MONEY FLOW AND OPEN INTEREST WEIGHTED PRICES: MAJOR TREND INDICATORS FOR USE IN MULTIPLE HEDGING WITH MOVING AVERAGES

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PREFACE

This study was conducted to ascertain the usefulness of monitoring the revealed opinions of all participants and observers in Live Cattle Futures markets. Identification of trends in public sentiment as to market price in conjunction with price trends should prove useful to producers in managing futures hedge positions.

Any effort toward development and investigation of a theory benefits from liberal support and encouragement. The author extends the most sincere appreciation for such support and encouragement to his committee chairman, Dr. John R. Franzmann. Appreciation is also expressed to other members of the committee, Dr. Kim Anderson, Dr. James Russell, Dr. Marilyn Kletke and Dr. Larry Makus for their many individual and collective contributions.

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CHAPTER I

INTRODUCTION

Risk and Uncertainty

Daily operation of a business enterprise requires a successful manager or entrepreneur to continually assess and confront risk and uncertainty. "Risk is simply the lack of perfect knowledge about the future" (Forster, 1984, p. 33). The consequences of current management and marketing decisions are not known with certainty.

Bullock (1985) delineates the differences between risk and uncertainty by stating that uncertainty exists whenever a decision maker is unable to fully control a process that determines the outcome of any particular action initiated by the decision maker. Risk exists when a subset of decision outcomes may be considered undesirable by the decision maker. Risk is defined after the manager categorizes and quantifies undesirable potential outcomes. Risk is the probability of an undesirable result that may occur from implementation of an action with numerous possible outcomes.

Risk arises from many possible sources of variation. Production variability, unseasonal or adverse weather, competitors' actions, legislative mandates, external financial crises, and unsteady world affairs all contribute to the business environment in which today's agriculture operates. "Where there is risk, there must be a profit reward to encourage managers to continue taking risks" (Oster, 1979, p. 21).

Keynes (1930) and Hicks (1946) noted that uncertainty may produce a desire to transfer risk. Keynes notes that risk averse individuals (hedgers) will transfer the risk of holding a commodity to less risk averse individuals (speculators). Speculators are attracted to the market by the bias in futures prices created by the efforts of hedgers to take short positions (Keynes, 1930).

Marketing is an area of management focus that requires the successful marriage of interdisciplinary concepts, relationships, actions, and consequences. This approach has been emphasized by numerous economists working in the areas of decision making and risk management. Statements such as the following by John Ikerd (1984) are quite common:

> Farm and ranch management decisions are not purely production, finance, and marketing decisions. Production decisions have financial and marketing implications, marketing decisions have production and finance implications, and financial decisions have production and marketing implications (p. 22).

Risk in Slaughter Cattle Production

Producers of slaughter weight cattle are typically presented with a very wide range of daily cash prices over any particular feeding period. The traditional commercial cattle finishing operation feeds cattle a high concentrate diet for 90 to 150 days. Most operations feed cattle for a period of time sufficient to bring at least 70 to 80 percent of each lot of cattle to the United States Department of Agriculture (USDA) Choice grade. Decisions to market early or hold cattle for a brief period of time are often made in anticipation of short term price expectations for slaughter cattle. Such expectations of price influence the timing of sales of slaughter cattle.

The purchase of feeder cattle for such operations requires substantial capital outlays. Delivered costs of 700 pound feeder cattle have generally been above $65 per hundredweight for the past six years. Costs of gain, including feed, management, labor, interest expense, death loss, pharmaceuticals, and biologicals generally range between $50 to $65 per hundredweight.

Decisions in the cattle feeding business at the margin are crucial. The difference of a few cents saved per pound of gain may be the difference between a favorable closeout statement or financial disaster. Any decline in the cash price of cattle of a few cents per pound could turn a profitable venture into a dramatic erosion of capital. If the producer is heavily leveraged with external financing, the individual's own equity may fully evaporate. Should the enterprise be self-financed, the loss in equity reduces the ability to re-enter the marketplace with another lot of cattle to attempt to recover initial net worth prior to an adverse break in prices.

Future market conditions are beyond the control of each individual producer. Each operator functions as a classical pure competitor. Prices will be changed little, if any, whether each producer as an individual feeds cattle or not. A pragmatist would conclude that were producer A not to feed cattle, those same animals would be owned, fed, and slaughtered by either producer B or C sometime in the near future. Thus, future price uncertainty adds to the basic production and financial worries of the typical cattle feeder.

Livestock feeders have been well supported with research in the physical production of finished cattle. Much effort has been expended

on the communication of new techniques for promotion of rapid, economic weight gain, reduction of losses from disease and stress, and maximization of feedstuff efficiency. The daily operations of most cattle feeding enterprises entails a great deal of attention to such details. Cattle feeders often act as if there were no control over marketing decisions. The attitude of producers was well stated by Peterson (1984) when he wrote "marketing is often viewed as a necessary function, but one that does not require decisions until after production and financing decisions have been made and implemented" (p. 7).

Over the brief interval required to finish a pen of cattle, a producer is often faced with violent $10 to $15 per hundredweight swings in the cash and futures markets for slaughter-ready cattle.

Feeders need analyses of alternatives that have the potential to reduce or minimize market price risk and attendant financial exposure. Various marketing methods have been utilized in recent years, ranging from vertical integration, spreading the marketing effort over a lengthy time period, a variety of cash forward contracts and sales of product through a regulated futures exchange.

Vertical and Horizontal Integration

Producers have made efforts to minimize risk and maximize profits through both vertical and horizontal integration. Vertical integration involves the extension of a business enterprise's efforts to another related level in the production-to-consumption chain. A feedlot operation may become involved in slaughter operations or in a cow-calf or yearling enterprise. Costs of marketing (shrink, freight,

commission) may be captured by involving an operation in another sector of the production process. Certainty and quality of supply, or of a more reliable market for products, are often reasons for vertical integration. The costs of the middleman may be reduced or eliminated through this type of integration. Each middleman must recover all costs in order to exist in the marketplace in a competitive environment such as the livestock industry. Exclusion of some market middlemen may reduce the cost to the operation that retains the ownership of the cattle through more phases of the production process. Cost reductions may be derived from increased efficiency such as less handling and freight and reduced overhead cost.

Horizontal integration is the expansion of an operation in an effort to gain economies of size, market share and increased operating income. Specialized facilities, management and procedures may be more economical on a per head basis for larger operations. Overhead costs, such as management expertise, are reduced when operation size is increased. Purchasing and marketing efforts may be enhanced by the ability to gain volume discounts and guarantee large steady supplies of products to processors or buyers of an operations finished product.

Many large scale operations incorporate both vertical and horizontal integration. Modestly sized feedlot operations may be involved in farming, cow-calf or yearling operations, and/or have a relationship with a slaughter facility.

Cash Forward Contracts

Cash forward contracts are often sought as an alternative to waiting to sell cattle when they are ready for slaughter. Cash

contracts allow a producer to solicit bids for cattle over a longer period of time than if the decision were delayed until the cattle reached a marketable weight and grade. Spreading the market price search over a period of several weeks gives the producer an opportunity to evaluate more fully the market conditions. Extension of the marketing time period provides flexibility and opportunity to gain the most advantageous price possible as compared with the producer who ships his cattle and accepts that day's price.

One important fact of interest related to the forward contracting producer is that the purchaser assumes the risk of price variation from the producer. Such service is not without cost. The purchaser must seek protection either with sufficient margins of profit for the risks taken, or must forward contract or hedge the position. As with any forward contract, it is imperative that all parties be financially able to carry out the contract specifications. The ability to enter and exit such cash forward contracts freely is severely limited by the number of capable and willing participants and the attendant risks due to price variation.

Futures Hedging

Trading in live cattle futures contracts began on the Chicago Mercantile Exchange (CME) in November, 1964. The development of a viable liquid futures contract for a perishable product such as live cattle has permitted producers to avail themselves of the benefits of the forward contract while minimizing the premium that must be discounted in the simple cash forward contract. Although early concern over the probable success of a live cattle contract was

substantial (Skadberg and Futrell, 1966), their use and application by producers for more than 20 years stands as a testament to the practical value of such futures contracts.

Currently hedgers of finished cattle use the live cattle contracts traded on the CME (40,000 pounds) or its smaller counterpart, the Mid-America Commodity Exchange (20,000 pounds). The contract specifies the quantity, weight ranges, quality, location(s) premiums and discounts, and time of delivery. Contract specifications are established to meet the basic standards used by the cash trade. The specifications are liberal enough to ensure that sufficient numbers of cattle are available to encourage convergence of cash and futures prices in the delivery month. Current standards call for 40,000 pounds of Choice grade steers with the bulk of the cattle qualifying as United States Department of Agriculture Yield Grade 2. No more than four head of USDA Yield Grade 4 cattle are permitted in a par delivery unit. Discounts and premiums are established and assessed for variations within specified limits above and below the specified par delivery unit (1983 CME Yearbook).

The Classical Hedge

The classical "Bankers' Hedge" (Harris, 1974) entails the forward sale of a futures contract that "locks in" a price for the producer. Banks provide operating loans to the producers securing their position with collateral interests in the cattle. Additional lines of credit for the producers are provided for a commodity margin account. Margin funds are maintained in a segregated account with a CME clearing member (Havenstein, 1975). All futures contracts are settled daily,

with any gains or losses being credited or debited to individual accounts based upon the change in closing prices for the past day's trading. Banks loan funds on the premise that, should the market price of cattle fall, losses in the cash market will be offset by gains from the prior sale of a futures position. The previously discussed large capital requirements for cattle feeding require that the producer either borrow from external sources, or finance his cattle feeding with substantial quantities of his own capital.

One major criticism of the bankers' hedge is that the producer may "lock in" a respectable profit margin, and subsequently watch a dramatic rise in cash cattle prices in which a potential windfall profit is used to meet margin calls in the commodity hedge margin account. "A producer should hedge in the futures market only when he is convinced that his cash situation, at the current time, is wrong" (Bainbridge, 1979, p. 26). Often a hedge is placed when the lender insists or when the producer cannot withstand the risk of an exposed cash position.

The Basis Hedge

A more appropriate use of the bankers' or textbook hedge is the use of a basis hedge. The basis is the difference between the CME futures price and the local cash price of live cattle. This difference reflects location, shipping, quality and sex differentials between local market values and the futures prices in Chicago. Basis price patterns reflect seasonal variations and local market conditions. At times when the futures price is substantially higher than local cash prices producers placing hedges will profit from the

convergence of futures and cash prices. Hedged positions during periods of abnormally low basis differences will lose from any widening of the basis to more normal levels. A hedged position with no change in basis would be the classical bankers hedge. Changes in the basis of a dollar per hundredweight would have a ten or eleven dollar per head impact. A narrowing basis would have a positive impact and a widening basis would reduce net returns to the producer.

The bankers' hedge is a simplified form of the basis hedge, as it assumes a constant basis. The successful hedger must be aware of the current and historical basis levels. Proper expectations of future basis levels are required in order to maintain any degree of long term hedging success.

Multiple Hedging

Multiple Hedging has been proposed as a possible alternative to the classical bankers' hedge (Ikerd and Franzmann, 1980; Scronce, 1981). Rational producers should desire to protect their financial asset base and profits when market declines are expected. During periods of price appreciation, a producer will benefit if he is not hedged. A fully hedged position for a cattle feeder in a period of price appreciation would force the producer to meet maintenance margin calls. In effect price rises would not benefit the feeder. In fact, interest on margin loans may offset a small, once acceptable profit.

Multiple hedging is defined as the placement and lifting of a hedge more than once during the production period. A producer would sell his cattle when prices were deemed high, with high probability of price erosion. Conversely, short hedge positions would be covered with expectations for price appreciation.

Such a marketing technique can increase flexibility and an operation's long term profitability as compared to the classical bankers' hedge (Ikerd and Franzmann, 1980). Given that multiple hedging is a legitimate and viable market alternative, the problem becomes one of determining the timing of placement and lifting of hedge positions. Moving averages, oscillators, fundamental analysis, market charting techniques, and numerous other methods are provided by service companies and detailed in many popular press publications.

Multiple Hedging with Technical Analysis

Technical analysis is employed as an aid in identification of a trend and measurement of probable price movement and reaction. Many market technician's tools are available for timing order entry and determination of price support and resistance zones.

Bankers hedges and basis hedges provide price and equity protection. Major market moves are of less consequence to the hedger who utilizes these strategies than those with no protection who gain or lose depending on the direction and magnitude of the price adjustment. Successful multiple hedging allows producers of live cattle to retain the windfall profits that accrue in rising or "bull" markets. A trend following technical trading tool that aids in placement and lifting of hedge positions only has value if the method produces greater returns than the basis or bankers hedges. Simple moving averages have been presented as a means of smoothing short term market variability and to determine the trend in the market. Multiple hedging based on combinations of short term moving averages subject a producer to numerous commission changes while longer term moving

average combinations expose the producer to greater losses as these systems are less sensitive to changes in market direction.

Crowd Psychology

Crowd psychology is a factor in futures markets. A crowd convinced that some anticipated event will occur is hard to persuade otherwise. Major market moves are accompanied by the crowd psychology phenomenon. The market may appear to be subject more to attitudes and opinions of the masses than to the professionals who make it their business to anticipate price adjustments.

The research effort reported in this paper focuses on the analyses of readily available daily market information. Producers of slaughter cattle may be able to use this basic information to identify trends and market characteristics of the futures markets. Technical trading techniques that have been popularized by successful speculators may prove to be applicable to producers.

Objectives

The objective of this research is to determine whether specified measures of market sentiment may be useful to multiple hedgers in the live cattle futures markets. The daily closing price and daily open interest statistic are hypothesized to reveal the attitudes of future price direction of the live cattle futures market. Open interest and closing price statistics have been reported to be of value in measurement of trader commitment (Jiler, 1965). Producers of slaughter cattle may be able to filter their moving average multiple hedge trading technique in such a way as to enhance the profitability of their business enterprise.

Hypotheses

The two filters developed and tested in this research are both hypothesized to be measures of all traders' and observers' sentiments toward market and price direction. It is further hypothesized that through the use of the filters in conjunction with moving averages, multiple hedgers will be able to increase profits.

General Approach

The first step taken in this research after a review of other investigations was to determine the profitability of moving average trading techniques. This analysis was completed over all contract months for a period of seven years. Measures of trader sentiment and general market direction were established based on open interest and price relationships. These measures of market direction were used as pre-filters for traditional two moving average crossover trading. Various filters and a wide array of moving average combinations were evaluated in a search for an optimal trading strategy.

The analysis of the filters included the computation of profits over the period investigated and profits in a post test period of one year following the initial period evaluated. The number of consecutive losses for each contract month and for all contracts combined was also evaluated. Profits for buy and sell signals were examined to determine the optimal trading strategy.

The most profitable moving average systems were then modified by each of the filters and the results compared with one another and the results of the base system.

Summary

This chapter introduces the problem of risk, its origins, and some alternatives available to reduce or minimize market price risk exposure for livestock feeders. Discussion of these alternatives included bankers' and basis hedges, cash forward contracts and moving hedges, vertical and horizontal integration. A producer may apply selective or moving hedge strategies to protect his portfolio asset position. Placement of short hedges in declining markets and covering of the short position at relatively low prices may be the most profitable and prudent means of risk management and profit maximization available to the successful livestock feeder.

Technical market analysis tools are presented as the means for timing market entry and exit. These tools are commonly used by speculative traders and may be of value for producers to develop and use in their risk management efforts.

CHAPTER II

LITERATURE REVIEW

Introduction

Livestock producers utilizing "technical" trading techniques often raise comments and often suspicion among skeptical observers. The following quote from the introduction in Paul Cootner's text, The Random Character of Stock Market Prices (1984) appropriately summarizes this skepticism:

> The subject matter of this paper is bound to be considered heresy. I can say this without equivocation, because whatever views anyone expresses on this subject are sure to conflict with someone elses beliefs (p. 47).

The research effort reported herein deals with the use of open interest and price data in an innovative manner. The literature was reviewed for evidence of similar applications and theoretical foundations.

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 given commodity (Teweles, Harlowe, and Stone, 1977, p. 62). Charts are a newsreel of the results of the day to day struggles between supply and demand (Oster, 1979).

The evidence of these struggles are the daily market statistics. Those most commonly observed are the opening price, high and low price

for the day and the close or settlement prices. Two other bits of information available are the volume of trading and the open interest or outstanding commitment at the end of the day. These six figures impart to the chart observer the strength, variation and quality of each day's price action, once it is compared to previous market activity (Dorsey, 1965).

Volume and Open Interest

Two of the six daily statistics available for each contract month of each commodity traded on regulated U.S. futures exchanges are volume and open interest. Most research on technical analysis has been concerned with prices and price changes. Few investigations of volume and open interest have been completed. Edwards and Magee (1966) note specific volume characteristics that are typical in numerous chart formations. Analyses of market price action, or pattern relative to specific volume and open interest has been discussed in a qualitative sense (Jiler, 1965). Cornell (1980) found a significant positive contemporaneous correlation between changes in volume and prices in 14 of 18 commodities studied. A more rudimentary discussion of some volume and chart pattern relationships is given by Cox (1972). Jiler concentrates on a few of the numerous possible combinations of price, volume and open interest. His focus was on identification of climax buying or selling that precedes major market reversals. Jiler expressed secondary interest in analysis of strength of a price move that is underway.

Basically, the rules for trading decisions which use volume and open interest have been developed in accordance with understanding

crowd psychology. The detection of the movement into or out of a market by the public provides substantial information to the astute market observer. The public leaves a market for such reasons as profit taking, greater attractions and profit potential elsewhere, or from losses that have to be realized. Observation of recent price action and attendant changes in open interest provide a measure of market sentiment. Volume and open interest are indicators that can measure a new frenzy of activity, losers racing to exit a market, or new participants forcing their presence into a market. New entrants into a market often drive prices beyond previous areas of support or resistance.

Volatility and Time to Maturity

Casual observation of price and volume patterns has instigated numerous investigations of the consequences of time remaining to maturity on price volatility (Tesler, 1956). Samuelson (1965) found the maturity effect to be highly significant in explaining price volatility. Anderson (1981) concurred that the contract maturity effect in live cattle futures contracts was significant in explaining the volatility in the daily price of futures contracts. Cornell (1980) also found much of the daily price variability attributable to relative volume of trading in futures markets. Fundamental (supply/demand) information available to the market each day tends to be of a short term nature. Daily slaughter numbers, prices, meat and by-product prices, competitive product prices and other data are reported daily. Therefore, most of the information available on a

daily basis tends to be of short term value, in that it will quickly be reflected in the market supply/demand equilibrium.

Samuelson (1965) proposed that futures prices follow a martingale or random process, and that spot cash prices were generated by an autoregressive process. As a futures contract matures to delivery the character of the price change process shifts from a random walk to an autoregressive adjustment process.

Random Walk and Information Aggregation

There have been numerous challenges raised against the credibility, statistical and economic inconsistency of trend following methods. The random walk hypothesis of Cootner (1962), Houthaker (1961), and Bachelier (1900) rests on their quantitative findings that the change in price from one day to the next is purely random, by statistical test. The random walk hypotheses serves as a challenge against technical trend following methods. Factors, such as new information which may be available to the market in an ongoing basis, has been asserted and tested by Larson (1960). He found that new fundamental information available to a market is assimilated into the rationally expected new price equilibrium in a non-random manner. Traders with varying degrees of skill in analysis and interpretation will each react and assume market positions over a period of several days after new information is made public.

Research by Bear (1979) indicates that information flows to the market place in a uniform manner, and that traders properly anticipate this information flow. However, traders' reactions to the information

are not immediate. His study of market actions concludes that market realization of any new information may take up to three days. Bear also found that when a market is closed over a weekend or holiday a greater amount of information occurs between closings than does between concurrent trading days.

Lucas (1972) observed that in a world of differential information the marketplace will tend to aggregate that information. Grossman (1975, 1977) concluded that as long as the market price does not perfectly aggregate all information, differing beliefs will lead to futures trading. Bear, Lucas, and Grossman all suggest the hypothesis that different interpretations and acknowledgement times for information among individuals will manifest itself in futures trading volume and changes in open interest.

Since new information is constantly being "fed" to the markets, a stable equilibrium price eludes capture by the public. Markets tend to require news to feed their current trend (Gann, 1919). During periods of rising (falling) prices the investing public searches for and demands to know why. The press, brokers, brokerage firms, and commodity analysts "find" basic fundamental reasons to justify the current trend. When good (or bad) news is no longer available to support the current trend, Gann considered the move to be near an end.

Technical Trading

W.D. Gann and Edwin LeFevre (1923) (more popularly known as Larry Livingstone) were both traders of legendary success. By Gann's and LeFevre's own reports both went broke three times prior to their acquisition of wealth through speculative success. They attribute

their losses to a failure to follow the basic rules of the market and understanding crowd psychology. Charts and mathematical analyses were the tools of these early day market technicians.

Market technicians use a wide variety of methods of analyses of the six basic daily trading figures of open, high, low, close volume and open interest. Practically all of the methods employed by technical analysts and traders are trend following systems. As such, the mechanical systems make no attempt at forecasting the direction or extent of price movements (Donchian, 1965). The market entry and exit signals are followed on the premise that once a trend is established it has a tendency to continue for some period of time. The objective of a trend following method is to stay with a trend until its conclusion, then reverse market position once the trend itself turns.

Giving full consideration to the negative disposition of statisticians who find no serial correlation of price changes (Osborne, 1959) it has been found that simple trend following methods utilizing small filters yielded high profits in the Dow Jones and Standard and Poor Industrial averages over the period from 1897 to 1959 (Alexander, 1964). Alexander's findings are summarized as follows: "...in speculative markets price changes appear to follow a random walk over time, but a move, once initiated, tends to persist" (p. 93).

A price move or trend continues for a period of time, although the price movement within any period of trend or over several trends, both up and down, appears to be random. Trend following methods allow trading profits to accumulate as the filtered mechanical system buffers the traders position from the random market action on a day to day basis.

Moving Averages

Neftci and Policano (1983) found that moving average (trend following) systems tended to identify the probable future trend for a short period of time, but that the market entry/exit profitability of various systems were mixed. Any one set of moving averages provided widely varied results across commodities, and even across contracts for one commodity.

Two moving average crossover trading systems serve as a means of trend following. Positions are taken from signals generated by the crossing of a longer term or period moving average by a shorter period moving average. If the shorter average crosses the longer from below, a buy signal is generated. Conversely, crossing of the long average by the short average from above gives a sell signal. These methods are detailed by many authors including Cox (1972), Hochheimer (1978), and Ikerd (1982).

There has been a significant amount of institutional research by Merrill Lynch (Hochheimer, 1978). This effort entails both simple moving average crossover models and the observation of a third moving average. A three crossover model is a modified two crossover model as previously discussed. The third average is a confirming average. The system discussed by Hochheimer entails obeying the two-average buy signal only if the confirming third average value is greater than its previous value. Conversely, sell signals are honored only if the confirming average value is less than it's previous day's value.

Hedging with Moving Averages

The work of several researchers considers the results of risk shifting for producers following moving averages. Cash positions or required future cash positions are protected with the purchase or sale of futures contracts to minimize the uncertainty, and therefore the risk of producers.

Studies that take into consideration the nature of the cash/futures relationship have been conducted. Moving averages have been accepted as legitimate means of trend following. They may be employed successfully by producers (Brown, 1977; Shields, 1980; and Scronce, 1981). Selective hedge placement with the use of a moving average signal has been accepted as a successful tool (Ikerd, 1982).

Application of moving average systems with penetration rules have been investigated by Shields and Franzmann (1981) and Franzmann and Lehenbauer (1979). Moving average trading signals are honored only if the crossing is greater than some predetermined quantity.

Shield's study developed optimal buy hedges of feeder cattle with 3-4-6 day moving average and a $0.07 penetration rule. Corn purchases were signaled with a 7W-15-26 day average and a $0.009 penetration rule. Live cattle were hedged following signals from a 1-3-5W average and a $0.09 penetration requirement, where the "W" designates a linearly weighted average. These systems were optimized over the 1975 to 1979 time period. These averages were used in a trend following manner to optimize producer profitability. Purchase of cash positions in grain and feeder cattle and cash sale of finished cattle were implemented to test the applicability, practicality and profitability of trend following methods in shifting risk for producers.

Scronce(1981) studied the possibility of re-optimizing moving averages over various time periods and observing the effectiveness through the following time interval. This study entails the utilization of the Box Complex procedure (Richardson, Ray, and Trapp, 1979). The Box Complex procedure has limitations in that it is designed for continuous data. Optimal combinations of averages have to be adjusted to discrete values. The method suffers when modified to function on discrete data such as price series. The procedure has difficulty in determining whether local global maxima have been identified. Scronce concludes that his efforts at reoptimization were disappointing, as the profits from his reoptimization scheme in a hedge program were not significant.

Among the more recent studies for live cattle multiple hedging was a study completed by Lehenbauer. His optimal results were from the use of a 4 day-8 day linearly weighted moving average with a $0.05 penetration rule. This was the most profitable multiple hedging system for a period of tests in 1978.

Many of the currently applied technical trading methods use combinations of systems to develop trading signals. Moving averages, as discussed previously, are one major field of technical focus. Other areas of technical analyses include bar chart, trend line and pattern analyses, point and figure graphs, and cycle analyses. Oscillators are used to determine "market" characteristics. One of the most widely used oscillators is that of Welles Wilder (1978). His Relative Strength Index (RSI) is a measure of relative price gains and losses on a closing basis over some period of past trading days. RSI is bounded between zero and 100 in values. Overbought and oversold

conditions are signaled by this index which cautions traders against trading with the recent trend. These reactions are observed in both market consolidation and reversal situations.

Summary

This chapter reviewed the basic research in market price action studies. Market equilibration and assimilation response periods have impact on price change and on volume and open interest. Price volatility and trade volume are correlated. Methods of trend identification were discussed. The nature of spot cash prices and nearby futures price adjustment is different from that of more distant delivery contracts. These differences and the changes in prices result from differences in the nature of market information available for current and future time periods.

Various trend following techniques have been tested and accepted as practical decision aids for producers. Simple moving averages, two moving average crossovers and two average crossovers with a third confirming average have been the primary focus of technical analyses for hedging applications. Oscillators have been used as filters for some of the trading systems.

No literature was located in which research utilizing volume and/or open interest in combination with closing prices for hedge or moving hedge applications.

CHAPTER III

MONEY FLOW AND AGGREGATE PRICE FILTERS FOR MOVING AVERAGE TREND-FOLLOWING SYSTEMS

Introduction

The objective of this research is to determine whether the hypothesized methods for quantification of market sentiment from basic daily trading information are useful in further identification of price trends for multiple hedging applications. Basic daily trading statistics were used to develop a money flow statistic and an open interest weighted or aggregate price statistic, both of which were used as moving average pre-filters. Verification of superior trend identification methods would be of benefit to producers who utilize multiple hedging in their marketing and risk management portfolio.

Multiple hedging requires a producer to utilize some means of analysis from which market positions can be established. Moving average systems alone have value in trend identification. A reading of general sentiment and attitude is important to a hedging producer whose objectives are to protect equity and gain from price appreciation. This effort would be aided if the producer were more certain of the attitudes and opinions of other market participants.

