THE EFFECTS OF TRADITIONAL AND MANAGED HEDGING STRATEGIES FOR CATTLE FEEDERS

by

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INTRODUCTION

Conventional microeconomic theory is based on the abstracted concept of producer actions in a perfectly competitive world. Inherent to the perfectly competitive model is the concept of a perfect market. The assumptions of the perfect market concept are:

1. A large number of buyers and sellers, none of which has any influence on prices paid or received.
2. Perfect knowledge by everyone of prices and of all the economic factors and other forces affecting prices.
3. A commodity that is perfectly homogeneous in type and quality.
4. No barriers to entry and exit from the industry by individual firms.
5. Perfect mobility of all factors of production (land, labor, and capital) to enter or leave the industry or to shift from one sector of the industry to another.
6. No outside interference from government or other institutions in the economy.
7. Immediate adjustments to supply and demand at any level of the market.

The real world falls short of its theoretical counterpart. It is the departure from the perfect market concept that causes production agriculture to face such a volatile and uncertain price structure.

The fixity or immobility of some production resources in agriculture presents a most serious departure from the perfect market concept. Farm land, feedlots, equipment, and buildings cannot be shifted in and out of agriculture at will. Farm land, regardless of ownership, will be used for the production of agricultural commodities. Large feedlots will, in the economic short-run, still finish cattle as long as there are cattle that need finishing and feed costs can be recovered. This tends to hold these factors in production even when prices are below the total average costs of production. In fact, producers often attempt to increase crop production or feed cattle and hogs to heavier weights in efforts to offset the effects of lower prices on incomes.

Presented with circumstances in which they cannot greatly affect the prices received for their products or the prices paid for their inputs, farmers and ranchers necessarily center attention mainly on costs and efficiency. The concentration on efficiency is intensified by the upward effects of inflation on prices paid for virtually all production inputs. As the cost-price squeeze tightens, producers begin using even newer, more efficient equipment and techniques. There are two problems with this. First, the new technology tends to increase production and total output. The new methods also tend to increase capital and cash operating requirements. The results are lower prices and an even more rigid and inflexible higher cost structure.

With perfect knowledge, production and marketing decisions of primary producers could be made with certainty. Under conditions of the perfect market there is one price in the market at any one time and location and everyone is aware of that price.

Production sectors of agriculture fall short of the perfect market condition of perfect knowledge. While there are a relatively large number of buyers and sellers in most major agricultural commodities, knowledge is far from perfect. Risk and uncertainty arise in the absence of perfect knowledge. Through improved market news and information, attempts have been made to line up market characteristics of agriculture more in the direction of perfect knowledge conditions. Enough uncertainty remains, however, that along with the time consuming biological characteristics of plants and animals, the system is afflicted with lags, leads, and other temporary maladjustments. Weather generally is a disturbing factor and is, in a large degree, unpredictable. Production and supplies are not always coordinated with market requirements at prices which cover all necessary costs including competitive profits. Adjustments often require considerable time.

Conventional economic theory characterizes the economic function of a producer as maximizing profits or minimizing losses, given the imperfections in production and marketing. In the real world situation of imperfect knowledge, several methods can be applied to help fulfill the economic function. This study was undertaken to examine the effects of hedging as a potential managerial tool for that purpose.

Hedging is defined as taking a position in futures markets which is equal and opposite to a similar position already held or anticipated in physical units of the cash commodity.[1] The assumption is that any losses in one market will be offset by an equal gain in the other market.

In order for this assumption to hold true, two basic conditions that are fundamental to hedging must exist: (1) over time the prices in the two markets must move generally in the same direction, and (2) both prices must come reasonably close together at the par delivery points at maturity of the futures contract. These conditions will be discussed further in the next chapter.

A simple hypothetical example of the operation of hedging is traced in Table 1.1. This table uses hypothetical data to illustrate the use of the

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[1]Hedges are generally classified by referring to the trader's position in the futures market. If the trader has the physical commodity on hand and sells a futures contract to hedge against a price decline, he is said to be "short" in the futures market, and the trade terminology would refer to this as a "short hedge". Conversely, if the hedger is anticipating possession of the physical commodity at a later date and buys a futures contract to protect against a price rise, he is said to be taking a "long" position in the futures market, or executing a "long hedge".

futures market to place a hedge against a price decline in the cash market during a feeding period, as well as the effect of hedging in a period of rising prices.

Table 1.1. Hypothetical example illustrating the use of the futures market for hedging.

	Period of falling prices		Period of rising prices	
	Cash market (physical commodity)	Futures market (contract)	Cash market (physical commodity)	Futures market (contract)
T_1	current price $35.00	sell at $36.00	current price $35.00	sell at $36.00
T_2	sell at $34.00	buy at $34.00	sell at $38.00	buy at $38.00
Gain in each market	-$1.00	+$2.00	+$3.00	-$2.00
Hedged selling price	$34.00 + $2.00 = $36.00		$38.00 - $2.00 = $36.00	

Assume that a cattle feeder places steers in a feedlot during period T_1, which he plans to finish out and sell in period T_2. In this hypothetical example the price for choice slaughter steers is assumed to be $35.00 per hundredweight at T_1. The futures price, with any needed adjustments for quality and location, is assumed to be $36.00 per hundredweight at T_1, which is enough to cover breakeven costs and is an acceptable price to the producer. To protect against a price decline during the feeding period the hypothetical cattle feeder sells a futures contract at period T_1, equal in liveweight to the number of steers he intends to have available for sale at the end of the feeding period, at the adjusted futures price of $36.00 per hundredweight. Assume that the cash price drops to $34.00 per hundredweight by the time the steers are finished and ready for market (T_2), and that the futures market also declines - so that the futures and cash prices converge at exactly $34.00. The producer then buys back his futures contract for $34.00, or a gain of $2.00 per hundredweight over what the contract was sold for. Thus, his actual return would be the $34.00 cash selling price plus the $2.00 gain on the futures contract, or $36.00 per hundredweight.

If the prices were to rise during the feeding period, the producer would still receive a $36.00 per hundredweight price. This is shown in the right hand side of Table 1.1. Assume that the initial conditions are the same as in the previous example, but that the two prices converge at $38.00 per hundredweight at the end of the feeding period. The loss in the futures market would be $2.00 per hundredweight, and the hedged return would be $36.00 ($38.00 cash selling price minus the $2.00 loss on the futures contract equals $36.00). Unfortunately, a hedge "protects" from a favorable price movement just as it does from an adverse price movement; however, a selling price of $36.00 per hundredweight was achieved, which was an acceptable price to the producer when he placed his steers on feed in this example.

These hypothetical examples assumed no brokerage fees and margin requirements, which would have to be subtracted from futures profits (or added to futures losses) to arrive at a true hedged selling price.

Such a close and precise correspondence in the movements of prices in the two markets is highly unusual in the real world and represents a principal source of difficulty and problems in hedging. That main reason for this divergence is that the relevant cash market price is for the market where the producer normally markets his product, while the futures price represents an approximation or estimation of value at particular "par" markets at the particular time that the contract is scheduled for maturity. The cash-futures price difference, the "basis",[2] at the time that the hedge is placed and future changes in the basis, especially at the time the hedge is lifted, are extremely important from a hedging standpoint.

Objectives

This study was undertaken to determine the potential of hedging in the futures market for live cattle as a management tool for a cattle feeder, given the fixity of some of his production resources, imperfect knowledge, and other conditions that represent at departure from the perfect market concept. Specific objectives were:

1. to compare the results from a policy of consistent (routine) hedging versus one of never hedging,
2. to update a previously published study involving traditional selective hedging methods,
3. to develop new selective hedging criteria, which include the possibility of managing the hedge by lifting and placing the hedge at opportune times during the feeding period,
4. to measure the effects of hedging on profit levels, and
5. to measure the effects of hedging on risk levels.

Procedures

To measure the impact on average profit and risk levels, a simulated feedlot was developed in an attempt to approximate the cost of gain and cash profits

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[2] Although the literature generally refers to the basis only as the difference in the cash and futures price, the basis in this study was more specifically defined as the amount by which the cash price is greater than (or less than) the futures price for a specified commodity at a given location at a given point in time.

from feeding cattle at all times throughout the study period.[3] The model assumed a 20,000 commercial Kansas feedlot that was buying and selling cattle weekly. Chapter III gives a more detailed account of the simulated feedlot.

Different hedging strategies were then tested on the cattle coming out of the simulated feedlot. The difference in profits were accounted for entirely by the marketing strategies, as the cost of gain, cash prices, and futures prices were identical on any given lot of cattle. The variance in profits was used as a measure of risks. For a hedging strategy to have been considered successful in this framework the average profits must have been increased without a corresponding increase in variance, or the variance must have been decreased without a corresponding reduction in average profits, or both conditions must have been met simultaneously.

All marketing strategies were developed and tested in a hedging framework and it is not implied that the results would be the applicable when used for speculative purposes.

[3]The study period began with the development of the live beef cattle contract on the Chicago Mercantile Exchange. The first lot was assumed to be placed on feed November 30, 1964, and marketed on May 1, 1965. The last lot was placed on feed January 31, 1976, and marketed June 28, 1976. A total of 583 lots were analyzed.

Chapter II

THE HISTORY AND DEVELOPMENT OF THE FUTURES MARKET, AND APPRAISAL OF THE LIVE BEEF CATTLE CONTRACT

Primary producers of agricultural commodities are faced with two distinct types of entrepreneurial uncertainty. Technical uncertainty arises from imperfect knowledge of the production function and the quantitative or physical relationships among inputs and outputs associated with and derived from the production function. These uncertainties are derived from the unknown effects of weather, disease, technology, etc. Market uncertainty arises from imperfect knowledge of present and future prices of inputs and outputs. Market uncertainty also may be related to imperfect knowledge regarding the future availability of inputs or the existence of market outlets.

Insurance is one means of protecting the individual firm from certain kinds of production losses. For example, a farmer can insure farm buildings against destruction by fire. He may also purchase wind or hail damage insurance. These events are insurable because they are independent in occurrence, the probabilities of occurrence are calculated for large numbers, and the probabilities of individual occurrence decline as underwriters' commitments increase. Hence, the quantitatively calculated probabilities of these uncertainties can be converted to risks, and thus to costs. However, uncertainties of loss to holders of inventory or primary producers due to a decline in prices are uninsurable risks in a normal sense. For instance, a price decline affects all stocks of the commodity equally, thus unfavorable events are not independent in occurrence. Further, the risks of loss increase rather than decrease with the size of commitments. "This explains why neither risks due to technical uncertainties affecting total or a very large portion of total supplies (e.g., vagaries of the weather affecting the entire crop) nor risks of fluctuations in market values due to other causes are convertible into 'cost' by means of ordinary insurance."[1]

The concept of forward trading has emerged to help fill this void of insuring against market uncertainties due to unforeseen future events. Cash forward trading, or forward contracting, consists of buyers and sellers entering into a formal and enforceable agreement to transfer ownership and possession of a specified physical commodity at a later date. Thus, the seller and the buyer are protected from a price decline or rise, respectively, during the contract period.

So long as the forward price agreed upon is satisfactory to the participants, changes in the price of the commodity between the time that the contract is entered into and the time that the contract is fulfilled should be irrelevant. In the case of the producer, two conditions may disturb this bliss, however. First, suppose that the market price of the commodity rises substantially during the contract period, so that the seller could have sold his commodity for much more than he agreed to when entering the contract. Since his contract is binding, the producer must deliver and simply regret his earlier decision and lack of foresight. Second, suppose that the producer's actual physical commodity that he intended to deliver was destroyed or reduced in quality due to disease, rodent damage, etc. He would then be forced to acquire additional supplies from reserve uncontracted stocks or on the open market in order to meet his contract. If prices have gone up during the contract period or if the quality of the commodity needed is in short supply, then acquiring replacement stocks may be very costly.

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[1]Gerda Blau, "Some Aspects of the Theory of Futures Trading," Review of Economic Studies, 12(1944-45), p. 1.

The buyer, on the other hand, may face an oversupply or reduced demand condition at the end of the contract period which has drastically lowered the price from that price agreed to when he entered into the contract. If a reduced demand has made it impossible or undesirable to move inventories on hand, the buyer may also be restricted by limited physical capacity to receive the contracted commodity, which he is legally bound to do. In the case of a price decline the buyer will find a disadvantage in that he must pay a price that will cause him to be at a competitive disadvantage with other buyers that did not contract and can purchase the commodity at the lower current price.

In short, cash forward trading does not eliminate loss due to technical uncertainties and may increase or at least not reduce the risks of regret. Since the risks of individual uncertainty can not be eliminated by forward contracting but merely transferred from one group to another, the question arises as to what group would agree to accept the risks. Usually the participants in forward trading are persons whose business income is derived from the transformation of inputs into outputs or the providing of time, form, and place utility with respect to a particular commodity. They may reap entreperneurial rewards for the risk bearing associated with their activities, but their prime motive is usually to earn stable returns to other resources and reduce as much income variation due to uncertainty as possible. In order for both conventional parties to a forward trade to shift the risks of unfavorable events, a third, outside group of persons must be induced to assume these risks. That is, speculators willing to put up "risk capital" to forward buy or sell commodities in anticipation of gains due to favorable price changes must be induced to participate in forward trading. Cash forward trading, however, greatly limits the amount of "risk capital" entering to assume such burdens since cash forward trading requires the outright purchase or sale of the physical goods and thus requires large amount of money capital. Further, cash forward trading also ultimately involves the actual delivery and possession of the commodity even though in the case of transferable forward contracts, the rights to possession or disposition of the commodity may have changed hands several times during the contract period.

In order to attract more speculative interest, several organized commodity futures exchanges have developed in various parts of the world. By trading in these exchanges the amount of "risk capital" needed to assume rights over possession or disposition of a commodity is greatly reduced and greater financial leverage is obtained. Traders are required to post margin money representing only a fraction of the value of the contract as a sign of "good faith" on their part in fulfilling their contractual obligations. Furthermore, the traders are buying and selling standardized contracts which do not specify any actual physical commodity, only the standards and grades of a commodity necessary to fulfill the contract. The vast majority of the contractual obligations are fulfilled by merely making an offsetting transaction to an original position, and very little of the actual physical commodity is delivered on the contract, but rather is marketed through established cash marketing channels. Thus, the risk of damage to the physical commodity due to technical uncertainties as outlined earlier is eliminated.

In an earlier theoretical work Nicholas Kaldor[2] outlined some of the criteria for a successful commodity futures market. The market must be one such that speculative demand or supply amount only to a small proportion of total demand and supply, so that speculative activity, while it can influence the magnitude of a price change, cannot at any time change the direction of a price movement. The commodity must be traded in a perfect, or semi-perfect, market; and must be a product that has low carrying costs. In order to meet these last

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[2]Nicholas Kaldor, "Speculation and Economic Stability," Review of Economic Studies, 7(1959), p. 3.

two criteria, the commodity must possess the following four attributes:

(1) The good must be fully standardized, or capable of full standardization.

(2) It must be an article of general demand.

(3) It must be durable.

(4) The commodity must be valuable in proportion to its bulk.

The development of the organized futures market has opened the door to hedging by producers and processors as a means to reduce market uncertainty. Conventional theory describes hedging as taking a position in futures markets which is equal to and opposite to a similar position already held or anticipated in physical units of the cash commodity. In actual practice, hedging activities usually do not strictly conform to this definition. The closest correspondence between the definition and actual practice occurs in the case of the grain merchant or processor who short hedges his total inventory during the storage period. That is, a pure routine hedger hedges all stocks carried forward by selling futures contracts equivalent to the quantity of the commodity which he has in storage or in production. A pure hedger might also be a long hedger if he buys futures contracts equivalent to the quantities of the commodity which he expects to acquire through the cash market at a later date.

In order for the futures market to provide an adequate hedging mechanism, there are two fundamental cash-futures price relationships that must be fulfilled: (1) over a period of time cash prices and futures prices for a given commodity of a given standard and quality must move in the same general direction, and (2) during the month of a futures contract maturity the cash price at par delivery points and the price of the expiring futures contract must come reasonably close together, differing by approximately the amount of the delivery costs required to transfer ownership at the par market. Blau expressed this as follows:

> The system of futures trading is based on the fact that cash and futures prices move together. Clearly, the effectiveness of hedging (i.e., the effectiveness of neutralizing price risks in the cash market by assuming opposite risks in the futures market) must be impaired to the extent to which the movements of cash and futures prices diverge.[3]

Erratic day-to-day, or short-period deviations from this condition do occur and are not particularly damaging. Moreover, it has been shown that profits can be enhanced through a consideration of these deviations.[4] However, any long, sustained, unpredictable movements would render the futures market untenable for hedging purposes.

Differences in the movements between the futures price and cash price arises out of imperfect knowledge regarding future events. Futures prices are determined by traders' (mostly speculators') actions based primarily on two factors: (1) their individual expectations of future supply and demand conditions, and (2) the reaction of other traders in the futures market to their own expectations of future supply and demand conditions. Expectations regarding future supply and demand conditions are deduced from current and anticipated conditions. Current cash prices are, on the other hand, based upon appraisal of the current supply and demand situation, which is, in turn, conditioned by future expectations. Thus, cash and futures prices usually react in the same direction to continuously developing supply and demand factors.

The tendency for cash prices at par delivery points and futures prices to come reasonably close together at the expiration of a futures contract is assured by the fact that buyers (or sellers) of futures are entitled to demand

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[3]Blau, p. 7.

[4]Grain merchandisers and traders have depended for a share of their profits to accrue by trading on the basis movements. For more on this see Holbrook Working, "The Theory of the Price of Storage," American Economic Review, 39(1949), p. 1260.

