An evaluation of placement hedging in developing alternative marketing strategies for Iowa cattle feeders, 1974-1984

by

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CHAPTER I. INTRODUCTION

The Problem

Recent highly volatile cattle prices and greater costs of operation have made cattle feeding increasingly risky. The cattle feeder has become subjected to more instability in price levels during the feeding period. For example, the average annual price range in Omaha choice steers was nearly three times as great for the period 1973-1984, as it was for the period 1960-1972, $15.37 per cwt. versus $5.97 per cwt. (see Table 1).

The number of cattle on feed in Iowa has declined over 50 percent since 1970 (Figure 1). The predicted number of cattle on feed in Iowa, if the past trend continues, would be 650,000 head by January 1, 1990 and this means a significant drop (approximately one-third) from one million head on January 1, 1984.

The profitability of feeding cattle depends upon the price margin, which is the difference between the price paid per pound for feeder cattle and the price received per pound for slaughter cattle, and the feeding margin which is the difference between the cost of producing one pound of gain and the price received per pound of gain.

During the feeding period until the feeder is ready for sale, there is the risk that decreases in the price of slaughter cattle may result in a loss for a feeding operation. Farmers are usually uncertain about the price of a product that they will sell in the future.

Table 1. Annual price variation, dollars per cwt., for Omaha choice steers

Year	High	Low	Annual Range
1960	31.00	24.50	6.50
1961	28.25	22.25	6.00
1962	31.75	25.50	6.25
1963	28.85	21.75	7.10
1964	25.92	19.85	6.07
1965	27.59	22.15	5.44
1966	30.25	23.63	6.62
1967	27.50	23.55	3.95
1968	28.72	25.28	3.44
1969	34.58	27.18	7.40
1970	31.50	26.12	5.38
1971	34.69	27.12	7.57
1972	38.88	32.44	6.44
1973	56.02	37.05	18.97
1974	48.38	35.45	12.93
1975	54.70	34.15	20.55
1976	44.60	34.72	9.88
1977	43.98	36.70	7.08
1978	63.00	42.75	20.25
1979	79.25	54.88	24.37
1980	76.25	59.00	17.25
1981	52.25	57.50	14.75
1982	74.24	56.09	18.15
1983	69.10	58.30	10.80
1984	70.00	60.40	9.60

1960-1973 averages 5.97
1973-1984 averages 15.37

Source: Derived from data published in Livestock, Meat, Wool Market News, Livestock Division, Ames, USDA, various issues, 1960-1985.

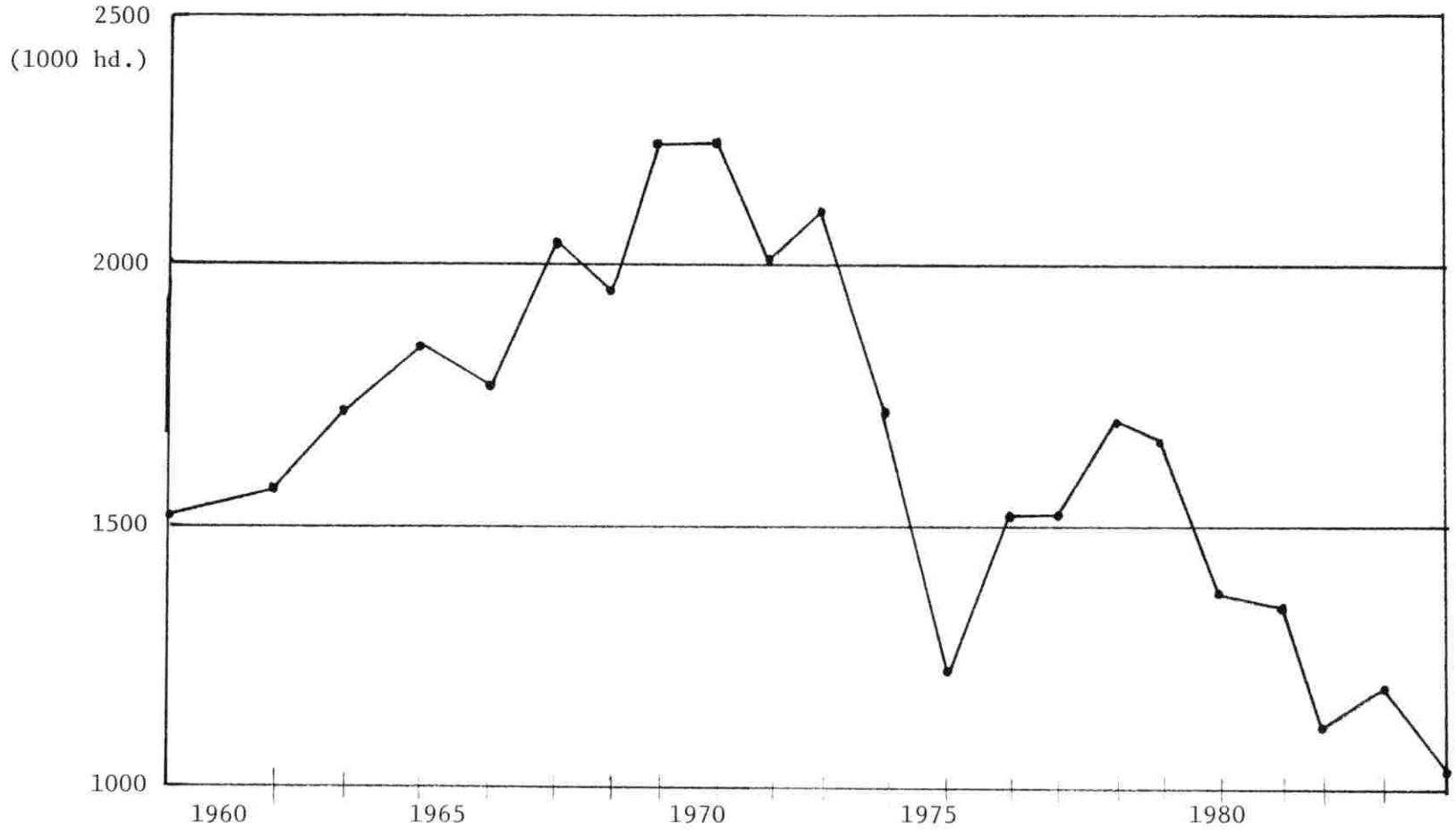

Figure 1. Number of cattle on feed in Iowa, January 1, 1960-1984

Source: The Iowa Cattle Feeding Industry, Past, Present, and Future, Final Report, presented to Iowa Cattleman's Association, prepared by Cattle Fax, Englewood, Colorado, November 12, 1984.

Cattle feeders have to wait for about 6 months after beginning to feed feeders before knowing the final price for the finished product. Farmers have to make production and marketing decisions in this uncertain environment. "Infrequent buying and selling may increase the risk of unfavorable price changes, so farmers rarely use formal marketing strategies to reduce risks"(1).

