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Pre-Harvest Hedging Behavior and Market Timing Performance of Private Market Advisory Services

Joao Martines-Filho and Scott H. Irwin*

Market advisory services are one the major providers of marketing information to agricultural producers. However, limited objective evidence exists regarding the hedging behavior and value of marketing information provided by these firms. In this study, the pre-harvest hedging behavior and market timing ability of six market advisory services are examined. Daily data on recommended corn and soybean futures and options hedging positions are available for the 1991-1994 pre-harvest seasons. The analysis of hedging behavior resulted in a number of interesting findings. For example, the services use a wide array of hedging positions, mostly short, sometimes long, and both futures and options are employed. Also, there is substantial time series variation in the hedge recommendations. Considering the advisors as a group, they exhibit no market timing ability with respect to corn hedging recommendations. In contrast, the advisors strongly exhibit evidence of market timing ability with respect to soybean hedging recommendations.

Introduction

Commodity marketing is an important activity for virtually all agricultural producers. In a national survey (Smith, 1989), eighty percent of producers reported that marketing decisions were either important or very important to their financial success. This survey also highlighted the growing role of market advisory services. Sixty-six percent of all producers indicated that they had used a market advisory service. Also, out of eleven market information sources, market advisory services were ranked first in terms of usefulness.

Advisory services are major providers of marketing information to producers. However, limited objective evidence exists regarding the hedging behavior and value of marketing information provided by these firms. No study comprehensively documents the hedging behavior of advisory services. Only one study investigates the value of the marketing recommendations of these services. Gehrt and Good (1993) analyze the

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performance of five advisory services for corn and soybeans over the 1985-86 through 1989-90 marketing years. Assuming a representative producer follows the hedging recommendations for each advisory service, an average annual net price received is computed and compared to a benchmark price. They generally find that producers obtain a higher price by following the advisory services' corn and soybean hedging recommendations. However, formal hypothesis tests were not conducted, and it is therefore uncertain whether improvements are statistically significant.

In this study, the pre-harvest hedging behavior and market timing ability of six market advisory services are examined. Daily data on recommended corn and soybean futures and options hedging positions are available for the 1991-1994 pre-harvest seasons. The basic unit for describing the hedging behavior of the advisory services is the recommended net hedge ratio. A variety of descriptive statistics are calculated to characterize the behavior exhibited by the hedge ratio. Three tests are used to determine whether the advisors possess significant market timing ability: i) the Henriksson-Merton test, ii) the Cumby-Modest test, and iii) a zero mean return test. These tests provides rigorous statistical evidence of the advisors' ability to forecast the direction of market price trends.

Data

The database for this study is provided by the Merrill Lynch Ag-Hedge Program, which monitors and executes different hedging strategies recommended by several market advisory services for corn and soybeans. The advisors included in the study are: Bill Johnson's Market Commentary, Brock and Associates, Inc., Deanfield Consulting, Inc., Jim Gill's Market Commentary, Merrill Lynch Senior Analysis, and, Professional Farmers of America, Inc. Throughout the remainder of the paper the advisors are referenced by a randomly assigned number between one and six.

The Merrill Lynch Ag-Hedge Program tracks advisors' hedging recommendations on a real-time basis and then executes the recommended positions for their customers. Hence, this data has the advantageous property that an objective third-party records and executes the recommendations. More specifically, there is a monetary incentive to accurately record the information.

Advisor recommendations are placed and lifted on futures only positions, options only positions, or futures and options combination positions. For example, when a short futures hedging position is recommended, the following information is reported: i) the date the position is initiated, ii) the contract (e.g. December corn), iii) the amount to be hedged (e.g. 20% of expected production), and iv) the actual futures price at which the short or long position is initiated. Positions may be revised on a daily basis, and revisions can occur in several ways. An advisory service can recommend an increase in the amount to be hedged (e.g. increase hedging from 20% to 50% of expected production), a decrease in the amount hedged (e.g. decrease hedging from 20% to 10% of expected production), or the original position can be offset (0%

hedged). In each of these cases, the appropriate entry and exit trading information is recorded in the database.

All of the advisors make futures and options hedging recommendations for both the pre-harvest and post-harvest seasons. Two of the advisors do not make cash sale recommendations during the post-harvest season. Hence, post-harvest hedge ratios are ill-defined in these cases. Because of this problem, analysis is limited to the pre-harvest crop season, defined as the period from September 1 of the year prior to harvest through December 1 (November 1) of the year of harvest for corn (soybeans).

Pre-Harvest Hedging Behavior

The agricultural economics literature is filled with theoretical models of optimal producer hedging. However, Brorsen and Irwin (1994) note the paucity of data on the actual day-to-day hedging behavior of producers. Advisory service hedging recommendations provide unique evidence on this issue. Since the advisory service recommendations correspond to actual hedging positions placed for producers, it is reasonable to assume the recommendations are consistent with the preferences of producers enrolled in the program.

A wide variety of hedge positions are evident in the advisory service data. Common strategies recommended by the advisory services are shown in Table 1. Each strategy can be initiated as a conventional short hedge or a more unconventional long "hedge" position. Since producers are assumed to be long expected production, any strategy adopted to decrease downside price risk is defined as a short hedge position. Using the opposite logic, any strategy adopted to increase downside price risk is defined as a long hedge position. As shown in Table 1, hedge strategies range from the relatively simple, such as short futures or long puts, to the more exotic, such as fences, strips, and straps. Finally, note that all hedging positions are taken in December (November) futures and options contracts for corn (soybeans).

As discussed in the previous section, the advisory services not only provide recommendations regarding the type of hedging instrument, but also the quantity of expected production to hedge. This quantity recommendation, known as the hedge ratio, holds a central place in the optimal hedging literature. It is therefore natural to focus attention on this variable in describing the pre-harvest hedging behavior of the market advisory services.

The hedge ratio is recorded *daily* for each advisory service using the following convention: a positive (negative) hedge ratio corresponds to a short (long) hedge position. Positions are classified as short or long hedges according to the taxonomy found in Table 1. For example, if an advisory service recommends hedging 25 percent of expected production by selling futures, a 25 percent hedge ratio is recorded. Likewise, the same hedge ratio is obtained if puts are purchased on 25 percent of

with the peak in July for corn and September for soybeans. Finally, the plots reinforce an earlier impression that the quantity hedged pre-harvest is not large, even during peak hedging periods.

The seasonal patterns suggests it is worthwhile to investigate the correlation of hedge ratios across advisory services. Pairwise Pearson correlation coefficients for the daily hedge ratios are presented in Tables 6 and 7. There is a little correlation in the daily hedge ratios for corn, with the average correlation coefficient being only 0.08. In contrast, there is substantial positive correlation in the daily soybean hedge ratios. Nearly all correlation coefficients for soybeans exceed 0.25 and the average is 0.39. Hence, advisory service recommendations follow similar patterns in soybeans, but not in corn.

More detailed information on the positions underlying the hedge ratios is presented in Tables 8 and 9. The relative frequency of futures, options, and futures-options hedge positions is indicated by the percentage of total pre-harvest days each class of position is held. The summary statistics for 1991-1994 indicate that four out of the six market advisory services (1,2,3, and 6) use futures as the main instrument for hedging corn, and two (4 and 5) rely most heavily on options and/or futures-options. The results are the same for soybeans, with the exception that one advisor (4) switches to more reliance on futures. There is some variation in these tendencies across crop years for most of the advisory services. In addition, while option hedging strategies are frequently recommended by some services, there is not a general trend towards more usage of options positions over the sample period.

