Changes in Informational Value and the Market Reaction to USDA Reports in the Big Data Era

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Abstract

The impact of U.S. Department of Agriculture (USDA) production forecasts for corn and soybeans is analyzed over the period 1976-2014. Two tests of informational value (relative accuracy and price reaction) are applied and two different methods (sub-sample period analysis and rolling-window regressions) are used to investigate possible changes in the informational value over time. The results suggest that the USDA production forecasts provide valuable information to market participants, and forecasts' informational value varies across time. Thus, the information in USDA production forecasts has not been replaced by private data sources that have become increasingly available during the most recent decades, and the forecasts continue to provide valuable new information in this big data environment.

Key words: announcement effects, big data, corn, crop production, futures markets, informational value, price reaction, soybean, USDA reports

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1. Introduction

The economic value of public information has long been a question of interest for both researchers and practitioners. Various previous studies investigated the informational value of USDA reports, which have been historically the predominant source of public information on commodities.[1] However, the emergence of large data sets collected by private firms that can be potentially mined for information, also known as "big data," has substantially increased agricultural market participants' access to new sources of information to be used in their decision making process. The evolvement of private data sources has raised the question of the value and changing role of public information programs. Some argue that these public programs can be downsized or eliminated as private data essentially makes these programs irrelevant by reducing their informational value. There is ample evidence in the literature that the USDA reports have played a key role in agricultural commodity markets and led to market price and volatility movements (e.g., Isengildina-Massa et al., 2008; Adjemian, 2012; Karali, 2012; Lehecka, Wang, and Garcia, 2014; Dorfman and Karali, 2015). However, what is not known is whether the impact and importance of the information from USDA reports has diminished over time with the growth of big data.

Only a few previous studies investigated possible changes in the value of USDA reports. For instance, Fortenbery and Sumner (1993) showed that the impact of USDA reports (Crop

[1] See, for example, Sumner and Mueller (1989), Colling and Irwin (1990), Fortenbery and Sumner (1993), Grunewald, McNulty, and Biere (1993), Baur and Orazem (1994), Garcia et al. (1997), Egelkraut et al. (2003), Isengildina, Irwin, and Good (2006), Isengildina-Massa et al. (2008), McKenzie (2008), Adjemian (2012), Karali (2012), Dorfman and Karali (2015).

Production and WASDE) on corn and soybean futures and options markets diminished during 1985 through 1989 relative to earlier periods. In contrast, Garcia et al. (1997) showed that the USDA's corn and soybean production forecasts were still valuable after the mid-1980s. Our study extends the sample period used in these previous studies and investigates whether the informational value of USDA reports, measured in terms of both relative forecast accuracy and market price reaction, has decreased over time as "big data" from the private information sources has improved in quality and quantity. We focus on USDA's production estimates for both corn and soybeans contained in monthly Crop Production reports as well as private analysts' expectations of these production figures.

Our findings demonstrate that the value of USDA reports has not been replaced by private information sources during the big data era. The first set of results showed the higher decrease in the market forecast variance due to report releases in the more recent years, particularly for October reports. The second set of results demonstrated that while the price reaction is the strongest for January reports (as they reveal the final values), the price impact of October reports has increased over time, particularly in the corn market. Overall, price reaction to corn production reports appears to have increased during 1996-2011, while price reaction to soybean production reports remained relatively stable over time.

2. USDA Crop Production Reports and Private Forecasts

This study examines the informational value of USDA's Crop Production reports over 1976/77 through 2014/15 marketing years. Crop Production reports, which contain forecasts of marketing year yield and production for major crops, are prepared by the National Agricultural Statistics

Service (NASS) agency of USDA and typically released between the 9th and 15th of each month.[2] For corn and soybeans, these production forecasts are typically released from August through November, and finalized in January. Thus, crop production forecasts released from September to November represent an update of the previous forecast describing a marketing year total production, which is released in January in Crop Production Annual Summary report. For more information on the preparation of these reports, see Irwin, Sanders, and Good (2014).

As a proxy for market expectations of government reports, several previous studies have used industry analysts' estimates, which are usually released a few days before the USDA reports (e.g., Colling and Irwin, 1990; Grunewald, McNulty, and Biere, 1993; Garcia et al., 1997; Egelkraut et al., 2003). In our study we use an average of production forecasts by Conrad Leslie and Informa Economics (formerly Sparks Companies, Inc.) as a measure of private analysts' forecasts during the period 1976-2000. For the period 2001-2005, the private forecasts are represented by the average between the Informa Economics estimate and the average analyst estimate reported by the Dow Jones Newswire survey. Finally, the average of the Dow Jones survey is used for the period 2006-2015.[3]

3. Informational Value of USDA Crop Production Reports

3.1. Relative forecast accuracy tests

The first test of informational value used in this study was originally proposed by Baur and Orazem (1994) and applied by Garcia et al. (1997). It is based on the premise that the social welfare value of a government supply forecast is proportional to the reduction in the market's supply forecast variance resulting from the introduction of the government forecast.

[2] Starting in 1985, Crop Production and World Agricultural Demand and Supply Estimates (WASDE) reports were released simultaneously.
[3] See Good and Irwin (2006) for further details on the pre-release analysts' forecasts for corn and soybeans.

We implement this test by first estimating the "partial information" equation (1) to obtain a measure of the market's production forecast variance (as measured by adjusted R-squared) before the USDA report is released:

$$q^{U}_{Final,t} = \theta + \phi_1 q^{P}_{i,t} + \delta t + \varepsilon_{i,t}, \tag{1}$$

where $q^{U}_{Final,t}$ is the final USDA estimate of annual production of corn and soybeans in marketing year t (t = 1976/77, …, 2014/15), $q^{P}_{i,t}$ is the private analysts' estimate of final production of corn and soybeans released in month i (i = August, September, October, and November), t is a linear trend indicating the marketing year, and $\varepsilon_{i,t}$ is the random error term. All production quantities are converted into natural logarithms to account for crop size changes over time. A similar measure of the market's production forecast variance (adjusted R-squared) after the release of USDA report is obtained by estimating the "full information" equation:

$$q^{U}_{Final,t} = \theta + \phi_1 q^{P}_{i,t} + \phi_2 q^{U}_{i,t} + \delta t + \varepsilon_{i,t}, \tag{2}$$

where $q^{U}_{i,t}$ is the USDA forecast of final production of corn and soybeans reported in month i of marketing year t. Finally, a reduction in the market's production forecast variance resulting from the USDA report is assessed with the difference in the adjusted R-squared values between the "full information" equation (2) and the "partial information" equation (1). The larger the difference, the more valuable the USDA forecast is in reducing the production forecast variance of the market. Analogously, the smaller the difference, the better the private analysts' forecasts and the less valuable are the USDA reports.

