Development of a Market Benchmark Price for AgMAS Performance Evaluations

by

Darrel L. Good, Scott H. Irwin, and Thomas E. Jackson

AgMAS

Development of a Market Benchmark Price for AgMAS Performance Evaluations

by

Darrel L. Good, Scott H. Irwin, and Thomas E. Jackson[1]

December 1998

AgMAS Project Research Report 1998-02

---

[1] Darrel L. Good and Scott H. Irwin are Professors in the Department of Agricultural and Consumer Economics at the University of Illinois at Urbana-Champaign. Thomas E. Jackson is the AgMAS Project Manager in the Department of Agricultural and Consumer Economics at the University of Illinois at Urbana-Champaign. The authors would like to thank the AgMAS Advisory Board, which consists of Henry Bahn, Frank Beurskens, Renny Ehler, Chris Hurt, Terry Kastens, and Robert Wisner, for their helpful comments on an earlier draft of the paper. The authors also would like to thank Mike Matwichuk and Jinghong Shu, graduate students in the Department of Agricultural and Consumer Economics at the University of Illinois at Urbana-Champaign, for their research help for this paper.

Abstract

The purpose of this research report is to identify the appropriate market benchmark price to use to evaluate the pricing performance of market advisory services that are included in the annual AgMAS pricing performance evaluations. While it is interesting to compare the net advisory price achieved as a result of following one market advisory service versus another, it also is useful to compare the results of an individual market advisory service, or the results of the service as a group, with a "benchmark" measure of the market price during a particular marketing time frame.

Conceptually, a useful benchmark should: 1) be *simple* to understand and to calculate; 2) represent the returns to a marketing strategy that could be *implemented* by producers; 3) be directly *comparable* to the net advisory price received from following the recommendations of a market advisory service; 4) not be a function of the actual recommendations of the advisory services or of the actual marketing behavior of farmers, but rather should be *external* to their marketing activities; and 5) be *stable*, so that it represents the range of prices made available by the market throughout the marketing period instead of representing the price during a small segment of the marketing period.

Three potential specifications of the market benchmark price are considered: the average price received by Illinois farmers, the harvest cash price, and the average cash price over a two-year time span that extends from (approximately) one year prior to harvest through one year after harvest. The average price received by farmers is reported by USDA and is widely cited as a measure of the economic condition of the farm sector. It is not directly comparable to the net advisory price, however, because it includes quality discounts and premiums. The average price received also is a function of farmers' actual marketing behavior. The harvest cash price is very straightforward and easy to calculate because production risk and storage costs are not included. However, in a given year, the harvest cash price may not represent the average price that was available to farmers for that crop.

The average cash price meets all of the selection criteria, except that it would not be easily implementable by farmers since it involves marketing a small portion of each crop every day of the two-year marketing window. It can be shown, though, that the price realized via a more manageable strategy of "spreading" sales during the marketing window can very closely approximate the average cash price. Therefore, it is determined that the average cash price meets all five selection criteria, and is the most appropriate market benchmark to be used in evaluating the pricing performance of market advisory services.

Introduction

The objective of the Agricultural Market Advisory Service (AgMAS) project is to evaluate the performance of selected agricultural market advisory services. One of the principal components of that evaluation is the calculation of a "net advisory price" received by farmers who follow the recommendations of an advisory service for a given marketing year. The methodology for calculating that net advisory price for corn and soybeans is described by Jackson, Irwin, and Good. Once the net advisory price is calculated for each service, a relative evaluation of the services for a particular marketing year and for multiple marketing years is straightforward. That is, services can be compared to one another in terms of net price received from following their recommendations. This is commonly referred to as a "manager universe" performance benchmark. In the stock market, for example, the performance of mutual funds can be compared to each other (e.g., Bodie, Kane, and Marcus, pp. 723-724).

In addition to a relative comparison, it is useful to evaluate performance in comparison to a market benchmark price. Comparison to a benchmark price is needed to evaluate the performance of advisory services relative to pricing opportunities offered by the market. Hence, this type of benchmark is commonly called a "market" performance benchmark. In the stock market, mutual funds can be, and are, evaluated with respect to market benchmark performance criteria (e.g., Bodie, Kane, and Marcus, pp. 725-747). These benchmarks are typically indexes of stock market returns over the period of evaluation, e.g., the Dow Jones Industrial average, Standard and Poor's 500, etc.

For the evaluation of agricultural market advisory service performance, either a single benchmark price or multiple benchmark prices can be employed. The challenge is to identify and calculate useful benchmarks. This paper presents the characteristics of a useful market benchmark, identifies potential benchmarks, and determines which of the alternative specifications of a market benchmark is the most appropriate for evaluating the performance of agricultural market advisory services.

Benchmark Properties

Webster's New Collegiate Dictionary defines a benchmark as "a point of reference from which measurements may be made", or "something that serves as a standard by which others may be measured". In the context of farm marketing strategies, a market benchmark serves as "a point of reference" or "standard" to measure and evaluate the economic performance of the strategies. The importance of selecting an appropriate market benchmark should be self-evident.

While market benchmarks are widely employed in studies of farm marketing strategies, there is surprisingly little discussion of the properties a "good" benchmark should possess. Nearly all studies of this type simply apply a given benchmark without justification or discussion of alternatives. Fortunately, some guidance can be found in the financial literature (e.g., Bailey, 1992a, 1992b). The following list (Bailey, 1992a) is representative of the fundamental properties considered to be important in constructing a benchmark for money managers:

- Unambiguous: the names and weights of securities constituting the benchmark are clearly delineated.
- Investable: the option is available to forgo active management and simply hold the benchmark
- Measurable: the benchmark's return can be calculated on a reasonably frequent basis.
- Appropriate: the benchmark is consistent with the manager's style.
- Reflective of current investment options: the manager has current investment knowledge of the securities that make up the benchmark.
- Specified in advance: the benchmark is constructed prior to the start of an evaluation period.

These properties cannot be applied directly to the problem at hand, but they are representative of the type of characteristics that need to be specified.

