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TECHNICAL ANALYSIS OF THE FUTURES MARKET  
AND ITS RELATION TO HEDGING

By

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## CHAPTER I

### Introduction:

The cattle market is known for its extreme price fluctuations that can make a pauper out of a prince. The boom or bust nature of the industry is nothing new, but as the chart of prices in Figure 1 indicates, the change in price can be fairly dramatic. Since the price that a cattle feeder receives for his cattle has a large impact on his profits, the severe price changes have had a major impact on the variation in net profits for cattle feeders.

The variation in profits due to price changes is demonstrated by Table I in the appendix which simulates the profitability of a corn belt cattle feeder. As one can easily see, the cattle feeding period from November, 1973 to May, 1974 was very unprofitable. The chart of prices in Figure 1 shows this period to be one of drastic price decline.

Even at relatively high prices, a feedlot operator can easily lose money because the prices of feeder cattle rise faster than the prices of fat cattle. A feedlot operator who has purchased his feeder cattle at the peak price will find himself losing a great deal of money on every steer sold even though the price may be at a high level.

# Annual Price of Choice Steers at Omaha.

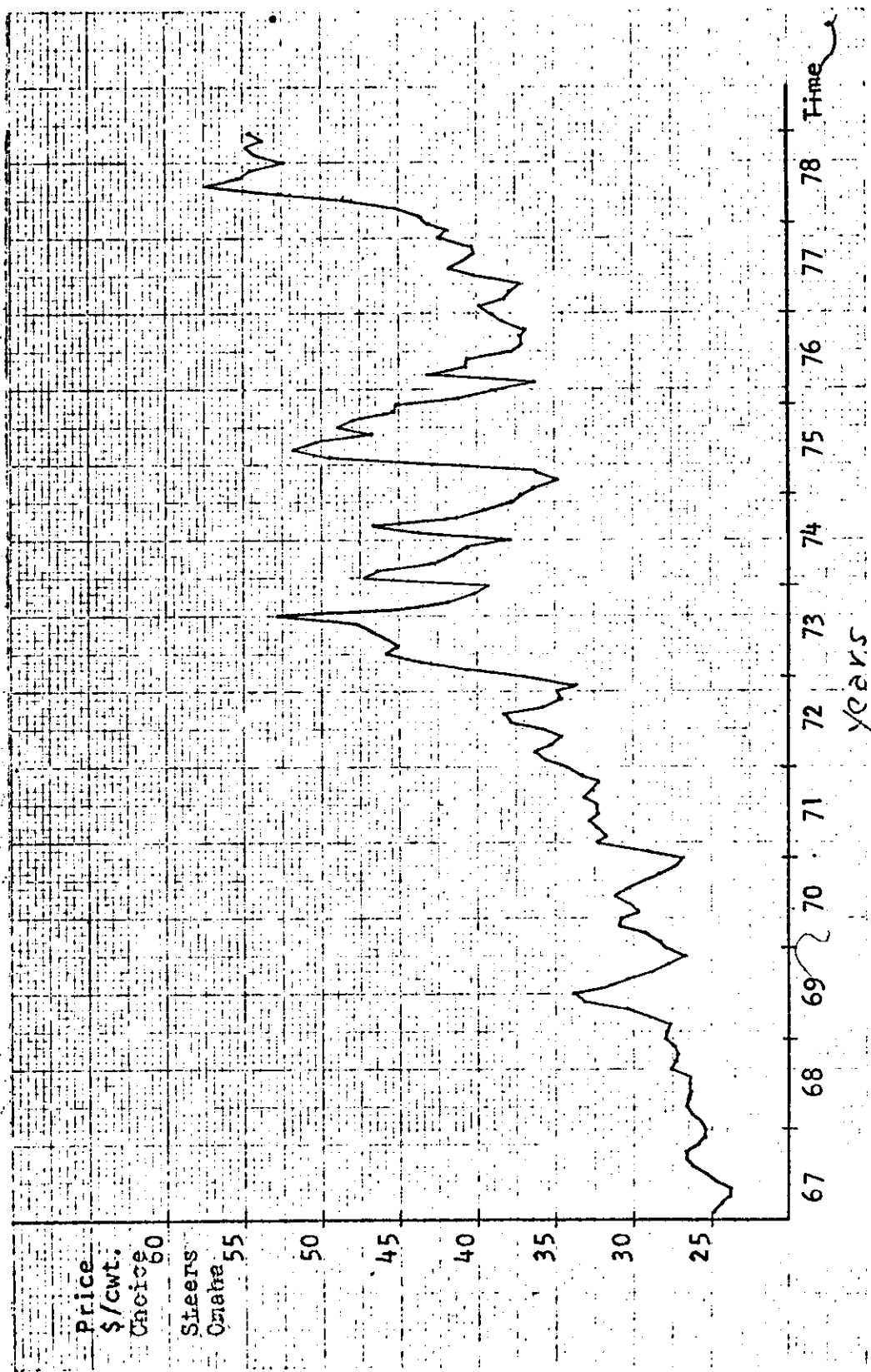


Figure 1.

While the feedlot operator is locked into the production process, he can take a substantial beating in the price of his finished product. Many producers have sought ways to minimize their exposure to price risk. Some producers minimize their risk by purchasing feeders at the same time they sell finished cattle and buying the same quality of cattle and feeding to the same weight and quality for sale. For this type of operation, variations in the feeding margin average out over a number of production cycles so that, in the long run, they get the industry average returns plus or minus their own technological skills in return to those of the industry. Most operators prefer to vary the quality and size of calves purchased and steers sold, based on existing and expected price relationships. Many of these managers use a number of alternative schemes to reduce their price risk. Some of them contract their cattle to a packer when the cattle are placed on feed. Others have integrated forward into the packing business. But many have adopted the use of futures markets to hedge their cattle.

Hedging is defined as the placing of an equal but opposite position in the futures market that the entrepreneur has in the cash market. Working expanded the motivations of hedging to include: (1) facilitating buying and selling decisions, (2) providing greater freedom for business action, (3) providing a reliable basis for conducting storage of commodity surpluses, and (4) reducing business risks.

Working also discovered from analyzing the activities of grain merchants that they are "selective" in choosing when they hedge. Few hedge all of their risk all of the time. From this developed the concept of selective hedging, which is the focus of this paper. Selective hedging is partial hedging which occurs when the hedger has made a subjective or objective determination on a price rise or fall in a coming period. Because of this determination, the hedger may leave some or all of his inventory unhedged. Thus a firm will employ short hedging only when a price decline is expected and would not carry short hedges at all when a price increase is expected.

More recently, work has been done to add more objectivity to the selective hedging process, and a means of doing this is to use technical analysis of the futures markets to determine optimal entry and exit dates for placing and lifting hedges.

**Problem:**

If a cattle feeder is going to reduce his price risk by using selective hedging, he has to either (a) be a good price forecaster or (b) have some strategy that is less subjective than price forecasting. If his judgment is incorrect, he could be hedged when the price is increasing and unhedged when the price is decreasing, increasing the volatility of his income and decreasing the average income. Therefore, if the entrepreneur is going to be able to use the futures market to protect himself from price declines, he will need

to be able to determine when the futures price is going to fall.