(or to enforce acceptance of) delivery of the commodity. Although actual deliveries are as a rule but a very small fraction of the total volume of futures trading, the right to demand or to enforce acceptance of delivery is of the utmost importance for keeping cash and futures prices in line. If futures prices were higher than cash prices for the same standard and quality of a commodity during the delivery period of a futures contract traders could make a profit by selling in the futures market, simultaneously buying in the cash market, and fulfill the futures contract by delivering the commodity. Such transactions could be carried on until the increased stimulus for cash buying and futures selling had raised cash prices and lowered futures prices to approximately the same level. On the other hand, if cash prices were above futures prices, traders that were long in the futures market would find it profitable to demand actual delivery and re-sell the goods in the cash market rather than liquidate their position by selling futures.

It is not mandatory that a hedger has to be a pure hedger, with exact amounts of the physical commodity in opposite positions in the two markets. He is, however, a speculator in the amount of the physical commodity that is not exactly offset in the two markets. For example, a grain producer may have 7,500 bushels of wheat that he has harvested and placed in storage. If he is interested in hedging that wheat he will sell futures contracts. If the standardized quantity of a wheat futures contract calls for 5,000 bushels, the producer has two options. One, he can sell one futures contract, which hedges 5,000 bushels of his stored wheat, and be "long" 2,500 bushels of wheat in the cash market; or, two, he can sell two futures contracts and be 2,500 bushels "short" in the futures market. In either case he is a speculator (i.e., not hedged) on 2,500 bushels of wheat.

A producer may wish a "mix" in the marketings of his physical commodity by forward contracting, hedging, holding available unhedged inventories, or others. He may also place different risks on each marketing alternative. Thus, for any given individual, an optimum hedging level is that quantity of a physical commodity held in the futures market relative to the cash position that results in the best attainable combination of average profits and risks for that particular individual.

The live beef cattle contract

Futures trading in live beef cattle contracts was initiated on the Chicago Mercantile Exchange on November 30, 1964. Cattle feeding differs in several basic ways from holding inventories or producing crops. Cattle feeding is a dynamic production process in which product form is continually in transformation during the production period. Cattle feeding is thus yielding time and form utility rather than only time utility which is created by holding grain stocks. Furthermore, live cattle are non-storable commodities in the normal sense. Cattle can not physically be held in unchanging form nor can they economically be held in changing form for long periods after optimal market weights have been reached. Unlike crop production, cattle feeding is not technically forced into a seasonal production pattern although seasonality of cattle feeding and marketing may result from economic factors and biological aspects of bovine reproduction.

Thus, the qualifications for a successfully traded commodity on a futures exchange as outlined by Kaldor[5] and other earlier theorists are not strictly applicable to the live cattle contract. Skadberg and Futrell[6], in an early critical appraisal of the economic effectiveness of the live cattle futures,

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[5]Kaldor, p. 3.

[6]Marvin J. Skadberg and Gene Futrell, "An Economic Appraisal of Futures Trading in Livestock," Journal of Farm Economics, 48(1966), p. 1985-89.

discuss six conditions departing from traditional requirements for a futures market that limits the effectiveness of the contract for hedging purposes:

1. The conditions for complete standardization in both the futures and the cash markets are not met, making it next to impossible for accurate price-quality relationships to exist in both markets. The criteria for choice grade cattle encompass a range, and in the cash market cattle are priced by where they fall in that range. In the futures market the quoted price applies to some non-conceptual point in that range, making some choice cattle overpriced and some underpriced.

   This same phenomena is apparent somewhat in grains, and in both markets it is assumed that the futures price applies to the cheapest deliverable cash commodity which meets contract specifications. However, the cash price-quality relationship in choice cattle is not constant over time with respect to the weight of the cattle, e.g., sometimes a cash premium is paid for the lightest choice cattle and sometimes for the heaviest. In grains there is no corresponding weight differential in a given quality grade.

2. The futures market in live cattle does not exist to help even out some imbalanced production - utilization schedule as in the case of grains. Live cattle are basically commodities with continuous production and immediate utilization.

3. The basis for live cattle rarely reflects the same price-quality relationships at the beginning of the feeding period as it does at the end of the feeding period. This creates another variable for basis adjustments to arrive at the effective hedge price. This variable is almost impossible to empirically determine.

4. The market positions in the two markets are not comparable until the

very end of the feeding period. In the futures market the contract always specifies finished (slaughter) cattle, while the physical commodity that is hedged is in reality feeder cattle in different stages of transition, and would have to be sold as such on the cash market. Ehrich[7] argues that the closest basis relationship for cattle ought to occur between cash feeder cattle and futures live cattle. Based on empirical studies Ehrich presents the following as the appropriate model for the cash-futures price relationship for live cattle:

$$P_s^* - Pf = (P_s^* - C)\ (1 - \frac{Ws}{Wf})$$

Where: P_s^* = current futures price of the relevant live cattle contract,

Pf = current price of feeder steers,

C = total cost of gain per hundredweight,

Ws = finished weight of steers, and

Wf = beginning weight of steers.

5. There are weak economic hedging incentives for producers of beef cattle, since hedging under the wrong circumstances can produce drastic losses. Economic conditions have changed since this article was written (1966), and this may no longer be a valid criticism.
6. The futures market in live cattle does not provide a cash pricing mechanism, and its risk transferring capabilities are limited. The cash market is not priced relative to the futures as in the case of grains, and no one can argue that the futures market is a good predictor

[7]R.L. Ehrich, "Cash-Futures Price Relationships for Live Beef Cattle," American Journal of Agricultural Economics, 51(1969), p. 30.

of spot prices. In fact, Leuthold[8] presents empirical evidence that for 4 - 8 months prior to delivery the cash market is actually a better predictor of subsequent spot prices than the futures market in live cattle. He also presents evidence to indicate that the futures price is a downward biased estimate of future spot prices. This is so, he reasons, because there is an imbalance of short hedgers relative to long hedgers and speculators to offset their positions.

Heifner[9] also finds evidence to support the downward bias in live cattle futures prices. His explanation is that this bias reflects the risk premium demanded by speculators. Heifner also presents empirical evidence to show that even under optimum hedging conditions only about 1/3 to 1/2 the market risk is shifted from producers to speculators.

The existence and use of a live cattle futures market may materially improve cattle feeders' returns in principally two ways. First, given the decision to feed a particular number of cattle in a particular production process, hedging may protect the cattle feeder from windfall losses due to changing conditions during the production period, although hedging also prohibits windfall gains. That is, hedging may "fix" the outcomes from cattle feeding within a range of possibilities so that optimal decisions of the firm at T_1 will remain in some sense optimal at T_2, even though difference decisions might have been made if conditions had been perfectly foreseen. Second, beef futures and the prices they generate may be used directly in the decision process as a decision tool to aid farmers in choosing optimal product and input

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[8]Raymond M. Leuthold, "The Price Performance on the Futures Market of a Nonstorable Commodity: Live Beef Cattle," American Journal of Agricultural Economics, 56(1974), p. 275.

[9]Richard J. Heifner, "Optimal Hedging Levels and Hedging Effectiveness in Cattle Feeding," Agricultural Economics Research, 24(1972), p. 32.

combinations. In other words, a hedging decision model may be used (1) to make an optimal decision or (2) to protect an optimal decision.

Chapter III

THE EFFECTS OF ROUTINE HEDGING ON CATTLE FEEDING PROFITS

Introduction

In order for routine hedging to be considered a viable management tool for live cattle producers, one or both of two conditions must be fulfilled over the long run: (1) average profits must be increased from the unhedged levels without increasing the level of risk (i.e., the variance of profits), or (2) risk levels must be reduced from the unhedged levels without a corresponding reduction in average profits. Without meeting one or both of these criteria over the long run, hedging would be increasing rather than decreasing market uncertainty.

Methodology

To measure the impact of hedging on cattle feeding profits, it was necessary to develop pertinent data. To accomplish this, the period from December, 1964, through June, 1976, was used to develop a simulated cattle feeding model.

This model assumed that choice feeder steers weighing 650 pounds were placed on feed at a cost represented by the weekly average price for 600-700 pound choice feeder steers at Kansas City during that week. The cattle were fed for 147 days (21 weeks) in a 20,000 head Kansas feedlot at 100% capacity. The first lot was placed on feed November 30, 1964, and marketed May 1, 1965. The last lot was placed on feed January 31, 1976, and marketed June 28, 1976. A total of 583 lots were analyzed. Rate of gain, before and after a 4.0 percent pencil shrink was 3.0 and 2.7 pounds per day, respectively. Feed requirements and rations were adjusted as the cattle progressed through the feeding period, and the cost of feedstuffs was based on current weekly prices. The ending weight after shrink was assumed to be 1047 pounds, and the selling prices for the finished cattle were weekly average quotations for 900-1100 pound choice steers at Kansas City.[1]

The average profit per head for cattle to be sold with no hedging involved was defined as follows:

$$(1)\quad CP = (10.47 \cdot C_{(t+20)}) - (6.5 \cdot P_{(t)}) - (NFC \cdot I_n) - \sum_{t=1}^{21} FC_t$$

where: CP = profit or net revenue per head for cattle sold at the end of the feeding period,

10.47 = finished weight after shrink in hundredweight,

$C_{(t+20)}$ = average weekly price for Kansas City quotation for choice 900-1100 pound slaughter steers in the week the cattle were sold,

6.5 = beginning weight in hundredweight,

P_t = average weekly price for Kansas City quotation for choice 600-700 pound feeder steers in the week the cattle were placed on feed,

NFC = average non-feed cost per steer during the 147-day feeding period,

I_n = weighted price index, and

FC_t = variable feed cost for one steer during week t.

Futures market per head profit on hedged cattle sold was defined as follows:

$$(2)\quad HP = ((F_{t_0} - F_{t_1}) \cdot 10.47) - CC$$

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[1]Rations, non-feed costs, and nutrition requirements are outlined in more detail in Appendix A.

where: HP = profit per head resulting from the hedge or sell-buy activities in the futures market for cattle sold,

F_{t_0} = average closing price of the relevant futures contract at Chicago during the week that the contract was sold,

F_{t_1} = average closing price of the relevant futures contract at Chicago during the week that the contract was purchased back,

10.47 = finished weight in hundredweight, after shrink, and

CC = hedging costs on a per head basis.

The relevant futures contract used was the contract that expired in the month that the cattle were marketed, or the next succeeding month if the cattle were not sold in a delivery month. The hedging costs that were used are shown in Table 3.1, and reflect closely the actual hedging charges of a typical brokerage house during the study period.

Table 3.1. Hedging costs used during the study period.

	Commission	Initial Margin		Interest on margin (147 days)	Total cost	Cost per head[a]
25,000 lb. contract 1965-Aug. 1969	$25.00	$ 500.00	@ 6%	$12.08	$37.08	$1.55
40,000 lb. contract Aug. 1969-Jan. 1971	$36.00	$ 550.00	@ 6%	$13.29	$49.29	$1.29
40,000 lb. contract Jan. 1971-Dec. 1972	$40.00	$ 400.00	@ 6%	$ 9.66	$49.66	$1.29
40,000 lb. contract Jan. 1973-Apr. 1974	$40.00	$ 900.00	@ 8%	$29.00	$69.00	$1.81
40,000 lb. contract Apr. 1974-Jul. 1976	$50.00	$1200.00	@ 8%	$38.66	$88.66	$2.32

[a]Based on an average weight of 1,047 lbs. per steer.

The total per head profit for a lot of cattle was defined as follows:

(3) TP = HP + CP.

Cash (unhedged) marketing

The simulated weekly profits from feeding cattle without using the hedging possibilities of the futures market are represented by the solid line in Figure 3.1. The variation in profits was substantial, due largely to highly volatile feed costs and cattle prices. The average per head profit for the period was $13.82 (Table 3.2), although there was extreme variation around this average, with the highest profits (approximately $200/head) in the summer of 1975 to the greatest losses (approximately $150/head) in early 1974. During the period, profits were returned on 70 percent of the unhedged lots.

Table 3.2. Average annual profits and variances from unhedged marketings, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	Average profits (dollars per head)	Variance of profits
1965	36.43	265.693
1966	13.60	580.593
1967	3.33	130.177
1968	19.78	48.971
1969	28.24	1302.794
1970	1.46	495.800
1971	23.61	256.720
1972	29.18	496.956
1973	2.71	5842.695
1974	-60.00	1170.847
1975	63.10	6028.867
1976	-11.23	914.859
Total period	13.82	1516.381

Prior to 1973 cattle feeding was generally profitable. The combination of consistent profits with relatively low variation generated little interest in the use of hedging. By the end of 1973, however, the cattle feeding industry was in financial difficulty. Fed cattle prices, and food prices in general, rose steadily through 1972 and the early part of 1973 (see Figure 3.2), mostly as a result of disruptions from the normal supply and demand

THIS BOOK CONTAINS NUMEROUS PAGES WITH DIAGRAMS THAT ARE CROOKED COMPARED TO THE REST OF THE INFORMATION ON THE PAGE.

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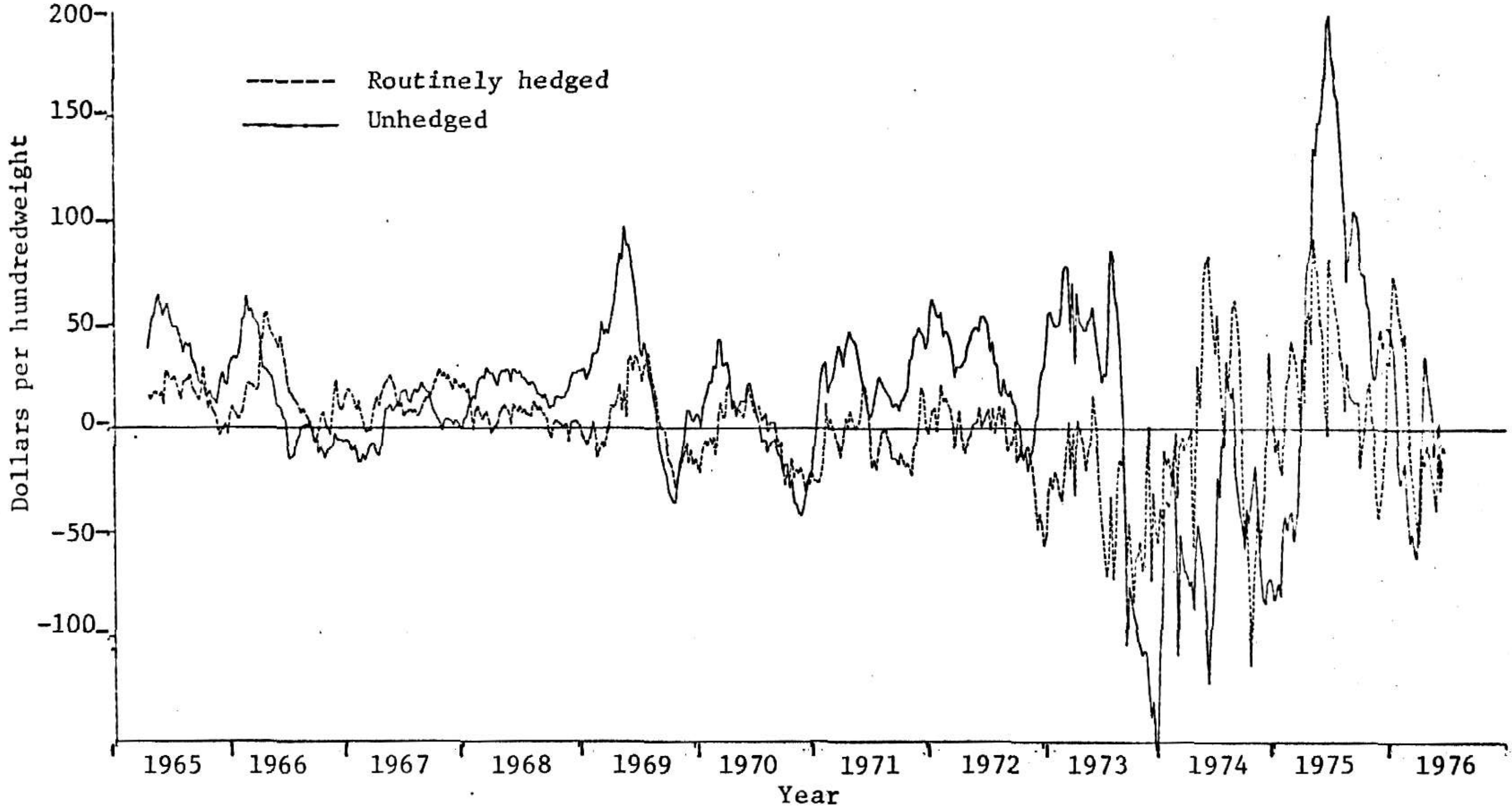

Figure 3.1. - Unhedged and routinely hedged profits, 583 simulated study lots, Kansas, May 1965 - July 1976.