Results of the relative accuracy tests for corn and soybeans are presented in table 1. Over the entire sample period of 1976-2014, the USDA's corn forecasts reduced market's production forecast variance relatively more than soybean forecasts, consistent with the findings in Garcia et al. (1997). The largest impact of USDA's corn forecasts is seen in September reports followed by August reports, while the smallest impact is observed in November. This suggests that the USDA forecasts were more valuable during the early stages of corn production process. The impact of USDA's soybean forecasts is rather limited, with August and September reports showing no reduction in market forecast variance on average. The largest impact was observed for October reports, which was of similar magnitude as October reports in corn. However, note that the reductions in the adjusted R-squared values were very small for both corn and soybeans, suggesting that the private analysts' production forecasts are close to the final production figures and the informational value of USDA's Crop Production report is limited. When all report months are pooled together, a similar conclusion is reached, with USDA's corn forecasts having more informational value compared to soybean forecasts.

To investigate whether the informational value of USDA production forecasts has changed over time, especially in the era of information becoming available from private "big data" sources, we divided our sample period into four sub-periods: 1976-1984, 1985-1994, 1995-2006, and 2007-2014. These sub-periods roughly represent a decade and some important developments in the big data environment, such as the emergence of architecture for data warehousing in 1985, the explosion of the world wide web in 1995, and the emergence of open source data storage in 2007. Table 1 shows that the informational value of USDA forecasts changed dramatically across these sub-periods. For example, while August report was the most influential in the corn markets during 1976-1984 sub-period, it was replaced by September report during 1985-1994 sub-period and by November report in the following 1995-2006 and 2007-2014 sub-periods in terms of highest reduction in market forecast variance. More specifically, the highest average reduction in corn market forecast variance across subsamples was observed for October report during 1995-2006 sub-period, which reduced market variance by 5.43 percentage points, followed by August report during 1976-1984 (3.95 percentage points), September report during 1985-1994 (3.73 percentage points), and October report during 2007-2014 (3.59 percentage points). Overall, when all report months were pooled, the most recent 2007-2014 sub-period experienced the largest reduction of 2.41 percentage points in market forecast variance followed by the earliest sub-period which experienced an average of 1.21 percentage points reduction in market forecast variance, while 1995-2006 had the lowest average reduction of 0.38 percentage points in market forecast variance due to the USDA Crop Production reports.

Almost an opposite pattern is observed in relative accuracy of soybean production forecasts. As the bottom portion of table 1 demonstrates, these reports resulted in the highest reduction in market forecast variance during 1995-2006 sub-period with an average of 2.94 percentage points (which was slightly higher than the highest sub-period in corn) across all report months, with August forecast having the highest overall reduction of 6.05 percentage points (again higher than the highest reduction in corn). On the other hand, the earlier two sub-periods, 1976-1984 and 1985-1994, show hardly any sign of reduction in market forecast variance due to USDA reports with the exception of November reports. A very moderate reduction of 0.68 percentage points on average and 3.43 percentage points for the strongest reduction in soybean market forecast variance in November was observed in the most recent 2007-2014 sub-period.[4]

Estimation of equations (1) and (2) in a rolling regression framework allows showing gradual changes in report impact over time that is not affected by the arbitrary choice of sub-periods. Specifically, for each report month we estimate these equations with a 20-year rolling

[4] Note that November report has consistently been the least important in corn.

window by dropping the earliest marketing year and adding the newest one as we move forward in time, resulting in a total of 20 observations per regression. For the pooled report months, regressions are performed by using a rolling window of 10 years, resulting in a total of 40 observations per regression. Figure 1 presents the plots of the changes in adjusted R-squared values from these rolling regressions for corn and soybeans.[5] This graph mimics the patterns observed in table 1, but with greater detail. The top panel shows the declining impact of the August report and the increasing impact of the October report in the corn markets as well as the relative importance of the September report, which was not as clear in table 1. The relative dominance of the October report in soybeans is illustrated in the middle panel. Finally, the bottom panel demonstrates that a dramatic increase in the impact of soybean reports during 1995-2006 sub-period lingered all the way to 2012.

3.2. Price reaction tests

Following Colling and Irwin (1990) and Garcia et al. (1997), the second test of informational value used in this study is based on the efficient market hypothesis. In efficient markets, asset prices reflect all publicly available information and instantly adjust to incorporate new information entering the market (Fama, 1970). Accordingly, prices will respond only to the unanticipated, or "surprise," component of the new information.

Thus, under the assumption of efficient futures markets, the informational value of USDA reports can be tested by investigating whether futures prices respond to unanticipated information (i.e. "market surprise") measured as the difference between the USDA forecasts and

[5] Due to federal budgetary limitations, the USDA did not release October report in 2013. Thus, the last sample period in figure 1 for the October reports refers to 1994-2014, with the exclusion of year 2013. In the pooled rolling regressions, the year 2013 is dropped from the sample.

the private analysts' forecasts. If futures prices do not change in response to the unanticipated information in the USDA reports, then the information has no value to the market.

We perform the price reaction tests using daily data for both nearby and new crop futures contracts for corn and soybeans. Table 2 lists the specific futures contract maturities used in each calendar month for these two price series. Specifically, nearby series are constructed by rolling over to the second closest to expiration contract once that next contract has a trade volume exceeding the nearest delivery contract. Due to relatively low trading volume, we eliminated August contract for soybeans and September contract for both corn and soybeans. The primary new crop futures contracts for corn and soybeans are December and November, respectively.

