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Market Efficiency and Marketing to Enhance Income of Crop Producers

by

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MARKET EFFICIENCY AND MARKETING TO ENHANCE INCOME OF CROP PRODUCERS

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Recent changes in farm policy have renewed interest in using marketing strategies based on futures and options markets to enhance the income of crop producers. This article reviews the literature surrounding the dominant academic theory of the behavior of futures and options markets, the efficient market hypothesis. The following conclusion is reached: while individuals can beat the market, few can consistently do so. Those few who consistently earn trading returns have superior access to information or superior analytical ability. This conclusion is consistent with Grossman and Stiglitz's model of market performance when information is costly. One implication is that if any "expert" offers advise on taking a futures or options position, first ask for a statement of their past trading record. To follow on, we recommend that reporting of actual performance be required by the Commodity Futures Trading Commission. A second implication is the importance of cost of production relative to marketing in determining the long term survival of crop producers. With very few exceptions, the crop producers who survive will be those with the lowest cost of production since efforts to improve revenue through better marketing will have limited success. Thus, a good marketing program starts with a good program for managing and controlling cost of production. However, all is not lost for the individual crop producer when it comes to enhancing income from prudent marketing. Simple strategies exist which can enhance average return. These strategies use the market as a source of information, rather than as a trading medium. An example is to base storage decisions on whether the current basis exceeds the cost of storage, and to time storage decisions based on when a producer harvests the crop relative to the national harvest of the crop. Stated somewhat differently, an effective marketing program begins with first learning and practicing effective cash marketing.

INTRODUCTION

The use of futures and, more recently, option markets to enhance income long has been a topic of interest to producers and others, as well as the subject of many academic investigations (Tomek, 1987). For crop producers, this topic has taken on new importance because of the recent changes in farm policy. These changes reduce the role of government in determining prices and incomes earned by producing the major field crops (Nelson and Schertz, 1996). Given this new context, we review the main concepts of the dominant academic theory concerning the behavior of futures and options markets, the efficient market hypothesis. This rich conceptual base and associated empirical research has several, important implications for the use of futures and options markets to enhance income. In essence, it

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provides guideposts for who should be able to profit from futures and options trading, and what strategies should be profitable.

MAJOR CONCEPTS OF EFFICIENT MARKET HYPOTHESIS

According to Fama (1970, updated 1991) an efficient market is one that accurately incorporates all known information in determining price[1]. Fama's original definition came to be known as the efficient market hypothesis (EMH). It is essentially an extension of the zero profit equilibrium of a competitive market in a certain world to an uncertain world of price dynamics. Although considerable disagreement exists about the degree to which EMH holds, it has become the dominant paradigm used by economists to understand and investigate the behavior of financial and commodity markets[2].

The following equation allows a simple discussion of the major concepts underlying the EMH:

(1) $$P_{t+1} = \alpha + \beta P_t + \epsilon_t,$$

where P_{t+1} is the price at time $t + 1$, P_t is the current price, α and β are parameters, and ϵ_t is a random error term with the usual properties (i.e., mean of zero, constant variance, and no correlation among residuals).

To aid in understanding the key concepts of EMH, equation 1 is rearranged as follows:

(2) $$P_{t+1} - \beta P_t = \alpha + \epsilon_t$$

If $\alpha = 0$ and $\beta = 1$, then

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

Taking the expectations of equation 3 yields:

(4) $$E_t(P_{t+1} - P_t) = 0$$

This price process is usually described as a random walk[3] (Tomek and Querin, 1984). The expected average change in price is zero. Hence, no price bias exists. Furthermore, since the ϵ_t's are uncorrelated, changes in prices are uncorrelated. A commonly used analogy of a random walk is the flipping of a fair coin.

A fundamental principle of modern finance is that higher risk should be compensated with a higher return. Hence, if a risk exists that can not be diversified, an activity associated with that risk should earn a return which exceeds the risk-free rate of return. Thus, if buying or selling futures and/or options incurs a risk which can not be diversified, then trading should earn a positive return to compensate for these risks. Hence, it is possible that a market could be efficient in terms of Fama's definition and a price bias exists, i.e., $E_t(P_{t+1}) - P_t \neq 0$, provided the price bias compensates for risk.

A convenient way of thinking about the price bias is to use the terminology introduced by Keynes (1930). He divided price biases into normal backwardation and contango. In normal backwardation, the expected price is lower than the realized price. If this situation exists, futures prices should increase over the course of a contract, resulting in positive trading returns to a long position. In a contango, the reverse is true, and the expected price is higher than the realized price. Hence, a short futures position will earn positive trading returns.

To summarize this discussion, there are two versions of Fama efficiency. In the first, $\alpha = 0$ and $\beta = 1$. In the second, $\alpha \neq 0$ and $\beta = 1$, provided a non-zero α is a return to risk. The second situation is commonly referred to as a random walk with drift. Normal backwardation implies that $\alpha > 0$, while contango implies that $\alpha < 0$. These price biases may be constant over time or may vary over time. The existence of price biases is extremely controversial, but, whatever the investigator's belief, the existence of price biases is an empirical, not conceptual, question.

Violations of Fama's Assumptions

Fama assumed no transaction costs, costless information, and that the implications of current information for both current price and the distributions of future prices are generally accepted by all market participants. At least two assumptions are unrealistic. First, transaction costs, such as brokerage fees, exist. The existence of transaction costs changes the criteria by which market efficiency is evaluated: a market is efficient if gross trading returns do not exceed transaction costs. Second, information is costly. Information which is costly will be acquired and analyzed only if a return is earned to cover the costs.

If information is costly, Grossman and Stiglitz (1980) show that it is impossible for prices to perfectly reflect all available information. Otherwise, those who used resources to obtain it would earn no compensation to cover their costs. This insight introduces the potential for profitable trading based on the acquisition and analysis of information. Profit is earned by using the information and analysis to take a position in the market in anticipation of price changes which will occur subsequently as the rest of the market learns about the information. These trading returns represent a return to the costs incurred in acquiring and analyzing information.

Grossman and Stiglitz's model of market performance has come to be known as noisy rational expectations[4]. Relative to Fama's model of market efficiency, it implies that β may not equal 1 because the market acquires and analyzes information (i.e., learns) slowly, with the traders possessing superior access to information and/or analytical ability acquiring the information first. It suggests an alternative statement of market efficiency: a market is efficient with respect to the information set available at time t if economic returns generated by trading on this information set does not exceed transaction and information costs (Jensen, 1978).

