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The Impact of Situation and Outlook Information in Corn and Soybean Futures Markets: Evidence from WASDE Reports

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The purpose of this study was to examine the impact of situation and outlook information from World Agricultural Supply and Demand Estimates (WASDE) in corn and soybean futures markets over the period 1985 to 2006. Results indicate that WASDE reports containing National Agricultural Statistics Service (NASS) crop production estimates and other domestic and international situation and outlook information have the largest impact; causing return variance on report sessions to be 7.38 times greater than normal return variance in corn futures and 6.87 times greater than normal return variance in soybean futures. WASDE reports limited to international situation information and domestic and international outlook information have a smaller impact. The results show that the impact of WASDE reports has increased over time.

Key Words: corn, market impact, outlook, situation, soybeans, WASDE

JEL Classifications: Q100, Q110, Q130

The economic value of public situation and outlook information has been debated for several reasons, including the growth of private firms that provide relatively low cost information and market analysis of the type traditionally provided by public programs according to evolving priorities within the U.S. Department of Agriculture (Just; Salin et al.). In response to this ongoing debate, numerous empirical studies have examined the impact of public information in agricultural markets (e.g., Colling and Irwin; Fortenbery and Sumner; Garcia et al.; Grunewald, McNulty, and Biere; Sumner and Mueller). These studies have employed some variant of event study methodology. The basic notion of an event study is simple: if prices react to the announcement of information (''the event'') in an efficient market, then the information is valuable to market participants (Campbell, Lo, and MacKinlay). Much of this work has focused on U.S. Department of Agriculture (USDA) crop production reports and livestock inventory reports. Recent studies have also examined public announce-

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ments of food recalls (McKenzie and Thomsen) and animal disease test results (Tse and Hackard).

World Agricultural Supply and Demand Estimates (WASDE) reports are a prominent component of the public information system in agriculture. WASDE reports provide supply and demand balance sheets and season-average price forecasts for numerous crops, and they are a product of the joint effort of various USDA agencies (Spilka; Vogel and Bange). The monthly WASDE reports provide a commodity-by-commodity and country-by-country (selected countries) balance sheet of supply, consumption, and stocks for numerous crops. From May through July prior to harvest, U.S. corn and soybean acreage projections are based on planting intention reports or actual planted acreage surveys. Yield-trend analysis, weather patterns, and weekly crop condition reports provide input for the yield projections over the same period. From August forward, National Agricultural Statistics Service (NASS) corn and soybean production estimates (harvested acreage $\times$ yield) are used in U.S. balance sheets. Consumption forecasts are based on a wide array of information sources and analytical techniques. Foreign production estimates, which impact U.S. export prospects, rely on weather analysis, agricultural attaché reports, satellite imagery, and other public and private information sources. Specific projections of consumption by category are based on historical patterns of consumption, formal demand models, and expert judgment. Corn and soybean price projections reflect a simultaneous consideration of supply, consumption, and stocks (Vogel and Bange). Due to their comprehensive nature, objectivity, and timeliness, WASDE reports are widely considered to be benchmarks for other public and private forecasts (Purcell and Koontz; Vogel and Bange).

WASDE reports are unique compared to most other USDA reports because they contain both situation and outlook information. Adopting the terminology of Just et al., the situation component generates relatively unprocessed or raw statements of fact, while the outlook component produces analysis, synthesis, and interpretative reports. From this perspective, domestic and international crop production estimates in WASDE reports can be classified as situation information, whereas domestic and international consumption, ending stocks, and price forecasts can be classified as outlook information. While numerous studies have investigated market reaction to USDA reports that contain only situation information (e.g., hogs and pigs reports), it is surprising to find that only one previous study has analyzed the impact of WASDE situation and outlook information in crop markets.[1] Fortenbery and Sumner investigated the market impact of WASDE reports in corn and soybean markets from 1985 through 1989. The authors did not find evidence of significant price reaction to the release of WASDE reports in any month and concluded " . . . that USDA reports no longer provide news to markets." (p. 171) At the same time, Fortenbery and Sumner recognized the limitations of the study, in particular, a relatively small data period with generally depressed prices. Other possible limitations of the study included the time horizon used to detect price reaction and the use of only new crop futures prices in the analysis.

Given the limited nature of previous research, ongoing debates, and the traditional importance of WASDE reports, a comprehensive and systematic investigation of the impact of WASDE reports in crop markets is needed. The purpose of this study is to examine the impact of WASDE situation and outlook information in corn and soybean futures markets. These markets are of particular interest because corn and soybeans account for about 80% of total U.S. grain and oilseed production. Daily returns of nearby corn and soybean futures contracts over the period 1985–2006 were used to measure the impact of WASDE reports. Parametric and nonparametric statistical tests were used to detect differences in return variability on report release sessions and pre- and postreport

[1] Isengildina, Irwin, and Good investigated the impact of WASDE reports in live/lean hog and live cattle futures markets.

sessions. Market reaction was tested for all announcement months jointly as well as individual calendar months. In addition, WASDE reports were divided into two groups: (a) one that included domestic and international situation and outlook information; and (b) one that was limited to international situation information and domestic and international outlook information. Possible changes in the market reaction to WASDE reports due to changing supply/demand conditions and different U.S. agricultural policy regimes were analyzed by examining market impact in three different subsamples. The sensitivity of the results to the use of close-to-open returns versus close-to-close returns also was examined.