To investigate possible differences in market reaction to reports released in different months, we first estimate the following equation by ordinary least squares (OLS) for each report month separately (as well as pooled estimation for all report months) using only the daily price observations in respective months:

(3) $$\Delta P_{d,i} = \mu + \lambda\left(q^{U}_{d,i} - q^{P}_{d,i}\right) + \varepsilon_{d,i},$$

where the term $q^{U}_{d,i} - q^{P}_{d,i}$ is our proxy for "market surprise," the difference between the USDA's and private analysts' production forecasts on day d of month i (i = August, September, October, November, and January), [6] $\Delta P_{d,i} = 100 \times (\ln P_{d,i} - \ln P_{d-1,i})$ is the percentage change in futures contract's settlement price from day $d-1$ to day d, and $\varepsilon_{d,i}$ is the random error term. The market surprise variable takes the value of zero on non-report days in month i. [7]

[6] While private production forecasts for August through November reports are available from 1976, private estimates of January final forecasts only go back to 1984.

[7] Release time of Crop Production report has changed a couple of times during our sample period. From January 1964 to May 1994, the reports were released at 3:00pm EST; from June 1994 to December 2012 at 8:30am EST; and from January 2013 to present at 12:00pm EST. We take the following approach in assigning report release days. If a report is released before or during trading hours, then the impact of this report should be observed in that day's settlement price. On the other hand, if a report is published after trading hours, then the impact of this report should

Table 3 presents the results from equation (3) for nearby futures contracts. Because these estimations are performed using only the days in the report months (August through November, and January), the nearby and the new crop futures contracts are exactly the same (see table 2) and therefore only the results from nearby futures series are presented. Table 3 shows that the market price reaction is inversely related to corn production surprise (whenever the estimate is statistically significant) as expected from the economic theory. When there is a positive production surprise, the supply is higher than what the market participants expected and therefore the prices tend to decrease. On the other hand, when the supply announced by the USDA falls short of what is expected by the market expectations (i.e. a negative production surprise), prices tend to increase. Over the entire sample period of 1976-2014, the largest price reaction to corn production surprise is observed for the January report (1.393 percentage points). The price reaction to August production surprise for corn is the largest during 1995-2006 (1.288 percentage points). Production surprises in September reports are found to affect corn futures prices only during 1995-2006. The largest price reaction to November surprises are seen during 1985-1994 (2.249 percentage points), whereas the largest reaction to January surprise is observed during 2007-2014 (3.026 percentage points). Figure 2 presents the average production surprise in each report month for the various sub-periods used in this study along with the statistically significant estimates from table 3. The top panel of figure 2 shows that there is not much of a clear pattern in the corn production surprise over time. Despite the small magnitude of average January production surprise in 2007-2014, the average price reaction is noticeably large (3.026 percentage points).

be seen on the next day's settlement price. Accordingly, we assign the announcement day as the day following the report release during 1976-1993, and as the exact release date during 1994-2015.

In the case of soybeans, the price reaction to August and November production surprises was the largest during 1985-1994, and the reaction to September, October, and January surprises were the largest in the latest sample period of 2007-2014. Figure 3 shows that even though the average production surprise in November was quite small in all time periods, the price reactions were considerably large, especially during 1985-1994. Price reactions to January production surprises are also substantially large compared to other months, with futures prices changing by 3.456 percentage points in the last sub-period.

To further investigate possible changes in the price reactions over time and to allow for time-varying volatility observed in futures prices, we modify equation (3) as follows:

(4)

$$\Delta P_d = \mu + \sum_{s=1}^{S} \lambda_s (q_d^U - q_d^P)\, I_s + \varepsilon_d,$$
$$\varepsilon_d \sim t(0, \sigma_d^2, \nu),$$
$$\sigma_d^2 = \exp(\omega + \psi D_d) + \alpha\varepsilon_{d-1}^2 + \beta\sigma_{d-1}^2,$$

where the estimation is performed using all the daily price observations in our sample period of February 1976 through January 2015. The variable I_s in the conditional mean equation is an indicator function taking the value of one for sub-period s (s = 1976-1984, 1985-1994, 1995-2006, and 2007-2014), and zero otherwise. The market surprise variable, $q_d^U - q_d^P$, takes the value of zero on non-report days. As futures price volatility has been shown to increase on announcement days (Sumner and Mueller, 1989; Isengildina-Massa et al., 2008; Isengildina, Irwin, and Good, 2008; Adjemian, 2012; Karali, 2012), the conditional variance equation in the above GARCH system (4) contains a dummy variable, D_d, which takes the value of one on day d if Crop Production report was released on that day (adjusted for trading hours and report release times), and zero otherwise. The error term, ε_d, is assumed to follow a Student-t distribution as it is shown in the literature to better fit to financial data (Baillie and Bollerslev, 1989; Hsieh, 1989; McKenzie, Thomsen, and Dixon, 2004).

Table 4 presents coefficient estimates for the market surprise variable in the mean equation and the report-day dummy variable in the variance equation in columns (II) for each set of results.[8] Results for the full sample period obtained by replacing the conditional mean equation above with $\Delta P_d = \mu + \lambda(q_d^U - q_d^P) + \varepsilon_d$ are shown in columns (I). The first thing to note is that the results from the nearby futures and the new crop futures series are very similar, especially for corn. All the market surprise coefficients in the table are statistically significant and inversely related to futures price changes, as expected. Further, the report-day dummy variable in the variance equation is statistically significant and positive, consistent with the earlier studies that showed volatility spikes around announcement days.

For corn, a 1% positive production surprise leads to about a 0.8 percentage point decrease, on average, in both nearby and new crop futures prices during the entire sample period. When we analyze the coefficients on the market surprise variable for each sub-period, it is seen that the magnitude of the price reaction increases over time until 2007, and tapers off thereafter. However, as the F-tests in the lower part of table 4 show, the equality of these coefficients is rejected in some cases. Specifically, while the null hypothesis of equality cannot be rejected for sub-periods 1976-1984, 1985-1994 and 2007-2014, there is evidence that the price reaction during 1995-2006 is significantly higher than the other sub-periods, with prices moving by 1.3 percentage points for a 1% production surprise.

For soybeans, the market response to production surprise during the entire sample period is, on average, 0.6 percentage points with both futures price series. Unlike corn, the market response seems to increase in the last sample period. The F-test results show that the price

[8] Full estimation results are available from the authors upon request.

reaction in 1976-1984 is significantly smaller than all other sample periods, and is the smallest. On the other hand, the market responses in periods 1985-1994, 1995-2006, and 2007-2014 are found not to statistically differ from each other.

