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News sentiment, credit spreads, and information asymmetry

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ABSTRACT

This paper examines how the sentiment of firm-specific news affects CDS spreads conditional on the degree of information asymmetry. Using a large set of news releases, we document a strong negative relationship between the sentiment of firm-specific news and CDS spreads. More importantly, consistent with the role of public news in reducing information asymmetry, we find evidence that the relation between news sentiment and CDS spreads is stronger for firms with higher information asymmetry. Furthermore, the relation is stronger for news with negative sentiment and during the 2008 financial crisis. Our results are robust to alternative sentiment measures.

1. Introduction

For decades, researchers have devoted substantial efforts to understanding whether and how information is incorporated into asset prices (e.g., Copeland, 1976; Fama, Fisher, Jensen, & Roll, 1969; Roll, 1984). The media disseminates or rebroadcasts financial news about firms, such as earnings announcements, rating changes, and corporate decisions. It is a key information distribution channel through which investors acquire relevant information and form their expectations about the risk and return of financial assets. A large body of theoretical and empirical studies show that price movements in financial markets are influenced by financial news (see, e.g., Boudoukh, Feldman, Kogan, & Richardson, 2019; Calomiris & Mamaysky, 2019; De Long, Shleifer, Summers, & Waldmann, 1990; Fang & Peress, 2009; Hillert, Jacobs, & Müller, 2014; Huberman & Regev, 2001; Klibanoff, Lamont, & Wizman, 1998; Tetlock, 2007, among others). These studies focus primarily on the response of asset prices to financial news in the equity markets. However, the response of asset prices to financial news in the credit markets, where institutional investors are dominant, is not well studied.[1] For example, it is not clear whether the sentiment of firm-specific news has a differential impact on the CDS spreads of firms with different levels of information asymmetry (between insiders and investors). In this paper, we attempt to fill this void by investigating how the sentiment of firm-specific news affects credit risk valuation in the credit default swap (CDS) market from the perspective of information asymmetry.

The CDS market provides a unique testing ground for examining how financial news affects institutional investors' valuation of credit risk for two main reasons. First, CDS contracts are typically traded with $10 million or more in notional value, and therefore

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[1] Prior studies have somehow examined this topic and provided relevant evidence (e.g., Norden, 2008; Lok & Richardson, 2011; Longstaff et al., 2011; Marsh & Wagner, 2015; Givoly, Hayn, & Katz, 2017, among others).

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investors in the CDS market are exclusively institutional investors.[2] This setting allows us to study the response of asset prices to the sentiment of firm-specific news solely from institutional investors. As institutional investors closely monitor firm-specific news from various distribution channels (see, e.g., Ben-Rephael, Da, & Israelsen, 2017; Li, Ramesh, & Shen, 2011; Twedt, 2016; You, Zhang, & Zhang, 2018), their credit risk valuation should be reflected in changes in CDS spreads. In addition, institutional investors also likely have access to privileged/private information before the news is released to the public. And if such news causes any changes in their credit risk valuation resulting in changes in CDS spreads, the response of CDS spreads may occur before, on and after the release of the news. Second, empirical studies show that the CDS market leads the stock markets and the bond markets in price discovery (Blanco, Brennan, & Marsh, 2005; Lee, Naranjo, & Velioglu, 2018; Zhu, 2006) and exhibits a high degree of information asymmetry (Acharya & Johnson, 2007). This allows us to examine how the sentiment of firm-specific news resolves information asymmetry in the CDS market.

Our first and main research question is whether the sentiment of firm-specific news has a differential impact on the CDS spreads of firms with different levels of information asymmetry. Prior empirical studies show that firm-specific news reduces information asymmetry in the equity market (e.g., Bushee, Core, Guay, & Hamm, 2010; Neuhierl, Scherbina, & Schlusche, 2013; Peress, 2014; Tetlock, 2010). Furthermore, these studies show that firm-specific news resolves information asymmetry more for firms with higher information asymmetry, which implies that the response of credit spreads to firm-specific news is stronger for these firms. Since the sentiment of firm-specific news somehow summarizes the content of firm-specific news, it is easier for investors to evaluate the impact of the news using news sentiment. Therefore, news sentiment could possibly help resolve information asymmetries in the credit market. Hence, we conjecture that the impact of news sentiment on CDS spreads is stronger for firms with higher information asymmetry.

To test this hypothesis, we use a comprehensive news dataset collected by RavenPack and construct a sample of daily news sentiment on U.S. firms with CDS trading.[3] We employ an event sentiment score provided by RavenPack as a proxy for public information and use changes in CDS spreads as a measure of adjustments in credit risk valuation. To examine the differential effects on firms with different levels of information asymmetry, we conduct a series of subsample analyses based on a set of proxies for information asymmetry. Specifically, we divide the main sample into subsamples using the sample median of proxies for information asymmetry. We find that the negative relation between news sentiment and CDS spreads is more pronounced in firms with higher dispersion in analysts' earnings forecasts, lower analyst coverage, smaller sizes, lower credit ratings, and more dealers. Consistent with our hypothesis, the results suggest that the sentiment of firm-specific news facilitates credit risk valuation by reducing information asymmetry, especially for firms with high information asymmetry.

To provide more insights on how the sentiment of firm-specific news affects credit risk valuation conditional on the degree of information asymmetry, we conduct additional analyses of the effect of news sentiment on CDS spreads. First, we examine how the response of CDS spreads to news sentiment varies with news characteristics and over time. We find that the negative relation between news sentiment and CDS spreads is more pronounced for negative news, news more relevant to firms' fundamentals, news flashes and hot news flashes, and unscheduled news. Furthermore, the relation is stronger during crisis periods during which information asymmetry is higher. Consistent with the prior empirical finding that institutional investors closely monitor financial news, these results suggest that incorporating information from financial news in credit risk valuations is influenced by various news characteristics and financial crisis.

Second, we examine the effect of news sentiment on CDS contracts with different maturities. We find that the responses of both one-year and five-year CDS spreads to news sentiment are negative and statistically significant, suggesting that news sentiment affects short-term as well as long-term credit risk.

Finally, we conduct two robustness checks using alternative measures of news sentiment. Our main sentiment measure may include fundamental information from firm-specific news. We employ a tone-based sentiment score that is derived only from positive and negative words and phrases in news articles. We also use sentiment in press-released news to control for fundamental information. Our results are robust to these alternative measures of news sentiment.

One limitation of our study is that since our analysis simply documents correlation between the sentiment of firm-specific news and CDS spread and does not establish a causal relationship, these results should be interpreted with caution.

Our paper contributes to different strands of literature. First, our paper contributes to a growing literature on the effects of financial news or disclosure on price movements in the financial markets. Recent empirical studies document that positive sentiment of financial news or disclosure increases a wide range of asset prices, including stock indexes (García, 2013; Tetlock, 2007), individual stocks (Ahmad, Han, Hutson, Kearney, & Liu, 2016; Tetlock, Saar-Tsechansky, & Macskassy, 2008), gold futures (Smales, 2014b), crude oil (Brandt & Gao, 2019), and credit spreads (Doshi, Patel, Ramani, & Sooy, 2019; Smales, 2016a; Tsai, Lu, & Hung, 2016). Consistent with these studies, we find that news sentiment is negatively associated with CDS spreads. More importantly, the focus of our study is to examine how the level of information asymmetry mediates the association between the news sentiment and CDS spread. Our results show that the effect of news sentiment is stronger for firms with higher information asymmetry, which is consistent with the role of public news in resolving information asymmetry (Bushee et al., 2010; Neuhierl et al., 2013; Peress, 2014;

[2] To mitigate counterparty risk, CDS investors are also required to sign standard documents from the International Swaps and Derivatives Association (ISDA). This further excludes retail investors from trading CDSs. See Bongaerts, De Jong, and Driessen (2011) for a snapshot of CDS market participants.

[3] RavenPack collects news data from Dow Jones Financial Wires, the Wall Street Journal, Barron's, and MarketWatch. These news sources have good coverage on U.S. firms.

Tetlock, 2010). Our results shed light on the response of institutional investors to financial news. Our setting allows us to examine the impact of financial news on asset prices in a market in which the market participants are purely institutional investors.

Second, we also contribute to the literature on credit risk valuation. As documented in earlier empirical studies (see, e.g., Chen, Collin-Dufresne, & Goldstein, 2009; Collin-Dufresn, Goldstein, & Martin, 2001; Elton, Gruber, Agrawal, & Mann, 2001; Huang & Huang, 2012), variables that theoretically determine credit spreads have limited explanatory power. Recent studies attempt to address this puzzle by considering liquidity (Ericsson, Jacobs, & Oviedo, 2009), jump risk (Cremers, Driessen, & Maenhout, 2008; Zhang, Zhou, & Zhu, 2009), firm fundamentals (Bai & Wu, 2016), information asymmetry (Corò, Dufour, & Varotto, 2013), CEO compensation structure (Carlson & Lazrak, 2010), and counterparty credit risk (Arora, Gandhi, & Longstaff, 2012). Our findings shed light on this puzzle by providing evidence that information asymmetry hinders the accuracy of credit risk valuations and public news helps institutional investors to resolve information asymmetry.

