Do Big Crops Get Bigger and Small Crops Get Smaller? Further Evidence on Smoothing in USDA Crop Production Forecasts

by

Olga Isengildina-Massa, Scott H. Irwin,
and Darrel L. Good

Suggested citation format:

Isengildina-Massa, O., S. H. Irwin, and D. L. Good. 2007. "Do Big Crops Get Bigger and Small Crops Get Smaller? Further Evidence on Smoothing in USDA Crop Production Forecasts." Proceedings of the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. Chicago, IL. [http://www.farmdoc.uiuc.edu/nccc134].

Do Big Crops Get Bigger and Small Crops Get Smaller?
Further Evidence on Smoothing in USDA Crop Production Forecasts

By

Olga Isengildina-Massa

Scott H. Irwin

Darrel L. Good[1]

Paper presented at the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management Chicago, Illinois, April 16-17, 2007

*Olga Isengildina-Massa is an Assistant Professor in the Department of Applied Economics and Statistics at Clemson University; Scott H. Irwin is the Laurence J. Norton Professor of Agricultural Marketing and Darrel L. Good is a Professor in the Department of Agricultural and Consumer Economics at the University of Illinois at Urbana-Champaign. The funding support of the Economic Research Service of the US Department of Agriculture under Cooperative Agreement No. 43-3AEK-8-80106 is gratefully acknowledged. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

Do Big Crops Get Bigger and Small Crops Get Smaller?
Further Evidence on Smoothing in USDA Crop Production Forecasts

Practitioner's Abstract

The purpose of this paper is to determine whether smoothing in USDA corn and soybean production forecasts is concentrated in years with relatively small and large crops. The sample consists of all USDA corn and soybean production forecasts released over the 1970 through 2006 crop years. Results show that USDA crop production forecasts in both corn and soybeans have a marked tendency to decrease in small crop years and increase in big crop years. The magnitude of smoothing is surprisingly large, with corn and soybean production forecasts cumulatively revised downward by about 6 to 7 percent in small crop years and upward by about 5 to 6 percent in large crop years. Crop condition ratings are useful in predicting whether the current year is likely to be a small, normal, or big crop year. Hence, there appears to be an opportunity for the USDA to incorporate additional information into the forecasting process to reduce or eliminate the smoothing inherent in different types of crop years.

Key Words: corn, crop production, forecasts, smoothing, soybeans, USDA

There's an old saying in this business that big crops get bigger and small crops get smaller…I guess I'm in the camp that believes the 10.3 million bushel [USDA] corn estimate is a little bit too high.

---Tom Mueller, Taylor Ridge, Illinois farmer (*Quad-City Business Journal*, 2005)

Introduction

Conventional analysis of forecast accuracy does not answer the question of how forecasts change during a forecasting cycle. Systematic under- and over- adjustments are revealed through analysis of forecast revisions. Two previous studies have examined the revisions process for U.S. Department of Agriculture (USDA) crop production forecasts. Gunnelson, Dobson, and Pamperin (1972) analyzed first and second revisions for seven U.S. crops over 1929-1970 and reported, "While a relatively high percentage of the revisions was successful, the revised forecasts tended to under compensate for the errors in the previous estimate. Thus, for example, if first crop forecasts underestimated or overestimated crop size, the first revision was likely to exhibit similar characteristics." (pp. 641-42). In a more recent study, Isengildina, Irwin and Good (2006) found that revisions to USDA corn and soybean crop production forecasts over 1970-2005 were under-adjusted, or "smoothed." The smoothing was revealed in positive correlations between adjacent monthly revisions and consistency in the direction of changes. For example, directional tests revealed that positive monthly revisions in corn forecasts were followed by positive revisions 79% of the time and negative revisions remained negative

56% of the time. In soybeans, positive and negative monthly revisions were followed by revisions in the same direction 66% of the time. The smoothing is a violation of forecast efficiency because new information is incorporated into forecasts too slowly (Nordhaus, 1987).

Isengildina, Irwin, and Good (2006) also interviewed officials responsible for compilation of USDA crop production forecasts to assess their views on potential sources of smoothing in production forecasts. The officials soundly rejected correction for measurement error or strategic behavior on the part of USDA analysts as possible explanations. The discussions instead suggested that smoothing may be related to the procedure used to translate information about plant fruit counts into objective yield indications. Specifically, the existing procedure does not take into account current crop growing conditions when forecasting the relationship between plant fruit counts and yield. Another source may be a conservative bias in farm operators' assessment of yield prospects.

Given the significant role that USDA crop reports play in corn and soybean markets (e.g., Sumner and Mueller, 1989), it is important to understand the source of smoothing in USDA crop forecasts. The purpose of this paper is to determine whether smoothing in USDA corn and soybean production forecasts is concentrated in years with relatively small and large crops. The sample for the study consists of all USDA corn and soybean production forecasts released over the 1970 through 2006 crop years. The statistical framework is drawn from the event study literature. First, crops for each year are classified as "small," "normal," or "big" based on deviations from trend yields. Next, cumulative average revisions are computed for each revision date for the three groups of crop years. If revisions are unrelated to the crop year category, cumulative average revisions should be equal to zero for each category. Standard t-tests and non-parametric sign tests are used to test the statistical significance of cumulative revisions.