Five properties are proposed for an appropriate market benchmark for the evaluation of market advisory services. These properties mirror those employed in the financial literature with adjustments that recognize the agricultural setting:

- *Simplicity*. The market benchmark price should be easy to understand and easy to calculate. If the process is complicated, acceptance of the benchmark is negatively impacted.

- *Implementability*. There should be a straightforward marketing strategy that could be employed by farmers that results in a net price equal to the market benchmark. Otherwise, the benchmark is an abstract economic calculation rather than a practical market benchmark for evaluating performance.

- *Comparability*. The benchmark should be calculated in such a way that it is directly comparable to the net price received based on advisory service recommendations. For corn and soybeans, the benchmark price should reflect the same grades, qualities, and location as the prices used in calculating advisory service net prices.

- *Externality*. The market benchmark price should not be based on or calculated from the average performance of advisory services, or on the pricing performance of farmers in general. That is, the benchmark should not be relative, but should reflect pricing opportunities actually available in the market during the evaluation period. The benchmark should reflect market performance, not performance of market participants.

- *Stability*. The benchmark should not be unduly influenced by short-term price movements within a given marketing time frame. When measured over many marketing periods, if corn and soybean markets are "efficient" the observed price at a given time within the marketing period (after adjusting for carrying costs) should closely approximate the average of all prices available over the entire time frame. However, in any given marketing period the price measured over a short time interval may differ substantially from the average price for the entire period.

In the next section, alternative specifications of the market benchmark price are identified. Each is evaluated in terms of how well it meets the five properties discussed above.

Benchmark Candidates

Three classes of market benchmarks can be identified in the literature on farm marketing strategies. The first is the actual average price received by farmers over the marketing period. The second is the market price for a single period during the entire marketing time frame. The third is the average of market prices over the marketing period. For the purposes of this study, the three classes of market benchmarks will be represented by, respectively: 1) the average price received by farmers; 2) the harvest cash price; and 3) the average cash price for the entire marketing period. Each of these benchmarks will be analyzed in terms of their consistency with the five properties identified in the previous section.

In the corn and soybean markets, one widely-cited benchmark price is the "average price received by farmers" during the 12 month marketing year. This price is estimated by the National Agricultural Statistical Service (NASS) of the U.S. Department of Agriculture (USDA). Each month during the marketing year (September through August) NASS surveys grain buyers (elevators) to determine the number of bushels of each crop purchased from farmers and the average price paid for those bushels. The average price is calculated as total expenditures for grain divided by the number of bushels purchased. The calculation includes crops under contract that were received and paid for in that month. At the end of the marketing year, a weighted average price per bushel is calculated for each state and the U.S.

At first glance, it would appear that the average price received includes only prices that were available during the 12-month marketing year as defined by USDA (September 1 of the harvest year through August 31 of the following year for corn and soybeans). However, cash-forward transactions also are included in the average price received. For example, the average price received for the month of October includes not only spot cash sales during the month of October, but also grain delivered during October to fill cash-forward contracts. Therefore, the reported average price received for the month of October includes some grain that is being sold for the cash prices quoted in October and some grain that is being sold for a cash-forward price that could have been fixed months in advance.

While the average price received is a widely used benchmark, it fails to exhibit nearly all of the properties of a useful benchmark. First, as the above discussion highlights, the average price received is far from simple to calculate. Second, the average price received by all producers does not represent a strategy that could be implemented by an individual producer, since the timing and amount of marketings is not known in advance. Third, the average price received for corn and soybeans "... reflects prices received by farmers for all classes and grades of the commodity being sold, including quality premium or discounts" (USDA). In the AgMAS project, the net advisory price is calculated using the overnight bid of country elevators for No. 2 yellow corn and No. 1 yellow soybeans in Central Illinois. These prices are collected and reported daily by the Illinois Market News Service. Since quality discounts can be large, especially for corn, the average price received (as reported by USDA) is not comparable to the quoted bid price for a standard grade. The primary function of the USDA's average price received estimate is for input into farm income calculations, not as a benchmark of market performance. Fourth, the average price received is influenced by the timing of pricing decisions of corn and soybean producers. Conceptually, an average price received reflects the marketing performance of farmers, rather than the range of available market prices. It is a relative benchmark rather than an external or objective benchmark. Finally, the average cash price received is only available on a statewide basis, whereas the AgMAS calculation is for central Illinois. This introduces another potential bias, since the average cash basis for the entire state may be different from the cash basis in central Illinois.

A second benchmark price that is often used to evaluate producer or advisory service performance is the "average harvest cash price", or more specifically the average daily bid price for a standard grade during the harvest period. The selection of a single period price is justified with the argument that efficient markets will not demonstrate seasonality after adjusting for carrying costs over long periods of time. The average price during any time period, adjusted for storage costs, should equal the average price during any other time period and should equal the marketing year average in the long run. The harvest period is often selected in marketing strategy studies since it reflects a strategy that could be implemented by producers, incurs no storage costs, and eliminates the yield uncertainty associated with pre-harvest sales.

The average harvest cash price meets four of the desired properties for a market benchmark. It is simple, easy to implement, comparable to net advisory price, and based on prices external to actual farmer or advisory service behavior. However, it violates the stability property specified for selection of a benchmark price. For any particular marketing year, the harvest period may be an "outlier" and not reflect average prices for the marketing year. That being the case, single period average prices may demonstrate significant variability from year to year, even though in the long-term they may be reflective of average prices.

A third market benchmark candidate is the concept of an "average cash price" offered by the market for a standard grade across the entire marketing time horizon. There are several issues related to the construction of the average cash price. First, since the average cash price gives equal weight to daily prices throughout the entire marketing window, daily prices must be weighted by some factor. Prior to harvest, the daily prices need to be weighted based on expected yield, while post-harvest prices need to be weighted by actual yields. In most years, those yields will be different. The adjustment, however, can be easily accommodated by changing the daily weighting factor after the actual crop size is known.

