DO USDA NEWS AND FIRM-LEVEL ANNOUNCEMENTS COMPLEMENT OR SUBSTITUTE EACH OTHER?

by

ANIL BANSTOLA

(Under the Direction of Berna Karali)

ABSTRACT

This thesis investigates whether the arrival of USDA reports affects the incorporation of information in firm-level earnings announcements into the stock prices of publicly traded agricultural and food companies. We estimate buy-and-hold abnormal returns (BHAR) around the earnings announcement days to measure immediate stock price reactions and post-earnings announcement drift (PEAD) to quantify delayed price reactions. In general, we find that the arrival of USDA reports does not immediately affect the market reaction to earnings surprises but increases the PEAD for agricultural firms. When each report is considered separately, the Crop Production report is associated with a reduction in immediate price reaction and a significant increase in the PEAD for grain processors, which suggests a substitute relationship with earnings announcements. Other USDA reports have mixed effects for different groups of companies, with some affecting the immediate market reactions and others the PEAD.

INDEX WORDS: Earning Announcements, Market Efficiency, Post-Earning Announcement Drift, Stock Price, USDA reports

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DEDICATION

I would like to dedicate this thesis to my parents, the late Premnath Banstola, Bhagawati Banstola, as well as my beloved wife Aarati Poudel and my sweet daughter Aayana Banstola, for their love and support.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Stock market participants face different kinds of information every day, which is incorporated into equity prices by influencing their trading decisions. This information can be at various levels of the economy, ranging from firm-level news to national or global economic information. At the firm level, one of the most important information that drives the price discovery process is the quarterly earnings announcement of the company (Ball & Brown, 1968, 2019). At the broader economic level, various macroeconomic reports like interest rates, employment situation, manufacturing, and consumption status are important information that affects the stock market (Hirshleifer & Sheng, 2022). In between, there are various other firm-level, sector-level, and macro-level information that influence the investors' decision-making process and, thus, have an impact on price discovery and, subsequently, on stock returns.

Previous studies document that the stock price reaction to firms' earnings announcements has been generally sluggish if there is an overlapping broader level news (Hirshleifer & Teoh, 2003; Peng & Xiong, 2006; Dellavigna & Pollet, 2009; Hirshleifer et al., 2009, 2011; Gulen & Hwang, 2012). When investors receive multiple pieces of news at the same time, they face a tradeoff between allocating their limited attention and cognitive resources to firm-level announcements versus macro-level news (Hirshleifer & Sheng, 2022). This distraction usually leads to an underreaction to company news, with a smaller immediate stock price reaction and a larger adjustment thereafter, known as the post-earnings announcement drift (PEAD), causing a less efficient price discovery (Ball & Brown, 1968, 2019). This is referred to as a *substitute* relationship between firm-level news and broader economic news, with investors allocating more of their limited attention and cognitive resources to process the broader economic information.

However, recent studies show that distracting information can also lead to overreaction to firms' earnings news, with a stronger immediate reaction in the stock price followed by a weaker PEAD (Ben-Rephael, Da, & Israelsen, 2021; Brunnermeier et al., 2022; Hirshleifer & Sheng, 2022). This is referred to as a *complementary* relationship between firm-level and macro-level news, with overlapping macro news enhancing the efficient incorporation of firm-level news into stock prices.

In the agricultural context, the reports prepared and published by the United States Department of Agriculture (USDA) are well documented to significantly influence the price and volatility of agricultural commodities and, therefore, valuable to investors in derivative markets (Colling & Irwin, 1990; Isengildina-Massa et al., 2008; Adjemian, 2012; Karali, 2012; Dorfman & Karali, 2015; Adjemian & Irwin, 2018, 2020; Karali et al., 2019; Karali, Isengildina-Massa, & Irwin, 2020; Huang et al., 2021; Cao & Robe, 2022).[1] These reports contain fundamental commodity information, such as planted and harvested area, crop yield and production, existing grain stocks, and domestic use and export demand. Recent studies demonstrate the effects of these USDA reports on the broader economy as well (Ferguson & Gars, 2020; Goyal & Adjemian, 2021; Jo and Adjemian, 2023). Further, with the rapid financialization of the commodity market and a significant increase in commercial investors' share of open interests in commodity futures (Irwin & Sanders, 2012; Seddon, 2020; Xiao et al., 2023), we can expect that, in addition to derivative market participants, stock market investors are increasingly attentive to

[1] For a detailed review of previous studies on the impact of USDA reports, see Isengildina-Massa, Karali, and Irwin (2024).

the USDA report’s news content. In fact, Cao et al. (2024) show for the first time that the surprise component of selected USDA reports affects the stock returns of food sector companies.

Therefore, in this study, we explore the possible impact of USDA reports, which can be considered broader-level agriculture sector news, on the efficient processing of firm-level earnings announcements of publicly traded agricultural and food sector companies. Specifically, we investigate whether the releases of USDA reports on the same day as firms’ earnings announcements lead to a stronger immediate stock price reaction and a weaker drift (i.e., complementary relationship) or to a weaker immediate reaction and a stronger drift (i.e., substitute relationship).

We follow the approach by Cao et al. (2024) for identifying the companies that are likely to be affected by USDA reports and categorize them into three different groups: 1) Farm Input Suppliers – including chemical and pesticide manufacturers, farm machinery manufacturers, etc.; 2) Farm Output Buyers – including all food and feed processors, biofuel processors, food retailers, and food services companies; 3) Grain Processors - including a subset of farm output buyer companies that directly use the grains, oilseeds, or grain products as raw materials in their manufacturing process and are most likely to be affected by commodity price movement. We find that the overlapping of USDA reports with earnings announcements, in general, increases the PEAD for agricultural companies, with the highest impact observed for grain processors. Further, when we analyze the impacts of each USDA report separately, we find that the Crop Production report is associated with a significant reduction in the immediate reaction and an increase in the PEAD, suggesting a *substitute* relationship between USDA reports and the firm’s earnings announcements. Other reports had mixed effects for different groups of companies, with some affecting the immediate market reactions and others affecting the PEAD. The results of this study are insightful for executives, investors, and analysts in the food and agricultural sector for making strategic decisions about releasing earnings announcements around USDA report release days. Finally, this research also contributes to the debate on USDA reports' value and cost-worthiness in modern times.

CHAPTER II

LITERATURE REVIEW

Earnings Announcements, Efficient Markets, and Distractions

According to the efficient market hypothesis (EMH) of Fama (1970), current asset prices fully reflect all available information.[2] In the stock markets, firms' earnings announcements – which come either as positive or negative surprises – are important for investors' informed decision-making (Ball & Brown, 1968). However, extensive studies on the stock markets have reported the tendency of sluggish incorporation of earnings news into stock prices over multiple days, leading to post-earnings announcement drift (Jones & Litzenberger, 1970; Foster et al., 1984; Bernard & Thomas, 1989). This PEAD arises due to transaction barriers like high equity transaction costs and arbitrage risks (Bhushan, 1994; Mendenhall, 2004; Jeffrey et al., 2008), illiquidity – difficulty in quickly liquidating stock without significant price movement (Chordia et al., 2009), and limited investor attention (Dellavigna & Pollet, 2009; Hirshleifer et al., 2009; Ben-Rephael et al., 2021; Hirshleifer & Sheng, 2022).

Studies show that investors' attention to firm-level information, such as earnings announcements, could be limited due to information crowding (Hirshleifer et al., 2009) or distraction from other news/activities (Dellavigna & Pollet, 2009). Researchers have reported that major macroeconomic reports like the Federal Open Market Committee (FOMC) decisions, unemployment situation, personal consumptions, and industrial productions have statistically and

[2] Fama (1970) defines three forms of market efficiency based on the information reflected in current asset prices: strong-form efficiency, in which the information set includes public and private information; semi-strong-form efficiency, with public information constituting the information set; and weak-form efficiency, where the information set contains only the past prices.

economically significant impacts on stock returns, which leads to substantial investors' attention toward the implications of such reports on stock returns (Gilbert et al., 2017; Hirshleifer & Sheng, 2022). Thus, when macroeconomic reports overlap with a firm's earnings announcements, there is a distribution of investors' limited attention level toward each of these reports. Studies suggest that attention-constrained investors tend to focus more on sector-wide and economy-wide information than firm-specific information, causing inefficient price discovery for the firms (Peng & Xiong, 2006). This distraction of broader-level news in full incorporation of earning news into asset prices is known as the *substitution* effect. The magnitude and duration of PEAD due to such distractions have an inverse relation with the firm size (Foster et al., 1984; Bernard & Thomas, 1989), with smaller firms in the U.S. stock market having higher PEAD after earnings announcements while no PEAD has been observed at all in large and liquid stocks (Milian, 2015; Martineau, 2021). This also gives a rationale for our study, as most publicly traded agribusiness companies are smaller in market size (Cao et al., 2024) and therefore, more likely to showcase PEAD.

However, a few studies have reported that firm-level news is efficiently processed and becomes more valuable when it overlaps with major macroeconomic reports. For instance, Savor and Wilson (2014) report that the asset pricing models are efficient on macro-report days, while Ben-Rephael et al. (2021) emphasize that the capital asset pricing model performs well for individual stocks with higher average returns on macro-report release days. Similarly, Hirshleifer & Sheng (2022) report an increase in the immediate price reaction and a decrease in the PEAD when macroeconomic reports overlap with firm-level announcements, suggesting *complementarity* between these information pieces.

