A Prehedging Strategy For The Feedlot Operation

Ronald W. Spahr and William J. Sawaya

During recent years, the feeder cattle industry has experienced financial instability. This paper provides a possible marketing strategy that may help reduce this financial instability by providing a Prehedging Strategy for the feedlot operator. The Prehedging Strategy establishes a dynamic hedge on the major factors of production of the feedlot operator and is shown to provide higher average returns and lower financial risk.

In recent years the feeder cattle industry periodically has experienced a financial squeeze due to increasing costs of operation and insufficient increases in cattle prices. Obviously, this ever present risk of unexpected losses affects the ability of feeders to operate at or near optimal physical efficiency. Future markets are one tool by which feeders may manage this risk; however, many cattle producers have been reluctant to use hedging in any form [Williams]. Some have engaged in hedging with unsatisfactory results and, as a consequence, do not use the futures markets [Riley, et. al.]. Nonetheless, the advantages usually attendant with using the futures market as a hedging tool should be applicable to the cattle industry [Heifner; Leuthold, 1974].

At various times during the cattle production process, hedging may be used to "lock-in" profits. The exact point in time at which the hedge should be initiated is a function of the prices for feeder cattle, slaughter cattle and feeds as well as the grower's or feeder's definition of a "reasonable profit" depends on his evaluation of the "riskiness" of the market-cost situation that he is facing at the particular point in time.

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This study investigates, empirically, the potential benefits of a particular hedging strategy for the cattle feeders. Only the feeder operation which consists of buying feeder cattle and feed and selling fat or slaughter cattle is investigated. The exact hedging strategy recommended by this study will not be of value to other types of operations; however, the basic premise "that hedging can be used" and the rather dramatic results should serve to interest the managers of other types of operations in investigating their own situations.

In this study the risk-return relationship is measured by the mean and variance of the dollar return per head of cattle. It is well documented in the finance and economic literature that the first two moments of the probability distribution, mean and variance, measure the risk-return relationship exactly only if the probability distribution of returns is normally distributed or if the investor's utility function is quadratic. Since neither of these restricting assumptions will be met perfectly, the use of the two parameter models will only approximate the true risk-return characteristics of the feedlot operator. However, since the probability distribution of dollar return per head of cattle is not highly skewed and models using higher order parameters are not well developed, the mean and variance will be used in this study, as is common throughout the literature, to reflect the risk and return for the feedlot operator. This study will produce the locus of points in
mean-standard deviation space which may loosely be termed an E-V Frontier. This frontier is generated by allowing the required hedging profit to vary thus demonstrating the various risk-return combinations that can be obtained using the proposed hedging strategy.\(^1\) It must be pointed out that measuring risk by the standard deviation or variance is defining risk as total variability of dollar returns and completely ignores any portfolio effects that may be present.

**Hedging Strategies**

Studies by Farris, Purecell, Hague and Holland, Menzie and Archer, Leuthold [1975], McCoy and Price and Erickson all have examined hedging strategies consisting of taking short positions in slaughter cattle futures after feeding commences. These studies generally conclude that hedging reduces risk, but also reduces the mean return to unattractive levels. If, however, selective hedging was practiced where hedging was practiced only when futures prices exceeded production costs, variances of incomes were reduced and sometimes expected incomes were increased.

Studies by Shafter, Griffin and Johnston and Leuthold and Mokler [1979] expanded this simple short hedging strategy by analyzing hedges which simultaneously forward price the main factors of production, feeder cattle and corn, along with the short hedge of the fat cattle. Both of these studies suggest that the three-way hedge may give superior results to ignoring the input futures markets and placing only the single short hedge. Also, there was no evidence that leaving the feedlot idle on occasion increased mean return over a continuous feeding operation with selective hedging. For an excellent survey article concerning the development of the livestock futures literature including live-stock hedging, see Leuthold and Tomek [1979].

The reason for the success of the prehedging strategies is that the input cost-output profit margins are explicitly considered. The futures market allows the input costs to be locked in — except for basis changes — and the output revenues to also be locked in except for basis changes. What remains, however, is to determine the optimal input-output profit margin relationship as it affects the realized profits received by the cattle feeder.

The *Chicago Board of Trade Statistical Annual* was used to collect weekly (Wednesday) futures prices for corn and the Chicago Board of Trade Cash, box car, price for No. 2 yellow corn was used to determine feed costs. The *Chicago Mercantile Exchange Yearbook* was used to collect weekly (Wednesday) futures prices for feeder cattle and fed cattle and cash (Omaha based) prices for feeder and fed cattle were used to calculate cattle values. A hedging strategy called the “Prehedging Strategy” is tested in this paper because it allows easy entry and exit in each futures market used and provides a dynamic hedging strategy.

