The Performance of Agricultural Market Advisory Services in Corn and Soybeans

by

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Abstract

The purpose of this paper is to evaluate the performance of market advisory services for the 1995-2000 corn and soybean crops. A new database from the Agricultural Market Advisory Services (AgMAS) Project is used in the evaluation. This database should not be subject to survivorship and hindsight biases. Overall, the results provide limited evidence that advisory programs as a group outperform market benchmarks, particularly after considering risk. In contrast, some evidence exists that advisory programs as a group outperform the farmer benchmark, even after taking risk into account. There is little evidence that advisory programs with superior performance can be usefully selected based on past performance.

Key Words: advisory service, corn, market efficiency, performance, price, risk management, soybeans

The Performance of Agricultural Market Advisory Services in Corn and Soybeans

For a subscription fee, agricultural market advisory services provide specific pricing advice to farmers, such as when and what amount to hedge in the futures market or sell in the cash market.[1] Advisory services frequently assert that farmers sell two-thirds of their crops in the bottom one-third of the seasonal price range, but with the assistance and guidance a service provides, farmers can substantially improve marketing performance.[2] Numerous surveys show that farmers view market advisory services as an important tool in managing price and income risk (e.g., Sogn and Kraner; Smith, 1989; Patrick, Musser and Eckman). Furthermore, Davis and Patrick find that the use of market advisory services has a significant influence on the use of forward pricing by farmers.

Given the important role that advisory services play in farm marketing, it is somewhat surprising that only two previous academic studies investigate whether the performance claims of market advisory services are true (Gehrt and Good; Martines-Filho).[3] The results generally suggest that corn and soybean farmers can obtain a higher price by following the marketing recommendations of advisory services. While a useful starting point, these studies have important limitations. First, the cross-section of advisory services tracked for each crop year is quite small, with the largest sample including only six advisory services. Second, the results may be subject to survivorship bias, a consequence of tracking only advisory services that remain in business at the end of a sample period. The literature on the performance of mutual funds, hedge funds and commodity trading advisors provides ample evidence of the upward bias in performance results that can result from survivorship bias (e.g., Brown, Goetzmann, Ibbotson and Ross; McCarthy, Schneeweis and Spurgin; Brown, Goetzmann and Ibbotson). Third, the results may be subject to hindsight bias because advisory service recommendations are not collected on a "real-time" basis (Jaffe and Mahoney). Hindsight bias is the tendency to collect or record profitable recommendations and ignore or minimize unprofitable recommendations after the fact.

This discussion highlights the need for further research on the performance of agricultural market advisory services. In particular, much larger samples of advisory services are needed and databases should be more carefully constructed to avoid survivorship and hindsight biases. The purpose of this paper is to evaluate the pricing performance of market advisory services in corn and soybeans using a new database available from the Agricultural Market Advisory Services (AgMAS) Project at the University of Illinois at Urbana-Champaign. Data for no fewer than 23 market advisory services are available for each crop year over 1995-2000.[4] While the sample of advisory services is non-random, it is constructed to be generally representative of the majority of advisory services offered to farmers. Further, the sample of advisory services includes all programs tracked by the AgMAS Project over the study period, so pricing performance results should not be plagued by survivorship bias. The AgMAS Project subscribes to all of the services that are followed and records recommendations on a real-time basis. This should prevent the pricing performance results from being subject to hindsight bias.

Following the literature on mutual fund and investment newsletter performance (e.g., Metrick; Jaffe and Mahoney), two basic questions will be addressed in the paper: 1) Do market advisory services, on average, outperform appropriate benchmarks? and 2) Do market advisory services exhibit persistence in their performance from year-to-year? Explicit marketing assumptions are made to produce a consistent and comparable set of results across different advisory programs. Based on these assumptions, the net price received by a subscriber to a market advisory program is calculated for the 1995-2000 corn and soybean crops. The first performance test compares the average price of advisory programs and benchmarks. The second compares both the average price and risk of advisory programs and benchmarks. The third evaluates the predictability of advisory program performance from year-to-year. Both market and farmer benchmarks are developed for the evaluations. The benchmarks are computed using the same assumptions as those applied to advisory service track records.

Market Advisory Service Recommendations

The AgMAS Project was initiated in 1994 with the goal of providing unbiased and rigorous evaluation of market advisory services. Five criteria have been used to determine which advisory services are included in the AgMAS study. First, marketing recommendations from an advisory service must be received electronically in real time. Second, a service has to provide marketing recommendations to farmers rather than (or in addition to) speculators or "traders." Third, marketing recommendations from an advisory service must be in a form suitable for application to a representative farmer. That is, the recommendations have to specify the percentage of the crop involved in each transaction ---cash, futures or options--- and the price or date at which each transaction is to be implemented. Fourth, advisory services must provide "blanket" or "one-size fits all" marketing recommendations so there is no uncertainty about implementation. Fifth, a candidate service must be a viable, commercial business.

Three forms of survivorship bias may be potential problems when assembling an advisory program database. The first and most direct form of survivorship bias occurs if only advisory programs that remain in business at the end of a given sample period are included in the sample. This form of bias should not be present in the AgMAS database of advisory programs because all programs that have been tracked over the entire time period of the study are included in the sample. The second form of survivorship bias occurs if discontinued advisory programs are deleted from the sample for the year when they are discontinued. This is a form of survivorship bias because only survivors for the full crop year are tracked. The AgMAS database of advisory programs should not be subject to this form of bias because programs discontinued during a crop year remain in the sample for that crop year. Cash positions remaining after the date of discontinuation are sold using the same strategy as the market benchmarks utilized for this study. The third and most subtle form of survivorship bias occurs if data from prior periods are "back-filled" at the point in time when an advisory program is added to the database. This is a form of survivorship bias because data from surviving advisory programs are back-filled. The AgMAS database should not be subject to this form of bias because recommendations are not back-filled when an advisory program is added. Instead, recommendations are collected only for the crop year after a decision has been made to add an advisory program to the database.

The AgMAS Project subscribes to all of the services that are followed and records recommendations on a real-time basis, and therefore, the database of recommendations should not be subject to hindsight bias. The information is received electronically, via satellite transmission, website or e-mail. For the programs that provide multiple daily updates, typically in the morning and at noon, information is recorded for all updates. In this way, the actions of a farmer-subscriber are simulated in real-time. The final set of recommendations attributed to each advisory program represents the best efforts of the AgMAS Project staff to accurately and fairly interpret the information made available by each advisory program. In cases where a recommendation is considered vague or unclear, some judgment is exercised as to whether or not to include that particular recommendation. This occurs most often when a program suggests that "a farmer might consider" a position, or when minimal guidance is given as to the quantity to be bought or sold. Given that some recommendations are subject to interpretation, the possibility is acknowledged that the AgMAS track record of recommendations for a given program may differ from that stated by the advisory program, or from that recorded by another subscriber.[5]

Advisory programs employ a diverse set of futures, options and cash positions (Bertoli *et al.*). These must be weighted in some manner before valid comparisons can be made. Since the price exposure of a portfolio of positions is a weighted-average of the price exposures of the individual positions, where the weights are the deltas of the individual positions (Hull), "marketing profiles" can be constructed that are comparable across programs.[6] More specifically, a marketing profile shows the net amount priced (sold) by an advisory program, on a cumulative basis, each day over the marketing window. Two marketing profile examples in corn for the 2000 crop year are presented in Figure 1.[7] These profiles nicely illustrate the wide range in marketing "styles" found across advisory programs.[8] The top panel shows a "conservative" program that engages in minimal pre-harvest pricing and makes a small number of pricing transactions post-harvest. The bottom panel shows an "aggressive" program, which in this example includes full to no hedging of expected production during the pre-harvest period, some periods where the net position is long during post-harvest (negative net amount priced) and very late sales of much of the cash commodity.

The marketing profile examples suggest three interesting observations. First, the time-series variation in the net amount priced (hedge ratio) often is much larger than what optimal hedging models typically generate (e.g., Lei, Liu and Hallam; Martines-Filho). Second, advisory programs engage in what Working termed "selective" hedging strategies. Third, a similar type of behavior has been frequently observed in the risk management programs of financial and non-financial corporations, where it is labeled "hedging with a view" (Stulz; Brown and Khokher; Brown, Crabb and Haushalter).

Computing the Returns to Marketing Recommendations

In order to simulate a consistent and comparable set of results across different market advisory programs, certain explicit marketing assumptions are made. These assumptions are intended to accurately depict "real-world" marketing conditions. Several key assumptions are: i) the advice for a given crop year is considered to be complete for each advisory program when cumulative cash sales of the commodity reach 100%, all futures positions covering the crop are offset, all option positions covering the crop are either offset or expire, and the advisory program discontinues giving advice for that crop year, ii) with a few exceptions, the marketing window for a crop is 24 months in length and runs from September of the year before harvest through August after harvest, iii) cash prices and yields refer to a central Illinois farm, iv) commercial storage costs are charged to post-harvest sales, v) brokerage costs are subtracted for all futures and options transactions and vi) Commodity Credit Corporation (CCC) marketing loan recommendations made by advisory programs are followed wherever feasible. Based on these and other assumptions, a weighted-average net price is computed for each advisory program included in a particular crop year. It should be interpreted as the harvest-equivalent net price received by a farmer who precisely follows the marketing advice for a given program (as recorded by the AgMAS Project). The price is stated on a harvest-equivalent basis because post-harvest sales are adjusted for physical storage and interest opportunity costs. An example will help illustrate the computation of net advisory prices. For the 2000 crop year in corn, the highest net advisory price is $2.78 per bushel, and it is computed as the unadjusted cash sales price ($2.05) minus commercial storage costs ($0.27) plus futures and options gain ($0.69) minus brokerage costs ($0.06) plus marketing loan benefits ($0.37). The AgMAS research report by Irwin, Martines-Filho and Good contains complete details on assumptions and computation of net advisory prices.