The Moving Average Technique

One of the primary tools of multiple hedging is the use of moving averages to identify trends. Moving averages of various combinations of daily market data constitute the foundation of the position placement techniques hypothesized in this chapter.

Numerous methods of calculating moving averages are employed by market technicians. The first used was the simple or truncated moving average. The number of elements in the series is constant. As each new element of price information is added to the series the oldest price is dropped. The average of this moving total is the simple moving average. Assume a closing price, C_t, over a time period, t. The moving average (M_t) at time t is:

$$M_t = \frac{C_t + C_{t-1} + C_{t-2} + \ldots + C_{t-n+1}}{n}$$

or

$$M_t = \frac{\sum_{i=1}^{n} C_i}{n} \qquad i = 1, 2, \ldots n$$

where

M_t = moving average at time t,

t = most recent day observed,

C_i = daily closing price $\qquad i = n, n-1, \ldots t+1, t,$

n = number of days in time period.

As each new closing price C_t is added, the n^{th} historical observation is dropped. This smoothing technique allows the market to be observed in a less erratic pattern than the individual price patterns would allow.

Weighted averages are computed in a similar fashion, except that each observed price is weighted in value, with the denominator of the equation equal to the sum of the weights. Linear weighting assigns the oldest observation a value of one, the second oldest a weight of two and so forth to the most recent observation which receives a weight equal to the total number of observations used in the average (t).

Various techniques have been used for the generation of signals from the moving averages. The most rudimentary method of using a moving average to follow a trend and establish market entry and exit points is that of comparing each days' close to a moving average of some length of past days trading. As long as today's closing price is above the moving average the price trend is rising. A sell signal is generated once the market closes below the moving average. With a system such as this it is obvious that in a non-trending or sideways trading market the system will generate a substantial amount of trading signals. By lengthening the period of the moving average, the numbers of signals may be reduced in all but the most dull, non-trending or sideways markets. The generation of numerous market entry signals within a brief time period leads to the increased probability of whip-saw trading. A whip-saw occurs when a position is reversed with little gain or loss, only to be reversed again, and possibly a third and fourth time. Each trade makes little or no profit, yet costs the trader a full commission.

In order to reduce the whip-saw effects of a single average close crossing signal generating system, many permutations of the basic single average system have been considered and tested. The most

common is the implementation of a two moving average system. A moving average of only a few days' prices tends to be more sensitive to changes in trend than one of a longer period. Subsequently, the shorter average changes direction quicker than a longer average. The most common two moving average system functions as follows: when the short average crosses the long average a position change is signaled. If the short average crosses the long average from below a buy signal is generated. Conversely, when the short average crosses the long average from above a sell signal is generated.

The use of two averages serves to buffer the effects of the single average, closing price crossover technique. The single moving average may be crossed by the closing price often in a period of a week or two, depending upon the length of the moving average and the trend in the market. This generation of numerous trades creates whip-saw trading with few profits and numerous commissions accumulating. The use of two moving averages minimizes the sensitivity of the position reversal mechanism. Day-to-day closing price variation is buffered by something with a simple moving average, even with relatively few observations.

A third "rule" invoked in a two moving average crossover system is the requirement that the short moving average cross the long average by some predetermined quantity. This penetration rule or filter is intended to minimize the whip-saw effect.

Data

The data used for study was obtained from the CME Yearbooks. The period of 1976 through 1982 was chosen for analysis. Optimization of

filtered and non-filtered technical trading systems for live cattle were completed for this time period.

Reasons for selection of the 1976 to 1982 time period are both pragmatic and statistically founded. First, grading standards for slaughter cattle were changed in 1976. Essentially, the top third of the old USDA Good grade was included in the new USDA Choice grade. As a result of this grade standard change, the CME introduced a new contract reflecting the new standards. During 1976 two contracts for live cattle were traded for several delivery months. Problems of dual observations are avoided by restricting the data set to the new contract.

Another reason for the use of 1976 as the initial point of analyses is that the live cattle market was relatively mature by then. Trading volume and liquidity had attained respectable levels only in the last few years prior to the grade change. The maturity of a contract is a reflection of both speculator and user interest and activity.

The year 1982 was chosen as a cutoff for the period investigated as the 1983 CME yearbook was not available prior to June, 1985. The 1983 CME trading information was used as a test period for selected trading strategies.

Open Interest Filters

Contracts for live cattle may trade for a long period of time. The CME opens a new future contract month for trading when there is sufficient interest to establish some degree of liquidity in accordance with other rules and regulations of the exchange.

The consideration of a trading rule precluding trades until a certain percentage of the total livestock open interest was represented in a contract month was derived from several sources. First, most hedgers of slaughter cattle do not own those cattle forthe full life of the contract. This is a practical consideration. Furthermore, in recollection of the findings of Tesler (1956), Samuelson (1965), and Anderson (1981), the time remaining to contract maturity was significant in explaining price volatility. Samuelson further concludes that futures prices followed a random process, with spot prices following an autoregressive process. If this is the case, this research further proposes that in a continuum of time the nearby futures months follow more of an autoregressive nature than the more distant months. Conversely, the more distant months follow a random process. It is proposed that if the price changes are purely random then no gain could be made in trading over the long run. This is more true when commission costs are included in the analyses.

The lack of significant liquidity in distantly traded contract months stands as a sizeable deterrent to trading those months. Order execution may be poor, if trades can be consumated at all. For this reason, and those stated earlier, an open interest filter has been proposed to be used prior to analyses of the filtered moving averages. Fifteen and twenty-five percent open interest filters will be compared. The comparisons will be made for various combinations of a simple crossover of moving averages. No trade signals will be honored until the contract month in question has attained the minimum 15 or 25 percent of the total open interest in all contracts. Overall profits and profits for specific combinations of averages will be compared.

The most profitable open interest filtered moving average will be used as a standard of comparison for the money flow and open interest weighted or aggregate price filters as applied to the simple and linearly weighted to moving average crossover models presented in the following two hypotheses.

Hypotheses

Two hypotheses were developed and tested. Both utilize combinations of daily closing prices and trading volume for each contract month. Multiple hedging profits may be improved by consideration of the revealed attitudes and opinions of all market participants. Producers may benefit from following the price trend and the trend in public opinion in their multiple hedging programs.

Two measures of market sentiment are proposed. First is a measure of total financial commitment in live cattle futures. This is referred to as money flow. The second measure is that of an open interest weighted or aggregate price.

The open interest weighted price is a weighted aggregate of all of each day's closing prices in the live cattle futures on the CME. This single current value is an information discounted value for cattle across all contracts. As a discounted value of current and anticipated future market situations, the open interest weighted price should adjust in a relative manner, reflecting daily incorporation of new information. If this is the case, the series of open interest weighted prices should follow a trend which is readily identifiable with a two moving average crossover technique.

Both measures of market sentiment are used as filters for moving average trading techniques. A producer who follows both the price trend and the trend of trader sentiment with a multiple hedging program should fare better than one who utilizes only bankers or basis hedge techniques, as discussed in Chapter I.

Hypothesis 1: Money Flow

W.D. Gann (1923), LeFevre (1923), and even Charles Dow (1901) paid close attention to the changes in outstanding short or long positions in stock market margin accounts. Gann used the same technique in commodities. The total real financial commitment to a market tends to rise with the development of a trend. Their intuition about crowd philosophy may be established and used as a filter for moving averages, or other technical trading systems.

A market begins to move toward a new equilibrium price level from changes in the basic fundamentals of supply and demand. This move is generally anticipated to some degree by those who make dealing in commodities their business. These are often called insiders by Gann, Dow, and LeFevre. As prices rise, an excitement stirs in the speculative public. The more dramatic the price change the more intense speculative interest becomes. Insiders establish their positions and tend to wait patiently until the majority of the price adjustment has occurred before lifting their positions, or placing new positions once they determine new equilibrium levels in price have been attained. The speculators continue to purchase, seeking more news, creating news and adding to the trading frenzy. Along the way to higher prices some speculators or interested producers sell into

the higher prices, anticipating a break. The effect of new buying and selling is revealed directly in increases in both volume and open interest.

The market aggregates information, the bulk of which is shorter term in nature. This leads to a major portion of total open interest accumulating in the nearby two or three contract months of trading. Spreaders, those professionals who buy one month and sell another, attempt to arbitrage profits from market misalignment. They buy or sell the distant month and offset that position in a more nearby month. Their behavior suggests that they are acting on knowledge from their longer term information that leads them to the conclusion that current price relationships are out of line with one another.

If every day one were to consider the total real financial commitment of traders it would be the outstanding full asset position of the market. This revealed value is best described as money flow. By summing the open interest multiplied by each contract's closing price a daily total for the outstanding commitment can be determined.

$$\text{Money flow} = \sum_{i=1}^{n} OI_i C_i$$

where

i = contract month $\quad i = 1, 2, \ldots, n$

OI = open interest

C = close or settlement price

As prices rise and/or open interest rises, money flow will rise. Gann considered that by the time the general public was aware of a price move a substantial portion of it would be over. He reasoned that once the public was fully involved the insiders would cover their

major positions and take opposite small positions against the trend. This would cause the money flow in the market to reverse. Gann (1923) felt that such a signal, direct from the market place, could not be ignored. The general public would not be aware of the top in a market until it was painfully obvious that the rise was over. The total financial commitment in a commodity can be considered as a measure of public sentiment of price level and volatility. Increases or decreases in price are the incentives that motivate speculative interest. As the price trend develops, more traders are attracted by the past profits gained by earlier investors on the correct side of the move. Such is the nature of the prolonged bull or bear market. However, once prices have moved to (or beyond) a new relative equilibrium plateau, the market is vulnerable to profit taking selloffs. Finally, in the climax move the traders who are on the wrong side of the market liquidate their positions. The closing out of their loss positions tends to push prices even further against the more stalwart traders with the same position. On the other side of the move those traders with accumulated open trade profits may move to close out and solidify the accrued profit into their own bank accounts. Those who delay observe paper profits eroding rapidly. Continuous profit taking then adds to the impetus that violently reverses over-extended price moves. Charles Dow best summarized speculative attitudes in this quote of June 8, 1901:

> There is always a disposition in peoples minds to think that existing conditions will be permanent. While the market is down and dull, it is hard to make people believe that this is the prelude to a period of activity and advance. When prices are up and the country is prosperous, it is always said that while preceding booms have not lasted, there are circumstances connected with this one which make it unlike its predecessors and give assurance of permanency (p. 56).

If money flow is an indicator of significance, it may be used as a pre-filter for a moving average technique. Sell signals would only be honored if the money flow is declining, and buy positions only if money flow is increasing. The simplest determination of money flow trend is by comparison of two moving averages of different length. Should the short average be greater than the average of a longer period, a positive filter value would allow buy signals from price moving averages to be honored. The opposite situation would allow only sell orders to be entered.

Speculators "know" that profits are made from application of the basic rules of buying low and selling high. General public sentiment is to buy first and enjoy profits from a bull or rising market. Selling any commodity short is often a difficult trading decision for many speculators, therefore, declining prices may not attract speculative sellers. Falling prices may offset open interest increases producing a constant or declining calculated money flow during a developing strong declining or bear market.

The use of the money flow by speculative traders highlights an effort to avoid getting trampled in front of crowd psychology. Trading profits are made by following the crowd, then upon proper anticipation of the end of the move, liquidating and/or reversing positions.

Review of a technical trading rule that observes money flow as a pre-filter to a simple moving average system is the objective of the first of the technical moving average filters. A dummy variable of -1 for declining money flow, and +1 for increasing money flow as a pre-filter will be reviewed. If a mechanical moving average system

signaled a trade, that trade would only be honored if the money flow sign agreed with the sign of the position. A sell signal, generated by a short moving average crossing a longer average from above is only honored only if the money flow trend were negative.

Since money flow is erratic on a day-to-day basis this figure required smoothing. Two smoothing techniques on money flow were be applied. First, a simple moving average, ranging from three to eight days was compared to the calculated money flow for the current days trading. If the daily value were less than the average, then money flow would be negative, indicative of a recently passed peak. Second, combinations of short and longer term moving averages were used to determine money flow trend. Relatively short periods for averaging were selected, as a pre-filter should be sensitive enough to not preclude order entry near market peaks and lows. Insensitive filters would allow market entry only after a major move were underway, and the trader would give up much of the advantage of the trend following ability of a moving average system. Averages of shorter duration would be more sensitive than averages over longer time periods.

It is possible that money flow may be a biased indicator, more reliable at market tops than bottoms. The possible bias of money flow is a function of the method of its calculation. Money flow is the product of closing price and open interest. Traditionally, at relatively low prices, open interest is also relatively low, resulting in a low money flow figure. Conversely, high prices tend to attract attention. Once profit-taking begins and open interest declines, money flow may drop dramatically while prices are constant or possibly still rising. If this tool provides better, more profitable sell

signals than buy signals it would be an advantage to prospective sell hedgers. Most livestock feeders are primarily in need of sell hedge price protection.

Hypothesis 2: Open Interest Weighted or Aggregate Price

"What did the market do today?" is one of the questions most commonly asked of commodity account executives, market analysts, traders, fellow producers, and spouses of market observers.

"Why?" is the second most often asked question and as such merits mention. Why the market did what it did is included in the domain of fundamental analysis beyond the scope of this research.

In the realm of commodity futures, particularly perishable commodities such as live cattle, when a "market" is discussed the question of "which" market needs to be addressed. Cattle ready for June slaughter cannot economically or practically be converted or stored to turn those same cattle into December cattle. Factors and information available for nearby June delivery cattle are not the same as the information about potential supply and demand in distant December.

The closer to maturity a contract is, the more sensitive the contract is to news. New information tends to be more abundant for the short term than the longer term. Spreader or arbitrage activity tends to equilibrate the nearby price with the more distant, allowing considerations of relatively sketchy but different information pertinent to the more distantly traded month. They buy or sell the distant month and offset that position in a more nearby month. An

Arbitrageur would be assumed to be acting on knowledge from short and longer term information that leads to a conclusion that relative prices are out of line with one another. These two factors taken together lead to the hypothesis that a single value for the market may be developed. Price volatility and open interest are functions of information, time to maturity and expectation of changes over the relative time horizon.

The calculation of an open interest weighted price is proposed as a single value to use in definition and discussion of the market. This would resolve the issues of which month and the length of time remaining. The information or news available to the market would be the same. An open interest weighted price may be a useful evaluation of the market. Factors or news influencing the nearby months will carry weight in proportion to the open interest in the contract months. Arbritrage compensates for the anticipated longer term implications of the short term news flow.

The market value can be calculated and in effect would provide an information discounted current single value of live cattle. All factors relative to demand and all anticipated costs of production of cattle including risk, profit, acquisition, feed, and opportunity costs are reflected in each contract month's price of live cattle. Existence of extraordinary profits in any contract month would encourage some arbitrageur or enterprising producer to intervene. As more such actions are taken and this news is made public the disparity in relative prices would diminish to zero.

If today's market is too low it would be expected to be forced higher in the next day or two. The market value for perishable

commodities such as live cattle is defined as an open interest weighted aggregate price (AP). This type of analysis would be appropriate for any commodity which requires a period of time from birth through to the finished product point. Information about inventory, calves born, slaughter rates, placements on feed, marketing rates, intentions, feed and range conditions, weather, financial situations, etc. is available to some observer. Some efforts to increase or reduce future supply take a substantial amount of time to have a noticeable effect. Other actions, such as feeding cattle longer to put more weight on, can have a substantial short term effect. The evaluation of all information relative to anticipated effects on the market price over the available delivery periods is proposed to be aggregated into this single valued open interest weighted or aggregate price (AP).

$$AP = \frac{\sum_{i=1}^{n} OI_i C_i}{\sum_{i=1}^{n} OI_i}$$

where

OI = open interest

C = closing price

i = contract month i = 1...n

An open interest weighted price would provide a full accounting of all information for all contracts over the market time period in which any trader or observer has an opinion. Observers are implicitly included, as it is assumed if an observer held substantial contrary beliefs he would place an order and become a trader.

Should the overall livestock market be rising a producer of slaughter cattle would not want to have a short hedge in place. If the overall market price be declining a short hedge would be warranted. This would be due to the fact that the preponderence of information, as interpreted, would provide a single value signal of overall anticipations of price direction.

A filter that applies this concept of aggregate price was investigated. This filter for classical moving averages systems will be implemented on the same basis as that used for money flow. If the AP trend is determined to be up only buy signals were honored. Conversely, if the trend is down only sell signals from moving averages were honored.

Analysis of Hypothesized Trading Methods: Method

Several methods for analyzing the performance of mechanical trend following systems are available. The main criteria for comparisons of systems and methods was profitability over all contracts for the years 1976 through 1982. The length of run of loss, or maximum capital erosion for any time period was determined for the most profitable method, both by contract month and for all months combined. Lastly, comparisons of buy and sell position profits were compared in order to determine if any trading system has a bias that should be important to any hedging producer. Average profits, number of trades and variability of returns for the most profitable trading systems are calculated and analyzed.

The primary concern of a multiple hedging program is the overall profitability of the trading system. Total performance of all buy/sell signals were reviewed for selected systems. Special note was made of the general nature and characteristics of the basic trend following methods proposed. A trading system that produces a small percentage of profitable combinations within that system is not as acceptable as one that generated comparable profits in a large percentage of possible combinations in that system.

The second method of analysis was to observe and report the maximum length of run of loss of the most profitable combinations for any particular set of trading rules. A system is not acceptable if it suffers periods of extensive losses, even though the overall profitability is high. Performance such as described may be the result of a system identifying a few major moves for high profits while suffering numerous consecutive losses during the interim.

For selected trend following methods, a comparative analysis of profits of buy vs. sell signals was completed. A trading system may provide biased outcomes due to the nature of the filtering rule employed. Another possible consideration for biased results is that the underlying market allowed one side of the market trading system to earn more profit. Ideally a producer would prefer a system that provided greater profits from short live cattle positions than from long positions. If biased signals exist, the next logical extension of trading rules would be to use one signal to enter a position and another to exit the trade.

The first step in optimization of filtered moving averages is to establish a basis from which to develop comparisons. The foundation

used in this study was the two-moving average crossover model. All short term averages were calculated as simple moving averages. The longer averages tested included both simple and linearly weighted averages. Positions were taken at the opening price of the day following the crossing of the long average by the shorter average. If the date that the position were to be taken were a limit move day, the position was taken on the following days' open.

To simplify reporting of various techniques tested, the terminology of simple-simple and simple-weighted will be used when referring to the moving average calculation itself. Simple-simple indicates that both the short term and long term average are calculated as simple averages. Simple-weighted indicates that the short term average is a simple average and the long term average is a linearly weighted moving average as previously discussed. When specific days are used the number of observations in the short average are presented first, and the number of observations in the longer average are presented last. For example a 3 day-5 day average would be a 3 day simple moving average compared daily to a simple 5 day moving average. Linearly weighted averages are identified in the text when they are discussed.

Most studies of technical trading systems have been developed for speculative purposes. Producers' interests are in profitability, capital retention and market liquidity. Trading rules for most speculative systems allow trading only in the contract month nearest to but not in delivery. On the first day of delivery the trader's position is closed or moved forward to the next contract month. A legitimate hedge by a producer should not be handled in such a manner.

Producers of slaughter cattle need to concern themselves with liquidity. A trend following system is of little value if there are few, if any, other market participants. Signals to place or lift a position in a thin market subject the hedger to choppy market action, resulting in poor order execution and whip-saw trading. Thin markets are markets for a specific contract or an entire commodity in which there are few participants. Without sufficient hedger and speculative activity there may be a large spread between offers to buy and sell. The worst case of a thin market is when there are no willing participants with which to trade without giving up a sizeable margin in order to execute the desired trade. A hedge trader may avoid the described problems of thin markets by requiring that any contract month traded hold some minimum percentage of total open interest.

First, comparisons of simple-simple and simple-weighted moving average combinations were completed. Combinations of long averages ranging from two to 30 days were matched with short averages ranging from one to 24 days. Seventy-seven combinations of short and long moving averages were tested. The expense of testing all 720 possible combinations was prohibitive. Selected moving average combinations were tested for profitability with various combinations of open interest filters. The most profitable of the open interest filtered moving average systems were then tested with various money flow and aggregate price filters. The most profitable open interest and money flow filtered moving average system and the most profitable open interest and aggregate price filtered moving average system were then more closely inspected. Several combinations of moving averages surrounding the highest identified single combination of moving

averages were observed to assure that the absolute highest profit combination of moving averages was isolated.

The results from a moving average technique were selected as a basis for comparison with hypothesized filtered moving average results. Three or more combinations of averages were evaluated for each of the two filters proposed and results from each filter technique were compared to those of a simple moving system without the use of the pre-filters.

Once the best technical trading system of those reviewed was determined, an analyses of length of runs of profits and losses on an all contract basis and on a contract by contract basis was completed. As a result, the accumulation and erosion of capital was measured. The consideration of all contract months relevant to continuous feeding operations and monthly considerations are important for the smaller or seasonal cattle feeder.

Lastly, an analysis of trading profits from buy and sell positions was completed and inferences drawn from the characteristics of the market and the trading results observed.

Summary

This chapter introduces the hypothesized use of daily market information to discern the attitudes of traders. It is hypothesized that aggregate opinions are quantifiable into a measure of money flow and an aggregate (open interest weighted) price. Money flow and aggregate price are proposed as pre-filters for standard moving average multiple hedging or trend following techniques.

The methods of analysis to test the two hypothesized measures of market sentiment as filters are presented. Requirements for a basis of comparison were developed. Techniques for isolation of the most profitable moving average system were presented. Reasons for and methods of a detailed analysis of profits and losses were given.

CHAPTER IV

OPEN INTEREST FILTER RESULTS

The appendix of this paper displays tables and three dimensional profit diagrams for various filtered moving average trading systems. The first four tables are pictured in the first four figures. The tabled information presents the financial results of each moving average combination reviewed. Results of all system combinations are depicted in the three-dimensional figures.

Each cell of each table represents trading profits for each moving average that was tested. Long averages are presented across the top of the table; short averages are presented down the left side of the first 12 tables. Table cells representing trading combinations with negative returns are shaded to further aid in overall inspection and analysis of the various filtered moving average trading systems.

Fifteen Percent Open Interest Filter

Tables I and II (Figures 1 and 2) present profits of moving average trend following systems. Trades were initiated only after a contract had attained a level of 15 percent of the outstanding open interest of all live cattle contracts traded. Note that only 13 of 77 combinations of the simple-simple averages in Table I generated trading profits for the 1976 through 1982 time period. The most profitable combination was that of a 9 day-15 day simple moving

TABLE I

1976-1982 15 PERCENT OPEN INTEREST SIMPLE-SIMPLE AVERAGES

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT AVERAGE												
1	-184158	-79886	-72010	-67938	-55756	-36154	-30380	-25278	-31956	-21946	-12874	-5700
3	.	-10732	-19230	-23350	-23952	-12036	-20800	-2838	-7882	-10642	3880	11024
5	.	.	-37606	-40882	-42694	-35130	-20624	-420	346	-6218	-12200	-3298
7	.	.	.	-57500	-33172	-15370	-5376	-38	-6014	-8890	-2704	-3274
9	.	.	.	.	-22706	-11218	12254	-2698	-15790	-9506	-15632	-5070
11	.	.	.	.	.	-12814	3700	-7758	-6262	-2776	-16138	-24260
13	.	.	.	.	.	.	-512	702	-4674	1988	-15942	-14614
15	.	.	.	.	.	.	.	-8122	-8032	-2786	-9878	-824
18	.	.	.	.	.	.	.	.	10568	7082	4060	5918
21	.	.	.	.	.	.	.	.	.	3470	1866	-7944
24	.	.	.	.	.	.	.	.	.	.	-16108	-21318

TABLE II

1976-1982 15 PERCENT OPEN INTEREST SIMPLE-WEIGHTED AVERAGES

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM
SHORT AVERAGE												
1	-219370	-120884	-81856	-71028	-74370	-52906	-41824	-44648	-35620	-36380	-35434	-25464
3	.	9302	-1864	-19610	-18724	-20912	-17916	-18156	-16686	-17744	-14192	-8722
5	.	.	-65718	-52584	-51714	-44132	-37112	-22774	-25990	-6414	-7318	-5484
7	.	.	.	-40356	-38026	-24862	-12570	-10464	-9994	-1440	204	-6520
9	.	.	.	.	-11298	-35604	-6988	266	-1246	-6840	-2274	-9122
11	.	.	.	.	.	-7712	-7288	-18760	-12818	-4940	-10696	-23238
13	.	.	.	.	.	.	-6524	-13744	-29508	-30040	-17374	-12246
15	.	.	.	.	.	.	.	-33746	-2838	-22668	-14420	-17260
18	.	.	.	.	.	.	.	.	-28700	-40712	-49012	-13610
21	.	.	.	.	.	.	.	.	.	-18486	-38392	-39528
24	.	.	.	.	.	.	.	.	.	.	-29652	-47982

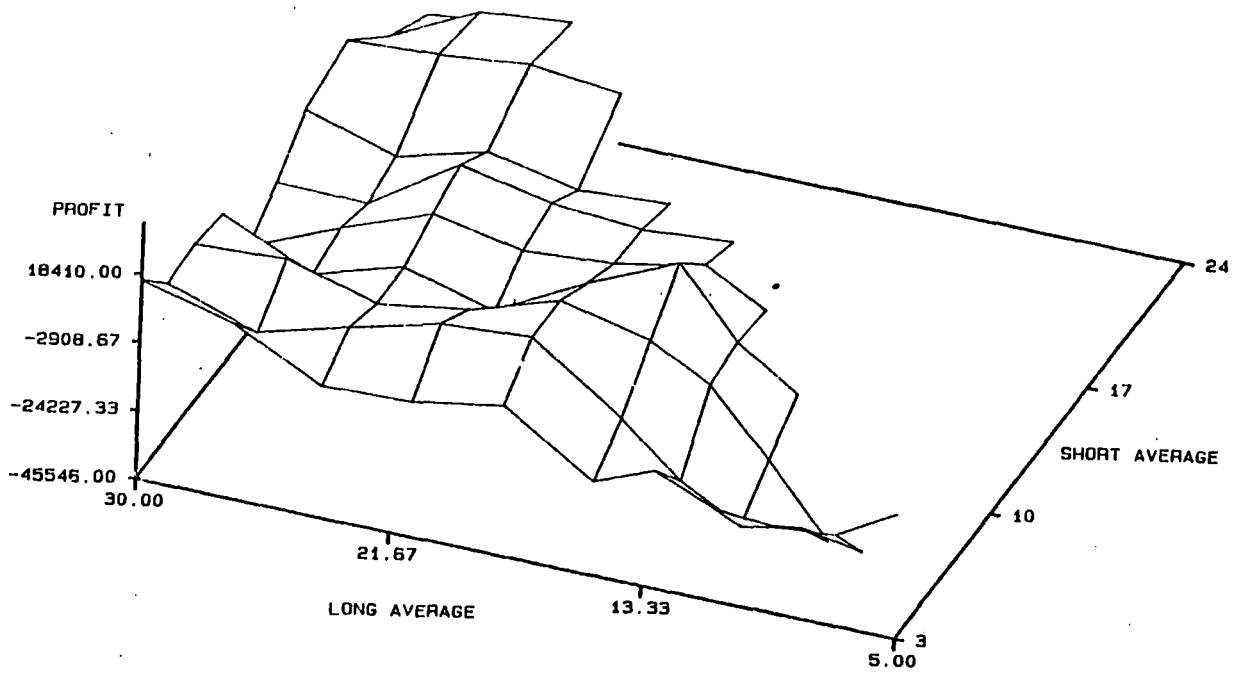

Figure 1. 1976-1982 15 Percent Open Interest Simple-Simple Averages

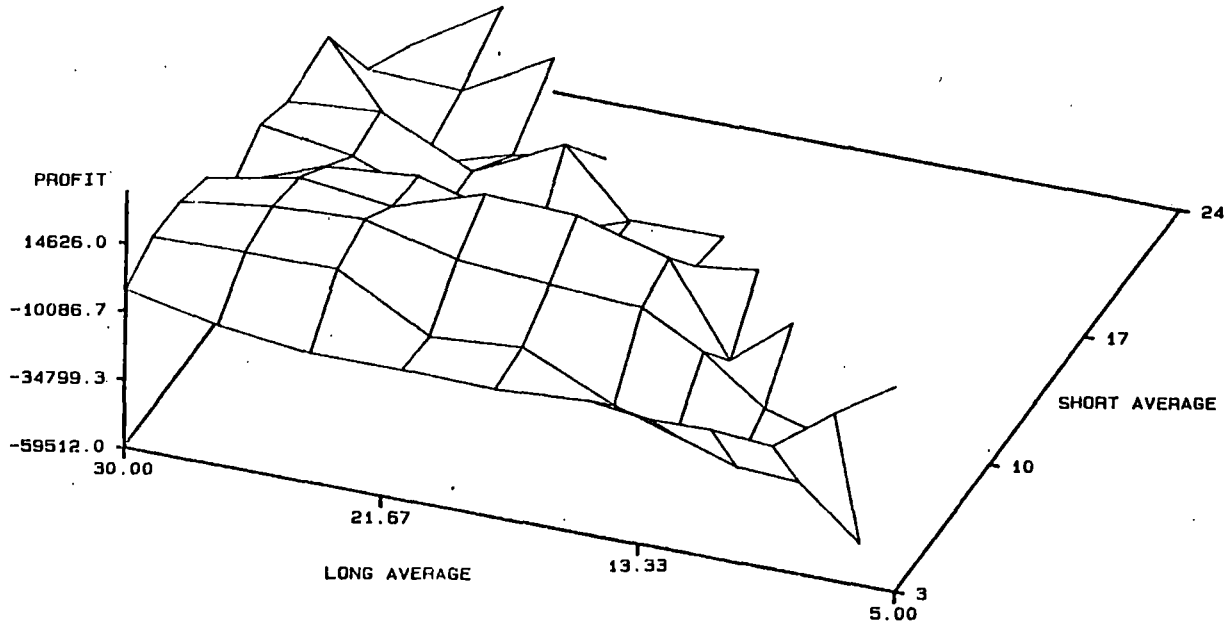

Figure 2. 1976-1982 15 Percent Open Interest Simple-Weighted Averages

average trading method. This combination yielded a profit of $12,254 for all 36 contract months tested. The simple-weighted average system (Table II) with a 15 percent open interest filter reveals only three profitable trading combinations. The most profitable was the 3 day-5 day combination with a net return of $9,302 over the time period reviewed.