The rest of the paper is organized as follows. We discuss the related literature and develop our hypothesis in Section 2. Section 3 describes the construction of the sample and the empirical methodology. We present the empirical results in Sections 4 and 5. Section 6 reports robustness analyses. Section 7 concludes the paper.

2. Literature review and hypothesis development

In this section, we discuss the relevant literature and highlight our contributions to the literature in Sections 2.1 and 2.2. Section 2.3 develops the hypothesis for our empirical tests based on the insights gained from the literature review.

2.1. News and asset prices

Financial news disseminates public information into the financial markets and thus greatly influences investors across various assets classes. Using textual analysis algorithms, a growing number of studies show that the context and linguistic characters of financial news are incorporated into the prices of various financial assets. Specifically, recent empirical literature documents a positive relationship between financial news sentiment and returns on stock indexes, including the Dow Jones Industrial Average and the S&P 500 index (Allen, McAleer, & Singh, 2017; García, 2013; Kräussl & Mirgorodskaya, 2017; Smales, 2015, 2016b; Tetlock, 2007; Uhl, 2014); individual firms (Agrawal, Azar, Lo, & Singh, 2018; Ahmad et al., 2016; Heston & Sinha, 2017; Tetlock et al., 2008; Wang, Zhang, & Zhu, 2017); and IPO underpricing (Bajo & Raimondo, 2017). In a similar vein, the news sentiment is reflected in the price of gold futures (Smales, 2014b) and crude oil (Brandt & Gao, 2019).

2.2. News and credit risk valuation

Studies on earnings announcements (Batta, Qiu, & Yu, 2016; Callen, Livnat, & Segal, 2009) and credit rating events (Lee et al., 2018) show that favorable (unfavorable) earnings surprises and rating events alleviate (increase) credit risk. Consistently, prior empirical studies document a negative relationship between the sentiment in financial news and credit risk proxied by CDS spreads (Doshi, Patel, Ramani, & Sooy, 2019; Liebmann, Orlov, & Neumann, 2016; Smales, 2016a; Tsai et al., 2016). Therefore, we expect that negative news sentiment will lead to an increase in the credit risk valuation of firms, and vice versa. Liebmann et al. (2016) show that stock and CDS traders have different interpretations of financial news. Smales (2016a) finds a negative relation between news sentiment and the credit risk of major international banks. Tsai et al. (2016) quantify text information from news articles and find that negative news sentiment increases credit risk. Doshi et al. (2019) find that uncertain tone levels in 10-Q/K fillings are associated with changes in CDS spreads.

Our paper differs from these studies in several important ways. First, our sample consists of a large number of firms and spans a long period, from 2001 to 2016, covering the 2008 financial crisis. Second, this paper investigates and identifies the importance of information asymmetry as an important channel through which media sentiment affects institutional investors' valuation of credit risk. We provide evidence that the effect of news sentiment on CDS spreads is mainly driven by firms with higher dispersion in analysts' earnings forecasts, lower analyst coverage, more dealers, smaller sizes, and lower credit ratings. Third, investors may have varying ability to process information and diverse responses across news with different characteristics and over time. We conduct subsample analyses and find that the relationship between news sentiment and credit risk valuation is stronger for negative news, news more relevant to firms' fundamentals, news flashes and hot news flashes, and unscheduled news and during the 2008 financial crisis, when information uncertainty/asymmetry was more relevant to market participants. Finally, we include analyses of the effect of news sentiment on CDS spreads for contracts with shorter maturities.

2.3. News and information asymmetry

Prior studies show that public news reduces information asymmetry. Tetlock (2010), for example, finds that the price impact of informed trading in a firm's stock decreases on news days, which implies that public news resolves information asymmetry. Neuhierl et al. (2013) document decreases in bid-ask spreads following most types of press releases issued via major newswire services. It is possible that firms with higher information asymmetry will experience larger price movements in response to public news information. Acharya and Johnson (2007) document the existence of significant information asymmetry in the CDS market. Tang (2009) uses Moody's 1982 credit rating refinement to study its effects on firms' borrowing costs and finds that the release of credit rating refinement reduces information asymmetry in the credit market and refinement upgrades lead to lower borrowing costs. The

finding in Tang (2009) suggests that favorable (adverse) information results in a positive (negative) effect on credit valuation and that this effect could be stronger for firms with higher information asymmetry. Gao, Wang, Wang, Wu, and Dong (2019) find the impact of media coverage on bond offering yields is stronger for firms with higher information asymmetry. Additionally, Chiu, Guan, and Kim (2018) and Hu, Liu, and Zhu (2018) show that the effect of risk factor disclosures and annual report readability on the valuation of credit risk in the CDS market is more pronounced for firms with higher information asymmetry, respectively. Taken together, the foregoing discussions lead to our main hypothesis:

Hypothesis 1. *The sentiment of firm-specific news has a negative effect on CDS spreads conditional on the degree of information asymmetry, and the negative effect is stronger for firms with higher information asymmetry.*

3. Data and empirical methodology

We obtain end-of-day prices for single-name CDS contracts on U.S. companies from Markit Group Limited over the period from January 2001 to September 2016. Following prior studies (Liebmann et al., 2016; Smales, 2016a; Tsai et al., 2016), we focus on five-year contracts for our main analyses since they are the most liquid contracts. To analyze the effect of the sentiment of firm-specific news on short-term credit spreads, we also obtain end-of-day prices for one-year contracts. The Markit data also provide a composite depth measure which is essentially the number of market makers contributing prices to the calculation of Markit's end-of-day consensus valuation.

We rely on the CDS spreads, instead of the credit spreads of corporate bonds, as a measure of credit risk for two reasons. First, the CDS spreads are arguably a "cleaner" measure of credit risk than the credit spreads of corporate bonds because a CDS contract is a derivative contract and thus is less subject to liquidity constraints and demand pressure (see, e.g., Longstaff, Mithal, & Neis, 2005). The credit spreads of corporate bonds contain a significant liquidity premium component (see, e.g., Bao, Pan, & Wang, 2011; Friewald, Jankowitsch, & Subrahmanyam, 2012). Second, a CDS contract is a standard instrument whose price reflects the homogeneity of the contract, whereas corporate bonds are issued with various features and covenants that affect their prices.

We obtain firm-specific news data from the Dow Jones Edition of RavenPack News Analytics, which collects and analyzes financial news disseminated via Dow Jones Newswires, regional editions of the Wall Street Journal, Barron's, and MarketWatch.[4] To proxy the information in firm-specific news, we employ RavenPack's event sentiment score (ESS), which reflects not only the direction but also the strength of the sentiment embedded in a given news release by systematically matching the story on training sets typically classified by financial experts as having a short-term favorable or unfavorable financial or economic impact. For example, credit rating downgrade is categorized by financial experts as having negative financial impact. The strength of the negative impact comes from the actual rating changes. The ESS ranges from 0 (most negative tone) to 100 (most positive tone), where a score of 50 corresponds to a neutral sentiment. It has been widely used in recent empirical studies (see, e.g., Akbas, Boehmer, Erturk, & Sorescu, 2016; Dang, Moshirian, & Zhang, 2015; Gao, Parsons, & Shen, 2018; Ho, Shi, & Zhang, 2013; Ruf, Song, & Zhang, 2016; Shi, Liu, & Ho, 2016; Von Beschwitz, Keim, & Massa, 2018; Wang et al., 2017).

To exclude irrelevant and repeated news, we require that a news event has a maximum relevance score of 100 and a maximum event novelty score (ENS) of 100. To mitigate the potential confounding effect around a news event, we also require that the time interval between two similar news stories is greater than 10 days.[5] To facilitate our empirical analysis, we follow Dang et al. (2015) and Gao et al. (2018) to rescale the ESS to the unit interval by subtracting 50 from the raw score and scaling it by 50. The resulting score falls in an interval between -1 and 1, with zero representing neutral sentiment.[6] We average the adjusted ESS values of all qualified stories for each firm on a given day. In addition to ESS, RavenPack also provides news classifications, types of news, and an indicator representing whether a news event is scheduled or unscheduled.[7]

Following prior studies (Blanco et al., 2005; Shivakumar, Urcan, Vasvari, & Zhang, 2011; Zhang et al., 2009), we construct a set of control variables by retrieving the S&P 500 index (SPX) from the Center for Research in Security Prices (CRSP), the S&P 500 implied volatility index (VIX) from the Chicago Board Options Exchange (CBOE), and the three-month Treasury rate (Treasury) together with the slope of the yield curve (Term Spread) computed as the 10-year Treasury rate minus the three-month Treasury rate from the Federal Reserve Board. In addition, to facilitate our subsample analyses, we obtain the S&P credit ratings, total assets from Compustat, and analyst coverage and analyst forecasts from the I/B/E/S.