The quote at the beginning of this paper indicates that many believe USDA crop production forecasts are smoothed in a particular manner, i.e. big crop forecasts tend to get bigger and small crop forecasts tend to get smaller across the forecasting cycle. The results of this research will provide new evidence on the magnitude of smoothing and whether it is in fact concentrated in "small" and "big" crop years. Market participants can make use of the information to improve their understanding and application of USDA production forecasts. The results can also be used by the USDA to improve the accuracy of the crop production forecasting process.

Data

USDA forecasts of corn and soybean production over the 1970 through 2006 crop years are examined in this study. The USDA forecasts are released in August, September, October, and November of each year.[1] USDA corn and soybean production forecasts are considered fixed-event forecasts because the series of forecasts is related to the same terminal event, q_T^i, where T is the release month (January) for the final estimate of crop production in the i^{th} year.[2] The forecast of the terminal event for month t is denoted as q_t^i, where t = 1:August, 2:September, 3:October, 4:November, 5:January and i =1970, …, 2006. Isengildina, Irwin, and Good (2006) provide a detailed review of USDA crop production forecasting processes.

The analysis is based on cumulative forecast revisions. Cumulative revisions are calculated in log percentage form in order to standardize for increasing crop size over time:

$$(1) \qquad R_t^i = 100 \times \ln\left(q_t^i / q_1^i \right) \qquad t = 2,...,5; \quad i = 1970,...,2006.$$

This layout of fixed-event forecasts and corresponding cumulative revisions is illustrated for the USDA corn and soybean production forecasting cycle in figure 1. Note that the January cumulative revision is exactly equal to the August forecast error.

Procedures

Previous studies of smoothing in USDA crop production forecasts (Gunnelson, Dobson, and Pamperin, 1972; Isengildina, Irwin, and Good, 2006) estimate measures of the correlation between adjacent monthly revisions for all sample years. A different procedure is needed to determine whether revisions are concentrated in years with small and big crops. An event study framework (Campbell, Lo, and MacKinlay, 1997, p.149) is nicely suited to this purpose, as it focuses on cumulative effects and allows different types of events to be easily grouped. In the present context, the events are the release of revisions to USDA corn and soybean production forecasts in September, October, November, and January. The first step in the analysis of these events is to classify each crop year as “small,” “normal,” and “big” based on deviations from trend yields. The second step is to compute cumulative average revisions of USDA corn and soybean production forecasts for each revision date (September, October, November, and January) for the three groups of crop years. If revisions are unrelated to the crop year category, cumulative average revisions should be equal to zero for each category. Alternatively, if “big crops get bigger and small crops get smaller,” cumulative average revisions will be negative for small crop years, zero for normal crop years and positive for large crop years.

Standard t-tests and non-parametric sign tests are used to test the null hypothesis that average cumulative revisions equal zero for each category of crop years. For a given commodity (corn or soybeans) and category (small, normal, big), the t-statistic is:

$$(2) \qquad t_{CAR} = \frac{\bar{R}_t}{\sqrt{Var\left(R_t\right)/K}} \qquad t = 2,...,5$$

where $\bar{R}_t = \frac{1}{K}\sum_{i=1}^{K} R_t^i$, $Var(R_t) = \frac{1}{K-1}\sum_{i=1}^{K}(R_t^i - \bar{R}_t)^2$, and K refers to the number of observations in the given category. The test statistic t_{CAR} is distributed as a t-distribution with *K-1* degrees of freedom.

The null hypothesis for the non-parametric sign test is that the direction of cumulative revisions is equally likely to be positive or negative regardless of the crop year category. The test statistic for a given commodity (corn or soybeans) and the small crop category is:

$$d_{CAR} = K^{-} \quad (3)$$

where K^{-} is the number of negative cumulative revisions for small crop years. The test statistic for a given commodity (corn or soybeans) and the normal or big crop year categories is:

$$d_{CAR} = K^{+} \quad (4)$$

where K^{+} is the number of positive cumulative revisions for normal or big crop years. The test statistic d_{CAR} follows a binomial distribution with $p = 0.5$. An advantage of the sign test is that it only requires independence of cumulative revisions for a given category across crop years.

A key part of the event study framework is categorizing crop years into small, normal, and big crop years. Two methods have been proposed in the previous literature. Wisner, Blue and Baldwin (1998) used a 10% difference in actual yield versus trend. That is, if actual yield was 10% or more below trend yield the crop is considered small. Taylor (2003) used a 5% difference between the USDA's August yield forecast and trend. Since the cut-off point in both studies is somewhat arbitrary, the inter-quartile range of percentage differences from trend is used in this study for crop condition classification. Using this approach, yield differences from trend are ranked from the smallest to largest and the lower and upper 25% of the observations are considered small and big crop years, respectively, while the middle 50% is assumed to contain normal crop years.

As noted above, Wisner, Blue, and Baldwin (1998) compared trend yields to actual yields whereas Taylor (2003) compared trend yields to USDA's August yield forecasts. Both studies computed trend yields as the fitted values from a regression of actual yields on time over the respective sample periods. We follow Wisner, Blue, and Baldwin and compute the percentage difference between actual yields (January USDA estimates) to trend yields estimated over the entire sample period (1970 – 2006).[3] This has two advantages. First, comparison of actual yield to trend provides a better indication of whether a crop was truly "small" or "large" because actual yield, not a forecast of yield, is used. Second, Isengildina, Irwin, and Good (2006) showed that USDA forecasts of corn and soybean production in August are inefficient due to smoothing effects. Therefore, additional noise would be introduced into the classification of crop years if August forecasts are used in the comparisons.

