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Information in CDS spreads

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ABSTRACT

We investigate how public and private information affects corporate CDS spreads prior to rating announcements. First, CDS spreads of firms with high news intensity change significantly earlier and more strongly prior to negative rating announcements than those of firms with low news intensity. Second, the contents of daily corporate news significantly influence the direction in which the CDS spreads move. Third, CDS spreads change more strongly for firms with more bank relationships and days with no news but large abnormal CDS spread changes are more frequent prior to negative rating announcements than prior to positive ones. The study provides new evidence on the informational efficiency of the CDS market, the impact of credit rating announcements, and insider trading.

1. Introduction

Credit derivatives, especially credit default swaps (CDS), have been considered as the most significant financial innovation of the past 20 years. The market has shown unprecedented growth in the period before the global financial crisis of 2007–2009 and has been resilient during the financial crisis. While there is abundant evidence on the efficiency of various securities markets, there is little direct evidence on the informational efficiency of the market for credit derivatives. In this paper we investigate how public and private information affects CDS spreads prior to credit rating announcements. We base the analysis on direct measures of public information derived from corporate news to provide evidence on the informational efficiency of the CDS market, the impact of credit rating announcements, and insider trading.

Investigating the impact of public and private information on CDS spreads is important for several reasons. Differently from stock markets there are only institutional traders in the CDS market (e.g., banks, insurance companies, hedge funds, and mutual funds). Corporate CDS trading has emerged from bilateral OTC trading through the phone to internet based trading platforms and it is predominantly driven by information about credit risk. The latter is available from various sources, such as corporate financial statements, credit ratings, and the continuous flow of corporate news. Credit rating announcements are key information events for traders in the CDS market (e.g., Hull, Predescu and White, 2004; Norden and Weber, 2004). Furthermore, private information might affect CDS spreads. Banks and other institutional investors frequently invest in large firms and trade in the CDS market at the same time, having access to private information about these firms through their screening, monitoring and advisory activities (Acharya and Johnson, 2007; Ivashina and Sun, 2011). Therefore, private information might influence the role that bankers take in the CDS market (e.g., British Banker's Association, 2006; Minton, Williamson, and Stulz, 2009; Stulz, 2010; Bolton and Oehmke, 2011). There are also some real incidents of CDS insider trading. For example, in its first CDS insider trading investigation in 2009 the SEC charged a hedge fund manager and bond salesman with insider trading in CDS of VNU N.V., an international holding company that owns Nielsen Media.[1] Moreover, the CDS market has hardly been subject to any regulation and the financial reporting of CDS trading follows minimum requirements for off-balance sheet items. As a reaction to the global financial crisis some institutional features of the CDS market have been modified (e.g., Stulz, 2010). Central counterparties were introduced, such as the Depository Trust and Clearing Corporation (DTCC) in the U.S., and the credit event definitions were narrowed

[1] See, for example, U.S. Securities and Exchange Commission (2009-102, May 5, 2009), "SEC Charges Hedge Fund Manager and Bond Salesman in First Insider Trading Case Involving Credit Default Swaps", and Harrington and Glover (2006) "Credit-Default Swaps May Incite Regulators Over Insider Trading", Bloomberg, October 10, 2006.

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and further standardized to facilitate netting and reduce counterparty risk.

Our study contributes to the research on the informational efficiency of the CDS in three ways. First, we investigate whether public information affects CDS spreads prior to rating announcements. Specifically, we consider news intensity as a direct measure of the extent of public information and hypothesize that CDS spread changes are stronger when news intensity is high. We do not claim that the firm-specific news intensity reflects all public information, but it is plausible that it is highly correlated with it. Second, we investigate whether the contents of daily corporate news influence the direction in which CDS spreads move prior to rating announcements. We hypothesize that more negative (positive) rating related news prior to negative (positive) rating announcements should gradually increase (decrease) firms' CDS spreads. Third, we investigate whether private information affects CDS spreads prior to rating announcements. We analyze uncontaminated trading windows prior to rating announcements to detect days with significantly abnormal CDS spread changes and no or no related public information. A significantly higher fraction of these days in windows before rating events than in the full sample would be consistent with the presence of private information-based trading. Moreover, we consider firms' number of major bank lenders in the market for syndicated loans as a proxy for private information because these banks have special access to private information and are the most important participants in the CDS market at the same time. If private information based trading occurs prior to the rating actions, we can infer that this information is incorporated only in the CDS spreads but not the rating actions. Such finding would explain why investors in the stock market have increasingly paid attention to CDS spreads rather than credit ratings, as shown by Chava, Ganduri and Ornthanalai (2016).

We base the analysis on a large and international sample of frequently traded firms from the early years of the CDS trading, spanning the period from 2000 to 2006.[2] We obtain the three main results. First, public information, measured by news intensity, significantly affects CDS spreads before rating announcements. Second, daily rating related corporate news from news wires significantly influence the run up of CDS spreads. Third, private information also affects CDS spreads before rating events. The anticipative CDS spread changes are more pronounced for firms with a high number of bank relationships, supporting the view that private information of these lenders spills over to markets through their CDS trading. Furthermore, there is a significant clustering of days with no (or no related) news but large abnormal CDS spread changes before negative rating events. Interestingly, the latter result is not found for positive rating announcements. Both findings together indicate that there is insider trading in the CDS market and that this insider trading is asymmetric. Our findings are consistent with Acharya and Johnson (2007) but obtained with different empirical methods. Overall, the evidence suggests that the CDS market quickly incorporates public information and that private information also influences CDS spreads. Several additional empirical checks confirm that the main results are robust and not the product of particular choices of samples, methods, or model specifications.

[2] During this period the CDS market has developed rapidly and matured. The trading volume of U.S. commercial banks and trust companies increased from 302 billion dollars in Q1:2000 to 9,019 billion dollars in Q4:2006 (see Office of the Comptroller of the Currency, Bank Derivatives Reports). This growth slowed down during the financial crisis of 2007-2009 because of counterparty credit risk and restarted after the introduction of central clearing counterparties. We do not believe that institutional changes mentioned above influenced the effects we analyze here because CDS trading is still limited to institutional investors, news wires remain the key source of information for CDS traders, and corporate credit ratings remain to be important indicators of credit risk.

The remainder of this paper is organized as follows. In Section 2 we summarize related research and present our hypotheses. In Section 3 we describe the data and the empirical strategy. In Section 4 we examine the influence of public and private information on CDS spreads prior to rating events. In Section 5 we summarize results from further empirical checks and robustness tests. Section 6 concludes.

2. Related literature and hypotheses

2.1. Related literature

This study relates to the literature on informational efficiency of capital markets in general (Fama, 1970), and credit derivatives market in particular. We provide a brief summary of research on CDS that relates to credit rating announcements, insider trading, links with other markets, and bank lending behavior.[3]

First, there is evidence that the CDS market reacts significantly around rating announcements (e.g., Hull, Predescu, and White, 2004; Norden and Weber, 2004). CDS spreads display a significant reaction to rating downgrades and an even stronger response to announcements of reviews for downgrades, while there is no clear reaction prior to positive rating announcements. Most important in the context of our study, CDS spreads already move early and substantially prior to rating announcements. CDS spreads start changing approximately two to three months prior to negative rating events. These findings are robust and have been confirmed in subsequent studies (e.g., Galil and Soffer, 2011; Finnerty, Miller and Chen, 2013). However, these studies do not explain *why* CDS spreads change prior to rating announcements. Almost entirely missing is direct evidence on whether and how public and/or private information affects CDS spreads prior to rating announcements. This is the main topic of our study.

Second, CDS spread changes have significant predictive power for future stock returns, in particular prior to adverse changes to the credit quality of the firms (Acharya and Johnson, 2007). This effect is stronger for firms with a higher number of bank relationships and consistent with the presence of insider trading in the CDS market. For comparison, in our study we consider direct indicators of public information instead of taking the stock market as indirect benchmark for public information. This approach has an advantage when analyzing information events such as rating downgrades because the latter can be associated with positive or negative stock market reactions depending on the reason for the rating change (increase of leverage vs. decrease of profitability; Goh and Ederington, 1993). In contrast, the prediction for the impact of negative rating-related news on CDS spreads is unambiguous (Jorion and Zhang, 2007).