After merging the CDS data with the news data and control variables, we obtain a sample of 266,608 firm-date observations on 938 U.S. firms. The detailed sample construction procedure and the sample distribution based on year and industry are provided in Table 1.

[4] We eliminate stories on trading or prices (stock prices, order imbalances, technical analysis, and insider trading) following prior studies utilizing RavenPack data (Weller, 2017; Agrawal et al., 2018; Gao et al., 2018).

[5] The time interval is measured by the variable ENS_SIMILARITY_GAP in RavenPack. Our results are robust to different choices of the time interval.

[6] We obtain similar results using changes in ESS.

[7] The RavenPack applies the four-level event taxonomy to every story: topic (highest level), group, type, and category (lowest level). For more details, see "A Guide to Trading and Investment Applications Using News Analytics", available at https://www.ravenpack.com/.

Table 1
Sample selection and distribution.

Step	Sample selection	Observations (firm-day)
Panel A: Sample selection procedure		
1	We start from end-of-day prices for single-name five-year CDS contracts on U.S. companies from Markit Group Limited over the period from January 2001 to September 2016.	3,344,297
2	We then merge CDS data from Step 1 with the news data from Dow Jones edition of RavenPack News Analytics.	273,986
3	We finally merge the sample from Step 2 with firm-level control variables	266,608

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Total
Panel B: Sample distribution based on year and industry									
2001	320 (4.3%)	49 (0.7%)	3235 (43.9%)	1181 (16.0%)	182 (2.5%)	650 (8.8%)	1490 (20.2%)	268 (3.6%)	7,375
2002	443 (3.7%)	102 (0.9%)	5101 (42.8%)	2133 (17.9%)	176 (1.5%)	1085 (9.1%)	2166 (18.2%)	718 (6.0%)	11,924
2003	516 (3.8%)	183 (1.4%)	5760 (43.0%)	2394 (17.9%)	226 (1.7%)	1147 (8.6%)	2290 (17.1%)	889 (6.6%)	13,405
2004	738 (4.2%)	322 (1.8%)	7407 (41.8%)	3041 (17.1%)	332 (1.9%)	1388 (7.8%)	2987 (16.8%)	1524 (8.6%)	17,739
2005	826 (4.3%)	385 (2.0%)	8083 (41.6%)	3209 (16.5%)	445 (2.3%)	1374 (7.1%)	3345 (17.2%)	1741 (9.0%)	19,408
2006	817 (4.2%)	375 (1.9%)	8252 (42.3%)	2991 (15.3%)	478 (2.5%)	1208 (6.2%)	3447 (17.7%)	1936 (9.9%)	19,504
2007	792 (4.1%)	448 (2.3%)	8312 (42.5%)	3034 (15.5%)	436 (2.2%)	1193 (6.1%)	3635 (18.6%)	1693 (8.7%)	19,543
2008	842 (4.5%)	463 (2.5%)	7549 (40.6%)	3034 (16.3%)	433 (2.3%)	1219 (6.6%)	3473 (18.7%)	1579 (8.5%)	18,592
2009	790 (4.8%)	390 (2.4%)	6879 (42.1%)	2793 (17.1%)	318 (1.9%)	1133 (6.9%)	2697 (16.5%)	1340 (8.2%)	16,340
2010	692 (4.6%)	340 (2.3%)	6166 (41.0%)	2536 (16.9%)	299 (2.0%)	1173 (7.8%)	2507 (16.7%)	1317 (8.8%)	15,030
2011	632 (4.5%)	330 (2.4%)	5620 (40.1%)	2359 (16.8%)	323 (2.3%)	1131 (8.1%)	2406 (17.2%)	1203 (8.6%)	14,004
2012	599 (4.6%)	358 (2.7%)	5179 (39.4%)	2111 (16.0%)	304 (2.3%)	1053 (8.0%)	2324 (17.7%)	1233 (9.4%)	13,161
2013	488 (4.2%)	306 (2.6%)	4600 (39.8%)	1794 (15.5%)	262 (2.3%)	947 (8.2%)	2137 (18.5%)	1036 (9.0%)	11,570
2014	476 (4.6%)	206 (2.0%)	4057 (38.9%)	1739 (16.7%)	174 (1.7%)	895 (8.6%)	1857 (17.8%)	1029 (9.9%)	10,433
2015	434 (3.9%)	201 (1.8%)	4417 (39.9%)	1913 (17.3%)	203 (1.8%)	836 (7.6%)	2016 (18.2%)	1051 (9.5%)	11,071
2016	400 (4.9%)	158 (1.9%)	3243 (39.4%)	1438 (17.5%)	155 (1.9%)	647 (7.9%)	1446 (17.6%)	738 (9.0%)	8,225

Panel A reports our sample selection procedure. Panel B reports sample distribution based on year and industry. Numbers in parentheses are the percentages that each industry accounts for in each year. Columns are (1) Mining; (2) Construction; (3) Manufacturing; (4) Transportation, Communications, Electric, Gas, And Sanitary Services; (5) Wholesale Trade; (6) Retail Trade; (7) Finance, Insurance, And Real Estate; and (8) Public Administration.

3.1. Descriptive statistics

Panel A of Table 2 provides summary statistics of news topics covered in our U.S. sample. News topics with observations less than 1% of total observations are omitted. Out of a total of 552,514 economically important firm-specific news stories, the most frequent topics are earnings (147,350), revenues (64,832), and products-services (59,630). The mean (median) value of *ESS* for the total sample is 0.11 (0.08), with a standard deviation of 0.29. The distribution of *ESS* is heterogeneous across different news groups. The mean of *ESS* ranges from −0.26 (legal) to 0.31 (products-services). Panel B of Table 2 presents the summary statistics of the changes in CDS spreads and control variables on news days. The mean and median of five-year CDS spread changes are 0.08 basis points (bps) and 0 bps, respectively. The one-year CDS spread changes are similar, with a mean and median of 0.07 bps and 0 bps, respectively. The standard deviations of both the five-year CDS spread changes and one-year CDS spread changes are 7.73 bps and 10.44 bps, suggesting that the CDS spread, especially the short-term CDS spread, is quite volatile. The average values for changes in *SPX*, *VIX*, *Treasury,* and *Term spread* are 0.24, −0.03%, 0%, and 0%, respectively. The correlation matrix of the variables is provided in Panel C of Table 2.

3.2. Methodology

To examine the effect of news sentiment on CDS spreads, we estimate the following regression model:

$$\Delta Spread_{i,t}[t_1, t_2] = \beta_1 \cdot ESS_{i,t} + \beta_2 \cdot \Delta SPX_{i,t} + \beta_3 \cdot \Delta VIX_{i,t} + \beta_4 \cdot \Delta Treasury_{i,t} + \beta_5 \cdot \Delta TermSpread_{i,t} + u_i + v_t + \varepsilon_{i,t}. \quad (1)$$

The dependent variable, $\Delta Spread_{i,t}[t_1, t_2]$, is the change in CDS spreads from t_1 to t_2. We focus on changes in CDS spreads over three periods around news release dates: the five-day period preceding the release date $[-5, -1]$, the release date [0, 1], and the five-day period following the release date [1, 5]. These time periods are used to capture the effect of news anticipation and post-announcement drifts (Liebmann et al., 2016).[8] The main explanatory variable, *ESS*, is an event sentiment score on a given news day provided by RavenPack. Additionally, we include contemporaneous changes in *SPX*, *VIX*, *Treasury*, and *Term Spread* that are potentially related to CDS spreads. u_i is firm fixed effect, v_t is time fixed effect, and $\epsilon_{i,t}$ is the error term.

To examine whether the effect of news sentiment on CDS spreads is stronger for firms with higher information asymmetry, we define a set of firm-specific dummy variables: *Disp*, *LowCoverage*, *SmallSize*, *LowRating*, and *Dealer*. *Disp* equals one if the analyst

[8] To reduce the influence of outliers, we winsorize changes in CDS spreads at the 1% and 99% levels.

Table 2
Summary statistics.