The statistics in Tables 8 and 9 also reveal a generally consistent pattern in the total proportion of days that advisors hold hedge positions during the pre-harvest season. Overall, the advisory services recommend some type of hedging position a substantial proportion of the pre-harvest season. Consider the results for both corn and soybeans over the entire 1991-1994 sample. In all but three cases (advisor 1, corn and soybeans; advisor 4, corn) advisors recommend holding a hedge position between 30 to 50 percent of the time. Again, there is some variation across the crop years for each advisor.

Three additional indicators of hedging behavior are shown in Tables 10 and 11: the number of trades per crop year, the average trade length per crop year, and the turnover ratio. With the exception of advisor 5, the number of trades per crop year is almost always less than ten. This indicates a tendency to revise hedging positions, on average, only once every two to three months. While the hedges generally are not revised frequently, the average trade lengths indicate the positions also are not held for long periods of time, typically from seven to thirty days. It is also interesting to note that the trading frequency and average trade lengths generally are consistent across crop years for a given advisor and commodity.

The turnover ratio is defined as the sum of the short or long hedge ratio recommendations over each pre-harvest crop year. This provides a measure of trading frequency weighted by the quantity hedged. A clear division in the short turnover ratios across the advisors is observed for both corn and soybeans. Considering the averages across 1991-1994, short turnover ratios for advisors 1 through 4 generally are less than 100 percent. In contrast, short turnover ratios for advisors 5 and 6 typically are much larger. The short turnover ratio for advisor 5 is almost 400 percent! There is a good bit of variation in the long turnover ratios, with advisor 5 again having the largest ratio over 1991-1994. It is interesting to note the frequency with which positive long turnover ratios are observed.

The results in this section present an interesting picture of the hedging behavior of market advisory services. First, the services use a wide array of hedging positions, mostly short, sometimes long, and both futures and options are employed. Second, there is substantial time series variation in the hedge recommendations. Within a pre-harvest season, hedge ratios may be as low as -50 percent and as high as +200 percent. Third, the time series variation is at least partially attributable to a distinct seasonal pattern in the hedge positions recommended by the advisory services. This seasonal component typically consists of short positions of modest size, peaking at less than 40 percent of expected production. Fourth, the speculative component of advisory service hedging recommendations can be quite large and often dominates the hedging component. Fifth, there is substantial variation in the recommendations across the advisory services. This is especially true for corn, and less so for soybeans. Finally, despite the speculative orientation, the services generally do not recommend trades more than once a month.

The hedging behavior just described presents a two important challenges to theoretical models of optimal producer hedging. The most obvious is the emphasis on speculation. Traditional models assume that markets are efficient, and hence, the current futures price is the best forecast available. Advisory service hedging behavior clearly is not consistent with this assumption. Another important difference is the quantity of expected production hedged. While the quantity can be large for particular advisory service positions, generally it is fairly modest, on the order of 25 to 50 percent of expected production. Theoretical estimates for pre-harvest hedges typically are closer to 100 percent of expected production (e.g. Karp, 1987; Martinez and Zearing, 1992).

Market Timing Tests

The hedging strategies recommended by market advisory services contain a substantial speculative element. So, it is useful to investigate whether the advisors have an ability to predict the direction of market trends. Three tests are used to determine whether the advisors possess significant market timing ability: i) the Henriksson-Merton test, ii) the Cumby-Modest test, and iii) a zero mean return test.

Hedging recommendations are used to infer directional forecasts of price movements. In doing so, it is desirable to examine only the speculative component of the hedging recommendation. One possibility is to compute deviations from the seasonal hedging patterns reported in the previous section. But, this entails an obvious use of *ex post* data, when *ex ante* tests are highly preferred. Given the difficulty of disentangling the speculative and hedging components, each recommendation is treated as if it is completely speculative. Results should be interpreted with this assumption in mind.

Several additional assumptions are required to apply market timing tests to the hedging recommendations. First, time periods with no hedging positions or long hedging positions are assumed to indicate upward price forecasts, and time periods with short hedging positions are assumed to indicate downward price forecasts. Second, directional forecasts are assumed to apply to December futures prices for corn and November futures prices for soybeans. In other words, a hedge ratio is assumed to indicate a forecast of futures price direction, whether the hedge ratio pertains to a futures position, an options position, or a combined futures and options position. Third, periods with differing hedge ratios are assumed to represent different positions. Fourth, open positions are assumed to be exited on the last trading day of the pre-harvest crop year.

Henriksson-Merton Test

Merton (1981) develops a theoretical model of the value of forecasts that is not dependent upon a particular equilibrium asset pricing model. His model is based on the reasonable assumption that forecasts only have positive value if they cause rational investors to alter their expectations about the future. If there is no such alteration, all of the information contained within the forecast has already been assimilated into the market; thus, the forecast has no positive value. Merton shows that directional accuracy is a sufficient statistic for market timing ability.

A brief description of Merton's model follows. First, define a market direction variable for the *jth* futures contract (*j* = December Corn, November Soybeans), $M_{j,t}$, such that,

$$M_{j,t} = 1 \quad if \quad FP^{X}_{j,t+i} > FP^{E}_{j,t}$$
$$M_{j,t} = 0 \quad if \quad FP^{X}_{j,t+i} \leq FP^{E}_{j,t} \qquad (1)$$

where $FP^{E}_{j,t}$ is closing futures price of the *jth* futures contract at time t and $FP^{X}_{j,t+i}$ is the closing futures price of the *jth* futures contract i days from the entry date t. Next, define a forecast direction variable, $F^{k}_{j,t}$, such that,

$$F^{k}_{j,t} = 1 \quad \text{if} \quad \text{Upward forecast} \quad (FP^{XF}_{j,t+i} > FP^{E}_{j,t}, \text{ negative or zero hedge ratio})$$
$$F^{k}_{j,t} = 0 \quad \text{if} \quad \text{Downward forecast} \quad (FP^{XF}_{j,t+i} \leq FP^{E}_{j,t}, \text{ positive hedge ratio}) \qquad (2)$$

where $F_{j,t}^{k}$ is the futures price forecast direction at the beginning of period *t* by the *kth* market advisory service ($k = 1, \ldots, 6$) of the *jth* futures contract, and $FP_{j,t+i}^{XF}$ is the exit futures price *forecast*, which is not reported in the data set but inferred from the recommended hedging position. Again, a positive hedge ratio recommendation is assumed to forecast downward price movements in the futures market, and a negative or zero hedge ratio recommendation is assumed to forecast upward price movements. Also, note that the length of each forecast period may vary.

Next, probabilities for $F_{j,t}^{k}$ conditional upon the realized direction of futures price change, $M_{j,t}$, can be defined as:

$$\begin{aligned} p_{1,j}^{k} &= \text{Prob}\,[F_{j,t}^{k} = 1 \mid M_{j,t} = 1] \\ 1 - p_{1,j}^{k} &= \text{Prob}\,[F_{j,t}^{k} = 0 \mid M_{j,t} = 1] \\ p_{2,j}^{k} &= \text{Prob}\,[F_{j,t}^{k} = 0 \mid M_{j,t} = 0] \\ 1 - p_{2,j}^{k} &= \text{Prob}\,[F_{j,t}^{k} = 1 \mid M_{j,t} = 0] \end{aligned} \tag{3}$$

Hence, $p_{1,j}^{k}$ is the conditional probability of correctly forecasting that futures price will increase and $p_{2,j}^{k}$ is the conditional probability of correctly forecasting that futures price will decrease or stay constant by the *kth* market advisory service of the *jth* futures contract. Merton shows that the sum of the conditional probabilities of correctly forecasting the direction of price change is a sufficient statistic for market timing value. More specifically, Merton shows that the sum of conditional probabilities $p_{1,j}^{k}$ and $p_{2,j}^{k}$ must exceed one as a necessary condition for rational forecasts to exhibit positive market timing value.