USDA Reports and Market Reactions

USDA publishes a variety of reports, which serve as important public sources of agricultural information. Understanding the economic value of these reports is crucial as they affect a wide range of stakeholders, from farmers to investors. A handful of studies have utilized the welfare models to directly evaluate the value of USDA reports (Abbott et al., 2016; Antonovitz & Roe, 1984; Bradford & Kelejian, 1978; Gouel, 2020; Hayami & Peterson, 1972). Another widely used approach is the event study model, which is based on the variation in price movement and volatility observed in the financial markets around the report release period compared to the non-report period. If there is a significant price movement and volatility difference between the two periods, then the report is considered valuable to market participants (Campbell et al., 1998).

Numerous previous studies have reported significant price movements and increases in volatility of futures contracts for agricultural markets around report releases (Colling & Irwin, 1990; Isengildina-Massa et al., 2008; Adjemian, 2012; Karali, 2012; Dorfman & Karali, 2015; Adjemian & Irwin, 2018, 2020; Karali et al., 2019, 2020; Huang et al., 2021; Cao & Robe, 2022). These studies demonstrate that there is valuable information related to the supply, demand, and availability of agricultural commodities in these USDA reports, which are reflected in subsequent futures price discovery. In an efficient market, the futures price represents the conditional expectation of spot prices of these commodities at contract maturity time. Thus, movements in futures prices after the USDA reports change market participants' expectations about spot prices in the future. There are many firms and industries which are directly or indirectly affected by price movements in agricultural commodities; especially those in food, feed, biofuel, and agricultural technology sectors. These may include those groups of companies that utilize agricultural commodities in their production cycle (farm output users) or provide tools and technology necessary to produce these commodities (farm input producers). We can assume that commodity price movements affect the revenue and future earnings of these companies (Cao et al. 2024).

Despite the potential effect of USDA reports on stock markets, the attention to these reports in the literature has been very limited. Recently, Cao et al. (2024) found that the USDA reports do not have a significant effect on the stock market as a whole, but there is an economically and statistically significant effect on stock returns for food-sector/agricultural companies. Further, they found that planted area surprises in Prospective Plantings and Acreage reports have the largest effect on these stock returns followed by the surprises in Grain Stocks reports, with the surprises in World Agricultural Supply and Demand Estimates (WASDE) reports only having a modest impact. Our paper contributes further to this literary dimension by studying whether USDA reports complement or substitute the information in a firm’s earnings announcements.

CHAPTER III

DATA AND METHODOLOGY

Data

We attain daily stock returns of the publicly traded companies included in our sample from the Center for Research in Security Prices (CRSP). The firms' earnings announcements, including their release dates and times, the actual amount of earnings per share, and the median of analysts' expectations of earnings per share are obtained from the Institutional Brokers' Estimate System (I/B/E/S). We also acquire data on the selected financial indicators, including the firm's market value and number of outstanding shares, from Compustat. Dellavigna & Pollet (2009) note that companies' earnings announcements started to be accurately reported in the I/B/E/S after 1995. Therefore, we limit our sample period to 1995-2023. We attain the daily return on the Standard and Poor's 500 (S&P 500), which is a stock market index tracking the stock performance of 500 of the largest companies listed in U.S. stock exchanges, from the CRSP and use it as a proxy for market returns. We also collect data on the 90-day U.S. Treasury bill rate from the Federal Reserve Economic Data (FRED) database.

Among the USDA reports, we specifically focus on those that contain information about the three major grain and oilseed commodities - corn, soybean, and wheat - including Crop Production Annual Summary (CPAS), Winter Wheat Seedings (WWS), Prospective Plantings (PP), Acreage (ACR), Crop Production (CP), and Grain Stocks (GS). Specifically, for each report, we obtain the release day and time and the associated figure (production in CP and CPAS; acreage in WWS, PP, and ACR; and ending stocks in GS) from the USDA's website.

We carefully select and group publicly traded companies that are related to the agricultural and food sectors following Cao et al. (2024). For our analysis, we include companies that are directly using agricultural commodities in their production processes as well as those companies that are associated with commodity production, retailing, and distribution processes. Broadly, these companies are categorized into either farm input suppliers, which include fertilizers, pesticides, farm machines, and farm technology providers, or farm output buyers, which include food processors, beverage brewers, biofuel producers, food retailers and distributors, and food service companies. Further, we also create a subset of farm output buyer companies that directly use grains, oilseeds, or grain products in their production systems, which we call grain processors. These primarily include food, feed, beverage, and biofuel producers. Intuitively, companies in the grain processors group are likely to have the largest impact on their future earnings/cash flows due to commodity price movements. The full list of companies in each group is available in Appendix A.

In our data set, we remove the companies for which earnings announcements were not available in the I/B/E/S and those whose earnings announcements never overlap with any of the selected USDA reports. We also remove the observations on the earnings announcement days if the stock price was less than $1. When firms merge or split, we consider them as separate companies before and after the merger/split. We also exclude four companies (ADM, The Andersons, Bunge, and The Seaboard) that have activities tied to both the production and the transformation of grains and oilseeds (Cao et al., 2024). Similarly, if a firm diversifies its business such that it is neither a farm input supplier nor a farm output buyer, then that firm is excluded after it makes those changes.

After data cleaning, we are left with 94 companies, 13 of which are farm input suppliers and 81 of which are farm output buyers. Among the farm output buyers, 32 companies are grain processors. Table 1 provides more detailed information about the number of earnings announcements, the USDA reports, and counts of overlapping USDA reports with the earnings announcements.

Table 1: Earnings Announcements (EA) and USDA Reports Count in Dataset

	Actual number of days with report releases	Total occurrence of reports in panel data	Overlapping observations with EA	% of overlapping observations
Observations	434,267	434,267		
EA	5,699	5,699		
USDA	318	18,884	321	5.63%
CPAS+WWS+GS (Jan)	29	1,708	3	0.05%
PP+GS (Mar)	29	1,712	20	0.35%
ACR+GS (Jun)	29	1,730	27	0.47%
CP (May-Nov)	202	12,007	260	4.56%
GS (Sep)	29	1,727	11	0.19%

Note: EA refers to the count of Earnings Announcements, USDA refers to the count of USDA reports included in our analysis over the sample period, CPAS is Crop Production Annual Summary, WWS is Winer Wheat Seedings, GS is Grain Stocks, PP is Prospective Plantings, ACR is Acreage Report, CP is Crop Production Report, which we include from May to November to account for corn, soybean and all wheat varieties production information.

During the sample period, a total of 5,699 earnings announcements were made by the firms included in our data set and a total of 318 days when USDA report included in our analysis were released. There were 29 report release days each for January release of CPAS, WWS and GS reports; March release of PP and GS reports; June release of ACR and GS reports and September release of GS reports. Similarly, we consider the CP report from May to November to include production information about all varieties of wheat, corn and soybean; and there were 202 CP reports for those months during our sample period. USDA report releases are counted for each firm separately; therefore, the total number of observations with USDA report releases is greater than the actual number of reports released by the USDA during this time period. The overall overlapping between firms' earnings announcement days and the USDA report release days is 5.63%. For each kind of USDA report release day, Crop Production reports from May to November have highest overlapping count at 4.56% while January release of CPAS, WWS and GS report has lowest overlapping count at 0.05% to

Returns and Surprises

a. Earnings Surprises

We follow existing literature (Hirshleifer et al., 2009; Hirshleifer & Sheng, 2022) and calculate standardized unexpected earnings (SUE) as:

$$SUE_{k,\tau} = \frac{EPS_{k,\tau} - \widehat{EPS}_{k,\tau}}{P_{k,\tau-1}} \ , \tag{1}$$

where $EPS_{k,\tau}$ is the actual earnings per share of company *k* on earnings announcement day τ, $\widehat{EPS}_{k,\tau}$ is the median of analysts' estimate of earnings per share of company *k* to be announced on day τ, and $P_{k,\tau-1}$ is the closing stock price of company *k* on the day before the earnings announcement. Scaling the difference between actual earnings and the median earnings forecast by the firm's stock price makes the measurement of earnings surprise relative to the per-dollar stock price of the firm, thus providing a more standardized measure among companies with different levels of stock prices. A positive earnings surprise is considered good news, while a negative earnings surprise is bad news for the stock price of that firm.

In the finance literature, it has been argued that SUE does not behave well in linear regression models due to nonlinear effects and outliers (Bernard & Thomas, 1989). Therefore, researchers follow the practice of ranking the SUE into quantiles rather than using the SUE values directly. Following the literature, we rank firms' SUE in each quarter from the smallest to the largest and assign them into 11 quantiles. The negative SUE values are equally assigned to quantiles 1 to 5, and the positive SUE values are equally assigned to quantiles 7 to 11. Firms with zero SUE are grouped in quantile 6. This means firms with the lowest and highest earnings surprises for the quarter are in quantiles 1 and quantile 11, respectively.

b. Buy-and-Hold Abnormal Returns (BHAR)

It is very common in finance literature to measure the cumulative abnormal returns (CAR) to quantify stock price reactions to important events. The CAR is calculated by adding up all the abnormal returns (i.e., the difference between actual returns and predicted returns obtained using the market model) over a certain time period. However, Barber & Lyon (1997) point out that the CAR is a biased predictor of buy-and-hold abnormal returns (BHAR) and suggest using the BHAR as it is consistent with actual investment practice. The BHAR is the percentage of the stock return that exceeds the market return when the stock is bought at the beginning of the event window and held until a certain time-period. It is also called continuously compounded returns.