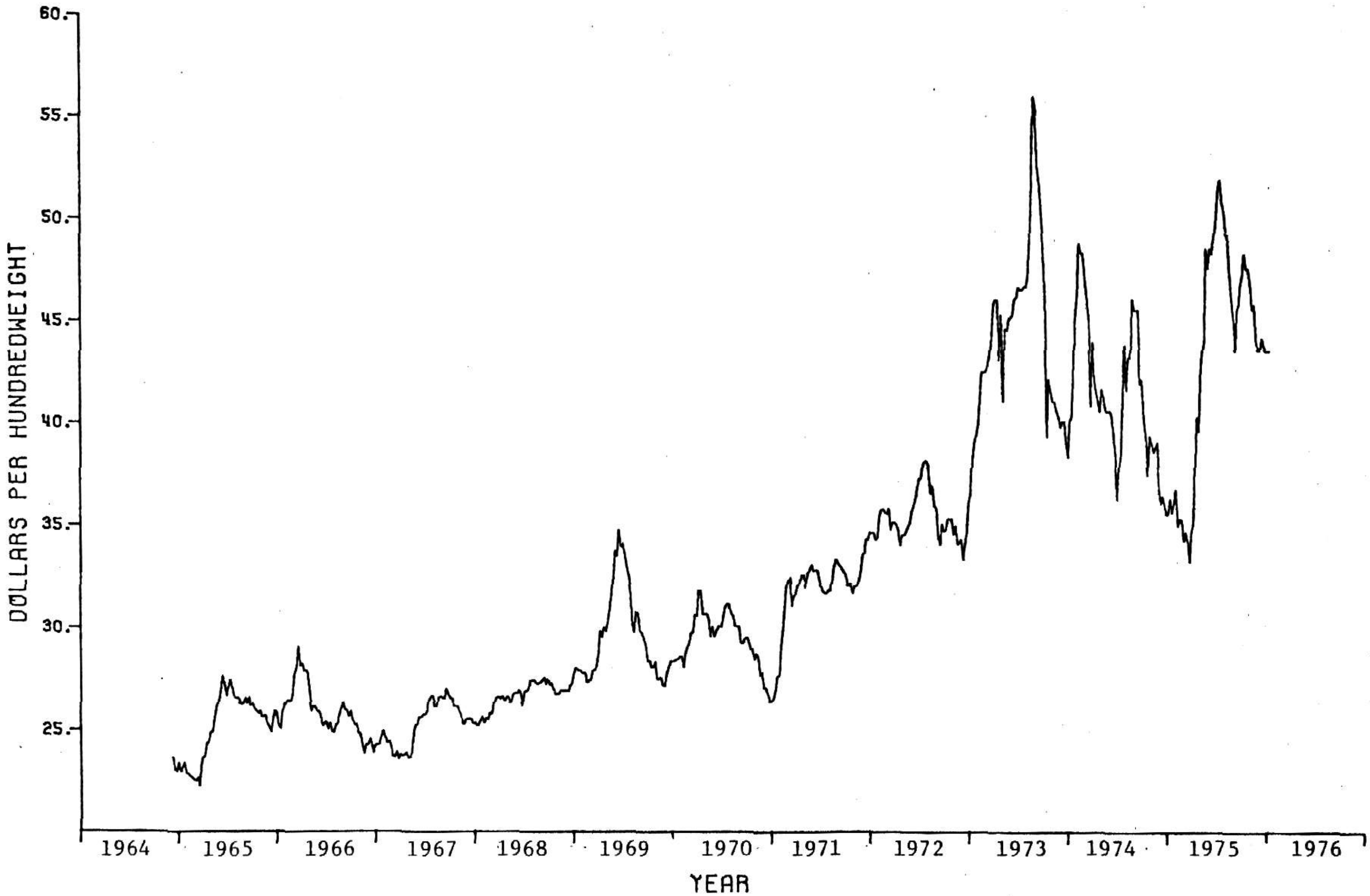

Figure 3.2. Choice 900-1100 pound slaughter steers, Kansas City, 1965-July 1976.

conditions in the general economy brought on by increased world demand for grain.

In an effort to check the rise in food prices, President Nixon in early 1973 placed a price ceiling on retail beef that was scheduled to be lifted in September, 1973. Cattle feeders, who had observed a marked rise in hog prices after a similar ceiling had been lifted on pork earlier in the year, held back marketings of finished cattle in anticipation of even higher prices after the ceiling was lifted on beef. The resultant glut in over-finished cattle after the ceiling was lifted caused cattle prices to drop $25.00 per hundredweight by the beginning of 1974. This fact, coupled with extraordinarily high break-even costs that had come about by aggressive bidding for feeder cattle and feed grains earlier in the year, caused profits in cattle feeding to drop from approximately +$100 to -$150 per head in the same period.

The average simulated profits for feeding cattle from September 1, 1973, until June 30, 1976, was -$9.29 per head, with a variance in profits of 2850.786. The reduced profit level from feeding cattle without hedging during this period has prompted much interest in the potential of hedging price risks in the futures market for live beef cattle.

Routine hedging

There is nothing in conventional hedging theory which suggests that the use of routine hedging would increase average per head profits. However, the variance in profits should be reduced by the use of hedging if cash and futures prices move in the same general direction.

During the relevant 21 week feeding periods used in this simulation, cash and futures prices exhibited a positive correlation of 0.921. This fact suggests that routine hedging should have been effective in reducing the variation in profits from the unhedged position. Routine hedging did reduce variance significantly (α = .01) during the study period, from 1516.381 to 500.161.

However, this was accomplished only by a significant ($\alpha = .01$) reduction in profits from $13.82 to $2.45 (Table 3.3).

The profits from routine hedging during the study period are represented by the broken line in Figure 3.1. It is readily apparent that the variation in profits was less under routine hedging than in unhedged marketings. It is also apparent from Figure 3.1 that hedged and unhedged profits exhibited, by-and-large, and inverse relationship, i.e., when unhedged profits were positive, hedged profits tended to be much lower, in many cases even negative; and when unhedged profits were negative, hedged profits were less negative, and in some cases were positive.

Table 3.3. Average annual profits and variances from *routinely hedged marketings, 583 simulated* study lots, Kansas, May 1965 - July 1976.

Year	Average profits (Dollars per head)	Variance of profits
1965	15.11	77.419
1966	17.47	269.277
1967	14.47	58.132
1968	6.50	33.589
1969	3.87	318.260
1970	-3.39	201.694
1971	-6.05	158.243
1972	-3.21	205.329
1973	-33.01	619.281
1974	-0.46	1944.313
1975	21.00	1018.272
1976	-0.81	1520.868
Total period	2.45	500.161

The profits and variances of routine hedging broken down by years are shown in Table 3.3. In the years prior to 1973, when unhedged marketings were showing profitable returns, the use of routine hedging would have seemed an irrational practice, as routine hedging would have increased returns over unhedged positions (Table 3.1) in only two years, 1966 and 1967. In the period since September 1, 1973, routine hedging would have shown an average profit of $1.65 per head, and a variance of 1675.570. This is both a significantly higher (α = .01) average profit and a significantly lower (α = .01) variance than unhedged marketings for the same period.

The effects of routine hedging are shown in detail in Table 3.4. The left hand side of this table shows the simulated returns of unhedged marketings during the study period. There were 409 lots that returned an average profit of $36.09 per head, and 174 lots that returned an average loss of -$38.51 per head. The right hand side of the table shows the redistribution of these profits and losses by the use of routine hedging. There were 59 lots that turned a profit unhedged which would have shown an average increase in profits of $15.64 per head by the use of hedging. Hedging reduced the profits on 213 lots by hedging, and increased the losses from the unhedged position on another 24 lots. Seventy lots that returned losses unhedged would have been converted to profits by hedging; however, this was more than offset by 137 lots that were changed from profits to losses by the use of hedging. The net effects of hedging was an increase in profits on 209 lots by an average of $32.77 per head, and an average reduction in profits of -$36.05 per head on 374 lots.

Thus, in the framework of this study, routine hedging could not be considered a successful management tool for cattle feeders. The reduced variation in profits was achieved only by taking a significant reduction in average profits - a reduction which would appear to be unacceptable. Because the time period used in this study was one of generally rising prices (see Figure 3.2), it might be expected that a policy of routine hedging would return a lower average profit than never hedging. An obvious alternative arises that possible a cattle feeder might desire to alternate between hedging and not hedging, i.e., selective hedging.

Table 3.4. Effect on profits of routine hedging, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge every lot for the entire length of the feeding period.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	0	-----	------
			Profits increased[2]	59	27.45	15.64
Profits	36.09	409	Profits reduced[3]	213	14.66	-31.14
			Losses changed to profits[2]	70	22.73	49.87
			Subtotal profits	342	18.52	-6.49
			LOSSES			
			Unhedged[1]	0	------	-----
			Profits changed to losses[3]	137	-15.69	-47.13
Losses	-38.51	174	Losses reduced[2]	80	-23.37	30.44
			Losses increased[3]	24	-37.00	-16.33
			Subtotal losses	241	-20.36	-18.32
All lots	13.82	583	All lots	583	2.45	-11.37

[1]Lots that would not have been covered by a hedge under the program considered (none in this program).
[2]Lots for which profits were increased by hedging, 209 lots, average increase, $32.77/head.
[3]Lots in which profits were reduced by hedging, 374 lots, average reduction, -$36.05/head.

Chapter IV

SELECTIVE HEDGING STRATEGIES AND THEIR LIMITATIONS

Introduction

In view of the results obtained from comparing the strategies of never hedging and routine hedging, the need for selective hedging strategies became apparent. This chapter is devoted to updating three previously published selective hedging programs[1], and evaluating their potential as a management tool for live beef cattle producers.

Before turning to the strategies that were tested, a further discussion of traditional hedging theory will be presented to illustrate the logic involved in the development of these strategies. The four prices that are relevant to hedging are symbolized as follows:

C_1 = the cash price at the beginning of the production or storage period,

F_1 = the futures price at the beginning of the period for the futures contract that will mature at or near the end of the period,

C_2 = the cash price at the end of the period, and

F_2 = the futures price at the end of the period.

Traditional hedging theory, as it has been derived from the seasonally produced storable commodities, defines the normal relationship of these prices. Normally C_1 will be below F_1 by the cost of storing[2] the commodity from the beginning to the end of the period. F_2 will be above C_2 normally by the amount

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[1]John H. McCoy and Robert V. Price, "Cattle Hedging Strategies," Bulletin 591, Kansas Agricultural Experiment Station, 1975.

[2]A more general term sometimes used is "carrying costs" which includes interest and other costs associated with the actual physical costs of storage.

of the actual delivery costs incurred in the delivery of the physical commodity against the futures contract at the end of the period. These relationships can be represented as follows:

(1) $F_1 - C_1 = S$ where S = costs of storage

(2) $F_2 - C_2 = D$ where D = costs of delivery

or

(3) $F_1 - C_1{}^* = 0$ where $C_1{}^* = C_1 + S$

(4) $F_2 - C_2{}^* = 0$ where $C_2{}^* = C_2 + D$

If F_1 were above $C_1{}^*$ a trader could assure himself a profit equal to $F_1 - C_1{}^* - D$ by selling the futures contract and buying or holding an existing quantity of the cash commodity in storage for delivery at contract maturity. This action, along with the similar action of other traders who recognized the situation, would tend to lower the futures price and raise the cash price. If this were continued F_1 and $C_1{}^*$ would be forced into equilibrium.

If F_1 were below $C_1{}^*$ storage would not be indicated as a profitable venture. Holders of the cash commodity would then be faced with the following two alternatives: (1) hold the commodity for sale at a later date without hedging, or (2) sell the commodity on the current cash market. If the trader needed the inventory of the commodity for processing purposes, or if he wished to speculate on a higher cash market price at a later date, he would follow the first alternative. This would give no cause for a basis adjustment. If the trader did not desire to hold the commodity for sale at a later, unknown price, he would sell the product at the current cash price. This action, in conjunction with those of other traders with the same desire, would cause a reduction in $C_1{}^*$. There would be no direct reason for this to lessen F_1, and it would be possible for the basis to be restored to equilibrium.

The existence of F_1 less than $C_1{}^*$ also indicates the profitability of selling and lifting the hedge on any commodity that was previously hedged with the basis in an equilibrium condition. The equilibrium basis would then tend to be restored, as selling the cash commodity would reduce C_1*, and the buying back of futures contracts would tend to increase F_1.

It would also hold that, anytime during the storage period, a hedge that was placed with F_1 greater than C_1* could be profitably lifted whenever the basis narrowed by more than the accumulated storage costs, rather than holding the commodity until contract maturity. This action would also tend to restore a normal basis equilibrium.

To summarize, the condition of F_1 above C_1* indicates that the present price of the commodity is less than a possible value at a future date. The activities of traders to capitalize on this profitable differential would, in turn, eliminate it. On the other hand, F_1 less than C_1* suggests that a product may be worth more at the present than in the future. The optimum action for traders in terms of immediate monetary gains would be to sell unhedged inventories, terminate existing hedged storage, and, possibly buy futures. Thus, in the theoretical context, the only equilibrium condition would be for F_1 to equal C_1* in the seasonally produced storable commodities.

The condition as stated in equation (4), $F_2 - C_2^* = 0$, is self-fulfilling in light of the fact that if F_2 is greater than C_2 by more than D, traders would buy the cash commodity, not for storage, but only to immediately deliver it against the futures contract. This would tend to bid up C_2 until it was equal to F_2 - D. Conversely, if F_2 was below C_2, traders would find it profitable to buy futures, force delivery, and immediately sell on the cash market. This action would tend to also restore the basis equilibrium.

In order for the concepts that are pertinent to hedging seasonally produced storable commodities to be applicable to hedging live cattle, the underlying premises must be similar. In light of the fact that live cattle represent a commodity that is continuously produced and immediately utilized (e.g., very little or no storage), a logical equilibrium basis relationship similar to that for storable commodities would not apply. The only necessary basis equilibrium condition for live cattle is that $F_2 - C_2{}^* = 0$, a condition that alert traders will insure.

Paul and Wesson have suggested that in the case of custom feeding the basis represents the cost of feedlot services.[2] Ehrich has hypothesized that the true basis relationship is between live cattle futures and cash feeder cattle prices.[3] In both cases, the concept of storage for the determination of the basis was replaced by the concept of the breakeven costs of feeding cattle. Equilibrium conditions would then call for F_1 to equal the breakeven price over the long run. This equilibrium can be represented by the following:

(5) $F_1 - BE = 0$ where BE = breakeven costs (including the price of feeder calves) per hundredweight.

If this hypothesis is true, traders actions should be determinate. If F_1 were greater than BE, an above normal profit would be indicated. Cattle feeders would be expected to react to this by putting cattle on feed and selling futures. This would intensify competition for feeder cattle and feed grains. This would tend to force F_1 down and increase BE.

If F_1 were below BE an adjustment might not be readily made. For those cattle feeders incurring no fixed costs of feeding, i.e., one who buys cattle and places them in a custom operated feedlot, a more optimum action at this time might be to buy futures rather than feed cattle. This would help to restore the basis. The cattle feeder with fixed resources, however, would be better off continuing his operation in the short run as long as he could recover his variable costs. Thus, he might still purchase feeder steers and sell

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[2]Allen B. Paul and William R. Wesson, "Pricing Feedlot Services Through Cattle Futures," U.S.D.A. Agricultural Economics Research, 19(1967), p. 34-36.

[3]R. L. Ehrich, "Cash-Futures Price Relationships for Live Beef Cattle," American Journal of Agricultural Economics, 51(1969), p. 30-35.

futures, which would tend to push the basis further from equilibrium. More logically, he would continue his feeding operations without the use of hedging. This would not aid in restoration of the basis equilibrium.

The hypothesis that, in equilibrium, F_1 will equal BE is based on the premise that selling revenue must equal all production costs. This is true only in the long run, when adjustments in all resources, fixed as well as variable, are possible. The application of long run equilibrium conditions to futures contracts that are traded in the short run might be somewhat doubtful.

In any event, using BE as a component in the basis equilibrium does not produce any explanation of the relationship between F_1 and C_1. It would be necessary to define this relationship if a cattle feeder desired to hedge in a contract whose delivery date did not correspond to that of the termination of the feeding period. In assessing hedging potentials, the best assumption must be that the price-quality relationship represented by the futures price when the hedge position is taken will coincide with the price-quality relationship that exists in the cash market at the time of marketing. Under this assumption the equilibrium condition then would be the following identity.

(6) $F_1 - C_1 = F_2 - C_2$

Since a theoretically determinable basis at the beginning of the feeding period does not exist, any departures from the assumed equilibrium identity will result in windfall losses or profits to the hedger. The only theoretical equilibrium basis is $F_2 - C_2$ at contract maturity (i.e., in a delivery month); outside of a delivery month it is impossible to correct a disequilibrium condition.

Three selective strategies for hedging live cattle were tested using the assumptions discussed above. The three strategies were (1) hedge whenever F_1 is greater than BE + D, (2) hedge whenever F_1 is greater than C_1 + D, and (3) hedge whenever conditions (1) and (2) are met simultaneously. All cattle that did not meet these requirements were assumed to be feed out unhedged, in an attempt to help recover fixed costs and to not further disturb any assumed basis disequilibrium.

In this study it was assumed that both BE and D would have to be estimated at the beginning of the feeding period. Feed costs at the beginning of the 147 day feeding period were used in the estimation of BE. The actual breakeven figure was then computed assuming that feed was purchased "hand-to-mouth" as the cattle progressed through various phases of the feeding period, and feed costs were adjusted weekly. The closeout basis was estimated to be -\$1.00 (e.g., D equals +\$1.00) per hundredweight, both in the delivery and non-delivery months.

Hedge when F_1 > BE + D

The effect on profits by using this strategy are broken down in detail in Table 4.1. The assumed long-run equilibrium relationship as explained in equation (5) was observed in 347 of the simulated lots (i.e., only 347 of the 58 583 lots were hedged), or only 60 percent of the time (footnotes 2 and 3, Table 4.1). This fact would seem to cash doubt on the validity of this hypothesized equilibrium even in the long run, as the period covered by this study (over 11 years) could be conceived as a period that would be long enough for adjustments in fixed resources to take place.

Furthermore, when cattle feeding took place unhedged in face of an assumed disequilibrium condition, it turned out to be profitable 66% of the time (155 lots turning profits in 236 unhedged lots), and all of the unhedged lots turned an average profit of \$6.35 per head (footnote 1, Table 4.1). Profits were enhanced on 146 hedged lots and reduced on 201 hedged lots, for a net average decrease of -\$4.48 per head on the hedged lots from their corresponding unhedged positions. The total effect for both the hedged and unhedged lots was a reduction in average profits of \$2.66 per head from the unhedged level (\$13.82 - \$11.16 = \$2.66).