Since many subscribers to market advisory services produce both corn and soybeans, it is relevant to examine a combined measure of corn and soybean pricing performance for each market advisory program. One way to aggregate the results is to calculate the per-acre revenues implied by the pricing performance results. The per-acre revenue for each commodity is found by multiplying the net advisory price for each market advisory service by the actual central Illinois corn or soybean yield for each year. A simple average of the two per acre revenues is then taken to reflect a farm that uses a 50/50 rotation of corn and soybeans.

Two different types of benchmarks are used to compute the returns to the marketing advice provided by advisory programs. The first class of benchmarks is based on the theory of efficient markets. In its strongest form, efficient market theory predicts that market prices always fully reflect available public and private information (Fama). The practical implication is that no trading strategy can consistently beat the return offered by the market. Hence, the return offered by the market becomes the relevant benchmark. In the context of this study, a market benchmark should measure the average price offered by the market over the marketing window of a representative farmer who follows advisory program recommendations. The average price is computed in order to reflect the returns to a naïve, "no-information" strategy of marketing equal amounts each day during the marketing window. The difference between advisory prices and the market benchmark measures the value of advisory service information. The theory of efficient markets predicts this difference, on average, will equal zero.[9]

If all market participants are rational in the way efficient market theory assumes, then the only relevant benchmarks are market benchmarks. However, there is growing evidence that many market participants may not be fully rational in the efficient market sense. Hirshleifer provides a comprehensive review of the judgment and decision biases that appear to affect securities market investors. He also provides an exhaustive review of empirical studies that attempt to measure the potential impact of such biases on securities prices and investment returns. As an example, Barber and Odean find that individual stock investors under-perform the market by an average of one-and-a-half percentage points per year, an economically significant amount, particularly when viewed over long investment horizons. They argue that a combination of overconfidence and excessive trading explains this finding. New "behavioral" theories of market pricing have been developed based on the assumption that market participants are subject to judgment and decision biases (e.g., Daniel, Hirshleifer and Subrahmanyam).

Behavioral market theory suggests that the average return actually achieved by a significant number of market participants may be less than that predicted by efficient market theory, due to the judgment and decision biases that plague these participants. As a result, the average return actually received by this particular group of market participants becomes an appropriate benchmark. In the context of this study, a behavioral benchmark should measure the average price actually received by (unadvised) farmers for a crop. The difference between net advisory prices and a farmer benchmark measures the value of market advisory service information relative to the information used by farmers. Behavioral market theory does not predict a specific value for this difference. It may be positive, negative or zero, depending on the impact of judgment and decision biases on advisory services versus farmers.

Both a 24-month and a 20-month market benchmark are specified in order to test the sensitivity of performance results to different market benchmarks. The 24-month market benchmark is computed as the average cash price over the entire 24-month marketing window, which begins on September 1 of the year prior to harvest and ends on August 31 of the year after harvest. Cash forward contract prices for harvest delivery are averaged during the pre-harvest period, while spot cash prices are averaged during the post-harvest period. The second market benchmark is the average cash price over a 20-month window. This benchmark is computed by simply deleting the first four months of the 24-month pricing-window from the computations of the average market price. The farmer benchmark is based on the USDA average price received for the state of Illinois. The same marketing assumptions applied to advisory service track records (e.g., commercial storage costs charged to post-harvest sales) are applied to the market and farmer benchmarks. Again, the AgMAS research report by Irwin, Martines-Filho and Good contains complete details on the computation of benchmark prices and revenues.

Net Advisory Prices and Benchmarks

Descriptive statistics for net advisory prices, revenues and benchmarks for the 1995-2000 crop years are reported in Table 1.[10] As shown in panel A, the average advisory price for corn ranges between $2.02 per bushel in 1999 and $3.03 per bushel in 1995. Minimum and maximum statistics reveal that net advisory prices for corn vary substantially within individual crop years. The most dramatic example is 1995, where the minimum is $2.29 per bushel and the maximum is $3.90 per bushel. Even in years with less market price volatility, it is not unusual for the range of prices across advisory programs to be nearly a dollar per bushel. The variation in benchmark prices from year-to-year is similar to that of average net advisory prices. However, there can be substantial differences in benchmark prices for a particular crop year. For example, the 24-month market benchmark in 1998 is $2.24 per bushel, while the farmer benchmark is only $1.97 per bushel. There is some variation in the proportion of net advisory prices above the two market benchmarks in corn for individual crop years, particularly 1998, but the patterns are similar overall. The average proportion for 1995-2000 is 51% versus the 24-month benchmark and 59% versus the 20-month benchmark, indicating a slight to marginal chance of advisory prices in corn exceeding market benchmark prices. In contrast, the proportion of net advisory prices above the farmer benchmark exceeds 50% each crop year and appears to increase somewhat over time. The average proportion above the farmer benchmark over 1995-2000 is 74%.

As shown in panel B of Table 1, the average advisory price for soybeans ranges from $5.45 per bushel in 2000 to $7.27 per bushel in 1996. Similar to corn, the range of individual net advisory prices within a crop year is substantial. The most dramatic example is 1999, where the range in advisory prices approaches $2.50 per bushel. The variation in soybean benchmark prices from year-to-year is similar to that of average net advisory prices. Once again, there can be substantial differences in benchmark prices for a particular crop year. Not surprisingly then, the proportion of advisory programs above the benchmarks can be sharply different for individual crop years (e.g., 1998 and 1999). The average proportions for 1995-2000, 61% versus the 24-month benchmark and 70% versus the 20-month benchmark, both indicate a better than average chance of advisory prices exceeding market benchmark prices in soybeans. The proportions above the farmer benchmark are all above 50% and average 74% over 1995-2000, the same as for corn.

Panel C of Table 1 contains the combined corn and soybeans revenue results. The lowest average advisory revenue, $298 per acre, occurred in 2000, while the highest average advisory revenue, $369 per acre, occurred in 1996. Given the results for corn and soybeans, the large range of individual advisory revenues within a crop year is not surprising; in three of the six crop years (1995, 1999 and 2000), the range exceeds $100 per acre. Revenue proportions typically are between those of corn and soybeans, with an average proportion for 1995-2000 of 57% versus the 24-month benchmark and 66% versus the 20-month benchmark. These indicate a better than average chance of advisory revenue exceeding market benchmark revenue. The proportion of advisory revenues above the farmer benchmark exceeds 50% each crop year and averages 77% over 1995-2000. This indicates a sizable chance of advisory revenue exceeding farmer benchmark revenue.

Average Price Tests

The performance indicator examined in this section is the average price of advisory programs relative to the average price associated with market and farmer benchmarks. Given that risk is not considered, this indicator is strictly applicable only to farm decision-makers with risk-neutral preferences. While this may seem unrealistic from a theoretical perspective, there is evidence that many farmers focus mainly on expected returns, a point emphasized recently by Tomek and Peterson.

A number of different statistical tests can be used to determine the significance of observed differences in sample means. In the present context, it is critical to recognize that there is a "natural" pairing in the sample data that can be used to increase the power of statistical tests (Snedecor and Cochran, pp. 101). More specifically, net advisory prices and benchmark prices for the same crop year are paired, in the sense that the same crop year receives different "treatments" from advisory programs and benchmarks. The treatments correspond to the differing marketing strategies used by advisory programs and benchmarks.

Given that the sample data are paired, the appropriate test of the null hypothesis of zero difference between the mean of net advisory and benchmark prices is the paired *t*-test. First, define the following difference for a given commodity and benchmark,

(1) $$r_{it} = NAP_{it} - BP_t \qquad (i = 1,...,N;\; t = 1,...,T)$$

where NAP_{it} is the net price for the i^{th} advisory program in the t^{th} crop year and BP_t is the benchmark price in the t^{th} crop year. The underlying statistical model is,

(2) $$r_{it} = \beta + e_{it}$$

where β is the expected value (mean) of the difference between the net price for the i^{th} advisory program and the benchmark price and e_{it} is the error term for the i^{th} advisory program in the t^{th} crop year. Note that the model assumes the expected value of the difference between net advisory prices and the benchmark is the same for all programs and crop years. Three key assumptions typically are made about the error term. The first, $e_{it} \sim N(0, \sigma_i^2)$, implies that errors are normally distributed with an expected value of zero and variance equal to σ_i^2. The second assumption, $\text{cov}(e_{it}, e_{is}) = 0 \;\; \forall t, s$, implies that errors for the same advisory program are independent through time. The third assumption, $\text{cov}(e_{it}, e_{jt}) = 0 \;\; \forall i, j$, implies that errors for the same crop year are independent across advisory programs. Given these assumptions, it is straightforward to test the null hypothesis of no difference in mean price (or revenue) for a crop year or all crop years pooled together, as a conventional *t*-statistic can be computed and used to infer the significance of observed mean differences.

