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# Analysis of hedging strategies for southern Iowa stocker operations

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# CHAPTER 1. INTRODUCTION

## Statement of the Problem

Beef cattle production in the United States consists of three stages: cow-calf production, an intermediate forage based feeding phase and confined feedlot finishing. The cow-calf stage produces weaned calves which are either kept for cow herd replacements (heifer calves) or sold. The intermediate stage is a period in which the weaned calves consume a ration which is high in roughage and contains little or no concentrate feed. This roughage requirement is usually met by having the weaned calves graze on high quality forage for about six months. The final stage of beef cattle production entails feeding beef animals a ration which contains a high proportion of concentrate feeds, such as corn, until they reach slaughter weight.

Recently, the intermediate stage has often become a specialized enterprise operated separately from the cow-calf and feedlot finishing enterprises. It has become known as a backgrounding or stocker production enterprise. Both terms will be used in this study.

The stocker operation faces both production and price risk. Production risk can arise from variability in weight gains or death of the animal. The variability in gains can be the result of forage quality variability caused by different moisture and temperature conditions. This type of production risk is much greater for stocker operations than for a feedlot operation where gains are fairly predictable.

The other major type of risk faced by the stocker operation is price risk. A southern Iowa stocker will purchase feeder cattle in the spring and sell them in the fall after a summer of grazing. This type of marketing strategy must contend with two major problems involving price movement. First, there exists a seasonal feeder cattle price pattern that exhibits highs in the spring and lows in the fall. The second problem is the extreme variability in prices from year to year. With this variability in prices comes variable profits.

Figure 1.1 shows an eleven year average of weekly October feeder cattle futures prices. The tendency was for prices to be higher in the spring and lower in the fall. Only two years during this period did not exhibit this seasonal price trend. In some years even the most efficient stocker operations would have sustained large losses because of the poor buy/sell margins for that year. For example, in 1974 the cash price for a 450 pound steer in the Sioux City market in the third week of April was $49.3/cwt. By September a 650 pound steer in the same market only brought $32.5/cwt.

The wide price variability in feeder cattle is illustrated in Figure 1.2. The eight year period from 1978 to 1985 contained dramatic changes in price. Feeder cattle prices ranged from $45/cwt to $89/cwt over this period.

Stocker operations need to explore alternative marketing methods to reduce the risks associated with poor buy/sell margins and price variability so that backgrounding returns are higher and less variable.

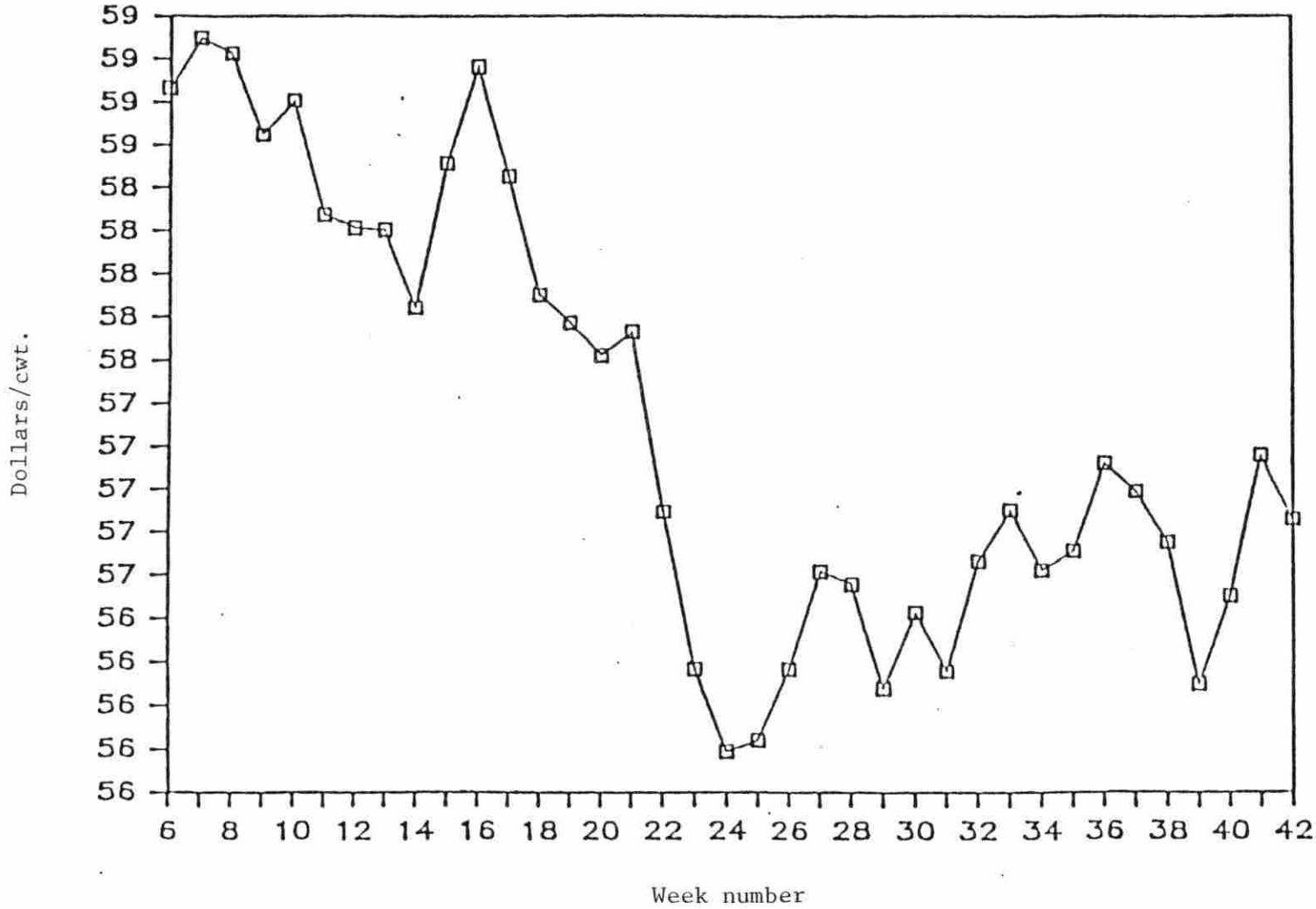


Figure 1.1. Eleven-year average of weekly prices, October feeder cattle futures contract, 1974-1984 (Jenkins, Carver and Menkaus, 1986)

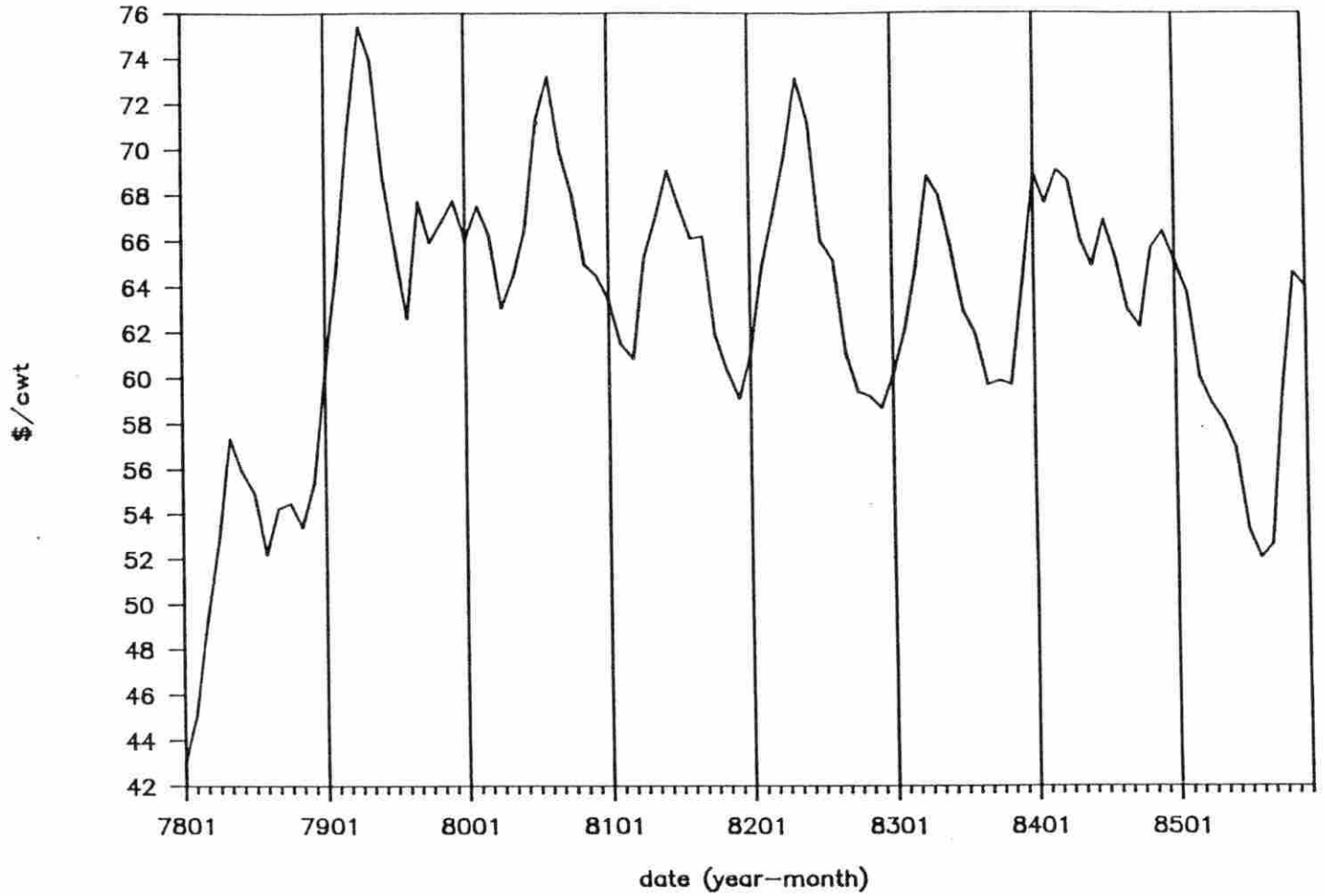


Figure 1.2. Interior Iowa monthly average choice steer prices, 1978 through 1985 (Schroeder, 1986)

Marketing alternatives could include: examining the possibility of purchasing and selling cattle at earlier or later dates depending on local supply and demand conditions; purchasing different types of cattle including using heifers instead of steers; being prepared to purchase or sell cattle in markets where prices are out of line with local prices; exploring the possibility of grazing on a contract basis; and taking advantage of hedging strategies. This study will focus on using hedging to reduce variability and increase profits for the stocker operation.

Since 1971 the Chicago Mercantile Exchange has offered a feeder cattle contract that both producers and consumers of feeder cattle can use to seek protection from price changes. The stocker operation can use the feeder cattle futures to hedge both the purchase of lightweight feeders in the spring and their sale in the fall.

Although futures markets for agricultural products have been available as a marketing tool for some time now, there is evidence that these markets have not been utilized by many producers (Schroeder, 1986). Typically mentioned reasons for lack of use of the feeder cattle futures market by stocker operations include: contract size that is incompatible with the volume of small producers, not understanding the mechanics of hedging, potential basis risk, risk attitudes of producers, and contract delivery problems.

This study will examine whether a southern Iowa stocker operation can use alternative hedging strategies with feeder cattle futures to improve profits and/or reduce risk.

This study will also explore the effects of the recent change in the feeder cattle futures from delivery of cattle to cash settlement as a means to fulfill futures contract obligations upon contract maturity.

## Review of Literature

There have been numerous studies on the effectiveness of various hedging strategies for agricultural commodities. Explorations of hedging strategies that use the feeder cattle futures contract have been common since its inception in 1971. Many studies have examined the feedlot operators' use of the contract to hedge the purchase price of feeder cattle. Some studies have explored the contracts' use by cow-calf operations in hedging their selling price of weaned calves. Very few studies exist that delve into the use of the contract by stocker operators to hedge both the selling price and the purchase price of feeder cattle.

Franzmann and Lehenbauer (1979) used moving averages to time long feeder cattle hedges for cattle feeders from 1972 through 1979. They found that selectively hedging feeder cattle purchases reduced the variability of purchase prices and reduced the average price paid for feeders.

Many recent studies have used feeder cattle futures for feedlot hedging of purchase price in conjunction with hedges placed for live cattle and corn. These three way hedges are concerned with locking in returns for cattle feeders.

Leuthold and Mokler (1980) investigated a three way hedge for cattle feeders during the 1972-76 period. They examined the potential attainment of various profit levels. A target profit margin of $5/cwt proved to be superior to all other target levels.

Spahr and Sawaya (1981) also examined three way hedges for cattle feeders. Using the period from 1974 to 1978 they found a maximum mean return per head of $27.50. As profit levels increased so did the variance of returns.

Franzmann and Shields (1981) used moving average techniques to signal when to hedge using the three way hedge strategy for cattle feeders. Using weekly data from 1975 through 1979 they found that three way hedging strategies had higher means than both the cash only strategy and any other strategies.

Pluhar, Shafer, and Sporleder (1985) evaluated many of the three way hedges previously contained in the literature as well as some of their own strategies. They found that none of the strategies performed as well over a more recent time span than they had during the period analyzed by their original investigators. They concluded that hedging strategies need to be continuously revised to keep abreast of new market characteristics.

Schroeder (1986) examined the use of price forecasts to signal the placing of three way hedges. He found that forecast-signaled feeder cattle hedges were able to increase profitability though not decrease variability of returns. Forecast-signaled hedges for feeder cattle, corn

and fed cattle combined were able to both increase returns and decrease variability of returns.

Dole and St. Clair (1981) examined the use of short hedges on feeder cattle for both cow-calf and stocker operations. Strategies used for the cow-calf operation included placing hedges based on; breakeven returns, basis levels, and moving averages. In general, the hedging strategies increased returns. In about half of the cases, they also decreased the variability of returns compared to cash marketing.

Dole and St. Clair also examined two hedging strategies for a stocker operation. The first was a short hedge placed at the time the cattle were purchased in May and lifted when the cattle were sold in October. Over the period studied (1972-77), this strategy increased gross returns per head by 25% and reduced the standard deviation by 63% compared to cash marketing. The second strategy was the same as the first but with an added long April hedge placed in the first week of January. This strategy increased returns 45% and increased the standard deviation 13% over cash marketing.

Bobst, Grunewald and Davis (1982) studied the placing of short hedges at the time of cash purchases of feeder cattle for stocker operations in Kentucky for the 1973-80 period. The results for two different starting weights and five different feeding length periods were compared to cash marketing. They found that both means and standard deviations of rates of returns for unhedged enterprises were larger than for their hedged counterparts.

Jenkins, Carver and Menkhaus (1986) examined the optimum time period in which to place a short feeder cattle hedge for a cow-calf or stocker operation for the 1974-85 period. They found that late February or early March represented the best time to place a short fall hedge. The early May to late June period proved to be a poor time to place a short hedge.

Schupp and Whitehead (1986) evaluated the potential use of technically oriented selective hedging strategies with feeder cattle futures as a means of reducing price variability for cow-calf or stocker operations. They found that average returns could be increased over unhedged returns with the use of technical systems that produce buy and sell signals. They compared the variance of returns from the various hedging strategies, but no comparison with the variance of unhedged returns was made.

## Objectives

The objectives of this study are:

1. To determine the profitability of stocker operations in Southern Iowa from 1974 to 1985 on a cash marketing basis alone. The results of this analysis will be used as a guideline by which all hedging strategy results will be compared.
2. To develop and test the historical profitability of several selective hedging strategies for stocker operations using the feeder cattle futures contract.

3. To compare and rank the marketing strategies tested according to the distribution of profits and losses from a simulated marketing process.
4. To examine how the performance of hedging strategies may change with the advent of cash settlement instead of delivery as the means by which futures contract obligations are fulfilled upon maturity.

