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Abstract

Marketing is viewed as an important component of the farm management process, and poor marketing is often cited as a cause of low farm incomes. However, widespread beliefs about poor performance are not based upon a large body of research, and available evidence is too limited to make definitive conclusions about farmer marketing abilities. This paper examines the actual marketing performance of corn and soybean producers in Illinois. Farmer marketing data is based on the USDA's "Average Producer Price Received" over the period 1975-2002. Marketing performance is assessed using 20- and 24-month average price market benchmarks. A comparison of farmer prices received to the price range for each crop year reveals that in the majority of years producers market their crop in the top- or middle-third of the price range. Despite these findings, farmer prices fell below the average price offered by the market in most normal crop years; weighting these shortfalls by actual production reveals substantial, avoidable income loss. In short crop years, however, farmer prices exceeded the market benchmarks for both crops. Observed farmer marketing performance is explained in the context of price and marketing patterns; farmers appear to market too much of their crop in the latter part of the marketing year, when, in most years, prices are at their lowest. Shifting a portion of sales to the pre-harvest period is proposed as a likely means of improving farmer marketing performance and easing avoidable income loss.

Keywords: Farmer Marketing, Corn & Soybean Producers, Illinois, Performance Analysis

Introduction

Marketing is an important component of the farm management process, and poor marketing is often cited as a cause of low farm incomes (ERS, 2001). It is a common belief among market observers that farmers substantially under-perform the market, as evidenced by the oft-repeated adage that "farmers market most of their crop in the bottom portion of the price range." This belief is apparently widespread even among farmers: for example, a survey taken at extension meetings offered by the University of Illinois in December 2000 found that 77% of attendees agreed with the statement, "On average, corn and soybean producers market 2/3 of their crop in the bottom 1/3 of the price range." Given the prevalence of this belief, it should come as no surprise that government programs, academic research, and producer education efforts have focused on improving pricing decisions as a means of increasing farm revenues (e.g. Kunze, 1990), in spite of abundant evidence that it is difficult for farmers to consistently achieve "abnormal" marketing returns through active marketing strategies (e.g., Zulauf and Irwin, 1998).

Widespread beliefs about the marketing performance of farmers, however, are not based upon a large body of evidence. In fact, only two previous academic studies directly investigate the actual marketing performance of farmers. Using elevator transactions, Slusher (1987) analyzed the use and effectiveness of various marketing strategies among Indiana soybean producers during the 1981-1984 marketing years, and found that producers who made spot sales at harvest, and those who used pre-harvest forward contracts received higher prices than those that waited until late in the crop year to sell. While this study provides some evidence on the relative performance of alternative marketing strategies employed by actual farmers, results were not compared to any external measure of marketing performance. Brorsen and Anderson (2002) again used elevator transactions in a study of Oklahoma wheat producers over the period 1992-2000. They found that almost half of the producers in the study sold in the upper one-third of the price range, and that the majority received a price that exceeded the 12-month average cash price. This evidence suggests that wheat farmers actually outperform the market. However, wheat marketing strategies may differ significantly from those used by corn and soybean producers. Seasonal price patterns for wheat are substantially different from those of corn and soybeans and production risk is perceived to be higher for wheat than corn or soybeans. Corn and soybean producers make greater use of forward contracting, and the marketing window for these crops extends over a greater period of time than the 12-month wheat marketing window studied by Brorsen and Anderson (USDA, 2003).

The evidence lent by studies using elevator transactions is limited by the nature of the survey data used and the relatively short span of time investigated. The coverage of farmer sales measured by elevator transactions may be incomplete, and possibly exclude multiple sales to different elevators by individual producers. In order to accurately assess marketing performance, farmer marketing transactions should be drawn from as large a sample as possible.

Implicit evidence of farmer under-performance is also seen in a study by Irwin et al. (2003), in which the marketing performance of professional marketing advisory service programs was analyzed. Advisory service net prices were compared to both a market and a "farmer" benchmark, based on USDA price received data. During the period 1996-2001, the farmer benchmark prices were often below those of the market benchmark; however, this was not the primary focus of the study, and the span of time covered by it is relatively short.

Nevertheless, the methodologies employed by Irwin, et al. offer useful guidance in choosing appropriate farmer marketing data and market benchmarks.

More direct evidence on the marketing performance of farmers is provided by Nivens, Kastens, and Dhuyvetter (2002), who examined the importance of various management traits in a ten year study of 1020 Kansas farms. This study found that price was not a statistically significant component of a producer's profit function. However, the authors used a peer-benchmark to assess the importance of management traits of individual producers; it did not compare the price received by producers, as a group, relative to the price offered by the market.

As the preceding discussion indicates, available evidence is too limited to make definitive conclusions about farmer marketing performance; prior research on marketing performance has been limited by the scope of transactions examined, the span of time studied, and choice of benchmark against which farmer performance is judged. Given these limitations, and the importance attached to marketing decisions by producers, educators, and policy makers, further investigation of actual farmer marketing performance is needed. This research examines the actual marketing performance of corn and soybean producers in Illinois, over the 1975 through 2002 crop years, a period that incorporates a variety of supply/demand, weather, and policy conditions. A sample size of 28 years should be large enough to provide a reasonable depiction of actual farmer marketing performance.

Three key performance issues are examined. The first is the proportion of the study period that farmer prices fall in the lower, middle, and upper thirds of the price range for a given crop year. This directly assesses the validity of the commonly held belief that farmers market most of their crops in the bottom portion of the year's price range. The second issue is the average price-level difference between the farmer price received and the price offered by the market for a given crop year. Without evidence on the magnitude of either under- or over-performance, it is impossible to determine the economic impact of farmer marketing decisions. Consistent under-performance by producers, relative to the market, may indicate avoidable income loss. The third is the difference between the average price and risk of farmer marketing strategies and the average price and risk offered by the market.

Computing Farmer Marketing Performance

Data on actual producer grain marketing must be collected to evaluate farmer marketing performance. The process of calculating the marketing performance for a randomly selected sample of producers is theoretically simple: the average prices received by a randomly selected, representative sample of grain producers in a specific geographical area are weighted by actual production amounts during the marketing window. Marketing data should reflect all types of farmer sales, including cash transactions, forward contracts, and the use of futures and options.

In practice, however, detailed data about individual producer marketing performance is not readily available. Two data series collected by the USDA, covering monthly prices received and the portion of crop marketed each month by farmers in Illinois, provide the only known approximations of farmer marketing behavior. The USDA "average price received" data series measures sales from producers to first buyers of a commodity; this data is collected by the Illinois Agricultural Statistics Service, the state office of NASS. Prices are based on monthly

mail and telephone surveys of approximately 200 grain dealers, processors, and elevators in the state that actively purchase grain from farmers. Survey respondents report the quantity of grain purchased from farmers by crop and the gross value, including quality discounts and premiums, of sales made during the previous month. Gross value estimates do not reflect deductions for drying, handling, cleaning, storage, grading, or check-off fees. Grain purchases are reported in the month when the buyer takes delivery of the grain. Thus, transactions involving spot cash sales, forward contracts, basis contracts, minimum price contracts, and hedge-to-arrive contracts are all reported in the month of delivery.[1] The gross values reported by survey respondents are summed, as are the quantities reported. The monthly average price received estimate is calculated by dividing the total gross value by the total quantity.

The USDA series appears to provide a reasonable approximation of farmer marketing performance, as it reflects the actual pattern of cash grain marketing transactions by farmers, and thereby incorporates the marketing windows and timing strategies actually used by farmers. Despite the recording of most transactions at the time of delivery, the series includes different types of marketing tools and contracts that are commonly used by producers. The average price received series does, however, have several shortcomings as a measure of farmer marketing performance: it is only available in the form of a state average, it includes transactions for mixed grades and qualities of grain, and it does not include futures and options trading profits/losses of farmers.

Fortunately, none of these factors appear serious enough to prohibit the use of the USDA average producer price received series, and the magnitudes of any resulting biases are expected to be small and offsetting. A geographical adjustment, to enable comparison with commonly available prices, such as those in Central Illinois, is straightforward but unnecessary; state and Central Illinois prices are nearly equivalent. No statistical adjustment can be made for the effects of co-mingled commodity grades and qualities present in the USDA series. While the relative amounts are unknown, it is clear that the inclusion of at least some discounted grain causes the USDA average price to be biased downward compared to the average price of standard grade sales. The magnitude of this bias, however, is likely quite small, as evidenced by surveys taken by Hill, Kunda, and Rehtmeyer (1982) and Irwin et al. (2002). Another possible limitation of the use of the USDA price received series as an indicator of farmer marketing performance arises from the omission of futures and options gains/losses, specifically those arising from selective hedging; the effect of excluding these transactions is limited, however, by the small scale of farmer futures and options trading, e.g. Patrick, Musser, and Eckman, 1998.

Since most sales are recorded at the time of delivery, the NASS average price received series does not differentiate between old and new crop sales. If old crop sales are recorded at new crop spot prices in the same proportion every marketing year, the price received series will not be biased. Bias arises only when the proportion of sales shifted varies from year to year, and the magnitude of the bias will be limited to the extent of this variation. Evidence on the proportion of shifted sales is lent by Irwin, et al. (2002); they found on-farm ending stocks for

[1] The only exception to this reporting rule are deferred payment sales (alternately known as installment sales) and delayed pricing contracts, in which bushels are delivered ahead of payment; the quantity and gross value of these sales are recorded in the month that payment is received.

corn and soybeans did vary, but averaged only 4% of corn production and 3% of soybean production. A significant bias in the USDA series is likely to arise only if producers, in aggregate, have a perfect ability to predict old-crop/new-crop price spreads and time their sales accordingly; there is no evidence of such predictive ability.

Two adjustments are made to the USDA average price received data. First, post-harvest prices are adjusted to a harvest-equivalent level, accomplished by applying commercial storage charges to the monthly average price received estimates for post-harvest months. The cost of storage consists of physical storage fees and the opportunity cost of foregone sales. In the case of off-farm commercial storage, the marginal cost of physical storage is the sum of physical storage, drying and shrinkage fees, and interest charges. A 1982 study of the characteristics of Illinois elevators by Hill, Kunda, and Rehtmeyer, and an informal telephone survey for the period 1995-2001, conducted by Irwin, et al. provide estimates of commercial storage charges; costs reported by these sources are nearly identical. Due to the lack of substantial variation in the cost of commercial storage over time, a single set of assumptions is applied to all crop years. Using the storage cost estimates provided by the two surveys, commercial storage charges are assumed to be a flat 13¢/bu. from the end of harvest through December 31. After January 1, physical storage charges are assumed to be 2¢ per month (per bushel). Interest charges are computed by multiplying the harvest price[2] by the daily compounded interest rate, drawn from the *Agricultural Finance Databook*. In addition to the cost of storage, post-harvest prices are adjusted for a drying charge to reduce corn moisture from 15% to 14%, which is applied at a flat rate of 2¢ per bushel. Shrinkage charges of 1.3% per bushel for corn, based on the harvest price, are also assessed (no shrinkage is assumed for soybeans in commercial storage). Since the USDA series represents a monthly average of prices received, mid-month storage fees are deducted from monthly prices for each complete post-harvest month of the twelve-month USDA marketing year. In those years in which harvest ends at some point during a month, storage charges are deducted for the remaining portion of that month.