The classification of crop years for corn and soybeans over 1970-2006 is presented in Table 1. With a sample of 37 years, the 9 years ($\approx 25\%$) with the largest negative differences in absolute value terms are considered "small," the 9 years ($\approx 25\%$) with the largest positive differences are considered "big," and the remaining 19 years ($\approx 50\%$) are considered "normal." Previous research generally shows that yield distributions for corn and soybeans are left-skewed (e.g., Sherrick et al., 2004) and this is reflected in the distribution of deviations from trend. The average difference for small crop years is -16.9% and -13.7% for corn and soybeans, respectively, whereas the average difference for big crop years is only 10.0% and 7.6%. Correlation of the differences across corn and soybeans for the same crop year is high (+0.77) but this still leads to some variation in the classification of crop years across the two commodities. Notable contrasts between corn and soybean differences occurred in 1970 and 2003. Finally, application of the inter-quartile range results in cut-off points in corn between the 10% cut-off Wisner, Blue, and Baldwin and the 5% cut-off suggested by Taylor. Soybean cut-off points are near Taylor's 5% cut-off.

Results

Results of the cumulative revisions analysis by type of crop year are presented graphically in figures 2 and 3. Note that the figures implicitly start at zero for August forecasts and then the average magnitude of revisions relative to August is cumulated through the remainder of the forecasting cycle. The figures indicate that USDA crop production forecasts in both corn and soybeans have a marked tendency to decrease in small crop years and increase in big crop years. The cumulative nature of forecast smoothing is seen in the gradual fall of cumulative average revisions during small crop years and gradual rise in big crop years. The magnitude of smoothing is especially noteworthy, with corn and soybean production forecasts cumulatively revised downward by about 6 to 7 percent in small crop years and upward by about 5 to 6 percent in large crop years. The smoothing process in small and big crop years is largely complete by the release of November forecasts. At the end of the forecasting cycle, the magnitude of smoothing is about the same in small and big crop years for corn, but not soybeans. A modest tendency for forecasts to rise is observed in normal crop years.

Cumulative average revisions and associated statistical test results for corn and soybeans are shown in Table 2. For ease of interpretation, the sign test statistic is reported as a proportion of the years for a given category. In a majority of cases, both the t-test and sign test indicate that cumulative average revisions are statistically different from zero in small and big crop years. At least one test statistic indicates significance in all cases for small and big crop years. While cumulative average revisions for normal crop years are positive for all months, statistical significance is found only in November. The magnitude of smoothing in normal crop years is also quite small in comparison to small and big crop years. Consistent with the findings in Isengildina, Irwin, and Good (2006), full sample tests do not reject the null hypothesis in any case.

The economic importance of smoothing in small and big crop years is illustrated by the impact on forecast errors. First, note that the cumulative average revision for January is identically equal to the August production forecast error. Then, the results indicate August forecasts of corn production are on average 6.18% too large in small crop years and 6.32% too small in large crop years. For an August corn production forecast of 12 billion bushels this translates into over- and under-estimates around 750 million bushels. Likewise, the results indicate August forecasts of soybean production are on average 7.22% too large in small crop years and 5.09% too small in large crop years. For an August soybean production forecast of 3 billion bushels this translates into over- and under-estimates between 150 and 200 million bushels. These levels of bias are substantial by any reasonable standard.

Two additional sets of results are generated to analyze the sensitivity of the findings to changes in assumptions. The first sensitivity analysis examines USDA yield per acre forecast revisions instead of total production revisions. The yield revision results for corn and soybeans, found in table 3, are quite similar to the results for production revisions. This is not surprising given that yield revisions are by far the dominant driver of changes in production forecasts for corn and soybeans (Good and Irwin, 2006).

The second sensitivity analysis directly estimates the relationship between cumulative revisions and deviations from trend. Specifically, regressions of the following form are estimated for corn and soybeans:

$$R_t^i = \alpha + \beta d_t^i + e_t^i \qquad t = 2, \ldots, 5;\ i = 1970, \ldots, 2006 \tag{5}$$

where d_t^i is the percentage difference between actual and trend yields. This approach has the advantage that crop years do not have to be classified into “small,” “normal,” or “big” years. The disadvantage of this approach is that the same linear relationship is imposed for positive and negative revisions. Results of the regression analysis are presented in table 4. Consistent with the earlier cumulative average revisions results, slope estimates are significantly positive in every case. Production coefficients range from 0.19 to 0.40 in corn and from 0.26 to 0.53 in soybeans. Similar estimates are reported for yields. These slope coefficients indicate, for example, that a trend deviation of +/- 10% for soybeans will lead to +/- 3.8% bias in the January cumulative revision (August forecast error). This estimate is somewhat smaller than the estimates generated by the cumulative average revision analysis. R-squared values indicate that deviations from trend explain 33 to 43% of the variation in corn production cumulative revisions and 31 to 52% of the variation in soybean production cumulative revisions. The R-squared values for January also imply that crop growing conditions (trend deviations) explain 35 and 42% of the variation in August production forecast errors for corn and soybeans, respectively.

The results strongly demonstrate that smoothing in USDA corn and soybean production forecasts is concentrated in years with relatively small and big crops.