**The Prehedging Strategy**

Often a feedlot operator will simultaneously purchase feeder cattle, contract for the necessary feed and place a selling hedge on the future sale of slaughter cattle. In the material which follows this method of operation will be referred to as a “partial hedge”. Compared to no hedge at all, the partial hedge may provide the feedlot operator some downside price protection. However, in using a partial hedge the operator is protecting only one of three major prices which may effect his profitability unless he has contracted for the feed and feeders ahead of time.

Under the “Prehedging Strategy”, which will be defined as a strategy where all of the major factors of production and the resulting product are prehedged, the feedlot operator will examine the futures market for feed,
feeder cattle and slaughter cattle weeks prior to actually purchasing the feeder cattle and if an adequate profit can be assured, the feeder will make simultaneous hedges in feed, feeder cattle and slaughter cattle. Therefore, some control is attempted on the pricing of the major factors of production.

Several major benefits of hedging in the cattle industry have been identified, “futures trading provides for shifting risks from production and marketing specialists to others who are willing to bear the risks at lower costs... Another... benefit arises when the forward prices generated by the futures trading enable producers and marketing firms to better coordinate their expectations and plans. This can result in an improved allocation of production resources over time” [Heifner]. The Prehedging Strategy as outlined above applies these benefits to all of the major factors of production. It is the ability to prehedge selectively prior to any cash market commitment that is the salient aspect of this strategy.

Methodology

The cattle feeder may consider placing a prehedge as soon as a futures contract for slaughter cattle is available. If a futures contract for slaughter cattle does not exist, obviously the selling hedge cannot take place and the prehedge cannot be made. Therefore, the cattle feeder only can place a prehedge when futures contracts are available for corn, feeders and slaughter cattle where corn is assumed to be the major source of feed.

For purpose of this study it is assumed that the first attempt to place the prehedge will occur seventeen weeks prior to the purchase of the corn and the feeder cattle and thirty-nine weeks prior to the sale of the slaughter cattle. As an example, assume a feedlot operator has decided to purchase feeder cattle on January 3, 1979. On January 3rd he will also contract for the necessary corn to “feed out” the feeder cattle. In order to use the prehedging strategy, the feedlot operator must begin by testing the hedging profit of September 6, 1978. If the hedging profit is more than some cut-off level on September 6, 1978, a buying hedge is placed on March, 1979 corn and March 1979 feeders and a selling hedge is placed on June 1979 slaughter cattle. Notice that the futures contract used in all cases is that futures contract that expires nearest to but subsequent to the actual cash transaction. If the hedging profit indicated on 6 September is not sufficient (is less than some predetermined cut-off level), no action is taken and the hedging profit is tested again on 13 September 1978. The hedging profit is tested each week until a sufficient profit is indicated or until 3 January 1979 when, if a prehedge has not been made, the cattle feeder will accept the cash prices.

Obviously, whether or not the prehedge is placed depends on the hedging profit that is desired. The higher the desired profit, the less likely it is that a prehedge will be placed. Therefore, if the Prehedging Strategy is to be a desirable marketing tool, the optimal or best hedging profit cut-off level must be determined. This setting of a level of an activity, profit, is not an uncommon method of dealing with risk [Heifner].

It is assumed in this study that the feedlot will be in continuous operation and that feeder cattle will be purchased and fed cattle sold each week. It is also assumed that if the prehedge were not placed by the time feeders are purchased, no short hedge will be attempted for the fed cattle. Obviously, a different strategy similar to the partial hedges previously discussed could be attempted, where a short hedge only may be placed on the fed cattle if the prehedge never was feasible. This partial hedge was not attempted because its inclusion would tend to mask the effect of the prehedge, and sufficient literature already exists to determine the additional benefits that could be gained.

No attempt has been made to localize the basis for a particular feeding operation. The procedure which usually is used to localize the basis is to add or subtract a constant from the futures price. As may be seen in the next section, the hedging profit figure that will be obtained for a site-specific feedlot operation

33
must be adjusted for the localized basis for feeders, corn and fed cattle.