Government price assistance programs also significantly affect the prices producers receive for their crops. It is assumed that a "rational" producer would take advantage of such programs. The USDA average price received series must be adjusted to reflect the effects of government programs in which individual farmer decisions about participation could have substantially altered prices and incomes received. The non-recourse loan commodity loan program provided significant price assistance in some years, but the loan rate has generally been capped at a relatively low level to maintain competitiveness in world commodity markets. Between the years of 1975 and 1995, the non-recourse loan program did have a price impact on the corn and soybean markets; this impact, however, affected all producers in approximately the same way. In years in which prices fell below the loan rate, this program effectively put a floor on market prices, and this effect was not generally dependant upon the decisions of individual producers.

Since the enactment of the 1996 FAIR Act, marketing loan benefits have been available through participation in the marketing loan program, or by loan deficiency payments. In years in

[2] The harvest price is defined as the average of prices during a 25-business-day harvest window.

which prices are below the loan rate for a significant period of time, farmer decisions about the use of the marketing loan and loan deficiency programs could have an important impact on the price they receive. In each year over 1998-2002, both corn and soybean prices were below the loan rate for a significant portion of time. Therefore, the USDA average price received data needs to be adjusted to reflect LDP and MLG payments. Records of actual benefits paid to farmers in the state of Illinois are available from the Farm Service Agency's Price Support Division. Estimates of the "effective benefit rate", which reflect benefit payments weighted by farmer participation rates, are added to the final yearly average price received estimate.

Once the farmer price received data has been adjusted, it must be weighted. NASS tabulates the distribution of farmer sales during each marketing year; these "monthly crop marketings" are calculated by dividing by total sales during a twelve-month marketing year by the sales quantity for each month. The USDA average price received series, adjusted for carrying charges and government payments is weighted by the NASS monthly marketing weights in order to produce a weighted average price for each twelve-month marketing year. Since many Illinois farmers grow both corn and soybeans during a single marketing year, an evaluation of revenues received in a dual crop production environment provides another useful measure of marketing performance. A revenue received series is constructed by multiplying the weighted adjusted average price received for each crop by its respective actual yield in each year, and dividing the product by two. This average provides an estimate of producer revenues received for an equal, "50/50", mix of corn and soybean production.

The monthly crop marketings data series does not provide sufficient information to determine the length of the marketing window or pricing pattern of an average producer during that window. The USDA records farmer sales during a twelve-month period, beginning in the September of the harvest-year; this definition of the marketing year does not reflect the pattern of sales made by producers using forward pricing instruments. Since almost all types of marketing transactions, including use of forward pricing tools, are recorded at the time of delivery, the twelve-month USDA window almost certainly understates the actual period of marketing activity reflected by the price-received series.

Market Benchmarks

One way to assess pricing performance is to compare farmer returns to an objective measure of performance, or a benchmark. Agricultural benchmarks should represent pricing opportunities available through alternative marketing strategies. Generally, a "good" benchmark should be one that is easy to understand, practical to implement, comparable to actual producer performance, and stable across time (Good, Irwin, Jackson, 1998). This study uses a market benchmark created by Irwin, et al. for use in the AgMAS Project at the University of Illinois. This benchmark measures the weighted average cash price offered by the market over the length of the marketing period. The average price reflects a naïve marketing strategy of incremental sales each day of the marketing year; pre-harvest sales are weighted by expected yields, and post-harvest sales are weighted by actual Central Illinois yields.

Determining the length of the marketing period is critical to the construction of the benchmark. The marketing window of a representative Illinois corn or soybean producer should begin at the time of production planning and extend to the end of the storage season for a given

crop (Good, Hieronymus, Hinton, 1980). In Illinois, this period typically runs from October or November of the year prior to planting through July or August of the year following harvest, resulting in a marketing window between 21 and 23 months in length.

Two temporal specifications are used in this study: a 20-month benchmark, beginning in January of the year of harvest and ending in August the year after harvest, and a 24-month benchmark, beginning in September of the year prior to harvest and ending in August of the year after harvest. Marketing windows of this length successfully capture a wide range of pricing opportunities available to producers. As discussed, the USDA employs a twelve-month marketing window to record farmer marketing transactions; most transactions are recorded at the time of delivery. Therefore, it is impossible to assess exactly how the two marketing benchmark specifications compare to the length of farmer marketing activity measured by the USDA series. Evidence on producer use of pre-harvest pricing instruments suggests that marketing window of a typical farmer, and thus, transactions measured by the price-received data series, stretches well beyond the twelve month period used by the USDA. In the absence of solid evidence about the length of the marketing window, the 20- and 24-month lengths of the market benchmarks appear to offer reasonable alternative specifications of the marketing window implicit in the USDA data.

The market benchmarks represent a weighted average of daily forward and spot cash prices over the length of the marketing window. Spot cash prices are available from the Illinois Department of Ag Market News, and reflect the average of North and South Central Illinois Price Reporting District prices. Daily pre-harvest forward contract prices for fall delivery are generally reported beginning in February of the year of harvest. Since the marketing window used for the 24-month benchmark begins in September of the year prior to harvest, pre-harvest forward prices must be estimated for the first five to six months of the marketing window; this is accomplished by subtracting the first available forward basis estimate (in February) from the closing price of the harvest futures contract for each day to be estimated. Since the estimation of pre-harvest forward cash bids is dependant upon the availability of futures data, the 1975 – 1982 crop year 24-month benchmarks are slightly abbreviated: they begin in the first month for which complete price data exists. Benchmarks in subsequent years, and the 20-month benchmarks, are not affected by this problem.

Several studies suggest that the pre-harvest forward basis systematically widens as the distance from harvest increases (Harris and Miller, 1981; Elam and Woodworth, 1989; Brorsen, Coombs and Anderson, 1995; Townsend and Brorsen, 2000). If this behavior characterizes the forward basis in Illinois, it is reflected in the actual forward bids, which are generally available beginning in February of the harvest year; it should therefore also be applied to the estimates of the forward basis used prior to the availability of actual forward bids. In order to adjust the estimated forward basis data, the widening present in the available forward bid data is computed; the average weekly change in forward basis estimates is determined for each crop year, for both corn and soybeans. Weekly changes in forward basis estimates are then averaged across all years in order to determine the average widening of forward bids present in the available forward basis data. The estimates of average widening are converted to a daily adjustment factor, and applied each day to the previously estimated forward basis data.

Daily forward and spot cash prices are weighted by expected trend yields pre-harvest, using a linear regression of a 20-year moving window of yields; post-harvest prices are weighted by actual Central Illinois yields post-harvest. This weighting accounts for changing yield expectations and their effect upon the quantity of sales. In years where drought or other conditions produce yields substantially below expectations, pre-harvest yield expectations are revised prior to harvest using the August *Crop Production Report*, which is typically released around August 10th. If the USDA corn or soybean yield estimate for the Central Illinois Crop Reporting District is 20% (or more) below trend yield, the USDA yield estimate is used for daily weighting from the release of the August report until the first day of harvest.

As in the case of the producer price received data series, the market benchmarks are adjusted to reflect the costs of commercial storage incurred by producers after harvest. Physical storage, drying and shrinkage fees, and interest charges are subtracted from the daily post-harvest spot prices used in calculating the market benchmark. Market benchmark prices are also be adjusted to reflect the influence of government payments. Daily loan rates, and LDP/MLGs for Illinois are available from the interactive LDP database at the Center for Agricultural and Rural Development (CARD) at Iowa State University. In the absence of price forecasting ability, it is assumed a rational producer will take loan payments at harvest, when theory predicts the difference between a fixed support level and market prices will be the largest. In fact, data from the producer price received series reflect the fact that most Illinois corn and soybean farmers take LDP/MLG payments at or near harvest-time. To adjust the market benchmark prices, the average of daily available LDP/MLGs during the 25-business day harvest window is added the final market benchmark price for each crop year over the period 1998-2002.

In addition to constructing single-crop benchmarks, the prices for the two crops are weighted by their respective yields in order to make a meaningful comparison between farmer prices and market benchmarks under a dual-crop production environment. For each crop year, the 20- and 24-month market benchmark prices for corn and soybeans are multiplied by actual Central Illinois yields for that year. These two values are then averaged in order to arrive at a market revenue benchmark for a 50/50 mix of corn and soybean production.

Price Range Percentile and Price-Level Tests of Producer Marketing Performance

Two primary indicators of marketing performance are calculated for the adjusted USDA average producer price received series for the 1975 through 2002 marketing years. First, the price data used to construct the market benchmarks is used to estimate each crop year's price range; farmer prices received are compared to the price-range percentiles in order to determine if farmers market most of their crop in the lower portion of the price range. Second, the average producer price received and the market benchmarks are compared for each crop year in order to assess claims of systematic poor farmer marketing performance.

The market benchmark price data includes all forward and spot cash prices during the period in which a producer makes marketing decisions. The maximum and minimum prices for each marketing year can be used to construct a percentile distribution of prices; the daily forward and carry-adjusted spot prices from the market benchmarks are sorted, and the minimum and maximum prices are identified, as well as 33rd and the 66th percentiles of the distribution. Table 1 presents corn and soybean producer price received data over the period 1975-2002. Producer

prices received for corn fell in the top or middle third of the price range in 54% of the crop years; more strikingly, soybean prices received fell in the top or middle third of the price range during 79% of the crop years. The average producer prices received fell in the middle third of the price range in most crop years, for both corn and soybeans. While there is evidence that producer prices received do not always fall in the middle or top portion of the year's price range, the results of this research appear to refute the contention that farmers routinely market the bulk of their crop in the bottom portion of the price range.