Furthermore, the magnitude of the smoothing bias is surprisingly large. It is important to recognize, however, that the results are not based on strict tests of forecast efficiency because the information used to explain cumulative revisions is not fully available at the time production forecasts are made. Actual yields and in-sample trend estimates are not available to USDA analysts when August, September, October, and November forecasts are generated.[4] This does not, however, diminish the importance of the findings with regard to understanding the nature of smoothing and how it might be corrected.

The key question at this point is whether information is available that could be used *ex ante* to identify whether the current crop year is likely to be a small, normal, or big year as early as August 1st. Several sources of potential information are available, including private crop forecasts, weather and yield models, satellite imagery data, and crop condition ratings. We focus here on U.S. crop conditions ratings released weekly by the USDA. Several thousand "crop reporters" across the U.S. are asked each week to estimate the percentage of a particular crop that is in each of five condition categories ranging from very poor to excellent.[5] The relationship between the sum of good and excellent crop condition ratings on the date closest to August 1st and trend deviations is estimated for corn and soybeans over 1986-2006. Previous research has shown that the sum of good and excellent ratings forecasts corn and soybean yields reasonably well at this point in the growing season (Good, 2006). The sample starts in 1986 because crop conditions ratings for the U.S. are not available before this date. Trend deviations for 1986-2006 are drawn from Table 1.

Figures 4 and 5 reveal a clear relationship between crop condition ratings on August 1st and subsequent deviations of actual yield from trend for both corn and soybeans. The t-statistic for the slope coefficient is 7.35 for corn and 4.12 for soybeans. Hence, the indicated relationships are highly significant statistically. Explanatory power is higher for corn than soybeans, a sensible result considering that more of the critical growing period has passed for corn by August 1st (Thompson, 1969, 1970). This exercise, while by no means definitive, demonstrates that information is available to help predict whether the current year is likely to be a small, normal, or big crop year. Hence, there appears to be an opportunity for the USDA to incorporate this, or similar, information into the forecasting process to reduce or eliminate the smoothing inherent in the different types of crop years.

Summary and Conclusions

The purpose of this paper is to determine whether smoothing in USDA corn and soybean production forecasts is concentrated in years with relatively small and large crops. The sample for the study consists of all USDA corn and soybean production forecasts released over the 1970 through 2006 crop years. The statistical framework is drawn from the event study literature, with crops for each year classified as "small," "normal," or "big" based on deviations from trend yields. Cumulative average revisions are computed for each revision date for the three groups of crop years. If revisions are unrelated to the crop year category, cumulative average revisions should be equal to zero for each category.

The results show that USDA crop production forecasts in both corn and soybeans have a marked tendency to decrease in small crop years and increase in big crop years. The magnitude of smoothing is surprisingly large, with corn and soybean production forecasts cumulatively revised downward by about 6 to 7 percent in small crop years and upward by about 5 to 6 percent in large crop years. A modest tendency for forecasts to rise is observed in normal crop years. Cumulative average revisions are statistically significant based on at least one test statistic in all cases for small and big crop years.

The economic importance of smoothing in small and big crop years is illustrated by the impact on forecast errors. For example, August forecasts of corn production are on average 6.18% too large in small crop years and 6.32% too small in large crop years, which translates into over- and under-estimates around 750 million bushels for a corn production forecast of 12 billion bushels. August forecasts of soybean production are on average 7.22% too large in small crop years and 5.09% too small in large crop years, implying over- and under-estimates between 150 and 200 million bushels for a soybean production forecast of 3 billion bushels. These levels of bias are substantial by any reasonable standard.

When interpreting the results, it is important to note that the analysis is not based on strict tests of forecast efficiency because information used to explain cumulative forecast revisions was not fully available at the time production forecasts are made. Further analysis was conducted to determine whether information is available that could be used *ex ante* to identify whether the current crop year is likely to be a small, normal, or big year as early as August 1st. The additional results clearly demonstrate that crop condition ratings are useful in predicting whether the current year is likely to be a small, normal, or big crop year. Hence, there appears to be an opportunity for the USDA to incorporate this, or similar, information into the forecasting process to reduce or eliminate the smoothing inherent in the different types of crop years.

The results raise the interesting question of whether market participants understand and anticipate the smoothing inherent in USDA corn and soybean production forecasts. There is widespread anecdotal evidence that farmers, traders, and market analysts believe "big crops get bigger and small crops get smaller." If market participants are indeed aware of the smoothing process and account for it in forming expectations, economic welfare losses may be minimal. If instead market participants are unaware of or misunderstand the nature of the revisions process, welfare losses may result. The degree to which market participants actually use this knowledge in forming their own crop production forecasts is an interesting area for further research.

References

Campbell, J.Y., A.W. Lo, and A.C. MacKinlay. *The Econometrics of Financial Markets.* Princeton University Press. Princeton, N.J., 1997.

Good, D. "Corn: Consumption to Expand Rapidly." *Grain Price Outlook*, University of Illinois Extension, July 2006. [http://www.farmdoc.uiuc.edu/marketing/grainoutlook/pdf/072106.pdf]

Good, Darrel L. and Scott H. Irwin. "Understanding USDA Corn and Soybean Production Forecasts: An Overview of Methods, Performance and Market Impact over 1970-2005." AgMAS Project Research Report 2006-01, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, February 2006. [http://www.farmdoc.uiuc.edu/agmas/reports/06_01/AgMAS06_01.pdf]

Gunnelson, G., W. Dobson, and S. Pamperin. "Analysis of the Accuracy of USDA Crop Forecasts." *American Journal of Agricultural Economics* 54(1972):639-645.