Because of the uncertainty regarding prices, it is important for cattle feeders to examine alternative methods of selling or marketing the finished cattle in order to stabilize income and minimize price risk in the cattle feeding business. One common method that has been suggested to transfer part of the price risk to others is through the use of futures markets (i.e., hedging).

Forward pricing of cattle with a packer before the date of delivery is another marketing alternative that would reduce, or perhaps eliminate, the uncertainty over what the slaughter price will be after feeding. Risk attitudes of cattle feeders would affect the desirability of using any method, however. Iowa cattle feeders can be considered as risk averse meaning they would prefer more certain or less variable outcomes rather than more uncertain outcomes that have the same expected value.

Facing uncertain prices, farmers need to evaluate alternative marketing strategies. Strategies should be examined carefully to determine if they would result in the farmer's risk being reduced and/or the expected return being increased.

In considering the use of marketing strategies that involve hedging, it is important to determine if hedging or using future markets is a better alternative than the cash market. The cattle feeder can evaluate alternative hedging strategies by comparing the results of those strategies to those that would have been realized with a cash strategy for a particular feeding period.

Cattle feeders must also "choose a strategy that fits their needs" [30]. Whether hedging or using futures markets is best for farmers may depend on their knowledge of futures markets and what hedging is.

Objectives of the Study

The main objective of this study is to analyze the likely impact of selected alternative cattle marketing strategies on the risks and returns associated with cattle feeding.

Specific strategies to be tested involve the use of futures markets by cattle feeders to hedge at the time of placement future cattle marketings. A strategy of selling in the cash market all the time (routine cash) will be used as the base strategy with which to evaluate the results of more sophisticated hedging strategies. The more complicated hedging strategies that will be examined are often referred to as selective hedging strategies, meaning that the producer is more selective about hedging. That is, some criterion or condition must be met before the cattle are hedged; otherwise, the cattle would be sold in

the cash market. The specific criteria that are used to define alternative hedging strategies will be explained later.

CHAPTER II. LITERATURE REVIEW

There has been much work done on evaluating the performance of alternative cattle or hog marketing strategies. Most of these previous studies use a cash marketing strategy as the basis for evaluating other marketing strategies. Some of the results that have been reported in the literature are now summarized.

Leuthold and Peterson [21] used a mean-variance analysis of net return per hog in evaluating several hedging strategies; (1) cash only, (2) rou- tine hedge, (3) hedge sales during the heavy marketing months (January, March, April, May, October and December), (4) hedge sales in the light marketing months (February, June, July, August, and September), (5) hedge sales in delivery months (February, April, June, July, August, October and December), (6) hedge sales in nondelivery months, (7) hedge if the hog-corn price ratio is greater than 15 when the feeding period begins, (8) hedge if the hog-corn price ratio is less than 15 when the feeding period begins, (9) hedge if the localized price is greater than the break-even price when the feeding period begins, (10) hedge if the localized futures price is greater than the break-even price plus $1.00 per cwt. when the feeding period beings, (11) hedge if the localized futures price is greater than the break-even price plus $2.00 per cwt. when the feeding period begins, (12) hedge if the localized futures price is greater than the break-even price plus $4.00 per cwt. when the feeding period begins, (13) hedge if the cash price is less than the break-even price when the

feeding period begins and (14) hedge if the localized futures price is greater than the cash price at the beginning of the feeding period. Leuthold and Peterson found that the most favorable strategies for hog feeders were those that involved comparing localized futures prices to break-even prices.

Menzie and Archer [25] applied four different strategies to a simulated cattle feedlot. The strategies were (1) the nonhedge or routine cash strategy, (2) the complete or routine hedge strategy, (3) a selective hedge strategy using a break-even price, and (4) a selective hedge strategy using a five-year moving average of an index of monthly slaughter cattle prices. They compared the results of these decision strategies by using the mean and variance of the average net revenue per head excluding the feed costs. They concluded that hedging reduced risk when the projected returns with hedging exceeded the estimated costs of feeding. The best strategy in their study was to hedge when the localized futures price was greater than or equal to a five-year moving average of an index of monthly slaughter cattle prices. Finally, they concluded in their study that not all pens of cattle should necessarily be hedged. They stated that, except under special marketing circumstances, there does not appear to be any justification to hedge all feeding and, in fact, such a strategy will likely result in lowered returns over time without significantly reducing risks compared to selling in the cash market all of the time.

Shafer, Griffin and Johnston [33] examined the usefulness of cattle, feeder cattle and corn futures contracts in integrated selective hedging strategies for cattle. They used mean-variance analysis to evaluate the performance of the following hedging strategies: (1) lock-in an expected profit or do not feed, (2) lock-in an expected profit or sell in the cash market, (3) an extended lock-in (ELI) strategy that was the same as the lock in or cash market strategy except that a cattle hedge could be triggered on any day during the feeding period when the expected lock-in margin equalled or exceeded the specified required lock-in margin, (4) a technical trading strategy that used a 10- and 15-day moving average of cattle prices for placing and lifting long hedges in corn and feeder cattle during the two-month planning period. This strategy also was used for placing and lifting short hedges in live cattle during the planning period as well as after the feed-out began. The authors concluded that the use of their technical factor to selectively hedge was the most profitable of the hedging strategies although the variance of profits with this strategy was also larger. They stated that basis risks were less than price risks and thus an appropriate selective hedging strategy can probably reduce price risk in cattle feeding.

Spahr and Sawaya [34] analyzed a pre-feeding hedging strategy using mean-variance analysis. With their strategy, the feedlot operator examines the futures markets for corn, feeder cattle and slaughter cattle prior to actually purchasing the feeder cattle to see

if an adequate profit can be assured. Spahr and Sawaya concluded that by using this strategy, a feedlot operator may increase his average return and also might reduce the risk involved in the operation.

Purcell [30] also evaluated alternative cattle hedging approaches. The approaches evaluated were as follows: (1) hedge cattle when a predetermined lock-in margin can be hedged, (2) hedge with the use of trend lines (this strategy used a chart that illustrated the price trend lines of live cattle futures contracts to help the feeder in deciding to place and lift the hedges), and (3) hedge with use of moving averages (this strategy used a 3 and 10-day moving average of the settlement prices).

During March and April some feeders are wondering whether they should place hedges on cattle to finish in September and October, cattle hedgers are worse off by hedging if the market trends higher after the hedge is placed. Purcell's second strategy tests one way to handle placing hedges with the use of trend lines. If the market closed below an up trend line, a "sell stop" order under the trend line was used to set the hedge. Otherwise, the cattle were not hedged.

Purcell found that the 5- and 15-day averages alone or 5 and 15 with a 4-day weighted lead indicator proved far superior to the popular 3- and 10-day averages or the 5- and 10-day, which had been considered to be superior to the 3- and 10-day. Finally, Purcell didn't identify a particular strategy as being the best and recommended that the feeder

should use the strategy that fits his or her needs after understanding the strengths and weaknesses of that strategy.