Third, there are studies that analyze the link between prices in the corporate CDS, bond, and stock market. These studies document that the CDS market leads the bond market and that the former contributes more to price discovery than the latter (e.g., Blanco, Brennan, and Marsh, 2005; Houweling and Vorst, 2005; Zhu, 2006; Norden and Weber, 2009). There is also evidence that lagged stock returns significantly explain contemporaneous CDS spread changes in firm-specific time-series analysis. Zhang, Zhou and Zhu (2009) construct high-frequency measures of volatility risk and jump risk using stock market data. These measures alone have already substantial explanatory power and can explain, after including credit ratings, macroeconomic variables, and firms' financial statements, around 70% of the variation in CDS spreads. Callen, Livnat, and Segal (2009) provide evidence that CDS spread

[3] We focus on the segment of single name corporate CDS and do not summarize research on sovereign CDS.

changes are inversely correlated with quarterly earnings announcements and earnings surprises (i.e., higher profits reduce the risk of default in the short-run). They also show that CDS spread changes are positively (negatively) associated with the accruals (cash flows) component of earnings. Jorion and Zhang (2007) test for intra-industry price effects in stock and CDS markets around different types of credit events. They find that Chapter 11 bankruptcies create contagion effects, i.e., CDS spreads of non-defaulting firms from the same industry also increase. Chapter 7 bankruptcies create competitive effects, i.e., CDS spreads of surviving firms from the same industry decrease. Interestingly, these effects can be better observed in the CDS market than in the stock market. Furthermore, Chava, Ganduri and Ornthanalai (2016) go one step further and show that firms' stock prices react significantly less to credit rating downgrades when firms are traded in the CDS market. This result suggests that stock market investors have increasingly paid attention to information revealed in the CDS market rather than to credit rating agencies.

Fourth, there is evidence that the CDS market affects bank lending behavior, in particular loan pricing and credit supply. Norden and Wagner (2008) document that the pricing of syndicate loans to large U.S. firms is significantly positively related to price information from the CDS market and that this link has become more immediate and more pronounced in recent years. Hirtle (2009) shows that a greater use of credit derivatives increases banks' credit supply to large firms and that loan maturities become longer and loan spreads lower. Ashcraft and Santos (2009) find adverse effects for the funding costs of risky and opaque firms and a small positive effect for low risk and transparent firms. Norden, Silva Buston and Wagner (2014) document that banks with larger gross CDS positions charge significantly lower corporate loan spreads. The result is consistent with banks passing on risk management benefits to corporate borrowers but not with alternative channels through which credit derivative use may affect loan pricing. Ivanov, Santos and Vo (2016) find that CDS market-based loan pricing is associated with lower interest rates and simplified covenant structures. The findings point at benefits for borrowers, but also at potential adverse consequences resulting from the decline in bank monitoring.

2.2. Hypotheses

We propose three hypotheses following the reasoning from the introduction and the literature on the informational efficiency of markets and the economic function of credit rating agencies (e.g., Fama, 1970; Acharya and Johnson, 2007; Stulz, 2010; Ivashina and Sun, 2011; Bannier and Hirsch, 2010; Bolton and Oehmke, 2011).

First, as explained in Section 2.1 related studies document that CDS spreads change significantly already some time before rating announcements are made. This anticipation could be due to public information. If there is relatively more public information available about a firm, i.e., its news intensity is higher than for other firms, it is likely that there will be also more news related to the rating announcements. Such news can convey expectations, speculations, rumors, intentions, or announcements of procedures and actions indirectly or directly related to the rating process. The term news intensity that we employ in this study refers to the extent or amount of public information, but not to its contents. We state the following hypothesis:

Hypothesis 1: Firms' news intensity significantly positively affects CDS spreads prior to rating announcements.

Second, if the extent of public information influences CDS spreads prior to rating announcements, then the following reasoning should hold and can be tested empirically. There should be more negative news before negative rating announcements than in other periods and more positive news before positive rating announcements than in other periods. The clustering of negative news before negative rating events should result in positive spread changes and the clustering of positive news before positive events should result in negative spread changes. More generally, the frequency and contents of public information (negative versus positive) relative to the type of rating announcement that follows (negative versus positive) imply the direction in which CDS spreads should change. We state the following hypothesis:

Hypothesis 2: The contents of daily corporate news significantly affect the direction in which CDS spreads change before rating announcements.

Furthermore, next to public information it is possible that private information affects CDS spreads before rating announcements. Banks that lend to the firms traded in the CDS market might have early and proprietary information from their screening, monitoring and advisory activities. They might know or be able to infer the fundamental reasons for upcoming rating changes and can exploit such insider information by trading the CDS market. Another possibility is that upcoming rating actions are leaked to certain market participants other than banks (e.g., hedge funds, institutional investors, mutual funds, brokers, etc.). These market participants might have incentives to exploit this knowledge in the CDS market and thereby significantly move the CDS spreads. We therefore state the following hypothesis:

Hypothesis 3: Private information significantly affects CDS spreads prior to rating announcements.

3. Data and empirical strategy

We base our study on an international sample of 95 firms that are frequently traded in the CDS market. The sample includes 148,580 firm-day observations, spanning the period from the start of 2000 to the start of 2006. The average number of CDS spread observations per firm is 1455. The data cover the U.S. (33%) and Europe (67%) as well as industrial firms (68%) and financial institutions (32%). The sample period includes up- and downturns in the CDS market and years with predominantly positive or negative rating announcements. Hence, the results are not biased towards particular market movements.

The data come from the following sources. First, firm-specific time series of daily CDS spreads come from CreditTrade and one large European bank. We focus on single name CDS that refer to contracts of five year maturity and senior unsecured debt since these have emerged as the benchmark for CDS trading. The most frequently traded firms are included in the sample (Credit Trade's Benchmark names).

Second, we collect extensive data on credit ratings and rating announcements from Bloomberg. The data cover the three major rating agencies (Standard & Poor's, Moody's, and Fitch Ratings) and different types of events (rating changes and reviews/watch listings). We focus on rating changes and rating reviews since these events reflect decisions made by the rating committee, while "rating outlook" announcements (not considered here) are under the discretion of individual rating analysts.

Third, we merge the previous data with news data from FACTIVA. We identify public information using news stories in two ways: the news intensity of the firms traded in the CDS market over the whole period from 2000 to 2006 and the contents of daily corporate news. We consider four measures of firm-specific news intensity that depend on different sources and types of information: the total of all news stories (*All news*), the total of news from news wires (*News wires*), the total of all news stories that match the search items "rating" or "downgrade" or "upgrade" in the full text (*Rating related news*), and the total of news from news wires that match the search items "rating" or "downgrade" or "upgrade"

Table 1
Summary statistics.
This table reports summary statistics on CDS spreads (in basis points) by credit ratings, the frequency of credit rating announcements by agency and type, news intensity and daily corporate news, and firm size and the number of bank relationships. The variables shown in Panel C and D are explained in Appendix A1. The analysis is based on an international sample of 95 firms from the period 2000–2006.

Panel A: CDS spreads

Spread	Mean	Median	Min	Max	N
CDS spread level (mid price, bps)	62	38	4	1250	148,850
CDS bid-ask spread (relative to mid, %)	22	21	0	166	137,538
CDS spread level S&P AAA-AA	25	20	4	243	29,383
CDS spread level S&P A	45	35	7	455	61,689
CDS spread level S&P BBB	113	72	16	1062	31,355
CDS spread level S&P BB-B	299	295	28	1138	2997

Panel B: Credit rating announcements

Agency / Event	Reviews for downgrade	Downgrades	Reviews for upgrade	Upgrades	Total
S&P	99	125	11	41	276
Moody's	119	116	30	42	307
Fitch	51	98	8	26	183
Total	269	339	49	109	766

Panel C: News intensity and daily corporate news

News intensity	Mean (Median)	Min	Max
All news	47,667 (35,462)	5629	223,686
News wires	21,851 (15,659)	2964	86,662
Rating related news	6662 (3866)	578	39,351
News wires rating related	2933 (1874)	296	14,082
Daily corporate news	**Mean**	**Min**	**Max**
News per day and firm	1.61	0	220
Words per day and firm	1142.53	0	215,943
Positive news per day and firm	0.47	0	113
Negative news per day and firm	0.19	0	70
News per day and firm including "upgrade"	0.05	0	35
News per day and firm including "downgrade"	0.04	0	55

Panel D: Firm size and number of bank relationships

	Mean	Median	Min	Max
Size	40,449	24,651	1362	376,003
Bank relationships	6.36	6	1	16

in the full text (*News wire rating related*). These four measures are all firm-specific but time-invariant.