This analysis contributes new evidence regarding the value of USDA situation and outlook information. The combination of alternative statistical tests, multiple return series, a relatively long sample period, and variable market conditions over the sample provide conclusive evidence about the market impact of WASDE reports in corn and soybean futures markets.

Data

The ''events'' analyzed in this study included the release of all WASDE reports for corn and soybeans over the period 1985 through 2006. A total of 264 WASDE reports was released during this time period, and all but a few of the releases occurred between the 9th and 12th of the month. One important change in the release schedule for WASDE reports occurred during the sample period. Monthly reports between January 1985 and April 1994 and in December 1994 were released at 3:30 p.m. EST, after the end of the daily trading session at the Chicago Board of Trade (CBOT). Monthly reports between May 1994 and December 2006 (except December 1994) were released at 8:30 a.m. EST, before the start of trading at the CBOT.[2]

Following previous research (Fortenbery and Sumner), WASDE reports during the sample period are divided into two groups. The first group consists of WASDE reports released during August through November, January (excluding 1985 and 1986), and February (1985 and 1986 only), when WASDE reports included NASS corn and soybean production estimates for the United States.[3] This ''WASDE and NASS'' group of reports includes domestic situation information (NASS production estimates for the United States), international situation information (Foreign Agricultural Service [FAS] production estimates for non-U.S. countries), and domestic and international outlook information (consumption, ending stocks, and price forecasts for the U.S. and non-U.S. countries). The second group consists of WASDE reports released during December, January (1985 and 1986 only), February (excluding 1985 and 1986), and March through June and July (excluding 1985–1989); these months did not coincide with the release of NASS corn and soybean production estimates for the United States.[4] This ''WASDE only'' group of reports is limited to international situation information and domestic and international outlook information.

Corn and soybean futures prices for nearest-to-maturity CBOT contracts (but which mature after the release month) were collected for six trading days before the release of each WASDE report, the day of

[2] An interesting discussion of the background for the change in release times can be found in Colling.

[3] Previous to 1985, NASS crop production reports and WASDE reports were not released on the same dates. Starting in January 1985, NASS crop production reports and WASDE reports were released simultaneously, and WASDE balance sheets incorporated NASS production estimates (Fortenbery and Sumner).

[4] The classification of release months is consistent across the entire sample, with the exception of January, February, and July. The variation for January and February is due to the release of NASS final production estimates in February 1985 and 1986, as compared to January for the remainder of the sample. The variation for July is due to the release of NASS corn and soybean production estimates during 1985–1989. The July estimates were discontinued in 1990.

Table 1. Futures Contracts Used in Market Reaction Tests

WASDE Release	Corn	Soybeans
January	March	March
February	March	May
March	May	May
April	May	May
May	July	July
June	July	July
July	September	August
August	September	September
September	December	November
October	December	November
November	December	January
December	March	January

Note: All contracts refer to Chicago Board of Trade futures contracts.

release, and five trading days after the release of each WASDE report, or a total of 12 days for each release over the January 1985 through December 2006 sample period. Both opening and closing futures prices were collected for each day. Nearest-to-maturity (nearby) contracts were used for two reasons. First, nearest-to-maturity contracts typically are the most heavily traded and, hence, liquid contracts. Second, theory suggests that nearby contracts for storable commodities generally reflect the price impact of both old and new crop information (Working). This is important because both old crop and new crop information on corn and soybeans is released in most WASDE reports. For these reasons, it is reasonable to argue that the best measurement of price impact can be derived from nearest-to-maturity contracts for each release. The specific CBOT futures maturity matched to each WASDE release is presented in Table 1.

Measurements of market reaction in corn and soybean futures markets are complicated by the presence of limit moves. Limit moves restrict futures price movements, and thus futures prices may not represent equilibrium prices on the days with limit moves. Consequently, analyses that use futures prices affected by limit moves may result in biased estimates of price impact. The daily price change for CBOT corn contracts was limited to 10¢/bushel (expandable to 15¢/bu. on the second day and third day) until January 1994, 12¢/bu. (expandable to 18¢/bu. on the second day) from January 1994 to September 2000, and 20¢/bu. since September 2000. Out of a total of 3,432 observations included in this study, corn futures were subject to limit moves 21 times on a close-to-open basis and 44 times on a close-to-close basis, or 0.6% and 1.3%, respectively. On WASDE report release days, corn futures reached the limit only eight times on a close-to-open basis and eight times on a close-to-close basis out of 264 release days, or 3.0%.

Daily price changes for CBOT soybean contracts were limited to 30¢/bu. (expandable to 45¢/bu. on the second day) until September 2000 and 50¢/bu. since that time. During the sample period for this study, soybean futures prices hit the limit 15 times on a close-to-open basis and 28 times on a close-to-close basis, or 0.4% and 0.8%, respectively. On WASDE report release days, soybean futures reached the limit only seven times on a close-to-open basis and six times on a close-to-close basis out of 264 release days, or 2.7% and 2.3%, respectively.

McKenzie, Thomsen, and Dixon have shown that the existence of price limits is unlikely to lead to a failure to detect price reaction when it actually exists (type II error).