**Hypothesis:**

An objective method of selecting the timing of placing and lifting hedges is needed for some producers. Technical analysis of the futures market can be used by cattle feeders to determine optimal entry and exit points of the futures market by selective hedging. This method of selective hedging should generate higher levels of income than being fully hedged and should provide a more stable income than not hedging.

**Procedure:**

Different parameters for technical methods will change the results of using these methods dramatically. Therefore, different parameters will be used for the moving average and point and figure trading techniques. The superior parameters will be used for trading strategies to compare profitability and reduction of price variability against the unhedged strategy and the completely hedged strategy.

On November 30, 1964, trading of live beef cattle futures contracts began on the Chicago Mercantile Exchange. This contract is now one of the most actively traded contracts on the Chicago Mercantile Exchange. This contract offers cattle feeders the opportunity to forward price their product shifting some of the price risk to someone else.

The direct use of the futures markets by producers has been minimal. A 1976 survey of U.S. farmers with gross sales of over \$10,000 revealed that only 5.6% of them traded on the futures market. Some of the reasons given for not using the futures markets included: not acquainted with how futures markets operate, size of farming operation too small to warrant using futures contracts, futures markets are too risky, and lack of adequate capital.

Hopefully, this paper will acquaint some with how the futures markets operate and provide them with a disciplined method of trading the futures market.



## CHAPTER II

### SOME THEORETICAL CONSIDERATIONS OF FUTURES MARKETS

The notion of a competitive market is based on the assumptions that: (1) the commodity is homogeneous, (2) there are a large number of buyers and sellers so that no individual has an influence on price, (3) both buyers and sellers possess perfect information about the prevailing price and current bids and they take advantage of every opportunity to increase profits, (4) entry into and exit from the market is free for buyers and sellers. The founders of futures markets apparently designed them with the competitive market in mind because the requirements come remarkably close to being fulfilled. There are a large number of participants in the futures market, and the ownership tends to be widely diffused. Occasionally individual positions will become large enough to be influential, but in general the ownership is so widely diffused that no single position can have an appreciable influence on price. All trading must occur in one pit, assuring maximization of the number trading in a given market and minimizing the influence of any individual. Product homogeneity is approached by rigid contract specifications of identical lots of a commodity. Free entry and exit is approximated by the small margins required on each contract. The perfect information requirement

is approximated by requiring open outcry in the pits and the instantaneous dissemination of prices. Also, the existence of futures markets results in the generation of large amounts of information about production, stocks, movement, and use of commodities traded.

#### Relationship of Futures to Cash Prices:

If a futures contract is held until maturity, its owner will soon realize that it is a contract for an actual commodity that is purchased and sold in the cash market. It is this reason that commodity prices are related to cash prices and are not just a number <sup>5</sup>/<sub>1</sub> game that is independent of the actual supply and demand conditions of the commodity. If the futures price in the delivery period is less than the cash price, trading would accept delivery rather than purchase the commodities on the cash market. On the other hand if the futures price is greater than the cash price by more than the transfer costs, producers will sell on the futures and deliver for the higher price rather than accept the cash price.

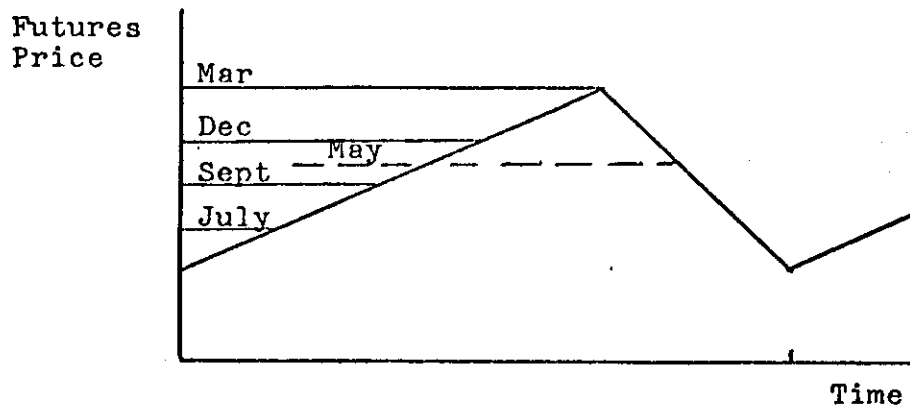
#### Basis:

When analyzing the difference between the cash price and a futures price for a different time period, the relationship between the cash and futures price is not as simple as when comparing the cash to the futures price in the delivery period. At times the cash price may change and the futures price change in the opposite direction. The basis commonly

defined as the difference between a futures contract price and the cash price at a particular time and place is fundamental to understanding and studying the futures market.

The actions of the basis are a function of the type of commodity. For storable commodities, the relationship of cash and futures prices is based on the theory of the carrying charge. There are generally three basic characteristics of storable commodities: (1) the product is produced at one time of year and used at other times of the year, (2) there are costs of storage, and (3) there is very little cost of holding futures contracts. These three reasons cause the difference between prices of different months of the same futures to be equal to the carrying charge between the months. (Figure 2) demonstrates this situation.

FIGURE 2  
One Production Period



The relationship of a futures contract price and the cash price of a nonstorable commodity is not as simple as the carrying charge for a storable commodity. The price of each delivery period is a true forecast of the equilibrium price that will prevail at that future time. Nonstorable commodities such as live beef change in form over time and there is no necessary tie between today's cash price and the price for deferred delivery. Some adjustment can take place between periods of feeding to heavier weights but the ability to do this is limited.

The basis can be influenced by the location of the commodity. The difference in prices at any location and the futures can be due to: (1) condition of supply and demand for the commodity at the location, (2) condition of supply and demand for substitutes, (3) spatial conditions including transportation costs and geographical location with respect to market, (4) storage availability and costs, and (5) quality of the commodity.

#### Random Walk:

Many people have discounted technical analysis of the commodity markets because they believe the Random Walk theory to be a good description of the behavior of commodity prices.

As Grange and Morgenstern<sup>12</sup> describe the random walk model, the price at time  $t$  equals the price at time  $t-1$  plus

the residual at time  $t$ . The residual series has zero mean and is uncorrelated with all previous terms in the residual series. The model can be described in mathematical notation as:

$$P_t = P_{t-1} + \epsilon_t$$

where  $E[\epsilon_t] = 0$ ,  $\text{cov}[\epsilon_t, \epsilon_{t-S}] = 0$ , all  $S \neq 0$

The implication of this model is that the best predictor of tomorrow's price is today's price, or price changes cannot be predicted from previous prices.

$$P_{t+1} = P_t + \epsilon_{t+1}$$

One can project this to more than one period:

$$P_{t+n} = P_t + \sum_{j=1}^n \epsilon_{t+j}$$

and since  $E[\sum_{j=1}^n \epsilon_{t+j}] = 0$  and each term is the residual sum is uncorrelated with all residuals, the prediction of price  $n$  time units ahead has a variance of:

$$V_n = \text{variance} \left( \sum_{j=1}^n \epsilon_{t+j} \right)$$

$$= \sum_{j=1}^n \text{variance} (\epsilon_{t+j})$$

which simply means that the variance increases as the length of time of the prediction increases. A further implication of the model is that the price series has no purely cyclical components such as a seasonal pattern or trend term.

The random walk model does not say that price changes are unpredictable. It says that they are unpredictable from previous price changes. It makes no statement about the predictive ability of other variables such as elements of supply and demand.

