Have Extended Trading Hours Made Agricultural Commodity Markets Riskier?

By Nathan Kauffman

Traders in agricultural commodity markets view volatility differently depending on their objectives. Producers generally dislike uncertainty and often trade on futures markets to mitigate the risk associated with potential changes in prices. If futures markets themselves become excessively risky, however, due to high volatility in the prices of futures contracts, producers may begin to question the use of futures markets to mitigate risk. Unlike producers, nonproducers—traders with no direct involvement in producing or using the underlying commodity—seek to profit from uncertainty by predicting which direction prices are headed. Volatile futures prices, therefore, present nonproducers with a profit opportunity.

Commodity exchanges have undergone structural changes recently, leading to concerns about price volatility and risk management. In May 2012, the Chicago Mercantile Exchange (CME) extended its electronic trading hours. Since then, the CME and other exchanges have been open for trading during the release of key government supply and demand reports. Producers are concerned that trading during the release of U.S. Department of Agriculture (USDA) reports will exacerbate price volatility, thus distorting markets and making risk management strategies more difficult. Proponents of extended trading hours, however, have argued for greater flexibility and modernization in commodity trading.

Nathan Kauffman is an assistant vice president and branch executive at the Omaha branch of the Federal Reserve Bank of Kansas City. This article is on the bank's website at www.KansasCityFed.org.

This article examines the effect of extended trading hours on intraday volatility in corn futures markets. The article concludes that trading during USDA supply and demand reports has led to periods of elevated volatility that, although very brief, could present challenges for some producers seeking to manage risk. However, many producers whose long-term trading strategies are not sensitive to brief spikes in intraday volatility are unlikely to be adversely affected.

Producers have, at times, expressed concern that nonproducer participation in commodity markets impinges on their ability to mitigate risk. Greater market participation, however, has had the benefit of helping absorb the volatility shocks generated by the release of new information. In particular, by increasing liquidity in commodity markets, nonproducer participation appears to have exerted a downward effect on volatility, at least partially limiting the rise resulting from extended trading hours.

Section I discusses how price volatility affects agricultural producers and describes their concerns about extended trading hours. Section II analyzes the effects of extended trading hours on the magnitude and persistence of volatility spikes following the release of monthly USDA reports. Recognizing that volatility patterns are not constant across years, Section III offers possible explanations for observed shifts in these patterns over time.

I.   PERCEPTIONS OF PRICE VOLATILITY IN COMMODITY MARKETS

Recent structural changes in agricultural commodity markets have raised questions about potential implications for traders. In 2012, two major commodity exchanges expanded their trading hours, allowing trades during the release of key government reports. Agricultural producers are concerned that extended trading hours may lead to increased volatility and make risk management more challenging. Nonproducers have, in general, supported the change, which has improved access to trading in commodity futures markets.

Futures trading by producers and nonproducers

Price volatility is often considered a measure of risk, with high levels of volatility typically associated with elevated risk. Volatility tends to

be high when uncertainty is high in a specific market or when markets are surprised by new information. As new data is released and beliefs about market fundamentals change, prices tend to swing more widely. Conceptually, these swings may be more pronounced if the information is released when markets are open and traders are attempting to process the new information as quickly as possible before placing a trade.

Volatility can be interpreted over various time horizons depending on trading objectives. Traders whose strategies are affected by price changes over short time intervals may conclude that intraday price changes create a volatile market even if prices are generally stable over a longer time horizon. Conversely, prices may not change substantially over short time intervals, but only over longer time horizons. In this case, traders affected by fluctuating prices over a longer horizon may also conclude that prices are volatile. In either case, volatile prices have the potential to make agricultural producers' risk management decisions more difficult.

Farming has two basic forms of risk—price risk and production risk. Price risk is the exposure to potential price fluctuations between the time of planting—when decisions are made—and harvest. These decisions include, for example, which crops to plant, choice of seeds, or potential fertilizer applications. Grain producers often rely on futures markets to manage price risk, a strategy known as hedging. By hedging, producers expecting to harvest a certain amount of grain can effectively lock in their sales price by selling their output in advance using futures contracts. Production risk, arising from uncertainty in crop yields, is typically addressed through federal crop insurance.[1]

Research has shown that producers' hedging decisions often depend on futures prices, particularly when production risk and price risk are correlated (Lapan and Moschini). Price and production risk are usually negatively correlated in the major crop-producing regions of the country. Separate from futures hedging, this correlation provides producers with a natural hedge by compensating production losses with price gains. As prices rise, the effectiveness of the natural hedge begins to outweigh the relative effectiveness of a futures hedge, potentially causing producers to revise their futures hedge when prices change. Using Iowa as an example, a local drought that reduces expected corn yields only in Iowa will raise futures prices because Iowa accounts for nearly 20 percent of U.S.

production. If futures prices increase, producers in Iowa may want to lower their hedged positions because of the inverse relationship between expected production and prices.

When production and price risk are uncorrelated, the theoretically optimal hedging decision would be unaffected by changes in futures prices. A hedging decision made by a small farming operation in Mississippi, a state that accounts for less than 1 percent of U.S. corn production, would differ from the Iowa example. A local drought that reduces corn yields in Mississippi would be unlikely to affect futures prices significantly because there is relatively little corn grown in the Southeast. A change in futures prices would be unlikely to affect the hedging decision of a farmer in Mississippi because of the lack of a connection between his expected production and prices.

Producers employ many different types of hedging strategies that may be affected by price volatility. One example of such a strategy is the use of stop-loss orders. Stop-loss orders limit losses caused by adverse price movements beyond a trader-defined price level, or threshold. Suppose that the futures price for corn is $5.40 per bushel. A producer might seek to limit his losses by setting a threshold of $5.00 per bushel that would automatically trigger a sell order if prices dip to that level. Extreme price volatility, even if brief, could push prices to $5.00—triggering the trade—but subsequently push prices as high as $5.80 and potentially back to $5.40.[2] In this case, price volatility would cost the farmer 40 cents per bushel relative to simply selling at $5.40. For a small farming operation of 300 acres with an average yield of 200 bushels per acre that sought to hedge a third of its expected output, volatility would result in a loss of $8,000.

Unlike producers, nonproducers often prefer markets with higher volatility. Called speculators by some market analysts, nonproducers seek to profit from commodity futures investments by correctly anticipating price movements. If prices stay constant, nonproducers have no way to profit in futures markets.[3]

Nonproducers play two important roles in agricultural commodity markets. First, they provide additional liquidity that allows potential market shocks to be more easily absorbed. Second, nonproducers frequently buy futures contracts that producers sell when hedging. This mechanism allows producers to lock in a price for their crop in

advance, with nonproducers accepting the price risk that producers prefer to avoid.

