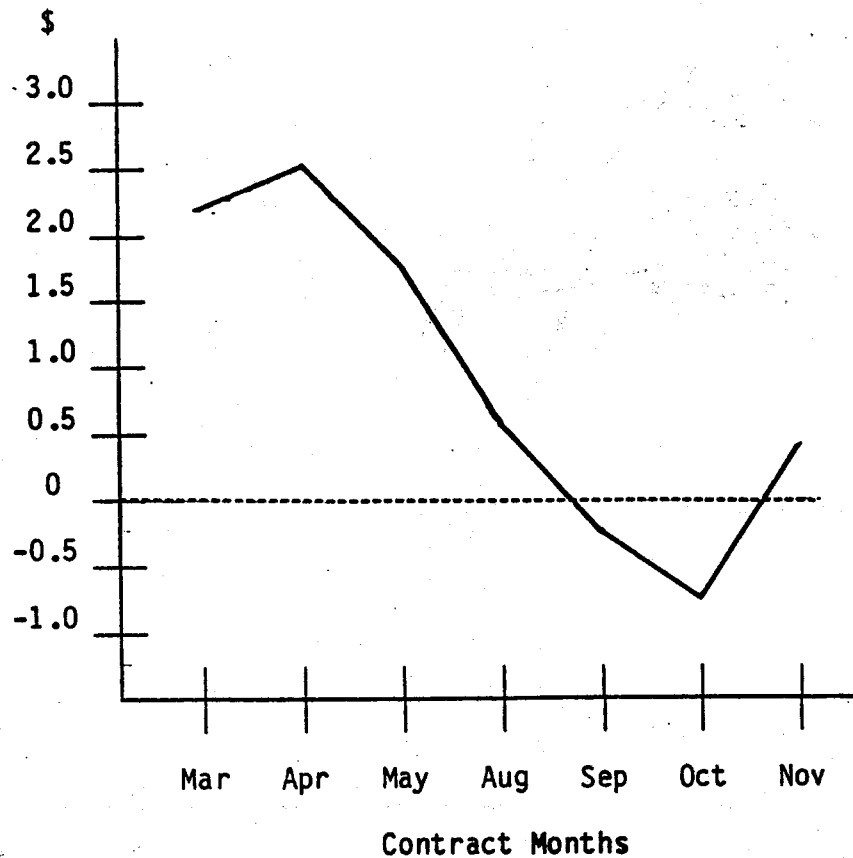


Figure 3. Mean Feeder Cattle Basis by Contract Month, West Fargo, 1972-1981

collected and examined, but were not used in most analyses due to the comparatively small number of observations.

Regression analysis identified a widening trend in the basis means. The January contract had the highest standard deviation (\$2.70) and the second highest mean basis (\$2.52) for all contract months. However, the lower number of observations would tend to make the standard deviation higher. The different time span makes comparison difficult.

#### Differences Among Contract Months

The basis means among contract months were significantly different at the 1 percent level, as determined by ANOVA. Duncan's Multiple Range test was used to determine significant differences among contract means, and results

