TOO MUCH INFORMATION? HOW RELEVANT ARE AGRICULTURAL REPORTS THAT PROVIDE SIMILAR INFORMATION?

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Selected Paper prepared for presentation at the 2017 Agricultural & Applied Economics Association Annual Meeting, Chicago, IL, July 30-August 1

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INTRODUCTION

Several studies in agricultural futures markets have aimed to identify if public information contained in the United States Department of Agriculture (USDA) crop or livestock reports contain valuable information to the market (Sumner and Mueller, 1989; Fortenberry and Sumner, 1993; Garcia et al., 1997; Isengildina-Massa et al., 2008; Adjemian, 2012). These studies have resulted from the ongoing debate over how commodity prices respond to new information and whether USDA reports contain relevant information or if their economic value does not cover the public cost of gathering and evaluating the information they contain. The fundamental theory behind these studies has been the Market Efficiency Hypothesis: if an "event" (in this case, the release of an agricultural report) contains relevant information, market participants will react to the new information causing larger than normal volatility surrounding the event. Previous research on this topic has primarily focused on the impact of the World Agricultural Supply and Demand (WASDE) report release or the impact of the WASDE report in combination with various other reports. Prior studies have identified that major USDA reports do tend to increase market volatility, indicating these reports continue relevant information to the market.

However, previous research has generally neither identified nor focused in how initial reports impact futures price volatility when multiple reports are released within a short period of time. Importantly, reports that are released on nearby dates and contain the same or similar information may mask each other's impact on market volatility. For example, on July 11, 2012, the July WASDE and Crop Production reports were released, along with U.S Department of Energy ethanol production data. The next day, government data on corn and soybean exports were released. Finally, on July 16, 2012 a government report detailing the condition and progress of growing crops was released. Hence, within 5 days, 5 different reports containing similar supply and demand information were all released. It is possible that within this timeframe, some reports masked the impacts of other reports' information. Focusing attention on only one report, such as the WASDE, may lead to erroneous conclusions about the reports true impact on the market. This example and others raise the question of how much attention market participants pay to different reports released near the same date that provide similar information.

The objective of this study is twofold: identifying the impact of several agricultural reports on crop market volatility, and exploring how reports released near each other may mask one another's impacts on market volatility. The study will include USDA and other agency reports, including the aforementioned World Agricultural Outlook Board's WASDE, the Foreign Agricultural Service's (FAS) weekly Export Sales report, the National Agricultural Statistics Service's (NASS) monthly National Crop Progress Reports, annual March Prospective Plantings report, annual June Acreage report, monthly Crop Production report, Quarterly Stocks report, and the U.S Energy Information Administration's (EIA) Weekly Ethanol Plant Production report released between 1985 and 2016.

Data for this research consist of daily futures prices for corn and soybeans traded in the CME Group between 1985 and 2016, along with the released dates and times for all reports previously indicated. Two time-eries are used for each commodity: nearby futures price and new-crop futures price (November contract for soybeans and December contract for corn). Research methods follow previous techniques used by Isengildina-Massa et al. (2016), Adjemian (2012), and McKenxie and Darby (2016). Overall, an event-study framework is adopted. Event days (when reports are released) are identified, as well as an "event window": 3 days before and 3 days after the release of each report. Price response is measured by futures price returns, i.e. the percentage change in futures price before and after the reports were release. The analysis controls for situations in which reports with similar information are released at nearby dates, and for seasonality, day-of-the-week effect, proximity to futures contract maturity, and level of inventory in the market.

Findings from this study can shed new light on how futures prices in commodity markets respond to new information. This can be helpful for those interested in the relevance of different agricultural reports publicly available in the market, and contribute to the discussion about the importance of the government's reporting system. It can also be useful for market participants who trade or rely on futures markets (such as producers and agribusiness firms) since it will provide insights on price changes (volatility) around the release of different reports, which can help them improve their hedging or trading strategies.

REPORTS

This section presents the reports investigated in the study and discusses their main characteristics.

Ethanol Report

Weekly ethanol plant production reporting is prepared by the EIA. Established in 1977, the EIA is an administration within the Department of Energy responsible for the collection and analysis of U.S energy data ("About EIA: Our Mission", n.d.). Ethanol data is released simultaneously with petroleum and other liquid fuel data every week. According to the May 10th, 2017 *Weekly Petroleum Status Production Report,* weekly production data is gathered through mandatory surveying of all facilities located in all 50 states that produce fuel ethanol. Reporting for the previous week is due Monday so that data can be released on Wednesday. A cut-off method is used to sample from respondents: the EIA arranges facilities from largest to smallest by volume, and data from the largest companies are added until approximately 90% of the production volume is accounted for. Exponential smoothing is used to estimate production for any facilities that did not respond, and data is generally prepared by the end of Tuesday.