Structural changes at commodity market exchanges

Recent structural changes at commodity exchanges have sparked concerns about price volatility. In May 2012, the Intercontinental Exchange (ICE) began offering futures contracts in corn, wheat, soybeans, soybean oil, and soybean meal in addition to its other commodity offerings. At the same time, the ICE announced that trading in agricultural commodities would be open for 22 hours per day. The CME responded by extending its trading hours as well. Since May 2012, agricultural commodity futures contracts have been traded at the CME for 21 consecutive hours, from 5 p.m. CST to 2 p.m. CST the next day (Figure 1).[4]
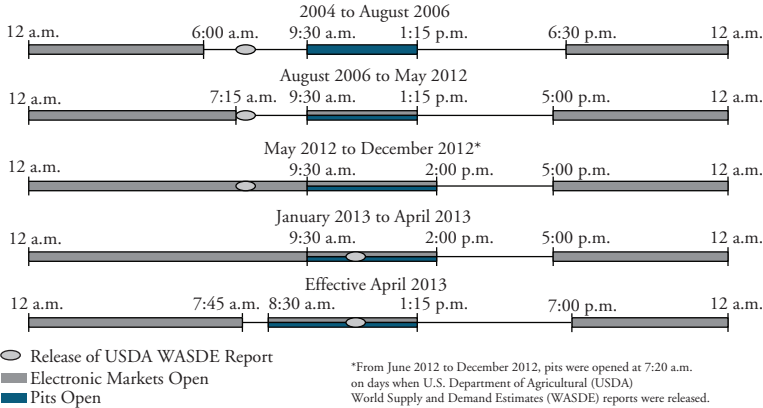
With the expansion of trading hours, markets have been open during the release of important government agricultural reports. In particular, the CME has been open for trading during the USDA's monthly release of the World Agricultural Supply and Demand Estimates (WASDE).[5] Kept confidential prior to its release, WASDE reports provide agricultural commodity markets with important information about current and projected agricultural market fundamentals. For corn, WASDE reports provide highly anticipated projections of global feed, food, seed, industrial use, and export demand.

Some traders have supported the extension of trading hours. Proponents of around-the-clock trading say other markets have sufficiently adapted to the change, citing energy markets as an example. They also say the globalization of commodity markets has created a need for extended hours as a way to deal with different time zones across countries.

In addition to extended trading hours, the level of nonproducer trading has increased and exchanges have shifted to electronic markets in recent years. Producers suggest these changes will compound the effects of extended trading hours on price volatility. Defined by the Commodity Futures Trading Commission (CFTC) as "non-commercial traders," nonproducers held 38 percent of total corn futures contracts on average between 2006 and 2010, up from 31 percent in 2000 and 26 percent in 1990 (Chart 1). Moreover, electronic trading at the CME now accounts

Figure 1

CHICAGO MERCANTILE EXCHANGE HOURS OF OPERATION

2004 to August 2006

| 12 a.m. | 6:00 a.m. | 9:30 a.m. | 1:15 p.m. | 6:30 p.m. | 12 a.m. |

August 2006 to May 2012

| 12 a.m. | 7:15 a.m. | 9:30 a.m. | 1:15 p.m. | 5:00 p.m. | 12 a.m. |

May 2012 to December 2012*

| 12 a.m. | 9:30 a.m. | 2:00 p.m. | 5:00 p.m. | 12 a.m. |

January 2013 to April 2013

| 12 a.m. | 9:30 a.m. | 2:00 p.m. | 5:00 p.m. | 12 a.m. |

Effective April 2013

| 12 a.m. | 7:45 a.m. | 8:30 a.m. | 1:15 p.m. | 7:00 p.m. | 12 a.m. |

◯ Release of USDA WASDE Report
▬ Electronic Markets Open
▬ Pits Open

*From June 2012 to December 2012, pits were opened at 7:20 a.m. on days when U.S. Department of Agricultural (USDA) World Supply and Demand Estimates (WASDE) reports were released.

for about 95 percent of daily trading volume for agricultural futures contracts (Chart 2).

An agricultural boom has sparked investor interest in agricultural commodities. Corn prices, which doubled from 2005 to 2007, have again nearly doubled. The surge in prices has caused the volume of futures contracts traded on exchanges to soar in recent years. At the CME, corn futures volume has jumped by roughly 300 percent over the past decade (Chart 3). Demand for agricultural commodities is also surging across the world. On China's Dalian Commodity Exchange, which began trading corn futures in September 2004, the volume of corn futures contracts grew threefold from 2005 to 2006 before softening after the global financial crisis. Commodity exchanges in South America and Europe have seen higher trading volumes as well.

Critics of the extension of trading hours express two general concerns (USDA 2012). The first concern is that, because USDA reports are released while markets are open, small agricultural enterprises may not have the resources to process new information quickly enough to place trades in competition with large trading firms. Whereas producers specialize in commodity production, nonproducers typically have a comparative advantage in information technology. Large hedge funds often specialize in gathering information. Other commodity traders make huge investments to process trades faster than their competitors.

Chart 1

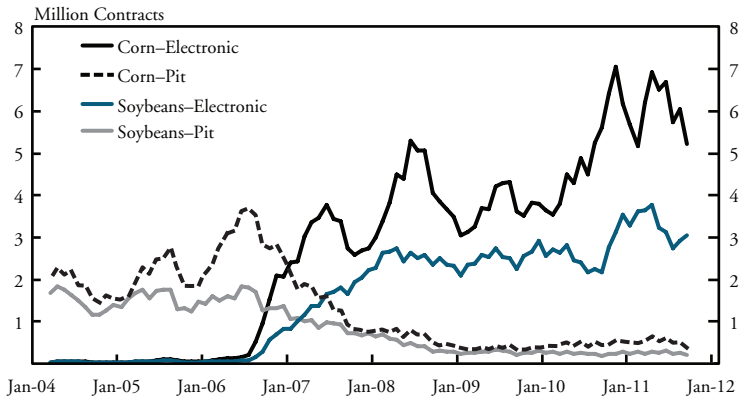## SHARE OF CORN FUTURES CONTRACTS HELD BY PRODUCERS AND NONPRODUCERS

Percent
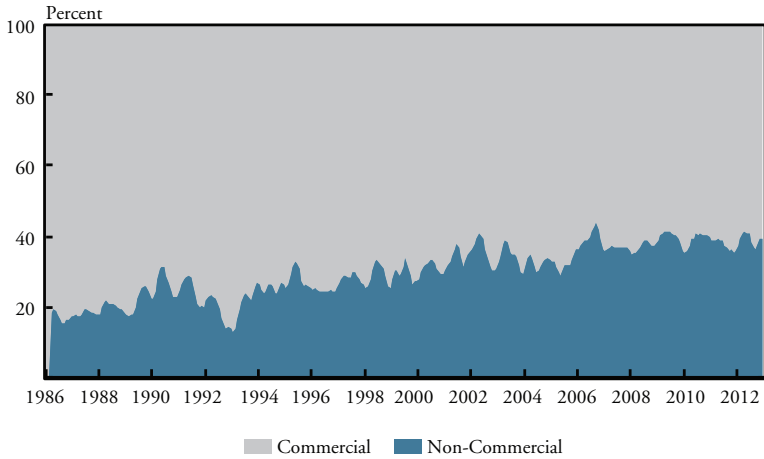
Source: Commodity Futures Trading Commission.
Note: Includes open interest from both futures contracts and futures-equivalent options.