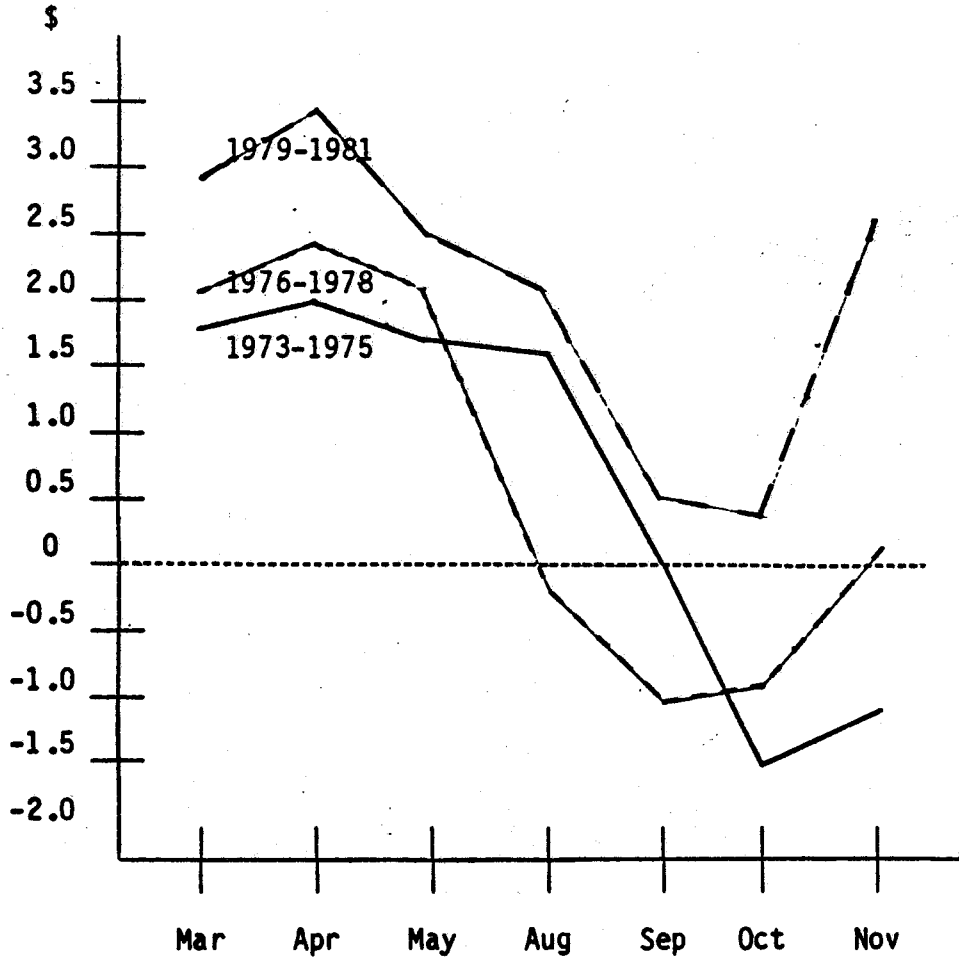


Figure 4. Mean Feeder Cattle Basis Values by Contract Month at West Fargo, 1973-1975, 1976-1978, and 1979-1981

are presented in Table 6. The March contract was significantly different from the fall contracts; April and May were different from each other, and from all fall contracts, August and November were different from September and October, and all spring contracts. September and October were different from August and November and all spring contracts.

Scheffe's test of significant differences also was used. It is a more conservative test and requires larger observed differences to be significant. The results were similar to Duncan's Multiple Range test, with two exceptions (Table 7). April and May were not significantly different from each other, and September and November were not significantly different from each other.

#### 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.

TABLE 5. FEEDER CATTLE BASIS BY CONTRACT MONTH, WEST FARGO, 1972-1981

Contract Month	Days number	Mean	Low Value	High Value	Range	Standard Deviation
-----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.

TABLE 6. DUNCAN'S MULTIPLE RANGE TEST OF SIGNIFICANT DIFFERENCES AMONG CONTRACT MONTHS FOR FEEDER CATTLE BASIS MEANS, WEST FARGO, 1972-1981

Month	March	April	May	August	September	October	November
March							
April							
May		X					
August	X	X	X				
September	X	X	X	X			
October	X	X	X	X			
November	X	X	X		X	X	

X--denotes significant difference.

Probabilities of low or negative basis values were greater for the fall contracts than for the spring contracts (Table 8). 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 69.9 percent, followed by September with 60.7 percent.

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

TABLE 7. SCHEFFE'S TEST OF SIGNIFICANT DIFFERENCES AMONG CONTRACT MONTHS FOR FEEDER CATTLE BASIS MEANS, WEST FARGO, 1972-1981

Month	March	April	May	August	September	October	November
March				X	X	X	X
April				X	X	X	X
May				X	X	X	X
August					X	X	
September							
October							X
November							

X--denotes significant difference.