Isengildina, O., S.H. Irwin, and D.L. Good. "Are Revisions to USDA Production Forecasts Smoothed? *American Journal of Agricultural Economics* 88(2006):1091-1104.

Nordhaus, W.D. "Forecasting Efficiency: Concepts and Applications." *Review of Economics and Statistics* 69(1987):667-674.

Sherrick, B.J., F.C. Zanini, G.D. Schnitkey, and S.H. Irwin. "Crop Insurance Valuation under Alternative Yield Distributions." *American Journal of Agricultural Economics* 86(2004):406-419.

Sumner, D.A., and R.A.E. Mueller. "Are Harvest Forecast News? USDA Announcements and Futures Market Reactions." *American Journal of Agricultural Economics* 71(1989):1-8.

Taylor, S.E. "Climate Trends and Agricultural Management." Working Paper, Department of Agronomy, Iowa State University, 2003. [http://ag.arizona.edu/ANS/swnmc/papers/2003/taylor.pdf]

Thompson, L.M. "Weather and Technology in the Production of Corn in the U.S. Corn Belt." *Agronomy Journal* 61(1969):453-456.

Thompson, L.M. "Weather and Technology in the Production of Soybeans in the Central United States." *Agronomy Journal* 62(1970):232-236.

Wisner, R.N., E.N. Blue, and E.D. Baldwin. "Pre-Harvest Marketing Strategies Increase Net Returns for Corn and Soybean Growers." *Review of Agricultural Economics* 20(1998):288-307.

Endnotes

[1] The USDA also publishes corn and soybean production forecasts for July. These forecasts were generated by NASS using the same procedures outlined in this paper until 1988. Since that time, USDA July production forecasts are based on NASS June acreage estimates and trend yield projections by the World Agricultural Board (WAOB). Since the focus of this paper is the NASS production forecasts and July NASS forecasts were discontinued in 1988, no July forecasts are included in the analysis.

[2] Sometimes the January "final" estimates are subsequently revised. This happens most frequently in January following the end of the marketing year. Due to the sporadic nature and long time lag of the subsequent revisions they are not considered in this analysis. In addition, prior to 1986 "final" estimates were released in February rather than January.

[3] Trend yields are "in-sample" in the sense that regression estimates are based all available observations over 1970-2006. "Out-of-sample" trend yields also were considered in the cumulative average revisions tests. In this procedure, the trend yield for 1970 was estimated over 1960-1969, the trend yield for 1971 was estimated over 1960-1970, and so on. Test results were similar to those generated using "in-sample" trend yields and are available from the authors upon request.

[4] As discussed in endnote 4, the use of in-sample trend estimates does not appear to be a critical restriction.

[5] The report containing state and U.S. crop condition ratings is released at 4:00 PM on the first business day of each week, usually Monday, from April 1st to November 30th. For further information on crop conditions ratings, see the fact sheet available at:
http://www.nass.usda.gov/Surveys/Crop_Progress_and_Condition/index.asp.

Table 1. Classification of Corn and Soybean Crop Years Based on Crop Size, 1970 - 2006

	Corn		Soybeans	
Crop Size	Crop Year	Yield Difference from Trend (%)	Crop Year	Yield Difference from Trend (%)
Small	1988	-33.8	1988	-23.7
	1983	-28.0	1983	-20.5
	1974	-21.9	2003	-18.9
	1993	-21.8	1974	-15.0
	1995	-11.3	1984	-11.4
	1970	-10.8	1980	-10.7
	1991	-9.5	1993	-10.5
	1980	-7.9	1976	-9.0
	2002	-7.3	1999	-4.0
Normal	1976	-3.8	2002	-3.9
	1975	-3.0	1995	-3.8
	1997	-2.5	1989	-3.7
	1977	-2.0	2000	-0.8
	1996	-0.9	1991	-0.5
	1999	-0.1	1990	-0.1
	2001	0.4	1981	1.0
	2003	0.6	1978	1.4
	1984	0.8	2001	1.9
	1989	0.9	1996	2.5
	2000	1.0	1987	2.9
	1990	1.3	1975	3.3
	2006	1.4	1998	3.5
	1998	1.8	2006	3.9
	2005	1.9	1977	4.2
	1971	6.3	1973	4.3
	1978	6.7	1986	4.5
	1987	6.7	1997	4.9
	1973	6.9	1982	5.2
Big	1992	8.1	2004	5.5
	1986	8.2	1970	5.7
	1985	8.8	2005	6.2
	1981	8.9	1972	6.2
	1982	9.9	1985	6.6
	1994	10.2	1971	6.8
	2004	10.7	1992	7.2
	1979	11.9	1979	9.3
	1972	12.9	1994	14.6

Note: Yield differences from trend are ranked from the smallest to largest and the lower and upper 25% of the observations are considered small and big crop years, respectively, while the middle 50% is assumed to contain normal crop years.