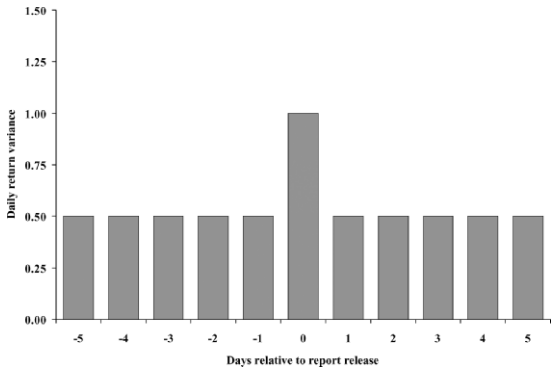

Figure 1. Hypothetical example of daily return variance around WASDE report release

Using Monte Carlo simulations, they demonstrated that abnormal performance is detected at levels well below 1% for large sample sizes and at about 1.5% for smaller sample sizes. Abnormal returns of this magnitude are well within the range of price limits specified for CBOT contracts over the study period. This evidence and the small incidence of limit moves in the sample suggest that price limits are not likely to have a substantial impact on market reaction test results.

Statistical Tests

Based on the theory of efficient markets, variability of futures prices around important scheduled news announcements should be characterized by a "spike" in variability on the announcement date and "normal" variability on nonannouncement dates (Sumner and Mueller). Since, under market efficiency, futures prices represent the conditional expectation of spot prices at contract maturity, the spike in futures return variance reflects the change in market participants' expectation of spot prices due to the news announcement. Note that the change in futures prices can be either positive or negative depending on the implications of the news for the level of price (i.e., information is "bullish" or "bearish"). Figure 1 provides a hypothetical example of this reaction pattern, where daily return variance doubled on WASDE release dates compared to nonrelease dates.[5] The statistical tests presented in this section are designed to detect whether the pattern shown in Figure 1 is evident in the variability of corn and soybean returns around WASDE releases.

Tests for variability immediately after the release of WASDE reports is larger than "normal" require careful definition of the measure of normal variability and the measure of variability immediately after the release of WASDE reports. To begin, note that a time index (t) and an event index (i) are needed. The time index is $t = -6, \ldots, -1, 0, +1, \ldots, +5$, where zero indicates the daytime trading session (henceforth, "session") at the CBOT immediately following the release of a given WASDE report, a negative number indicates sessions before the given release, and a positive number indicates sessions after release. For example, +5 indicates the session is five trading sessions after the day 0 trading

[5] The event study framework presented here assumes markets are not strong-form efficient. Under strong-form market efficiency (Fama, 1970), prices always fully reflect all available public and private information. This means that markets are able to fully anticipate not only the information contained in scheduled public news announcements like WASDE reports, but also all private ("insider") information possessed by market participants. In terms of Figure 1, the spike in variability on WASDE release days would not exist if corn and soybean futures markets were strong-form efficient; instead, variability would be the same as on any other day. There are two reasons why this is generally rejected as a reasonable model of actual market behavior. First, a large body of research rejects strong-form market efficiency for all types of markets, including agricultural futures markets (e.g., Fama, 1991; Zulauf and Irwin). Second, there is a logical contradiction at the center of strong-form market efficiency. Grossman and Stiglitz proved that a market will cease to function as informational efficiency approaches the strong-form limit. The problem is that the incentive to collect and analyze information disappears if the market can fully anticipate all forms of information. In simple terms, the market collapses because there is no incentive to collect and analyze costly information. Hence, most event studies in financial economics and agricultural economics either implicitly or explicitly assume markets are less than strong-form efficient.

session.[6] The event index is $i = 1, \ldots, 264$, where 1 indicates the release of the January 1985 WASDE report and 264 indicates the release of the December 2006 WASDE report.

The theory of efficient markets predicts that new information in WASDE reports will be reflected instantaneously in futures prices as soon as a trading session begins. Since WASDE reports are released either after the close of trading on the release date (before May 1994 and in December 1994) or before the opening of trading on the release date (May 1994 and after, with the exception of December 1994), close-to-open returns that span the release time of WASDE reports should best reflect the immediate reaction of corn and soybean futures prices (Williams, p. 798). Price reaction measured on a close-to-close basis may mask the market's reaction to WASDE reports due to the added variability associated with other information that becomes available to the market during the trading day. Previous studies (e.g., Ferris and Chance; Fleming, Kirby, and Ostidek) have documented that the variance of open-to-close returns ("daytime variance") for agricultural futures is about twice that of close-to-open returns ("overnight variance"). Hence, a given market impact of WASDE reports will be smaller when compared to the variance of close-to-close returns (sum of overnight and daytime variance) as opposed to the variance of close-to-open returns.[7]

For the reasons outlined already, the primary statistical results for this study were based on close-to-open futures returns. Specifically, returns for a given WASDE release were computed as follows:

$$(1) \quad r_{t,i} = \ln\left(p^{o}_{t,i} \Big/ p^{c}_{t-1,i}\right) \times 100, \qquad t = -6, \ldots, 0, \ldots, +5,$$

where $p^{o}_{t,i}$ is the opening price of the nearest-to-maturity corn or soybeans futures contract for session t and event i, $p^{c}_{t-1,i}$ is the closing (settlement) price of the nearest-to-maturity corn or soybeans futures contract for session $t - 1$ and event i, and ln is the natural logarithm. Sensitivity of the results to the use of close-to-close returns was also examined. Note that five returns were computed previous to the release of a WASDE report, one return was computed for the report release session, and five returns were computed after the release. Hence, the total length of the event window is 11 trading sessions, similar to the event window lengths used by Sumner and Mueller and Fortenbery and Sumner.[8]