TABLE 8. 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

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 8, the October contract had the highest probability of occurrence.

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.

If the factors that affect the basis do not change over time, past probabilities can be used with reasonable accuracy in predicting future

probabilities. The relationship among the contract months, with the exception of the November contract, has remained constant over the 10-year period (Figure 3). Therefore, past probabilities could be used with a reasonable chance of success. Consideration should be given to the increasing trend in the November contract, and the general increasing trend in basis values over time.

Basis Probabilities By Contract Month, 1979-1981

Using past basis probabilities as a guide to estimating basis values for use in hedging strategies can be helpful. When a trend exists, values in more recent years can be expected to be more representative than those in earlier years. The analysis by year identified an increasing trend in the basis, so basis probabilities for each contract month were calculated for years 1979 through 1981 (Table 9).

TABLE 9. FEEDER CATTLE BASIS PROBABILITIES BY CONTRACT MONTH, WEST FARGO, 1979-1981

Contract Month	\$0.00 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	23.4	25.5	25.5	48.9	57.4	68.1	78.7
March	11.1	18.5	25.9	40.7	59.3	72.2	83.3
April	5.0	8.3	13.3	25.0	48.3	65.0	78.3
May	9.5	14.3	23.8	42.9	61.9	79.4	92.1
August	20.8	29.2	45.8	60.4	68.8	77.1	87.5
September	44.2	51.9	55.8	75.0	78.8	94.2	98.1
October	46.0	54.0	60.0	70.0	88.0	94.0	98.0
November	20.4	27.8	27.8	35.2	51.9	70.4	83.3

Although the seasonal pattern of basis values during the last three years was similar to the seasonal pattern for the entire study period, price level inflation had reduced the probabilities for low basis values. The probability of zero or negative basis values for the September and October contracts was reduced from 61 and 70 percent to 44 and 46 percent, respectively. Similar changes occurred in all other contracts, except January. Probabilities for the January contract changed very little because it was traded for the last four years of the study period only.

The contract showing the most change was the November contract. Probabilities from all 10 years showed the November contract to be similar to all other fall contracts. However, results of the last three years reveal the November contract to be more like the spring contracts than the fall contracts. That is, it has a much lower probability of low basis values than do the August, September, and October contracts.

The probability of a \$2.00 or less basis ranged from 25 to 43 percent for the November, March, April, and May contracts. This contrasts with the 60 to 75 percent probabilities for the August, September, and October contracts. The April contract had the lowest probability of a basis of \$5.00 or less. The probability of a basis value greater than \$5.00 was 22 percent for the April contract, while only 2 percent for the September and October contracts.

The Basis By Delivery and Nondelivery Periods

The nearby period was divided into the delivery and nondelivery periods for further analysis. The delivery period included approximately the first 20 days of the delivery month, since trading ceases on the twentieth, or the last trading day prior to the twentieth of the contract month. The month prior to the delivery month was the nondelivery period.

The potential for delivery may be expected to bring cash and futures prices closer together as the contract approaches the delivery month. If this did not occur and the two prices remained substantially apart, arbitragers could profit by selling in one market and simultaneously buying in the other market. In addition to a narrowing basis, the variation or fluctuation in the basis, as measured by the standard deviation, could be expected to decrease into the delivery month.

Analysis of the feeder cattle basis showed that this did not necessarily hold true at West Fargo (Table 10). The basis for the April,

TABLE 10. FEEDER CATTLE BASIS MEANS BY CONTRACT MONTH, WEST FARGO, 1972-1981

Period	Contract Month							
	January	March	April	May	August	September	October	November
Nondelivery	4.16	2.02	2.63	2.22	0.20	-0.19	-1.05	0.26
Delivery	0.65	2.30	2.36	1.37	1.08	-0.44	0.27	0.77

May, and September contracts narrowed from the nondelivery to the delivery period, while the March, August, October, and November basis widened. A narrowing in the basis would be beneficial from a short hedger's standpoint.