The random walk model was originally applied to the stock market. Even those who apply it to the stock market question the applicability of the commodity markets. The difference of characteristics of investors lead many to believe that the random walk model does not apply to commodity markets. Granger and Morgenstern<sup>11</sup> conclude ". . . that if the level of speculative activity is not sufficiently high compared to long-term investment activity the model will not completely hold."

Hieronymus<sup>12</sup> and others have stated that the random walk hypothesis rests on the efficient market hypothesis that new information enters markets in a random fashion and competition causes the effects of new information to be reflected instantly in commodity prices. To Hieronymus, the efficient market theory is not reasonable and he concludes, ". . . that prices probably move at random when they are going nowhere and move in a trending fashion when events require a change in the level of prices. A good trend following scheme will make money when there is a trend and lose money when there is no trend." He goes on to state, "To some extent, trading systems are self-fulfilling and price trends grow on what they feed on. The extent and impact of mechanical trading

systems has not been investigated. Market observers generally think that the impact is substantial."

Teweles, Harlow and Stone<sup>14</sup> not only defend the technical approach but they attack the fundamental analysis when they say, "Although the fundamental laws of supply and demand have been generally accepted as determining the long-run price behavior of commodity futures prices, they have certainly failed in the short run to provide a similar insight. Most traders will agree that in the short run there is simply no significant correlation between "fundamentals" and prices, yet it is precisely in the short run that traders establish open profits and receive open losses."

Ferris<sup>15</sup> has noted that in the short run, fundamental analysis of price can be very difficult. He states, "We make extensive use of statistical tools and computers to measure such phenomenon as how producers respond to prices and costs and how consumers change their buying practices as their incomes change and as prices and other influences on demand change. Using these techniques, we can do a reasonable job in predicting annual and quarterly prices, but have not been able to predict with much precision daily, weekly or monthly price movements." He goes on to say, "technical analysis focus on these shorter term market movements. While the fundamentalists draw heavily from economic theory, the technical analysts base their predictions on human psychology and some less well defined theories on how prices are established

as buyers and sellers, tug away in the marketplace, and are convinced that day to day movements in commodity markets are not strictly random.

Empirical studies have tried to determine the randomness of price movement. Such studies have included runs analysis, correlation analysis, filter rules, and special analysis. Leuthold<sup>15</sup> used spectral analysis of the daily closing prices to determine if the random walk hypothesis is applicable to the live beef cattle futures price behavior. When stating his results, he said, "Thus, this analysis indicates that a simple stochastic process appears consistent with live beef cattle futures price behavior part of the time but not at other times." After using spectral analysis, he used filter rules which further substantiated the rejection of the random walk hypothesis as an explanation for live beef cattle futures price behavior.



## CHAPTER III

### METHODS OF TECHNICAL ANALYSIS COMPARED

There are basically two schools of analysis of commodity markets, One being the fundamentalists. This group concentrates on identification of major supply and demand factors which affect prices and attempts to measure their relative impact. Many in the group of fundamentalists believe in the random walk theory of futures markets and in turn believe that one has to look to other things than past prices to explain future movements in price. The fundamentalists desire only the facts about future supply and demand.

The technicians on the other hand, do not believe that the random walk is an adequate description of the futures market. What is more, many of them contend that studying the fundamentals is a waste of time and effort because the market has already incorporated the fundamental information before the information is "known". This statement relates to the desire of fundamentalists to have the facts about supply and demand so they can forecast price. In the short run, "facts" about supply and demand are often not available. The supply of a quantity has to be forecast and the demand also has to be forecast to arrive at a forecast of price.

Technical analysis refers to a study of the market itself rather than of the external factors that affect the supply of and demand for a commodity. It is the belief that a study of previous prices can give some insight into the future actions of prices.

Within the school of technical analysis, there are three basic methods of analysis that are most prevalent. Bar chart analysts plot each days high, low, close, and volume on a chart corresponding to the date. These analysts look for trends, support and resistance, formations, and gaps to forecast the "direction" of movement of price. Some analysts try to forecast a price in the future but the bulk of bar chart technicians forecast only the direction of movement of price.

The other two technical methods of analysis are commonly called trend following techniques. The moving average technique involves calculation of the average of a specified number of days prior to the current day. Variants of decision rules for trading are numerous for this method. A more common method is to compare two moving averages of different length. Since a shorter moving average will follow the movements of price more closely than a longer moving average, the shorter moving average will be less than the longer moving average when the price is trending downward and will be above the longer moving average when the price is trending upward.

The point and figure technical analysis believes that the date and volume of trading are less useful in evaluating the price movements. The relevant variables for this method are the high and low price of each day. Two parameters are involved with this method. Those being the box size and reversal number. The greater the box size, the more price will have to change before the trend is considered to be continuing or reversed. The greater the reversal number, the more the high will have to be in a currently downtrending market before a reversal to an uptrending market is indicated.

#### Description of Moving Average Technique:

Perhaps a description of how the moving averages are calculated and used would be appropriate. Suppose the lengths of the two averages to be used are the 10 day average and the 5 day average. For the 10 day average, the closes of the previous 10 days are summed and this sum is divided by 10. For the 5 day average, the sum of the closing prices of the previous five days are calculated and this sum is divided by five. If the 5 day average is less than the 10 day average, we can assume that the price is declining, and conversely if the 5 day average is greater than the 10 day average, we can assume that the closing prices are trending upward.

The number of days chosen for each average is very important. The shorter the number of days used in the calculation

of a moving average, the closer the moving average will follow the price. This has an important effect on the trading success of the technique. A shorter moving average will signal a buy or sell signal earlier but runs a greater risk of creating whipsaws. The longer moving average reduces the possibility of whipsaws, but a large part of the trending move will have taken place before a trade is signaled.

Several variants of the moving average are used. Some traders prefer to weight the most recent days in the average more heavily than previous days. Another commonly used technique is to require that the shorter moving average be below the longer moving average by a certain amount rather than strictly be less than absolutely. Table <sup>V</sup>IV in the appendix demonstrates the differences in income on selling trades that occur when different penetration values and short run moving averages are combined with a 15 day moving average.

#### Description of Point and Figure Technique:

The point and figure technique is different from the moving average technique in that it ignores dates and also it is able to determine the prices where the stops should be set so the trader can possibly enter the market quicker than the trader using moving averages. Because the moving averages uses the averages of closing prices, the next morning after a trade is signaled by a moving average is the earliest a trade can be executed. The point and figure trading techniqiue allows

the trader to specify the price he desires whatever the time of day may be.

A point and figure chart is easily constructed. The first task is to scale the chart. This means assigning a uniform value to the boxes. Next the trader specifies the reversal number which is the number of boxes that must be spanned before a reversal is indicated. When the prices are rising in an uptrend, X's are placed in the boxes corresponding to the filled prices. If the prices are falling, O's are placed in the boxes corresponding to the prices. A description of how to chart the point and figure is possibly described best by Zieg and Kaufman:<sup>4</sup>

. . . if the current or most recent column is composed of X's, the daily high is reviewed. If the high is at least one box higher than the highest X in the current column, the appropriate number of additional X's are drawn.

If the daily high is high enough to require the drawing of one or more additional X's in the current column, the daily low is totally ignored. This same pattern of looking first at the highs and drawing more X's continues as long as each succeeding daily high is one or more boxes higher than the last X drawn in the current column.