The Hedging Profit

A prehedge will be made if it is evident that the calculated hedging profit exceeds some predetermined cut-off level. This hedging profit for a given week may be calculated as:

\[
HP_t = 1025 (FPSN_{N+22})_t - 600 (FPF_N)_t - 425 \left( \frac{FP_C}{56} \right)_t 7.75 + C_o
\]

where

- \(HP_t\) = the hedging profit for week \(t\), if the prehedge is placed for feeder cattle to be purchased in week \(N\) and the 1025 pound feed cattle are sold at \(N+22\) weeks
- \((FPSN_{N+22})_t\) = the futures price for slaughter cattle in week \(t\) for a futures contract that will expire after the sale of the slaughter cattle adjusted for the localized basis
- \((FPF_N)_t\) = the futures price in week \(t\) for feeder cattle associated with a futures contract which will expire closest to but subsequent to the cash purchase date, \(N\), adjusted for the localized basis
- \(C_o\) = nonfeed costs per pound of gain. (For detailed

It is assumed that each bushel of corn will weigh 56 pounds and it will take 7.75 pounds of corn for one pound of gain of a feeder calf. The subscript \(t\) refers to the current week, or the week for which the hedging profit is calculated, the subscript \(N\) refers to the week of cash purchase of the feeder cattle and the week for which corn is contracted. \(N + 22\) refers to the time of sale of the slaughter cattle. It is assumed that the feeder cattle weigh 600 pounds and slaughter cattle weigh 1025 pounds.

Other fixed costs of operation such as feed supplements, cost of using future markets, commissions, interest opportunity cost etc. are not included in the hedging profit calculations nor in the subsequent calculations for the realized returns because they are assumed to be nearly linear transformations of the respective profit functions. Such costs as commissions, interest on margins and feed supplements are linear transformations if costs do not change during the study. Interest on margin calls obviously is not a linear transformation but because of its relatively small magnitude compared to other costs it should not seriously bias the study. If these fixed costs are included for the site-specific operation, the hedging profit and realized return figures will undoubtedly be reduced.

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\(^a\)One percent death loss valued at 40 cents per pound for an 800 pound steer.
As an example of the hedging profit calculation, assume that on 1 September 1976 a feedlot operator is trying to determine whether or not to place a prehedge with respect to the feeder cattle that will be purchased 29 December 1976. On 1 September 1976 the June futures price for slaughter cattle was $.4485 per pound, and the March futures price for feeder cattle was $.4255 per pound, and the March futures price for corn was $2.9325 per bushel. Therefore,

\[
HP_{\text{Sept}} = 1025(.4485) - 600(.4255) - 425\left(\frac{2.9325}{56}\right)7.75 + .070256 = 459.71 - 255.30 - 172.48 - 29.84 = $2.09
\]

It is expected that gross revenue from the sale of the slaughter cattle will be $459.71 and that the cost of operation will include $255.30 to purchase a feeder calf, $172.48 to feed the calf, and $29.84 in variable overhead, and that the resulting profit per head is $2.09. If the $2.09 profit is considered to be sufficient, the hedge will be placed. If this profit is not considered to be sufficient, the feedlot operator will wait one week and calculate the hedging profit for 8 September 1976, etc. Again, this hedging profit is calculated assuming a zero basis.

**Realized Profit on Return**

Obviously, the Prehedging Strategy will not result in a profit exactly equal to the hedging profit that is predicted because cash prices and futures prices do not always move together — i.e., the basis changes over time. While cash prices and futures prices are highly correlated, they do move somewhat differently. The actual realized return when the complete hedge has been placed is:

\[
RR_{N+22} = 1025\left(\frac{PS_{N+22}}{56}\right)7.75 + .070256 - 425\left(\frac{PC_N}{56}\right) - 600(PF_N) + \left[\left(\frac{FPS_{N+22}}{56}\right) - \left(\frac{FPS_{N+22}}{56}\right)\right](1025) + \left[\left(\frac{FPC_{N+22}}{56}\right) - \left(\frac{FPC_{N}}{56}\right)\right](7.75)(425),
\]

where,

- \(PS_{N+22}\) = the cash price received on the sale of the slaughter cattle 22 weeks after the purchase of the feeders
- \(PF_N\) = the cash price paid for the feeders at the time of delivery
- \(PC_N\) = the contracted cash price for the corn at the time of delivery of the feeders
- \(FPS_{N+22}\) = the futures price for slaughter cattle when the selling hedge is placed adjusted for the localized basis
- \(FPS_{N+22}\) = the futures price for slaughter cattle when the contract is bought back completing the roundturn at the time of the sale of the slaughter cattle at cash price, adjusted for the localized basis
- \(FPC_{N}\) = the futures price for feeder cattle when the hedge is placed adjusted for the localized basis