A simple example is helpful in illustrating Merton's market timing condition. Suppose that the forecasting of the price direction movement is based on the toss of a fair coin. In this case, the conditional probability of correctly forecasting that futures price will rise ($p_{1,j}^{k}$) equals 0.5, and the conditional probability of correctly forecasting that futures price will fall or remain constant ($p_{2,j}^{k}$) equals 0.5. Since $p_{1,j}^{k} + p_{2,j}^{k}$ equals, but does not exceed, one, the model does not satisfy the condition for market timing value. As pointed by Henriksson and Merton (1981), this represents the necessary and sufficient condition for a market advisory service's predictions to have *no* value.

Henriksson and Merton derive a statistic to test the null hypothesis of no market timing value (H_0: $p_{1,j}^{k} + p_{2,j}^{k} = 1$). The test proposed by Henriksson and Merton is the same as the one-tail Fisher exact test (Fisher, 1935). Cumby and Modest (1987) note that the Fisher exact test is the uniformly most powerful unbiased test of this null hypothesis. For a given advisor *k* and contract *j*, the test is best seen in the context of the following 2 x 2 contingency table, Forecast Change

		$F^k_{j,t} = 1$	$F^k_{j,t} = 0$	*Total*
Actual Change	$M_{j,t} = 1$	n_1	$N_1 - n_1$	N_1
	$M_{j,t} = 0$	n_2	$N_2 - n_2$	N_2
	Total	n	$N - n$	N

where N_1 is the number of times that actual futures price increases, N_2 is the number of times that actual futures price decreases or stays constant, N equals the sum of N_1 and N_2, n_1 is the number of times that futures prices is *correctly* forecast to increase, n_2 is the number of times that futures prices is *incorrectly* forecast to decrease or stay constant, and n equals the sum of n_1 and n_2 which represents the number of times that futures prices are forecast to increase.

By definition we can write,

$$E(\frac{n_1}{N_1}) = p^k_{1,j}, \quad \text{and} \quad E(\frac{N_2 - n_2}{N_2}) = p^k_{2,j} \tag{4}$$

where E is the expected operator. Now, let us define the one-tail confidence level, c, associated with the *rejection* of the null hypothesis which is based on the hypergeometric distribution and is given by the following formula,

$$c = 1 - \sum_{x=n_1}^{\min(N_1,n)} \frac{\binom{N_1}{x}\binom{N_2}{n-x}}{\binom{N}{n}} \tag{5}$$

Hence, the null hypothesis of *no* market timing is rejected for any level of significance greater than a specific c level (e.g., 0.90).The assumed alternative hypothesis for this study is H_A: $p^k_{1,j} + p^k_{2,j} \neq 0$, to allow for the possibility of perverse forecasters. Thus, a two-tail confidence level is computed.

It is important to note that for a 2 x 2 contingency table the two-tail confidence level is *not* simply two times the one-tail hypergeometric probability, as observed by Henriksson and Merton in their 1981 paper (p. 519). Yates (1984) presents an interesting discussion about the different procedures available to compute the two-tail probability level, and he suggests a *common-sense* procedure (p. 442-443). The SYSTAT statistical software package is utilized in this study, and it computes the two-tail probability level according to Yate's *common-sense* procedure.

Table 12 shows the Henriksson-Merton market timing test results for the market advisory services over 1991-1994 . For corn, the sum of the conditional probabilities exceeds one for only three of the six advisors. In only one of these cases, advisor 6, is the sum significantly larger than one at conventional confidence levels. A similar lack of market timing is indicated for soybeans. While the sum of the conditional probabilities exceeds one for five of the six advisors in soybeans, in no case is significance indicated.

An additional test is conducted by pooling the data for all six advisors for a given commodity. This has two advantages. First, the power of the test is increased by enlarging the sample size. This is particularly important for the Henriksson-Merton test, as it has low power in small samples (Cumby and Modest, 1987). Second, the pooled test is a formal test of the joint hypothesis of no market timing ability across all advisors for a given commodity.

The pooled results for corn indicate that the sum of conditional probabilities is quite close to one, and not surprisingly, does not differ significantly from one. Hence, the joint hypothesis of no market timing cannot be rejected in the case of corn. The pooled results for soybeans are suggestive of significant market timing ability. The sum of conditional probabilities is large than one, and the confidence level is eighty-eight percent. While not exceeding a conventional confidence level, such as ninety percent, the test statistic suggests positive evidence of market timing ability in soybeans.

Overall, the Henriksson-Merton test results provide no evidence of market timing ability on the part of the market advisory services in corn. Some evidence of market timing is found for soybeans. Advisors are modestly successful in predicting the direction of soybean futures price movements.

Cumby-Modest Test

A drawback of the Henriksson-Merton market timing test is that it assumes conditional probabilities are independent of the expected magnitude of returns. As a result, forecasters that are successful in predicting price changes of large magnitude, but are unsuccessful otherwise, will not exhibit market timing ability under the Henriksson-Merton test.

Cumby and Modest (1987) construct a further test of market timing ability, utilizing only Merton's criteria that changing price expectations are due to changing forecast information. Their test incorporates information on the magnitude of subsequent price changes. For this reason, the Cumby-Modest test is sometimes referred to in the literature as a test of "big hit" timing ability (e.g Hartzmark, 1991).

The first step in conducting the Cumby-Modest test is to compute price changes over the period of each trading position. This is done for each advisory service k as follows:

$$R^{k}_{j,t} = [\ln(FP^{x}_{j,t+i}) - \ln(FP^{E}_{j,t})] \times 100 \qquad (6)$$

where $R^{k}_{j,t}$ represents the continuously compounded rate of futures price change in the *jth* futures between time period t and $t+i$. As with the Henriksson-Merton test, the time period for each position may differ considerably.

The second step of the Cumby-Modest test is to estimate the following regression for each advisory service:

$$R^{k}_{j,t} = \alpha + \beta F^{k}_{j,t} + \varepsilon^{k}_{j,t} \qquad (7)$$

where $\varepsilon^{k}_{j,t}$ is a standard normal error term. If the slope coefficient, β, is significantly greater than zero, the null hypothesis of no market timing ability is rejected. Equivalently, the advisory service exhibits a significant ability to predict large price movements.

Table 13 shows the results of the Cumby-Modest tests of market timing ability. The test results for corn are identical to the results found with the Henriksson-Merton test. That is, the slope coefficient is significantly greater than one only for advisor 6 and the pooled results indicate the joint hypothesis of no market timing ability cannot be rejected. This is not the case for soybeans, where the Cumby-Modest test indicates substantially more market timing ability than is found with the Henriksson-Merton test. Using the Cumby-Modest test, four of the six advisors have significant market timing ability (advisors 1,2,3, and 4), and most importantly, the joint hypothesis of no market timing ability is strongly rejected. This indicates the advisors are successful in predicting large soybean price moves.

Overall, the Cumby-Modest test suggest more evidence of market timing ability than the Henriksson-Merton test. It is interesting to note that Cumby and Modest (1987) find a similar result in their study of exchange rate forecasting services.

Zero Mean Return Test

The Henriksson-Merton and Cumby-Modest tests provide useful information on the ability of advisors to predict the direction and magnitude of futures price movements. A further test of timing ability can be constructed that combines these two properties. In this test, gross daily trading returns are computed. If average returns significantly exceed zero, then evidence of market timing ability is indicated. Gerlow, Irwin, and Liu (1993) call this test the 'zero mean return test.' An important advantage of this approach is that the unit of observation is daily return, whereas the unit of observation for the Henriksson-Merton and Cumby-Modest tests is the holding period of the position. By calculating daily returns, the results can be compared to familiar investment benchmarks.