As before, to avoid possible impact of sub-period selection on our results, we implement the price reaction tests by estimating equation (4) in a rolling regression framework. Specifically, we estimate equation (4) with a 10-year rolling window by dropping the earliest calendar year and adding the newest one as we move forward in time, resulting in a total of approximately 2,520 observations per regression.[9] Figure 4 shows the coefficient estimates and their two-standard-error bands for the nearby futures series. Because the results from nearby and new crop futures series are very similar, only the nearby results are presented. In order to evaluate the magnitude of the price responses relative to the magnitude of production surprises, a rolling average of production surprises is computed and shown in the figure.

For corn, the price response is considerably stable until 2000, ranging between -0.5 and -0.7 percentage points. When observations after 2000 are added to the rolling estimations, the price reaction starts to increase over time, peaking at -1.86 percentage points during 2002-2011. With the years 2012-2014 added in the estimation periods, the magnitude of the market response starts to decrease, but still stays relatively large compared to the reaction in the earlier time periods. There is almost a mirror image between the price reaction pattern and the average production surprises after 1990s, showing that the larger the surprise, the larger the price change.

Soybean futures prices show a relatively more stable reaction pattern over time. While there is a slight increase in the price response until 1990s, the estimates are pretty constant afterwards until the period 1996-2005. When observations after 2005 are included in the

[9] There are approximately 252 trading days in a year, resulting in 252*10=2520 observations for 10 years.

estimation period, the price reaction starts to decrease in magnitude. Average soybean production surprise also stays considerably flat over time.

4. Summary and Conclusions

The goal of this study was to investigate whether the informational value and the market reaction to public information contained in the USDA's Crop Production reports have decreased over time as the private information available from big data sources has increased substantially in recent years. To this end, two tests of informational value were conducted for corn and soybean markets. The first test focused on the relative accuracy of USDA reports by measuring the reduction in the market's forecast variance due to information contained in USDA forecasts. The second test focused on the futures market price reaction to the unanticipated component of the USDA production forecasts. Two alternative approaches were taken to analyze possible changes in the informational value of USDA forecasts over time: (1) splitting the entire sample period into several sub-periods to test the differences in estimates across time periods; (2) conducting rolling window estimations to identify instabilities over time.

Our relative accuracy tests showed that USDA production forecasts carry new information that leads to the reduction in forecast variance in the market and that the reduction is generally larger in later time periods, except for August corn forecasts. While the USDA's August report provides information on the early stages of corn production, the private analysts' seem to have improved their corn forecasts over time (as shown in Egelkraut et al). On the other hand, the importance of October reports has increased over time in both commodities.

Our price reaction tests provided evidence that the surprise component of the USDA production forecasts still moves the futures prices in the late sample periods, meaning that the reports still provide valuable information to the markets beyond the private analysts' forecasts. Since the mid-1990s, the price reaction to January report was the largest compared to other report months for both corn and soybeans. This finding is not surprising since the January report contains the final production estimates. Furthermore, the price impact of October reports has increased over time, particularly in corn. When these tests are performed using all report months together in a GARCH framework and with a rolling estimation window, it is seen that the soybean price reaction is relatively more stable over time compared to corn. The corn price response exhibits a pronounced upward trend (in magnitude) from the mid-1980s to late 2000s. Thus, these results provide clear evidence that the information contained in USDA reports has not been replaced by the private sources and the reports continue to have significant impact on the markets. The impact of market conditions (as reflected in relative stocks/use levels) and government policies (in particular biofuel mandate) on futures price reaction to USDA reports represent interesting areas for future research that may help explain the increased impact of corn production reports and the difference in price reaction to corn versus soybean production reports.

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Table 1. Relative Accuracy Tests of the Informational Value of USDA Crop Production Reports, 1976-2014

	1976-2014			1976-1984			1985-1994			1995-2006			2007-2014		
	Adjusted R^2			Adjusted R^2			Adjusted R^2			Adjusted R^2			Adjusted R^2		
	Partial Information	Full Information	Difference	Partial Information	Full Information	Difference	Partial Information	Full Information	Difference	Partial Information	Full Information	Difference	Partial Information	Full Information	Difference
Corn															
August	0.9375	0.9442	0.0067	0.9211	0.9606	0.0395	0.8386	0.8118	-0.0268	0.8604	0.8434	-0.0170	0.7585	0.7610	0.0025
September	0.9682	0.9756	0.0074	0.9917	0.9937	0.0020	0.8419	0.8792	0.0373	0.8391	0.8337	-0.0054	0.8929	0.9156	0.0227
October	0.9840	0.9899	0.0059	0.9968	0.9973	0.0005	0.9229	0.9344	0.0115	0.9218	0.9761	0.0543	0.9464	0.9823	0.0359
November	0.9955	0.9979	0.0024	0.9989	0.9995	0.0006	0.9766	0.9942	0.0176	0.9891	0.9943	0.0052	0.9850	0.9847	-0.0003
Pooled	0.9717	0.9771	0.0054	0.9438	0.9559	0.0121	0.9112	0.9231	0.0119	0.9064	0.9102	0.0038	0.9103	0.9344	0.0241
Soybeans															
August	0.9354	0.9344	-0.0010	0.9761	0.9730	-0.0031	0.8669	0.8452	-0.0217	0.5763	0.6368	0.0605	0.8713	0.8743	0.0030
September	0.9621	0.9616	-0.0005	0.9403	0.9348	-0.0055	0.8550	0.8317	-0.0233	0.7186	0.7434	0.0248	0.9160	0.9017	-0.0143
October	0.9825	0.9875	0.0050	0.9610	0.9549	-0.0061	0.9299	0.9225	-0.0074	0.9166	0.9691	0.0525	0.9289	0.9545	0.0256
November	0.9945	0.9968	0.0023	0.9827	0.9844	0.0017	0.9773	0.9938	0.0165	0.9900	0.9930	0.0030	0.9633	0.9976	0.0343
Pooled	0.9690	0.9706	0.0016	0.9369	0.9393	0.0024	0.9055	0.9048	-0.0007	0.8053	0.8347	0.0294	0.9307	0.9375	0.0068

Notes. Results are obtained by ordinary least squares (OLS) estimation of equations (1) and (2).