35 Spahr and Sawaya
Western Journal of Agricultural Economics

(FPFN)N = the futures price for feeder cattle when the contract is sold completing the roundturn at the time of the purchase of the feeder cattle for cash, adjusted for the localized basis

\[(FPC_N)_t = \text{the future price for corn when the buying hedge is placed adjusted for the localized basis}\]

\[(FPC_N)_N = \text{the future price for corn when the contract is sold completing the roundturn at the time the corn is actually contracted for cash, adjusted for the localized basis}\]

Using the example from the previous section, if the prehedge had actually been placed on 1 September 1976, the realized return for feeder cattle purchased on 29 December 1976 would have been:

\[
RR_{29 Dec} = 1025(.4070) - 600(.4025) - 425\left(\frac{.4450}{56}\right) 7.75 + .0702 + (.4485) - (.4166) 1025 + (.3920) - (.4255) 600 + 2.5625 - 2.9325 \cdot \frac{7.75}{56} (425) = $417.18 - $241.50 - $29.84 + $32.70 - $21.67 = -$7.13
\]

Thus even though the hedging profit was predicted to be $2.09, the actual return would have been a negative $7.13. It is apparent from the above that the gross cash received for the slaughter cattle was $417.18, the cost of the feeders was $241.50, the cost of the feed was $143.81 and there was an overhead cost of $29.84 per head. This much of the return equation represents what would have happened with no hedging i.e., the feedlot operator worked only in the cash market (he would have received $2.03 per head). In the futures market, however, $32.70 would have been received from the selling hedge on slaughter cattle, but hedging losses of $20.10 and $20.76 were experienced in the feeder cattle and corn futures contracts, respectively.

The reason this example showed an expected return of $2.09 for hedging profit, but ended up losing $7.13 per head is a function of the basis. As discussed previously, no basis calculations were used in this study and it is apparent, at least in this example, that the feeder will not pay or receive the same prices as reflected in the futures market. These future prices, for a site-specific operation, must be “localized” by some average basis. Basis risk still would exist because cash and futures may not completely converge. The basis may be different than expected. However, to minimize the basis risk, no feeder should make hedging decisions based on futures prices alone, but futures prices adjusted for expected local basis.

A possible problem may arise since the contracts don’t match in units. This study is being done on a per unit basis, thus it is implicitly assuming that futures contracts are infinitely divisible; however, in reality, one feeder cattle contract calls for 42,000 pounds or about 70 head while a fed or slaughter cattle contract calls for 40,000 pounds or about 35 head. One corn contract equals 5,000 bushels or about 280,000 pounds, but 70 feeder cattle will eat about (7.75 \times 70 \times 425) 230,562 pounds of corn. Thus, in reality, failure to match the size of futures contracts to the actual feeding opera-
tion asks the feeder to assume additional risks through partial speculation. This problem, however, may be reduced if the feeder is of sufficient size to have a minimum level of hedging activity of 5 or 6 fed cattle contracts, 3 feeder contracts and 2 corn contracts. This combination will work out to approximately the right number of pounds and bushels of each commodity. Also, the mini-contract on the Mid America Exchange would be an alternative to this minimum combination.

Test of the Complete Hedging Strategy

It was assumed that the feedlot operator would buy feeder cattle to place on feed each of the 261 weeks during the years 1974, 1975, 1976, 1977 and 1978. For each of the 261 weeks the Prehedging Strategy was attempted using hedging profit cut-off levels of from $-10 to $60. Table 2 displays the actual average dollar return per head and the standard deviation of dollar return per head and the number of complete hedges that were placed as a function of the required hedging profit for a number of different time periods.

It is apparent from Table 2 that by using the prehedging strategy the feedlot operator may increase his average dollar return per head. If the standard deviation of dollar return per head can be equated with the risk associated with the feedlot operation, the use of the prehedging strategy may allow the operator to increase his average dollar return and simultaneously reduce the risk involved in the operation. Figure 1 shows the E-V Frontier for the 1974-1978 time period. The feedlot operator depending on this utility function may select any point on this locus of points which we loosely call the E-V Frontier. Figure 1 was developed by plotting the average dollar return per head versus the standard deviation of dollar return for the 1974-1978 period. This data is found in Table 2. For example, if the feeder used a required hedging profit of $27.50, the point on the E-V Frontier would represent an average dollar profit of $44.53 and a standard deviation of $51.83. Thus, adjusting the required hedging profit allows the E-V Frontier as shown in Figure 1 to be plotted. Obviously, this E-V Frontier will differ for different time periods, thus the entire 1974-1978 time span was used to create as stable a function as the available data will allow.