The computation of daily gross trading returns is relatively straightforward. The change in futures prices from t to $t+1$ is:

$$GR_{j,t} = [\ln(FP^{x}_{j,t+1}) - \ln(FP^{E}_{j,t})] \times 100 \qquad (8)$$

On a daily basis, the directional futures price forecast for a given advisor is given by:

$$GF^{k}_{j,t} = 1 \quad \text{if} \quad \text{Upward forecast} \quad (FP^{XF}_{j,t+1} > FP^{E}_{j,t}, \text{ negative or zero hedge ratio})$$

(9)

$$GF^{k}_{j,t} = -1 \quad \text{if} \quad \text{Downward forecast} \quad (FP^{XF}_{j,t+1} \leq FP^{E}_{j,t}, \text{ positive hedge ratio})$$

where $GF^{k}_{j,t}$ is the forecast signal for the next day. Finally, since equation (8) gives the return for a long futures position, the return for a short position is found by simply multiplying equation (8) by negative one. So, the daily gross rate of return for a given advisor k is:

$$GR^{k}_{j,t} = GF^{k}_{j,t} \times GR_{j,t} \qquad (9)$$

where $GR^{k}_{j,t}$ is the daily gross rate of return on forecasting price direction from t to $t+1$. Since treasury bills can be deposited as margin on futures contracts, the gross return can be considered as excess returns above the riskless rate of interest.

The zero mean return test results are reported in Table 14. Two points should be noted before commenting on the test results. First, average returns and standard deviations are reported in annualized form for ease of interpretation. Second, the standard deviations for a given commodity are nearly identical across advisors because the returns are differentiated only by sign and not magnitude.

In the case of corn, four out of the six market advisory services show a positive annual average return. But significance is indicated in only one case, advisor 4. Interestingly, neither of the previous tests indicate significant market timing ability on the part of this advisor in corn. Also, average returns are not significant for advisor 6, whereas the previous two tests indicate significant market timing ability. Pooled average returns are quite small, about one percent per year, and are not significantly greater than zero. This is the same result found with the Henriksson-Merton and Cumby-Modest tests.

In the case of soybeans, average returns are positive for all six advisors. Two of the average returns exceed twelve percent per year and are significantly greater than zero (advisors 3 and 4). This finding is consistent with the Cumby-Modest test results. Two of the advisors (1 and 2) did not have significant average returns, but market timing ability is indicated by the Cumby-Modest tests. Inference regarding individual advisor market timing ability clearly is somewhat sensitive to the different tests.

Pooled average returns for soybeans are substantial, averaging 8.25 percent, and strongly significant. Consistent with the previous market timing tests, the joint null hypothesis of no market timing ability can be rejected. The economic significance of the pooled soybean returns is noteworthy. This level of returns equals the long-run average excess returns for common stocks (Ibbotson Associates, Inc., 1992).

Overall, the pooled results for the three market timing tests are consistent. As a group, the advisors exhibit no market timing ability with respect to corn hedging recommendations. In contrast, the advisors strongly exhibit evidence of market timing ability with respect to soybean hedging recommendations.

Conclusions

Private advisory services are major providers of marketing information to producers. However, limited objective evidence exists regarding the hedging behavior and value of marketing information provided by these firms. No study comprehensively documents the hedging behavior of advisory services. Only one study investigates the value of the marketing recommendations of these services.

In this study, the pre-harvest hedging behavior and market timing ability of six market advisory services are examined. Daily data on recommended corn and soybean futures and options hedging positions are available for the 1991-1994 pre-harvest seasons. The basic unit for describing the hedging behavior of the advisory services is the recommended net hedge ratio. A variety of descriptive statistics are calculated to characterize the behavior exhibited by the hedge ratio. Three tests are used to determine whether the advisors possess significant market timing ability: i) the Henriksson-Merton test, ii) the Cumby-Modest test, and iii) a zero mean return test. These tests provides rigorous statistical evidence of the advisors' ability to forecast the direction of market price trends.

The analysis of hedging behavior resulted in a number of interesting findings. First, the services use a wide array of hedging positions, mostly short, sometimes long, and both futures and options are employed. Second, there is substantial time series variation in the hedge recommendations. Third, the time series variation is at least partially attributable to a distinct seasonal pattern in the hedge positions recommended by the advisory services. Fourth, the speculative component of advisory service hedging recommendations can be quite large and often dominates the hedging component. Fifth, there is substantial variation in the recommendations across the advisory services. Finally, despite the speculative orientation, the services generally do not recommend trades more than once a month.

The hedging behavior of market advisory services presents at least two important challenges to theoretical models of optimal producer hedging. The most obvious is the emphasis on speculation. Another is the quantity of expected production hedged. Generally it is fairly modest, on the order of 25 to 50 percent of expected production.

Overall, the market timing results are consistent across the three tests. Considering the advisors as a group, they exhibit no market timing ability with respect to corn hedging recommendations. In contrast, the advisors strongly exhibit evidence of market timing ability with respect to soybean hedging recommendations. The level of average soybean returns, 8.25 percent per year, is noteworthy. This level of returns equals the long-run average excess returns for common stocks.

Explaining the difference in market timing results across corn and soybeans represents an interesting challenge. It may be simply a function of the particular sample period analyzed in this study. Or, it may be due to differences in hedging behavior across the two markets.

References

Brorsen, B. W. and S. H. Irwin. "Research on Price Forecasting and Marketing Strategies: Improving our Relevance." Proceedings of the *NCR-134 Conference: Applied Commodity Price Analysis, Forecasting, and Market Risk Management*. B. Wade Brorsen, ed., Stillwater, OK: Oklahoma State University, 1994, pp. 1-14.

Cumby, R.E. and D.M. Modest. "Testing for Market Timing Ability: a framework for forecast evaluation." *Journal of Financial Economics* 19(1987):169-189.

Fisher, R.A. "The Logic of Inductive Inference." *Journal of the Royal Statistic Society (A)* 98(1935):39-54.

Gehrt, D.W. and D. Good. "Evaluation of Market Advisory Services for Corn and Soybeans." *Journal of the American Society of Farm Managers and Rural Appraisers* 57(1993):1-7.

Gerlow, M.E., S.H. Irwin, and T. Liu. "Economic Evaluation of Commodity Price Forecasting Models." *International Journal of Forecasting* 9(1993):387-397.

Hartzmark, M.L. "Luck versus Forecast Ability: Determinants of Trader Performance in Futures Markets." *Journal of Business* 64(1991):49-74.

Henriksson, R.D. and R.C. Merton. "On Market Timing and Investment Performance. II. Statistical Procedures for Evaluating Forecasting Skills." *The Journal of Business* 54(1981):513-533.

Ibbotson Associates, Inc. *Stocks, Bonds, Bills and Inflation: 1991 Yearbook*, Chicago, 1992.

Karp, L.S. "Methods for Selecting the Optimal Dynamic Hedge when Production Is Stochastic." *American Journal of Agricultural Economics* 69(1987):647-657.

Martinez, S.W. and K.D. Zearing. "Optimal Dynamic Hedging Decisions for Grain Producers." *American Journal of Agricultural Economics* 74(1992):879-888.

Merton, R.C. "On Market Timing and Investment Performance. I. An Equilibrium Theory of Value for Market Forecasts." *The Journal of Business* 54(1981):363-406.

Smith, R.D. "National Assessment of Producer Marketing Alternative: Practices and Attitudes." College Station: Texas Agricultural Extension Service/Texas A&M University/USDA, 1989.

SYSTAT for Windows: Statistics (Version 5.01). 5th ed. Evanston: SYSTAT, Inc., 1992.