Another issue in the use of an average cash price benchmark is determination of the appropriate pricing period. It can be argued that for corn and soybeans, the pricing period ends just prior to the harvest of the next crop. Storage into the next crop year or deferred pricing arrangements are possible, but are not common and are generally not recommended by market advisory services. The more difficult task is to determine the beginning of the pricing period. Since futures contracts begin trading two or more years prior to maturity, an extremely long pricing period is possible. Some restriction on the starting date seems reasonable, however, based on common producer practices and recommendations of market advisory services. Observation suggests that it is uncommon to routinely price corn and soybeans more than a year prior to harvest. The pricing period for a given year's crop, then, can be reasonably defined as a two-year period -- from September in the year prior to planting through August in the year after harvest. The average cash price would capture the full range of forward pricing opportunities and the opportunities to sell grain out of storage following harvest.

A final issue is that the cash price data that are available for corn and soybeans in central Illinois do not span the entire two year pricing period. The Illinois Department of Agriculture typically begins reporting "new crop" contract bids (harvest delivery) in February prior to harvest. Those contract bids are not available for the previous September through January period. Those prices, however, can be approximated by using the daily closing prices of the appropriate new-crop futures contract during the September through January period and the actual new crop basis implied in the first "new crop" bid in February.

This concept of an average cash price is easy to calculate – it is the simple average of daily prices for the entire marketing window, with post-harvest prices discounted by storage and ownership costs to produce a "harvest-equivalent" price. The average cash price is comparable to the net advisory price, since both are calculated using the same cash price series, and post-harvest prices are adjusted to a harvest equivalent. The average cash price provides an external, objective measure of the actual pricing opportunities available during the marketing window. Such a benchmark allows the evaluation of advisory services in comparison to the market instead of a relative measure of farmer performance. A potential shortcoming is that a producer strategy to achieve the "average cash price" would be extremely difficult to implement. Selling one five-hundredth of the crop every business day for two years obviously is not practical.

Table 1 provides a summary comparison of the previous discussion of the alternative market benchmarks. The comparison quickly leads to the conclusion that the average price received is not a useful benchmark for the evaluation of market advisory service performance, as it exhibits only one of the five properties. The other two benchmarks exhibit four of the five properties. Unfortunately, each fails on a different property (harvest cash price: stability; average cash price: implementability), so there is not a clear preferred benchmark. For this reason, we turn to an analysis of the empirical behavior of the benchmark candidates.

Empirical Comparison

The values of the three proposed market benchmarks were calculated for the 1990 through 1997 corn and soybean crops. This time period was considered long enough to make meaningful quantitative comparisons, and still be able to validly apply available data on storage costs.

While the analysis of properties in the previous section eliminated the average price received from consideration, it is included for comparison purposes. The "average price received" was calculated as follows:

1) The average monthly price received by Illinois farmers was weighted by the percentage of the crop marketed for each month. Both of these data series are reported by USDA in the *Agricultural Prices* publication.

2) All post-harvest sales are adjusted for carrying costs.

3) No yield adjustment is made, since it is impossible to identify which sales were made prior to harvest.

The "harvest cash price" was calculated as the simple average of the daily cash prices in Central Illinois for a five-week period centered on the harvest mid-point. The harvest mid-point is the day that harvest progress reached 50 percent in Central Illinois. No yield adjustment is made, since actual yield is assumed to be known. No carrying charges are assigned, since no storage of the crop occurs.

The "average cash price" is a weighted average of the daily cash prices in Central Illinois over a two-year marketing window that is centered (approximately) on the harvest period for the given crop. For example, the marketing window for the 1995 crop begins on September 1, 1994, and ends on August 31, 1996. Graphs of the daily prices used in computing the average cash price can be found in Figures 1–16. Prior to harvest, the expected (trend) yield is used to determine the weighting factor for each day. From harvest on, the weighting factor is based on the actual reported yield for the crop year. Post-harvest prices are adjusted to a harvest equivalent by subtracting the accrued carrying charges.

The results for the 1990 through 1997 marketing years, plus the mean and standard deviation for each benchmark across the eight crop marketing periods, are reported in Tables 2 and 3. All of the benchmarks are calculated on a "harvest equivalent" basis, i.e., all post-harvest prices are net of storage charges. The details of the calculation of each benchmark, including the storage charges and weights used in the averaging, are included in the *Technical Appendix* of this report. The Central Illinois cash prices and harvest equivalent prices for corn and soybeans for the 1990 through 1997 marketing years are illustrated in Figures 1 through 16.

In the case of corn, the mean of the average cash prices for the eight-year period was $2.34 per bushel. The mean of the harvest cash prices was $2.40, and the mean of the average prices received by Illinois farmers was $2.29. The standard deviation of the average cash prices was $0.28 per bushel, around 10 cents per bushel less than the standard deviation of the average prices received and the harvest cash prices. For individual years, the harvest price varied by as much as $0.32 from the average cash price. This confirms that there is reason to be concerned about the stability of the harvest cash price as a market benchmark in individual years.

In the case of soybeans, the mean of the average cash prices for the eight-year period was $6.00 per bushel, equal to the mean of the harvest cash prices. The mean of the average prices received by Illinois farmers was only slightly less, at $5.97. For individual years, the harvest cash prices varied by as much as $.41 from the average cash prices. As with corn, the standard deviation of the average cash prices was lower than the standard deviation of the average prices received and the harvest cash prices by around 10 cents per bushel.

The empirical results suggest that the average cash price (not surprisingly) is more stable than the harvest cash price. Hence, based on the stability property, the average cash price is the preferred market benchmark. But there is still the issue of implementation with respect to the average cash price.

As mentioned previously, there is no practical way for a producer to implement a marketing strategy that would precisely capture the average cash price. The question then becomes "Is there a mechanical (naive) pricing strategy that is implementable and would approximate the average cash price?" In order to evaluate whether the implementability of the average cash price is a relevant concern, the price results of three mechanical strategies were empirically compared to the average cash price for the 1990 through 1997 crop years for corn and soybeans.