Table 4.1. Effect on profits of hedging when $F_1 > BE + D$, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge the entire length of the feeding period when F_1>BE+D.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	155	30.33	------
			Profits increased[2]	58	27.77	15.88
Profits	36.09	409	Profits reduced[3]	162	17.49	-32.95
			Losses changed to profits[2]	63	24.91	54.31
			Subtotal profits	438	24.45	-2.27
			LOSSES			
			Unhedged[1]	81	-39.54	------
			Profits changed to losses[3]	34	-10.31	-45.78
Losses	-38.51	174	Losses reduced[2]	25	-19.41	42.83
			Losses increased[3]	5	-32.17	-14.38
			Subtotal losses	145	-28.96	-3.84
All lots	13.82	583	All lots	583	11.16	-2.66

[1]Lots that would not have been covered by a hedge under the program considered, 236 lots, average profit, $6.35/head.
[2]Lots for which profits were increased by hedging, 146 lots, average increase, $37.08/head.
[3]Lots in which profits were reduced by hedging, 201 lots, average reduction, -$34.66/head.

Annual profits and variance under this strategy are shown in Table 4.2. The total variance of the profits under this strategy was significantly reduced (α = .01) from the unhedged level. The average profit was also reduced, although the reduction was statistically non-significant (α = .05). Thus, from the absolute value of the reduced profit, this strategy does not meet the necessary condition for a superior strategy to unhedged marketing, although from a strictly statistical standpoint the strategy was successful in reducing variance without reducing average profits.

Hedge when $F_1 > C_1 + D$

The assumed equilibrium identity of equation (6) was used as the theoretical base for developing this strategy. The logic of the strategy rests on the supposition that if a hedge were placed in a premium situation[4], and if the

[4]A premium situation was considered as a situation in which the futures price was above the cash price, and a discount situation when the futures price was below the cash price. In a true premium situation the distant futures would also be above the near futures, and vice versa for a discount situation.

theoretical closeout basis was $F_2 - C_2 = D$, any movement of the two prices that caused them to converge would work out more to the advantage of the hedger than if the hedge were placed in a discount situation.

Table 4.2. Average annual profits and variances by hedging when $F_1 > BE + D$, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	Average profits (dollars per head)	Variance in average profits
1965	17.28	58.523
1966	17.45	270.341
1967	14.47	58.132
1968	11.98	56.857
1969	7.86	486.670
1970	-4.02	299.247
1971	22.29	265.281
1972	19.64	368.542
1973	4.96	3825.296
1974	-5.15	2237.854
1975	24.82	1351.344
1976	-3.89	1783.696
Total period	11.16	902.589

This assumption can be illustrated by observing Table 4.3. If D is assumed to be \$1.00 per hundredweight, and F_2 is in equilibrium with C_2, the top part of the table shows potential gains from hedging with any combination of price movement from a beginning premium situation. Likewise, the potential losses are shown from hedging in a discount situation in the bottom part of the table.

The redistribution of simulated profits by using this strategy was shown in detail in Table 4.4. The condition for hedging was not met on 350 lots which were fed out unhedged for an average per head profit of \$16.73 (footnote 1, Table 4.4). Hedging increased profits on 126 lots by an average of \$40.87 per head, and reduced profits on 107 lots by an average of -\$42.30 per head. The net effect was a non-significant ($\alpha = .05$) increase in profits of \$1.07 per head.

Table 4.3. Hypothetical gains and losses from hedging in a premium and a discount situation.

Premium situation ($F_1 > C_1$)

Price movements	Cash unchanged Futures lowers		Cash increases Futures unchanged		Both Prices lower		Both Prices increase	
	Cash market	Futures market	Cash market	Futures market	Cash market	Futures market	Cash market	Futures market
T_1	\$30.00	\$35.00	\$30.00	\$35.00	\$30.00	\$35.00	\$30.00	\$35.00
T_2	\$30.00	\$31.00	\$34.00	\$35.00	\$29.00	\$30.00	\$35.00	\$36.00
Gain in each market	0.00	+\$4.00	+\$4.00	0.00	-\$1.00	+\$5.00	+\$5.00	-\$1.00
Total gain	+\$4.00		+\$4.00		+\$4.00		+\$4.00	

Discount situation ($F_1 < C_1$)

Price movements	Cash unchanged Futures increased		Cash lowers Futures unchanged		Both Prices lower		Both prices increase	
	Cash market	Futures market	Cash market	Futures market	Cash market	Futures market	Cash market	Futures market
T_1	\$35.00	\$30.00	\$35.00	\$30.00	\$35.00	\$30.00	\$35.00	\$30.00
T_2	\$35.00	\$36.00	\$29.00	\$30.00	\$28.00	\$29.00	\$36.00	\$37.00
Gain in each market	0.00	-\$6.00	-\$6.00	0.00	-\$7.00	+\$1.00	+\$1.00	-\$7.00
Total gain	-\$6.00		-\$6.00		-\$6.00		-\$6.00	

The profits and variances per year on the simulated lots are shown in Table 4.5. The resulting variance was a significant (α = .01) reduction from the unhedged position. This strategy would have been considered successful in this study as an alternative to unhedged marketing.

Table 4.4. *Effect on profits of hedging when $F_1 > C_1 + D$, 583 simulated study lots, Kansas, May 1965 - July 1976.*

Unhedged			Hedge the entire length of the feeding period when $F_1 > C_1 + D$.			
Financial outcome	Avg. profit or loss ($ per head)	Number of lots	Financial outcome	Number of lots	Avg. profit or loss ($ per head)	Avg. change due to hedging ($ per head)
			PROFITS			
			Unhedged[1]	263	32.79	------
			Profits increased[2]	41	28.40	17.16
Profits	36.09	409	Profits reduced[3]	74	21.63	-34.83
			Losses changed to profits[2]	54	24.05	54.76
			Subtotal profits	432	29.37	2.51
			LOSSES			
			Unhedged[1]	87	-31.83	------
			Profits changed to losses[3]	31	-13.83	-62.18
Losses	-38.51	174	Losses reduced[2]	31	-24.45	48.02
			Losses increased[3]	2	-23.93	-10.86
			Subtotal losses	151	-26.52	-3.05
All lots	13.82	583	All lots	583	14.89	1.07

[1] Lots that would not have been covered by a hedge under the program considered, 350 lots, average profit, $16.73/head

[2] Lots for which profits were increased by hedging, 126 lots, average increase, $40.87/head.

[3] Lots in which profits were reduced by hedging, 107 lots, average reduction, -$42.30/head.

Table 4.5. Annual average profits and variance by hedging when $F_1 > C_1 + D$, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	Average profits (dollars per head)	Variance in average profits
1965	30.19	224.719
1966	24.10	534.129
1967	14.47	58.132
1968	20.11	44.302
1969	27.90	1298.209
1970	-3.00	320.735
1971	13.07	269.146
1972	29.18	469.956
1973	-15.55	2306.603
1974	1.85	1630.768
1975	38.69	1858.328
1976	-11.61	918.093
Total period	14.89	840.769

Hedge when $F_1 > C_1 + D$ and $F_1 > BE + D$

This strategy was tested in an effort to improve hedging by considering both the assumed equilibrium conditions of equations (5) and (6). The redistribution effects of the simulated profits are shown in Table 4.6.

Table 4.6. Effect on profits of hedging when $F_1 > BE + D$ and $F_1 > C_1 + D$, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge the entire length of the feeding period when F_1>BE+D and F_1>C_1+D.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	295	34.13	-----
			Profits increased[2]	41	28.34	17.16
Profits	36.09	409	Profits reduced[3]	64	24.20	-34.30
			Losses changed to profits[2]	53	24.48	55.64
			Subtotal profits	453	31.07	3.22
			LOSSES			
			Unhedged[1]	102	-36.62	-----
			Profits changed to losses[3]	9	-12.01	-66.43
Losses	-38.51	174	Losses reduced[2]	18	-20.90	51.47
			Losses increased[3]	1	-20.25	- 9.34
			Subtotal losses	130	-32.61	2.46
All lots	13.82	583	All lots	583	16.87	3.05

[1]Lots that would not have been covered by a hedge under the program considered, 397 lots, ave. profit, $15.95/head.
[2]Lots for which profits were increased by hedging, 112 lots, average increase, $40.88/head.
[3]Lots in which profits were reduced by hedging, 74 lots, average reduction, -$37.87/head.

Both conditions were met simultaneously on only 186 (32%) of the simulated lots (footnotes 2 and 3, Table 4.6). Hedging was effective in increasing profits on 112 of these lots. The net effect was an increase in profits of $3.05 per head.

The average annual profits and variances are broken down in detail in Table 4.7. The net result was an increase (non-significant at $\alpha = .05$) in average profits and a significant decrease ($\alpha = .01$) in variance. This strategy was considered the best strategy of the tested traditional selective hedging alternatives.

Table 4.7. Annual average profits and variances by hedging when $F_1 > C_1+D$, and $F_1 > BE + D$, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	Average profits (dollars per head)	Variance in average profits
1965	30.19	224.719
1966	24.10	534.129
1967	14.47	58.132
1968	20.11	44.302
1969	27.90	1298.209
1970	-3.00	320.735
1971	22.21	266.170
1972	29.18	496.956
1973	4.96	3825.296
1974	-6.11	2341.284
1975	39.01	1857.642
1976	-11.61	918.093
Total period	16.87	1039.537

Conclusion and Implications

In view of the above results, considerable doubt would be cast on the hypothesized equilibrium conditions of equations (5) and (6). The shortcomings of these assumed equilibrium conditions can be partially accounted for by the departures from theory in real world conditions.

The two estimated components of equation (5), BE and D, varied considerably from actual breakeven and closeout basis figures. Figure 4.1 shows the relationship between estimated and actual breakeven for the 583 lots in the simulation. The error in estimating BE are represented in Figure 4.2. The wide variation in error since 1973 might suggest another adjustment between F_1 and BE to allow an estimation error margin.[5] The variation in the

[5]It may also be possible for a cattle feeder to pin down his breakeven costs more exactly by purchasing or contracting all of the needed feed at the beginning of the feeding period.

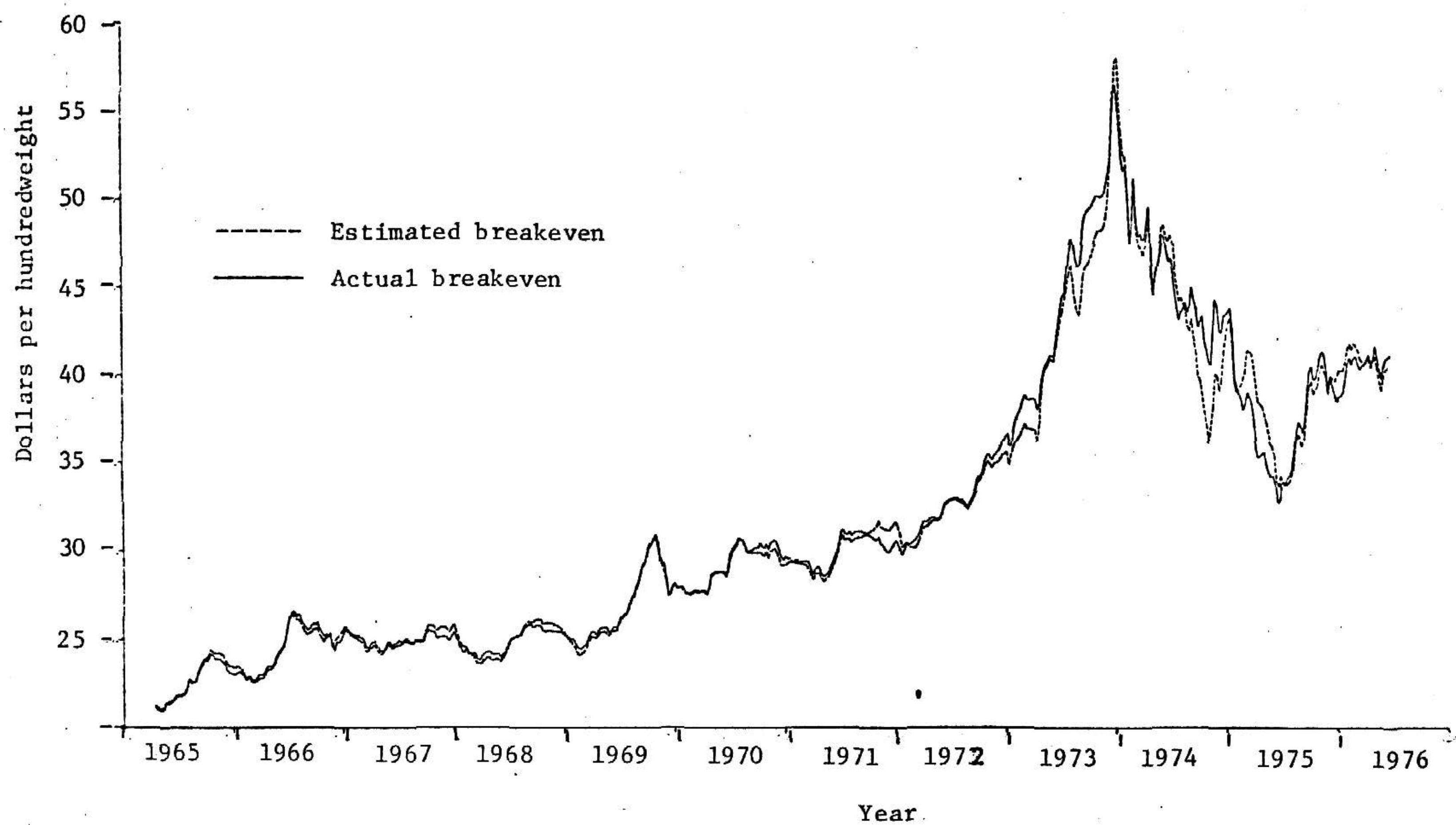

Figure 4.1. Estimated and actual breakeven, 583 simulated study lots, Kansas, May 1965 - July 1976.

estimated closeout basis also fluctuated drastically around the assumed -$1.00 figure, as shown in Figure 4.3.

It is assumed equilibrium identity of equation (6) that presents the largest shortcoming of traditional hedging theory when applied to a nonstorable commodity like live cattle. The right-hand side of the identity suffers from the above discussed limitation in the estimation of D, while the left-hand side of the identity is indeterminate. It is indeterminate because arbitrage activities which were possible for stable commodities during the storage period would not apply during the production period for live cattle.

To look at this in another way, the following differences may be drawn between traditional theory and its application to nonstorable commodities. In the case of hedged grain, a merchandiser is holding stored grain which he has sold forward on a futures contract. He is thus holding nothing except storage as a source of risk, and arbitrage is possible to combat this risk at any time during the storage period. The cattle feeder, in the case of hedged cattle, is holding only <u>potential</u> finished cattle and a <u>commitment</u> for future delivery on a contract which he can not arbitrate on the cash market until his cattle are finished. He is thus holding three sources of risk: (1) technical production risks on the cattle he is feeding, (2) price risk on the cash market during the production period, and (3) price risk on his futures market commitment to deliver finished cattle.

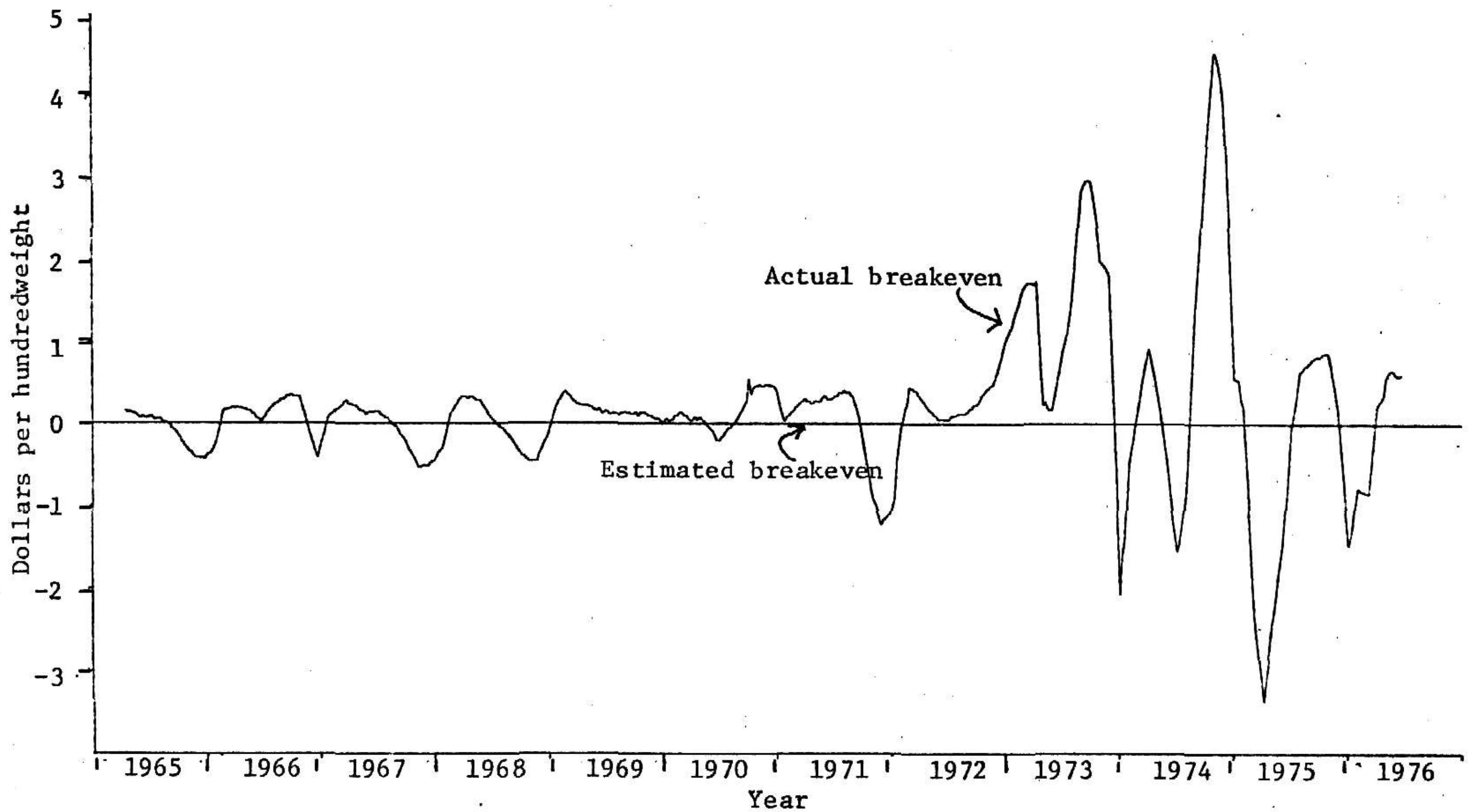

Figure 4.2. Error in estimating breakeven, 583 simulated study lots, Kansas, May 1965 - July 1976.