Table 2. Cumulative Average Revision Test Results for USDA Corn and Soybean Production Forecasts, 1970-2006

Category/	Corn Revision Month				Soybeans Revision Month			
Statistic	September	October	November	January	September	October	November	January
Small Crop								
CAR (%)	-3.77 *	-5.59 **	-7.10 **	-6.18 *	-4.16 *	-6.72 **	-7.43 **	-7.22 **
t-statistic	-2.02	-2.35	-2.36	-1.87	-2.08	-3.01	-3.64	-3.52
Sign test	0.89 **	0.67	0.67	0.56	0.78 **	0.89 **	0.89	0.89 **
Normal Crop								
CAR (%)	0.13	0.72	1.50 *	1.36	0.53	0.94	1.67 *	1.43
t-statistic	0.23	1.13	2.07	1.60	0.93	1.29	1.92	1.40
Sign test	0.32	0.47	0.47	0.42	0.47	0.53	0.53	0.47
Big Crop								
CAR (%)	1.24 **	3.28 **	5.11 **	6.32 **	0.97	3.81 **	5.56 **	5.09 **
t-statistic	2.56	3.87	4.46	5.05	1.12	2.79	4.00	2.86
Sign test	0.89 **	0.78 **	0.89 **	0.89 **	0.78 **	0.89 **	0.89 **	0.89 **
Full Sample								
CAR (%)	-0.55	-0.19	0.29	0.73	-0.51	-0.23	0.40	0.21
t-statistic	-0.90	-0.23	0.26	0.62	-0.75	-0.24	0.38	0.20
Sign test	0.38	0.43	0.46	0.43	0.43	0.49	0.49	0.46

Note: CAR denotes cumulative average revision of USDA crop production forecasts. Single and double asterisks (*) denote statistical significance at the 10% and 5% levels, respectively. The number of observations is 37 for the full sample, 9 for small crops, 19 for normal crops, and 9 for big crops. For ease of interpretation, the sign test statistic is reported as a proportion of the years for a given category.

Table 3. Cumulative Average Revision Test Results for USDA Corn and Soybean Yield Forecasts, 1970-2006

Category/	Corn Revision Month				Soybeans Revision Month			
Statistic	September	October	November	January	September	October	November	January
Small Crop								
CAR (%)	-3.41 *	-5.03 *	-6.50 *	-6.23 *	-4.01 *	-6.40 **	-7.03 **	-7.03 **
t-statistic	-1.96	-2.22	-2.28	-2.02	-2.07	-2.99	-3.51	-3.60
Sign test	0.67	0.67	0.67	0.67	0.78 **	0.89 **	0.89 **	0.89 **
Normal Crop								
CAR (%)	0.35	0.87	1.75 **	1.60 **	0.53	1.01	1.75 *	1.80 *
t-statistic	0.68	1.49	2.61	2.22	0.97	1.47	2.09	1.88
Sign test	0.32	0.47	0.47	0.42	0.42	0.53	0.53	0.47
Big Crop								
CAR (%)	1.26 **	3.38 **	5.12 **	5.55 **	0.98	3.87 **	5.64 **	5.09 **
t-statistic	2.54	4.08	4.67	4.40	1.15	2.82	4.04	2.89
Sign test	0.78 **	0.89 **	0.89 **	0.78 **	0.78 **	0.89 **	0.89 **	0.78 **
Full Sample								
CAR (%)	-0.34	0.04	0.56	0.65	-0.47	-0.10	0.56	0.45
t-statistic	-0.60	0.05	0.54	0.59	-0.71	-0.11	0.54	0.42
Sign test	0.35	0.46	0.46	0.41	0.41	0.49	0.49	0.43

Note: CAR denotes cumulative average revision of USDA crop yield forecasts. Single and double asterisks (*) denote statistical significance at the 10% and 5% levels, respectively. The number of observations is 37 for the full sample, 9 for small crops, 19 for normal crops, and 9 for big crops. For ease of interpretation, the sign test statistic is reported as a proportion of the years for the given category.

Table 4. Cumulative Revision Regression Results for USDA Corn and Soybean Production and Yield Forecasts, 1970-2006

Category/ Statistic	Corn Revision Month				Soybeans Revision Month			
	September	October	November	January	September	October	November	January
Production								
Slope	0.19 **	0.31 **	0.40 **	0.38 **	0.26 **	0.45 **	0.53 **	0.49 **
t-statistic	4.16	5.18	5.29	4.37	4.00	5.48	6.11	5.05
R^2	0.33	0.43	0.44	0.35	0.31	0.46	0.52	0.42
Yield								
Slope	0.18 **	0.28 **	0.38 **	0.37 **	0.25 **	0.44 **	0.51 **	0.50 **
t-statistic	4.09	4.99	5.13	4.60	4.06	5.59	6.13	5.45
R^2	0.32	0.42	0.43	0.38	0.32	0.47	0.52	0.46

Note: Single and double asterisks (*) denote statistical significance at the 10% and 5% levels, respectively. The number of observations is 37 for all regressions. The dependent variable is the cumulative percentage revision for a given crop year and revision month. The independent variable is the percentage difference between actual yield and trend yield for the crop year.

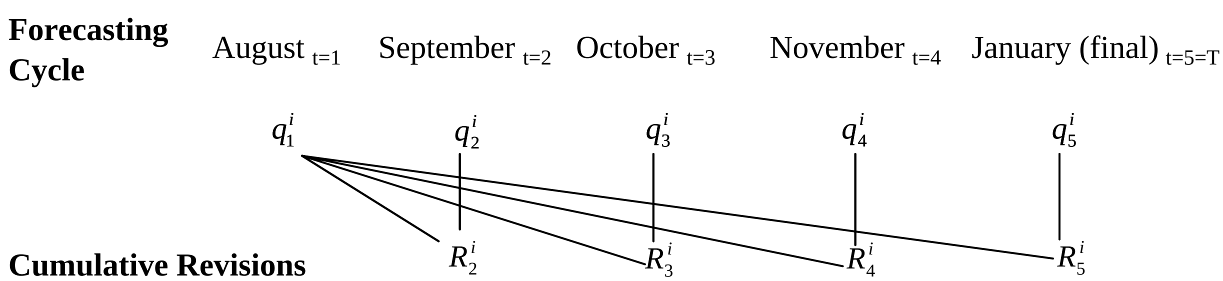

Figure 1. USDA Corn and Soybean Production Forecasting Cycle and Corresponding Cumulative Revisions