Chart 2
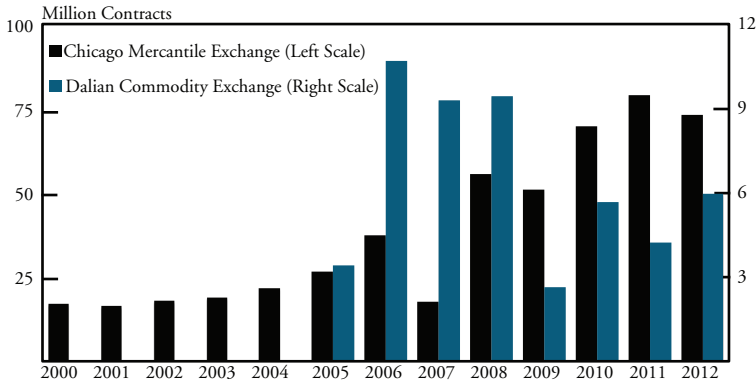
CME MONTHLY FUTURES CONTRACT VOLUME BY PLATFORM

Three-Month Moving Average

Million Contracts

Source: CME Group.

Chart 3
CORN FUTURES VOLUME

Million Contracts

Chicago Mercantile Exchange (Left Scale)
Dalian Commodity Exchange (Right Scale)

Source: Barchart.com Advanced Commodities Service.

For example, in the data center that houses the CME's GLOBEX electronic trading platform, traders pay up to $25,000 a month to have computers co-located next to the CME's servers so they can process trades faster (Bowley). In 2010, Hibernia Atlantic announced plans to spend $300 million to install fiber-optic cables between Chicago and New York to cut order transmission times by a mere three milliseconds (Troianovski). Because of their comparative advantage, hedge funds and high-frequency traders have been shown in some instances to earn higher returns than smaller traders (Baron, Brogaard, and Kirilenko). Addressing this concern as a result of extended trading hours, however, is beyond the scope of this article.

A second concern is that active trading during the release of extensive new information may exacerbate price volatility and impair the ability of producers to manage risk. This effect could constitute an external cost to producers and perhaps to society at large. The possibility of such a cost warrants close examination and is assessed below.

II.   EFFECTS OF EXTENDED TRADING HOURS ON PRICE VOLATILITY

The extension of trading hours at commodity exchanges has changed market dynamics. The release of WASDE reports while markets are open has led to brief spikes in the volatility of corn futures prices after the release. Price volatility, which has been only slightly

higher in the minutes preceding WASDE releases, has jumped sharply upon release and persisted for a short time afterward. These short bursts of high volatility stemming from extended trading hours could adversely affect some producers employing certain risk management strategies. There is, however, little indication that higher price volatility following a WASDE release persisted throughout the remainder of the trading day. In general, producers seeking to manage risk mainly over longer time horizons are unlikely to be adversely affected by the short-term instances of volatility arising from extended trading hours.

Price volatility can be measured in various ways. Typically, daily settlement prices for options have been used to measure the effect of WASDE releases on commodity price volatility (Sumner and Mueller; Fortenberry and Sumner; Isengildina-Massa and others; and Adjemian). In general, studies have found that WASDE reports contain significant information that is transmitted to futures markets in varying speeds and intensities. Prior to the extension of trading hours, Isengildina-Massa and others concluded that WASDE releases reduce volatility when using end-of-day prices to determine volatility.

However, using daily prices to determine the effect of the information release on volatility misses intraday effects. Higher frequency data clearly show a spike in volatility at the instant the reports are released. Intraday volatility can be important because many traders actively track market prices throughout the day when making trading decisions. Even brief periods of high volatility can affect risk management strategies. Moreover, if the release of WASDE reports while markets are open has affected volatility, the impact is likely to be most noticeable immediately after the release.

One simple way to way to measure the effect of WASDE releases and extended trading hours on price volatility is to compare the difference in volatility on WASDE-release days with a baseline. Baseline measures of volatility were developed separately for 2008, 2009, 2010, 2011, and 2012 using non-WASDE-release days—one baseline for each year. To determine the intraday effect, a calculated measure of volatility on WASDE-release days for each year was then compared with its respective baseline, obtained from information on non-WASDE-release days.[6]

Volatility was calculated using corn futures price data obtained from the CME for trades placed on its electronic platform, GLOBEX.

For each day from 2008 to 2012, volatility was calculated as a 60-second moving average of squared returns using the December futures contract price for corn.
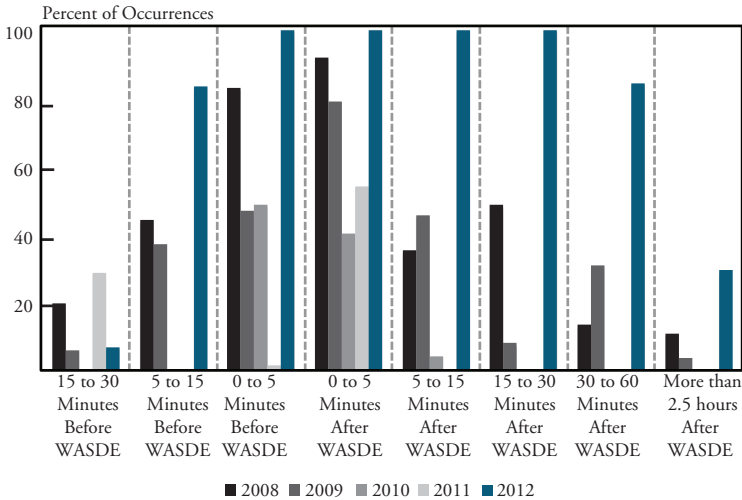
A baseline for each year was obtained by regressing volatility calculated from non-WASDE-release days on time variables. Specifically, each regression accounted for differences in month of year, hour of day, and the first three minutes of open outcry trading. Month dummy variables control for differences from one month to the next and hourly dummy variables are included from 7 a.m. to 1 p.m. to capture hour-specific intraday effects. The first three minutes of open outcry are included because, prior to May 2012, there was a gap in trading when both electronic markets and pits were closed (Figure 1). As a result, volatility spiked daily at 9:30 a.m. as pits reopened from the previous day's close and electronic markets reopened after a morning pause. Because WASDE was released at 7:30 a.m., markets were first able to process the information at 9:30 a.m. When considering minute dummy variables, only the first three minutes were significant in the regressions on non-WASDE days. These regressions provide estimates of the volatility on a typical, non-WASDE-release day. The results of these regressions and an interpretation of coefficients can be found in the Appendix and corresponding tables in the column labeled Model 1.

Corn is chosen for the analysis because it is often interpreted as the leading agricultural commodity. The December contract was used because it is the contract generally associated with the fall harvest. In addition, only the days from June 1 to November 6 of each year were used in the analysis for two reasons. First, trading hours were not extended until May 2012. From June to November in 2012, reports were released when markets were open. Second, the December futures contract is less heavily traded in the springtime compared with contracts of other months. Including springtime months in the analysis might underestimate the effects of WASDE releases on volatility during the key summer growing season and subsequent harvest.

Baseline estimates of volatility on non-WASDE days are compared with actual volatility on WASDE days. Volatility is considered higher on WASDE-release days when the estimate of volatility on WASDE-release days significantly exceeds the baseline estimate of volatility at

Chart 4

ELEVATED VOLATILITY ON WASDE RELEASE DAYS RELATIVE TO NON-WASDE BASELINE

Percent of Occurrences

15 to 30 Minutes Before WASDE · 5 to 15 Minutes Before WASDE · 0 to 5 Minutes Before WASDE · 0 to 5 Minutes After WASDE · 5 to 15 Minutes After WASDE · 15 to 30 Minutes After WASDE · 30 to 60 Minutes After WASDE · More than 2.5 hours After WASDE

■ 2008 ■ 2009 ■ 2010 ■ 2011 ■ 2012

a particular time of day. In this article, volatility will be referred to as "elevated" in these instances.[7]

In every year, volatility was significantly higher on many WASDE release days although the frequency of this elevated volatility differed across years (Chart 4). For example, in the five minutes after a release, volatility was significantly higher than non-WASDE days in 92 percent of the occurrences in 2008, 40 percent in 2010 and 100 percent in 2012. The results suggest that there are periods of high intraday volatility that could pose challenges for producers making risk-management decisions, although markets appear to be reacting to, and processing, the new information relatively quickly.