	Mean	SD	5%	Median	95%	N
Panel A: ESS by news topics						
Total news	0.11	0.29	−0.46	0.08	0.56	552,514
Analyst ratings	0.12	0.41	−0.52	0.02	0.56	45,601
Credit ratings	−0.02	0.29	−0.52	0.00	0.46	31,352
Earnings	0.12	0.35	−0.54	0.00	0.66	147,350
Revenues	0.07	0.24	−0.40	0.00	0.56	64,832
Acquisitions-mergers	0.14	0.26	−0.08	−0.02	0.52	29,083
Assets	0.17	0.18	−0.06	0.24	0.3	11,247
Credit	0.06	0.24	−0.48	0.04	0.48	8,718
Dividends	0.07	0.21	0.00	0.00	0.62	19,544
Equity actions	0.08	0.25	−0.44	0.00	0.48	24,958
Investor relations	0.00	0.01	0.00	0.00	0.02	15,502
Labor issues	0.03	0.12	−0.14	0.08	0.08	52,171
Legal	−0.26	0.35	−0.58	−0.48	0.12	8,701
Marketing	0.07	0.07	0.00	0.14	0.14	18,388
Partnerships	0.21	0.07	0.22	0.22	0.24	11,239
Products-services	0.31	0.19	−0.04	0.38	0.62	59,630

	Mean	SD	5%	Median	95%	N
Panel B: Dependent and control variables						
Δ5-year CDS Spread (bps)	0.08	7.73	-8.01	0.00	8.52	266,608
Δ1-year CDS Spread (bps)	0.07	10.44	−9.15	0.00	9.21	241,555
ΔSPX	0.24	15.10	−24.15	0.89	22.74	266,608
ΔVIX (%)	−0.03	1.76	−2.24	−0.11	2.47	266,608
ΔTreasury (%)	−0.00	0.05	−0.05	0.00	0.05	266,608
ΔTerm spread (%)	0.00	0.07	−0.10	0.00	0.11	266,608

	(1)	(2)	(3)	(4)	(5)	(6)
Panel C: Correlation matrix						
(1) ΔSpread	1.00					
(2) ESS	−0.01***	−0.01***				
(3) ΔSPX	−0.02***	−0.02***	−0.02***			
(4) ΔVIX	0.01***	0.01***	0.01***	0.01***		
(5) ΔTreasury	−0.01***	−0.01***	−0.01***	−0.01***	−0.01***	
(6) ΔTerm Spread	−0.00**	−0.00**	−0.00**	−0.00**	−0.00**	−0.00**

This table presents summary statistics of the main variables on news release days in our sample. Our sample consists of 266,608 daily observations of 938 U.S. firms, spanning the period from January 2001 to September 2016. Panel A displays the summary statistics of news sentiment ESS for the groups that represent more than one percent of the observations. The hard news subsample consists of four news groups, and the soft news subsample consists of 15 news groups. Panel B reports summary statistics of CDS spread changes and control variables for the full sample. Panel C reports the correlation matrix for the variables used in the regressions. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

earnings forecast dispersion is above the sample median, and zero otherwise. Analyst earnings forecast dispersion is the standard deviation of analyst earnings forecasts recorded by the I/B/E/S, normalized by the stock price from CRSP. *LowCoverage* takes a value of one if the number of analyst earnings forecasts from the I/B/E/S is below the sample median, and zero otherwise. *SmallSize* equals one if the market value of equity is below median, and zero otherwise. *LowRating* takes a value of one if the firm's credit rating is below investment grade, and zero otherwise. *Dealer* equals one if the number of dealers is above the sample median, and zero otherwise.

To study the relationship between news sentiment and CDS spreads across news characteristics and over time, we employ another set of dummy variables: *NegSenti, HardNews*, *NegSenti,* and *Crisis*. *NegSenti* equals one if the average *ESS* on the day is negative, and zero otherwise. *HardNews* takes a value of one if the news day involves hard news, and zero otherwise. *Unscheduled* equals one if the news day has an unscheduled event, and zero otherwise. *Crisis* takes a value of one if the date is in the crisis period, and zero otherwise.[9]

Using the above-defined dummy variables, we estimate the following regression model:

$$\begin{aligned}\Delta Spread_{i,t}[t_1, t_2] &= \beta_1 \cdot ESS_{i,t} + \beta_2 \cdot ESS_{i,t} \times Dummy_{i,t} + \beta_3 \cdot Dummy_{i,t} + \beta_4 \cdot \Delta SPX_{i,t} + \beta_5 \cdot \Delta VIX_{i,t} + \beta_6 \cdot \Delta Treasury_{i,t} + \beta_7 \\ &\quad \cdot \Delta TermSpread_{i,t} + u_i + v_t + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

[9] Following the National Bureau of Economic Research's (NBER) definition of recession, the crisis period is from December 2007 to June 2009.

where *Dummy* is one of the dummy variables: *Disp*, *LowCoverage*, *SmallSize*, *LowRating*, *Dealer*, *NegSenti*, *HardNews*, *Unscheduled*, or *Crisis*. Our identification strategy relies on the differential responses of CDS spreads to the sentiment of firm-specific news. The interaction term *ESS* × *Dummy* captures the differential effects of news sentiment on CDS spreads between the subsamples, which is the primary variable of interest to this paper.

4. Is the impact of news sentiment on CDS spreads stronger for firms with higher information Asymmetry?

In this section, we test our main hypothesis that the effect of public financial news on CDS spreads is stronger for firms with higher information asymmetry. We first establish the negative relationship between the sentiment of firm-specific news and changes in CDS spreads in Section 4.1. Then, we employ a battery of proxies for information asymmetry to conduct subsample analyses that test whether the relation between news sentiment and changes in CDS spreads is stronger for firms with higher information asymmetry in Section 4.2.

4.1. Effects of news sentiment on CDS spreads

Prior studies show a negative relationship of news sentiment to the pricing of credit risk (e.g., Liebmann et al., 2016; Smales, 2016a; Tsai et al., 2016).[10] To test whether news sentiment is negatively associated with changes in CDS spreads, we run the panel regressions specified in Eq. (1) for the U.S. sample. Table 3 presents the regression results for all three time intervals around the news release (the five-day period preceding the release date $[-5, -1]$, the release date $[0, 1]$, and the five-day period following the release date $[1, 5]$). As shown in column (2), the coefficient estimate of *ESS* is -2.31 and highly significant ($t = -9.19$) on the news release date, indicating that news sentiment has a negative impact on CDS spreads immediately after news is released. In terms of economic magnitude, a one-unit increase in news sentiment leads to a cumulative drop of 16.05 bps in CDS spreads from the five-day period preceding the news release date to the five-day period following the news release date, suggesting that this relationship is economically significant.

In column (1), the negative and significant estimate of *ESS* indicates that the effect of news sentiment is partially anticipated by institutional investors even before news release dates. This is interesting because prior studies show that CDS spreads contribute significantly to price discovery and provide unique credit risk information (Lee et al., 2018). Furthermore, CDS investors may conduct informed trading before important events (Acharya & Johnson, 2007). Therefore, the effect of news sentiment could be partially anticipated by CDS investors. As shown in column (3), the impact of ESS on CDS spreads is negative and still significant over the five-day window after the news release. These results are consistent with the findings in Liebmann et al. (2016).

In summary, there is a strong negative relationship between news sentiment and changes in CDS spreads even after controlling for variables that can affect CDS pricing. Our finding suggests that firm-specific news plays an important role in helping institutional investors with credit risk valuation. Since the analysis in this section simply documents some correlation between the sentiment of firm-specific news and CDS spread and does not establish a causal relationship, these results should be interpreted with caution.

4.2. Subsample analyses

4.2.1. Analyst forecast dispersion and coverage

To better understand how news sentiment affects the CDS spreads of firms with different levels of information asymmetry, we first follow Oehmke and Zawadowski (2017) and use analyst earnings forecast dispersion as a proxy for a reference entity's information asymmetry. We define a dummy variable *Disp* that equals one if analyst earnings forecast dispersion is above the sample median, and zero otherwise. Panel A of Table 4 reports the regression results in Eq. (2) with the interaction of *ESS* and the dummy *Disp*. The coefficient estimates of the interaction term *ESS* × *Disp* are negative and statistically significant in columns (1)–(3), suggesting that the effect of news sentiment on CDS spreads is more pronounced for firms with higher dispersion in analysts' earnings forecasts.

Next, we follow Mansi, Maxwell, and Miller (2011) and Gao et al. (2019) and use analyst coverage to measure a firm's information asymmetry. Panel B of Table 4 presents the results using Eq. (2) with the interaction term between *ESS* and a dummy variable *LowCoverage* that equals one if the number of analyst earnings forecasts is smaller than the sample median, and zero otherwise. The coefficient estimates of *ESS* × *LowCoverage* are all negative and highly significant in columns (1)–(3), suggesting that the negative relation between news sentiment and CDS spreads is stronger for firms with fewer analysts following. In summary, these results support our hypothesis that the effect of firm-specific news on CDS spreads is stronger for firms with higher information asymmetry.

4.2.2. Firm size

Stiglitz and Weiss (1981) demonstrate that small firms have higher information frictions. In this section, we follow prior empirical studies and use firm size as a proxy for information asymmetry. We sort the U.S. sample by the market value of equity and construct a dummy variable *SmallSize* that equals one if the market value of equity is below median, and zero otherwise. Panel C of Table 4 presents the regression results in Eq. (2) with the interaction term between *ESS* and the dummy variable *SmallSize*. The negative and

[10] The content of the news is in relation with the actual impact on CDS spread. For instance, following the news that the credit rating of American International Group Inc. (AIG) was downgraded from AA- to A- on September 15, 2008, the CDS spread of AIG increased from 865 bps on September 14, 2008 to 1857 bps.

Table 3
Effects of news sentiment on CDS spreads.