Before conducting the statistical tests, it is important to investigate if the key assumptions discussed above hold for the available sample of net advisory prices and revenues. The first assumption, normality, is tested via the Jarque-Bera test (Bera and Jarque, 1981, 1982). The test statistics indicate normality is rejected for one crop year in corn, three crop years in soybeans and two crop years for revenue.[11] The rejections appear to be largely due to high kurtosis values, or "fat tails." Since normality is rejected for a moderate proportion of the six crop years, non-normality does not appear to be a serious problem. Furthermore, the *t*-test generally is a conservative (in the sense of controlling the probability of Type I error) and reliable approximation in the absence of normality (Greene, p. 106). The second assumption implies that advisory program differences versus a benchmark are independent across crop years. The following section on predictability of performance supplies, at best, modest evidence of dependence through time. So, this does not appear to be a serious statistical problem either.

The third assumption implies that advisory program differences versus a benchmark are independent across programs for a given crop year. It is difficult to provide direct evidence about this assumption because the sample is not large enough to independently estimate all possible pair-wise correlations.[12] Useful evidence can be generated by estimating "market model" regressions for each commodity. This entails simply regressing net advisory prices (or revenue) for a given program on a market benchmark. If net advisory prices share a common "market factor" the explanatory power of the regressions will be high. In order to maximize the number of time-series observations available for each program, the sample for this analysis is limited to the 17 programs active in all six crop years. The explanatory power of the market model regressions turns out to be quite substantial, with an average R^2 of 0.79 in corn, 0.81 in soybeans and 0.69 for revenue, and the regressions all have positive slope estimates.[13] These estimates are not surprising because many of the programs appear to use similar methods of analysis and all make heavy use of similar supply and demand information (primarily from the USDA). Furthermore, alternative programs offered by the same advisory service are likely to generate similar pricing results. The bottom-line is that it appears to be grossly inappropriate to assume that advisory program differences are independent across programs.

The implication of incorrectly assuming independence of differences across programs is potentially severe. The reliability of sample mean difference estimates is likely to be substantially overstated, which will in turn bias *t*-tests towards a conclusion that pricing performance is significantly positive (assuming differences are positive on average). A similar statistical problem occurs when testing the capital asset pricing model (CAPM) in the stock market because stock returns tend to be positively correlated across stocks. Fama and MacBeth develop a cross-sectional methodology to address this problem that has been applied in numerous studies of stock returns. In the context of the present study, implementation of the Fama-MacBeth approach involves two steps. The first step is to compute the average net advisory price across all programs active in a crop year and then subtract the benchmark price from this "average" advisory price. Call this difference b_i and repeat the computation for all six crop years $(i = 1,...6)$. Since the underlying differences are assumed to be normally distributed and independent through time, the time-series of six b_i will be normally distributed and independent. As a result, the second step is to simply compute the usual *t*-statistic for the time-series of six b_i.

The results of the average pricing test based on the Fama-MacBeth approach are found in Table 2. Average differences from market benchmarks for corn over 1995-2000 are small, ranging from one to three cents per bushel.[14] At 11¢ cents per bushel, the average difference from the farmer benchmark for corn is larger. Average differences versus the market benchmarks for soybeans are larger than for corn, ranging from 13 to 17¢ per bushel. The average difference versus the farmer benchmark in soybeans equals 23¢ per bushel. Average differences for 50/50 advisory revenue range from three to seven dollars per acre for market benchmarks over 1995-2000. The average revenue difference versus the farmer benchmark is $14 per acre. Note that the average differences can mask considerable variability across the benchmarks within a crop year and across crop years. A dramatic example of this occurred in 1998 for soybeans, where the average difference from the 24-month market benchmark is –4¢ per bushel, while the average difference from the farmer benchmark is +64¢ per bushel.

In corn, *p*-values for average differences versus both market benchmarks are substantially larger than 0.05, so it can be concluded that average differences are insignificantly different from zero. Just the opposite conclusion is reached versus the farmer benchmark. The *p*-value of 0.02 indicates the average difference of 11¢ per bushel in corn is highly significant. Soybean results versus the market benchmarks are mixed, with statistical significance indicated for the average difference from the 20-month benchmark, but not the 24-month benchmark. With a *p*-value of 0.07, the 24-month average difference just misses a 0.05 cutoff for significance. Like corn, the average difference of 23¢ per bushel in soybeans versus the farmer benchmark is significantly different from zero. Test results for 50/50 advisory revenue follow a similar pattern as in soybeans. Overall, the test results indicate no evidence of statistically significant average price performance in corn versus market benchmarks, mixed evidence of significant performance in soybeans versus market benchmarks, mixed evidence for 50/50 advisory revenue versus market benchmarks and consistent evidence of significant performance in corn, soybeans and 50/50 advisory revenue versus the farmer benchmark.[15]

An interesting issue is the source of advisory program differences from the benchmarks. Information in this regard is found in Table 3. Panel A shows average net advisory prices and benchmarks broken out by component. Panel B presents the average difference in the components between advisory programs and the benchmarks. In cases where the average net advisory price is above the average benchmark price (e.g., net advisory price in corn vs. the farmer benchmark) the difference is primarily explained by the higher net cash sales price of advisory programs. The average net futures and options gain of advisory programs is relatively small, as is the difference in marketing loan benefits between advisors and the benchmarks.

It is noteworthy that average differences versus the farmer benchmark appear to be non-trivial from an economic decision-making perspective. For example, the average advisor return relative to the farmer benchmark, $14 per acre, is over four percent of average farmer benchmark revenue. This represents a substantial increase in net farm income (defined as returns to farm operator management, labor and capital) in Illinois, typically about $50 per acre for grain farms (Lattz, Cagley and Raab). The comparison does not account for yearly subscription costs, which average $333 per program for the 2000 crop year, but this is not a major problem because subscription costs are quite small relative to revenue. For example, subscription costs are less than one-tenth of one percent of average farmer benchmark revenue for a 2,000 acre farm and about two-tenths of one percent for a 500 acre farm. A more serious issue is fully accounting for the cost of implementing, monitoring and managing the marketing strategies recommended by advisory programs. Such costs are difficult to measure, but may well be substantial (Tomek and Peterson).

Finally, a systematic price pattern is present during the sample period and it is important to highlight possible impact this may have on the results. More specifically, corn and soybean prices over the 24-month marketing window have a sharp downward price trend, with pre-harvest highs in corn and soybean prices averaging about 70¢ and 90¢ per bushel, respectively, higher than post-harvest lows.[16] Any marketing strategy that systematically prices more heavily in the pre-harvest period compared to the post-harvest period would perform much better in this environment than a strategy that does not. It turns out that advisory programs and the market benchmarks price much more heavily during the pre-harvest period over the 1995-2000 crop years than the farmer benchmark. Consequently, the superior performance of advisory programs relative to the farmer benchmark may simply be an artifact of the sample period. If advisors and farmers do not change their marketing behavior in the future and price trends flatten, then the superior performance of advisory programs relative to the farm benchmark could disappear. This suggests caution when considering advisory program performance results over 1995-2000.

Average Price and Risk Tests

As noted in the previous section, average price or revenue comparisons may not provide a complete picture of performance. For example, two advisory programs can generate the same average advisory price, but the risk of the programs may differ substantially. The difference in risk may be the result of using different pricing tools (cash, forward, futures or options), different timing of sales and variation in the implementation of marketing strategies.

A number of theoretical frameworks have been developed to analyze decision-making under risk. The mean-variance (EV) model is relatively simple and has been widely-applied in the marketing and risk management literature (Tomek and Peterson). To apply the single-period EV model to a particular decision, either distributions of outcomes must be normal or decision-makers must have quadratic utility functions (Hardaker, Huirne and Anderson). If either or both of these conditions hold, then risky choices can be divided into efficient and inefficient sets based on the famous EV efficiency rule: if the mean of choice A is greater than or equal to the mean of choice B, and the variance of A is less than or equal to the variance of B, with at least one strict inequality holding, then A is preferred to B by all risk-averse decision makers. Since quadratic utility has the unlikely characteristic that absolute risk aversion increases with the level of the outcome, application of the EV model usually is based upon an assumption of normally distributed outcomes. This presents a potential problem in the case of market advisory programs that employ options strategies. Such strategies are designed to create non-normal price distributions by truncating undesirable prices, either on the downside or the upside, or both. Simulation analysis suggests that the EV model produces reasonably accurate results even in cases where options strategies are employed (Hanson and Ladd; Ladd and Hanson; Garcia, Adam and Hauser).

The basic data needed for assessing market advisory pricing performance in an EV framework are presented in Table 4. For each advisory program tracked in all six crop years, the six-year average net advisory price or revenue and standard deviation of net advisory price or revenue are reported.[17] The average price and standard deviation of the three benchmarks also are reported. The sample of advisory programs for the EV analysis is limited to those which are tracked all six crop years in order to maximize the number of observations available to estimate risk (standard deviation).[18] Even with this restriction, six observations would appear to be a relatively small sample for estimating the risks of market advisory programs. However, Anderson explored the reliability of agricultural return-risk estimates based on limited data and found the surprising result that even as few as three or four observations can be very useful. Nonetheless, the standard deviations reported in Table 4 may be somewhat inaccurate estimators of the true risks of advisory programs. With that in mind, the standard deviations suggest that the risk of advisory programs varies substantially. In corn, the standard deviations range from a low of \$0.18 per bushel to a high of \$0.67 per bushel. In soybeans, the standard deviations range from a low of \$0.35 per bushel to a high of \$1.03 per bushel. Finally, revenue standard deviations for the 17 programs range from a low of \$17 per acre to a high of \$43 per acre.