The extension of trading hours in 2012 appears to have led to a more pronounced period of elevated volatility in the minutes following WASDE releases. Higher volatility persisted significantly longer following WASDE releases in 2012 than in previous years (Chart 5). Although volatility was elevated for more than five minutes after WASDE releases in 2008 and 2009, it lasted considerably longer in 2012. In 2012, elevated volatility persisted for 30 consecutive minutes following

Chart 5

ACTUAL VOLATILITY AND EXPECTED VOLATILITY FOR WASDE-RELEASE DAYS
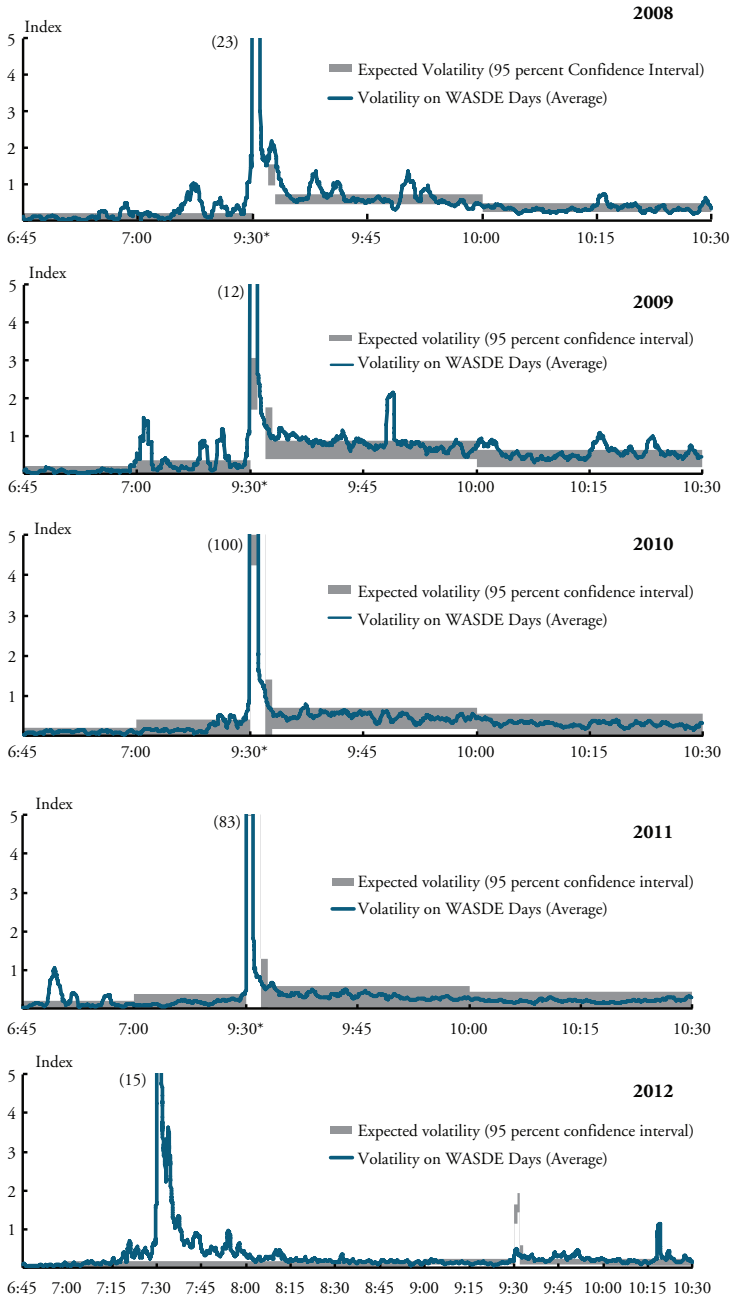
* The time gap between 7:15 a.m. and 9:30 a.m. when markets were closed, is omitted from the charts.
Notes: Volatility is indexed between 0 and 100 with a value of 100 corresponding to the maximum in the data between 2008 and 2012, which corresponds to 9:31 a.m. in 2010. Numbers in parentheses indicate the peak in volatility, exceeding the chart's scale.

WASDE releases. And, in the 30-to-60-minute window after WASDE releases, volatility was elevated 84 percent of the 30-minute span.

In the minutes preceding WASDE releases, there is only slight evidence of elevated volatility. In most years, volatility was somewhat higher than the baseline in the minutes immediately preceding a WASDE release as traders took positions in advance of the reports (Chart 5). However, in the five minute interval preceding WASDE releases, volatility was elevated in the majority of occurrences only in 2008 and 2012 (Chart 4). Conversely, elevated volatility was apparent in only 47 percent of occurrences in 2009, 49 percent in 2010, and 2 percent in 2011. Since 2008 there has been little evidence of elevated volatility more than 15 minutes before a WASDE release.

Although the analysis points to higher volatility up to 60 minutes following WASDE releases, the information contained in the releases was largely incorporated thereafter. Evidence suggests that volatility declined sharply within two or three hours after WASDE releases. Spikes in intraday volatility may be expected when new information is released, especially if the information is surprising. Although WASDE releases have frequently led to shifts in the level of prices, which have often persisted to the end of the trading day, the vast majority of this shift has taken place in the first 30 minutes of trading following the release. It is unlikely, then, that extended trading hours have significantly affected producers' risk management practices if the decisions are not dependent on intraday price movements since these shifts would have likely occurred even if trading hours were not extended. However, risk management strategies affected by intraday fluctuations are likely to be affected by the period of higher volatility following report releases.

The intraday patterns of elevated volatility obtained from the above analysis also highlight the value of liquidity. High levels of liquidity help markets absorb potential shocks and can help keep volatility subdued. Liquidity, as measured by the average volume of contracts traded in a given time frame, was generally at its highest from 9:30 a.m. to 10:30 a.m. on non-WASDE days (Chart 6). In contrast, trading volumes were highest at 7:30 a.m. on days when WASDE reports were released, and volumes were noticeably lower from 8:30 a.m. to 9:30 a.m. compared with later hours during open outcry trading. Spikes in volatility quickly dissipated in years prior to 2012 when the first

Chart 6

AVERAGE INTRADAY CORN FUTURES VOLUME PER MINUTE, 2012
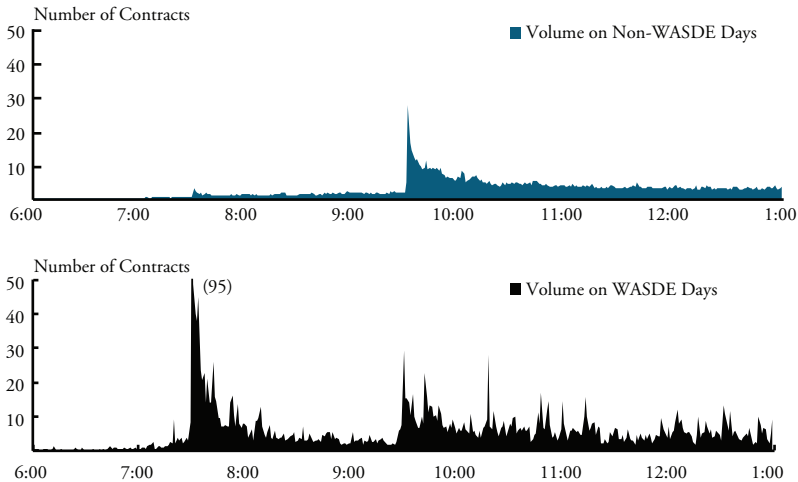
minutes of trading following WASDE releases (after 9:30 a.m.) were periods of high liquidity. Conversely, in 2012, the first minutes of trading following WASDE releases (after 7:30 a.m.) were periods of relatively low liquidity.[8] This result supports the USDA decision to move the WASDE release time to 11 a.m. in 2013.