Table 2 indicates that a required hedging profit of $27.50 would have given the highest expected dollar return per head; whereas, a required hedging profit of $2.50 usually would have minimized the risk of operation. If the feedlot operator had a required hedging profit of $55.00 or greater, no hedges were placed. Thus using a required hedging profit of $55.00 or higher resulted in the same operation as a cattle feeder who did not choose to hedge, however, the original intent or objective obviously was different. The operator who did not hedge during these test years (1974-1978) would have had a return per head of $23.81, significantly lower than could have been obtained using the prehedging strategy. The standard deviation of the non hedger's dollar return of $60.78 was significantly higher than for most of the operators who used the prehedging strategy. Thus, as stated above, the use of the "Prehedging Strategy" may allow the feedlot operator to increase his expected dollar return and simultaneously reduce the risk of the operation.

As was pointed out previously, it is assumed that the feedlot operator will buy large enough numbers of feeder cattle so as to effectively use the futures market by buying and selling contracts for feeder cattle and corn, and slaughter cattle, respectively. Obviously, effective hedging cannot be done with one feeder. While the analysis presented in this study is done on a per head basis, a large scale operation must exist if the markets are to be used effectively.

Hedging Strategy Stability

The period 1974 through 1978 represents both a depressed price period and an im-

3Again, it must be pointed out that this study was done without adjusting future prices for local basis.
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*aAssuming a zero basis

bA required hedging profit above this level resulted in no hedges being placed.
proved price period for cattle. A logical question concerning the “Prehedging Strategy” is whether or not a strategy using one required level of hedging profit will result in maximizing the expected dollar return during both the depressed price period and the improved price period.

Table 2 displays the average dollar return.
per head, standard deviation and number of hedges placed for not only the 1974-1978 time periods but also for the 1974-1977, 1974-1976, 1977 and 1978 time periods. It is apparent from this table that the highest level of expected dollar return per head results from a required hedging profit of $27.50. Thus, regardless of the state of the cattle market the highest dollar return was obtained when the required hedging profit was $27.50.

During 1977 and 1978, the optimal use of the “Prehedging Strategy” resulted in $6.07 and $11.71 respectively increases in expected dollar profit per head and $5.02 and $17.50 respectively decreases in the standard deviation of return over no hedging; whereas, during the 1974 through 1976 period the Prehedging Strategy resulted in a $28.54 increase in expected dollar profit per head and a $7.40 decrease in the standard deviation of dollar return compared to a no hedging strategy. Thus, it appears that the use of the “Prehedging Strategy” is most beneficial to the cattle feeder during depressed price periods; however, during periods of higher prices there is still a benefit to be gained.

It may be pointed out that during the depressed market period, 1974-1976, if no hedging were done, the dollar profit per head was a loss of $8.58. By using the Prehedging Strategy the profit per head during this period was increased to $19.96. This difference during the depressed market may very well represent the difference between a viable operation and bankruptcy.

Because of the apparent stability when using the Prehedging Strategy, the recommended policy is to use not more than the $27.50 required hedging profit adjusted for local basis and attempt to place the hedges during all types of pricing conditions found in the cattle market assuming the feeder’s utility function is such that he is attempting to maximize dollar return per head.

Conclusions

The “Prehedging Strategy” is an attempt at applying hedging strategies to all major inputs to the feedlot operation where the possibilities or opportunities for profit are greatly expanded because it offers an opportunity to select from profits offered each week over a 17 week period rather than profits that are available on the day the cattle are placed on feed. In this study the common form of feedlot operation was assumed where the operator buys 600 pound feeder cattle, buys corn to “feed-out” the cattle and then sells 1025 pound slaughter cattle. The feedlot operator will attempt to place a buying hedge on feeder cattle and corn and a selling hedge on slaughter cattle as soon as the necessary futures contracts become available and the indicated hedging profit is adequate. In this study it was assumed that the operator would begin testing the hedging profit in an attempt to place the complete hedge seventeen weeks prior to the purchase of the feeder cattle.

The results indicate that by using the “Prehedging Strategy”, the feedlot operator would be able to increase his expected dollar return per head and simultaneously reduce the risk of operation compared to the feedlot operation which does not use hedging. The results strongly support the use of hedging in the feedlot operation. In times of depressed prices, as was the case between 1974 and 1976, hedging could make the difference between being profitable and not being profitable. During this time period, the cattle feeder who did not use hedging would have lost $8.58 per head with a standard deviation of $60.35; whereas, during the same time period if he used the Prehedging Strategy, his maximum return could have been $19.96 per head with a standard deviation of $52.95. During periods of higher profitability in the cattle industry, for example during 1978, the nonhedger would have received a return of $98.45 per head with a standard deviation of $68.95; whereas, the hedger in this case could have received a maximum return per head of $110.16 with a standard deviation of $51.45.
References


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