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Analysis of alternative marketing strategies for slaughter hog producers in Tennessee

John R. Adams

To the Graduate Council:

I am submitting herewith a thesis written by John R. Adams entitled "Analysis of alternative marketing strategies for slaughter hog producers in Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Dan L. McLemore, Major Professor

We have read this thesis and recommend its acceptance:

Emmit L. Rawls, Charles Sappington

Accepted for the Council:

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Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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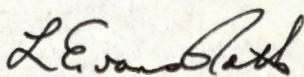
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and recommend its acceptance:

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Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

ANALYSIS OF ALTERNATIVE MARKETING STRATEGIES FOR SLAUGHTER

HOG PRODUCERS IN TENNESSEE

A Thesis

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Degree

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ABSTRACT

Avoiding risk associated with adverse cash price movements and
improving overall profit level are assumed objectives for the market
hog producer. This research evaluated various marketing strategies
for finish and farrow-to-finish hog operations to determine their
impact on price risk and profit levels. These strategies were simu-
lated with the use of models to represent the Tennessee finish and
farrow-to-finish hog producer's operations during the 1972-79 period.
The strategies simulated included variations on cash contracting,
futures market hedging, and the typical cash sale. Simulations were
also used to evaluate the effectiveness of using production criteria
in conjunction with selected marketing strategies as a method of
avoiding production during unprofitable periods. The mean and variance
of profitability were used as criteria for comparing the effectiveness
of the strategies simulated.

The primary results of the simulations showed that selective hedg-
ing and selective cash contracting strategies could give larger mean
and lower variance of profitability than the full-cash, full-hedge, or
full-contract strategies. This would indicate that a producer using
the full-cash strategy could increase profits and reduce price risk by
switching to one of the more selective hedging or cash contracting
strategies, assuming similar production and market conditions to those
of the simulation period. Analysis for hogs marketed before 1976
and after 1975 separately, showed no substantial changes in the ranking
of the marketing strategies between the two periods. The use of cash
and futures market price signals as criteria for production did not
have a positive impact on mean profit for the hog finishing operation.

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CHAPTER I

INTRODUCTION

The pork industry comprises a major part of Tennessee's agri-
cultural system. In 1978 a total of 1,821,000 hogs and pigs were
marketed in the state, these accounted for 10.2 percent of the total
cash receipts of all farm commodities (18, 1979, pp. 5 and 49). The
percentage of total receipts varied from 6.7 percent to 10.6 percent
over the years from 1968 to 1978 and most of the percentages were
greater than 8 percent (18). This seems to indicate a certain degree
of stability in the swine industry's share of the total agricultural
system.

Hog production in Tennessee is largest in the western and middle
parts of the state. The greatest concentration of all hogs and pigs
occurred in Weakley, Obion, Gibson and Henderson counties in West
Tennessee according to 1978 data (18, 1979, pp. 56-57). These four
counties accounted for nearly 22 percent of all hogs and pigs in
Tennessee.

Tennessee ranked thirteenth among all states for quantity of
hogs produced (live weight) in 1978 (19, 1979, p. 319). This is a
rather high ranking, but Tennessee accounted for only 2 percent of
total production. Iowa, Illinois, Indiana, Minnesota, Missouri and
Nebraska are the major hog producers, with Indiana alone accounting
for 25 percent of 1978's total U.S. production.

The number of hogs fluctuates a great deal over time due to the
pattern of the hog cycle. This cycle is very prominent in Tennessee's

production as past data indicate. In 1965 the December 1 inventory of hogs was 931,000 (18, 1972, p. 47). This quantity increased to 1,395,000 by 1970 and then fell to 880,000 by 1974 (18, 1979, p. 49). Since 1974 the December 1 inventory has been increasing and was up to 1,300,000 in 1978.

The structure of Tennessee's hog producing system consists of many farms with small inventories of hogs and pigs and few farms with relatively large inventories. In 1974 there were 13,267 farms which had inventories of hogs and pigs, each of these farms had to have commodity sales of at least $2,500 to make the survey (20, p. 122). Of these farms 11,760 or 88.6 percent had less than 100 hogs and pigs, and accounted for only 40 percent of the total inventory. The majority of the animals were on the 1,507 farms which had inventories of 100 or more hogs and pigs. Even though the majority of the farms did not have a large number of livestock, there were 48 farms which had 1,000 or more head.

I. The Problem and Justification

One of the major problems faced by hog farmers is the risk associated with adverse price changes during the production process. A farmer who is not using any type of marketing tool, such as hedging or cash contracting, has no protection from downward movements in price. For many farmers with tight financial conditions, one sharp depression in the cash market could cause great hardships and might threaten the survival of their farm businesses.

The cash market for hogs in Tennessee shows many fluctuations that are difficult to predict. These price changes can be attributed to the hog cycle and to seasonal changes in hog marketings, as well as other economic factors such as changes in foreign trade, shifts in demand, and the general state of the economy. These changes in price can sometimes be rather drastic. For instance, the price for market hogs fell from $58.70 per cwt. on August 10, 1973 to $40.15 on December 10, 1973 (3). Of course, the market also shows rapid upward movements. Prices rose from $47.85 on May 22, 1975 to $63.25 on September 22, 1975.

The problem of adverse price fluctuations can be very detrimental to the farmer. Many farmers, if not most, operate with a large percentage of debt capital and often have to borrow money to meet their operating capital needs. It is of utmost importance to both the farmer and in many cases his banker to have some type of protection from price changes that could cause major losses to the farmer and could possibly cause him to lose his enterprise.

The use of the futures market for hedging or cash contracting has been suggested as a tool for risk reduction (4, 5, 8, 10, 12). By cash contracting the farmer can guarantee a price for his livestock when delivery is still several months away. This allows the farmer to avoid having to accept the price offered at the time he takes his livestock to market. Of course, the farmer can always wait and sell on the cash market if it seems to be the most profitable marketing method. However, the option to cash contract may help the farmer to reduce some of his risk as well as increase profit levels.

The process of hedging consists of substituting basis risk for price risk through the selling and buying of futures contracts on the commodity exchange. If the basis varies to a lesser degree than the cash price, then there should be less risk associated with hedging as compared to strictly selling on the cash market. Past research has shown hedging to be a profitable and successful marketing tool (4, 10, 12), and further research in hedging and cash contracting using Tennessee cash data and budgets seems to be needed.

II. Growth and Activity on the Live Hog Futures Market

The futures market for live hogs on the Chicago Mercantile Exchange was activated in February, 1966, and it has shown rapid growth in volume of trading since its' initiation (2, p. 137). In 1966 there were 8,063 transactions in live hog futures. This volume varies from year to year, but has remained above the 1 million level since 1973.

The contract months for the live hog futures market are February, April, June, July, August, October and December. Trading usually begins about a year before the contract is scheduled to expire. Each contract is for 30,000 pounds. This averages approximately 130 head weighing about 230 pounds each. The contract provides specifications on the grade and weight of the hogs, and penalties are assessed for hogs not meeting these specifications. The commodity exchange has many rules that must be followed for delivery on an open contract, but it is very rare for a farmer to actually deliver on a contract.

Trading activity by farmers in the futures market has been limited in the past. During the period 1972-1976 only 5.3 percent of Southeastern farmers with annual gross commodity sales greater than $10,000 traded on the futures market (6, p. 26). Only 7 percent of livestock farmers traded futures contracts during that time period.

Forward contracts have also not been widely used. Less than 1 percent of Southeastern farmers signed forward contracts to sell livestock in 1976, but 62.8 percent of these farmers had the price for their forward contracts based on futures market prices (6, pp. 34 and 37). These data do not directly show the volume of trades by farmers on the live hog futures market, but it does indicate, in general, the low percentage of farmers who have actively participated in the futures market in the past.

The most significant reason for low futures activity by farmers was lack of familiarity (6, p. 40). Almost 42 percent of the Southeastern farmers cited this as their reason for not trading futures contracts. This was also the most significant reason listed by other groups of farmers. However, with a growing body of research showing higher profits and lower risk attainable by using the futures market for hedging and cash contracting, there should be increased interest in the use and operation of the futures market, especially among the larger farms.

III. Review of Literature

Commodity futures markets have been in operation for over a century and a great deal of literature has been developed concerning

the operations and usefulness of futures trading to the farmer.
Hieronymus (8) and Gold (5) discussed the history and development of
the futures market and its use by both speculators and hedgers. Each
of these authors described the intracies involved in futures trading
and things the hedger and speculator should be aware of before making
the first trade on the commodity exchange.

Commodity exchanges offer futures contracts in many different
commodities. Studies have been made of the speculative and hedging
uses of many of these commodity contracts. For example, Leuthold
(10) and Franzmann and Lehenbauer (4) simulated various hedging
strategies using the feeder cattle futures contract, and found that
many of the hedging strategies could give higher means and lower
variance of profit than attainable by selling on the cash market
alone.

The use of the futures market specifically for hedging live hogs
was discussed by Hicks (7) and Ikerd (9). The specifications of the
live hog futures contract were mentioned as well as the concepts
underlying hedging and the "ideal" hedge. These authors analyzed
the advantages and disadvantages of hedging and why some farmers,
who cannot afford extensive price risk, might improve their position
by hedging on the futures market. This type of information is very
helpful for farmers who are not knowledgeable about the futures
market and who are considering whether they should hedge their com-
modity on the futures market.

The risk associated with hedging is basis risk. The futures
price at the time the hedge was placed less the basis at the time

the hedge is closed will be the price that the farmer receives for his hogs. If he can accurately predict the basis, then the sale price is determined at the time the futures contract is sold. However, the basis is usually difficult to predict, and this may cause a sizeable amount of risk to be associated with hedging.

Research by Bobst (1) in 1971 compared the variance of hedging revenues for slaughter hogs on selected Southern markets with the hedging revenue on a Midwest market. The purpose of this comparison was to test the effect of basis variability upon revenues in regions with and without delivery-point markets. It was hypothesized that the absence of delivery-point markets in the South could cause greater basis variability which could reduce the mean hedging returns. However, Bobst's results showed no significant difference between the variance of returns in the South and in the Midwest markets. According to these results, hedging could have been of equal effectiveness in the two regions.

An accurate prediction of the basis is important for the farmer considering hedging, even though this information is often difficult to obtain. An analysis of the Tennessee basis using Tennessee auction market cash data, as well as other Tennessee cash markets, was performed by McLemore (13) and McLemore and Adams (14) for the period January, 1970 through March, 1979. Each month was divided into three ten-day periods and a basis mean and standard deviation was calculated for each ten-day period. The results of these studies showed that there was no observable trend pattern in the basis over this time period, but there did appear to be a definite seasonal

variation. This variation was attributed to seasonal cash movements and to the proximity to the delivery month. The farmer should be aware of these seasonal variations when trying to predict the basis.

Sappington (17) studied the profitability of finishing feeder pigs using Tennessee budgets with and without the use of the futures market. The uses of the futures market were limited to two types. The first use was as a guide in the production decision. Accordingly, feeder pigs were bought if the futures showed a profit of at least $1 per head. The other use made of the futures market was in estimating returns and placing a hedge if expected returns were at least $4 per head. The results showed that the use of the futures market in making production decisions would increase mean returns and reduce labor requirements, as compared to no use of the futures market, by eliminating production in months that did not show positive returns of at least $1 per head. The hedging simulations showed that annual net returns per head were much lower with hedging than those achieved when futures were used only as a guide in production. It was also concluded that the futures market did a relatively poor job of predicting the cash price five or six months into the future.

The efficiency of the hog futures market in predicting cash prices was analyzed by Leuthold and Hartmann (11) through the use of an econometric model. The model was set up to predict a price reflecting all publicly available information. This estimate was then compared with the live hog futures market's estimate of price. This comparison showed that the hog futures market did not reflect all of the publicly available information. These results indicate a

need for further research in the areas of futures market efficiency and methods of increasing efficiency.

The use of various hedging strategies was analyzed by Leuthold and Peterson (12) using Illinois budgets and cash data. The strategies were simulated for producers purchasing 50 pound feeder pigs once a month and feeding them for four months to a market weight of about 230 pounds. Some of the strategies simulated were full cash, full hedge, and selective hedging triggered when breakeven was less than futures, and when cash was less than futures. Also simulated were strategies which would trigger hedging when hogs would be sold during heavy marketing months, light marketing months, delivery months, and nondelivery months. These strategies were simulated with and without margin liquidation rules. Two different liquidation rules were used. One rule called for the liquidation of the hedge after one margin call, while the second rule called for liquidation of the hedge after two margin calls. Mean-variance analysis was used to compare the efficiency of the hedging strategies, and full cash was used as a benchmark for comparison. The results showed that only one of the strategies without any liquidation rules had a higher mean and lower variance of profitability than full cash, whereas all but one of the strategies with liquidation rules had higher means and lower variances than full cash. These results seem to indicate a need for further research in margin liquidation rules using other strategies and other state's budgets and cash markets.

There has been very little research performed simulating the use of different marketing strategies, including the use of the futures

market, with Tennessee budgets and cash data. However, based upon the results of some of the studies which simulated different marketing strategies using other state's data, the use of some of these strategies may give desirable results that would improve Tennessee swine producer's marketing procedures.

IV. Objectives

The objectives of this study were:

(1) To simulate hog finishing operations and farrow-to-finish hog operations using historical data and various marketing strategies including cash contracting, hedging, and the typical cash sale.

(2) To determine the optimal marketing strategies using the mean and variance of profitability as criteria for comparison.[1]

(3) To test the accuracy of the futures market as a guide to finish hog producers in making the decision to produce or not.

The alternative marketing strategies studied in this research were limited to pricing alternatives rather than including other types of marketing decisions. This limitation was based upon the judgment that the decision of how or when to price the produce is probably the most important marketing decision.

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[1]Profitability as used throughout the text refers to returns above variable costs.

CHAPTER II

METHODOLOGY

Simulation procedures were used to analyze the effectiveness of
the different marketing methods. Simulation is an operations research
technique used in analyzing a real system as it actually occurs. A
model is constructed to represent the real system, and modifications
can be made to test the effects of changes in the exogenous variables.

Models were developed to simulate finish and farrow-to-finish
hog operations in Tennessee.[2] These models were set up to represent,
as accurately as possible, a Tennessee producer's operation. Even
though the simulated models may not exactly correspond with a producer's
actual operation, they still provide an adequate method of testing
marketing strategies, because the different strategies were simulated
under the same set of operating conditions.

Variable factors included within the models were cash and futures
prices, basis estimates, production costs and marketing methods. Cash
prices were used to determine the selling price in order to calculate
profit for groups of hogs hedged on the futures market or cash con-
tracted with a packing plant. The cash and futures prices were also
used with some of the strategies as part of the criteria for making
the production decision and for determining whether to hedge.

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[2]The finish hog operation referred to a producer who buys feeder
pigs and feeds them to slaughter weight before selling. The farrow-
to-finish operation referred to a producer who owned his own sows to
farrow pigs which were fed to slaughter weight before selling.

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Basis estimates were used in the models for those strategies which included localized futures as part of the criteria for hedging or making the production decision. These estimates were necessary to convert the futures price to the local market in order to obtain a localized futures price. If the basis is accurately predicted the producer can determine the selling price for his hogs before the marketing date by hedging his livestock on the futures market. Therefore, an accurate estimate of the basis is very important to the farmer who uses a localized futures price as part of his hedging criteria.

Budgets were developed to estimate a producer's cost of production. These budgets only included the variable costs of production, and the production costs per cwt. were designated as breakeven prices. These prices were needed in the calculation of profitability and were also used as part of the criteria for some of the hedging, cash contracting, and production decision strategies.

Various marketing strategies were simulated with the models in an attempt to identify the otpimal strategies. The mean and variance of profitability were used as the criteria for comparison, and strategies resulting in a large mean with low variance were considered more desirable. Some of the simulated strategies were attempts to achieve either risk avoidance or larger profitability, whereas others were constructed to give both high means and relatively low variance. The choice of the right type of strategy for a producer would depend upon his own preferences.

I. Development of the Price Data Base

Live hog futures price data and Tennessee auctions cash price
data constituted the major portion of data collected for the simu-
lations. These data were collected for the period beginning in
January 1970 and extending through March 1979. The live hog futures
data were collected from yearbooks published by the Chicago Mercantile
Exchange (2). The Federal-State Market News Service published the
prices used as the source of the Tennessee auctions cash data (3).