According to the U.S Department of Energy, "The amount of corn used for ethanol production increased substantially between 2001 and 2010, as nearly all gasoline was transitioned to 10% ethanol." Between 2010 and 2016, ethanol production accounted for approximately 5% of total corn use in the United States ("U.S Total Corn Production", 2016). Therefore, changes in ethanol production levels can impact corn demand, and therefore participants' expectations about future prices. It should also be noted that the WASDE report often uses EIA ethanol data to update current crop year projections of corn used for ethanol production. Because the EIA releases data every Wednesday, the release of data often coincides with the releases of other governmental reports, such as the WASDE, Crop Production, and Quarterly Stocks reports.

Export Sales

Export sales reporting under the FAS of the USDA began in 1973. The program was established following the 1972 "Great Russian Grain Robbery". According to the FAS, "The huge, unanticipated purchases of U.S. wheat and corn that year depleted U.S. reserve stocks which caused a sizable run-up in U.S. food prices." Additionally, smaller exporting firms expressed concern that larger firms had access to "market sensitive" information unavailable to the public, giving these larger firms an unfair advantage in the market. So, in 1973 congress mandated export sales reporting so that all market participants could receive the same information at the same time.

Under congressional law, exporters must report export data for a variety of commodities, including corn, soybeans, and soybean products. Exporters must report weekly data on quantity (generally in 1000 MT), type and class of commodity, marketing year of shipment, and end destination. According to the FAS, around 370 export firms provide this export information through fax, email, and online entry. The FAS export reporting teams compile this information weekly and release the aggregate export data for the listed commodities every Thursday for week ending the previous Friday. The FAS takes steps to ensure accuracy, including "a memorandum of understanding with USDA's Grain Inspection, Packers and Stockyards Administration to resolve discrepancies in export data" as well as periodic meetings with exporters to continually ensure sound reporting practices ("USDA Export Sales Reporting", 2006).

According to Caphart. T (2017) of the Economic Research Service of the USDA, "The United States is the world's largest corn producer and currently exports between 10 and 20 percent of its annual production." For soybeans, the picture is even more dramatic, as exports have accounted for between 30 and 50 percent of annual production since 1980 (Ash. M, 2017). Because exports represent a large component of usage for both corn and soybeans, it is plausible that unexpected changes in export data impact futures prices. Exports also play a role in WASDE balance sheets for both corn and soybeans, as the WASDE includes projected yearly exports based on current and historic FAS export data (Vogel and Bange, 1999). It is the only other report in this analysis to include export data. Since it is released every Thursday, release days have often coincided with other reports such as the WASDE, Crop Production, and Quarterly Stocks reports.

Acreage Report

The June Acreage report is prepared by NASS, part of the USDA. The report contains detailed information on estimated planted and forecasted harvested acreage of many commodities in the U.S including corn and soybeans as of June 1. The estimates are based on surveying done in the first two weeks of June each year so the data can be released at the end of June. These are based on probability area frame surveys with a sample of around 11,000 parcels of land and a probability list frame survey with a sample of approximately 75,000 -85,000 farm operators Farmers with land inside of the sampled area frame survey are personally contacted to provide data on their operations. Data from operations in the list frame are gathered through mail, telephone, internet, and personal interview. Data is checked for accuracy based on historical reporting, and estimates are made based on the data and the historical relationship between previous estimates and survey data (Vogel and Bange, 1999; *Guide to Sample Surveys*, 2012).

The Acreage report is an important report, as it is the first to include estimates of actual production and harvest acreage. Subsequent Crop Production and WASDE reports' estimates and forecasts are based on these acreage estimates until they are updated in late fall after harvest (Vogel and Bange, 1999). Because total production is net yield multiplied by total harvested acreage, the data in the Acreage report play an important role in estimating production for the coming crop year. The Acreage report is released in late June, *prior* to the release of the next month's WASDE but it does not include the demand side information provided by the WASDE.