McCoy and Price [24] used Mean-Variance analysis to evaluate seven alternative marketing programs including the following: (1) sell unhedged or routine cash, (2) routinely hedge, (3) hedge when the expected hedged price (HP) is greater than the break-even price (B.E.P.), (4) hedge when the expected hedge price is greater than the current cash price (CP), (5) hedge when the expected hedged price is greater than the break-even price and the hedged price is greater than the cash price, (6) hedge only lots that would be sold during September, October, November, or December, and (7) cash contract cattle at a price equal to the current cash price. This latter strategy didn't use a futures market, but assumed that cattle were contracted (when placed on feed) for delivery at the end of the finishing period at the prevailing cash price for finished cattle when they were placed on feed. It was found in this study that the fifth strategy provided the highest profit of all strategies tested even though only 29 percent of the lots would have been hedged using this strategy.

Holland, Purcell, and Hague [13] used mean-variance of net returns as a method for evaluating the performance of the following strategies: (1) unhedged feeding operation or routine cash, (2) complete or routine hedging, (3) seasonal hedging of cattle marketed September through December, (4) hedge if the expected lock-in margin is less than the mean net return of the unhedged operation, (5) hedge if the expected

lock-in margin is greater than the mean net return of the unhedged operation, (6) hedge if the expected net revenue is less than the mean net return and the expected lock-in is greater than zero during the whole period of year and (7) seasonal hedging with correction for price changes. This strategy allowed the feeder to correct his unhedged position in the spring if typical price patterns were altered. Strategy seven provided for the hedging of all cattle being marketed in the September through December months with additional hedging during the remainder of the year if a price decrease of more than $1.00 per cwt. occurred over a four-week interval. The investigators concluded that the fifth strategy was superior. It accomplished a significant decrease in the variance of net returns compared with a routine hedging strategy while at the same time causing a small increase in mean net returns. The authors concluded that hedging strategies can be used successfully by managers of cattle feeding operations.

Gorman and Southward [9] evaluated and compared several hedging strategies for finished cattle. These were (1) no hedge, (2) routine hedge, (3) hedge if the estimated break-even price is less than the localized futures prices, and (4) hedge using 3-, 4-, 10-, and 18-day moving averages of heifer and steer prices in conjunction with estimated break-even costs and profit targets. With this strategy, the hedge was allowed to be lifted and placed several times during the feeding period. This strategy compared the moving average prices of heifers and steers to the break-even prices alone and to the break-even

prices plus profit targets of $3.00 and $5.00 per cwt.. The authors concluded that selective hedging was highly profitable under certain circumstances. In particular, this study reinforced Purcell's finding that moving average strategies can produce superior results compared to other strategies. These results also reported that not all cattle would necessarily be hedged all of the time and that some risk remained even when estimated break-even costs were used. The authors stated that cattle feeding was not profitable during the 6.5 years studied (the average cash market loss was $24.50 per head), but a carefully chosen hedging strategy could have reduced the loss by 50 percent.

Most of these previous studies that have evaluated alternative cattle marketing strategies are based on data for the 1960s or for the early 1970s. This study extends the analysis through the 1970s and the first part of the 1980s. Hence, this study re-evaluates or re-examines some cattle marketing strategies to see if they are still effective at reducing risk and/or increasing returns for cattle feeders since the early 1970s when, as it was indicated earlier, cattle prices became increasingly volatile. In addition, this study examines a marketing strategy that has not been tested in the literature previously. This strategy is based on forecasts of future cattle prices as forecasted by extension economists in the Economics department at Iowa State University.

CHAPTER III. CONCEPTUAL FRAMEWORK

Decision Making Under Uncertainty

While operating in an uncertain world that is characterized by a lack of information about the future, cattle feeders need to use a decision making method or approach that enables them to take into consideration the risk associated with marketing alternatives.

Risk and uncertainty can be characterized by either objective or subjective probabilities about the likelihood of some future event happening. In this study, there is no distinction made between risk and uncertainty as economists often use both terms interchangeably. In the case of decision making under uncertainty, the cattle feeder is confronted with a set of marketing choices, only one of which he can eventually choose. A crucial feature of his/her choice is that the actual outcome of any particular choice is not known in advance. The cattle feeder does not know what the price of the finished cattle is going to be, because he or she does not know what state of nature will happen.

If C_j, j=1, ..., n represents a set of all possible choices (e.g., marketing alternatives) facing an individual, and E_i, i=1, ..., m represents a set of all possible events or states of nature, the outcome O_{ij} depends on E_i and C_j.

Risk Attitudes and Expected Utility

Cattle feeders can be classified according to their attitudes toward risk, that is, their like or dislike of variability (price or

income) involved in feeding cattle. Those categories are as follows:

1. Risk averse: These individuals do not like price or income variability and would prefer a certain or known outcome to uncertain outcomes provided they have the same expected value.

2. Risk Loving: These individuals like variability (or risk) and would prefer uncertain outcomes to certain ones, everything else the same. These individuals are like gamblers in that they derive satisfaction from participating in risky ventures.

3. Risk Neutral: These individuals are indifferent about price or income variability or are indifferent between certain outcomes and uncertain outcomes provided they have the same expected value.

These types of risk attitudes can be explained more fully with expected utility function theory.

If a cattle feeder conforms to the axioms of the Von-Nuemann Morgenstern utility theory, and if probabilities P_i, i=1-I subjective or objective are specified for each future state of nature (E_i, i=1,..., I), then the cattle feeders can evaluate the utility of each choice by the expected utility of the outcome (12). In a risky world, the optimal decision rule is to choose the alternative that maximizes the expected utility of the outcome.

The expected utility function can be derived from the known utility function. If the utility function (u) is a function of income, U=U(M) where M=income, and applying Taylor's expansion around the mean (M) and considering terms only through the second term, ignoring the

rest by assuming them to be small, then the expected utility is as follows:

$$E[U] = E[U(\bar{M}) + (M-\bar{M})U'(\bar{M}) + 1/2U''(\bar{M})(M-\bar{M})^2]$$

$$= U(\bar{M}) + E[(M-\bar{M})U'(\bar{M})] + E[1/2U''(\bar{M})(M-\bar{M})^2]$$

$$E[U] = U(\bar{M}) + 1/2U''(\bar{M})\sigma^2 M$$

where;

$$\sigma_M^2 = E[M-M]^2$$

Thus, the expected utility is a function of the expected income and its variance [22]. Risk attitudes can be explained by the mean and the variance of the income. This is seen in Figure 2.

The risk averse cattle feeder will choose X_1 instead of X_2 because the two alternatives provide the same expected income, but X_2's variance is greater than that of X_1.

The risk lover cattle feeder will prefer X_2 to X_1 becuase the expected utility from being involved in a riskier project is greater. The risk neutral cattle feeder would be indifferent between X_1 and X_2 because he/she ignores variability and chooses alternatives only on the basis of expected income.