IMPLICATIONS OF MARKET EFFICIENCY FOR MARKETING STRATEGIES

The marketing of commodities, including crops, can be divided into four types of strategies[5]. The first is to routinely buy or sell at a given time, such as to sell only at the end of the production process (i.e., harvest) or to always sell a percent of expected production before harvest. The other strategies condition buying and selling on an assessment of the current and future market situation. Such an assessment may be based on the status of a systematic factor or on a forecast of future price behavior. The forecast may be generated either by the market or the individual. We categorize the resulting strategies as systematic, market-generated forecasts, and individual-generated forecasts.

Routine Strategies

The most obvious routine strategy is to sell 100 percent of production at the end of the production period. Using any other marketing strategy yields the following total return:

(5) *Return to Marketing Strategy + Return to Selling at Harvest*

This equation leads to an obvious, but nevertheless important observation: only when a marketing strategy earns a positive return can it enhance total income.

One way for a routine strategy to enhance returns above that achieved at harvest is to take advantage of a price bias that routinely occurs in futures and/or options prices. Numerous studies of this phenomena have been conducted. The most extensive is by Kolb (1992). He investigated the existence of normal backwardation in daily prices of 29 futures markets from 1959 (or first year of trading) through 1988. Among the agricultural commodities analyzed, he found that feeder cattle, live cattle, live hogs, and frozen concentrated orange juice conform to the normal backwardation hypothesis, while cotton, soybeans, soy oil, and soy meal partially conform to normal backwardation. The other commodities, including the grains, exhibited no evidence of normal backwardation.

Kolb's review of the literature reveals that the existence of a routine normal backwardation is sensitive to the time period analyzed. Also, Kolb does not account for the effect of overlapping sample periods. Nevertheless, Kolb's findings suggest that routine strategies with regard to agricultural commodities need additional investigation.

A particular type of pricing bias, known as the drought risk premium (Wisner, 1991), has been much discussed in recent years. This strategy is based on the argument that, during the period before harvest, crop futures and option prices will be priced in anticipation of a drought. Because a drought does not normally occur, futures prices will decline. By extension, routinely selling a futures and/or option contract before harvest should be profitable. Therefore, the drought risk premium argument implies a contango price bias.

We examine the drought risk premium for the pre-harvest quotes of corn and soybean new crop futures over the 1952-1996 period. Table 1 presents the difference between the November soybean and December corn futures quote on March 1, May 1, July 1, and September 1 and the quote on the following November 1 or December 1. November 1 and December 1 represent harvest, March 1 represents pre-planting, May 1 represents planting, July 1 represents the middle of the growing season, and September 1 represents the late growing season. A positive difference means the pre-harvest quote on average was greater than the harvest quote, while a negative number means the pre-harvest quote on average was less than the harvest quote. The differences are tested for statistical significance at the five percent level using a two-tailed test. Note that these comparisons do not account for transactions costs incurred when trading[6].

Over the entire 1952-1996 observation period, none of the pre-harvest quotes for corn and soybeans differed significantly from the harvest quote. Furthermore, none of the eight t-statistics have a p-value which is less than 20 percent. When the observation period is divided in half, one t-statistic is significant at the five percent test level: soybeans, May 1, 1952-1973 (-2.59). Over this period, November soybean futures prices increased significantly from May 1 through November 1. When the observation period is split into fourth, three t-statistics are significant: corn, March 1, 1952-1962 (2.49); soybeans, May 1, 1963-1973 (-2.64); and soybeans, July 1, 1985-1996 (2.28). Two of these significant observations are consistent with contango, while the other is consistent with normal backwardation.

The number of significant coefficients do not deviate by much from the laws of chance. For example, random chance implies that approximately 0.9 observations (16 times 0.05) over the two equally divided sub-periods should be significant at the five percent test level. One significant coefficient is observed. Similar results are obtained for the 32 cases when four sub-periods are used. Furthermore, among the significant coefficients, there is no consistent pattern of normal backwardation or contango.

Table 2 presents the gross trading returns from buying September and November (December) soybean (corn) put options at the same four pre-harvest dates evaluated for futures. Because options expire during the month before the underlying futures contract expires, a September put option is not available on September 1. The put position was closed out on the 15th day of the month before the underlying futures contract expires or the last day of trading, whichever came first. Again, trading costs were not included in the calculations.

The current option contracts did not begin trading until 1985 for corn and soybeans. Along with the 1985-1996 period, the 1990-1996 period is included because, following Grossman and Stiglitz, markets must learn how to price new contracts. Thus, reasons exist for believing that any new market can generate inaccurate pricing.

Only one average gross trading return is significant at the 5 percent level: cor September put, 1985-1996 (2.66). However, the comparable t-statistic for 199 insignificant (1.27). In total, there is no consistent evidence of significant trading the routine buying of a put before harvest.

Table 3 presents an analysis of the drought risk premium within the farm making framework, instead of a price behavior framework. Farm level yields were for 21 farms operated by the University of Illinois over the 1985-1995 period. Thurs prices are available for regions of the state (Good). The same strategies as discusse were evaluated, but the only pre-harvest date used was May 1. The futures and har strategies are lifted at harvest, while the September put strategy is closed out on the las trading but no later than August 15. Harvest is defined as the week in which 50 percen Illinois corn or soybean harvest was completed.

Table 3 contains for each routine marketing strategy the average gross per acre across the 21 farms. Also presented is the average t-statistic across the 21 farms for the the difference between gross returns from using the pre-harvest strategy and the gross from selling at harvest in the cash market. Although the average gross return is higher f pre-harvest marketing strategies, none of the pre-harvest strategies yield a significantly l return than selling at harvest using a five percent test level.

Table 3 also contains the gross trading returns from selling futures and buyin options on May 1 for the 1985-1995 period. As expected, the results for price bias are si to the results for the farm level tests: the pre-harvest marketing strategies yield a higher r than selling at harvest, but the return is not significantly higher. Alexander (1996) also f that routine pre-harvest marketing strategies did not significantly increase returns to production relative to selling at harvest. He examined four Ohio farm situations over 1985-1995 period.