Prospective Planting

The Prospective Planting report is a report released by NASS which covers U.S farmers' planting intentions in the spring, as of March 1; the report has been released since 1965. Of interest to us are the intended acres to be devoted to corn and soybean production for the coming crop year for each individual state as well as the entire U.S. According to the March 2017 *Prospective Plantings* report, NASS surveys farmers in the first two weeks of March so the report can be released at the end of March. A probability survey is used, in which a sample of approximately 83,300 farms is generated (where each operation in the U.S has equal probability of being selected). Data from producers is gathered via mail, internet, and telephone. Estimates are then made based on the survey data gathered and the historical relationship between official estimates to the survey data.

The Prospective Planting report is a major crop report. It offers NASS's first estimates of production in the coming crop year. While the report is highly tentative and does not provide corn or soybean yield forecasts, it does give market participants a first glimpse at supply side estimates for the coming crop year. Additionally, the May WASDE, which is the first to include forecasts of supply and demand of corn and soybeans for the coming crop year, uses the Prospective Plantings report's acreage estimates to generate supply side forecasts. It is not until July following the June Acreage report that these acreage estimates are updated.

Grain Stocks

The Grain Stocks report was first released in 1973 under NASS. Since 1987, this quarterly report has generally been released in the beginning of January, at the end of March, at the end of June, and at the end of September. This report gives on and off-farm storage estimates in the U.S for major crops including corn and soybeans. Currently, the January report gives the first look at new crop grain stock levels as of December 1. The March report gives estimated stocks as of March 1, and the June report gives estimated stocks as of June 1. Finally, the September report gives estimates of stock levels as of September 1, right before the start of the new corn and soybean crop year. Beginning stocks help generate a sense of the levels of supply in the market; the rate at which stocks are used throughout the year can give a sense of the level of demand in the market. Additionally, large ending stocks contribute to large beginning stocks, as stocks connect marketing years.

Estimates of on and off-farm storage levels are obtained differently. For on-farm storage, operations are chosen from both area frame and a list frame for multiple frame estimates. Operations on the list frame are chosen based on relative size of the operation (in terms of the commodity of interest) compared to others on the list; area frame sampling is used to account for any agricultural land not in the list frame. A minimum sample size is set depending on the time of year; data is collected via personal interviews, mailing, and telephone usually in the last two weeks of the month prior to the report release date. Farmers give data on total acreage, acreage by commodity, total storage capacity, and storage by commodity. In March and June, this survey is the same as the Prospective Plantings and Acreage report survey respectively.

Estimates of off-farm storage are done through surveying that targets all commercial facilities that store grain and oilseeds. These surveys occur during the first two weeks of the month the report is released. Surveys ask for storage capacities of facilities and quantities of stored grains and oilseeds of both new and old crop. The quarterly survey to get these estimates attempts to survey over 9,000 facilities. Standard adjustments are made for non-reporters based on historical data (*Guide to Sample Surveys,* 2012).

The WASDE report updates its projection of beginning stocks and usage based on changes in Grain Stocks Report. For example, according to the October 2016 WASDE (about corn), "Projected feed and residual use for 2016/17 is lowered, despite the larger crop, reflecting implications of the lower-than-expected disappearance for 2015/16 indicated by the June 30 Grain Stocks report" (p. 2). It is plausible that since the Grain Stocks report tends to be released over a week prior to the upcoming WASDE and Crop Progress reports (except for January), it has the potential to increase speculation in the days leading up to the release of the WASDE.

Crop Progress

The Crop Progress report has been released by NASS since 1995. The reports provide a detailed analysis of major crop conditions, including for corn and soybeans. Average topsoil and subsoil

conditions are reported for each state, as is the average number of days suitable for field work. Throughout the course of the year, the report updates both the progress (such as percent of soybeans setting pods) and condition of crops in different states. Conditions ratings are Very Poor, Poor, Fair, Good, and Excellent, and the report estimates the percentage of new crops both across the U.S and in major producing states that fall into each category.

Each state participates in crop progress and condition reporting. States maintain lists or reporters, who report crop progress and condition in their area each week. According to NASS's *Guide to the Sample Surveys and Census Programs of NASS* (2012), each report accounts for at least 75 percent of acreage for major commodities. Surveyed operators are asked to estimate the proportion of each crop that is at each stage of development and what proportion of each crop belongs to each of the five condition categories. Data from operators are received through mail and online as of Sunday, and the report is finalized by 4:00 p.m. Eastern Time of Monday each week.

The crop progress report can give market participants information about the quality of crops in the field throughout the growing season. Because of this, it provides information about coming supply that goes beyond acreage estimates. While acreage is one piece of supply, yield is another. According to Vogel and Bange (1999), production forecasts used in the WASDE and Crop Production reports are made based on current crop conditions and are projected with the assumption that average crop conditions will hold for the remainder of the season. These assumptions include, e.g. that precipitation and temperature will remain normal and that the first killing frost date will be the historical average. The important point is that as crop conditions change throughout the year, yield forecasts also change, often because of changing weather.