## Procedures

Ten hedging strategies will be developed that incorporate most of the common techniques that can be used in hedging with the feeder cattle futures contract.

An analysis will be done of the recent historical (1974 through 1985) opportunities for stocker operators to have increased returns and decreased variance of returns by using the feeder cattle contract. The ten hedging strategies will be evaluated and compared to a cash marketing strategy using relevant data for a southern Iowa stocker operation. The strategies will contain short positions, long positions, and short and long positions placed simultaneously or placed independently.

Marketing alternatives will be compared to determine the superior marketing strategy for the 1974 through 1985 simulation period. These results should provide stockers with a useful evaluation of marketing strategies that could be used in their operations.

The new cash settlement addition to the feeder cattle contract will be examined to determine if it will be successful in reducing basis risk and thereby make hedging a more attractive marketing alternative.

By examining multiple hedging strategies involving the use of the feeder cattle futures to hedge both the purchase and sale of feeder cattle for a stocker operation, this study will be examining an area neglected in the present literature. With the analysis being directly applied to southern Iowa stocker operations, the findings of this study should have practical applications for these producers.

## Organization

This study is organized as follows:

Chapter 2 examines various hedging strategies and the motivation behind their creation and use. The potential advantages and disadvantages of each strategy in various price behavior climates is discussed.

Chapter 3 provides a summary of the strategies used in the historical hedging strategy simulations, and the assumptions made when implementing and assessing the strategies. This chapter also contains the results of the simulation and the ranking of the alternative marketing strategies.

Chapter 4 examines the effects of the new cash settlement aspect of hedging with feeder cattle futures, and how it changes appropriate hedging procedures. Cash settlement's effect on basis risk will be used as a criterion for judging its effectiveness.

Chapter 5 contains a summary of the marketing strategies evaluated, and mentions factors that need to be considered in the future use of these strategies.

# CHAPTER 2. HEDGING STRATEGIES

There are several categories of hedging strategies that a stocker operation could use to hedge its cash position. These categories range from placing a hedge at a certain time of the year to placing a hedge based on complex price forecasts. Certain strategies only involve the placement of a single short position or a single long position to hedge either the selling or the buying price. Other strategies include the simultaneous placement of short and long positions to lock in an expected margin. Hedging strategies may require that a position be held until the cattle are either bought or sold, while others contain rules for lifting and replacing positions. Each type of strategy has its advantages. A producer needs to compare the potential returns from different strategies to the risk involved in using them and the costs required to implement them when deciding which hedging approach, if any, should be used.

## Hedges

### Routine hedge

A routine hedge is defined as placing a short hedge at the time the feeding period begins. This hedge can be placed simply, though it may not cover total costs, variable costs or cash flow requirements.

### Seasonal hedge

A seasonal hedge is one that is placed at a particular time of the year. For example, if feeder cattle prices have a tendency to rise from

January to April each year, the producer may decide to hedge April cash purchases with a long April futures position taken in the first week of January every year. The decision to hedge was made in advance and did not depend on actual price levels that prevailed in January.

Profit level hedge

A profit level hedge is placed when the appropriate futures price is at a level that is equal to or greater than a predetermined price. This target price is equal to the cost of production plus a specified profit. Stocker operations have the ability to use this approach with the fall contract or with a combination of the spring and fall contracts.

Short hedge The short profit level hedge is placed anytime after the start of the feeding period when the fall futures price can provide a return greater than or equal to a selected profit goal. If over the course of backgrounding the fall futures price does not yield returns at or above the profit goal, then no hedge is placed.

To determine if the futures market offers a breakeven return or not, the futures price needs to be converted into a local cash price. This is accomplished by adjusting the futures price according to the local basis. If the expected local basis (cash - futures) for September is $2.00/cwt then the futures price is converted into a local cash price by adding $2.00/cwt to its amount.

It is difficult for the hedge to yield the exact amount expected because of basis fluctuation. For example, after purchasing feeder

cattle in the spring the stocker knows most of his costs and can fairly easily estimate those costs not yet incurred. Based on this cost figure the stocker can calculate the selling price needed to breakeven. When checking the futures market to see if the fall contract is at or above this price, the stocker needs to convert the futures price into a local cash price. If the final basis differs from the one expected then the hedge will not yield the exact return expected. Sometimes the change in basis can be beneficial and other times not.

With the profit level hedge there is always the possibility that no hedge will be placed because the futures did not reach the target price anytime during the backgrounding phase. This is a definite disadvantage because there are times when locking in a small profit or a small loss is a superior alternative to sustaining larger losses in an unhedged market.

Long-short hedge A potential hedge that exists for stocker operations is to hedge both the purchase and sale of feeder cattle using different contract months. The long-short profit level hedge is placed when the spread between the spring and fall futures contracts reaches an amount that yields the target profit. The target profit is equal to a breakeven price plus a predetermined profit. The breakeven price is defined as:

B.E. = (expected weight at sale * adjusted fall futures)
- (expected weight at purchase * adjusted spring futures)
- all nonfeeder costs

If the target profit is reached, the stocker buys the spring contract and sells the fall contract. When the cattle are purchased the spring contract is sold, thus offsetting the long position. When the cattle are sold the fall contract is purchased, thus offsetting the short position.

In order to ascertain if the futures spread offers a return greater than the target price, both contracts need to be converted into local cash prices by adjusting for expected local basis. As in the short profit level hedge, actual basis amounts that differ from the ones used to calculate the target price can make the final returns differ from the expected.

This hedging strategy has the particular advantage of enabling the stocker to determine and lock in profits months before the actual purchase of feeder cattle is made. Another advantage is the potentially long period of time for a good hedging opportunity to present itself. In many years, the September contract starts trading in October of the previous year. This provides the stocker operation with almost six months to lock in a long-short profit level hedge.

Such a hedge might help a stocker secure the loan necessary to cover the purchase price of feeder cattle in the spring. Lending institutions are more inclined to loan money to enterprises that insulate themselves from price risk.

Basis hedge

With a basis hedge, the decision of when or whether to hedge relies upon the distant month's basis. If the feeders are going to be sold in September then the difference between today's cash price and the September futures is used as a guideline for hedging.

Distant month basis is actually a price expectation. If the basis for September in April is below the delivery month basis for September then the futures market is expecting cash prices will fall. This alone is not a reason to hedge. If cash prices do indeed fall to the level predicted by the futures market then a hedge would not have insulated the stocker from the decline in prices because the futures market had already successfully incorporated the price change. Hedging could only provide protection if prices had fallen by more than the amount predicted in April. On the other hand, if prices fall, but not by the amount predicted by the futures market, then the September contract will have to rise in price and hedging under this scenario would have produced a loss for the futures contract even though cash prices had fallen.

Dole and St. Clair (1981) advanced two theories involving the use of basis to hedge. One theory states that a negative basis (futures greater than cash) indicates that futures market participants believe prices will rise. The second theory states that a negative basis is an indication that futures will have to fall relative to cash to reach normal delivery month basis. The theories assume a local basis of $0.00. A stocker would need to know his local basis in order to determine if the distant month's basis was more negative than the delivery month basis.

Both theories assume the futures market prediction about fall prices is incorrect. The first theory assumes that prices will rise by more than the amount predicted by the futures market and the second theory assumes the price will rise by less than the futures prediction.

Hedging under the first theory involves placing a short fall hedge anytime after the start of the feeding period when the fall delivery month basis becomes more negative than usual. This level is determined by a historical review of the basis.

Hedging under the second theory involves placing a short fall hedge anytime after the start of the feeding period when the fall delivery month basis becomes more positive than usual. Again, this level is determined by a historical review of the basis.

## Technical hedges

Technical analysis can be used to forecast price direction and hedges can be placed accordingly. Technical analysis is the art of using past prices to explain or predict future changes in prices. Practitioners of technical analysis believe that by observing past prices, patterns in their behavior can be discerned. There are numerous technical indicators that can be used to forecast price changes and thereby place hedges. Two of the more common indicators will be discussed.

Moving average hedge One simple tool used by technicians is the moving average. A moving average is a progressive average of prices. As

time progresses, new prices are added to the calculation, and an equal number of the oldest prices are deleted.

Technicians have observed that by using different length moving averages it may be possible to identify trends in prices. A ten day moving average will be much more sensitive to a change in current prices than a thirty day moving average because a higher percent of its prices are the most current available. Whenever the shorter length average "crosses" (on a plot) a longer length average then the technicians believe a trend in prices may have been established. A crucial aspect of using moving averages is to find the correct length of the two averages. In general, the smaller the difference in lengths the less sensitive is the system in signalling a new price trend. This keeps the system from sending false price signals, but it also slows down the process of identifying a real trend.

Price trend signals generated from moving averages can be used as hedging signals. An increasing price trend signal generated in October through April could be used as an indicator to buy the April contract and insulate feeder purchases from increasing prices. A decreasing price trend signal generated in May through September could be used as an indicator to sell the September contract and insulate feeder sales from decreasing prices. A hedge could be placed and lifted one or more times depending on the number of signals generated.

Oscillator hedge Oscillators use price changes to signal trends. A momentum oscillator analyzes the rate of change of prices from one time

period to the next. As momentum decreases, technicians believe a change in the direction of prices is imminent.

When the momentum values change from positive to negative during the feeding period a short fall hedge is placed. When the momentum values change from negative to positive before the cattle are purchased a long position in the spring contract is placed.

Oscillators are very good at predicting price changes (Schupp and Whitehead, 1986). This feature can be both an advantage and a hindrance. If price changes are few and strong then the early indication of change provided by an oscillator is useful. If price changes are occurring rapidly then oscillators can generate two to three times more trades than moving averages and reduce the profit potential of each trade. Similar to using moving averages, a hedge could be placed and lifted multiple times until the cattle are bought or sold.

ARIMA hedge

An ARIMA hedge is one that uses time series analysis to generate price forecasts. Time series refers to the analysis of observations on a variable that occurs in a time sequence. Similar to technical analysis, time series uses past price behavior to predict future prices. Unlike technical analysis, however, time series quantifies the relationship. Correlation is used to measure the relationships between observations within a price series.

ARIMA models may contain both autoregressive (AR) and integrated moving average (IMA) terms. Autoregressive terms describe how an

observation (price) is related to the immediately past value of the same variable. Integrated moving average terms describe how an observation is related to the unexplained part of previous price behavior.

Forecasts of future prices can be made based on the ARIMA terms discovered from past price behavior. If forecasts for spring prices are higher than April futures then a long hedge should be placed. If forecasts for fall prices are lower than September futures then a short hedge should be placed. For more details on the use of time series analysis see Pankratz (1983).

Econometric hedge

Econometrics is the art and science of using statistical methods for measuring economic relationships. Economic theory helps identify the variables which should appear in a relationship. Statistical methods determine the sign and magnitudes of variable coefficients that describe the relationship.

In the case of feeder cattle prices, economic theory suggests there is a relationship between the price of feeder cattle and its supply and demand. Using the statistical method of linear regression provides a measurement indicating the direction and magnitude of the effect these supply and demand variables have upon feeder cattle prices.

If reliable data can be found that accurately indicate the supply and demand for feeder cattle, then an econometric model can be developed that produces estimates of feeder prices that are very close to the actual values. When using such a model to forecast prices, forecasted

values of the supply and demand variables must be used. Therefore, even if an econometric model can correctly estimate current prices using current supply and demand variables there is no guarantee it will forecast future prices with the same accuracy.

For hedging purposes, a long hedge is placed in the October to April time period if the model predicts higher prices than an appropriate futures value. A short hedge is placed in the May to September period if the model predicts a lower price than an appropriate futures value.

Stop order

Any hedge can be supplemented with a stop order that can be used by hedgers to exit positions. A fixed stop is placed when a position is taken. It is an instruction to the broker to offset the hedge if prices fall or rise to a specified amount. Short hedgers hope to exit short positions when prices are rising and long hedgers hope to exit long positions when prices are falling.

The stop order should be used with caution. The execution of the order once again places the stocker at the mercy of price changes. Stop orders work well in years with strong price trends. In these years either prices trend down and the stop order never comes into play, or prices trend up and the order is executed and the loss of price protection has no adverse effects. In years with alternating price movements a stop order could lift the hedge in a climate where price risk protection is needed. The correct price level to place the order at is

extremely important in these nontrend years. It would be tempting to look at historical data and "discover" a stop-loss order level that would have correctly lifted the hedge in all years where the final price was above purchase price and that would not lift the hedge when the final price was below purchase price. There is little evidence to suggest that this "ideal" stop order would perform as well in subsequent years.

# CHAPTER 3. SIMULATION PROCEDURES AND RESULTS

To evaluate the potential returns from hedging, alternative hedging strategies were developed and applied to data from 1974 through 1985. The results were compared to cash marketing returns for a southern Iowa stocker operation. The strategies, though, are applicable to backgrounding operations in any geographical region.

## Simulation Assumptions

The simulation involved backgrounding cattle for 5 months each year during the period from 1974 through 1985. Cattle were assumed to be placed on pasture in the third week of April and marketed in the third week of September.

The production assumptions that were used in the simulation are shown in Table 3.1. The feeder cattle were purchased at an average weight of 600 pounds. The average daily gain was 1.13 lbs and the cattle gained approximately 170 lbs. The average daily gain figure incorporates shrink. The pasture was assumed to be improved bluegrass with an annual application of 60 pounds per acre of nitrogen fertilizer. Death loss was assumed to be one percent of all animals on pasture. The assumptions are based on Iowa State University estimates (Strohbehn, 1985).

Assumed production costs for the simulation are shown in Table 3.2. All costs are listed on a per head basis. Pasture rent figures were obtained from the Iowa Crop and Livestock Reporting Service. The per head pasture costs are based on the cost per acre for renting improved

Table 3.1. Production assumptions for simulation

| | |
|---|---|
| Placement weight | 600 lbs. |
| Effective marketing weight (minus shrink) | 770 lbs. |
| Time on pasture | 5 months |
| Total gain | 170 lbs. |
| Average daily gain | 1.13 lbs. |
| Death loss | 1 percent |
| Acres/steers | .67 |
| Pasture type | Improved bluegrass |
| Fertilizer | 60 pounds nitrogen |

grass in southern Iowa for the summer grazing period. Per head interest charges are based on interest rates reported in the the USDA Meat and Poultry Situation and Outlook Report for a corn belt feedlot operation in the April to September period. The interest charges cover the five month feeding period. All other costs were based on 1985 estimates from Iowa State University (Strohbehn, 1985). Their pre-1985 values were obtained by deflating the 1985 values by price changes which occurred in cost series for closely related products. All costs series other than salt and fertilizer were found in the corn belt feedlot operation costs reported by U.S.D.A. Salt and fertilizer costs were found in Agricultural Prices, a U.S.D.A. publication.

Price data for cash and futures markets were used in the simulation. Futures market prices used were daily closing prices for feeder cattle traded on the Chicago Mercantile Exchange. Cash prices were for 600 and 800 pound medium frame number one feeder steers prices for Iowa livestock markets. These prices were obtained from the Livestock Market Summary, a

Table 3.2. Cost of gain assumptions for simulation (all amounts are $/hd)

| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pasture | 13.40 | 14.74 | 16.08 | 17.42 | 18.09 | 22.11 | 21.44 | 23.45 | 25.46 | 22.11 | 20.77 | 18.09 |
| Interest | 11.01 | 8.41 | 10.76 | 9.21 | 12.64 | 20.41 | 25.00 | 29.93 | 28.82 | 24.77 | 22.89 | 23.32 |
| Fertilizer | 8.43 | 12.30 | 8.77 | 8.43 | 8.66 | 9.34 | 13.90 | 13.44 | 12.42 | 11.62 | 12.53 | 11.39 |
| Operating | 1.47 | 1.62 | 1.74 | 1.83 | 1.89 | 2.19 | 2.46 | 2.73 | 2.82 | 2.91 | 3.03 | 3.00 |
| Marketing | 4.77 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Vet-med | 2.45 | 2.70 | 2.90 | 3.05 | 3.15 | 3.65 | 4.10 | 4.55 | 4.70 | 4.85 | 5.00 | 5.00 |
| Salt | 0.56 | 0.65 | 0.69 | 0.80 | 0.87 | 0.96 | 1.10 | 1.31 | 1.38 | 1.43 | 1.50 | 1.50 |
| Labor | 0.73 | 0.76 | 0.81 | 0.81 | 0.86 | 1.05 | 0.98 | 1.28 | 1.18 | 1.21 | 1.25 | 1.25 |
| Death | 2.82 | 1.95 | 2.91 | 2.49 | 3.42 | 5.52 | 4.50 | 4.20 | 4.14 | 4.20 | 4.08 | 4.17 |
| Total | 45.64 | 48.13 | 49.66 | 49.04 | 54.58 | 70.23 | 78.48 | 85.89 | 85.92 | 78.10 | 76.05 | 72.72 |

publication of the Iowa Department of Agriculture, which reports weekly data on Iowa feeder cattle prices.