Twenty-Five Percent Open Interest Filter

Tables III and IV (Figures 3 and 4) present the same moving average combinations as those for Tables I and II. The difference is that a moving average market signal was not honored in any contract until that contract month has attained a level of 25 percent of the total open interest of all live cattle contracts traded.

The simple-simple moving average system with a 25 percent open interest pre-filter (Table III) has 36 profitable combinations, substantially more than the 15 percent open interest pre-filter as shown in Table I. The most profitable combination is the 9 day-15 day simple crossover system. Trading profits more than doubled from $12,254 shown in Table I to $28,248 as shown in Table III. The only difference is the change in the open interest pre-filter from 15 to 25 percent. There are 23 more combinations of moving averages that generate profits with a 25 percent open interest pre-filter than from use of a 15 percent open interest pre-filter.

One observation to note is that the 3 day-5 day simple-weighted 15 percent open interest pre-filtered system (Table II) generated over $9,302 in trading profits. The same moving average combination with a 25 percent open interest pre-filter (Table IV) lost $4,436. This

TABLE III

1976-1982 25 PERCENT OPEN INTEREST SIMPLE-SIMPLE AVERAGES

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM
SHORT AVERAGE												
1	-117600	-50522	-54784	-44688	-31928	-16800	-8498	-4518	-13272	-110	-416	2946
3	.	-17328	-18518	-7256	-6182	2752	-6520	5202	3388	-858	6412	10990
5	.	.	-29162	-17230	-18134	-8668	-306	13806	13700	2240	-764	1828
7	.	.	.	-20606	-12440	-2380	9106	10752	7474	-474	-5062	-120
9	.	.	.	.	5402	4650	28248	6560	-5286	-3780	-2710	1298
11	.	.	.	.	.	1466	16446	2938	-128	2498	-1676	-6088
13	.	.	.	.	.	.	12130	16240	4176	8990	2120	-206
15	.	.	.	.	.	.	.	-3510	-1492	6538	4220	1094
18	.	.	.	.	.	.	.	.	10898	8782	7540	6136
21	.	.	.	.	.	.	.	.	.	4716	4676	-1754
24	.	.	.	.	.	.	.	.	.	.	-6704	-9312

TABLE IV

1976-1982 25 PERCENT OPEN INTEREST SIMPLE-WEIGHTED AVERAGES

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT AVERAGE												
1	-145034	-84376	-56326	-53262	-52888	-34394	-20226	-19510	-14118	-18988	-20208	-8582
3	.	-4436	-12000	-15596	-5486	-8054	-1772	2940	-4932	-6784	-6642	1140
5	.	.	-49962	-31070	-31204	-20408	-12640	-1914	-9976	5276	3188	4748
7	.	.	.	-28160	-27030	-806	6504	5634	4396	11182	14048	2180
9	.	.	.	.	-18028	-14334	2596	6058	2380	-784	2444	600
11	.	.	.	.	.	-19546	-11380	-7358	1558	670	132	-11574
13	.	.	.	.	.	.	-22200	-17958	-8824	-7546	750	2872
15	.	.	.	.	.	.	.	-41536	-9182	-14626	-4084	-6792
18	.	.	.	.	.	.	.	.	-28040	-35712	-30526	-222
21	.	.	.	.	.	.	.	.	.	-18682	-33378	-35436
24	.	.	.	.	.	.	.	.	.	.	-29878	-42202

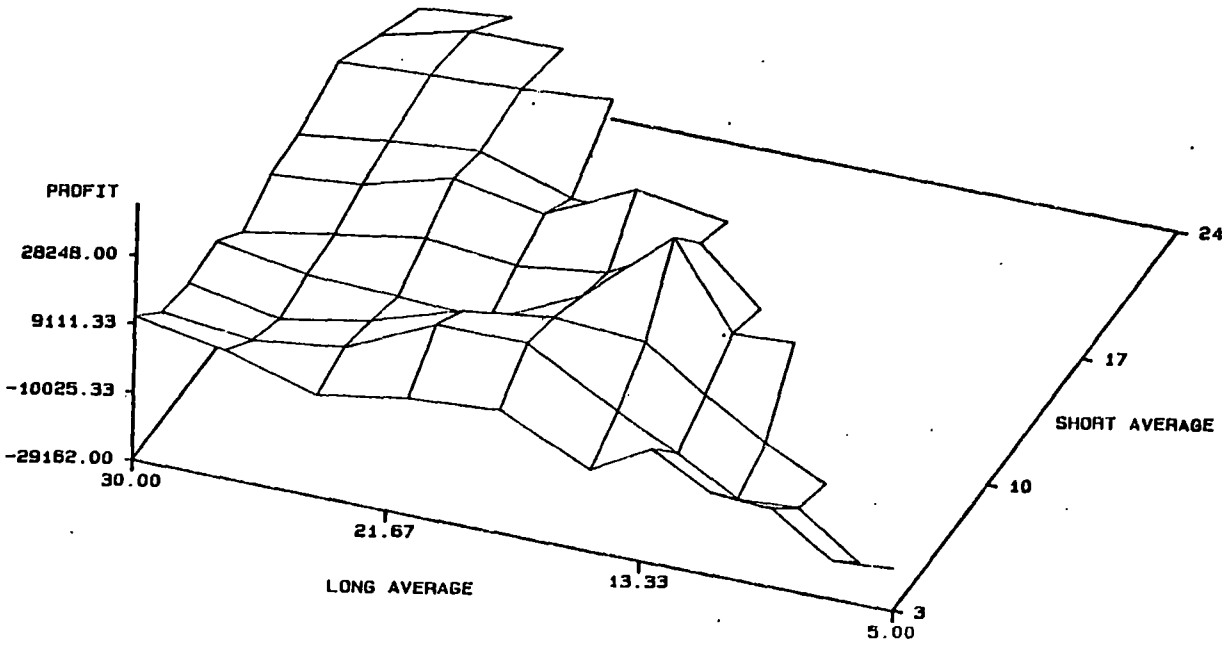

Figure 3. 1976-1982 25 Percent Open Interest Simple-Simple Averages

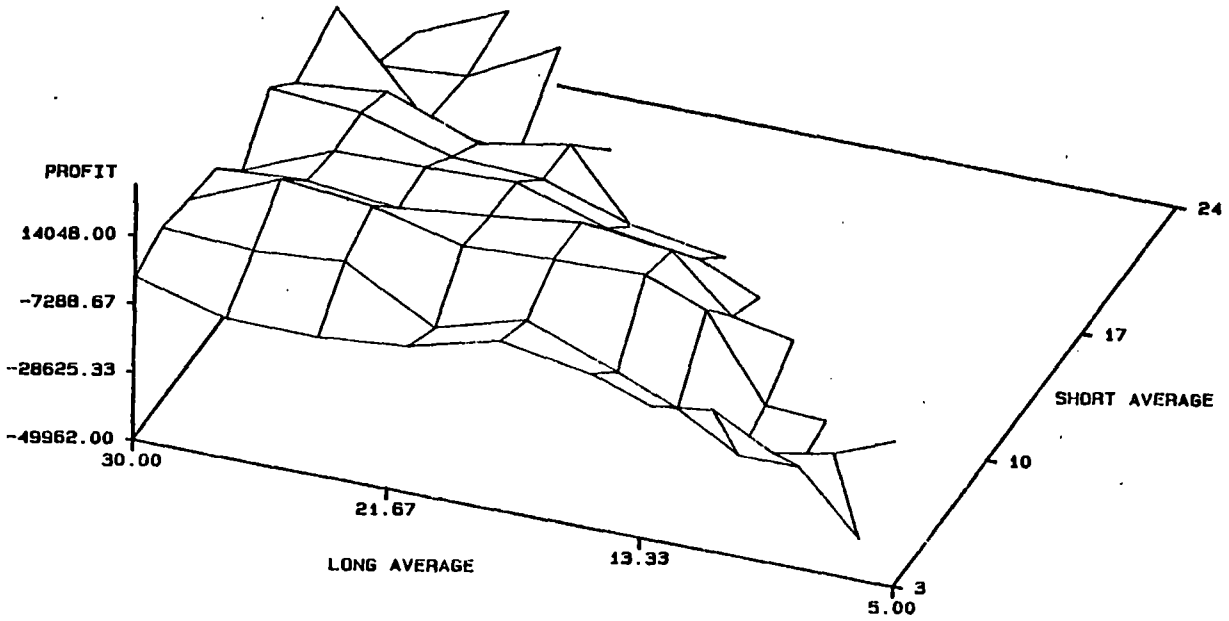

Figure 4. 1976-1982 25 Percent Open Interest Simple-Weighted Averages

indicates that this particular moving average combination generated profits early in the life of some contract months. The 15 percent filter allows trading to commence much earlier in the life of a contract than the 25 percent open interest filter.

Open Interest Filter Summary

The overall trading results of the 15 percent and 25 percent open interest filters, as applied to simple-simple and simple-linearly weighted moving averages were compared. The purpose of this step was to identify which open interest filter and which basic format for moving averages to use as a base for comparison when considering the two filters hypothesized in Chapter III.

The most profitable combination for both open interest filters observed was the 9 day-15 day simple-simple moving average.

The increase in overall profits and profitable trading combinations of the 25 percent open interest pre-filter over the 15 percent open interest pre-filter is significant. This result suggests the use of the 25 percent open interest pre-filtered simple-simple moving averages as a foundation for comparison and as a basis from which to develop other filtered moving average trading techniques.

The basis for other filtered moving average trading systems is the simple-simple moving average with a 25 percent open interest pre-filter. The remaining filtered moving average systems evaluated in this paper all comply with these basic trading rules. This reduces the number of potential combinations of systems to review, and facilitates closer inspection and further analysis of the hypothesized trading filters.

CHAPTER V

MONEY FLOW FILTERS FOR SIMPLE MOVING AVERAGES

Three combinations of simple moving averages were used to determine money flow trend. Money flow is the calculated total financial commitment to a market at the end of any days trading. The combinations of moving averages used were a 1 day-3 day, a 1 day-5 day and a 3 day-5 day simple-simple moving average. Two combinations were chosen for a specific reason. A 1 day-3 day system is fairly sensitive to changes in trend yet smoothed sufficiently to avoid numerous false signals for changes in trend direction. A 1 day-2 day was not considered as preliminary trials on data subsets proved it to be ineffective as a filter for moving averages that could increase trading profits. A 3 day-5 day simple moving average on money flow was also thoroughly reviewed. This combination is the smallest pair of adjacent odd numbers possible after that of a 1 day-3 day filter. This holds with the convention of utilization of odd numbers of observations that is common in the technical analysts trade although the primary benefit from the use of odd numbers is the ability to center averages.

The 1 day-5 day filter was used as an alternative measure of money flow trend. Results of all three filters were compared one to another and to the base as established in Chapter IV.

Tables V, VI, and VII are depicted in Figures 5, 6, and 7. The tabled information presents the financial results. Each cell of each table represents trading profits for each of the money flow filters tested. Long averages are presented across the top of each table with the short averages presented down the left side of each table.

One Day - Three Day Money Flow Filter

Table V (Figure 5) presents various combinations of simple moving average crossover systems, utilizing a 1 day-3 day money flow filter as described in Chapter III. Sell signals from crossover of the simple moving averages are honored only if the daily money flow figure is below that of the three day average of money flow. Conversely, buy signals are honored only if money flow is confirmed as rising. This confirmation is made by the daily money flow being greater than the longer term money flow average. Thirty-four of the 77 combinations presented in Table V have profitable results. Most of the highest profit combinations are contained in the window of short averages ranging from 7 to 11 days and long averages from 11 to 15 days. Profits ranging from $12,000 to $35,940 per moving average combination are all in the window of high profit trading combinations. Figure 5 reveals the extent of the surface of profitable combinations.

One Day - Five Day Money Flow Filter

Table VI (Figure 6) presents trading results for a 1 day-5 day money flow filter. This filtered moving average system is not as sensitive to changes in price direction as the 1 day-3 day money flow

TABLE V

1976-1982 SIMPLE-SIMPLE AVERAGES, 25 PERCENT OPEN INTEREST,
ONE DAY-THREE DAY MONEY FLOW PRE-FILTER

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM
SHORT AVER-AGE												
1	-61276	-49512	-38278	-43830	-33332	-17684	-10172	-1914	118	-80	-2396	4968
3	.	-27590	-30322	-15046	-14738	-4614	-7226	13982	10148	5168	-182	6642
5	.	.	-25710	512	-704	9270	10160	12034	15720	11494	1682	-6422
7	.	.	.	5114	12056	23188	34408	18722	10656	236	-11144	-3654
9	.	.	.	.	35940	18516	25908	17374	3578	-10886	-14064	-9102
11	.	.	.	.	.	20896	14946	16052	-924	-3902	-7072	-20668
13	.	.	.	.	.	.	14560	18880	7666	4366	-5204	-10466
15	.	.	.	.	.	.	.	3850	-7758	-3836	-15470	-10398
18	.	.	.	.	.	.	.	.	2832	-7854	-8412	-10976
21	.	.	.	.	.	.	.	.	.	-20072	-7186	-11906
24	.	.	.	.	.	.	.	.	.	.	-6366	-16240

TABLE VI

1976-1982 25 PERCENT OPEN INTEREST, SIMPLE-SIMPLE AVERAGES
ONE DAY-FIVE DAY MONEY FLOW PRE-FILTER

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT AVERAGE												
1	-8990	-14898	-11454	-20890	-10420	2822	6316	13118	11154	11692	12694	16298
3	.	-14538	-14290	4256	3636	1670	-4206	16018	15128	11278	11228	15012
5	.	.	-6826	7952	512	-6818	5742	20790	16596	12302	1230	6982
7	.	.	.	5444	2142	21554	18346	14436	7768	4000	-9980	-5606
9	.	.	.	.	19680	7162	16114	11304	-2710	-10530	-8388	-5802
11	.	.	.	.	.	12828	11032	8826	864	1970	628	-16068
13	.	.	.	.	.	.	2962	25028	6370	7878	-8984	-10342
15	.	.	.	.	.	.	.	13558	-1538	-2576	-11646	-8842
18	.	.	.	.	.	.	.	.	-1032	-7064	-3652	438
21	.	.	.	.	.	.	.	.	.	-1918	3190	-8252
24	.	.	.	.	.	.	.	.	.	.	5946	-8708

TABLE VII

1976-1982 25 PERCENT OPEN INTEREST SIMPLE-SIMPLE AVERAGES
THREE DAY-FIVE DAY MONEY FLOW PRE-FILTER

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT AVER-AGE												
1	-2944	-15536	-25518	-28350	-11774	-2436	-1522	4660	4030	5100	-0	3096
3	.	-18770	-24422	-2562	750	3090	-2338	13076	11938	7374	-1806	5816
5	.	.	-15592	2152	-2742	-6578	542	11276	12354	5874	366	388
7	.	.	.	-5184	-3542	-380	-3810	7292	508	4990	-3512	-2806
9	.	.	.	.	-7128	126	5528	-1410	-4306	-6232	-6288	-7670
11	.	.	.	.	.	13072	5094	-2142	-614	1720	-4680	-15986
13	.	.	.	.	.	.	-6128	6146	-3364	-1398	-8866	-12122
15	.	.	.	.	.	.	.	13504	-4166	-9840	-15754	-12012
18	.	.	.	.	.	.	.	.	-3916	-10408	-8406	-3988
21	.	.	.	.	.	.	.	.	.	-8136	-1648	-7962
24	.	.	.	.	.	.	.	.	.	.	-1288	-11284

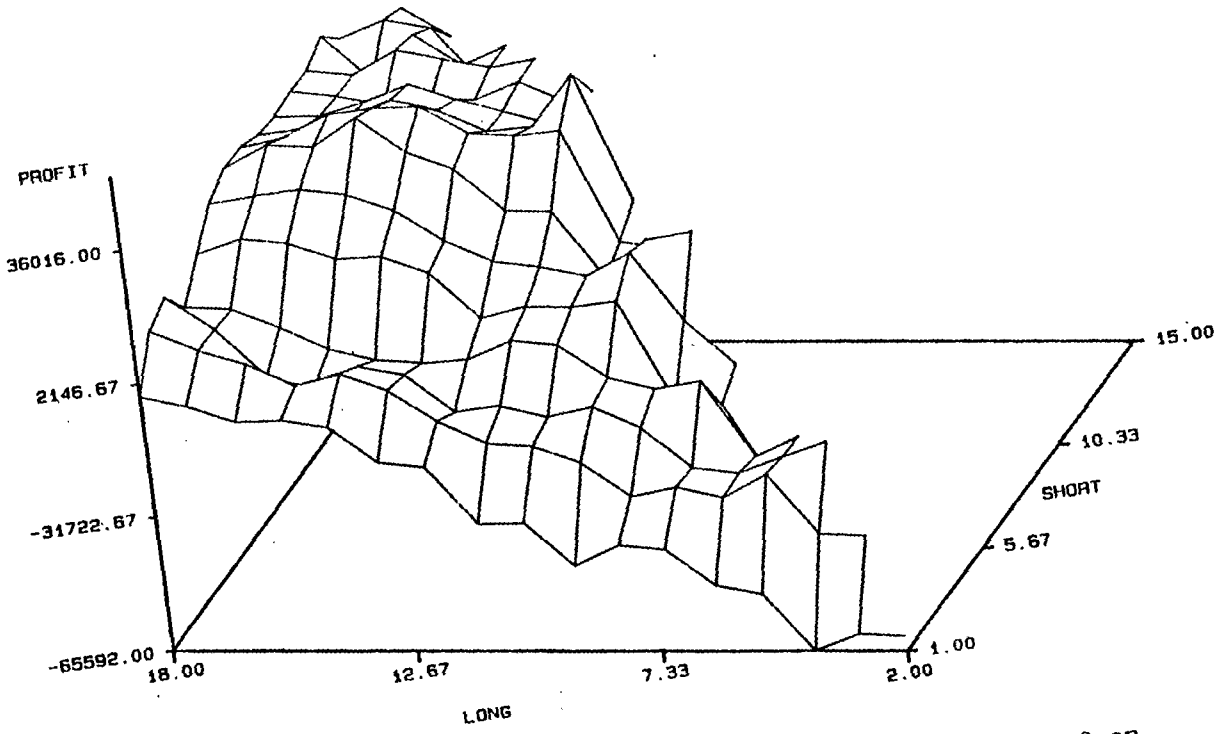

Figure 5. 1976-1982 Simple-Simple Averages, 25 Percent Open Interest, One Day-Three Day Money Flow Pre-Filter

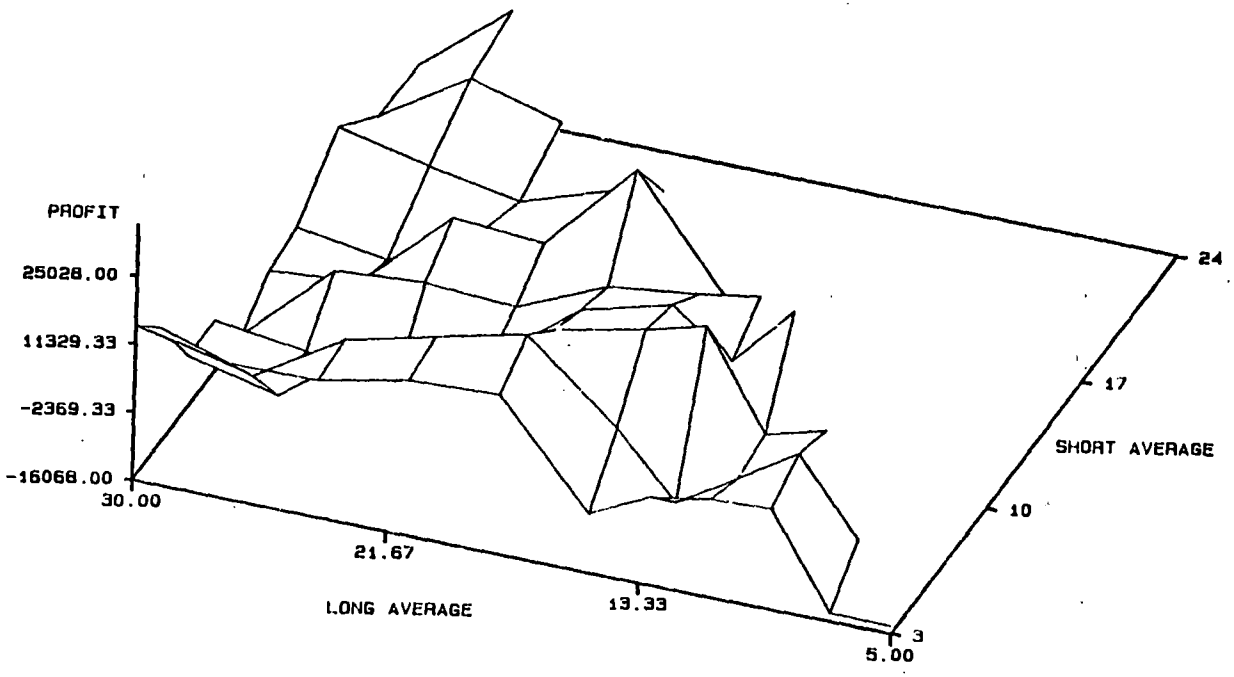

Figure 6. 1976-1982 25 Percent Open Interest Simple-Simple Averages, One Day-Five Day Money Flow Pre-Filter

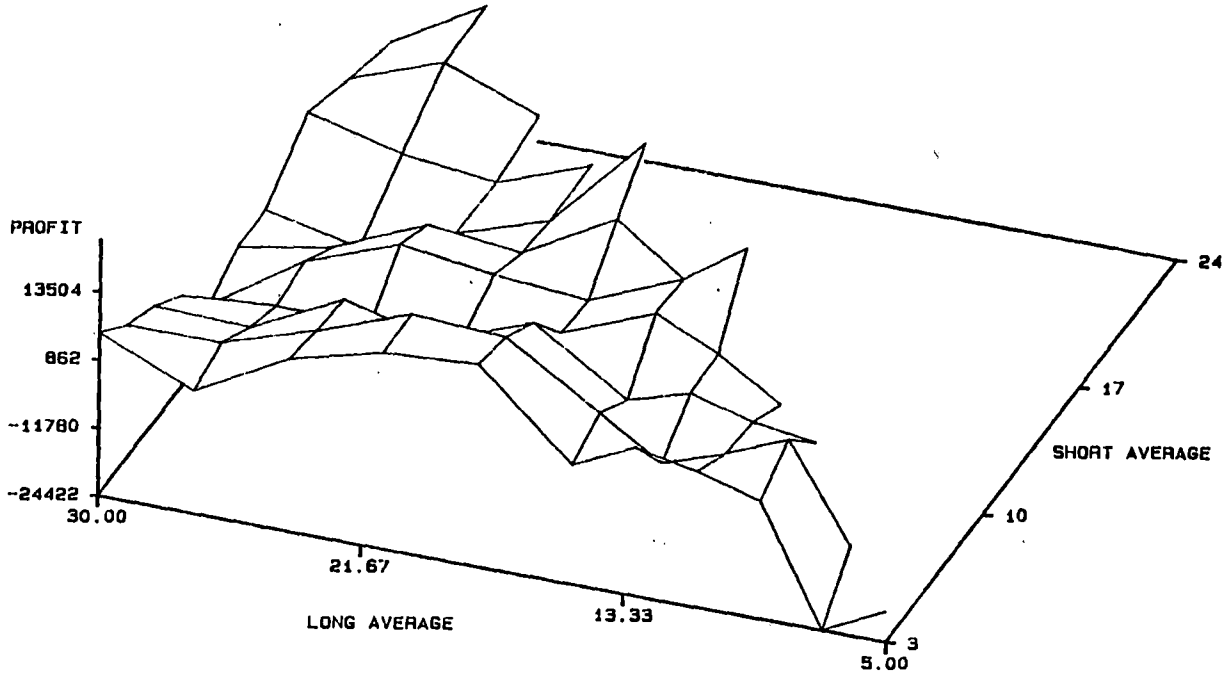

Figure 7. 1976-1982 25 Percent Open Interest Simple-Simple Averages, Three Day-Five Day Money Flow Pre-Filter

filter. The single value of money flow crosses the five day average less often than it crosses the three day average. It also crosses later in a trend than the more sensitive 1 day-3 day filter. Thus potential changes in trading position following the 1 day-3 day filter are more numerous and are signaled nearer the change of price direction than the 1 day-5 day money flow filter. Review of Tables V and VI, or inspection of Figures 5 and 6 reveal that the 1 day-5 day money flow filter offers more combinations of profitable moving averages (46) than does the 1 day-3 day filter (34). However, the overall profits of the two systems are reversed. The 1 day-3 day money flow filter presents several combinations of averages that gained profits in excess of $23,000. The 1 day-5 day filter has only three combinations that gained over $20,000. These were the 7 day-13 day average with a profit of $21,554, the 13 day-18 day with a profit of $25,028 and the 5 day-18 day with a profit of $20,790.