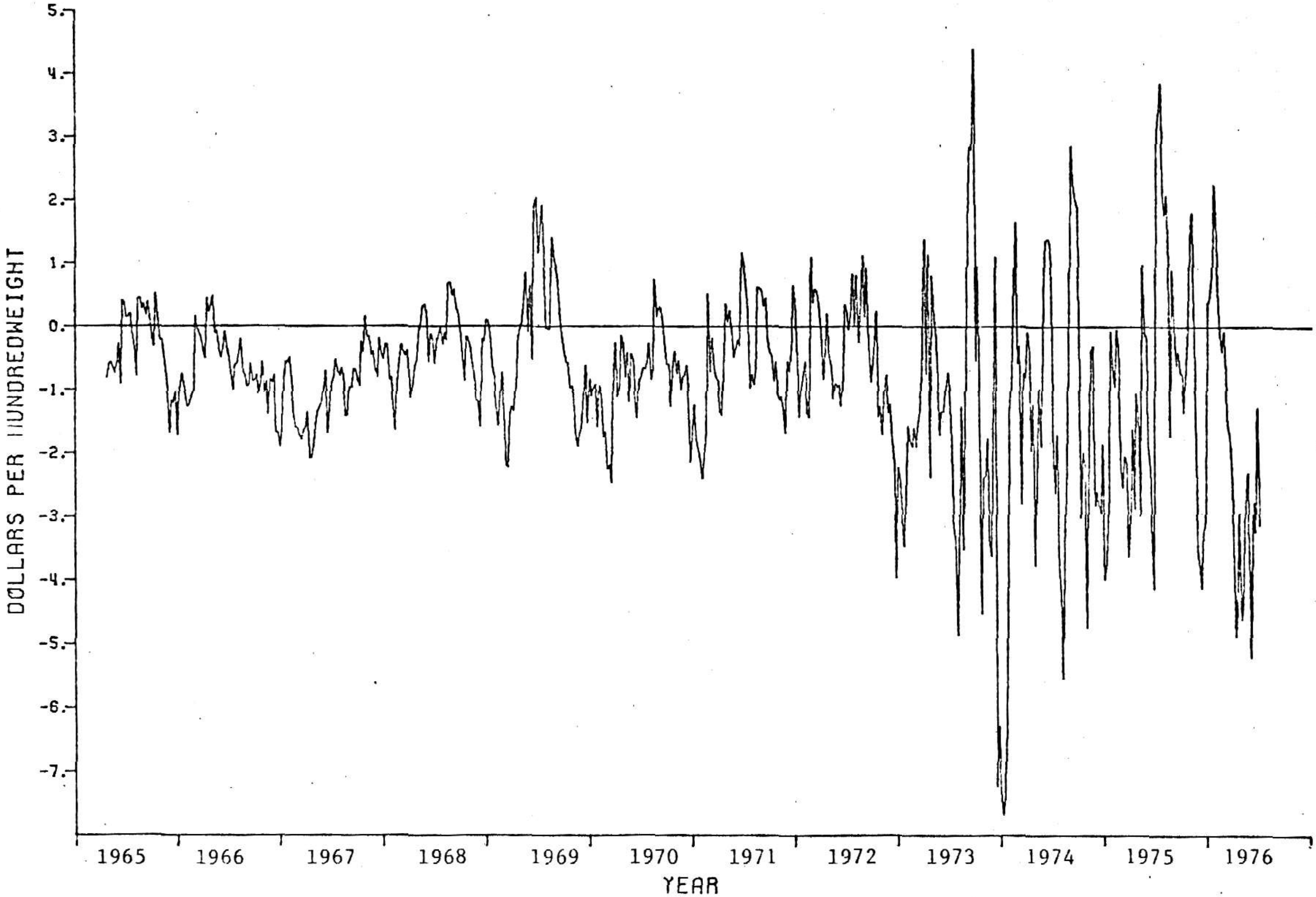

Figure 4.3. Closeout basis, 583 simulated study lots, Kansas, May 1965 - July 1976.

Chapter V

THE MANAGED HEDGE CONCEPT

Introduction

The discussion to this point has led to the observation that the futures market and the cash market in live cattle are two separate, although highly related, markets. In the previous chapter the use of traditional forms of hedging (i.e., placing a hedge at the beginning of the feeding period and not lifting the hedge until the cattle were sold) were found to be somewhat limited when applying them to live cattle. Given the theoretical justification for and the actual observance of the divergencies of cash and futures prices, there appeared to be justification for testing the feasibility of "managed" hedging. A managed hedge allows for the lifting of a hedge, and the possibility of reestablishing it during a feeding period in reaction to specified price movements. In managing a hedge, a cattle feeder must make his decision to place and/or lift a hedge on predetermined formulae or on his ability to predict and/or recognize price movements in each market.

The factors that influence price movements in the cash market were topics beyond the scope of this study. Criteria were developed and tested to aid in the management of a contract in the futures market during the time that the cattle were on feed in this study.

A cattle feeder would be better off not hedging in the futures market during periods of rising prices, but selling futures contracts during periods of price declines for market "insurance" on his cattle that are in various stages of production. Thus, it was considered feasible, and was hypothesized desirable, to lift and place hedges on the cattle more than once while they were being finished, to make better use of the futures market.

The following two methods were tested to aid in managed hedging: (1) managing the futures contract by use of a stop-loss order, and (2) managing the contract by use of moving averages of current prices. Profits on the futures contract transactions were figured using equation (2) in Chapter III of this paper. The total per head profit equation was then changed to the following:

(1) $TP = CP + \Sigma FP$

where TP, CP, and FP are as defined in equation (3) in Chapter III. The summation of FP would result whenever more than one hedge was placed on any lot of cattle.

Managed hedging using a stop-loss order

A stop-loss order is an order to a broker to buy or sell at the market when the market reaches a designated price. This may be considered use of a formula. The purpose of the order is to close out an unprofitable long or short position.

The three selective strategies discussed in Chapter IV were modified so that the initial decision to sell a futures contract could be made up until the 15th week of the feeding period. The conditions regarding F_1, C_1, and BE were the same in deciding whether or not to initialize the hedge. When an order was placed to sell a contract, and accompanying stop-loss order was assumed to be placed at $1.00 above the sell price. If the price moved up to the stop price the contract was purchased back and the cattle feeding continued without the hedge. If and when the price came back down to the point where the stop-loss order had been previously activiated a new contract was sold with an accompanying new stop-loss order of $1.00 above that price. These criteria were effective until the end of the 15th week of the feeding period. It was assumed that the cattle feeder would maintain his position (hedged or unhedged) during the last six weeks of the feeding period.

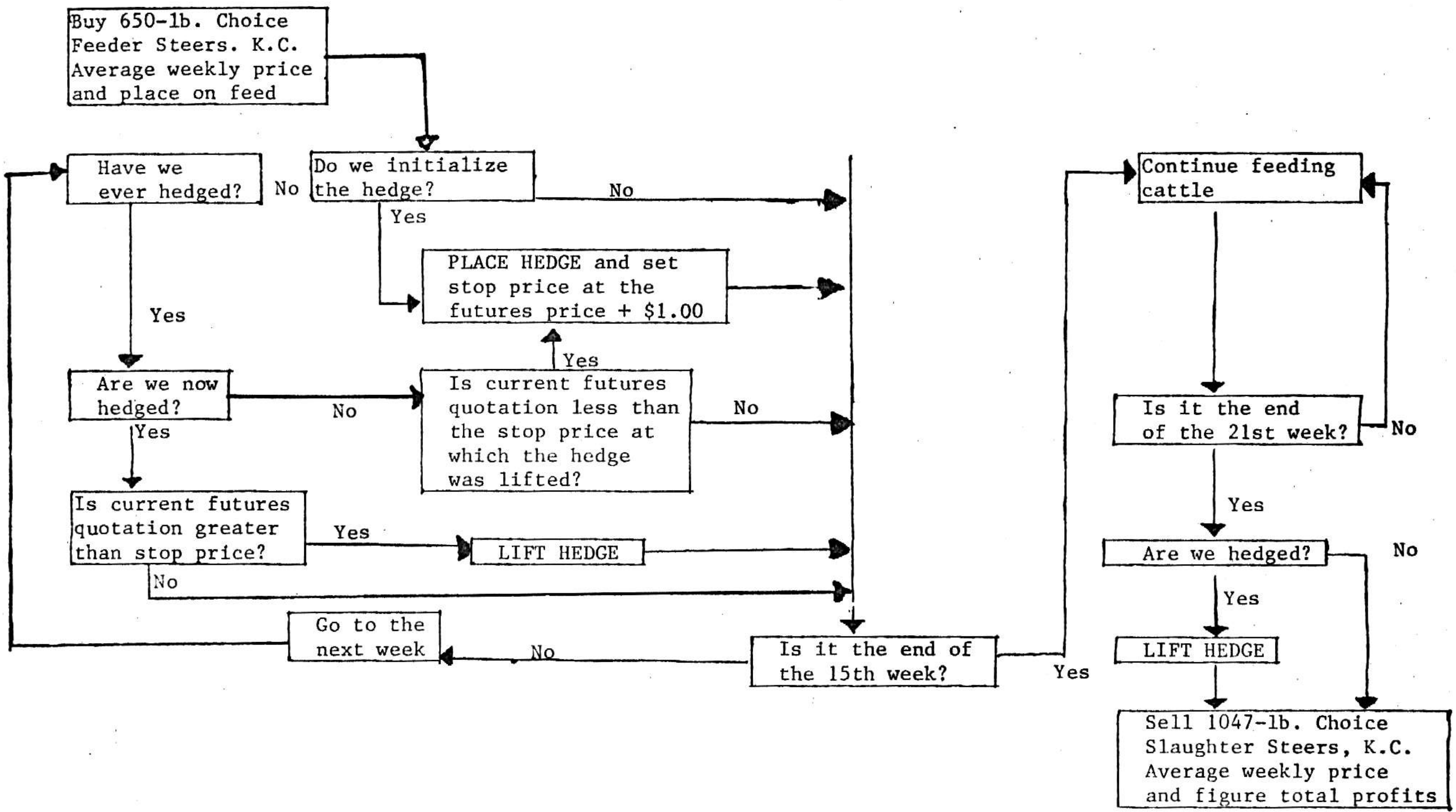

Figure 5.1. Decision flow for the stop-loss managed hedge.

Table 5.1. Annual average profits from traditional forms of hedging and stop-loss managed hedging, Kansas, 583 simulated study lots, Kansas, May 1965 - July 1976.

Alternative	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	July 1976	Ave. period profits	Variance
	Dollars per head													
1. Unhedged	36.43	13.60	3.33	19.78	28.24	1.46	23.61	29.18	2.71	-60.00	63.10	-11.23	13.82	1516.381
Traditional hedging														
2. Routine hedge	15.11	17.47	14.47	6.50	3.87	-3.39	- 6.05	- 3.21	-33.01	- 0.46	21.00	- 0.81	2.45**	500.161**
3. F_1>BE+D	17.28	17.45	14.47	11.98	7.86	-4.02	22.29	19.64	4.96	- 5.15	24.82	- 3.89	11.16	902.589**
4. F_1>C_1+D	30.19	24.10	14.47	20.11	27.90	-3.00	13.07	29.18	-15.55	1.85	38.69	-11.61	14.89	840.769**
5. F_1>BE+D & F_1>C_1+D	30.19	24.10	14.47	20.11	27.90	-3.00	22.21	29.18	4.96	- 6.11	39.01	-11.61	16.87	1039.537**
Stop loss managed hedging														
6. Routine hedge	18.69	20.78	13.99	7.46	15.92	-5.25	4.82	6.71	- 6.64	-18.54	44.07	- 9.45	8.22**	1074.549**
7. F_1>BE+D	18.62	20.89	13.99	11.32	16.38	-6.42	14.26	6.89	-10.29	-14.06	46.48	0.48	10.10	949.084**
8. F_1>C_1+D	28.42	18.49	13.99	20.47	20.66	-5.34	13.86	27.61	- 1.39	-19.15	62.46	-17.51	14.61	1088.065**
9. F_1>BE+D & F_1>C_1+D	28.42	18.80	13.99	20.46	20.66	-5.69	15.91	26.24	- 9.67	-12.61	65.30	- 9.55	15.10	964.929**

**Indicates that the difference as compared to unhedged value is statistically significant at the one percent level.

The decision flow for the stop-loss managed hedge is shown in Figure 5.1.

Results of the stop-loss managed hedge

The results of using the stop-loss managed hedge are broken down by years in Table 5.1. For comparison purposes the results from the traditional forms of these strategies, as discussed previously, are also shown in Table 5.1.

The only strategy that emerged with higher average profits using the stop-loss managed strategy was routine hedging. Even then, the increased profit was accompanied with an extreme increase in variation. Tables 5.2 through 5.5 show the redistribution effects of these strategies when compared to unhedged marketing.

The stop-loss order proved effective in increasing profits for routine hedging by liquidating unfavorable positions early, often in the second week of the feeding period. Even then, there were more lots that had profits reduced from the unhedged position with managed routine hedging than with traditional routine hedging (393 and 374, respectively).

In the selective strategies the simple stop-loss managed hedge concept as tested did not prove successful. This can be accounted for by two main reasons. First, when comparing the number of hedged lots in each strategy, in each case the managed hedge strategies produced more hedged lots than did their traditionally hedged counterparts. Furthermore, many of the lots had hedges placed and lifted more than one time, sometimes as high as four or five times. Each time that a round turn was made hedging costs were charged off to the cattle feeding profits. Thus, each time a hedge was lifted that did not increase the hedged profit more than the amount of the hedging cost the per head profits of that lot were reduced instead of being increased by hedging.

The second reason that profits were not aided by the simple placing of stop-loss orders is that although the stop order worked to get a producer out of an unfavorable position, it did not aid in tipping off a favorable situation.

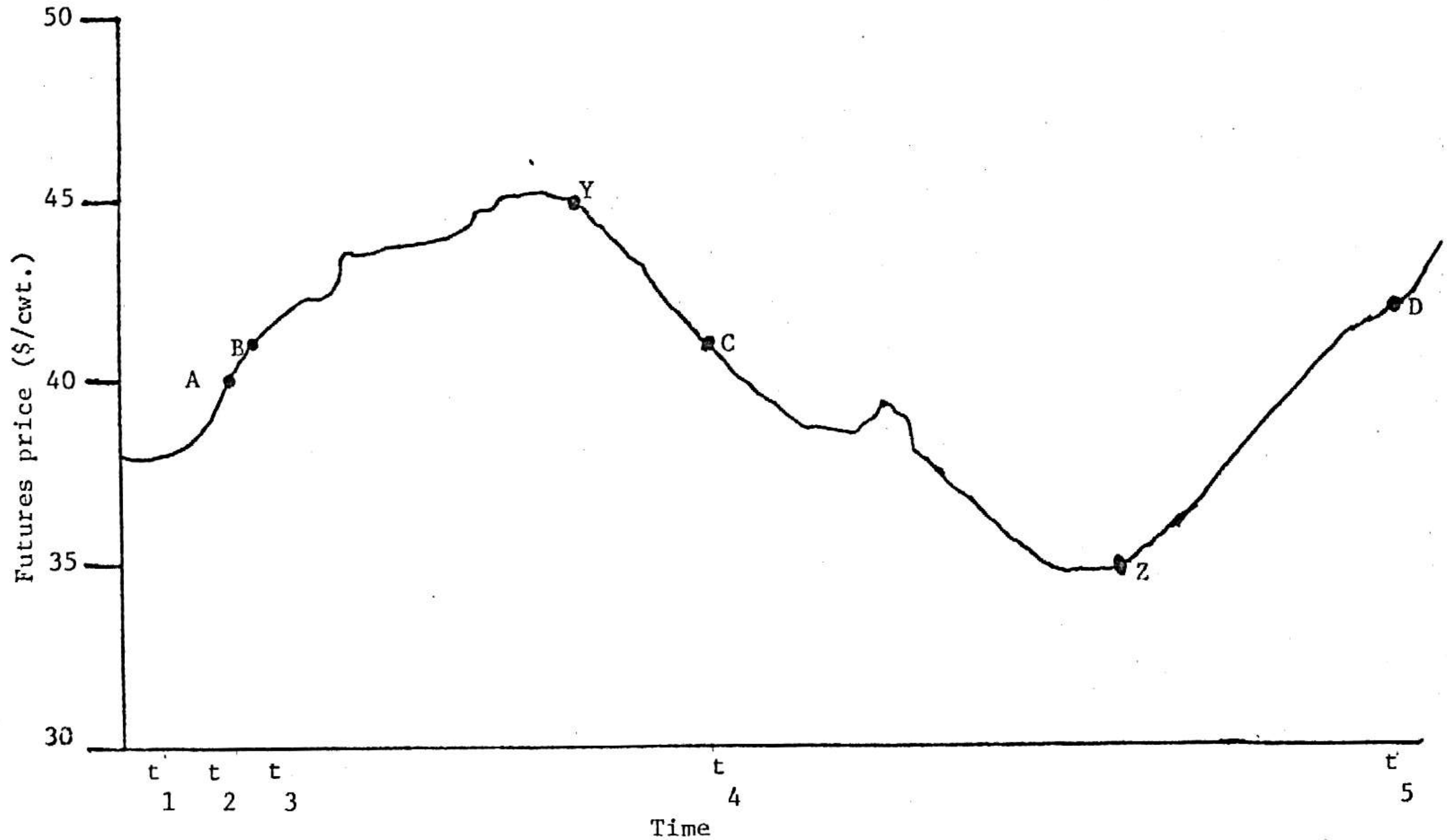

Figure 5.2. Hypothetical example of the stop-loss managed hedge.