Yates, F. "Tests of Significance for 2 x 2 Contingency Tables." *Journal of the Royal Statistic Society (A)* 147(1984):426-449.

Table 1. Common strategies recommended by market advisory services

SHORT HEDGE	LONG HEDGE
Futures: short	**Futures**: long
Call: short	**Call**: long
Put: long	**Put**: short
Synthetic Put: short futures and long a call at strike price nearest the futures	**Synthetic Call**: long futures and long put at a strike price nearest the futures
Synthetic Futures: long put and write call at the same strike price	**Synthetic Futures**: short put and buy call at the same strike price
Fence: long a put at current futures price and short a call with strike prices above current futures price	**Fence**: long a call at current futures price and short a put with strike prices below current futures price
Synthetic Fence: short futures and long call at current futures price and short a call with strike prices above current futures price	**Synthetic Fence**: long futures and long a put at current futures price and short a put with strike prices below current futures price
Strip: long put and call at the same strike prices with higher hedge ratio recommendation for put	**Strap**: long put and call at the same strike prices with higher hedge ratio recommendation for call

Table 2. Descriptive statistics for pre-harvest hedge ratio recommendations, corn futures / options

Crop Year	Statistics	Adv.1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6	Average
1991	Low	-20	-20	0	0	-33	-50	-20.50
	Hi	50	50	60	95	100	25	63.33
	Mean	4.14	19.29	23.91	25.4	10.51	9.19	15.41
	StDv	11.03	20.51	26.81	24.55	33.38	18.55	22.47
1992	Low	0	0	0	0	0	-50	-8.33
	Hi	40	40	40	75	100	100	65.83
	Mean	2.58	18.04	14.39	31.5	13.76	8.5	14.80
	StDv	9.19	14.16	18.2	30.48	24.79	20.39	19.54
1993	Low	0	-50	0	-25	0	0	-12.50
	Hi	30	40	50	80	175	75	75.00
	Mean	2.3	-9.63	12.18	12.07	85.35	7.21	18.25
	StDv	6.56	28.22	15.68	36.33	60.21	18.26	27.54
1994	Low	0	-50	0	-50	0	0	-16.67
	Hi	60	25	50	40	100	100	62.50
	Mean	7.58	-13.8	19.23	-5.95	27.3	12.11	7.75
	StDv	17.52	30.27	23.8	32.17	43.92	22.59	28.38
91-94	Low	-20	-50	0	-50	-33	-50	-33.83
	Hi	60	50	60	95	175	100	90.00
	Mean	4.15	3.46	17.42	15.75	34.25	9.25	14.05
	StDv	11.96	28.56	22.02	34.3	52.24	20.08	28.19

Table 3. Descriptive statistics for pre-harvest hedge ratio recommendations, soybean futures / options

Crop Year	Statistics	Adv.1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6	Average
1991	Low	-20	-20	0	-40	-50	-50	-30.00
	Hi	25	40	30	60	100	25	46.67
	Mean	3.55	10.59	10.53	13.85	19.77	-0.49	9.63
	StDv	8.65	17.72	12.52	34.23	27.28	9.94	18.39
1992	Low	0	0	0	0	-50	0	-8.33
	Hi	40	40	20	80	30	75	47.50
	Mean	1.58	19.93	9.34	30.31	-0.69	7.57	11.34
	StDv	7.09	17.23	9.13	30.45	16	16.13	16.01
1993	Low	0	-50	0	-25	-80	0	-25.83
	Hi	40	30	50	40	100	50	51.67
	Mean	4.79	-13.62	12.4	7.48	-2.76	13.08	3.56
	StDv	11.69	24.33	21.1	13	29.7	12.67	18.75
1994	Low	0	-50	0	0	-30	0	-13.33
	Hi	50	50	50	75	205	100	88.33
	Mean	5.84	-5.1	17.24	20.71	36.58	43.09	19.73
	StDv	15.23	37.43	23.04	31.1	57.14	48.25	35.37
91-94	Low	-20	-50	0	-40	-80	-50	-40.00
	Hi	50	50	50	80	205	100	89.17
	Mean	3.94	2.95	12.37	18.07	13.21	15.8	11.06
	StDv	11.2	28.64	17.67	29.63	39.27	31.32	26.29

Table 4. Monthly averages of pre-harvest hedge ratio recommendations for corn futures / options

Crop Year	Advisor	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
91-94	Adv. 1	0.00	0.00	0.91	0.00	0.00	0.00	0.00	3.52	10.95	8.69	17.40	12.45	7.90	0.00	0.00
	Adv. 2	5.02	10.87	10.54	15.00	8.26	8.23	0.12	3.86	10.46	2.84	-0.64	4.43	-1.25	5.00	-5.14
	Adv. 3	0.00	5.80	0.00	0.00	0.00	0.00	0.00	1.82	12.09	32.61	40.16	45.00	45.00	46.19	30.78
	Adv. 4	0.00	0.00	1.19	4.35	-3.74	-9.25	-4.23	-3.75	5.09	19.66	47.96	53.53	51.25	49.23	27.48
	Adv. 5	0.00	3.69	1.19	0.00	25.37	49.05	74.23	83.13	55.50	33.67	57.59	58.33	23.44	32.84	13.86
	Adv. 6	1.56	6.25	6.25	6.25	6.25	6.25	6.25	18.56	21.46	20.77	28.63	10.67	-3.06	5.44	-4.38
	Average	1.10	4.43	3.35	4.27	6.02	9.05	12.73	17.86	19.26	19.71	31.85	30.73	20.55	23.11	10.43

Table 5. Monthly averages of pre-harvest hedge ratio recommendations for soybean futures / options

Crop Year	Advisors	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	Jun.	July	Aug.	Sept.	Oct.
91-94	Adv. 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.86	10.11	10.49	17.81	6.98	5.69	0.00
	Adv. 2	3.50	4.35	1.43	7.86	12.86	2.00	-12.50	-2.96	-8.22	-0.77	10.33	10.54	7.73	4.79
	Adv. 3	0.00	0.00	0.00	0.00	0.00	0.00	2.28	3.52	12.34	21.48	32.27	32.39	37.50	25.25
	Adv. 4	0.00	0.00	0.00	0.00	1.63	-4.63	14.42	-1.70	21.46	30.00	55.48	59.21	58.07	33.92
	Adv. 5	0.00	0.00	0.00	0.00	0.00	12.00	14.13	22.86	16.37	-0.28	13.45	51.72	63.69	-4.69
	Adv. 6	0.00	0.00	0.00	0.00	3.13	0.00	2.99	12.75	32.04	37.79	36.23	33.77	31.82	29.76
	Average	0.58	0.72	0.24	1.31	2.94	1.56	3.55	6.39	14.02	16.45	27.59	32.43	34.08	14.84

Table 6. Correlations of pre-harvest hedge ratio recomendations for corn

Advisor	Adv. 1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6	*Average*
Adv. 1		0.19	0.33	0.07	0.16	0.27	0.20
Adv. 2	0.19		-0.07	0.14	-0.26	-0.05	-0.01
Adv. 3	0.33	-0.07		0.61	-0.06	-0.04	0.15
Adv. 4	0.07	0.14	0.61		-0.07	-0.01	0.15
Adv. 5	0.16	-0.26	-0.06	-0.07		0.20	-0.01
Adv. 6	0.27	-0.05	-0.04	-0.01	0.20		0.08

Table 7. Correlations of pre-harvest hedge ratio recomendations for soybean futures / options