Table 2 presents descriptive statistics for corn and soybean close-to-open returns from 1985 through 2006. Statistics were calculated by pooling all release session returns and pre- and postrelease session returns. The means of both corn and soybean futures returns are quite small and statistically insignificant. However, the mean of the absolute returns, which reflects variability in price movements, is significantly different from zero. All series exhibit significant skewness and kurtosis. Therefore, it is not surprising that Jarque-

[6] The time index is specified for "trading sessions" instead of the more conventional "trading days" because of the change in WASDE release times during the sample. Between January 1985 and April 1994 and in December 1994, WASDE reports were released at 3:00 p.m. EST, after the close of trading on the release date. If day 0 is defined as the release date in this case, an inconsistency would be created because the impact of the WASDE release would be reflected in day +1 returns because report returns are computed using the opening or closing futures price the day after release. Between May 1994 and December 2006 (except December 1994), WASDE reports were released at 8:30 a.m. EST, before the start of trading on the release date. If day 0 is defined as the release date in this case, no inconsistency would be created because the impact of the WASDE release would be reflected in day 0 returns, since report returns are computed using the opening or closing futures price on the day of release. To avoid the inconsistency created for WASDE releases before May 1994 and in December 1994, the time index was specified using trading sessions, where session 0 was defined as the first session after the release of a WASDE report. This definition is not affected by the changing release time of WASDE reports.

[7] See Isengildina, Irwin, and Good for further discussion of this issue and a detailed example.

[8] A wider event window would overlap in several cases with the release of other USDA reports, such as quarterly hogs and pigs reports and monthly cattle-on-feed reports.

Table 2. Descriptive Statistics for Corn and Soybean Close-to-Open Returns, January 1985–December 2006

	Corn		Soybeans	
Statistic	r	$\|r\|$	r	$\|r\|$
Mean	−0.0198	0.4861***	−0.0156	0.4662***
Median	0.0000	0.2773	−0.0128	0.2591
Variance	0.6977	0.4618	0.6417	0.4245
Skewness	1.0723***	3.7391***	−0.0213	3.8148***
Kurtosis	13.1366***	19.5846***	13.5807***	20.6404***
Jarque-Bera	21438***	53177***	22317***	58593***

Note: Returns (r) are computed as the difference in the natural logarithm of price multiplied by 100. Number of observations is 2,904 for each crop. One star indicates significance at the 10% level. Two stars indicate significance at the 5% level. Three stars indicate significance at the 1% level.

Bera tests reject normality in all cases at the 1% significance level. This indicates that the normality assumption will be violated for parametric statistical tests used to detect market reaction to WASDE reports. Non-normality is a well-known distributional characteristic of agricultural futures returns, which have often been shown to be skewed and leptokurtotic (e.g., Yang and Brorsen). To address this issue, nonparametric tests that do not assume normality were used to cross-check and confirm the findings of the parametric tests.

The null hypothesis for all statistical tests is that return variability for report sessions and pre- and postreturn sessions is equal (no reaction). This null was tested with parametric tests applied directly to returns, including the two-tailed F-test, Bartlett test, Levene test, and Brown-Forsythe test (see Snedecor and Cochran for test details). The null hypothesis was also tested with nonparametric tests applied to absolute returns, including the Mann-Whitney, Kruskal-Wallis, chi-square, and Van der Waerden tests (see Conover for test details). Several parametric and nonparametric tests were applied to insure that results were not sensitive to test selection. All statistical tests were computed using the *EViews* econometric software package.

Results

The impact of WASDE reports is first illustrated graphically. Figure 2 plots corn and soybean return variance for the 11 trading sessions surrounding all WASDE releases from January 1985 to December 2006. Corn and soybean return variance on WASDE release sessions is about three times the level of return variance on other days in the event windows, indicating that WASDE reports have a large impact in corn and soybean futures markets. The overall pattern of return variances shown in Figure 2 is close to the theoretically predicted pattern found in Figure 1. Figure 2 also demonstrates that postreport variance is about the same as prereport variance; the ratio of postreport to prereport variance equals 1.09 for corn and 1.11 for soybeans (neither of these ratios is statistically significant based on F-tests).

Table 3 presents statistical test results for the entire sample period, January 1985 through December 2006. To conserve space, only one parametric test (F-test) and one nonparametric test (Van der Waerden test) are presented because the results of the other tests are consistent with the presented results and are available from the authors upon request.[9] Since results generally are consistent across the parametric and nonparametric tests, the find-

[9] F-statistics were computed with the smaller of the two variances in the numerator. Hence, the F-statistic is the inverse of the ratio of report to prereport and postreport variance when the report variance is smaller than the pre- and postreport variance.