Table 2. Maturities of Futures Contract Used in Empirical Analyses

	Corn		Soybeans	
Calendar Month	Nearby	New Crop	Nearby	New Crop
January_t	March_t	March_t	March_t	March_t
February_t	March_t	December_t	March_t	November_t
March_t	May_t	December_t	May_t	November_t
April_t	May_t	December_t	May_t	November_t
May_t	July_t	December_t	July_t	November_t
June_t	July_t	December_t	July_t	November_t
July_t	December_t	December_t	November_t	November_t
August_t	December_t	December_t	November_t	November_t
September_t	December_t	December_t	November_t	November_t
October_t	December_t	December_t	November_t	November_t
November_t	December_t	December_t	January_{t+1}	January_{t+1}
December_t	March_{t+1}	March_{t+1}	January_{t+1}	January_{t+1}

Notes. The subscript, t or t + 1, refers to the year of the futures contract expiration date relative to the year t of the daily price being computed.

Table 3. Price Reaction Tests of the Informational Value of USDA Crop Production Reports, 1976-2014 (OLS)

	1976-2014		1976-1984		1985-1994		1995-2006		2007-2014	
	Nearby Surprise Coefficient (p-value)	Obs.	Nearby Surprise Coefficient (p-value)	Obs.	Nearby Surprise Coefficient (p-value)	Obs.	Nearby Surprise Coefficient (p-value)	Obs.	Nearby Surprise Coefficient (p-value)	Obs.
Corn										
August	-0.793	864	-0.904	201	-0.579	221	-1.288	266	0.222	176
	(0.115)		(0.217)		(0.186)		(0.179)		(0.421)	
September	-0.534	796	-0.334	184	-0.333	205	-1.011	244	-0.388	163
	(0.172)		(0.269)		(0.234)		(0.293)		(0.615)	
October	-1.193	863	-0.829	197	-0.184	221	-1.339	266	-1.940	179
	(0.219)		(0.372)		(0.441)		(0.276)		(0.793)	
November	-1.059	793	-1.047	182	-1.249	204	-0.833	245	-0.689	162
	(0.244)		(0.359)		(0.268)		(0.597)		(1.164)	
January	-1.393	809	0.366	189	-0.749	212	-2.997	246	-3.026	162
	(0.158)		(0.388)		(0.139)		(0.430)		(0.514)	
Pooled	-0.912	4125	-0.693	953	-0.626	1063	-1.374	1267	-0.951	842
	(0.072)		(0.125)		(0.096)		(0.121)		(0.271)	
Soybeans										
August	-0.419	864	-0.386	201	-0.534	221	-0.362	266	-0.419	176
	(0.121)		(0.335)		(0.218)		(0.192)		(0.276)	
September	-0.429	796	-0.674	184	-0.435	205	-0.136	244	-0.972	163
	(0.144)		(0.319)		(0.271)		(0.196)		(0.502)	
October	-0.856	863	0.709	197	-0.845	221	-1.120	266	-0.942	179
	(0.131)		(0.462)		(0.180)		(0.166)		(0.377)	
November	-0.984	793	-1.219	182	-2.838	204	0.181	245	-0.944	162
	(0.220)		(0.506)		(0.027)		(0.397)		(0.433)	
January	-1.395	809	-0.514	189	-0.782	212	-2.532	246	-3.456	162
	(0.168)		(0.310)		(0.235)		(0.320)		(0.586)	
Pooled	-0.678	4125	-0.448	953	-0.729	1063	-0.641	1267	-0.908	842
	(0.064)		(0.161)		(0.106)		(0.096)		(0.173)	

Notes. Results are obtained by ordinary least squares (OLS) estimation of equation (3). Estimation is performed for each report month separately using all trading days in the respective months. Pooled estimation is performed using all trading days in all report months.

Table 4. Price Reaction Tests of the Informational Value of USDA Crop Production Reports, 1976-2014 (GARCH)

	Corn				Soybeans			
	Nearby Futures		New Crop Futures		Nearby Futures		New Crop Futures	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
Mean eq.								
Surprise (1976-2014)	-0.795		-0.796		-0.621		-0.621	
	(0.049)		(0.049)		(0.036)		(0.037)	
Surprise (1976-1984)		-0.598		-0.593		-0.350		-0.333
		(0.092)		(0.092)		(0.106)		(0.107)
Surprise (1985-1994)		-0.638		-0.633		-0.659		-0.725
		(0.094)		(0.095)		(0.100)		(0.105)
Surprise (1995-2006)		-1.264		-1.266		-0.599		-0.634
		(0.092)		(0.092)		(0.060)		(0.047)
Surprise (2007-2014)		-0.720		-0.746		-0.718		-0.663
		(0.152)		(0.150)		(0.106)		(0.092)
Variance eq.								
Report dummy	2.185	2.088	2.126	2.032	1.828	1.613	1.971	1.936
	(0.578)	(0.620)	(0.484)	(0.520)	(0.312)	(0.686)	(0.225)	(0.237)
Hypotheses tests		Chi-squared (p-val)		Chi-squared (p-val)		Chi-squared (p-val)		Chi-squared (p-val)
H_0: Surp(76-84) = Surp (85-94)		0.09		0.09		4.48		6.83
		[0.762]		[0.764]		[0.034]		[0.009]
H_0: Surp(76-84) = Surp (95-06)		26.3		26.74		4.16		6.65
		[0.000]		[0.000]		[0.042]		[0.010]
H_0: Surp(76-84) = Surp (07-14)		0.47		0.76		6.02		5.46
		[0.492]		[0.384]		[0.014]		[0.020]
H_0: Surp(85-94) = Surp (95-06)		22.52		22.95		0.26		0.63
		[0.000]		[0.000]		[0.609]		[0.428]
H_0: Surp(85-94) = Surp (07-14)		0.21		0.41		0.16		0.20
		[0.646]		[0.524]		[0.687]		[0.658]
H_0: Surp(95-06) = Surp (07-14)		9.27		8.74		0.95		0.08
		[0.002]		[0.003]		[0.331]		[0.782]
Obs.	9829	9829	9829	9829	9829	9829	9829	9829
Log Likelihood	-16052.20	-16043.78	-15896.13	-15887.49	-16627.73	-16538.47	-16308.04	-16305.57
AIC	32118.40	32107.56	31806.26	31794.98	33267.46	33096.93	32628.09	32629.14
BIC	32168.75	32179.49	31856.61	31866.91	33310.62	33168.86	32671.25	32693.88
Distribution	t	t	t	t	N	t	N	N

Notes. Results are obtained by maximum likelihood estimation of the GARCH(1,1) system in equation (4). Values in ( ) are standard errors and values in [ ] are p-values.