Futures transaction brokerage commissions were assumed to be $60 per contract (round turn) for feeder cattle. Margins for hedging were assumed at $1200 per contract. Interest charges on margins were calculated with the interest rates used in Table 3.2 from the time of margin deposit until the liquidation of the hedge.

Assumptions also had to be made about predicted basis. When hedging, all futures prices need to be converted into local cash prices so that potential profits can be determined. In order to localize a futures price one needs to form an expectation about what the basis will be at the time the hedge is lifted. Typically, this expectation would probably be based on an average of the basis occurring over the last few years. Since there was little change in the basis over the last 12 years, an average for the entire period was used rather than recalculate an estimated basis each year from prior data.

## Profit Opportunities

The entire process of developing and testing hedging strategies is a moot one if no profit opportunities exist through the use of the futures market. Figure 3.1 shows the estimated returns to a southern Iowa stocker operation from 1974 to 1985 using cash marketing. Profits averaged $2.06/hd during this period. Whether or not profit opportunities were present using the feeder cattle futures market was

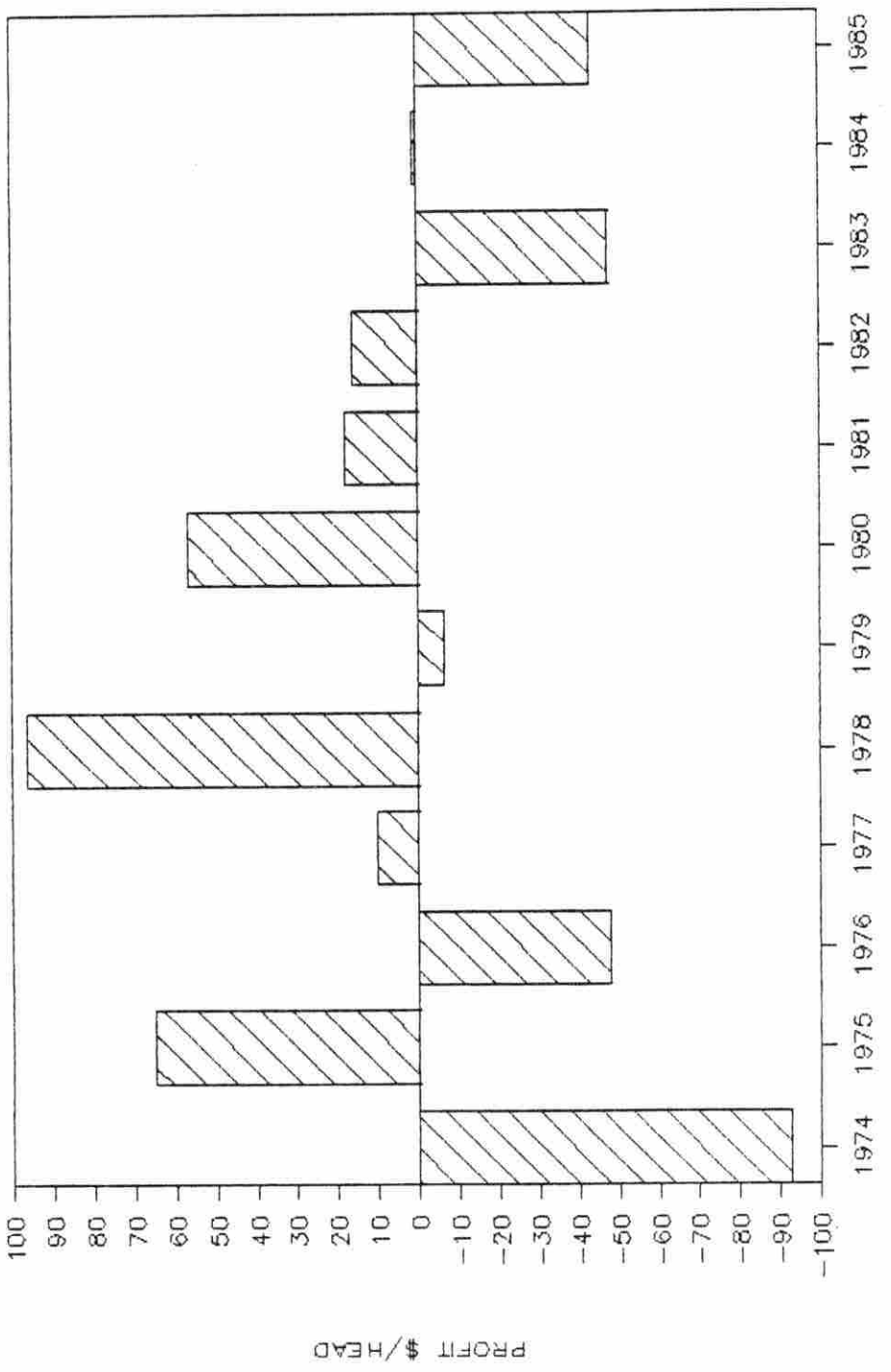


Figure 3.1. Estimated profits for a southern Iowa stocker operation, 1974 through 1985

tested using both long and short hedges during the time both contracts for the same year were trading simultaneously.

Buying an April contract and selling a September contract on the same day and offsetting both contracts on their expiration dates produces price protection for both the purchase and sale of feeder cattle. Adjusting each futures price for local basis and subtracting nonfeeder costs produces a net profit return for each day both the April and September contracts of the same year are being traded.

Table 3.3 shows different profit levels and the percent of trading days that they were available during the simulation period. Overall, only 14 percent of the days when both the April and September contracts for the same year were being traded was the profit not above zero. Almost 43 percent of the returns were between zero and ten dollars per head and 43 percent were between 20 and 60 dollars per head profit. Of the individual years, only 1975 was unable to provide a breakeven return. Seven of the years did not contain any trading days that returned a below breakeven profit level.

## Marketing Strategies

Nine hedging strategies were simulated using 1974-1985 data and ten using the 1981-1985 data to determine if returns could be increased and/or variance decreased over the cash marketing position. Each hedging strategy and its implementation are discussed below.

Table 3.3. Distribution of daily profit opportunities from an April-September spread, 1974-1985

| | Profit levels ($/hd) | | | | |
|---|---|---|---|---|---|
| | 60+ | 40-60 | 20-40 | 0-20 | -20-0 |
| 1974 | | | 10.5 | 84.2 | 5.3 |
| 1975 | | | | | 100.0 |
| 1976 | | | 1.9 | 96.2 | 1.9 |
| 1977 | | | 25.5 | 74.5 | |
| 1978 | | | 13.9 | 85.4 | .7 |
| 1979 | 3.4 | 75.9 | 20.7 | | |
| 1980 | | 61.5 | 37.8 | .7 | |
| 1981 | | 6.9 | 92.4 | .8 | |
| 1982 | | | 2.9 | 42.4 | 54.7 |
| 1983 | | | 1.0 | 69.0 | 30.0 |
| 1984 | | | .9 | 99.1 | |
| 1985 | | 44.9 | 42.3 | 12.8 | |
| 1974-85[a] | .4% | 19.3% | 23.7% | 42.7% | 13.8% |

[a]This is not a simple average of each year, it is an average of all trading days during these years when both contracts for the same year were trading simultaneously.

Strategy I: routine hedge

A short position in the September futures contract was taken in the third week of April at the time the feeder cattle were purchased. This contract was offset in the third week of September by buying the September contract. The hedge was held until the sale of the cattle in September regardless of price movements during the feeding period.

Strategy II: routine hedge with a stop order

The same strategy as I but with a stop-loss order placed $2.00/cwt above the September futures hedge entry price. Once the order was executed there was no reentry into the futures market.

Strategy III: short breakeven hedge

A short position in the September contract was taken any time during or after the third week of April when the futures price covered all costs. If a hedge was placed anytime during the feeding period, it was offset during the third week of September. In order to determine if futures offered a breakeven return or not the September futures price was converted into a local cash price by adding the expected delivery month basis for September. The expected basis was arrived at by computing the average September basis for a southern Iowa stocker over the 1974 to 1985 period.

Strategy IV: short breakeven hedge with a stop order

The same as strategy III but with a stop-loss order placed $2.00/cwt above the September futures hedge entry price. Once the order was executed there was no reentry into the futures market.

Strategy V: long-short breakeven hedge

A short position in the September contract and a long position in the April contract were simultaneously taken when the spread between the two contracts provided a hedge that covered all costs. The April contract was offset in the third week of April when the cattle were purchased and the September contract was offset when the cattle were sold in the third week of September.

Both the April and September contracts were adjusted for local delivery month basis so that they would reflect local cash prices. The

April and September delivery month basis were determined by computing their averages for southern Iowa during the 1974-1985 period.

Strategy VI: long-short $15/hd profit hedge

The same as strategy V except the simultaneous placement of the long April and short September positions was not made unless the basis adjusted futures' prices offered a $15/hd profit. The $15/hd profit was not chosen as an optimal level. It was, however, a profit amount that was available every year except 1975 when no profits were available using a long-short hedge.

Strategy VII: negative basis hedge

A short position in the September contract was placed anytime during the feeding period when the September basis became more negative than $-2.50. The contract was offset in September with the sale of the cattle. The weekly basis was calculated based on Sioux City 600-700 lb medium frame #1 steers.

Strategy VIII: positive basis hedge

A short position in the September contract was placed anytime during the feeding period when the September basis (cash-futures) became greater than $2.50. The contract was offset in September when the cattle were sold. The weekly basis was calculated based on Sioux City 600-700 lb medium frame #1 steers.

Strategy IX: moving average hedge

A short position in the September contract was placed anytime from May to September when the moving averages signaled a down trend in prices. The contract was offset when either an up trend in prices was signaled or when the cattle were sold in September. A long position in the April contract was placed anytime from October to April when the moving averages signaled an up trend in prices. The contract was offset when either a down trend in prices was signaled or when the cattle were purchased in September. Multiple buy or sell signals could be generated during a year and cash positions were hedged and unhedged accordingly. Thirty day and ten day moving averages were used so that trends could be identified without the whipsaw effect that comes from moving averages using shorter time spans. These two moving averages were only chosen to illustrate the use of moving averages in hedging. They are not optimal length averages. Supposed optimal length moving averages are only optimal over the historical data they were tested on.

Strategy X: econometric hedge

The quarterly econometric model produced one quarter ahead price forecasts. The futures price of the nearby contract for the next quarter was the price being predicted. Forecasts were available in the third week of January, April, July and October. If the January futures forecast made in the third week of October was higher than the January futures on that date then a long April position was taken. If the April futures forecast made in January was higher than the April futures

contract on that day then a long position was taken in the April contract, unless it was already placed in the previous quarter.

If the July forecast made in April was lower than the August futures (there is no contract for July) on that day then a short September position was taken. If the October futures forecast made in July was lower than the October futures on that day then a short position in the September contract was taken, unless it was already placed in the previous quarter.

The econometric hedge was used to produce forecasts for the 1981 to 1985 period. There was insufficient data prior to 1974 to develop earlier forecasts. Appendix A contains a complete explanation of the econometric hedge and its limitations.

## Performance of Alternative Marketing Strategies

### Performance criterion

The marketing strategies were analyzed with a standard mean variance analysis. Strategies having higher average returns and lower variances than the cash marketing position are unambiguously superior to cash marketing. Strategies with lower means and higher variances are unambiguously inferior to cash marketing. Strategies with either a higher mean and higher variance or a lower mean and lower variance can't be defined as superior or inferior to cash marketing.

Although mean variance analysis has an intuitive appeal as a performance criterion for hedging strategies, it contains some drawbacks.

Under this criterion a strategy is unambiguously superior to another only if it contains both a higher mean and a lower variance. Comparisons between two strategies, each with either a superior mean or variance can't be made. For example, a strategy that produced no profits but had a very low variance could not be deemed inferior to a strategy with much higher returns and a slightly higher variance. High variance may not be a problem when returns are significantly higher too.

A performance criterion that can complement mean variance analysis is the one standard deviation rule. If returns are distributed normally then the mean return minus one standard deviation will be an indicator of the potential problems associated with high variance. Subtracting one standard deviation from the mean will produce a profit figure that approximately 82% of all expected profit returns should be larger than. The larger this amount, the less variability is a concern. This performance criterion should help distinguish among the strategies that can't be compared by mean variance analysis. It is important to note that this criterion implicitly assumes a one to one tradeoff between mean and variance. This weighting system may not be applicable to many decision makers. The risk aversion of a stocker operator should be accounted for in assigning weights to the mean variance tradeoff.