In addition to differences in liquidity or trader participation strategies, there is potentially an alternative explanation for higher volatility associated with extended trading hours. Some anecdotal evidence suggests that individuals attempting to download WASDE precisely when it is released have faced significant delays, likely due to server congestion.[9] Thus, higher volatility may have persisted longer since May 2012 if some groups of traders, wishing to place a trade only after accessing WASDE, are unable to access the information at the same time as others with faster access.

III. EXPLAINING INTRADAY VOLATILITY PATTERNS ACROSS YEARS

The previous analysis shows that intraday volatility patterns have differed over the years. There are several potential explanations for this difference. One possibility is that some WASDE reports have contained

larger information surprises than others when considering underlying supply and demand fundamentals. Another possibility is that liquidity has differed based on trader participation. Specifically, the number of market participants (including nonproducers) and the volume of trading activity may explain some differences in volatility across years.

Unexpected information

The release of unexpected information in WASDE reports may help explain why the duration of elevated volatility was longer in some years. Every month, the USDA updates its estimates of supply, demand, and a range of forecasted prices. Information on supply includes inventory estimates, projected crop yields, projections of harvested acreage, and imports. Larger-than-expected adjustments in price expectations or in individual supply and demand projections may generate longer periods of elevated volatility as markets react to surprising information.

The size of adjustments in supply and demand estimates from one WASDE release to the next may be one factor explaining differences in volatility across years. In 2012, the average adjustment to projected corn yields, a widely reported headline number, was 5.7 percent from May to November (Chart 7). In 2008, another year with relatively high intraday volatility, the average yield adjustment was 2.2 percent. Conversely, the average yield adjustment made from one WASDE release to the next was only 1.3 percent and 1.4 percent in 2010 and 2011, respectively. These years also coincided with relatively low intraday volatility. Although it is difficult to determine what markets may have expected prior to WASDE releases, this result provides some support for the notion that traders may be responding to unexpected changes in the headline crop yield projections.

The month of WASDE releases, coupled with the size of adjustment, may also be factors that explain intraday volatility patterns across years. In 2010, few adjustments were made to corn yield projections before October, when yields were revised down by 4.1 percent. For the majority of 2010, intraday volatility was relatively low before spiking sharply with the October adjustment. Conversely, yields were revised higher by 4.4 percent and 4.0 percent in August 2008 and 2009, respectively. The size of the intraday volatility spikes in those months paled in comparison to the spike in October 2010, although intraday

Chart 7

AVERAGE MONTH-TO-MONTH WASDE ADJUSTMENTS (MAY TO NOVEMBER)
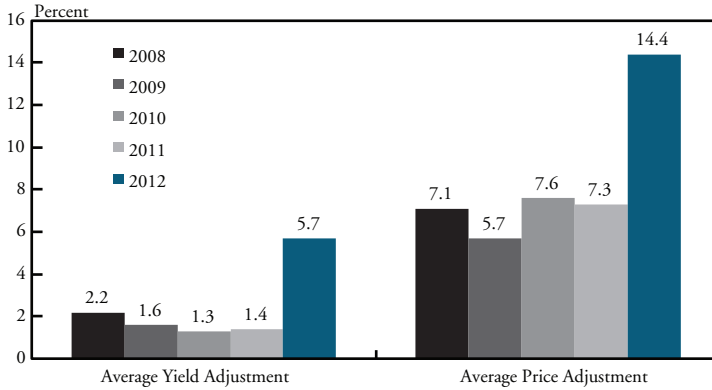
Source: USDA.

volatility was generally higher throughout both 2008 and 2009. This result suggests that for adjustments made early in the year, spikes in intraday volatility may be smaller than when the adjustment is made later in the year. However, significant adjustments made earlier in the year have resulted in noticeably higher intraday volatility for the remainder of the growing season.

A change in projections of season-average prices from month to month might also be a factor contributing to differences in intraday volatility across years (Chart 7). In addition to providing supply and demand estimates each month, the USDA also provides an estimated range of farm prices for the year for individual crops. Price projections are determined from estimates of both supply and demand. However, there was no discernible pattern between the average size of price adjustments and intraday volatility across years. There is a more observable correlation between adjustments to supply projections and volatility. This suggests that traders might place more emphasis on adjustments made by the USDA to supply estimates than to general shifts in demand.

The size of inventories might also be considered a relevant factor contributing to differences in volatility. Although post-drought inventories were low in 2012, a year with higher intraday volatility, inventories were also 25 percent below average in September 2011, a year with

relatively low intraday price volatility. While inventories may affect volatility over longer time horizons, their influence on intraday price volatility patterns appears limited.

Nonproducer participation

Nonproducers provide commodity markets with liquidity and depth, which can help absorb potential market shocks. Nonproducer trading activity is known to vary over time, leading to changes in liquidity and depth. Including nonproducer trading activity in the baseline volatility estimates presented in Section II shows that volatility might have been greater in 2012 without the additional liquidity and depth nonproducers provided.

Market liquidity and market depth are closely related. High liquidity refers to the ability to sell assets in a market without affecting price, whereas depth refers to the ability to place large orders in a market without affecting price. Markets that are deep, though, also tend to be liquid. In this article, volume is used as a proxy for market liquidity (Datar, Naik, and Radcliffe; Brennan, Chordia, and Subrahmanyam). Open interest, the number of contracts outstanding at a given time, is used as a proxy for market depth (Bessembinder and Seguin; Ragunathan and Peker).

Nonproducers typically seek to profit from price fluctuations in commodity markets by actively adjusting their positions. In fact, the aggregate positions and relative importance of nonproducers have changed significantly over the years. In the early 1990s, nonproducers held as little as 6 percent of total open interest in corn futures contracts. Since 2000, nonproducers' share of open interest has ranged from 19 percent to 38 percent, and throughout 2012 has averaged 33 percent.

Nonproducers can be categorized in various ways. One category, which is tracked by the CFTC, is managed money traders (MMTs). MMTs, often viewed as large speculators, consist of hedge funds and commodity pool operators. MMTs seek profits from both price increases and decreases. Another category is commodity index traders (CITs). Unlike MMTs, CITs typically seek profits only from price increases through general commodity market exposure. Investing in popular indexes such as the Goldman Sachs Commodity Index or Dow Jones UBS Commodity Index is often considered a passive form of

commodity market speculation in which positions are rolled automatically from an expiring contract to the next contract available.