The lack of a routine drought premium in corn and soybean futures and options pr without adjusting for transaction costs is consistent with Fama efficiency and with the v that over the preharvest period $\alpha = 0$ and $\beta = 1$. In other words, the corn and soyb futures and options markets incorporate the average economic value of a growing-seas drought into their pre-harvest estimate of the harvest price. Because a drought usually d not happen, it is not surprising that over the 1974-1996 period corn and soybean new cr futures declined two-thirds of the time between May 1 and November 1/December 1 (Figur 1 and 2). However, the average price increase was much greater than the average pri decrease (Figures 1 and 2). As a consequence, futures and options prices are unbias predictors {i.e., (average price increase times the probability that price increased) minu (average price decrease times the probability that price decreased) is not statistically differe from zero}. Hence, while a trader can predict that corn and soybean prices will normall decline over the growing season, this information can not be used to trade profitably unless th trader can predict in which years price will increase and decrease. Stated somewha differently, the trader must be able to predict a drought before it occurs.

One last point: the observed bias on futures prices varied substantially from subperiod to subperiod. For example, over 1974-1984 the May 1 quote of the November soybean contract averaged 25 cents lower than the November 1 quote of the November contract (Table 1). In contrast, over 1985-1996, the May 1 quote averaged 40 cents higher than the November 1 quote. Thus, a routine sell strategy would have generated substantial profits over 1985-1996, but substantial loses over 1974-1984. This discussion emphasizes the importance of having an adequate sample before projecting past price behavior into the future. It also urges extreme caution in drawing any conclusions regarding the performance of option based strategies, given that only 12 years of data exist.

The lack of a routine bias in pre-harvest quotes of corn and soybean futures and options prices implies that, from the perspective of enhancing income, routinely selling before harvest is no better than simply selling at harvest. Conversely, selling at harvest is no better than selling before harvest, if done routinely[7].

While pre-harvest routine strategies do not appear to enhance income for crop farmers, routine storage decisions may provide such an opportunity. These strategies make use of the "j" shaped pattern of cash prices over the harvest period. Cash prices are high at the beginning of harvest, reach a low around the middle of harvest, then begin to climb as harvest winds down. This pattern suggest that returns to storage may be conditioned on time of harvest.

Evidence of a routine storage return is presented in Figures 3 and 4 for corn produced in Ohio over the 1964-1989 period. Returns to storage are evaluated for the week in which 10, 50, or 90 percent of Ohio's corn crop is normally harvested. Returns, net of interest and physical storage costs, are computed for both hedged and unhedged corn stored off the farm. The storage hedge was placed in the July futures[8]. Average net return to storage consistently exceeds zero over the various storage horizons only for harvest at the 50 percent completion date.

The routine strategy which generates the highest income should be used as the benchmark against which marketing programs are evaluated. For producers of commodities with a seasonal harvest, the benchmark for evaluating income enhancement appears to be harvest-time sales for those who harvest early or late during the harvest season. For those harvesting during the middle of the harvest season, the appropriate benchmark appears to include the return from routine storage.

Systematic Strategies

Systematic strategies base the buy/sell decision on the status of an indicator variable. One such strategy is based on the argument that a hedging pressure risk premium exists. This argument was first stated by Keynes (1930) and Hicks (1946). It is based on the assumption that producers engage in hedging to reduce risk. Assuming that speculators are risk-averse, they will assume the risk being transferred by hedgers only if they are paid for doing so.

Normal backwardation is a mechanism by which hedgers of cash commodities (i.e., hedgers) pay speculators to assume the price risk avoided by hedging. By analogy, a co is the mechanism by which long hedgers pay speculators to assume the price risk avoic hedging (Cootner, 1960). These arguments imply that a long position will be profita hedgers are net short, while a short position will be profitable if hedgers are net long.

A recent examination of this issue by Bessembinder (1992) over the period Ja 1967 through December 1989 finds little evidence that returns in agricultural market conditional on the net position of hedgers. The specific agricultural markets examined live cattle, soybeans, world sugar, wheat, cotton, and corn. The strongest individual m evidence was for corn, but the evidence was internally inconsistent.

A second systematic strategy is to condition trading positions on the state of economy. In the academic literature, this is frequently referred to as a time-varying ma economic risk premium. Bessembinder and Chan (1992) find that returns in the soyb wheat, cotton, and cattle futures markets over the interval January 1975 to December 1989 related to one or more of the following macro-economic variables: Treasury bill yields, eq dividend yields, and 'junk" bond premium. However, the regression R^2's are extremely l with the highest being 0.07. Taken together, these results suggest that a time-varying r premium tied to the state of the macro-economy may exist, but that the returns it command unlikely to be economically meaningful.

It is possible that other systematic strategies may be valid. A number of systema price biases have been presented in the stock market literature. These include, among othe the firm size effect, the January effect, the weekend effect, and the value-line effect. For more complete listing and discussion, see Gallinger and Poe (1995) and for a discussion of t evidence see Ball (1996) and Fama (1991). These systematic price biases lead to systemat trading strategies[9], such as always being long in the stock market during January. We wou not be surprised if similar pricing biases exist in agricultural futures market; however, as c this time there is no convincing body of evidence that biases of the kind found in the stoc markets exist in the futures markets for crops.

In summary, evidence exists that both a hedging pressure risk premium and a time varying risk premium tied to macro-economic variables may exist in agricultural futures. Their presence obviously suggests that systematic hedging strategies could be timed to coincide with the values of these risk factors. However, the evidence also suggests that the economic payoff to these systematic strategies is likely to be limited.

Marketing Strategies Using Market-Generated Forecasts

Forecast-based strategies may enhance returns provided the forecasts can predict the future direction of prices. This section discusses the academic evidence concerning two types of marketing strategies based on forecasts generated by the market.

One such marketing strategy was first discussed by Working (1953). He argued that the current futures-cash basis provides a market determined estimate of the expected return to storage. Working discussed this strategy in the context of storage at the futures market delivery point. This allowed him to use the convergence of futures and cash markets during the futures delivery month, i.e., the basis becomes nearly zero. At non-delivery points or during non-delivery months, the storage agent would compare the average basis expected to exist at the project sell date with the current basis. A producer should store only when this expected change in basis exceeds the cost of storage[10].

Working's basis forecast strategy was evaluated for corn production in Ohio over the 1964-1989 period. The parameters of the analysis were the same as those described for the time of harvest analysis, except that the analysis was conducted only for the 50 percent harvest date[11]. Working's strategy increased average net storage returns by 3-5 cents for hedged storage over most storage periods (Figures 5 and 6). Similar results are reported in Heifner (1966) and Tomek (1987). For unhedged storage, the basis strategy increased returns to storage up to 20 weeks after harvest, i.e., approximately the middle of April. For longer storage periods, there was no benefit to using the basis strategy. In summary, this simple analysis suggests the importance of conditioning hedged as well as unhedged storage decisions on the market-generated forecast of whether storage will be profitable.