## Results of strategies

The results of the alternative marketing strategies for feeder cattle are shown in Tables 3.4 through 3.14. Each table (except for cash marketing) contains the dates and corresponding futures prices for each

Table 3.4. Cash marketing strategy

| Year | Purchased | | Sold | | Per animal gain | Non-feeder costs | Net profit |
|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | |
| 1974 | 4/19 | 47.00 | 9/20 | 30.50 | -47.15 | 45.64 | -92.79 |
| 1975 | 4/18 | 32.50 | 9/19 | 40.00 | 113.00 | 48.13 | 64.87 |
| 1976 | 4/19 | 48.50 | 9/20 | 38.00 | 1.60 | 49.66 | -48.06 |
| 1977 | 4/15 | 41.50 | 9/20 | 40.00 | 59.00 | 49.04 | 9.96 |
| 1978 | 4/20 | 57.00 | 9/20 | 64.00 | 150.80 | 54.58 | 96.22 |
| 1979 | 4/20 | 92.00 | 9/20 | 80.00 | 64.00 | 70.23 | -6.23 |
| 1980 | 4/18 | 75.00 | 9/19 | 76.00 | 135.20 | 78.48 | 56.72 |
| 1981 | 4/16 | 70.00 | 9/18 | 68.00 | 103.60 | 85.89 | 17.71 |
| 1982 | 4/16 | 69.00 | 9/20 | 67.00 | 101.90 | 85.92 | 15.98 |
| 1983 | 4/15 | 70.00 | 9/20 | 58.50 | 30.45 | 78.10 | -47.65 |
| 1984 | 4/19 | 68.00 | 9/20 | 63.00 | 77.10 | 76.05 | 1.05 |
| 1985 | 4/19 | 69.50 | 9/20 | 58.00 | 29.60 | 72.72 | -43.12 |
| | | | | 1974-85 | Mean | | 2.06 |
| | | | | | Std | | 51.95 |
| | | | | | Mean-std | | -49.90 |
| | | | | 1981-85 | Mean | | -11.21 |
| | | | | | Std | | 28.54 |
| | | | | | Mean-std | | -39.74 |

Table 3.5. Strategy I routine hedge

| Year | Sale | | Purchase | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | 4/19 | 44.75 | 9/20 | 30.00 | 113.86 | 1.89 | -92.79 | 19.18 |
| 1975 | 4/18 | 32.00 | 9/19 | 38.75 | -52.11 | 1.98 | 64.87 | 10.78 |
| 1976 | 4/19 | 46.00 | 9/20 | 35.60 | 80.28 | 1.85 | -48.06 | 30.37 |
| 1977 | 4/15 | 44.70 | 9/20 | 40.50 | 32.42 | 1.85 | 9.96 | 40.53 |
| 1978 | 4/20 | 54.95 | 9/20 | 67.90 | -99.96 | 1.85 | 96.22 | -5.59 |
| 1979 | 4/20 | 90.37 | 9/20 | 84.90 | 42.22 | 1.85 | -6.23 | 34.15 |
| 1980 | 4/18 | 71.65 | 9/19 | 75.42 | -29.10 | 2.25 | 56.72 | 25.37 |
| 1981 | 4/16 | 72.67 | 9/18 | 69.72 | 22.77 | 2.59 | 17.71 | 37.89 |
| 1982 | 4/16 | 64.00 | 9/20 | 67.85 | -29.72 | 2.55 | 15.98 | -16.29 |
| 1983 | 4/15 | 65.65 | 9/20 | 59.37 | 48.48 | 2.06 | -47.65 | -1.23 |
| 1984 | 4/19 | 65.50 | 9/20 | 64.95 | 4.25 | 2.26 | 1.05 | 3.03 |
| 1985 | 4/19 | 68.45 | 9/20 | 62.70 | 44.39 | 2.26 | -43.12 | -0.99 |
| | | | | 1974-85 | Mean | | 2.06 | 14.77 |
| | | | | | Std | | 51.95 | 18.23 |
| | | | | | Mean-std | | -49.90 | -3.46 |
| | | | | 1981-85 | Mean | | -11.21 | 4.48 |
| | | | | | Std | | 28.54 | 17.96 |
| | | | | | Mean-std | | -39.74 | -13.47 |

Table 3.6. Strategy II routine hedge with a stop order

| Year | Sale | | Purchase | | Per animal gain with futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | 4/19 | 44.75 | 9/20 | 30.00 | 113.86 | 1.89 | -92.79 | 19.18 |
| 1975 | 4/18 | 32.00 | 5/5 | 34.00 | -15.44 | 1.23 | 64.87 | 48.20 |
| 1976 | 4/19 | 46.00 | 9/20 | 35.60 | 80.28 | 1.85 | -48.06 | 30.37 |
| 1977 | 4/15 | 44.70 | 9/20 | 40.50 | 32.42 | 1.85 | 9.96 | 40.53 |
| 1978 | 4/20 | 54.95 | 4/28 | 56.95 | -15.44 | 1.05 | 96.22 | 79.73 |
| 1979 | 4/20 | 90.37 | 9/20 | 84.90 | 42.22 | 1.85 | -6.23 | 34.15 |
| 1980 | 4/18 | 71.65 | 5/12 | 73.65 | -15.44 | 1.28 | 56.72 | 40.00 |
| 1981 | 4/16 | 72.67 | 9/18 | 69.72 | 22.77 | 2.58 | 17.71 | 37.90 |
| 1982 | 4/16 | 64.00 | 4/21 | 66.00 | -15.44 | 1.05 | 15.98 | -0.51 |
| 1983 | 4/15 | 65.65 | 9/20 | 59.37 | 48.48 | 2.33 | -47.65 | -1.50 |
| 1984 | 4/19 | 65.50 | 7/16 | 67.50 | -15.44 | 1.77 | 1.05 | -16.16 |
| 1985 | 4/19 | 68.45 | 9/20 | 62.70 | 44.39 | 2.26 | -43.12 | -0.99 |
| | | | | 1974-85 | Mean | | 2.06 | 25.91 |
| | | | | | Std | | 51.95 | 25.86 |
| | | | | | Mean-std | | -49.90 | 0.05 |
| | | | | 1981-85 | Mean | | -11.21 | 3.75 |
| | | | | | Std | | 28.54 | 18.06 |
| | | | | | Mean-std | | -39.74 | -14.31 |

Table 3.7 Strategy III short breakeven hedge

| Year | Sale | | Purchase | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | 4/19 | 44.75 | 9/20 | 30.00 | 113.86 | 1.89 | -92.79 | 19.18 |
| 1975 | 5/2 | 33.75 | 9/19 | 38.75 | -38.60 | 1.98 | 64.87 | 24.29 |
| 1976 | 4/19 | 46.00 | 9/20 | 35.60 | 80.28 | 1.85 | -48.06 | 30.37 |
| 1977 | 4/15 | 44.70 | 9/20 | 40.50 | 32.42 | 1.85 | 9.96 | 40.53 |
| 1978 | 4/20 | 54.95 | 9/20 | 67.90 | -99.96 | 1.85 | 96.22 | -5.59 |
| 1979 | 4/20 | 90.37 | 9/20 | 84.90 | 42.22 | 1.85 | -6.23 | 34.15 |
| 1980 | 4/18 | 71.65 | 9/19 | 75.42 | -29.10 | 2.25 | 56.72 | 25.37 |
| 1981 | 4/16 | 72.67 | 9/18 | 69.72 | 22.77 | 2.58 | 17.71 | 37.90 |
| 1982 | 5/6 | 66.75 | 9/20 | 67.85 | -8.49 | 2.55 | 15.98 | 4.94 |
| 1983 | 5/5 | 66.35 | 9/20 | 59.37 | 53.88 | 2.33 | -47.65 | 3.90 |
| 1984 | 4/23 | 65.30 | 9/20 | 64.95 | 2.70 | 2.26 | 1.05 | 1.49 |
| 1985 | 4/19 | 68.45 | 9/20 | 62.70 | 44.39 | 2.26 | -43.12 | -0.99 |
| | | | | 1974-85 | Mean | | 2.06 | 17.96 |
| | | | | | Std | | 51.95 | 15.74 |
| | | | | | Mean-std | | -49.90 | 2.22 |
| | | | | 1981-85 | Mean | | -11.21 | 9.45 |
| | | | | | Std | | 28.54 | 14.37 |
| | | | | | Mean-std | | -39.74 | -4.92 |

Table 3.8. Strategy IV short breakeven hedge with stop

| Year | Sale | | Purchase | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | 4/19 | 44.75 | 9/20 | 30.00 | 113.86 | 1.89 | -92.79 | 19.18 |
| 1975 | 5/2 | 33.75 | 6/9 | 35.75 | -15.44 | 1.23 | 64.87 | 48.20 |
| 1976 | 4/19 | 46.00 | 9/20 | 35.60 | 80.28 | 1.85 | -48.06 | 30.37 |
| 1977 | 4/15 | 44.70 | 9/20 | 40.50 | 32.42 | 1.85 | 9.96 | 40.53 |
| 1978 | 4/20 | 54.95 | 5/1 | 56.95 | -15.44 | 1.05 | 96.22 | 79.73 |
| 1979 | 4/20 | 90.37 | 9/20 | 84.90 | 42.22 | 1.85 | -6.23 | 34.15 |
| 1980 | 4/18 | 71.65 | 5/12 | 73.65 | -15.44 | 1.28 | 56.72 | 40.00 |
| 1981 | 4/16 | 72.67 | 9/18 | 69.72 | 22.77 | 2.58 | 17.71 | 37.90 |
| 1982 | 5/6 | 66.75 | 8/6 | 68.75 | -15.44 | 1.94 | 15.98 | -1.40 |
| 1983 | 5/5 | 66.35 | 9/20 | 59.37 | 53.88 | 2.33 | -47.65 | 3.90 |
| 1984 | 4/23 | 65.30 | 7/13 | 67.30 | -15.44 | 1.77 | 1.05 | -16.16 |
| 1985 | 4/19 | 68.45 | 9/20 | 62.70 | 44.39 | 2.26 | -43.12 | -0.99 |
| | | | | 1974-85 | Mean | | 2.06 | 26.28 |
| | | | | | Std | | 51.95 | 25.50 |
| | | | | | Mean-std | | -49.90 | 0.78 |
| | | | | 1981-85 | Mean | | -11.21 | 4.65 |
| | | | | | Std | | 28.54 | 17.93 |
| | | | | | Mean-std | | -39.74 | -13.28 |

Table 3.9. Strategy V long-short breakeven hedge

| Year | Date | September | | | April | | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sale price | Purchase | | Purchase price | Sale | | | | Without hedge | With hedge |
| | | | Date | Price | | Date | Price | | | | |
| 1974 | 3/5/74 | 41.30 | 9/20 | 30.00 | 42.20 | 4/19 | 46.00 | 116.56 | 2.55 | -92.79 | 21.22 |
| 1975 | | | | | | | | 0.00 | 0.00 | 64.87 | 64.87 |
| 1976 | 1/6/76 | 38.50 | 9/20 | 35.60 | 38.80 | 4/20 | 47.75 | 91.47 | 3.10 | -48.06 | 40.31 |
| 1977 | 11/12/76 | 42.00 | 9/20 | 40.50 | 41.65 | 4/20 | 45.00 | 37.44 | 3.42 | 9.96 | 43.98 |
| 1978 | 9/26/77 | 42.55 | 9/20 | 67.90 | 42.10 | 4/20 | 57.00 | -80.67 | 4.05 | 96.22 | 11.51 |
| 1979 | 9/21/78 | 73.50 | 9/20 | 84.90 | 72.92 | 4/20 | 93.87 | 73.72 | 4.05 | -6.23 | 63.44 |
| 1980 | 10/4/79 | 83.50 | 9/19 | 75.42 | 85.82 | 4/18 | 71.45 | -48.55 | 5.54 | 56.72 | 2.62 |
| 1981 | 10/6/80 | 81.00 | 9/18 | 69.72 | 81.55 | 4/20 | 71.15 | 6.79 | 6.81 | 17.71 | 17.70 |
| 1982 | 10/1/81 | 68.95 | 9/20 | 67.85 | 67.90 | 4/20 | 67.95 | 8.88 | 6.67 | 15.98 | 18.18 |
| 1983 | 11/24/82 | 65.80 | 9/20 | 59.37 | 65.40 | 4/20 | 70.07 | 85.68 | 4.84 | -47.65 | 33.19 |
| 1984 | 11/3/83 | 64.10 | 9/20 | 64.95 | 64.80 | 4/19 | 66.90 | 9.65 | 5.15 | 1.05 | 5.55 |
| 1985 | 12/28/84 | 68.22 | 9/20 | 62.70 | 72.07 | 4/19 | 65.25 | -10.04 | 4.14 | -43.12 | -57.30 |
| | | | | | | 1974-85 | | Mean | | 2.06 | 22.11 |
| | | | | | | | | Std | | 51.95 | 31.06 |
| | | | | | | | | Mean-std | | -49.90 | -8.95 |
| | | | | | | 1981-85 | | Meam | | -11.21 | 3.46 |
| | | | | | | | | Std | | 28.54 | 31.62 |
| | | | | | | | | Mean-std | | -39.74 | -28.16 |

Table 3.10. Strategy VI long-short $15/hd profit hedge

| Year | Date | September | | | April | | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sale price | Purchase | | Purchase Price | Sale | | | | Without hedge | With hedge |
| | | | Date | Price | | Date | Price | | | | |
| 1974 | 3/18/74 | 45.50 | 9/20 | 30.00 | 45.00 | 4/19 | 46.00 | 127.37 | 2.21 | -92.79 | 32.37 |
| 1975 | | | | | | | | 0.00 | 0.00 | 64.87 | 64.87 |
| 1976 | 3/2/76 | 40.50 | 9/20 | 35.60 | 39.02 | 4/20 | 47.75 | 105.21 | 2.47 | -48.06 | 54.68 |
| 1977 | 11/17/76 | 42.12 | 9/20 | 40.50 | 41.02 | 4/20 | 45.00 | 43.23 | 3.42 | 9.96 | 49.77 |
| 1978 | 10/3/77 | 43.00 | 9/20 | 67.90 | 42.22 | 4/20 | 57.00 | -78.12 | 4.05 | 96.22 | 14.05 |
| 1979 | 9/21/78 | 73.50 | 9/20 | 84.90 | 72.92 | 4/20 | 93.87 | 73.72 | 4.05 | -6.23 | 63.44 |
| 1980 | 10/4/79 | 83.50 | 9/19 | 75.42 | 85.82 | 4/18 | 71.45 | -48.55 | 5.54 | 56.72 | 2.62 |
| 1981 | 10/6/80 | 81.00 | 9/18 | 69.72 | 81.55 | 4/20 | 71.15 | 6.79 | 6.81 | 17.71 | 17.70 |
| 1982 | 10/1/81 | 68.95 | 9/20 | 67.85 | 67.90 | 4/20 | 67.95 | 8.88 | 6.67 | 15.98 | 18.18 |
| 1983 | 11/24/82 | 65.80 | 9/20 | 59.37 | 65.40 | 4/20 | 70.07 | 85.68 | 4.84 | -47.65 | 33.19 |
| 1984 | 12/6/83 | 66.45 | 9/20 | 64.95 | 67.55 | 4/19 | 66.90 | 6.56 | 4.66 | 1.05 | 2.95 |
| 1985 | 1/9/85 | 68.55 | 9/20 | 62.70 | 71.05 | 4/19 | 65.25 | 0.39 | 4.14 | -43.12 | -46.88 |
| | | | | | | 1974-85 | | Mean | | 2.06 | 25.58 |
| | | | | | | | | Std | | 51.95 | 30.35 |
| | | | | | | | | Mean-std | | -49.90 | -4.77 |
| | | | | | | 1981-85 | | Mean | | -11.21 | 5.03 |
| | | | | | | | | Std | | 28.54 | 27.66 |
| | | | | | | | | Mean-std | | -39.74 | -22.63 |

Table 3.11. Strategy VII negative basis hedge

| Year | Sale | | Purchase | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | | | | | 0.00 | 0.00 | -92.79 | -92.79 |
| 1975 | | | | | 0.00 | 0.00 | 64.87 | 64.87 |
| 1976 | 5/21 | 44.50 | 9/20 | 35.60 | 68.70 | 1.68 | -48.06 | 18.96 |
| 1977 | | | | | 0.00 | 0.00 | 9.96 | 9.96 |
| 1978 | | | | | 0.00 | 0.00 | 96.22 | 96.22 |
| 1979 | 8/17 | 82.50 | 9/20 | 84.90 | -18.53 | 1.20 | -6.23 | -25.96 |
| 1980 | 5/9 | 72.95 | 9/19 | 75.42 | -19.07 | 2.25 | 56.72 | 35.41 |
| 1981 | 4/16 | 72.67 | 9/18 | 69.72 | 22.77 | 2.58 | 17.71 | 37.90 |
| 1982 | 8/6 | 67.87 | 9/20 | 67.85 | 0.15 | 1.66 | 15.98 | 14.48 |
| 1983 | | | | | 0.00 | 0.00 | -47.65 | -47.65 |
| 1984 | 5/11 | 64.60 | 9/20 | 64.95 | -2.70 | 2.26 | 1.05 | -3.92 |
| 1985 | 4/19 | 68.45 | 9/20 | 62.70 | 44.39 | 2.26 | -43.12 | -0.99 |
| | | | | 1974-85 | Mean | | 2.06 | 8.87 |
| | | | | | Std | | 51.95 | 47.83 |
| | | | | | Mean-std | | -49.90 | -38.95 |
| | | | | 1981-85 | Mean | | -11.21 | -0.04 |
| | | | | | Std | | 28.54 | 28.05 |
| | | | | | Mean-std | | -39.74 | -28.08 |