The three mechanical strategies included in the empirical analysis were:

1) price 25 percent of the crop on May 15 (or nearest business day) prior to harvest; 25 percent on October 15; 25 percent on February 15 after harvest; and 25 percent on July 15 after harvest;

2) price one-twelfth of the crop on September 15 in the year prior to planting and an additional one-twelfth of the crop on the 15th of every other month through July following harvest; and

3) price one-twelfth of the crop on the 15th of each month from September of the year of harvest through August following harvest.

Average prices for each of the strategies were calculated using the following decision rules:

1) all pre-harvest sales were weighted by expected (calculated trend) yield.

2) All post harvest sales were weighted by actual yield, with the adjustment from expected to actual averaged over all post harvest sales.

3) All post harvest prices were adjusted for carrying charges to produce a harvest-equivalent price.

The results for the three naive "mechanical" strategies are reported in Tables 4 and 5. The mean of the annual prices achieved by the three mechanical strategies for corn ranged from $2.31 to $2.36 per bushel. On average, each of the alternatives approximates the average cash price. For strategies 1 and 3, the largest annual difference from the average cash price was $0.47 and $0.76, respectively. For strategy 2, however, the annual difference from the average cash price did not exceed $0.05 per bushel. The average cash price is highly correlated with strategies 1 and 2, with correlation coefficients of 0.974 and 0.996, respectively. The correlation between the average cash price and strategy 3 is 0.917.

For soybeans, the mean of the annual prices of the mechanical strategies varied from $5.94 to $6.05. As with corn, the aggregate results were similar for all the potential benchmarks and mechanical strategies. For strategies 1 and 3, the largest annual difference from the average cash price was $0.34 and $0.63, respectively. For strategy 2, however, the annual difference from the average cash price did not exceed $0.10 per bushel. The correlations also are similar to those for corn. The average cash price is highly correlated with strategies 1 and 2, with correlation coefficients of 0.970 and 0.997, respectively. The correlation between the average cash price and strategy 3 is 0.929.

This analysis suggests that the average cash price benchmark for corn and soybeans in central Illinois can be closely approximated by a simple mechanical pricing strategy. That strategy involves pricing one-twelfth of the crop on the 15th day of the month every other month from September in the year before harvest through July after harvest. That being the case, the average cash price meets all of the crucial properties of a sound benchmark price.

Table 1. Comparison of Market Benchmark Candidates and Desired Properties.

Properties	Average Price Received	Harvest Cash Price	Average Cash Price
Simplicity		✓	✓
Implementability		✓	
Comparability		✓	✓
Externality		✓	✓
Stability	✓		✓

Table 2. Value of Three Alternative Specifications of the Market Benchmark for Corn, 1990-91 to 1997-98

Year	Average Price Received	Harvest Cash Price	Average Cash Price
	--	$/bu	--
1990-91	$2.09	$2.19	$2.15
1991-92	2.19	2.39	2.23
1992-93	1.87	1.94	2.07
1993-94	2.34	2.33	2.25
1994-95	2.02	1.93	2.17
1995-96	3.06	3.03	2.90
1996-97	2.50	2.77	2.65
1997-98	2.23	2.65	2.33
Mean	$2.29	$2.40	$2.34
Std. Dev.	0.37	0.39	0.28

Table 3. Value of Three Alternative Specifications of the Market Benchmark for Soybeans, 1990-91 to 1997-98.

Year	Average Price Received	Harvest Cash Price	Average Cash Price
	------------------------------------ $/bu	------------------------------------	------------------------------------
1990-91	$5.49	$5.95	$5.56
1991-92	5.40	5.72	5.56
1992-93	5.43	5.22	5.61
1993-94	6.22	6.00	5.99
1994-95	5.29	5.20	5.59
1995-96	6.59	6.30	6.26
1996-97	7.17	7.07	7.11
1997-98	6.17	6.57	6.30
Mean	$5.97	$6.00	$6.00
Std. Dev.	0.68	0.64	0.55

Table 4. Comparison of the Average Cash Price Benchmark and Three Mechanical Pricing Strategies for Corn, 1990-91 to 1997-98.

Year	Average Cash Price	Strategy 1[1]	Strategy 2[2]	Strategy 3[3]
	---------- $/bu ----------			
1990-91	$2.15	$2.12	$2.12	$2.01
1991-92	2.23	2.13	2.24	2.12
1992-93	2.07	1.99	2.07	1.85
1993-94	2.25	2.16	2.29	2.27
1994-95	2.17	2.14	2.14	2.06
1995-96	2.90	3.37	2.94	3.66
1996-97	2.65	2.65	2.70	2.42
1997-98	2.33	2.28	2.38	2.14
Mean	$2.34	$2.35	$2.36	$2.31
Std. Dev.	0.28	0.45	0.31	0.57

[1]Strategy 1 consists of selling 25% of the crop on May 15 prior to harvest, 25% on October 15 of the harvest year, 25% on February 15 of the year after harvest, and 25% on July 15 after harvest.

[2]Strategy 2 consists of selling 1/12th of the crop on September 15 prior to planting and an additional 1/12th on the 15th of alternating months through July 15 after harvest.

[3]Strategy 3 consists of selling 1/12th of the crop on September 15 of the harvest year and an additional 1/12th on the 15th of each following month through August 15 of the year after harvest.

Table 5. Comparison of the Average Cash Price Benchmark and Three Mechanical Pricing Strategies for Soybeans, 1990-91 to 1997-98.

Year	Average Cash Price	Strategy 1[1]	Strategy 2[2]	Strategy 3[3]
	---------- $/bu ----------			
1990-91	$5.56	$5.48	$5.53	$5.28
1991-92	5.56	5.32	5.58	5.30
1992-93	5.61	5.72	5.66	5.46
1993-94	5.99	5.87	6.09	6.12
1994-95	5.59	5.44	5.65	5.22
1995-96	6.26	6.60	6.30	6.89
1996-97	7.11	7.19	7.19	7.24
1997-98	6.30	6.39	6.34	6.02
Mean	$6.00	$6.00	$6.05	$5.94
Std. Dev.	0.55	0.66	0.57	0.78

[1]Strategy 1 consists of selling 25% of the crop on May 15 prior to harvest, 25% on October 15 of the harvest year, 25% on February 15 of the year after harvest, and 25% on July 15 after harvest.