Three Day - Five Day Money Flow Filter

Table VII (Figure 7) summarizes the profitability of the array of 77 simple moving average combinations with a 3 day-5 day money flow filter. The important results of this method are that smaller profits are generated for fewer moving average combinations than those previously reviewed. Only 26 of the possible combinations are profitable. A window of high profit combinations is observed for short averages ranging from three to five days and long averages ranging from 18 to 21 days. The most profitable combination is that of the 15 day-18 day average. This profit figure is $13,504. The second most profitable simple moving average crossover system with a 3

day-5 day money flow pre-filter are those of a three day short average and an 18 day long average and the 11 day-13 day combination. These combinations of filtered averages yielded profits of $13,076 and $13,072, respectively, over the period investigated.

Comparison of Table III and Table V leads to the general conclusion that the consideration of money flow in conjunction with the price trend will increase the long term profitability of a multiple hedge trading system.

The 7 day-15 day moving average with a 1 day-3 day money flow and a 25 percent open interest filter had a gain of $34,408 over the base period of data used. This is substantially more than the $9,106 profit for the unfiltered moving average combination.

The 9 day-15 day moving average filtered with a 1 day-3 day money flow accumulated a profit of $25,908. This is less than the $28,248 for the same moving average without a money flow filter.

Comparison of Tables III and V, and Figures 3 and 5 reveals that as the plane of profits rises, losses diminish. Maximum losses decrease from $117,000 to $61,278. The 1 day-5 day filtered averages presented in Table VI and Figure 6 is a more dramatic presentation of this fact. The largest loss if $14,898. Fifty of the filtered moving average combinations were profitable with only 27 losing combinations.

Money Flow Filter Summary

Inspection and review of the individual moving average combinations that utilize a money flow pre-filter, as discussed in Chapter III, indicates that consideration of money flow did increase the profits of a moving average multiple hedge technique. The

filtered averages yielded higher profits for more combinations of moving averages than the established base of moving averages established for comparison. These results can be observed by comparison of Table III and Table V. Graphical inspection of the same data is presented in Figure 3 and Figure 5.

The 1 day-3 day money flow filter produced the greatest profit over more of the possible moving average combinations investigated than any other moving average combination.

CHAPTER VI

AGGREGATE PRICE FILTERS FOR SIMPLE MOVING AVERAGES

The second pre-filter technique evaluated was that of trading with the trend of the market. The market is identified in Chapter III as an open interest weighted or aggregate price (AP). The trading rules for use of a market trend direction pre-filter for moving averages are as follows: sell signals generated by the crossing of a long moving average by a shorter average are honored only if the short term open interest weighted price or AP value is less than the longer term average of AP. Buy signals from the crossing of two moving averages are honored only if the trend in AP is determined to be rising. This determination is made by a requirement that short term average of AP exceed the long term average.

The various AP pre-filters for simple moving average crossover systems are presented in Tables VIII, IX and X. The same results are presented in three-dimensional graphs in Figures 8, 9, and 10.

One Day - Three Day AP Filter

Table VIII and Figure 8 present the results of a simple moving average crossover system with a 1 day-3 day AP pre-filter. The highest returns within the various combinations of moving averages are those of the 7 day-15 day and 7 day-13 day combinations. The respective profits of these two combinations are $25,630 and $24,892.

TABLE VIII

1976-1982 25 PERCENT OPEN INTEREST SIMPLE-SIMPLE AVERAGES
ONE DAY-THREE DAY AGGREGATE PRICE PRE-FILTER

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM	PROFIT SUM
SHORT AVERAGE												
1	-99848	-41536	-33538	-33228	-23376	-5636	-456	3328	-7250	12568	6240	9974
3	.	-3976	-9054	1804	-6816	4040	6892	7028	2514	4146	11224	1530
5	.	.	-11520	3354	-1152	13938	15664	17176	11180	1350	566	5368
7	.	.	.	956	10930	24892	25630	14872	9984	3370	-148	-2844
9	.	.	.	.	14520	12578	11196	20414	10414	-5164	-2546	-5370
11	.	.	.	.	.	22388	23146	17042	8668	1220	5900	-9576
13	.	.	.	.	.	.	13600	9188	5424	15564	4296	890
15	.	.	.	.	.	.	.	-788	6400	-270	-2446	-1166
18	.	.	.	.	.	.	.	.	6148	2724	-2184	-556
21	.	.	.	.	.	.	.	.	.	-15048	-5550	-9090
24	.	.	.	.	.	.	.	.	.	.	-10358	-14540

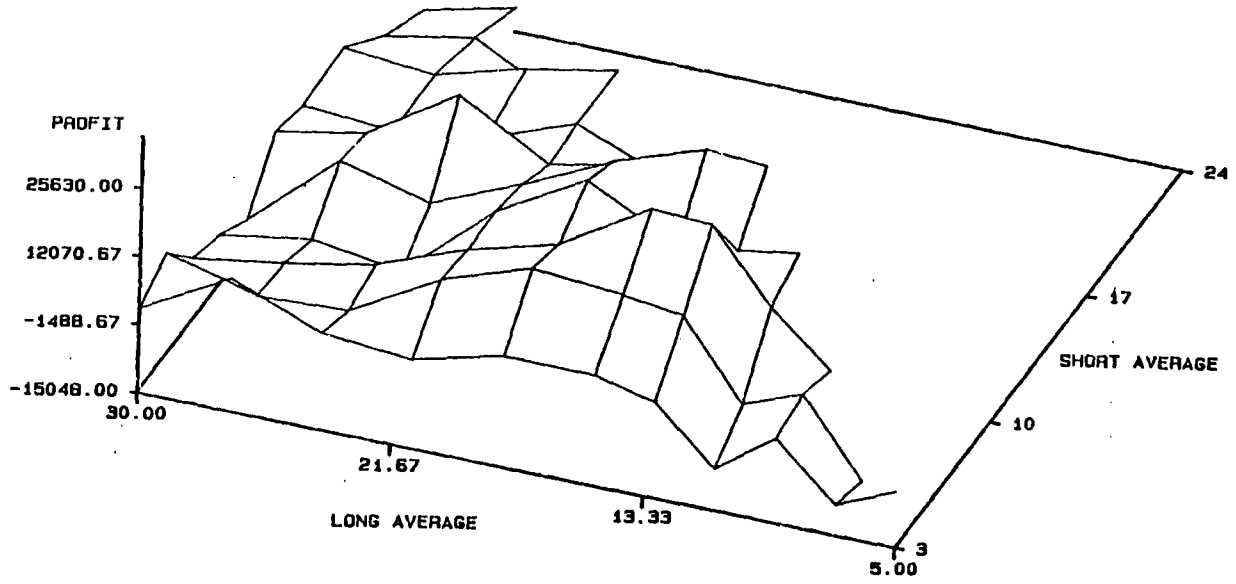

Figure 8. 1976-1982 25 Percent Open Interest Simple-Simple Averages, One Day-Three Day Aggregate Price Pre-Filter

Note that the number of possible combinations which are profitable increases significantly with the introduction of an AP pre-filter when comparing Table VIII to Table III. In Table III (simple-simple averages with no pre-filter), only 34 of the possible trading combinations are profitable over the population of 77 trading combinations reviewed. Table VIII, representing the AP (open interest weighted-price) pre-filter for the same simple moving average techniques, presents 47 of 77 possible combinations as profitable.

One Day - Five Day AP Filter

Table IX and Figure 9 present 56 profitable moving average combinations utilizing the 1 day-5 day AP as a pre-filter trading signal. The 11 day-13 day average returns a maximum of $32,084 over the time period investigated. Rarely does a trader use a combination of averages that are so little different in proportion to one another as these averages. Several of the combinations return over $17,000. The 7 day-13 day average contributed the second highest return of $20,468.

Three Day - Five Day AP Filter

Table X and Figure 10 present the results of a 3 day-5 day open interest weighted price filter. Fifty-eight of the possible combinations of simple moving averages have profitable returns. Two trading combinations provided a yield greater than $34,000 and 7 combinations return over $20,000. The 9 day-15 day average generates a trading profit of $34,912.

TABLE IX

1976-1982 25 PERCENT OPEN INTEREST SIMPLE-SIMPLE AVERAGES
ONE DAY-FIVE DAY AGGREGATE PRICE PRE-FILTER

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT AVER-AGE												
1	-58562	-45970	-32256	-32240	-23172	-4200	5240	4416	-2614	17292	8196	19018
3	.	-3808	-10138	-640	-512	5412	1340	11008	4646	-374	9002	15286
5	.	.	-13768	2722	-6242	2040	10692	17288	15584	7584	1690	2296
7	.	.	.	-4338	4678	20468	17586	12156	8478	5570	1056	5058
9	.	.	.	.	18076	7842	17184	12106	2710	-2934	914	3922
11	.	.	.	.	.	32084	20154	14968	10220	5734	6220	-1506
13	.	.	.	.	.	.	5646	11330	10886	20086	9780	3266
15	.	.	.	.	.	.	.	5576	14092	8820	7808	1526
18	.	.	.	.	.	.	.	.	17426	7776	6328	2764
21	.	.	.	.	.	.	.	.	.	-2272	2218	-11390
24	.	.	.	.	.	.	.	.	.	.	-5162	-13936

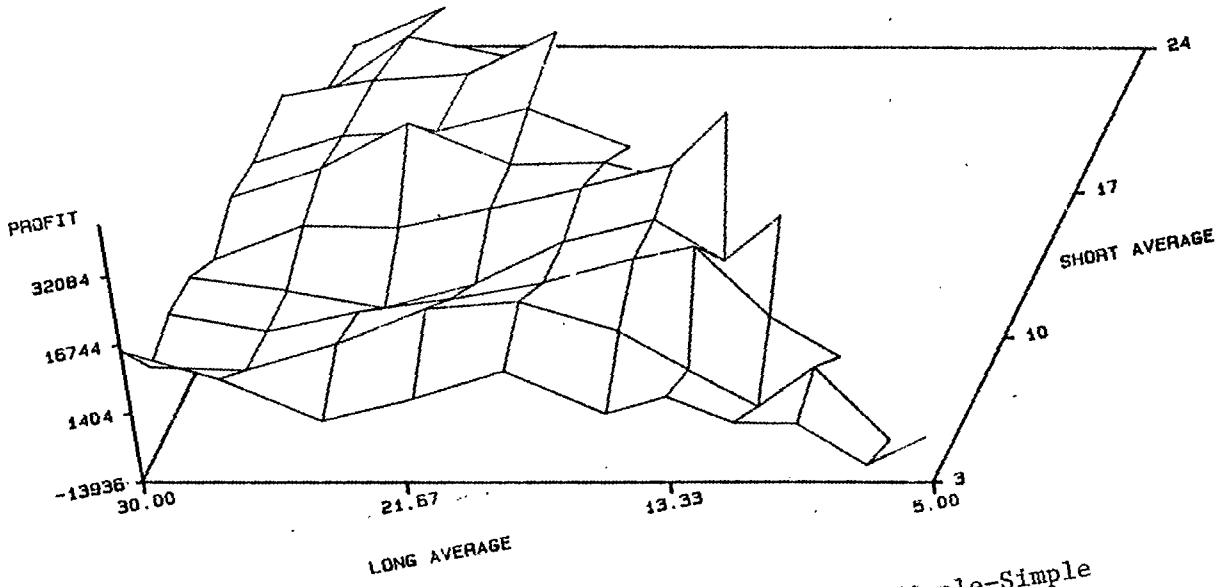

Figure 9. 1976-1982 25 Percent Open Interest Simple-Simple Averages, One Day-Five Day Aggregate Price Pre-Filter

TABLE X

1976-1982 25 PERCENT OPEN INTEREST SIMPLE-SIMPLE AVERAGES
THREE DAY-FIVE DAY AGGREGATE PRICE PRE-FILTER

	LONG AVERAGE											
	3	5	7	9	11	13	15	18	21	24	27	30
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT AVER-AGE												
1	-846	1420	-3492	-15826	-2398	7888	11028	7584	1846	16060	12574	21872
3	.	-6352	-10840	2972	-948	3944	1646	4028	10658	-360	11540	16026
5	.	.	-5636	-2560	-7492	-1504	7120	20202	14494	9434	8660	4814
7	.	.	.	-1054	6510	17082	21904	17504	9336	12866	3528	3326
9	.	.	.	.	17564	15164	34912	16092	7652	1968	1038	2100
11	.	.	.	.	.	34248	27076	24280	13584	-64	3306	-4314
13	.	.	.	.	.	.	17836	15362	6302	12822	9914	4658
15	.	.	.	.	.	.	.	10144	10460	12190	7356	-722
18	.	.	.	.	.	.	.	.	18700	12172	8438	1382
21	.	.	.	.	.	.	.	.	.	4902	1144	-6906
24	.	.	.	.	.	.	.	.	.	.	-2146	-10660

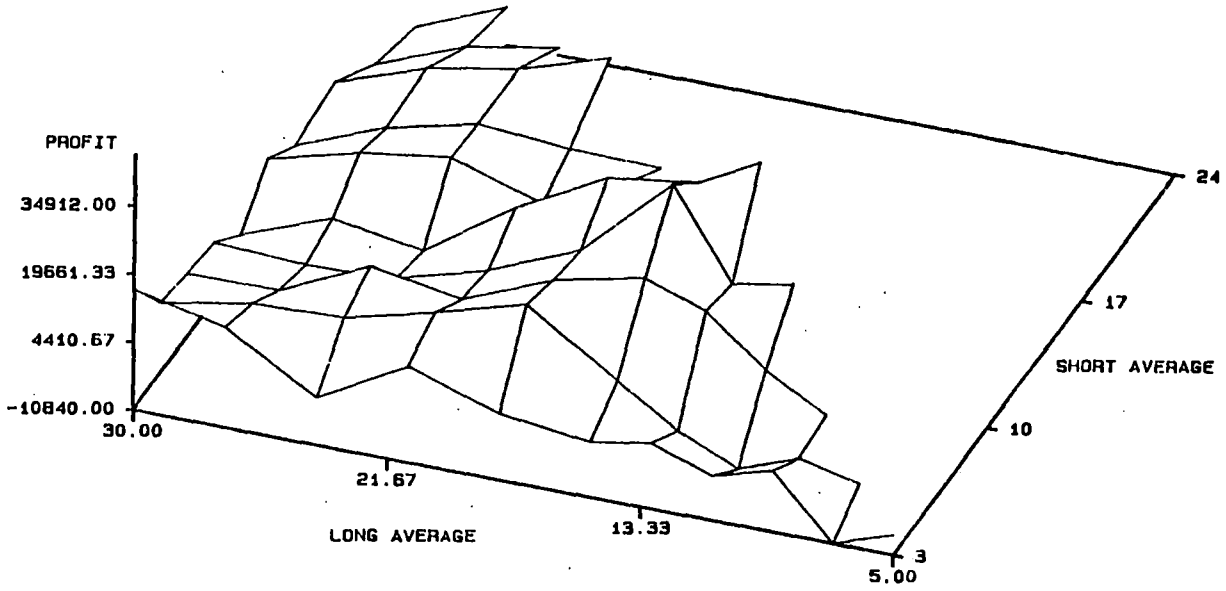

Figure 10. 1976-1982 25 Percent Open Interest Simple-Simple Averages, Three Day-Five Day Aggregate Price Pre-Filter

Note that the largest loss for the 3 day-5 day aggregate price filter is $15,826. Application of this filter reduces losses (including commissions) substantially. This is readily observed by comparison of Tables III and X or Figures 3 and 10.

Aggregate Price Filter Summary

The proposed aggregate price or open interest weighted price presented in Chapter III was investigated. The aggregate price is calculated on a daily basis and was intended to provide a representative price of the market for live cattle futures contracts. The aggregate price discounts the value of current information relating to cattle. Aggregate price is considered to discount all factors of anticipated supply and demand as interpreted by various traders and market observers. Any misalignment between reflected current contract prices and a rationally anticipated price equilibrium will eventually be adjusted by the process of arbitrage.

Trading techniques employed with the aggregate price filter were the same as those of the money flow filter. Positions in the futures market were taken only when the direction of trend in closing price was the same as that of the aggregate or open interest weighted price. Three combinations of moving averages of the aggregate price were applied as filters. Each filter was tested on a total of 101 combinations of closing price moving averages.

The inclusion of AP (open interest-weighted prices) as a pre-filter increased the profits of simple moving average trading techniques. The filtered averages yielded higher profits smaller

losses and more profitable combinations of averages investigated than did the unfiltered simple moving average technique. The 1 day-3 day and 3 day-5 day AP pre-filters were the most profitable of the three AP filters.

CHAPTER VII

FURTHER ANALYSIS OF SELECTED FILTERED MOVING AVERAGE TRADING TECHNIQUES

One Day - Three Day Money Flow Filter

A majority of the most profitable moving average combinations reviewed were combinations of a seven or nine day short average with a 13 or 15 day long average. This holds for most combinations of moving averages of the money flow filters. This window of profitable moving averages merits further analysis. Initially a wide range of averages had to be considered to ensure the most profitable trend following system for a hedger was isolated. Consideration of time and computational cost constraints required initial analyses of only some of the many possible moving average combinations. Seventy-seven of 720 combinations possible were initially reviewed, when considering all combinations of short averages up to 24 days coupled with all long averages up to 30 days. Profits (losses) from the selected moving average combinations were determined for both the money flow and aggregate price filters.

The 1 day-3 day money flow filter produced both higher profits and more profitable combinations than the unfiltered moving average methods reviewed and presented in Table III. For this reason the 1 day-3 day money flow was selected for further analysis. Table XI presents trading results from 1977 through 1983 with a 25 percent open

TABLE XI

SIMPLE-SIMPLE MOVING AVERAGES, 25 PERCENT OPEN INTEREST
ONE DAY-THREE DAY MONEY FLOW FILTER

	LONG*AVERAGE											
	11				12				13			
	PROFIT				PROFIT				PROFIT			
	N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
SHORT*AVERAGE												
6	227	2374	10	1002	208	7332	35	1067	196	8864	45	1153
7	226	12744	56	1006	220	9572	44	1020	201	18638	93	1149
8	235	23146	98	976	219	21134	97	1041	206	23708	115	1144
9	247	30190	122	954	238	19328	81	988	213	17494	82	1108
10	266	19664	74	933	232	13612	59	1015	221	18418	83	1110

	LONG*AVERAGE											
	14				15				16			
	PROFIT				PROFIT				PROFIT			
	N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
SHORT*AVERAGE												
6	195	15298	78	1192	181	18038	100	1187	174	20340	117	1206
7	199	23094	116	1187	183	34086	186	1241	180	26756	149	1192
8	201	28078	140	1170	196	27616	141	1192	181	28990	160	1238
9	206	22984	112	1136	193	25422	132	1187	180	23224	129	1225
10	203	19966	98	1167	188	24040	128	1247	188	19364	103	1233

interest filter, using simple-simple moving averages, utilizing a 1 day-3 day money flow pre-filter as discussed. Note that the table considers all combinations of short averages ranging from 6 to 10 days and long averages ranging from 11 to 16 days. This window of combinations considers 30 moving average combinations, of which only six are included in the previous tables.

The 1 day-3 day filter produces only positive returns for all combinations of moving averages reviewed. The 1 day-3 day money flow pre-filter produced profit of $34,086 for the 7 day-15 day moving average combination, with an average profit per trade of $183. The total profit for the 9 day-11 day average is nearly $30,190 from 247 trades.

Table XII presents the results of a 1 day-3 day money flow pre-filter for combinations of moving averages of less than 10 days. This step in the analysis was completed to certify that the most profitable combinations for this particular pre-filter were found. None of the combinations with long averages of seven days or less were profitable. The most profitable moving average combination was the 6 day-9 day, with a net profit of $7,412.

The 7 day-15 day simple-simple moving average with a 1 day-3 day money flow pre-filter generated the highest profits of any of the money flow filtered moving average combinations. This filtered moving average merits closer inspection for equity accumulation, length of run of loss, and buy and sell profits. An analysis of monthly performance was also completed.

TABLE XII

SHORT TERM SIMPLE-SIMPLE MOVING AVERAGES, 25 PERCENT
OPEN INTEREST, ONE DAY-THREE DAY MONEY FLOW FILTER

	LONG							
	2	3	4	5	6	7	8	9
	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT	PROFIT
	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM
SHORT								
1	-61872	-61276	-65592	-51188	-49026	-39854	-38638	-44030
2	.	-42132	-41566	-26382	-32412	-29668	-32092	-23556
3	.	.	-23616	-27590	-31874	-30322	-20324	-15046
4	.	.	.	-28038	-33072	-13920	-15942	-13094
5	.	.	.	.	-46978	-25710	-25062	512
6	.	.	.	.	.	-20984	-9848	7412
7	.	.	.	.	.	.	7212	5114
8	.	.	.	.	.	.	.	-2874
9	.	.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.
11	.	.	.	.	.	.	.	.
12	.	.	.	.	.	.	.	.
13	.	.	.	.	.	.	.	.
14	.	.	.	.	.	.	.	.
15	.	.	.	.	.	.	.	.

Detailed Analyses of the 7 Day-15 Day Simple Moving Average Combination With a 1 Day-3 Day Money Flow Pre-Filter, Contract Years 1977-1983

One of the criteria that must be considered by any trader in live cattle futures contracts is that of capital drawdown by the trading system employed. The system employing the 7 day-15 day simple moving average with a 1 day-3 day money flow filter generated the most consistent trading profits of any of the various money flow filters investigated. This particular technical trading system was analyzed for the 1976 to 1982 period in a previous section of this chapter. This chapter section evaluates the system performance of all contracts by contract month and by position (long or short) for the period of 1977 through 1983. The year 1983 is then considered a post-period application of the trading method.

Table XIII (Figure 11) presents every trade executed from 1977 through 1983 following the 7 day-15 day moving average with a 1 day- 3 day money flow filter trade signal technique as described in Chapter III and reported in earlier in Chapter IV. The contract month, year and date of the trade, position, exit and entry prices are presented. The individual closed trade profits and cumulative trading profits are displayed in the last columns of Table XIV. The first trade shown for each new contract month is actually the date that the contract attained 25 percent of the total open interest. The next trading signal generated after this date was honored.