While evaluating producer performance relative to the price range provides some evidence on the marketing ability of farmers, it does not provide enough quantitative information on the efficiency of farmer marketing decisions. Of particular interest is the price received by producers compared to an objective, achievable, standard of performance, as measured by the average price offered by the market, weighted by crop yield. The differences between the producer price received series and market benchmarks for corn are illustrated in Figure 1. The adjusted producer price received series for corn was less than both the 20- and 24-month market benchmarks in 22 of the 28 crop years included in this study; producers under-perform the market benchmarks during much of the sample period. Figure 2 shows that soybean producers underperformed the 20-month market benchmark in 20 of the years between 1975 and 2002, and underperformed the 24-month benchmark in 18 of those years. With the inclusion of LDP/MLG payments, producer performance improved; farmers outperformed the 20-month benchmark in two additional years and the 24-month benchmark in one additional year. Despite the large number of years in which the average price received for soybeans was below that of either market benchmark, Figure 2 illustrates that the relative magnitude of these differences is smaller than those for corn. As seen in Figure 3, producer revenues fell below the 20-month revenue benchmark in 21 of the 28 years, and were below the 24-month benchmark in 20 of those years. With the addition of LDP/MLG payments, producer revenues received shift above the both benchmarks in 2001, while the magnitude of underperformance is diminished in the other, post-FAIR, years.

The comparison of producer and market benchmark prices takes into account both the direction and magnitude of differences between the producer price received data and the market benchmarks. The difference is calculated as the average producer price received for a given crop year minus the benchmark price for that year. A positive difference indicates average producer performance above the benchmark, whereas a negative difference indicates producer under-performance.

Table 2 presents summary data on the average differences between the series during the period 1975-2002, for both corn and soybeans. A paired *t*-test of zero difference is used to assess the statistical significance of price level differences between the two series. Average producer marketing performance in corn was significantly below both benchmark specifications; the length of the corn market benchmark does not affect the results of a price comparison. Farmer performance, relative to the benchmarks, declined slightly with the inclusion of government payments. Test statistic values were significant at the 5% level, indicating statistically significant differences between prices received and market benchmarks for both temporal specifications, and both with and without the inclusion of government payments. Farmer prices received for soybeans were also found to be below the soybean market benchmarks; however, statistical tests yielded insignificant *p*-values when soybean price

received data was compared to both the 20-month and 24-month market benchmarks. Thus, although soybean producers under-perform, in dollar terms, the relevant market benchmarks in many years, the amount of this shortfall is not statistically significant. Unsurprisingly, producer revenues were below both benchmark specifications; differences between producer revenue received and both market benchmarks were statistically significant, both with and without the inclusion of LDP/MLG payments.

By multiplying the dollar/bushel price received estimates and market benchmarks by annual crop production estimates, the performance comparisons between producer performance and market benchmarks can be analyzed in terms of income. If farmers consistently under-perform the market benchmarks, a measure of the income differential between actual performance and the market benchmark will provide a useful gauge of welfare loss. Table 3 shows average annual and total producer welfare loss attributable to under-performance relative to the market benchmarks. Farmer underperformance in corn marketing created approximately $3 to $4 billion in avoidable losses over the sample. The considerably better performance of producers in marketing soybeans led to smaller estimated welfare losses for this crop than for corn; farmer underperformance led total losses of approximately $650 to $930 million.

As can be seen, farmer under-performance relative to the market benchmark has important financial consequences. The market benchmarks measure the average price offered by the market, and represent performance that could be achieved by producers through the use of a marketing strategy that spread sales over time. Government marketing loan payments had a somewhat ameliorative effect upon losses, specifically in the case of soybeans. However, even when farmers only slightly under-perform the market benchmarks, the results, in terms of income, can be stark. For example, in 1991, Illinois corn producers under-performed the 20-month benchmark by 2¢/bu. While small when measured in dollars per bushel, when this loss rendered in terms of income it becomes an estimated welfare loss of almost $26 million dollars.

Crop Year Category Analysis

While these results seem to indicate substantial producer under-performance in corn and mixed-crop marketing and modest, but not statistically significant, under-performance in soybean marketing over the sample period, they provide no insight about how producer performance is influenced by different market conditions. The 28 years included in this study incorporate several distinct types of market conditions: normal crop years, in which actual production is roughly equal to expected production, short crop years, in which actual production is significantly below expected production, and the post-FAIR years of 1996-2002, during which government assistance programs were substantially revised. Examining producer performance, relative to the market benchmarks, during years in which these different conditions prevailed may shed light on under-performance observed over the whole of the sample

Using a methodology developed by Wisner et al. (1998), a linear trend regression is performed on United States corn and soybean yields; a 20-year moving window is used to forecast the expected yield for each crop year. Years in which the expected yield is more than 5% above the actual yield are classified as “short” crop years; among the 28 years included in this study, this method defines five short crop years for corn and soybeans. Actual corn yields were 5% below trend US yields in 1977, 1980, 1983, 1988, and 1995; soybean short crops

occurred in 1980, 1983, 1984, 1988, and 1995. In addition, the years after 1996 are classified as "post-FAIR" years for both crops, in which set-asides were eliminated and the LDP/MLG programs came into widespread use. Table 4 presents summary data on the average difference between producer prices and revenues and market benchmarks for each of these market conditions, for corn and soybeans. Marketing performance during these periods is also analyzed for the 50/50 revenue measure; in this case, short crop years are those in which either corn or soybean actual yields were 5% or more below trend.

As can be seen in Table 4, producer marketing performance was worse during normal crop years than during short crop years for both corn and soybeans. During normal crop years, the average producer price received for corn was significantly below both market benchmark specifications. Producer prices were -$0.09/bu. below the 20-month benchmark (-$0.10/bu. below with the inclusion of LDP/MLG payments) and -$0.13/bu. below the 24-month benchmark (-$0.14/bu. below with loan payments). During short crop years, the average producer price received was slightly below the 20-month benchmark ($0.02/bu.), but outperformed the 24-month benchmark by $0.07/bu. (both with and without the inclusion of loan payments).[3] A similar pattern of performance was found for soybeans. The average producer prices received for soybeans during normal crop years were $0.07/bu. below the 20-month market benchmark ($0.06/bu. below with loan payments) and $0.11/bu. below the 24-month benchmark ($0.10/bu. below with payments). Producer soybean prices received during short crop years were above both benchmarks ($0.13/bu. above the 20-month benchmarks and $0.25/bu. above the 24-month benchmarks, both with and without loan payments). Average 50/50 producer revenue performance reflected the patterns observed for corn and soybeans: revenues were $8.53/acre below the 20-month revenue benchmark in normal crop years ($8.23/acre below with loan payments) and $12.24/acre below the 24-month benchmark ($11.93/acre below with payments); these differences were statistically significant. Revenues during short crop years exceeded the 20-month benchmark by $2.27/acre, and the 24-month benchmark by $8.86/acre.

Income-enhancing government payments available during the post-FAIR years appear to have had a mixed effect on producer marketing performance, in both price and revenue terms, when compared to the same period without these payments. Average producer prices received for corn were one cent lower with the inclusion of payments during normal crop years; the differences between producer prices and both benchmarks remained statistically significant. Soybean under-performance improved modestly in post-FAIR years (4¢/bu. higher than the same period without the inclusion of loan payments). Dual-crop revenue underperformance, relative to both benchmarks, remained unchanged with the inclusion of LDP/MLG payments. It is interesting to note that without the inclusion of LDP/MLG payments during the post-FAIR period, which is composed entirely of "normal" crop years, producer prices and revenues were very similar to those observed for all "normal" crop years, suggesting that producer marketing patterns and performance have not significantly changed during this period.

[3] No short crop years have occurred since the introduction of the LDP/MLG programs, so these differentials do not differ with the inclusion of government payments.

Mean-Variance Evaluation of Farmer Marketing Performance

The preceding price-level comparison of farmer prices received to the market benchmarks provides a useful perspective on marketing performance. However, this type of performance evaluation may not provide a complete picture of performance; the difference in risk between farmer prices and the market benchmarks may reflect the use of different tools or different timing and frequency of marketing tool use. Mean-variance (EV) analysis is the simplest and most popular method of evaluating decision-making under risk; Table 4 presents the data needed to conduct this analysis.

As with the average price level performance tests of marketing performance, the EV analysis is conducted using both market benchmark specifications, as well as both with and without the inclusion of government loan payments. With 28 observations, the sample size is approaching a reasonable number so that reliable conclusions can be drawn about the risk and return of farmer marketing performance. As predicted by statistical theory, the standard deviations for the 24-month benchmarks, for both commodities, are slightly lower than those for the 20-month benchmarks; however, in the case of the revenue benchmarks, the 20-month benchmark had a lower standard deviation than the 24-month benchmark.

Both the 20- and 24-month market benchmark specifications dominate farmer marketing performance in corn. The inclusion of LDP/MLG payments serves to reduce the standard deviations of both series, but does not affect dominance. Similarly, both soybean market benchmarks were found to dominate the farmer price received series; however, the mean farmer price received was much closer to the mean market benchmark price than was the case for corn. Thus, farmer corn and soybean marketing does appear to involve more risk than that assumed by the market benchmark. However, an ambiguous result is found with respect to revenue: farmer revenues received have a slightly lower risk level than the market benchmarks, but also a lower mean price. With the addition of LDP/MLG payments, the risk of both the farmer revenue series and the market benchmarks increase, so that the results remain unchanged. The lower risk of the farmer revenue series is likely due to the difference in correlations between prices and yields for the farmer revenue received series and the market benchmarks.

The primary goal of mean-variance analysis is to determine whether consideration of risk alters the performance conclusions drawn upon average price level performance evaluations. Price level analysis revealed significant under-performance in farmer corn marketing, and modest under-performance in soybean marketing, when price received data were compared to both the 20- and 24-month benchmarks. The EV analysis does not affect these conclusions. In the case of producer revenue received, however, the inclusion of risk in the performance evaluation causes some ambiguity in interpretation. Although producer revenue levels are below those offered by the market, so too is the risk level of producer dual-crop marketing.