For each earnings announcement day τ of a firm, we estimate the BHAR for the event window t_1 and t_2 as:

$$BHAR[t_1, t_2] = \left[\prod_{j=\tau+t_1}^{\tau+t_2}(1 + R_{k,j}) \ - 1\right] - \hat{\beta}_{k,\tau}\left[\prod_{j=\tau+t_1}^{\tau+t_2}(1 + R_{m,j}) - 1\right], \qquad (2)$$

where t_1 and t_2 are the starting and ending periods over which the BHAR is calculated for the earnings announcement day τ, $R_{k,j}$ is the stock return of company *k* on day *j*, $R_{m,j}$ is the market return on day *j*, which is proxied by the S&P 500 stock index returns, $\hat{\beta}_{k,\tau}$ is the coefficient for stock *k* obtained from the market model regression, $R_{k,j} = \alpha_{k,\tau} + \beta_{k,\tau} R_{m,j} + \epsilon_{k,j}$, where, $j = \tau -$

$300, \cdots, \tau - 46$. We calculate the BHAR for two different event windows. The first window covers the earnings announcement day and the next trading day, $[t_1 = 0, t_2 = 1]$, to study the immediate stock price reaction. The second event window ranges from two to sixty trading days after the earnings announcement, $[t_1 = 2, t_2 = 60]$, to study the PEAD.

Table 2 shows the summary statistics of the selected variables during our sample period. There are a total of 5,699 earnings announcements made by the firms in our sample with a mean value of standardized unexpected earnings at -0.0005 per dollar share value. The average BHAR for the [0, 1] window is 0.0027% and for the [2, 60] window is 0.0131%. The average market return during the sample period is 0.0528%.

Table 2: Summary Statistics of Returns and Surprises on Earnings Announcement Days

S.N.	Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
1	SUE	5,699	-0.0005	0.0245	-0.945	0.5385
2	BHAR[0,1]	5,698	0.0027	0.0852	-0.5839	1.9270
3	BHAR[2,60]	5,620	0.0131	0.1908	-0.6025	5.1348
4	Market returns	5,699	0.0528	1.1928	-9.5113	10.7890

Note: SUE refers to the standardized unexpected earnings and is calculated for each earnings announcement, so the total count of SUE is same as total number of earnings announcements. BHAR[0,1] is the buy-and-hold abnormal return based on market model over days [0,1]. BHAR[2,60] is the buy-and-hold abnormal return based on market model over days [2,60]. Market returns are the daily returns on the S&P 500 stock market index for earnings announcement days

Empirical Models

Complementarity vs. Substitution Hypothesis

Following Hirshleifer & Sheng (2022), we first examine the stock response of firms with the most positive earnings surprises (quantile 11) and the most negative earnings surprises (quantile 1) and estimate the following model:

$$BHAR[t_1, t_2] = \alpha_k + \delta_t + \beta_1 SUEQ\,Top_{k,\tau} + \beta_2 d(USDA)_\tau + \beta_3\big(SUEQ\,Top_{k,\tau} \times d(USDA)_\tau\big) \; + \; \sum X_\tau + \varepsilon_{k,\tau}, \tag{3}$$

where $SUEQ\,Top_{k,\tau}$ is a dummy variable that takes the value of one if company k's SUE quantile is 11 (top companies) and zero if the SUE quantile is 1 (bottom companies), $d(USDA)_\tau$ is a dummy variable indicating the release of any of the USDA reports included on earnings announcement day τ, X_τ contain control variables, including company-level market value decile, top market return dummy (i.e., if the market return on that day is in the top 10 percentile among market returns during the study period), Friday dummy, and year dummies, α_k is the company fixed effects, δ_t is the year fixed effects, and $\varepsilon_{k,\tau}$ is the error term.

We run the above regression separately for the dependent variables BHAR[0,1] and BHAR[2,60]. In these regressions, the coefficient of interest for testing the complementarity vs. substitution hypothesis is β_3. If there is a substitution effect of USDA reports on earnings announcements, there should be a weaker immediate reaction (β_3 < 0 for BHAR[0,1]) and a stronger drift (β_3 > 0 for BHAR[2,60]). On the contrary, a stronger immediate reaction (β_3 > 0 for BHAR[0,1]) and a weaker drift (β_3 < 0 for BHAR [2,60]) would suggest a complementary relationship between USDA reports and firms' earnings announcements.

We also create separate dummy variables for each specific USDA report release day. Specifically, we create dummy variables for the reports simultaneously released in January (CPAS+WWS+GS), in March (GS +PP), and June (ACR+GS). We create a dummy variable for the CP reports released from May to November and another dummy for the GS report released in September. Then, we include these dummy variables to replace the variable $d(USDA)_\tau$ in eqn. (3) and interact each of them with $SUEQ\,Top_{k,\tau}$.

$$BHAR[t_1, t_2] = \alpha_k + \delta_t + \beta_1 SUEQ\ Top_{k,\tau} + \beta_2 d(PP\_GS)_\tau + \beta_3\ d(ACR\_GS)_\tau$$

$$+\beta_4\ d(CP)_\tau + \beta_5 d\left(GS_{sep}\right)_\tau + \beta_6\ d(CPAS\_WWS\_GS)_\tau + \beta_7\big(SUEQ\ Top_{k,\tau} \times$$

$$d(PP_{GS})_\tau\big) + \beta_8\ \big(SUEQ\ Top_{k,\tau} \times\ d(ACR_{GS})_\tau\big) + \beta_9\big(SUEQ\ Top_{k,\tau} \times d(CP)_\tau\big)\ +$$

$$\beta_{10}\left(SUEQ\ Top_{k,\tau} \times d\left(GS_{sep}\right)_\tau\right) +\ \beta_{11}\big(SUEQ\ Top_{k,\tau} \times d(CPAS\_WWS\_GS)_\tau\big) +$$

$$\sum X_\tau + \varepsilon_{k,\tau}\ , \tag{4}$$

where $d(PP\_GS)_\tau$ is the dummy variable for March release of PP and GS reports, $d(ACR\_GS)_\tau$ is the dummy variable for June release of ACR and GS reports, $d(CP)_\tau$ is the dummy variable for Crop Production report from May to November, $d\left(GS_{sep}\right)_\tau$ is the dummy variable for September Grain stock report, $d(CPAS\_WWS\_GS)_\tau$ is the dummy variable for January release of CPAS +WWS+GS reports. All other variables and coefficients are same as defined in eqn (3). Here, β_7 to β_{11} are our coefficients of interest and they are tested for complementarity vs substitution effects of each interacted USDA reports on firm's earnings announcements as explained above.

To take advantage of our full sample of firms, we expand our sample to include all SUE quantiles and estimate the following model:

$$BHAR[t_1, t_2] = \alpha_k + \delta_t + \beta_1 SUEQ_{k,\tau} + \beta_2 d(PP\_GS)_\tau + \beta_3\ d(ACR\_GS)_\tau + \beta_4\ d(CP)_\tau +$$

$$\beta_5 d\left(GS_{sep}\right)_\tau + \beta_6\ d(CPAS\_WWS\_GS)_\tau + \beta_7\big(SUEQ_{k,\tau} \times d(PP_{GS})_\tau\big) +$$

$$\beta_8\ \big(SUEQ\ _{k,\tau} \times\ d(ACR_{GS})_\tau\big) + \beta_9\big(SUEQ_{k,\tau} \times d(CP)_\tau\big)\ + \beta_{10}\Big(SUEQ_{k,\tau} \times$$

$$d\left(GS_{sep}\right)_\tau\Big) +\ \beta_{11}\big(SUEQ_{k,\tau} \times d(CPAS\_WWS\_GS)_\tau\big) + \sum X_\tau + \varepsilon_{k,\tau}\ , \tag{5}$$

where $SUEQ_{k,\tau}$ is company k's SUE quantile ranging from 1 to 11 for a given quarter. All other variables are same as defined above for eqn (4) and our complementarity vs substitution effects are defined same as in eqn (3).

Impact of USDA Report Contents on Stock Returns

Our analysis so far explores the possible effect of the arrival of USDA reports on firm's earnings announcements without considering the surprise contents for corn, soybeans, and wheat in those USDA reports. However, recent findings from Cao et al. (2024) demonstrate that there are significant effects of price-bullish and price-bearish surprises for these commodities in USDA reports on the stock returns of agricultural companies. Expanding on their analysis, we also explore whether there is an interaction between firm's earnings surprises and surprise components of USDA reports. Specifically, we investigate whether the impact of USDA surprises on stock markets are affected by the arrival of firms' earnings announcements on the same day. This analysis is basically a different perspective to study the interaction between these two pieces of information. We explain this analysis and results in detail in Appendix B.

CHAPTER IV

RESULTS AND DISCUSSION

We categorize the companies in our sample into four groups - all firms, farm input suppliers, farm output buyers, and grain processors. Tables 3 and 4 show the regression results for testing the complementary vs. substitution hypothesis between earnings announcements and overlapping of USDA reports for each group of companies that have the highest and lowest earnings surprises (SUE quantiles 1 and 11).[3]

Table 3. Impact of USDA Report Releases on Stock Returns of Firms with Large Earnings Surprises: All Firms And Input Suppliers

	All Firms		Input Suppliers	
	BHAR[0,1]	BHAR[2,60]	BHAR[0,1]	BHAR[2,60]
SUEQ Top	0.088***	-0.014	0.061***	0.028
	(0.009)	(0.037)	(0.016)	(0.049)
d(USDA)	0.004	-0.152	-0.026	0.054
	(0.020)	(0.056)	(0.026)	(0.087)
SUEQ Top × d(USDA)	-0.032	0.188**	-0.035	-0.052
	(0.029)	(0.088)	(0.064)	(0.142)
Controls	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	672	658	132	129
# of companies	38	38	6	6

Note: The estimates are obtained from an unbalanced panel fixed effects regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies. Control variables include company-level market value decile, top 10% market return day dummy, and Friday dummy.