Just as in the previous section, it is important to consider the level of aggregation for the EV analysis. One possibility is to examine the mean and standard deviation of the "average" advisory program constructed for the average price tests. Unfortunately, this is not a useful concept because the risk of the average program will be substantially smaller than that typically experienced by subscribers to individual advisory programs (due to diversification effects). An alternative is to consider a single "randomly-selected" advisory program (e.g., Elton, Gruber and Rentzler). Such a program reflects both the average price and average risk of individual advisory programs. Estimates for a single randomly-selected program can be found in Table 4 along the row labeled "Average." While this is a useful way to summarize mean-standard deviation results for advisory programs, the difficulty is that an actual time-series of net prices (or revenues) for a randomly-selected program cannot be constructed. This makes it difficult to conduct joint statistical tests for mean-standard deviation dominance.[19] The analysis here will focus on individual programs so that appropriate statistical tests can be conducted. The tradeoff is that aggregation of individual program test results may be problematic due to the high correlation of net prices across advisory programs. This should be kept in mind when considering summary measures of the number of programs that dominate a particular benchmark.

Mean-standard deviation dominance results for individual programs entail straightforward application of the EV efficiency rule discussed above. Testing the statistical significance of the dominance results is less straightforward. Fortunately, Bradley and Blackwood develop a simultaneous test of the equivalence of means and variances for paired data. This test was first applied in the economics literature by Owen and Rabinovitch. The initial step in the development of the test is to define the differences and sums for a given advisory program and benchmark as $D_t = NAP_t - BP_t$ and $S_t = NAP_t + BP_t$. The first variable simply changes the notation used in equation (1). Next, specify the following regression relationship between the differences and sums,

(3) $$D_t = \beta_1 + \beta_2 S_t + e_t .$$

Now assume that net advisory and benchmark prices have a bi-variate normal distribution with a correlation coefficient between -1 and +1. Under this assumption, Bradley and Blackwood show that,

(4) $$\beta_1 = \left(\mu_i - \mu_{BP}\right) - \left[\left(\sigma_i^2 - \sigma_{BP}^2\right) / \sigma_S^2\right] \cdot \left(\mu_i + \mu_{BP}\right)$$

(5) $$\beta_2 = \left(\sigma_i^2 - \sigma_{BP}^2\right) / \sigma_S^2$$

where μ_i is the mean price for the advisory program, μ_{BP} is the mean price for the benchmark, σ_i^2 is the variance of the advisory program, σ_{BP}^2 is the variance of the benchmark and σ_S^2 is the variance of the sum of advisor and benchmark prices. Note that $\mu_i = \mu_{BP}$ and $\sigma_i^2 = \sigma_{BP}^2$ if and only if $\beta_1 = \beta_2 = 0$. As a result, the simultaneous test of the equivalence of means and variances (standard deviations) can be implemented in two steps. First, run a regression of the relevant differences on the sums. Second, calculate the *F*-statistic for the joint null hypothesis that the intercept (β_1) and slope parameters (β_2) equal zero and compare the test statistic to critical *F*-values.[20]

Mean-standard deviation dominance results for the 17 market advisory programs over 1995-2000 are presented in Table 5. Following the notational scheme suggested by Hardaker, Huirne and Anderson (p.143), a "+" indicates the average price for an advisory program is higher than the given benchmark and the standard deviation for the program is lower than the given benchmark. In this case, the advisory program exhibits mean-standard deviation dominance of the given benchmark. A "?" indicates the average price for an advisory program is higher (lower) than the given benchmark and the standard deviation for the program is higher (lower) than the given benchmark. In this case, the advisory program does not exhibit mean-standard deviation dominance of the given benchmark, and *vice versa*. A "-" indicates the average price for an advisory program is lower than the given benchmark and the standard deviation for the program is higher than the given benchmark. In this case, the given benchmark exhibits mean-standard deviation dominance of the advisory program. Based on the *F*-statistic from the Bradley-Blackwood regression, two stars indicate statistically significant dominance at the one percent level and one star indicates statistically significant dominance at the five percent level.

The results in Table 5 show that only 1 of the 17 advisory programs (6%) in corn dominates the 24-month market benchmark. Dominance in this case is not statistically significant. Six advisory programs are dominated by the 24-month market benchmark, and in three cases the dominance is statistically significant. Advisory programs fare somewhat better when compared to the 20-month market benchmark, where 6 of the 17 advisory programs dominate (35%). Only one of these cases is statistically significant, however. Advisory program performance in corn is strongest versus the farmer benchmark, with 10 of the 17 advisory programs dominating (59%), two in a statistically significant manner. Only one program in corn is dominated by the farmer benchmark, and this is not statistically significant.

Similar patterns are evident for soybeans. Only 2 of the 17 advisory programs (12%) in soybeans dominate the 24-month market benchmark, none of which are statistically significant. Six advisory programs are dominated by the 24-month market benchmark, but, again, none are statistically significant. Advisory programs also fare somewhat better in soybeans when compared to the 20-month market benchmark, where 9 of the 17 advisory programs dominate (53%). However, only one case is statistically significant. Like corn, advisory program performance in soybeans is strongest versus the farmer benchmark, with 13 of the 17 advisory programs dominating (76%). Two of the cases do so in a statistically significant manner.

Not surprisingly, the pattern for 50/50 advisory revenue resembles that of corn and soybeans. Only 1 of the 17 advisory programs (6%) for revenue dominates the 24-month market benchmark, and this case is not statistically significant. Eight advisory programs are dominated by the 24-month market benchmark, but none of these cases are statistically significant. Seven of the 17 advisory programs (41%) dominate both the 20-month market benchmark and the farmer benchmark. One case is statistically significant versus the 20-month benchmark and two cases are statistically significant versus the farmer benchmark. No advisory program for 50/50 revenue is dominated by the 20-month market benchmark or the farmer benchmark.

Overall, the test results in this section suggest little or no evidence of statistically significant average price and risk performance for advisory programs in corn, soybeans and 50/50 advisory revenue. The significance test results are consistent across the market and farmer benchmarks. While interesting, these findings are not a major surprise given that statistical tests for dominance are applied to individual programs using only six observations. Simple dominance counts across the programs provide additional and useful perspective when attempting to characterize the average price and risk performance of advisory programs. Few programs (6 to 12%) dominate the 24-month market benchmark in corn, soybeans or 50/50 revenue. More programs (35 to 53%) dominate the 20-month market benchmark. In parallel with the average price results, the strongest evidence is found versus the farmer benchmark, where a relatively large number of programs (41 to 76%) dominate. Nonetheless, one is still left with the result that consideration of risk tends to weaken evidence regarding the pricing performance of advisory programs.

Predictability Tests

Even if, as a group, advisory programs do not tend to generate positive market returns, there is a wide range in performance for any given year. This raises the important question of the predictability of advisory program performance from year-to-year. Two types of predictability tests are used in the following analysis: i) "winner" and "loser" counts across crop years and ii) the differences between prices for "top" and "bottom" performing advisory programs across crop years. The tests have been widely applied in studies of investment performance (e.g., Malkiel).[21]

The first test of predictability is based on placing advisory programs into "winner" and "loser" categories across adjacent crop years. For a given commodity, the first step in this testing procedure is to form the sample of all advisory programs that are active in adjacent crop years. The second step is to rank each advisory program in the first year of the pair (e.g., t = 1997) based on net advisory price. For example, the program with the highest net advisory price is ranked number one, and the program with the lowest net advisory price is assigned a rank equal to the total number of programs for that commodity in the given crop year. Then the programs are sorted in descending rank order. The third step is to form two groups of programs in the first year of the pair: winners are those programs in the top half of the rankings and losers are programs in the bottom half. The fourth step is to rank each advisory program in the second year of the pair (e.g., $t+1$ = 1998) based on net advisory price and once again form winner and loser groups of programs. The fifth step is to compute the following counts for the advisory programs in the pair of crop years: winner t-winner $t+1$, winner t-loser $t+1$, loser t-winner $t+1$, loser t-loser $t+1$. If advisory program performance is unpredictable, approximately the same counts will be found in each of the four combinations. The appropriate statistical test in this case is Fisher's Exact Test (Conover, pp.188-189).[22] This non-parametric test is robust to outliers, which may be important when analyzing predictability across all advisory programs.

Results of the winner and loser predictability test are shown in Table 6. Winner and loser counts for individual crop years indicate a modest difference, at best, in the chance of a winner or loser in one period being a winner or loser in the subsequent period. As an example, consider the results for corn in 1997 and 1998. Of the eleven winners (top half) in 1997, six are winners in 1998 and five are losers (bottom half). Of the twelve losers in 1997, five are winners in 1998 and seven are losers. In other words, the conditional probability of a winner from 1997 repeating in 1998 is 55% (6/11) and the conditional probability of a loser from 1997 repeating in 1998 is 56% (7/12). Across all paired comparisons, the conditional probability of a winner repeating averages 57% and the conditional probability of a loser repeating averages 60%. These probabilities are only slightly higher than what would result from flipping a coin (randomness). There is only one case (50/50 revenue, 1999 vs. 2000) where individual year counts are significantly different from the equal distribution expected under an assumption of no predictability. In sum, the results imply that the performance of winning and losing advisory programs is not predictable through time.[23]

While predictability may be limited or non-existent across all advisory programs, it is possible for sub-groups of advisory programs to exhibit predictability. In particular, predictability may only be found at the extremes of performance. That is, only top-performing programs in one year may tend to perform well in the next year, or only poor-performing programs may perform poorly in the next year, or both. This is the motivation for the second test of predictability, which is based on the difference between net advisory prices for top- and bottom-performing advisory programs across adjacent crop years. For a given commodity, the first step in this testing procedure is to sort programs by net advisory price in the first year of the pair and group programs by quantiles (thirds and fourths). The second step is to compute the average net advisory price for the quantiles in the second year of the pair. Note that the same programs make up the quantiles in the first and second year of the pair. For example, the average price of the top fourth quantile formed in 1995 is computed for 1996. The third step is to compute the difference in average price for the top- and bottom-performing quantiles. If performance for the top- and bottom-performing quantiles is the same, the difference will equal zero. The appropriate statistical test in this case is a paired *t*-test of the difference in the means of the top- and bottom-performing quantiles. There are a total of five comparisons (1995 vs. 1996, 1996 vs. 1997, 1997 vs. 1998, 1998 vs. 1999 and 1999 vs. 2000), so there are four degrees of freedom for the *t*-test. Since differences are computed for an "average" advisory program in top- and bottom-performing quantiles, dependence across individual advisory programs is not an issue, and *p*-values for the *t*-test are unbiased. Carpenter and Lynch recommend this test because it is well-specified and among the most powerful in their comparison of several predictability tests for mutual funds.