An Interpretation

In seeking to understand the results of these performance evaluations, it is useful to examine to the original data on farmer marketing and price patterns. First, consider the pattern of market prices over the study period: Figure 6 illustrates the path of the monthly average price offered by the market during all crop years, as well as during normal and short crop years. Post-

harvest monthly average prices in this figure reflect the deduction of commercial carrying charges. For both corn and soybeans, monthly prices in all study years trended downward over the course of a 24- month marketing window. This decline is steeper in the case of corn prices, which fell $0.50/bu. over the window, compared to a $0.40/bu. decline in soybean prices. In the case of both commodities, however, prices did not begin to move significantly lower until after harvest, which occurs in August or September of most years. The price pattern observed during normal crop years for both corn and soybeans is roughly the same as the pattern of all years. Only during short crop years are post-harvest prices significantly higher than prices before harvest; this post-harvest increase is more prolonged in the case of corn, but prices for both crops decline at the end of the window. The LDP and MLG payments available to producers since 1996 have changed the price pattern for both corn and soybeans: pre-harvest post-FAIR corn prices are higher than average, while post-harvest prices are substantially lower. Monthly average prices for both pre- and post-harvest soybean sales during these years are below the prices observed for the whole of the sample.

This pattern of corn and soybean prices should be kept in mind when considering the available data on producer marketing behavior. Figures 4 and 5 illustrate the distribution of NASS monthly marketing weights across a twelve-month marketing year for the period 1975-2002, for both corn and soybeans. Figure 4 presents the maximum, minimum, and average marketing percentages for each month over the period 1975-2002. While the weights vary across the marketing year, it is noteworthy that, for the most part, the difference in these percentages remains relatively constant over the sample. The constancy of the pattern across the marketing year indicates a relatively stable pattern of sales; the magnitude of marketing varies between marketing years, but the relative amount marketed each month generally remains the same. These figures show that farmers sell most of their corn production between December and March following harvest, and most soybean production between September and December. In following months, the percentage of sales remains relatively constant. When the sample is divided into normal, short, and post-FAIR crop years, farmer marketing patterns, with very little variation, are nearly identical with respect to crop year type.

The USDA records sales during a twelve-month period, beginning in the September of the harvest-year; this definition of the marketing year does not necessarily reflect the pattern of sales made by producers using forward pricing instruments. Studies have suggested that producers may price an average of 15% of their production pre-harvest. This, however, leaves a large portion of the crop to be priced post-harvest, and it is in this post-harvest pricing that much of the under-performance observed in this study can be understood.

Given the stability of farmer marketing patterns over time, marketing performance would appear to be determined largely by the pattern of market prices. Since these marketing patterns are also stable with respect to market conditions, observed over-performance in short crop years, and under-performance in normal crop year can be explained by the pattern of farmer sales. The highest frequency of marketings, in all types of years, occurred during the winter and spring of the year following harvest; during normal crop years, this is a period of declining prices, but in short crop years, prices rise steadily until later in the summer. Fundamentally, the permanence of marketing patterns would appear to indicate that farmers are not responding to market signals about crop sizes: the pattern of sales observed for both corn and soybeans is best suited to conditions that occur relatively infrequently. In order to reduce underperformance in normal

crop years, especially in the case of corn, producers may need to price a greater portion of their crop pre-harvest. Returning to Figure 4 it can be seen that beginning in the April following harvest, the sales percentages remain relatively constant until the end of the marketing window. By the August following harvest, even the price increases observed in short crop years have largely disappeared, and in normal crop years, prices fall precipitously during the late summer. If producers were to shift a portion of sales made during this period of universally low prices to a time earlier in the crop year, the net price received might be substantially improved.

The reason that producers delay the sale of so much of their crop until late in the post-harvest season is obscure; each participant enters the market with a unique strategy and set of expectations about the future. However, farmers, like all other decision makers, are subject to certain psychological pitfalls that can undermine even a well-considered marketing plan. Since the data used in this study reflects the aggregate behavior of many individual producers, it would appear that farmers, as a class, are falling victim to several well-documented behavioral mistakes.

In a paper on behavioral finance and marketing, Brorsen and Anderson (2001), surveyed the extensive literature devoted to cognitive biases in financial decision-making, and suggested the applicability of these theories to understanding farmer behavior. They identified two biases in particular would seem to explain much of the underperformance observed in this study: "anchoring," and "loss aversion and regret." Anchoring refers to the reluctance one feels to revising a long-held opinion. If a farmer makes the same pattern of sales, year after year, their faith in this pattern will grow over time; this strategy becomes a psychological anchor point, from which it is difficult to deviate. The constancy observed in monthly marketings over the study period, regardless of market conditions, would seem to indicate a firmly entrenched belief in a well-worn, but not necessarily successful marketing plan. Specifically, farmers seem unable to revise their beliefs when the markets send clear signals about short and normal crop years.

The fact that a substantial portion of marketings are made in the late summer, when prices are almost always at their lowest, would seem to point to the presence of another bias, "loss aversion and regret." In order to avoid the painful regret associated with making a "losing" decision, farmers put off realizing losses by storing until late in the marketing year. Unwilling to accept that prices have peaked, farmers appear to hold their crops long after prices have substantially declined. Further investigation of behavioral factors and their influence on farmer marketing and decision-making would be a useful future extension of the research begun in this study.

Summary and Conclusions

The results of this research tell two equally compelling stories. First, the available evidence about the efficiency of farmer marketing decisions is generally disappointing: in most normal crop years, farmers receive prices for their crops significantly below those offered by the market. While the magnitude of these shortfalls appears small in dollar-per-bushel terms, when weighted by actual annual production, the severity of under-performance becomes apparent. In accord with previous research (e.g., Irwin et al., 2003), this study found that farmers do a better job at marketing soybeans than corn. Therefore, welfare losses incurred through soybean marketing were significantly less than those observed for corn. The combination of the two

commodities, in a 50/50 revenue mix, appears to reduce the riskiness of prices received, but not eliminate underperformance relative to the market.

On its face, this study seems to offer an indictment of farmer marketing abilities; income losses attributable to inefficient marketing, totaling in the billions of dollars over the length of the sample period, are not reassuring measures of marketing performance. However, all hope is not lost for producers when it comes to enhancing incomes through marketing. While there is ample evidence to suggest farmers will not be able to garner abnormal returns to marketing, there is no reason, even in a perfectly efficient market, that they cannot achieve the average price offered by the market during the year. The market benchmarks, against which farmer performance was assessed and from which welfare losses were determined, represent a practical marketing strategy that farmers can implement. The magnitude of welfare losses suggests that such a marketing strategy would significantly enhance income during normal crop years.

The implicit message of the market benchmark is the necessity of spreading marketing transactions over the length of the marketing window. Farmer marketing patterns remain relatively constant over time, and are unvarying with regard to market conditions. Were farmers to spread a larger portion of their sales between the pre-harvest and post-harvest periods, under-performance would likely be reduced. Despite the fact farmers receive above-average prices during short-crop years, these years do not occur with enough frequency to be depended upon. The marketing patterns reflected in the USDA data do not reflect the use of a price-averaging strategy, spreading sales, which would be beneficial in all crop years.

The second major implication of this study, and perhaps the more reassuring, is that farmer marketing performance, although inefficient, is not as poor as is commonly believed. All manner of expensive marketing tools are sold to farmers on the basis of the canard, "farmers market most of their production in the bottom portion of the price range." Less explicitly, but no less importantly, extension educators and government policy makers base their decisions on a similar belief. This study found that the prices farmers receive for corn and soybeans, in Central Illinois, fall in the middle one-third of the price range in most crop years. There is no evidence that farmers consistently market most of their production in bottom one-third of the price range.

Middle of the road performance makes for a less compelling storyline than dramatic under-performance, but farmers should take solace in their proven abilities. Marketing is a difficult task, as evidenced by the importance placed on it and the attention it receives. A ready-made solution, in the form of spreading sales, exists for the under-performance observed in this study; this solution will produce consistent results near the market average price over time. In an efficient market, this is likely the only reliable income-enhancing marketing strategy available to farmers; as such, it should be considered by those whose yearly sales fall short of the average price offered by the market. The importance of spreading sales across time is reflected in the growing popularity of "new generation" grain marketing contracts, offered by Cargill, CGB, e-markets and others. These contracts give producers the average market price over a set period of time, and allow them to enjoy the price-increasing and risk-reducing benefits of spreading sales without the facing the cognitive biases that may undermine such a strategy (Hagedorn, et al, 2003).

Table 1. Price Ranges of Average Producer Price Received Series and Market Benchmarks, without LDP/MLG Payments, 1975-2002

Price Range	Corn	Soybeans
Top Third of Price Range	11%	21%
Middle Third of Price Range	43%	58%
Bottom Third of Price Range	46%	21%

Table 2. Significance Tests of the Difference between the Average Producer Price Received and the Market Benchmark Prices, Corn, Soybeans, and 50/50 Revenue, 1975-2002 Crop Years

Commodity / Window Length	Benchmark Price	Producer Price Received	Average Difference Between Producer Price Received and Benchmark	Standard Error	*t*-statistic	Two-tail *p*-value
			-- $ per bushel (harvest equivalent) --			
Corn - Without LDP/MLG Payments						
20-Month Marketing Window	2.21	2.13	-0.08	0.09	-4.68	0.0001*
24-Month Marketing Window	2.22	2.13	-0.09	0.14	-3.49	0.0017*
Corn - With LDP/MLG Payments						
20-Month Marketing Window	2.24	2.15	-0.09	0.10	-4.81	0.0001*
24-Month Marketing Window	2.25	2.15	-0.10	0.15	-3.61	0.0012*
Soybeans - Without LDP/MLG Payme						
20-Month Marketing Window	5.75	5.71	-0.04	0.27	-0.70	0.49
24-Month Marketing Window	5.76	5.71	-0.05	0.38	-0.65	0.52
Soybeans - With LDP/MLG Payments						
20-Month Marketing Window	5.86	5.83	-0.03	0.27	-0.55	0.58
24-Month Marketing Window	5.87	5.83	-0.04	0.38	-0.55	0.59
			-- $ per acre (harvest equivalent) --			
50/50 Revenue - Without LDP/MLG Payments						
20-Month Marketing Window	267	261	-6.60	10.14	-3.45	0.0019*
24-Month Marketing Window	269	261	-8.47	15.30	-2.93	0.0068*
50/50 Revenue - With LDP/MLG Payments						
20-Month Marketing Window	273	267	-6.35	10.52	-3.20	0.0035*
24-Month Marketing Window	275	267	-8.22	15.49	-2.81	0.0092*