Furthermore, we consider the contents of rating-related daily corporate news, which is firm-specific and time-varying. We collect the full text of all news wire stories that match the search items "rating" or "downgrade" or "upgrade" in the full text for every firm, resulting in a total of 240,200 text files. We focus on news wires (ticker news from Dow Jones News Service, Reuters, AFX, and other electronic press releases, etc.) because they are the key source of information for institutional traders in the CDS market. It is most likely that stories on tickers and news from news wires precede or coincide with newspaper articles. Moreover, these news stories are firm-specific but this does not mean that they ignore industry- or economy-wide news. Our measures allow for the possibility that the latter type of news might also affect firms' CDS spreads and rating changes. For each news story we observe the date and time, the headline, the full text, the names of companies, industries, and news subjects that relate to the story (assigned by FACTIVA) and the total of words. We assign news that is released on Saturdays or Sundays (1.97% of the total) to the next trading day. Eventually, we use the news stories from FACTIVA to double-check the dates of the rating announcements collected from Bloomberg. We do not claim that these measures capture all public information. Nevertheless, we believe it is likely that they reflect a significant proportion of the information that affects prices in the CDS market.

Finally, we consider the number of major bank relationships of the firms traded in the CDS market as a potential channel through which private information might influence the CDS market. The number of lead banks in a lending syndicate has been employed as standard proxy for the number of bank relationships in the related literature (e.g., Acharya and Johnson, 2007; Acharya and Johnson, 2010; Ivashina and Sun, 2011). We collect this information from LPC DealScan at the parent company level for banks and firms. If there are several lead arrangers the credit risk assessment and contracting is delegated to one of them, but the information is shared among the lead arrangers (Standard & Poor's, 2006). We note that this proxy does not measure the actual number of bank relationships. But, it is likely that it captures the most important lenders because the market for syndicated loans is the key market for large firms to raise credit from institutions.

We also collect firms' stock market capitalization to use it as a proxy for firm size. Appendix A1 provides a list of the variables with descriptions and Table 1 reports summary statistics.

During the sample period the cross-sectional time series mean CDS spread amounts to 62 basis points (median = 37 basis points), varying from 4 to 1250 basis points. The mean percentage bid-ask spread of CDS is 22%. Most of the firms are rated A (S&P: 50%, Moody's: 43%, Fitch: 39%). The sample includes a total of 766 rating announcements (269 reviews for downgrade and 339 downgrades (hereof: 197 downgrades preceded by reviews and 142

downgrades unpreceded by reviews)). Moreover, the mean news intensity (*All news*) is 47,667 news stories per firm during the period 2000–2006, with a minimum of 5629 (Metro AG) and 223,686 (Ford Motor Company).[4] The measures *All news* and *Rating related news* (*News wires* and *News wire rating related*), which are based on different sources of information, exhibit a Spearman rank correlation coefficient of 0.84 (0.89). The measures *All news* and *News wires* (*Rating related news* and *News wire rating related*), which are based on different types of information, exhibit a rank correlation of 0.93 (0.92). Furthermore, we consider daily rating-related corporate news from news wires, the mean (median) number of news per day is 1.62 (0.00) and the maximum is 220. The mean (median) number of words per story and day is 665 (538). Positive news are slightly more often released than negative news,[5] while news that include the search items "upgrade" and "downgrade" are observed at a similar frequency. Firms' mean market capitalization is 40.4 billion Euros, and the number of major bank lenders collected from the LPC DealScan database ranges between one and 16 with a median of six.[6]

Based on this data we calculate daily changes of each firm's CDS spreads and subtract changes of a rating-specific CDS index to obtain abnormal CDS spread changes (ASCs), following Norden and Weber (2004) and related studies. The CDS index corresponds to an equally-weighted index based on five-year senior unsecured mid CDS spreads of the full universe of "CreditTrade's Benchmark" firms. The index is rating-specific (AAA, AA, …, BB), i.e., daily CDS spread changes of firms that exhibit a rating "AA" on a particular day are adjusted by changes of the AA-CDS index. In this way, we control for the fact that the magnitude of abnormal CDS spread changes might be driven by the rating event and the pre-event rating level. The results do not change (except the magnitude of the coefficient of the index) if we alternatively use a constant-rating CDS index (for AA, A, and BBB ratings, which are the most prevalent in the dataset).[7] We then transform calendar time around rating announcements by the three major rating agencies into event time, starting 90 trading days before and ending 20 days after the event day. Eventually, we calculate mean abnormal CDS spread changes (ASCs) as well as mean cumulative abnormal CDS spread changes (CASCs) for the event time window [−90, 20].[8] Everything else equal, we interpret reviews for downgrade and downgrades unpreceded by reviews for downgrade as unexpected events, whereas we consider downgrades preceded by reviews for downgrade as being expected by the market (e.g., Bannier and Hirsch, 2010).[9] Fig. 1 displays the results from the univariate event study for the three types of negative rating announcements.[10]

Fig. 1 shows that CDS spreads change already before the rating announcement that occurs at event time = 0. The market response reaches its maximum shortly after the announcement day, ranging between 35 and 55 basis points. These findings are similar to earlier studies and can be seen as an out-of-sample test based on a longer time series per firm (e.g., Hull, Predescu, and White, 2004; Norden and Weber, 2004). For reviews for downgrade, the CASCs are small early before the event, but become relatively strong during approximately ten days before the event. For downgrades, the CASCS are larger early before the event and increase gradually when we approach the announcement day. For downgrades preceded by reviews we observe an increase in the reaction at around twenty days before the announcement. Univariate statistical tests for ASCs and CASCs at different points in time during the [−90, 20] window (e.g., *t*-tests and non-parametric Wilcoxon sign tests, not reported here) confirm the significance of the results shown in Fig. 1.[11] We also compute the percentage run up of the CDS market by event type and rating agency to quantify the speed and timing of the market anticipation. The average percentage CDS market run up, defined as the CASCs during [−90, −11] divided by the CASCs during [−90, 0], is 51% before reviews for downgrade, 74% before downgrades unpreceded by reviews, and 80% before downgrades preceded by reviews.

4. Empirical analysis

4.1. The impact of public information: news intensity

We investigate whether and how news intensity influences CDS spread changes before rating announcements. News intensity is by definition related to the number and frequency of corporate news. This measure partially captures the overall attention of CDS traders paid to firms which, in turn, may affect the likelihood of firms being traded in CDS markets. This link holds for the CDS trading of banks irrespective of their trading motive (income from speculation, relative value trades, or market making; credit portfolio management). Nonetheless, pure income-generating trading, in particular CDS trading in firms with which a bank has no lending relationship, is likely to be more based on public information, while credit portfolio management-related CDS trading may be more based on private information (and therefore also about the bank's lending strategy towards existing or future borrowers). The point here is that public information may affect prices in the CDS market irrespective of the bank's trading motive.

To gain a first impression of the CDS market response to rating announcements and the potential influence of news intensity

[4] News intensity is positively but not perfectly correlated with firm size. The rank correlation between news intensity and the average market capitalization of the firms (in Euro) ranges between 0.36 and 0.55. We revisit this issue in Section 5.

[5] News stories are classified as negative (positive) if they include one or more of the following content proxies: *positive, good, up, strong, well, better, upgrade, optimistic, improve, increase, and raise* (*negative, bad, down, weak, badly, worse, downgrade, pessimistic, deteriorate, decrease, and lower*). This definition does not capture all negative news. Thus, the use of these proxies creates a bias against finding effects since only a subset of all public information is considered.

[6] For nine out of 95 firms we could not reliably identify any lead arranger in LPC Deal Scan. Since these firms are likely to have a positive number of bank relationships (instead of no bank relationships at all) that has simply not been reported to LPC, we impute the median number of bank lenders from the full sample to these firms. Note that all subsequent results remain unchanged if we drop these firms from the sample. In addition, the number is smaller than in Acharya and Johnson (2007) because our sample includes more European firms (which tend to have a smaller number of lead banks) than U.S. firms and we calculate the number at the parent company level for borrowers and lenders.