Another marketing strategy based on a market-generated forecast is profit-margin hedging. This strategy calls for placing a hedge in output and/or input futures whenever the expected profit from production based on expected expenses and current futures prices (adjusted via the basis to local conditions) exceed some specified level. As a group, the studies of profit market hedging find that it may enhance returns and/or reduce risk. For a review of the profit margin hedging literature see Johnson, Zulauf, Irwin, and Gerlow (1991).

The existing profit margin hedging studies were conducted using extremely small samples and did not use appropriate statistical techniques. Irwin, Zulauf, and Jackson (1996) found no statistically significant evidence of mean reversion in agricultural futures prices when appropriate statistical techniques were used. Mean reversion is probably a needed attribute of price behavior for profit-margin hedging to be a successful strategy[12]. Nevertheless, the existing literature regarding profit margin hedging suggests the need for further research using appropriate statistical techniques.

Marketing Strategies Using Individual-Generated Forecasts

Grossman and Stiglitz's model of market efficiency implies that positive trading returns can be earned by those who are the first to acquire new information or possess superior analytical ability. Large traders, especially those involved in producing or transforming commodities, are immersed in national and international information flows. They also have more resources than most individuals with which to collect and analyze information. Because of these advantages, Grossman and Stiglitz's model implies that large traders should make most of the money from trading on futures and options markets. In contrast, because of their limited ability to be among the first to acquire new information, small traders should lo money as a group.

These implications of Grossman and Stiglitz's model are supported by several studies traders' returns. Hartzmark (1989) analyzed the Commodity Futures Trading Commission report on the position of large traders in nine markets over the period 1977-1981. Larg hedgers had gross trading profits of $728 million, large speculators made $125 million, whi small traders lost $853 million (Table 4). Leuthold, Garcia, and Lu (1994) found that larg traders in frozen pork bellies were able to generate significant profits over the period 198 1990, while Phillips and Weiner (1994) found that major oil companies earned significa profits from forward trades of Brent Blend crude oil over the 1983-1989 period. Both of thes studies attribute the significant profits of larger traders to superior information and/c forecasting ability. Last, Irwin, Krukemyer, and Zulauf (1993) found that public commodit pools earned significant gross trading returns[13]. The findings of each of these studies c traders' returns are inconsistent with Fama's definition of efficiency, but are consistent wit Grossman and Stiglitz's model of market performance[14].

While the above results seem to suggest that traders with superior forecasting abilit can earn trading returns, the more pertinent question for most agricultural producers, includin crop farmers, is whether small traders can "out-forecast" the market. Hartzmark's (1989 analysis implies that small traders lose money as a group. However, it is possible that thes small traders were not using the best forecasting methods.

A review of the pricing efficiency of agricultural futures markets by Garcia, Hudson and Waller (1988) found the evidence mixed in regard to whether forecasting models car improve upon the forecast performance of futures markets. The share of observations ir which forecast models performed better than futures markets varied by commodity (inefficiency was more common in livestock than crops), by period of analysis, by forecast horizon, and by method of analysis (inefficiency was more common with tests involving past prices than public information). A review of economic forecasting in agriculture by Allen (1994, p. 105) found that econometric and other multivariate models do slightly worse than the naïve no change forecast, with other univariate methods (trend extrapolation and exponential smoothing) performing the worst. Vector autocorrelation was the best performing forecast method, although Allen argues that it has generally been compared with relatively weak alternatives. In his overview of commodity futures prices as forecasts, Tomek (1997) argues that futures markets may be "poor" forecasters of price, but that model-based forecasts will generally be no better because markets are efficient.

Irwin, Gerlow, and Liu (1994) found no significant difference between the forecast accuracy of live hog and live cattle futures prices and U.S. Department of Agriculture expert predictions over the period 1980-1991. Bessler and Brandt (1992) found that the forecast of cattle prices by the expert they evaluated outperformed the live cattle futures market over the period 1972-1986; however, the expert's forecasts regarding hog prices did not out perform the live hog futures markets. Kastens and Schroeder (1996) found that Kansas City wheat futures outperformed econometric forecasting over the 1947 to 1995 period. If one turns to research on technical trading, work by Lukac, Brorsen, and Irwin (1988) and Lukac and Brorsen (1990) found that several technical trading systems earned significant risk-adjusted profits above transaction costs. However, it appear that to earn consistent profits, technical trading systems must be used with a portfolio of markets, not just a single market.

In evaluating these mixed findings with respect to the performance of publicly available forecasts, it is useful to keep in mind an article by Tomek and Querin (1984). They show through a simulation exercise that, even if prices are generated by a random walk process, price trends (after the fact) will exist. It is likely that historical analysis will discover some technical trading rule that was profitable over the period analyzed. The same conclusion can be reached with regard to any type of forecasting model. Hence, the expectation is that forecasting studies will find mixed evidence regarding market efficiency and trading profitability. What is more important is whether consistent results are found repeatedly for a given forecasting model. On this score, the evidence is fairly clear: no publicly available forecasting model has been found to generate consistent trading profits when applied to a single market.

Another area of investigation recently has emerged that falls somewhere between the large trader return studies and the public price forecasting studies. This area focuses on evaluating the performance of advisory services who provide marketing assistance to farmers. Because of their on-going collection and evaluation of information, it is possible that these services may be able to enhance farmer income. The available studies have focused on corn and soybeans. They include Gehrt and Good (1993); Martines-Filho (1996), and Good, Irwin, Jackson, and Price (1997). Taken together, these studies hint that market advisory services may be able to enhance income relative to the returns obtained from selling at harvest. Robustness of the results is limited by extremely small sample concerns and by the considerable variance in performance by advisory service and crop. Nevertheless, the early evidence indicates that additional investigation is warranted.

In summary, the available evidence on forecasting is largely consistent with an efficient market at least in the Grossman and Stiglitz's sense. This finding should not come as a surprise. According to Patel, Zeckhauser, and Hendricks (1991), market efficiency is expected when investors play for significant stakes, investors have sustained opportunities for practice, economic selection eliminates non-rational traders, and poaching (i.e., arbitrage) opportunities can be seized readily. These characteristics describe futures and options markets where entry is easy, trading opportunities exist daily, loses are visible daily, and loses are magnified through the leverage provided by margin money.