* denotes statistical significance at 5% level

Table 3. Estimated Income Loss, Corn, Soybeans, and 50/50 Revenue, 1975-2001

Commodity / Window Length	Average Difference Between Price Received and Benchmark	Average Annual Income Loss	Total Income Loss
Corn - Without LDP/MLG Payments	-- $/bu. --	-- in Millions of Dollars --	
20-Month Marketing Window	-0.08	-$116	-$3,255
24-Month Marketing Window	-0.09	-$147	-$4,104
Corn - With LDP/MLG Payments			
20-Month Marketing Window	-0.09	-$127	-$3,569
24-Month Marketing Window	-0.10	-$158	-$4,418
Soybeans - Without LDP/MLG Payments			
20-Month Marketing Window	-0.04	-$24	-$653
24-Month Marketing Window	-0.05	-$35	-$932
Soybeans - With LDP/MLG Payments			
20-Month Marketing Window	-0.03	-$20	-$546
24-Month Marketing Window	-0.04	-$31	-$826
50/50 Revenue - Without LDP/MLG Payments	-- $/acre --	-- in Millions of Dollars --	
20-Month Marketing Window	-7.19	-74.67	-$2,016
24-Month Marketing Window	-9.19	-$97	-$2,614
50/50 Revenue - With LDP/MLG			
20-Month Marketing Window	-7.13	-$74	-$2,002
24-Month Marketing Window	-9.13	-$96	-$2,599

Table 4. Average Differences Between Average Producer Prices Received and Market Benchmark Prices, Corn, Soybeans, and 50/50 Revenue, 1975-2002, by Crop Year Type

	Average Difference Between Producer Price Received and Market Benchmarks			
Commodity / Window Length	All Crop Years	Normal Crop Years	Short Crop Years	Post-FAIR Crop Years
		-- $ per bushel (harvest equivalent) --		
Corn - Without LDP/MLG Payments				
20-Month Marketing Window	-0.08*	-0.09*	-0.02	-0.10*
24-Month Marketing Window	-0.09*	-0.13*	0.07	-0.14*
Corn - With LDP/MLG Payments				
20-Month Marketing Window	-0.09*	-0.10*	-0.02	-0.12*
24-Month Marketing Window	-0.10*	-0.14*	0.07	-0.17*
Soybeans - Without LDP/MLG Payments				
20-Month Marketing Window	-0.04	-0.07	0.13	-0.05
24-Month Marketing Window	-0.05	-0.11	0.25	-0.10
Soybeans - With LDP/MLG Payments				
20-Month Marketing Window	-0.03	-0.06	0.13	-0.02
24-Month Marketing Window	-0.04	-0.10	0.25	-0.07
		-- $ per acre (harvest equivalent) --		
50/50 Revenue - Without LDP/MLG Payments				
20-Month Marketing Window	-6.60*	-8.53*	2.27	-8.47
24-Month Marketing Window	-8.47*	-12.24*	8.86	-13.40*
50/50 Revenue - With LDP/MLG				
20-Month Marketing Window	-6.35*	-8.23*	2.27	-7.47
24-Month Marketing Window	-8.22*	-11.93*	8.86	-12.40

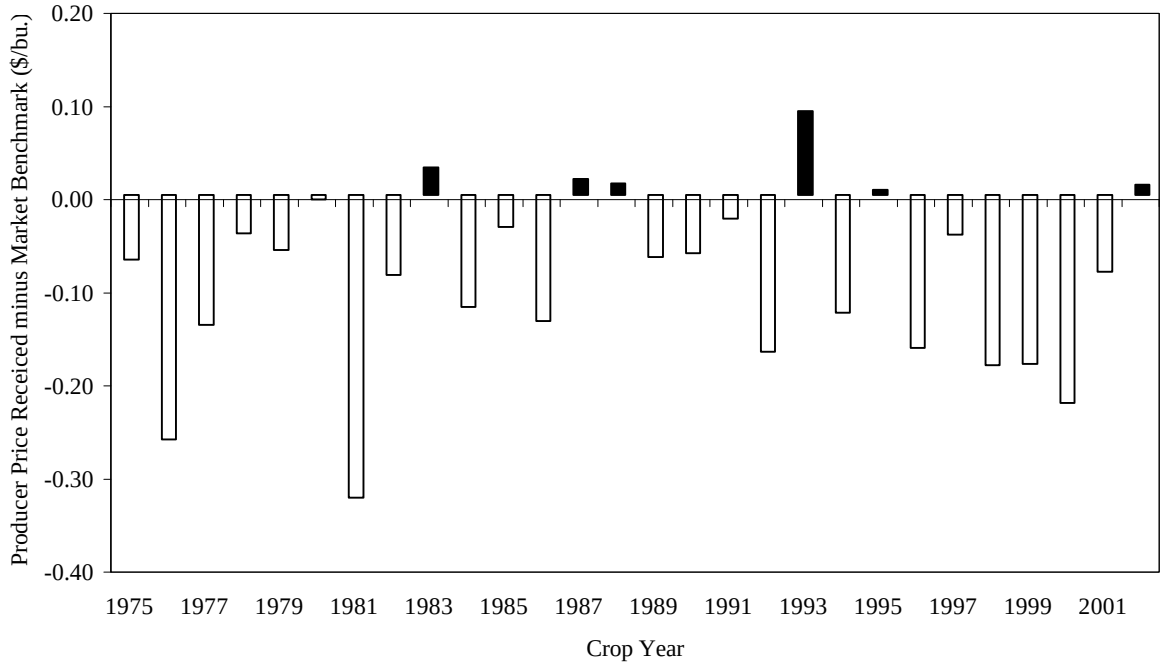
* denotes statistical significance at 5% level

Table 4. Means and Standard Deviations, Average Producer Price Received, and Market Benchmarks, Corn, Soybeans, and 50/50 Revenue, 1975-2002

Commodity / Benchmark	Mean	Standard Deviation	Dominance vs. Farmer Price Received
	-- $ per bushel (harvest equivalent) --		
Corn - Without LDP/MLG Payments			
USDA Average Producer Price Received	2.13	0.38	
20-Month Marketing Window	2.21	0.36	+
24-Month Marketing Window	2.22	0.32	+
Corn - With LDP/MLG Payments			
USDA Average Producer Price Received	2.15	0.36	
20-Month Marketing Window	2.24	0.33	+
24-Month Marketing Window	2.25	0.30	+
Soybeans - Without LDP/MLG Payments			
USDA Average Producer Price Received	5.71	0.89	
20-Month Marketing Window	5.75	0.77	+
24-Month Marketing Window	5.76	0.70	+
Soybeans - With LDP/MLG Payments			
USDA Average Producer Price Received	5.83	0.75	
20-Month Marketing Window	5.86	0.63	+
24-Month Marketing Window	5.87	0.57	+
	-- $ per acre (harvest equivalent) --		
50/50 Revenue - Without LDP/MLG Payments			
USDA Average Producer Revenue Received (without LDP/MLGs)	261	38	
20-Month Marketing Window (without LDP/MLGs)	267	38	?
24-Month Marketing Window (without LDP/MLGs)	269	39	?
50/50 Revenue - With LDP/MLG Payments			
USDA Average Producer Revenue Received	267	38	
20-Month Marketing Window	273	39	?
24-Month Marketing Window	275	41	?

Figure 1. Difference Between Producer Prices Received and Market Benchmarks, Corn, With LDP/MLG Payments, 1975-2002

Panel A: Producer Prices Received Less 20-Month Market Benchmark



Panel B: Producer Prices Received Less 24-Month Market Benchmark

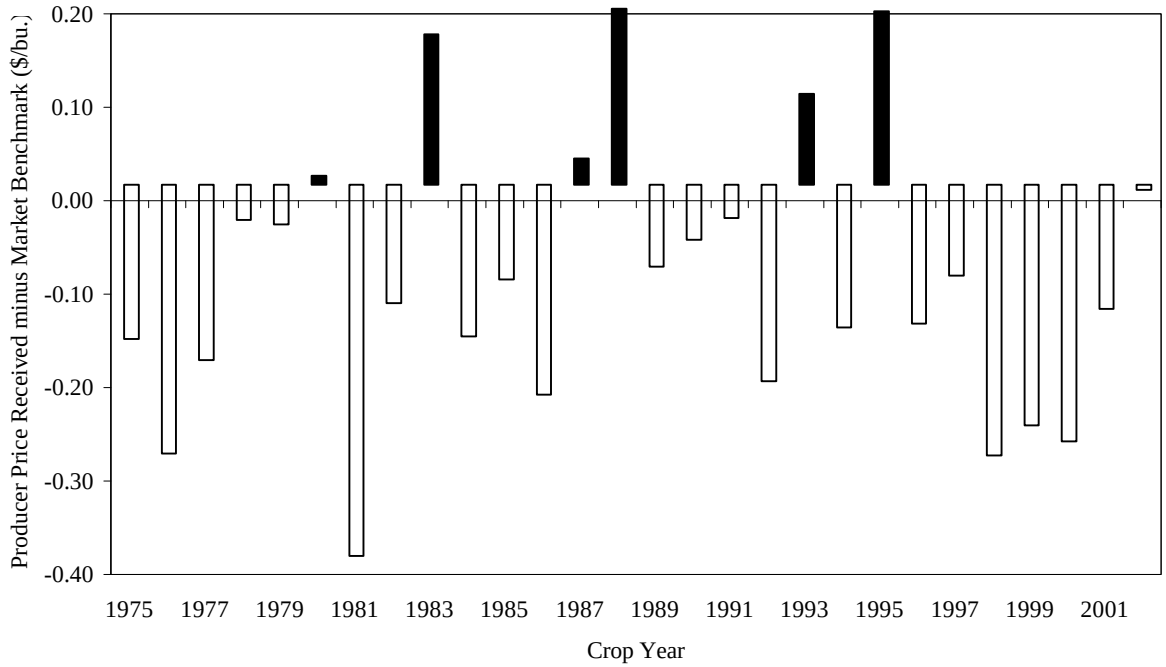
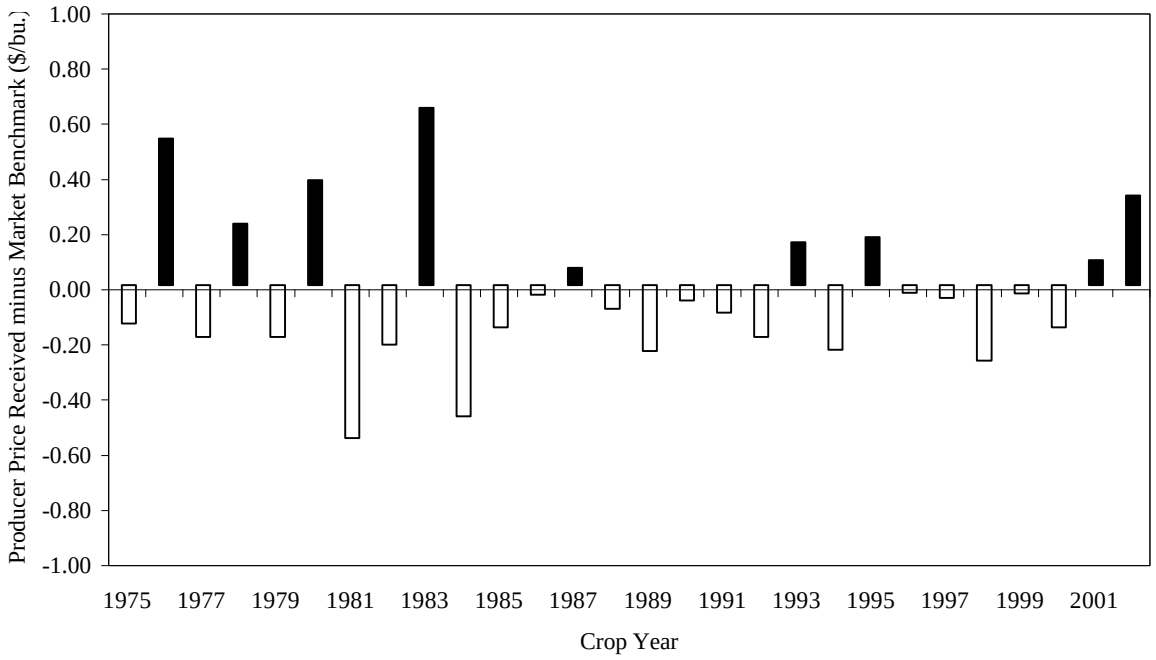