Mixed results also were obtained from analysis of the variation in basis values during the delivery month as compared to the nondelivery month. The standard deviation of the basis for nondelivery and delivery months is shown in Table 11. March, August, and October contracts yielded greater variation in basis values during the delivery month than the preceding month. The standard deviation decreased in the delivery month for April, May, September, and November contracts.

TABLE 11. STANDARD DEVIATION OF FEEDER CATTLE BASIS MEANS BY CONTRACT MONTH, WEST FARGO, 1972-1981

Period	Contract Month							
	January	March	April	May	August	September	October	November
Nondelivery	2.12	1.67	2.13	1.73	1.88	2.37	1.97	2.42
Delivery	2.01	2.65	1.55	1.68	2.73	1.78	2.14	2.32

The January contract basis was analyzed separately and narrowed from \$4.16 in the nondelivery period to \$0.65 in the delivery period. Also, the standard deviation decreased slightly from \$2.12 to \$2.01.

#### The Basis By Week

The nearby period also was analyzed by individual weeks prior to delivery. 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 were available beginning with the first trading day of the month prior to delivery.

Analysis by week, without regard to contract month, indicated the basis was at its lowest point during the last week of the nondelivery period (Figure 5). In general, the basis widened from the eighth week to the sixth week, then narrowed to the fourth week, and then widened until trading terminated during Week 1.

Mean basis, standard deviation, and the number of observations are shown in Table 12. Week 8 had the smallest standard deviation, and the second narrowest average basis; however, results may have been influenced by the smaller number of observations. The average basis reached its narrowest point (\$0.54) during the fourth week prior to termination of contract trading and more than doubled during the final three weeks of trading.

The standard deviation showed very little change over the eight-week period. Weeks 1, 2, 4, and 5 were all within \$0.06 of each other. The remaining weeks were not more than \$0.25 above or below this range.

Results indicated that the best time to lift a hedge would be in the last week prior to the delivery month. At this time, the basis is likely to be at its narrowest point, and the variation in the basis is not significantly different from any other week during the nearby period.



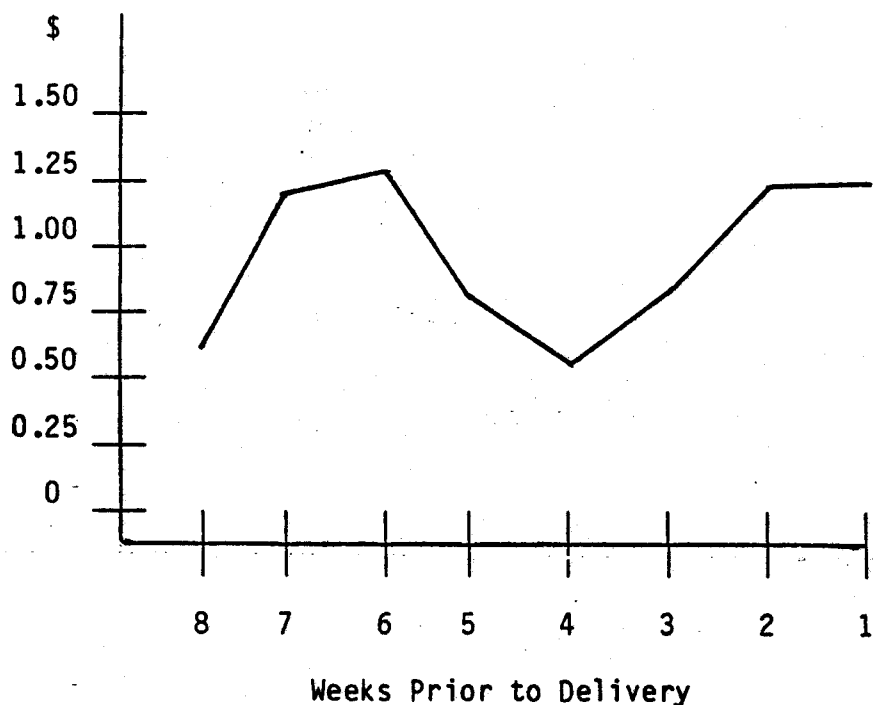


Figure 5. Mean Feeder Cattle Basis by Week Prior to Maturity for all Contracts, West Fargo, 1972-1981