CONCLUSIONS AND IMPLICATIONS FOR FARMER MARKETING STRATEGIES

A review of the literature leaves the following conclusion: while individuals can beat the market, the available evidence suggests that very few can consistently do so. The ability to consistently earn trading returns lies with those who have superior access to information or superior analytical ability. In a related observation, there is mixed evidence regarding whether routine or systematic marketing strategies can earn positive returns when applied to crop futures and options, but the available evidence suggests that, if profits exists, they are not substantial. In particular, there is no evidence that a routine drought premium exists in new crop futures during the winter, spring or summer before harvest. When taken as a whole, we conclude that, for most crop producers the potential for pre-harvest marketing strategies to enhance income is limited because of their limited access to information. In a sense, this conclusion reaffirms the no-free lunch rule.

These conclusions are consistent with Grossman and Stiglitz's model of market efficiency when information is costly. The existence of a Grossman and Stiglitz world underscores the importance of cost of production relative to marketing when it comes to the long term survival of crop and, more broadly, commodity producers. With very few exceptions, those producers who survive will be those who have the lowest cost of production since efforts to improve revenue through better marketing of the commodity produced will meet with limited success over time. Hence, a world where information is costly and learning occurs suggests that producers will increase their long-term survival by using their scarce resources to first maximize their production efficiency before chasing the allure of marketing profits. In other words, a good marketing program starts with a good program for managing and controlling cost of production.

However, all is not lost for the individual producer when it comes to enhancing income from prudent marketing. Simple strategies do appear to exist which can enhance average return. These strategies require that the producer use the market as a source of information, rather than just as a trading medium. An example is to base storage decisions on whether the current basis exceeds the cost of storage, and to time storage decisions based on when a producer harvests the crop relative to the national harvest of the crop. Stated somewhat differently, this conclusion suggests that an effective marketing program begins with first learning and practicing effective cash marketing.

We end by noting the rather poor performance of econometric and other economic models in predicting future prices. This is not to say that such models are useless. In a world where information is costly, learning is not instantaneous, and the economic system is in a constant state of change; economic model building is likely to be an important part of improving our understanding of the economic world. Thus, the value of economic model building is not in forecasting prices better than the futures markets, but it is in helping us understand market parameters and in devising less costly means to analyze and collect information.

ENDNOTES

1. Fama (1970) referred to the definition used here as strong-form efficient in his 1970 article and as tests for private information in his 1991 sequel article.

2. For an excellent discussion of the impacts and controversies surrounding the Efficient Market Theory in the context of the stock market see Ball (1996).

3. While the random walk price process is a useful pedagogical tool, the martingale price process has supplanted it within the efficient market literature. An excellent discussion of the efficient market theory and its relationship to the random walk and martingale price processes is provided by LeRoy (1989). Both the martingale and random walk imply that, given the information set available at time t, the best guess of price at t+1 is the price at t and that the expected change in price is zero. The difference between the two price processes is that a martingale rules out a relationship between the expected mean price change and the information set available at t, whereas the random walk rules out this relationship and any other relationship involving higher conditional moments of price changes and the information set at t. Thus, a martingale is consistent with the well established heteroskedasticity of changes in futures prices.

4. See Brorsen and Irwin (1996) for a more thorough discussion of Grossman and Stiglitz's model and its relationship to Fama's model, which is similar to Muth's rational expectation model (1961).

5. It is worth emphasizing that this discussion of marketing strategies occurs within the context of a competitive market with homogenous products. In a market with differentiated products, marketing strategies acquire a different and more diverse set of attributes, often described as revolving around the four P's: price, product positioning, promotion, and place.

6. Transaction costs include brokerage fees and liquidity costs. Currently, brokerage fees are commonly cited as $50 for a round-trip futures trade and $30 per single option trade (Good, Irwin, Jackson, and Price, 1997). Liquidity costs are payments earned by floor traders (scalpers) for filling an order to sell at the market. They have been estimated to be one price tick (1/4 cent per bushel for grain futures and 1/8 cent per bushel for grain options) for the more heavily traded nearby contracts and two price ticks for the more lightly traded contracts that are more than 5 months from delivery (Brorsen and Nielsen, 1996, and Thompson and Waller, 1987). Summing these two components, transaction costs are at least $75 for a round-trip futures trade and $36.25 for a single option trade.

7. If futures are used for pre-harvest selling, cash flow requirements may be significant due to margin calls (Alexander, 1996). The same cash flow consideration does not exist when purchasing put options, although a premium must be paid when the option is purchased.

8. For a complete discussion of the calculation procedures, see Leeds, Zulauf, and Irwin (1992b).

9. There is considerable disagreement about whether these pricing anomalies generate trading returns which are consistent with a time-varying risk premium or whether they generate abnormal trading returns (i.e., price anomalies).

10. For a detailed discussion of the basis forecast procedure see Tomek (1997).

11. For a complete discussion of the calculation procedures, see Leeds, Zulauf, and Irwin (1992a).

12. This observation is based on the argument that over time prices should equal the cost of production in a competitive market. If the output price offers a profit for production and producers respond to this profit, this price will decline toward the cost of production as production expands. The reverse should happen if output price signals a loss. Hence, price reverts to the cost of production, or its mean value in a competitive market.

13. Irwin, Krukemyer, and Zulauf (1993) found that, after adjusting for costs and risk, public commodity pools do not earn abnormal profits despite their large and significant gross trading returns.

14. Fama (1991) reached the same conclusion with respect to the literature on private information in the stock market, i.e., private information exists which generates abnormal trading returns. An example is the information possessed by corporate insiders.

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TABLE 1. Price of Harvest Futures at Selected Times before Harvest Minus Harvest-time Price of Harvest Futures, December Corn and November Soybean Futures, 1952 -1996.