[3] For brevity, we only present the parameters associated with earnings announcements and USDA reports in these tables. Full regression results are provided in Appendix C.

In Table 3, the coefficient for the interaction term (*SUEQ Top × d(USDA)* in the BHAR[0,1] regression for all firms is negative but statistically insignificant at the conventional levels, suggesting that reactions of stock prices of all agricultural and food companies to a large earnings surprise are indifferent to USDA reports' arrival. This coefficient in the BHAR[2,60] regression is positive and statistically significant, implying that there is a sluggish response to the firms earnings surprises when it overlaps with USDA reports. This could also be due to delayed reaction to the information contained in USDA reports, which is gradually absorbed by investors and thus causes the price to drift. This result supports the substitution hypothesis between the earnings announcements and USDA reports. For farm input suppliers, we find no significant difference between price reactions to a large earnings surprise with or without the arrival of the USDA reports. This result aligns with the general intuition that most of the firms that supply farms are larger corporations with a wider range of products, which are usually not only limited to the agricultural sector. So, agricultural shocks are less likely to have significant effects on their stock prices.

The results for farm output buyers and grain processors in Table 4 show that the coefficients of the interaction term in the BHAR[0,1] regressions are statistically insignificant, suggesting that there is no difference in the immediate stock price reaction to a large earnings surprise when USDA reports are released on the same day. However, for both groups of companies, there is a statistical evidence for a positive PEAD on the USDA report days compared to general earnings announcement days, revealed by the coefficient on the interaction term in the BHAR[2,60] regression. The magnitude of this drift is higher for grain processors compared to output buyers, which aligns with our expectation that grain processors are more likely to be affected by USDA reports. This again suggests that there is some distraction to the investors' attention when USDA reports are released on the same day as earnings announcements, resulting in a gradual price drift. These sets of results also point towards the hinderance of the USDA reports in efficient price discovery of agricultural company stocks.

Table 4. Impact of USDA Report Releases on Stock Returns of Firms with Large Earnings Surprises: Output Buyers and Grain Processors

	Output Buyers		Grain Processors	
	BHAR[0,1]	BHAR[2,60]	BHAR[0,1]	BHAR[2,60]
SUEQ Top	0.101***	-0.038	0.087***	-0.174
	(0.013)	(0.049)	(0.017)	(0.101)
d(USDA)	0.013	-0.174***	-0.071*	-0.266*
	(0.023)	(0.063)	(0.042)	(0.124)
SUEQ Top x d(USDA)	-0.038	0.230**	0.043	0.457*
	(0.034)	(0.104)	(0.040)	(0.240)
Controls	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	540	529	170	166
# of Companies	32	32	10	10

Note: The estimates are obtained from an unbalanced panel fixed effects regression with company fixed effects and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies. Control variables include company-level market value decile, top 10% market return day dummy, and Friday dummy.

Overall, these results suggest that there is no measurable substitution effect of USDA reports on the immediate price reaction among top and bottom surprise companies for these output buyer groups. However, the presence of the significant drift could be due to both earnings news and USDA reports being subjected to delayed attention by investors, and gradually, their informational value is incorporated into the stock price discovery giving rise to the drift. In other words, we think that the drift comes primarily from delayed informational interaction of USDA reports with earnings announcements rather than hindering investors' attention towards earnings news.

Table 5. Impact of Each USDA Report Releases on Stock Returns of Firms with Large Earnings Surprises: Grain Processors

	Grain Processors	
	BHAR[0,1]	BHAR[2,60]
SUEQ Top	0.095***	-0.135
	(0.020)	(0.090)
d(CP)	0.134***	-0.321**
	(0.020)	(0.128)
d(PP+GS)	0.005***	0.028***
	(0.000)	(0.000)
SUEQ Top × d(CP)	-0.123***	1.283***
	(0.025)	(0.216)
Controls	Yes	Yes
Year Effects	Yes	Yes
Company FE	Yes	Yes
Observations	170	166
# of Companies	10	10

Note: The estimates are obtained from an unbalanced panel fixed effects regression with company fixed effects and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies. Control variables include company-level market value decile, top 10% market return day dummy, and Friday dummy.

Next, we explore the effects of each USDA report on the grain processors group. We still use only the firms with the largest earnings surprise (quantile 11) and the smallest earnings surprise (quantile 1). We create separate dummy variables for each of the USDA reports mentioned earlier in eqn. (4) and interact each of them with the best-earnings dummy. As reported in Table 5, the CP reports from May to November and PP report simultaneously released with the March issue of GS report induce a positive stock return for the grain processors during our sample period. Specifically, the BHAR[0,1] increases by 0.134 percentage points on the days with CP releases, and by 0.005 percentage points on the days with PP and GS releases. However, the coefficient for the interaction term between the CP report and the largest earnings surprise indicator is negative, indicating that CP reports hinder the immediate reaction in stock prices for grain processors. Further, when we analyze the PEAD for these companies (i.e., the BHAR[2,60] regression), the interaction term coefficient is positive and statistically significant.

These results show that the investors in grain processing companies are distracted by CP reports when they are released on earnings announcement days, and prevent full incorporation of earnings news into stock returns, which is subsequently realized as post-earnings announcement drift. This phenomenon confirms the substitution effect of these reports on firm’s earnings announcements.

In the analysis so far, we have restricted the dataset to extreme earnings surprise quantiles where their potential impacts on stock prices are the highest. To take advantage of the full sample of the companies in our data set we next analyze the stock price reactions using all the quantiles of earnings surprises and separately run the model using eqn. (5) above for all firms and input suppliers, which is presented in Table 6.

We find slightly different results when using the sample of all companies. Overall, there is not much immediate reaction or significant drift due to each USDA report being released on earnings announcement days. However, the GS report released in September seems to increase the immediate reaction to the earnings news overall. Similarly, for the input suppliers, the arrival of PP and GS reports in March and ACR and GS reports in June seem to enhance the immediate reaction in stock returns. No significant drift is evident for any of these reports. For both groups of companies here, we find that these reports result in an enhanced immediate reaction, which also helps to explain the lack of significant drift.

Table 6. Impact of Each USDA Report Release on Stock Returns of Firms with any Level of Earnings Surprise: All Firms and Input Suppliers

	All Firms		Input Suppliers	
	BHAR[0,1]	BHAR[2,60]	BHAR[0,1]	BHAR[2,60]
SUEQ	0.009***	0.002	0.008***	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
d(CPAS+WWS+GSday)	0.024	-0.029		
	(0.017)	(0.055)		
d(PP+GSday)	0.082	0.148	-0.125***	0.099*
	(0.065)	(0.115)	(0.033)	(0.053)
d(ACR+GSday)	0.015	-0.012	-0.066**	0.069
	(0.034)	(0.051)	(0.029)	(0.067)
d(CPday)	0.002	-0.135**	-0.022	-0.307
	(0.019)	(0.068)	(0.119)	(0.223)
d(GSsep)	-0.103***	0.015		
	(0.033)	(0.084)		
SUEQ x d(CPAS+WWS+GSday)	-0.006***	-0.008		
	(0.002)	(0.006)		
SUEQ x d(PP+GSday)	-0.008	-0.021	0.018*	-0.023
	(0.007)	(0.014)	(0.009)	(0.014)
SUEQ x d(ACR+GSday)	-0.001	-0.003	0.009*	-0.009
	(0.005)	(0.008)	(0.005)	(0.009)
SUEQ x d(CPday)	0.000	0.017	0.006	0.033
	(0.003)	(0.011)	(0.013)	(0.024)
SUEQ x d(GSsep)	0.011***	0.002		
	(0.004)	(0.012)		
Controls	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	5698	5620	859	847
# of Companies	94	94	13	13

Note: The estimates are obtained from an unbalanced panel fixed effects regression with company fixed effects and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies. Control variables include company-level market value decile, top 10% market return day dummy, and Friday dummy.

Table 7. Impact of Each USDA Report Release on Stock Returns of Firms With any Level of Earnings Surprise: Output Buyers and Grain Processors

	Output Buyers		Grain Processors	
	BHAR[0,1]	BHAR[2,60]	BHAR[0,1]	BHAR[2,60]
SUEQ	0.009***	0.001	0.009***	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)
d(CPAS+WWS+GSday)	0.024	-0.028		
	(0.017)	(0.056)		
d(PP+GSday)	0.138**	0.154	0.021	0.140
	(0.061)	(0.146)	(0.089)	(0.199)
d(ACR+GSday)	0.041	0.035	0.042	0.023
	(0.037)	(0.046)	(0.036)	(0.036)
d(CPday)	0.006	-0.132*	0.061**	-0.223
	(0.020)	(0.069)	(0.029)	(0.212)
d(GSsep)	-0.100***	0.001	0.048	-1.268***
	(0.036)	(0.082)	(0.107)	(0.290)
SUEQ x d(CPAS+WWS+GSday)	-0.007***	-0.009	-0.001	-0.018
	(0.002)	(0.006)	(0.009)	(0.021)
SUEQ x d(PP+GSday)	-0.015**	-0.018	-0.003	-0.018
	(0.007)	(0.016)	(0.009)	(0.024)
SUEQ x d(ACR+GSday)	-0.004	-0.012*	-0.004	-0.011*
	(0.006)	(0.006)	(0.006)	(0.006)
SUEQ x d(CPday)	-0.001	0.017	-0.010**	0.043
	(0.003)	(0.012)	(0.004)	(0.037)
SUEQ x d(GSsep)	0.011**	0.004	-0.008	0.170***
	(0.005)	(0.011)	(0.014)	(0.040)
Controls	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	4839	4773	1802	1775
# of Companies	81	81	32	32

Note: The estimates are obtained from an unbalanced panel fixed effects regression with company fixed effects and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies. Control variables include company-level market value decile, top 10% market return day dummy, and Friday dummy.