The closing live hog futures prices were used as the closest
approximation of the price for each day's futures trading. The live
hog futures prices were listed per cwt. and applied to U.S.D.A. grades
No. 1-4. Discounts were applied to delivery units containing more
than 90 head of U.S.D.A. grade No. 3 hogs or up to 8 head of U.S.D.A.
grade No. 4 hogs (2). Delivery units with more than 8 No. 4 hogs
were nondeliverable. Hogs must have weighed between 190 and 240
pounds and at least 90 hogs in a delivery unit must have weighed
between 200 and 230 pounds.

The Tennessee auctions cash data were an average of the prices
at selected markets throughout Tennessee. These markets were located
in West, Middle and East Tennessee and thus gave a reasonably accurate
representation of the Tennessee slaughter hog cash price. The markets
included in the Tennessee auctions cash data varied over the simulation
time period but remained a reasonable cross section of Tennessee
markets. The Tennessee auctions prices were on a per cwt. basis and

the prices used were for U.S.D.A. grades No. 1-3 hogs weighing between 190 and 240 pounds (3).[3]

II. Development of the Finish Producer's Budgets

The budgets for the finish hog producer's simulations were computed using the variable costs listed in the Tennessee Farm Planning Manual (16). Only the variable costs were computed for the budgets, and fixed costs and management were assumed to receive the residual of returns above variable costs.

The variable costs included in the budgets were: feeder pig prices, corn prices, supplement prices, veterinary and medicine costs, interest costs, truck costs, grind and mix costs, and labor costs. These costs were computed and divided by 2.3 to give a breakeven price per cwt., assuming a 230 pound market hog.

The costs used for veterinary and medicine, grind and mix, and truck were obtained from the 1969, 1973, 1975, and 1978 Tennessee Farm Planning Manuals. Straight line interpolation was used to yield estimates of costs for the years between these Manual publications.

The prices used in calculating feeder pig costs were obtained from Tennessee Agricultural Statistics bulletins (18). All weights and grades are included under these prices, but weights averaged 45-50 pounds. A weight of 45 pounds was assumed for all feeder pigs, with a 3 percent death loss. Simple interpolation was used to derive

[3]The grade and weight ranges used for Tennessee auctions cash prices varied slightly at times but were always close to U.S.D.A. grades No. 1-3, 190 to 240 pounds.

estimates of the missing prices for the 2 months in 1972 where there were few pigs sold due to cholera.

Corn prices used were average prices per bushel received by the farmer and were obtained from Tennessee Agricultural Statistics. A usage rate of 10-6 bushels per hog was used for all production periods. This rate was obtained from the 1975 Tennessee Farm Planning Manual. Usage rates of 1.48 cwt. of supplement and 1.1 hours of labor per hog were also obtained from the Manual. Supplement prices came from yearly publications of Tennessee Agricultural Statistics. Labor costs of $2 per hour in 1970 and $3 per hour in 1978 were estimated and interpolation was used to obtain estimates of labor costs between 1970 and 1978. The $3 per hour wage was also used for the 2 months in 1979.

Interest costs were calculated for the operating capital invested in the market hog enterprise. The interest rates were obtained from U.S. Agricultural Statistics publications (19) and were divided by 3 to take into account the 4 month production period. Interest charges were computed for half of the corn, supplement, veterinary and medicine, grind and mix, truck and labor costs because they were spread out over the entire production period. The cost of buying feeder pigs occurred at the beginning of the production period and required an interest cost for the entire four months. After the interest costs were added to total costs, the total costs were divided by 2.3, assuming a 230 pound market hog, to yield a per cwt. breakeven price.

A breakeven price was computed for each month from January 1970 through February 1979 (Appendix A). Each production operation

simulated used the breakeven price for the month at the beginning of the production period. This assumes that costs not occuring at the beginning of the production period would remain constant throughout the remainder of the production period. This procedure was necessary because a breakeven price was needed at the beginning of the production period for many of the cash contracting, hedging and production decision simulations. This procedure was used in determining the breakeven price for both the finish and farrow-to-finish operations.

III. Development of the Farrow-to-Finish Producer's Budgets

The farrow-to-finish budgets were computed much like that for the finish producer. The budgets were based upon a one sow unit for one year and costs were adjusted to a per cwt. basis. Only variable costs were used and the costs to be included in the budgets were obtained from Tennessee Farm Planning Manuals (16). Fixed costs and management were assumed to receive the residual of returns above variable costs.

Variable factors used in calculating the breakeven prices were: corn price, live capital, supplement price, veterinary and medicine cost, creep feed price, grind and mix cost, pasture cost, electricity cost, interest rates, truck cost, sow price, and labor cost. The prices used to obtain the cost of live capital, veterinary and medicine, creep feed, grind and mix, pasture, electricity, and truck were obtained from the 1969, 1973, 1975 and 1978 Farm Planning Manuals. Interpolation was used to estimate prices for years between these publications. Live capital refers to money invested in sows, replacement gilts, and boars and was used in computing interest costs.

The 1975 Farm Planning Manual was used as a guide in determining the production unit. Accordingly, each sow was assumed to have two eight-pig litters per year and 0.5 head was retained each year for sow replacement. A sow culling rate of one-half sow per year for each sow unit was included in the budget. The sow prices were obtained from Tennessee Agricultural Statistics (18), and a selling weight of 4.50 cwt. was used for calculating revenue from the sale. A death rate of 1 1/2 percent was assumed for feeder pigs. Boar depreciation was computed on a $250 boar which sold for $100 after two years. Each boar was assumed to service 30 sows which resulted in a $2.50 boar depreciation charge per sow per year.

Corn prices used in the budgets came from annual Tennessee Agricultural Statistics publications (18). A usage rate of 184 bushels of corn per sow and two litters for each year was obtained from the 1975 Tennessee Farm Planning Manual. The 1975 Manual was also used for the supplement and labor usage rates. Thirty hours of labor were required per sow and two litters and 25 cwt. of supplement was needed. Supplement prices were obtained from Tennessee Agricultural Statistics bulletins and labor prices were derived by estimating a $2 per hour wage in 1970 and $3 per hour wage in 1978. Interpolation was used to obtain estimates for the years between 1970 and 1978. The $3 per hour wage used in 1978 was also used for January and February in 1979.

Interest costs were computed on operating capital invested in the enterprise. Costs that were spread out through the production period were divided into half and multiplied by half the interest rate.

Live capital investment occurred at the beginning of the year and was therefore simply multiplied by the interest rate to give the interest cost for that year. Revenue from selling one half a cull sow was subtracted from variable costs to give the net costs for the year. Net variable costs were then divided by 35.65, which was the total number of cwt. of market hogs produced, to arrive at the cost of production per cwt. This breakeven price was calculated for each month between January 1970 and February 1979 (Appendix A).

IV. Calculation of Basis Estimates

The basis was calculated by subtracting the cash price from the futures price. This is the usual method of calculation, even though cash minus futures is sometimes used. The basis estimation procedure was organized by dividing each month into three ten-day periods. The basis for the days in each period was averaged to arrive at a mean for each ten-day period. The mean was used as an estimate of the basis for each day in the ten-day period. The fifth day of the month and the twentieth, as later discussed, were chosen as the days to begin and end the production process. Therefore, hog marketings on the fifth used the first ten-day period of the month as a basis estimate. Hog marketings on the twentieth used the third ten-day period of the month since some of the production occurrences ended on the twenty-first or twenty-second rather than the twentieth.

A two-year moving average was used to estimate the basis. Ten-day periods for two consecutive years were averaged together to obtain an estimate of the basis for the ten-day periods in the

following year. The two-year moving average method of estimation was chosen because it would be a relatively easy method for the producer to utilize. It assumed that the producer would simply estimate the basis during the anticipated sale period based upon his experience during the two immediately preceding years. This procedure was used in estimating the basis for all of the simulation periods. The first two years of data, 1970 and 1971, were used only for basis estimation. After 1971 each year was used for production and marketing strategy simulations, as well as for the estimation of the basis for the following two years (Appendix B).

V. Costs of Trading Futures

The deposit of margin money and payment of a commission charge are required when a speculator or hedger transacts a futures contract through a brokerage firm. The commission charge was included as part of the farmer's cost of hedging because he does not receive a refund on that payment. Margin money is returned to the futures trader after the contract is liquidated, therefore only an interest charge on the margin money was included in the farmer's cost of hedging.

The commission charge is set by the brokerage firm. Based upon communication with Chicago Mercantile Exchange officials, a charge of $50 per contract was assumed to be representative of the actual charge for the production periods simulated. The $50 was deducted from the revenue earned from each of the hedged lots of hogs.

The minimum margin requirement is established by the commodity exchange and brokerage firms can raise their requirement above this

minimum level. An initial margin payment is required of the producer and a maintenance level is set below the initial margin. If the futures market moves against the farmer's position by more than the difference between the initial and maintenance requirements the farmer will receive a margin call. This will require him to pay additional margin money to bring his account back up to the maintenance level. If the futures market moves in the direction favorable to the farmer's position, he is allowed to withdraw margin money depending on the amount of movement in the futures price.

Initial margin data obtained from the Chicago Mercantile Exchange for the period of study (Appendix C) was averaged together and the mean ($750) was used as the estimate of the initial margin requirement for the hedging simulations. This mean initial margin requirement was used to calculate interest costs. The possibility of margin calls was not considered in the study. A 10 percent interest rate was used as an estimate for the time period analyzed. The interest cost for the four-month finishing hog operation was $25, for the six-month farrow-to-finish hog operation the cost was computed to be $37.50. The interest costs for these enterprises were deducted from the revenue earned per lot of hogs when a hedge occurred in either of these enterprises.

VI. Finish Hog Producer's Simulation Procedures

The finish hog producing enterprise consisted of a producer buying feeder pigs at an average weight of 45 pounds and feeding them for four months. The hogs were sold at the end of this production

period at an average weight of 230 pounds. The simulations assumed that a producer would buy a lot of feeder pigs equivalent to the quantity needed for a futures contract on the fifth and twentieth of every month and sell a lot of market hogs equivalent to the futures contract on the fifth and twentieth of every month four months later.[4] The simulations began with a lot of feeder pigs bought on January 5, 1972 and ended with the last lot of hogs simulated sold on February 20, 1979. There were 164 possible simulations over this time period. Two of these were not available due to a lack of cash data, leaving a total of 162 simulations.

The fifth and twentieth were chosen as the days to begin and end the production process for both the finish and farrow-to-finish operations. The fifth was chosen so that the hedged producer would not have difficulty liquidating futures contracts for hogs sold during delivery months. The twentieth of the month was chosen due to its location at the midpoint between the fifth days of consecutive months. The futures contract month nearest following the actual selling date was used. Futures trading during delivery months ends on the twentieth, therefore hedged lots of hogs sold on the fifth did not pose a problem for contract liquidation during delivery months. However, hedged hogs sold on the twentieth during delivery months were hedged using the next nearest futures contract, instead of the futures contract closing the same day that the hogs were sold.

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[4]If the fifth or twentieth occurred on a weekend or holiday the next available day was used for the simulation.

VII. Farrow-to-Finish Hog Producer's Simulation Procedures

The farrow-to-finish simulations consisted of a six-month pro-
duction period. Farrowing marked the beginning of the production
period and pigs were weaned after two months. After weaning, the
pigs were fed for four months to a market weight of 230 pounds and
sold. Each production simulation contained the equivalent of one
commodity futures contract of hogs or 30,000 pounds. Assuming each
sow farrows eight pigs, approximately 16 sows were required for each
production process to produce enough pigs for one commodity futures
contract.

Production processes were initiated on the fifth and twentieth
of every month.[5] After the first six months, production processes
were also being closed out on the fifth and twentieth of every month.
The simulations began January 5, 1972 and the last lot of hogs were
sold February 20, 1979. Two of the 160 possible simulations were not
available due to a lack of cash data, leaving a total of 158 simu-
lations for each of the farrow-to-finish marketing strategies.

VIII. Cash Contracting Strategies

The option to cash contract hogs is available to many producers
in Tennessee. Packing plant facilities that offer this type of trans-
action are located in Memphis, Trenton, Savannah, Decaturville, Milan
and Newbern (15). Currently, there are none of these facilities in

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[5]The fifth and twentieth were chosen for the same reasons dis-
cussed in Section VI. When either of these days occurred on a weekend
of holiday the next available day was used in the simulation.

Middle and East Tennessee. However, the largest concentration of hog production occurs in West Tennessee.

The use of cash contracting was analyzed for both the finish and farrow-to-finish operations. The simulations were conducted assuming that the sale price was determined at a $2 discount below the relevant futures price (15).[6,7] In other words, the producer could have contracted a selling price for his hogs before they were market weight by contracting with the packer at $2 per cwt. below the futures price. When the hogs reached market weight they were delivered to the packer and the farmer received the contracted price for his animals.

Full-Contract

The cash contracting strategy was simulated with and without the use of selective contracting criteria. The nonselective or "full contract" strategy simulated a producer automatically contracting his hogs with a packing plant the day after the production process began. For the finish operation this was the day after the feeder pigs were bought and for the farrow-to-finish operation this was the day after the sows farrowed. This type of strategy is relatively naive and would probably not be used by the farmer because he would be more selective in his decision making. However, it is useful for comparison with other strategies.

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[6]The futures contract month maturing nearest the hog selling date was used for determining the cash contracting price. Hogs sold on the twentieth of delivery months were cash contracted using the next nearest maturing futures.

[7]The $2 discount rate would probably be too low for 1980 due to higher interest rates and higher commission charges.

Contract Greater Than Breakeven

A selective strategy would be more typical of the type of strategy the producer might consider. The selective strategy was based upon a comparison between the contract price and the producer's breakeven price. The selective or "contract greater than breakeven" strategy simulated the producer contracting his hogs when the cash contracting price was greater than his breakeven cost of production. By contracting at this price, the producer was assured of at least covering his variable costs when he contracted the hogs. In this way the producer could have remained in operation in the short run because he could cover his variable costs of production.

The contract greater than breakeven strategy was also simulated at various dollar per cwt. increments above the breakeven price. The dollar increments were added to breakeven to try to arrive at the optimum increment level for cash contracting. By contracting at a level above his breakeven price, the producer was assured of covering his variable costs and at least part of his fixed costs. As the criterion for contracting became more selective or restrictive, the probability of meeting the criterion decreased and fewer contracts were executed.

Under the selective strategies the producer was allowed to test whether the criterion for contracting was met until the first day of the month before the month that he marketed the hogs. If the criterion for contracting had not been met by that time, the producer stopped testing and sold the hogs on the cash market at the end of the production period.

IX. Hedging Strategies and Full-Cash Simulations

The marketing strategies simulated included use of selective hedging strategies as well as full-cash and full-hedge strategies. These strategies were simulated for both the finishing and farrow-to-finish operations.

When a selective hedging strategy was used, the criterion was tested on each day until a hedge was made or until the first day of the month before the month that the hogs were to be sold. If a hedge had not been triggered after that length of time, the testing would end and the producer would sell the hogs on the cash market at the end of the production period. If the criterion was met and a hedge was triggered during the testing time period, a futures contract would be sold by the producer on the next available futures trading day. When the hogs were sold on the cash market at the end of the production period, an offsetting futures contract would be purchased by the producer to close the hedge. If the contract was sold at a higher price than the contract was bought, the producer made a profit on the hedging transaction. The profit or loss on the futures trade was added to the cash price to determine the price the producer received for his hogs.

The localized futures price was used in the selective hedging strategies and was calculated by subtracting the relevant basis estimate from the futures price. This price was used as an estimate of the actual local net price which the farmer would receive. The accuracy of the localized futures price depended upon how well the

basis was estimated. An accurate prediction of the basis enabled the farmer to determine the price for his hogs before they were marketed.

Full-Cash

Hog producers probably actually use the full-cash strategy more often than any other marketing technique. Because of its popularity, the full-cash strategy was used as a benchmark for comparison with other strategies. This strategy simply involves the producer selling his market hogs on the local cash market at the end of the production period. The price received for the hogs depends entirely on the cash price at the time of marketing. The producer does not use the futures market and has no protection from downward price movements.