Year	Average Price of Harvest Futures at Harvest[a]	Price Difference by Date Before Harvest			
		September 1	July 1	May 1	March 1
		Corn (¢/bushel)[b]			
1952 - 1996	197	1.19	7.21	2.65	2.79
		(0.37)	(1.21)	(0.44)	(0.47)
1952 - 1973	133	-0.47	0.28	-2.07	-2.35
		(-0.31)	(0.08)	(-0.42)	(-0.40)
1974 - 1996	259	2.78	13.83	7.16	7.72
		(0.44)	(1.25)	(0.65)	(0.76)
1952 - 1962	127	2.34	3.91	4.95	5.18
		(1.55)	(1.47)	(1.96)	(2.49*)
1963 - 1973	138	-3.28	-3.34	-9.09	-9.88
		(-1.34)	(-0.50)	(-0.97)	(-0.86)
1974 - 1984	280	4.89	2.05	1.11	4.02
		(0.61)	(0.12)	(0.06)	(0.24)
1985 - 1996	239	0.85	24.63	12.71	11.10
		(0.09)	(1.79)	(1.12)	(0.90)
		Soybeans (¢/bushel)			
1952 - 1996	458	5.07	9.66	-2.13	-5.40
		(0.73)	(0.83)	(-0.15)	(-0.41)
1952 - 1973	277	0.84	2.95	-13.36	-13.34
		(0.12)	(0.54)	(-2.59*)	(-1.81)
1974 - 1996	632	9.12	16.09	8.62	2.20
		(0.77)	(0.72)	(0.32)	(0.09)
1952 - 1962	246	-5.17	3.11	-4.66	-0.65
		(-1.41)	(0.45)	(-0.90)	(-0.10)
1963 - 1973	307	6.85	2.79	-22.06	-26.02
		(0.49)	(0.32)	(-2.64*)	(-2.09)
1974 - 1984	675	-2.39	-19.30	-25.11	-19.30
		(-0.13)	(-0.50)	(-0.49)	(-0.43)
1985 - 1996	592	19.67	48.52	39.54	21.90
		(1.25)	(2.28*)	(1.91)	(0.89)

[a] Harvest is defined as November 1 for soybeans and December 1 for corn.

[b] The t-test is reported in the parenthesis for null hypothesis: Price of Harvest Futures before Harvest Minus Price of Harvest Futures at Harvest = 0. * indicates significance at 5 percent test level using a two-tailed test.

SOURCE: original calculations

TABLE 2. Average Return to Selling Put Options at Selected Times before Harve Corn and Soybean September and Harvest Futures Options, 1985 - 1996.

Year	Return to Selling Put Option by Date Before Harvest[b]			
	September 1	July 1	May 1	March 1
		Corn September Option (¢/bushel)		
1985 - 1996	NA	9.98	7.67	9.01
		(2.66*)	(1.40)	(1.22)
1990 - 1996	NA	8.25	1.70	4.64
		(1.27)	(0.22)	(0.45)
		Corn December Option (¢/bushel)		
1985 - 1996	2.32	12.78	8.00	8.08
	(0.49)	(1.51)	(1.39)	(1.45)
1990 - 1996	5.70	16.09	10.41	11.11
	(079)	(1.23)	(1.19)	(1.35)
		Soybean September Option (¢/bushel)		
1985 - 1996	NA	7.26	10.31	8.52[c]
		(0.88)	(0.89)	(0.64)
1990 - 1996	NA	-0.10	-0.45	1.66
		(-0.10)	(-0.04)	(0.11)
		Soybean November Option (¢/bushel)		
1985 - 1996	9.68	15.79	18.29	20.47
	(1.21)	(1.26)	(1.29)	(1.40)
1990 - 1996	10.71	4.45	11.45	14.34
	(0.87)	(0.32)	(0.90)	(0.95)

NA - not applicable

[a] The put option position is closed on the 15th day of the month before the delivery month of the futures contract or the last day of trading, whichever came first.

[b] The t-test is reported in the parenthesis for the null hypothesis: return to option position = 0.
* indicates significance at 5 percent test level using a two-tailed test.

[c] The soybean September option price was not available for March 1, 1985.

SOURCE: original calculations

st [a],

TABLE 3. Average Return to Various Marketing Strategies, 21 Illinois Farms, Corn and Soybeans, 1985 -1995.

Strategy	Corn		Soybean	
	Mean	t-statistic[a]	Mean	t-statistic[a]
	Gross Production Returns[b] ($/acre)			
Sell at Harvest	303	NA	251	NA
Sell Futures on May 1[c]	319	0.82	266	1.56
Buy Sept. Put on May 1[d]	319	2.04	260	1.30
Buy Harvest Put on May 1[c]	310	0.93	259	0.97
	Gross Trading Returns to Futures or Option Position (¢/ bushel)			
Sell Futures on May 1[c]	11.0	0.90	33.8	1.66
Buy Sept. Put on May 1[d]	10.6	2.07	15.4	1.35
Buy Harvest Put on May 1[c]	4.9	0.85	14.6	1.02

[a] The t-statistic for gross returns per acre is for the null hypothesis: gross returns with pre-harvest strategy - gross returns from selling at harvest = 0. The t-statistic for trading returns is for the null hypothesis: gross trading return = 0.

[b] Gross return for selling at harvest equals cash price during week in which 50 percent of Illinois crop is harvested times the farm's yield. Gross return for the other marketing strategies includes the return from selling futures or buying the put. It is assumed that 100 percent of expected production (five-year moving average of yield minus high and low yield) is sold before harvest.

[c] Futures and harvest put positions are closed out on the same date the cash sale is made, i.e. the week in which 50 percent of the Illinois crop is harvested.

[d] September put option position is closed on the 15th day of August or the last day of trading, whichever came first.

SOURCE: original calculations

TABLE 4. Gross Trading Returns Earned by Traders Grouped According to Commodity Futures Trading Commission Report on Position of Large Traders, Selected Commodities, 1977-1981.

Commodity	Gross Trading Returns (Million $)		
	Large Hedger	Large Speculator	Small Trader
Oats	9.63	0.64	-10.28
Wheat [a]	66.73	13.53	-80.30
Pork Bellies	79.05	1.48	-80.56
Live Cattle	-130.27	197.12	-66.85
Feeder Cattle	29.13	75.42	-104.55
T-bonds	559.09	-169.07	-390.02
T-bills	114.96	5.48	-120.44
TOTAL	728.00	125.00	-853.00

[a] This includes the Chicago, Kansas City, and Minneapolis wheat futures markets.

SOURCE: Hartzmark, pages 1298-1299.