The results of Table XIII are important as they approximate the multiple hedge positions that would be taken by a cattle feeder who

TABLE XIII

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE-FILTER ALL TRADES IN ALL CONTRACT MONTHS

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
10/11/76	2	77	SOLD	41.90	0.00	0	0
11/01/76	2	77	BOUGHT	39.60	41.90	-970	-970
12/02/76	2	77	SOLD	41.55	39.60	-830	-1800
12/07/76	8	77	SOLD	42.75	0.00	0	-1800
12/20/76	2	77	BOUGHT	40.15	41.55	-610	-2410
12/20/76	4	77	BOUGHT	39.35	0.00	0	-2410
12/29/76	4	77	SOLD	39.90	39.35	-270	-2680
12/30/76	2	77	SOLD	40.35	40.15	-130	-2810
01/06/77	2	77	BOUGHT	38.35	40.35	-850	-3660
01/07/77	4	77	BOUGHT	38.37	39.90	-662	-4322
01/10/77	8	77	BOUGHT	42.00	42.75	-350	-4672
01/25/77	4	77	SOLD	39.00	38.37	-302	-4974
01/25/77	8	77	SOLD	42.80	42.00	-370	-5344
01/26/77	2	77	SOLD	37.80	38.35	170	-5174
02/09/77	8	77	BOUGHT	42.15	42.80	-310	-5484
02/11/77	4	77	BOUGHT	39.25	39.00	50	-5434
02/11/77	6	77	BOUGHT	41.50	0.00	0	-5434
02/18/77	2	77	BOUGHT	38.95	37.80	410	-5024
03/10/77	4	77	SOLD	38.65	39.25	190	-4834
03/10/77	6	77	SOLD	41.05	41.50	130	-4704
03/10/77	8	77	SOLD	42.00	42.15	10	-4694
03/29/77	4	77	BOUGHT	38.42	38.65	-142	-4836
04/01/77	6	77	BOUGHT	41.42	41.05	98	-4738
04/01/77	8	77	BOUGHT	42.40	42.00	110	-4628
04/07/77	8	77	SOLD	43.35	42.40	-430	-5058
04/11/77	6	77	SOLD	43.75	41.42	-982	-6040
04/12/77	4	77	SOLD	40.10	38.42	-722	-6762
05/04/77	8	77	BOUGHT	43.90	43.35	170	-6592
05/10/77	6	77	BOUGHT	44.25	43.75	150	-6442
06/20/77	6	77	SOLD	39.90	44.25	1690	-4752
06/27/77	8	77	SOLD	42.60	43.90	470	-4282
06/27/77	10	77	SOLD	40.85	0.00	0	-4282
07/13/77	8	77	BOUGHT	40.30	42.60	-970	-5252
07/13/77	10	77	BOUGHT	39.10	40.85	-750	-6002
08/19/77	8	77	SOLD	41.20	40.30	-410	-6412
08/26/77	10	77	SOLD	39.10	39.10	-50	-6462
09/01/77	12	77	SOLD	38.15	0.00	0	-6462
10/14/77	12	77	BOUGHT	40.32	38.15	818	-5644
10/20/77	10	77	BOUGHT	42.50	39.10	1310	-4334
10/24/77	12	77	SOLD	41.95	40.32	-702	-5036
10/26/77	2	78	SOLD	39.35	0.00	0	-5036
11/07/77	12	77	BOUGHT	40.45	41.95	-650	-5686
11/08/77	2	78	BOUGHT	38.50	39.35	-390	-6076
11/18/77	12	77	SOLD	41.95	40.45	-650	-6726
11/21/77	2	78	SOLD	39.90	38.50	-610	-7336
12/20/77	12	77	BOUGHT	43.62	41.95	618	-6718
01/11/78	2	78	BOUGHT	41.40	39.90	550	-6168
01/23/78	2	78	SOLD	42.05	41.40	-310	-6478
01/25/78	4	78	SOLD	42.25	0.00	0	-6478
02/17/78	2	78	BOUGHT	46.65	42.05	1790	-4688
04/11/78	4	78	BOUGHT	53.60	42.25	4490	-198
04/11/78	6	78	BOUGHT	52.20	0.00	0	-198
04/13/78	6	78	SOLD	52.25	52.20	-70	-268
06/07/78	6	78	BOUGHT	59.10	52.25	2690	2422
06/07/78	8	78	BOUGHT	56.75	0.00	0	2422
07/10/78	8	78	SOLD	52.75	56.75	1550	3972
07/27/78	8	78	BOUGHT	54.10	52.75	490	4462
07/28/78	8	78	SOLD	52.77	54.10	482	4944
08/08/78	8	78	BOUGHT	51.90	52.77	-398	4546
08/23/78	10	78	SOLD	51.35	0.00	0	4546
08/23/78	12	78	SOLD	53.12	0.00	0	4546
09/26/78	10	78	BOUGHT	54.60	51.35	1250	5796

TABLE XIII(Continued)

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE	CUMULATIVE PROFIT
09/26/78	12	78	BOUGHT	55.90	53.12	1062	6858
10/05/78	2	79	SOLD	59.15	0.00	0	6858
10/05/78	12	78	SOLD	58.97	55.90	-1278	5580
10/06/78	10	78	SOLD	57.30	54.60	-1130	4450
10/17/78	2	79	BOUGHT	56.50	59.15	-1110	3340
10/17/78	12	78	BOUGHT	55.75	58.97	-1338	2002
11/06/78	2	79	SOLD	55.20	56.50	470	2472
11/13/78	12	78	SOLD	53.70	55.75	770	3242
12/12/78	12	78	BOUGHT	56.80	53.70	1190	4432
12/28/78	2	79	BOUGHT	58.70	55.20	1350	5782
12/28/78	4	79	BOUGHT	60.80	0.00	0	5782
01/08/79	2	79	SOLD	61.70	58.70	-1250	4532
01/08/79	4	79	SOLD	64.70	60.80	-1610	2922
02/14/79	4	79	BOUGHT	66.30	64.70	590	3512
02/16/79	4	79	SOLD	67.05	66.30	-350	3162
02/16/79	6	79	SOLD	68.60	0.00	0	3162
02/20/79	2	79	BOUGHT	67.10	61.70	2110	5272
04/03/79	4	79	BOUGHT	73.25	67.05	2430	7702
04/03/79	6	79	BOUGHT	71.90	68.60	1270	8972
04/16/79	6	79	SOLD	76.70	71.90	-1970	7002
05/08/79	6	79	BOUGHT	75.00	76.70	-730	6272
05/08/79	8	79	BOUGHT	73.25	0.00	0	6272
06/18/79	8	79	SOLD	67.50	73.25	2250	8522
06/19/79	6	79	SOLD	71.15	75.00	1490	10012
06/21/79	8	79	BOUGHT	66.00	67.50	-650	9362
07/09/79	8	79	SOLD	67.75	66.00	-750	8612
07/20/79	10	79	BOUGHT	64.25	0.00	0	8612
07/23/79	8	79	BOUGHT	65.00	67.75	-1150	7462
08/15/79	10	79	SOLD	63.00	64.25	450	7912
08/15/79	12	79	SOLD	65.40	0.00	0	7912
08/16/79	8	79	SOLD	63.75	65.00	450	8362
10/03/79	10	79	BOUGHT	69.17	63.00	2418	10780
10/03/79	12	79	BOUGHT	72.40	65.40	2750	13530
10/26/79	2	80	SOLD	70.40	0.00	0	13530
11/07/79	12	79	SOLD	69.25	72.40	1210	14740
11/29/79	12	79	BOUGHT	67.00	69.25	-950	13790
12/04/79	2	80	BOUGHT	71.70	70.40	470	14260
12/18/79	12	79	SOLD	68.77	67.00	-758	13502
12/27/79	2	80	SOLD	71.40	71.70	70	13572
12/27/79	4	80	SOLD	73.50	0.00	0	13572
01/08/80	2	80	BOUGHT	68.00	71.40	-1410	12162
01/08/80	4	80	BOUGHT	69.97	73.50	-1462	10700
02/01/80	4	80	SOLD	68.75	69.97	438	11138
02/04/80	2	80	SOLD	65.47	68.00	962	12100
02/25/80	6	80	BOUGHT	71.90	0.00	0	12100
03/03/80	4	80	BOUGHT	69.00	68.75	50	12150
04/15/80	4	80	SOLD	65.00	69.00	1550	13700
04/18/80	6	80	SOLD	64.05	71.90	3090	16790
05/05/80	8	80	BOUGHT	62.60	0.00	0	16790
05/13/80	6	80	BOUGHT	67.00	64.05	1130	17920
05/15/80	6	80	SOLD	64.82	67.00	822	18742
05/15/80	8	80	SOLD	65.02	62.60	-1018	17724
05/22/80	6	80	BOUGHT	64.60	64.82	-138	17586
05/30/80	8	80	BOUGHT	65.50	65.02	142	17728
06/10/80	6	80	SOLD	66.75	64.60	-910	16818
06/16/80	8	80	SOLD	66.65	65.50	-510	16308
07/25/80	10	80	SOLD	71.05	0.00	0	16308
08/12/80	10	80	BOUGHT	70.40	71.05	-310	15998
08/20/80	8	80	BOUGHT	73.75	66.65	2790	18788
09/03/80	12	80	SOLD	70.50	0.00	0	18788
09/09/80	10	80	SOLD	68.85	70.40	570	19358
09/18/80	10	80	BOUGHT	69.00	68.85	10	19368
09/18/80	12	80	BOUGHT	70.65	70.50	10	19378
09/25/80	12	80	SOLD	70.00	70.65	210	19588

TABLE XIII (Continued)

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
09/26/80	12	80	BOUGHT	70.20	70.00	30	19618
10/10/80	2	81	SOLD	73.70	0.00	0	19618
10/10/80	10	80	SOLD	69.40	69.00	-210	19408
10/10/80	12	80	SOLD	71.95	70.20	-750	18658
10/28/80	2	81	BOUGHT	72.00	73.70	-730	17928
10/28/80	12	80	BOUGHT	70.20	71.95	-750	17178
11/21/80	2	81	SOLD	72.35	72.00	-190	16988
12/03/80	2	81	BOUGHT	70.50	72.35	-790	16198
12/05/80	4	81	BOUGHT	72.90	0.00	0	16198
12/19/80	12	80	SOLD	66.45	70.20	1450	17648
02/17/81	2	81	SOLD	62.20	70.50	3270	20918
02/17/81	4	81	SOLD	66.80	72.90	2390	23308
02/17/81	6	81	SOLD	69.80	0.00	0	23308
02/27/81	4	81	BOUGHT	65.30	66.80	-650	22658
02/27/81	6	81	BOUGHT	68.20	69.80	-690	21968
04/01/81	4	81	SOLD	63.75	65.30	570	22538
04/01/81	6	81	SOLD	68.45	68.20	-150	22388
05/01/81	8	81	BOUGHT	68.00	0.00	0	22388
05/07/81	6	81	BOUGHT	68.50	68.45	-30	22358
06/05/81	6	81	SOLD	68.70	68.50	-130	22228
06/05/81	8	81	SOLD	66.80	68.00	430	22658
07/01/81	8	81	BOUGHT	66.30	66.80	-250	22408
07/01/81	10	81	BOUGHT	63.05	0.00	0	22408
07/22/81	10	81	SOLD	61.80	63.05	450	22858
07/23/81	10	81	BOUGHT	61.90	61.80	-10	22848
07/28/81	10	81	SOLD	62.40	61.90	-250	22598
08/05/81	8	81	SOLD	67.05	66.30	-350	22248
08/26/81	12	81	BOUGHT	65.20	0.00	0	22248
09/02/81	12	81	SOLD	67.25	65.20	-870	21378
09/25/81	10	81	BOUGHT	66.50	62.40	1590	22968
09/25/81	12	81	BOUGHT	67.65	67.25	110	23078
10/19/81	2	82	SOLD	65.70	0.00	0	23078
10/20/81	10	81	SOLD	63.60	66.50	1110	24188
11/02/81	2	82	BOUGHT	63.85	65.70	-790	23398
11/09/81	12	81	SOLD	64.00	67.65	1410	24808
11/11/81	2	82	SOLD	65.60	63.85	-750	24058
11/20/81	12	81	BOUGHT	63.50	64.00	-250	23808
11/24/81	2	82	BOUGHT	61.65	65.60	-1630	22178
12/31/81	12	81	SOLD	55.50	63.50	3150	25328
01/05/82	2	82	SOLD	56.30	61.65	2090	27418
01/05/82	4	82	SOLD	56.00	0.00	0	27418
02/19/82	2	82	BOUGHT	66.25	56.30	3930	31348
02/22/82	6	82	BOUGHT	62.62	0.00	0	31348
02/24/82	6	82	SOLD	63.60	62.62	-442	30906
04/20/82	4	82	BOUGHT	72.05	56.00	6370	37276
04/22/82	8	82	SOLD	64.85	0.00	0	37276
06/08/82	6	82	BOUGHT	70.20	63.60	2590	39866
06/08/82	8	82	BOUGHT	62.75	64.85	-890	38976
06/28/82	8	82	SOLD	64.50	62.75	-750	38226
06/28/82	10	82	SOLD	61.40	0.00	0	38226
07/08/82	8	82	BOUGHT	62.30	64.50	-930	37296
07/12/82	10	82	BOUGHT	61.80	61.40	110	37406
07/16/82	8	82	SOLD	64.55	62.30	-950	36456
07/16/82	10	82	SOLD	62.75	61.80	-430	36026
07/28/82	8	82	BOUGHT	62.80	64.55	-750	35276
07/30/82	10	82	BOUGHT	62.00	62.75	-350	34926
08/06/82	8	82	SOLD	64.65	62.80	-790	34136
08/06/82	10	82	SOLD	63.15	62.00	-510	33626
08/30/82	10	82	BOUGHT	62.15	63.15	-450	33176
08/30/82	12	82	BOUGHT	62.42	0.00	0	33176
10/04/82	12	82	SOLD	56.65	62.42	2258	35434
10/13/82	10	82	SOLD	62.67	62.15	-258	35176
10/26/82	2	83	BOUGHT	59.80	0.00	0	35176
10/27/82	12	82	BOUGHT	61.40	56.65	1850	37026
11/11/82	2	83	SOLD	60.25	59.80	-230	36796
11/11/82	12	82	SOLD	61.90	61.40	-250	36546

TABLE XIII (Continued)

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
11/23/82	2	83	BOUGHT	56.85	60.25	-1410	35136
11/24/82	12	82	BOUGHT	60.10	61.90	-770	34366
12/20/82	12	82	SOLD	59.95	60.10	10	34376
12/27/82	2	83	SOLD	59.30	56.85	-1030	33346
12/27/82	4	83	SOLD	60.35	0.00	0	33346
01/27/83	2	83	BOUGHT	59.57	59.30	58	33404
01/27/83	4	83	BOUGHT	60.40	60.35	-30	33374
02/02/83	2	83	SOLD	61.95	59.57	-1002	32372
02/03/83	4	83	SOLD	62.45	60.40	-870	31502
04/20/83	4	83	BOUGHT	69.42	62.45	2738	34240
04/20/83	6	83	BOUGHT	67.15	0.00	0	34240
04/22/83	8	83	BOUGHT	64.15	0.00	0	34240
05/13/83	8	83	SOLD	64.50	64.15	-190	34050
05/17/83	6	83	SOLD	67.30	67.15	-110	33940
05/26/83	8	83	BOUGHT	62.40	64.50	-890	33050
06/01/83	6	83	BOUGHT	66.25	67.30	-470	32580
06/17/83	8	83	SOLD	62.00	62.40	110	32690
06/21/83	8	83	BOUGHT	61.60	62.00	-210	32480
07/01/83	8	83	SOLD	61.70	61.60	-90	32390
07/08/83	8	83	BOUGHT	61.82	61.70	-2	32388
07/29/83	8	83	SOLD	62.50	61.82	-322	32066
07/29/83	10	83	SOLD	60.65	0.00	0	32066
08/17/83	10	83	BOUGHT	58.80	60.65	-790	31276
08/18/83	12	83	BOUGHT	59.00	0.00	0	31276
08/19/83	8	83	BOUGHT	63.00	62.50	150	31426
09/13/83	10	83	SOLD	59.15	58.80	-190	31236
09/13/83	12	83	SOLD	59.55	59.00	-270	30966
10/11/83	12	83	BOUGHT	59.75	59.55	30	30996
10/12/83	10	83	BOUGHT	60.90	59.15	650	31646
10/26/83	12	83	SOLD	59.10	59.75	210	31856
11/01/83	12	83	BOUGHT	59.25	59.10	10	31866
11/10/83	12	83	SOLD	60.50	59.25	-550	31316
12/20/83	12	83	BOUGHT	67.55	60.50	2770	34086

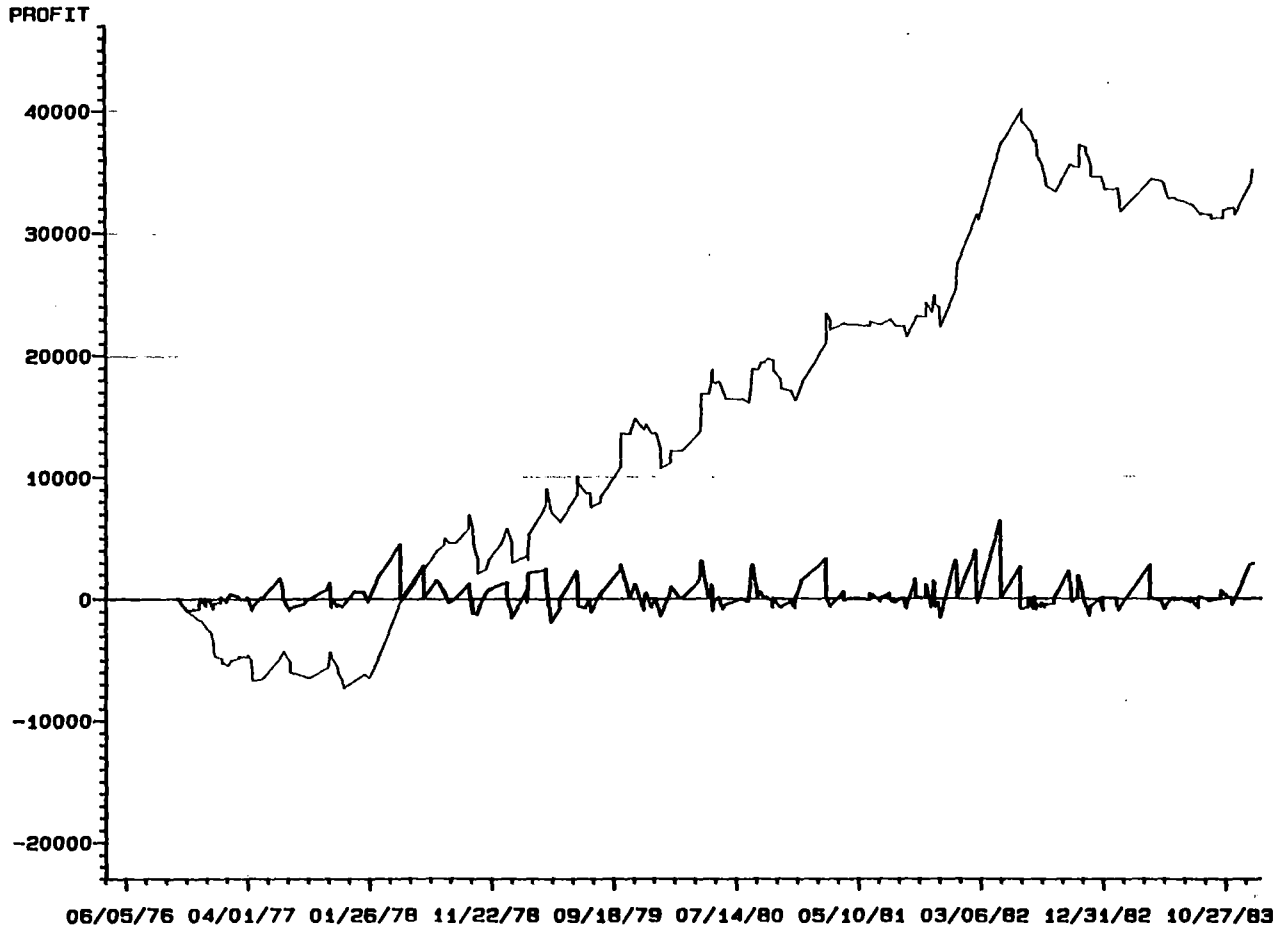

Figure 11. 1977-1983 One Trade Profits and Cumulative Profits Seven Day-Fifteen Day Simple Moving Averages One Day-Three Day Money Flow Filter 25 Percent Open Interest Filter

TABLE XIV

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE-FILTER ALL FEBRUARY CONTRACTS

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
10/11/76	2	77	SOLD	41.90	0.00	0	0
11/01/76	2	77	BOUGHT	39.60	41.90	-970	-970
12/02/76	2	77	SOLD	41.55	39.60	-830	-1800
12/20/76	2	77	BOUGHT	40.15	41.55	-610	-2410
12/30/76	2	77	SOLD	40.35	40.15	-130	-2540
01/06/77	2	77	BOUGHT	38.35	40.35	-850	-3390
01/26/77	2	77	SOLD	37.80	38.35	170	-3220
02/18/77	2	77	BOUGHT	38.95	37.80	410	-2810
10/26/77	2	78	SOLD	39.35	0.00	0	-2810
11/08/77	2	78	BOUGHT	38.50	39.35	-390	-3200
11/21/77	2	78	SOLD	39.90	38.50	-610	-3810
01/11/78	2	78	BOUGHT	41.40	39.90	550	-3260
01/23/78	2	78	SOLD	42.05	41.40	-310	-3570
02/17/78	2	78	BOUGHT	46.65	42.05	1790	-1780
10/05/78	2	79	SOLD	59.15	0.00	0	-1780
10/17/78	2	79	BOUGHT	56.50	59.15	-1110	-2890
11/06/78	2	79	SOLD	55.20	56.50	470	-2420
12/28/78	2	79	BOUGHT	58.70	55.20	1350	-1070
01/08/79	2	79	SOLD	61.70	58.70	-1250	-2320
02/20/79	2	79	BOUGHT	67.10	61.70	2110	-210
10/26/79	2	80	SOLD	70.40	0.00	0	-210
12/04/79	2	80	BOUGHT	71.70	70.40	470	260
12/27/79	2	80	SOLD	71.40	71.70	70	330
01/08/80	2	80	BOUGHT	68.00	71.40	-1410	-1080
02/04/80	2	80	SOLD	65.47	68.00	962	-118
10/10/80	2	81	SOLD	73.70	0.00	0	-118
10/28/80	2	81	BOUGHT	72.00	73.70	-730	-848
11/21/80	2	81	SOLD	72.35	72.00	-190	-1038
12/03/80	2	81	BOUGHT	70.50	72.35	-790	-1828
02/17/81	2	81	SOLD	62.20	70.50	3270	1442
10/19/81	2	82	SOLD	65.70	0.00	0	1442
11/02/81	2	82	BOUGHT	63.85	65.70	-790	652
11/11/81	2	82	SOLD	65.60	63.85	-750	-98
11/24/81	2	82	BOUGHT	61.65	65.60	-1630	-1728
01/05/82	2	82	SOLD	56.30	61.65	2090	362
02/19/82	2	82	BOUGHT	66.25	56.30	3930	4292
10/26/82	2	83	BOUGHT	59.80	0.00	0	4292
11/11/82	2	83	SOLD	60.25	59.80	-230	4062
11/23/82	2	83	BOUGHT	56.85	60.25	-1410	2652
12/27/82	2	83	SOLD	59.30	56.85	-1030	1622
01/27/83	2	83	BOUGHT	59.57	59.30	58	1680
02/02/83	2	83	SOLD	61.95	59.57	-1002	678

operates on a relatively constant inventory on a year round basis. Such a producer would have cattle scheduled for finishing over a period of time roughly represented by the lead two or three contract months. Few producers would purchase long futures positions except for cross-hedging of feeder cattle requirements. Typically, feeder cattle inventories are purchased outright with a multiple hedge technique or a basis hedge applied to minimize risk exposure to the producer.

During 1976 and 1977, the system generated losses with the maximum drawdown of closed trades amounting to a $7,336 loss. Profits then accumulated to a $14,740 peak in 1979 experiencing runs of losses of less than $3,000. Closed position profits revealed a 1981 peak at $19,588. Equity accumulation then continued through 1982 reaching $30,966. Most of the trading profits were generated during the major rise in price levels in 1978 and 1979 and then again in the last half of 1981 and the first half of 1982. Both of these time periods were witness to major price increases. Reasons for the increase included inflation, speculative fervor and expectations of general economic prosperity in agriculture. The majority of the profits from the trend following moving average systems investigated occurred during these two periods of "bull" markets. Figure 11 presents a plot of individual trade profits and losses. Figure 11 also includes a cumulative profit line graph. The figure facilitates inspection and visualization of the time periods contributing to capital accumulation and equity erosion. The general magnitude of capital drawdown is observable. This figure represents graphically the same data displayed in Table XIV.

A post-period analysis of the 7 day-15 day simple-simple moving average with a 25 percent open interest pre-filter and a 1 day-3 day money flow filter was completed. Trading in 1983, following this mechanical system, generated trading profits of $2,810. This is below the average of $4,424 over the entire period, yet producing profits in a year that did not experience the major bull markets as discussed for 1978-1979 and 1981-1982.

Monthly Analysis

Tables XIV through XIX present the trades and profits for each specific contract month using the 7 day-15 day moving average and a 1 day-3 day money flow filter. The format is the same as Table XII as previously detailed. Each month was reviewed for trading profits. Characteristics of each contract month's performance were evaluated. These include the total number of trades and the number of long and short positions taken. Evaluation of total and average profits per trade was completed for each contract month.

Table XIV presents the results of the 7 day-15 day money flow filter average system for the February contract from 1977 through 1983. The total profits over the time period were only $678. Thirty-five trades were implemented for an average profit of just under $20 per trade. The equity position from closed trades in the February contract ranged from a $3,810 loss to a $4,292 gain. The selected 7 day-15 day filtered moving average system suffered a loss for all 1983 contracts. The loss, as displayed in Table XIV, was $3,614. One trade in 1983 was profitable for the February contract and that was only a $58 trade profit.

TABLE XV

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE FILTER ALL APRIL CONTRACTS

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
12/20/76	4	77	BOUGHT	39.35	0.00	0	0
12/29/76	4	77	SOLD	39.90	39.35	-270	-270
01/07/77	4	77	BOUGHT	38.37	39.90	-662	-932
01/25/77	4	77	SOLD	39.00	38.37	-302	-1234
02/11/77	4	77	BOUGHT	39.25	39.00	50	-1184
03/10/77	4	77	SOLD	38.65	39.25	190	-994
03/29/77	4	77	BOUGHT	38.42	38.65	-142	-1136
04/12/77	4	77	SOLD	40.10	38.42	-722	-1858
01/25/78	4	78	SOLD	42.25	0.00	0	-1858
04/11/78	4	78	BOUGHT	53.60	42.25	4490	2632
12/28/78	4	79	BOUGHT	60.80	0.00	0	2632
01/08/79	4	79	SOLD	64.70	60.80	-1610	1022
02/14/79	4	79	BOUGHT	66.30	64.70	590	1612
02/16/79	4	79	SOLD	67.05	66.30	-350	1262
04/03/79	4	79	BOUGHT	73.25	67.05	2430	3692
12/27/79	4	80	SOLD	73.50	0.00	0	3692
01/08/80	4	80	BOUGHT	69.97	73.50	-1462	2230
02/01/80	4	80	SOLD	68.75	69.97	438	2668
03/03/80	4	80	BOUGHT	69.00	68.75	50	2718
04/15/80	4	80	SOLD	65.00	69.00	1550	4268
12/05/80	4	81	BOUGHT	72.90	0.00	0	4268
02/17/81	4	81	SOLD	66.80	72.90	2390	6658
02/27/81	4	81	BOUGHT	65.30	66.80	-650	6008
04/01/81	4	81	SOLD	63.75	65.30	570	6578
01/05/82	4	82	SOLD	56.00	0.00	0	6578
04/20/82	4	82	BOUGHT	72.05	56.00	6370	12948
12/27/82	4	83	SOLD	60.35	0.00	0	12948
01/27/83	4	83	BOUGHT	60.40	60.35	-30	12918
02/03/83	4	83	SOLD	62.45	60.40	-870	12048
04/20/83	4	83	BOUGHT	69.42	62.45	2738	14786

TABLE XVI

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE FILTER ALL JUNE CONTRACTS - 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
02/11/77	6	77	BOUGHT	41.50	0.00	0	0
03/10/77	6	77	SOLD	41.05	41.50	130	130
04/01/77	6	77	BOUGHT	41.42	41.05	98	228
04/11/77	6	77	SOLD	43.75	41.42	-982	-754
05/10/77	6	77	BOUGHT	44.25	43.75	150	-604
06/20/77	6	77	SOLD	39.90	44.25	1690	1086
04/11/78	6	78	BOUGHT	52.20	0.00	0	1086
04/13/78	6	78	SOLD	52.25	52.20	-70	1016
06/07/78	6	78	BOUGHT	59.10	52.25	2690	3706
02/16/79	6	79	SOLD	68.60	0.00	0	3706
04/03/79	6	79	BOUGHT	71.90	68.60	1270	4976
04/16/79	6	79	SOLD	76.70	71.90	-1970	3006
05/08/79	6	79	BOUGHT	75.00	76.70	-730	2276
06/19/79	6	79	SOLD	71.15	75.00	1490	3766
02/25/80	6	80	BOUGHT	71.90	0.00	0	3766
04/18/80	6	80	SOLD	64.05	71.90	3090	6856
05/13/80	6	80	BOUGHT	67.00	64.05	1130	7986
05/15/80	6	80	SOLD	64.82	67.00	822	8808
05/22/80	6	80	BOUGHT	64.60	64.82	-138	8670
06/10/80	6	80	SOLD	66.75	64.60	-910	7760
02/17/81	6	81	SOLD	69.80	0.00	0	7760
02/27/81	6	81	BOUGHT	68.20	69.80	-690	7070
04/01/81	6	81	SOLD	68.45	68.20	-150	6920
05/07/81	6	81	BOUGHT	68.50	68.45	-30	6890
06/05/81	6	81	SOLD	68.70	68.50	-130	6760
02/22/82	6	82	BOUGHT	62.62	0.00	0	6760
02/24/82	6	82	SOLD	63.60	62.62	-442	6318
06/08/82	6	82	BOUGHT	70.20	63.60	2590	8908
04/20/83	6	83	BOUGHT	67.15	0.00	0	8908
05/17/83	6	83	SOLD	67.30	67.15	-110	8798
06/01/83	6	83	BOUGHT	66.25	67.30	-470	8328