Table 5.2. Effect on profits of managing the routine hedge with a stop loss order, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge every lot during the initial week and manage with a stop loss order.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	0	-----	-----
			Profits increased[2]	57	27.03	15.19
Profits	36.09	409	Profits reduced[3]	278	25.03	-20.07
			Losses changed to profits[2]	63	22.57	48.41
			Subtotal profits	398	24.93	- 4.18
			LOSSES			
			Unhedged[1]	0	-----	-----
			Profits changed to losses[3]	74	-12.31	-33.20
Losses	-38.51	174	Losses reduced[2]	70	-26.14	25.62
			Losses increased[3]	41	-58.23	-22.89
			Subtotal losses	185	-27.72	- 8.66
All lots	13.82	583	All lots	583	8.22	- 5.60

[1]Lots that would not have been covered by a hedge under the program considered (none in this program).
[2]Lots for which profits were increased by hedging, 190 lots, average increase, $30.05/head.
[3]Lots in which profits were reduced by hedging, 393 lots, average reduction, -$22.84/head.

Table 5.3. Effect on profits of hedging when F_1>BE+D and managing the hedge with a stop loss order, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge when F_1>BE+D and manage with a stop loss order.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	23	18.56	-----
			Profits increased[2]	62	26.14	14.18
Profits	36.09	409	Profits reduced[3]	269	25.01	-19.81
			Losses changed to profits[2]	69	21.21	50.72
			Subtotal profits	423	24.21	- 2.25
			LOSSES			
			Unhedged[1]	37	-24.93	-----
			Profits changed to losses[3]	55	-12.40	-40.29
Losses	-38.51	174	Losses reduced[2]	44	-27.33	36.64
			Losses increased[3]	24	-64.41	-25.78
			Subtotal losses	160	-27.20	- 7.64
All lots	13.82	583	All lots	583	10.10	- 3.72

[1]Lots that would not have been covered by a hedge under the program considered, 60 lots, average profit, -$8.26/head.
[2]Lots for which profits were increased by hedging, 175 lots, average increase, $34.23/head.
[3]Lots in which profits were reduced by hedging, 348 lots, average reduction, -$23.46/head.

Table 5.4. Effect on profits of hedging when $F_1 > C+D$ and managing the hedge with a stop loss order, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge when $F_1 > C_1 + D$ and manage with a stop loss order.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	173	30.24	-----
			Profits increased[2]	45	32.51	18.96
Profits	36.09	409	Profits reduced[3]	160	34.27	-18.38
			Losses changed to profits[2]	54	24.33	53.30
			Subtotal profits	432	31.23	1.83
			LOSSES			
			Unhedged[1]	42	-23.92	-----
			Profits changed to losses[3]	31	-17.24	-33.20
Losses	-38.51	174	Losses reduced[2]	47	-28.96	33.02
			Losses increased[3]	31	-67.02	-27.70
			Subtotal losses	151	-32.96	- 2.23
All lots	13.82	583	All lots	583	14.61	0.79

[1] Lots that would not have been covered by a hedge under the program considered, 215 lots, average profit, $19.66/head
[2] Lots for which profits were increased by hedging, 146 lots, average increase, $36.19/head.
[3] Lots in which profits were reduced by hedging, 222 lots, average reduction, -$21.75/head.

Table 5.5. Effect on profits of hedging when $F_1 > C_1 + D$ and $F_1 > BE + D$ and managing the hedge with a stop-loss order, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge when $F_1 > BE+D$ and $F_1 > C_1 + D$ and manage with a stop loss order.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	179	29.74	-----
			Profits increased[2]	45	32.51	18.96
Profits	36.09	409	Profits reduced[3]	150	34.57	-18.67
			Losses changed to profits[2]	58	23.02	53.89
			Subtotal profits	432	30.80	2.73
			LOSSES			
			Unhedged[1]	52	-25.74	-----
			Profits changed to losses[3]	35	-16.61	-40.64
Losses	-38.51	174	Losses reduced[2]	40	-27.91	38.58
			Losses increased[3]	24	-61.05	-23.06
			Subtotal losses	151	-29.81	- 2.87
All lots	13.82	583	All lots	583	15.10	1.28

[1] Lots that would not have been covered by a hedge under the program considered, 231 lots, average profit, $17.25/head
[2] Lots for which profits were increased by hedging, 143 lots, average increase, $38.82/head.
[3] Lots in which profits were reduced by hedging, 209 lots, average reduction, -$22.85/head.

Figure 5.2 is presented to clarify that point. In Figure 5.2, assume that a cattle feeder is estimating his breakeven (BE) to be $39.00 per hundredweight. Further assume that C_1 is $39.00 per hundredweight and D is $1.00, so that the futures price needed to initiate a hedge under any of the three strategies would be $40.00 per hundredweight (C_1 + D = $40.00 and/or BE + D = $40.00). If he places cattle in his feedlot at t_1, where the futures price is below $40.00, the conditions are not right to place a hedge. However, the price moves up to $40.00 (point A) by t_2, and a futures contract is sold. By t_3 (point B) the market moves against him by $1.00, and the contract is purchased back for a loss of approximately $12.00 per head (10.47 hundredweight x $1.00/hundredweight + 1.55 per head hedging cost). The market peaks at about $45.00 (point Y) and starts down. By t_4 the price is down to where he bought the contract back to complete the initial hedge, so he reinitiates his hedge at $41.00 (point C). He also places another stop-loss at $42.00. The market continues downward until it hits $35.00 (point Z) and then begins an upturn. By t_5 the market is back up to $42.00 (point D) and the hedge is again lifted for another $12.00 per head loss. Under these circumstances a cattle producer trying to hedge against price declines would have suffered approximately $24.00 per head in windfall losses.

If the producer in the above example had been gifted with the foresight to hedge for the price decline from point Y to point Z, the returns from his hedging operations would have been approximately a $100.00 per head profit instead of a $24.00 per head loss. Hedging decisions based on an attempt to insure against price declines are nullified if the timing of the placing and lifting of the hedges do not coincide with the uptrends and the downtrends of the futures market.

Managed hedging using moving averages

Most market analysts use a two-pronged approach to decision making involving hedging. The first of these approaches is known as fundamental analysis. As the term implies, fundamental analysis is the analysis of the basics of the market pricing mechanisms, mainly supply and demand factors. To the extent that the fundamental analysis is correctly interpreted, the long-range movements of prices can be recognized and long-range actions and goals can be decided.

However, any hedging decision based on fundamental relationships can be unsuccessful if the timing of the placing and lifting of a hedge does not somewhat coincide with the actual turning points of the futures market. To aid the decision process for timing market actions, most commodity analysts depend on various forms of charting, or technical analysis. The reasoning is that even if it were possible to find all the fundamental information about the supply and demand of a commodity, and even if the time was taken to compile all this information and allow for the factors such as weather, strikes, disease, etc., a person would still not have the clue to futures market response. It is not the these factors alone that influence the prices on the futures market, but instead it is how traders react to both fundamental and technical factors.

Technical analysts approach the study of the futures market by adhering to the adage of "let the market itself tell you what it is doing". The clues to technical analysis lie in the day-to-day changes in price, volume, and open interest. This study examined one of the more common technical tools that cattle producers may use in making their decisions regarding in the timing of lifting and placing hedges--i.e., the use of moving averages.

Moving averages have long been used by analysts in the commodity market, although their use as guides to selective cattle hedging has only recently begun to be explored.[1] The concept is relatively simple. Two averages are

[1]For more discussion on the techniques as applies to live cattle futures see the following:

Wayne Purcell, "Moving Average Strategy Might Boost Profits in Cattle Hedging Plan," BEEF magazine, April, 1976.

Henry Hollis Shaefer, "The Determination of Basis Patterns and the Results of Various Hedging Strategies for Live Cattle and Live Hogs," Unpublished M.S. thesis, Iowa State University, 1974.

generally used together, a longer average to get a longer term trend of prices, and a shorter average to measure short term changes in the market.[2] These averages are computed by summing the settlement prices for the previous relevant number of days, and dividing to obtain the average:

$$(2)\quad MAVE_t = \left(\sum_{i=t-n}^{t} S_i\right)/n$$

where: $MAVE_t$ = the moving average price at the close of trading on day "t",

S_i = the settlement price on day "i", and

n = the number of days in the moving average.

The logic of the technique is that in periods of generally rising prices, the short average will tend to stay above the long average. Eventually, the market will reach a "top" and start down. When this happens, the short average will cross the long average and go below it. As long as the market goes down, the short average will tend to stay below the long average. When the market reaches a "bottom", the short average will cross back over to be above the long average. Therefore, a cattle producer can key off of these crossovers, short hedge his cattle in a down market and lift his hedges in an up market.

Figure 5.3 helps to illustrate these points. As the market is trending upwards the short moving average will tend to stay above the long average, although there may be wide fluctuation in both averages. At point A in the Figure 5.3, the short average crosses over below the long average and a hedge is placed. When the short average crosses back over to the top of the long average (point B), the hedge is lifted. At point C another down market is indicated and the hedge is replaced.

This study examined the effect of using 10-and-3 day and 10-and-5 day moving averages to test their effects on cattle feeding profits in the simulation

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[2]Variations of the technique include using three or more moving averages, although only two are relied upon in more common usage.

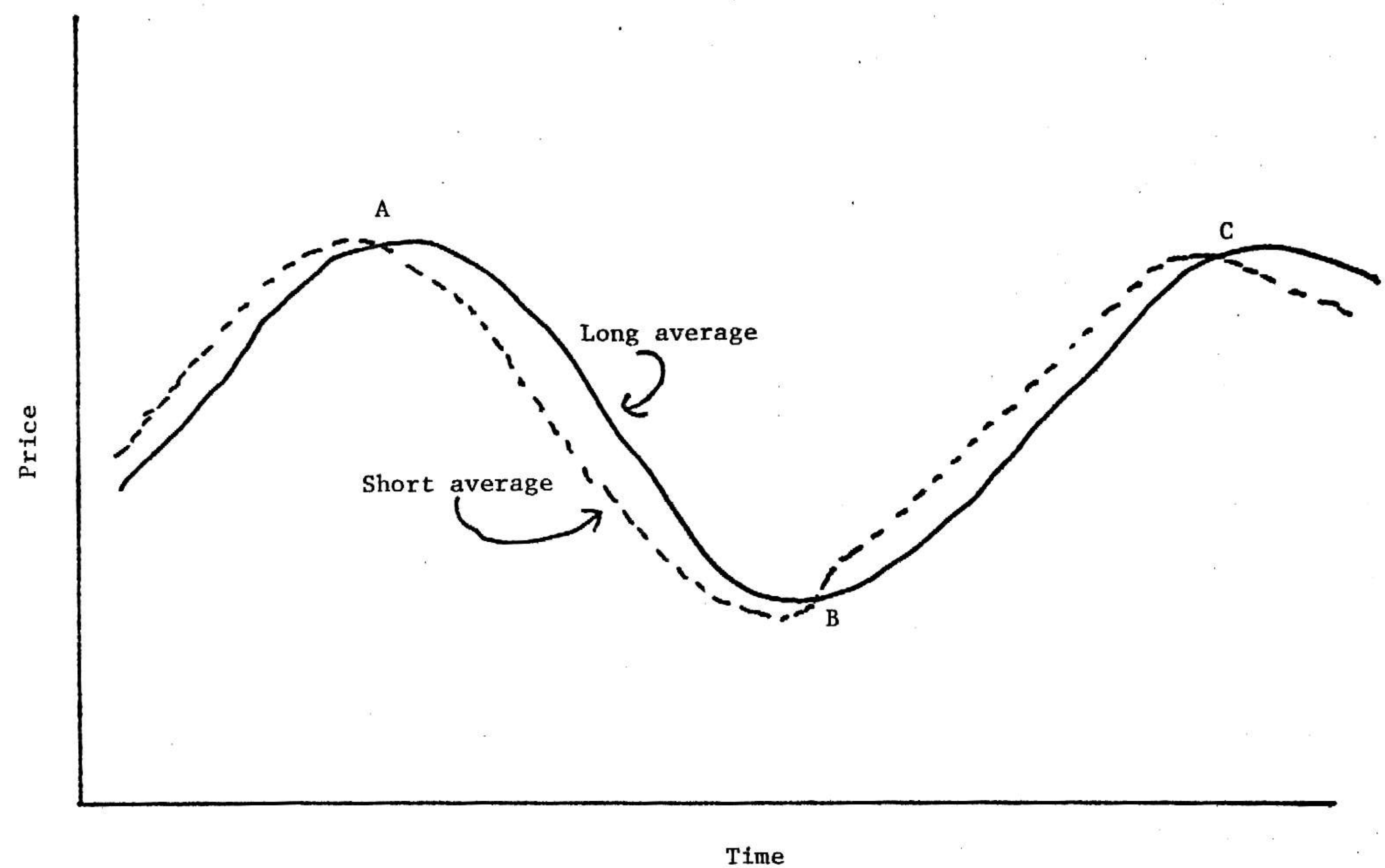


Figure 5.3. Hypothetical movement of moving averages.

model. There is nothing "magical" about the length of the long and short averages used, but these strategies were tested because they are the ones most commonly used by traders, and the averages can be obtained from many major wire services if the cattle producer does not want to compute them himself. It was assumed that all transactions took place with the settlement price for the day that the signals indicated an action.

Results from using moving average managed hedging

Table 5.6 shows annual profits and variances using moving averages. Also included in the table is the average number of times that a hedge was placed and lifted per lot of cattle.

Table 5.6. Average annual profits and variances from managed hedging by moving averages, 583 simulated study lots, Kansas, May 1965 - July 1976.

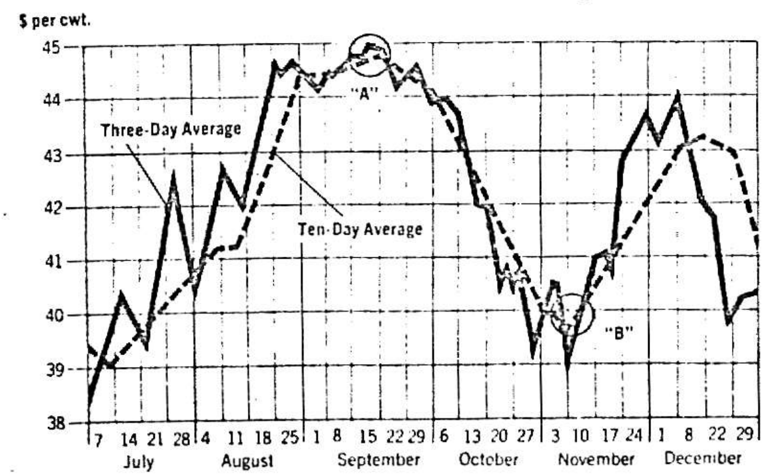
Year	10-and-3 day moving average			10-and-5 day moving average		
	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot
1965	14.67	192.219	6.027	14.47	241.307	5.973
1966	12.86	514.577	5.000	14.46	558.052	4.423
1967	0.18	71.379	6.692	4.56	98.758	5.846
1968	10.96	47.846	5.865	10.90	35.277	5.308
1969	7.58	734.644	6.000	12.27	526.184	5.731
1970	-5.93	444.399	5.712	0.83	439.448	5.077
1971	11.90	222.882	6.340	8.15	201.519	6.019
1972	14.56	172.811	5.442	16.16	142.109	4.885
1973	42.47	1111.744	4.096	42.74	1175.468	3.404
1974	28.06	2186.864	5.135	25.30	1657.729	4.558
1975	32.62	8219.313	5.365	60.03	4510.977	4.923
1976	1.82	1267.547	5.200	0.27	1396.778	4.480
Total period	14.88	1291.792	5.581	18.37	908.989	5.057

The 10-and-3 day moving average managed hedge gave results comparable to unhedged marketing (see Table 3.2), with a nonsignificant increase in average profits and a small reduction (significant at α = .05) in variance. This strategy had the highest variance of any hedging strategy tested in the current study.

The redistribution effects of 10-and-3 day moving averages as compared to unhedged operations are shown in detail in Table 5.7. All lots were hedged at least once during the feeding period, and the net effect was a $1.06 per head increase in profits from never hedging.

The 10-and-5 day moving average resulted in significantly increased profits (α = .05) and reduced variance (α = .01) from the unhedged position. There were also fewer roundturns on the average per lot of cattle than under the 10-and-3 day strategy. The redistribution effects of 10-and-5 day moving average managed hedge are shown in detail in Table 5.8.

The major shortcoming of using moving averages as a guide to selective hedging is that many times the averages give a false cross-over signal (see Figure 5.4). They may indicate that the market is turning around when actually there may be only a very short movement opposite to a long market trend. Although the false signals in this case could be self-corrected in a few days, unnecessary and perhaps expensive transactions may result.



Source: BEEF Magazine.

Figure 5.4. Illustration of moving averages for the April, 1976, live beef cattle contract.

Table 5.7. Effect on profits using moving average managed hedging where long average is ten days, and short average is three days, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 3 day average is below 10 day average.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	0	-----	-----
			Profits increased[2]	78	40.43	15.10
Profits	36.09	409	Profits reduced[3]	261	25.67	-18.06
			Losses changed to profits[2]	80	31.60	74.42
			Subtotal profits	419	29.55	5.77
			LOSSES			
			Unhedged[1]	0	-----	-----
			Profits changed to losses[3]	70	-17.37	-36.93
Losses	-38.51	174	Losses reduced[2]	37	-16.45	38.22
			Losses increased[3]	57	-33.05	-11.09
			Subtotal losses	164	-22.61	-10.99
All lots	13.82	583	All lots	583	14.88	1.06

[1] Lots that would not have been covered by a hedge under the program considered (none in this program).
[2] Lots for which profits were increased by hedging, 195 lots, average increase, $43.82/head.
[3] Lots in which profits were reduced by hedging, 388 lots, average reduction, -$20.44/head.