Figure 2. Difference Between Producer Prices Received and Market Benchmarks, Soybeans, With LDP/MLG Payments, 1975-2002

Panel A: Producer Prices Received Less 20-Month Market Benchmark



Panel B: Producer Prices Received Less 24-Month Market Benchmark

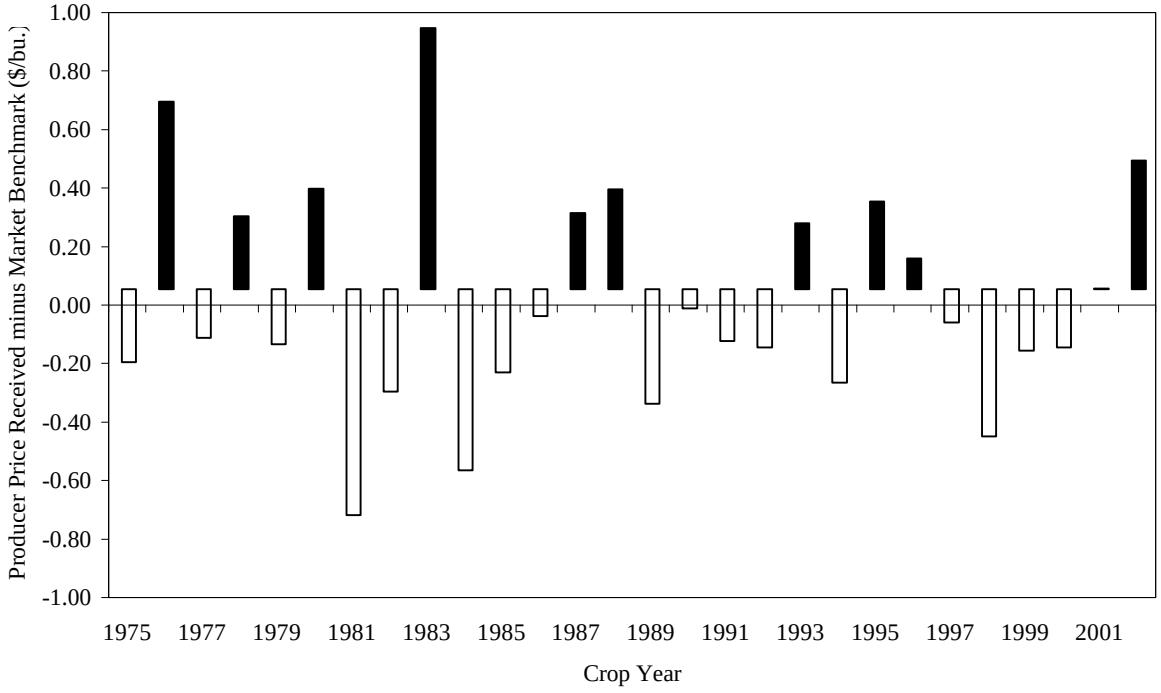
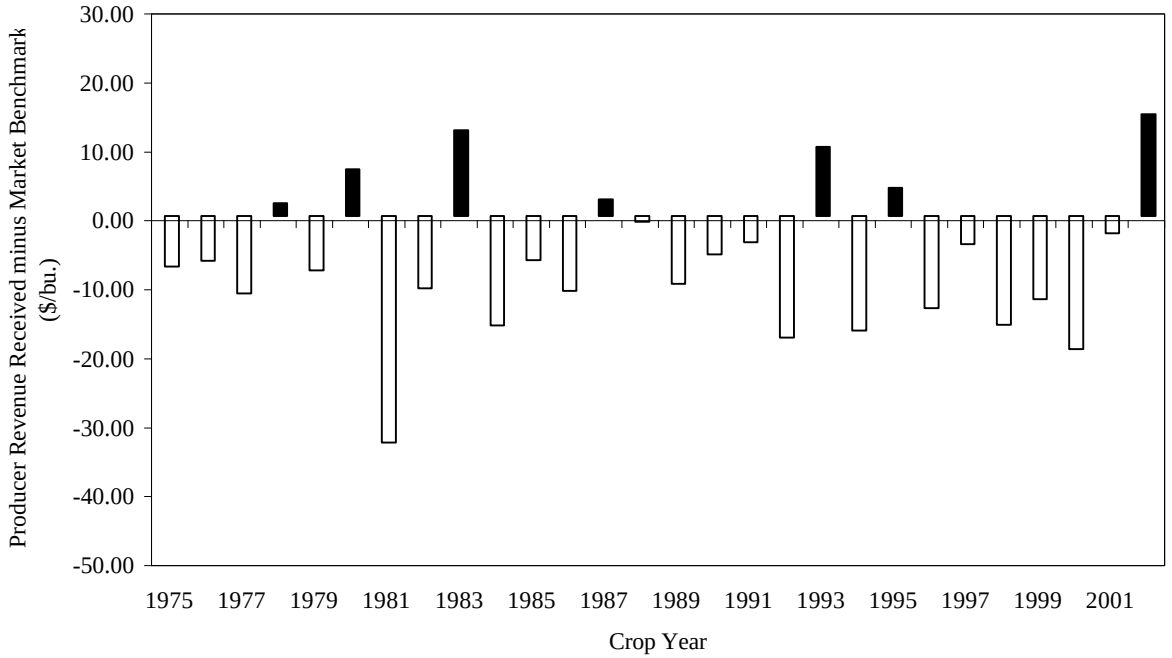


Figure 3. Difference Between Producer Revenue Received and Market Benchmarks, With LDP/MLG Payments, 1975-2002

Panel A: Producer Revenue Received Less 20-Month Market Benchmark



Panel B: Producer Revenue Received Less 24-Month Market Benchmark

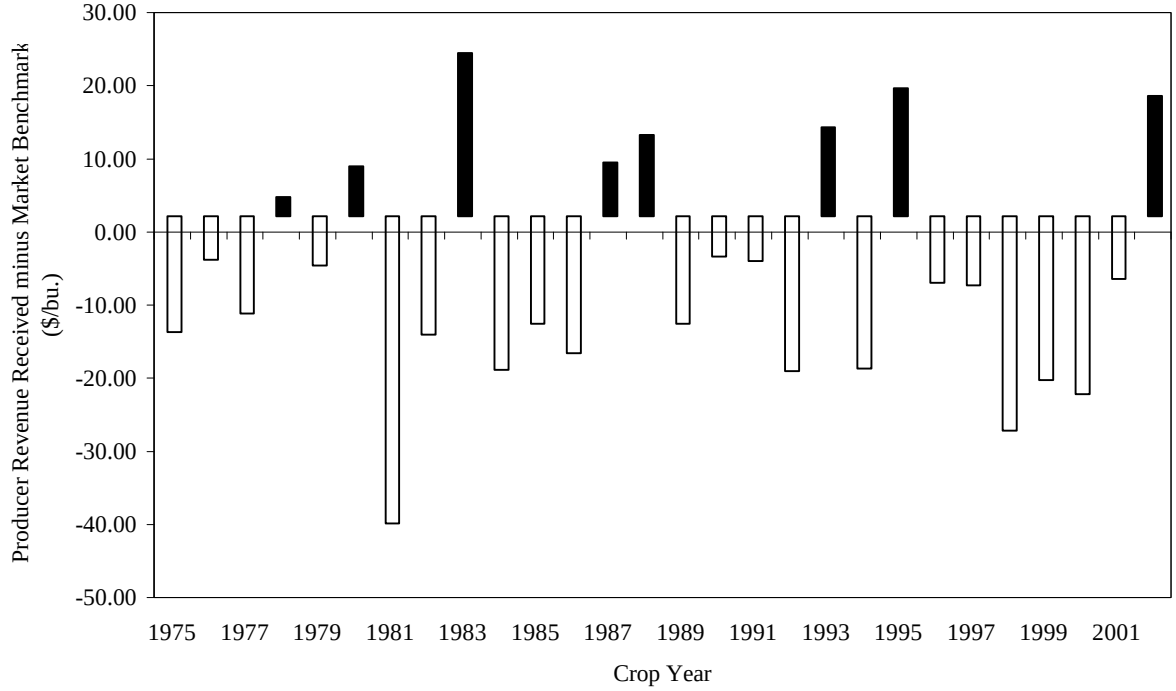
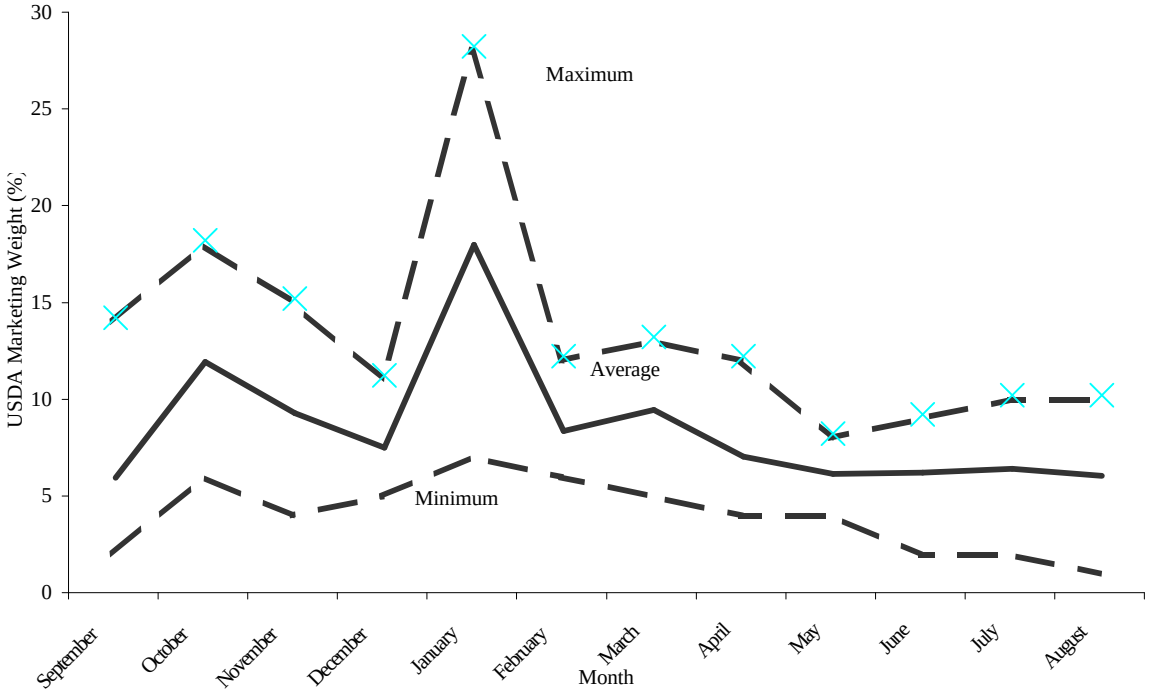