Crop Production

NASS's Crop Production Report has provided monthly estimates of acreage, harvest, and yield for major U.S crops since 1964. Forecasts for corn and soybeans are usually given in the August report; the subsequent WASDE reports use the Crop Production forecasts for acreage and yield.

Production estimates are made of two components: acreage and yield. Initial acreage estimates come from the June Acreage report; this estimate usually does not change during the crop year. From August until November, yield forecasts/estimates are generate from two types of surveys. The Crop Progress report is used to estimate the conditions of the crop, which go into monthly yield forecasts. As with the other reports, these estimates are as of the first of the month that the report is released on.

The monthly yield forecasts/ estimates are obtained first from the June survey and updated each month. A subset of respondents is chosen to prevent questioning farmers who are not currently growing the commodity of interest. These farmers are asked their expected yield pre-harvest and their actual harvest yield post-harvest (with weighting given to operations based on acreage at harvest). Area frame sampling is used to obtain objective yield forecasts each month. These occur in the largest

producing states of each commodity and are based on physical crop characteristics in the field (Vogel and Bange, 1999).

The Crop Production report is most relevant to corn and soybean markets starting with the August report, when forecasts for these crops are provided, but the actual values remain unknown. As stated, the Crop Production report is usually released simultaneously with the WASDE and provide the same acreage and yield forecasts starting with the August report. The WASDE provides additional forecasts of demand, while the Crop Production report gives a more detailed analysis of production across different states.

WASDE

The World Agricultural Supply and Demand Estimates (WASDE) is a monthly report produced by the World Agricultural Outlook Board. It combines information from multiple agencies to provide supply and demand forecasts for major U.S crops including corn and soybeans. A major part of each WASDE are the balance sheets for the listed commodities. Supply forecasts/ estimates (beginning stocks, imports, and production) and demand forecasts/ estimates (domestic use, exports, and ending stocks) are given separately and come from various agencies and forecasting techniques. Agencies including the Foreign Agricultural Services, Economic Research Services, NASS, and Agricultural Marketing Services all provide data and input to reach the final forecasts and estimates. Estimates are continually reviewed and revised as new information comes in throughout the year. Each month, the WASDE is prepared under lock-up conditions to guarantee that all market participants receive the same information at the same time (Vogel and Bange, 1999).

Supply and demand forecasts/ estimates for major commodities are continually changed and updated each month. These updates can change market participants' ideas about prices and subsequently impact futures prices. The May WASDE is the first to provide forecasts for the coming crop year (i.e. the crops that are currently in the field). Production forecasts come from forecasts and estimates of both yield and acreages. Acreage estimates come from the Planting Intentions report in March for WASDE reports between May through July, while subsequent reports use the June Acreage reports. Yield forecasts come from crop progress and weather pattern/satellite analysis. Beginning in August, NASS Crop Production report data is used to forecast production in balance sheets. Historical patterns and data from other agencies are used to project consumption in the balance sheets (Vogel and Bange, 1999).

DATA

Release dates and times for reports were gathered through multiple sources. NASS reports and the WASDE release dates were gathered from Cornell's Mann Library database, which contains all WASDE, Crop Progress, Quarterly Stocks, Acreage, Prospective Planting, and Crop Progress reports released. Release times were gathered from individual reports, agency publications about crop reporting, and personal contact with the USDA and NASS.

Since 1985, major NASS reports (Crop Production, Quarterly Stocks, Acreage, Prospective Plantings) have followed the released times of the WASDE report. From 1985 to 1994, these reports were released at 3:00 pm Easter Time; after May 10, 1994, the reports were all scheduled for released at 8:30 am Easter time. In 1985, the WASDE and Crop Production report were set to be releases simultaneously. Additionally, the January Quarterly Stocks reports were added to the release date of the January WASDE and Crop Production to reduce the number of release days; this implementation was finalized in 1987 (Allen. R, 2007). In January 2013, the major reports release times were switched to 12:00 pm Eastern Time release times (USDA, Office of Comminutions, 2012).