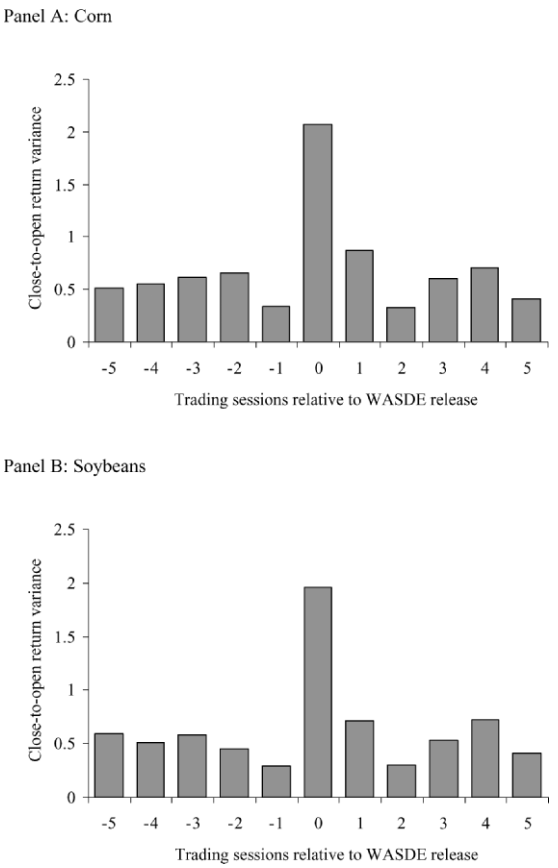

Figure 2. Corn and soybean close-to-open return variance around all WASDE report release months: January 1985–December 2006

ings are robust to different statistical test assumptions. Return variance across all months on report sessions is 3.70 times greater than pre- and postreturn variance for corn and 3.84 times greater for soybeans. Both of the presented test statistics show that the increase in variability on report sessions for corn and soybeans is significant at the 1% level.[10] These results indicate that the situation and outlook information released in WASDE reports generally changes the expectations of futures market participants regarding subsequent spot prices.[11,12]

For the WASDE and NASS group of reports, Table 3 shows that there was substantially more price variability on report sessions than on pre- and postreport sessions; return variance on report sessions was 7.38 times greater than pre- and postreturn variance for corn and 6.87 times greater for soybeans. Both ratios are significantly different from one at the 1% level. Thus, the domestic and international situation and outlook information released in the WASDE and NASS group of reports clearly has a large impact on futures return variance. This further implies that the situation and outlook information released in WASDE and NASS reports leads to relatively large changes in the expectations of futures market participants regarding subsequent spot prices. These results are consistent with previous research on the impact of NASS production forecasts in corn and soybean futures markets (e.g., Sumner and Mueller).

For WASDE-only months, Table 3 indicates small impacts compared to WASDE and

[10] The same hypothesis test conclusions are reached when return variance on report sessions is compared to prereport, postreport, or combined pre- and postreport return variance.

[11] Limit moves were excluded from the sample to check the sensitivity of results to the presence of price limits. The magnitude of test statistics generally was slightly smaller after removal of limit observations, and hypothesis test conclusions were unchanged. This confirms the earlier argument that price limits should not substantially impact the results. Test results without limit observations are available from the authors upon request.

[12] Previous studies (Ferris and Chance; Fleming, Kirby, and Ostidek) have indicated that weekend overnight variance (Friday close to Monday open) is at least twice the overnight variance on weekdays. Depending on the distribution of WASDE release days of the week, this weekend effect could potentially bias market impact tests. Only 25 (9.5%) WASDE report returns were weekend returns (Friday after the close prior to May 1994 and December 1994 or Monday before the open after May 1994 except December 1994). In contrast, 522 (19.8%) pre- and postreport returns were weekend returns. Excluding all weekend returns from the sample marginally increased the size of test statistics, consistent with the relatively heavier concentration of weekend returns in pre- and postreport returns. However, hypothesis test conclusions are unchanged. These alternative results are available from the authors upon request.

Table 3. Futures Return Volatility Test Results for WASDE Reports in Corn and Soybean Markets, Close-to-Open Returns, January 1985–December 2006

		Corn					Soybeans				
Report Group	*N*	Report Sessions Variance	Pre-/ Postreport Sessions Variance	Difference in Report and Pre-/ Postreport Variance	*F*-statistic	Van der Waerden χ^2 statistic	Report Sessions Variance	Pre-/ Postreport Sessions Variance	Difference in Report and Pre-/ Postreport Variance	*F*-statistic	Van der Waerden χ^2 statistic
All Months	264	2.07	0.56	1.51	3.70***	37.76***	1.96	0.51	1.45	3.84***	61.01***
WASDE and NASS	115	3.88	0.53	1.24	7.38***	82.26***	3.72	0.54	3.18	6.87***	86.21***
WASDE	149	0.69	0.59	0.10	1.17	0.40	0.60	0.49	0.12	1.24*	3.95**
January	22	5.65	0.20	5.45	28.66***	26.97***	3.20	0.23	2.97	14.01***	21.89***
February	22	0.19	0.13	0.07	1.52	3.67*	0.16	0.13	0.03	1.21	0.07
March	22	0.18	0.20	−0.01	1.07	0.04	0.24	0.24	0.00	1.01	2.78*
April	22	0.39	0.31	0.08	1.26	2.09	0.36	0.17	0.19	2.09**	5.42**
May	22	1.98	0.51	1.47	3.90***	0.48	2.08	0.40	1.68	5.17***	6.34**
June	22	1.00	1.35	−0.34	1.34	0.86	0.44	0.90	−0.46	2.06**	0.81
July	22	1.41	1.90	−0.49	1.34	0.57	1.19	1.74	−0.55	1.46	0.13
August	22	5.95	0.71	5.23	8.34***	24.79***	5.65	1.01	4.64	5.60***	16.22***
September	22	1.38	0.36	1.02	3.85***	4.19**	2.47	0.44	2.03	5.56***	11.44***
October	22	4.56	0.49	4.06	9.23***	20.53***	5.82	0.32	5.50	18.13***	25.19***
November	22	1.84	0.39	1.44	4.68***	18.35***	2.02	0.27	1.75	7.52***	17.11***
December	22	0.10	0.16	−0.07	1.71*	2.40	0.13	0.26	−0.13	1.96**	0.06