[7] There are CDS indices, which are based on frequently traded CDS underlyings (e.g., iTraxx Europe, CDX for North America). However, most of these indices only start in the years 2004 or 2005, i.e., we cannot use these benchmarks our sample starts already in 2000.

[8] The results are qualitatively very similar for abnormal percentage changes of CDS spreads and the product of the corresponding growth factors (geometric sum of abnormal spread changes) instead of taking the arithmetic sum of first differences. In addition, we are aware of the fact that CDS spreads exhibit a decreasing time-to-maturity between standard maturity dates. This phenomenon is not a problem here since it affects the individual CDS spreads and the CDS index in the same way, i.e., the calculation of abnormal spread changes is consistent with respect to the underlying maturity.

[9] Rating changes can be preceded by rating reviews, but they do not have to be. Related studies report that around 60 (70) percent of all downgrades (upgrades) are not preceded by reviews for downgrades (e.g., Bannier and Hirsch, 2010, for the time period from 1992 to 2004). In our sample, this fraction is 58.4 (66.4) percent, which is close to the numbers reported by Bannier and Hirsch (2010). The mean time for rating reviews ranges between 60 and 105 days (Holthausen and Leftwich, 1986; Norden and Weber, 2004; Bannier and Hirsch, 2010). In our sample, the mean review time is 74 trading days.

[10] In unreported analyses we find that the CDS market also exhibits a weak anticipation prior to *positive* rating announcements (reviews for upgrade and upgrades). Consistent with earlier studies on the stock and bond market response to rating events (e.g., Dichev and Piotroski, 2001; Kim and Nabar, 2007), these effects are neither statistically nor economically significant.

[11] The findings are similar to related studies and remain robust in the subsequent multivariate analysis.

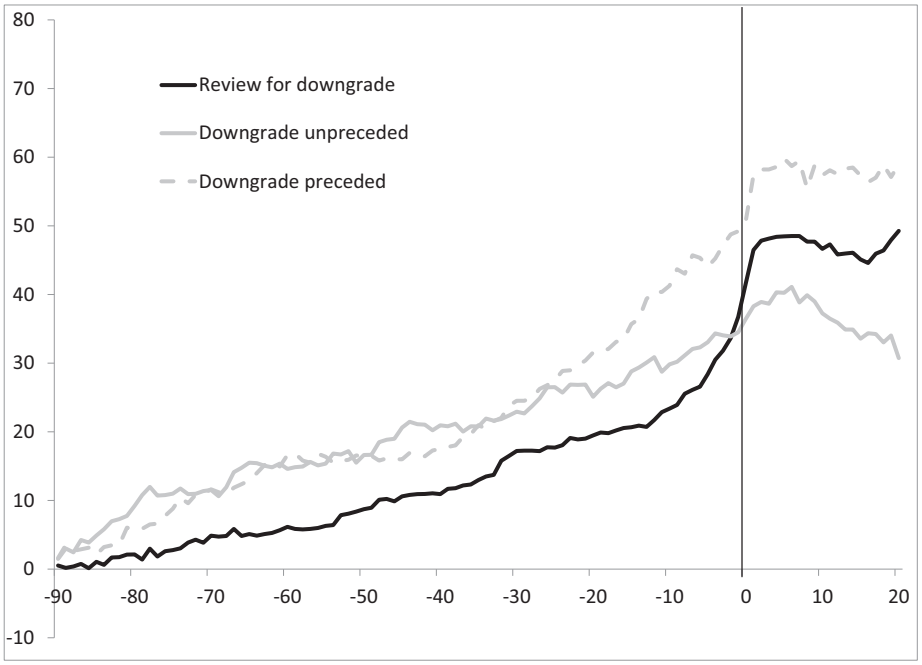

Fig. 1. Mean cumulative abnormal CDS spread changes by event type.
Mean cumulative abnormal CDS spreads changes (CASC) in basis points are calculated as the cumulative sum of the daily cross-sectional mean abnormal CDS spread changes at event time t, starting 90 days prior to a rating announcement. The sample includes 269 reviews for downgrade (black line), 142 downgrades unpreceded by reviews for downgrade (grey line) and 197 downgrades preceded by reviews for downgrade (grey broken line). The analysis is based on an international sample of 95 firms from the period 2000–2006.

we estimate a regression model similar to Norden and Weber (2004). The dependent variable is the firm's raw CDS spread change on day t. Explanatory variables are the changes of the CDS index ΔI_{rt} (matching the firm's rating r on day t) and the continuous measures of news intensity *All news*, or alternatively *News wire rating related*, and interaction terms with the [−1, 1] event window indicators for reviews for downgrade and downgrades. We differentiate between downgrades that are unpreceded by reviews for downgrade ("expected downgrades") and those that are not ("unexpected downgrades") and between downgrades to non-investment grade versus downgrades to investment grade. We also add dummy variables for firms from the financial industry (*Financial*), telecommunication industry (*Telecommunication*),[12] U.S. firms (*US*), and year fixed-effects as controls. Table 2 reports the results.

First, we find that the CDS market reaction is large and highly significant at reviews for downgrades. We do not find any amplifying effect of news intensity for reviews for downgrade. Second, we do find amplifying effects of news intensity on CDS spreads at rating downgrades. We obtain significantly larger abnormal CDS spread changes for firms with relatively high news intensity for unpreceded and preceded downgrades (column (1) and (2)) and for downgrades to non-investment grade ratings and downgrades to investment grade ratings (column (3)). Third, we perform Wald tests to analyze whether the influence of news intensity differs between different types of rating events, comparing the coefficients of the respective interaction terms within one regression model (not reported in Table 2). In column (1) the coefficient of *Downgrade unpreceded*All news* (0.0569) is significantly larger than the one of *Downgrade preceded*All news* (0.0274; p-value = 0.0962). In column (2) there is no significant difference between the coefficients of *Downgrade unpreceded*News wire rating related* (0.6438) and *Downgrade preceded*News wire rating related* (0.9926). In column (3) the coefficient of *Downgrade NIG-NIG*News wire rating related* (1.3800) is significantly larger than the one of *Downgrade NIG-IG*News wire rating related* (0.6533; *p*-value = 0.0530). Overall, the results suggest that news intensity has an influence on the short-term CDS market reaction to downgrade announcements.

We now investigate the potential influence of public information on CDS spreads during a longer time period prior to rating announcements, as stated by Hypothesis 1. For this purpose, we compare the cumulative abnormal CDS spread changes of firms with low and high news intensity, using a median split based on the variable *All news*. Fig. 2 displays the CASCs in basis points by types of events.

We see a clear difference between firms with high and low news intensity. From Fig. 2a–c we see that the run up of the CDS market starts earlier and it is stronger for firms with high news intensity (black line) than for those with low news intensity (grey line). The result holds for reviews for downgrade, downgrades unpreceded by reviews, and downgrades preceded by reviews. The result is driven by firms' news intensity and remains robust if we control for firm size, industry, country or time effects; we summarize the corresponding robustness tests in Section 5. The results are similar for S&P and Moody's (not shown here; the results are less clear for Fitch) and similar for the other three measures of news intensity (not shown here; *News wires, Rating related news* and *News wire rating related*). Furthermore, there are some differences in the magnitude and the dynamics of the CASCs across types of events. We see a qualitatively consistent pattern for the CDS spreads of firms with high news intensity (black line) all three figures. However, there is a difference for firms with low news intensity (grey line): CDS spreads change already some time before downgrades that are preceded by reviews (Fig. 2c) because

[12] Firms from the telecommunication industry in many countries issued very large bonds during our sample period to fund the acquisition of new generation cell phone network licenses and the corresponding investments in physical assets. As a consequence of the increased leverage many of these firms experienced credit rating downgrades and significant CDS spread increases. In alternative unreported analyses, we added a full set of industry dummies and obtain similar results in all regressions.