For almost all months in the sample, WASDE and Crop Production were released simultaneously. Generally, this occurs between the 9th and 12th of each month. Prior to 1987, the Grain Stocks' release months were generally February, April, July, and September. As mentioned previously, in January 1987 the Grain Stocks release dates were changed. In 1985, NASS was contemplating changing the corn marketing year from beginning October 1 to beginning September 1; this matched with changing the reference date for new stocks from January 1 to December 1, which would first be reported in the January Quarterly Stocks report (Allen. R, 2007). Following 1986, the release dates of the Grain Stocks report were the beginning of January, and the end of March, June, and September.

The Prospective Plantings report has followed the same release time schedule as the WASDE since it is a major NASS report (Allen. R, 2007). Since 1987, the report has usually been released on March 31st of each year, but occasionally on the 28th, 29th, or 30th. In 1985, the report was released on February 15th, and in 1986 it was released on March 18th.

The Crop Progress report is released every Monday during the growing season (April-November) after 4:00 p.m. ET; the report has been released since April 1995. If a Monday corresponds with a federal holiday, the release day is moved to Tuesday. The June Acreage report has been released since 1975, generally on June 30th, but occasionally on the 27th, 28th, or 29th except during the 1986-1989 crop years, when the Acreage reports were released as a part of the Crop Production reports.

EIA reporting on the production of fuel ethanol has been done since June 2010. Data on weekly production (in thousands of barrels per day) is released through the EIA online database every Wednesday at 10:30 a.m. Eastern Time for the week ending the previous Friday. When Federal holidays fall on a Wednesday, data is released the next day at 11:00 a.m. Eastern Time (*Weekly Petroleum Status Report Schedule,* 2017).

Finally, export data is released Thursdays at 8:30 am Eastern Time, except on federal holidays. If a Federal holiday falls on Thursday, reports are released the following day.

The entire sample has 8,117 days, and at least one report was released in 3,127 of those days. Except for the crop progress and ethanol production reports, all others were available since the beginning of the sample. Reports on weekly exports and crop progress have the most observations, since they have a higher frequency compared to others. On the other hand, reports on prospective planting and acreage have the least observation due to their lower frequency (Table 1).

Many reports have overlapping release dates. Table 1 shows the number of days in which each report was released on the same day as at least one other report. For example, out of the 387 days in which the WASDE report was released, another report was also released in 241 days, two other reports were also released in 139 days, and three other reports were also released in 6 days (Table 1). Hence, in almost all days in which the WASDE report was released, there was at least another report released on the same day. The same can be said for the reports on prospective planting, acreage, quarterly stocks and crop production (Table 1).

Table 1: Number of days in which each report was released between January 7, 1985 and March 24, 2017

	WASDE	Prospective planting	Acreage	Crop progress	Quarterly stocks	Weekly exports	Crop production	Ethanol production
Total number of days in which each report was released	387	32	27	769	129	1,677	385	351
First release date in the sample	1/7/1985	1/7/1985	1/7/1985	4/3/1995	1/7/1985	1/7/1985	1/11/1985	6/9/2010
Number of days in which each report was released with at least one other report on the same day								
one other report	241	21	15	4	54	15	233	5
two other reports	139	9	11	21	44	99	136	18
three other reports	6	0	0	1	5	5	6	1
four other reports	0	0	0	0	0	0	0	0
five other reports	0	0	0	0	0	0	0	0
six other reports	0	0	0	0	0	0	0	0
seven other reports	0	0	0	0	0	0	0	0
total	386	30	26	26	103	119	375	24

In order to investigate the impact of reports on prices, daily futures price data between January 1985 and March 2017 for both corn and soybeans were collected from the CME Group. Both price series refer to the nearby futures contract, with rollover happening on the first day of the delivery month. Since reports are released during the day, we will focus on the daily percentage returns (r) based on the open and close prices of the futures market as shown in equation 1, where p_t^C is the close price on day t and p_t^O is the open price on day t.

$$r_t = \ln\left(\frac{p_t^C}{p_t^O}\right) \quad (1)$$

Table 2 presents summary statistics for absolute returns $(|r|)$ and squared returns (r^2). Mean absolute returns and mean squared returns are 1.0252% and 0.0203% for corn, and 0.9552% and 0.0172% for soybeans, respectively, and they are all statistically distinguishable from zero at 1%. Summary statistics also suggest positive skewness and high kurtosis in all series. Charts of daily returns, absolute returns and squared returns are shown in the Appendix.