Full-Hedge

The full-hedge is a non-selective hedging strategy. This simulated strategy consisted of a producer selling a live hog futures contract on the first futures trading day following the beginning of the production period. When the hogs were sold a live hog futures contract was bought to cancel out the previous transaction. This rather naive strategy would probably not be used by the sophisticated producer because it does not have a selective scheme for trading. However, it is a useful benchmark for comparison with other strategies.

Delivery Months

This strategy is based upon the traditional observation that futures and cash prices usually move closer together as the futures contract approaches expiration. This characteristic causes the basis to become more predictable. The more accurately the basis can be

predicted the less is the risk associated with hedging. Thus, hedging hogs that are to be marketed near or during delivery months should be less risky than hedging hogs at other times.

The delivery month strategy was simulated in two different ways. One system (Delivery Months I) required that all hogs be hedged that were to be sold on the fifth of delivery months as well as hogs sold on the twentieth of months immediately before delivery months. The other system, designated Delivery Months II, simulated a producer hedging only those hogs that were sold on the fifth day of delivery months. All hogs that were hedged under either of these two procedures were hedged on the first futures trading day following the beginning of the production period. Hogs that were not hedged were sold only on the cash market.

Seasonal Lows

Seasonal cash price variations are apparent for slaughter hogs (14, p. 25). In view of this, one alternative strategy was to hedge hogs sold during seasonal cash lows. This was accomplished by placing a hedge the day after the beginning of the production period. Two periods of seasonally low cash prices were used in the simulations, these periods occurred from the middle of March through the middle of June and from the middle of October through the middle of December (14). Hogs sold from the twentieth of March through the fifth of June and from the twentieth of October through the fifth of December were hedged. By hedging hogs to be sold during these periods the producer may be able to avoid below average returns caused by low cash prices. Hogs marketed at other times were sold only on the local cash market.

Localized Futures Greater Than Cash

This selective strategy was used to hedge hogs when the localized futures price was above the cash price. This would allow the producer to hedge when the futures market appeared more profitable than the current cash market. The strategy was also simulated with different dollar per cwt. increments added to the cash price to try to determine the optimal increment level for hedging. The testing period for the hedging criterion extended until the first day of the month before the month in which the hogs were marketed. Groups of hogs which were not hedged were sold only on the cash market.

Localized Futures Greater Than Breakeven

This hedging criterion insures that the producer will at least cover all variable costs, if the basis is accurately predicted and the difference between localized futures and breakeven is sufficient to cover the cost of trading futures. The criterion was expanded to test with different dollar amounts added to the breakeven price to try to find the optimal level for placing a hedge. The hedging criterion was tested until the first day of the month before the month in which the hogs were marketed. Groups of hogs not hedged by this time were sold on the cash market.

Moving Averages

Moving Averages is a technique used to trace movements of futures market prices. This is accomplished by making a comparison of moving averages of futures prices. There are many types of averages that can and have been used such as the comparison of two different length

moving averages, three different length moving averages, and weighted averages. This technique has been used by both hedgers and speculators for analyzing the futures market in order to determine the optimal time for placing a trade on the futures market (4,5).

The moving average technique was used as a signal for the producer to know when to place a hedge. The technique compares different length moving averages of futures prices to indicate a change in the direction of the futures price movement. Shorter length moving averages are more sensitive to price changes than the longer length moving averages. Therefore, when a short length crosses a long length a change in futures price direction is indicated. A cross from above indicates a downward turn in price, and a cross from below indicates an upward turn in price. By using moving averages, the producer can examine price change indications in an attempt to place hedges only at peak prices. Thus, the producer would remain unhedged on a rising market, but would hedge when price began to decline.

The moving average strategies included in this study used the 3--10-day, 5--10-day, and 5--15-day moving averages. These criteria were used to trigger a hedge when the shorter length average crossed the longer length average from above. After the hedge was placed, there was no further trading activity until the hogs were sold. The testing period for each of the strategies extended until the first day of the month before the month in which the hogs were sold. At the end of the production period hedged hogs were sold on the local cash market and a futures contract was purchased to cancel out the hedge. Unhedged hogs were sold only on the local cash market.

X.   The Production Decision for Finish Hog Producer's Operation

One of the biggest decisions faced by finish hog producers is
the choice of whether to produce. There are times at which market
forces create conditions that are unfavorable for the producer to
operate. Therefore, several different production criteria were
selected to include in the simulations in an attempt to find a market-
ing technique that will provide information to prevent production
during unfavorable times for marketing hogs.

Production criteria were simulated with five different marketing
strategies on the finish hog producer's operation. The criteria were
checked on the day that would begin the production period. If the
criterion for production was met the producer would buy and finish
out feeder pigs, if the criterion was not met the producer would not
buy feeder pigs for that production period. By using production
criteria, the producer was allowed to analyze market conditions before
making his decision on whether to produce.

The marketing strategies simulated with production criteria were:
full-cash, full-hedge, localized futures greater than breakeven + $10,
localized futures greater than cash + $5, and cash contract greater
than breakeven + $10. Full-cash was chosen because it is the typical
marketing tool. Full-hedge was chosen mainly for comparison and the
other three were included because they had proven to be successful
strategies when simulated without the production decision.

Production criteria used in the simulations were: produce if
localized futures greater than breakeven, localized futures greater
than breakeven + $1, cash greater than breakeven, cash greater than

breakeven + $1, localized futures or cash greater than breakeven, localized futures or cash greater than breakeven + $1, and localized futures or cash greater than breakeven + $2. Each of these criteria was simulated with the five marketing strategies discussed in the previous paragraph. If the criterion for production was met, the hogs were marketed using the specified marketing strategy. The purpose of using the production criterion was to attempt to avoid producing during unprofitable production periods. Therefore, when computing the mean profit from production the total number of possible production periods was used as the divisor rather than the number of actual production occurrences, because the producer is mainly concerned with total returns for the entire simulated time period rather than returns per production occurrence. If including the production criteria in the simulation eliminated producing during unprofitable periods, the mean return would rise even though there were fewer production occurrences.

Localized Futures Greater Than Breakeven and Breakeven + $1

A comparison between the localized futures and breakeven price was used as a production criterion to test the efficiency of the futures market in predicting the cash price in the future. If the futures market is an accurate predictor then this criterion should prevent the producer from operating when he cannot cover his variable costs. Of course, basis variability would also be a factor affecting the accuracy of the localized futures prediction ability and the usefulness of this production criterion.

Cash Greater Than Breakeven and Breakeven + $1

The local cash price at the beginning of the production period may be a major factor considered by the producer when making the production decision. The local cash price was analyzed as a production criterion based on the assumption that the producer considers this price to be a relatively accurate estimator of the price he will receive when he markets his hogs. If it is a good estimator then losses should be avoided by not producing when the cash price is below the breakeven price.

Localized Futures or Cash Greater Than Breakeven and Breakeven + $1 and + $2

The producer was simulated as analyzing both the localized futures and cash prices in making the production decision under this criterion. If either of these prices predicted a profit level above variable costs the producer would buy and finish out feeder pigs for the production period. If both of the prices were below the breakeven price the producer would skip production during that period.

XI. Methods of Analysis

The mean and variance of revenue above variable costs were used as measures of desirability for analyzing results of the simulated strategies. A mean and variance was computed for each strategy over the seven-year period. These statistics were used as measures of the profitability and risk, respectively, associated with the strategies and provided the principal indicators for drawing conclusions about the relative merit of the various strategies.

In addition, separate means and variances were computed for each
strategy for all hogs marketed before 1976 and after 1975 in order
to determine whether there were structural differences that may have
occurred during the simulated time period to effect the relative
profitability and risk of the various strategies. The end of 1975
was chosen as the dividing point because it was approximately the mid-
point of the data set used in the simulations. The resulting means
and variances provided a method for comparing the effectiveness of
the strategies for these two different time periods separately. If
the strategies which were optimal in the two time periods were dif-
ferent, this would cash doubt on the accuracy of the strategies
which were optimal for the entire seven-year period as indicators of
the future.

Separate means and variances were also computed for hogs sold on
the fifth of the month and for those sold on the twentieth of the month.
This analysis served as a rather weak test of the theory of lower risk
associated with hedged hogs sold during delivery months. These com-
putations also served to analyze differences in profitability and
risk associated with marketing hogs at different times of the month.

CHAPTER III

RESULTS

The hog producer, as well as most other producers, would like to operate with high profits at a low level of risk. The mean and variance of profitability are measures of the levels of profit and risk, respectively, and thus are appropriate means for analyzing the results of the strategy simulations. However, there is a tradeoff between different levels of mean and variance which makes it difficult to make absolute comparisons between strategies. For example, it is difficult to determine whether a strategy with a high mean and average variance is better than a strategy with an average mean and lower variance. Therefore, the choice of the best strategy is a subjective decision that would depend upon the individual's financial needs and preferences.

I. Analysis of Finish Hog Producer's Strategy Simulations

The mean and variance for each of the finish hog producer's strategies are listed in Table 1 and illustrated in Figure 1. The mean represents the average net revenue for the total lots of hogs marketed under each strategy, and the variance represents the variability of net revenue among the lots of hogs that were marketed under each strategy. The number of non-full-cash transactions in Table 1 shows the number of times that a hedge or cash contract occurred for each of the simulated strategies. The maximum and minimum values of profitability are listed to show the range over which the profit level varied per group of hogs.

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Table 1. Mean and Variance of Profitability, Maximum and Minimum Profit Levels, and Number of Non-Full-Cash Marketings for Simulated Finish Hog Operations Using Specified Marketing Strategies, Tennessee, 1972–1979

Marketing Strategy	Mean	Variance	Maximum	Minimum	Number of Non-Full-Cash Marketings
		------Dollars------			
Full-Cash	1843.27	3531494.00	7758.66	-3564.60	0
Full-Hedge	894.11	1220179.00	4431.00	-1823.25	162
Delivery Months I	1255.31	2277410.00	6798.66	-2359.02	95
Delivery Months II	1541.60	2997597.00	6798.66	-2652.54	48
Seasonal Lows	1472.10	2979186.00	7758.66	-2229.60	67
Localized Futures Greater Than Cash	1323.13	1910340.00	6126.78	-2359.02	121
Localized Futures Greater Than Cash + $1	1509.75	2212442.00	6733.11	-2359.02	104
Localized Futures Greater Than Cash + $3	1948.73	2396422.00	7758.66	-2359.02	81
Localized Futures Greater Than Cash + $4	1951.47	2459846.00	7758.66	-2359.02	71
Localized Futures Greater Than Cash + $5	2064.25	2788768.00	7758.66	-2359.02	58
Localized Futures Greater Than Cash + $6	1990.20	3294107.00	7758.66	-2359.02	39
Localized Futures Greater Than Breakeven	988.39	1003036.00	4431.00	-1914.30	158
Localized Futures Greater Than Breakeven + $1	1011.87	1056028.00	4431.00	-2274.30	150
Localized Futures Greater Than Breakeven + $2	1091.94	946360.00	4431.00	-2274.30	146
Localized Futures Greater Than Breakeven + $3	1190.53	954617.00	4431.00	-2359.02	143
Localized Futures Greater Than Breakeven + $5	1510.77	944394.00	4431.00	-2359.02	120
Localized Futures Greater Than Breakeven + $7	1751.51	1306239.00	4431.00	-2359.02	100

Table 1 (Continued)

Marketing Strategy	Mean	Variance	Maximum	Minimum	Number of Non-Full-Cash Marketings
		------Dollars------			
Localized Futures Greater Than Breakeven + $9	1942.16	2006836.00	5548.49	-3564.60	82
Localized Futures Greater Than Breakeven + $10	2059.51	2441417.00	7758.66	-3564.60	69
Localized Futures Greater Than Breakeven + $11	2056.46	2807618.00	7758.66	-3564.60	48
Localized Futures Greater Than Breakeven + $12	1996.59	3503709.00	7758.66	-3564.60	30
Full-Contract	516.07	1188839.00	3726.00	-1899.72	162
Contract Price Greater Than Breakeven + $3	1176.25	652952.00	3726.00	-2359.02	128
Contract Price Greater Than Breakeven + $6	1683.82	1036752.00	4377.21	-2359.02	92
Contract Price Greater Than Breakeven + $7	1793.45	1128455.00	4377.21	-2359.02	89
Contract Price Greater Than Breakeven + $8	1876.62	1714659.00	5131.08	-3564.60	80
Contract Price Greater Than Breakeven + $9	2093.73	2755622.00	7758.66	-3564.60	56
Contract Price Greater Than Breakeven + $10	2143.38	2940632.00	7758.66	-3584.60	42
Contract Price Greater Than Breakeven + $11	2031.38	3358562.00	7758.66	-3564.60	29
3 - 10-Day Moving Average	1074.40	1666468.00	5349.33	-2243.34	161
5 - 10-Day Moving Average	1065.98	1623739.00	5154.33	-2693.34	161
5 - 15-Day Moving Average	1134.49	2108951.00	7758.66	-2138.25	155

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Figure 1.   Mean and Variance of Profitability for Simulated Finish Hog
            Operations Using Specified Marketing Strategies, Tennessee,
            1972-1979

1. Full-Cash
2. Full-Hedge
3. Delivery Months I
4. Delivery Months II
5. Seasonal Lows
6. Localized Futures Greater
   Than Cash
7. Localized Futures Greater
   Than Cash + $1
8. Localized Futures Greater
   Than Cash + $3
9. Localized Futures Greater
   Than Cash + $4
10. Localized Futures Greater
    Than Cash + $5
11. Localized Futures Greater
    Than Cash + $6
12. Localized Futured Greater
    Than Breakeven
13. Localized Futures Greater
    Than Breakeven + $1
14. Localized Futures Greater
    Than Breakeven + $2
15. Localized Futures Greater
    Than Breakeven + $3
16. Localized Futures Greater
    Than Breakeven + $5

17. Localized Futures Greater
    Than Breakeven + $7
18. Localized Futures Greater
    Than Breakeven + $9
19. Localized Futures Greater
    Than Breakeven + $10
20. Localized Futures Greater
    Than Breakeven + $11
21. Localized Futures Greater
    Than Breakeven + $12
22. Full-Contract
23. Contract Price Greater
    Than Breakeven + $3
24. Contract Price Greater
    Than Breakeven + $6
25. Contract Price Greater
    Than Breakeven + $7
26. Contract Price Greater
    Than Breakeven + $8
27. Contract Price Greater
    Than Breakeven + $9
28. Contract Price Greater
    Than Breakeven + $10
29. Contract Price Greater
    Than Breakeven + $11
30. 3 - 10-Day Moving Average
31. 5 - 10-Day Moving Average
32. 5 - 15-Day Moving Average

Key: * Compares Localized Futures and Cash

      + Compares Localized Futures and Breakeven

      ✿ Compares Contract Price and Breakeven

      ◊ Moving Averages

Figure 1.

An analysis of the results can best be performed by inspection of Figure 1. Using full-cash (No. 1) as the benchmark for comparison, there were 12 strategies that resulted in both a higher mean and a lower variance than the full-cash strategy. These strategies included hedging as well as cash contracting simulations. For example, the strategy contract price greater than breakeven + $10 (No. 28) had a mean of profits that was $300 more than the mean for full-cash. This would increase profits on the average by the amount of $7,200 a year. This strategy also provided a lower variance of profitability, which would reduce the risk associated with using the strategy. There were also several other successful strategies which had slightly lower means than full-cash but had much lower risk levels. These selective strategies might be preferable to full-cash.

Since smaller variance and larger mean were the desired character-istics, those strategies for which there were no other strategies with both smaller variance and larger mean were potential optimal strategies. That is, if there were no strategies below and to the right of any particular strategy (Figure 1), then it was superior to others in its immediate vicinity which did not meet this criterion. Strategies which met this criterion were numbers 23, 16, 24, 25, 26, 18, 19, 27, and 28. This set of strategies traced a mean-variance frontier which would provide a tangency to the mean-variance indifference curve of the producer. Thus, one of this set of strategies would be optimal for any particular producer. The choice of the best strategy for a producer would depend upon his own preferences and his ability to withstand risk.