TABLE 12. FEEDER CATTLE BASIS BY WEEK PRIOR TO MATURITY OF ALL CONTRACTS, WEST FARGO, 1972-1981

Week	Observations number	Mean -----dollars per hundredweight-----	Standard Deviation
1	128	1.24	2.29
2	173	1.23	2.34
3	168	0.85	2.55
4	167	0.54	2.31
5	167	0.79	2.35
6	175	1.26	2.47
7	159	1.20	2.58
8	55	0.63	2.06

Basis Probabilities By Week

The percentages of observations that were at or below designated values are shown in Table 13. At lower basis values some differences can be seen, particularly in the case of zero or negative values. During the final week

TABLE 13. FEEDER CATTLE BASIS PROBABILITIES BY WEEK, WEST FARGO, 1972-1981

Week	\$0.00 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-----							
1	34.4	43.0	51.6	67.2	76.6	85.2	94.5
2	30.1	46.2	54.9	68.2	75.7	87.9	93.1
3	43.5	49.4	57.7	69.6	82.7	89.9	93.4
4	44.9	50.9	58.0	72.5	85.0	94.0	96.4
5	39.5	46.7	51.5	68.9	81.4	90.4	97.0
6	26.3	37.1	46.9	65.1	77.1	86.9	93.1
7	30.8	39.0	50.3	65.4	78.6	86.8	93.7
8	38.2	47.3	54.5	70.9	89.1	96.4	100.0

before delivery, nearly 45 percent of the observations were negative, while only 26.3 percent of the observations were negative during the sixth week. Over half the basis values were \$1.00 or less during all weeks except the sixth week. Less than 7 percent of the observations for any week were greater than \$5.00.

#### The Basis By Week For Each Contract

Individual contracts were examined by week prior to expiration. Analysis of all contracts by week showed the mean basis to be narrowest during the fourth week prior to maturity, while the standard deviation was similar for all weeks. However, analysis showed that the basis means of individual contract months varied considerably from the average of all contract months.

The March contract followed the average of all contracts. The basis was narrowest during the fourth week prior to maturity, and then widened during the delivery month (Table 14). The standard deviation was smallest during the fifth week, and increased considerably during the delivery month.

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 15). 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.

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 16). 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.

TABLE 14. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE MARCH CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations	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

TABLE 15. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE APRIL CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations	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 August contract basis was narrowest during the fourth week, when cash prices averaged \$0.10 above the futures price (Table 17). 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.

The September contract basis was most favorable during Week 4 with a basis of \$0.86 (Table 18). The basis was negative during the last five weeks of trading. The standard deviation followed a similar pattern, decreasing through Week 4, and then increasing during the delivery month.

Except for the final week of trading, the October contract had negative basis means throughout the nearby period. Week 4 had the widest negative basis

TABLE 16. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE MAY CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations number	Mean	Low Value	High Value	Standard Deviation
-----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 17. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE AUGUST CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations number	Mean	Low Value	High Value	Standard Deviation
-----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

means and would have been the most favorable for lifting a short hedge (Table 19). The standard deviation was also most favorable (smallest) during this week.

The mean basis for the November contract was negative, and therefore most favorable for lifting hedges 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 20).

Analysis of basis means by week prior to maturity by contract month, indicated the most favorable basis for lifting hedges did not occur during the

TABLE 18. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE SEPTEMBER CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations number	Mean	Low Value	High Value	Standard Deviation
-----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	9	0.30	-2.80	4.40	2.94

TABLE 19. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE OCTOBER CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations number	Mean	Low Value	High Value	Standard Deviation
-----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

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.