[2]Strategy 2 consists of selling 1/12th of the crop on September 15 prior to planting and an additional 1/12th on the 15th of alternating months through July 15 after harvest.

[3]Strategy 3 consists of selling 1/12th of the crop on September 15 of the harvest year and an additional 1/12th on the 15th of each following month through August 15 of the year after harvest.

REFERENCES

Bailey, J.V. "Are Manager Universes Acceptable Benchmarks?" *Journal of Portfolio Management*. 18(1992a): 9-13.

Bailey, J.V. "Evaluating Benchmark Quality". *Financial Analysts Journal*. 48(1992b): 33-39.

Bodie, Z., A. Kane, and A.J. Marcus. *Investments*. Irwin: Homewood, IL, 1989.

Jackson, Thomas E., Scott H. Irwin, and Darrel L. Good, *1996 Pricing Performance of Marketing Advisory Services for Corn and Soybeans*, AgMAS Project Research Report 1998-01, January 1998.

United States Department of Agriculture, Statistical Reporting Service, *Scope and Methods of the Statistical Reporting Service*, Miscellaneous Publication Number 1308, Revised September 1983.

Technical Appendix

This section describes the data and assumptions used to calculate the results of the benchmark prices and the mechanical pricing strategies.

Cash Prices

The daily cash prices used in the benchmark price calculations are Central Illinois prices for No. 2 yellow corn and No. 1 soybeans. These prices are collected and reported on a daily basis by the Illinois Market News Service. Prices for the post-harvest period are the posted overnight spot cash bids for each day. For the pre-harvest period, the cash-forward basis for Central Illinois on each Thursday is used to calculate the cash-forward price. The basis is assumed to remain constant until the next Thursday when a new basis is reported. The daily cash-forward price series is then generated by applying this cash basis to the daily futures settlement price of the Chicago Board of Trade. The December futures contract is used for corn and the November futures contract is used for soybeans.

For the purposes of this project, daily cash-forward prices are used beginning with the first business day of September of the year prior to harvest. Although new-crop corn and soybean futures contracts are traded with sufficient daily trading volume at this time, cash-forward basis bids are not reported by the Illinois Market News Service until January or February of the year of harvest. Therefore, an assumption is made about the appropriate cash-forward basis to be used for the four to five months before actual reported bids are available. In this study, the first actual cash bid to be reported is assumed to be the appropriate basis for the period before the bids are available. For example, the first actual cash-forward bid for the 1996 corn crop was reported on January 18, 1996, and was 18.5 cents below the December 1996 futures contract. Therefore, the daily cash-forward bids for the 1996 crop from September 1, 1995 through January 17, 1996 is calculated as the December 1996 corn futures closing price minus 18.5 cents.

Harvest Dates

The actual dates of harvest for corn and soybeans are an important factor for several calculations in this report. The time of harvest determines the dates over which the harvest cash price is calculated, and the timing of the yield adjustment and storage charge calculations. Since the actual date of harvest can vary by several weeks, an assumption of a single time period (e.g., the month of October) for all years is not appropriate.

For the purpose of this study, a five-week harvest “window” is used. In most years, a five-week window will include about 80 percent of the harvest. This five-week window is centered on the date when harvest is 50% complete in the Central Illinois Crop Reporting District, as reported by the Illinois Agricultural Statistics Service each Monday during harvest in its Weekly Crop Progress publication. Since the 50% completion date rarely occurs exactly on the report date, a linear interpolation is done for the week during which the 50% mark was reached.

For example, if harvest progress is reported at 40% complete in one report and 54% in the next report, it is assumed that harvest progressed at a rate of 2% per day (14%/7 days per week) for that week. In most weeks it is unlikely that equal amounts of progress were made each day, but a more precise calculation is not feasible given the data available.

Once the date of 50% harvest progress is identified, that date is used as the mid-point of harvest. The five-week harvest window is constructed using the 12 business days before and after this harvest mid-point. The harvest period, then, consists of 25 business days, or 5 business weeks. The harvest periods and mid-points for 1990 through 1997 are reported in Table A.2.

Expected Yields

In evaluating benchmark strategies, changing yield expectations are a factor for any strategy that includes sales made prior to harvest. In this study, this is an issue that impacts the calculation of the average cash price and naive strategies 1 and 2. When making hedging or forward contracting decisions prior to harvest, the actual yield is unknown. Hence, an assumption regarding the amount of expected production per acre is necessary to determine how much crop should be sold. Prior to harvest, the best estimate of the current year's expected yield is a function of yield in previous years. In this study, the assumed yield prior to harvest is the calculated trend yield, while the actual reported yield is used from the harvest period forward.

The expected yield is based upon a linear regression trend model of actual Central Illinois yields from 1972 through the year prior to harvest. For example, the calculated trend yield for the 1991 crop is estimated using actual yield data from 1972 through 1990, while the trend yield for the 1996 crop uses data through 1995. The calculated trend yields and actual observed yields from 1990 through 1997 are listed in Table A.1.

When calculating the average cash price, the daily weighting factor is the expected yield divided by the number of business days in the entire marketing year. For example, in 1992 the trend yield for corn is 122.9 bushels per acre (bpa), and there are 502 business days (days for which corn prices are quoted) in the marketing year extending from September 1991 through August 1993. Therefore, for each day prior to the 1992 harvest, the price is weighted by 0.245 bpa (122.9/502). At the beginning of the harvest period, the actual yield is assumed to be known. In 1992, the harvest period began on October 6. By this time, the daily prices had been weighted by a total of 67.3 bpa. The actual realized yield for 1992 was 158 bpa. Therefore, as of October 6 there were 91.7 bpa (158 - 67.3) of the 1992 crop left to be sold, and there were 227 business days left in the marketing year. The daily weight was then changed to 0.399 bpa (91.7/227) through the end of the marketing window. This daily weighting of sales results in total sales of the 1992 crop of 158 bpa.