Commodity market speculators have generated substantial debate surrounding their potential to influence food prices and volatility (Robles, Torero, and von Braun; Irwin, Sanders, and Merrin; Stoll and Whaley; Baffes and Haniotis). Although the effects of speculation on prices and volatility may be controversial, speculation has long been recognized as valuable in providing markets with additional depth and liquidity (Working). Still, the CFTC continues to push for tighter speculative trading limits.

The CFTC regulates commodity futures and options markets and discloses the reported trading information to the public. Weekly positions of commercial and non-commercial traders are disclosed through the CFTC large trader reporting program to provide some transparency in commodity derivative markets. The positions are reported as open interest. The CFTC aggregates daily positions of various trader groups in futures and options contracts and provides this information to the public weekly.[10]

Regression analysis was used to examine the effect of nonproducer activity on price volatility. As in the previous section, regressions of realized volatility on non-WASDE days were conducted for each individual year from 2008 to 2012 on the same time variables as in the earlier regressions. In addition to variables in the earlier regressions, total open interest, MMT open interest, and CIT open interest were each included separately as explanatory variables to identify the effect of nonproducer trading. A summary of these regression results can be found in Table 1 in the Appendix in the columns labeled Model 2, Model 3, and Model 4.

Market depth may explain some differences in intraday volatility across years. The inclusion of trader positions in the regressions suggests that volatility is generally reduced with higher levels of open interest, the proxy used for market depth. The marginal effects of total open interest and MMT open interest were consistently negative and highly significant in the past three years (Chart 8). The two years with the least persistence of elevated volatility, 2010 and 2011, coincided with years in which the marginal effect of total open interest was most pronounced. The marginal effect of CIT open interest on realized volatility was not statistically significant in the last three years.

Chart 8

THE MARGINAL EFFECT ON VOLATILITY OF OPEN INTEREST BY TRADER GROUP
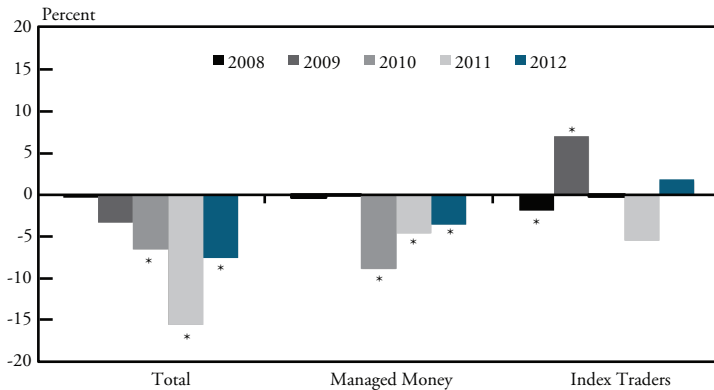
* Effect is significant at the 5 percent significance level.
Note: Marginal effects indicate the percentage change in estimated volatility associated with a 1 percent increase in open interest when evaluated at the mean values of the data.

The results suggest that crop prices in 2012 may have been more volatile if not for the presence of nonproducers. With WASDE reports released during a time of day with relatively low trading volumes, there might have been even less market participation if nonproducers were excluded from the market. Thin markets could have caused elevated volatility to persist for a longer period of time and at higher levels following WASDE releases.

IV.   CONCLUSION

Agricultural commodity producers are highly focused on managing risk. Producers typically oppose any change in market structure that affects their ability to mitigate exposure to price volatility. Conversely, nonproducers often welcome price volatility because it provides them with an opportunity to profit from changing prices.

The extension of trading hours at commodity exchanges in May 2012 has allowed markets to trade for the first time during the release of fundamental supply and demand reports. Producers have expressed concerns that extended trading hours at commodity exchanges could exacerbate price volatility. The extended trading hours have in fact

resulted in brief shocks in corn futures price volatility around the release of the USDA's WASDE reports.

The brief spikes in volatility due to extended trading hours are likely to pose a challenge for producers whose risk management strategies are affected by intraday price swings. Typically, however, the heightened volatility has not lasted more than 30 to 60 minutes. Thus producers whose risk management strategies are not affected by intraday price swings likely will not be affected significantly by extended trading during the release of WASDE reports.

With shifting market conditions, intraday price volatility patterns have varied significantly over the past five years. Fluctuations in supply and demand, particularly unexpected forecast adjustments, have partly shaped these differences. Information surprises have typically generated more intraday volatility, but the magnitude of the effect has depended on the time of year in which the information shocks have taken place.

Although the debate continues about the role and impact of speculation in agricultural commodity markets, one effect of the participation of nonproducers in these markets is positive: at least to some extent, it has helped limit volatility. Nonproducers provide these markets with additional liquidity and depth, which are key factors in helping absorb potential shocks.

APPENDIX

The results of the regressions, using observations from non-WASDE days, to predict intraday volatility for a typical non-WASDE day, are provided in Tables 1a to 1e under the heading of Model 1. Although some variables are found to be insignificant in certain years, the time dummy variables used for each year are the same in order to consistently compare results across years. The coefficient estimate of the regression can be interpreted as the contribution to estimated volatility on an annualized percentage basis. For example, annualized volatility at 9:30 a.m. on a non-WASDE day in July 2012 is estimated as 15.05 percent (-0.81 + 3.74 + 12.13). Assuming a normal distribution, standard errors were obtained from the coefficient estimates to generate a 95 percent confidence interval for expected price volatility.

In the third section, open interest (O.I.) for various trader groups are incorporated as additional explanatory variables. Weekly data on total open interest, managed money trader (MMT) open interest, and commodity index trader (CIT) open interest were obtained from the Commodity Futures Trading Commission (CFTC). Each measure of open interest was added separately as an explanatory variable for the entire corresponding week of realized volatility. Although total open interest is available daily, the weekly observation was used to compare marginal effects with those of the various trader groups consistently. Regression results are provided in Tables 1a to 1e under the headings of Model 2, Model 3, and Model 4 for the individual inclusion of total open interest, managed money open interest, and index trader open interest, respectively.

Table 1a

REGRESSION RESULTS FOR 2008 NON-WASDE DAYS

	2008			
	Model 1	Model 2 Total O.I.	Model 3 Managed Money O.I.	Model 4 Index Traders O.I.
Variable	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	-2.15 (0.14)	3.37 (0.74)	4.54 (0.30)	9.19*** (0.00)
Jul.	-0.83 (0.72)	-1.37 (0.55)	-1.79 (0.24)	-2.33** (0.01)
Aug.	2.97 *** (0.00)	2.52 (0.26)	1.58 (0.64)	-2.36 (0.12)
Sep.	2.72 *** (0.00)	1.87 (0.68)	-1.38 (0.80)	-3.39** (0.01)
Oct.	5.83*** (0.00)	5.43*** (0.00)	4.89*** (0.00)	1.61 (0.71)
Nov.	5.74*** (0.00)	5.32*** (0.01)	4.78** (0.01)	-2.29 (0.57)
5 a.m.	2.16 (0.14)	2.16 (0.14)	2.16 (0.14)	2.16 (0.14)
8 a.m.	N/A	N/A	N/A	N/A
9 a.m.	8.07*** (0.00)	8.07*** (0.00)	8.07*** (0.00)	8.07*** (0.00)
10 a.m.	6.09*** (0.00)	6.09*** (0.00)	6.09*** (0.00)	6.09*** (0.00)
11 a.m.	4.83*** (0.00)	4.83*** (0.00)	4.83*** (0.00)	4.83*** (0.00)
12 p.m.	5.14*** (0.00)	5.14*** (0.00)	5.14*** (0.00)	5.14*** (0.00)
1 p.m.	5.94 (0.00)	5.94*** (0.00)	5.94*** (0.00)	5.94*** (0.00)
9:30 to 9:31	24.48 (0.00)	24.48 (0.00)	24.48 (0.00)	24.48 (0.00)
9:31 to 9:32	28.66 (0.00)	28.66 (0.00)	28.66 (0.00)	28.66 (0.00)
9:32 to 9:33	8.90 (0.00)	8.90 (0.00)	8.90 (0.00)	8.90 (0.00)
O.I.	N/A	-3.37 (0.64)	-7.19 (0.20)	-14.47 (0.00)
R-square	0.3074	0.3075	0.3075	0.3080