Mean-Variance Analysis

The expected utility of a choice can be transformed into mean-variance analysis under two conditions. Tobin [35] specified these conditions as (1) the probability distribution of the function under consideration is normally distributed and (2) the individual's utility

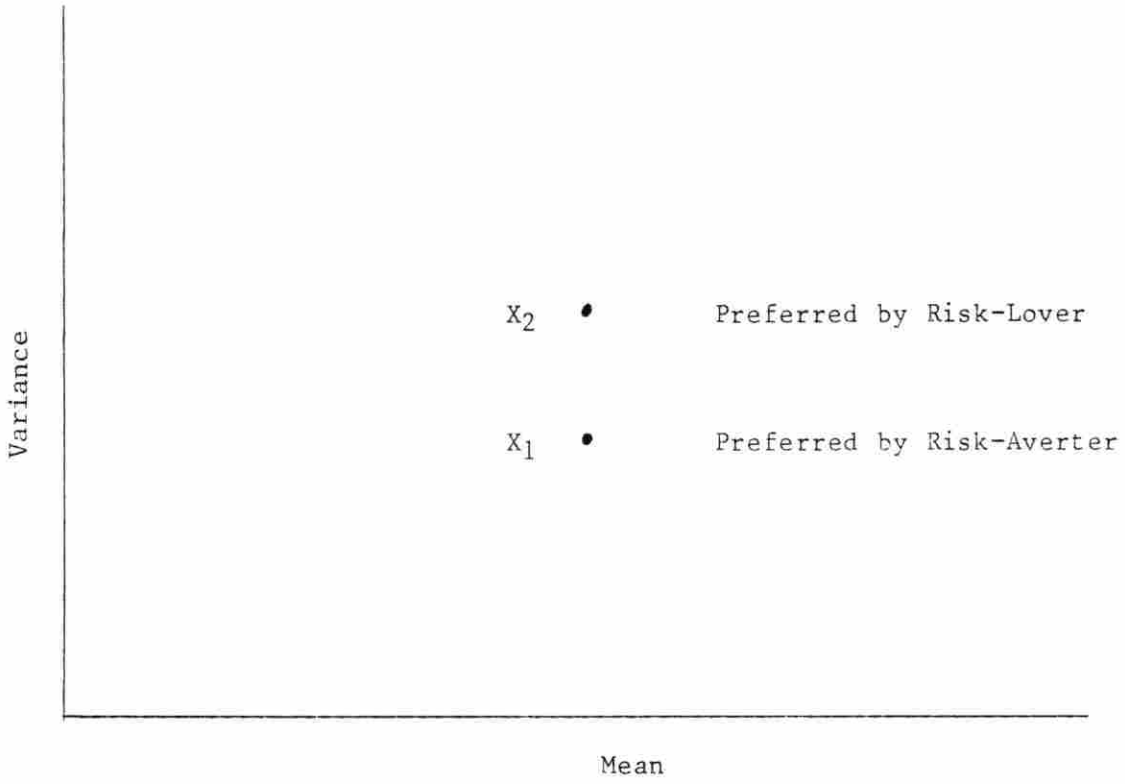

Figure 2. An Illustration of Mean-Variance Combinations of Income Preferred by Risk-Averse Versus Risk-Loving Individuals

function is quadratic where a quadratic function has the following general form:

$$Y = a + b_0X + b_1X^2$$

where Y is the dependent variable,

x is the independent variable,

and b_0, b_1 are coefficients.

Mean-variance analysis is the main analytical tool used to evaluate the performance of the alternative marketing strategies that are studied in this paper. This technique is commonly used despite its restrictive assumptions that are unlikely to be met exactly. However, studies have shown that this approach can still be used to approximate real risk-return characteristics of feedlot operators [34].

In using the mean-variance method, the individual's decision procedure is to maximize the expected return for any given risk (i.e., variance) or, alternatively, to minimize the level of risk for any given expected return. Economists are often satisfied with using the variance of income as a measure of risk, with increasing variance taken to mean increasing risk [6].

CHAPTER IV. METHODOLOGY

Feedlot Simulation

In this study, an Iowa feedlot operation is simulated. It is assumed that the cattle feeder purchases 650 pound feeder steers and feeds them six months until the finished animals reach 1150 pounds. Producing 500 pounds of gain per animal requires 42 bushels of corn, 2.2 tons of silage, and 185 pounds of supplement. The first feeding period analyzed begins in February, 1974 and new feeding periods are analyzed starting every May, August, and November thereafter (i.e. every quarter) until the last period of November, 1984. This results in 44 different feeding period observations. The results of alternative marketing strategies are analyzed using actual prices for these 44 feeding periods.

The 40,000-pound live cattle futures contract on the Chicago Mercantile Exchange is assumed to be the relevant futures contract used for hedging purposes in this analysis. All inputs required for each feeding period are assumed to be unaffected by the method of marketing chosen by the cattle feeder and, hence, are not analyzed in the paper. Feeder steers are valued at the monthly average of daily prices for Interior Iowa for the placement month and fat cattle are assumed to be sold at the monthly average of daily prices for choice steers, 900-1100 pounds, for Interior Iowa for the marketing month.

Other input costs, operating and overhead, and labor are based on estimates made by the economics department of Iowa State University [14].

Once all input costs on a per head basis are known at the beginning of each feeding period, the total cost divided by 11.5 cwt. is used to determine a break-even price which reflects the prices that the cattle feeder would need (per cwt.) on the fat cattle in order to cover all costs.

Marketing Strategies and the Use of Futures Markets

In this study, the simulated cattle feeder operation is assumed to be large enough to use futures markets as a hedging tool or marketing alternative to reduce price risk and/or increase prices received in selling cattle. A futures contract does not enable a cattle feeder to fix the price of cattle absolutely, but it does allow him/her to establish the price within a fairly narrow range which makes it easier to project profits and make financial plans [18].

While hedging using the futures market, cattle feeders try to establish a future delivery price for the slaughter cattle. Futures trading in live cattle contracts began on November 30, 1964 [24].

One-way or traditional hedging of live beef cattle is evaluated in this analysis. The production level is determined before the hedging decision is made. All of the inputs needed for the feeding operation are assumed to be purchased before the cattle are placed on feed.

The farmer attempts to reduce income variability associated with selling finished cattle by using the futures market. The procedure used for placing and lifting the hedge is as follows: When the feeder cattle are placed on feed at the beginning of the placement month, the feeder places a hedge by selling the futures contract that will expire during or after the marketing month (see Table 1). If hedging occurs, the hedge is placed on the first day of the feeding period and is held until the cattle are marketed.

Table 1. Placement Dates, Marketing Dates, and Contract Months in which Hedges are Placed

Placement Date	Marketing Date	Contract Month
February 1	August 1	August
May 1	November 1	December
August 1	February 1	February
November 1	May 1	June

Hedges are assumed to be placed in the relevant contract at the closing price for the placement date, or the first day thereafter for which there is a futures price available if there was no trading on the placement date. The closing price on the marketing date or first date thereafter is also used to calculate prices received when the hedges are lifted.