TABLE XVII

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE FILTER ALL AUGUST CONTRACTS - 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
12/07/76	8	77	SOLD	42.75	0.00	0	0
01/10/77	8	77	BOUGHT	42.00	42.75	-350	-350
01/25/77	8	77	SOLD	42.80	42.00	-370	-720
02/09/77	8	77	BOUGHT	42.15	42.80	-310	-1030
03/10/77	8	77	SOLD	42.00	42.15	10	-1020
04/01/77	8	77	BOUGHT	42.40	42.00	110	-910
04/07/77	8	77	SOLD	43.35	42.40	-430	-1340
05/04/77	8	77	BOUGHT	43.90	43.35	170	-1170
06/27/77	8	77	SOLD	42.60	43.90	470	-700
07/13/77	8	77	BOUGHT	40.30	42.60	-970	-1670
08/19/77	8	77	SOLD	41.20	40.30	-410	-2080
06/07/78	8	78	BOUGHT	56.75	0.00	0	-2080
07/10/78	8	78	SOLD	52.75	56.75	1550	-530
07/27/78	8	78	BOUGHT	54.10	52.75	490	-40
07/28/78	8	78	SOLD	52.77	54.10	482	442
08/08/78	8	78	BOUGHT	51.90	52.77	-398	44
05/08/79	8	79	BOUGHT	73.25	0.00	0	44
06/18/79	8	79	SOLD	67.50	73.25	2250	2294
06/21/79	8	79	BOUGHT	66.00	67.50	-650	1644
07/09/79	8	79	SOLD	67.75	66.00	-750	894
07/23/79	8	79	BOUGHT	65.00	67.75	-1150	-256
08/16/79	8	79	SOLD	63.75	65.00	450	194
05/05/80	8	80	BOUGHT	62.60	0.00	0	194
05/15/80	8	80	SOLD	65.02	62.60	-1018	-824
05/30/80	8	80	BOUGHT	65.50	65.02	142	-682
06/16/80	8	80	SOLD	66.65	65.50	-510	-1192
08/20/80	8	80	BOUGHT	73.75	66.65	2790	1598
05/01/81	8	81	BOUGHT	68.00	0.00	0	1598
06/05/81	8	81	SOLD	66.80	68.00	430	2028
07/01/81	8	81	BOUGHT	66.30	66.80	-250	1778
08/05/81	8	81	SOLD	67.05	66.30	-350	1428
04/22/82	8	82	SOLD	64.85	0.00	0	1428
06/08/82	8	82	BOUGHT	62.75	64.85	-890	538
06/28/82	8	82	SOLD	64.50	62.75	-750	-212
07/08/82	8	82	BOUGHT	62.30	64.50	-930	-1142
07/16/82	8	82	SOLD	64.55	62.30	-950	-2092
07/28/82	8	82	BOUGHT	62.80	64.55	-750	-2842
08/06/82	8	82	SOLD	64.65	62.80	-790	-3632
04/22/83	8	83	BOUGHT	64.15	0.00	0	-3632
05/13/83	8	83	SOLD	64.50	64.15	-190	-3822
05/26/83	8	83	BOUGHT	62.40	64.50	-890	-4712
06/17/83	8	83	SOLD	62.00	62.40	110	-4602
06/21/83	8	83	BOUGHT	61.60	62.00	-210	-4812
07/01/83	8	83	SOLD	61.70	61.60	-90	-4902
07/08/83	8	83	BOUGHT	61.82	61.70	-2	-4904
07/29/83	8	83	SOLD	62.50	61.82	-322	-5226
08/19/83	8	83	BOUGHT	63.00	62.50	150	-5076

TABLE XVIII

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE FILTER ALL OCTOBER CONTRACTS - 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
06/27/77	10	77	SOLD	40.85	0.00	0	0
07/13/77	10	77	BOUGHT	39.10	40.85	-750	-750
08/26/77	10	77	SOLD	39.10	39.10	-50	-800
10/20/77	10	77	BOUGHT	42.50	39.10	1310	510
08/23/78	10	78	SOLD	51.35	0.00	0	510
09/26/78	10	78	BOUGHT	54.60	51.35	1250	1760
10/06/78	10	78	SOLD	57.30	54.60	-1130	630
07/20/79	10	79	BOUGHT	64.25	0.00	0	630
08/15/79	10	79	SOLD	63.00	64.25	450	1080
10/03/79	10	79	BOUGHT	69.17	63.00	2418	3498
07/25/80	10	80	SOLD	71.05	0.00	0	3498
08/12/80	10	80	BOUGHT	70.40	71.05	-310	3188
09/09/80	10	80	SOLD	68.85	70.40	570	3758
09/18/80	10	80	BOUGHT	69.00	68.85	10	3768
10/10/80	10	80	SOLD	69.40	69.00	-210	3558
07/01/81	10	81	BOUGHT	63.05	0.00	0	3558
07/22/81	10	81	SOLD	61.80	63.05	450	4008
07/23/81	10	81	BOUGHT	61.90	61.80	-10	3998
07/28/81	10	81	SOLD	62.40	61.90	-250	3748
09/25/81	10	81	BOUGHT	66.50	62.40	1590	5338
10/20/81	10	81	SOLD	63.60	66.50	1110	6448
06/28/82	10	82	SOLD	61.40	0.00	0	6448
07/12/82	10	82	BOUGHT	61.80	61.40	110	6558
07/16/82	10	82	SOLD	62.75	61.80	-430	6128
07/30/82	10	82	BOUGHT	62.00	62.75	-350	5778
08/06/82	10	82	SOLD	63.15	62.00	-510	5268
08/30/82	10	82	BOUGHT	62.15	63.15	-450	4818
10/13/82	10	82	SOLD	62.67	62.15	-258	4560
07/29/83	10	83	SOLD	60.65	0.00	0	4560
08/17/83	10	83	BOUGHT	58.80	60.65	-790	3770
09/13/83	10	83	SOLD	59.15	58.80	-190	3580
10/12/83	10	83	BOUGHT	60.90	59.15	650	4230

TABLE XIX

SEVEN DAY-FIFTEEN DAY SIMPLE MOVING AVERAGE, ONE DAY-THREE DAY MONEY FLOW PRE FILTER ALL DECEMBER CONTRACTS - 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT	ENTRY	ONE TRADE PROFIT	CUMULATIVE PROFIT
09/01/77	12	77	SOLD	38.15	0.00	0	0
10/14/77	12	77	BOUGHT	40.32	38.15	818	818
10/24/77	12	77	SOLD	41.95	40.32	-702	116
11/07/77	12	77	BOUGHT	40.45	41.95	-650	-534
11/18/77	12	77	SOLD	41.95	40.45	-650	-1184
12/20/77	12	77	BOUGHT	43.62	41.95	618	-566
08/23/78	12	78	SOLD	53.12	0.00	0	-566
09/26/78	12	78	BOUGHT	55.90	53.12	1062	496
10/05/78	12	78	SOLD	58.97	55.90	-1278	-782
10/17/78	12	78	BOUGHT	55.75	58.97	-1338	-2120
11/13/78	12	78	SOLD	53.70	55.75	770	-1350
12/12/78	12	78	BOUGHT	56.80	53.70	1190	-160
08/15/79	12	79	SOLD	65.40	0.00	0	-160
10/03/79	12	79	BOUGHT	72.40	65.40	2750	2590
11/07/79	12	79	SOLD	69.25	72.40	1210	3800
11/29/79	12	79	BOUGHT	67.00	69.25	-950	2850
12/18/79	12	79	SOLD	68.77	67.00	-758	2092
09/03/80	12	80	SOLD	70.50	0.00	0	2092
09/18/80	12	80	BOUGHT	70.65	70.50	10	2102
09/25/80	12	80	SOLD	70.00	70.65	210	2312
09/26/80	12	80	BOUGHT	70.20	70.00	30	2342
10/10/80	12	80	SOLD	71.95	70.20	-750	1592
10/28/80	12	80	BOUGHT	70.20	71.95	-750	842
12/19/80	12	80	SOLD	66.45	70.20	1450	2292
08/26/81	12	81	BOUGHT	65.20	0.00	0	2292
09/02/81	12	81	SOLD	67.25	65.20	-870	1422
09/25/81	12	81	BOUGHT	67.65	67.25	110	1532
11/09/81	12	81	SOLD	64.00	67.65	1410	2942
11/20/81	12	81	BOUGHT	63.50	64.00	-250	2692
12/31/81	12	81	SOLD	55.50	63.50	3150	5842
08/30/82	12	82	BOUGHT	62.42	0.00	0	5842
10/04/82	12	82	SOLD	56.65	62.42	2258	8100
10/27/82	12	82	BOUGHT	61.40	56.65	1850	9950
11/11/82	12	82	SOLD	61.90	61.40	-250	9700
11/24/82	12	82	BOUGHT	60.10	61.90	-770	8930
12/20/82	12	82	SOLD	59.95	60.10	10	8940
08/18/83	12	83	BOUGHT	59.00	0.00	0	8940
09/13/83	12	83	SOLD	59.55	59.00	-270	8670
10/11/83	12	83	BOUGHT	59.75	59.55	30	8700
10/26/83	12	83	SOLD	59.10	59.75	210	8910
11/01/83	12	83	BOUGHT	59.25	59.10	10	8920
11/10/83	12	83	SOLD	60.50	59.25	-550	8370
12/20/83	12	83	BOUGHT	67.55	60.50	2770	11140

Individual trades for the April contract are shown in Table XV. The April contract displays the largest profit of any contract month. Profits through 1982 were $12,948. The trading system generated a return of $1,838 during 1983. Total April profits were $14,786. Average profit per trade was $643 for the period initially investigated and the 1983 contract.

Table XVI presents trades for the June contract. Trading profits through 1982 were $6,760. Profits of $1,568 during the 1983 contract year contributed to the 1977-1983 total profit of $8,328. Average profit per trade for the June contract was $347.

The August contract displays the poorest trading performance of any contract month. Table XVII presents individual trades for the August contract. Losses through 1982 totaled $3,632,with the loss through 1983 totalling $5,076. Average loss per trade over 40 trades was $127 in the seven years tested. The August contract following the 7 day-15 day moving average with a 1 day-3 day money flow filter had its best performance in 1980. The 1980 contract with this particular trend following system had a net profit of $1,404. The 1982 August contract had the poorest performance with this filtered moving average system losing $5,060. The 1983 August contract suffered a $1,444 loss.

Table XVIII presents the October contract trading results for the 7 day-15 day moving average system with a 1 day-3 day money flow pre-filter. Profits from closed positions peaked at $6,558 in 1982. Total profits for the 1977 through 1983 period were $4,320. Average profits were $169 for each of the 25 trades initiated. The October 1983 contract lost $330 following this trading system.

Table XIX presents the trades and results for the December contract from 1977-1983. Total profits for this time period were $11,140. An average profit of $309 was earned for each of the 36 trades during the time period investigated. Trading profits were $2,200 in 1983.

Position Analysis

Table XX presents the profits of long (bought) and short (sold) futures positions. The 7 day-15 day moving averages with a 1 day-3 day money flow filter generated 91 short and 92 long positions from 1976 through 1983. The long position returns averaged $293 for a total profit of $26,940. The short positions returned $79 each for a total profit of $7,146.

The column labeled "STD" is the population standard deviation. Since the entire population was reported, this figure is a population rather than a sample standard deviation.

The plane of profits for various combinations of filtered moving averages for long (bought) positions is shown in Figure 12. Figure 13 presents the profit plane for short (sold) positions for various combinations of simple moving averages with a 1 day-3 day money flow filter.

Further Analysis of the 3 Day-5 Day Aggregate Price (AP) Filter

As previously stated the most profitable moving average combinations reviewed are of a seven or nine day short average and with a 13 or 15 day long average. This holds for most combinations of

TABLE XX

SIMPLE-SIMPLE MOVING AVERAGES, 25 PERCENT OPEN INTEREST
1 DAY - 3 DAY MONEY FLOW FILTER BUY/SELL PROFITS

		LONG*AVERAGE											
		11				12				13			
		PROFIT				PROFIT				PROFIT			
		N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
SHORT*A-VERAGE	POSITION												
6	BOUGHT	113	12966	115	1114	103	12550	122	1225	96	13392	140	1379
	SOLD	114	-10592	-93	869	105	-5218	-50	883	100	-4528	-45	881
7	BOUGHT	112	15192	136	1153	109	12950	119	1169	99	19342	195	1311
	SOLD	114	-2448	-21	835	111	-3378	-30	847	102	-704	-7	962
8	BOUGHT	117	18438	158	1039	109	18454	169	1148	103	20866	203	1273
	SOLD	118	4708	40	910	110	2680	24	922	103	2842	28	997
9	BOUGHT	124	25128	203	1051	120	19344	161	1092	107	17898	167	1263
	SOLD	123	5062	41	843	118	-16	-0	866	106	-404	-4	924
10	BOUGHT	133	17338	130	1024	117	15298	131	1130	111	18926	171	1313
	SOLD	133	2326	17	832	115	-1686	-15	881	110	-508	-5	855

		LONG*AVERAGE											
		14				15				16			
		PROFIT				PROFIT				PROFIT			
		N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
SHORT*A-VERAGE	POSITION												
6	BOUGHT	95	17530	185	1390	88	18524	211	1345	85	18958	223	1338
	SOLD	100	-2232	-22	964	93	-486	-5	1011	89	1382	16	1064
7	BOUGHT	99	20530	207	1321	92	26940	293	1406	90	22328	248	1313
	SOLD	100	2564	26	1036	91	7146	79	1045	90	4428	49	1055
8	BOUGHT	101	22186	220	1309	98	22260	227	1325	90	21416	238	1403
	SOLD	100	5892	59	1010	98	5356	55	1042	91	7574	83	1051
9	BOUGHT	103	22182	215	1313	97	20550	212	1324	90	19460	216	1390
	SOLD	103	802	8	921	96	4872	51	1032	90	3764	42	1036
10	BOUGHT	102	21068	207	1382	94	20668	220	1454	95	19082	201	1433
	SOLD	101	-1102	-11	893	94	3372	36	897	93	282	3	985

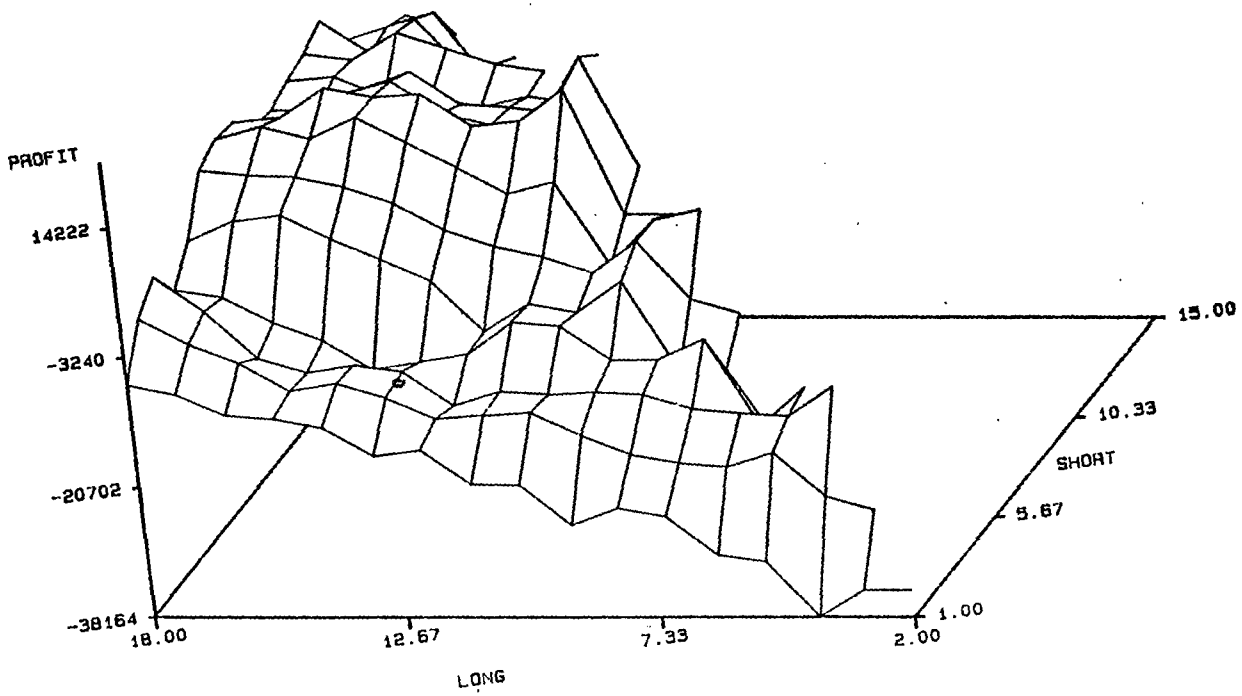

Figure 12. 1976-1982 Simple-Simple 25 Percent Open Interest One Day-Three Day Money Flow Buy Profits For All Months

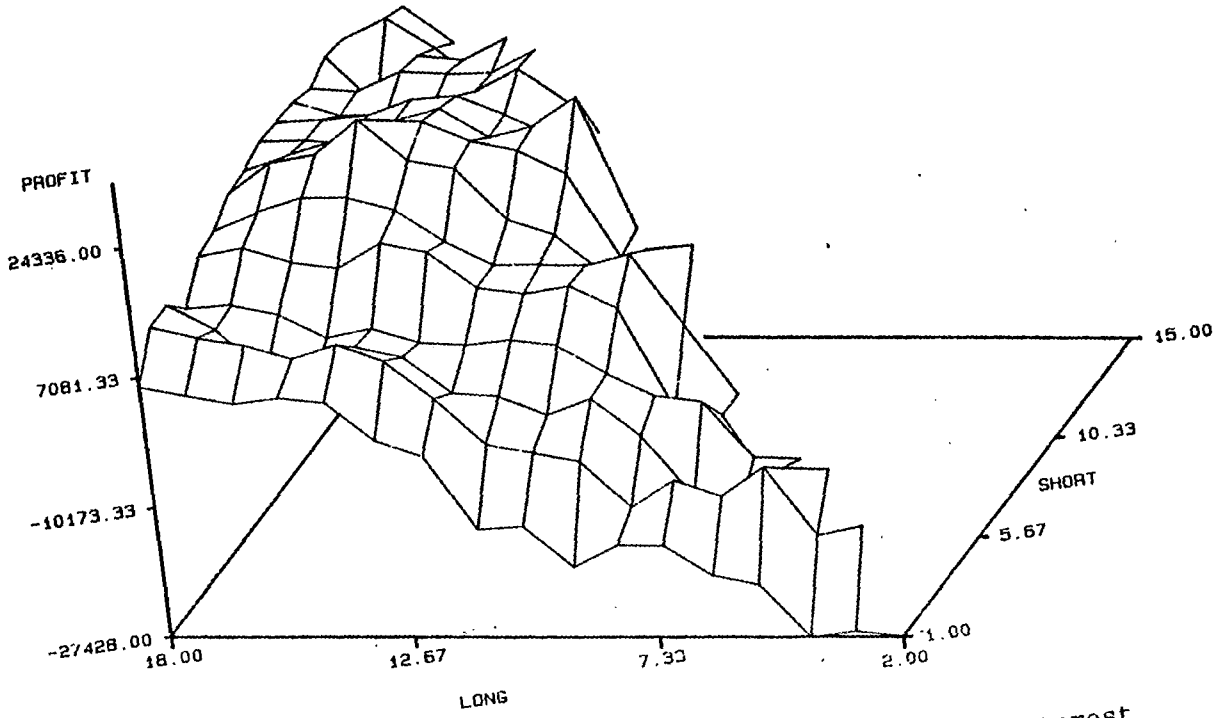

Figure 13. 1976-1982 Simple-Simple 25 Percent Open Interest One Day-Three Day Money Flow Sell Profits For All Months

moving averages with both money flow and aggregate price filters. This window of profitable moving averages was further analyzed for the AP filter. It was noted earlier in this chapter that a wide range of combinations of averages were considered to ensure that the most profitable trend following system for multiple hedging was isolated.

The 3 day-5 day aggregate price (AP) filters produced the highest profit of any of the AP filter combinations reviewed. The AP filtered systems were more profitable than the unfiltered moving averages discussed earlier in this chapter. The 3 day-5 day AP combination was selected for further analysis.

Table XXI presents results of trading from 1977 through 1983. A 25 percent open interest filter is utilized for the simple-simple moving average systems reviewed. Combinations of short moving averages ranging from six to 10 days and long moving averages ranging from 11 to 16 days are considered. This window of averages reviews 30 combinations, of which only six were included previously in Table X. The 9 day-15 day moving average with the 3 day-5 day aggregate price filter, presented in Table XXI, has the highest return. This return is $37,990, with an average profit per trade of $217.

Detailed Analysis of the 9 Day-15 Day Simple Moving Averages With a 3 Day-5 Day Aggregate Price Filter

One of the criteria that must be considered by any trader in live cattle futures is that of capital drawdown by the trading system employed. The system employing the 9 day-15 day simple moving average with a 3 day-5 day aggregate price filter generated the most

TABLE XXI

SIMPLE-SIMPLE AVERAGES, 25 PERCENT OPEN INTEREST
3 DAY - 5 DAY AGGREGATE PRICE FILTER

	LONG*AVERAGE											
	11				12				13			
	PROFIT				PROFIT				PROFIT			
SHORT*AVERAGE	N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
6	245	-10910	-45	1005	225	-5166	-23	1107	207	8998	43	1135
7	231	7018	30	1042	212	7160	34	1145	204	12464	61	1186
8	229	8410	37	1089	202	18288	91	1204	209	16010	77	1217
9	226	11468	51	1056	211	20914	99	1172	203	14150	70	1154
10	252	26352	105	1086	214	24976	117	1124	209	18094	87	1142

	LONG*AVERAGE											
	14				15				16			
	PROFIT				PROFIT				PROFIT			
SHORT*AVERAGE	N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
6	202	12000	59	1139	190	11540	61	1163	191	12606	66	1196
7	200	15708	79	1282	189	23102	122	1274	177	14994	85	1251
8	197	26282	133	1271	186	34672	186	1270	173	32782	189	1277
9	193	28554	148	1173	175	37990	217	1274	171	32766	192	1261
10	188	26944	143	1156	174	29556	170	1220	170	29840	176	1223

consistent trading profits of any of the various aggregate price filters investigated. This particular technical trading system was analyzed for the 1976 to 1982 period. Those results were presented in Table X and reported in this section of Chapter IV. This extended investigation was completed for 1976 through the end of 1983. The 1983 trades serve as a post-period sample for purpose of analysis. This section evaluates system performance on an all contracts basis, by contract month and by position (long or short).

Table XXII presents every trade executed from 1977 through 1983 following the 9 day-15 day AP filtered trading technique described in Chapter III and reported in Chapter VI. The format of Tables XXII through XXVIII is the same as that of Tables XIII through XIX. The contract month, year and date of the trade, position, exit and entry prices are presented. The individual closed trade profits and cumulative trading profits are displayed in the last columns of Table XIV. The first trade shown for each new contract month is actually the date that the contract attained 25 percent of the total open interest. The next trading signal generated after this date was honored.

Figure 14 presents a line graph of individual and cumulative trade profits for all trades in all contract months. This figure graphically presents the line by line results of Table XXII. Figure 14 facilitates inspection and visualization of the time intervals contributing to capital accumulation and equity erosion. The general magnitude of capital drawdown is observable.