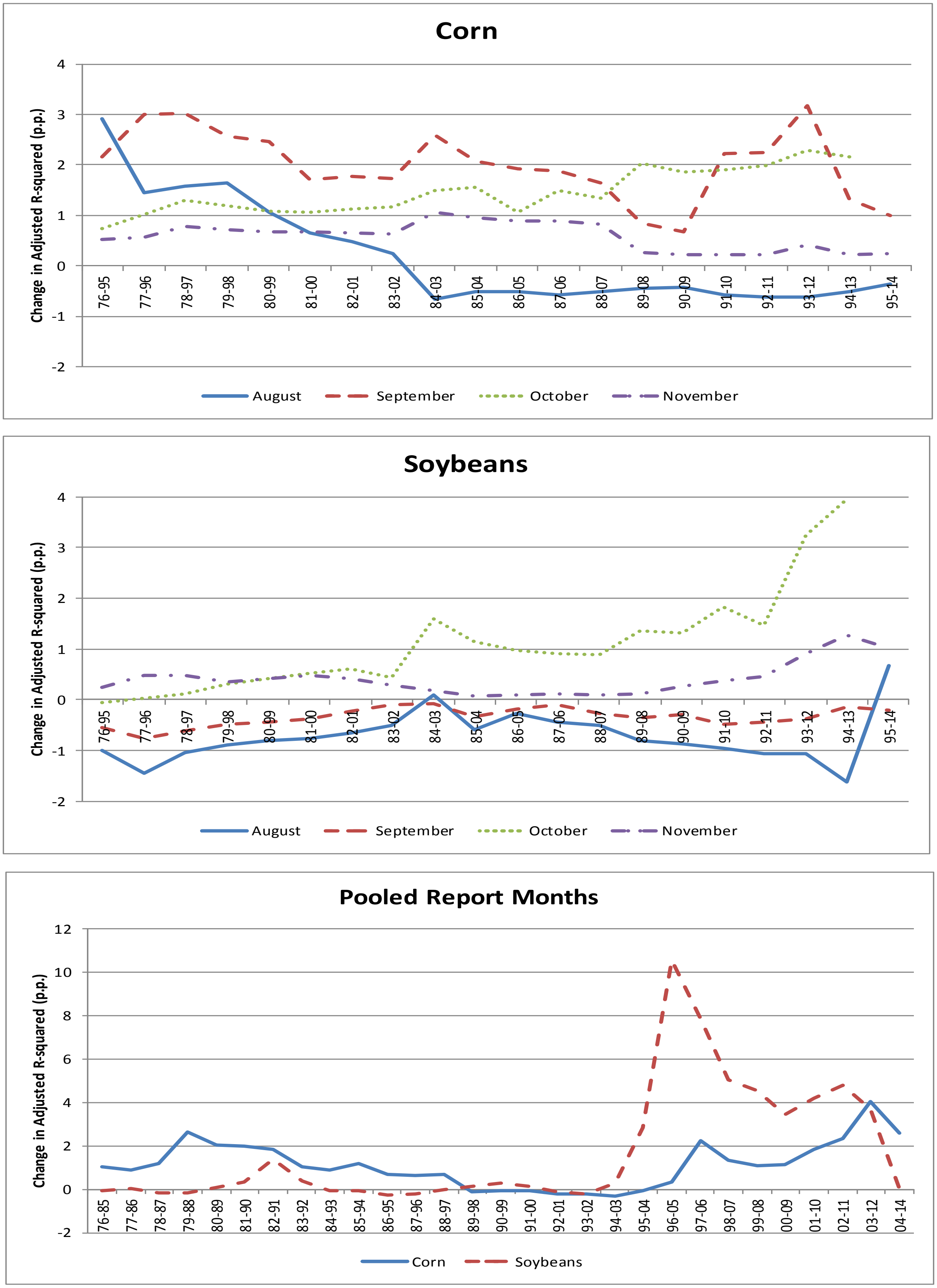
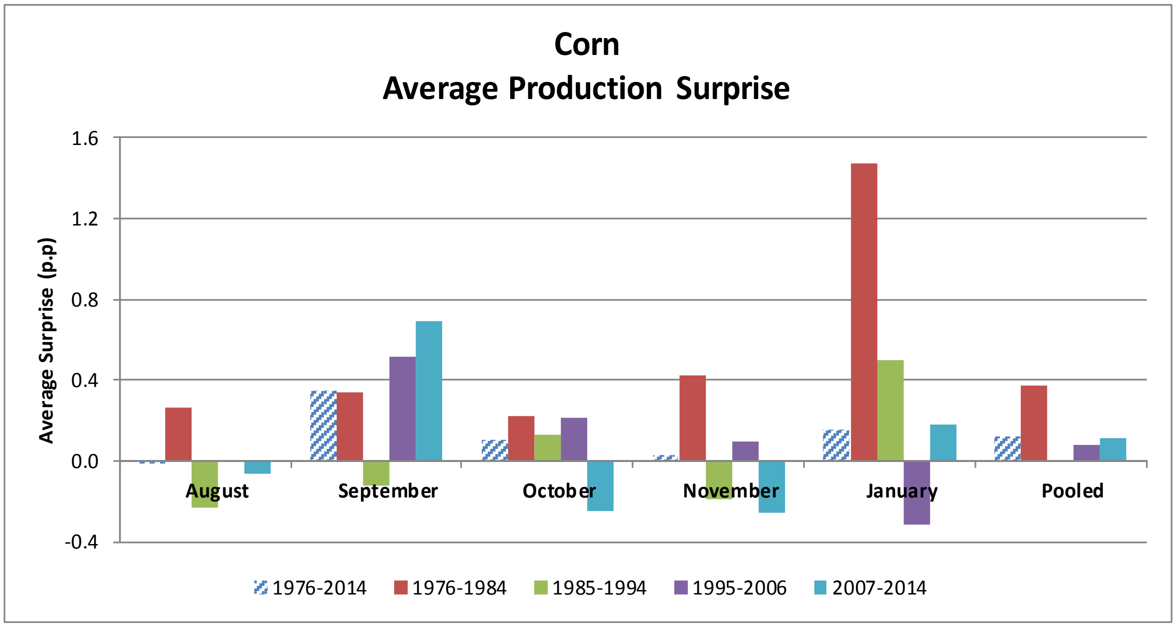