Table 7 presents the results for farm output buyers and grain processors, which are mostly mixed. We find that the release of CPAS, WWS, and GS reports in January and of PP and GS in March weakens the immediate stock market reaction to firms' earnings surprises, but there is no significant drift observed. September GS report enhances the immediate reaction of output buyers in general. However, the same report does not affect the immediate reaction for grain processors, but there is a significant and positive drift. Further, the CP report significantly reduces the immediate reaction for grain processors, which was also the case with top earnings surprise quantiles. However, CP has no overall significant effect on drift for grain processors.

The only report with a negative effect on the PEAD for output buyers and grain processors is the ACR and GS reports simultaneously released in June. However, it is difficult to interpret this significant drift without a significant reduction in the initial stock reaction. The best we can argue is that the content of USDA reports play a role in the drift. In a broader picture, except for a few exceptions, USDA reports have a substitution effect on the stock market's incorporation of earnings announcements by either weakening the immediate reaction or strengthening the post-earnings announcement drift.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Our study is the first to explore the impact of the arrival of USDA reports on the stock market's ability to incorporate a firm's earnings announcements into stock prices. Stemming motivation from major macroeconomic reports' ability to enhance or hinder the incorporation of earning news into stock prices, this research attempts to evaluate the significance of USDA reports as important agricultural-sector news for agricultural-related public firms.

Broadly, we find that the arrival of USDA reports, in general, increases the post-earnings announcement drift for agricultural and food companies, except for the input suppliers. The magnitude of such drift is the highest for grain processors, followed by farm output buyers and all firms. Despite no significant impact on the immediate reaction to earnings surprises, a significant drift would suggest a substitution effect of USDA reports over the firms' earnings announcements. This substitution effect is more evident when studying the effect of each USDA report separately. We find a clear substitution effect of the Crop Production report on the impact of earnings announcements for grain processors that are at the top quantile of earnings surprises compared to those processors at the bottom quantile, with a significant reduction in the immediate reaction and an increase in the post-earnings drift. Even with any level of earnings surprise, crop production reports still have a significant reduction in earnings news reaction for grain processors, which confirms the substitution effect of crop production reports.

It is difficult to draw a definite conclusion for the other USDA reports, as they have mixed effects. The simultaneous release of Prospective Plantings and Grain Stocks reports in

March is found to increase both immediate reaction as well as post-earnings drift for grain processors with largest earnings surprises. Considering all quantiles of earnings surprises, we again find that the release of these reports in March is associated with an increased reaction for input suppliers but a decreased reaction for output buyers and no effect on grain processors. Similarly, the September Grain Stocks report seems to enhance the stock market reaction for output buyers but leads to a significant drift for grain processors. A significant positive drift without a significant reduction in immediate reaction could also signal investors' delayed attention toward the USDA reports' surprises, which might have a positive effect on stock returns on its own.

In a nutshell, our research findings indicate that USDA reports generally have a substitution effect on a firm's earnings news either by increasing PEAD or reducing immediate reaction. The major USDA report of concern here is the Crop Production report. We expect the findings of this study to help stakeholders and investors within agricultural and food industries to better anticipate and respond to stock market movements during the USDA reports' release days.

The findings of this study have implications for publicly traded agricultural firms, investors, and the value of USDA reports. First, this research supports the idea that USDA reports affect not only the commodity futures markets but also the stock market of firms that use these commodities. By showing that USDA reports affect the incorporation of firms' earnings announcements into stock returns, our results extend the findings by Cao et al. (2024) who reported that USDA reports also affect the stock market. Thus, we broaden the literature and open up further research insights into wider implications of USDA reports on stock markets and the general economy. By doing so, this research also helps to establish the position that public data and information like USDA reports, which are produced using taxpayers' money are still valuable to the investors and economy, and they have significant effects on market movements and stock returns far beyond commodity futures markets.

Further, the findings here have important strategic implications for publicly traded agricultural companies. With the awareness that USDA reports can affect returns on earnings announcement days, food and grain processing companies may plan to strategically avoid or overlap releasing their earnings news with USDA reports. This strategic report can help the companies gain more from a positive earnings surprise or lose less from a negative earnings surprise. Similarly, institutional and retail investors, as well as equity funds managers, might want to be more careful about USDA reports and their possible implications on stock returns. This can help them make better investment decisions and increase their returns by anticipating the potential market movement and information inefficiency due to the overlapping of USDA reports with earning announcements.

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APPENDICES

A. Full Sample of Tickers Used to Identify Agricultural Firms (1995-2023)

Group	Company Tickers
Farm Input Suppliers	AG, AGCO, AGFS, ALG, ALMO, ARTW, AVD, BLT, CAT, CF, CNH, CNHI, DD, DE, DOW, DWDP, FMC, LINZ, LNN, MBII, MON, MOS, RKDA, SANW, SYT, TITN, TSCO, TTC, TWI, UAVS
Farm Output Buyers	ACCOB, AGRO, AMRS, AMTX, AQB, ARKR, ARMK, BDL, BGS, BJNRY, BJRI, BLMN, BNYY, BOBE, BRFS, BUD, BBQ, BREW, BRID, CAKE, CALM, CAG, CASY, CBRL, CDB, CHEF, CHGO, CHUY, CHX, CMG, CORE, COKE, CPB, CPKI, CPO, DAR, DAVE, DENN, DEO, DINE, DNKN, DPZ, DRI, EAT, EAST, ESDI, FARM, FAT, FDP, FF, FIZZ, FLO, FM, FRGI, FRPT, GEVO, GIS, GMCR, GPP, GPRE, GTIM, HAIN, HANS, HFFG, HNZ, HOOK, HRL, HSY, HTSI, IHOP, IFMK, INGR, IHP, JACK, JAX, JBS, JBSS, JBX, JJSF, K, KDP, KFT, KHC, KO, KR, KRFT, LANC, LOCO, LUB, LW, LWAY, MCD, MDLZ, MED, MGPI, MKC, MNST, NATH, NBEV, NDLS, NGVC, NH, NOSH, PEP, PFGC, PF, PLAY, POST, PPC, PZZA, PZZI, RAH, RAVE, REED, REGI, REX, RMCF, RKY, RSC, RRGB, RUTH, SAFM, SAM, SBUX, SFDS, SFM, SJM, SMPL, STKS, STZ, SVU, SWY, SXT, TACO, TAP, TAST, THS, TR, TRY, TXRH, TWNK, UFC, UNFI, USFD, WEN, WFM, WFMI, WING, WMK, YUM

Grain Processors	ACCOB, AGRO, AMRS, AMTX, BGS, BNYY, BRFS, BRID, BREW, BUD, CAG, DEO, EAST, FDP, FF, FIZZ, FLO, GMCR, GPP, GPRE, HAIN, HNZ, INGR, JBSS, JJSF, K, KDP, KFT, KHC, KO, KRFT, LANC, MDLZ, MGPI, MKC, MNST, NBEV, PEP, PF, POST, REED, REGI, REX, RSC, SAM, SJM, SMPL, STZ, TAP, THS, TWNK

B. Impact of Earnings Announcements in the Incorporation of USDA Surprises into Stock Returns

This part of our analysis explores how the arrival of earnings announcements on the same day as USDA report releases affects the impact of the news content of USDA reports on stock returns of agricultural firms. Basically, these set of analysis are based on the findings of Cao et al. (2024), where they report that surprises in the corn, soybean, and wheat in USDA reports affects the stock returns of the agricultural companies. We try exploring whether the arrival of firms' earnings announcements on those USDA reports release days affects the incorporation of USDA surprises into stock returns.

i. Data

For this analysis, we collect actual reported value and the estimated value for each commodity (corn, soybean, and wheat) included in USDA reports. We collect the actual values reported in the following USDA reports: Crop Production Annual Summary (CPAS), Winter Wheat Seeding (WWS), Prospective Plantings (PP), Acreage (ACR), Crop Production (CP), and Grain Stocks (GS). Then, we use the mean (or median) of private analysts' forecasts as a proxy for market expectations of these USDA reports (Colling and Irwin, 1990; Grunewald et al., 1993; Garcia et al., 1997, Egelkraut et al., 2003; Karali et al. 2019). Private analysts' forecasts for WWS, PP, and ACR reports are obtained from Knight Ridder/Dow Jones (1995-2015) and Thomson Reuters (2016-2023). For corn and soybeans, private analysts' forecasts for CP and CPAS reports are taken as the average of forecasts by Conrad Leslie and Informa Economics (1995-2000), the average between the Informa Economics estimate and the average analyst estimate reported by the Dow Jones Newswire survey (2001-2005), the average of the Dow Jones survey (2006-2012), and the average of the Bloomberg survey (2013-2023). Private expectations for wheat CP reports are based on the average analysts' forecasts reported by

Knight-Ridder/Dow Jones Newswire. These data are used to calculate USDA report surprises, which is the percentage difference between USDA figures and market expectations.

i. USDA Report Surprises

Following previous studies, we calculate the surprise content of USDA reports in percentage terms as:

$$SURPRISE_{r,t} = 100 \times \frac{USDA_{r,t} - \widehat{USDA}_{r,t}}{USDA_{r,t}}, \tag{6}$$

where $USDA_{r,t}$ is the actual value in USDA's report *r* released on day *t* and $\widehat{USDA}_{r,t}$ is the mean (or median) of analysts' estimates for that report.