Carrying charges

An important element in assessing returns to an advisory program is the economic cost associated with storing grain instead of selling grain immediately at harvest. The cost of storing grain after harvest (carrying costs) consists of two components: physical storage charges and the opportunity cost incurred by foregoing sales when the crop is harvested. Physical storage charges can apply to off-farm (commercial) storage, on-farm storage, or some combination of the two. Opportunity cost is the same regardless of the type of physical storage.

For the purposes of this study, it is assumed that all storage occurs off-farm at commercial sites. This is assumed for several reasons. First, commercial storage costs reflect the full economic costs of physical storage, whereas on-farm storage cost estimates may not, due to differing accounting methods and/or time horizons. Second, commercial storage costs are relatively consistent across producers in a given area, whereas on-farm storage costs likely vary substantially among producers. Third, commercial storage cost data are readily available, whereas this is not the case for on-farm storage.

Carrying charges are assigned beginning with the end of the harvest period. Physical storage charges are assumed to be a flat 13 cents per bushel from harvest through December 31. After January 1, physical storage charges are assumed to be 2 cents per bushel per month, with this charge pro-rated to the day when the cash sale is made. The storage costs represent the typical storage charges quoted in a telephone survey of Central Illinois elevators.

The interest rate used to calculate opportunity cost of capital is the average rate for all commercial agricultural loans for the fourth quarter of the harvest year and the subsequent three quarters as reported in the *Agricultural Finance Databook* published by the Board of Governors of the Federal Reserve Board. The interest charge for storing grain is the interest rate compounded daily from the mid-point of harvest to the date of sale. The annual interest rates are listed in Table A.3.

In addition to the storage and interest costs, another charge is assigned to corn (but not soybeans) that goes into commercial storage. This charge, referred to as a "shrink charge", is commonly deducted by commercial elevators on corn that is delivered to the elevator to be stored, and reflects a charge for drying and volume reduction (shrinkage) which occurs in drying the corn from (typically) 15% to 14% moisture. The charge for drying is a flat 2 cents per bushel, while the charge for volume reduction is 1.3% per bushel. The per-bushel charge for the volume reduction is 1.3% times the harvest period cash price for the given marketing year.

It should be noted that the cost of drying corn to 15% moisture and the cost of drying soybeans to storable moisture are not included in the calculations. This cost is incurred whether or not the grain is stored or sold at harvest, or whether the grain is stored on-farm or off-farm.

Table A.1 Expected and Actual Central Illinois Corn and Soybean Yields, 1990-97.

	Corn		Soybeans	
Year	Expected Yield	Actual Yield	Expected Yield	Actual Yield
1990	117.3	137.0	41.7	44.5
1991	121.4	127.0	42.6	43.5
1992	122.9	158.0	43.2	46.0
1993	129.5	142.0	44.1	46.5
1994	132.7	172.0	45.0	49.5
1995	140.0	119.0	46.2	42.0
1996	138.0	155.0	46.0	45.5
1997	141.9	140.0	46.5	46.5

Table A.2. Harvest dates for Central Illinois, Corn and Soybeans, 1990-97.

	Corn		Soybeans	
Year	Harvest Mid-point	Harvest “Window”	Harvest Mid-point	Harvest “Window”
1990	10/19	10/3 - 11/6	10/17	10/1 – 11/2
1991	9/19	9/3 - 10/7	9/27	9/11 – 10/15
1992	10/22	10/6 - 11/9	10/8	9/22 – 10/26
1993	10/22	10/6 - 11/9	10/7	9/21 – 10/25
1994	10/13	9/27 - 10/31	9/30	9/14 – 10/18
1995	10/9	9/21 - 10/25	10/4	9/18 - 10/20
1996	10/18	10/2 - 11/5	10/11	9/25 - 10/29
1997	10/15	9/29 - 10/31	10/3	9/17 - 10/21

Table A.3. Annual Interest Rates and Shrink Charges.

Year	Interest Rate	Corn Shrink Charge
	(annual %)	(cents per bushel)
1990	10.45	4.84
1991	8.28	5.11
1992	7.50	4.53
1993	7.58	5.03
1994	9.30	4.51
1995	8.60	5.93
1996	9.13	5.60
1997	9.20	5.44