The full-hedge (No. 2) and full-contract (No. 22) strategies were used as benchmarks to test how these basic hedging and cash contracting strategies compared with other strategies. Both of these strategies resulted in very low means with relatively low levels of variance. The low means can be attributed to the nonselective nature of the strategies and most of the other strategies would be preferable because they have higher profit levels. However, the full-hedge and full-contract strategies did result in low variance due to an avoidance of cash price risk, but the lower variance would probably not outweigh the very low profit levels.

Inspection of Figure 1 shows that the marketing strategies that compared localized futures and cash, localized futures and breakeven, and contract price and breakeven had rather distinctive patterns. As the strategies became more selective the mean of profitability began to rise and the variance started to rise after an initial decline. A point of maximum profitability was reached and further increases in selectivity caused the strategy to regress back toward full-cash. A point could have eventually been reached at which a strategy became so selective that the results were exactly equal to full-cash.

The less selective strategies did not result in large means of profitability due to the inadequate criteria for choosing a selling price. However, they did result in lower variance as compared to full-cash because they offered a method of protection from cash price variability. The very large risk associated with full-cash can be attributed to its complete dependence on the cash price at the time of marketing.

The moving average strategies (Nos. 30, 31, 32) that were simu-
lated did not show a very high level of profitability. However, the
profit level was above that attainable by the full-hedge strategy.
This indicated that the moving averages provided better criteria for
placing a hedge, but the larger risk asociated with the moving averages
would also be an important factor to consider when choosing a strategy
for actual use.

The use of delivery months (Nos. 3, 4) and seasonal lows (No. 5)
as criteria for hedging gave poor results when compared to some of the
other more successful strategies. It was anticipated that, due to
expected lower basis variability near or during delivery months, the
delivery month hedging strategy would give a low risk level. However,
this did not materialize. Hedging hogs to be sold at times when the
cash price was expected to be seasonally low did not improve the
profit level above that attainable using the full-cash strategy.
However, the variance was lower due to avoidance of some of the cash
price variability.

Analysis of Selected Strategy Simulations on a Yearly Basis

The mean and variance of profitability were further analyzed on
a yearly basis for a selected group of marketing strategies, so that
the actual affects of the levels of mean and variance on the producer's
annual cash flow could be more closely examined. These strategies
included full-cash and full-hedge as well as some of the strategies
that appeared to be more successful for the time period over which
the strategies were simulated. The results of the yearly mean com-
putations are listed in Table 2. The effects of the level of variance

Table 2. Yearly Means of Profitability for Selected Finish Hog Producer's Strategies, Tennessee, 1972-1979

Marketing Strategies	1972[1]	1973	1974	1975	1976	1977	1978	1979[2]
				----Dollars----				
Full-Cash	1476.86	2819.25	567.57	3327.45	886.33	1044.28	2484.02	2921.35
Full-Hedge	771.86	1007.62	1162.88	1656.45	1443.83	332.09	425.81	1642.61
Localized Futures Greater Than Cash + $5	1446.86	3077.87	2216.66	3114.58	862.58	841.16	2690.44	2328.86
Localized Futures Greater Than Breakeven + $10	1476.86	3319.49	1774.74	3051.84	1170.45	1044.28	2313.81	2662.61
Contract Price Greater Than Breakeven + $7	1476.86	2362.74	1968.44	2175.71	1003.70	1044.28	2267.93	2827.60
Contract Price Greater Than Breakeven + $10	1476.86	3488.12	1575.70	3269.80	1190.70	1044.28	2629.81	2921.36

[1]1972 included only 16 observations for calculating the mean profit for each strategy.

[2]1979 included only 4 observations used in calculating the mean profit for each strategy.

are clearly evident. Strategies with a high level of variance in
Table 1 such as full-cash and contract price greater than breakeven
+ $10 showed a much larger degree of variability from one year to the
next than did strategies with a lower level of variance such as full-
hedge and contract price greater than breakeven + $7. The yearly
means for the full-cash strategy changed by as much as $2,759.88
moving from one year to the next, whereas the largest change for the
contract price greater than breakeven + $7 strategy was $1,223.65.
The effects of variability on the mean level can be compared between
other strategies as well.

Mean-Variance Analysis of Strategy Simulations for Hogs Marketed on the Fifth Day of the Month and on the Twentieth

The mean and variance of profitability were also computed
separately for hogs marketed on the fifth day of the month and on
the twentieth in an attempt to determine the possible effects of the
marketing date upon profitability. The results of these computations
are listed in Table 3. The variance of returns was largest for hogs
marketed on the fifth under 15 of the marketing strategies. This is
about half of the total number of strategies. Therefore, it was
difficult to assess which marketing date had the lowest risk level.
These results did not support the theory of lower risk associated
with hedged hogs sold during the delivery period, because many of the
strategies with a large number of hedging occurrences, including full-
hedge, had a larger variance for hogs sold on the fifth than for
those sold on the twentieth. Inspection of Table 3 also shows that
the mean profit levels were higher in all except five strategies when

Table 3. Mean and Variance of Profitability for Hogs Marketed on the
5th Day of the Month and for Hogs Marketed on the 20th Under
Simulated Finish Hog Operations Using Specified Marketing
Strategies, Tennessee, 1972-1979

Marketing Strategy	Hogs Marketed On The 5th		Hogs Marketed On The 20th	
	Mean	Variance	Mean	Variance
		----Dollars----		
Full-Cash	1738.49	3511984.00	1950.68	3573199.00
Full-Hedge	864.30	1332980.00	924.69	1118101.00
Delivery Months I	1142.52	2146817.00	1370.93	2413459.00
Delivery Months II	1142.52	2146817.00	1950.68	3573199.00
Seasonal Lows	1450.97	3064632.00	1493.78	2928476.00
Localized Futures Greater Than Cash	1282.94	2023579.00	1364.33	1815072.00
Localized Futures Greater Than Cash + $1	1460.92	2118324.00	1559.82	2332002.00
Localized Futures Greater Than Cash + $3	1912.05	2578683.00	1986.34	2237143.00
Localized Futures Greater Than Cash + $4	1895.55	2535676.00	2008.80	2406740.00
Localized Futures Greater Than Cash + $5	1982.48	2741336.00	2148.08	2858727.00
Localized Futures Greater Than Cash + $6	1822.97	3480727.00	2161.62	3085778.00
Localized Futures Greater Than Breakeven	961.06	1080691.00	1016.41	934541.00
Localized Futures Greater Than Breakeven + $1	960.98	1194210.00	1064.04	922271.00
Localized Futures Greater Than Breakeven + $2	1042.13	1083191.00	1143.01	812828.00
Localized Futures Greater Than Breakeven + $3	1200.54	1006602.00	1180.29	913192.00
Localized Futures Greater Than Breakeven + $5	1513.97	825023.00	1507.51	1078721.00
Localized Futures Greater Than Breakeven + $7	1759.82	1175343.00	1743.01	1456842.00
Localized Futures Greater Than Breakeven + $9	1909.71	1974048.00	1975.43	2063731.00
Localized Futures Greater Than Breakeven + $10	2027.37	2561740.00	2092.47	2346873.00
Localized Futures Greater Than Breakeven + $11	1976.04	3057024.00	2138.89	2573944.00
Localized Futures Greater Than Breakeven + $12	1925.77	3430826.00	2069.18	3612373.00
Full-Contract	577.76	1152662.00	452.87	1232985.00
Contract Price Greater Than Breakeven + $3	1161.80	571628.19	1191.08	744165.00
Contract Price Greater Than Breakeven + $6	1590.46	878494.00	1779.53	1193823.00

Table 3 (Continued)

Marketing Strategy	Hogs Marketed On The 5th		Hogs Marketed On The 20th	
	Mean	Variance	Mean	Variance
	------------------Dollars------------------			
Contract Price Greater Than Breakeven + $7	1722.17	1000229.00	1866.53	1263535.00
Contract Price Greater Than Breakeven + $8	1805.44	1560355.00	1949.59	1883945.00
Contract Price Greater Than Breakeven + $9	2015.73	2619454.00	2173.69	2917419.00
Contract Price Greater Than Breakeven + $10	2066.99	2832136.00	2221.69	3076952.00
Contract Price Greater Than Breakeven + $11	1945.35	3223495.00	2119.58	3524115.00
3 - 10-Day Moving Average	982.50	1716201.00	1168.62	1618815.00
5 - 10-Day Moving Average	1022.38	1645636.00	1110.69	1617844.00
5 - 15-Day Moving Average	1135.02	2282294.00	1133.97	1957975.00

hogs were marketed on the twentieth as compared to those sold on the fifth. Even though the difference between the means for many of the strategies was not very large, the results still indicated that the twentieth would be a better day to market hogs than the fifth.

Mean-Variance Analysis of Strategy Simulations for Hogs Marketed Before 1976 and After 1975

This analysis was performed to test whether there were structural changes that occurred during the simulation period that might have affected the relative success of the strategies over the time period. The results of the mean and variance of profitability for hogs marketed before 1976 and for hogs marketed after 1975 are listed in Table 4. The mean of profitability for all of the strategies was larger for hogs marketed before 1976. The breakeven prices were generally higher for hogs being sold after 1975 and cash prices did not increase in breakeven prices. The variance of returns was larger for hogs marketed before 1976 under 15 of the marketing strategies. This is about half of the total number of strategies that were simulated.

Inspection of the results shows that the ranking of the strategies changed very little between the two time periods. That is, strategies that performed well before 1976 also resulted in favorable returns after 1975. Therefore, the differences in mean returns between the two time periods can apparently be attributed to changes in cash and breakeven prices rather than to structural changes, which might have affected the relative success of the various strategies.

Table 4. Mean and Variance of Profitability for Hogs Marketed Before 1976 and for Hogs Marketed After 1975 for Simulated Finish Hog Operations Using Specified Marketing Strategies, Tennessee, 1972-1979

Marketing Strategy	Before 1976		After 1975	
	Mean	Variance	Mean	Variance
		Dollars		
Full-Cash	2103.20	4442401.00	1529.16	2381163.00
Full-Hedge	1178.80	911541.00	571.99	1388158.00
Delivery Months I	1523.83	2211718.00	951.49	2206078.00
Delivery Months II	1813.18	3263307.00	1234.31	2556303.00
Seasonal Lows	1966.35	3298951.00	912.85	2059567.00
Localized Futures Greater Than Cash	1720.29	1622501.00	873.73	1876550.00
Localized Futures Greater Than Cash + $1	1881.21	1981969.00	1089.45	2165980.00
Localized Futures Greater Than Cash + $3	2375.23	2045724.00	1466.14	2381343.00
Localized Futures Greater Than Cash + $4	2363.44	2200059.00	1485.33	2372351.00
Localized Futures Greater Than Cash + $5	2553.90	2669472.00	1510.20	2375238.00
Localized Futures Greater Than Cash + $6	2393.82	3711421.00	1533.49	2467010.00
Localized Futures Greater Than Breakeven	1228.54	780564.00	716.66	1127589.00
Localized Futures Greater Than Breakeven + $1	1258.71	770291.00	732.57	1245023.00
Localized Futures Greater Than Breakeven + $2	1336.68	658658.00	815.03	1138651.00
Localized Futures Greater Than Breakeven + $3	1461.98	578085.00	883.40	1213997.00
Localized Futures Greater Than Breakeven + $5	1794.66	405988.00	1189.55	1370202.00
Localized Futures Greater Than Breakeven + $7	2082.66	721614.00	1376.81	1718215.00
Localized Futures Greater Than Breakeven + $9	2325.45	1730140.00	1508.46	1988202.00
Localized Futures Greater Than Breakeven + $10	2491.95	2333930.00	1570.19	2138826.00
Localized Futures Greater Than Breakeven + $11	2494.46	2927788.00	1560.84	2240062.00
Localized Futures Greater Than Breakeven + $12	2341.15	4277787.00	1606.71	2383075.00
Full-Contract	895.61	878118.00	86.62	1204771.00
Contract Price Greater Than Breakeven + $3	1339.53	330073.00	991.51	962443.00
Contract Price Greater Than Breakeven + $6	1957.14	355734.00	1374.56	1639815.00

Table 4 (Continued)

Marketing Strategy	Before 1976		Before 1976	
	Mean	Variance	Mean	Variance
	---------------------Dollars-------------------			
Contract Price Greater Than Breakeven + $7	2042.44	361258.00	1511.73	1861580.00
Contract Price Greater Than Breakeven + $8	2165.23	1315322.00	1550.06	1986548.00
Contract Price Greater Than Breakeven + $9	2508.76	2817352.00	1624.11	2301497.00
Contract Price Greater Than Breakeven + $10	2544.06	3099371.00	1690.00	2407665.00
Contract Price Greater Than Breakeven + $11	2403.13	3907999.00	1610.73	2442993.00
3 - 10-Day Moving Average	1464.87	1539682.00	632.58	1459734.00
5 - 10-Day Moving Average	1470.73	1515519.00	607.99	1367634.00
5 - 15-Day Moving Average	1684.15	2149783.00	512.54	1352429.00

II. Analysis of Selected Finish Hog Producer's Strategies
Simulated With Eight Different Production Criteria

The production criteria simulated with the five different market-
ing strategies were tested in order to determine whether the criteria
could improve profitability by eliminating production during unfavor-
able market conditions. The mean and variance of profitability for
these simulations are listed in Table 5. The number of production
occurrences is also included in this table. Under the full-production
criterion there were 162 production occurrences. However, with the
use of some of the selective production criteria the number of pro-
duction occurrences fell below this level. For example, the localized
futures greater than breakeven + $1 criterion reduced the number of
occurrences to 123.

The results of the mean and variance of profitability for each
of the strategies are illustrated in Figures 2, 3, 4, 5 and 6. These
figures showed that, for all of the marketing strategies except for
full-hedge, the use of a production criterion could not both increase
the mean and reduce the variance of profitability when compared with
the full-production criterion. The full-hedge was the only one of
these strategies for which the use of production criteria was better
than the full-production criterion. The production criteria that
worked best with the full-hedge strategy were the localized futures
greater than breakeven and localized futures greater than breakeven
+ $1. These criteria were successful at eliminating losses by pro-
ducing only if the localized futures price was greater than the
breakeven price on the trading day before a hedge would be placed.