Table 2
The CDS market response to rating announcements and news intensity.
This table reports the CDS market response to rating announcements considering the firms' news intensity. The dependent variable is the daily raw CDS spread change (ΔCDS_{it}). Explanatory variables are the change of the rating grade-specific CDS index (ΔI_{rt}) and two alternative continuous measures of news intensity: *All News* in column (1) and *News wire rating related* in column (2). Both news intensity measures are divided by 1000 for scaling purposes. The models include dummy variables for the rating events (*Review for downgrade, Downgrade unpreceded, Downgrade preceded, Downgrade IG-IG and Downgrade IG-NIG*), interaction terms between the rating events and news intensity, and controls. All variables are explained in Appendix A1. *P*-values are based on robust standard errors clustered on firms. The analysis is based on an international sample of 95 firms from the period 2000–2006. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.: ΔCDS_{it}	(1) Coeff.	p-val.		(2) Coeff.	p-val.		(3) Coeff.	p-val.	
ΔI_{rt}	0.5284	0.000	***	0.5282	0.000	***	0.5282	0.000	***
News intensity									
All news	0.0007	0.016	**						
News wire rating related				0.0105	0.020	**	0.0105	0.020	**
Rating events									
Review for downgrade	4.9609	0.006	***	5.3454	0.002	***	5.3454	0.002	***
Downgrade unpreceded	−0.7376	0.603		−1.1360	0.372				
Downgrade preceded	−0.9782	0.954		−1.6963	0.138				
Downgrade IG-IG							−1.4432	0.108	
Downgrade IG-NIG							2.9549	0.425	
Interaction of rating events and news intensity									
*Review for downgrade * All news*	−0.0190	0.389							
*Downgrade preceded * All news*	0.0274	0.100	*						
*Downgrade unpreceded * All news*	0.0569	0.042	**						
*Review for downgrade * News wire rating related*				−0.2406	0.466		−0.2340	0.487	
*Downgrade preceded * News wire rating related*				0.6438	0.031	**			
*Downgrade unpreceded * News wire rating related*				0.9926	0.009	***			
*Downgrade IG-IG * News wire rating related*							0.6533	0.020	**
*Downgrade IG-NIG * News wire rating related*							1.3800	0.007	***
Controls									
Financial	−0.0198	0.033	**	−0.0297	0.011	**	−0.0287	0.011	**
Telecommunication	−0.0326	0.027	**	−0.0476	0.003	***	−0.0466	0.003	***
US	−0.0198	0.893		−0.0199	0.020	**	−0.0213	0.020	**
Constant	0.0243	0.001	***	0.0312	0.054	*	0.0319	0.054	*
Year fixed effects	Yes			Yes			Yes		
Number of observations	148,580			148,580			148,580		
R^2	0.0460			0.0461			0.0463		

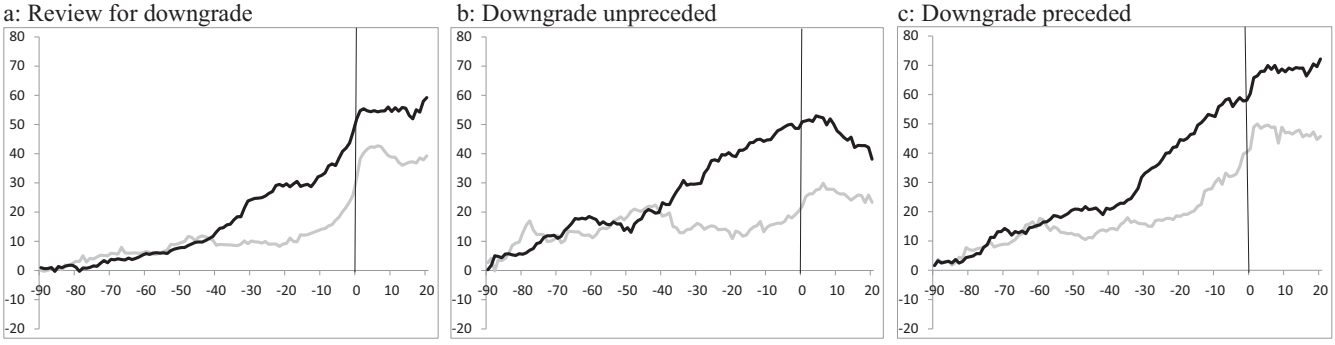

Fig. 2. Mean cumulative CDS spread changes by event type and news intensity.
This figure reports the mean cumulative abnormal CDS spreads changes (CASC) calculated as the cumulative sum of the daily cross-sectional mean abnormal CDS spread changes at event time t, starting 90 days prior to a rating announcement. Fig. 2a is based on 269 reviews for downgrade, Fig. 2b on 142 downgrades unpreceded by reviews, and Fig. 2c on 197 downgrades preceded by reviews, respectively, announced by S&P, Moody's or Fitch. The black (gray) line displays the CASC of firms with relatively high (low) news intensity. News intensity is high (black line) if *All News* is above the median in the sample, and otherwise low (grey line). The analysis is based on an international sample of 95 firms from the period 2000–2006.

these events can be interpreted as being expected by the market. Nonetheless, the anticipation is stronger for firms with high news intensity.

In Table 3 we report the corresponding CASCs prior to rating events for different time intervals and differentiate the results by event type, agency, and news intensity. We test whether the CASCs are statistically different from zero and whether they are statistically different between firms with high and low news intensity.

We find that the CASCs from 71 of 72 cells in Table 3 are statistically significant from zero at the 5% level; for expositional reasons we do not report the corresponding individual p-values. We focus on the comparison between high and low news intensity. We assess the statistical significance a *t*-test with unequal variance and a Wilcoxon rank sum test and consider the lower of the two test statistics (higher *p*-value) for each pairwise comparison. We find that the CASCs of firms with high news intensity are significantly larger than those of firms with low news intensity. The result holds in 31 out of 36 pairwise comparisons at the 5% level. It is consistent for S&P (9 of 9 cells) and Moody's (9 of 9 cells). The result is less clear and less pronounced for Fitch (4 of 9 cells), but still

Table 3
Cumulative abnormal CDS spread changes prior to rating announcements by news intensity.
This table reports the cumulative abnormal CDS spread changes (*CASC*, in bps) at event time −11, −1 and 0, starting at event time −90, respectively. The sample includes 269 reviews for downgrade and 339 downgrades by S&P, Moody's, and Fitch. News intensity is measured by *All News*, i.e., it is low (high) if a firm's total of news stories during the sample period is below (above) the sample median. The analysis is based on an international sample of 95 firms from the period 2000–2006. Statistical significance of the difference between low and high news intensity is tested with a *t*-test with unequal variance and a Wilcoxon rank sum test. We report the outcome of the test that yields a lower test statistic (larger p-value). ***, **, * denote statistically significant differences at the 0.01, 0.05, and 0.10-level.

CASC (in bps)		S&P			Moody's			Fitch			Full sample		
Event type	Event time	Low	High		Low	High		Low	High		Low	High	
Review for downgrade	−11	4.60	31.51	***	14.25	36.41	***	22.10	28.28		13.65	32.07	**
	−1	18.78	50.60	***	27.44	53.50	***	31.68	38.46	***	25.97	47.52	***
	0	17.87	60.45	***	32.79	57.55	***	44.09	37.56		31.58	51.85	***
Downgrade unpreceded	−11	11.37	46.75	***	11.49	43.47	***	16.98	42.40	***	13.28	44.21	***
	−1	18.53	48.56	***	14.66	41.97	***	27.73	55.49	***	20.31	48.66	***
	0	19.84	51.58	***	15.71	45.46	***	30.44	55.82	***	22.00	50.95	***
Downgrade preceded	−11	16.70	55.83	***	21.04	42.02	***	45.67	60.82		27.80	52.89	***
	−1	18.45	62.93	***	36.05	48.82	***	66.59	62.38		40.36	58.04	***
	0	18.01	65.67	***	41.40	52.77	***	64.76	62.51		41.39	60.32	***

statistically significant before downgrades unpreceded by reviews. Overall, the combined evidence from Fig. 2 and Table 3 is consistent with Hypothesis 1 and suggests that CDS spreads move significantly stronger prior to rating announcements when the news intensity of the underlying firms is high.