Results for the *t*-test of predictability are shown in Table 7. The first column under each commodity heading shows the average price of the different quantiles in the first year of the comparisons (five in total). The average price for the first year is "in-sample" because this is the formation year for the quantiles. The second column under each heading reports the average price of the same quantiles in the second year of the comparisons. The average price for the second year is "out-of-sample" because this is the year after formation of the quantiles. In all cases, the average price or revenue of the top quantile relative to the bottom quantile declines substantially from the first to the second year of the comparisons. Nonetheless, the average difference between top- and bottom-performing quantiles for the second year of the pair is consistently positive. For example, programs in the top third beat the bottom third in the second year by an average of 14¢ per bushel in corn, 29¢ per bushel in soybeans and $14 per acre for revenue. Average differences are significantly different from zero for both cases in corn and 50/50 revenue and marginally significant in soybeans. Average prices for the top quantile out-of-sample also exceed benchmark prices for the same period (1996-2000). Top third returns beat the 24-month market benchmark by an average of 5¢ per bushel in corn, 26¢ per bushel in soybeans and $9 per acre for 50/50 revenue. Top fourth returns beat the 24-month market benchmark by an average of 9¢ per bushel in corn, 31¢ per bushel in soybeans and $12 per acre for 50/50 revenue.

The quantile results provide evidence that the performance of top- and bottom-performing market advisory programs can be predicted across adjacent crop years. However, the evidence is not sufficient to conclude that performance predictability is useful from an economic standpoint, due to the overlapping nature of the marketing windows for each crop year. To see the point, consider the case of a farmer who uses 1995 performance results to select a top-performing advisory program. Since the 1995 marketing window ends on August 31, 1996, halfway through the 1996 marketing window and one day before the beginning of the 1997 marketing window, the farmer could not implement their selection of an advisory program until the 1997 crop year. Performance would have to persist across three crop years, 1995, 1996 and 1997, for a farmer to benefit from the predictability.

Quantile results for non-overlapping crop years are shown in Table 8. The testing procedure is the same as before, except there are only four comparisons (1995 vs. 1997, 1996 vs. 1998, 1997 vs. 1999 and 1998 vs. 2000) and three degrees of freedom for the *t*-test. The results for non-overlapping crop years continue to show a positive difference between top- and bottom-performing quantiles in the second year of the pair. However, the magnitude of the differences is substantially smaller than in the case of adjacent crop years. For example, programs in the top fourth beat the bottom fourth in the second year only by an average of 1¢ per bushel in corn, 14¢ per bushel in soybeans and $1 per acre for revenue. None of the average differences are significantly different from zero. These results indicate predictability of pricing performance for top and bottom advisory programs is short-lived, in the sense that performance does not persist long enough to be taken advantage of by farmers.

The predictability results presented so far are all based on individual crop year comparisons. It is possible for performance to be predictable over long time horizons, but unpredictable over short horizons due to a large amount of "noise" in performance from year-to-year (e.g., Summers). To assess long-term predictability, the sample is limited to the 17 programs active in all six crop years of the study. Next, net advisory prices are averaged for each of the 17 programs for the first three crop years of the sample (1995-1997) and the second three years (1998-2000). The two tests of predictability are then applied to the two sets of averages. The results are striking, in that virtually no evidence of predictability is found for any of the tests. Winner-loser counts are quite close to what is expected under randomness and the average difference between top- and bottom-performing programs is very small (zero difference for 50/50 advisory revenue).[24] These results occur despite the fact that the same program is ranked first in both sub-periods for corn and 50/50 advisory revenue.

The test results presented in this section provide little evidence that the pricing performance of advisory programs can be usefully predicted from past performance. This conclusion does not mean it is impossible to predict advisory program performance. There may be other variables that are useful for predicting performance. Chevalier and Ellison study whether mutual fund performance is related to characteristics of fund managers that indicate ability, knowledge or effort, and find that managers who attended higher-SAT undergraduate institutions generate systematically higher returns. Barber and Odean examine the trading records of individual stock investors and report that frequent trading substantially depresses investment returns. Similar factors, such as education of advisors, cash only programs versus futures and options programs, frequency of futures and options trading, or storage costs, may be useful in predicting the performance of market advisory programs.

Summary and Conclusions

The purpose of this paper is to evaluate the pricing performance of market advisory services for the 1995-2000 corn and soybean crops. A new database on market advisory service recommendations from the Agricultural Market Advisory Services (AgMAS) Project at the University of Illinois at Urbana-Champaign is used. The AgMAS Project subscribes to all of the services that are followed and records recommendations on a real-time basis, which should prevent pricing performance results from being subject to survivorship or hindsight bias. Explicit marketing assumptions are made to produce a consistent and comparable set of results across different advisory programs. Based on these assumptions, the net price received by a subscriber to a market advisory program is calculated for the 1995-2000 corn and soybean crops. Since many subscribers to market advisory services produce both corn and soybeans, per acre revenue also is computed. Both market and farmer benchmarks are developed for the evaluations. The benchmarks are computed using the same assumptions as those applied to advisory service track records.

Three basic tests of performance are examined for advisory program prices and revenues over 1995-2000. The first test compares the average price or revenue of advisory programs to benchmarks. Average differences from market benchmarks for corn over 1995-2000 are small, ranging from one to three cents per bushel.[25] At 11¢ cents per bushel, the average difference from the farmer benchmark for corn is larger. Average differences versus the market benchmarks for soybeans are larger than for corn, ranging from 13 to 17¢ per bushel. The average difference versus the farmer benchmark in soybeans equals 23¢ per bushel. Average differences for 50/50 advisory revenue range from three to seven dollars per acre for market benchmarks over 1995-2000. The average revenue difference versus the farmer benchmark is $14 per acre. Statistical tests indicate no evidence of significant average price performance in corn versus market benchmarks, mixed evidence of significant performance in soybeans versus market benchmarks, mixed evidence for advisory revenue versus market benchmarks and consistent evidence of significant performance in corn, soybeans and advisory revenue versus the farmer benchmark.

The second test is the average price and risk of advisory programs relative to benchmarks. Only a few programs (6 to 12%) exhibit mean-standard deviation dominance of the 24-month market benchmark in corn, soybeans or revenue. More programs (35 to 53%) dominate the 20-month market benchmark. The strongest evidence is found versus the farmer benchmark, where a relatively large number of programs (41 to 76%) dominate. Statistical tests show that very few of the dominant cases are significant, which is not a major surprise given that the tests for mean-standard deviation dominance are applied to individual programs using only six observations. Overall, these results show that consideration of risk tends to weaken evidence regarding the pricing performance of advisory programs.

The third test is the predictability of advisory program performance from year-to-year. "Winner" and "loser" predictability results are similar for corn, soybeans and advisory revenue. The conditional probability of a winner (top half of programs) repeating averages 57% and the conditional probability of a loser (bottom half of programs) repeating averages 60%. These probabilities are only slighter higher than what would result from flipping a coin (randomness) and provide scant evidence that pricing performance for all advisory programs can be predicted from past performance. The performance of top- and bottom-performing programs does not appear to be predictable in a useful sense either. For example, comparisons of non-overlapping crop years show that programs in the top fourth beat the bottom fourth only by an average of 1¢ per bushel in corn, 14¢ per bushel in soybeans and $1 per acre for 50/50 advisory revenue.

Overall, the results provide an interesting picture of the performance of market advisory programs in corn and soybeans. There is limited evidence that advisory programs as a group outperform market benchmarks, particularly after considering risk. This supports the view that grain markets (cash, futures and options) are efficient with respect to the types of marketing strategies available to farmers (e.g., Zulauf and Irwin) over the view that grain markets are inefficient and provide substantial opportunities for farmers to gain additional profits through marketing (e.g., Wisner, Blue and Baldwin). Market advisory services (as a group) appear to have limited access to information not available to other market participants and/or mildly superior analytical skills. In addition, there is little evidence that advisory programs with superior performance can be usefully selected based on past performance.