Table 5. Mean and Variance of Profitability and Number of Production Occurrences for Selected Production Criteria Simulated With Five Different Marketing Strategies for Finish Hog Operations, Tennessee, 1972-1979

Marketing Strategy	Production Criterion	Mean	Variance	Number of Production Occurrences
		-----Dollars-----		
Full-Cash				
	Full-Production	1843.27	3531494.00	162
	Localized Futures Greater Than Breakeven	1620.26	3895841.00	132
	Localized Futures Greater Than Breakeven + $1	1469.03	3648650.00	123
	Cash Greater Than Breakeven	1668.08	3843631.00	142
	Cash Greater Than Breakeven + $1	1599.21	3952146.00	136
	Localized Futures Or Cash Greater Than Breakeven	1785.95	3604212.00	157
	Localized Futures Or Cash Greater Than Breakeven + $1	1787.24	3601632.00	156
	Localized Futures Or Cash Greater Than Breakeven + $2	1619.41	3666096.00	140
Full-Hedge				
	Full-Production	894.11	1220179.00	162
	Localized Futures Greater Than Breakeven	966.21	962258.00	132
	Localized Futures Greater Than Breakeven + $1	927.03	1015339.00	123
	Cash Greater Than Breakeven	828.30	1272038.00	142
	Cash Greater Than Breakeven + $1	771.40	1281354.00	136
	Localized Futures Or Cash Greater Than Breakeven	909.41	1177522.00	157

Table 5 (Continued)

Marketing Strategy	Production Criterion	Mean	Variance	Number of Production Occurrences
		------Dollars------		
	Localized Futures Or Cash Greater Than Breakeven + $1	907.35	1183109.00	156
	Localized Futures Or Cash Greater Than Breakeven + $2	909.17	1171784.00	140
Localized Futures Greater Than Cash + $5	Full-Production	2064.25	2788768.00	162
	Localized Futures Greater Than Breakeven	1848.32	2874070.00	132
	Localized Futures Greater Than Breakeven + $1	1678.38	2561040.00	123
	Cash Greater Than Breakeven	1886.45	2993553.00	142
	Cash Greater Than Breakeven + $1	1821.64	3142219.00	136
	Localized Futures Or Cash Greater Than Breakeven	2006.33	2800121.00	157
	Localized Futures Or Cash Greater Than Breakeven + $1	2004.28	2800408.00	156
	Localized Futures Or Cash Greater Than Breakeven + $2	1839.54	2717312.00	140
Localized Futures Greater Than Breakeven + $10	Full-Production	2059.51	2441417.00	162
	Localized Futures Greater Than Breakeven	1841.64	2526643.00	132
	Localized Futures Greater Than Breakeven + $1	1694.47	2330028.00	123
	Cash Greater Than Breakeven	1831.76	2631994.00	142

Table 5 (Continued)

Marketing Strategy	Production Criterion	Mean	Variance	Number of Production Occurrences
		——Dollars——		
	Cash Greater Than Breakeven	1886.45	2993553.00	142
	Cash Greater Than Breakeven + $1	1821.64	3142219.00	136
	Localized Futures Or Cash Greater Than Breakeven	2006.33	2800121.00	157
	Localized Futures Or Cash Greater Than Breakeven + $1	2004.28	2800408.00	156
	Localized Futures Or Cash Greater Than Breakeven + $2	1839.54	2717312.00	140
Localized Futures Greater Than Breakeven + $10	Full-Production	2059.51	2441417.00	162
	Localized Futures Greater Than Breakeven	1841.64	2526643.00	132
	Localized Futures Greater Than Breakeven + $1	1694.47	2330028.00	123
	Cash Greater Than Breakeven	1831.76	2631994.00	142
	Cash Greater Than Breakeven + $1	1757.93	2708739.00	136
	Localized Futures Or Cash Greater Than Breakeven	1990.94	2469715.00	157
	Localized Futures Or Cash Greater Than Breakeven + $1	1992.22	2454262.00	156
	Localized Futures Or Cash Greater Than Breakeven + $2	1799.37	2420439.00	140

Table 5 (Continued)

Marketing Strategy	Production Criterion	Mean	Variance	Number Production Occurrences
		----Dollars----		
Contract Price Greater Than Breakeven + $10	Full-Production	2143.38	2940632.00	162
	Localized Futures Greater Than Breakeven	1910.93	3096275.00	132
	Localized Futures Greater Than Breakeven + $1	1754.82	2850828.00	123
	Cash Greater Than Breakeven	1956.67	3209595.00	142
	Cash Greater Than Breakeven + $1	1879.65	3301942.00	136
	Localized Futures Or Cash Greater Than Breakeven	2085.84	2993748.00	157
	Localized Futures Or Cash Greater Than Breakeven + $1	2087.12	2978639.00	156
	Localized Futures Or Cash Greater Than Breakeven + $2	1888.09	2996487.00	140

Figure 2. Mean and Variance of Profitability for Selected Production
Criteria Using the Full-Cash Marketing Strategy for Finish
Hog Operations, Tennessee, 1972-1979

1. Full-Production
2. Localized Futures Greater
   Than Breakeven
3. Localized Futures Greater
   Than Breakeven + $1
4. Cash Greater Than
   Breakeven
5. Cash Greater Than
   Breakeven + $1
6. Localized Futures or Cash
   Greater Than Breakeven
7. Localized Futures or Cash
   Greater Than Breakeven + $1
8. Localized Futures or Cash
   Greater Than Breakeven + $2
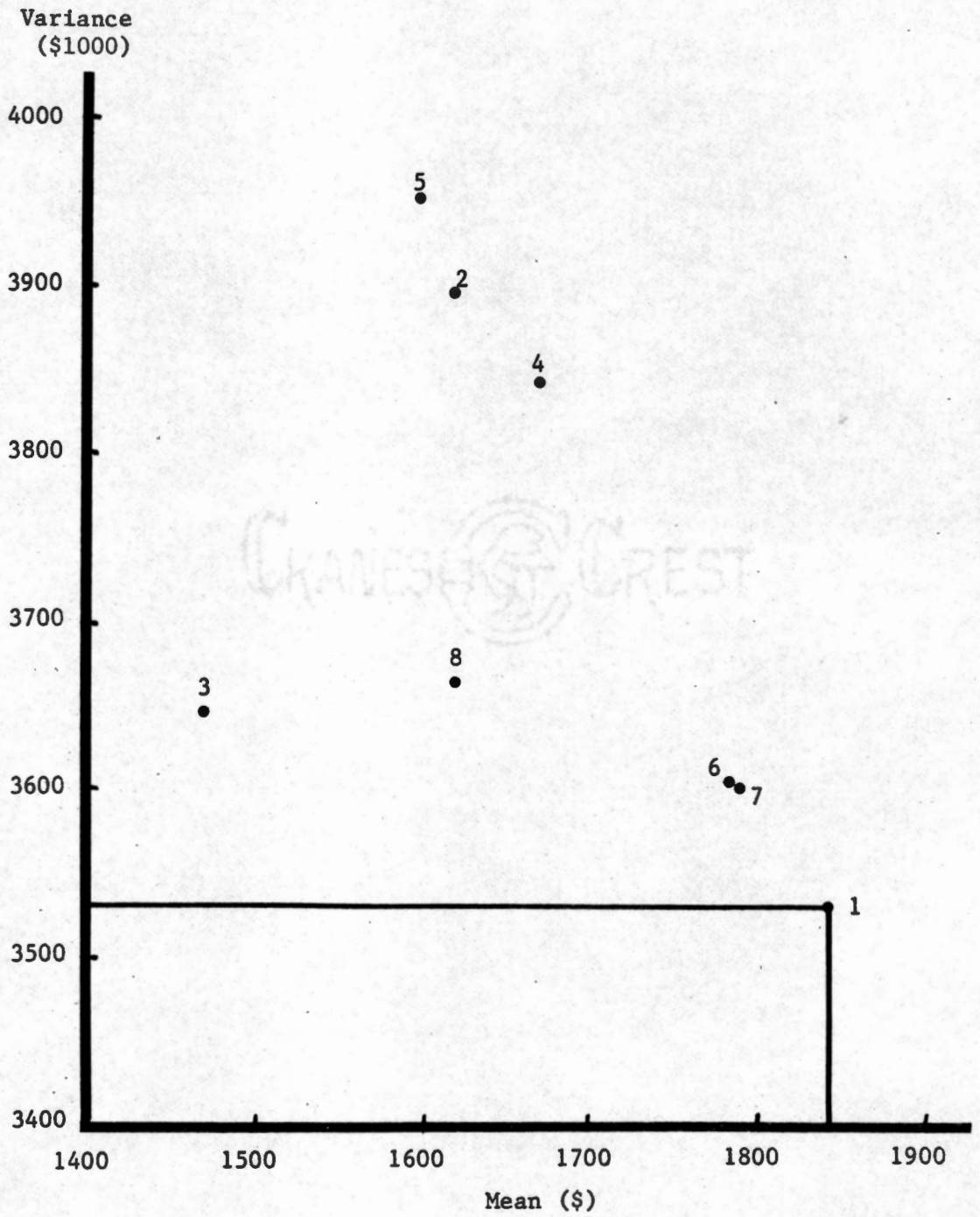
Figure 2.

Figure 3. Mean and Variance of Profitability for Selected Production
Criteria Using the Full-Hedge Marketing Strategy for Finish
Hog Operations, Tennessee, 1972-1979

1. Full-Production
2. Localized Futures Greater
   Than Breakeven
3. Localized Futures Greater
   Than Breakeven + $1
4. Cash Greater Than
   Breakeven
5. Cash Greater Than
   Breakeven + $1
6. Localized Futures Or Cash
   Greater Than Breakeven
7. Localized Futures Or Cash
   Greater Than Breakeven + $1
8. Localized Futures Or Cash
   Greater Than Breakeven + $2
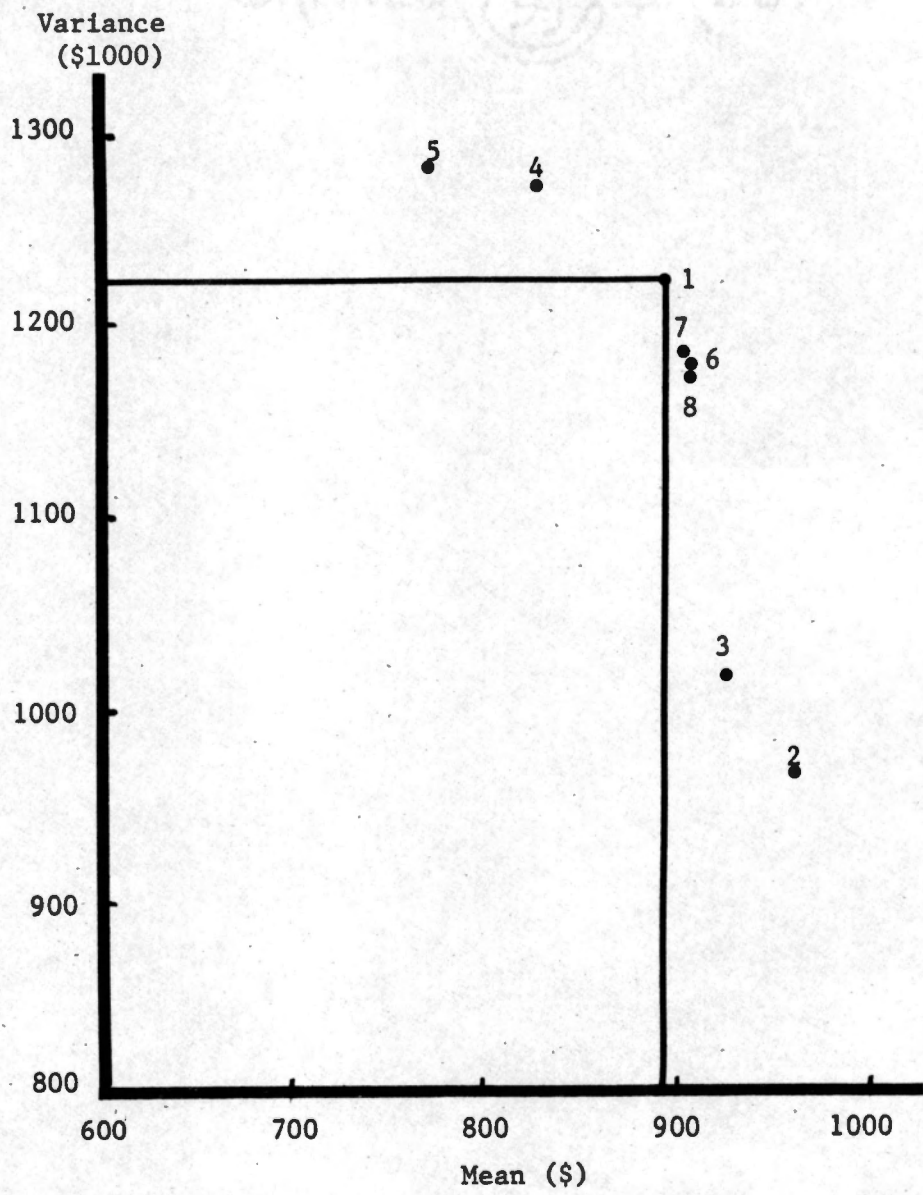
Figure 3.

Figure 4. Mean and Variance of Profitability for Selected Production
Criteria Using the Localized Futures Greater Than Cash + $5
Marketing Strategy for Finish Hog Operations, Tennessee,
1972–1979

1. Full-Production
2. Localized Futures Greater
    Than Breakeven
3. Localized Futures Greater
    Than Breakeven + $1
4. Cash Greater Than
    Breakeven
5. Cash Greater Than
    Breakeven + $1
6. Localized Futures Or Cash
    Greater Than Breakeven
7. Localized Futures Or Cash
    Greater Than Breakeven + $1
8. Localized Futures Or Cash
    Greater Than Breakeven + $2
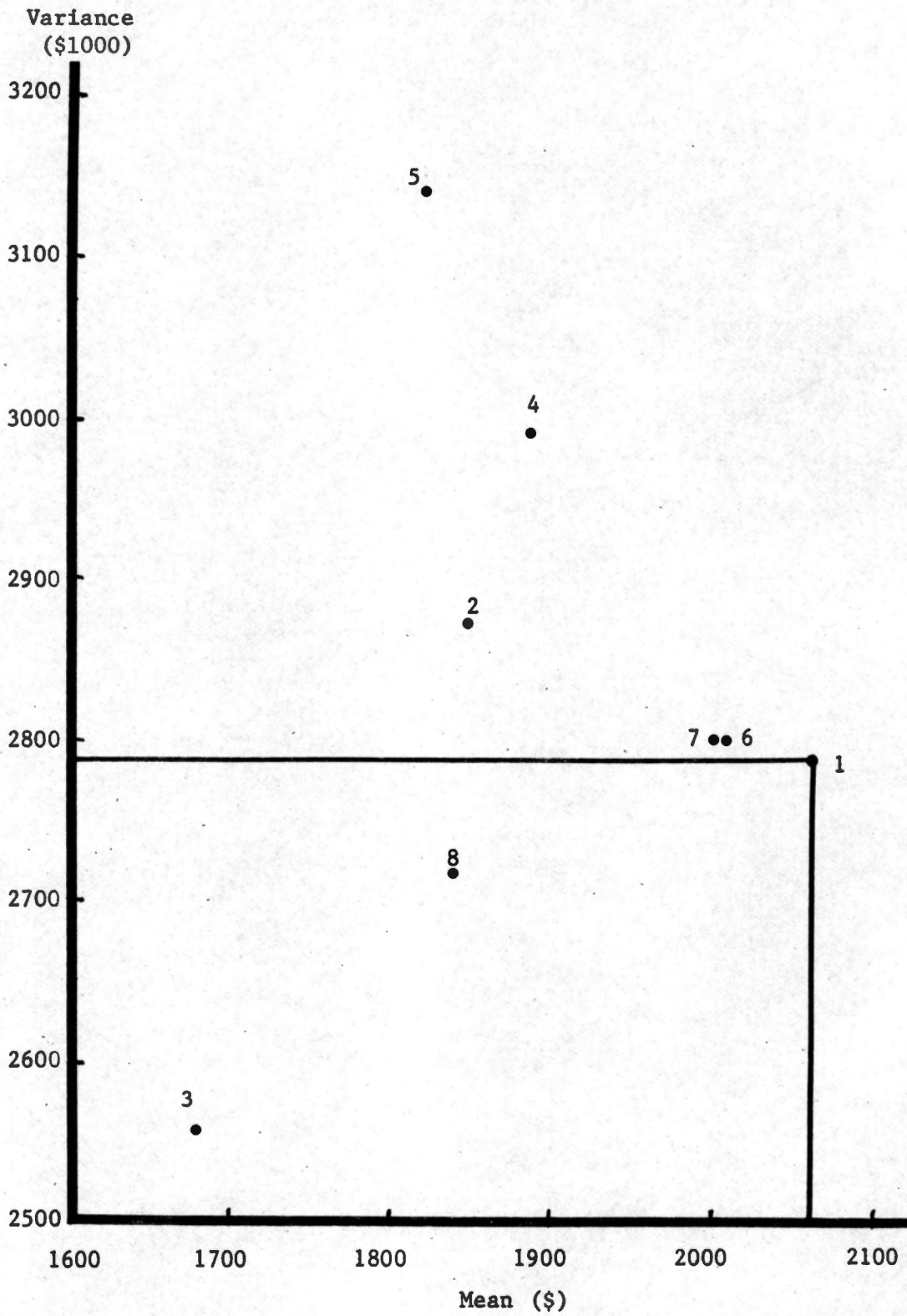
Figure 4.
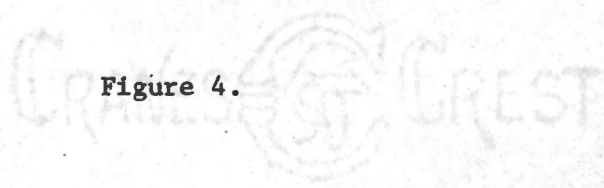
Figure 5. Mean and Variance of Profitability for Selected Production
Criteria Using the Localized Futures Greater Than Breakeven
+ $10 Marketing Strategy for Finish Hog Operations, Tennessee,
1972–1979