But finally then will come a time when the daily high will not permit the drawing of new X's. Only when this occurs will the daily low be of interest. Therefore, if the daily high was not at least one box higher than the highest X, the daily low is reviewed to determine whether the price advance has reversed. If the low is lower than the highest X by the value of three (reversal number) boxes, the price advance is considered broken and a column of O's is drawn with the first O being placed one column to the right of the X column and one box below the highest X.

If the current column is a declining column of O's, the daily procedures are reversed.

#### Review of Previous Studies on Technical Analysis for Hedging

Many producers do not feel at ease in using the futures market. They have no trading plan or strategy by which to establish a hedge or lift it. In many years, the producer's income is lower if he hedges than if he does not hedge. Several studies have been conducted providing rules for timing of hedges for farmers. These studies have used both fundamental and technical analysis of the futures markets to time hedges for livestock and crops.

One of the more recent studies was done by Franzmann<sup>1</sup> where he analyzed the possibility of using point and figure analysis for hedging cotton selectively. He chose to analyze the December 1977 contract using a 40¢ box and a two box reversal number to demonstrate that using technical analysis could allow the producer to place his hedges near the contract high.

Purcell and Richardson<sup>2</sup> used a model of the corn supply and demand plus technical analysis to determine the results of different strategies involving technical and fundamental analyses of the futures markets. The hedges were buy hedges for corn. Some of the strategies they chose involved five and ten day moving averages of closing futures prices and projected cash prices. Their results suggest that hedging can be a more

effective tool for reducing costs when hedging decisions are based on reasonable expectations of future price.

Brown<sup>3</sup> used price prediction models and technical analysis in alternative hedging strategies for sell hedges of feeder cattle. He demonstrated that a strategy using five and ten day moving averages offered the highest mean returns when compared with completely hedged or non-hedged strategies. In total he analyzed eight strategies: (1) unhedged, (2) completely hedged, (3) hedge and hold with first sell sign indicated by moving averages, (4) hedge or lift hedge when the moving averages indicate a sell or buy signal, (5) hedge if the price is forecast to decline, (6) hedge if the price is forecast to decline and the moving averages indicate a sell signal, (7) hedge if the price is forecast to decline and the moving average indicates a sell and lift hedge when the moving average indicates a purchase, (8) hedge if the price is forecast to decline and lift hedge when the price is forecast to increase.

Purcell<sup>4</sup> used a 5 day, 10 day, and 4 day linearly weighted moving average strategy for <sup>90</sup>ninety and 180 day planning periods of selective long hedging of feeder cattle. His results indicated the success of using moving averages for hedging the purchase of feeder cattle.

Lehenbauer<sup>5</sup> was able to conclude that selective hedging strategies using point and figure charts and/or moving averages could effectively increase returns and decrease the variability

of income for feeder cattle producers when compared with a no hedge strategy. His strategies for short hedging evaluation included: (1) no hedge, (2) hedge and hold, hedge and lift hedge according to sell and buy signals from: (3) 3 day and 10 day moving averages, (4) 4-day linearly weights, 5 day and 10 day averages, (5) 4-day and 8 day linearly weighted with a 5¢ penetration rule, (6) 20¢ box with 3 box reversal, (7) 40¢ box with 1 box reversal and a trailing stop, (8) 5¢ box with a 5 box reversal rule and a trailing stop. All of the selective hedging strategies resulted in mean returns greater than both the no hedge and the hedge and hold strategy.

Holland, Purcell and Hague<sup>6</sup> used seasonal variation in price to select hedging dates for hedging live beef cattle. Their strategies included: (1) unhedged, (2) completely hedged, (3) seasonal hedged, (4) hedge if expected lock-in is less than the mean net return, (5) hedge if expected lock-in is greater than or equal to the mean net returns, (6) hedge if expected net revenue is less than the mean net revenue and expected lock-in is greater than zero, (7) seasonal hedging operation with correction for price change. The results indicate that a higher mean return with lower variance can be reached with seasonal hedging than by unhedged operations.

Leuthold<sup>7</sup> used nine selective hedging strategies which included comparisons of break-even, cash, and futures prices. He also compared the differences between hedging until delivery



months as compared to non-delivery months. His results indicated that certain strategies involving comparison of cash and break-even prices to futures prices could increase the producer's mean return and decrease the variance of that return from the mean and variance of strictly a cash position.

Erickson<sup>8</sup> expanded Leuthold's study to include strategies which allowed the cattle feeder to not feed cattle if the break-even price is greater than the futures price plus \$1/cwt. He was a step closer to approximating the actual conditions of cattle feeders with this addition and his results indicate that the mean income of cattle feeders can be increased and the variance of income can be reduced by selective hedging.

These studies indicate that the cattle feeder or livestock producer has a great number of options for hedging. It seems that if a feeder is willing to accept a little more risk than the always hedging strategy, he can increase his income quite substantially without reaching a variance of income as high as the always unhedged position.

## CHAPTER IV

### METHODS, DATA, PROCEDURE

Since this study is directed toward the corn-belt cattle feeders, there are some restrictions which were not encountered by other studies of hedging in other areas of the country. All of the previous studies considered situations such that the cattle feeder places the cattle on feed every month of the year. However, the placement of cattle in the corn-belt is characterized by a large degree of seasonality. The feeders here are comprised mainly of small-scale feeding operations. Most of the feeders also raise crops and therefore are not prepared to handle increased numbers of cattle in their feedlots until after the harvest season.

Hoffman<sup>18</sup> has demonstrated that Iowa exhibits the most fluctuation in inventory levels of the seven major cattle feeding states. The peak placement of cattle in feedlots occurs in October which coincides with the marketing of the spring calf crop and the completion of the grain harvest. The peak placement of steers in Iowa occurs in December because of the feed production.

The strong seasonality of cattle feeding in the corn-belt limits the usefulness of previous studies which

use a situation where cattle are placed on feed every month of the year. Seasonal indexes show that during the winter and spring when corn-belt cattle feeders are the busiest, the price is usually rising. Therefore, the corn-belt cattle feeder is primarily interested in hedging in years when the price makes major drops, as compared to feeders who market cattle continuously which requires them to consider the seasonal influence on price more carefully.

Procedure:

There seems to be no good theory of the selection of parameters for the moving averages and point and figure trading methods except that the longer parameters avoid whipsaws and the shorter parameters allow entry into the market at an earlier point in a move. In order to determine the optimal parameters, computer routines were developed which calculated the profits net of commissions for several different parameters for the period May 15 to November 15 over the eleven year period 1968 through 1978. The annual results from point and figure trading in the futures market are shown in Table IV in the appendix for several different box sizes and reversal numbers. Net profits from moving average trading for various parameters are shown in Table V of the appendix.

The calculation of profits in the futures market for the moving average routine used the opening prices for the days after which the signal for a trade had been indicated because the closing prices are used to calculate the purchase and sale dates and thus a trade could not be made on the day the averages crossed. A <sup>cost</sup> price of 55 dollars was deducted each time a contract was sold to cover the commission charges. If a contract was still open when the cattle were sold on November 15, it was closed at the opening price on that date.

The point and figure routine was able to pick the prices at which a contract would be sold and at which the contract would be purchased. The price chosen was lower than a previous low by the amount of the box size for a contract sale and was higher than a previous high point by the box size for a purchase. A charge of 55 dollars was deducted each time a contract was sold to reflect commission charges.