Advisor	Adv. 1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6	*Average*
Adv. 1		0.25	0.29	0.27	0.25	0.35	0.28
Adv. 2	0.25		-0.03	0.35	0.19	0.03	0.14
Adv. 3	0.29	-0.03		0.71	0.46	0.62	0.44
Adv. 4	0.27	0.35	0.71		0.27	0.40	0.43
Adv. 5	0.25	0.19	0.46	0.27		0.50	0.36
Adv. 6	0.35	0.03	0.62	0.40	0.50		0.39

Table 8. Percentage of total pre-harvest business days that market advisory services make hedging recommendations for corn futures / options

Crop year	Hedge Form[1]	Adv.1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6
1991	FH	4.31	51.69	45.23	4.92	0.00	63.08
	OH	10.46	4.00	0.00	0.00	34.46	0.00
	F-OH	1.54	3.69	1.85	60.92	30.77	0.00
	Total	16.31	59.38	47.08	65.85	65.23	63.08
1992	FH	7.98	69.63	41.10	2.45	28.83	27.91
	OH	0.00	0.00	0.00	0.31	0.00	0.00
	F-OH	0.00	0.00	0.00	61.35	0.00	0.00
	Total	7.98	69.63	41.10	64.11	28.83	27.91
1993	FH	0.00	12.58	41.72	7.67	5.21	16.56
	OH	1.23	28.53	0.00	33.44	60.43	0.00
	F-OH	11.04	0.00	0.00	30.98	7.36	0.00
	Total	12.27	41.10	41.72	72.09	73.01	16.56
1994	FH	16.56	2.45	41.10	0.00	28.53	27.61
	OH	0.00	38.65	0.00	29.14	0.00	0.00
	F-OH	0.00	20.25	0.00	39.57	0.00	0.00
	Total	16.56	61.35	41.10	68.71	28.53	27.61
91-94	FH	7.21	34.08	42.29	3.76	15.66	33.77
	OH	2.92	17.81	0.00	15.73	23.71	0.00
	F-OH	3.15	5.99	0.46	48.20	9.52	0.00
	Total	13.28	57.87	42.75	67.69	48.89	33.77

[1] FH - hedging with futures only; OH - hedging with options only; F-OH - hedging with futures and options

Table 9. Percentage of total pre-harvest business days that market advisory services make hedging recommendations for soybean futures / options

Crop Year	Hedge Form[1]	Adv.1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6
1991	FH	13.49	32.24	41.78	14.47	1.64	6.91
	OH	4.61	4.28	0.00	16.78	43.75	0.00
	F-OH	0.00	2.63	1.97	28.62	6.91	0.00
	Total	18.09	39.14	43.75	59.87	52.30	6.91
1992	FH	5.25	62.62	54.75	52.46	4.92	21.64
	OH	0.00	0.00	0.00	0.00	16.39	0.00
	F-OH	0.00	0.00	0.00	6.23	0.00	0.00
	Total	5.25	62.62	54.75	58.69	21.31	21.64
1993	FH	15.79	3.95	26.64	6.91	0.00	51.97
	OH	0.00	29.61	0.00	0.33	20.72	0.00
	F-OH	0.00	0.00	0.00	22.04	14.47	0.00
	Total	15.79	33.55	26.64	29.28	35.20	51.97
1994	FH	13.82	23.36	37.17	37.17	0.00	45.72
	OH	0.00	33.55	0.00	0.00	25.33	0.00
	F-OH	0.00	0.00	0.00	0.00	32.24	0.00
	Total	13.82	56.91	37.17	37.17	57.57	45.72
91-94	FH	12.08	30.57	40.10	27.77	1.64	31.55
	OH	1.15	16.84	0.00	4.27	26.54	0.00
	F-OH	0.00	0.66	0.49	14.22	13.39	0.00
	Total	13.23	48.07	40.59	46.26	41.58	31.55

[1] FH - hedging with futures only; OH - hedging with options only; F-OH - hedging with futures and options

Table 10. Number of trades, average trade length, and turnover ratios for corn futures / options

Crop Year	Trade[1] / Turnover	Adv. 1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6
1991	# of trades	9	9	5	9	31	4
	Average trade length (days)	5.89	21.44	30.60	23.78	6.84	51.25
	Turnover ratio SH	175	190	60	135	523	25
	Turnover ratio LH	20	20	0	0	366	50
1992	# of trades	5	7	4	7	8	19
	Average trade length (days)	5.20	32.43	33.50	29.86	11.75	4.79
	Turnover ratio SH	100	120	40	75	349	420
	Turnover ratio LH	0	0	0	0	0	50
1993	# of trades	5	3	7	9	12	7
	Average trade length (days)	8.00	44.67	19.43	26.11	19.83	7.71
	Turnover ratio SH	40	70	100	120	325	145
	Turnover ratio LH	0	50	0	25	0	0
1994	# of trades	4	5	3	7	7	5
	Average trade length (days)	13.50	40.00	44.67	32.00	13.29	18.00
	Turnover ratio SH	60	50	50	70	400	175
	Turnover ratio LH	0	150	0	50	0	0
91-94	# of trades	23	24	19	32	58	35
	Average trade length (days)	7.52	31.42	29.32	27.56	10.98	12.57
	Turnover ratio SH	93.75	107.50	62.50	100.00	399.25	191.25
	Turnover ratio LH	5.00	55.00	0.00	18.75	91.50	25.00

[1] Average trade length are in days. Turnover ratio SH (short hedge, bearish) and LH (long hedge, bullish) are in percentage.

Table 11. Number of trades, average trade length, and turnover ratios for soybean futures / options

Crop Year	Trade[1] / Turnover	Adv.1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6
1991	# of trades	4	8	3	9	13	2
	Average trade length (days)	13.75	14.88	44.33	20.22	12.23	10.50
	Turnover ratio SH	65	160	30	105	730	25
	Turnover ratio LH	20	20	0	80	150	50
1992	# of Trades	2	6	2	9	7	15
	Average trade length (days)	8.00	31.83	83.50	19.89	9.29	4.40
	Turnover ratio SH	40	160	20	125	60	350
	Turnover ratio LH	0	0	0	0	200	0
1993	# of trades	3	7	3	6	11	5
	Average trade length (days)	16.00	14.57	27.00	14.83	9.73	31.60
	Turnover ratio SH	65	30	50	60	180	100
	Turnover ratio LH	0	50	0	25	210	0
1994	# of trades	5	2	5	6	23	2
	Average trade length (days)	8.40	86.50	22.60	18.83	7.61	69.50
	Turnover ratio SH	125	50	50	95	445	100
	Turnover ratio LH	0	-50	0	0	120	0
91-94	# of trades	14	23	13	30	54	24
	Average trade length (days)	11.50	25.43	38.00	18.77	9.37	16.00
	Turnover ratio SH	73.75	100.00	37.50	96.25	353.75	143.75
	Turnover ratio LH	5.00	5.00	0.00	26.25	170.00	12.50

[1] Average trade length are in days. Turnover ratio SH (short hedging, bearish) and LH (long hedging, bullish) are in percentage.

Table 12. Henriksson-Merton market timing test results for corn and soybeans, 1991-1994

Advisory Service	Corn[1]			Soybeans		
	p_1	p_2	$p_1 + p_2$	p_1	p_2	$p_1 + p_2$
1	0.3571	0.5652	0.9223 (0.2620)	0.6364	0.5000	1.1364 (0.3040)
2	0.5217	0.4444	0.9661 (0.0000)	0.4706	0.4375	0.9081 (0.2680)
3	0.3333	0.6875	1.0208 (0.0000)	0.4167	0.6667	1.0834 (0.0000)
4	0.4000	0.7273	1.1273 (0.4850)	0.4118	0.7727	1.1845 (0.7010)
5	0.3333	0.5333	0.8666 (0.7450)	0.5610	0.5778	1.1388 (0.7200)
6	0.5909	0.6875	1.2784 (0.9460)	0.4615	0.6154	1.0769 (0.2640)
Pooled	0.4274	0.6026	1.0300 (0.3730)	0.5045	0.5970	1.1015 (0.8770)

Note: Numbers within parentheses report the two-tail confidence level (c), as demonstrated by equation (5) in this study, associate with the *rejection* of the null hypothesis of no market timing ability (H_0: $p_1 + p_2 = 1$)

[1] p_1 is the conditional probability of correctly forecasting that price will increase and p_2 is the conditional probability of correctly forecasting that price will decrease or stay constant.