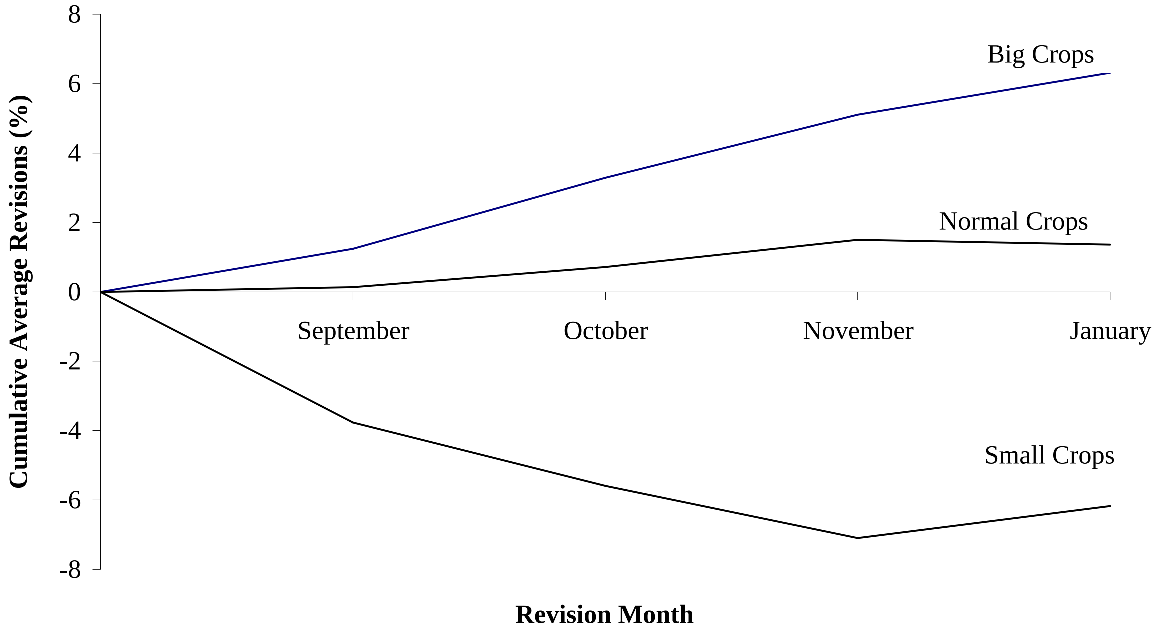

Figure 2. Cumulative Average Revisions of USDA Corn Production Forecasts in Small, Normal, and Big Crop Years, 1970-2006

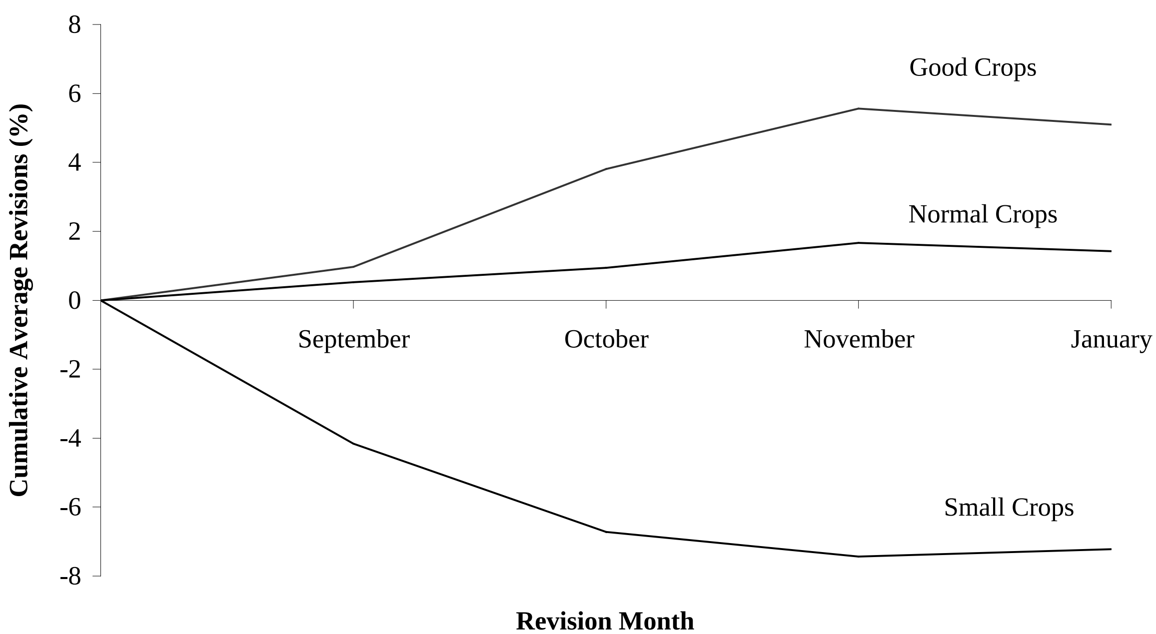

Figure 3. Cumulative Average Revisions of USDA Soybean Production Forecasts in Small, Normal, and Big Crop Years, 1970-2006