4.2. The impact of public information: daily corporate news

It is likely that the contents of daily corporate news affect the direction in which the CDS spreads move before rating announcements in addition to the overall (cross-sectional) news intensity. Surprisingly, almost entirely missing from the related literature is an empirical test of this potential channel that could explain why CDS spreads change early and substantially before rating events. The news intensity mainly influences the average likelihood of observing news for a firm during a period of time and may be useful proxy for the attention of CDS traders paid to individual firms. However, it is not possible to directly relate our measures of news intensity to individual days before rating announcements since they are time-invariant.

We now examine if and how the contents of daily corporate news influence CDS spreads before rating announcements to provide evidence on Hypothesis 2. We focus on rating-related news from news wires, the subset of public information that is most relevant for CDS traders. The news measure we employ now is firm-specific and time-varying, which makes it possible for us to identify the frequency and contents public information on single days and relate it to CDS spread changes. To illustrate the frequency and contents of public information before rating events, Fig. 3 displays averages of the total of rating-related news from news wires, the number of negative news and the number of news including "downgrade" for the [−90, 20] window by event type.

Fig. 3a and b exhibit large spikes in all three measures on the announcement day, indicating that the news from news wires we collected from FACTIVA are clearly related to the rating announcement dates. Moreover, the intensity of news from news wires (thin black line, scale of the left axis) is slightly higher before downgrades (Fig. 3b) than before rating reviews (Fig. 3a). This is consistent with the view that on average downgrades are less surprising than rating reviews.

Given that there is rating-related public information prior to rating announcements we now investigate when this information is released and how the information disseminates before the events. We calculate the difference between the number of news stories that include the words "upgrade" and "downgrade" for each firm and day, sum these daily differences during the window [−90, 20], and then examine the evolution of the cross-sectional mean of *Cumulative news difference*. The results are similar if we take the absolute number of news stories including the word "downgrade" only. We show the results based on the net measure *Cumulative news difference* because this approach is more careful in the sense that it controls for public information that might induce a market reaction in the opposite direction. Furthermore, it is useful to differentiate the analysis by event type (reviews for downgrade, downgrades) and news intensity (*All news*) because both factors might influence the cumulative content of daily corporate news. Fig. 4 displays the evolution of *Cumulative news difference* aggregated across rating agencies prior to negative rating events.[13]

We obtain three results. First, there is a negative drift in the *Cumulative news difference* for firms with high news intensity (left axis) in the pre-event time that steepens the closer we are to the announcement day. Stated differently, the number of news that include "downgrades" is more frequent than news that include "upgrade" when we approach the event time =0. There is no clear pattern for firms with low news intensity except that there is a negative spike around the event data. In particular, there is no significant and systematic anticipation in pre-event time. This result indicates that public information for firms with high news intensity is not only on average higher but especially on individual days before rating events. Second, for firms with high news intensity the run up of public information starts earlier for downgrades (bold gray line) than for reviews for downgrade (bold black line), indicating that rating reviews are less anticipated in the public. This result is consistent with the rating agencies' claim that a firm's rating review status (watch listings) is as important as the credit rating itself. Third, we find a strong negative link between *Cumulative news difference* shown in Fig. 4 and the mean cumulative CDS spread changes shown in Fig. 1. This link is particularly strong for firms with high news intensity (Pearson's correlation coefficient is −0.97 for downgrades and −0.93 for reviews for downgrade), suggesting that high news intensity on average is associated with a more efficient price formation in the CDS market. For comparison, the correlation is substantially weaker in the case of firms with low news intensity.

We continue with a multivariate regression analysis to investigate how the daily public information affects CDS spread changes prior to rating events. Since Fig. 4 indicates that the negative public information becomes increasingly prevalent before negative rating

[13] In addition, we have analyzed *Cumulative news difference* by event types and news intensity for each rating agency separately. We also differentiated between downgrades unpreceded and preceded by reviews. Since the observed patterns are similar, we only report on the aggregated results to conserve space.

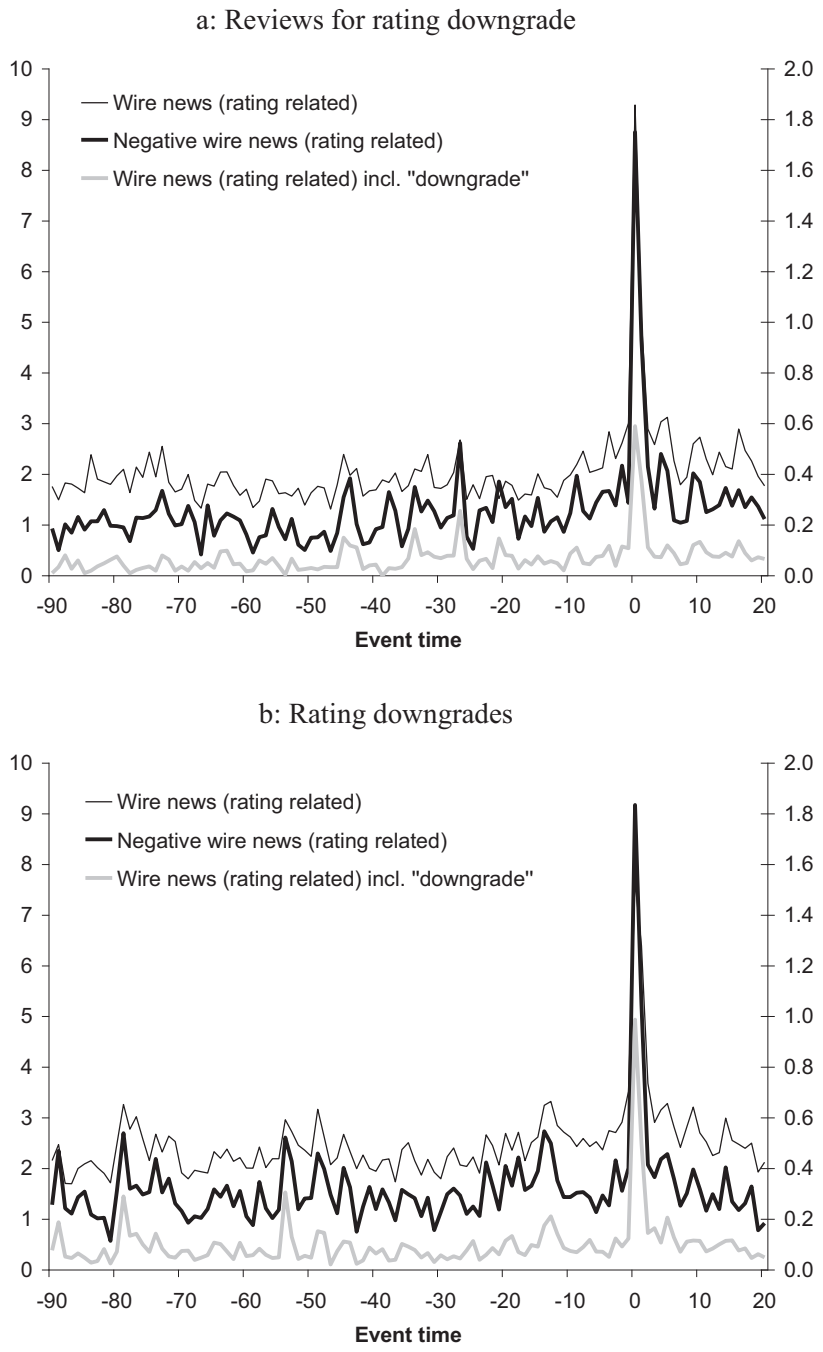

Fig. 3. Intensity and content of daily corporate news by event type.
This figure depicts the mean number of all news from news wires per day (thin black line, scale of the left axis), negative news from news wires (bold black line, scale of the right axis) and news from news wires including "downgrade" (bold grey line, scale of the right axis) prior to reviews for downgrade and downgrades by rating agencies. The analysis is based on an international sample of 95 firms from the period 2000–2006.

events, we add indicator variables[14] for days with negative rating-related news from news wires in the event time interval [−11, −2] to the regression model to study the impact of public information on CDS spread changes. If theses indicator variables exhibit significantly positive coefficients it is likely that the CDS spread changes are related to this news.[15] Table 4 presents the results. We perform the analysis aggregated across agencies in column (1) and disaggregated by agency in column (2) and report the estimated coefficients by categories.