1. Full-Production
2. Localized Futures Greater
Than Breakeven
3. Localized Futures Greater
Than Breakeven + $1
4. Cash Greater Than
Breakeven
5. Cash Greater Than
Breakeven + $1
6. Localized Futures Or Cash
Greater Than Breakeven
7. Localized Futures Or Cash
Greater Than Breakeven + $1
8. Localized Futures Or Cash
Greater Than Breakeven + $2
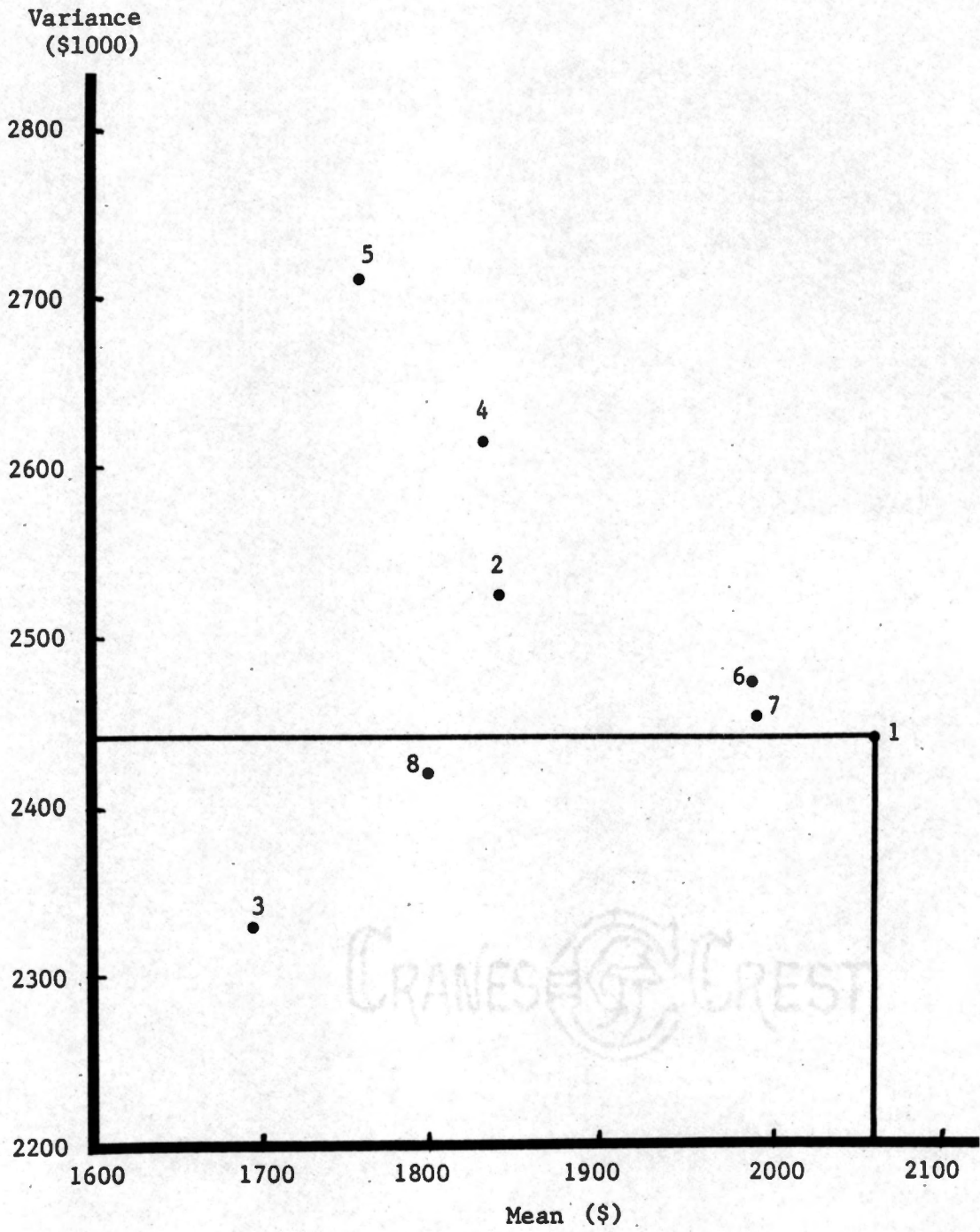
Figure 5.

Figure 6. Mean and Variance of Profitability for Selected Production
Criteria Using the Contract Price Greater Than Breakeven
+ $10 Marketing Strategy for Finish Hog Operations, Tennessee,
1972-1979

1. Full-Production
2. Localized Futures Greater
    Than Breakeven
3. Localized Futures Greater
    Than Breakeven + $1
4. Cash Greater Than
    Breakeven
5. Cash Greater Than
    Breakeven + $1
6. Localized Futures Or Cash
    Greater Than Breakeven
7. Localized Futures Or Cash
    Greater Than Breakeven + $1
8. Localized Futures Or Cash
    Greater Than Breakeven + $2
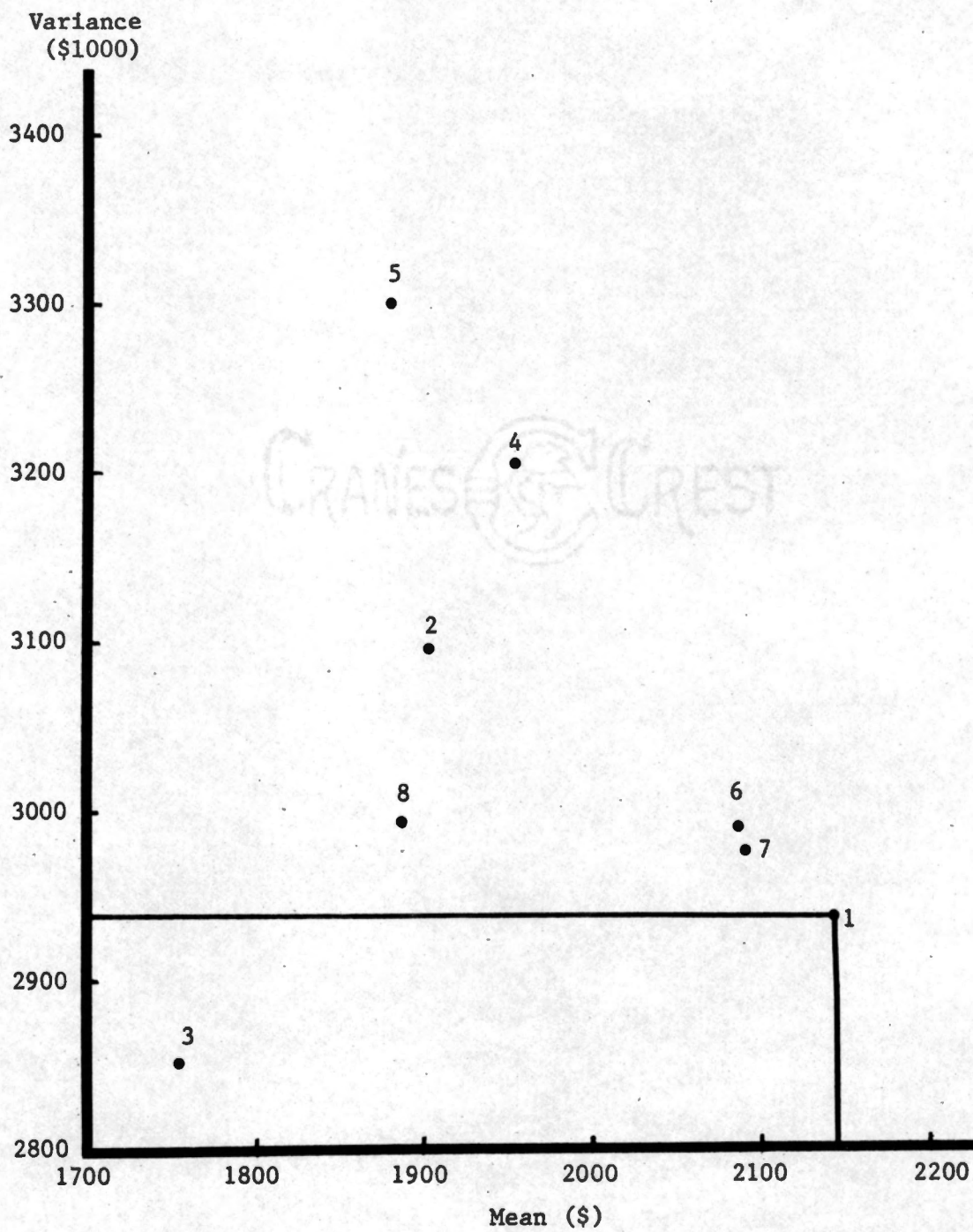
Figure 6.

However, because of the nonselective nature of the full-hedge strategy, even with these production criteria it was still not as profitable as many of the other marketing strategies without production criteria.

III. Analysis of Farrow-to-Finish Hog Producer's
Strategy Simulations

The results of the mean and variance of profitability computations for farrow-to-finish simulations are shown in Table 6 and illustrated in Figure 7. Table 6 also lists the maximum and minimum profit levels per group of hogs and the number of non-full-cash marketings which occurred for each strategy.

The illustration of the mean and variance in Figure 7 is useful for comparison of the different strategies. There were 10 strategies with both a higher mean and lower variance than full-cash. These strategies included comparisons between localized futures and cash, localized futures and breakeven, and contract price and breakeven. For example, the strategy localized futures greater than cash + $5 (No. 10) had a lower variance than full-cash and a mean profit level that was about $250 larger, which would result in an increase in profits of $6,000 per year. There were five other strategies with a higher mean and higher variance than full-cash, but these probably would not be preferable to the 10 strategies with the higher mean and lower variance than full-cash and might not be preferable to full-cash, because of the higher risk factor. The 10 strategies with the higher mean and lower variance were not the only ones that a producer might consider for actual use. Localized futures greater than cash + $3

Table 6. Mean and Variance of Profitability, Maximum and Minimum Profit Levels, and Number of Non-Full-Cash Marketings for Simulated Farrow-to-Finish Hog Operations Using Specified Marketing Strategies, Tennessee, 1972-1979

Marketing Strategy	Mean	Variance	Maximum	Minimum	Number of Non-Full-Cash Marketings
		----------Dollars----------			
Full-Cash	5153.24	4882723.00	11382.51	-215.49	0
Full-Hedge	3839.75	3323610.00	9436.24	-461.30	158
Delivery Months I	4341.09	4146021.00	10422.51	-111.86	92
Delivery Months II	4746.53	4568681.00	11125.14	-26.09	47
Seasonal Lows	4633.32	5604368.00	11382.51	-461.30	63
Localized Futures Greater Than Cash	4477.28	3032452.00	8504.59	-491.09	124
Localized Futures Greater Than Cash + $1	4665.88	2941342.00	8444.59	734.14	110
Localized Futures Greater Than Cash + $3	5150.83	3280913.00	11382.51	1869.81	90
Localized Futures Greater Than Cash + $4	5248.32	3093295.00	11382.51	1869.81	81
Localized Futures Greater Than Cash + $5	5406.12	3449355.00	11382.51	1869.81	69
Localized Futures Greater Than Cash + $6	5370.36	3859700.00	11382.51	1212.03	54
Localized Futures Greater Than Cash + $7	5287.07	4389097.00	11382.51	-215.49	34
Localized Futures Greater Than Breakeven	3838.89	3323610.00	9436.24	-461.30	158
Localized Futures Greater Than Breakeven + $1	3849.18	3254208.00	9436.24	-461.30	158
Localized Futures Greater Than Breakeven + $3	3873.58	3101322.00	9436.24	-461.30	158
Localized Futures Greater Than Breakeven + $9	4046.78	2461316.00	9436.24	918.70	153

Table 6 (Continued)

Marketing Strategy	Mean	Variance --------Dollars--------	Maximum	Minimum	Number of Non-Full-Cash Marketings
Localized Futures Greater Than Breakeven + $12	4415.94	1736358.00	9436.24	1869.81	138
Localized Futures Greater Than Breakeven + $15	4741.33	1589761.00	9436.24	1869.81	118
Localized Futures Greater Than Breakeven + $18	4943.27	2014247.00	9436.24	1869.81	97
Localized Futures Greater Than Breakeven + $21	5202.31	2863575.00	9436.24	1869.81	69
Localized Futures Greater Than Breakeven + $23	5259.40	4168045.00	11382.51	-215.49	58
Localized Futures Greater Than Breakeven + $24	5303.02	4734297.00	11382.51	-215.49	52
Localized Futures Greater Than Breakeven + $25	5330.90	4987149.00	11382.51	-215.49	48
Localized Futures Greater Than Breakeven + $26	5394.54	5281757.00	11382.51	-215.49	43
Localized Futures Greater Than Breakeven + $27	5425.14	5740131.00	11382.51	-215.49	30
Full-Contract	3463.31	2748672.00	8354.22	55.41	158
Contract Price Greater Than Breakeven + $5	3540.95	2404444.00	8354.22	1287.60	157
Contract Price Greater Than Breakeven + $10	3966.95	1484681.00	8354.22	1869.81	140
Contract Price Greater Than Breakeven + $12	4276.00	1186422.00	8354.22	1869.81	127
Contract Price Greater Than Breakeven + $15	4657.54	1246496.00	8354.22	1869.81	106
Contract Price Greater Than Breakeven + $18	4988.12	1865701.00	8385.39	1869.81	86

Table 6 (Continued)

Marketing Strategy	Mean	Variance	Maximum	Minimum	Number of Non-Full-Cash Marketings
		------Dollars------			
Contract Price Greater Than Breakeven + $21	5212.67	3279637.00	11382.51	1869.81	63
Contract Price Greater Than Breakeven + $22	5221.12	3959054.00	11382.51	-215.49	52
Contract Price Greater Than Breakeven + $23	5303.90	4247362.00	11382.51	-215.49	46
Contract Price Greater Than Breakeven + $24	5341.38	5021510.00	11382.51	-215.49	39
Contract Price Greater Than Breakeven + $25	5397.00	5279264.00	11382.51	-215.49	35
3 - 10-Day Moving Average	3882.07	4067191.00	9862.24	-1804.91	158
5 - 10-Day Moving Average	3872.71	3985835.00	9862.24	-1804.91	158
5 - 15-Day Moving Average	4128.52	3621840.00	10114.75	-641.30	158

Figure 7. Mean and Variance for Simulated Farrow-to-Finish Hog Opera-
           tions Using Specified Marketing Strategies, Tennessee, 1972-
           1979

1. Full-Cash
2. Full-Hedge
3. Delivery Months I
4. Delivery Months II
5. Seasonal Lows
6. Localized Futures Greater
    Than Cash
7. Localized Futures Greater
    Than Cash + $1
8. Localized Futures Greater
    Than Cash + $3
9. Localized Futures Greater
    Than Cash + $4
10. Localized Futures Greater
    Than Cash + $5
11. Localized Futures Greater
    Than Cash + $6
12. Localized Futures Greater
    Than Cash + $7
13. Localized Futures Greater
    Than Breakeven
14. Localized Futures Greater
    Than Breakeven + $1
15. Localized Futures Greater
    Than Breakeven + $3
16. Localized Futures Greater
    Than Breakeven + $9
17. Localized Futures Greater
    Than Breakeven + $12
18. Localized Futures Greater
    Than Breakeven + $15
19. Localized Futures Greater
    Than Breakeven + $18
20. Localized Futures Greater
    Than Breakeven + $21

21. Localized Futures Greater
    Than Breakeven + $23
22. Localized Futures Greater
    Than Breakeven + $24
23. Localized Futures Greater
    Than Breakeven + $25
24. Localized Futures Greater
    Than Breakeven + $26
25. Localized Futures Greater
    Than Breakeven + $27
26. Full-Contract
27. Contract Price Greater
    Than Breakeven + $5
28. Contract Price Greater
    Than Breakeven + $10
29. Contract Price Greater
    Than Breakeven + $12
30. Contract Price Greater
    Than Breakeven + $15
31. Contract Price Greater
    Than Breakeven + $18
32. Contract Price Greater
    Than Breakeven + $21
33. Contract Price Greater
    Than Breakeven + $22
34. Contract Price Greater
    Than Breakeven + $23
35. Contract Price Greater
    Than Breakeven + $24
36. Contract Price Greater
    Than Breakeven + $25
37. 3 - 10-Day Moving Average
38. 5 - 10-Day Moving Average
39. 5 - 15-Day Moving Average

Key: * Compares Localized Futures and Cash

     ◆ Compares Localized Futures and Breakeven

     ✿ Compares Contract Price and Breakeven

     ◊ Moving Averages

Figure 7.