Notes: Significance levels of 1 percent, 5 percent, and 10 percent are denoted by *, **, and *** respectively. *P*-values are in parentheses beneath the coefficient estimates. The coefficient estimates are interpreted as the contribution to estimated volatility as an annualized percentage. Each model is used as a baseline for comparing volatility on WASDE-release days and includes month dummy variables, hour dummy variables, dummy variables for the first three minutes of open-outcry trading and open interest (O.I.) where applicable.

Table 1b

REGRESSION RESULTS FOR 2009 NON-WASDE DAYS

	2009			
	Model 1	Model 2 Total O.I.	Model 3 Managed Money O.I.	Model 4 Index Traders O.I.
Variable	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	-2.59 (0.16)	11.81* (0.07)	-2.38 (0.92)	-16.24** (0.01)
Jul.	2.93* (0.09)	-1.66 (0.72)	2.93* (0.09)	-2.99 (0.31)
Aug.	3.84*** (0.00)	-1.20 (0.89)	3.82* (0.07)	-3.82 (0.27)
Sep.	4.40*** (0.00)	1.03 (0.92)	4.40*** (0.00)	-4.56 (0.24)
Oct.	4.31*** (0.00)	3.16 (0.14)	4.31*** (0.00)	-5.85 (0.13)
Nov.	4.11* (0.09)	3.72 (0.17)	4.09 (0.18)	-5.98 (0.14)
5 a.m.	2.35 (0.47)	2.35 (0.47)	2.35 (0.47)	2.35 (0.47)
8 a.m.	N/A	N/A	N/A	N/A
9 a.m.	8.43*** (0.00)	8.43*** (0.00)	8.43*** (0.00)	8.43*** (0.00)
10 a.m.	6.44*** (0.00)	6.44*** (0.00)	6.44*** (0.00)	6.44*** (0.00)
11 a.m.	5.78*** (0.00)	5.78*** (0.00)	5.78*** (0.00)	5.78*** (0.00)
12 p.m.	5.77*** (0.00)	5.77*** (0.00)	5.77*** (0.00)	5.77*** (0.00)
1 p.m.	6.82* (0.08)	6.82* (0.08)	6.82* (0.08)	6.82* (0.08)
9:30 to 9:31	14.43*** (0.00)	14.43*** (0.00)	14.43*** (0.00)	14.43*** (0.00)
9:31 to 9:32	29.09*** (0.00)	29.09*** (0.00)	29.09*** (0.00)	29.09*** (0.00)
9:32 to 9:33	7.28* (0.05)	7.28* (0.05)	7.28* (0.05)	7.28* (0.05)
O.I.	N/A	-12.25* (0.06)	-1.70 (0.98)	29.60** (0.02)
R-square	0.0445	0.0446	0.0445	0.0447

Notes: Significance levels of 1 percent, 5 percent, and 10 percent are denoted by *, **, and *** respectively. *P*-values are in parentheses beneath the coefficient estimates. The coefficient estimates are interpreted as the contribution to estimated volatility as an annualized percentage. Each model is used as a baseline for comparing volatility on WASDE-release days and includes month dummy variables, hour dummy variables, dummy variables for the first three minutes of open-outcry trading and open interest (O.I.) where applicable.

Table 1c

REGRESSION RESULTS FOR 2010 NON-WASDE DAYS

	2010			
	Model 1	Model 2 Total O.I.	Model 3 Managed Money O.I.	Model 4 Index Traders O.I.
Variable	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	2.67 (0.18)	13.57*** (0.00)	16.04*** (0.00)	3.77 (0.92)
Jul.	-1.45 (0.71)	-3.20* (0.09)	-4.81*** (0.00)	-1.41 (0.75)
Aug.	(0.36) (0.98)	3.81** (0.04)	-1.03 (0.85)	0.81 (0.95)
Sep.	0.73 (0.92)	5.35*** (0.00)	5.16*** (0.00)	0.96 (0.92)
Oct.	-2.67 (0.21)	5.98*** (0.01)	7.00*** (0.00)	-2.64 (0.27)
Nov.	-3.61 (0.19)	6.76** (0.02)	7.89*** (0.00)	-3.63 (0.19)
5 a.m.	2.49 (0.47)	2.49 (0.47)	2.49 (0.47)	2.49 (0.47)
8 a.m.	N/A	N/A	N/A	N/A
9 a.m.	6.81*** (0.00)	6.81*** (0.00)	6.81*** (0.00)	6.81*** (0.00)
10 a.m.	5.37*** (0.00)	5.37*** (0.00)	5.37*** (0.00)	5.37*** (0.00)
11 a.m.	4.43*** (0.00)	4.43*** (0.00)	4.43*** (0.00)	4.43*** (0.00)
12 p.m.	4.62*** (0.00)	4.62*** (0.00)	4.62*** (0.00)	4.62*** (0.00)
1 p.m.	5.43 (0.33)	5.43 (0.33)	5.43 (0.33)	5.43 (0.33)
9:30 to 9:31	23.39*** (0.00)	23.39*** (0.00)	23.39*** (0.00)	23.39*** (0.00)
9:31 to 9:32	26.25*** (0.00)	26.25*** (0.00)	26.25*** (0.00)	26.25*** (0.00)
9:32 to 9:33	5.03 (0.40)	5.03 (0.40)	5.03 (0.40)	5.03 (0.40)
O.I.	N/A	-12.11*** (0.00)	-22.10*** (0.00)	-3.89 (0.96)
R-square	0.0326	0.0330	0.0336	0.0326

Notes: Significance levels of 1 percent, 5 percent, and 10 percent are denoted by *, **, and *** respectively. *P*-values are in parentheses beneath the coefficient estimates. The coefficient estimates are interpreted as the contribution to estimated volatility as an annualized percentage. Each model is used as a baseline for comparing volatility on WASDE-release days and includes month dummy variables, hour dummy variables, dummy variables for the first three minutes of open-outcry trading and open interest (O.I.) where applicable.