The producer must deposit an initial margin for each contract sold and the margin will serve as a security deposit. The initial margin is generally about 10 percent of the value of the contract [21]. The

farmer always has to keep a certain amount of money on deposit which is called the maintenance margin. If futures prices fall, profits are made. However, if futures prices rise, some or all of the margin could be lost. When producers gain money, profits will be added to his/her initial margin, but if he/she loses, the money that is lost will be deducted from the initial margin and the maintenance margin level could be reached. If the producer's account balance declines to the maintenance level, the cattle feeder will receive a call from the broker asking him or her to deposit enough additional money to bring the account balance back up to the original level.

In this paper, the hedger is assumed to maintain his or her position in the futures market until the cattle are marketed.

This study examines the performance of the following strategies, which are explained in more detail in the following chapter:

1. Unhedged (or routine cash only)
2. Hedge if $\hat{FP} > CP$
3. Hedge if $\hat{FP} >$ B.E.P.
4. Hedge if $\hat{FP} >$ B.E.P. + \$3.00
5. Hedge if $\hat{FP} >$ B.E.P. + \$4.00
6. Hedge if $\hat{FP} >$ B.E.P. + \$5.00
7. Hedge if $\hat{FP} >$ B.E.P. + \$6.00
8. Hedge if $\hat{FP} >$ B.E.P. $> CP$
9. Hedge if $\hat{FP} > \hat{CP}$

$$\hat{FP} = FS - \hat{B} - HC$$

where, $\hat{FP}$ = the expected "localized" futures price to be received from hedging;

FS = the price at which the futures contract is sold;

$\hat{B}$ = the expected basis = the expected difference between the price at which the cattle will be sold in the cash market and the price at which the contract will be bought back when the hedge is lifted. The expected basis that is used in this study is a 5-year moving average of the basis for the relevant contract.

Basis is typically less variable from year to year than cash prices [18]. Hence, once a cattle feeder places a hedge, he or she is more certain as to the price that will be received from the finished cattle than he or she would be by waiting to sell in the cash market only.

HC = the cost of hedging.

CP = cash price (Interior Iowa) that exists at the time the cattle are placed on feed.

B.E.P. = the breakeven price per cwt.

= (choice 650 pound feeder steer purchase cost based on feeder prices at the time of placement + feed costs based on corn prices at the time of placement + operating costs + overhead) ÷ 11.5.

The operating costs and overhead are based on these costs for the feeding period just ending as reported by the Iowa State University Extension Service [14]. In some years, these reported costs were multiplied by 6/7 because the feeding period assumed was 7 months whereas we assume a feeding period of 6 months.

$\hat{CP}$ = The Iowa State University forecast available at the time of placement as to what the future cash cattle price will be when the cattle are marketed.

The average net returns per cwt. (ANR) for a given strategy are calculated as follows:

$$ANR = \sum_{i=1}^{n} \frac{(P_i - C_i)}{n}$$

where,

i = the ith feeding period, i=1, ..., 44 (except for strategy 9, where n=32)

P_i = the price received per cwt. for cattle marketed at the end of the ith feeding period. P_i = the hedged price if the hedging criterion is met at the time of placement; otherwise, P_i = the cash price of steers at the time of marketing, and

C_i = the cost per cwt. of feeding cattle during the ith feeding period.

n = number of times cattle were placed on feed.

CHAPTER V. RESULTS OF THE STUDY

The results of this study are reported in this chapter in the three following sections: (1) results across all feeding periods, (2) results for selected feeding periods for which there was a future cash price forecast available at the time of placement, and (3) results by feeding period.

Results Across All Feeding Periods

This section reports the results for each of the strategies studied across all feeding periods (see Table 3). Table 3 provides the means and the variances of the net returns per cwt. and the percent of time that hedges would have been placed during 1974-1984 for each strategy.

1. The Unhedged Strategy

With this strategy, feeding is carried on without hedging. It is assumed for this strategy that cattle are sold in the cash market regardless of their profitability. This strategy is usually used as a basis for comparing other strategies. The average net return per cwt. for this strategy was $3.05 per cwt. and the variance was $46.20. The results of this strategy and the rest of the strategies will be explained in the discussion section.

2. Hedge if FP > CP

With this strategy, when the localized future price is greater than or equal to the current cash price of slaughter steers, the cattle are hedged at the same time they are placed on feed by selling the relevant futures contract. The contract is bought back at the end of the feeding period when the cattle are sold for slaughter. When this, or any other, hedging criterion is not met, the cattle are assumed to be fed unhedged and sold in the cash market. The average net return for the period 1974-1984 for this strategy was $3.28/cwt. and the variance was $17.70.

3. Hedge if FP > B.E.P.

This strategy involves hedging the cattle when placed on feed only if the localized futures price for the delivery month is greater than or equal to the estimated break-even price that is calculated at the beginning of the feeding period.

When this hedging criterion is not met, the cattle are assumed to be fed unhedged and sold in the cash market. This strategy has been a rather common recommendation of market analysts on the assumption that it provides insurance against cattle feeding losses (24).

The average net return per cwt. for this strategy was $3.14 per cwt. and the variance was $7.04.

4. Hedge if FP > B.E.P. + $3.00

This strategy is the same as the third strategy except that the selective hedging criterion in this case is more stringent. It

requires the producer to expect at least a $3.00 per cwt. profit margin from hedging before doing so. This strategy resulted in an average net return of $3.60 per cwt. and a variance of $22.82.

5. Hedge if FP > B.E.P. + $4.00

This strategy is a slight modification of the fourth strategy in that the required profit margin is $4.00 per cwt. instead of $3.00 per cwt. This strategy resulted in a mean profit of $3.50 per cwt. with a variance of $26.66.

6. Hedge if FP > B.E.P. + $5.00

This strategy is a further modification of the fourth strategy, increasing the profit margin required to hedge to $5.00 per cwt. The average net return for this strategy was $4.09 per cwt. with a variance of $35.65.

7. Hedge if FP > B.E.P. + $6.00

This strategy is an even further modification of the fourth strategy, increasing the profit margin required for hedging to $6.00 per cwt. The results of this strategy showed a net average return of $4.09 per cwt. and a variance of $40.25.

8. Hedge if FP > B.E.P. > CP

With this strategy, cattle are hedged when they are placed on feed only if the localized futures price is greater than or equal to the break-even price which, in turn, is greater than or equal to the cur-

rent cash price. Lots which are placed when these conditions do not hold are fed unhedged and sold in the cash market. This strategy is included in this study because previous studies have shown that it has provided a relatively high profit when compared to other strategies. This strategy produced a net average profit of $3.37 per cwt. with a variance of $17.04.