In column (1) we find large and highly significant coefficients for *Negative news before review for downgrade* and for *Review for*

[14] These variables cover a relatively short period to minimize contamination effects due to other rating events. We obtain qualitatively similar, but statistically weaker, results if we employ longer event time intervals.

[15] There might be a concern about reverse causality. However, given the practices of press agencies, news wires, and media companies it is unlikely that such reverse effect dominates the effect of corporate news on CDS spreads. Some rating agencies consider significant changes in market prices as trigger for a rating analysis before they announce rating outlooks, reviews or rating changes (e.g., Munves, Jiang and Lam, 2006). It is important to note that such changes in market prices merely serve as trigger, not as a reason for a potential rating action that might follow or not.

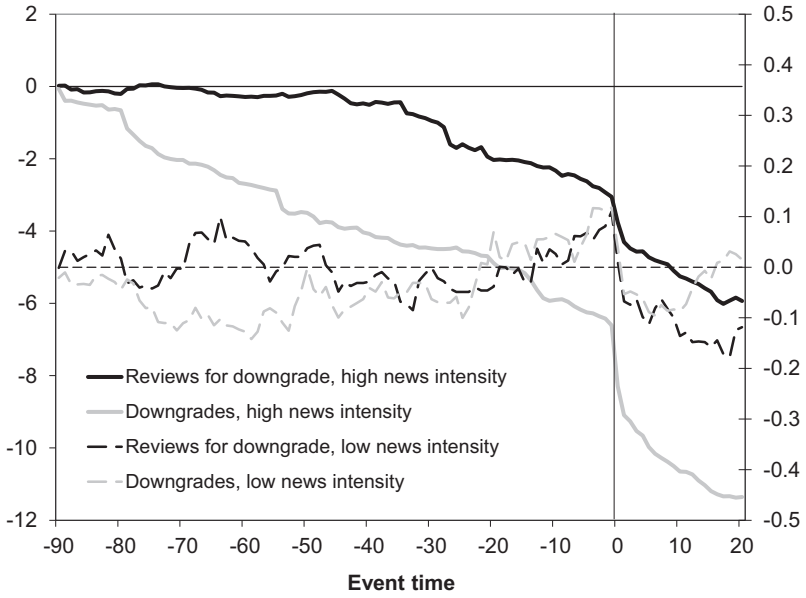

Fig. 4. The impact of corporate news by event type and news intensity.
The figure displays the mean cumulative difference between news stories from news wires including "upgrade" and "downgrade" (*Cumulative news difference*) around reviews for downgrade and downgrades by all three rating agencies. Bold lines indicate *Cumulative news difference* for firms with high news intensity on the scale of the left axis, broken lines indicate *Cumulative news difference* for firms with low news intensity on the scale of the right axis. News intensity is high if *All News* is above the median in the sample, and otherwise low. Black lines refer to reviews for rating downgrade and grey lines to downgrades. All variables are explained in Appendix A1. The analysis is based on an international sample of 95 firms from the period 2000–2006.

downgrade. In column (2) we find significantly positive coefficients for *S&P Negative news before review for downgrade* and *Moody's Negative news before review for downgrade* as well as for *S&P Review for downgrade, Moody's review for downgrade* and *Moody's downgrade preceded*. We fail to find any significant effects of negative news before or at announcements made by Fitch. The absence of any significant effects for Fitch comes out even more clearly than in Table 3 and extends evidence from earlier studies that points in the same direction. Norden and Weber (2004) show in a multivariate analysis that there is no significant CDS spread response to rating announcements made by Fitch, but there is a significant response to announcements made by Moody's and S&P. Bongaerts, Cremers and Goetzmann (2012) find that Fitch rating additions or changes for bonds that are not close to the investment grade boundary do not change the bond yields. They further find that Moody's ratings perform best to predict one-year default rates, followed by S&P and then by Fitch. The credit ratings by Moody's and S&P add significant forecasting power to those of Fitch, whereas the reverse is not the case. They argue that "this result is consistent with Fitch providing limited additional valuation information relative to that contained in Moody's and S&P ratings." We also differentiate between downgrades to non-investment grade and investment grade (not reported here). We find a highly significant abnormal CDS spread change on the announcement date, but there is no significant effect of negative news before the announcements.

Overall, the findings indicate that the direction of CDS spread changes prior to negative rating announcements is significantly related to the frequency and contents of daily public information, suggesting that CDS spreads quickly incorporate rating-related public information. The evidence is consistent with Hypothesis 2.

4.3. The impact of private information

The previous results support the Hypotheses 1 and 2, suggesting that public information significantly influences CDS spreads before rating announcements. We showed that firms' overall news intensity as well as the frequency and contents of daily corporate news influences the CDS market response prior to rating actions. We now examine whether and under which conditions private information might affect CDS spreads before rating announcements to provide evidence on Hypothesis 3.

First, we split the sample of 95 firms in three tercile groups conditional on their number of lead banks,[16] as reported in LPC Deal Scan (*Bank relationships tercile 1*: 1–5, *Bank relationships tercile 2*: 6–7, and *Bank relationships tercile 3*: 8–16). We note that the number of lead banks in a lending syndicate has been employed as standard proxy for the number of bank relationships in related studies (e.g., Acharya and Johnson, 2007; Acharya and Johnson, 2010; Ivashina and Sun, 2011). As stated in Hypothesis 3, we expect that the run up in CDS spreads before negative rating announcements starts earlier and becomes stronger for firms with a higher number of bank lenders. Fig. 5 displays the cumulative abnormal CDS spread changes for the [−90, 20] interval around reviews for rating downgrades and rating downgrades. We aggregate the CDS spread change across announcements of the three major rating agencies to conserve space. The results are qualitatively similar for the CDS market response to each of the rating agencies and unpreceded and preceded downgrades, separately.

The positive run up of the CDS market starts earlier and is strongest for firms with the highest number of major bank lenders (upper tercile, solid black line). The magnitude of the run up in the upper tercile is most pronounced in absolute and relative terms. In addition, there is a monotonic rank order of all three terciles on most days before the announcements (for reviews for downgrade only during the interval [−40, −5]; for downgrades in the entire interval [−90, 0]). The run up of the upper tercile before downgrades is particularly strong in comparison to the mid and lower

[16] As expected the number of major bank lenders (*Bank relationships*) is positively correlated with the firms' average market capitalization (ρ=0.04) and their news intensity (e.g., ρ(*Bank relationships, All news*)=0.13 and ρ(*Bank relationships, Rating related news*)=0.26). However, given that this correlation far away from being perfect it is reasonable to expect that the variable *Bank relationships* includes additional information that goes beyond firm size and public information.

Table 4
The influence of negative corporate news before rating announcements.
The dependent variable is the daily raw CDS spread change (ΔCDS_{it}). Explanatory variables are the change of the rating grade-specific CDS index (ΔI_{rt}), dummy variables indicating the [−1, 1] interval around rating events, dummy variables indicating negative news on news wires during the [−11, −2] interval before rating events, and controls. All variables are explained in Appendix A1. P-values in all regressions are based on robust standard errors considering the clustering on firms. The analysis is based on an international sample of 95 firms from the period 2000–2006. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

Dep. Var.: ΔCDS_{it}	(1) Aggregate negative rating events			(2) Negative rating events by agency		
	Coeff.	p-val.		Coeff.	p-val.	
ΔI_{rt}	0.5282	0.000	***	0.5282	0.000	***
Negative news before rating events						
Negative news before review for downgrade	3.1699	0.002	***			
S&P Negative news before review for downgrade				2.7932	0.043	**
Moody's Negative news before review for downgrade				2.6614	0.006	***
Fitch Negative news before review for downgrade				1.8562	0.169	
Negative news before unpreceded downgrade	−0.5596	0.563				
S&P Negative news before unpreceded downgrade				−0.7921	0.641	
Moody's Negative news before unpreceded downgrade				−0.6897	0.629	
Fitch Negative news before unpreceded downgrade				0.7317	0.627	
Negative news before preceded downgrade	−1.0924	0.371				
S&P Negative news before preceded downgrade				−2.9132	0.087	*
Moody's Negative news before preceded downgrade				−0.5827	0.729	
Fitch Negative news before preceded downgrade				0.3971	0.805	
Rating events						
Review for downgrade	3.1294	0.000	***			
S&P Review for downgrade				3.6719	0.007	***
Moody's Review for downgrade				2.4253	0.033	**
Fitch Review for downgrade				−0.3484	0.766	
Downgrade unpreceded	0.4403	0.560				
S&P Downgrade unpreceded				0.3592	0.742	
Moody's Downgrade unpreceded				0.8201	0.410	
Fitch Downgrade unpreceded				0.6953	0.724	
Downgrade preceded	0.9265	0.144				
S&P Downgrade preceded				1.0911	0.280	
Moody's Downgrade preceded				3.1410	0.003	***
Fitch Downgrade preceded				−0.6044	0.622	
Controls						
Financial	−0.0118	0.201		−0.0078	0.451	
Telecommunication	−0.0633	0.002	***	−0.0622	0.005	***
US	−0.0037	0.745		−0.0040	0.739	
Constant	0.0356	0.000	***	0.0352	0.001	***
Year fixed effects	Yes			Yes		
Number of observations	148,580			148,580		
R^2	0.0473			0.0481		

tercile. The latter can be explained by a reinforcing effect of public and private information.