Table 1d
REGRESSION RESULTS FOR 2011 NON-WASDE DAYS

	2011			
	Model 1	Model 2 Total O.I.	Model 3 Managed Money O.I.	Model 4 Index Traders O.I.
Variable	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	3.33** (0.04)	20.07*** (0.00)	11.37*** (0.00)	11.71 (0.15)
Jul.	-2.81 (0.17)	-8.26*** (0.00)	-5.69*** (0.00)	-2.59 (0.25)
Aug.	-3.42** (0.04)	-7.79*** (0.00)	-5.04*** (0.00)	-4.01** (0.01)
Sep.	-0.63 (0.95)	-7.49*** (0.00)	-4.60*** (0.00)	-2.18 (0.48)
Oct.	-2.79 (0.17)	-8.02*** (0.00)	-5.25*** (0.00)	-4.38* (0.06)
Nov.	-3.04 (0.36)	-7.79*** (0.00)	-4.25* (0.07)	-4.52 (0.12)
5 a.m.	2.12 (0.60)	2.12 (0.60)	2.12 (0.60)	2.12 (0.60)
8 a.m.	N/A	N/A	N/A	N/A
9 a.m.	5.44*** (0.00)	5.44*** (0.00)	5.44*** (0.00)	5.44*** (0.00)
10 a.m.	4.07*** (0.00)	4.07*** (0.00)	4.07*** (0.00)	4.07*** (0.00)
11 a.m.	3.40** (0.04)	3.40** (0.04)	3.40** (0.04)	3.40** (0.04)
12 p.m.	3.50** (0.03)	3.50** (0.03)	3.50** (0.03)	3.50** (0.03)
1 p.m.	4.12 (0.57)	4.12 (0.57)	4.12 (0.57)	4.12 (0.57)
9:30 to 9:31	25.54*** (0.00)	25.54*** (0.00)	25.54*** (0.00)	25.54*** (0.00)
9:31 to 9:32	27.11*** (0.00)	27.11*** (0.00)	27.11*** (0.00)	27.11*** (0.00)
9:32 to 9:33	5.12 (0.39)	5.12 (0.39)	5.12 (0.39)	5.12 (0.39)
O.I.	N/A	-16.62*** (0.00)	-14.82*** (0.00)	-18.47 (0.19)
R-square	0.0376	0.0386	0.0384	0.0377

Notes: Significance levels of 1 percent, 5 percent, and 10 percent are denoted by *, **, and *** respectively. *P*-values are in parentheses beneath the coefficient estimates. The coefficient estimates are interpreted as the contribution to estimated volatility as an annualized percentage. Each model is used as a baseline for comparingvolatility on WASDE-release days and includes month dummy variables, hour dummy variables, dummy variables for the first three minutes of open-outcry trading and open interest (O.I.) where applicable.

Table 1e

REGRESSION RESULTS FOR 2012 NON-WASDE DAYS

	2012			
	Model 1	Model 2 Total O.I.	Model 3 Managed Money O.I.	Model 4 Index Traders O.I.
Variable	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	3.31*** (0.00)	10.35*** (0.00)	7.56*** (0.00)	-3.87 (0.74)
Jul.	-0.81 (0.68)	-1.15 (0.39)	-2.46*** (0.00)	0.89 (0.78)
Aug.	-3.29*** (0.00)	-2.02** (0.03)	-3.12*** (0.00)	-2.90* (0.06)
Sep.	-3.16*** (0.00)	-2.59*** (0.00)	-2.79*** (0.00)	-2.79* (0.05)
Oct.	-3.50*** (0.00)	-1.89* (0.08)	-2.41*** (0.00)	-3.20*** (0.01)
Nov.	-3.57*** (0.00)	-0.63 (0.90)	-2.24 (0.14)	-3.25** (0.03)
5 a.m.	2.46*** (0.00)	2.46*** (0.00)	2.46*** (0.00)	2.46*** (0.00)
8 a.m.	2.69*** (0.00)	2.69*** (0.00)	2.69*** (0.00)	2.69*** (0.00)
9 a.m.	3.74*** (0.00)	3.74*** (0.00)	3.74*** (0.00)	3.74*** (0.00)
10 a.m.	3.52*** (0.00)	3.52*** (0.00)	3.52*** (0.00)	3.52*** (0.00)
11 a.m.	3.18*** (0.00)	3.18*** (0.00)	3.18*** (0.00)	3.18*** (0.00)
12 p.m.	3.06*** (0.00)	3.06*** (0.00)	3.0*** (0.00)	3.06*** (0.00)
1 p.m.	3.54 (0.22)	3.54 (0.22)	3.54 (0.22)	3.54 (0.22)
9:30 to 9:31	12.13*** (0.00)	12.13*** (0.00)	12.13*** (0.00)	12.13*** (0.00)
9:31 to 9:32	13.51*** (0.00)	13.51*** (0.00)	13.51*** (0.00)	13.51*** (0.00)
9:32 to 9:33	4.65** (0.03)	4.65** (0.03)	4.65** (0.03)	4.65** (0.03)
O.I.	N/A	-9.21*** (0.00)	-9.72*** (0.00)	8.10 0.56
R-square	0.0174	0.0184	0.0183	0.0174

Notes: Significance levels of 1 percent, 5 percent, and 10 percent are denoted by *, **, and *** respectively. *P*-values are in parentheses beneath the coefficient estimates. The coefficient estimates are interpreted as the contribution to estimated volatility as an annualized percentage. Each model is used as a baseline for comparing volatility on WASDE-release days and includes month dummy variables, hour dummy variables, dummy variables for the first three minutes of open-outcry trading and open interest (O.I.) where applicable.

ENDNOTES

[1]When hedging with futures markets, there is a third form of risk known as basis risk. Basis risk is the risk that the local cash price may differ from the futures price at harvest.

[2]At the Chicago Board of Trade, corn futures prices are limited to daily price movements of 40 cents per bushel in either direction of the previous day's close.

[3]Nonproducers could, however, still profit when there is no price volatility by using options. One example is a short straddle, which might involve selling both an at-the-money call and an at-the-money put.

[4]In April 2013, CME again revised its trading hours. Effective April 8, 2013, a pause in electronic trading is observed from 7:45 a.m. to 8:30 a.m. Both pit and electronic platforms now close at 1:15 p.m. with electronic markets reopening at 7 p.m.

[5]From May 2012 to January 2013, WASDE reports were released at 7:30 a.m. After considerable debate, the USDA began releasing WASDE at 11 a.m. CST in January 2013. The justification for the change was to release the report at a time when liquidity was likely to be highest. Prior to the change, the CME had expanded pit trading hours on WASDE release days to increase liquidity beyond that of only electronic markets.

[6]Baseline estimates of volatility are generated independently for each year for two key reasons. First, information from 2008 to 2011 is of limited use in examining volatility in 2012 around the time of WASDE releases because markets were not open during WASDE releases in those years. Second, conducting the analyses for each year separately highlights interesting results of volatility patterns across years, which is explored further in the next section.

[7]Elevated volatility is technically defined as instances when the estimate lies outside the 95 percent confidence interval determined by the regressions in the analysis.

[8]Beginning in June 2012, the CME announced that open outcry hours would begin at 7:20 a.m. on days of a WASDE release in an attempt to increase liquidity. Pit trading opened at its usual time (9:30 a.m.) on all other days.

[9]This issue was discussed by participants at the NCCC-134 Applied Commodity Price Analysis, Forecasting, and Market Risk Management Conference on April 22, 2013, in St. Louis, Missouri.

[10]See *http://www.cftc.gov/IndustryOversight/MarketSurveillance/LargeTradeReportingProgram/index.htm* for more information on the CFTC program, data, and trader groups.

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