Note: Returns are computed as the difference in the natural logarithm of price times 100. *N* indicates the number of reports released. One star indicates significance at the 10% level. Two stars indicate significance at the 5% level. Three stars indicate significance at the 1% level. The WASDE and NASS group includes WASDE reports released in August through November, January (excluding 1985–1986) and February (1985–1986 only). The WASDE group includes WASDE reports released in December, January (1985–1986 only), February (excluding 1985–1986), March through June and July (excluding 1985–1989).

NASS months. Report session variance for corn is 1.17 times higher than pre- and postreport session variance for WASDE-only months, but both test statistics indicate that the increase is insignificant. In soybeans, report session variance is 1.24 times higher for WASDE-only months, and both statistics indicate the increase is significant. Hence, the evidence is mixed in terms of the significance of market impact for the WASDE-only group of reports. Overall, the test results show that the international situation information and domestic and international outlook information released in the WASDE-only group of reports have a measurable impact on corn and soybean futures return variance, but it is small in comparison to the impact of the WASDE and NASS group of reports.

In terms of individual calendar months, Table 3 shows consistent evidence (both parametric and nonparametric tests are significant) of market reaction to the WASDE and NASS reports released in January, August, September, October, and November in both corn and soybeans. Consistent evidence of market reaction for WASDE-only months is found in April and May for soybeans, and marginal evidence (only one test is significant) of an increase in report return variance is found for corn in February, May, and December and for soybeans in March, June, and December. Hence, situation and outlook information released in WASDE-only reports impacts soybean futures returns in some months, while there is little evidence that this group of reports has an impact on the variability of corn futures returns. In Table 3, it is interesting to observe that the largest relative impact is evident for the months of January and October. For the full sample period, return variance on January report sessions is 28.66 times greater than pre- and postreport return variance in corn and 14.01 times greater in soybeans. Return variance on October report sessions is 9.23 times greater than pre- and postreport return variance in corn and 18.13 times greater in soybeans. However, it is important to keep in mind that these *F*-statistics are based on different pre- and postreport variance levels; that is, a large absolute change in variability may yield a moderate *F*-ratio when compared to relatively high pre- and postreport variance. In absolute terms, the January WASDE report caused the largest change in return variance of corn futures (5.45) followed by the August (5.23) and October (4.06) reports. The October WASDE report caused the largest change in return variance (5.50) in soybeans, followed by August (4.64) and January (2.97).

Previous studies (e.g., Garcia et al.) have suggested that the impact of USDA reports may vary over time depending on market conditions and government policies. To evaluate whether the impact of situation and outlook information in WASDE reports changes depending on these factors, the sample was divided into three subperiods: January 1985–December 1989, January 1990–December 1995, and January 1996–December 2006. The first subperiod is characterized by large year-to-year carryover of government-owned stocks of grains and, consequently, limited uncertainty regarding future market conditions. Carryover of government stocks in the second and third subperiods is either small or nonexistent, and, hence, there is more uncertainty in market conditions. The last subperiod also reflects the increased market orientation of farm programs associated with the 1996 and 2002 Farm Bills.

Results for the three subperiods are presented in Table 4.[13] The subperiod results are consistent with the results for the full sample—a consistently significant impact is found in each of the subperiods for all months and WASDE and NASS months, but only mixed evidence is found for WASDE-only months. Interestingly, the magnitude of impact for all categories increases across the three subperiods. For example, the ratio of report to pre-

[13] Results for individual calendar months are not presented for the subperiods due to the small numbers of observations that are available for such tests during the subperiods. In addition, no particular concentration of limit moves was observed in any of the subperiods. Limit moves on report release sessions occurred on three, one, and four days for the respective subperiods in corn and two, two, and three days in soybeans.