We also create dummy variables for the USDA report release days and for positive and negative surprises for each report, where the positive (negative) surprise dummy takes the value of one if the surprise is positive (negative) and zero otherwise. All dummies take the value of zero on non-announcement days.

ii. Excess Returns

According to the capital asset pricing model (CAPM), the excess return is the difference between the actual return on an investment over the riskless interest rate (Treynor, 1961; Sharpe, 1964). We follow Cao et al. (2024) and estimate the excess return for company *k* on each trading day *t* using a two-parameter version of CAPM (Black, 1972) as follows:

$$ER_{k,t} = R_{k,t} - \left[R_{r,t} + \hat{\beta}_{k,t}\left(R_{m,t} - R_{r,t}\right)\right], \tag{7}$$

where $R_{k,t}$ is the stock return on company *k* on day *t*, $R_{m,t}$ is the market return on day *t* (proxied by the S&P 500 stock index returns), $R_{r,t}$ is the risk-free interest rate on day *t* (proxied by 3-month U.S. Treasury bill rate), and $\hat{\beta}_{k,t}$ is the coefficient obtained from the regression, $R_{k,t} = R_{r,t} + \beta_{k,t}\left(R_{m,t} - R_{r,t}\right) + \epsilon_{k,t}$ using 90-day rolling windows up until day *t*–10.

ii. Empirical Analysis

We follow Cao et al. (2024) and estimate the following model in eqn. (8) using entire trading day sample. Here, we use the dummy variable for earnings announcement day and interact it with each of the USDA report surprises for Corn, Soybean and Wheat. We estimate this model using unbalanced panel fixed effects regression with company fixed effects and year effects. With this specification, we investigate whether the impact of USDA report surprises on excess returns are affected by the release of earnings announcements.

$$ER_{k,t} = \alpha_k + \delta_y + \beta_1 d(EA)_t + \beta_2^+ USDA_t^+ + \beta_2^- USDA_t^- + \beta_3^+ (d(EA)_t \times USDA_t^+) + \beta_3^- (d(EA)_t \times USDA_t^-) + \sum X_t + \varepsilon_{k,t} \,, \tag{8}$$

where $ER_{k,t}$ is excess return (residual) estimated using CAPM for company *k* on trading day *t*, $d(EA)_t$ is the dummy variable taking the value of one on earnings announcement days and zero on non-announcement days for our sample firms, $USDA_t^+$ and $USDA_t^-$ are positive and negative surprises in USDA reports included for three major grains (CPAS: corn and soybean; WWS: winter wheat; PP: corn, soybean, and other spring wheat; ACR: corn, soybean, and other spring wheat; CP: corn, soybean, winter wheat, and other spring wheat; GS: corn, soybean, all wheat), all taking the value of zero on non-report release days, X_τ contain control variables, including company-level market value decile, top market return dummy (i.e., if the market return on that day is in the top 10 percentile among market returns during the study period), Friday dummy, and year dummies, α_k is the company fixed effects, δ_y is the year fixed effects, and $\varepsilon_{k,\tau}$ is the error term.

iii. Results

We estimate the model specification above for the grain processor companies, as they are the ones that are most likely affected by the USDA report surprises. The results of the analysis for grain processors are presented in Table B.1 below. From the table, we find that the impact of positive surprises of corn in CP and GS reports and positive surprises of spring wheat on PP on companies' excess returns increase on the earnings announcement days. Further, the impact of negative surprises of corn in PP and spring wheat in PP, ACR, and GS reports on companies' excess returns becomes negative or more negative on the earnings announcement days. However, soybean surprises seem to have the opposite effect. The impact of positive surprises of soybean in CPAS, PP, and CP reports becomes more negative on the earnings announcement days but the impact of negative surprises in PP becomes more positive on earning announcement days. Broadly, we can say that stock market reactions to surprises in USDA reports increase in magnitude on the earnings announcement days.

Table B.1. Effect of the Release of Earnings Announcements on the Impact of USDA Report Surprises on Excess Returns

Grain Processors											
Dependent Variable: Excess Return		Corn		Soy		Winter Wheat		Spring Wheat		All Wheat	
		+	−	+	−	+	−	+	−	+	−
d(EA)	0.276										
WWS						0.066	0.000				
d(EA) x WWS						*N/A*	*N/A*				
CPAS		0.335	-0.047	-0.179	0.172						
d(EA) x CPAS		*N/A*	*N/A*	-4.816***	*N/A*						
PP		0.795***	-0.505***	-0.191*	0.205**			-0.012	0.126**		
d(EA) x PP		0.976	-3.748**	-8.062***	3.419***			0.603***	-5.928***		
ACR		0.087	0.173**	0.177	0.075			0.021	-0.124**		
d(EA) x ACR		0.864	1.850***	1.643	1.366			-0.188	-3.651***		
CP		-0.034	0.070	0.002	0.056	0.014	-0.105***	-0.010	0.023***		
d(EAP) x CP		1.745*	0.126	-1.183*	0.700	-0.902*	1.313	1.039	-1.094***		
GS		0.006	-0.019	-0.007	0.006					0.003	-0.010
d(EA) x GS		0.090**	0.392	-0.322	-0.049					0.264	-1.989
Controls	Y										
Year Effects	Y										
Observations	126,319										
# of Companies	32										

Note: The estimates are obtained from an unbalanced panel fixed effects regression with company fixed effects and year fixed effects. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies. Control variables include company-level market value decile, top 10% market return day dummy, and Friday dummy.

C. Regression Results

Table C.1: Regression Results for Immediate and Delayed Price Reaction for Top Earnings Surprises: All Firms and Input Suppliers

	All firms		Input Suppliers	
VARIABLES	BHAR[0,1]	BHAR[2,60]	BHAR[0,1]	BHAR[2,60]
SUEQ Top	0.088***	-0.014	0.061**	0.028
	(0.009)	(0.037)	(0.016)	(0.049)
d(USDA)	0.004	-0.152***	-0.026	0.054
	(0.020)	(0.056)	(0.026)	(0.087)
SUEQ Top × d(USDA)	-0.032	0.188**	-0.035	-0.052
	(0.029)	(0.088)	(0.064)	(0.142)
d(MARKET_VALUE_DECILE)	0.002	-0.048**	0.021	-0.119
	(0.007)	(0.018)	(0.014)	(0.118)
d(TOP_MARKET_RETURN)	-0.001	0.121	0.008	0.111
	(0.014)	(0.080)	(0.023)	(0.122)
d(FRIDAY)	-0.003	-0.051*	0.038*	0.028
	(0.011)	(0.028)	(0.018)	(0.084)
YEAR EFFECTS				
1996	0.013	0.004	-0.004	0.116
	(0.023)	(0.041)	(0.014)	(0.160)
1997	-0.013	0.005	-0.023	0.225
	(0.026)	(0.039)	(0.015)	(0.179)
1998	0.016	-0.088**	-0.014	0.005
	(0.026)	(0.041)	(0.009)	(0.128)
1999	0.015	-0.222**	-0.031***	-0.079***
	(0.072)	(0.086)	(0.000)	(0.000)
2000	0.021	0.028	-0.008	-0.015
	(0.032)	(0.047)	(0.016)	(0.047)
2001	0.042	-0.108**	0.007	-0.116*
	(0.041)	(0.041)	(0.018)	(0.049)
2002	-0.002	-0.224**	0.022	-0.026
	(0.026)	(0.090)	(0.026)	(0.047)
2003	0.039	0.099	0.025	-0.013
	(0.041)	(0.098)	(0.024)	(0.116)
2004	0.043	-0.205***	-0.003	-0.121*
	(0.026)	(0.058)	(0.016)	(0.049)
2005	-0.003	-0.094	0.031	-0.208*
	(0.028)	(0.072)	(0.029)	(0.096)
2006	0.054	-0.033	0.027	-0.013
	(0.045)	(0.095)	(0.019)	(0.184)
2007	-0.004	-0.133**	-0.026	-0.067
	(0.026)	(0.064)	(0.045)	(0.102)
2008	0.106	-0.138*	0.135**	0.301
	(0.114)	(0.070)	(0.049)	(0.276)

2009	-0.016	0.104	0.030	0.042
	(0.053)	(0.096)	(0.043)	(0.079)
2010	0.004	-0.112**	0.051	0.165
	(0.040)	(0.054)	(0.031)	(0.138)
2011	0.009	-0.010	0.034	0.308
	(0.032)	(0.049)	(0.027)	(0.171)
2012	0.039	-0.044	-0.009	0.407
	(0.030)	(0.060)	(0.043)	(0.252)
2013	0.047	-0.005	0.012	0.145
	(0.029)	(0.059)	(0.031)	(0.281)
2014	0.004	-0.054	0.009	0.057
	(0.029)	(0.046)	(0.016)	(0.182)
2015	0.011	-0.073	0.038	0.059
	(0.030)	(0.049)	(0.059)	(0.208)
2016	-0.038	-0.062	-0.097	0.084
	(0.031)	(0.063)	(0.062)	(0.181)
2017	0.032	-0.022	0.052	0.337
	(0.031)	(0.081)	(0.034)	(0.371)
2018	0.021	-0.025	0.018	-0.017
	(0.029)	(0.069)	(0.024)	(0.184)
2019	0.004	-0.120**	-0.005	-0.133
	(0.026)	(0.054)	(0.080)	(0.146)
2020	0.007	0.213**	0.046*	0.226
	(0.034)	(0.102)	(0.022)	(0.288)
2021	0.037	-0.083	0.022	-0.129
	(0.030)	(0.073)	(0.033)	(0.068)
2022	0.007	-0.170	0.084**	0.009
	(0.032)	(0.103)	(0.025)	(0.178)
2023	0.022	0.051	0.040	
	(0.032)	(0.110)	(0.030)	
Constant	-0.058**	0.236***	-0.100**	0.204
	(0.027)	(0.055)	(0.033)	(0.129)
Observations	672	658	132	129
R-squared	0.120	0.106	0.361	0.301
Number of firms	38	38	6	6

Note: The estimates are obtained from an unbalanced panel fixed effects regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies.