Figure 1. Central Illinois Corn Prices for 1990-91 Marketing Period

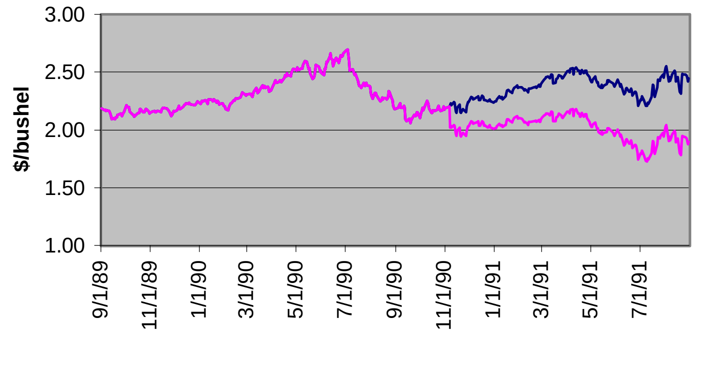


Figure 2. Central Illinois Corn Prices for 1991-92 Marketing Period

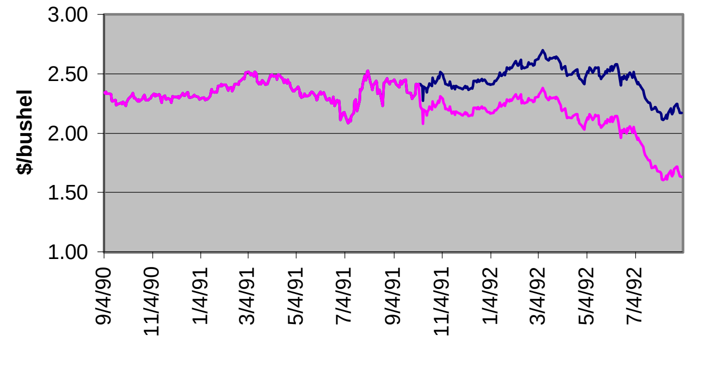
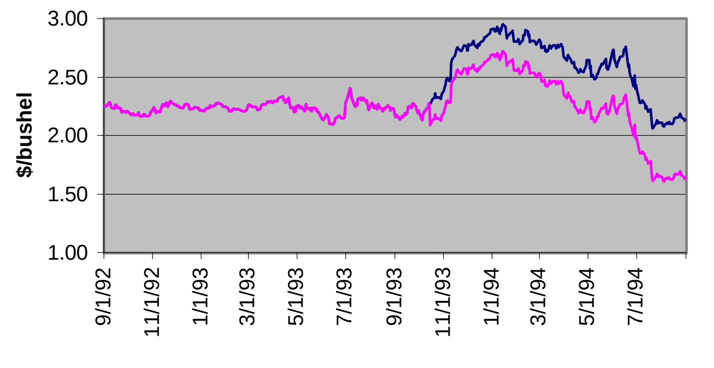


Figure 3. Central Illinois Corn Prices for 1992-93 Marketing Period

Figure 4. Central Illinois Corn Prices for 1993-94 Marketing Period



Note: For the post-harvest period, top line is Central Illinois cash price and bottom line is harvest-equivalent cash price (cash price minus carrying charges).

Figure 5. Central Illinois Corn Prices for 1994-95 Marketing Period

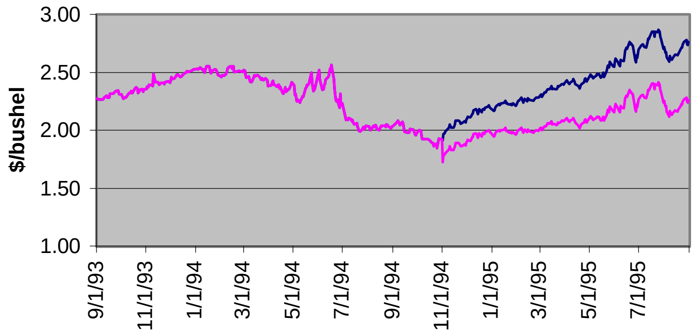


Figure 6. Central Illinois Corn Prices for 1995-96 Marketing Period

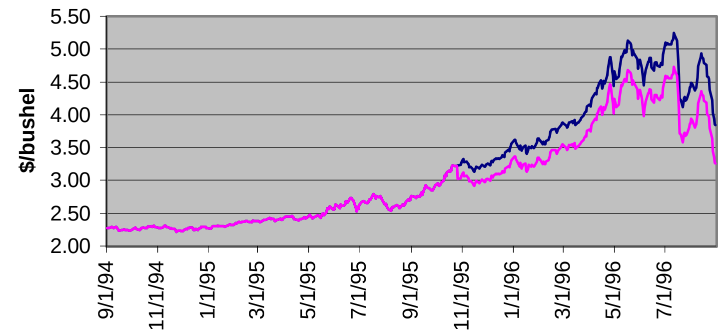


Figure 7. Central Illinois Corn Prices for 1996-97 Marketing Period

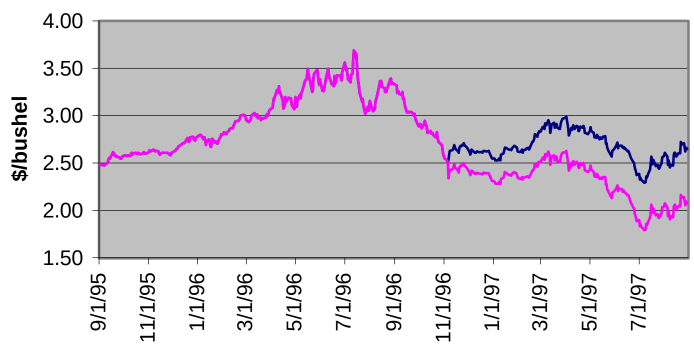
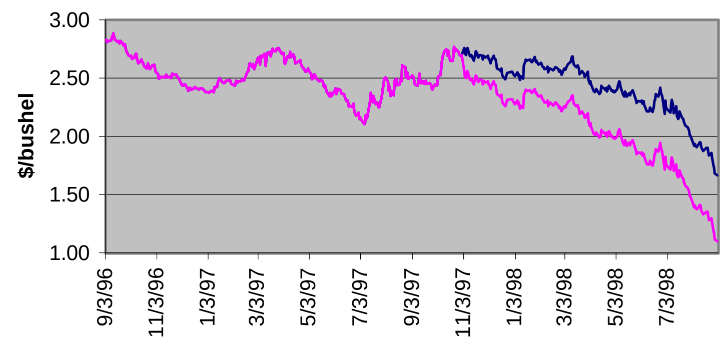


Figure 8. Central Illinois Corn Prices for 1997-98 Marketing Period



Note: For the post-harvest period, top line is Central Illinois cash price and bottom line is harvest-equivalent cash price (cash price minus carrying charges).