The results of Table XXI are important as they approximate the multiple hedge positions that would be taken by a cattle feeder who

TABLE XXII

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL CONTRACT MONTHS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
10/11/76	2	77	SOLD	41.90	0.00	0	0
11/01/76	2	77	BOUGHT	39.60	41.90	-970	-970
12/03/76	2	77	SOLD	41.05	39.60	-630	-1600
12/07/76	8	77	SOLD	42.75	0.00	0	-1600
12/22/76	2	77	BOUGHT	40.20	41.05	-390	-1990
12/22/76	4	77	BOUGHT	39.45	0.00	0	-1990
12/22/76	8	77	BOUGHT	42.35	42.75	-210	-2200
12/27/76	8	77	SOLD	42.85	42.35	-250	-2450
01/10/77	8	77	BOUGHT	42.00	42.85	-390	-2840
01/25/77	8	77	SOLD	42.80	42.00	-370	-3210
01/26/77	4	77	SOLD	38.80	39.45	210	-3000
01/27/77	2	77	SOLD	38.80	40.20	510	-2490
02/09/77	8	77	BOUGHT	42.15	42.80	-310	-2800
02/16/77	4	77	BOUGHT	39.15	38.80	90	-2710
02/16/77	6	77	BOUGHT	41.40	0.00	0	-2710
02/18/77	2	77	BOUGHT	38.95	38.80	10	-2700
03/11/77	4	77	SOLD	38.85	39.15	70	-2630
03/11/77	6	77	SOLD	41.12	41.40	62	-2568
03/11/77	8	77	SOLD	42.05	42.15	-10	-2578
03/30/77	4	77	BOUGHT	38.35	38.85	-250	-2828
04/12/77	4	77	SOLD	40.10	38.35	-750	-3578
05/03/77	8	77	BOUGHT	45.10	42.05	1170	-2408
05/10/77	6	77	BOUGHT	44.25	41.12	1202	-1206
06/20/77	6	77	SOLD	39.90	44.25	1690	484
06/27/77	8	77	SOLD	42.60	45.10	950	1434
06/28/77	10	77	SOLD	40.15	0.00	0	1434
07/12/77	8	77	BOUGHT	40.25	42.60	-990	444
07/12/77	10	77	BOUGHT	39.10	40.15	-470	-26
08/12/77	8	77	SOLD	40.15	40.25	-10	-36
08/22/77	10	77	SOLD	37.80	39.10	470	434
08/24/77	10	77	BOUGHT	38.90	37.80	390	824
08/29/77	10	77	SOLD	39.00	38.90	-90	734
08/31/77	12	77	SOLD	38.15	0.00	0	734
10/17/77	12	77	BOUGHT	40.35	38.15	830	1564
10/20/77	10	77	BOUGHT	42.50	39.00	1350	2914
10/25/77	12	77	SOLD	41.90	40.35	-670	2244
10/26/77	2	78	SOLD	39.35	0.00	0	2244
11/08/77	12	77	BOUGHT	40.50	41.90	-610	1634
11/09/77	2	78	BOUGHT	38.35	39.35	-450	1184
11/21/77	12	77	SOLD	42.55	40.50	-870	314
11/22/77	2	78	SOLD	40.05	38.35	-730	-416
12/20/77	12	77	BOUGHT	43.62	42.55	378	-38
01/10/78	2	78	BOUGHT	41.20	40.05	410	372
01/24/78	2	78	SOLD	42.20	41.20	-450	-78
01/25/78	4	78	SOLD	42.25	0.00	0	-78
02/17/78	2	78	BOUGHT	46.65	42.20	1730	1652
04/13/78	4	78	BOUGHT	53.60	42.25	4490	6142
04/13/78	6	78	BOUGHT	52.25	0.00	0	6142
04/17/78	6	78	SOLD	52.05	52.25	30	6172
06/08/78	6	78	BOUGHT	57.50	52.05	2130	8302
06/08/78	8	78	BOUGHT	54.60	0.00	0	8302
07/10/78	8	78	SOLD	52.75	54.60	690	8992
07/28/78	8	78	BOUGHT	52.77	52.75	-42	8950
08/08/78	10	78	BOUGHT	49.75	0.00	0	8950
08/18/78	8	78	SOLD	51.97	52.77	270	9220
08/24/78	10	78	SOLD	52.70	49.75	-1230	7990
08/24/78	12	78	SOLD	54.35	0.00	0	7990
09/27/78	10	78	BOUGHT	55.20	52.70	950	8940
09/27/78	12	78	BOUGHT	56.37	54.35	758	9698
10/06/78	2	79	SOLD	59.50	0.00	0	9698
10/06/78	10	78	SOLD	57.30	55.20	-890	8808
10/06/78	12	78	SOLD	59.20	56.37	-1182	7626
10/18/78	2	79	BOUGHT	56.75	59.50	-1150	6476

TABLE XXII (Continued)

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
10/18/78	12	78	BOUGHT	55.95	59.20	-1350	5126
11/09/78	2	79	SOLD	53.65	56.75	1190	6316
11/09/78	12	78	SOLD	52.50	55.95	1330	7646
12/14/78	12	78	BOUGHT	58.05	52.50	2170	9816
12/28/78	2	79	BOUGHT	58.70	53.65	1970	11786
12/29/78	4	79	BOUGHT	61.55	0.00	0	11786
01/09/79	2	79	SOLD	61.75	58.70	-1270	10516
01/09/79	4	79	SOLD	64.30	61.55	-1150	9366
02/15/79	4	79	BOUGHT	66.20	64.30	710	10076
02/20/79	2	79	BOUGHT	67.10	61.75	2090	12166
02/20/79	4	79	SOLD	67.95	66.20	-750	11416
02/20/79	6	79	SOLD	68.95	0.00	0	11416
04/20/79	4	79	BOUGHT	79.70	67.95	4650	16066
05/07/79	6	79	BOUGHT	75.00	68.95	2370	18436
05/09/79	8	79	BOUGHT	73.60	0.00	0	18436
06/19/79	8	79	SOLD	67.90	73.60	2230	20666
06/20/79	6	79	SOLD	68.75	75.00	2450	23116
06/25/79	8	79	BOUGHT	66.30	67.90	-690	22426
07/10/79	8	79	SOLD	67.75	66.30	-630	21796
07/23/79	10	79	BOUGHT	62.40	0.00	0	21796
07/24/79	8	79	BOUGHT	64.00	67.75	-1550	20246
08/16/79	8	79	SOLD	63.75	64.00	50	20296
08/16/79	10	79	SOLD	61.75	62.40	210	20506
08/16/79	12	79	SOLD	64.00	0.00	0	20506
09/25/79	10	79	BOUGHT	67.70	61.75	2330	22836
09/25/79	12	79	BOUGHT	68.95	64.00	1930	24766
10/19/79	10	79	SOLD	64.80	67.70	1110	25876
11/02/79	2	80	SOLD	71.10	0.00	0	25876
11/02/79	12	79	SOLD	68.15	68.95	270	26146
11/29/79	12	79	BOUGHT	67.00	68.15	-510	25636
12/03/79	2	80	BOUGHT	72.80	71.10	630	26266
12/18/79	12	79	SOLD	68.77	67.00	-758	25508
12/27/79	2	80	SOLD	71.40	72.80	510	26018
12/27/79	4	80	SOLD	73.50	0.00	0	26018
01/08/80	2	80	BOUGHT	68.00	71.40	-1410	24608
01/08/80	4	80	BOUGHT	69.97	73.50	-1462	23146
02/04/80	4	80	SOLD	69.20	69.97	258	23404
02/04/80	6	80	SOLD	72.00	0.00	0	23404
02/05/80	2	80	SOLD	67.00	68.00	350	23754
02/26/80	4	80	BOUGHT	70.00	69.20	270	24024
02/26/80	6	80	BOUGHT	72.20	72.00	30	24054
04/17/80	4	80	SOLD	63.65	70.00	2490	26544
04/24/80	6	80	SOLD	67.00	72.20	2030	28574
05/07/80	8	80	BOUGHT	63.60	0.00	0	28574
05/15/80	8	80	SOLD	65.02	63.60	-618	27956
06/02/80	6	80	BOUGHT	64.90	67.00	-890	27066
06/02/80	8	80	BOUGHT	65.00	65.02	-58	27008
06/17/80	8	80	SOLD	66.20	65.00	-530	26478
07/28/80	10	80	SOLD	71.30	0.00	0	26478
08/14/80	10	80	BOUGHT	70.25	71.30	-470	26008
08/20/80	8	80	BOUGHT	73.75	66.20	2970	28978
09/04/80	12	80	SOLD	70.90	0.00	0	28978
09/09/80	10	80	SOLD	68.85	70.25	510	29488
09/10/80	10	80	BOUGHT	68.15	68.85	-330	29158
09/16/80	10	80	SOLD	68.90	68.15	-350	28808
09/22/80	10	80	BOUGHT	68.47	68.90	-222	28586
09/22/80	12	80	BOUGHT	70.55	70.90	-190	28396
09/29/80	12	80	SOLD	68.90	70.55	610	29006
09/30/80	12	80	BOUGHT	68.55	68.90	-190	28816
10/13/80	2	81	SOLD	73.85	0.00	0	28816
10/13/80	10	80	SOLD	68.85	68.47	-202	28614
10/13/80	12	80	SOLD	72.10	68.55	-1470	27144
10/28/80	2	81	BOUGHT	72.00	73.85	-790	26354
10/28/80	12	80	BOUGHT	70.20	72.10	-810	25544
11/25/80	2	81	SOLD	71.05	72.00	330	25874
12/09/80	2	81	BOUGHT	69.50	71.05	-670	25204
12/09/80	4	81	BOUGHT	72.20	0.00	0	25204

TABLE XXII (Continued)

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
12/19/80	12	80	SOLD	66.45	70.20	1450	26654
01/15/81	4	81	SOLD	69.60	72.20	990	27644
01/21/81	4	81	BOUGHT	69.15	69.60	-230	27414
02/12/81	4	81	SOLD	66.85	69.15	870	28284
02/19/81	2	81	SOLD	62.50	69.50	2750	31034
02/19/81	6	81	SOLD	70.40	0.00	0	31034
02/25/81	4	81	BOUGHT	65.90	66.85	-430	30604
02/27/81	6	81	BOUGHT	68.20	70.40	-930	29674
04/01/81	6	81	SOLD	68.45	68.20	-150	29524
04/02/81	4	81	SOLD	63.40	65.90	950	30474
05/01/81	8	81	BOUGHT	68.00	0.00	0	30474
05/08/81	6	81	BOUGHT	69.60	68.45	410	30884
06/09/81	6	81	SOLD	70.25	69.60	-310	30574
06/09/81	8	81	SOLD	68.70	68.00	-330	30244
06/29/81	8	81	BOUGHT	67.00	68.70	-730	29514
06/29/81	10	81	BOUGHT	63.85	0.00	0	29514
07/28/81	10	81	SOLD	62.40	63.85	530	30044
08/05/81	8	81	SOLD	67.05	67.00	-70	29974
09/25/81	10	81	BOUGHT	66.50	62.40	1590	31564
09/25/81	12	81	BOUGHT	67.65	0.00	0	31564
10/19/81	2	82	SOLD	65.70	0.00	0	31564
10/20/81	10	81	SOLD	63.60	66.50	1110	32674
11/04/81	2	82	BOUGHT	64.17	65.70	-662	32012
11/09/81	12	81	SOLD	64.00	67.65	1410	33422
11/11/81	2	82	SOLD	65.60	64.17	-622	32800
11/20/81	12	81	BOUGHT	63.50	64.00	-250	32550
11/23/81	2	82	BOUGHT	62.00	65.60	-1490	31060
12/31/81	12	81	SOLD	55.50	63.50	3150	34210
01/07/82	2	82	SOLD	58.60	62.00	1310	35520
01/07/82	4	82	SOLD	57.10	0.00	0	35520
02/19/82	2	82	BOUGHT	66.25	58.60	3010	38530
03/24/82	6	82	BOUGHT	64.90	0.00	0	38530
03/29/82	6	82	SOLD	66.20	64.90	-570	37960
04/19/82	8	82	BOUGHT	63.45	0.00	0	37960
04/20/82	4	82	BOUGHT	72.05	57.10	5930	43890
04/22/82	8	82	SOLD	64.85	63.45	-610	43280
06/03/82	8	82	BOUGHT	64.70	64.85	-110	43170
06/04/82	6	82	BOUGHT	72.10	66.20	2310	45480
06/28/82	8	82	SOLD	64.50	64.70	30	45510
07/08/82	8	82	BOUGHT	62.30	64.50	-930	44580
07/19/82	8	82	SOLD	64.60	62.30	-970	43610
07/19/82	10	82	SOLD	63.10	0.00	0	43610
07/30/82	8	82	BOUGHT	63.30	64.60	-570	43040
07/30/82	10	82	BOUGHT	62.00	63.10	-490	42550
08/06/82	10	82	SOLD	63.15	62.00	-510	42040
08/09/82	8	82	SOLD	65.65	63.30	-990	41050
08/27/82	12	82	BOUGHT	63.00	0.00	0	41050
08/30/82	10	82	BOUGHT	62.15	63.15	-450	40600
09/29/82	12	82	SOLD	59.10	63.00	1510	42110
10/05/82	12	82	BOUGHT	57.87	59.10	-542	41568
10/14/82	10	82	SOLD	61.90	62.15	50	41618
10/15/82	12	82	SOLD	62.80	57.87	-2022	39596
10/27/82	2	83	BOUGHT	60.00	0.00	0	39596
10/28/82	12	82	BOUGHT	60.80	62.80	-850	38746
11/12/82	2	83	SOLD	60.95	60.00	-430	38316
11/12/82	12	82	SOLD	62.60	60.80	-770	37546
11/24/82	2	83	BOUGHT	57.65	60.95	-1370	36176
11/24/82	12	82	BOUGHT	60.10	62.60	-1050	35126
12/20/82	12	82	SOLD	59.95	60.10	10	35136
12/21/82	2	83	SOLD	58.30	57.65	-310	34826
12/21/82	4	83	SOLD	58.75	0.00	0	34826
01/25/83	2	83	BOUGHT	59.70	58.30	510	35336
02/03/83	2	83	SOLD	62.75	59.70	-1270	34066
03/14/83	6	83	BOUGHT	66.27	0.00	0	34066
03/15/83	6	83	SOLD	66.70	66.27	-222	33844
04/20/83	4	83	BOUGHT	69.42	58.75	4218	38062
04/20/83	6	83	BOUGHT	67.15	66.70	130	38192
04/25/83	8	83	BOUGHT	64.40	0.00	0	38192

TABLE XXII (Continued)

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
05/17/83	6	83	SOLD	67.30	67.15	-110	38082
05/17/83	8	83	SOLD	64.75	64.40	-190	37892
05/26/83	8	83	BOUGHT	62.40	64.75	-990	36902
06/02/83	6	83	BOUGHT	67.05	67.30	-150	36752
06/13/83	8	83	SOLD	63.55	62.40	-510	36242
06/21/83	8	83	BOUGHT	61.60	63.55	-830	35412
07/07/83	8	83	SOLD	62.30	61.60	-330	35082
07/11/83	8	83	BOUGHT	61.35	62.30	-430	34652
07/26/83	10	83	SOLD	60.25	0.00	0	34652
07/27/83	8	83	SOLD	61.75	61.35	-210	34442
08/18/83	10	83	BOUGHT	58.25	60.25	-850	33592
08/18/83	12	83	BOUGHT	59.00	0.00	0	33592
08/19/83	8	83	BOUGHT	63.00	61.75	450	34042
09/14/83	10	83	SOLD	58.40	58.25	-110	33932
09/14/83	12	83	SOLD	59.15	59.00	-110	33822
10/11/83	12	83	BOUGHT	59.75	59.15	190	34012
10/13/83	10	83	BOUGHT	60.82	58.40	918	34930
10/28/83	12	83	SOLD	59.70	59.75	-30	34900
12/20/83	12	83	BOUGHT	67.55	59.70	3090	37990

TABLE XXIII

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL FEBRUARY CONTRACTS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
10/11/76	2	77	SOLD	41.90	0.00	0	0
11/01/76	2	77	BOUGHT	39.60	41.90	-970	-970
12/03/76	2	77	SOLD	41.05	39.60	-630	-1600
12/22/76	2	77	BOUGHT	40.20	41.05	-390	-1990
01/27/77	2	77	SOLD	38.80	40.20	510	-1480
02/18/77	2	77	BOUGHT	38.95	38.80	10	-1470
10/26/77	2	78	SOLD	39.35	0.00	0	-1470
11/09/77	2	78	BOUGHT	38.35	39.35	-450	-1920
11/22/77	2	78	SOLD	40.05	38.35	-730	-2650
01/10/78	2	78	BOUGHT	41.20	40.05	410	-2240
01/24/78	2	78	SOLD	42.20	41.20	-450	-2690
02/17/78	2	78	BOUGHT	46.65	42.20	1730	-960
10/06/78	2	79	SOLD	59.50	0.00	0	-960
10/18/78	2	79	BOUGHT	56.75	59.50	-1150	-2110
11/09/78	2	79	SOLD	53.65	56.75	1190	-920
12/28/78	2	79	BOUGHT	58.70	53.65	1970	1050
01/09/79	2	79	SOLD	61.75	58.70	-1270	-220
02/20/79	2	79	BOUGHT	67.10	61.75	2090	1870
11/02/79	2	80	SOLD	71.10	0.00	0	1870
12/03/79	2	80	BOUGHT	72.80	71.10	630	2500
12/27/79	2	80	SOLD	71.40	72.80	510	3010
01/08/80	2	80	BOUGHT	68.00	71.40	-1410	1600
02/05/80	2	80	SOLD	67.00	68.00	350	1950
10/13/80	2	81	SOLD	73.85	0.00	0	1950
10/28/80	2	81	BOUGHT	72.00	73.85	-790	1160
11/25/80	2	81	SOLD	71.05	72.00	330	1490
12/09/80	2	81	BOUGHT	69.50	71.05	-670	820
02/19/81	2	81	SOLD	62.50	69.50	2750	3570
10/19/81	2	82	SOLD	65.70	0.00	0	3570
11/04/81	2	82	BOUGHT	64.17	65.70	-662	2908
11/11/81	2	82	SOLD	65.60	64.17	-622	2286
11/23/81	2	82	BOUGHT	62.00	65.60	-1490	796
01/07/82	2	82	SOLD	58.60	62.00	1310	2106
02/19/82	2	82	BOUGHT	66.25	58.60	3010	5116
10/27/82	2	83	BOUGHT	60.00	0.00	0	5116
11/12/82	2	83	SOLD	60.95	60.00	-430	4686
11/24/82	2	83	BOUGHT	57.65	60.95	-1370	3316
12/21/82	2	83	SOLD	58.30	57.65	-310	3006
01/25/83	2	83	BOUGHT	59.70	58.30	510	3516
02/03/83	2	83	SOLD	62.75	59.70	-1270	2246

TABLE XXIV

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL APRIL CONTRACTS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
12/22/76	4	77	BOUGHT	39.45	0.00	0	0
01/26/77	4	77	SOLD	38.80	39.45	210	210
02/16/77	4	77	BOUGHT	39.15	38.80	90	300
03/11/77	4	77	SOLD	38.85	39.15	70	370
03/30/77	4	77	BOUGHT	38.35	38.85	-250	120
04/12/77	4	77	SOLD	40.10	38.35	-750	-630
01/25/78	4	78	SOLD	42.25	0.00	0	-630
04/13/78	4	78	BOUGHT	53.60	42.25	4490	3860
12/29/78	4	79	BOUGHT	61.55	0.00	0	3860
01/09/79	4	79	SOLD	64.30	61.55	-1150	2710
02/15/79	4	79	BOUGHT	66.20	64.30	710	3420
02/20/79	4	79	SOLD	67.95	66.20	-750	2670
04/20/79	4	79	BOUGHT	79.70	67.95	4650	7320
12/27/79	4	80	SOLD	73.50	0.00	0	7320
01/08/80	4	80	BOUGHT	69.97	73.50	-1462	5858
02/04/80	4	80	SOLD	69.20	69.97	258	6116
02/26/80	4	80	BOUGHT	70.00	69.20	270	6386
04/17/80	4	80	SOLD	63.65	70.00	2490	8876
12/09/80	4	81	BOUGHT	72.20	0.00	0	8876
01/15/81	4	81	SOLD	69.60	72.20	990	9866
01/21/81	4	81	BOUGHT	69.15	69.60	-230	9636
02/12/81	4	81	SOLD	66.85	69.15	870	10506
02/25/81	4	81	BOUGHT	65.90	66.85	-430	10076
04/02/81	4	81	SOLD	63.40	65.90	950	11026
01/07/82	4	82	SOLD	57.10	0.00	0	11026
04/20/82	4	82	BOUGHT	72.05	57.10	5930	16956
12/21/82	4	83	SOLD	58.75	0.00	0	16956
04/20/83	4	83	BOUGHT	69.42	58.75	4218	21174

TABLE XXV

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL JUNE CONTRACTS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
02/16/77	6	77	BOUGHT	41.40	0.00	0	0
03/11/77	6	77	SOLD	41.12	41.40	62	62
05/10/77	6	77	BOUGHT	44.25	41.12	1202	1264
06/20/77	6	77	SOLD	39.90	44.25	1690	2954
04/13/78	6	78	BOUGHT	52.25	0.00	0	2954
04/17/78	6	78	SOLD	52.05	52.25	30	2984
06/08/78	6	78	BOUGHT	57.50	52.05	2130	5114
02/20/79	6	79	SOLD	68.95	0.00	0	5114
05/07/79	6	79	BOUGHT	75.00	68.95	2370	7484
06/20/79	6	79	SOLD	68.75	75.00	2450	9934
02/04/80	6	80	SOLD	72.00	0.00	0	9934
02/26/80	6	80	BOUGHT	72.20	72.00	30	9964
04/24/80	6	80	SOLD	67.00	72.20	2030	11994
06/02/80	6	80	BOUGHT	64.90	67.00	-890	11104
02/19/81	6	81	SOLD	70.40	0.00	0	11104
02/27/81	6	81	BOUGHT	68.20	70.40	-930	10174
04/01/81	6	81	SOLD	68.45	68.20	-150	10024
05/08/81	6	81	BOUGHT	69.60	68.45	410	10434
06/09/81	6	81	SOLD	70.25	69.60	-310	10124
03/24/82	6	82	BOUGHT	64.90	0.00	0	10124
03/29/82	6	82	SOLD	66.20	64.90	-570	9554
06/04/82	6	82	BOUGHT	72.10	66.20	2310	11864
03/14/83	6	83	BOUGHT	66.27	0.00	0	11864
03/15/83	6	83	SOLD	66.70	66.27	-222	11642
04/20/83	6	83	BOUGHT	67.15	66.70	130	11772
05/17/83	6	83	SOLD	67.30	67.15	-110	11662
06/02/83	6	83	BOUGHT	67.05	67.30	-150	11512

TABLE XXVI

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL AUGUST CONTRACTS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
12/07/76	8	77	SOLD	42.75	0.00	0	0
12/22/76	8	77	BOUGHT	42.35	42.75	-210	-210
12/27/76	8	77	SOLD	42.85	42.35	-250	-460
01/10/77	8	77	BOUGHT	42.00	42.85	-390	-850
01/25/77	8	77	SOLD	42.80	42.00	-370	-1220
02/09/77	8	77	BOUGHT	42.15	42.80	-310	-1530
03/11/77	8	77	SOLD	42.05	42.15	-10	-1540
05/03/77	8	77	BOUGHT	45.10	42.05	1170	-370
06/27/77	8	77	SOLD	42.60	45.10	950	580
07/12/77	8	77	BOUGHT	40.25	42.60	-990	-410
08/12/77	8	77	SOLD	40.15	40.25	-10	-420
06/08/78	8	78	BOUGHT	54.60	0.00	0	-420
07/10/78	8	78	SOLD	52.75	54.60	690	270
07/28/78	8	78	BOUGHT	52.77	52.75	-42	228
08/18/78	8	78	SOLD	51.97	52.77	270	498
05/09/79	8	79	BOUGHT	73.60	0.00	0	498
06/19/79	8	79	SOLD	67.90	73.60	2230	2728
06/25/79	8	79	BOUGHT	66.30	67.90	-690	2038
07/10/79	8	79	SOLD	67.75	66.30	-630	1408
07/24/79	8	79	BOUGHT	64.00	67.75	-1550	-142
08/16/79	8	79	SOLD	63.75	64.00	50	-92
05/07/80	8	80	BOUGHT	63.60	0.00	0	-92
05/15/80	8	80	SOLD	65.02	63.60	-618	-710
06/02/80	8	80	BOUGHT	65.00	65.02	-58	-768
06/17/80	8	80	SOLD	66.20	65.00	-530	-1298
08/20/80	8	80	BOUGHT	73.75	66.20	2970	1672
05/01/81	8	81	BOUGHT	68.00	0.00	0	1672
06/09/81	8	81	SOLD	68.70	68.00	-330	1342
06/29/81	8	81	BOUGHT	67.00	68.70	-730	612
08/05/81	8	81	SOLD	67.05	67.00	-70	542
04/19/82	8	82	BOUGHT	63.45	0.00	0	542
04/22/82	8	82	SOLD	64.85	63.45	-610	-68
06/03/82	8	82	BOUGHT	64.70	64.85	-110	-178
06/28/82	8	82	SOLD	64.50	64.70	30	-148
07/08/82	8	82	BOUGHT	62.30	64.50	-930	-1078
07/19/82	8	82	SOLD	64.60	62.30	-970	-2048
07/30/82	8	82	BOUGHT	63.30	64.60	-570	-2618
08/09/82	8	82	SOLD	65.65	63.30	-990	-3608
04/25/83	8	83	BOUGHT	64.40	0.00	0	-3608
05/17/83	8	83	SOLD	64.75	64.40	-190	-3798
05/26/83	8	83	BOUGHT	62.40	64.75	-990	-4788
06/13/83	8	83	SOLD	63.55	62.40	-510	-5298
06/21/83	8	83	BOUGHT	61.60	63.55	-830	-6128
07/07/83	8	83	SOLD	62.30	61.60	-330	-6458
07/11/83	8	83	BOUGHT	61.35	62.30	-430	-6888
07/27/83	8	83	SOLD	61.75	61.35	-210	-7098
08/19/83	8	83	BOUGHT	63.00	61.75	450	-6648

TABLE XXVII

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL OCTOBER CONTRACTS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
06/28/77	10	77	SOLD	40.15	0.00	0	0
07/12/77	10	77	BOUGHT	39.10	40.15	-470	-470
08/22/77	10	77	SOLD	37.80	39.10	470	0
08/24/77	10	77	BOUGHT	38.90	37.80	390	390
08/29/77	10	77	SOLD	39.00	38.90	-90	300
10/20/77	10	77	BOUGHT	42.50	39.00	1350	1650
08/08/78	10	78	BOUGHT	49.75	0.00	0	1650
08/24/78	10	78	SOLD	52.70	49.75	-1230	420
09/27/78	10	78	BOUGHT	55.20	52.70	950	1370
10/06/78	10	78	SOLD	57.30	55.20	-890	480
07/23/79	10	79	BOUGHT	62.40	0.00	0	480
08/16/79	10	79	SOLD	61.75	62.40	210	690
09/25/79	10	79	BOUGHT	67.70	61.75	2330	3020
10/19/79	10	79	SOLD	64.80	67.70	1110	4130
07/28/80	10	80	SOLD	71.30	0.00	0	4130
08/14/80	10	80	BOUGHT	70.25	71.30	-470	3660
09/09/80	10	80	SOLD	68.85	70.25	510	4170
09/10/80	10	80	BOUGHT	68.15	68.85	-330	3840
09/16/80	10	80	SOLD	68.90	68.15	-350	3490
09/22/80	10	80	BOUGHT	68.47	68.90	-222	3268
10/13/80	10	80	SOLD	68.85	68.47	-202	3066
06/29/81	10	81	BOUGHT	63.85	0.00	0	3066
07/28/81	10	81	SOLD	62.40	63.85	530	3596
09/25/81	10	81	BOUGHT	66.50	62.40	1590	5186
10/20/81	10	81	SOLD	63.60	66.50	1110	6296
07/19/82	10	82	SOLD	63.10	0.00	0	6296
07/30/82	10	82	BOUGHT	62.00	63.10	-490	5806
08/06/82	10	82	SOLD	63.15	62.00	-510	5296
08/30/82	10	82	BOUGHT	62.15	63.15	-450	4846
10/14/82	10	82	SOLD	61.90	62.15	50	4896
07/26/83	10	83	SOLD	60.25	0.00	0	4896
08/18/83	10	83	BOUGHT	58.25	60.25	-850	4046
09/14/83	10	83	SOLD	58.40	58.25	-110	3936
10/13/83	10	83	BOUGHT	60.82	58.40	918	4854

TABLE XXVIII

9 DAY - 15 DAY SIMPLE MOVING AVERAGES, 3 DAY - 5 DAY AGGREGATE PRICE PRE-FILTER, ALL TRADES IN ALL DECEMBER CONTRACTS 1977-1983

DT	CONTRACT MONTH	CONTRACT YEAR	POSITION	EXIT PRICE	ENTRY PRICE	ONE TRADE PROFIT	CUMULATIVE PROFIT
08/31/77	12	77	SOLD	38.15	0.00	0	0
10/17/77	12	77	BOUGHT	40.35	38.15	830	830
10/25/77	12	77	SOLD	41.90	40.35	-670	160
11/08/77	12	77	BOUGHT	40.50	41.90	-610	-450
11/21/77	12	77	SOLD	42.55	40.50	-870	-1320
12/20/77	12	77	BOUGHT	43.62	42.55	378	-942
08/24/78	12	78	SOLD	54.35	0.00	0	-942
09/27/78	12	78	BOUGHT	56.37	54.35	758	-184
10/06/78	12	78	SOLD	59.20	56.37	-1182	-1366
10/18/78	12	78	BOUGHT	55.95	59.20	-1350	-2716
11/09/78	12	78	SOLD	52.50	55.95	1330	-1386
12/14/78	12	78	BOUGHT	58.05	52.50	2170	784
08/16/79	12	79	SOLD	64.00	0.00	0	784
09/25/79	12	79	BOUGHT	68.95	64.00	1930	2714
11/02/79	12	79	SOLD	68.15	68.95	270	2984
11/29/79	12	79	BOUGHT	67.00	68.15	-510	2474
12/18/79	12	79	SOLD	68.77	67.00	-758	1716
09/04/80	12	80	SOLD	70.90	0.00	0	1716
09/22/80	12	80	BOUGHT	70.55	70.90	-190	1526
09/29/80	12	80	SOLD	68.90	70.55	610	2136
09/30/80	12	80	BOUGHT	68.55	68.90	-190	1946
10/13/80	12	80	SOLD	72.10	68.55	-1470	476
10/28/80	12	80	BOUGHT	70.20	72.10	-810	-334
12/19/80	12	80	SOLD	66.45	70.20	1450	1116
09/25/81	12	81	BOUGHT	67.65	0.00	0	1116
11/09/81	12	81	SOLD	64.00	67.65	1410	2526
11/20/81	12	81	BOUGHT	63.50	64.00	-250	2276
12/31/81	12	81	SOLD	55.50	63.50	3150	5426
08/27/82	12	82	BOUGHT	63.00	0.00	0	5426
09/29/82	12	82	SOLD	59.10	63.00	1510	6936
10/05/82	12	82	BOUGHT	57.87	59.10	-542	6394
10/15/82	12	82	SOLD	62.80	57.87	-2022	4372
10/28/82	12	82	BOUGHT	60.80	62.80	-850	3522
11/12/82	12	82	SOLD	62.60	60.80	-770	2752
11/24/82	12	82	BOUGHT	60.10	62.60	-1050	1702
12/20/82	12	82	SOLD	59.95	60.10	10	1712
08/18/83	12	83	BOUGHT	59.00	0.00	0	1712
09/14/83	12	83	SOLD	59.15	59.00	-110	1602
10/11/83	12	83	BOUGHT	59.75	59.15	190	1792
10/28/83	12	83	SOLD	59.70	59.75	-30	1762
12/20/83	12	83	BOUGHT	67.55	59.70	3090	4852