Table 13. Cumby-Modest market timing test results for corn and soybeans, 1991-1994

Advisory Service	Corn			Soybeans		
	α[1]	β[2]	R^2	α	β	R^2
1	-0.4436 (-0.443)	-0.4152 (-0.2640)	0.0019	-2.7035 (-2.0326)**	3.2343 (1.8125)*	0.1161
2	-0.9132 (-0.772)	0.6725 (0.4167)	0.0044	-1.4654 (-1.1008)	1.4045 (1.4045)*	0.0181
3	-1.3785 (-0.984)	1.7729 (0.7175)	0.0194	-3.4502 (-1.4199)	5.9966 (1.5233)*	0.1088
4	-1.5625 (-1.374)	3.0703 (1.5597)	0.0573	-1.5645 (-1.8288)*	3.0447 (1.9741)*	0.0953
5	0.4988 (0.8769)	-1.9234 (-2.1650)	0.0581	-0.6195 (-0.9860)	0.6857 (0.7627)	0.0069
6	-1.1264* (-1.834)	1.6601 (1.7641)*	0.0564	-0.8892 (-1.2927)	0.6374 (0.5935)	0.0094
Pooled	-0.6608 (-1.8009)*	0.42747 (0.7466)	0.0020	-1.4126 (-3.4081)**	1.8108 (2.9275)**	0.0341

Note: Numbers within parentheses report the *t*-statistics. One and two stars indicate statistical significance at the 10% and 5% level respectively, based on a one-tailed test of the slope coefficient and a two-tailed test of the intercept coefficient.

1 Intercept coefficient of the OLS estimator.

2 Slope coefficient of the OLS estimator.

Table 14. Zero mean return tests for corn and soybeans, 1991-1994

Crop	Statistic	Adv. 1	Adv. 2	Adv. 3	Adv. 4	Adv. 5	Adv. 6	*Pooled*
Corn	Average Return (annual %)	-0.61	2.38	5.41	12.79**	-13.07	7.27	1.06
	Standard Deviation (annual %)	16.002	16.002	15.999	15.8925	15.9826	15.9961	15.9973
	t-Ratio	0.0865	0.3345	0.7611	1.8	-1.9	1.02	0.3641
Soybeans	Annual Return (annual %)	8.53	4.73	13.77**	12.66*	6.34	3.47	8.25**
	Standard Deviation (annual %)	16.8995	16.9053	16.886	16.8894	16.9032	16.9065	16.8942
	t-Ratio	1.0983	0.609	1.7745	1.6321	0.8164	0.4462	2.6032

Note: One and two stars indicate statistical significance at the 10% and 5% level respectively, based on a one-tailed test.

Figure 1. Pre-harvest hedge ratio recomendations, advisor # 2, corn futures / options, 1991

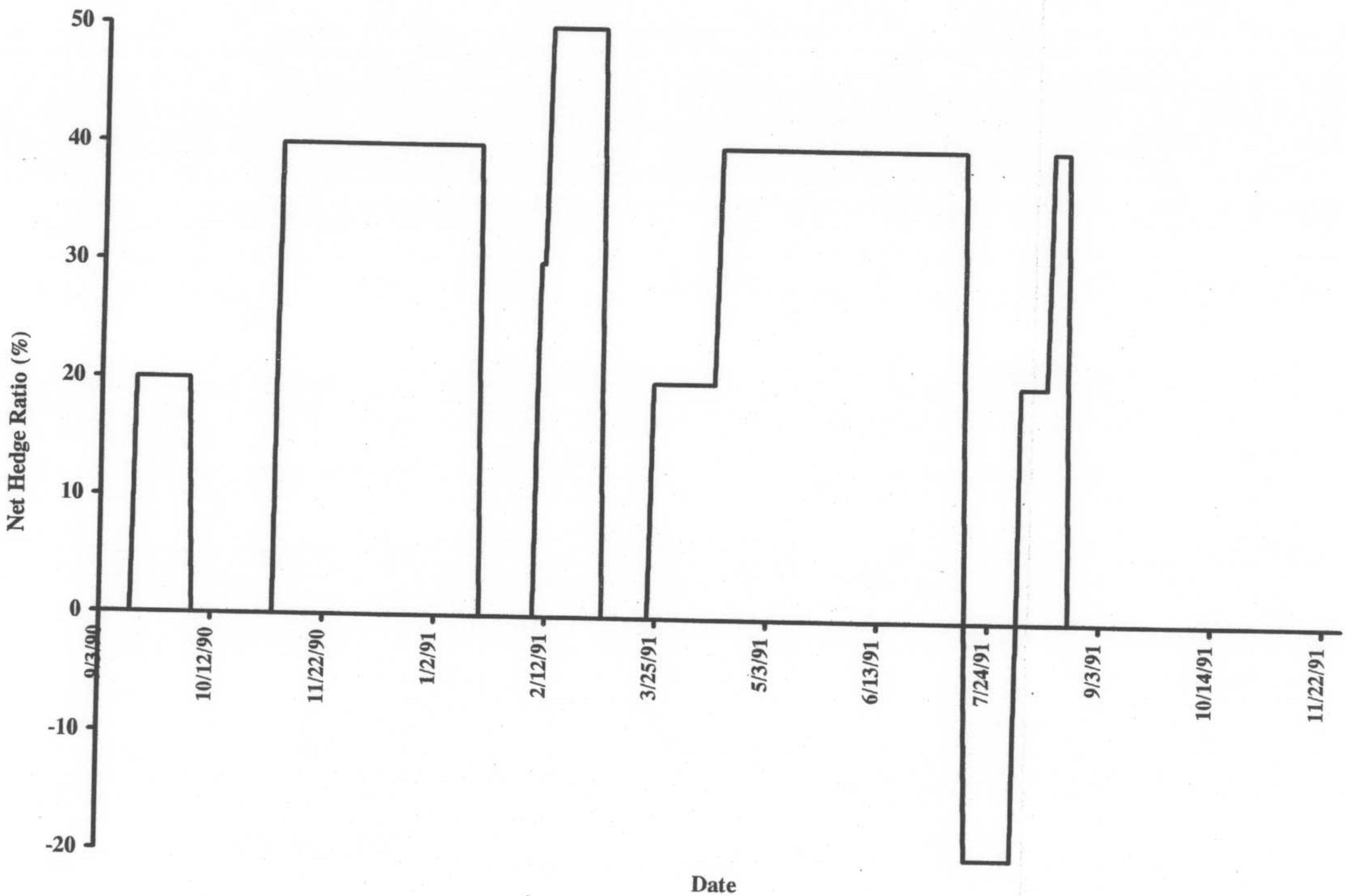

Figure 2. Pre-harvest hedge ratio recommendations, advisor # 5, soybeans futures / options, 1993