#### Cost of Production:

For a hedging strategy to be successful, it must make money in periods when losses are incurred in the cash market. Therefore the cost of production is needed for a full analysis. The cost of production budgets used in this study were those which are published by the U.S. Department of Agriculture in the Livestock and Meat Situation reports. These budgets

were chosen because they are used more widely than probably any other single budget for comparison of profits, and this allows the average cattle feeder to more easily apply the analysis to his own situation.

The budgets did not extend all the way back to 1968 because the U.S.D.A. started printing them in 1972. However, the budgets were generated for the previous years by using earlier Livestock and Meat Situation reports and Agricultural Finance reports.

The budgets shown in Table I of the appendix assume that the feeder calf is purchased at 600 pounds and sold at a finished weight of 1050 pounds, averaging 2.5 pounds average daily gain. The calculations of feed requirements using a two phase feeding system are shown in Table II of the appendix to demonstrate that the budgets include more than enough feed to fatten the cattle to the desired weight in the desired amount of time.

The evaluation of a strategy requires the addition of futures trading profits or the subtraction of their losses from the profits or losses sustained in the cash market. After this was done, the mean for each strategy over the eleven years and the variance of the total profits was calculated for the comparisons in the next chapter.

### Strategies for Hedging:

The strategies were derived from the previous studies of strategies. The hedges were placed only during the time between November 15 and May 15, and the trading of futures was limited to one contract as an open position at any one time.

#### Strategy 1:

No hedge strategy. This strategy is the same as that taken by many producers. It entails the producer accepting any price offered in May.

#### Strategy 2:

Fully hedged strategy. The cattle are hedged when they are placed on feed and the hedge is lifted when the cattle are sold. A contract is sold on November 15 and purchased on May 15. This strategy should provide higher profits to the feeder if the price falls and lower profits if the price rises than the unhedged strategy. Losses in the cash market should be offset by gains in the futures market and gains in the cash market should be cancelled by losses in the futures market.

#### Strategy 3:

Delayed hedging strategy. The producer waits until the moving average technique signals a down market before he sells a futures contract to place the hedge. After placing, the contract is held until the cattle are sold.

#### Strategy 4:

Selective hedging using the moving average technique. A contract is sold when the 5 day moving average is less than the fifteen day moving average by five cents per hundred weight. The contract is then purchased back when the 5 day moving average plus 5 cents is greater than or equal to the 15 day moving average.

#### Strategy 5:

Selective hedging using the moving average technique. A contract is sold when the 5 day moving average is less than the fifteen day moving average and the contract is purchased any time the 5 day moving average is greater than or equal to the 15 day moving average.

This strategy is proposed by Purcell<sup>20</sup> as a superior hedging strategy.

#### Strategy 6:

Selective hedging using the point and figure simple sell and simple buy signals. The box size is a 20 cent box and the reversal number is 5. This strategy assumes that the trader can set his stop at the box where the trade signals it and also receive that price.

**Strategy 7:**

Selective hedging using the point and figure simple sell and simple buy signals. The box size is a 20 cent box and the reversal number is 3. This strategy also assumes that the sell stop or buy stop price is achieved.

The 20 cent box and 3 box reversal is used by many charting services.



## CHAPTER V

### COMPARISONS OF STRATEGIES

Hedging when strictly defined, is a means of reducing the fluctuation of income. Selective hedging is a method of reducing the fluctuation of income but to be successful, must allow for an average income which is close to that of the no hedge strategy. Selective hedging is not new. Producers have been using this method for years. The methods of determining when to place and lift a hedge are numerous. Technical analysis is becoming more accepted by individuals who are trading commodities, and as it is used by more traders, some people contend that it feeds upon itself and becomes a self-fulfilling prophesy. In any case, a producer should be aware of this important short run tool for analyzing futures markets.

#### Evaluation Criteria:

When a producer is comparing alternative strategies, two characteristics of a strategy should be important to the producer: One, ~~should be~~ the level of profits or losses from using the strategy, and two, ~~should be~~ the variation of profits of the strategy. If a strategy has very high profits but also extreme variability of income, such that the producer

with limited financing would go bankrupt waiting for the extreme profits, one would question who would want to use the method. On the other hand, if the variability of income were extremely stable, but with very low income the producer would go broke in the long run.

A measure used to evaluate the variability of an income is the variance of the total income. This is a measure of the dispersion around the mean. The greater the dispersion, the greater will be the variance. A common measure of level of income is the mean income for each year. If one could have an ideal strategy, it would have the highest mean income and the lowest variance of any trading strategy.

#### Results:

Table 4 presents the results of the trading strategies for a pen of 39 steers. The results show that all of the strategies provided a higher mean income than the fully hedged strategy.

The delayed hedging strategy resulted in a mean income which was \$346.72 higher than the fully hedged strategy and its standard deviation \$133.47 greater than the standard deviation for the fully hedged strategy. As indicated, this strategy with costs of production as indicated produced at an average loss.

The strategy using the 5 day and 15 day moving averages with a 5¢ penetration rule proved to be one of the more

Table 4

## NET RETURNS FROM HEDGING STRATEGIES

Strategy	Average Return	Standard Deviation of Return	Low Return	High Return
1. No hedge	878.56	2476.30	-3611.79	5622.44
2. Fully Hedged	-984.31	537.38	-1854.54	14.23
3. Delayed Hedge	-637.59	670.85	-1285.15	1065.71
4. 5-15 (\$.05)	973.19	1825.26	-1259.02	4103.99
5. 5-15	767.75	1797.32	-1196.32	3473.64
6. .20 x 5	1168.75	1750.69	-1077.08	5179.90
7. .20 x 3	715.61	1677.45	-1449.08	3912.14

profitable strategies. Its mean return was \$1,957.50 greater than the fully hedged strategy and was also \$94.63 greater than the unhedged strategy. The standard deviation was \$1,287.88 greater than the fully hedged strategy but was less than the unhedged strategy.

The 5 day and 15 day moving average techniques proposed by Purcell also provided an income which averaged higher than that of the fully hedged position, but its mean income was not as high as the no hedge strategy.

The point and figure trading technique using a 20¢ box with a 5 box reversal provided the highest mean income of all strategies. This strategy provided a mean income which was \$2,153.06 greater than the fully hedged strategy and \$290.19 greater than the unhedged strategy. Unfortunately it had a standard deviation which was greater than the fully hedged strategy but was still less than that of the unhedged strategy.

The point and figure trading strategy using the 20¢ box and 3 box reversal resulted in a mean return which was the lowest of any of the selective hedging methods. Even being the lowest, it had an average income which was \$1,699.92 greater than the fully hedged strategy. This strategy provided the lowest variance of any of the selective strategies though.

## CHAPTER VI

### SUMMARY AND CONCLUSIONS

The cattle feeders of the corn belt are unique in their production of feed cattle. Seasonal indexes reveal that for these producers who purchase their steers in November and sell their finished product in May the price is usually rising throughout the period in which they are feeding. However, there may be periods in which the prices decline and perhaps decline until the sale date. After all, the sale date is the time in which an unhedged producer realizes what his income will be. For the producers who contract their product, they are generally locked into the contract because of penalties for cancellation of the contract.