While these conclusions run counter to the performance claims of advisory services, some evidence is found that advisory programs outperform the farmer benchmark, even after taking risk into account. This raises the intriguing possibility that even though advisory services do not "beat the market," they nonetheless provide an opportunity for farmers to improve marketing performance because farmers under-perform the market. Mirroring debates about stock investing, the relevant issue is then whether farmers can most effectively improve marketing performance by pursuing "active" strategies, like those recommended by advisory services, or "passive" strategies, which involve routinely spreading sales across the marketing window. Recently, a number of grain companies began offering "averaging" or "indexing" contracts that allow farmers to easily implement a passive approach to marketing (Smith, 2001). The rising interest in these "new generation" marketing contracts suggests the potential for historic changes in farmers' approach to grain marketing. Future research that aids farmers, educators and policy-makers in better understanding the costs and benefits of active versus passive approaches to marketing will be especially valuable.

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Endnotes

[1] Farmers subscribe to market advisory programs for a variety of reasons, including specific pricing recommendations, information, networking, education, marketing expertise, rational decision-making, diversification, and assistance with farm program decisions (Williams).

[2] It appears that many farmers believe this assertion about their marketing performance. For example, 77% of the participants at a University of Illinois extension program held in December 2000 agreed with the statement that "On average, corn and soybean producers sell two-thirds of their crops in the bottom one-third of the price range."

[3] Several related studies have been published. In an early and remarkable study, Marquardt and McGann evaluate 10 private and public outlook newsletters. This study investigates the accuracy of cash price predictions for the newsletters in corn, soybeans, wheat, cattle and hogs over 1970-1973, and finds that futures prices generally were a more accurate source of forecasts than the newsletters. King, Lev and Nefstad examine the corn and soybean recommendations of two market advisory services for a single year. The focus of their study is not pricing performance, but a demonstration of the market accounting program *Market Tools*. Kastens and Schroeder examine futures trading profits based on the advisory service information reported in *Top Producer* magazine for the 1988-1996 crop years. They find negative trading profits for wheat and positive trading profits for corn and soybeans.

[4] Throughout this report, the term "crop year" refers to the marketing window for a particular crop. This is done to simplify the presentation and discussion of market advisory service performance results. A "crop year" is more than twelve calendar months in length and includes pre-harvest and post-harvest marketing periods.

[5] The term "advisory program" will be used throughout the remainder of this paper because several advisory services have more than one distinct marketing program. This typically takes the form of one set of advice for farmers who are willing to use futures and options (although futures and options are not always used), and a separate set of advice for farmers who only wish to make cash sales. In this situation, both strategies are recorded and treated as distinct programs to be evaluated.

[6] The definition of delta is the dollar amount that the value of a position changes for a one unit increase in the price of the underlying commodity.

[7] A detailed explanation of the construction of marketing profiles and the full set of results for individual advisory programs and crop years can be found in Martines-Filho *et al.* (2002a, 2002b).

[8] Farmers and other market observers are familiar with the idea that advisory programs have different "marketing styles." For example, Williams identifies the marketing styles of five prominent advisors, labeled somewhat colorfully, as The Banker, The Race Car Driver, The Astronaut, The Sprinter and the Insurance Agent.

[9] Weaker versions of the theory of efficient markets predict advisory services may profit to the degree they have superior access to information and/or superior analytical ability (e.g., Zulauf and Irwin). While logically appealing, it is quite difficult, if not impossible, to specify market benchmarks based on weaker versions of the theory because it requires knowledge of the average access to information and analytical ability of market participants.

[10] The table shows that the number of programs included each crop year does not vary substantially. However, this does not necessarily imply that the same programs are included each crop year, as eight programs exited and ten programs entered the sample over the six crop years.

[11] The normality test results are available from the authors upon request.

[12] Assume 25 advisory programs are included in each crop year over 1995-2000. Then, a total of 300 pair-wise correlation coefficients would have to be estimated. However, the sample only contains 150 observations. There simply is not enough information (degrees of freedom) to estimate each correlation independently.

[13] The full set of regression results is available from the authors upon request.

[14] Differences are calculated as advisory price minus benchmark price. So, a positive difference indicates an advisory price above the benchmark price, and *vice versa*.

[15] Since there is some evidence of non-normality, a non-parametric test of mean equivalence also is applied to the differences for an average advisory program shown in Table 3. Given that the data are paired, the appropriate non-parametric test is the Wilcoxon signed rank test (Conover). The same hypothesis test conclusions are reached based on the Wilcoxon test as the *t*-test. These results are available from the authors upon request.

[16] Pooled time-trend regressions are estimated across the six crop years the 1995-2000 crop years. The slope estimate for corn is -2.44¢ per month and the associated *t*-statistic is -3.44. The slope estimate for soybeans is -2.85¢ per month and the associated *t*-statistic is -2.97. While it is probably inappropriate to assume that futures prices follow a trend stationary process (e.g., Zulauf *et al.*), the regressions provide a simple means of illustrating the large magnitude of the average trend in corn and soybean prices over the 24-month marketing window.

[17] Standard deviation is substituted for variance as an estimate of risk because it easier to understand. Performance results are the same whether standard deviation or variance is used to estimate risk (Hardaker, Huirne and Anderson, p.143), hence the use of the simpler measure.

[18] The restriction means that only advisory programs active all six crop years are included in the average price and risk evaluation. As a result, there is the potential for survivorship bias in the average price and risk comparisons to the benchmarks. Survivorship bias in the average estimates appears to be non-existent, as the average prices and average revenue for the 17 programs are actually less than the average prices and revenue computed across all advisory programs active in the 1995-2000 sample period. It is quite difficult to assess the degree of survivorship bias in advisory program standard deviation estimates with the limited number of crop years available.

[19] It is possible to conduct separate mean and standard deviation tests for a randomly-selected program and then combine the results based on a bounds condition (Collender). However, such procedures ignore the paired nature of advisory program and benchmark data, which would lead to tests with little or no power to reject the null hypothesis (Snedecor and Cochrane, p. 101).

[20] Jarque-Bera tests indicate that normality of net advisory prices is rejected for one crop year in corn and three in soybeans. Like the *t*-test, the *F*-test can be justified as a conservative and reliable approximation in cases where normality is rejected (Greene, p. 108).

[21] The tests presented in this section do not consider predictability of risk-adjusted performance measures. The six-year sample period is not long enough to estimate risk-adjusted performance during sub-periods, which is required for predictability tests.

[22] Fisher's Exact Test is the appropriate statistical test because both row and column totals are pre-determined in the 2 x 2 contingency table formed on the basis of winner and loser counts.

[23] Pooled test results are not reported because Fisher's Exact Test assumes sample observations are independent. As discussed in the section on average price performance, this clearly is not the case, and therefore, the *p*-values for such tests would overstate the true significance of the results.

[24] These results are available from the authors upon request.

[25] Differences are calculated as advisory price minus benchmark price. So, a positive difference indicates an advisory price above the benchmark price, and *vice versa*.

Table 1. Descriptive Statistics for Net Advisory Prices, Revenues and Benchmarks for Corn and Soybeans, 1995 - 2000 Crop Years

		Net Advisory Price or Revnue			Benchmark Price or Revenue			Proportion of Programs Above Benchmark		
Crop Year	Number of Programs	Minimum	Maximum	Average	24-Month Market	20-Month Market	Farmer	24-Month Market	20-Month Market	Farmer
Panel A: Corn		---$ per bushel (harvest equivalent)---			---$ per bushel (harvest equivalent)---			---percent---		
1995	25	2.29	3.90	3.03	2.90	3.07	3.06	76	56	56
1996	26	2.08	3.12	2.63	2.65	2.66	2.50	38	38	73
1997	25	2.00	2.74	2.32	2.33	2.27	2.23	52	64	68
1998	23	1.93	2.51	2.17	2.24	2.12	1.97	30	52	91
1999	26	1.66	2.49	2.02	2.05	1.97	1.93	54	69	77
2000	28	1.79	2.78	2.13	2.09	2.01	1.95	56	74	78
1995-2000 Average				2.38	2.38	2.35	2.28	51	59	74
Panel B: Soybeans		---$ per bushel (harvest equivalent)---			---$ per bushel (harvest equivalent)---			---percent---		
1995	25	5.66	7.94	6.59	6.26	6.39	6.59	84	72	52
1996	24	6.80	7.80	7.27	7.08	7.21	7.17	83	58	71
1997	23	6.06	6.99	6.38	6.30	6.22	6.17	57	65	74
1998	22	5.11	6.58	5.82	5.86	5.64	5.18	32	77	95
1999	25	4.68	7.10	5.67	5.50	5.30	5.39	60	96	88
2000	27	5.00	6.83	5.45	5.42	5.38	5.29	46	54	65
1995-2000 Average				6.19	6.07	6.02	5.97	61	70	74
Panel C: 50/50 Revenue		---$ per acre (harvest equivalent)---			---$ per acre (harvest equivalent)---			---percent---		
1995	25	255	382	319	304	317	320	76	60	56
1996	24	327	407	369	366	371	357	67	54	79
1997	23	283	354	311	310	304	300	57	70	70
1998	22	282	340	304	311	296	274	27	64	100
1999	25	266	371	299	297	286	285	52	80	80
2000	27	265	381	298	293	286	279	58	69	81
1995-2000 Average				316	313	310	303	57	66	77

Notes: Net advisory prices and benchmark prices are stated on a harvest equivalent basis. A crop year is a two-year marketing window from September of the year previous to harvest through August of the year after harvest. Averages for 1995-2000 are computed over the full set of advisory programs. As a result, averages of individual crop year prices, revenues or proportions may not equal the averages reported for 1995-2000.