Figure 1. Observed Probability of a Price Increase and Decline Between May 1 and November 1 on November Soybean Contract and May 1 and December 1 on December Corn Contract, 1974-96

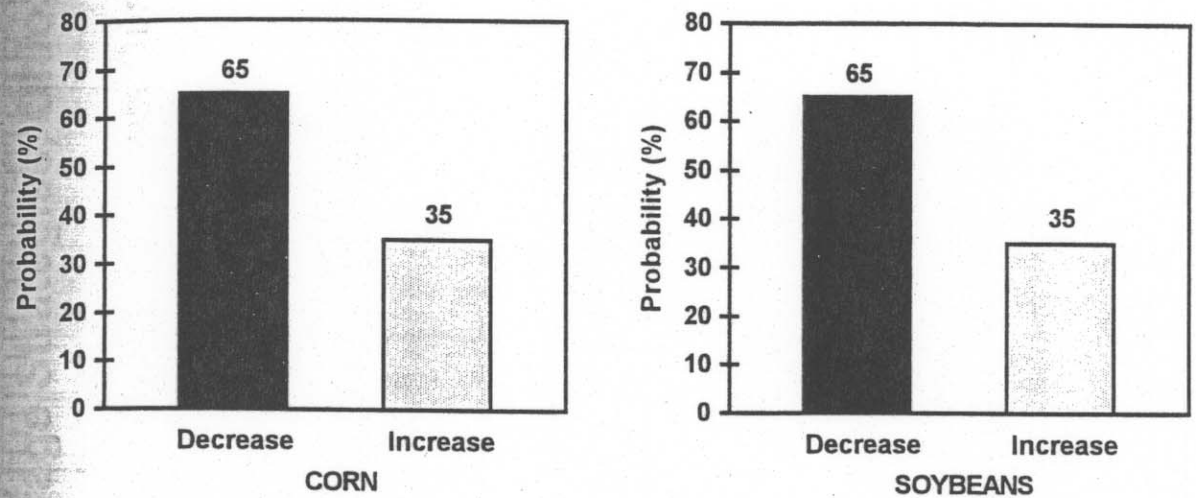

Figure 2. Average Price Increase and Average Price Decline Between May 1 and November 1 on November Soybean Contract and May 1 and December 1 on December Corn Contract, 1974-96