Table 2: Summary statistics for daily absolute returns (%) and squared returns (%) for corn and soybeans – January 1985 to March 2017 [(a)]

	Corn		Soybeans	
	$\lvert r \rvert$	r^2	$\lvert r \rvert$	r^2
Mean	1.0252 [(b)]	0.0203 [(b)]	0.9552 [(b)]	0.0172 [(b)]
Median	0.7426	0.0055	0.7185	0.0052
Maximum	10.5519	1.1113	8.8000	0.7745
Minimum	0.0000	0.0000	0.0000	0.0000
Std. deviation	0.9915	0.0463	0.8962	0.0370
Skewness	2.1199	7.0442	2.0022	6.2151
Kurtosis	10.1368	89.3787	9.1779	66.2409
Observations	8,117	8,117	8,117	8,117

(a) Returns are calculated as the percentage difference between open and close prices; (b) Statistically distinguishable from zero at 1%.

RESULTS

In this section, preliminary results will be discussed regarding mean returns on days when different reports are released. First, looking at all reports together, Table 3 shows mean absolute returns and mean squared returns for days when reports were released and days when no reports were released. For both corn and soybeans, mean returns are higher on report days than on non-report days, and the difference between them is statistically distinguishable from zero at 1% (Table 3). This means a larger gap between the open and close prices, suggesting larger price adjustment as new information was released in the market. Further, focusing only on report days, it can be explored whether returns differ

according to the number of reports released. Table 3 shows mean returns on days when only 1 report was released, when 2 reports were released, when 3 reports were released, and then when 4 reports were released. Mean returns become higher as the number of reports increase, suggesting also that there is a larger gap between open and close prices as more information (reports) arrive in the market. These differences between mean returns are statistically distinguishable from zero at 1% in all cases in Table 3.

Table 3: Daily mean absolute returns (%) and mean squared returns (%) for corn and soybeans on report and non-report days for all reports – January 1985 to March 2017

		Corn		Soybeans	
	Obs.	$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$	$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$
Report days [(a)]	3,127	1.1555	0.0258	1.0316	0.0202
Non-report days [(b)]	4,990	0.9436	0.0169	0.9073	0.0152
p-value [(c)]		0.0000	0.0000	0.0000	0.0000
Report days: 1 report [(d)]	2,668	1.0855	0.0217	0.9882	0.0180
Report days: 2 reports [(e)]	294	1.4364	0.0403	1.2217	0.0305
Report days: 3 reports [(f)]	159	1.7551	0.0636	1.3768	0.0366
Report days: 4 reports [(g)]	6	2.5945	0.1221	1.8892	0.0527
p-value [(c)]		0.0000	0.0000	0.0000	0.0000

(a) Report days: days in which at least one report was released; (b) Non-report days: days in which no report was released; (c) p-value for the Welch F-test for equality of means; (d) Number of days in which only 1 report was released; (e) Number of days in which 2 reports were released; (f) Number of days in which 3 reports were released; (g) Number of days in which 4 reports were released.

Now, our attention turns to specific reports, and mean returns on report days and non-reports days for each individual report will be investigated. Note that report and non-report days refer exclusively to a specific report. For example, a report day for the WASDE refers to a day when the WASDE report was released, regardless other reports were released on the same day. A non-report day for the WASDE refers to a day when there was no WASDE release, but other reports could have been released on that day.

Table 4 shows mean returns for report and non-report days for each individual report separately. For most reports, mean returns are higher on report days than on non-report days, and the difference is statistically distinguishable from zero at 1%. The only two exceptions are the reports on export sales and ethanol production. For the report on export sales, the difference between mean returns on report and non-report days is not statistically distinguishable from zero in any case. For the report on ethanol production, the difference between mean returns on report and non-report days for corn is not statistically distinguishable from zero. For soybeans, the difference between mean squared returns is also not statistically distinguishable from zero, but the difference between mean absolute returns is statistically distinguishable from zero. In this case, mean absolute returns for soybeans are higher on report days than on non-report days.

Table 4: Daily mean absolute returns (%) and mean squared returns (%) for corn and soybeans on report and non-report days for each individual report – January 1985 to March 2017