In evaluating or comparing the strategies, we can assume that a risk-averse cattle feeder will prefer one strategy over another if it has at least as great of expected return without any greater risk. Otherwise, it is important to realize that the cattle feeder's preferred strategy will depend upon his/her utility function and degree of risk aversion. The mean and variance for the various strategies studied in this paper are summarized in Tables 3, 4, and 5 and Figures 3 and 4.

The unhedged or cash strategy provides a base strategy that can be used for a comparison of the alternatives. The mean profit of the unhedged strategy was $3.05 per cwt., which was the lowest for all of the strategies and, at the same time, the variance for this strategy was the highest at $46.20. Hence, all of the other strategies should be preferred to this one. Strategy two produced an average profit of $.23 per cwt. higher than the unhedged average profit and the risk was also reduced by $28.50. This strategy would have resulted in cattle being hedged 59 percent of the time. Strategy three resulted in higher average profit of $.12 per cwt. compared to the unhedged strategy and

Table 3. Mean, variance, and range of net returns per cwt. for selected hedging strategies and percent of time hedges placed, 1974-1984[a]

Strategy	Mean	Variance	Range	Percent
	($/cwt.)	($/cwt.)	($/cwt.)	(%)
1. Cash	3.05	46.20	-7.97 to 23.38	0
2. FP > CP	3.28	17.70	-7.97 to 15.85	59
3. FP > B.E.P.	3.17	7.04	-4.11 to 8.87	89
4. FP > B.E.P. + $3.00	3.60	22.82	-4.99 to 15.85	39
5. FP > B.E.P. + $4.00	3.50	26.66	-4.99 to 15.85	30
6. FP > B.E.P. + $5.00	4.09	35.65	-4.99 to 23.38	23
7. FP > B.E.P. + $6.00	4.09	40.25	-5.5 to 23.33	14
8. FP > B.E.P. > CP	3.37	17.04	-7.97 to 15.85	57

[a]Based on 44 quarterly placements from 1974-1984.

the risk was lower as it had a variance of $7.04. This was the lowest variance for any strategy evaluated in this study although this strategy had the lowest mean return of any of the hedging strategies. Using this strategy, 89 percent of the placements would have been hedged. Strategy eight produced an eleven-year average profit of $3.37 per cwt. which was $.32 per cwt. more than the unhedged strategy. This strategy's variance was $17.04 which is considered low comparing it with the variance of the unhedged strategy. The percent of lots hedged with this strategy would have been 57 percent. Strategies 4, 5, 6 and 7 provided average profits of $3.60, $3.50, $4.09, and $4.09 per cwt., respectivley during 1974-1984. Strategies 6 and 7 resulted in the highest means of profit compared with the other alternatives, but the risk also generally was higher for these strategies. Strategies 4-7 had variances of $22.82, $26.66, $35.65, and $40.25, respectively. In comparing alternatives 6 and 7 for Iowa cattle feeders assuming they are risk averse, strategy six would be preferred to strategy seven because strategy six has a lower variance with the same mean return. For strategies 4-7 the percent of lots hedged were 39, 30, 23, and 14, respectively, which is expected because the more expected profit the cattle feeder requires before hedging, the less frequently hedges are placed. Requiring a greater profit margin before hedging also increases the variability of prices received by the farmers.

Table 3 also reports the range of result for each strategy. This shows that, even though the average return for each strategy was posi-

Table 4. Mean, variance, and range of net returns per cwt. for selected hedging strategies, selected placement periods and percent of time hedges placed, 1974-1984[a]

Strategy	Mean	Variance	Range	Percent
	($/cwt.)	($/cwt.)	($/cwt.)	($/cwt.)
1. Cash	3.92	44.14	-7.97 to 23.38	0
2. FP > CP	3.76	19.06	-7.97 to 15.85	50
3. FP > B.E.P.	3.28	7.42	-4.11 to 8.87	88
4. FP > B.E.P. + $3.00	4.08	21.36	-4.55 to 15.85	34
5. FP > B.E.P. + $4.00	3.81	22.98	-4.55 to 15.85	28
6. FP > B.E.P. + $5.00	4.49	35.17	-4.55 to 23.38	22
7. FP > B.E.P. + $6.00	4.79	38.25	-4.55 to 23.38	13
8. FP > B.E.P. > CP	3.76	19.06	-7.96 to 15.85	50
9. FP > CP	3.81	24.68	-7.97 to 15.85	25

[a]Based on 32 quarterly placements from 1974-1984.

tive, a feeder would have lost money with every strategy during at least some of the feeding periods.

Results Across Selected Feeding Periods

Table 4 provides the means and variances of the net returns per cwt. and the percent of time that hedges would have been placed for each strategy during 32 feeding periods from 1974-1984. The number of feeding periods studied here is 32, rather than 44 periods because the strategies were compared only for the periods when a marketing-date cash price forecast was available at placement during the period 1974-1984. For this analysis, another strategy (9), hedge if FP > CP, is evaluated. This strategy involves hedging the cattle when placed on feed only if the localized futures price for the delivery month is greater than or equal to the forecasted future cash cattle price for the marketing month. When this hedging criterion is not met, the cattle are assumed to be fed unhedged and sold in the cash market. As Table 4 shows the cash strategy still provided the highest variance of $44.14 but its mean net return was not the lowest. Strategy 9 reduced the risk to almost half of that provided by the unhedged strategy. Also, strategy 9 provided an average net return of $3.81 per cwt., which was close to the average provided by the unhedged strategy which was greater than the averages provided by strategies 2 and 3. The percent of lots hedged by strategy 9 would have been 25 percent. Table 4 shows that strategies 2, 3 and 8 provided means of $3.76 per cwt.,

$3.28 per cwt. and $3.76 per cwt., respectively which were lower than the mean provided by the unhedged strategy. The variances associated with these strategies were $19.06, $7.42 and $19.06 respectively, which reduced the risk relative to that for the unhedged strategy. The means provided by strategies 4, 6, and 7, were $4.08, $4.49, and $4.79, respectively, which were higher than the mean for the unhedged strategy. Moreover, the variances for these strategies were lower than that for the unhedged strategy. Again, it should be noticed that the risk (variance) increases as the required profit margin increases. Strategy 5 provided a mean of $3.81 per cwt. which was slightly lower than that for the unhedged strategy, but it reduced the variance by about half.

Results by Feeding Period

Table 5 shows the average profit for all the strategies by feeding period, during 1974-1984. The average of the profits for the unhedged strategy was the highest during the feeding period November to May. For the second strategy, feeding during the November-May period also provided the highest mean, but a lower variance when compared to the unhedged strategy. For the third strategy, feeding during November-May provided a high mean compared with other feeding periods and it provided the highest variability or variance. For strategy eight, feeding cattle during November-May provided a mean of $5.91, which is higher than the mean for the other feeding periods, while feeding the cattle

during May-November provided the highest variance compared with the other three feeding periods. For strategies 4-7, the highest means occurred during the feeding period November-May. The means were $6.43 per cwt., $5.95 per cwt., $8.29 per cwt., and $9.14 per cwt., respectively. The variances for these four strategies were high during November-May of $19.74, $28.03, $49.57, and $51.47, respectively. According to Table 5, it can be concluded that the more often the hedging criteria are met, the less variable profits are. This can be achieved through careful usage of the futures market in selective hedging.