Figure 1. Relative accuracy tests of the informational value of USDA Crop Production reports over time, 1976-2014 (rolling regressions)



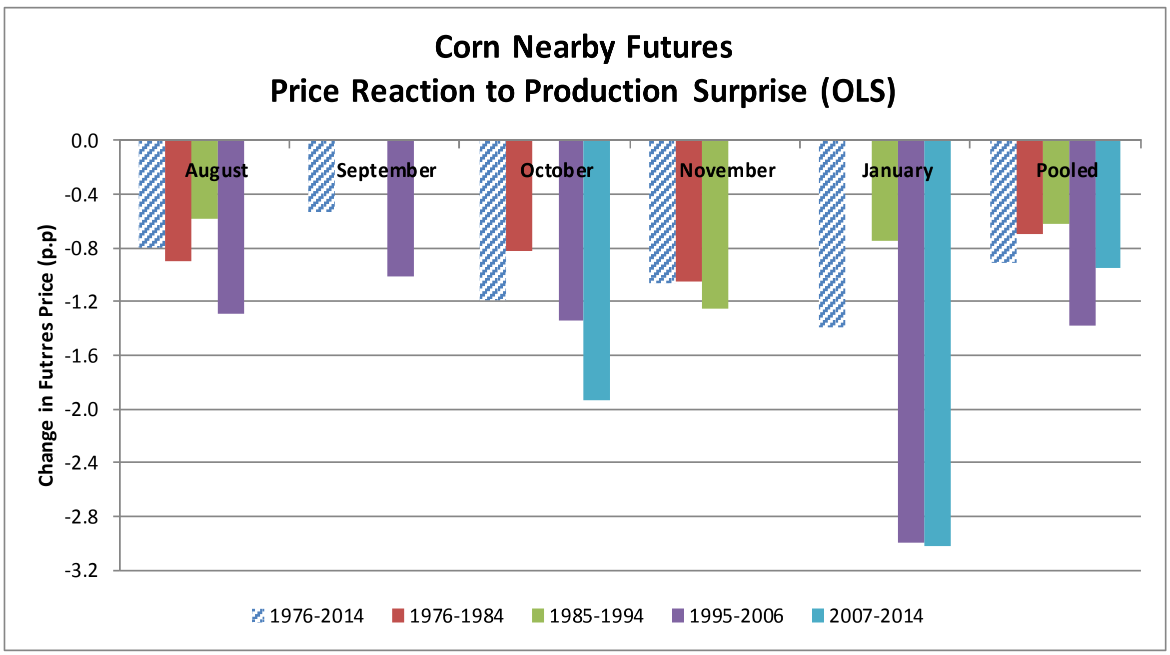
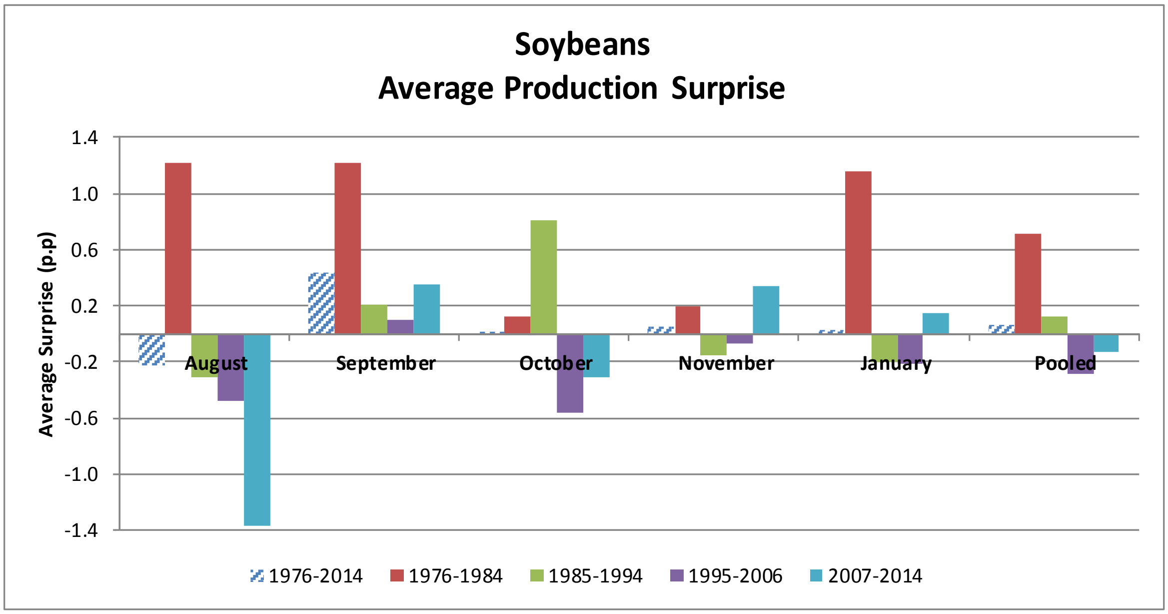


Figure 2. Average market surprise and nearby futures price reaction tests of the informational value of USDA Crop Production reports over time, 1976-2014, Corn