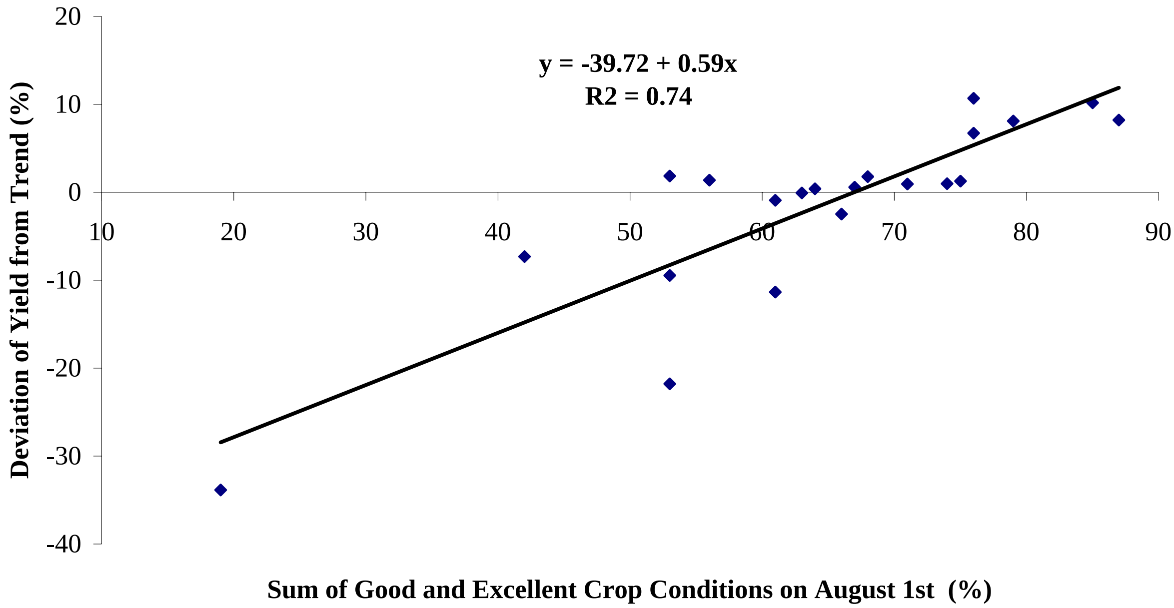

Figure 4. Relationship between U.S. Crop Condition Ratings on August 1st and Deviations from Trend for Corn, 1986-2006

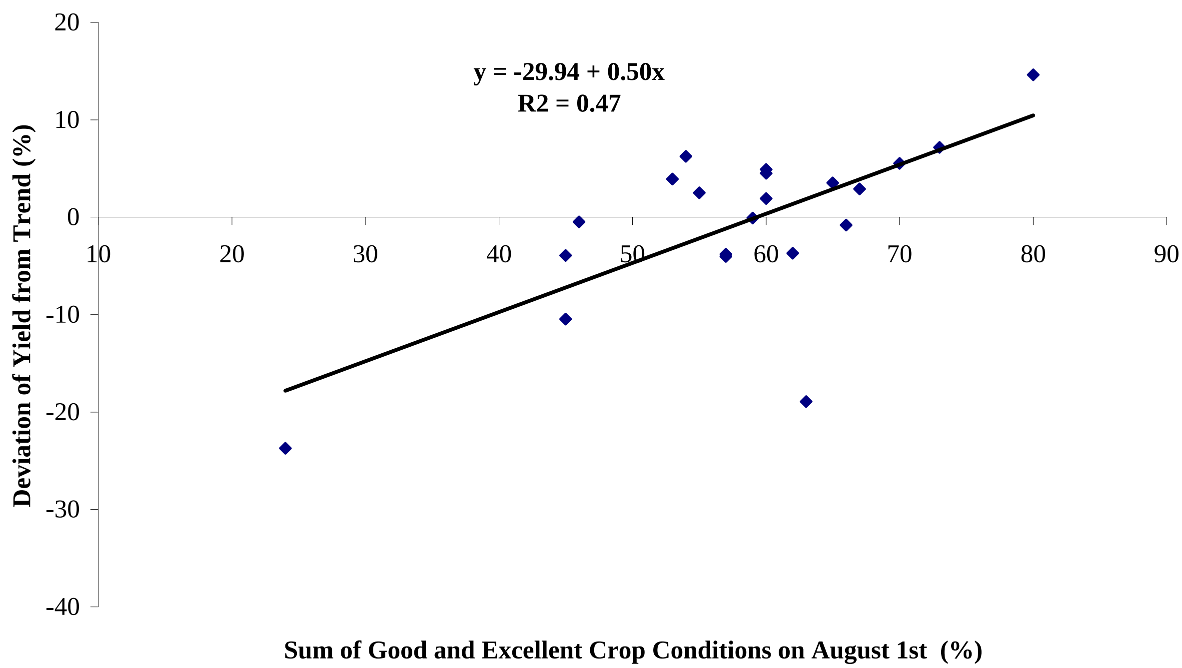

Figure 5. Relationship between U.S. Crop Condition Ratings on August 1st and Deviations from Trend for Soybeans, 1986-2006