According to Table 5, the highest mean of profits for all of the strategies occurred during the feeding period of November-May, but the variance fluctuated between high and low compared with the rest of the feeding periods. Table 5 shows that the variability of profits increased during November-May as the expected or required profit increased. Also, it can be seen that the strategy which worked best for a specific feeding period did not always work the best for the other feeding periods. For the feeding periods Aug-Feb. and May-Nov., strategies 2-8 would resulted in a better mean and variance than that provided by the unhedged strategy, while for the feeding period Nov-May the unhedged strategy had a higher mean than that provided by strategies 2, 3, 4, 5 and 8 although the variance for strategy 1 was still higher than that for the other strategies. Comparing all of the strategies during the feeding period Feb.-Aug., the unhedged strategy

Table 5. Mean and variance of net returns per cwt. and percent of time hedges placed by feeding period, 1974-1984

Strategy	Feeding Period											
	Aug. - Feb.			Nov. - May			Feb. - Aug.			May - Nov.		
	Mean ($/cwt.)	Var. ($/cwt.)	Percent (%)	Mean ($/cwt.)	Var. ($/cwt.)	Percent (%)	Mean ($/cwt.)	Var. ($/cwt.)	Percent (%)	Mean ($/cwt.)	Var. ($/cwt.)	Percent (%)
1. CP	1.11	38.76	0	7.89	66.24	0	3.06	34.84	0	.11	19.36	0
2. $\hat{FP}$ > CP	2.24	22.26	82	5.91	16.92	27	3.68	4.49	82	1.30	19.17	82
3. $\hat{FP}$ > B.E.P.	3.64	6.35	91	4.35	12.72	82	3.41	8.02	82	1.24	8.30	100
4. $\hat{FP}$ > B.E.P. + $3.00	3.32	12.12	27	6.43	19.74	18	4.01	30.53	45	.59	16.75	91
5. $\hat{FP}$ > B.E.P. + $4.00	3.99	18.40	36	5.95	28.03	0	3.47	35.31	36	.60	16.80	82
6. $\hat{FP}$ > B.E.P. + $5.00	3.99	18.40	27	8.29	49.57	0	3.47	35.31	27	.60	16.80	36
7. $\hat{FP}$ > B.E.P. + $6.00	3.16	26.63	9	9.14	51.47	9	3.47	35.33	18	.60	16.80	9
8. $\hat{FP}$ > B.E.P. > CP	2.58	20.11	18	5.91	16.92	45	3.68	4.49	36	1.30	19.17	82

had a lower variance (less risk) than did strategies 5, 6 and 7 but its mean was the lowest of all the strategies.

Figure 3 shows graphically that the choice of the best strategy depends upon the farmer's utility function and his/her risk attitude. Comparing strategies 6 and 7, the cattle feeder who is risk averse, as it is assumed, will prefer strategy 6 to 7 because they provide the same mean of $4.09/cwt. but strategy 7 had a higher variance (risk). Comparing strategies 4 and 5, the risk averse farmer would have preferred strategy 4 rather than 5 for similar reasons.

Figure 4 shows that strategy 5 and 9 provides the same mean of $3.81/cwt., which is very close for that provided by strategy 1, but strategy 5 and 9 accomplished a lower variance compared with that provided by strategy 1. Hence, the risk averse individual would have preferred strategies 5 and 9 to strategy 1. Also, the risk averse cattle feeder would have preferred strategy 5 to strategy 9 because 9 provided a higher variance relative to the variance provided by 5, even though they accomplished the same mean of the net return.

CHAPTER VI. CONCLUSION

In recent years, the cattle feeder has been confronted with increasing price risks. This study has evaluated several alternative marketing strategies which could be used by an Iowa cattle feeder to reduce the risk and/or to increase the expected net returns.

The performance of several placement hedging strategies was tested by using mean-variance analysis. The results indicate that price risks can be reduced and profits increased compared to a cash marketing strategy through the use of selective placement hedging strategies.

The average profit on unhedged operations for the eleven years studied, 1974-1984, was $3.05 per cwt. which represented the lowest mean compared with the other strategies and the unhedged strategy also had the highest variance of $46.20. Strategies 6 and 7 provided the highest mean of $4.09 per cwt. among the other strategies. The highest variance for strategies (except the unhedged strategy) was provided by strategy 7. Strategies 4-7 showed increasing mean profits, respectively, but increasing variability of profits as well. This study also revealed that the greater the level of profit required before hedging, the less frequently hedges will be placed and also the more variable profits are. As Table 4 shows, strategy 9 produced a better mean net return than that provided by strategies 2 and 3 and the same mean return as for strategy 5, but it provided a higher variance. Also, strategy 9 had a lower variance than did strategies 1, 6 and 7.