Table 3.12. Strategy VIII positive basis hedge

| Year | Sale | | Purchase | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|
| | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | 4/26 | 41.80 | 9/20 | 30.00 | 91.09 | 1.89 | -92.79 | -3.59 |
| 1975 | 5/30 | 33.45 | 9/19 | 38.75 | -40.91 | 1.78 | 64.87 | 22.18 |
| 1976 | 9/10 | 36.60 | 9/20 | 35.60 | 7.72 | 1.05 | -48.06 | -41.39 |
| 1977 | 6/10 | 39.65 | 9/20 | 40.50 | -6.56 | 1.53 | 9.96 | 1.87 |
| 1978 | 6/2 | 60.10 | 9/20 | 67.90 | -60.21 | 1.68 | 96.22 | 34.33 |
| 1979 | 5/4 | 86.40 | 9/20 | 84.90 | 11.58 | 1.85 | -6.23 | 3.50 |
| 1980 | 5/2 | 68.20 | 9/19 | 75.42 | -55.73 | 2.25 | 56.72 | -1.26 |
| 1981 | | | | | 0.00 | 0.00 | 17.71 | 17.71 |
| 1982 | 5/21 | 65.55 | 9/20 | 67.85 | -17.75 | 2.23 | 15.98 | -4.00 |
| 1983 | 5/20 | 65.05 | 9/20 | 59.37 | 43.85 | 2.05 | -47.65 | -5.86 |
| 1984 | | | | | 0.00 | 0.00 | 1.05 | 1.05 |
| 1985 | | | | | 0.00 | 0.00 | -43.12 | -43.12 |
| | | | 1974-85 | | Mean | | 2.06 | -1.55 |
| | | | | | Std | | 51.95 | 21.62 |
| | | | | | Mean-std | | -49.90 | -23.17 |
| | | | 1981-85 | | Mean | | -11.21 | -6.84 |
| | | | | | Std | | 28.54 | 19.95 |
| | | | | | Mean-std | | -39.74 | -26.79 |

Table 3.13. Strategy IX moving average hedge

| Year | Contract | Sold or bought | | Sold or bought | | Per animal gain from futures | Cost of hedging | Net profits | |
|---|---|---|---|---|---|---|---|---|---|
| | | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1974 | Sept | 4/26/74 | 41.80 | 9/20/74 | 30.00 | 91.09 | 1.89 | -92.79 | -3.59 |
| 1975 | April | 12/10/74 | 33.67 | 1/6 | 31.80 | -14.44 | 1.23 | 64.87 | 35.17 |
| | April | 3/21 | 30.65 | 4/18 | 32.45 | 13.89 | 1.23 | | |
| | Sept | 7/28 | 32.25 | 9/5 | 35.55 | -25.47 | 1.23 | | |
| 1976 | April | 9/16/75 | 36.50 | 4/20 | 47.75 | 86.84 | 2.15 | -48.06 | 75.24 |
| | Sept | 6/29 | 40.80 | 9/20 | 35.60 | 40.14 | 1.53 | | |
| 1977 | April | 11/4/76 | 42.85 | 1/10 | 38.40 | -34.35 | 1.37 | 9.96 | -12.50 |
| | April | 1/26 | 40.62 | 2/28 | 38.87 | -13.51 | 1.20 | | |
| | April | 3/4 | 40.35 | 4/20 | 45.00 | 35.89 | 1.37 | | |
| | Sept | 6/9 | 39.85 | 9/20 | 40.50 | -5.02 | 1.53 | | |
| 1978 | April | 10/11/77 | 42.07 | 10/19/77 | 41.50 | -4.40 | 1.05 | 96.22 | 201.86 |
| | April | 10/21/77 | 42.35 | 4/20 | 57.00 | 113.09 | 2.00 | | |
| 1979 | April | 10/2/78 | 72.70 | 4/20 | 93.87 | 163.42 | 2.15 | -6.23 | 161.46 |
| | Sept | 5/23 | 84.45 | 8/31 | 83.42 | 7.95 | 1.53 | | |
| 1980 | April | 9/28/79 | 87.40 | 3/10 | 80.55 | -52.88 | 2.47 | 56.72 | -51.89 |
| | Sept | 4/25 | 70.42 | 6/25 | 77.12 | -51.72 | 1.54 | | |
| 1981 | April | 10/1/80 | 80.22 | 1/26 | 73.87 | -49.02 | 2.25 | 17.71 | -23.08 |
| | Sept | 4/28 | 71.20 | 8/27 | 69.55 | 12.74 | 2.25 | | |
| 1982 | April | 8/27/81 | 68.25 | 10/26/81 | 66.10 | -16.60 | 1.66 | 15.98 | -13.76 |
| | April | 2/22 | 65.55 | 4/20 | 67.95 | 18.53 | 1.66 | | |
| | Sept | 6/8 | 63.20 | 7/15 | 66.70 | -27.02 | 1.34 | | |
| 1983 | April | 1/5 | 67.72 | 4/7 | 70.17 | 18.91 | 1.81 | -47.65 | 9.97 |
| | Sept | 4/21 | 64.92 | 9/20 | 59.37 | 42.84 | 2.33 | | |
| 1984 | April | 11/2/83 | 64.60 | 4/5 | 68.32 | 28.72 | 2.26 | 1.05 | 10.47 |
| | Sept | 4/23 | 65.30 | 7/10 | 66.87 | -12.12 | 1.77 | | |
| | Sept | 8/3 | 66.25 | 8/6 | 66.72 | -3.63 | 1.05 | | |
| | Sept | 8/21 | 66.20 | 9/5 | 65.90 | 2.32 | 1.28 | | |
| | Sept | 9/12 | 65.15 | 9/20 | 64.95 | 1.54 | 1.05 | | |
| 1985 | April | 10/10 | 69.75 | 3/5 | 69.40 | -2.70 | 2.26 | -43.12 | -4.02 |
| | Sept | 4/22 | 68.70 | 9/20 | 62.70 | 46.32 | 2.26 | | |
| | | | | | 1974-85 | Mean | | 2.06 | 32.11 |
| | | | | | | Std | | 51.95 | 73.68 |
| | | | | | | Mean-std | | -49.89 | -41.57 |
| | | | | | 1981-85 | Mean | | -11.21 | -4.08 |
| | | | | | | Std | | 28.54 | 13.14 |
| | | | | | | Mean-std | | -39.74 | -17.23 |

Table 3.14. Strategy X econometric hedge

| Year | Qtr | Contract | Sold or bought | | | | Per animal gain from futures | Cost of hedging | Net profit | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Date | Price | Date | Price | | | Without hedge | With hedge |
| 1981 | 2 | April | 1/20 | 76.55 | 4/20 | 71.15 | -41.68 | 1.96 | 17.71 | 45.43 |
| | 3 | Sept | 4/20 | 72.20 | 7/20 | 62.70 | 73.33 | 1.96 | | |
| 1982 | 2 | April | 1/20 | 60.85 | 4/20 | 67.95 | 54.81 | 1.94 | 15.98 | 57.02 |
| | 4 | Sept | 7/20 | 66.57 | 9/20 | 67.85 | -9.88 | 1.94 | | |
| 1983 | 2 | April | 1/20 | 67.65 | 4/20 | 70.07 | 18.68 | 1.81 | -47.65 | -5.96 |
| | 3 | Sept | 4/20 | 65.00 | 7/20 | 61.55 | 26.63 | 1.81 | | |
| 1984 | 4 | Sept | 7/20 | 67.30 | 9/20 | 64.95 | 18.14 | 1.77 | 1.05 | 17.42 |
| 1985 | 1 | April | 10/19 | 68.15 | 1/18 | 72.17 | 31.03 | 1.77 | -43.12 | -25.76 |
| | 2 | April | 1/18 | 72.17 | 4/19 | 65.25 | -53.42 | 0.72 | | |
| | 3 | Sept | 4/19 | 68.45 | 7/19 | 62.75 | 44.00 | 1.77 | | |
| | | | | | | | Average | | -11.21 | 17.63 |
| | | | | | | | Std | | 28.54 | 30.87 |
| | | | | | | | Mean-std | | -39.74 | -13.24 |

transaction in the feeder cattle futures market. Per head dollar amounts are listed for net gain from each futures transaction, the cost of each hedge (commissions and opportunity costs of margins), and profit with and without using the stated hedging strategy.

Summary statistics included in each table are the per animal mean and standard deviation of returns for both the 1974 to 1985 period and the 1981 to 1985 period. The inclusion of separate 1981-85 results was necessary so that all strategies could be compared to the econometric hedge where data limitations reduced forecasts to the 1981-85 period. The comparison of the strategies in the more recent years should also provide insight into which strategies performed well in a difficult cash marketing environment. The results from the one standard deviation criterion are also listed in each table.

## 1974-1985 results

A Southern Iowa stocker operation (Table 3.4) relying strictly on cash marketing would have realized an average return of $2.06/hd with a standard deviation of $51.59/hd. If profits were normally distributed then roughly half of the years experienced negative profits. The results indicate that five of the twelve years had negative returns. A two standard deviation rule suggests that roughly 95% of the returns would be expected to be between -$100/hd and $100/hd. During this twelve year period, the lowest profit was -$92.79/hd in 1974 and the highest was $96.22 in 1978.

Routine hedging (Table 3.5) increased returns and lowered variance over cash marketing. This implies that with no market monitoring and with no knowledge of production costs a producer could still improve returns by simply placing a short hedge when cattle were bought and lifting it when cattle were sold. Routine hedging negated large positive cash returns in 1976 and 78, but it also offset large losses in 1974,76,83 and 85.

A correctly placed stop order could let a producer benefit from favorable price movements while still providing price protection from unfavorable price moves. Table 3.6 shows the results from using a $2.00/cwt stop loss order with the routine hedge. The stop order was effective in reducing losses in the futures market in four years while only once lifting a hedge that was better left in place. As anticipated, the stop order lifted hedges in years with strong upward price moves and kept losses in the futures market from negating large cash returns.

All four hedging strategies based on profit level hedges had higher means and lower variances than cash marketing. The short breakeven hedge (Table 3.7) produced only two negative profit years. It has the same effect as routine hedging in reducing both large negative and positive cash positions. The breakeven hedge produced yearly results that were often different than breakeven. This was the result of several factors. In the late 1970s, above breakeven opportunities were available as soon as the cattle were purchased and hedges were placed immediately. Profits could also differ from breakeven because the basis was different than the expected basis used to calculate the breakeven futures price. For

example, in 1978 a more than breakeven hedge ($15.10/hd profit) was available in the September contract as soon as the cattle were purchased. This hedge resulted in a $-5.59/hd loss because the expected September basis of $-1.35/cwt. turned out to be $-3.90/cwt. During the summer of 1978 local cash prices did not rise as much as futures did. Therefore, cash gains were not able to offset losses from the short September futures position. As with routine hedging, the short breakeven hedge with a $2.00/cwt. stop loss order (Table 3.8) increased both returns and variances.

The long-short breakeven hedge (Table 3.9) had both higher means and variances than the short breakeven hedge. The two contract approach enabled the producer to place hedges as soon as both the April and September contracts for the same year were being simultaneously traded. In the 1970s this enabled the producer to place much greater than break even hedges the first day both contracts were in place.

The long-short $15/hd profit hedge (Table 3.10) increased returns over the long-short breakeven hedge as expected, but had an unexpectedly lower variance. Both long-short hedging strategies had only one negative profit year (1985). In 1985, abnormal local basis in both spring and fall caused large basis losses for the futures contracts. The April basis (cash-futures) was much wider than usual and the fall basis was much narrower. (The April contract was lower than cash by more than expected and the September contract was greater than cash by more than expected.) Both of these basis changes hurt the long-short hedging strategies' performances in 1985.

The two basis hedges did not perform as well as the other strategies. The positive basis hedge (Table 3.12) was the only strategy that resulted in lower average returns ($-1.55/hd) than cash marketing. The negative basis hedge (Table 3.11) had a higher mean and lower variance than cash, but to a lesser degree than the other strategies. The negative basis' main virtue was its success in not placing a hedge in strong cash marketing years, but it failed to insulate the producer from the 1974 price decline. The positive basis strategy did place a hedge in 1974 but it did not provide price protection in the 1985 price decline and it placed hedges that reduced potential returns in several strong cash years. Basis did not turn out to be a reliable indicator of future price movements.

The moving average hedge (Table 3.13) produced the most interesting results. Although this strategy incurred the largest hedging costs because of the large number of positions taken, it still produced the highest average return of $32.11/hd. The moving average hedge also had the highest standard deviation of all the strategies, including cash marketing. As expected, the moving average hedge performed well in years with strong price trends. Using the September contract it was able to capture large gains from years with large price declines (1974, 1983, 1985) and using the April contract large gains were made in years with major price increases (1976-79). Years with shifting or no trends (1980-82) produced large losses in both contracts.

1981-1985 returns

The average net profit per head with cash marketing during 1981-85 was $-11.21 with a $28.52/hd standard deviation. The variance was lower than the 1974-85 period but this offers little consolation when mean returns are negative. Cash marketing had the lowest return of any marketing strategy studied over this time period.

The basis hedges were again the least desirable of the hedging strategies. The average returns from these two strategies were both superior to cash but they were both negative as well.

Of the 1974 to 1985 strategies the short breakeven hedge produced the highest mean ($9.45/hd) and had the second lowest variance. The other profit level hedges and routine hedges all produced positive single digit average returns. The stop-loss orders were not as effective in this time period because price trends were not as strong.

In general, prices declined over this period but there were a sufficient number of price rallies to make it difficult to determine short term trends. Under this climate it is not surprising that the moving average strategy went from the highest mean in the earlier time period to one of the lowest.

The econometric hedge performed well. It had the highest mean and the second best mean-standard deviation result. The mean-standard deviation criterion was important during this period because although many hedging strategies had lower variances than the econometric hedge, their returns were so low that variance was not as much a consideration as negative profit. The econometric hedge had two negative profit years

and only three of the ten hedges placed during this period lost any money. The ability to always evaluate the placing of a hedge (long April during the fourth and first quarters and short September during the second and third quarters) provided opportunities during these lean years that the other strategies (except moving averages) did not have available. The model did have some short comings. The large price decline of 1985 was not predicted by the model and a long April position taken during this time produced the largest losses of the ten contracts placed. Despite this large loss that reduced the mean and increased the variance, the econometric hedge still produced average returns that were almost twice as large as the next best strategy and almost $30/hd more than cash marketing.

Table 3.15 shows the mean and variance results of all the hedging strategies for both time periods. The table illustrates the poor results from cash marketing and basis hedges. The profit level hedges performed well in both periods.

1974-1985 rankings

Figure 3.2 contains a plot of means and variances of the hedging strategies for the 1974-85 period. The cash marketing position is used as an axis point that divides the graph into four quadrants. Quadrant A represents the area that is unambiguously superior to cash marketing. Quadrant C is unambiguously inferior to cash and Quadrants B and D are ambiguous when compared to cash marketing.