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
ESS	−9.05***	−2.31***	−4.69***
	(-10.60)	(−9.19)	(−6.80)
ΔSPX	−0.19***	−0.11***	−0.17***
	(−16.37)	(−17.72)	(−14.85)
ΔVIX	0.36***	0.16***	0.60***
	(4.14)	(3.66)	(6.57)
ΔTreasury	−25.83***	−14.30***	−25.77***
	(−15.93)	(−16.64)	(−15.93)
ΔTerm Spread	−16.39***	−10.02***	−15.18***
	(−13.94)	(−16.13)	(−13.14)
N	262,048	266,608	262,951
Adjusted R^2	0.114	0.059	0.113
Fixed effects	Yes	Yes	Yes

This table displays estimates of the panel regressions of CDS spread changes on news sentiment ESS in Eq. (1). In the first column, the dependent variable is ΔSpread[−5, −1], the change in CDS spreads over the five-day period preceding the release of the news. In the second column, the dependent variable is ΔSpread[0, 1], the change in CDS spreads between the news release date and the date after. In the third column, the dependent variable is ΔSpread[1, 5], the change in CDS spreads over the five-day period following the news release date. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

significant coefficients on *ESS* × *SmallSize* in columns (1)–(3) suggest that the effect of *ESS* on changes in CDS spreads is stronger for firms with smaller size. This lends further support to our hypothesis that firm-specific news has a stronger impact on the valuation of credit risk for firms whose information asymmetry is higher.

4.2.3. Credit rating

He, Wang, and Wei (2011) document a positive relationship between the extent of change in stock information asymmetry and the magnitude of the bond rating changes. In this section, we use credit rating as a proxy for information asymmetry. We define a dummy variable *LowRating* that equals one if a firm's credit rating is below investment grade, and zero otherwise. Panel D of Table 4 reports the results of estimating Eq. (2) with the interaction term between *ESS* and the dummy variable *LowRating*. In columns (1)–(3), the coefficient estimates of *ESS* × *LowRating* are all negative and statistically significant, suggesting that the response of CDS spreads to news sentiment is stronger for firms with speculative ratings. This result supports our hypothesis that the relationship of public financial news to credit risk valuation is more pronounced among firms with a higher degree of information asymmetry.

4.2.4. CDS dealers

Boulatov and George (2013) theoretically show that the number of liquidity providers increases as the total number of heterogeneously informed traders increases. Acharya and Johnson (2007) find that liquidity provision in the CDS market rises with information asymmetry. Qiu and Yu (2012) document a positive association between the number of dealers quoting CDS prices and information asymmetry. Therefore, more dealers indicate higher information asymmetry. We define a dummy variable *Dealer* that equals one if the number of dealers is larger than the sample median, and zero otherwise. Panel E of Table 4 reports the results of estimating Eq. (2) with the interaction for *ESS* and the dummy variable *Dealer*. As shown in columns (1) and (2), the estimates of the interaction term *ESS* × *Dealer* are negative and statistically significant, indicating that the response of CDS spreads to news sentiment is stronger for firms with a larger number of dealers quoting CDS prices. This result is consistent with our expectation that the effect of firm-specific news on credit spreads is stronger for firms with a higher level of information asymmetry.

5. Additional analyses of the impact of news sentiment on CDS spreads

In this section, we conduct a variety of additional tests to provide further support to our main results. We first examine the heterogeneous response of CDS spreads to the sentiment of news with different characteristics in Section 5.1. We investigate whether the impact of financial news on CDS spreads is stronger during financial crises in Section 5.2. Finally, the effects of news sentiment on CDS spreads with different maturities are studied in Section 5.3.

5.1. News characteristics

The respective role of positive and negative news sentiment in credit risk valuation should be quite different. This is because debtholders might be more concerned with the downside risk of the firms due to their payoff structure. Smales (2016a) shows that negative news sentiment induces greater credit risk changes than positive news sentiment. We partition the U.S. sample into two subsamples: one with negative news sentiment and the other with positive or neutral sentiment. We assign a dummy variable *NegSenti*

Table 4
Subsample analyses.

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel A: Analyst forecast dispersion			
ESS	−1.22***	−0.78***	−1.80***
	(−2.88)	(−4.52)	(−4.06)
ESS × Disp	−11.71***	−2.71***	−5.37***
	(−7.90)	(−5.78)	(−4.10)
Disp	4.02***	0.80***	2.17***
	(6.24)	(5.67)	(3.31)
ΔSPX	−0.19***	−0.12***	−0.16***
	(−15.00)	(−16.18)	(−12.96)
ΔVIX	0.38***	0.16***	0.64***
	(4.31)	(3.35)	(6.59)
ΔTreasury	−22.69***	−12.87***	−22.99***
	(−14.52)	(−14.69)	(−14.50)
ΔTerm Spread	−14.30***	−9.00***	−13.90***
	(−12.42)	(−14.22)	(−11.72)
Observations	212,614	217,250	216,737
Adjusted R^2	0.111	0.057	0.110
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel B: Number of analyst forecast estimates			
ESS	−3.25***	−1.10***	−2.04***
	(−5.00)	(−5.60)	(−3.52)
ESS × LowCoverage	−9.98***	−2.33***	−5.45***
	(−6.40)	(−5.03)	(−3.63)
LowCoverage	0.85	0.35*	0.83
	(0.80)	(1.66)	(0.77)
ΔSPX	−0.20***	−0.12***	−0.17***
	(−15.78)	(−17.20)	(−13.80)
ΔVIX	0.32***	0.14***	0.60***
	(3.60)	(3.09)	(6.29)
ΔTreasury	−22.70***	−12.69***	−23.28***
	(−14.75)	(−15.35)	(−14.85)
ΔTerm Spread	−14.69***	−8.73***	−14.10***
	(−13.07)	(−14.68)	(−12.44)
Observations	241,825	246,010	245,180
Adjusted R^2	0.111	0.056	0.109
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel C: Firm size			
ESS	−0.87***	−0.41***	−0.80***
	(−2.89)	(−5.12)	(−3.90)
ESS × SmallSize	−2.73***	−1.49***	−3.27***
	(−3.85)	(−6.69)	(−6.07)
SmallSize	1.92***	0.59***	1.56**
	(3.43)	(4.78)	(2.57)
ΔSPX	−0.12***	−0.04***	−0.12***
	(−12.31)	(−9.39)	(−12.67)
ΔVIX	0.16***	0.16***	0.11**
	(2.66)	(5.41)	(2.28)
ΔTreasury	−12.02***	−8.57***	−10.59***
	(−9.36)	(−10.01)	(−9.68)
ΔTerm Spread	−5.34***	−5.56***	−6.23***
	(−7.04)	(−10.08)	(−8.23)
Observations	214,671	218,246	216,189
Adjusted R^2	0.108	0.057	0.108
Fixed effects	Yes	Yes	Yes

(*continued on next page*)

Table 4 (*continued*)

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel D: Credit rating			
ESS	−3.36***	−1.01***	−1.93***
	(−6.01)	(−4.38)	(−3.54)
ESS × LowRating	−22.91***	−5.14***	−12.91***
	(−6.19)	(−4.97)	(−4.36)
LowRating	0.80	−0.19	−4.76*
	(0.32)	(−0.39)	(−1.74)
ΔSPX	−0.19***	−0.12***	−0.18***
	(−12.45)	(−13.71)	(−11.62)
ΔVIX	0.37***	0.17***	0.57***
	(3.30)	(2.84)	(4.85)
ΔTreasury	−24.51***	−14.05***	−24.43***
	(−11.76)	(−12.17)	(−11.67)
ΔTerm Spread	−15.09***	−9.50***	−13.47***
	(−9.46)	(−11.58)	(−8.47)
Observations	164,431	167,145	165,190
Adjusted R^2	0.113	0.058	0.111
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel E: Number of CDS dealers			
ESS	−7.65***	−1.57***	−3.80***
	(−6.70)	(−4.64)	(−3.74)
ESS × Dealer	−2.66*	−1.33***	−1.53
	(−1.75)	(−2.63)	(−1.09)
Dealer	1.84**	−0.10	0.39
	(2.33)	(−0.57)	(0.45)
ΔSPX	−0.19***	−0.11***	−0.17***
	(−16.36)	(−17.22)	(−14.79)
ΔVIX	0.36***	0.18***	0.59***
	(4.17)	(3.88)	(6.41)
ΔTreasury	−25.82***	−14.23***	−26.50***
	(−15.91)	(−16.45)	(−15.92)
ΔTerm Spread	−16.39***	−10.05***	−14.90***
	(−13.93)	(−16.03)	(−12.73)
Observations	262,048	262,971	258,529
Adjusted R^2	0.114	0.059	0.113
Fixed effects	Yes	Yes	Yes