Table 2. Average Pricing Performance Results for Market Advisory Programs, Corn, Soybeans and 50/50 Advisory Revenue, 1995 - 2000 Crop Years

Commodity/ Benchmark	Difference Between Average Advisory Program and Benchmark 1995	1996	1997	1998	1999	2000	Average Difference	*t*-statistic	Two-tail *p*-value
				---¢ per bushel (harvest equivalent)---					
Corn									
24-Month Market Average	14	-2	-1	-8	-3	4	1	0.21	0.88
20-Month Market Average	-4	-4	5	5	5	11	3	1.28	0.26
Farmer	-3	12	9	20	9	18	11 *	3.33	0.02
				---¢ per bushel (harvest equivalent)---					
Soybeans									
24-Month Market Average	33	19	9	-4	18	2	13	2.34	0.07
20-Month Market Average	20	6	16	18	37	7	17 **	3.68	0.01
Farmer	1	10	21	64	28	15	23 *	2.56	0.05
				---$ per acre (harvest equivalent)---					
50/50 Revenue									
24-Month Market Average	15	2	1	-6	2	4	3	1.04	0.35
20-Month Market Average	2	-2	7	8	13	11	7 *	2.86	0.04
Farmer	-1	11	11	30	14	18	14 *	3.26	0.02

Notes: Two stars indicates significance at the one percent level and one star indicates significance at the five percent level (based on the *t*-

Table 3. Average Pricing Performance Results for Market Advisory Programs by Underlying Components, Corn and Soybeans, 1995 - 2000 Crop Years

	1995 - 2000 Average								
	Unadjusted	Commercial Storage Costs				Futures &			Net
Commodity/Advisory Program and Benchmark	Cash Sales Price	Physical Storage	Shrinkage	Interest	Net Cash Sales Price	Options Gain	Brokerage Costs	LDP / MLG	Advisory Price
					---$ per bushel---				
Panel A: Average Price Components									
Corn									
Advisory Programs	2.46	0.11	0.03	0.05	2.27	0.01	0.02	0.12	2.38
24-Month Market Benchmark	2.42	0.08	0.02	0.04	2.27	0.00	0.00	0.11	2.38
20-Month Market Benchmark	2.43	0.10	0.03	0.05	2.26	0.00	0.00	0.10	2.35
Farmer Benchmark	2.41	0.15	0.04	0.07	2.15	0.00	0.00	0.12	2.28
Soybeans									
Advisory Programs	6.00	0.11	0.00	0.12	5.77	0.05	0.02	0.39	6.20
24-Month Market Benchmark	5.88	0.08	0.00	0.10	5.70	0.00	0.00	0.37	6.07
20-Month Market Benchmark	5.87	0.10	0.00	0.12	5.66	0.00	0.00	0.36	6.02
Farmer Benchmark	5.90	0.14	0.00	0.17	5.59	0.00	0.00	0.38	5.97
Panel B: Average Difference in Price Components									
Corn									
Advisory Programs - 24-Month Benchmark	0.04	0.03	0.01	0.01	0.00	0.01	0.02	0.02	0.01
Advisory Programs - 20-Month Benchmark	0.03	0.01	0.00	0.00	0.01	0.01	0.02	0.02	0.03
Advisory Programs - Farmer Benchmark	0.05	-0.04	-0.01	-0.02	0.12	0.01	0.02	0.00	0.11
Soybeans									
Advisory Programs - 24-Month Benchmark	0.11	0.03	0.00	0.02	0.07	0.05	0.02	0.02	0.13
Advisory Programs - 20-Month Benchmark	0.12	0.01	0.00	0.00	0.11	0.05	0.02	0.02	0.17
Advisory Programs - Farmer Benchmark	0.10	-0.03	0.00	-0.05	0.18	0.05	0.02	0.01	0.23

Notes: Net cash sales price is calculated as unadjusted cash sales price minus commercial storage costs. Net advisory price is calculated as net cash sales price plus futures and options gains minus brokerage costs plus LDP/MLG, and therefore, is stated on a harvest equivalent basis. Market and farmer benchmark prices also are stated on a harvest equivalent basis. LDP stands for loan deficiency payment and MLG stands for marketing loan gain. LDP/MLGs were not paid for the 1995 - 1997

Table 4. Six-Year Average and Standard Deviation for 17 Market Advisory Programs, Corn and Soybean Net Advisory Prices and 50/50 Advisory Revenues, 1995 - 2000 Crop Years

	Corn		Soybeans		50/50 Advisory Revenue	
Market Advisory Program	**Average Net Advisory Price**	**Standard Deviation of Net Advisory Price**	**Average Net Advisory Price**	**Standard Deviation of Net Advisory Price**	**Average Revenue**	**Standard Deviation of Revenue**
	---$ per bushel (harvest equivalent)---		---$ per bushel (harvest equivalent)---		---$ per acre (harvest equivalent)---	
1	2.39	0.29	5.86	1.03	310	38
2	2.43	0.40	6.14	0.77	319	29
3	2.76	0.67	6.80	0.41	358	43
4	2.42	0.65	6.45	0.98	324	43
5	2.53	0.45	6.06	0.74	324	32
6	2.39	0.41	6.16	0.86	316	30
7	2.36	0.26	6.03	0.69	312	27
8	2.36	0.34	6.14	0.85	314	31
9	2.30	0.18	6.23	0.65	313	20
10	2.33	0.33	6.06	0.69	310	33
11	2.34	0.20	6.31	0.66	318	35
12	2.35	0.46	6.05	0.67	311	39
13	2.27	0.54	6.14	0.77	306	38
14	2.29	0.51	6.33	0.73	312	38
15	2.20	0.41	6.25	0.63	304	29
16	2.35	0.39	6.06	0.69	311	32
17	2.39	0.41	6.24	0.35	319	17
Average	2.38	0.41	6.19	0.72	316	33
Minimum	2.20	0.18	5.86	0.35	304	17
Maximum	2.76	0.67	6.80	1.03	358	43
Range	0.57	0.49	0.93	0.67	54	26
Benchmarks						
24-Month Market Average	2.38	0.33	6.07	0.62	313	27
20-Month Market Average	2.35	0.43	6.02	0.73	310	32
Farmer	2.28	0.44	5.97	0.81	303	32

Note: Results are shown only for the 17 advisory programs included in all six years of the AgMAS corn and soybean evaluations. Net advisory prices and benchmark prices are stated on a harvest equivalent basis. Consequently, 50/50 advisory and benchmark revenue are also stated on a harvest equivalent basis. A crop year is a two-year window from September of the year previous to harvest through August of the year after harvest.

Table 5. Mean-Standard Deviation Dominance Results for 17 Market Advisory Programs, Corn and Soybean Net Advisory Price and 50/50 Advisory Revenue, 1995 - 2000 Crop Years

	Dominance in Corn versus Benchmark			Dominance in Soybeans versus Benchmark			Dominance in 50/50 Revenue versus Benchmark		
Market Advisory Program	24-Month Market	20-Month Market	Farmer	24-Month Market	20-Month Market	Farmer	24-Month Market	20-Month Market	Farmer
1	+	+	+	-	- *	-	-	?	?
2	?	+	+ **	?	?	+	?	+ **	+ *
3	?	?	?	+	+	+ *	?	?	?
4	?	?	?	?	?	?	?	?	?
5	?	?	?	-	?	+	?	?	?
6	?	+	+	?	?	?	?	+	+ *
7	?	+ *	+ *	-	+	+	-	+	+
8	-	+	+	?	?	?	?	+	+
9	?	?	+	?	+	+	?	+	+
10	?	?	+	-	+	+	-	?	?
11	?	?	+	?	+	+	?	?	?
12	-	?	?	-	+	+	-	?	?
13	- **	-	-	?	?	+	-	?	?
14	- **	-	?	?	?	+ *	-	?	?
15	- **	?	?	?	+	+	-	+	+
16	-	?	+	-	+	+	-	?	?
17	?	+	+	+	+	+	+	+	+
Total Count									
+	1	6	10	2	9	13	1	7	7
?	10	9	6	9	7	3	8	10	10
-	6	2	1	6	1	1	8	0	0

Note: A "+" indicates the average price for an advisory program is higher than the given benchmark and the standard deviation for the program is lower than the given benchmark. In this case, the advisory program exhibits mean-standard deviation dominance of the given benchmark. A "?" indicates the average price for an advisory program is higher (lower) than the given benchmark and the standard deviation for the program is higher (lower) than the given benchmark. In this case, the advisory program does not exhibit mean-standard deviation dominance of the given benchmark, and *vice versa* . A "-" indicates the average price for an advisory program is lower than the given benchmark and the standard deviation for the program is higher than the given benchmark. In this case, the given benchmark exhibits mean-standard deviation dominance of the advisory program. Two stars indicates statistically significant dominance at the one percent level and one star indicates significant dominance at the five percent level.