Table 3.15. Mean and variance for all marketing strategies

1974-1985:

| Strategy | Mean | Standard deviation |
|---|---|---|
| IX Moving average | 32.11 | 73.68 |
| IV Short breakeven with stop | 26.28 | 25.50 |
| II Routine with stop | 25.91 | 25.86 |
| VI Long-short $15/hd target | 25.58 | 30.35 |
| V Long-short breakeven | 22.11 | 31.06 |
| III Short breakeven | 17.96 | 15.74 |
| I Routine | 14.77 | 18.23 |
| VII Negative basis | 8.87 | 47.83 |
| Cash | 2.06 | 51.95 |
| VIII Positive basis | -1.55 | 21.62 |

1981-1985:

| Strategy | Mean | Standard deviation |
|---|---|---|
| X Econometric | 17.63 | 30.87 |
| III Short breakeven | 9.45 | 14.37 |
| VI Long-short $15/hd target | 5.03 | 27.66 |
| IV Short breakeven with stop | 4.65 | 17.93 |
| I Routine | 4.48 | 17.96 |
| II Routine with stop | 3.75 | 18.06 |
| V Long-short breakeven | 3.46 | 31.62 |
| VII Negative basis | -0.04 | 28.05 |
| IX Moving average | -4.08 | 13.14 |
| VIII Positive basis | -6.84 | 19.95 |
| Cash | -11.21 | 28.54 |

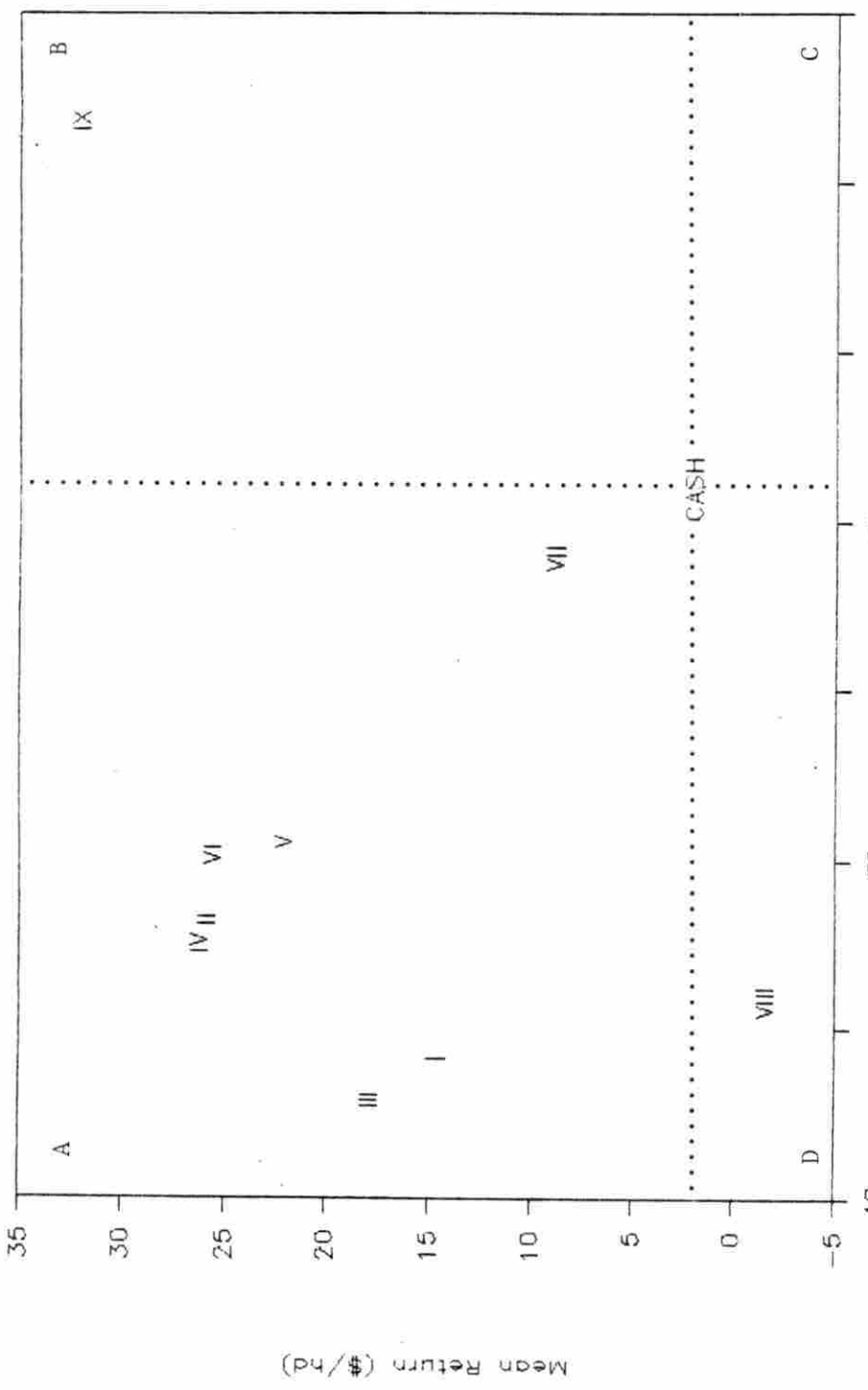


Figure 3.2. Mean variance analysis of marketing strategies, 1974 through 1985

All but two of the strategies were found to be clearly superior to cash marketing. They produced both higher means and lower variances. The strategy in the furthest upper left hand corner is the most preferred strategy. Strategy IV is superior to strategies II, VII, VIII and VI but cannot be compared directly to III which is superior to I. Individual producers could choose among these strategies based on their risk attitudes. Some may prefer the lower variance of III over the higher means of IV. Ignoring those strategies with stop orders (II and IV), the best strategies were the short breakeven hedge (III) and the long-short $15/hd profit hedge (VI).

None of the strategies were found to be inferior to cash marketing in both means and variance. The positive basis hedge had a lower variance but negative average returns. It could be argued that producers would not prefer a lower variance alternative to cash if the average returns were negative.

The moving average hedge produced the most interesting result. It had a significantly higher mean and variance than cash marketing. A producer could suffer significant losses using this strategy during a period of quick changes in price trends. Large gains could be made with a repeat of the strong price trends of the late 1970s.

Figure 3.3 ranks the strategies according to the one standard deviation rule. These rankings help compare strategies that are difficult to choose between with mean variance analysis. The one standard deviation criterion suggests that the short breakeven hedge (III) is superior to the long-short $15/hd profit hedge (VI).

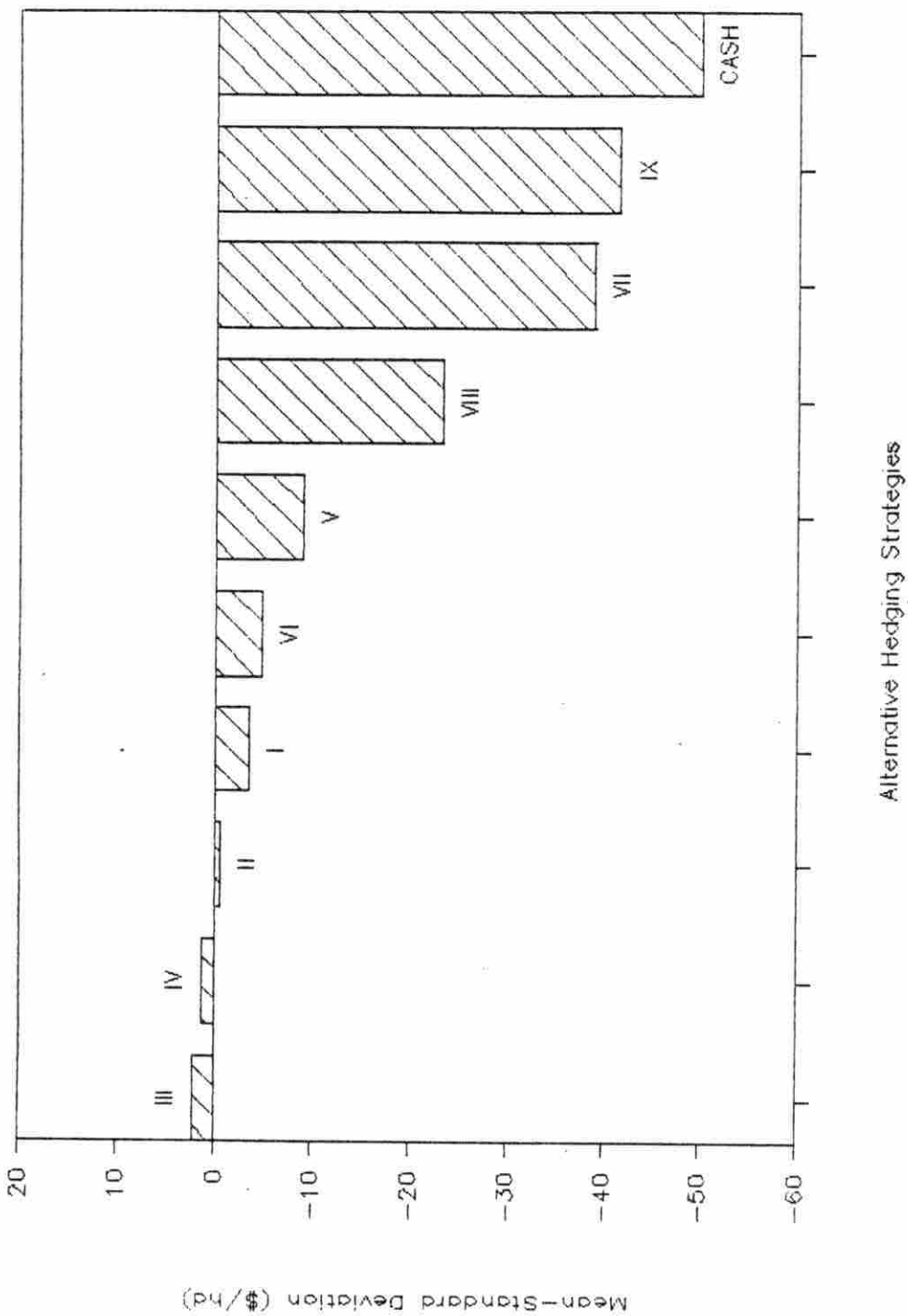


Figure 3.3. Mean minus standard deviation analysis of marketing strategies, 1974 through 1985

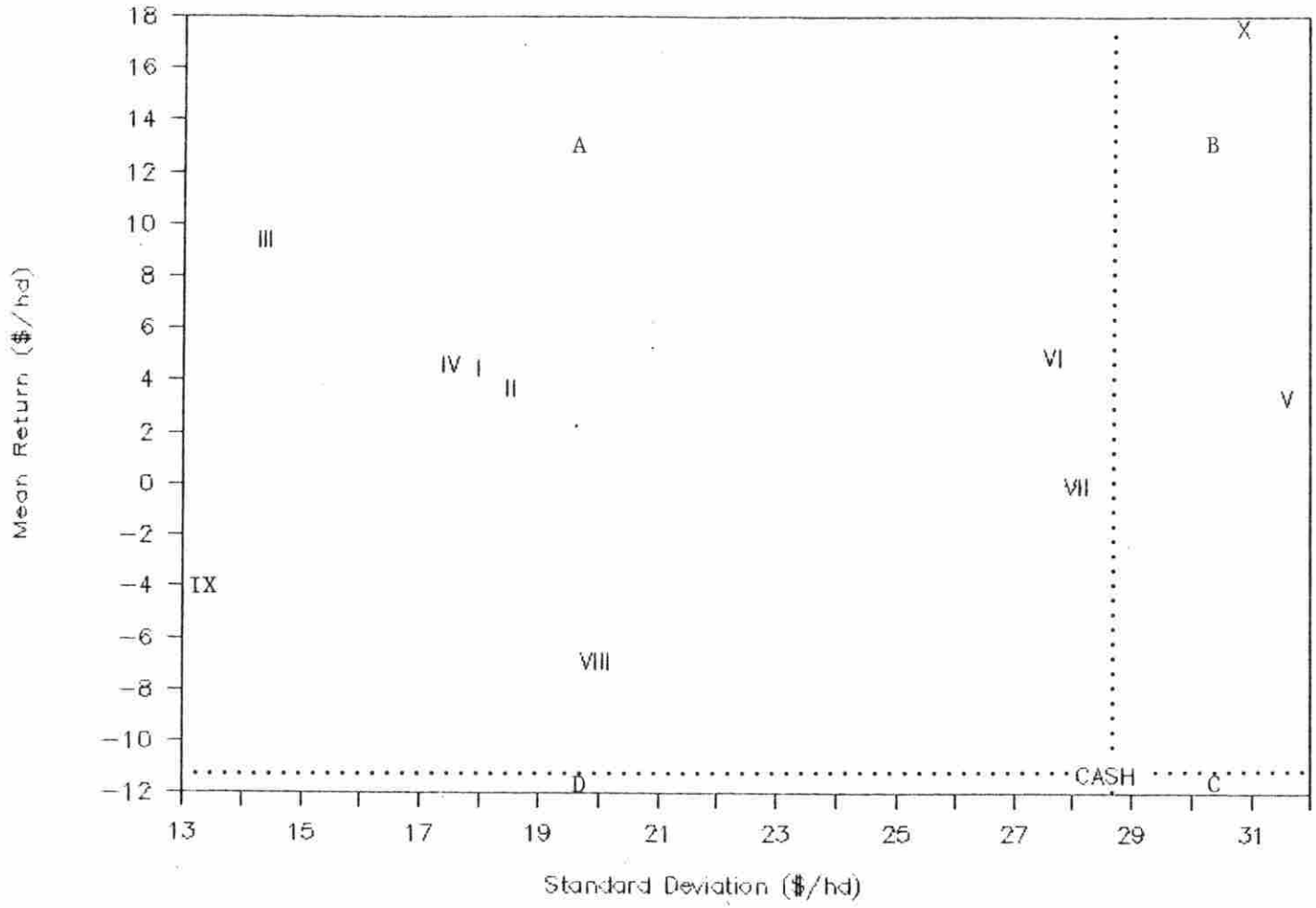


Figure 3.4. Mean variance analysis of marketing strategies, 1981 through 1985

Approximately 84 percent of the returns from the short breakeven hedge will be greater than $2.22/hd.

1981-1985 rankings

Using mean variance analysis (Figure 3.4) all but two hedging strategies were found to be superior to cash marketing. The econometric hedge and the long-short $15/hd profit hedge both had higher average returns and higher variances. Of the strategies that were unambiguously preferred over cash marketing, the short breakeven hedge was superior to all others. In fact strategy III dominates all others except IX and X. The moving average strategy (IX), however, has a negative mean return and is not as viable an alternative as the econometric hedge (X) that has the highest mean return.

Figure 3.5 ranks the strategies according to the one standard deviation rule. Strategies III and X have the best rankings but III is clearly superior using this criterion.

The mean variance criterion and the one standard deviation criterion used to rank the various marketing alternatives do not take into account one very important factor. The long-short hedging strategies have the added advantage of enabling the stocker to choose not to produce at all if the target profit is not achieved. With the other strategies, protection is not achieved until after the stocker has either purchased the cattle or has committed to purchase the cattle. The no production option associated with the long-short hedging strategies is a distinct

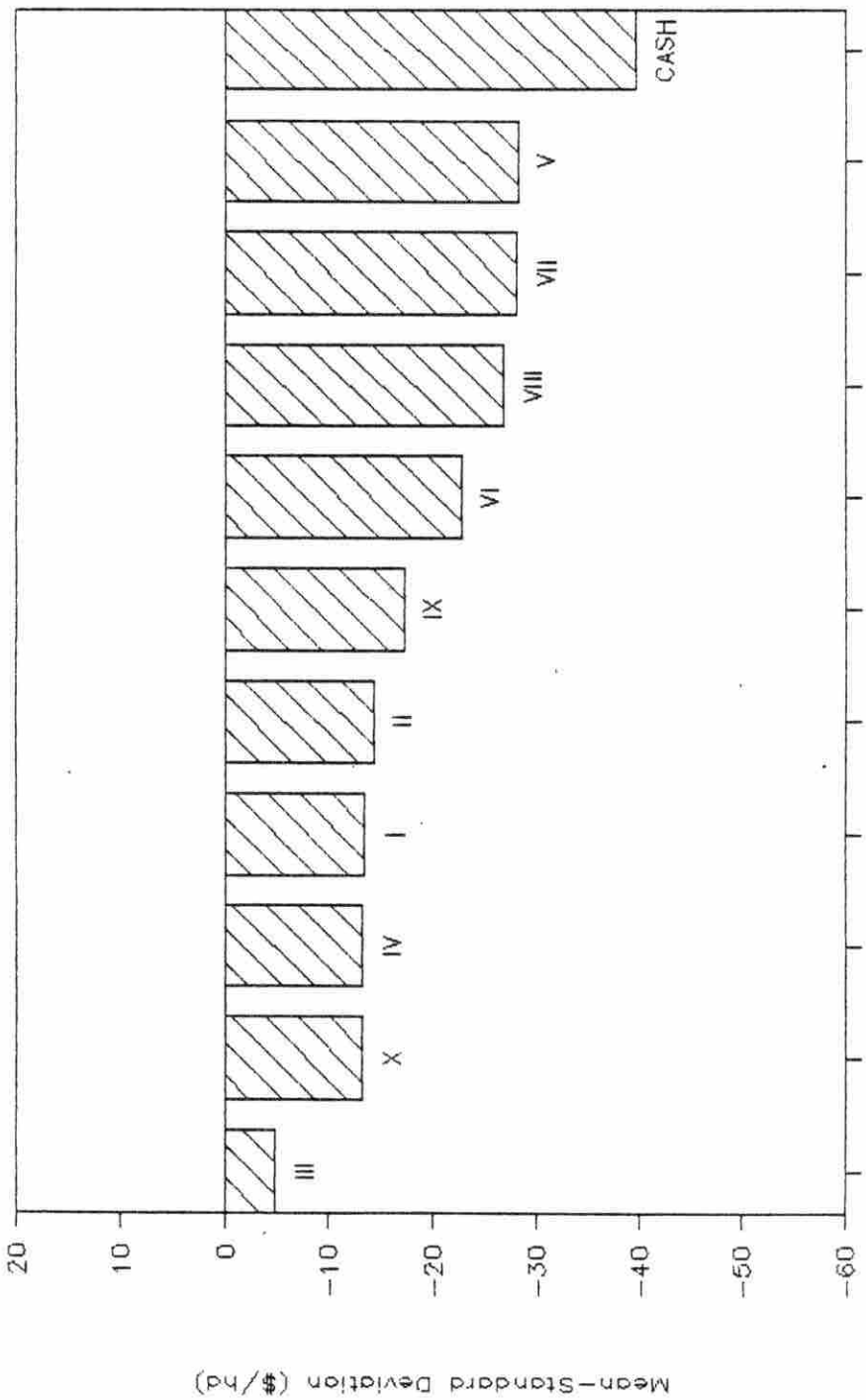


Figure 3.5. Mean minus standard deviation analysis of marketing strategies, 1981 through 1985

advantage not captured by either of the other two comparison criteria used in this study.