Panel A presents the estimates of the regressions in Eq. (2) investigating the impact of dispersion in analysts' earnings forecasts on the relation between news sentiment and CDS spreads. *Disp* is a dummy variable that equals one if the analyst earnings forecast dispersion is above the median, and zero otherwise. Analyst earnings forecast dispersion is the standard deviation of analysts' earnings forecasts recorded by the I/B/E/S, normalized by the stock price from CRSP. Panel B presents the estimates of the regressions in Eq. (2) examining the impact of analyst coverage on the relation between news sentiment and CDS spreads. *LowCoverage* is a dummy variable that equals one if the number of analyst earnings forecasts from the I/B/E/S is below the median, and zero otherwise. Panel C presents the estimates of the regressions in Eq. (2) examining the impact of firm size on the relation between news sentiment and CDS spreads. *SmallSize* is a dummy variable that equals one if the market value of equity is below median, and zero otherwise. Panel D presents the estimates of the regressions in Eq. (2) examining the impact of credit ratings on the relation between news sentiment and CDS spreads. *LowRating* is a dummy variable that equals one if the firm's credit rating is speculative grade, and zero otherwise. Panel E presents the estimates of the regressions in Eq. (2) examining the impact of dealer coverage on the relation between news sentiment and CDS spreads. *Dealer* is a dummy variable that equals one if the number of dealers is above the median, and zero otherwise. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

that equals one when the average *ESS* on the day is negative, and zero otherwise. Panel A of Table 5 reports the results of estimating Eq. (2) with the interaction term between *ESS* and *NegSenti*. As shown in the first and second columns, the coefficients on *ESS* × *NegSenti* are negative and statistically significant before and on the news release date. This result is consistent with our expectation that the response of CDS spreads to news sentiment is larger for negative news.

Stock investors have varying ability to process information and diverse responses to different news categories (see, e.g., Antweiler & Frank, 2006; Boudoukh et al., 2019; Engelberg, Reed, & Ringgenberg, 2012; Li et al., 2011). Prior studies (Liebmann et al., 2016; Smales, 2016a) suggest that the impact of financial news on credit risk valuation is heterogeneous across different news categories. Based on RavenPack data, Wang et al. (2017) broadly classify news into two types: hard news and soft news. Hard news, which consists of four news groups ("revenues", "earnings", "analyst-ratings", and "credit-ratings"), is more relevant to firms' fundamentals

Table 5
News characteristics.

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel A: Asymmetric effect of news sentiment			
ESS	−2.99***	−0.84***	−1.86**
	(−3.87)	(−3.33)	(−2.36)
ESS × NegSenti	−14.08***	−4.19***	−3.56
	(−5.39)	(−5.07)	(−1.61)
NegSenti	0.80	−0.06	1.34***
	(1.54)	(−0.32)	(2.63)
ΔSPX	−0.19***	−0.11***	−0.17***
	(−16.38)	(−17.71)	(−14.85)
ΔVIX	0.36***	0.16***	0.60***
	(4.13)	(3.68)	(6.58)
ΔTreasury	−25.84***	−14.29***	−25.76***
	(−15.94)	(−16.64)	(−15.93)
ΔTerm Spread	−16.39***	−10.02***	−15.17***
	(−13.94)	(−16.12)	(−13.13)
Observations	262,048	266,608	262,951
Adjusted R^2	0.114	0.059	0.113
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel B: Hard and soft news			
ESS	−4.42***	−0.76**	−2.09**
	(−4.71)	(−2.56)	(−2.56)
ESS×HardNews	−8.10***	−2.75***	−4.55***
	(−5.81)	(−6.31)	(−3.31)
HardNews	2.00***	0.35***	0.88***
	(5.57)	(2.99)	(2.59)
ΔSPX	−0.19***	−0.11***	−0.17***
	(−16.38)	(−17.73)	(−14.85)
ΔVIX	0.36***	0.16***	0.60***
	(4.16)	(3.67)	(6.57)
ΔTreasury	−25.80***	−14.30***	−25.77***
	(−15.92)	(−16.64)	(−15.93)
ΔTerm Spread	−16.38***	−10.02***	−15.18***
	(−13.93)	(−16.13)	(−13.14)
Observations	262,048	266,608	262,951
Adjusted R^2	0.114	0.059	0.113
Fixed effects	Yes	Yes	Yes

(*continued on next page*)

Table 5 (*continued*)

	Press release			News flash & Hot news flash			Full article			All news
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	ΔSpread[−5, −1]	ΔSpread[0, 1]	ΔSpread[1, 5]	ΔSpread[−5, −1]	ΔSpread[0, 1]	ΔSpread[1, 5]	ΔSpread[−5, −1]	ΔSpread[0, 1]	ΔSpread[1, 5]	ΔSpread[0, 1]
Panel C: News type										
ESS	−11.29***	−1.51**	−1.63	−8.51***	−2.19***	−5.29***	−3.30**	−1.28**	−1.59	−0.58***
	(−5.78)	(−2.40)	(−0.90)	(−8.77)	(−7.42)	(−5.99)	(−2.17)	(−2.12)	(−1.37)	(−5.07)
ESS × Flash										−0.48***
										(−4.21)
ΔSPX	−0.19***	−0.11***	−0.17***	−0.19***	−0.11***	−0.17***	−0.17***	−0.09***	−0.16***	−0.04***
	(−14.10)	(−12.11)	(−12.92)	(−14.03)	(−12.17)	(−12.50)	(−8.24)	(−5.88)	(−7.08)	(−10.80)
ΔVIX	0.25**	0.18**	0.58***	0.46***	0.17**	0.61***	0.37	0.20	0.68***	0.14***
	(2.20)	(2.47)	(4.90)	(4.00)	(2.31)	(5.30)	(1.62)	(1.17)	(2.85)	(5.20)
ΔTreasury	−28.52***	−16.44***	−27.95***	−26.25***	−13.89***	−27.80***	−17.68***	−9.83***	−19.10***	−8.34***
	(−14.38)	(−12.55)	(−13.95)	(−12.81)	(−10.26)	(−13.15)	(−4.84)	(−2.85)	(−4.98)	(−11.37)
ΔTerm Spread	−17.54***	−11.62***	−16.44***	−16.51***	−9.26***	−15.48***	−11.80***	−11.66***	−9.85***	−5.24***
	(−11.03)	(−10.99)	(−10.45)	(−11.60)	(−9.71)	(−10.98)	(−4.08)	(−5.64)	(−3.63)	(−10.63)
Observations	79,261	80,213	79,051	94,459	96,492	95,125	23,995	24,212	23,859	266,608
Adjusted R^2	0.124	0.074	0.130	0.123	0.060	0.116	0.076	0.048	0.091	0.027
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel D: Scheduled and unscheduled news			
ESS	−4.25***	−1.56***	−2.84*
	(−3.06)	(−3.09)	(−1.79)
ESS × Unscheduled	−5.71***	−0.90*	−2.20
	(−3.54)	(−1.67)	(−1.33)
Unscheduled	1.47***	0.37***	0.63*
	(4.12)	(2.76)	(1.72)
ΔSPX	−0.19***	−0.11***	−0.17***
	(−16.37)	(−17.71)	(−14.85)
ΔVIX	0.36***	0.16***	0.60***
	(4.14)	(3.67)	(6.57)
ΔTreasury	−25.83***	−14.29***	−25.78***
	(−15.93)	(−16.62)	(−15.93)
ΔTerm Spread	−16.38***	−10.01***	−15.19***
	(−13.92)	(−16.12)	(−13.14)
Observations	262,048	266,608	262,951
Adjusted R^2	0.114	0.059	0.113
Fixed effects	Yes	Yes	Yes

Panel A presents the estimates of the panel regressions in Eq. (2) examining the asymmetric response of CDS spreads to news sentiment. *NegSenti* is a dummy variable that equals one if the average *ESS* on the day is negative, and zero otherwise. Panel B presents the estimates of the panel regressions in Eq. (2) comparing the impact of the hard news versus soft news on the relation between news sentiment and CDS spreads. *HardNews* is a dummy variable that equals one if the news day involves hard news that is more relevant to firms' fundamentals, and zero otherwise. Panel C presents the estimates of the panel regressions in Eq. (1), examining the relation between news sentiment and CDS spreads on the basis of news types. *Flash* is a dummy variable that is equal to 1 for news flashes and hot news flashes, and 0 otherwise. Panel D presents the estimates of the panel regressions in Eq. (2) comparing the impact of the unscheduled news versus scheduled news on the relation between news sentiment and CDS spreads. *Unscheduled* is a dummy variable that equals one if the news day has an unscheduled event, and zero otherwise. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

than soft news, which comprises the remaining news groups, such as “credit”, “dividends”, “marketing”, and so on. Accordingly, we divide the U.S. sample into hard news and soft news. In Panel B of Table 5, we show the results of estimating Eq. (2) with the interaction term between *ESS* and a dummy variable *HardNews* that equals one for hard news, and zero otherwise. As shown in columns (1)–(3), the estimated coefficients on *ESS* × *HardNews* are significantly negative. This result indicates that the negative impact of news sentiment on CDS spreads is mainly driven by news more relevant to firms' fundamentals. This result also suggests that hard news has greater ability to resolve information asymmetry of firms.