#### The April and October Contracts

In addition to studying the nearby period for all contracts, an analysis was made of the basis for the entire trading period of the April and October contracts. Due to the amount of data involved, calculation of life of contract basis values was limited to two contracts. Analysis by contract month had

TABLE 20. FEEDER CATTLE BASIS BY WEEK PRIOR TO CONTRACT MATURITY FOR THE NOVEMBER CONTRACT, WEST FARGO, 1972-1981

Week Prior	Observations number	Mean	Low Value	High Value	Standard Deviation
-----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

indicated a significant difference in the basis between spring and fall contracts; therefore, a contract from each group was selected. The April contract was representative of spring contracts, and significantly different from fall contracts as indicated by the Duncan Multiple Range test. October fulfilled the same criteria as a representative fall contract.

Considerable difference in the mean basis was found for these two contracts. The average basis for the life of the April contract over the 10-year period was \$2.90. This compared to \$0.63 for the October contract. The range of observations was similar for both contracts; \$15.82 for April, and \$15.28 for October. A small difference was noted in the standard deviation. The standard deviation was \$2.51 for the April contract and \$2.91 for the October contract.

The mean basis for the April contract narrowed steadily from the beginning of trading in the previous May, until reaching its narrowest point in August of \$1.90 (Figure 6). It then widened to another high point of \$4.16 in November. From this point it narrowed to \$2.62 in January, and remained relatively constant until maturity in April.

The standard deviation for the April contract varied considerably. It was lowest during the months of February, April, and June; and the highest during October and November.

The October contract exhibited smaller fluctuations in the mean basis during the duration of trading than the April contract (Figure 7).

The widest basis occurred during November, the initial month of trading. November was also a seasonal wide point for the basis for the April contract. The basis showed a steady narrowing trend through September, to a low of -\$1.05, with minor upturns in February and July. It then increased sharply in October.