Figure 4. The Distribution of NASS Monthly Marketing Weights, 1975-2002

Panel A: Corn



Panel B: Soybeans

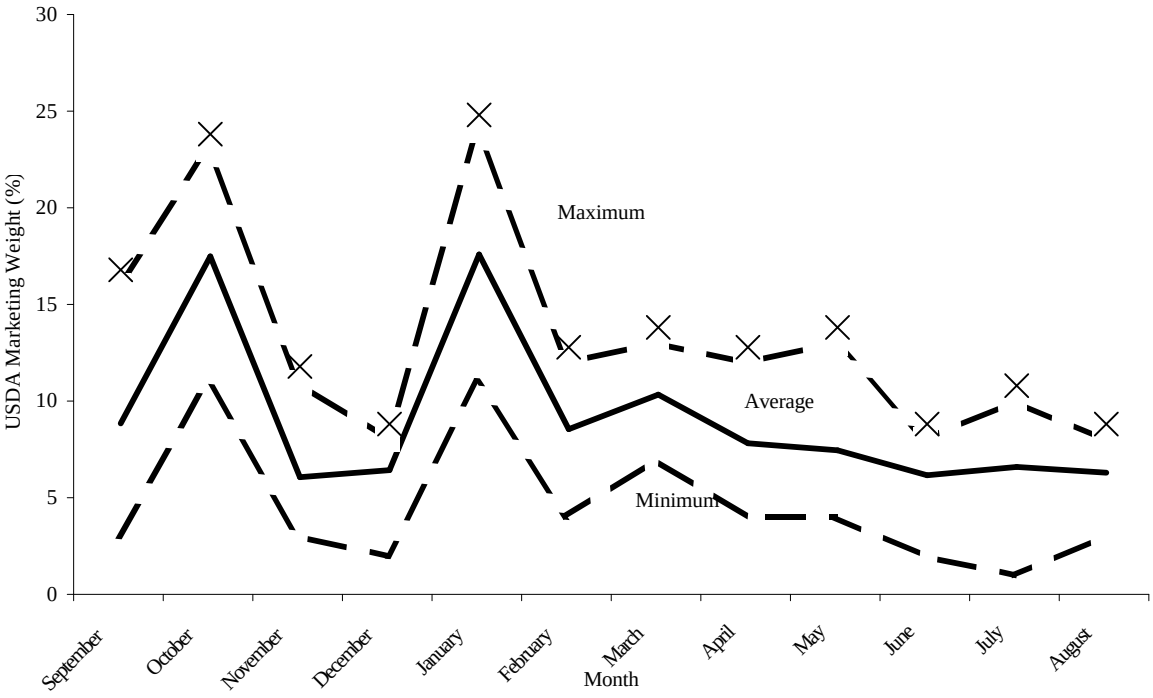
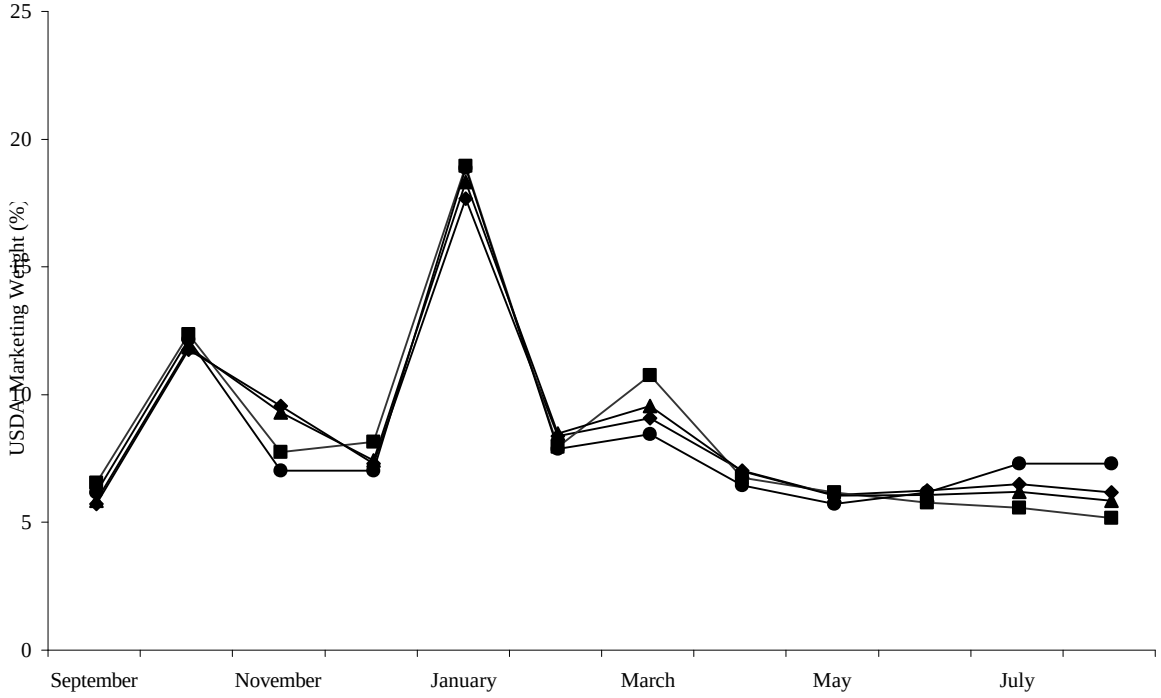


Figure 5. The Periodic Distribution of NASS Monthly Marketing Weights, 1975-2002

Panel A: Corn



Panel B: Soybeans

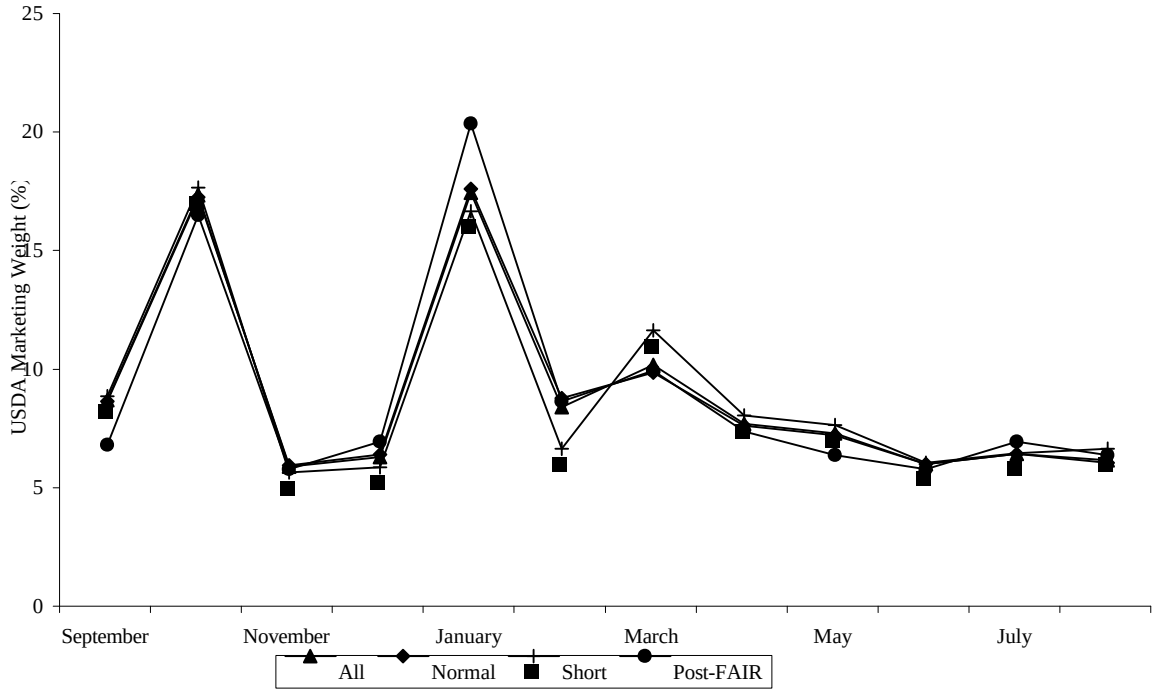
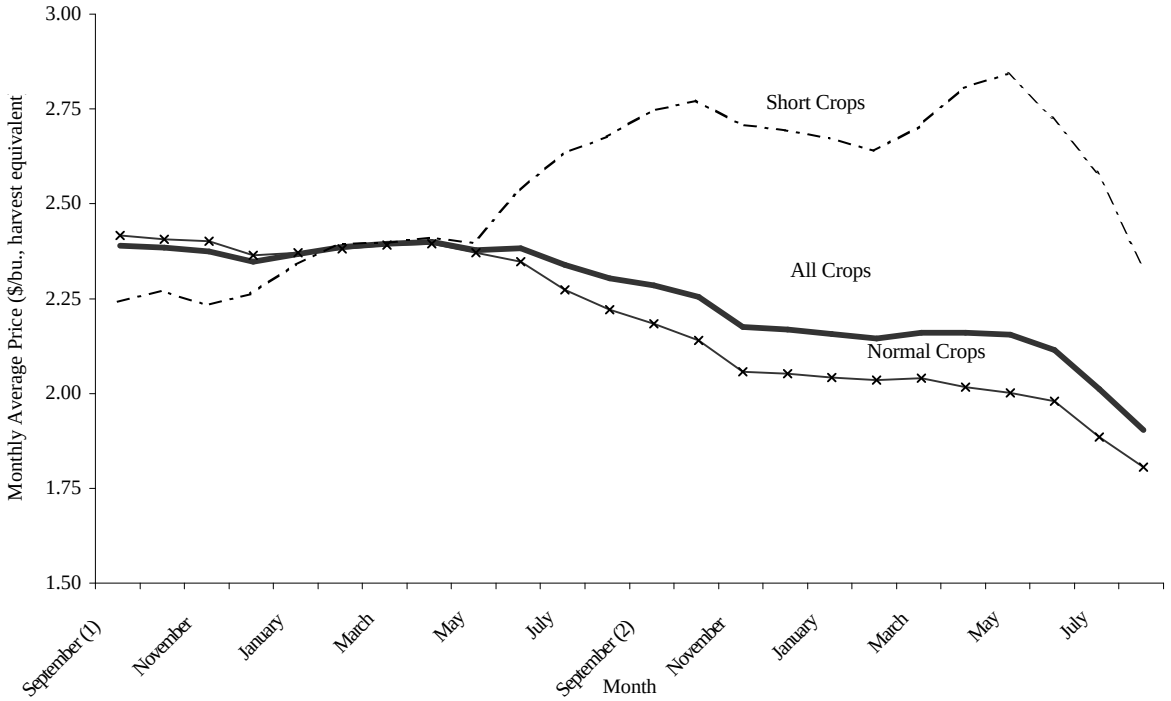