Von Beschwitz et al. (2018) find that the impact of RavenPack on stock prices is more pronounced for press releases that are directly released by companies than for news reports written by Dow Jones' journalists. They further attribute the finding to the timelier press releases and more accurate RavenPack sentiment for press releases. We divide the U.S. sample into press release, news flash and hot news flash, and full article subsamples following RavenPack's classification.[11] Panel C of Table 5 reports the results of the regressions defined in Eq. (1). As indicated in columns (2), (5), and (8), the coefficients on *ESS* are negative and statistically significant for the press release, news flash and hot news flash, and full article on news release date subsamples, indicating that the negative relation between news sentiment and changes in CDS spreads holds both for fresh news and news directly released by firms and full article stories created by journalists. These results suggest that the information contained in press-initiated and firm-initiated news has a significant impact on credit risk valuations by institutional investors. Moreover, the magnitude of responses to media sentiment on news release days is much higher for news flashes and hot news flashes than for press releases and full articles. A Wald test with *p*-value of 0.0% confirms that the coefficient for news flashes and hot news flashes is significant different from that for press releases and full articles. In addition, we have also included an indicator variable for the news type (news flashes and hot news flashes) and its interaction term with ESS in column (10) of Panel C of Table 5. Consistent with the Wald-test, the interaction term is negative and statistically significant.

Institutional investors may have different responses to news sentiment if an event is anticipated, arranged, or planned. Booker, Curtis, and Richardson (2018) distinguish scheduled news from unscheduled news and document a higher level of trading activities due to unscheduled news. In a similar manner, the sentiment of unscheduled news is more likely to affect credit risk prices. We separate the U.S. sample into scheduled news and unscheduled news to test whether the changes in CDS spreads in response to new information are more pronounced for unexpected events.[12] Panel D of Table 5 presents the estimates of the regressions defined in Eq. (2). We define a dummy variable *Unscheduled* that equals one if the news day has an unscheduled event, and zero otherwise. The interaction term between *ESS* and *Unscheduled* captures the differential effects of news sentiment on CDS spreads between scheduled and unscheduled news. The coefficients on *ESS* × *Unscheduled* are significantly negative in columns (1) and (2), suggesting that the sentiment of unscheduled news tends to have a larger influence on CDS spreads than scheduled news on the news day and in the five-day period before the news release.

5.2. Financial crisis

García (2013) concludes that the association between media sentiment and stock market returns is driven by periods of financial distress. Corò et al. (2013) show the impact of informed trading and information asymmetry on CDS prices is higher during the financial crisis. We expect that the effect of news sentiment on CDS spreads is stronger during the 2008 financial crisis, in which information uncertainty is more prevalent. Following the NBER definition of recession, we choose the crisis period to be from December 2007 to June 2009. Table 6 reports the results of estimating Eq. (2) with the dummy variable *Crisis*. The estimated coefficients of *ESS* × *Crisis* are all negative and statistically significant surrounding news release dates, as shown in columns (1) to (3). Consistent with our expectation, this result suggests that the response of CDS spreads to news sentiment is stronger during the 2008 financial crisis.

5.3. CDS spreads with different maturities

In prior sections, we focus on the effects of news sentiment on five-year CDS spreads. In this section, we conduct additional analyses on the effect of news sentiment on CDS contracts with different maturities. We re-estimate Eq. (1) using one-year CDS spreads. The results are reported in Panel A of Table 7. It can be seen that the results using the one-year CDS spreads are quite similar to the results using the five-year CDS spreads in Table 3, suggesting that news sentiment affects both short-term and long-term credit risk valuation. To test whether news sentiment has differential effects on CDS spreads with different maturities, we further regress the difference between the change in the five-year CDS spreads and the change in the one-year CDS spreads on news sentiment.[13] The results are presented in Panel B of Table 7. The estimates of *ESS* are generally statistically insignificant, indicating that the impact of news sentiment on CDS spreads is similar for both short-term and long-term maturities.

[11] A full article is a news article composed of both a headline and one or more paragraphs of mostly textual material. A news flash is a news article composed of a headline and no body text. A hot news flash is a news article composed of a headline and no body text marked as breaking news during the editorial process. A press release is a corporate announcement originated by an entity and distributed via a news provider.

[12] In RavenPack, a news event is defined as scheduled if the announcement of the event was anticipated, arranged or planned according to some schedule or timetable. For example, the event that a company announces its financial earnings results is a scheduled news story. The event that a company announces its shares or assets are being acquired by another entity is an unscheduled news story.

[13] We also conduct a Wald test of the difference in the coefficient ESS between Table 3 and Panel A of Table 7. The result confirms that the coefficient for long-term CDS spreads is not significant different from that for short-term CDS spreads.

Table 6
Crisis period.

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
ESS	−5.11***	−1.61***	−3.64***
	(−7.16)	(−7.34)	(−5.08)
ESS × *Crisis*	−29.36***	−5.45***	−7.85**
	(−7.31)	(−4.84)	(−2.17)
Crisis	12.37***	0.25	3.11
	(4.28)	(0.48)	(1.22)
ΔSPX	−0.18***	−0.11***	−0.17***
	(−15.94)	(−17.69)	(−14.77)
ΔVIX	0.46***	0.16***	0.62***
	(5.07)	(3.61)	(6.53)
ΔTreasury	−25.26***	−14.28***	−25.89***
	(−15.75)	(−16.57)	(−15.91)
ΔTerm Spread	−16.21***	−10.00***	−15.34***
	(−13.90)	(−16.03)	(−13.12)
Observations	262,048	266,608	262,951
Adjusted R^2	0.116	0.060	0.113
Fixed effects	Yes	Yes	Yes

This table presents the estimates of the panel regressions in Eq. (2) examining the impact of the 2008 financial crisis on the relation between news sentiment and CDS spreads. *Crisis* is a dummy variable that equals one if the date is in the crisis period from December 2007 to June 2009, and zero otherwise. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7
Effects of news sentiment on CDS spreads with different maturities.

Variables	(1) $\Delta Spread_{1Y}$[−5, −1]	(2) $\Delta Spread_{1Y}$[0, 1]	(3) $\Delta Spread_{1Y}$ [1, 5]
Panel A: changes in one-year CDS spreads			
ESS	−9.94***	−2.17***	−5.68***
	(−9.78)	(−7.35)	(−6.41)
ΔSPX	−0.21***	−0.10***	−0.19***
	(−15.60)	(−16.33)	(−14.04)
ΔVIX	−0.02	0.08*	0.24**
	(−0.21)	(1.66)	(2.44)
ΔTreasury	−29.14***	−14.13***	−28.22***
	(−15.25)	(−14.10)	(−14.99)
ΔTerm Spread	−17.26***	−9.48***	−14.98***
	(−13.36)	(−13.59)	(−12.21)
Observations	235,218	241,555	235,907
Adjusted R^2	0.099	0.040	0.100
Fixed effects	Yes	Yes	Yes

Variables	(1) $\Delta Spread_{5Y\text{-}1Y}$[−5, −1]	(2) $\Delta Spread_{5Y\text{-}1Y}$ [0, 1]	(3) $\Delta Spread_{5Y\text{-}1Y}$ [1, 5]
Panel B: Long-term maturity vs. short-term maturity			
ESS	0.54	−0.20	1.16**
	(1.11)	(−1.09)	(2.43)
ΔSPX	0.00	−0.02***	−0.00
	(0.33)	(−6.20)	(−0.53)
ΔVIX	0.41***	0.08**	0.39***
	(8.06)	(2.24)	(7.74)
ΔTreasury	1.74*	−0.41	0.81
	(1.80)	(−0.60)	(0.83)
ΔTerm Spread	0.14	−0.72	−0.74
	(0.20)	(−1.50)	(−1.08)
Observations	235,218	241,555	235,907
Adjusted R^2	0.009	0.001	0.011
Fixed effects	Yes	Yes	Yes

This table presents the estimates of the panel regressions in Eq. (1) examining the relation between news sentiment and the difference between five-year CDS spreads and one-year CDS spreads. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8
Robustness: Alternative sentiment measures.