The best performing strategies over both time periods were the profit level hedges. Short profit level hedges had smaller variances but long-short profit level hedges contained the no production option (i.e., no investment until target reached, then just basis risk thereafter). Which of these two hedging strategies is the best depends on the ability of the stocker to make use of the no production option of the long-short profit level hedges.

# CHAPTER 4. CASH SETTLEMENT

Starting with the September 1986 contract, the method used to fulfill a feeder cattle futures contract was changed from the delivery of feeder cattle to cash settlement. This chapter examines some of the problems with the old contract and their potential alleviation with the new one.

## Problems with Delivery

An advantage of hedging is that it allows the producer to lock in a return long before the commodity is marketed. How accurate this expected profit turns out to be depends on the accuracy of the producer's cost estimate and basis estimate. If either estimate is incorrect then the predetermined return will not be realized.

Table 4.1 shows how the expected return ($/hd) will differ from the actual as the result of the basis deviating from its expected value. A short breakeven hedge was used and costs were assumed to be known when the hedge was placed. Therefore, any deviation in returns from expected returns was the result of basis fluctuation. The expected basis used was the average September basis for the twelve year period. By design, the average deviation in returns was zero.

A narrower September basis (cash gains relative to futures) can produce an increase in profits such as in the 1974 to 1977 period. A wider basis causes a decrease in profits. In 1978 and 1985 large basis

Table 4.1. Change in profits caused by basis fluctuation

| Year | Expected profits | Actual profits | Difference |
|---|---|---|---|
| 1974 | 5.90 | 19.18 | 13.28 |
| 1975 | 5.22 | 24.29 | 19.07 |
| 1976 | 2.43 | 30.37 | 27.94 |
| 1977 | 34.97 | 40.53 | 6.57 |
| 1978 | 15.10 | -5.59 | -19.95 |
| 1979 | 62.56 | 34.15 | -27.45 |
| 1980 | 11.47 | 25.37 | 13.90 |
| 1981 | 41.76 | 37.90 | -3.86 |
| 1982 | 2.08 | 4.94 | 2.86 |
| 1983 | 1.20 | 3.90 | 2.70 |
| 1984 | 7.13 | 1.49 | -5.64 |
| 1985 | 24.78 | -0.99 | -25.77 |

deviations turned expected positive profits into actual negative returns.

Some of the factors causing this large basis variability were the result of having the delivery of feeder cattle as the method of settlement for a futures contract. There were eleven different delivery points that a hedger could choose for delivery. These delivery points ranged from Montgomery, Alabama to Billings, Montana. The uncertainty facing a buyer of feeder cattle on which delivery point a short might choose forced many longs to offset their contracts rather than let them expire and face the problems of accepting delivery.

Another problem with using delivery was the difficulty in putting together uniform lots (weights, types and condition) as required by the futures contract. The problems involved in making delivery caused many shorts to offset their contract rather than deal with delivery.

The combined effect of these two problems was to reduce both the number of shorts willing to make delivery and the number of longs willing to take delivery. In cases where the basis is deviating from its normal amount there usually exists an opportunity to arbitrage the market. With the costs and uncertainties involved in making and taking delivery with feeder cattle futures, however, this was not being accomplished as efficiently as in other markets.

## Cash Settlement Performance

Cash settlement is a device used in place of physical deliveries of a commodity to fulfill contract obligations upon contract maturity. Allen Paul (Paul, 1985) describes the mechanics of cash settlement as follows;

> "Under cash settlement, the seller, who has not offset his or her contract by the end of trading, in effect gives the buyer a sum of money equal to the current economic value of the item less a sum the buyer originally had to pay. Therefore, only the difference need be paid by the seller to the buyer, or by the buyer to the seller, according to whether the price rose or fell during the contract interval."

Determining the "current economic value" of the commodity can prove to be very difficult. Current cash prices provide an indicator of value, but which cash prices should be used is not obvious. The cash market for feeder cattle is composed of numerous thinly traded submarkets that differ in location, quality and types of cattle, and local supply and demand conditions. In order for an aggregation of these cash prices to

provide an adequate United States cash feeder cattle price, it must correlate fairly closely with changes in prices being faced by a substantial number of hedgers using the futures market.

Under the new Chicago Mercantile Exchange cash settlement provision, an average United States feeder cattle price calculated by Cattle-Fax will be used. Cattle-Fax is a cattle industry marketing and consulting firm which works extensively with feedlot and cow-calf operations to obtain accurate cash market prices for feeder cattle. The cash settlement of all expired contracts will be based on this price.

A recreation of basis over a five year period (1981-1985) using the Cattle-Fax price series as futures prices for the current month revealed that cash settlement has the potential to reduce basis variability.

Table 4.2 shows the mean and standard deviation of the basis for 1981 to 1985. Results for both cash settlement and delivery for the Sioux City market are shown. The cash settlement basis is the difference between the local cash price and the United States feeder steer price (USFSP) calculated by Cattle-Fax. The delivery basis is the difference between the local cash price and the nearby futures price.

The change to a cash settlement procedure changed the Sioux City basis (cash-futures) from a negative 1.70 average to a positive 2.17 average. Hedgers using the feeder cattle futures will need to be aware of the potential change in basis in their area and incorporate the new basis into their hedging strategies.

The standard deviation was reduced from 1.78 to 1.42 with the use of cash settlement. The cash settlement standard deviation was lower in

Table 4.2. Delivery and cash settlement basis 1981-85

Cash settlement:

| | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
| Mean | 1.66 | 1.28 | 1.21 | 1.62 | 3.07 | 3.95 | 2.54 | 2.47 | 2.38 | 2.15 | 2.10 | 1.46 |
| Minimum | 0.07 | 0.01 | -0.76 | -0.38 | -0.49 | 1.71 | 1.13 | 0.15 | 0.11 | -0.19 | -0.76 | -0.61 |
| Maximum | 3.25 | 3.27 | 3.64 | 4.64 | 6.02 | 6.42 | 4.16 | 4.82 | 4.51 | 4.05 | 4.81 | 3.46 |
| Standard deviation | 0.87 | 1.00 | 1.03 | 1.31 | 1.43 | 1.20 | 0.90 | 1.23 | 1.19 | 1.20 | 1.57 | 1.18 |

Delivery:

| | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec |
| Mean | -2.74 | -2.83 | -1.82 | -1.21 | 0.18 | 0.09 | -1.04 | -2.69 | -0.65 | -1.91 | -2.32 | -3.40 |
| Minimum | -5.15 | -5.40 | -3.90 | -4.07 | -1.70 | -4.22 | -2.95 | -5.00 | -3.72 | -6.32 | -5.92 | -7.05 |
| Maximum | 0.15 | 0.20 | 3.50 | 1.45 | 3.45 | 5.80 | 2.13 | -0.82 | 1.43 | 1.90 | 0.20 | 1.30 |
| Standard deviation | 1.61 | 1.59 | 1.86 | 1.69 | 1.64 | 2.97 | 1.36 | 1.39 | 1.59 | 1.89 | 1.54 | 2.22 |

eleven of the twelve months. The lower standard deviation associated with cash settlement could potentially reduce the basis risk that was being faced by hedgers using the feeder cattle futures market.

High variability may not be a hindrance if it can be predicted. If the delivery month basis followed a trend then the hedgers expected basis could be more accurate than an expected basis from a more stable but trendless basis. To test this hypothesis a basis expectation scheme was used to compare delivery basis variability against cash settlement basis variability. Three year moving averages of the April basis and the September basis were used as expectations for the current year's basis in each of those two months. Table 4.3 shows the differences between expected and actual basis for both cash settlement and delivery.

The average absolute difference between expected basis and actual basis was lower for cash settlement in all four cases. This indicates that hedgers using a three year moving average for an expected basis will face less basis risk with cash settlement than with delivery. There may, however, exist other methods of forming basis expectations that result in lower variability for delivery than for cash settlement.

The best method to analyze cash settlement would be to observe its actual performance as a contract settlement device. Unfortunately, at the completion of this study only three months of data exist where cash settlement was used for the feeder cattle futures contract. Table 4.4 shows the simulated average basis for September, October and November from 1981 to 1985 with cash settlement and the actual basis that occurred for these months in 1986 with cash settlement.

Table 4.3. Expected basis performance

Cash settlement:

| Year | April | | | September | | |
|---|---|---|---|---|---|---|
| | Expected basis | Actual basis | Absolute difference | Expected basis | Actual basis | Absolute difference |
| 1981 | 4.61 | 2.84 | 1.77 | 3.70 | 4.63 | 0.93 |
| 1982 | 4.42 | 3.26 | 1.16 | 3.60 | 4.39 | 0.79 |
| 1983 | 3.47 | 2.96 | 0.51 | 4.04 | 2.41 | 1.63 |
| 1984 | 3.03 | 3.41 | 0.38 | 3.70 | 2.61 | 1.09 |
| 1985 | 3.20 | 2.07 | 1.13 | 3.08 | 3.18 | 0.10 |
| | | Average | 0.99 | | Average | 0.91 |

Delivery:

| Year | April | | | September | | |
|---|---|---|---|---|---|---|
| | Expected basis | Actual basis | Absolute difference | Expected basis | Actual basis | Absolute difference |
| 1981 | -1.30 | -0.57 | 0.73 | -0.40 | -2.41 | 2.01 |
| 1982 | -0.86 | 0.14 | 1.00 | 0.00 | 0.31 | 0.31 |
| 1983 | -0.09 | -3.38 | 3.29 | -0.29 | -0.17 | 0.12 |
| 1984 | -1.27 | -2.25 | 0.98 | -0.76 | 0.83 | 1.59 |
| 1985 | -1.83 | -0.02 | 1.81 | 0.32 | -1.82 | 2.14 |
| | | Average | 1.56 | | Average | 1.23 |

Table 4.4. Actual performance of cash settlement basis

| Month | 1981-85 | 1986 |
|---|---|---|
| September | 2.38 | 2.11 |
| October | 2.15 | 3.60 |
| November | 2.10 | 1.72 |
| Average | 2.21 | 2.48 |

From observing this limited data base it appears that the local basis for Sioux City has indeed changed from cash less than futures to cash greater than futures. It will take several years of data to confirm whether basis variability has been reduced.

# CHAPTER 5. SUMMARY AND CONCLUSIONS

## Summary

Stocker operations face considerable risk in backgrounding feeder cattle. This study has focused on how stockers can improve profits and reduce price risk through the use of the feeder cattle futures market. The feeder cattle futures contract provides stockers with an opportunity to hedge both the purchase and sale price of feeder cattle.

A simulation was developed to test alternative marketing strategies over a twelve year period. Results from the simulation indicated that average returns from most hedging strategies were greater than returns from cash marketing. In addition, most hedging strategies had lower variances of returns as well.

Returns from cash marketing averaged $2.06/hd with a standard deviation of $51.95/hd for 1974-85. The best hedging strategy during this period was the short breakeven hedge with an average return of $17.96/hd and a $15.74/hd standard deviation. From 1981-85, cash marketing returns were $-11.21 with a standard deviation of $28.54/hd. The best hedging strategy during this period was the short breakeven hedge with returns of $9.45/hd and a standard deviation of $14.37/hd. The econometric hedge was also a strong alternative to cash marketing with average returns of $17.63/hd and a standard deviation of $30.87.

Overall, profit level hedges performed the best using the combination criterion of mean variance and mean-standard deviation

analysis. Long-short hedges had the particular advantage of potentially locking in profits before the cattle were even purchased. Larger mean returns were achieved with moving average and econometric hedges, but both strategies provided more variable profits.

An analysis of the potential impact of cash settlement indicated that basis variability may be reduced. A comparison between simulated basis under cash settlement and the actual basis indicated that cash settlement could reduce the volatility of basis by 25%. Actual results, while too few to draw definite conclusions about cash settlement, were consistent with simulated cash settlement results. It should be noted that even if cash settlement reduces basis variability, this does not imply an increase in profits. Reduced basis variability only ensures a greater chance that hedging will produce the locked in price.

## Conclusions

The results of the simulation provide encouraging news for stockers attempting to increase returns and reduce the volatility of backgrounding profits. The stocker program manager could have achieved these results with simple profit level hedges. Although simple to implement, these hedges require reliable estimates of the cost of production and basis for both the purchase and sale dates. The stocker also needs to monitor the futures market daily until the hedge is placed.

Other hedging strategies offered higher returns than profit level hedges, but only at a cost. The moving average hedge and the econometric hedge both had higher returns and higher variances. These strategies

also have higher costs of development and implementation. Larger stocker operations may find these strategies more useful since they can spread the costs over larger numbers of cattle.

Stocker operations may be reluctant to hedge because they do not perceive cash marketing returns to be as poor as those found in the simulation. Family run operations may not incorporate a labor cost or even a return to land cost. This approach may be reasonable if there are no opportunity costs for either their labor or land. Rural locations and small sections of land could make this assumption plausible. Eliminating these two costs yields a $12/hd profit instead of a $11.21/hd loss for 1981-85. This would also result in a corresponding increase in returns for each hedging strategy. Results like these help explain why stocker operations keep producing feeder cattle when returns appear negative to economists.

Another reason why stocker operations do not use the futures market is because a futures contract requires more cattle than the producer has on pasture. Results from this study are only applicable to stocker operations that are large enough to make use of the futures market contract (44,000 lbs. per contract).

The marketing strategies examined in this study were analyzed over a historical period. There is no guarantee that strategies that were successful in recent history will perform as well in the future. Changes in the livestock industry and futures markets could change the hedging environment.

New tax law changes that reduce the tax advantages for feedlot owners may reduce feeder cattle demand in the short run. Changing

consumer tastes away from red meat could also reduce the demand for feeder cattle. These structural changes in the cattle market could change the distribution of profit opportunities for stocker operators using strategies based on profit levels. For example, a $15/hd profit hedge might not be attainable in a lower profit margin market.