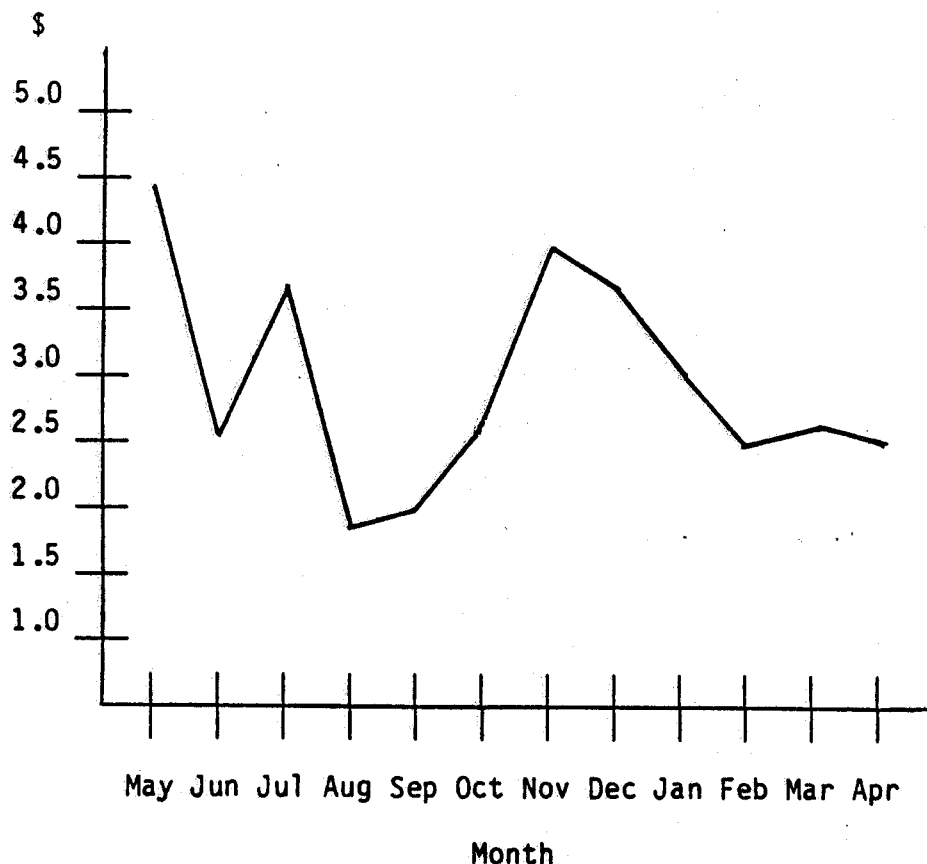


Figure 6. Mean Feeder Cattle Basis by Month for the April Contract, West Fargo, 1972-1981

The standard deviation of the October contract was less than that for the April contract. Largest standard deviations were in November, December, and January; and the smallest were in July and September.

Both contracts showed seasonally wider basis values in November and December, with the narrowest basis values occurring in August and September. A minor widening of basis values occurred in July for both contracts. The mean basis in the delivery month remained nearly constant with the month prior to it for the April contract. However, for the October contract, the delivery month basis widened markedly over the month prior to delivery.

#### Summary and Conclusions

Analysis focused on the nearby period for all contract months, and life of contract for one spring and one fall contract. Historic basis patterns, along with trends and seasonal movements were identified. The basis is a key element in successful hedging of a commodity. Much of the potential for