(No. 8) had a profit level nearly equal to full-cash with a much lower variance. Contract price greater than breakeven + $18 (No. 31) had a mean profit level about $150 below that of full-cash, but the variance was less than one-half the level associated with full-cash.

Since smaller variance and larger mean were the desired characteristics, those strategies for which there were no other strategies with both smaller variance and lower mean were potential optimal strategies. That is, if there were no strategies below and to the right of any particular strategy (Figure 7), then it was superior to others in its immediate vicinity which did not meet this criterion. Strategies which met this criterion were numbers 29, 30, 18, 31, 20, 9, and 10. This set of strategies traced a mean-variance frontier which would provide a tangency to the mean-variance indifference curve of the producer. Thus, one of this set of strategies would be optimal for any particular producer. The choice of the best strategy for a producer would depend upon his own preferences and his ability to withstand risk.

Two of the major differences between the results of the finish and farrow-to-finish simulations were the larger mean profit and variance obtainable through the farrow-to-finish operation, and the difference between dollar levels above breakeven price for the strategies which compared localized futures and breakeven, and contract price and breakeven. These differences can be attributed to the lower breakeven prices associated with the farrow-to-finish operation. These lower prices were caused by the differences in costs related to the two different methods used in obtaining feeder pigs. The simulated

finish producer bought feeder pigs on the cash market at a price which, in the long run, would include both the variable and fixed costs of production as well as changes related to shifts in supply and demand. However, the farrow-to-finish operator produced his own feeder pigs and only the variable costs of producing the feeder pigs were included in his budget. Therefore, the basic difference between the two enter-prises was the fixed costs of producing feeder pigs and the effects of supply and demand on the feeder pig price.

The full-hedge (No. 2) and full-contract (No. 26) strategies were included in the farrow-to-finish simulations as benchmarks for com-parison and resulted in very low mean levels with about average levels of variance. More selective hedging and cash contracting strategies were able to attain much larger mean profit levels with either lower or about equal levels of variance. These results indicate the value of selective measures for choosing an appropriate price for marketing hogs.

The strategies that compared localized futures and cash, localized futures and breakeven, and contract price and breakeven had a similar pattern to that discussed previously for the finish producer's market-ing strategies. The less selective of these strategies had a relatively low mean. As the strategies became more selective the mean of returns increased and the variance of returns initially decreased, but began to increase as the selectivity increased. The more selective strategies had fewer numbers of hedges and cash contracts and increases in selectivity would have eventually made these strategies equivalent to full-cash.

The results of the less selective strategies were similar to those of the finish producer's simulations. The delivery months I (No. 3), delivery months II (No. 4), seasonal lows (No. 5), and moving average strategies (Nos. 37, 38, 39) all performed rather poorly when compared with some of the more selective strategies, as well as full-cash. The use of the two delivery months strategies lowered the variance of returns below the level associated with full-cash. However, the variance was still larger for delivery months than for many of the other strategies which also had equal or larger mean profits. The use of seasonal lows to trigger hedges resulted in a large level of variance and a low mean profit. None of the moving averages fared very well with only the 5--15-day strategy giving results that appeared to be better than full-hedge. All of these results tended to indicate that the more selective strategies provided the producer with better returns.

Analysis of Selected Strategy Simulations on a Yearly Basis

The yearly means of profit for selected farrow-to-finish marketing strategies were computed for the years 1972 through 1979 to give an illustration of the effects of the different levels of mean and variance on the producer's annual cash flow. The results of the yearly mean computations are listed in Table 7. The full-cash and full-hedge strategies were chosen for comparison and localized futures greater than cash + $5, localized futures greater than breakeven + $24, and contract price greater than breakeven + $24 were chosen because they had large profit levels but still had lower variance than full-cash. Contract price greater than breakeven + $18 was included

Table 7. Yearly Means of Profitability for Selected Farrow-to-Finish Hog Producer's Strategies, Tennessee, 1972-1979

Marketing Strategy	1972[1]	1973	1974	1975	1976	1977	1978	1979[2]
Full-Cash	3999.61	6298.01	2865.46	6179.77	5712.59	3465.19	6509.83	7631.34
Full-Hedge	2935.61	2886.64	4277.83	4231.49	6190.73	2217.82	3597.83	4577.59
Localized Futures Greater Than Cash + $5	3958.57	6662.36	5197.81	5468.40	5688.32	3215.01	6639.16	7026.34
Localized Futures Greater Than Breakeven + $24	3999.61	6943.47	3459.63	5562.88	6210.71	3465.19	6462.39	7101.34
Contract Price Greater Than Breakeven + $18	3999.61	5712.26	5118.07	4820.38	5416.84	3465.19	5818.32	5400.08
Contract Price Greater Than Breakeven + $24	3999.61	6915.88	3369.20	5948.12	5852.46	3465.19	6739.32	7575.09

[1]1972 included only 12 observations for calculating the mean profit for each strategy.

[2]1979 included only 4 observations used in calculating the mean profit for each strategy.

because it had a relatively large profit level with a variance that was much lower than the variance of profit obtained with full-cash. The results shown in the table indicate the high degree of cash-flow variability associated with those strategies with large variance.

Mean-Variance Analysis of Strategy Simulations for Hogs Marketed on the Fifth Day of the Month and on the Twentieth

The mean and variance of profitability were analyzed for hogs marketed on the fifth day of the month and on the twentieth to test for possible effects of the marketing date upon profitability. These results are listed in Table 8 and were similar to those for the finish producer's operation. Over half of the strategies had a larger variance for hogs marketed on the fifth. The variance was not lower for hogs marketed on the fifth under strategies with a large number of hedging occurrences, which did not provide any support to the theory that the basis is less variable near or during delivery months. Only three of the strategies in Table 8 had a larger mean for hogs marketed on the fifth as compared to hogs marketed on the twentieth. This indicates that during the production period the twentieth was a more profitable day to market hogs than the fifth.

Mean-Variance Analysis of Strategy Simulations for Hogs Marketed Before 1976 and After 1975

Mean-variance analysis was also computed for hogs marketed before 1976 and for hogs marketed after 1975 in an attempt to detect possible structural changes that might have occurred and affected the results of the strategy simulations. Inspection of Table 9 indicates that the

Table 8. Mean and Variance of Profitability for Hogs Marketed on the
5th Day of the Month and for Hogs Marketed on the 20th Under
Simulated Farrow-to-Finish Hog Operations Using Specified
Marketing Strategies, Tennessee, 1972-1979

Marketing Strategy	Hogs Marketed On The 5th		Hogs Marketed On The 20th	
	Mean	Variance	Mean	Variance
	----------------Dollars----------------			
Full-Cash	5062.99	4954484.00	5245.80	4855438.00
Full-Hedge	2806.24	3351978.00	3874.12	3335425.00
Delivery Months I	4259.75	3860992.00	4424.52	4478440.00
Delivery Months II	4259.75	3860992.00	5245.80	4855438.00
Seasonal Lows	4560.18	5767780.00	4708.34	5498278.00
Localized Futures Greater Than Cash	4415.60	3418005.00	4540.54	2668354.00
Localized Futures Greater Than Cash + $1	4603.30	3072576.00	4730.07	2836735.00
Localized Futures Greater Than Cash + $3	5105.90	3416381.00	5196.91	3180382.00
Localized Futures Greater Than Cash + $4	5192.78	3084793.00	5305.28	3135799.00
Localized Futures Greater Than Cash + $5	5352.87	3496046.00	5460.73	3440381.00
Localized Futures Greater Than Cash + $6	5297.01	4021484.00	5445.59	3732599.00
Localized Futures Greater Than Cash + $7	5195.64	4510532.00	5380.84	4303961.00
Localized Futures Greater Than Breakeven	3803.99	3351741.00	3874.69	3334573.00
Localized Futures Greater Than Breakeven + $1	3805.87	3337477.00	3893.62	3207199.00
Localized Futures Greater Than Breakeven + $3	3827.99	3200290.00	3920.35	3035800.00
Localized Futures Greater Than Breakeven + $9	4004.67	2499506.00	4089.98	2450456.00
Localized Futures Greater Than Breakeven + $12	4390.84	1661966.00	4441.68	1833918.00
Localized Futures Greater Than Breakeven + $15	4657.31	1480647.00	4827.51	1707500.00
Localized Futures Greater Than Breakeven + $18	4847.21	1931002.00	5041.80	2106457.00
Localized Futures Greater Than Breakeven + $21	5096.28	2767527.00	5311.06	2975759.00
Localized Futures Greater Than Breakeven + $23	5161.77	4594879.00	5359.54	3764260.00
Localized Futures Greater Than Breakeven + $24	5225.08	4865322.00	5382.95	4648664.00
Localized Futures Greater Than Breakeven + $25	5296.75	5152939.00	5365.93	4879439.00

Table 8 (Continued)

Marketing Strategy	Hogs Marketed On The 5th		Hogs Marketed On The 20th	
	Mean	Variance	Mean	Variance
	----------Dollars----------			
Localized Futures Greater Than Breakeven + $26	5365.58	5476559.00	5424.25	5148798.00
Localized Futures Greater Than Breakeven + $27	5342.74	5668296.00	5509.65	5874129.00
Full-Contract	3519.19	2792386.00	3406.00	2733046.00
Contract Price Greater Than Breakeven + $5	3599.33	2413204.00	3481.08	2419593.00
Contract Price Greater Than Breakeven + $10	3994.50	1518937.00	3938.69	1467222.00
Contract Price Greater Than Breakeven + $12	4257.22	1171617.00	4295.38	1216275.00
Contract Price Greater Than Breakeven + $15	4602.07	1265308.00	4714.42	1236914.00
Contract Price Greater Than Breakeven + $18	4902.90	1762300.00	5075.54	1991039.00
Contract Price Greater Than Breakeven + $21	5118.19	3315269.00	5309.57	3267017.00
Contract Price Greater Than Breakeven + $22	5152.76	4008827.00	5291.23	3949647.00
Contract Price Greater Than Breakeven + $23	5246.41	4355655.00	5362.77	4184582.00
Contract Price Greater Than Breakeven + $24	5293.12	5095900.00	5390.88	5005074.00
Contract Price Greater Than Breakeven + $25	5348.10	5360403.00	5447.15	5259636.00
3 - 10-Day Moving Average	3785.69	4008960.00	3980.93	4160256.00
5 - 10-Day Moving Average	3805.83	3877288.00	3941.31	4139599.00
5 - 15-Day Moving Average	4084.23	3689747.00	4173.96	3595154.00

Table 9. Mean and Variance of Profitability for Hogs Marketed Before 1976 and for Hogs Marketed After 1975 for Simulated Farrow-to-Finish Hog Operations Using Specified Marketing Strategies, Tennessee, 1972–1979

	Before 1976		After 1975	
Marketing Strategy	Mean	Variance	Mean	Variance
	----------------Dollars-----------------			
Full-Cash	4965.68	6038057.00	5355.60	3620222.00
Full-Hedge	3661.21	2305563.00	4032.38	4395042.00
Delivery Months I	4219.05	3854866.00	4472.76	4481976.00
Delivery Months II	4595.91	4851516.00	4909.05	4272646.00
Seasonal Lows	4495.80	6083103.00	4781.70	5119156.00
Localized Futures Greater Than Cash	4418.34	2242137.00	4540.87	3918588.00
Localized Futures Greater Than Cash + $1	4574.69	1907583.00	4764.28	4078165.00
Localized Futures Greater Than Cash + $3	5115.84	2735906.00	5188.57	3910574.00
Localized Futures Greater Than Cash + $4	5248.41	2543566.00	5248.22	3728343.00
Localized Futures Greater Than Cash + $5	5524.93	3193664.00	5277.93	3739511.00
Localized Futures Greater Than Cash + $6	5411.72	3904736.00	5325.73	3858739.00
Localized Futures Greater Than Cash + $7	5208.65	4863658.00	5371.68	3921196.00
Localized Futures Greater Than Breakeven	3659.57	2304118.00	4032.38	4395042.00
Localized Futures Greater Than Breakeven + $1	3679.40	2177448.00	4032.38	4395042.00
Localized Futures Greater Than Breakeven + $3	3790.21	2011875.00	4050.93	4257928.00
Localized Futures Greater Than Breakeven + $9	3878.46	1586348.00	4228.40	3374786.00
Localized Futures Greater Than Breakeven + $12	4365.29	911666.00	4470.59	2644356.00
Localized Futures Greater Than Breakeven + $15	4773.08	899133.00	4707.08	2354547.00
Localized Futures Greater Than Breakeven + $18	5002.42	1568875.00	4879.46	2514221.00
Localized Futures Greater Than Breakeven + $21	5282.73	2565399.00	5115.55	3209204.00
Localized Futures Greater Than Breakeven + $23	5152.27	4521326.00	5375.00	3816072.00
Localized Futures Greater Than Breakeven + $24	5148.23	5296579.00	5470.03	4135785.00
Localized Futures Greater Than Breakeven + $25	5141.43	5546818.00	5535.34	4367670.00
Localized Futures Greater Than Breakeven + $26	5213.76	5904090.00	5589.60	4605835.00

Table 9 (Continued)

Marketing Strategy	Before 1976		After 1975	
	Mean	Variance	Mean	Variance
	-------Dollars-------			
Localized Futures Greater Than Breakeven + $27	5226.60	6540085.00	5639.35	4863194.00
Full-Contract	3374.15	2048253.00	3559.51	3523800.00
Contract Price Greater Than Breakeven + $5	3449.66	1704625.00	3639.44	3173448.00
Contract Price Greater Than Breakeven + $10	3818.88	1076696.00	4126.71	1895267.00
Contract Price Greater Than Breakeven + $12	4192.27	747546.00	4366.47	1660269.00
Contract Price Greater Than Breakeven + $15	4660.85	917198.00	4653.96	1618734.00
Contract Price Greater Than Breakeven + $18	5044.78	1501633.00	4927.00	2276523.00
Contract Price Greater Than Breakeven + $21	5223.94	3534904.00	5200.51	3047515.00
Contract Price Greater Than Breakeven + $22	5131.23	4494260.00	5318.10	3415559.00
Contract Price Greater Than Breakeven + $23	5207.00	4785079.00	5408.46	3702026.00
Contract Price Greater Than Breakeven + $24	5222.84	6071235.00	5469.29	3922933.00
Contract Price Greater Than Breakeven + $25	5267.70	6297441.00	5536.51	4212125.00
3 - 10-Day Moving Average	3683.24	2979932.00	4096.60	5205845.00
5 - 10-Day Moving Average	3642.70	2999712.00	4120.88	4983784.00
5 - 15-Day Moving Average	4228.54	2634126.00	4020.62	4714175.00

ranking of the strategies was about equal between these two time periods. The relative performance of the strategies changed very little. Therefore, the differences in mean and variance that occurred would seem to be the result of changes in cash and breakeven prices rather than due to structural changes that might have affected the performance of the strategies. Examination of Table 9 shows that the mean was larger for hogs marketed before 1976 under 10 of the marketing strategies. This would indicate that the cash price increased by a large enough amount after 1975 to more than cover, on the average, the increase in breakeven prices. The variance was larger for hogs marketed before 1976 under 15 of the marketing strategies. This is about half of the total number of strategies that were simulated, therefore there seems to be about an equal amount of risk for hogs marketed during these two time periods.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

I. Summary

The problem of adverse price fluctuations has been an ever-present burden to slaughter hog producers. Methods for avoiding the problem and increasing overall returns through the use of alternative marketing strategies were the general subjects of this research. The strategies considered involved use of futures markets for hedging or use of forward cash contracting as methods for increasing profitability and/or reducing the risk of adverse price movements in the cash market. The alternative strategies were evaluated by simulating their use over a period of time and comparing the resulting effects of profitability and variability of profit. Specifically, the objectives of this study were: (1) to simulate hog finishing operations and farrow-to-finish operations using historical data and various marketing strategies including cash contracting, hedging, and the typical cash sale; (2) to determine the optimal marketing strategies using the mean and variance of profitability as criteria for comparison; and (3) to test the accuracy of the futures market as a guide to slaughter hog producers in making the decision to produce or not.