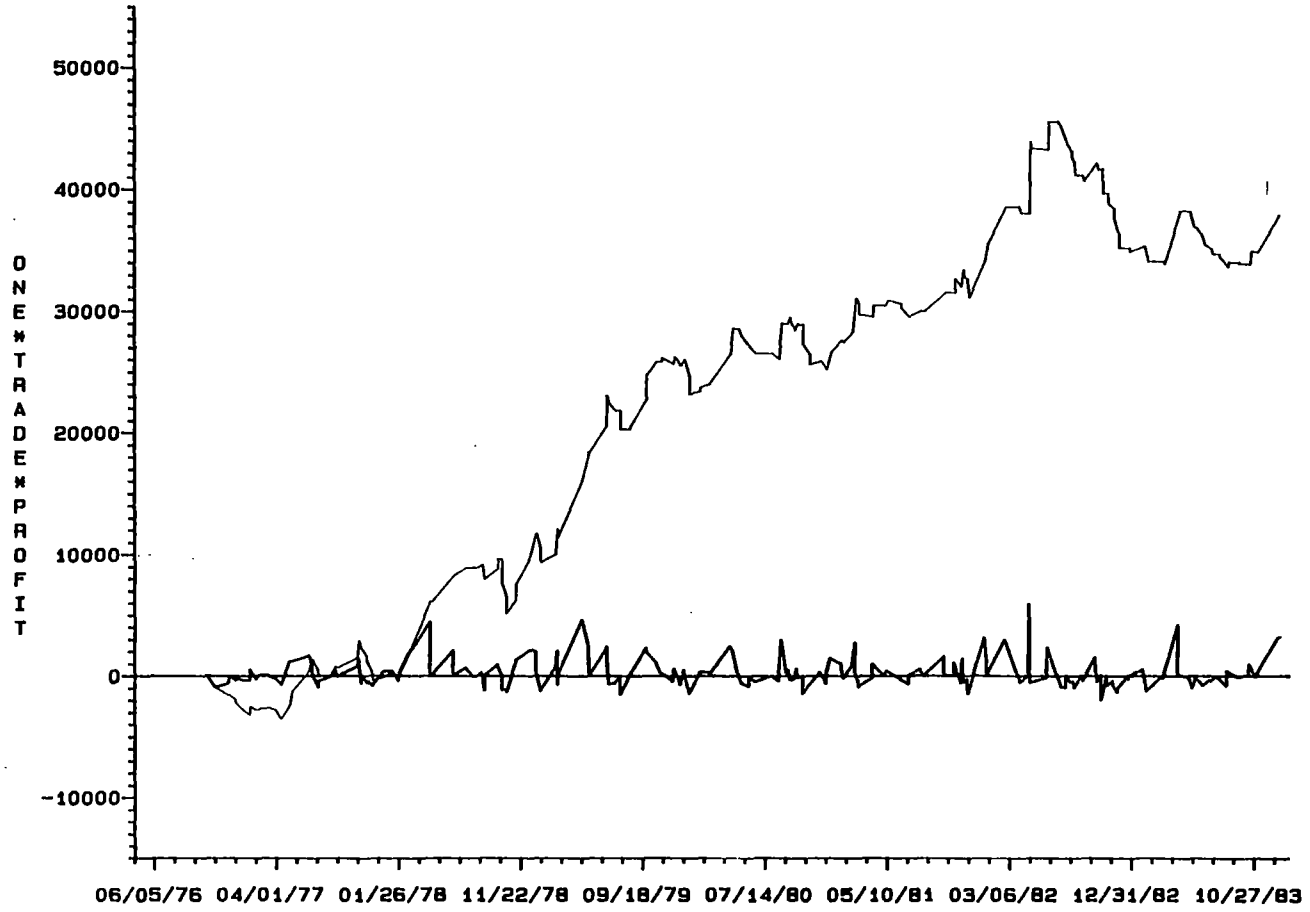

Figure 14. 1977-1983 One Trade Profits and Cumulative Profits Nine Day-Fifteen Day Simple Moving Averages Three Day-Five Day Aggregate Price Filter 25 Percent Open Interest Filter

operates on a relatively constant inventory, year round basis. The reasoning and approach is identical to the previous discussion of Table XII.

During 1976 and the first half of 1977 the systems generated more losses than profits in its signaled trades. The maximum drawdown of equity from closed trades was a loss of $3,578. Profits then accumulated to a late 1977 peak of $2,914. A series of losing trades brought cumulative equity down to a $416 loss. This is the last instance of a negative cumulative profit figure for the combined contracts. Closed trade profits accumulated to a peak of $45,480 in June of 1982. During this period of general accumulation of equity the maximum effect of losing trades was to reduce equity by $2,000 to $3,000. Cumulative profits then dropped to $34,066, rose to $38,192, declined to $34,012, and then closed at $37,990 at the end of 1983. These results are more readily observed in the accumulated profit line graph of Figure 14. The 9 day-15 day moving average with 3 day-5 day money flow filter increased the cumulative equity position by $3,164 in 1983.

Monthly Analysis

Tables XXIII through XXVIII present the trades, profits and cumulative profits for each contract month. The technical trading system used to generate these trades is the 25 percent open interest pre-filter with a 9 day-15 day simple moving average and a 3 day-5 day money flow pre-filter. Each contract month is evaluated for its general characteristics of overall profits and magnitude capital drawdown. An evaluation of total and average profits per trade was performed.

Trade profits for the post-sample period of 1983 are $4,398 for all contract months. This total is just below the $4,799 average profit over the previous seven years. This profit is impressive when one compares the general sideways trend of 1983 to the major bull markets of 1978-1979 and 1981-1982.

Table XXIII presents the trade results for the February contract. Thirty-three trades were completed for a total profit of $2,246. Average trade profit was $68. The maximum loss for any single trade was $1,490. The largest negative equity value was $2,690 with the highest cumulative positive equity totalling $5,116. Strings of losses reduced cumulative profits from $2,000 to $3,000 each. The February contract lost $2,870 in 1983 following the selected AP filtered moving average system.

Table XXIV presents the results of the investigated trend following system for the April contract. The contract had the best performance of any contract month. Cumulative closed profits were $21,174 with only 24 completed trades taken. Three years, 1978, 1982, and 1983, had only one trade each. The last two were liquidated on the last day of trading following the trading rules outlined in Chapter III. The April 1983 contract made a profit of $4,218. The lowest value of cumulative profits was $630 at the end of 1977. The largest string of losses from 1977 through 1983 was less than $1,500.

Table XXV presents the trade results for the contract month of June. Twenty trades generated a cumulative profit of $11,512. The June contract cumulative equity never declined below zero. The largest decline in accumulated profit equity was less than $1,500. Four trades in the June contract lost $352 in 1983.

Table XXVI presents the trading results for the August contract. Of the 40 trades initiated, only nine were profitable. The results of trades for the time period investigated was a cumulative loss of $6,648. A maximum cumulative loss of $7,098 was observed. Peak equity from closed positions was $2,728 observed in 1979. The August contract lost $3,040 in 1983.

Table XXVII presents the results of 28 trades taken in the October live cattle contract. Total profits for the 1977-1983 time period were $4,854. One run of losses totaled nearly $2,400 with another just over $1,100. The 1983 contract entered three trades for a total profit of $42.

Table XXVIII presents the results of 34 trades in the December live cattle contract. Total profits for the 1977-1983 time period were $4,852. Profit accumulation in the December contract was rather erratic. Cumulative runs of losses of $2,700 and $5,300 are observed. Cumulative profits from closed trades peaked at $6,936. The 1983 contract yielded a net income of $3,140 which is a major portion of the total profits of $4,852 gained from 1977 through 1983.

Position Analysis

Table XXIX includes the profits of long (bought) and short (sold) trading positions generated by the 9 day-15 day moving averages with 3 day-5 day aggregate price and 25 percent open interest pre-filters. The table presents the profits from all trading positions for short moving averages ranging from six to 10 days combined with long averages of 11 to 16 days.

TABLE XXIX

SIMPLE-SIMPLE MOVING AVERAGES, 25 PERCENT OPEN INTEREST
3 DAY - 5 DAY AGGREGATE PRICE FILTER BUY/SELL PROFITS

		LONG*AVERAGE											
		11				12				13			
		PROFIT				PROFIT				PROFIT			
		N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
SHORT*AVERAGE	POSITION												
6	BOUGHT	123	7662	62	1087	112	10524	94	1245	102	16396	161	1264
	SOLD	122	-18572	-152	907	113	-15690	-139	943	105	-7398	-70	987
7	BOUGHT	115	16982	148	1108	105	15938	152	1275	101	20918	207	1335
	SOLD	116	-9964	-86	963	107	-8778	-82	995	103	-8454	-82	1006
8	BOUGHT	115	15810	137	1136	101	21070	209	1350	104	21360	205	1402
	SOLD	114	-7400	-65	1035	101	-2782	-28	1031	105	-5350	-51	990
9	BOUGHT	113	18314	162	1158	106	25136	237	1364	101	18602	184	1331
	SOLD	113	-6846	-61	936	105	-4222	-40	924	102	-4452	-44	941
10	BOUGHT	127	29418	232	1214	107	27122	253	1322	104	21080	203	1296
	SOLD	125	-3066	-25	926	107	-2146	-20	867	105	-2986	-28	958

		LONG*AVERAGE											
		14				15				16			
		PROFIT				PROFIT				PROFIT			
		N	SUM	MEAN	STD	N	SUM	MEAN	STD	N	SUM	MEAN	STD
SHORT*AVERAGE	POSITION												
6	BOUGHT	99	16714	169	1259	93	16094	173	1308	94	18440	196	1350
	SOLD	103	-4714	-46	1004	97	-4554	-47	999	97	-5834	-60	1017
7	BOUGHT	99	21774	220	1504	94	24016	255	1484	88	15916	181	1415
	SOLD	101	-6066	-60	1006	95	-914	-10	1016	89	-922	-10	1064
8	BOUGHT	98	24392	249	1499	92	29220	318	1502	85	25650	302	1528
	SOLD	99	1890	19	990	94	5452	58	983	88	7132	81	971
9	BOUGHT	96	27780	289	1376	87	28606	329	1505	85	27518	324	1513
	SOLD	97	774	8	914	88	9384	107	991	86	5248	61	941
10	BOUGHT	94	26496	282	1367	87	26294	302	1496	86	25660	298	1484
	SOLD	94	448	5	883	87	3262	37	848	84	4180	50	872

There were 87 long and 88 short positions initiated in all contract months from 1977 through 1983. Long position profits totaled $28,606. Short position profits are $9,384. Long position profits averaged $329, just over three times the $107 average profit of the short positions.

Aggregate Price Filter Summary

This chapter evaluates the profitability of an aggregate price statistic in conjunction with currently accepted moving average techniques. Inclusion of a filter allowing trades only when the hedged position is in agreement with the aggregate price trend increased profits and reduced losses to a substantial degree.

Comparison of Table III to Tables XIII, IX and particularly Table X supports the general conclusion that the inclusion of the hypothesized price filter as a trading rule in a moving average trend following system will increase trading profits for moving average trend following systems. This type of a moving average trend following system is often employed as a multiple hedge position entry/exit signal generator.

Consideration of trading results for each contract month reveals that August is a poor trading month for the trend following methods considered. Conversely, the late winter and spring contracts of February, April and June generated consistent profits. This fact held true for both the initial period tested and the post-period year of 1983.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Introduction

Risk and uncertainty entail the probability of a loss, most typically a financial loss. Production of slaughter cattle entails risk and uncertainty from many sources, both economic and environmental. A successful manager is able to utilize various tools and business strategies to minimize risk. These efforts include use of vertical and horizontal integration, forward pricing and contracting, and various applications of the use of live cattle futures contracts for hedging actual or anticipated production. One such use of the live cattle futures market is the multiple hedge. A multiple hedge technique entails placement and removal of futures contracts on a selective basis more than once during a production period. The intent of a multiple hedge is to set a hedge, offset the hedge on a price decline, then reset the hedge on price strength.

One of the problems that needs to be resolved for multiple hedging to be successful is that some well defined method of timing of position entry and exit be employed. Moving averages have been tested and accepted as legitimate technical trading tools that may be applied to resolve the problem of timing. Two trading filters were developed and tested. Both filters were developed from daily price and open

interest statistics. Both filters were developed on the basis of the theory that changes in general equilibrium price levels are accompanied by increases in activity and numbers of market participants. The aggregate opinion of all traders is reflected in both changes in price and changes in volume and open interest. Moving averages are a trend identification and trend following system. Since price trends and trends in all traders (crowd) psychology are theorized to move in a parallel fashion and moving averages follow trends, this methodology was deemed appropriate.

Open Interest Filters

A basis for the comparison of hypothesized trend following techniques was developed through the application of a two moving average crossover model. Both simple-simple and simple-linearly weighted moving average trading results were obtained and observed. More importantly, an open interest filter was employed for the development of a basis for further comparison. The requirement that any contract month have a minimum of 25 percent of the total open interest of all contracts traded increased trading profits and profitable trading combinations to levels substantially higher than profits for a 15 percent open interest filter. These results were reviewed and discussed in Chapter IV. Tables I through IV and Figures 1 through 4 presented the results in tabular and graphical formats.

The results of this section of the study are detailed in Chapter IV and may be reviewed by comparing Tables I and III and Tables II and IV.

The striking increase in trading profits attained by waiting until a contract has 25 percent of total open interest stands as evidence that early trading in any contract subjects the hedger to poor order execution due to low liquidity. Available information pertaining to the more distant maturities is random. Price movements in the early history of contracts are random and therefore, trend following trading methods do not generate profits during the early life of contracts. An insignificant number of instances of early contract trading profits was observed. As a contract matures, more information is available for traders and market observers to consider in their analysis and decision process. The process of realization and utilization of trading information over a period of time lends support to the development of trends. A trend is identifiable with the use of moving average techniques and as such, trend following provides a means of observing the revealed attitudes of market participants over a time interval for any contract.

The 25 percent open interest trading filter was chosen as a standard open interest filter in the subsequent analyses of the two hypothesized market trend filters presented in Chapter III. The simple-simple moving average profits presented in Table III were used as a standard for comparing trading results.

Trading Filters

Two trading filters were developed and tested. Both were proposed measures of the revealed attitudes of all traders in all contract months. Both filters were developed from basic daily price and open interest statistics. The filters were developed on the basis

of the theory that changes in the general equilibrium price levels are accompanied by increases in activity and numbers of market participants. Their opinions are reflected in changes in price, trading volume, and open interest.

Money Flow Filter

A measure of total financial commitment was developed and defined as money flow. The concurrent tide of money flow with trends in closing prices formed the basis for the first filtered technical trading system evaluated. The trends in prices and money flow were both identified by two-moving average crossover methods. Whenever the value of a short term moving average of money flow exceeded that of a longer term average of the same data series, the trend was considered to be rising.

The measure of money flow was established as a sum of the products of each contract's closing price and open interest. Three different moving average combinations of money flow were tested. These were the 1 day-3 day, the 1 day-5 day, and the 3 day-5 day simple-simple moving averages on the calculated daily money flow data series. A trade signaled by a two-moving averages crossover system was honored only when the trend in money flow was in the same direction as the signaled trend in prices. The data series tested began with the 1976 revised live cattle data and ended in 1982. The year 1983 was used as a post-period test.

Results of analyses of the three money flow filters reveal several interesting and significant facts. First, the 1 day-3 day money flow filter generated the largest profits. Profits of all of

the moving average combinations are mapped and displayed in Figures 5, 6, and 7. The profits are substantially higher than those of the unfiltered moving averages established as a base and illustrated in Table III and Figure 3.

The 1 day-5 day money flow filter produced lower profits than the 1 day-3 day filter. It is important to note that the losses, for combinations of averages with losses, are substantially smaller than those of the 1 day-3 day filter. This same result occurred when a comparison was made with the unfiltered base. Losses for various combinations of averages in the reference unfiltered base are substantially higher than those of the 1 day-3 day filter. The 1 day-5 day filter had a much lower value for combinations that did generate losses.

Application of the 3 day-5 day money flow filter did reduce the losses for combinations of moving averages as compared to the established reference base. The profit surface, as shown in Figure 7, is more erratic than was observed for the other two money flow filters reviewed.

Application of a money flow filter reduced trading losses particularly for the more sensitive 1 day-3 day and 3 day-5 day filters. These results are significant in that the financial commitment of all traders can be used to aid in identification of the major perceived price trend. This enables a multiple hedger to quantify the general trend and then utilize other mechanical methods as aid in placement and lifting of hedges in a multiple hedging marketing and risk management plan.

Aggregate Price Filter

The second pre-filter evaluated was that of an aggregate price or open interest weighted price. This proposed filter is hypothesized to be a single daily information discounted value of the price of cattle. This value is of use when it is considered in a serial format, allowing the determination of a trend in revealed attitudes of all traders relative to all live cattle contracts traded at any particular time. Aggregate price is the sum of the products of each contract's closing price and an open interest divided by the total open interest in all contracts.

The aggregate price was calculated on a daily basis, intended to provide a representative price for the "market" for live cattle. Aggregate price is, therefore, an information discounted value. All factors of anticipated supply and demand as evaluated by various traders and market observers are considered to be reflected in this single daily statistic. Any misalignment between reflected current contract prices and a rationally anticipated price equilibrium will eventually be adjusted by the process of arbitrage.

Trading techniques employed with the aggregate price filter were the same as those of the money flow filter previously discussed. Three combinations of moving averages applied to aggregate price were employed as filters. The three filters tested were the 1 day-3 day, 1 day-5 day, and 3 day-5 day filters. Each filter was tested on 101 combinations of closing price moving averages. All of the various aggregate price filtered moving averages were pre-filtered with the 25 percent open interest requirements. This pre-filter was applied in

order to maintain uniformity with the loss established in Chapter IV. No trades were honored from filtered moving average signals until the contract had attained 25 percent of the total open interest in all contracts.

The 3 day-5 day aggregate price filter had several characteristics that elevate it above the 1 day-3 day and 3 day-5 day filters. The most profitable single 3 day-5 day filtered combination was the 9 day-15 day simple crossover moving average. This combination returned $34,912 over the period of 1976-1982. This is substantially higher than the $28,248 return for the unfiltered averages of the same length as shown in the reference base of Table III. The maximum loss of the 3 day-5 day aggregate price filter was $10,840 for the 3 day-7 day moving average combination. This loss is much less than the $117,600 maximum in the unfiltered reference base of Table III. The 1 day-3 day aggregate price filter maximum loss was $99,848. The maximum loss for the 1 day-5 day aggregate price filter was $58,562.

Application of the aggregate price filters increased trading profits (or reduced losses) as compared to the unfiltered base. These results are valid irrespective of the combinations of moving average or filter applied. The 3 day-5 day aggregate price filter was the most effective in minimizing trading losses, while including the highest profits of any of the aggregate price filters reviewed.

Contract Month Trading Results

Trading profits for the single highest profit filtered moving average combination were evaluated on a contract month basis. The 7

day-15 day simple moving average with a 1 day-3 day money flow trading filter and the 9 day-15 day simple moving average combined with a 3 day-5 day aggregate price filter produced the highest total returns for all contract months. The single most profitable contract month for the 1976-1983 time period was April. April consistently returned profits even in trading years when few contracts made any trading gains. Monthly trading results are very similar for both the money flow and aggregate price filters reviewed.

The August contract did not display any positive long term cumulative profits, in fact, in over 1,300 different combinations of moving averages and filtered moving averages, the August contract rarely broke even. The August contract experienced more trades than the other contract months for practically every technical trend following system investigated.

The February and June contract months were generally the second most profitable months after April. Some efforts in further research are suggested by these results. One particular hypotheses when considering these results and the basic Samuelson Hypothesis introduced in Chapter III is that the flow and quality of information is not constant throughout the calendar year. Major reports of livestock inventory are made available in January and again in June or July of each year. Apparently the summer report in conjunction with other season uncertainty provides a flow of information to the market that is not conducive to development of major trends. The choppy trading action initiates numerous trade signals, even when filtered. Most of the trades initiated were not profitable, as the intermediate trends in the August contract are usually small in both duration and relative price change.

The large trading profits evidenced in other contract months may be due to the relatively slow realization of supply and demand fundamentals. The realization may develop in a more orderly and consistent fashion through the late winter and spring months than for the summer trading month of August. The time period relative to the August contract month includes more than the mid-year inventory report. Various reports and realizations of crop and pasture conditions also effect the August contract. The type of winter weather effects stocker gains, conditions of winter wheat and wheat price anticipation influence anticipated and actual wheat maturity and therefore, pasture availability. Decisions made by producers in late winter have direct bearing on the timing of eventual slaughter of many stockers. Cow slaughter and non-fed slaughter tend to be more uncertain and therefore important price determining factors during late summer than at other times of the calendar year.

The significantly different trading results for different contract months utilizing identical trading rules lends substantial support to the conclusion of W. D. Gann (1923) that continuous charts should be on a contract by contract basis. Once a particular contract delivery month expires, the proposed proper method of charting would pick up the following years trading for the same delivery month. Most conventional charting techniques move to the next consecutive contract month upon expiration of the current delivery month. Gann observed that the factors that influence a delivery month are not identical to those of some other contract month. His method of long term charting considers these differences.

Summary

The money flow and aggregate price filters proposed and investigated in this research produced positive results. Chapters V and VI detail the comparison of the filtered moving average trade profits to the profits of the same moving average results without consideration of a market direction or attitude filter.

The 1 day-3 day money flow filter (Table V and Figure 5) proved to be the most successful combination of the money flow filters considered. The 7 day-15 day simple moving average crossover combination coupled with the 1 day-3 day filter provided the highest returns over the time period test. These trading results held through the 1983 post-sample test period. Consideration of the trend of outstanding financial commitment increased closed trade profits for the most profitable moving average combination by more than $6,000. In addition, inclusion of the money flow filter with a simple moving average trend following system increased the number of profitable combinations of moving averages and reduced the losses for those unprofitable combinations.

The application of a 3 day-5 day aggregate price filter to a simple moving average trading system (Table X, Figure 10) produced greater trade profits than the established reference base of unfiltered simple moving averages (Table III, Figure 3). The number of profitable combinations of simple moving averages increased with the inclusion of an aggregate price filter. Profits per filtered moving average combination were greater than for the same unfiltered moving average combinations. Filtered moving average combinations

with cumulative losses for the time period investigated tend to have much smaller losses than the losses derived from the unfiltered moving averages. The 9 day-15 day simple moving average crossover model with a 25 percent open interest filter and a 3 day-5 day aggregate price filter was the single most profitable combination of all of the aggregate price filters investigated.

Trading results between contract months varied considerably. August was the month that generated the least profits (or greatest losses), irrespective of the filters employed. Conversely, April was the most profitable, with February and June in contention for the next most profitable contract months for the filtered trend following systems investigated.

Conclusions

Filters for moving averages that identify trends in trader commitment and revealed attitudes and opinions may be derived from the basic daily reported market statistics of closing prices and open interest. These filters applied to trend following moving average technical trading definitely improve trading profitability when compared to the same unfiltered moving average combinations.

Granting that the basic pattern of closing prices has no positive serial correlation, as concluded by numerous researchers, the results of this research indicate that there are calendar periods and contract months in live cattle futures that consistently display major trending moves. These shifts in equilibrium prices may be identified and capitalized upon thorough application of technical trading with filtered moving average techniques. Profits from these methods are

enhanced substantially through the application of filters reflecting market sentiment characteristics. These characteristics are identifiable as total financial commitment to the futures market, and as an open interest weighted price.

Consideration of all traders opinions and the change in positions of all traders as a moving average pre-filter acts as an aid enhancing the profitability of technical trading. These techniques are suggested to be used by producers as a strategy in a multiple hedging risk management portfolio.

The single best filtered moving average is that of the 3 day-5 day aggregate price filter. Profits are the highest and more importantly, losses are minimized. This is important as the most profitable single combination in the future may not be the 9 day-15 day combination that generated the most profits during the test and post sample period. Selection of the aggregate price filter will minimize losses to the multiple hedger should the incorrect moving average combination be employed. The aggregate price filter is preferable to the money flow filter for this specific reason.

The intent of the identification, development and testing of additional market trend measures was to achieve greater success in the application of multiple hedging techniques. This study examined both buy and sell profits. A producer, feeding cattle, would not usually take an open long position in the futures market, except as a cross hedge for anticipated feeder cattle requirements. Profits from buy signals would not be realized as actual increases in futures margin account equity, but rather as increases in equity in the cash cattle in the feedlot realized upon the final sale of the cattle. A bankers

or basis hedge would not capture much, if any, equity appreciation resulting from major rises in prices such as witnessed in past years.

Suggestions for Further Research

The computational costs incurred in identification and verification of the hypothesized money flow and aggregate price filters precluded the consideration of research on hedging strategies. A study such as that done by Franzmann and Shields (1980) or Franzmann and Lehenbauer (1979) should be repeated. This type of study would consider implications of market exposure to unhedged cash cattle positions, the returns to equity and analyses of variance of long term profits for a simulated cattle feeding operation. Cross hedging of feeder requirements in the live cattle contract, or use of similarly optimized technical systems feeder cattle for contracts would be an appropriate field of consideration, as would use of technical trading signals to purchase or hedge feed (corn) requirements.

Lastly, the positive results of this particular research effort toward identification and monitoring trends in trader psychology should be encouragement to others to pursue this avenue of technical analyses. Price, after all, is a state of mind, of comparative value in use or exchange. The price/utility relationship may be further analyzed in other non-traditional, applied methods, such as was pursued in this research effort.

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Doctor of Philosophy

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