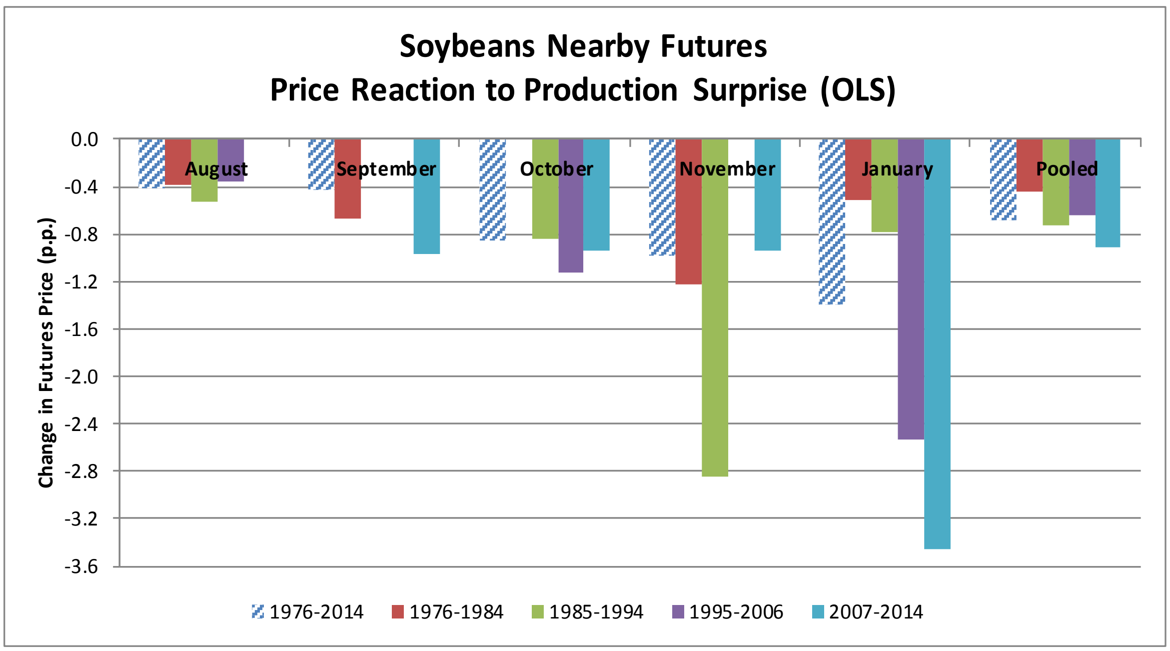


Figure 3. Average market surprise and nearby futures price reaction tests of the informational value of USDA Crop Production reports over time, 1976-2014, Soybeans

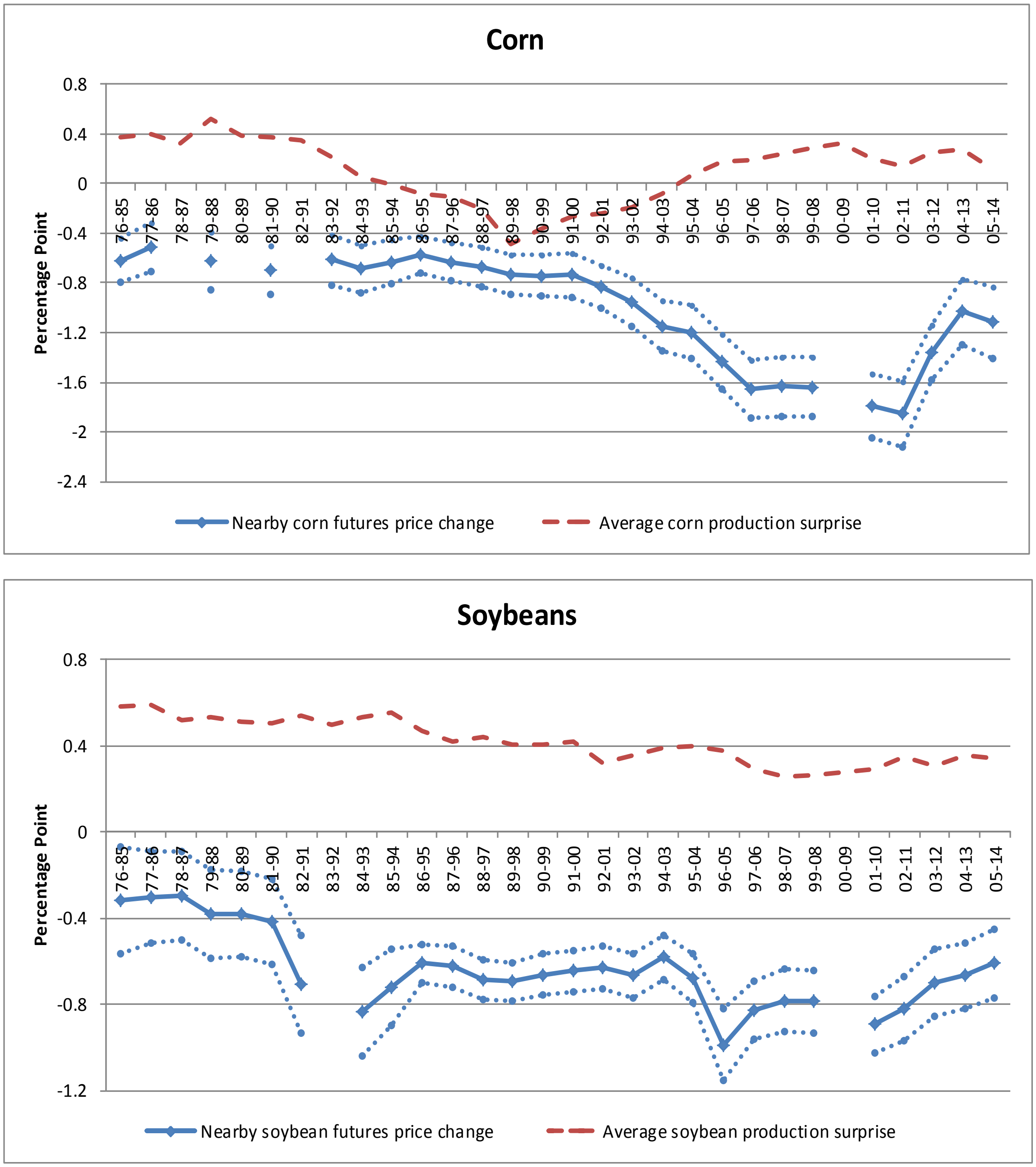


Figure 4. Average market surprise and nearby futures price reaction tests of the informational value of USDA Crop Production reports over time, 1976-2014 (rolling GARCH regressions)