The futures market can be a tremendous tool for most producers. It allows the producer to close out his hedged position when the price is rising, and contract when the price is falling. Some people contend that this activity of selling contracts when the price is falling and purchasing contracts when the price is rising is disruptive of the futures market, causing it to "overshoot" the equilibrium levels. Perhaps this is true, but the futures market is justified by the farmers use of it.

The results of this study indicate that technical analysis can aid a producer in using the futures market to its fullest. Few producers will want a stable income if they are going broke! Also, we have seen many producers who have lost their feedlots because of the extreme price fluctuations. However, the marketing strategy of each producer should be based on his own goals and preferences. Reduction in the variance is very important to some producers who feel they have an advantage in the production such that their costs are low.

The selective hedging strategies were able to reduce the variability in income when compared with the non-hedged strategy and some were able to increase the mean income over the non-hedged strategy. Both the moving averages and the point and figure methods work best when the price moves in long sustained drives. Both will give incorrect signals when the price is not trending. When the market is choppy, the point and figure and moving average techniques will not give correct signals as often.

The severe losses suffered by most of the techniques for the 1978 contract makes one wonder about the ability of any particular strategy to work over time. But as one can see from the chart of prices, the trading period started with a whipsaw and then made a long push upward in prices. It seems that the trading ability of any strategy is more a function of the trending nature within a year rather than time.

The actual outcomes of the strategies would have probably been slightly different in real life. The opening price of the next day after a trade was signaled was used as the price for each trade with the moving average. Although the series was checked for limit moves and days of low volume, the action of one trader might have influenced the price slightly so that what would have actually happened was not simulated. Point and figure trading allows the trader to determine the price at which he wants to set his stop. This price will not always be the price he actually receives.

It might be possible to incorporate fundamental analysis into the decision framework of when to place and lift hedges. In looking for fundamental forecasts for this paper, I was unable to find a consistent series of forecasts which indicated the movement of price, and the development of an econometric model for price forecasting was beyond the scope of this paper. However the results of strictly technical trading were positive for past data.

As some experts have explained, "Don't expect miracles." Some years will produce losses in future trading, but hopefully the cash market will produce revenues to offset the losses.

There is no guarantee that the strategies which produced the highest average returns for the data period will continue to do so in the future, although the number of years chosen for the study is hopefully long enough to indicate the long run ability of each strategy.

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TABLE I

BUDGETS FOR  
CORN BELT CATTLE FEEDING  
November 15 - May 15, 1968-1978

	Nov. 67	Nov. 68	Nov. 69	Nov. 70	Nov. 71	Nov. 72	Nov. 73	Nov. 74	Nov. 75	Nov. 76	Nov. 77
Purchased during	Nov. 67	Nov. 68	Nov. 69	Nov. 70	Nov. 71	Nov. 72	Nov. 73	Nov. 74	Nov. 75	Nov. 76	Nov. 77
Marketed during	May 68	May 69	May 70	May 71	May 72	May 73	May 74	May 75	May 76	May 77	May 78
EXPENSES											
600 lb. feeder steer	154.92	173.40	211.08	190.74	221.28	259.02	306.12	172.26	229.56	217.56	239.64
Transportation to feedlot											
(400 Miles)	4.32	4.32	4.32	4.32	4.32	4.32	4.80	5.28	5.28	5.28	5.28
Corn (45 Bu.)	42.75	45.90	47.70	57.60	43.20	53.10	99.00	148.50	104.40	90.90	87.30
Silage (1.7 tons)	13.96	14.62	15.20	17.03	14.74	16.90	25.72	39.47	33.46	33.37	29.60
Protein supplement											
(270 lb.)	13.90	13.50	13.90	14.72	14.58	20.12	23.22	25.78	23.36	21.14	26.19
Hay (400 lb.)	4.19	4.24	4.41	4.39	4.69	4.90	5.00	8.15	9.80	11.55	9.35
Labor (4 hr.)	5.76	6.20	6.68	7.20	7.52	8.00	8.84	9.84	9.80	9.84	10.80
Management	2.88	3.10	3.34	3.60	3.76	4.00	4.42	4.92	4.90	4.92	5.40
Vet medicine	1.61	1.67	1.75	1.83	1.95	2.06	2.45	2.89	3.05	3.09	3.26
Interest on purchase											
(6 mo.)	6.58	7.37	9.23	10.01	11.06	10.04	13.78	9.04	9.76	9.79	10.78
Power, equip, fuel, shelter,											
depreciation	7.43	7.72	8.11	8.46	9.01	9.53	11.35	13.37	14.12	14.29	15.06
Death loss (1% of purchase)	1.55	1.73	2.11	1.91	2.21	2.59	3.06	1.72	2.30	2.18	2.40
Transportation (100 miles)	1.89	1.89	1.89	1.89	1.89	1.89	2.10	2.31	2.31	2.31	2.31
Marketing expenses	3.15	3.15	3.15	3.15	3.15	3.15	3.25	3.35	3.35	3.35	3.35
Miscellaneous & indirect costs	3.21	3.34	3.51	3.66	3.90	4.12	4.91	5.78	6.10	6.18	6.51
TOTAL	268.10	292.15	336.38	330.51	347.26	403.74	518.02	452.66	461.55	435.75	457.23
Selling price/cwt. required											
to cover feed and feeder											
costs (1050 lb.)	21.88	23.97	27.84	27.09	28.43	33.72	43.72	37.54	38.15	35.67	37.34
Selling price/cwt. required											
to cover all costs (1050)	25.53	27.82	32.04	31.48	33.07	38.45	49.34	43.11	43.55	41.50	43.55
Choice steers, Omaha	26.33	33.18	29.57	33.07	35.70	45.74	40.52	49.48	40.62	41.95	57.28
Net margin/cwt.	.80	5.36	-2.47	1.59	2.63	7.29	-8.82	6.37	-3.34	.46	13.73

TABLE II  
FEED CALCULATIONS FOR  
CATTLE FEEDING BUDGETS

The amount of feed shown in the budgets is more than adequate for the feeding period if a two phase feeding system is used. The following calculations show that if corn, silage, protein supplement, and hay are fed to the steer weighing 600-799 pounds and the steer weighing 800-1050 pounds is fed only corn, silage, and protein supplement, the steer will gain 2.5 pounds per day on the average.

Ration for steers from 600 to 799 pounds

	% of ration	NEm Meg/cal/lb	NEg Meg/cal/lb	Digestible Protein %
Corn	53.401	x1.033=55.163	x .670=35.779	x 7.95= 4.245
Silage	32.332	x .707=22.894	x .448=14.507	x 4.80= 1.554
Protein	5.722	x .933= 5.393	x .621= 3.553	x43.80= 2.506
Hay	8.495	x .530= 4.502	x .217= 1.843	x12.40= 1.053
	<u>100.000</u>	<u>87.898</u>	<u>55.682</u>	<u>9.358</u>

Ration for steers from 800 to 1050 pounds

	% of ration	NEm Meg/cal/lb	NEg Meg/cal/lb	Digestible Protein %
Corn	58.359	x1.033=60.285	x .670=39.101	x 7.95= 4.640
Silage	35.398	x .707=25.019	x .448=15.854	x 4.80= 1.699
Protein	6.253	x .933= 5.834	x .621= 3.883	x43.80= 2.739
	<u>100.00</u>	<u>91.138</u>	<u>58.838</u>	<u>9.078</u>