Table 5.8. Effect on profits using moving average managed hedging where long average is ten days and short average is five days, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 5 day average is below 10 day average.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	0	-----	-----
			Profits increased[2]	102	44.59	14.79
Profits	36.09	409	Profits reduced[3]	266	24.65	-16.94
			Losses changed to profits[2]	75	27.34	70.24
			Subtotal profits	443	29.70	5.11
			LOSSES			
			Unhedged[1]	0	-----	-----
			Profits changed to losses[3]	41	- 5.87	-21.71
Losses	-38.51	174	Losses reduced[2]	53	-20.49	30.96
			Losses increased[3]	46	-24.31	- 7.88
			Subtotal losses	140	-17.46	2.78
All lots	13.82	583	All lots	583	18.37	4.55

[1] Lots that would not have been covered by a hedge under the program considered (none in this program).
[2] Lots for which profits were increased by hedging, 230 lots, average increase, $36.60/head.
[3] Lots in which profits were reduced by hedging, 253 lots, average decrease, -$16.33/head.

In an attempt to reduce the number of false signals three variations were made to the moving average strategies and tested. The variations were as follows: (1) variation A consisted of providing a tolerance of ten cents to the cross-over points, (2) variation B used the settlement price of the current day to confirm actions indicated by the moving averages, and (3) variation C included the conditions of (1) and (2) simultaneously. It was hypothesized that any variation which cut down the number of roundturns in the futures market would be effective in reducing false signals if it increased average profits from the pure moving average strategies, and would not be effective if it reduced averaged profits.

Borrowing from a textbook presentation of a standard statistics course, the types of errors that could be committed by moving average managed hedging are shown in Table 5.9. If profits were increased from using moving average variations that cut down on the number of average roundturns it was assumed that Type I errors (false cross-overs) were reduced. If profits were reduced as the number of roundturns were decreased it was assumed that Type II errors were increased (legitimate hedging opportunities foregone).

Table 5.9. Types of errors committed by moving average managed hedging.

Optimal market action / Moving average signal	Hedged	Unhedged
Hedged	No error	Type I error
Unhedged	Type II error	No error

Variation A of moving average managed hedging

Variation A involved using a tolerance in the cross-over points. It was assumed that the 3-day moving average must cross below the 10-day average by more than ten cents per hundredweight before a down market was indicated, and, conversely, the 3-day average must cross above the 10-day average by more than ten cents per hundredweight before an up market was indicated. Ten cents was used as a tolerance because examination of the false signals in the pure moving average managed hedging strategies showed that the 3-day average tended to cross the 10-day average by approximately ten cents or less many of the times that false signals were obtained.[1]

The results from hedging using variation A are shown in Table 5.10. The number of roundturns were reduced from the pure moving averages. Profits were increased and variance reduced from the pure moving averages, so Type I errors were assumed reduced. Profits from both strategies were significantly increased (α = .01) and variances were significantly reduced (α = .01) from the unhedged positions.

The redistribution effects of these strategies are shown in Tables 5.11 and 5.12. The interesting thing to notice in Table 5.12 is that using variation A of the 10-and-5 day moving average managed hedge left 14 lots that turned an average profit of $37.29 per head untouched, while there were no unhedged losses.

Variation B of moving average managed hedging

Variation B involved the settlement price on the day of the signal from the moving averages to confirm true market actions. It was assumed that the settlement price movement on the day that signals were indicated by the moving averages must be consistent with the signal given. That is, if the moving

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[1]The use of a ten cent tolerance was somewhat subjective, and further refinement of this variation would include "fine-tuning" the cross-over tolerance.

averages indicated a down market the settlement price must also be going down from the previous day, and vice versa, before any action was taken. No cross-over tolerance like that used in variation A was assumed.

Table 5.10. Average annual profits and variances from managed hedging by variation A of moving averages, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	10-and-3 day moving average			10-and-5 day moving average		
	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot
1965	22.12	256.667	3.216	26.20	267.397	2.135
1966	14.12	614.119	3.135	17.69	468.677	2.846
1967	7.92	87.195	3.058	11.12	42.995	2.346
1968	16.91	22.820	1.577	18.26	28.832	1.019
1969	15.09	659.219	3.192	19.29	922.962	3.058
1970	0.14	370.435	3.288	1.93	558.800	2.615
1971	14.63	207.299	3.000	14.51	252.222	2.509
1972	21.83	216.943	3.058	20.97	280.403	2.385
1973	42.27	1267.582	3.135	44.20	749.739	2.538
1974	31.06	1635.941	4.058	32.79	1484.686	4.346
1975	51.73	4018.719	4.712	51.15	3748.423	4.500
1976	2.49	1125.049	4.800	-1.19	953.003	4.24
Total period	20.78	876.641	3.288	22.32	819.921	2.838

The results of variation B are shown in Table 5.13. The number of round-turns using this variation fell between pure moving averages and variation A, as did average profit levels and variances. Thus, this variation was somewhat effective in reducing Type I errors over pure moving averages, but not as effective as variation A.

The redistribution effects of profits are shown in Table 5.14 and 5.15. All lots were hedged at least once under this variation. The average profits from both the 10-and-3 day and 10-and-5 day average were increased from the unhedged level (10-and-3 not significant at $\alpha = .05$; 10-and-5 significant at $\alpha = .01$), and variances were reduced (both significant at $\alpha = .01$).

Table 5.11. Effect on profits using moving average Variation A where long average is ten days, short average is three days and cross-over tolerance is ten cents, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 3 day average goes below 10 day average by 10 cents.			
Financial outcome	Avg. profit or loss ($ per head)	Number of lots	Financial outcome	Number of lots	Avg. profit or loss ($ per head)	Avg. change due to hedging ($ per head)
			PROFITS			
			Unhedged[1]	0	-----	-----
			Profits increased[2]	112	32.62	12.33
Profits	36.09	409	Profits reduced[3]	270	29.38	-15.07
			Losses changed to profits[2]	87	30.86	74.22
			Subtotal profits	469	30.43	8.04
			LOSSES			
			Unhedged[1]	0	----	-----
			Profits changed to losses[3]	27	- 6.61	-24.58
Losses	-38.51	174	Losses reduced[2]	47	-18.69	27.62
			Losses increased[3]	40	-27.53	- 8.76
			Subtotal losses	114	-18.93	2.49
All lots	13.82	583	All lots	583	20.78	6.96

[1]Lots that would not have been covered by a hedge under the program considered (none in this program).
[2]Lots for which profits were increased by hedging, 246 lots, average increase, $37.14/head.
[3]Lots in which profits were reduced by hedging, 337 lots, average reduction, -$15.09/head.

Table 5.12. Effect on profits using moving average Variation A where long average is ten days, short average is five days, and cross-over tolerance is ten cents, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 5 day average goes below 10 day average by 10 cents.			
Financial outcome	Avg. profit or loss ($ per head)	Number of lots	Financial outcome	Number of lots	Avg. profit or loss ($ per head)	Avg. change due to hedging ($ per head)
			PROFITS			
			Unhedged[1]	14	37.29	-----
			Profits increased[2]	127	35.84	10.17
Profits	36.09	409	Profits reduced[3]	245	30.79	-13.25
			Losses changed to profits[2]	91	27.07	68.54
			Subtotal profits	477	31.62	8.98
			LOSSES			
			Unhedged[1]	0	----	-----
			Profits changed to losses[3]	23	- 8.07	-16.15
Losses	-38.51	174	Losses reduced[2]	44	-20.01	28.62
			Losses increased[3]	39	-25.72	- 5.53
			Subtotal losses	106	-19.52	6.34
All lots	13.82	583	All lots	583	22.32	8.50

[1]Lots that would not have been covered by a hedge under the program considered, 14 lots, average profit, $37.29/head.
[2]Lots for which profits were increased by hedging, 262 lots, average increase, $33.54/head.
[3]Lots in which profits were reduced by hedging, 307 lots, average decrease, -$12.49/head.

Table 5.13. Average annual profits and variances from managed hedging by variation B of moving averages, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	10-and-3 day moving averages			10-and-5 day moving averages		
	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot
1965	17.65	238.016	4.784	18.24	236.443	4.324
1966	14.59	629.605	3.654	12.36	732.567	3.596
1967	3.38	70.797	5.365	7.61	66.549	4.327
1968	13.53	40.416	4.058	15.16	46.558	3.346
1969	14.65	762.864	3.692	19.98	703.079	3.077
1970	-6.26	409.965	4.712	3.70	648.227	3.212
1971	13.83	228.146	4.434	9.40	207.366	3.925
1972	18.07	167.671	3.904	17.78	207.841	3.077
1973	54.09	1110.945	2.731	40.86	1081.255	2.577
1974	25.81	2418.205	4.115	32.89	1498.084	3.288
1975	39.82	6944.281	4.077	62.35	3614.100	3.327
1976	3.58	1012.988	4.280	-3.97	1773.329	3.760
Total period	17.56	1199.713	4.129	20.18	867.298	3.453

Variation C of moving average managed hedging

Variation C was developed by incorporating the conditions of variations A and B. Before an action was considered the averages must have crossed by ten cents or more (variation A), and before the action was confirmed the move in the settlement price must have been consistent with the signal (variation B). The results of variation C are shown in Table 5.16.

The average number of roundturns under this variation were the lowest under any of the moving average managed strategies. In the case of the 10-and-3 day strategy it was hypothesized that this represented a further reduction in Type I errors. In the 10-and-5 day strategy, however, the reduced number of roundturns may have represented an increase in Type II errors from variation A, as the average profit was slightly reduced (not significant at $\alpha = .05$).

The redistribution effects of variation C are shown in Tables 5.17 and 5.18. The 10-and-3 day moving average managed hedge returned on average profit

Table 5.14. Effect on profits using moving average Variation B where long average is ten days, short average is three days, and settlement price considered, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 3 day average cross below 10 day average with settlement considered.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]	0	-----	-----
			Profits increased[2]	103	44.25	13.46
Profits	36.09	409	Profits reduced[3]	258	25.14	-16.39
			Losses changed to profits[2]	71	33.40	74.19
			Subtotal profits	432	31.06	5.62
			LOSSES			
			Unhedged[1]	0	-----	-----
			Profits changed to losses[3]	48	-16.49	-34.70
Losses	-38.51	174	Losses reduced[2]	59	-18.56	31.79
			Losses increased[3]	44	-29.56	- 9.50
			Subtotal losses	151	-20.99	- 1.59
All lots	13.82	583	All lots	583	17.56	3.74

[1]Lots that would not have been covered by a hedge under the program considered (none in this program).
[2]Lots for which profits were increased by hedging 233 lots, average increase, $36.63/head.
[3]Lots in which profits were reduced by hedging 350 lots, average decrease, -$18.03/head.

Table 5.15. Effect on profits using moving average Variation B, where long average is ten days, short average is five days, and settlement price considered, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 5 day average crosses below 10 day average, with settlement price considered.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
			Unhedged[1]			----
			Profits increased[2]	113	41.58	14.78
Profits	36.09	409	Profits reduced[3]	261	28.99	-14.27
			Losses changed to profits[2]	82	27.52	69.04
			Subtotal profits	456	31.84	7.83
			LOSSES			
			Unhedged[1]	0	----	----
			Profits changed to losses[3]	35	-6.94	-19.16
Losses	-38.51	174	Losses reduced[2]	52	-21.13	30.61
			Losses increased[3]	40	-26.15	-11.03
			Subtotal losses	127	-18.80	3.78
All lots	13.82	583	All lots	583	20.81	6.99

[1]Lots that would not have been covered by a hedge under the program considered (none in this program).
[2]Lots for which profits were increased by hedging , 247 lots, average increase, $36.21/head.
[3]Lots in which profits were reduced by hedging , 336 lots, average decrease, -$14.39/head.

of \$22.04 per head, which was a significant (α = .01) increase from the unhedged level. Five lots that returned an average profit of \$58.56 per head were not hedged (footnote 1, Table 5.17). The 10-and-5 day moving average managed hedge showed a significant (α = .01) increase in profits (\$21.69 per head) from the unhedged level, and left 27 lots returning an average of \$31.70 per head unhedged (footnote 1, Table 5.18).

Table 5.16. Average annual profits and variances from managed hedging by variation C of moving averages, 583 simulated study lots, Kansas, May 1965 - July 1976.

Year	10-and-3 day moving averages			10-and-5 day moving averages		
	Average profit (dollars per head)	Variance in average profits	Ave. no. of hedges per lot	Average profit (dollars per head)	Variance in average profit	Ave. no. of hedges per lot
1965	29.10	359.972	1.757	25.99	271.133	1.595
1966	12.07	680.336	2.962	17.01	423.599	2.231
1967	8.68	69.579	2.635	10.00	77.486	1.981
1968	17.46	27.288	1.346	19.80	39.582	0.635
1969	18.46	834.030	2.308	25.12	1078.096	1.750
1970	-0.82	391.856	2.654	-1.34	523.261	2.365
1971	13.65	185.166	2.585	11.22	213.487	2.132
1972	21.45	274.235	2.404	17.68	292.384	2.269
1973	48.04	1100.227	2.000	39.59	1118.723	1.923
1974	30.21	1762.695	3.519	36.57	1358.870	2.981
1975	55.41	3329.230	3.692	52.40	2960.908	3.269
1976	3.09	2015.934	4.000	-7.48	1259.585	3.640
Total period	22.04	880.758	2.616	21.69	771.566	2.182

Moving averages as a technical tool are basically both descriptive and predictive techniques. They are descriptive in light of the fact that they are representative of past market trends, up to and including the previous day. Any signal that is indicated is one to two days late, as the averages are behind the movements of the daily prices. That fact limits the predictive effects of moving averages. There is nothing inherent in the moving average technique that predicts when market turning points will take place. However, the indicated

Table 5.17. Effect on profits using moving average Variation C where long average is ten days, short average is three days, cross-over tolerance is ten cents, with settlement price considered, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 3 day average crosses below 10 day average by 10 cents, with settlement price considered.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
Profits	36.09	409	Unhedged[1]	5	58.56	----
			Profits increased[2]	130	38.45	13.56
			Profits reduced[3]	251	28.94	-14.76
			Losses changed to profits[2]	73	34.73	78.24
			Subtotal profits	459	32.88	8.22
			LOSSES			
Losses	-38.51	174	Unhedged[1]	0	----	----
			Profits changed to losses[3]	25	-6.79	-18.23
			Losses reduced[2]	58	-17.72	31.16
			Losses increased[3]	43	-24.67	-8.64
			Subtotal losses	124	-18.10	8.20
All lots	13.82	583	All lots	583	22.04	8.22

[1] Lots that would not have been covered by a hedge under the program considered, 5 lots, average profit, $58.56/hd.
[2] Lots for which profits were increased by hedging, 261 lots, average increase, $35.56/head.
[3] Lots in which profits were reduced by hedging, 317 lots, average decrease, -$14.18/head.

Table 5.18. Effect on profits using moving average Variation C where long average is ten days, short average is five days, cross-over tolerance is ten cents, and settlement price considered, 583 simulated study lots, Kansas, May 1965 - July 1976.

Unhedged			Hedge any time that 5 day average crosses below 10 day average by 10 cents, with settlement price considered.			
Financial outcome	Avg. profit or loss	Number of lots	Financial outcome	Number of lots	Avg. profit or loss	Avg. change due to hedging
	($ per head)				($ per head)	($ per head)
			PROFITS			
Profits	36.09	409	Unhedged[1]	27	31.70	----
			Profits increased[2]	121	35.14	12.26
			Profits reduced[3]	228	32.16	-15.20
			Losses changed to profits[2]	83	28.62	70.70
			Subtotal profits	459	32.28	8.47
			LOSSES			
Losses	-38.51	174	Unhedged[1]	0	----	----
			Profits changed to losses[3]	33	-8.60	-18.80
			Losses reduced[2]	59	-19.35	27.27
			Losses increased[3]	32	-23.25	-9.08
			Subtotal losses	124	-17.52	5.63
All lots	13.82	583	All lots	583	21.69	7.87

[1] Lots that would not have been covered by a hedge under the program considered, 27 lots, average profit, $31.70/hd.
[2] Lots for which profits were increased by hedging, 263 lots, average increase, $34.07/head.
[3] Lots in which profits were reduced by hedging, 293 lots, average decrease, -$14.94/head.

signals are hoped to be predictive of subsequent market trends.

Chapter VI

SUMMARY AND CONCLUSIONS

The results of all hedging strategies tested in this study are shown in Table 6.1. The moving average strategies are not directly comparable to other strategies as they involved the use of daily live cattle futures price closes and the other strategies used weekly average closing prices.

Throughout this study it has been assumed that a strategy would have been considered superior to unhedged marketing if it met one or both of the following conditions over the long run: (1) a reduction in variance from the unhedged level without an accompanying reduction in average profits, or (2) an increase in average profits from the unhedged level without a corresponding increase in variance. The variance figure was used as a measure of risk involved with using any of the tested marketing options.

All of the tested hedging strategies reduced the variance of profits significantly from the unhedged level. All of the reductions in variance were statistically significant at $\alpha = .01$ except the pure 10-and-3 day moving average strategy, which was significant at $\alpha = .05$. However, the resulting profit level was also reduced in the strategies that involved routine hedging and $F_1 > BE + D$ (strategies 2, 3, 6, and 7, Table 6.1). In a statistical context, only routine hedging involved significant reductions in variance from the unhedged level ($\alpha = .01$). Strategies 2, 3, 6, and 7 in Table 6.1 did not meet the condition of lower variance without lower profits when looking at the absolute value of the profits. However, in a strictly statistical sense, strategies 3 and 7 might still be considered superior strategies to unhedged marketing.