Table C.2: Regression Results for Immediate and Delayed Price Reaction for Top Earnings Surprises: Output Buyers and Grain Processors

	Output Buyers		Grain Processors	
VARIABLES	BHAR[0,1]	BHAR[2,60]	VARIABLES	BHAR[0,1]
SUEQ Top	0.101***	-0.038	0.087***	-0.174
	(0.013)	(0.049)	(0.017)	(0.101)
d(USDA)	0.013	-0.174***	-0.071	-0.266*
	(0.023)	(0.063)	(0.042)	(0.124)
SUEQ Top × d(USDA)	-0.038	0.230**	0.043	0.457*
	(0.034)	(0.104)	(0.040)	(0.240)
d(MARKET_VALUE_DECILE)	0.001	-0.049**	-0.006	-0.023
	(0.007)	(0.019)	(0.008)	(0.063)
d(TOP_MARKET_RETURN)	-0.003	0.124	-0.006	0.346
	(0.017)	(0.093)	(0.035)	(0.326)
d(FRIDAY)	-0.008	-0.079**	-0.011	-0.148
	(0.013)	(0.032)	(0.036)	(0.210)
YEAR EFFECTS				
1996	0.006	0.014		
	(0.021)	(0.022)		
1997	-0.013	-0.009		
	(0.029)	(0.041)		
1998	0.046	-0.070	0.049**	0.043
	(0.028)	(0.059)	(0.016)	(0.172)
1999	0.049	-0.313***		
	(0.098)	(0.110)		
2000	0.068*	0.094*		
	(0.038)	(0.051)		
2001	0.040	-0.133**		
	(0.057)	(0.054)		
2002	-0.014	-0.263***		
	(0.027)	(0.096)		
2003	0.040	0.190		
	(0.053)	(0.135)		
2004	0.038	-0.227***	0.004	-0.349**
	(0.028)	(0.069)	(0.018)	(0.127)
2005	-0.013	-0.089	0.014	-0.071
	(0.032)	(0.085)	(0.015)	(0.102)
2006	0.055	-0.022	-0.019*	-0.067
	(0.057)	(0.129)	(0.009)	(0.066)
2007	-0.008	-0.129	0.005	-0.320**
	(0.027)	(0.085)	(0.018)	(0.100)
2008	0.093	-0.199***	0.051*	-0.414**
	(0.129)	(0.066)	(0.026)	(0.165)
2009	-0.041	0.151		

	(0.065)	(0.120)		
2010	-0.015	-0.183***	0.173***	-0.281***
	(0.049)	(0.056)	(0.021)	(0.084)
2011	-0.002	-0.054	0.001	-0.198
	(0.037)	(0.045)	(0.013)	(0.144)
2012	0.039	-0.098	0.093**	-0.328
	(0.032)	(0.061)	(0.038)	(0.197)
2013	0.039	-0.032	0.118***	0.036
	(0.034)	(0.075)	(0.029)	(0.151)
2014	-0.006	-0.074	0.028	-0.211
	(0.034)	(0.057)	(0.028)	(0.188)
2015	-0.009	-0.092	0.076*	-0.239
	(0.032)	(0.061)	(0.037)	(0.193)
2016	-0.021	-0.109	0.028	-0.190
	(0.033)	(0.088)	(0.026)	(0.232)
2017	0.015	-0.111	0.100***	-0.324
	(0.036)	(0.074)	(0.018)	(0.180)
2018	0.017	-0.020	0.096**	-0.146
	(0.030)	(0.077)	(0.036)	(0.266)
2019	-0.001	-0.123**	0.040	-0.228
	(0.027)	(0.059)	(0.048)	(0.182)
2020	-0.009	0.221*	0.046	0.355*
	(0.038)	(0.114)	(0.035)	(0.169)
2021	0.030	-0.075	0.114***	-0.177
	(0.035)	(0.083)	(0.030)	(0.269)
2022	-0.016	-0.196	0.126***	-0.329
	(0.035)	(0.119)	(0.027)	(0.312)
2023	0.011	0.029	0.074**	0.121
	(0.034)	(0.107)	(0.025)	(0.196)
Constant	-0.051*	0.289***	-0.080*	0.383*
	(0.029)	(0.070)	(0.040)	(0.182)
Observations	540	529	170	166
R-squared	0.121	0.124	0.230	0.230
Number of firms	32	32	10	10

Note: The estimates are obtained from an unbalanced panel fixed effects regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies.

Table C.3: Regression Results for Impact of Each USDA Report Releases on Stock Returns of Firms with Large Earnings Surprises: Grain Processors

	Grain Processors	
VARIABLES	BHAR[0,1]	BHAR[2,60]
SUEQ Top	0.095***	-0.135
	(0.020)	(0.090)
d(CP)	0.134***	-0.321**
	(0.020)	(0.128)
d(CP_WWS_GS)	0.000	0.000
	(0.000)	(0.000)
d(PP_GS)	0.005***	0.028***
	(0.000)	(0.000)
d(ACR_GS)	0.000	0.000
	(0.000)	(0.000)
SUEQ Top x d(CP)	-0.123***	1.283***
	(0.025)	(0.216)
SUEQ Top x d(CP_WWS_GS)	0.000	0.000
	(0.000)	(0.000)
SUEQ Top x d(PP_GS)	0.000	0.000
	(0.000)	(0.000)
SUEQ Top x d(ACR_GS)	0.000	0.000
	(0.000)	(0.000)
d(MARKET_VALUE_DECILE)	-0.004	-0.014
	(0.009)	(0.068)
d(TOP_MARKET_RETURN)	-0.002	0.350
	(0.035)	(0.322)
d(FRIDAY)	-0.009	-0.125
	(0.036)	(0.208)
YEAR EFFECTS		
1998	0.058***	-0.025
	(0.018)	(0.132)
2004	-0.007	-0.291***
	(0.014)	(0.071)
2005	0.009	-0.040
	(0.014)	(0.071)
2006	-0.011	-0.081
	(0.013)	(0.055)
2007	0.012	-0.333***
	(0.022)	(0.096)
2008	0.053*	-0.375**
	(0.024)	(0.158)
2010	0.173***	-0.337***
	(0.024)	(0.059)

2011	0.005	-0.221
	(0.016)	(0.171)
2012	0.094**	-0.341
	(0.037)	(0.204)
2013	0.126***	0.016
	(0.028)	(0.161)
2014	0.032	-0.244
	(0.028)	(0.208)
2015	0.083*	-0.242
	(0.038)	(0.202)
2016	0.040	-0.202
	(0.027)	(0.254)
2017	0.092***	-0.311
	(0.011)	(0.185)
2018	0.091**	-0.187
	(0.034)	(0.263)
2019	0.052	-0.222
	(0.047)	(0.202)
2020	0.052	0.329*
	(0.035)	(0.167)
2021	0.110**	-0.315
	(0.041)	(0.317)
2022	0.120**	-0.408
	(0.037)	(0.374)
2023	0.086**	0.144
	(0.028)	(0.227)
Constant	-0.099*	0.344*
	(0.046)	(0.159)
Observations	170	166
R-squared	0.220	0.233
Number of cusip_id	10	10

Note: The estimates are obtained from an unbalanced panel fixed effects regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies.

Table C.4: Regression Results for Impact of Each USDA Report Releases on Stock Returns of Firms with any Earning Surprises: All Firms And Input Suppliers

	All firms		Input Suppliers	
VARIABLES	BHAR[0,1]	BHAR[2,60]	VARIABLES	BHAR[0,1]
SUEQ	0.009***	0.002	0.008***	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
d(CPday)	0.002	-0.135**	-0.022	-0.307
	(0.019)	(0.068)	(0.119)	(0.223)
d(CPAS+WWS+GSday)	0.024	-0.029		
	(0.017)	(0.055)		
d(PP+GSday)	0.082	0.148	-0.125***	0.099*
	(0.065)	(0.115)	(0.033)	(0.053)
d(ACR+GSday)	0.015	-0.012	-0.066**	0.069
	(0.034)	(0.051)	(0.029)	(0.067)
d(GSsep)	-0.103***	0.015		
	(0.033)	(0.084)		
SUEQ x d(CPday)	0.000	0.017	0.006	0.033
	(0.003)	(0.011)	(0.013)	(0.024)
SUEQ x d(CPAS+WWS+GSday)	-0.006***	-0.008		
	(0.002)	(0.006)		
SUEQ x d(PP+GSday)	-0.008	-0.021	0.018*	-0.023
	(0.007)	(0.014)	(0.009)	(0.014)
SUEQ x d(ACR+GSday)	-0.001	-0.003	0.009	-0.009
	(0.005)	(0.008)	(0.005)	(0.009)
SUEQ x d(GSsep)	0.011**	0.002		
	(0.004)	(0.012)		
d(MARKET_VALUE_DECILE)	0.002	-0.028***	-0.001	-0.021**
	(0.002)	(0.004)	(0.002)	(0.007)
d(TOP_MARKET_RETURN)	-0.001	0.015	0.008	0.026
	(0.004)	(0.012)	(0.011)	(0.029)
d(FRIDAY)	0.005*	-0.010	0.007	0.021
	(0.003)	(0.007)	(0.007)	(0.021)
YEAR EFFECTS				
1996	0.001	0.018	-0.011	0.050
	(0.007)	(0.021)	(0.013)	(0.037)
1997	-0.009	0.045**	-0.021	0.008
	(0.008)	(0.019)	(0.023)	(0.027)
1998	-0.003	-0.007	-0.023	-0.003
	(0.007)	(0.021)	(0.019)	(0.084)
1999	-0.011	-0.060**	-0.045	-0.049
	(0.008)	(0.026)	(0.029)	(0.040)
2000	-0.001	0.064***	-0.020	0.028
	(0.008)	(0.016)	(0.017)	(0.032)
2001	0.006	0.052**	-0.011	0.070