	Obs.	Corn		Soybeans	
		$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$	$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$
WASDE					
report days [(a)]	387	1.3739	0.0373	1.1988	0.0296
non-report days [(b)]	7,730	1.0078	0.0195	0.9430	0.0165
p-value [(c)]		0.0000	0.0000	0.0000	0.0000
Prospective planting					
report days [(a)]	32	2.3022	0.0845	1.6663	0.0516
non-report days [(b)]	8,085	1.0202	0.0201	0.9524	0.0170
p-value [(c)]		0.0000	0.0000	0.0000	0.0000
Acreage					
report days [(a)]	27	3.2714	0.1848	2.0019	0.0602
non-report days [(b)]	8.090	1.0177	0.0198	0.9517	0.0170
p-value [(c)]		0.0000	0.0000	0.0000	0.0000
Crop progress					
report days [(a)]	769	1.3281	0.0310	1.1802	0.0248
non-report days [(b)]	4,762	1.1520	0.0246	1.0387	0.0197
p-value [(c)]		0.0000	0.0021	0.0001	0.0015
Quarterly stocks					
report days [(a)]	129	2.3136	0.0992	1.6722	0.0495
non-report days [(b)]	7,988	1.0044	0.0191	0.9436	0.0166
p-value [(c)]		0.0000	0.0000	0.0000	0.0000
Export sales					
report days [(a)]	1,677	1.0145	0.0200	0.9497	0.0168
non-report days [(b)]	6,440	1.0280	0.0204	0.9566	0.0172
p-value [(c)]		0.6186	0.7174	0.7779	0.6707
Crop production					
report days [(a)]	385	1.3523	0.0363	1.1913	0.0292
non-report days [(b)]	7,728	1.0093	0.0196	0.9433	0.0166
p-value [(c)]		0.0000	0.0000	0.0000	0.0000
Ethanol production					
report days [(a)]	351	1.1534	0.0246	0.8860	0.0145
non-report days [(b)]	1,358	1.2184	0.0269	1.0008	0.0179
p-value [(c)]		0.3198	0.5056	0.0280	0.1008

(a) Report days: days in which a given report was released, with or without other reports released on the same day; (b) Non-report days: days in which a given report was not released; (c) p-value for the Welch F-test for equality of means.

Consistent with previous studies, Table 4 also shows evidence that new information released in those reports generally have an impact on grain prices. However, the main objective of this study is to explore the impact of reports released on the same day or within a few days from each other. For example, Table 4 suggests that mean returns on WASDE report days are higher than on non-report

days. The question is whether the higher returns on WASDE report days are entirely due to the WASDE report or whether there might also be an influence of another report released on the same day.

Table 5 shows mean returns only for report days, but this time the report days are separated according to the number of reports released on each day. For example, there are 387 report days for the WASDE in the sample, but only once the WASDE was the only report released on the report day. In 241 report days, there was one other report released in addition to the WASDE. In 139 report days, there were two other reports released in addition to the WASDE. Finally, in 6 report days, there were three other reports released in addition to the WASDE. Comparing these sub-samples, there is generally no statistically significant difference between mean returns. The only exception are the mean squared returns for corn, whose differences are statistically significant at 10% (Table 5). These results suggest that, in general, returns on WASDE reports days do not differ according to how many more reports are released on the same day. Similar findings hold for reports on crop progress and ethanol production (Table 5).

Table 5: Daily mean absolute returns (%) and mean squared returns (%) for corn and soybeans on report days only – January 1985 to March 2017

		Corn		Soybeans	
	Obs.	$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$	$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$
WASDE					
WASDE only [a]	1	0.6161	0.0038	1.0303	0.0106
WASDE+1 [b]	241	1.2532	0.0295	1.0895	0.0248
WASDE+2 [c]	139	1.5358	0.0474	1.3597	0.0372
WASDE+3 [d]	6	2.5945	0.1221	1.8892	0.0527
p-value [e] [f]		0.1343	0.0770	0.1145	0.2113
Prospective planting					
Prosp. planting only [a]	2	0.3594	0.0016	0.4814	0.0032
Prosp. planting+1 [b]	21	2.3354	0.0833	1.8779	0.0649
Prosp. planting+2 [c]	9	2.6564	0.1056	1.4358	0.0313
p-value [e]		0.0004	0.0015	0.0653	0.0213
Acreage					
Acreage only [a]	1	0.9929	0.0025	0.3738	0.0014
Acreage+1 [b]	15	3.0766	0.1617	2.4456	0.0841
Acreage+2 [c]	11	3.7887	0.2328	1.5448	0.0330
p-value [e] [f]		0.5501	0.5697	0.0930	0.0562
Crop progress					
Crop progress only [a]	743	1.3093	0.0302	1.1593	0.0243
Crop progress+1 [b]	4	2.0315	0.0449	1.8352	0.0445
Crop progress+2 [c]	21	1.7123	0.0485	1.8211	0.0412
Crop progress+3 [d]	1	4.4490	0.1979	0.6473	0.0042
p-value [e] [f]		0.1374	0.3024	0.0384	0.1774