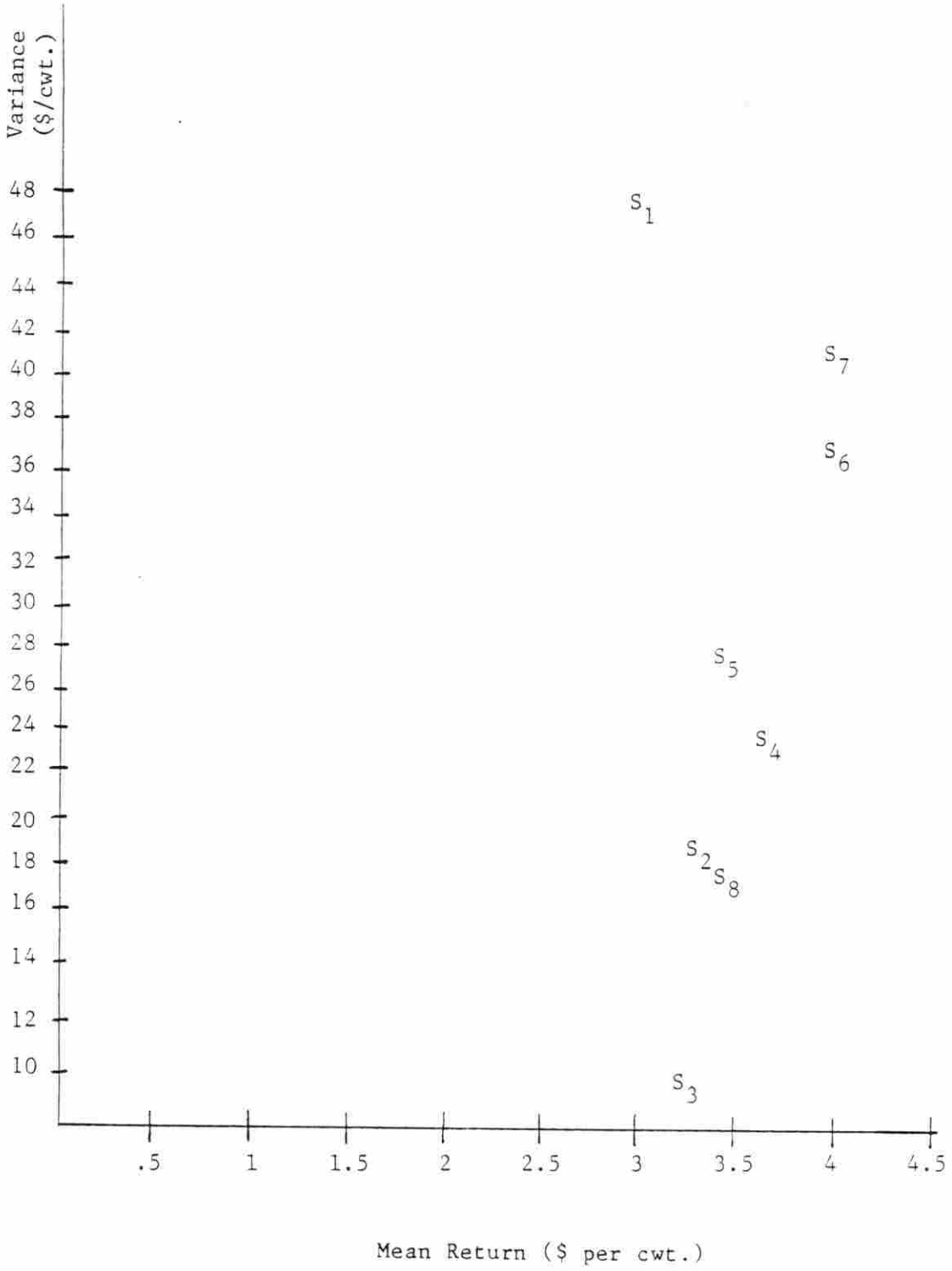

Figure 3. Relationship between mean and variance in net returns for selected marketing strategies, 1974-1984.

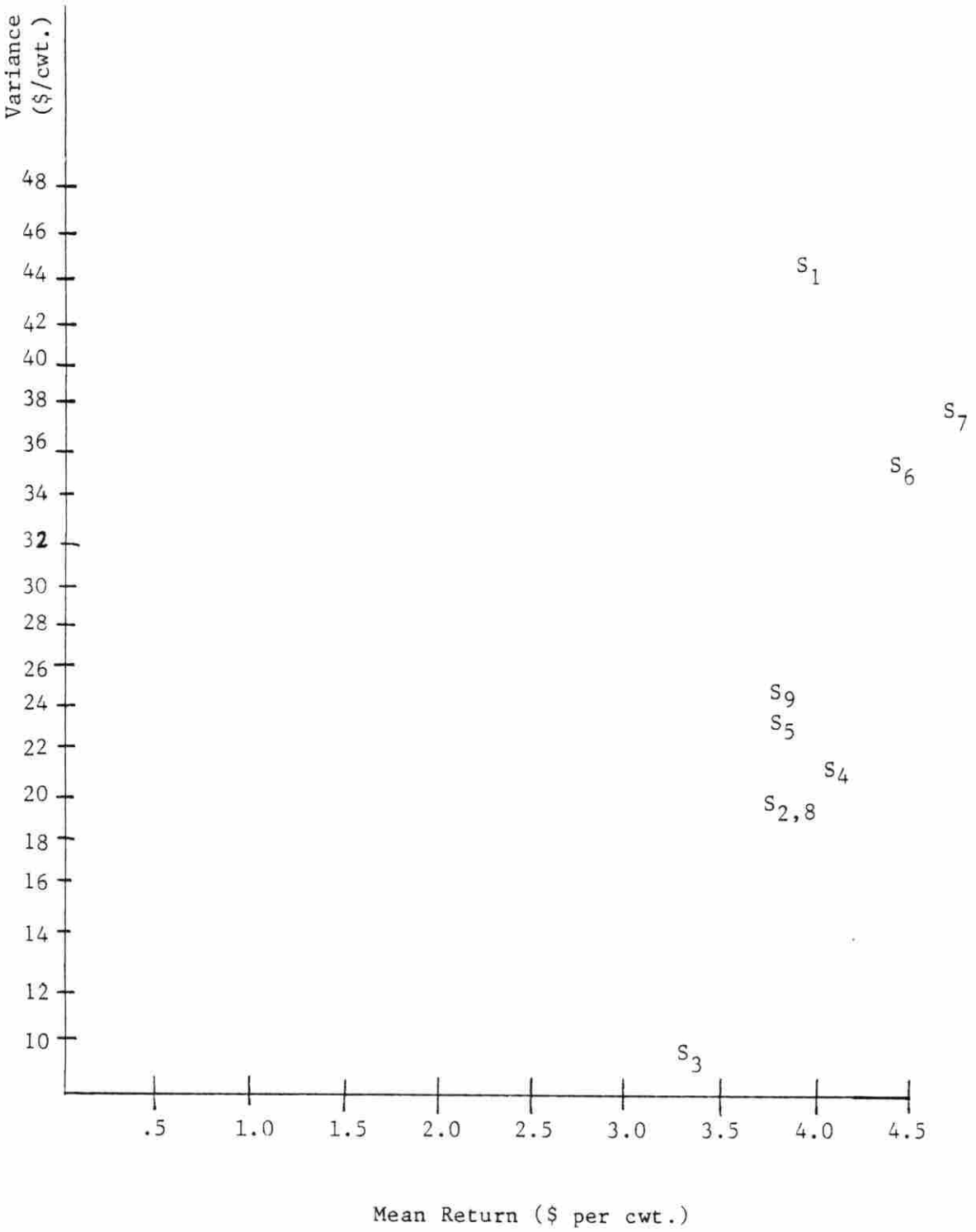

Figure 4. Relationship between mean and variance in net returns by strategy for selected feeding periods, 1974-1984

Feeding cattle during Nov.-May for the study periods 1974-1984 generally would have resulted in the highest mean, compared with the other feeding periods. Also this study showed that the strategy that worked best for one feeding period did not necessarily work the best for the other feeding periods which complicates the effective marketing of cattle by an Iowa cattle feeder.

This study indicates that futures markets can be used as a tool to reduce cattle feeder price risk. The study does not totally support the conclusion of Menzie and Archer [25] that feeding and hedging only when projected returns exceed estimated costs of feeding involves almost no risk at all. This study showed that some risk still exists even if an estimated break-even strategy is used. The results are more consistent with Gorman and Southward (9) who showed that some risk remained even when a break-even strategy was used.

A suggestion for future research is to test the strategies studied in this paper, while allowing hedges to be placed before or after the first day of placement to determine if expanding the hedging period would improve upon the results reported in this paper.

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