Figure 9. Central Illinois Soybean Prices for 1990-91 Marketing Period

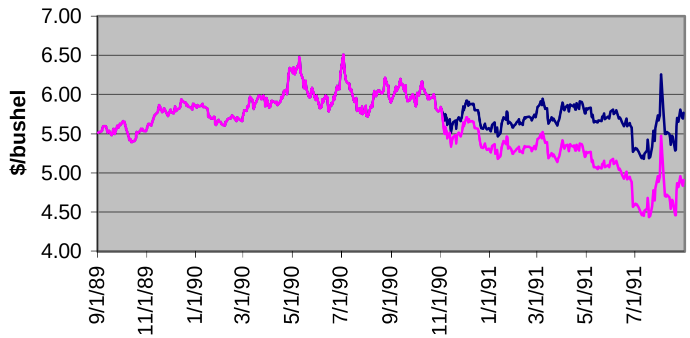


Figure 10. Central Illinois Soybean Prices for 1991-92 Marketing Period

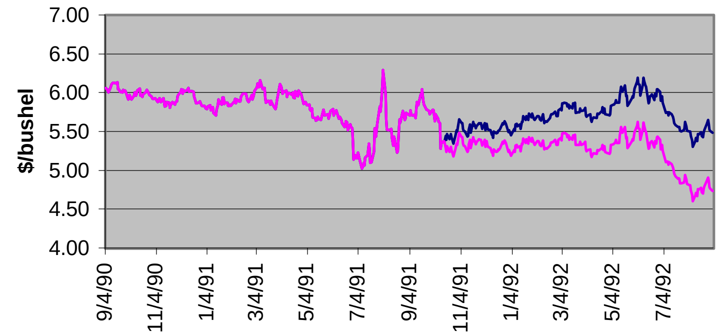


Figure 11. Central Illinois Soybean Prices for 1992-93 Marketing Period

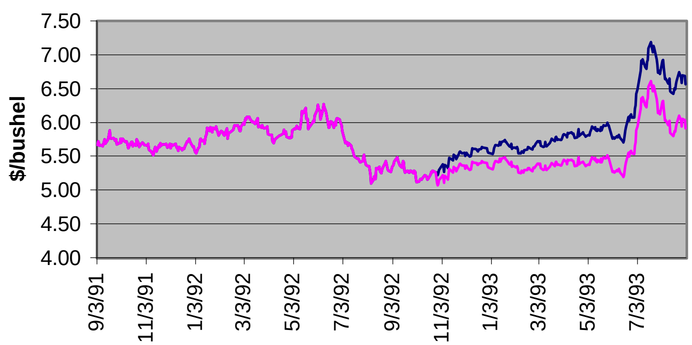
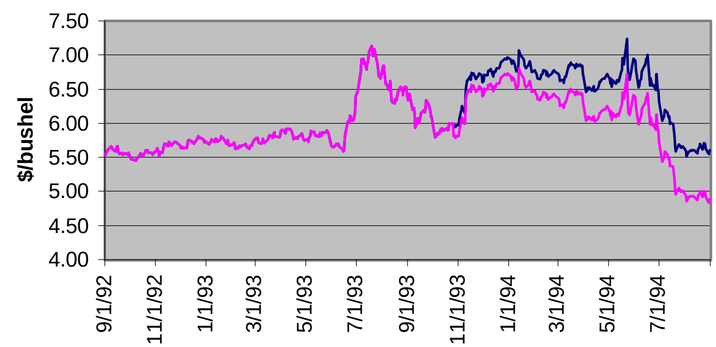


Figure 12. Central Illinois Soybean Prices for 1993-94 Marketing Period



Note: For the post-harvest period, top line is Central Illinois cash price and bottom line is harvest-equivalent cash price (cash price minus carrying charges).

Figure 13. Central Illinois Soybean Prices for 1994-94 Marketing Period

Figure 14. Central Illinois Soybean Prices for 1995-96 Marketing Period

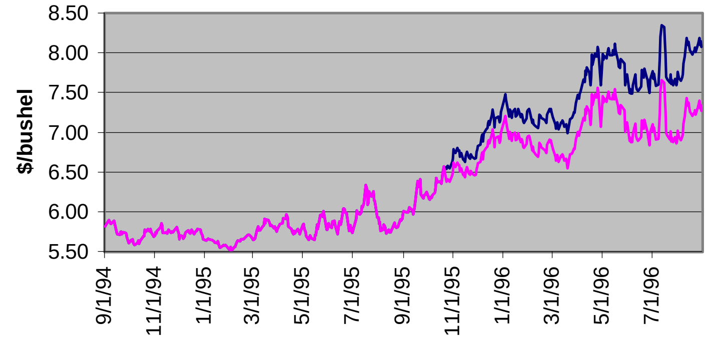


Figure 15. Central Illinois Soybean Prices for 1996-97 Marketing Period

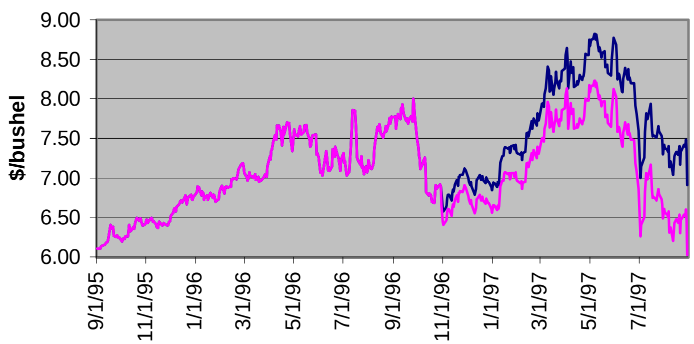
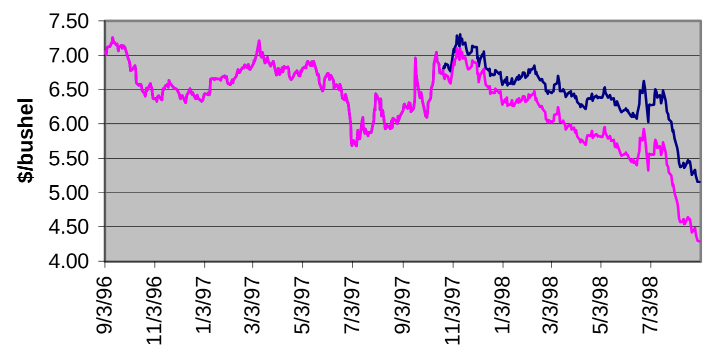


Figure 16. Central Illinois Soybean Prices for 1997-98 Marketing Period



Note: For the post-harvest period, top line is Central Illinois cash price and bottom line is harvest-equivalent cash price (cash price minus carrying charges).