Table 4. Futures Return Volatility Test Results for WASDE Reports in Corn and Soybean Markets, Close-to-Open Returns, January 1985–December 1989, January 1990–December 1995, and January 1996–December 2006

		Corn					Soybeans				
Report Group	*N*	Report Sessions Variance	Pre-/ Postreport Sessions Variance	Difference in Report and Pre-/ Postreport Variance	*F*-statistic	Van der Waerden χ^2-statistic	Report Sessions Variance	Pre-/ Postreport Sessions Variance	Difference in Report and Pre-/ Postreport Variance	*F*-statistic	Van der Waerden χ^2-statistic
					January 1985–December 1989						
All Months	60	1.35	0.63	0.72	2.15***	8.00***	1.20	0.50	0.70	2.39***	12.21***
WASDE and NASS	30	2.22	0.65	1.57	3.40***	11.52***	2.02	0.62	1.40	3.28***	8.08***
WASDE	30	0.49	0.60	−0.11	1.22	0.71	0.34	0.38	−0.04	1.13	3.90**
					January 1990–December 1995						
All Months	72	1.03	0.33	0.71	3.16***	10.15***	1.52	0.42	1.11	3.65***	21.53***
WASDE and NASS	30	2.00	0.35	1.65	5.70***	18.43***	3.19	0.49	2.70	6,.53***	32.22***
WASDE	42	0.37	0.31	0.06	1.20	0.19	0.32	0.37	−0.04	0.88	1.74
					January 1996–December 2006						
All Months	132	2.97	0.66	2.31	4.51***	22.14***	2.56	0.57	1.99	4.53***	29.26***
WASDE and NASS	55	5.89	0.55	5.34	10.67***	56.29***	4.94	0.53	4.41	9.30***	52.36***
WASDE	77	0.93	0.73	0.19	1.26	0.55	0.85	0.59	0.26	1.44**	0.46

Note: Returns are computed as the difference in the natural logarithm of price multiplied by 100. *N* indicates the number of reports released. One star indicates significance at the 10% level. Two stars indicate significance at the 5% level. Three stars indicate significance at the 1% level. The WASDE and NASS group includes WASDE reports released in August through November, January (excluding 1985–1986), and February (1985–1986 only). The WASDE group includes WASDE reports released in December, January (1985–1986 only), February (excluding 1985–1986), and March through June and July (excluding 1985–1989).

and postreport variance for WASDE and NASS months in corn increases from 3.40 to 5.70 to 10.67 for the earliest, middle, and latest subperiod, respectively. Furthermore, the ratio of report to pre- and postreport variance for WASDE-only months in soybeans increases from 1.13 to 0.88 to 1.44 for the earliest, middle, and latest subperiod, respectively. These patterns are consistent with the theoretical prediction that situation and outlook information is more valuable when uncertainty regarding future market conditions is higher (Falk and Orazem).

As noted earlier, market impact test results may be sensitive to the use of close-to-close versus close-to-open returns. To assess the sensitivity of test results to the measure of returns, all tests were recomputed using close-to-close returns. These alternative results are shown in Table 5, and, as expected, they indicate a smaller magnitude of market impact.[14] For example, the ratio of report to pre- and postreport variance for WASDE and NASS months in soybeans for the entire sample period drops from 6.87 for close-to-open returns (Table 3) to 2.93 for close-to-close returns. The reason for the decline is the denominator of the ratio, which is about three times larger using close-to-close returns. While the magnitude of market impact is smaller using close-to-close returns, hypothesis test conclusions for the entire sample are the same for all months and WASDE and NASS months whether close-to-close or open-to-close returns are used. Evidence of significant soybean market reaction to the WASDE-only group of reports detected using close-to-open returns disappears when close-to-close returns are used. Some of the subperiod results are even more varied across the two measures. For example, there is no evidence of market reaction to any grouping of WASDE reports during January 1985–December 1989 using close-to-close returns, whereas a substantial reaction is detected for all months, WASDE and NASS months in both commodities, and WASDE-only months in soybeans using close-to-open returns (Table 3). Overall, the alternative results indicate that the market impact of WASDE reports is dampened if measured using close-to-close returns, which supports the earlier argument that close-to-open returns are more suitable for detection of instantaneous reaction of futures prices to the release of USDA reports.[15]

Finally, it is interesting to compare the corn and soybean test results from this study with that of Fortenbery and Sumner. To review, Fortenbery and Sumner examined close-to-close returns of new crop futures (January soybean and December corn contracts) for the January 1985 through December 1989 period and did not find evidence of significant price reaction to the release of either group of WASDE reports. They concluded, " . . . that USDA reports no longer provide news to markets." (p. 171) As noted previously, close-to-close results for January 1985–December 1989 presented in Table 5 are consistent with Fortenbery and Sumner's findings. However, close-to-open results presented in Table 4 are not consistent with Fortenbery and Sumner's results. For all

[14] To conserve space, results are not presented for individual months. These results are available from the authors upon request.

[15] It is also possible that market inefficiency could explain the observed difference in results between close-to-open and close-to-close returns. If corn and soybean futures markets are inefficient and tend to overreact to the release of WASDE reports, then the use of close-to-open returns will overstate report impacts. Specifically, if corn and soybean futures markets tend to overreact, the initial reaction to the release of WASDE reports at the open will be too extreme, and price will subsequently reverse direction to arrive at the true equilibrium level later in the trading session. Statistically, overreaction would be reflected in a negative correlation between close-to-open and open-to-close returns for WASDE release sessions. The estimated correlation between close-to-open and open-to-close returns for all WASDE release sessions is -0.21 in corn and -0.24 in soybeans, indicating only a modest tendency for the initial impact on the open to be offset later in the session. Furthermore, the close-to-close results show that this tendency is not large enough to change the main conclusions of this study based on open-to-close results. The correlations do suggest that an interesting topic for further research would be the dynamics of futures market reaction to the release of WASDE reports over longer time horizons.