Table 5: Daily mean absolute returns (%) and mean squared returns (%) for corn and soybeans on report days only – January 1985 to March 2017 (continued)

	Obs.	Corn		Soybeans	
		$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$	$\lvert\bar{r}\rvert$	$\lvert\bar{r}^2\rvert$
Quarterly stocks					
Quart. stocks only [a]	26	1.3376	0.0401	1.0867	0.0208
Quart. stocks+1 [b]	54	2.3849	0.0945	1.8471	0.0578
Quart. stocks+2 [c]	44	2.8131	0.1388	1.7506	0.0548
Quart. stocks+3 [d]	5	2.2236	0.1070	2.1376	0.0623
p-value [e]		0.0364	0.0827	0.0604	0.0567
Export sales					
Exports only [a]	1,558	0.9761	0.0177	0.9355	0.0162
Exports+1 [b]	15	1.2026	0.0256	0.8215	0.0121
Exports+2 [c]	99	1.5209	0.0497	1.1659	0.0262
Exports+3 [d]	5	2.3707	0.1190	1.4668	0.0312
p-value [e]		0.0316	0.0868	0.2127	0.2495
Crop production					
Crop prod. only [a]	10	0.8558	0.0112	0.7313	0.0079
Crop prod.+1 [b]	233	1.2335	0.0284	1.0894	0.0248
Crop prod.+2 [c]	136	1.5376	0.0477	1.3690	0.0376
Crop prod.+3 [d]	6	2.5945	0.1221	1.8892	0.0527
p-value [e]		0.0583	0.0062	0.0337	0.0024
Ethanol production					
Ethanol only [a]	327	1.0931	0.0205	0.8550	0.0127
Ethanol+1 [b]	5	0.9999	0.0198	1.2899	0.0215
Ethanol+2 [c]	18	2.1504	0.0932	1.1637	0.0360
Ethanol+3 [d]	1	3.7131	0.1379	4.0013	0.1601
p-value [e] [f]		0.2081	0.2993	0.3959	0.4852

(a) Report "only": days in which only a given report was released, without any other report released on the same day; (b) Report "+1": days in which a given report is released and one more report is released on the same day; (c) Report "+2": days in which a given report is released and two more reports are released on the same day; (d) Report "+3": days in which a given report is released and three more reports are released on the same day; (e) p-value for the Welch F-test for equality of means; (f) events with only one observation are not included in the test.

On the other hand, distinct results are found for reports on acreage, quarterly stocks, export sales, and crop production. For the acreage report, there is no statically significant difference between mean returns on report days when one other report was also released and report days when two other reports were released for corn. But there is evidence of differences in mean returns for soybeans (Table 5). Similarly, for export sales reports, there is evidence of distinct mean returns for corn, but not for soybeans. Finally, for reports on quarterly stocks and crop production, differences in mean returns are statistically significant for both corn and soybeans.

CONCLUSIONS

Overall, preliminary results suggest that crop reports have an impact on grain prices as they bring new information to the market. Mean returns on report days are generally found to be higher than on non-report days. Focusing on individual reports, however, does not allow us to state whether the impact on grain prices was caused exclusively by a given report. It is possible that other reports released on the same day might also be influencing grain prices.

Taking the report on quarterly stocks as an example, mean absolute returns for corn on report days and non-report days are 2.31% and 1.00%, respectively. Looking only at report days, mean absolute returns are 1.33% when quarterly stocks was the only report on that day, 2.38% when one other report was released on the same day, 2.81% when two other reports were released on the same day, and 2.22% when three other reports were released on the same day. These numbers provide preliminary evidence that, in general, mean returns on quarterly stocks report days might actually be "inflated" by other reports released on the same day. If this report is investigated by itself, without considering other reports that are sometimes released on the same day, findings about its true impact on grain prices might be misleading.

Similarly, looking at the report for crop production for soybeans, mean absolute returns on report days and non-report days are 1.19% and 0.94%, respectively. Now focusing on report days only, mean absolute returns are 0.73% when crop production was the only report on that day, 1.08% when one other report was released on the same day,1.36% when two other reports were released on the same day, and 1.88% when three other reports were released on the same day. Again, exploring the impact of the crop production report on grain prices without taking into account other reports released on the same day may lead to ambiguous conclusions.

The next step of this project is to proceed with a more comprehensive and robust analysis of the impact of different reports on grain prices, trying to identify the influence of individual reports when they are released on the same day.

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APPENDIX

Figure 1: Daily open-close returns, absolute returns and squared returns for corn and soybeans, January 1985 to March 2017