Figure 6. Harvest Equivalent Central Illinois Corn and Soybean Prices, Without LDP/MLG Payments, 1975-2002

Panel A: Monthly Average Corn Prices for All, Short, and Normal Crop Years



Panel B: Monthly Average Soybean Prices for All, Short, and Normal

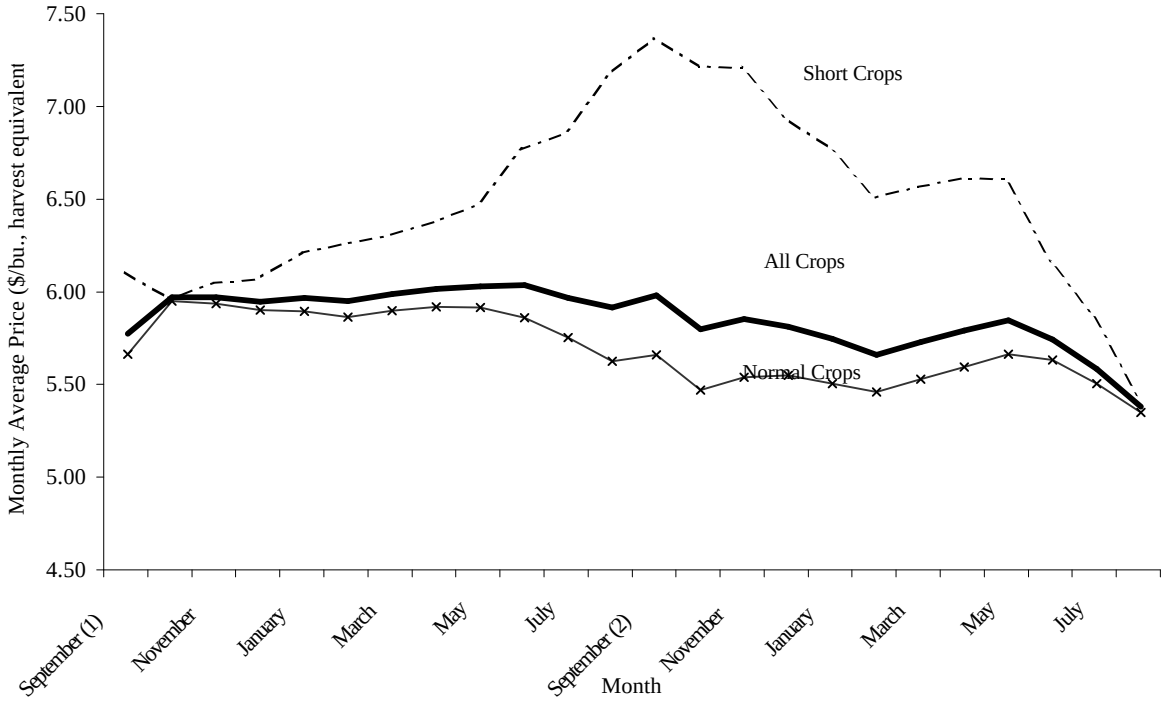
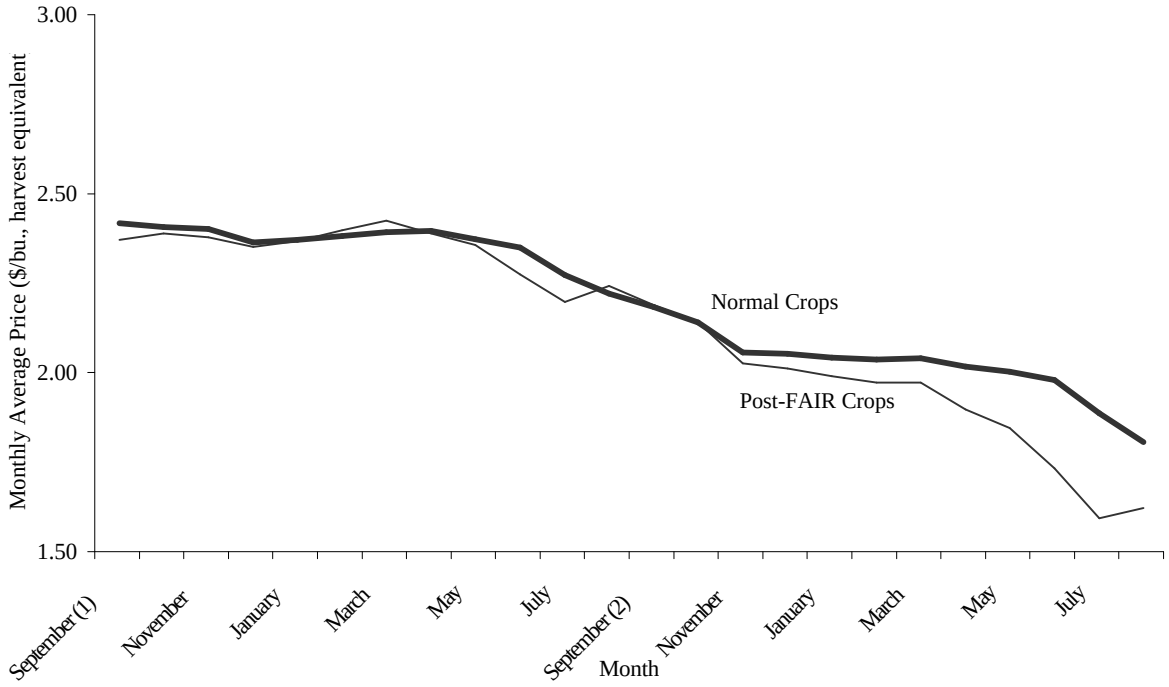
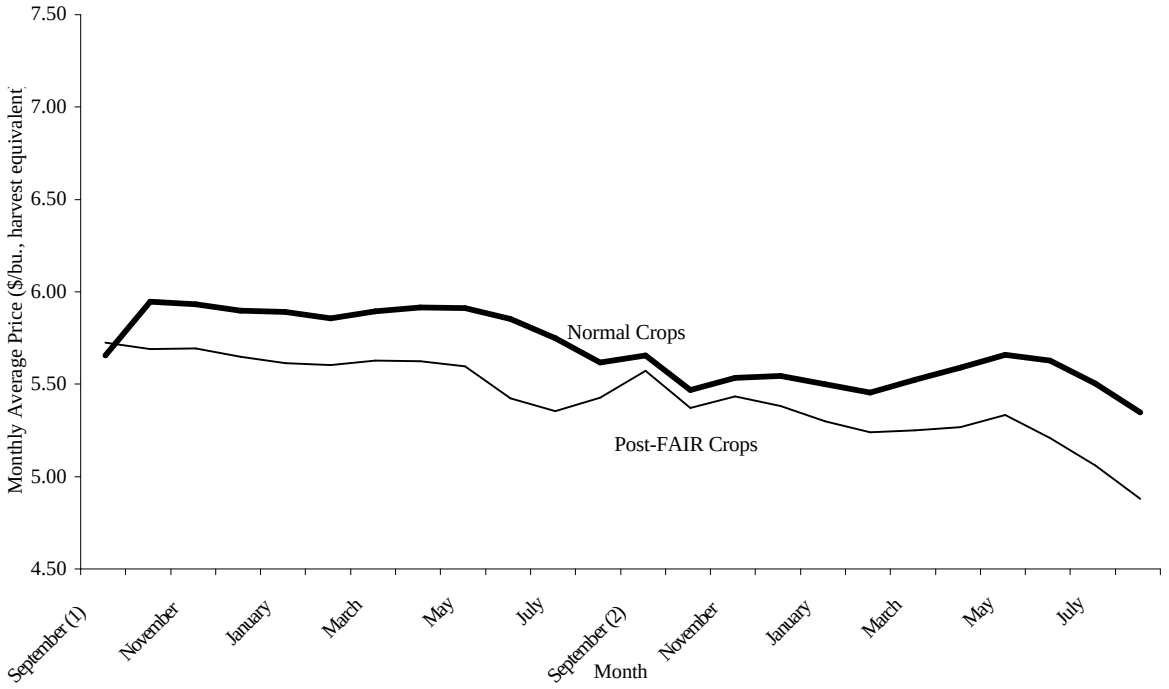


Figure 7. Harvest Equivalent Central Illinois Corn and Soybean Prices, Without LDP/MLG Payments, 1975-2002

Panel A: Monthly Average Corn Prices for Normal and Post-FAIR Crop Years



Panel B: Monthly Average Soybean Prices for Normal and Post-FAIR Crop Years



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