Table 6. Performance Predictability Results Based on Winner and Loser Categories Between Pairs of Adjacent Crop Years, Corn, Soybeans and 50/50 Revenue, 1995-2000 Crop Years

		Corn				Soybeans				50/50 Revenue			
Year *t*	**Year *t+1***		**Winner *t+1***	**Loser t*+1***	**Two-tail *p*-value for Fisher's Exact Test**		**Winner *t+1***	**Loser t*+1***	**Two-tail *p*-value for Fisher's Exact Test**		**Winner *t+1***	**Loser t*+1***	**Two-tail *p*-value for Fisher's Exact Test**
			---number of programs---				---number of programs---				---number of programs---		
1995	1996	**Winner *t***	5	6		**Winner *t***	6	5		**Winner *t***	7	4	
		Loser *t*	6	5	1.00	**Loser *t***	5	6	1.00	**Loser *t***	4	7	0.39
1996	1997	**Winner *t***	7	5		**Winner *t***	6	5		**Winner *t***	6	5	
		Loser *t*	5	7	0.68	**Loser *t***	5	6	1.00	**Loser *t***	5	6	1.00
1997	1998	**Winner *t***	6	5		**Winner *t***	6	4		**Winner *t***	3	7	
		Loser *t*	5	7	0.68	**Loser *t***	4	7	0.39	**Loser *t***	7	4	0.20
1998	1999	**Winner *t***	7	4		**Winner *t***	7	3		**Winner *t***	6	4	
		Loser *t*	4	7	0.39	**Loser *t***	3	8	0.09	**Loser *t***	4	7	0.39
1999	2000	**Winner *t***	8	4		**Winner *t***	8	4		**Winner *t***	9	3	
		Loser *t*	4	9	0.12	**Loser *t***	4	8	0.22	**Loser *t***	3	9	0.04 *

Note: The selection strategy consists of ranking programs by net advisory price in the first year of the pair (e.g., *t* = 1995) and then forming two groups of programs: "winners" are those services in the top half of the rankings and "losers" are services in the bottom half. Next, the same programs are ranked by net advisory price for the second year of the pair (e.g. *t+1* = 1996), and again divided into "winners" and "losers." For a given comparison, advisory programs must fall in one of the following categories: winner *t* -winner *t+1* , winner *t* -loser *t+1* , loser *t* -winner *t+1* , loser t-loser *t+1* . If advisory program performance is unpredictable, approximately the same counts will be found in each of the four combinations. Fisher's Exact Test is the appropriate statistical test of no predictability because both row and column totals are pre-determined in the 2 x 2 contingency table formed on the basis of winner and loser counts. Two stars indicates significance at the one percent level and one star indicates significance at the five percent level.

Table 7. Performance Predictability Results Based on Quantiles Between Pairs of Adjacent Crop Years, Corn, Soybeans and 50/50 Revenue, 1995-2000 Crop Years

	Corn		Soybeans		50/50 Revenue	
Performance Quantile in Year *t*	**Average Price in Year *t***	**Average Price in Year *t*+1**	**Average Price in Year *t***	**Average Price in Year *t*+1**	**Average Revenue in Year *t***	**Average Revenue in Year *t*+1**
	---$ per bushel (harvest equivalent)---		---$ per bushel (harvest equivalent)---		---$ per acre (harvest equivalent)---	
Top Third	2.65	2.32	6.72	6.29	341	324
Middle Third	2.46	2.27	6.32	6.04	321	313
Bottom Third	2.23	2.18	6.05	6.00	302	310
Top Third minus Bottom Third						
Average	0.42	0.14 *	0.68	0.29	38	14 *
t-statistic	N/A	3.85	N/A	2.28	N/A	2.85
Two-tail *p*-value	N/A	0.02	N/A	0.09	N/A	0.05
Top Fourth	2.70	2.36	6.81	6.34	346	327
Second Fourth	2.50	2.26	6.42	6.09	325	315
Third Fourth	2.41	2.24	6.25	6.07	318	313
Bottom Fourth	2.19	2.17	6.01	5.95	299	309
Top Fourth minus Bottom Fourth						
Average	0.31	0.19 *	0.41	0.39	26	18 *
t-statistic	N/A	4.04	N/A	2.24	N/A	2.76
Two-tail *p*-value	N/A	0.02	N/A	0.09	N/A	0.05

Note: The selection strategy consists of sorting programs by net advisory price in the first year of the pair (e.g., t = 1995) and grouping programs by quantiles (thirds and fourths). Next, the average net advisory price for each quantile is computed for the first year of the pair. Then, the average net advisory price of the quantiles formed in the first year is computed for the second year of the pair (e.g., $t+1$ = 1996). Next, the average net advisory price for the second year is averaged across the comparisons. There are a total of five comparisons (1995 vs. 1996, 1996 vs. 1997, 1997 vs. 1998, 19998 vs. 1999 and 1999 vs. 2000), so there are four degrees of freedom for the t-test. Some average differences of the quantiles may not equal the difference of the averages for the quantiles due to rounding.Two stars indicates significance at the one percent level and one star indicates significance at the five percent level

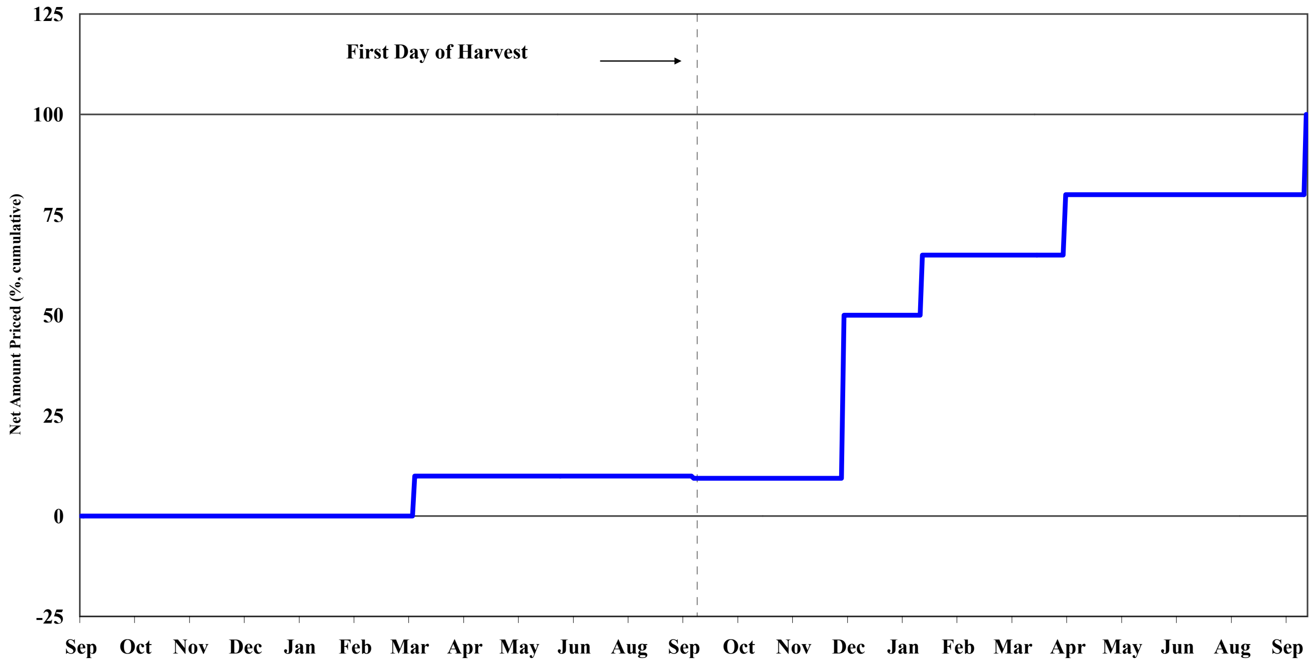
Table 8. Performance Predictability Results Based on Quantiles Between Pairs of Non-Overlapping Crop Years, Corn, Soybeans and 50/50 Revenue, 1995-2000 Crop Years

	Corn		Soybeans		50/50 Revenue	
Performance Quantile in Year *t*	**Average Price in Year *t***	**Average Price in Year *t*+2**	**Average Price in Year *t***	**Average Price in Year *t*+2**	**Average Revenue in Year *t***	**Average Revenue in Year *t*+2**
	---$ per bushel (harvest equivalent)---		---$ per bushel (harvest equivalent)---		---$ per acre (harvest equivalent)---	
Top Third	2.76	2.17	6.88	5.97	346	308
Middle Third	2.55	2.16	6.50	5.75	327	295
Bottom Third	2.32	2.13	6.23	5.76	307	304
Top Third minus Bottom Third						
Average	0.45	0.03	0.65	0.21	39	5
t-statistic	N/A	0.41	N/A	1.04	N/A	0.44
Two-tail *p*-value	N/A	0.72	N/A	0.41	N/A	0.70
Top Fourth	2.81	2.18	6.94	5.97	350	310
Second Fourth	2.60	2.19	6.58	5.81	330	296
Third Fourth	2.50	2.08	6.42	5.68	322	294
Bottom Fourth	2.28	2.17	6.19	5.82	303	308
Top Fourth minus Bottom Fourth						
Average	0.53	0.01	0.75	0.14	46	1
t-statistic	N/A	0.11	N/A	0.77	N/A	0.17
Two-tail *p*-value	N/A	0.92	N/A	0.52	N/A	0.88

Note: The selection strategy consists of sorting programs by net advisory price in the first year of the pair (e.g., t = 1995) and grouping programs by quantiles (thirds and fourths). Next, the average net advisory price for each quantile is computed for the first year of the pair. Then, the average net advisory price of the quantiles formed in the first year is computed for the second year of the pair (e.g., $t+2$ = 1997). Next, the average net advisory price for the second year is averaged across the comparisons. There are a total of four comparisons (1995 vs. 1997, 1996 vs. 1998, 1997 vs. 1999, and 1998 vs. 2000), so there are three degrees of freedom for the t-test. Some average differences of the quantiles may not equal the difference of the averages for the quantiles due to rounding.Two stars indicates significance at the one percent level and one star indicates significance at the five percent level

Figure 1. Marketing Profile Examples, Corn, 2000 Crop Year

Panel A: Conservative Program



Panel B: Aggressive Program