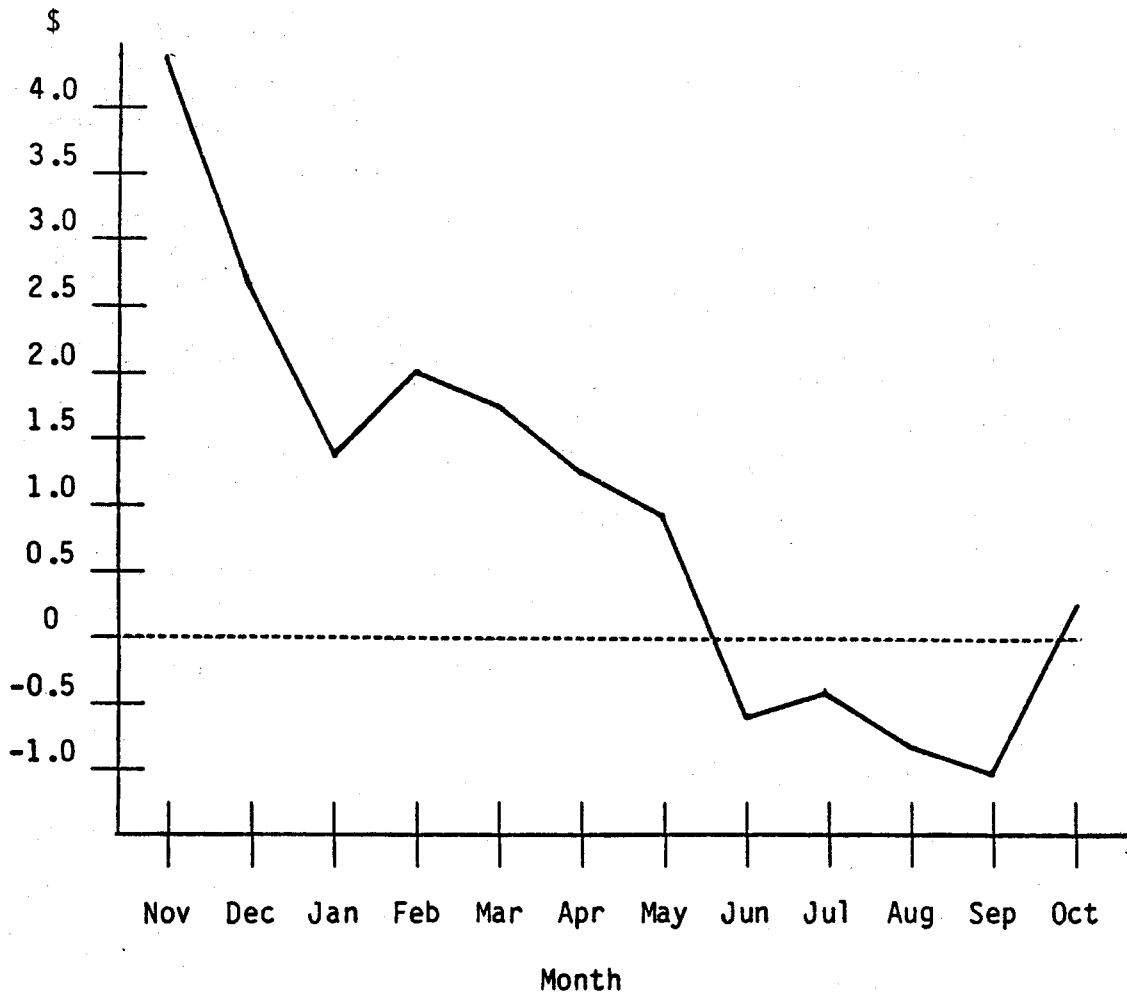


Figure 7. Mean Feeder Cattle Basis by Month for the October Contract, West Fargo, 1972-1981

successful hedging rests on accurate prediction of what the basis will be on the day the hedge is lifted.

Analysis of yearly basis means (averages) showed a widening trend in the basis over the 10-year study period. The basis was less than \$0.40 from 1972 to 1976, and increased slightly more than \$1.00 from 1977 to 1979. In 1980, the basis averaged \$1.96 and increased markedly to \$3.04 in 1981. This sharp increase in basis values poses a problem for prospective feeder cattle hedgers. Major questions that arise are will the basis continue to increase at the rate it did in 1980 and 1981, and what factors caused the sharp increase?

Although research was not conducted to identify factors affecting the increase in basis values, several reasons can be advanced which may help to explain it. First, inflationary factors in the economy, especially rising energy costs and interest rates, increased livestock marketing costs, and therefore directly affected basis values between market locations. Furthermore, during 1980 and 1981, there was an increased demand for large frame feeder cattle and medium frame cattle prices were discounted. Only the



medium frame market class was used to identify cash prices, which possibly caused some of the widening in basis values. The contract specifications called for feeder steers of medium frame and the lower two-thirds of the large frame size as defined by the USDA Official U.S. Standards for Grades of Feeder Cattle.

Significant differences existed in basis values among the contract months. The fall contracts exhibited narrower basis values than the spring contracts. 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. Probably the most potential exists for hedging feeder cattle to be marketed in the fall months, because historical seasonal price patterns indicate that prices generally increase until May and then decline until December.

The basis widened from nondelivery (the month prior to delivery) to delivery in March, August, October, and November contract months and narrowed in April, May, and September contracts. A narrowing in the basis would be beneficial from a short hedger's standpoint. Therefore, hedgers should consider lifting March, August, October, and November hedges during the nondelivery period; and April, May, and September hedges should be lifted during the delivery month.

Analysis of the basis by week prior to expiration identified weeks when the basis was narrowest and most favorable for lifting hedges for each contract. The fourth week prior to maturity of the contract was most favorable for March, August, September, and October contracts. The most favorable basis occurred during the final week of trading for the May contract, Week 3 for the April contract, and Week 8 for the November contract.

Research showed that relatively wide variations existed in the day-to-day feeder cattle basis in North Dakota, and that prediction of basis values for a particular day is difficult. Probabilities of certain basis values occurring were calculated and should be combined with an individual producer's ability and willingness to accept risk to determine the potential for hedging. The fact that particular basis patterns do exist means that basis values can probably 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.

Feeder cattle producers who are considering hedging should update the information reported in this study, particularly for the specific contract months they are considering trading in. Further adjustments in the basis may have to be made for potential hedgers who do not raise feeder cattle close to West Fargo, or who raise feeder cattle that do not meet the par-delivery specifications of the futures contract.

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