The various marketing methods were analyzed through the use of simulation models that were developed to represent finish and farrow-to-finish hog operations. These models simulated a production operation which started and finished the equivalent of one futures contract of hogs on the fifth and twentieth of every month for the period beginning

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in January 1972 and extending through February 1979. The budgets upon which the simulations were based included only the variable costs of production. Breakeven prices from these budgets were used in the calculation of profitability for each of the production occurrences. The mean levels of profit and the variance of profitability were the primary criteria used in analyzing the results of the swine production simulations. Optimality was based upon the farmer's assumed preference for a high mean level of profit and a low level of variance.

The marketing strategies simulated included the traditional full-cash and full-hedge as well as various selective cash contracting and hedging strategies. Selective cash contracting was evaluated under criteria that compared the contract price to various levels above the breakeven price. Selective hedging was evaluated with various types of criteria that utilized moving averages, localized futures and cash, and localized futures and breakeven, as well as hedging that occurred only during delivery months and at points of seasonal low prices. A selected group of these marketing strategies, including full-cash, full-hedge, and three of the more successful selective strategies, were also simulated with different production criteria in order to analyze the effectiveness of these production criteria in avoiding production during periods when positive returns could not be attained for the finish operation.

Mean-variance analysis was applied to the results of the strategy simulations for the finish and farrow-to-finish hog operations in order to determine which strategies performed best and to determine whether the use of production criteria was beneficial. The mean and variance

of profitability was also computed separately for hogs marketed on the fifth day of the month and on the twentieth, as well as separately for hogs marketed before 1976 and after 1975. These computations were made to test for possible effects of the marketing date upon profitability and to detect possible structural changes that might have occurred during the simulation period and affected the results of the simulations.

The mean-variance analysis showed that there were numerous strategies under both the finish and farrow-to-finish hog operations which had both a larger mean and a smaller variance than full-cash, which was used as a benchmark for comparison because it is probably the most widely used marketing strategy. These were the more selective strategies which compared localized futures and cash, localized futures and breakeven, and contract price and breakeven. There were also several other strategies which resulted in a slightly smaller mean than full-cash but a much smaller variance. The less selective strategies such as full-hedge and full-contract resulted in low variance, but they also showed an extremely low mean profit level.

More specifically, those strategies which made up the potential optimal set for finish hog operations were as follows:

1 - Contract if Contract Price Greater Than Breakeven Price + $3

2 - Hedge if Localized Future Price Greater Than Breakeven Price + $5

3 - Contract if Contract Price Greater Than Breakeven Price + $6

4 - Contract if Contract Price Greater Than Breakeven Price + $7

5 - Contract if Contract Price Greater Than Breakeven Price + $8

6 – Hedge if Localized Futures Price Greater Than Breakeven Price + $9

7 – Hedge if Localized Futures Price Greater Than Breakeven Price + $10

8 – Contract if Contract Price Greater Than Breakeven Price + $9

9 – Contract if Contract Price Greater Than Breakeven Price + $10

Those strategies which made up the potential optimal set for farrow-to-finish hog operations were as follows:

1 – Contract if Contract Price Greater Than Breakeven Price + $12

2 – Contract if Contract Price Greater Than Breakeven Price + $15

3 – Hedge if Localized Futures Price Greater Than Breakeven Price + $15

4 – Contract if Contract Price Greater Than Breakeven Price + $18

5 – Hedge if Localized Futures Price Greater Than Breakeven Price + $21

6 – Hedge if Localized Futures Price Greater Than Cash Price + $4

7 – Hedge if Localized Futures Price Greater Than Cash Price + $5

The mean and variance calculations computed separately for hogs marketed on the fifth day of the month and on the twentieth did not show that either of the marketing days had an advantage over the other in providing lower risk, and the strategies with a large number of hedging occurrences, including full-hedge, did not have lower variance for hogs marketed on the fifth. The results indicated that almost all strategies under both the finish and farrow-to-finish operations had higher means for hogs marketed on the twentieth rather than the fifth.

The mean and variance of profitability for hogs marketed before 1976 compared to those marketed after 1975 did not show substantial changes in the ranking of the strategies over the period of analysis. Larger means resulted for hogs marketed before 1976 under the finish hog operation. However, under the farrow-to-finish hog operation the mean was larger under more of the strategies for hogs marketed after 1975. The variance was about equal for the two time periods under both of these hog operations. The differences in results were attributed to changes in cash prices, futures prices, and breakeven prices rather than due to structural changes.

II. Conclusions and Implications

The results of the finish and farrow-to-finish hog operations simulations showed that there were selective strategies which could provide larger mean profit and smaller variance than the traditional full-cash strategy. In addition, several of the strategies showed higher means and lower variances than the full-hedge or full-contract strategies. Therefore, assuming that the market conditions during the simulation period are fairly representative of what will occur in the future and that the simulation procedures are sufficiently representative of actual Tennessee producers' operations, a producer using the full-cash strategy or one of the other less selective strategies could improve profitability and/or lower risk by switching to one of the more selective forward pricing strategies which proved to be more successful. Even though a producer's operation does not correspond exactly with the production operations that were simulated, if his budgeting process is similar these results should apply.

The production criteria that were tested with five of the market-
ing strategies under the finish operation gave poor results. The
comparisons between cash price and breakeven price and between local-
ized futures and breakeven price that were used as production criteria
were not successful in preventing production when the market was
unfavorable. These results indicate that cash and futures prices are
inadequate devices for prediction of cash prices in the future and
are, therefore, poor guides as to when production will be unprofitable.

The mean-variance analysis of profitability for hogs marketed on
the fifth day of the month and on the twentieth showed that the
variance was not less variable for hogs marketed on the fifth under
strategies with a large number of hedging occurrences, including full-
hedge. Therefore, the theory of less basis variability near or during
delivery months, which should result in less variability of profits,
was not substantiated by this evidence.

The analysis of mean and variance of profitability for hogs mar-
keted before 1976 and after 1975 showed no substantial differences in
the ranking of the marketing strategies for these two time periods.
Therefore, the relative rankings of the various strategies seemed to
be stable enough to be indicative of immediate future performance.

III. Future Research Implications

Prediction of the basis is of utmost importance to the producer
who is using the localized futures price as part of his criteria for
hedging livestock on the futures market. The two-year method of basis
estimation, which was used in this study, was chosen as a reasonable

technique for estimating the basis. However, further testing of this technique's actual prediction capabilities was beyond the scope of this study. Therefore, further research in the areas of basis analysis and prediction techniques seems to be needed in order to provide the producer with an efficient method of predicting the basis.

The success of the more selective marketing strategies in increasing profit and reducing risk indicates a need for further research in the area of marketing strategy simulation. Such techniques as point-and-figure analysis and more sophisticated moving averages strategies may prove to be successful. Research on the use of marketing strategies with other types of production operations and with different livestock enterprises, that are prominent throughout Tennessee, may also provide the producer with valuable information that would allow him to increase the profitability of his enterprise.

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APPENDIX

Table 10. Monthly Breakeven Prices for the Finish and Farrow-to-Finish Hog Operations, Tennessee, 1970-1979

Year	Month	Finish	Farrow-to-Finish
		--------Dollars per cwt.---------	
1970	January	22.523	14.924
	February	24.885	15.131
	March	25.722	15.276
	April	24.219	15.428
	May	22.174	15.535
	June	21.181	15.812
	July	20.637	16.079
	August	19.466	16.183
	September	19.586	16.625
	October	18.273	16.715
	November	17.891	16.999
	December	17.347	17.138
1971	January	17.543	17.745
	February	19.737	17.625
	March	19.493	17.712
	April	19.662	17.879
	May	20.095	17.819
	June	19.321	17.848
	July	19.510	17.822
	August	19.504	17.184
	September	18.373	15.969
	October	18.334	14.850
	November	18.148	14.790
	December	19.022	14.910
1972	January	21.365	15.323
	February	22.768	15.484
	March	24.149	15.816
	April	24.104	16.096
	May	24.000	16.096
	June	23.444	16.067
	July	23.849	16.077
	August	24.838	16.013
	September	23.686	16.111
	October	22.329	16.058
	November	21.499	16.637
	December	23.274	17.671
1973	January	27.140	20.266
	February	30.153	20.758
	March	33.707	21.211
	April	32.838	21.475
	May	35.864	24.864
	June	36.749	29.008
	July	42.265	28.062
	August	45.998	31.043
	September	39.096	27.138

Table 10 (continued)

Year	Month	Finish	Farrow-to-Finish
		---------Dollars per cwt.---------	
1973	October	37.848	25.897
	November	35.665	24.580
	December	35.437	26.518
1974	January	36.342	27.431
	February	37.682	28.079
	March	36.694	28.118
	April	34.828	26.675
	May	30.068	26.061
	June	28.284	26.065
	July	31.210	26.812
	August	34.862	31.700
	September	34.547	31.198
	October	36.907	31.815
	November	34.462	30.951
	December	35.441	30.342
1975	January	35.317	29.169
	February	37.384	27.778
	March	38.625	26.166
	April	40.896	26.743
	May	40.806	26.009
	June	42.427	25.941
	July	41.849	25.540
	August	44.859	26.293
	September	49.338	25.704
	October	44.730	24.903
	November	39.582	23.907
	December	38.643	23.834
1976	January	39.027	24.968
	February	40.793	24.656
	March	41.977	25.156
	April	43.028	25.001
	May	40.465	25.505
	June	40.313	27.771
	July	40.081	29.706
	August	38.309	28.836
	September	36.143	29.061
	October	32.528	28.267
	November	31.149	26.996
	December	33.520	28.143
1977	January	34.477	29.085
	February	39.013	29.606
	March	41.170	30.198
	April	42.363	30.917
	May	42.313	30.535
	June	39.236	29.928
	July	37.968	27.299
	August	38.232	24.898

Table 10 (continued)

Year	Month	Finish	Farrow-to-Finish
		--------Dollars per cwt.--------	
1977	September	34.962	23.422
	October	33.068	22.733
	November	32.769	24.137
	December	32.990	25.150
1978	January	35.022	25.774
	February	39.208	26.186
	March	42.459	26.316
	April	45.243	26.955
	May	45.519	26.828
	June	41.554	27.769
	July	41.077	27.647
	August	44.502	26.652
	September	43.328	26.032
	October	42.372	25.683
	November	40.523	26.616
	December	39.855	26.708
1979	January	40.781	26.899
	February	44.789	26.969

Table 11. Basis Estimates Computed Using Tennessee Auctions Cash
Data and a Two-Year Moving Average for the First and Third
Ten-Day Periods for Each Month, 1972-1979

Year	Month	Ten-Day Period	Basis Estimate
1972	January	1	1.158
	January	3	1.223
	February	1	0.422
	February	3	-0.110
	March	1	0.048
	March	3	1.493
	April	1	1.635
	April	3	4.137
	May	1	3.706
	May	3	2.460
	June	1	1.963
	June	3	1.419
	July	1	1.471
	July	3	0.068
	August	1	0.497
	August	3	-0.391
	September	1	0.013
	September	3	0.264
	October	1	0.163
	October	3	0.920
	November	1	1.176
	November	3	1.343
	December	1	1.449
	December	3	2.168
1973	January	1	2.189
	January	3	1.583
	February	1	1.129
	February	3	-0.376
	March	1	0.014
	March	3	1.386
	April	1	1.500
	April	3	4.449
	May	1	3.593
	May	3	2.130
	June	1	1.917
	June	3	1.809
	July	1	1.692
	July	3	0.321
	August	1	0.576
	August	3	-0.951
	September	1	-0.095
	September	3	0.482
	October	1	0.516

Table 11 (continued)

Year	Month	Ten-Day Period	Basis Estimate
1973	October	3	1.266
	November	1	1.863
	November	3	1.845
	December	1	1.619
	December	3	3.173
1974	January	1	2.599
	January	3	0.967
	February	1	0.901
	February	3	−1.422
	March	1	−0.867
	March	3	0.756
	April	1	0.933
	April	3	2.738
	May	1	2.771
	May	2	1.242
	June	1	1.786
	June	3	1.822
	July	1	2.206
	July	3	0.213
	August	1	0.630
	August	3	−3.218
	September	1	−1.179
	September	3	−1.527
	October	1	0.646
	October	3	0.729
	November	1	2.722
	November	3	2.490
	December	1	1.636
	December	3	3.570
1975	January	1	3.787
	January	3	1.555
	February	1	0.501
	February	3	−1.347
	March	1	−1.141
	March	3	−0.388
	April	1	0.761
	April	3	2.122
	May	1	2.116
	May	3	0.886
	June	1	1.373
	June	3	−0.276
	July	1	1.160
	July	3	1.716
	August	1	1.164
	August	3	−3.408
	September	1	−2.590
	September	3	−0.978
	October	1	0.461

Table 11 (continued)

Year	Month	Ten-Day Period	Basis Estimate
1975	October	3	2.061
	November	1	2.849
	November	3	2.878
	December	1	1.892
	December	3	2.220
1976	January	1	4.037
	January	3	1.803
	February	1	0.624
	February	3	−0.411
	March	1	−0.914
	March	3	0.655
	April	1	1.462
	April	3	4.309
	May	1	2.377
	May	3	0.635
	June	1	1.625
	June	3	−2.023
	July	1	−0.969
	July	3	0.767
	August	1	−0.782
	August	3	−3.183
	September	1	−2.890
	September	3	0.828
	October	1	0.381
	October	3	0.947
	November	1	2.800
	November	3	2.518
	December	1	1.562
	December	3	−0.390
1977	January	1	0.878
	January	3	−1.147
	February	1	−0.318
	February	3	−2.423
	March	1	−2.744
	March	3	0.530
	April	1	1.396
	April	3	4.221
	May	1	2.608
	May	3	0.561
	June	1	1.565
	June	3	−0.769
	July	1	−1.394
	July	3	−1.781
	August	1	−2.111
	August	3	−4.370
	September	1	−2.767

Table 11 (continued)

Year	Month	Ten-Day Period	Basis Estimate
1977	September	3	−0.887
	October	1	−0.048
	October	3	−1.105
	November	1	1.573
	November	3	1.411
	December	1	0.557
	December	3	−2.102
1978	January	1	−0.979
	January	3	−2.204
	February	1	−0.810
	February	3	−4.401
	March	1	−3.706
	March	3	−0.668
	April	1	1.240
	April	3	4.846
	May	1	4.581
	May	3	1.558
	June	1	1.907
	June	3	1.065
	July	1	−0.061
	July	3	−1.914
	August	1	−0.942
	August	3	−5.341
	September	1	−3.616
	September	3	−1.676
	October	1	−0.707
	October	3	−0.684
	November	1	−0.012
	November	3	0.877
	December	1	0.725
	December	3	−1.837
1979	January	1	−0.170
	January	3	−0.109
	February	1	1.042
	February	3	−3.561
	March	1	−2.157
	March	3	0.108
	April	1	1.647
	April	3	6.655
	May	1	6.186
	May	3	4.285
	June	1	3.461
	June	3	1.484
	July	1	1.452
	July	3	−0.273
	August	1	0.497

Table 11 (continued)

Year	Month	Ten-Day Period	Basis Estimate
1979	August	3	-3.970
	September	1	-2.184
	September	3	-0.003
	October	1	0.566
	October	3	-0.272
	November	1	1.075
	November	3	3.514
	December	1	3.514
	December	3	0.077

Table 12. Initial Margin Data Obtained From Chicago Mercantile
Exchange Officials for Use in the Calculation of a
Representative Initial Margin Requirement for the Simu-
lation Period 1972-1979

Year	Month	Day	Initial Margin
			-----Dollars-----
1970	July	1	400
1973	February	1	500
	March	1	700
	August	6	900
	August	27	1200
1975	June	18	900
1976	September	15	700
1978	March	27	700

VITA

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