Problems specific to the Iowa market may provide other limitations on the use of hedging. During the simulation period (1974-85), the number of cattle on feed in Iowa dropped approximately 50 percent and the Iowa calf crop fell almost 30 percent. With fewer calves being born in the state and fewer being brought into the state, the Iowa cash markets have been getting thinner. With fewer animals, there is a greater chance that local cash prices may be out of line with larger cash markets.

There are several positive developments that could improve the outlook for hedging strategies. If cash settlement is successful in reducing basis risk, then hedgers can have more confidence that their locked in price is the one actually received. In addition, the cost of using the futures markets has been decreasing dramatically in the past several years. Brokerage costs used in the simulation were $60 (round trip) per contract. Presently, discount brokers are charging $25 for the same service. Also, in 1987 the Chicago Mercantile Exchange will start trading an options on feeder cattle futures contract which will provide stocker operations with a new price risk management tool.

Southern Iowa stockers will need to supplement any hedging strategies used with plenty of flexibility. Delaying the sale of cattle until local basis is closer to its normal level or transporting cattle to

more liquid markets may be necessary. In order for hedging strategies to be effective, local cash markets must maintain a consistent relationship with the futures market. If local conditions are not providing that consistency, then stocker operators need to adjust accordingly.

Overall, hedging strategies should always be evaluated by stocker operations as a viable alternative to cash marketing. This study has shown that stockers who followed this advice for the last twelve years were presented with numerous opportunities to increase returns and decrease variance compared to cash marketing.

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# APPENDIX A. ECONOMETRIC MODEL

A single equation econometric model was developed to forecast feeder cattle prices on a quarterly basis. The forecasts from this model were compared to "forecasted" prices from the feeder cattle futures market. Hedging decisions were based on this comparison.

## The Model

$$PFC = B0 + B1\ SFC + B2\ DFC + B3\ PFC(T-1) + B4\ A + B5\ JU + B6\ O$$

where: PFC = feeder cattle price in the current quarter,

SFC = feeder cattle supply in the current quarter,

DFC = feeder cattle demand in the current quarter,

PFC(T-1) = feeder cattle price from last quarter, and

A, JU, O = dummies to deseasonalize the data.

## Variables

The dependent variable was the futures price for the near-by contract in the third week of the month starting a new quarter. For January, April and October this price was the closing price on that month's futures contract. Since there is not a July futures contract, the August futures price in the third week of July was used for the third quarter. The demand for feeder cattle was measured as the expected profits from cattle placed in feedlots at the start of a quarter. The expected profit was defined as:

$$E(P) = (LCFP(T+2) - E(COST))$$

where: E(P) = Expected profit for a feedlot from feeding cattle for the next six months.

LCFP(T+2) = Live cattle future price for a month two quarters ahead. Data from Chicago Mercantile Exchange in cents/lb

E(COST) = Expected cost to feed cattle in a feedlot for the next two quarters. Data from USDA in cents/lb.

The live cattle futures price is the futures market participants' expectation of live cattle prices in six months time. The expected cost is a USDA estimate of the price required to cover all costs involved in feeding cattle for the next six months. The difference between these two expected prices is the expected profit from purchasing feeder cattle in the current quarter and marketing them in two quarters time. A more popular approach is to use proxy variables such as the corn/cattle price ratio to represent expected profit and hence demand. Since the cost element of the expected profit figure in this model includes other relevant variables it is expected to be a superior indicator of demand for feeder cattle.

Feeder cattle supply figures were taken from the USDA's quarterly feeder cattle supply notices found in Livestock Situation and Outlook Report. This supply figure includes all calves under 500 lbs. not yet placed on feed, all steers over 500 lbs. not yet in feedlots and all heifers over 500 lbs. not yet on feedlots or being kept for cow herd replacements.

Using a supply figure of this nature has its advantages and disadvantages. The current number of feeder calves available to enter feedlots is the result of three calf marketing decisions.

1. Supplies are the result of herd expansion decisions made several years ago based on cow-calf operators' expectations of profits from retaining heifers for herd expansion versus selling them as feeder cattle. The USDA's quarterly feeder cattle supply figure reflects the effect of this decision.

2. The actual number of feeders available to enter feedlots is also the result of current decisions on cow herd expansion. The feeder supply figure used in this model includes all heifers over 500 lbs. not yet placed on feedlots or being kept for cow herd replacements. Unfortunately the supply figure does not distinguish between these two categories of heifers. A large number of 500 lbs. heifers could be an indication of large feeder supplies if they are destined for the feedlot, or they could be an indication of low feeder supplies if they are being kept for cow herd expansion. The supply figure used in this model does not capture the effects of this decision very well.

3. The third calf marketing decision is the weight at which to sell calves in the feeder market. An increase in price might induce more lightweight feeder cattle into the market or it may induce cow-calf operators to keep the animals longer. In either case it must be noted that if more steers are put on or withheld from the market in one quarter then once the decision process returns to "normal" the following quarters will show an equal change in the opposite direction in regard to the

marketing of steers. To illustrate this phenomenon suppose that cow-calf operators market large numbers of lightweight steers in the third quarter in response to some price change. If this is a one quarter decision then the fourth quarter will show a drop in supply because those lightweight steers would normally have been marketed in the fourth quarter.

The lagged feeder cattle price was included as an explanatory variable. This lagged price should incorporate all price changes up to the past quarter. Using lagged prices was found to be a superior method of handling the effects of inflation.

Three quarterly dummies were used to deseasonalize the data. The supply of feeder cattle has an annual trend with highs in the fall and lows in the spring. In order to have the supply variable reflect only change from its normal value and not the change from other quarter's normal values, dummy variables are required.

## Empirical results

The model was estimated using the data from 1974 to the second quarter of 1980. The model was reestimated for each subsequent year after the addition of four new quarters of data. The six models (1980-1985) and their coefficients are reported in table A.1.

The sign on the supply coefficient is negative, indicating that an increase in supply will cause a decrease in feeder cattle price. The sign on the demand coefficient is positive, indicating that an increase in expected profit will cause an increase in price.

Table A.1. Estimated parameter stability in the feeder cattle model

| | Sample period | | | | | |
|---|---|---|---|---|---|---|
| | 74-79 | 74-80 | 74-81 | 74-82 | 74-83 | 74-84 |
| Degrees of freedom | 18 | 22 | 26 | 30 | 34 | 38 |
| Parameters: | | | | | | |
| Intercept | 146.03 (4.50)[a] | 142.26 (4.95) | 141.96 (5.37) | 140.01 (5.73) | 140.47 (6.03) | 138.25 (6.02) |
| Supply | -.0027 (4.32) | -.0026 (4.76) | -.0026 (5.16) | -.0026 (5.51) | -.0026 (5.78) | -.0025 (5.75) |
| Demand | .420 (0.76) | .738 (1.54) | .779 (1.84) | .705 (1.93) | .803 (2.68) | .817 (2.71) |
| Lagged price | .438 (3.25) | .487 (4.39) | .488 (4.83) | .499 (5.36) | .501 (5.63) | .499 (5.60) |
| Dummy A | -14.31 (4.78) | -14.64 (3.37) | -14.70 (3.72) | -14.31 (4.01) | -14.90 (3.35) | -15.31 (4.72) |
| Dummy JU | 25.14 (8.54) | 24.71 (3.43) | 24.29 (3.75) | 23.94 (4.07) | 23.46 (5.58) | 23.03 (4.20) |
| Dummy O | 4.74 (3.86) | 5.12 (1.54) | 5.13 (1.78) | 4.99 (1.94) | 4.51 (2.35) | 4.04 (1.77) |
| Summary statistics: | | | | | | |
| $R^2$ | .93 | .94 | .94 | .94 | .94 | .94 |
| MSE | 33.05 | 30.09 | 25.66 | 22.76 | 20.79 | 21.21 |

[a] t statistics for individual parameters are in parentheses.

The 1974-85 model had a mean square error of 21.21. The coefficient of determination was approximately 94% for all six models. The t statistics were significant for all the variables in the 1974-85 model, except for the fourth quarter dummy variable in several of the sample periods.

## Forecasts

The model can be used as a one step ahead forecast if reasonable representations of next quarter's supply and demand variables can be found.

For the supply variable, the current quarter's change from its level the previous year is used as an approximation for the change in next quarter's supply from its level in the previous year. Next quarter's supply is equal to its value the previous year adjusted by the change factor calculated from the current quarter.

For the demand variable, the expected profit becomes:

$$E(P)T+1 = ( LCF(T+3) - COST(T) )$$

where: $E(P)T+1$ = expected profit for cattle put on feed in the next quarter,

$LCP(T+3)$ = live cattle futures price for a month three quarters ahead, and

$COST(T)$ = this quarter's cost figure is used as a naive forecast for next quarters cost.

Table A.2. Forecasted prices from the model versus actual prices

| Year | Quarter | Forecasted | Actual | Difference | Correct |
|---|---|---|---|---|---|
| 80 | 3 | 69.87 | 73.87 | -4.01 | No |
| 80 | 4 | 67.58 | 77.72 | -10.14 | No |
| 81 | 1 | 77.49 | 73.37 | 4.12 | Yes |
| 81 | 2 | 79.14 | 71.45 | 7.67 | No |
| 81 | 3 | 63.56 | 63.85 | -0.29 | Yes |
| 81 | 4 | 65.06 | 66.00 | -0.94 | Yes |
| 82 | 1 | 65.76 | 65.57 | 0.19 | Yes |
| 82 | 2 | 64.10 | 67.95 | -3.85 | No |
| 82 | 3 | 65.57 | 67.40 | -1.83 | Yes |
| 82 | 4 | 62.76 | 66.97 | -4.21 | Yes |
| 83 | 1 | 65.55 | 69.90 | -4.35 | No |
| 83 | 2 | 72.23 | 70.07 | 2.16 | Yes |
| 83 | 3 | 62.48 | 62.17 | 0.31 | Yes |
| 83 | 4 | 61.66 | 62.42 | -0.76 | No |
| 84 | 1 | 64.61 | 69.10 | -4.49 | Yes |
| 84 | 2 | 67.45 | 66.90 | 0.55 | Yes |
| 84 | 3 | 68.63 | 67.60 | 1.03 | Yes |
| 84 | 4 | 66.35 | 66.50 | -0.15 | Yes |
| 85 | 1 | 71.15 | 72.82 | -1.07 | Yes |
| 85 | 2 | 79.59 | 65.25 | 14.34 | No |
| 85 | 3 | 67.56 | 62.67 | 4.89 | Yes |
| 85 | 4 | 70.50 | 64.50 | 6.00 | Yes |

Mean absolute deviation = 3.52

Percent of quarters that model estimated correct direction of change in price = 68%

Root mean square error = 4.97

Results

Table A.2 shows the predicted prices for each quarter and the corresponding actual price. The predictions for 1981 are one quarter ahead forecasts based on the model using 1974-1980 data. The model was then updated with the 1981 data and one quarter ahead forecasts were found for 1982. This process was repeated for subsequent years.

The model correctly predicted 68% of the price direction changes between quarters. This is an important measurement because both speculators and hedgers can make use of reliable price direction information as well as absolute price level forecasts.

The average forecasted price was $3.52 different than the actual price. Eliminating the worst two price forecasts gives a $2.60 difference.

Futures comparison The forecasting ability of this model can be compared to the futures market's "forecast" of next quarter's price. In the third week of each new quarter, the futures price corresponding to the nearby month starting the next quarter is used to represent the market participants' best prediction of what next quarter's price will be. For example, on January 20th 1985 the April futures was 67.52. This figure is used as the futures market forecast for the second quarter of 1985. Table A.3 contains these forecasts and the results show that the futures market correctly predicted 55% of the price direction changes between quarters. The average absolute deviation between the futures price and the actual price was $3.70. Eliminating the worst two forecasts gave a $3.20 difference.

Table A.3. Forecasted prices from futures versus actual prices

| Year | Quarter | Forecasted price | Actual price | Difference in prices | Correct direction |
|---|---|---|---|---|---|
| 80 | 3 | 71.45 | 73.87 | -2.42 | No |
| 80 | 4 | 74.47 | 77.72 | -3.25 | Yes |
| 81 | 1 | 81.45 | 73.37 | 8.08 | No |
| 81 | 2 | 76.55 | 71.45 | 5.10 | No |
| 81 | 3 | 72.70 | 63.85 | 8.85 | No |
| 81 | 4 | 63.10 | 66.00 | -2.90 | No |
| 82 | 1 | 67.90 | 65.57 | 2.33 | No |
| 82 | 2 | 60.85 | 67.95 | -7.10 | No |
| 82 | 3 | 65.72 | 67.40 | -1.68 | Yes |
| 82 | 4 | 66.07 | 66.97 | -0.90 | Yes |
| 83 | 1 | 67.75 | 69.90 | -2.15 | Yes |
| 83 | 2 | 67.65 | 70.07 | 2.42 | No |
| 83 | 3 | 65.60 | 62.17 | 3.43 | Yes |
| 83 | 4 | 60.87 | 62.42 | -1.55 | No |
| 84 | 1 | 63.20 | 69.10 | -5.90 | Yes |
| 84 | 2 | 68.82 | 66.90 | 1.92 | Yes |
| 84 | 3 | 66.12 | 67.60 | -1.48 | No |
| 84 | 4 | 67.02 | 66.50 | 0.52 | Yes |
| 85 | 1 | 67.52 | 72.82 | -5.30 | Yes |
| 85 | 2 | 72.17 | 65.25 | 6.92 | Yes |
| 85 | 3 | 68.75 | 62.67 | 6.08 | Yes |
| 85 | 4 | 63.45 | 64.50 | 1.05 | Yes |

Mean absolute deviation = 3.70

Percent of quarters that forecasts had correct change in direction of prices = 55%

Root mean square error = 4.44

In both direction change and difference in price the econometric model performed better than the futures market. Root mean square error (RMSE) can also be used to compare the futures market to the econometric model. This measurement is the average of the forecast errors squared and is designed to penalize individual large forecast errors. Since the econometric model developed here contained the largest individual forecast errors its RMSE is higher (4.97) than the futures market value (4.44). Eliminating the worst two quarters from both forecasts gives a RMSE of 3.43 for the model and 3.99 for the futures market.

Hedging The forecasts from this model can be used to make hedging decisions. In the third week of each quarter, the model produces a forecast of the futures price for the next quarter. This futures price is for the nearby contract for the third week in each quarter. For January, April and October, the nearby contract is that month's contract. For July, the August futures is used. When the forecast is made, it is compared to the futures market price for next quarter. If the forecast price is higher than the futures then a long position is signaled. If the forecasted price is lower than the futures then a short position is signaled. This comparison is made only once each quarter. For example, on the last day in the third week of October, when a new forecast is produced, the forecasted price is compared to the January futures price. If the forecasted price is higher than the futures price then futures prices are predicted to rise.

In the econometric hedge, a prediction that January's futures price will rise is taken as a signal to place a long hedge. An assumption is

made that the long position could be taken in the January, March or April contract. In other words, if the forecast indicates that a particular month's futures price will rise, it is assumed that all other nearby contracts will rise as well. A long hedge signaled in January will be implemented with the April contract. Short hedges signaled in April or July will be implemented with the September contract.

Several refinements are needed to make this hedging strategy a more realistic marketing tool. First, the evaluation of whether or not to place a hedge should be a continuing process not a once a quarter decision. A comparison between the latest forecast and the appropriate futures price should be made daily until a hedge is placed. Second, in order to eliminate the assumption that nearby futures months are highly correlated, a two quarter ahead forecast for September and April would be appropriate. The forecasts from a two quarter ahead model could be compared directly with the futures month involving the sale or purchase of cattle.

Initial attempts to correct the continual comparison problem revealed that such a correction will enhance the hedging potential of the econometric model. Comparing the forecast and the futures each day of the quarter increased the chances that a hedging opportunity would develop. Time constraints restricted any further study in this area.