	DM intake	NEm requirement	NEg requirement	DP requirement
600	14.5	5.21/.878=5.9	8.6x.557=4.79	x9.358=1.357
700	16.5	5.85/.878=6.7	9.8x.557=5.46	x9.358=1.544
800	18.5	6.47/.911=7.1	11.4x.588=6.70	x9.078=1.679
900	20.0	7.06/.911=7.7	12.3x.588=7.23	x9.078=1.816
1000	21.5	7.65/.911=8.4	13.1x.588=7.70	x9.078=1.952

	Adg NE	Adg DP	Adg	Days of feeding	Feed consumed
600	2.60	2.35	2.35	42.6	14.5x42.6=617.70
700	2.63	2.70	2.63	38.0	16.5x38.0=627.00
800	2.88	2.90	2.88	34.7	18.5x34.7=641.95
900	2.85	3.10	2.85	35.1	20.0x35.1=702.00
1000	2.81	3.30	2.81	17.8	21.5x17.8=382.70
				<u>168.2</u>	<u>1726.65</u>

	Corn	Silage	Protein	Hay
600- 799	669.1	405.7	71.7	106.4
800-1050	1012.2	614.4	108.6	
	<u>1682.3</u>	<u>1020.1</u>	<u>180.3</u>	<u>106.4</u>
% Fed	1890	2550	202	119

TABLE IV  
NET PROFITS IN DOLLARS FROM THE LIVE CATTLE FUTURES MARKET  
USING POINT AND FIGURE CHARTS

Box Size	Rev. No.	Years											Total for Each Parameter Size
		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
.05	1	-792	-965	-95	75	-1015	100	4210	-1395	3050	-1831	-2250	-908
	2	-252	-990	-95	75	-1015	100	4210	-1395	3050	-1831	-2250	-393
	3	-392	-990	40	210	-1015	100	4210	-1395	3050	-1831	-2250	-263
	4	-257	-895	-160	-90	-1015	100	4210	-1395	3050	-1831	-2250	-533
	5	-337	-370	-200	140	-1475	100	4210	-1395	3050	-1831	-2250	-358
	6	-135	-510	-52	135	-1475	395	4210	-1395	3050	-1991	-2350	-118
.10	1	-197	-875	20	70	-1290	-20	4110	-1990	2930	-1871	-2290	-1403
	2	-397	-390	115	-75	-1195	-20	4110	-1990	2930	-1871	-2290	-1073
	3	-175	-550	243	35	-1635	315	4110	-1990	2930	-1816	-2450	-983
	4	-295	-670	243	-365	-965	315	4110	-1990	2810	-2151	-2450	-1408
	5	-175	-335	338	-190	-670	730	4110	-1695	2810	-1561	-2490	872
	6	-175	-415	-22	-550	-670	730	4110	-1695	1825	-1506	-2155	-523
.15	1	-162	-705	-32	-330	-820	20	3455	-745	2950	-1991	-2430	-790
	2	-295	-235	143	-165	-1360	315	3455	-745	2830	-2231	-2610	-898
	3	-175	-295	143	-585	-710	730	3455	-745	2830	-1286	-2670	692
	4	-175	-415	-42	-650	-710	550	2615	-745	2160	-1471	-2315	-1198
	5	-175	00	00	-235	-475	905	2615	-1105	2040	-1591	-890	1089
	6	-175	00	00	-235	00	605	2615	-1105	2040	-1591	-415	1739
.20	1	-215	-215	-85	-515	-1180	-220	3990	-2175	2930	-826	-2570	-1081
	2	-215	00	418	-110	-1125	155	3990	-2175	2690	-771	-2355	342
	3	-215	00	-375	-670	-910	985	3990	-2175	1465	-796	-2140	-841
	4	-215	00	00	-215	-535	825	3190	-2120	1920	-1116	-910	824
	5	-215	00	00	-215	00	345	4640	-2120	1920	34	-375	4014
	6	-215	00	00	-215	00	-215	3600	-1998	-350	-366	-775	-534
.25	1	-355	-510	478	-461	-1065	80	3570	-2195	2850	-786	-2175	-569
	2	-255	-455	278	-761	-710	690	3470	-2195	3005	-876	-2375	-184
	3	-255	00	00	-255	-555	845	3225	-1740	1960	-421	-1010	1794
	4	-255	00	00	-255	00	345	3735	-1933	2515	-621	-455	3076
	5	-255	00	00	-255	00	-155	3975	-1323	-710	-366	-855	56
	6	-255	00	00	-255	00	-155	3975	-1923	-1110	-466	-855	-1044
.30	1	00	00	378	-661	-1540	610	3870	-1520	2650	-1051	-3625	-889
	2	00	00	-415	-830	-535	905	3030	-2000	1800	-996	-2140	-1181
	3	00	00	00	-295	00	545	3705	-1733	1800	74	-535	3561
	4	00	00	00	-295	00	-175	3400	-1383	185	-406	00	1326
	5	00	00	00	-295	00	-895	2200	-1983	-535	-1790	00	-3298
	6	00	00	00	-295	00	-1671	1480	250	-535	-1790	00	-2561

TABLE IV (continued)

## NET PROFITS IN DOLLARS FROM THE LIVE CATTLE FUTURES MARKET

## USING POINT AND FIGURE CHARTS

Box Size	Rev. No.	Years											Total for Each Parameter Size
		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
.35	1	00	00	238	-390	-950	450	3925	-2035	3065	-931	-2795	577
	2	00	00	-127	-335	-475	785	3840	-1645	1720	-1296	-1985	482
	3	00	00	00	-335	00	-335	4175	-583	30	-66	-615	2271
	4	00	00	00	-335	00	-335	3615	-1088	-1510	-626	-895	-1174
	5	00	00	00	-335	00	-1035	1795	310	-1510	-1790	-1735	-4300
	6	00	00	00	-335	00	-1691	1935	-250	-475	-1790	00	-2606
.40	1	-215	00	-375	-430	-910	155	4740	-1720	1305	-1036	-2140	-626
	2	-215	00	00	-375	00	745	4475	-1985	1520	-821	-1070	2274
	3	-215	00	00	-375	00	-215	3815	-2183	-590	-606	00	-369
	4	-215	00	00	-375	00	-1015	2535	-485	-1710	-126	00	-1391
	5	-215	00	00	-375	00	00	2055	-270	-695	-375	00	125
	6	-215	00	00	-375	00	00	3550	-590	-695	-375	00	1300
.45	1	-235	00	-162	-650	-415	845	3560	-1645	1625	-1531	-1425	-33
	2	-235	00	00	-415	00	-235	4595	-1858	-525	-106	00	1221
	3	-235	00	00	-415	00	-235	3695	-1388	-595	-646	00	181
	4	-235	00	00	-415	00	-1611	1895	-110	-595	-595	00	-1666
	5	-235	00	00	-415	00	00	3390	-470	-595	-595	00	1080
	6	-827	00	00	-415	00	00	3390	-470	-595	-595	00	488
.50	1	00	00	-167	-455	00	945	4720	-1585	2760	-1276	-1765	3177
	2	00	00	00	-455	00	-255	3775	-1223	2070	-366	-855	2691
	3	00	00	00	-455	00	-1055	2775	-1165	-655	-855	-1855	-3265
	4	00	00	00	-455	00	00	1775	-310	-655	-1910	00	-1555
	5	00	00	00	-455	00	00	3430	-710	-655	-655	00	955
	6	00	00	00	-455	00	00	3430	-710	-655	-655	00	955
.55	1	00	00	153	-495	00	605	3305	-2640	1220	-2111	-1650	-1613
	2	00	00	00	-495	00	-495	2535	-2023	1055	-626	-715	-764
	3	00	00	00	-495	00	-495	2315	-605	-715	-495	00	-490
	4	00	00	00	-495	00	00	3470	-550	-715	-495	00	1215
	5	00	00	00	-495	00	00	3470	-550	-715	-495	00	1215
	6	00	00	00	-495	00	00	390	-550	-715	-495	00	-1855
.60	1	00	00	-535	-1070	00	665	5015	-1530	1440	-1060	-535	2389
	2	00	00	00	-295	00	-295	2375	-1088	-55	-766	00	-124
	3	00	00	00	-295	00	00	1175	-350	-775	-775	00	-1020
	4	00	00	00	-295	00	00	3390	-590	-775	-775	00	955
	5	00	00	00	-295	00	00	270	-590	-775	-775	00	-2165
	6	00	00	00	-295	00	00	270	425	-775	-775	00	-1150