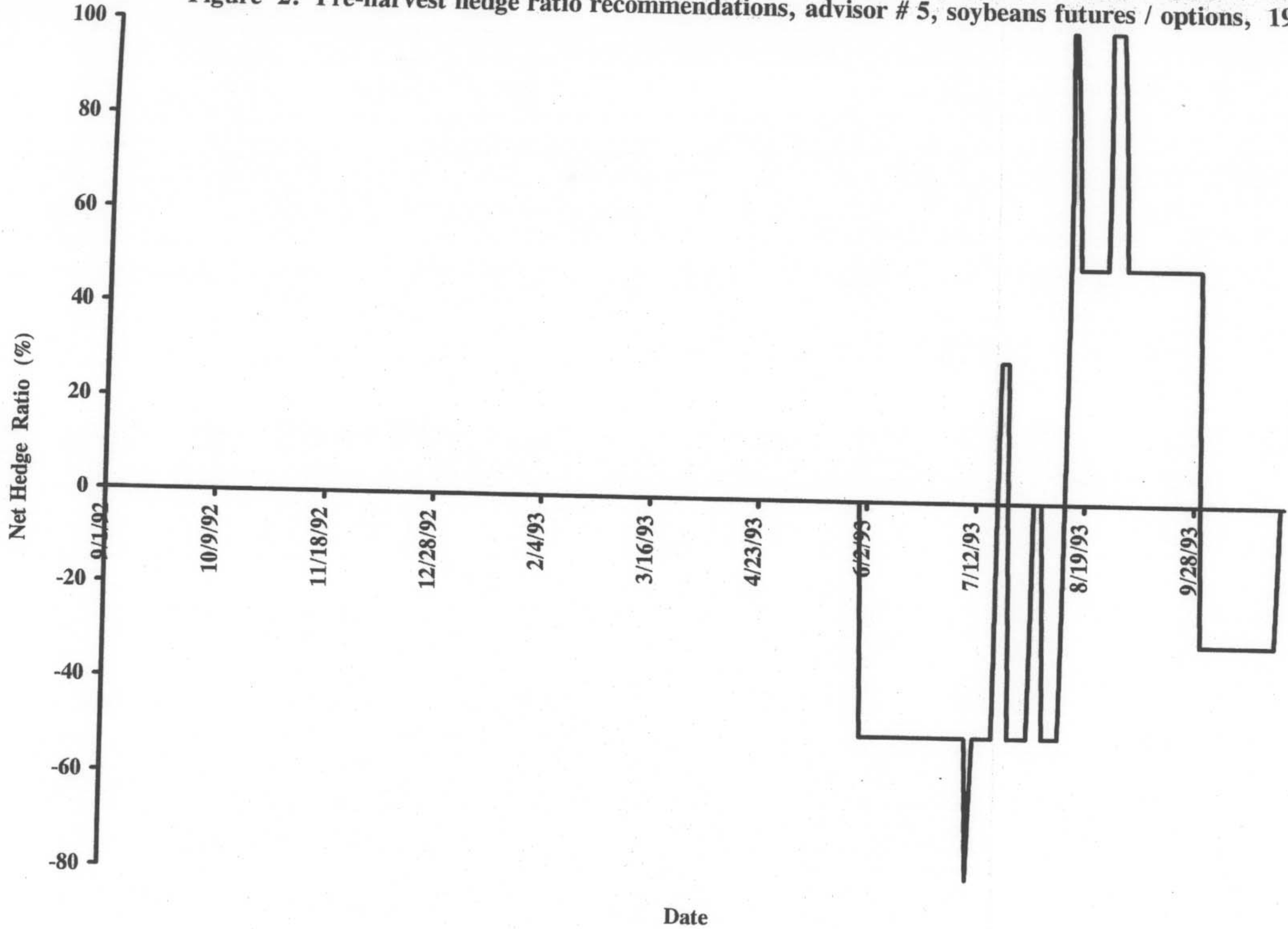

Figure 3. Pre-harvest hedge ratio recommendations, corn futures / options, 1994

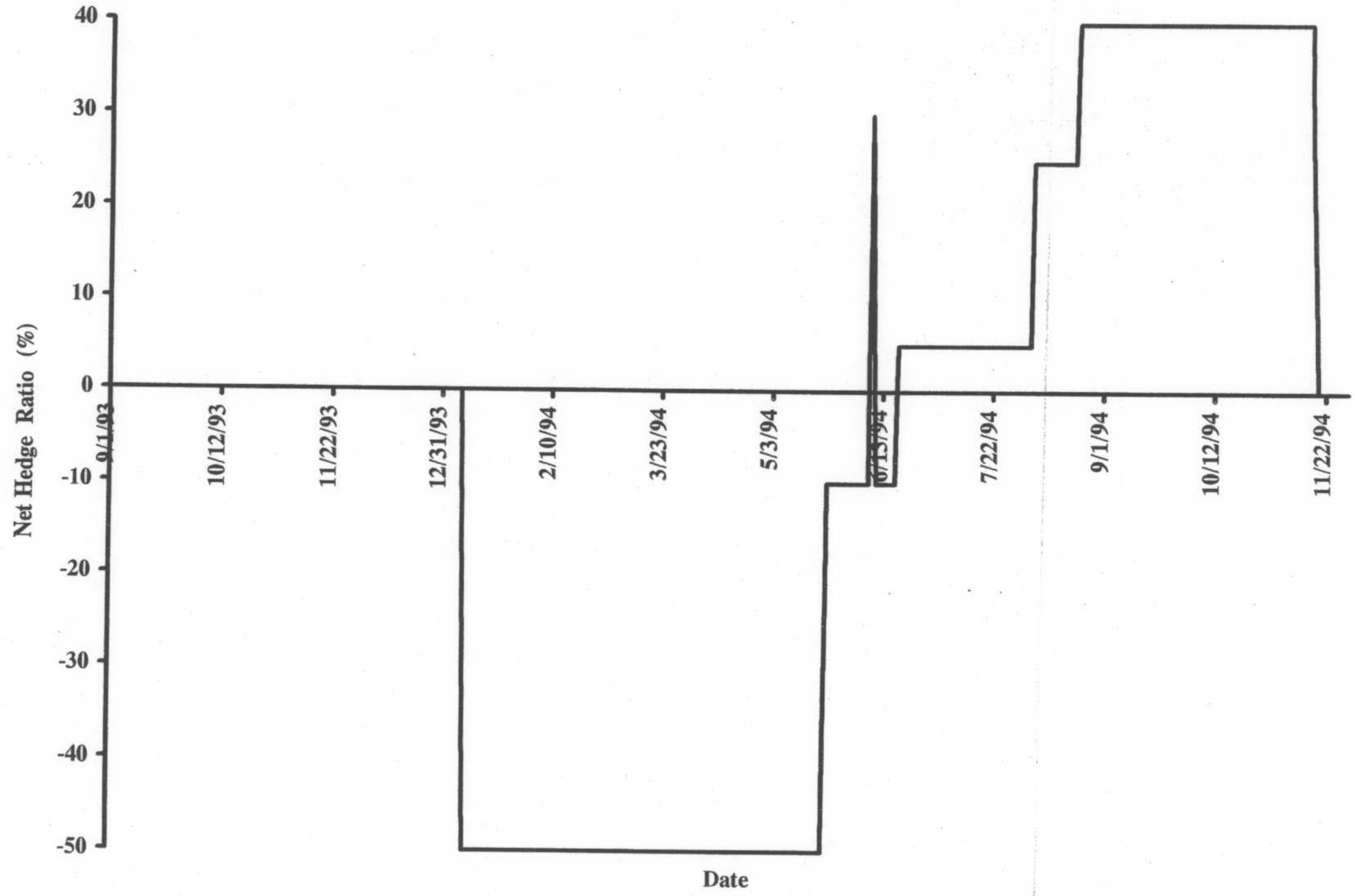

Figure 4. Monthly averages of pre-harvest hedge ratio recommendations, all advisors, 1991-1994