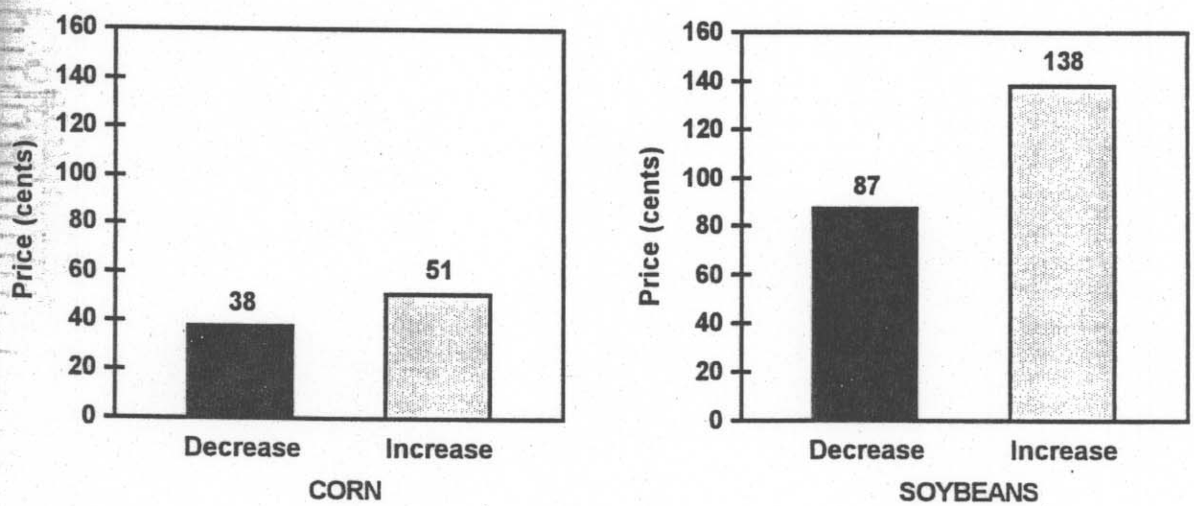

Figure 3. Net Return to Unhedged Storage by Time of Harvest, Ohio, 1964-1989

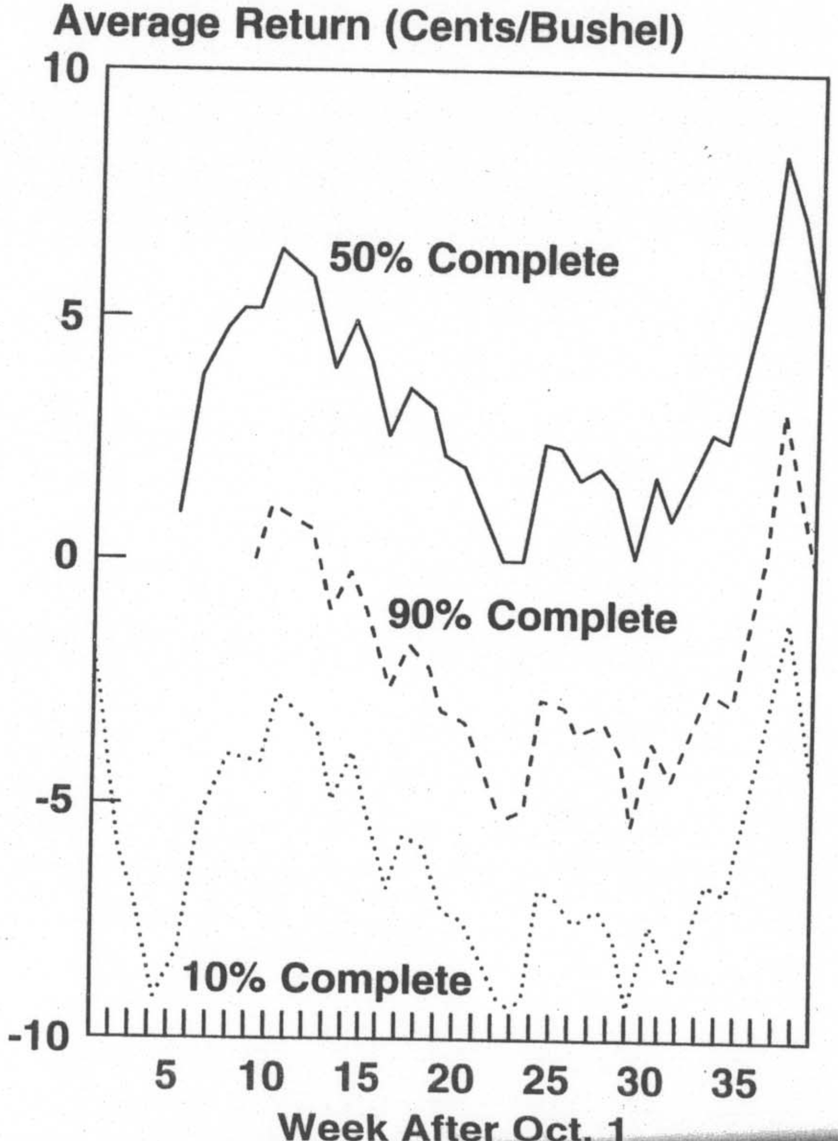

Figure 4. Net Return to Hedged Storage by Time of Harvest, Ohio, 1964-1989

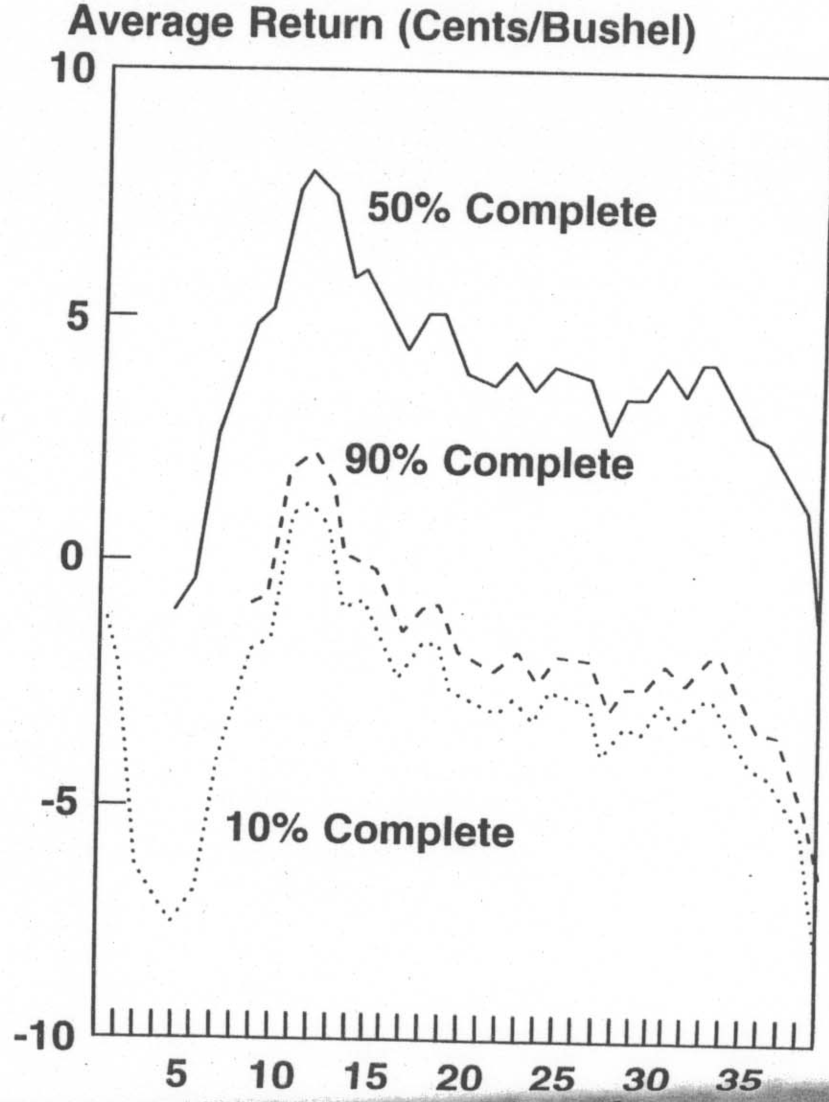

Figure 5. Net Return to Unhedged Storage Strategies, Ohio, 1964-1989

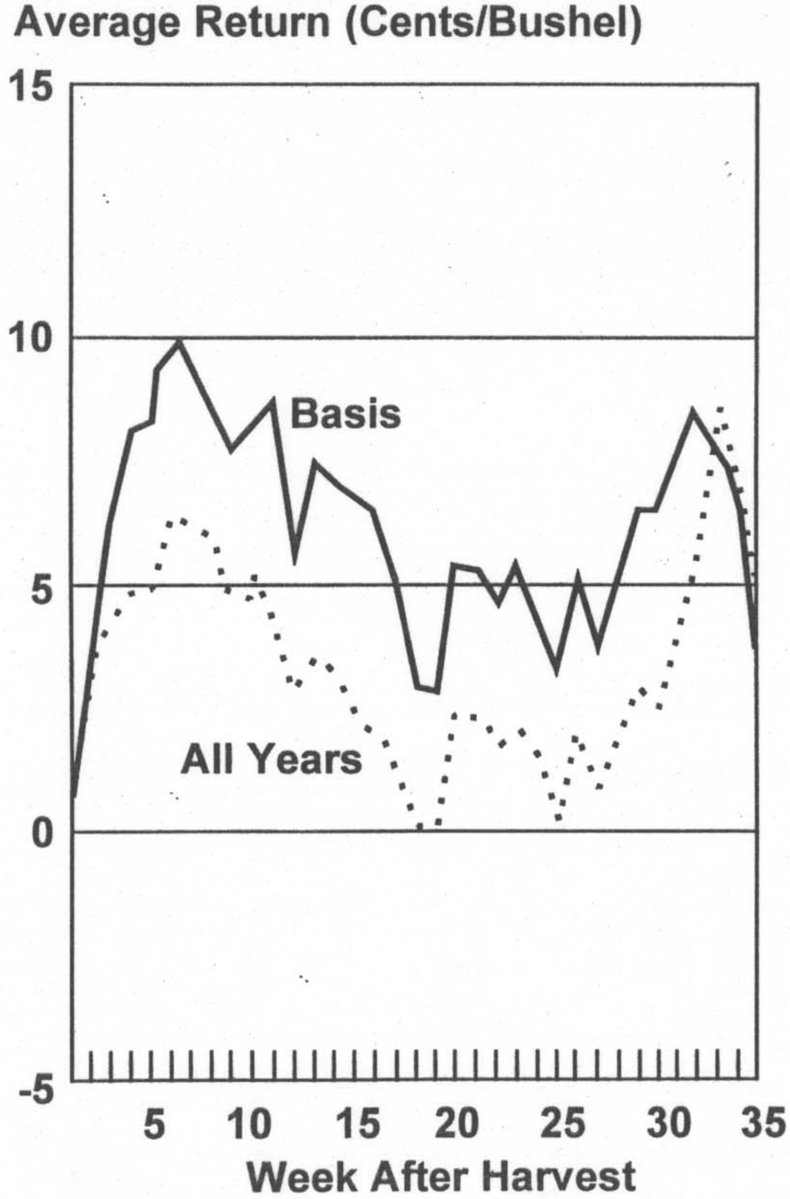

Figure 6. Net Return to Hedged Storage Strategies, Ohio, 1964-1989