TABLE V  
NET PROFITS IN DOLLARS FROM THE LIVE CATTLE FUTURES MARKET  
USING MOVING AVERAGE TECHNIQUE

Moving Averages	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Total
3-15 (.00)	-370	-840	-428	-556	-1870	-635	2225	-10	1605	-850	-1725	-3454
3-15 (.01)	-505	-745	-293	-556	-1783	-635	2225	265	1605	-850	-1725	-3017
3-15 (.02)	-545	-757	-198	-556	-1743	-635	2325	265	1105	-957	-1745	-3441
3-15 (.03)	-469	-757	29	-476	-1703	-595	2325	345	1105	-957	-1745	-2893
3-15 (.04)	-300	-777	137	-476	-1655	-595	2325	145	1105	-957	-1745	-2793
3-15 (.05)	-280	-777	165	-471	-1515	-595	2325	145	1225	-957	-1670	-2405
3-15 (.06)	-320	-637	165	-248	-1280	-595	2325	-115	1225	-1010	-1670	-2160
3-15 (.07)	-395	-797	260	-323	-1280	-435	2325	140	1225	-1165	-1925	-2370
3-15 (.08)	-467	-797	260	-343	-1280	-200	2325	140	1225	-1165	-1925	-2227
3-15 (.09)	-607	-797	120	-140	-1205	-200	2325	140	1185	-1113	-1925	-2117
4-15 (.00)	-430	-517	171	-688	-1785	-335	2585	85	633	-1330	-2030	-3541
4-15 (.01)	-478	-617	378	-608	-1547	-575	2585	85	713	-1330	-2030	-3424
4-15 (.02)	-458	-617	418	-556	-1547	-455	2585	85	833	-1330	-2030	-3072
4-15 (.03)	-292	-377	600	-556	-1547	-295	2585	85	833	-990	-2030	-1984
4-15 (.04)	-292	-377	655	-556	-1527	-295	2585	85	833	-1058	-2030	-1977
4-15 (.05)	-177	-377	703	-348	-1204	-120	2585	85	833	-1058	-2030	-1108
4-15 (.06)	-335	-417	615	-25	-957	-120	2645	85	773	-1038	-2030	-804
4-15 (.07)	-435	-437	487	75	-957	-60	2645	85	773	-1038	-2030	-892
4-15 (.08)	-503	-537	547	00	-957	-60	2385	85	901	-1038	-2030	-1207
4-15 (.09)	-507	-482	547	-12	-957	235	2385	185	851	-938	-2030	-713
5-15 (.00)	-498	-325	330	-340	-1410	140	3000	825	1253	-1282	-2013	-320
5-15 (.01)	-466	-337	520	-288	-1375	145	2925	825	1293	-1282	-1610	350
5-15 (.02)	-339	-277	687	-85	-1255	145	3325	825	1293	-1282	-1610	1427
5-15 (.03)	-284	-397	687	-213	-1232	-15	3325	880	1293	-1342	-1610	1092
5-15 (.04)	-145	-397	687	-208	-1100	180	3325	880	1293	-1342	-1610	1503
5-15 (.05)	-145	-397	587	15	-1125	220	3325	880	1293	-1342	-1410	1901
5-15 (.06)	-323	-397	587	15	-1125	260	3105	880	1293	-1342	-1410	1543
5-15 (.07)	-463	-362	427	-5	-1125	260	3105	960	1313	-1342	-1410	1358
5-15 (.08)	-495	-382	475	-80	-1125	260	2805	960	1313	-1362	-1410	959
5-15 (.09)	-359	-222	375	-112	-1113	-492	2905	960	1433	-1362	-1410	603
6-15 (.00)	-589	-105	492	-105	-1322	103	3720	-180	265	-1574	-970	-265
6-15 (.01)	-399	-165	544	-105	-1104	88	3720	-180	265	-1542	-970	152
6-15 (.02)	-232	-350	415	-105	-1104	168	3820	-180	265	-1542	-970	185
6-15 (.03)	-177	-362	415	-105	-1172	168	3820	-180	265	-1542	-910	160
6-15 (.04)	-165	-362	527	171	-1065	348	3820	-180	465	-1542	-970	1047
6-15 (.05)	-252	-362	507	171	-1065	348	3820	160	465	-1362	-970	1460
6-15 (.06)	-212	-322	507	96	-993	408	3820	160	465	-1302	-970	1657
6-15 (.07)	-419	-342	387	-92	-993	408	3845	160	465	-1302	-970	1147
6-15 (.08)	-336	-342	387	-104	-993	288	3630	160	465	-1302	-970	893
6-15 (.09)	-289	-222	387	-104	-993	288	3630	160	1085	-1494	-970	1478

Penetration rule  
 Long term moving average  
 Short term moving average

TABLE VI  
RESULTS FROM HEDGING STRATEGIES

Year	Strategies						
	1	2	3	4	5	6	7
1968	327.60	-481.14	-481.14	118.85	-234.15	48.85	48.85
1969	2194.92	-836.43	-836.43	1734.17	1806.17	2131.17	2131.17
1970	-1011.46	-1472.08	-972.08	-490.08	-747.08	-1077.08	-1449.08
1971	651.10	-692.81	-690.82	587.35	232.35	370.48	-106.58
1972	1076.98	-1214.77	-1151.77	-154.27	-453.52	1001.98	71.48
1973	2985.26	-683.92	-683.92	3147.14	3067.14	3272.14	3912.14
1974	-3611.79	-814.29	1065.71	-354.29	-679.29	960.71	310.71
1975	2608.52	14.23	14.23	3409.77	3354.77	324.72	266.83
1976	-1367.73	-1506.48	-1158.48	-138.48	-178.48	488.52	33.52
1977	188.37	-1285.15	-1285.15	-1259.02	-1196.32	154.87	-688.45
1978	5622.44	-1854.54	-833.64	4103.99	3473.64	5179.90	3341.14
Total	9664.21	-10827.38	-7013.50	10705.13	8445.23	12856.26	7871.73
$\sigma^2$	6132041.36	288774.11	450044.20	3331585.00	3230353.73	3064913.47	2813835.25
$\sigma$	2476.30	537.38	670.85	1825.26	1797.32	1750.69	1677.45