	(0.007)	(0.025)	(0.022)	(0.090)
2002	-0.000	-0.018	-0.006	0.025
	(0.008)	(0.026)	(0.029)	(0.110)
2003	-0.002	0.051**	-0.013	0.076
	(0.007)	(0.021)	(0.020)	(0.071)
2004	0.000	-0.003	-0.004	0.029
	(0.006)	(0.024)	(0.013)	(0.071)
2005	-0.006	0.020	-0.004	0.073
	(0.005)	(0.019)	(0.007)	(0.050)
2006	-0.006	0.015	-0.000	0.010
	(0.007)	(0.019)	(0.017)	(0.063)
2007	-0.014*	-0.004	-0.005	0.124**
	(0.008)	(0.020)	(0.037)	(0.052)
2008	0.007	0.023	0.002	0.035
	(0.013)	(0.021)	(0.016)	(0.076)
2009	-0.008	0.035	-0.030	0.010
	(0.010)	(0.027)	(0.030)	(0.071)
2010	-0.014**	0.024	-0.017	0.137*
	(0.006)	(0.022)	(0.020)	(0.074)
2011	-0.007	0.042*	-0.021	0.048
	(0.007)	(0.021)	(0.015)	(0.088)
2012	-0.005	0.036*	-0.023	0.076
	(0.007)	(0.020)	(0.018)	(0.069)
2013	-0.011*	0.050**	-0.020	0.010
	(0.006)	(0.022)	(0.012)	(0.073)
2014	-0.014**	0.021	-0.011	-0.018
	(0.007)	(0.020)	(0.022)	(0.070)
2015	-0.012*	0.021	0.001	-0.001
	(0.007)	(0.019)	(0.020)	(0.070)
2016	-0.017**	0.026	-0.022	0.035
	(0.007)	(0.019)	(0.025)	(0.065)
2017	-0.014*	0.033	-0.000	0.077
	(0.007)	(0.021)	(0.019)	(0.080)
2018	-0.016*	0.043*	0.000	0.021
	(0.008)	(0.022)	(0.019)	(0.070)
2019	-0.014*	0.009	-0.020	-0.001
	(0.008)	(0.020)	(0.019)	(0.067)
2020	-0.015*	0.109***	-0.007	0.162*
	(0.008)	(0.032)	(0.018)	(0.082)
2021	-0.009	-0.012	-0.020	0.027
	(0.006)	(0.022)	(0.018)	(0.076)
2022	-0.017**	0.034	-0.015	0.122
	(0.008)	(0.023)	(0.021)	(0.074)
2023	-0.021**	-0.010	-0.040**	-0.046
	(0.008)	(0.027)	(0.016)	(0.069)
Constant	-0.056***	0.145***	-0.030	0.068
	(0.010)	(0.030)	(0.026)	(0.071)

Observations	5,698	5,620	859	847
R-squared	0.100	0.047	0.135	0.101
Number of cusip_id	94	94	13	13

Note: The estimates are obtained from an unbalanced panel fixed effects regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies.

Table C.5: Regression Results for Impact of Each USDA Report Releases on Stock Returns of Firms with any Earning Surprises: Output Buyers and Grain Processors

	All firms		Input Suppliers	
VARIABLES	BHAR[0,1]	BHAR[2,60]	VARIABLES	BHAR[0,1]
SUEQ	0.009***	0.001	0.009***	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)
d(CPday)	0.006	-0.132*	0.061**	-0.223
	(0.020)	(0.069)	(0.029)	(0.212)
d(CPAS+WWS+GSday)	0.024	-0.028	-0.001	-0.018
	(0.017)	(0.056)	(0.009)	(0.021)
d(PP+GSday)	0.138**	0.154	0.021	0.140
	(0.061)	(0.146)	(0.089)	(0.199)
d(ACR+GSday)	0.041	0.035	0.042	0.023
	(0.037)	(0.046)	(0.036)	(0.036)
d(GSsep)	-0.100***	0.001	0.048	-1.268***
	(0.036)	(0.082)	(0.107)	(0.290)
SUEQ x d(CPday)	-0.001	0.017	-0.010**	0.043
	(0.003)	(0.012)	(0.004)	(0.037)
SUEQ x d(CPAS+WWS+GSday)	-0.007***	-0.009		
	(0.002)	(0.006)		
SUEQ x d(PP+GSday)	-0.015**	-0.018	-0.003	-0.018
	(0.007)	(0.016)	(0.009)	(0.024)
SUEQ x d(ACR+GSday)	-0.004	-0.012*	-0.004	-0.011*
	(0.006)	(0.006)	(0.006)	(0.006)
SUEQ x d(GSsep)	0.011**	0.004	-0.008	0.170***
	(0.005)	(0.011)	(0.014)	(0.040)
d(MARKET_VALUE_DECILE)	0.002	-0.030***	0.003	-0.029***
	(0.002)	(0.004)	(0.003)	(0.007)
d(TOP_MARKET_RETURN)	-0.003	0.013	0.004	0.024
	(0.004)	(0.014)	(0.007)	(0.032)
d(FRIDAY)	0.004	-0.013*	0.003	-0.010
	(0.003)	(0.007)	(0.005)	(0.008)
YEAR EFFECTS				
1996	0.004	0.011	-0.018	0.001
	(0.007)	(0.024)	(0.013)	(0.027)
1997	-0.007	0.051**	-0.013	0.014
	(0.008)	(0.022)	(0.011)	(0.019)
1998	0.000	-0.007	-0.013	0.013
	(0.007)	(0.020)	(0.010)	(0.023)
1999	-0.006	-0.063**	-0.019*	-0.022
	(0.008)	(0.030)	(0.010)	(0.059)
2000	0.002	0.068***	0.006	0.050***
	(0.008)	(0.018)	(0.013)	(0.015)
2001	0.009	0.046*	0.009	0.067**

	(0.007)	(0.026)	(0.010)	(0.029)
2002	0.001	-0.027	-0.009	-0.012
	(0.008)	(0.025)	(0.010)	(0.026)
2003	-0.001	0.044**	-0.000	0.035*
	(0.007)	(0.020)	(0.009)	(0.019)
2004	0.001	-0.010	0.002	0.017
	(0.006)	(0.025)	(0.010)	(0.022)
2005	-0.005	0.008	-0.015	-0.002
	(0.006)	(0.020)	(0.010)	(0.023)
2006	-0.007	0.012	-0.011	0.030
	(0.008)	(0.020)	(0.011)	(0.018)
2007	-0.015**	-0.029	-0.019**	-0.003
	(0.006)	(0.020)	(0.008)	(0.019)
2008	0.009	0.017	-0.009	0.033
	(0.014)	(0.022)	(0.010)	(0.034)
2009	-0.004	0.039	-0.011	0.044*
	(0.009)	(0.028)	(0.013)	(0.025)
2010	-0.012**	0.001	-0.015**	0.012
	(0.006)	(0.021)	(0.007)	(0.023)
2011	-0.004	0.036*	-0.014	0.059**
	(0.007)	(0.021)	(0.009)	(0.026)
2012	-0.001	0.025	-0.000	0.046*
	(0.007)	(0.021)	(0.012)	(0.026)
2013	-0.009	0.056**	-0.017*	0.086***
	(0.007)	(0.024)	(0.008)	(0.031)
2014	-0.014**	0.026	-0.025**	0.033
	(0.007)	(0.021)	(0.009)	(0.025)
2015	-0.015**	0.023	-0.012	0.059**
	(0.007)	(0.019)	(0.011)	(0.025)
2016	-0.016**	0.021	-0.022**	0.066**
	(0.007)	(0.020)	(0.009)	(0.028)
2017	-0.016**	0.022	-0.024**	0.022
	(0.007)	(0.021)	(0.011)	(0.025)
2018	-0.019**	0.045*	-0.031***	0.058
	(0.009)	(0.023)	(0.011)	(0.036)
2019	-0.013	0.008	-0.015	0.044*
	(0.009)	(0.021)	(0.013)	(0.025)
2020	-0.017*	0.097***	-0.029**	0.160**
	(0.009)	(0.034)	(0.011)	(0.067)
2021	-0.007	-0.021	-0.012	0.002
	(0.006)	(0.022)	(0.010)	(0.024)
2022	-0.018**	0.016	-0.011	0.012
	(0.008)	(0.024)	(0.011)	(0.034)
2023	-0.018**	-0.009	-0.027**	0.024
	(0.009)	(0.029)	(0.011)	(0.050)
Constant	-0.063***	0.168***	-0.062***	0.193***
	(0.011)	(0.029)	(0.018)	(0.048)

Observations	4,839	4,773	1,802	1,775
R-squared	0.101	0.051	0.124	0.052
Number of cusip_id	81	81	32	32

Note: The estimates are obtained from an unbalanced panel fixed effects regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The figures in parentheses are heteroskedasticity-robust standard errors clustered by companies.