Table 6.1. Average annual profits from unhedged marketing and 16 tested hedging strategies, Kansas, May 1965 - July 1976.

Alternative	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	July 1976	Ave. period profits	Variance
	Dollars per head													
1. Unhedged	36.43	13.60	3.33	19.78	28.24	1.46	23.61	29.18	2.71	-60.00	63.10	-11.23	13.82	1516.381
Traditional hedging														
2. Routine hedge	15.11	17.47	14.47	6.50	3.87	-3.39	- 6.05	- 3.21	-33.01	- 0.46	21.00	- 0.81	2.45**	500.161**
3. F_1>BE+D	17.28	17.45	14.47	11.98	7.86	-4.02	22.29	19.64	4.96	- 5.15	24.82	- 3.89	11.16	902.589**
4. $F_1>C_1$+D	30.19	24.10	14.47	20.11	27.90	-3.00	13.07	29.18	-15.55	1.85	38.69	-11.61	14.89	840.769**
5. F_1>BE+D & $F_1>C_1$+D	30.19	24.10	14.47	20.11	27.90	-3.00	22.21	29.18	4.96	- 6.11	39.01	-11.61	16.87	1039.537**
Stop loss managed hedging														
6. Routine hedge	18.69	20.78	13.99	7.46	15.92	-5.25	4.82	6.71	- 6.64	-18.54	44.07	- 9.45	8.22**	1074.549**
7. F_1>BE+D	18.62	20.89	13.99	11.32	16.38	-6.42	14.26	6.89	-10.29	-14.06	46.48	0.48	10.10	949.084**
8. $F_1>C_1$+D	28.42	18.49	13.99	20.47	20.66	-5.34	13.86	27.61	- 1.39	-19.15	62.46	-17.51	14.61	1088.065**
9. F_1>BE+D & $F_1>C_1$+D	28.42	18.80	13.99	20.46	20.66	-5.69	15.91	26.24	- 9.67	-12.61	65.30	- 9.55	15.10	964.929**

**Indicates that the difference as compared to unhedged value is statistically significant at the one percent level.

Table 6.1. (Continued)

Moving averages	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	July 1976	Ave. period profits	Variance
	- - -	- - -	- - -	- - -	- - -	- - -	- Dollars per head -							
10. 10-and-3 Pure	14.67	12.86	0.18	10.96	7.58	-5.93	11.90	14.56	42.47	28.06	32.62	1.82	14.88	1291.792*
11. 10-and-3 Variation A	22.12	14.12	7.92	16.91	15.09	0.14	14.63	21.83	42.27	31.06	51.73	2.49	20.78**	876.641**
12. 10-and-3 Variation B	17.65	14.59	3.38	13.53	14.65	-6.26	13.83	18.07	45.09	25.81	39.82	3.58	17.56	1199.713**
13. 10-and-3 Variation C	29.10	12.07	8.68	17.46	18.46	-0.82	13.65	21.45	48.04	30.21	55.41	3.09	22.04**	880.758**
14. 10-and-5 Pure	14.47	14.46	4.56	10.90	12.27	0.83	8.15	16.16	42.74	25.30	60.03	0.27	18.37*	908.989**
15. 10-and-5 Variation A	26.20	17.69	11.12	18.26	19.29	1.93	14.51	20.97	44.20	32.79	51.15	-1.19	22.32**	819.921**
16. 10-and-5 Variation B	18.24	12.36	7.61	15.16	19.98	3.70	9.40	17.78	40.86	32.89	62.35	-3.97	20.81**	876.298**
17. 10-and-5 Variation C	25.99	17.01	10.00	19.80	25.12	-1.34	11.22	17.68	39.59	36.57	52.40	-7.48	21.69**	771.556**

*Indicates that the difference as compared to unhedged value is statistically significant at the five percent level.

**Indicates that the difference as compared to unhedged value is statistically significant at the one percent level.

With the exception of these four strategies, all other strategies would have been considered to be superior to unhedged marketing by both reducing variance and increasing average profits. The increase in profits over unhedged marketing would have been statistically significant in six of the moving average strategies (strategies 11, 13, 15, 16, and 17, Table 6.1, significant at α = .01; strategy 14 significant at α = .05).

The ranges in profits one standard deviation around the respective means are presented in Table 6.2. The standard deviation is the square root of the variance, and the range encompassed by one standard deviation each side of the mean will encompass approximately two-thirds of the observations. By observing Table 6.2, it is easier to see the relationships between profits and variances.

Unhedged marketing during the study period produced an average profit of $13.82 per head, and approximately two-thirds of the profits were between -$25.12 and +$52.76 per head (Table 6.2). There would have been an equal probability to attain the profit at either end of this range.

Traditional routine hedging, when compared to unhedged marketing, would have resulted in a $5.21 reduction in losses on the bottom end of the standard deviation range; however, routine hedging would also have reduced the profit $27.95 per head on the upper end of the range. The strategy with the highest per head average profits during the study period, variation A of 10-and-5 day moving averages (strategy 15, Table 6.2), would have reduced the loss on the bottom end of the range by $18.81 per head when compared to unhedged marketing, and would have decreased the profit on the top end of the range by only $1.81 per head. Similar comparisons can be drawn for the other tested strategies.

The ranges in profits one standard deviation around the respective means as shown in Table 6.2 are the combined results of the mean and variance of

Table 6.2. Range in profits encompassed by one standard deviation around the mean, unhedged marketing and 16 tested hedging strategies, 583 simulated study lots, Kansas, May 1965 - July 1976.

Marketing strategy	Low end	Mean	High end
	Dollars per head		
1. Unhedged	-25.12	13.82	52.76
Traditional hedging			
2. Routine hedge	-19.91	2.45	24.81
3. F_1>BE+D	-18.88	11.16	41.20
4. F_1>C_1+D	-14.11	14.89	43.89
5. F_1>BE+D & F_1>C_1+D	-15.37	16.87	49.11
Stop loss managed hedging			
6. Routine hedge	-24.56	8.22	41.00
7. F_1>BE+D	-20.71	10.10	40.91
8. F_1>C_1+D	-18.38	14.61	47.60
9. F_1>BE+D & F_1>C_1+D	-15.96	15.10	46.16
Moving average managed hedging			
10. 10-and-3 Pure	-21.06	14.88	50.82
11. 10-and-3 Variation A	- 8.83	20.78	50.39
12. 10-and-3 Variation B	-17.08	17.56	52.20
13. 10-and-3 Variation C	- 7.64	22.04	51.72
14. 10-and-5 Pure	-11.78	18.37	48.52
15. 10-and-5 Variation A	- 6.31	22.32	50.95
16. 10-and-5 Variation B	- 8.79	20.81	50.41
17. 10-and-5 Variation C	- 6.09	21.69	49.47

each strategy. The effects of these statistics become more meaningful in combination than by looking at each individually when examining the factors of risk in using different hedging strategies.

The concentration of attention to the total period net effects of the strategies tested in this study may be somewhat misleading in two respects. First, in any given isolated short-run time period during the last 11 years, the returns from the strategies may not have held the same relationships as they did in total period average profits and variances.[1] Second, there is no guarantee that these relationships will not change in the future.

It is apparent that selective hedging is a management tool that cannot be readily overlooked by cattle feeders. It is also apparent that there is a need for more empirical research and education on the use of the live cattle futures market as a profit enhancing and risk reducing mechanism.

One area that suffers from inadequate theoretical and empirical analysis is that of the basis. The producer who is considering hedging should conduct a historical study of the basis in his area, or have one conducted for him. He can then compare this series to the basis movements at par markets to help isolate location differences.

Another major area for further research is in the development of various forms of technical charts which cattle feeders can use to show price trends and the relationship between futures prices and prevailing cash prices. A livestock producer should not try to rely strictly on his memory of these relationships, especially for a commodity like live cattle where the futures

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[1]By examining the tables in the text where profits and variances are shown by years, the reader can note where this is the case. For instance, the higher profits and lower variances obtained by routine hedging over never hedging since late 1973 were discussed in Chapter III.

market and the cash market are two separate, but highly related markets. Charts have several particular advantages for the average hedger. They make it much less necessary than otherwise for the hedger to know a great deal about economics. They include the effects of market psychology as well as of economic factors, and most types of charts require little time to construct and can be updated each day within a few minutes.

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Appendix A

SUPPORTIVE DATA AND STATISTICAL METHODS

1. Fixed costs used in the sumulation feedlot were from previously published research and are shown in Appendix Table 1. The weekly parity index for Kansas farmers as published in Agricultural Prices as applied to fixed costs to relate to the base period, which had an index of 302.

2. Feed costs were adjusted weekly. They were obtained from Agricultural Prices and mid-month averages were interpolated linearly.

3. Nutrition requirements are shown in Appendix Table 2. The rations fed in the simulation are shown in Appendix Table 3. Total feed requirements are shown in Appendix Table 4.

4. Dr. Jack Riley of the Department of Animal Science and Industry, Kansas State University, supplied the following rule of thumb for pricing corn silage based on corn grain equivalent:

$$Pcs = (Cp \cdot 5.6) + (2.25 \cdot I_n)$$

where: Pcs = price of corn silage in dollars per ton,

Cp = price per bushel of corn on September 1,

5.6 = number of bushels of corn in one ton of corn silage,

2.25 = base (1966) field costs for harvesting and hauling one ton of silage, and

I_n = weighted price index.

The price of silage was figured on September 1 of each year and held constant until the next September.

5. Death loss was assumed to be 1/2 of 1 percent during the feeding period. These cattle were assumed to be kept on feed for 1/2 of the total feeding period.

6. The significance of variance was computed using an F-test:

$F = S_1^2/S_2^2$ where S_1^2 = larger variance.

The variance was pooled over the total period by use of the following formula:

$$\text{Pooled } S^2 = \frac{S_1^{\,2}(N_1-1) + S_2^{\,2}(N_2-1) + \ldots\ldots + S_n^{\,2}(N_n-1)}{(N_1-1) + (N_2-1) + \ldots\ldots + (N_n-1)}$$

where $S_n^{\,2}$ = the variance for years 1 through n, and

N_n = the number of weeks in years 1 through n.

7. Because the variances were not assumed homogeneous, the Behrens-Fisher statistic was used in figuring the significance of mean profits:

$$t' = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\dfrac{S_1^{\,2}}{n_1} + \dfrac{S_2^{\,2}}{n_2}}}$$

where: n_1 and n_2 are the number of observations (583 in this study).

Appendix Table 1. Annual nonfeed costs for a 20,000 head commercial feed lot at 100% capacity[a].

Fixed costs:	
Depreciation	$ 46,975
Maintenance and repair	7,212
Taxes	4,485
Interest	16,939
Insurance	5,231
Management and office	46,015
Total fixed costs	$126,857
Variable costs:	
Veterinary	$ 25,751
Insecticide	5,684
Dues, fees and subscriptions	1,247
Trucking (other than cattle)	42,268
Equipment--maintenance and repair	22,672
Electricity	12,000
Fuel	19,993
Taxes on cattle	62,500
Interest on cattle	225,000
Insurance on feedlot	1,741
Hired labor	97,033
Total variable costs	$547,389
Buying, selling, and trucking cattle costs:[b]	
Buying cattle	$ 79,450
Selling cattle	0
Trucking cattle	217.430
Total	$296,880
Total all costs:	$971,676
Cost per head $19.83[c]	

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[a]John H. McCoy and Calvin C. Hausman, "Economies of Scale in Commercial Cattle Feedlots of Kansas - An Analysis of Non-feed Costs," Agricultural Experiment Station, Kansas State University, Technical Bulletin 151, April, 1967, pp. 45 and 47.

[b]Buying, selling and trucking cattle costs were adjusted to account for a 147-day feeding period rather than the original 140-day period.

[c]This per head cost was indexed weekly during the study period by the index of prices paid by Kansas farmers.

Appendix Table 2. Animal requirements used for determining rations.

Weight	Total (lbs) feed	Lbs. D.M.	Lbs. D.P.	Kcal. D.E. maintenance	Kcal. D.E. lb. gain	Kcal. D.E. 2.7 lb. gain	Total kcal.
600-700	18.75	16.8	1.4	9,550	5,625	15,187	24,737
700-800	21.0	18.8	1.6	10,650	6,275	16,942	27,592
800-900	23.0	20.8	1.8	11,725	6,900	18,630	30,025
900-1000	25.0	22.6	1.8	12,775	7,500	20,250	33,025
1000-1100	25.8	23.2	1.9	13,750	8,100	21,870	35,620

Feed (lb)	% D.M.	% D.P.	Kcal. D.E.
Sorghum, milo, grain	89	8.6	1,420
Soybean meal, expeller	90	39.4	1,480
Prairie hay, mid-bloom	91	2.0	910

Source: National Academy of Sciences-National Research Council, "Nutrient Requirement of Beef Cattle"

Appendix Table 3. Rations fed 650-1091# steers at various weight levels, 147 day feeding period.[1]

	Daily Intake Dry	Daily Intake As fed
	--pounds--	
Ration #1 for a 650# steer (7 day)		
Corn silage	12.7	36.4
Alfalfa hay	1.4	1.6
Milo	212	2.5
Soybean meal	1.5	1.7
Total	17.8	42.2
Ration #2 for a 675# steer (7 day)		
Corn silage	8.4	24.1
Alfalfa hay	1.5	1.7
Milo	7.5	8.5
Soybean meal	1.1	1.2
Total	18.6	35.5
Ration #3 for a 700# steer (7 day)		
Corn silage	3.8	11.0
Alfalfa hay	1.5	1.7
Milo	13.0	14.8
Soybean meal	.9	1.0
Total	19.2	28.5
Ration #4 for a 701-800# steer (35 day)		
Corn silage	1.3	3.8
Alfalfa hay	1.6	1.8
Milo	16.4	18.6
Soybean meal	.9	1.0
Total	20.2	25.2
Ration #5 for a 801-900# steer (35 day)		
Corn silage	1.3	3.7
Alfalfa hay	1.7	1.9
Milo	17.3	19.7
Soybean meal	.9	1.0
Total	21.2	47.5
Ration #6 for a 901-1091# steer (56 day)		
Corn silage	1.4	4.1
Alfalfa hay	1.8	2.0
Milo	17.7	20.1
Soybean meal	.9	1.0
Total	21.8	27.2

[1]Data on the average daily gain, shrink, death loss, and rations were suggested by Dr. Steven Armbruster, Department of Animal Science and Industries, Kansas State University.

Appendix Table 4. Weekly feed requirements in pounds for one steer.

	Feed requirements in pounds			
Week number	Grain sorghum	Soybean meal	Silage	Alfalfa hay
1	17.5	11.9	254.8	11.2
2	59.5	8.4	168.7	11.9
3	103.6	7.0	77.0	11.9
4	130.2	7.0	26.6	12.6
5	130.2	7.0	26.6	12.6
6	130.2	7.0	26.6	12.6
7	130.2	7.0	26.6	12.6
8	130.2	7.0	26.6	12.6
9	137.9	7.0	26.6	13.3
10	137.9	7.0	26.6	13.3
11	137.9	7.0	26.6	13.3
12	137.9	7.0	26.6	13.3
13	137.9	7.0	26.6	13.3
14	140.7	7.0	28.7	14.0
15	140.7	7.0	28.7	14.0
16	140.7	7.0	28.7	14.0
17	140.7	7.0	28.7	14.0
18	140.7	7.0	28.7	14.0
19	140.7	7.0	28.7	14.0
20	140.7	7.0	28.7	14.0
21	140.7	7.0	28.7	14.0
Total	2646.7	153.3	996.1	276.5

THE EFFECTS OF TRADITIONAL AND MANAGED HEDGING STRATEGIES FOR CATTLE FEEDERS

by

ROBERT VIRGIL PRICE

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Conventional theory describes hedging as taking a position in futures markets which is equal to and opposite to a similar position already held or anticipated in physical units of the cash commodity. To the extent that prices in the two markets move in the same general direction and converge at par delivery markets at the maturity of the futures contract, hedging may be used as price insurance in reducing profit variation and/or enhancing total profits.

The current study was undertaken in an effort to devise hedging strategies to aid cattle feeders in their managerial function. Traditional hedges and managed hedges were explored to provide a base for decisions regarding hedging opportunities for cattle feeders.

A cattle feedlot model was developed simulating Kansas feeding conditions. The model provided for the purchase of feeder cattle and sale of finished cattle from the initiation of the live cattle future contract on the Chicago Mercantile Exchange in late 1964 to mid 1976. The costs of gain and unhedged profits were calculated for each lot of cattle. A total of 583 lots were simulated.

Different hedging strategies were tested on each lot of cattle being fed in the simulation model, and the effect on profits of each strategy was analyzed. Any strategy was considered successful to unhedged marketing if one or both of the following conditions were met: (1) variance was reduced without reducing profits, or (2) profits were increased without increasing variance.

A policy of routine hedging would have resulted in significantly reduced variation in profits during the period, but only with a substantial reduction in profits. Three selective strategies were developed from assumed theoretical futures-cash price equilibrium conditions. Two of these strategies proved successful in meeting both conditions outlined above.

The departures from traditional hedging theory by a commodity that is continuously produced and not storable led to the observation that the futures market and cash market in live cattle are two separate, although highly related, markets. The concept of managed hedging, allowing for placing and lifting hedges more than once at opportune times during the feeding period, was then developed and tested.

The first phase of managed hedging tested the feasibility of using a stop-loss order to guard against unfavorable price moves. The use of stop-loss orders did not prove beneficial to managed hedging because they only worked to get hedgers out of unfavorable situations and did not help isolate times when hedging might prove beneficial.

Moving averages were then tested as a managed hedge technique. Pure moving average strategies tended to result in many unnecessary roundturns in the futures market. Three variations were made to moving average strategies that involved the use of cross-over tolerances and current day confirmations of the signals. The variations proved superior to pure moving averages.

From the standpoint of profit levels and variance levels, the strategies found most superior to unhedged marketing were moving average strategies combining the use of cross-over tolerances and current day confirmations.