Table 5. Futures Return Volatility Test Results for WASDE Reports in Corn and Soybean Futures Markets, Close-to-Close Returns, January 1985–December 2006

		Corn					Soybeans				
Report Group	*N*	Report Session Variance	Pre-/Postreport Session Variance	Difference in Report and Pre-/Postreport Variance	*F*-statistic	Van der Waerden χ^2-statistic	Report Session Variance	Pre-/Postreport Session Variance	Difference in Report and Pre-/Postreport Variance	*F*-statistic	Van der Waerden χ^2-statistic
					January 1985–December 2006						
All Months	264	3.06	1.63	1.43	1.88***	18.91***	2.90	1.57	1.33	1.85***	22.98***
WASDE and NASS	115	5.14	1.49	3.65	3.45***	54.28***	4.63	1.58	3.05	2.93***	35.22***
WASDE	149	1.49	1.74	−0.25	1.17	0.57	1.55	1.55	0.00	1.00	1.02
					January 1985–December 1989						
All Months	60	1.66	1.73	−0.07	1.04	0.18	1.83	1.65	0.18	1.11	0.23
WASDE and NASS	30	2.25	1.94	0.31	1.16	0.90	2.73	1.86	0.87	1.47	0.33
WASDE	30	1.09	1.46	−0.37	1.34	0.25	0.93	1.37	−0.44	1.47	0.00
					January 1990–December 1995						
All Months	72	1.25	1.04	0.21	1.20	0.83	1.86	1.10	0.76	1.69***	2.09
WASDE and NASS	30	2.13	0.90	1.23	2.37***	6.62***	3.42	1.13	2.29	3.02***	5.68**
WASDE	42	0.64	1.15	−0.51	1.79***	0.69	0.79	1.08	−0.29	1.37	0.02
					January 1996–December 2006						
All Months	132	4.64	1.90	2.74	2.44***	34.49***	3.98	1.79	2.19	2.23***	30.20***
WASDE and NASS	55	8.29	1.56	6.72	5.30***	90.46***	6.40	1.67	4.73	3.83***	42.57***
WASDE	77	2.08	2.15	−0.07	1.03	0.37	2.22	1.87	0.35	1.19	2.39

Note: Returns are computed as the difference in the natural logarithm of price multiplied by 100. *N* indicates the number of reports released. One star indicates significance at the 10% level. Two stars indicate significance at the 5% level. Three stars indicate significance at the 1% level. The WASDE and NASS group includes WASDE reports released in August through November, January (excluding 1985–1986), and February (1985–1986 only). The WASDE group includes WASDE reports released in December, January (1985–1986 only), February (excluding 1985–1986), and March through June and July (excluding 1985–1989).

months and WASDE and NASS months, strong evidence of significant price reaction is observed in both corn and soybeans over January 1985–December 1989.

Summary and Conclusions

World Agricultural Supply and Demand Estimates (WASDE) reports are prominent components of the public information system in agriculture. The purpose of this study was to examine the impact of WASDE situation and outlook information in corn and soybean futures markets over the period 1985–2006. Daily returns of nearby corn and soybean futures contracts were used to measure the impact of WASDE reports. Parametric and nonparametric statistical tests were used to detect market reaction based on the difference in return variance on report sessions and pre- and postreport sessions. Market reaction was tested for all announcement months jointly as well as individual calendar months. In addition, WASDE reports were divided into two groups: one that combined domestic and international situation and outlook information and one that was limited to international situation information and domestic and international outlook information.

Results of the empirical analysis suggest three main findings. First, WASDE reports containing domestic situation information (NASS crop production estimates) as well as international situation information and domestic and international outlook information have the largest impact: return variance on report sessions is 7.38 times greater than normal return variance in corn futures and 6.87 times greater in soybean futures. Second, WASDE reports limited to international situation information and domestic and international outlook information have a measurable impact on corn and soybean futures return variance, but the impact is small in comparison to the impact of the WASDE and NASS group of reports. Third, the overall impact of WASDE reports has increased over time. For example, the ratio of report to pre- and postreport variance for the WASDE and NASS group of reports in corn increases from 3.40 to 5.70 to 10.67 for the earliest, middle, and latest subperiod, respectively.

These findings clearly indicate that domestic situation information is quite valuable to market participants. However, this dominance does not necessarily imply that international situation information or domestic and international outlook information is without value. First, it is impossible to fully disentangle the separate impacts of each type of information due to the combined nature of WASDE reports (i.e., simultaneous release of forecasts for all balance-sheet categories, such as production, exports, crush, ending stocks, and price). Second, theory predicts that outlook information should be most valuable to market participants when uncertainty about market conditions is highest. Release of domestic situation information (NASS crop production estimates) may reduce uncertainty about the size of domestic production, but there may be considerable uncertainty about the impact of the information on other balance-sheet categories, in particular, price. A plausible argument can be made that outlook information is most valuable during release months when significant situation data also is released, and, therefore, outlook information should be ''credited'' with at least some of the observed impact on corn and soybean futures prices during months when domestic situation information is released along with international situation information and domestic and international outlook information.

Further research is needed to compare the impact of WASDE reports to other public situation and outlook reports, such as quarterly grain stocks and acreage intentions reports. In addition, it would be interesting to examine the market impact of WASDE reports using implied volatility from options markets (McNew and Espinosa).

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