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel A: Tone-based sentiment measure			
MCQ	−2.87***	−0.63***	−1.44***
	(−10.27)	(−7.05)	(−6.02)
ΔSPX	−0.19***	−0.11***	−0.17***
	(−16.37)	(−17.71)	(−14.85)
ΔVIX	0.36***	0.16***	0.60***
	(4.10)	(3.64)	(6.57)
ΔTreasury	−25.83***	−14.30***	−25.74***
	(−15.92)	(−16.63)	(−15.92)
ΔTerm Spread	−16.39***	−10.01***	−15.18***
	(−13.92)	(−16.12)	(−13.14)
Observations	262,048	266,608	262,951
Adjusted R^2	0.114	0.059	0.113
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel B: Sentiment measure based on difference between DJ and PR			
$ESS_{DJ\text{-}PR}$	−2.14	−1.96***	−6.45***
	(−1.27)	(−3.12)	(−3.64)
ΔSPX	−0.21***	−0.13***	−0.19***
	(−14.70)	(−14.58)	(−13.86)
ΔVIX	0.16	0.13**	0.50***
	(1.54)	(2.12)	(4.49)
ΔTreasury	−28.31***	−15.80***	−27.94***
	(−15.17)	(−13.27)	(−14.87)
ΔTerm Spread	−17.93***	−11.53***	−16.54***
	(−12.23)	(−12.55)	(−10.94)
Observations	120,774	121,913	119,799
Adjusted R^2	0.127	0.073	0.134
Fixed effects	Yes	Yes	Yes

This table displays estimates of the panel regressions of CDS spread changes on news sentiment in Eq. (1) using alternative news sentiment measures. Panel A uses the alternative tone-based news sentiment measures MCQ, and Panel B uses the alternative news sentiment measures $ESS_{DJ\text{-}PR}$ is defined as the difference in *ESS* between the Dow Jones version and the Press Release version. In the first column, the dependent variable is ΔSpread[−5, −1], the change in CDS spreads over the five-day period preceding the release of the news. In the second column, the dependent variable is ΔSpread[0, 1], the change in CDS spreads between the news release date and the date after. In the third column, the dependent variable is ΔSpread[1, 5], the change in CDS spreads over the five-day period following the news release date. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

6. Robustness checks

In this section, we conduct a battery of robustness tests for the relationship between news sentiment and CDS spreads. We first use a tone-based news sentiment measure and a measure based on the difference between Dow Jones and press release versions. Second, we construct a measure adjusted for press release sentiment.

6.1. Alternative sentiment measures

For robustness, we alternatively employ RavenPack's multi-classifier for equities (*MCQ*) to proxy news sentiment. *MCQ* is a tone-based multi-classifier score indicating the news sentiment of the most relevant firms mentioned in a story which is utilized by some empirical studies (e.g., Lerman & Tan, 2019; Smales, 2014a, 2016b). *MCQ* is derived from a combination of analytics values of classifiers on short commentaries and editorials, earnings evaluations, corporate actions, and changes in analyst recommendations. *MCQ* produces consistent sentiment classifications through discarding combinations that have contradictory scores among classifiers. The classifiers are generated by both a rule-based methodology mapping key words, phrases, combinations, and other word-level definitions to predetermined sentiment values, and an expert consensus methodology training classification algorithms on stories manually tagged by financial experts. RavenPack assigns scores of 0, 50, or 100, representing negative, neutral, or positive sentiment. To be comparable to previous results using *ESS*, we scale the values to the unit levels of −1, 0, and +1. In Panel A of Table 8, we report the regression results of replacing *ESS* with *MCQ* in Eq. (1). The estimated coefficients on *MCQ* are negative and significant in columns (1)–(3), which is consistent with the prediction that news sentiment is negatively related to changes in CDS spreads.

RavenPack's sentiment measures are constructed from the linguistic tone of news articles. The number of positive and negative

Table 9
Robustness: Additional tests.

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel A: Firm-level control variables			
ESS	−1.10***	−0.81***	−1.84***
	(−3.28)	(−6.07)	(−5.37)
Stock Return	0.07***	0.00	−0.00
	(4.93)	(0.17)	(−0.10)
Volatility	56.49***	5.78	17.61
	(3.18)	(1.26)	(1.01)
Market Value	−4.48***	−1.05***	−2.82***
	(−6.23)	(−6.67)	(−4.22)
Leverage	−2.29	0.10	1.87
	(−0.74)	(0.11)	(0.53)
Profitability	−0.14	0.09	0.09
	(−0.33)	(0.69)	(0.15)
S&P Rating	−0.93***	−0.26***	−0.51***
	(−5.99)	(−7.77)	(−4.29)
Risk-free Rate	0.78***	0.17***	0.90***
	(3.25)	(2.62)	(3.58)
Lagged CDS Spread	0.00	0.00	−0.00
	(0.38)	(0.32)	(−0.14)
Macro controls	Yes	Yes	Yes
Observations	137,964	144,758	144,079
Adjusted R^2	0.100	0.032	0.053
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−5, −1]	(2) ΔSpread[0, 1]	(3) ΔSpread[1, 5]
Panel B: Sentiment of corporate filings and market-wide news			
ESS	−2.45***	−1.38***	−3.03***
	(−3.50)	(−5.66)	(−4.81)
ESS_PR	0.86	0.70***	1.64***
	(1.24)	(3.01)	(2.77)
ESS_MKT	5.24**	−0.52	−0.91
	(2.01)	(−0.58)	(−0.34)
Macro controls	Yes	Yes	Yes
Observations	118,679	123,173	122,906
Adjusted R^2	0.062	0.029	0.062
Fixed effects	Yes	Yes	Yes

Variables	(1) ΔSpread[−3, −1]	(2) ΔSpread[1, 3]
Panel C: Alternative window length		
ESS	−1.19***	−1.82***
	(−6.62)	(−9.05)
ΔSPX	−0.09***	−0.09***
	(−12.32)	(−13.79)
ΔVIX	0.19***	0.17***
	(4.47)	(4.73)
ΔTreasury	−11.06***	−9.14***
	(−11.97)	(−10.85)
ΔTerm Spread	−5.98***	−6.00***
	(−9.63)	(−10.14)
Observations	253,024	259,207
Adjusted R^2	0.043	0.042
Fixed effects	Yes	Yes

Panel A reports estimates of the panel regressions of CDS spread changes on news sentiment in Eq. (1) including additional firm-level control variables. Panel B reports estimates of the panel regressions of CDS spread changes on news sentiment in Eq. (1) including sentiment of a firm's press release (*ESS_PR*) and average sentiment across all firms (*ESS_MKT*). Panel C reports estimates of the panel regressions of CDS spread changes on news sentiment in Eq. (1) using alternative window length. All regressions include firm and year fixed effects. Standard errors are clustered by firm. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

words in news stories may also be related to firms' fundamental information. We use the fact that the same corporate event could originate with the firm and be distributed through its press release or covered by a journalist in a news story. If we can capture the difference in linguistic tone between the two types of news articles (i.e., Dow Jones vs. press release), we could disentangle investor sentiment from the information environment because tone difference reflects the difference in investor sentiment regarding the same corporate event. Starting from 2004, RavenPack provides a PR Edition covering press releases and regulatory disclosures disseminated from a variety of newswires and press release distribution networks, including top newswires: PR Newswire, Business Wire, Globe Newswire, and Marketwired. Like the Dow Jones Edition, RavenPack creates many variables to facilitate research on firm-initiated press releases, including *ESS*. We construct $ESS_{DJ\text{-}PR}$ as the difference between the *ESS* in RavenPack's Dow Jones version and the press release edition. Panel B of Table 8 reports the results of regressing Eq. (1) based on the alternative news sentiment measure $ESS_{DJ\text{-}PR}$. The estimated coefficients on $ESS_{DJ\text{-}PR}$ are significantly negative in columns (2) and (3), supporting the negative association between news sentiment and changes in CDS spreads documented above.

6.2. Additional tests

We consider an additional set of commonly used firm-level control variables, including a firm's stock return, volatility of stock price, market value of equity, leverage, profitability, credit rating, and risk-free rate. These variables are used to further mitigate any omitted variable bias in our baseline regressions. Panel A of Table 9 shows that, after controlling for these variables, the relationship between news sentiment and CDS spreads is still statistically significant at the 1% level. To control for the sentiment of the firm's corporate filings and the sentiment of market-wide news, we use the sentiment of the firm's press release as a proxy for the sentiment of the firm's corporate filings and the average sentiment across all firms as a proxy for the sentiment of market-wide news. The results are reported in Panel B of Table 9. The main results still hold after controlling for these two sentiment measures. Finally, we use an alternative window length of three days for news anticipation and post-announcement drifts. The results still hold, as shown in Panel C of Table 9.

7. Conclusions

This paper investigates how the sentiment of firm-specific news affects credit spreads by institutional investors. We exploit a large set of news releases from RavenPack and the unique setting of the CDS market in which investors are all financial institutions. We document a negative relationship between news sentiment and CDS spreads conditional on the degree of information asymmetry. More importantly, the relation is stronger for firms with higher dispersion in analysts' earnings forecasts, lower analyst coverage, smaller sizes, lower credit ratings, and more dealers. This finding is consistent with the role of public news in reducing information asymmetry.

We further analyze the relationship of firm-specific news sentiment to CDS spreads across news characteristics and over time. The relation is stronger during the 2008 financial crisis and for news with negative sentiment, news more relevant to firms' fundamentals, news flashes and hot news flashes, and unscheduled news. The effect of news sentiment is also significant on short-term CDS spreads and robust to alternative sentiment measures.

CRediT authorship contribution statement

Shanxiang Yang: Conceptualization, Methodology, Data curation, Writing - original draft. **Zhechen Liu:** Conceptualization, Data curation, Investigation. **Xinjie Wang:** Methodology, Supervision, Writing - review & editing, Project administration, Funding acquisition.

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