Second, we compare the fraction of CDS spread changes that is due to public information with the fraction that is due to private information to provide further evidence on Hypothesis 3. We calculate daily abnormal CDS spread changes (ASC) for the full sample for four types of days: (1) all days, (2) days with negative news, (3) days with no negative news, and (4) days with no news. The full sample includes data from all firms on all days, i.e., periods with and without rating announcements. The four cases defined above serve as benchmark for the CDS market response prior to rating events. Recall that the ASCs are already corrected for the rating level, which makes them comparable between rating levels (i.e., they are calculated as raw CDS spread changes minus the change of the rating-specific CDS index). Then, we compute the ASCs for similarly defined days from an uncontaminated 20-day window before rating announcements made by all three agencies. Given the results from previous sections of this study, we expect significantly positive ASC for the average of all days in the 20-day window.

The key question is how much can be attributed to days with negative news, days with no negative news, and days with no news at all. Most important, significantly positive ASC on days with no negative news or days with no news (= no public information) prior to negative rating announcements would be consistent with the existence of CDS trading that is driven by private information. We note that private information could be any type of private information. It could comprise information of banks that know the fundamental reasons for upcoming rating changes, but also the leakage of upcoming rating actions to certain market participants. Based on these outcomes, we calculate the percentage of days with large positive ASCs on days with no negative news and no news during the 20-day pre-event window and compare it to the percentage in the full sample. Table 5 reports the results.

The upper part in Panel A of Table 5 indicates that there are significantly positive ASCs on days with negative news in the full sample (column (2)), while we fail to find a significant abnormal CDS market reaction on all days (column (1)), days with no negative news (column (3)), and days with no news (column (4)). The lower part in Panel A shows that there are significantly positive ASCs on average and on days with negative news during the uncontaminated 20-day window before negative rating announcements. For instance, the magnitude of the pre-event window ASCs is roughly six times bigger (1.74 basis points; column (2)) than on days with negative news in the full sample (0.29 basis points; column (2)). Interestingly, we also detect significantly positive ASCs on days with no negative news (0.25 basis points; column (3))

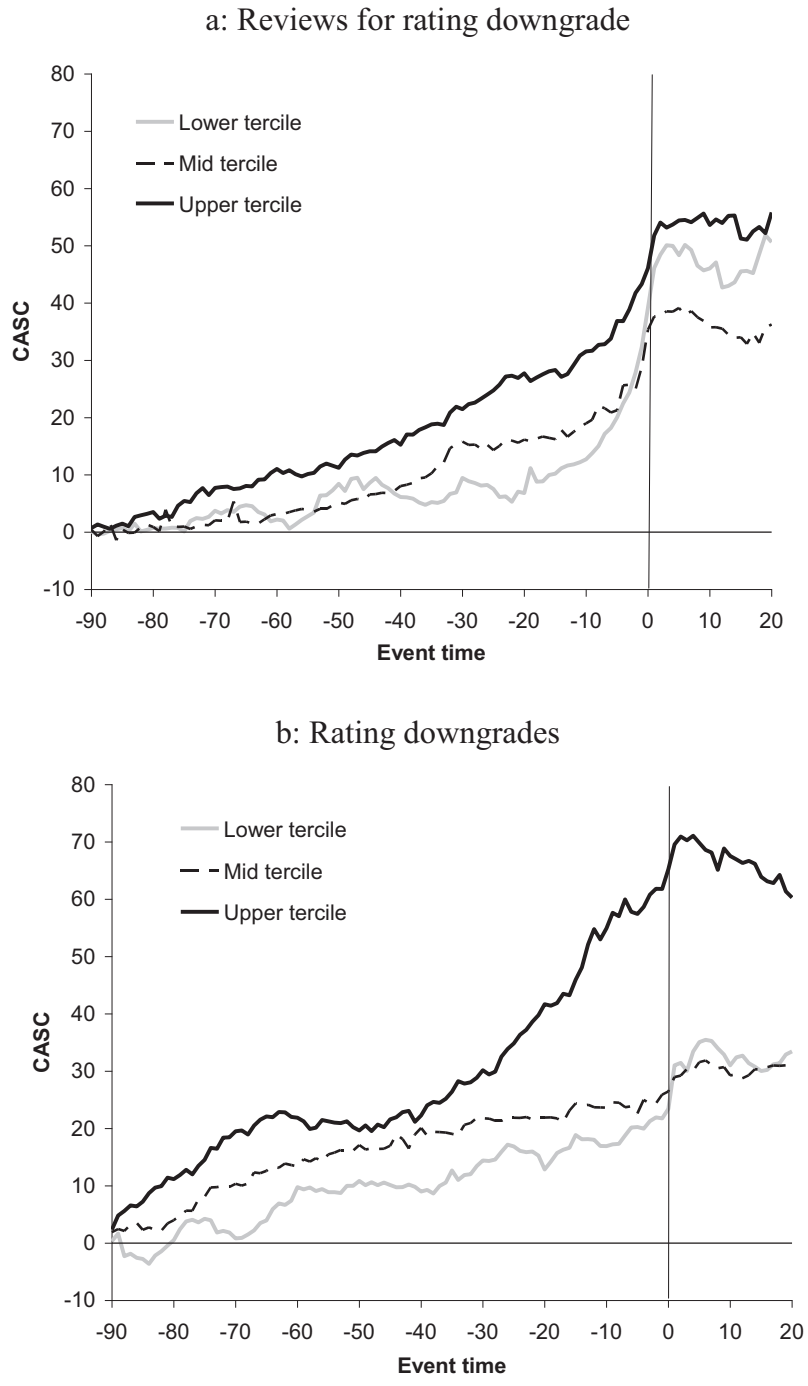

Fig. 5. CDS market response by number of major bank lenders.
Mean cumulative abnormal CDS spreads changes (CASC) are calculated as the cumulative sum of the daily cross-sectional mean abnormal CDS spread changes at event time t, starting 90 days prior to a rating announcement. The CDS underlyings are classified into terciles based on *Bank relationships* (lower tercile: 1–5, mid tercile: 6–7, upper tercile: 8–16). The sample includes 269 reviews for downgrade and 339 downgrades that are aggregated across rating agencies. All variables are explained in Appendix A1. The analysis is based on an international sample of 95 firms from the period 2000–2006.

and no news at all (0.30 basis points; column (4)). This abnormal market reaction cannot be explained by rating-related news stories from news wires which are the key source of public information for CDS traders. Hence, the CDS market response on these days is consistent with the existence of private-information based trading. We note that this result has been derived with an identification strategy that substantially differs from the one used by Acharya and Johnson (2007).

Panel B of Table 5 reports the percentage of firm-day observations with large ASCs and no negative news (*Info1*) in column (1) and large ASCs and no news (*Info2*) in column (2) for the full sample as well as for the 20-day window before different types of negative rating announcements. Large ASCs correspond to ASCs that exceed the 90% quantile of the distribution of ASCs in the full sample (2.32 basis points per day). It can be seen that this fraction of these days (*Info1*) amounts to 16.68% before negative rating announcements, which is almost twice as large as in the full sample (8.97%). The same holds for days with no news (*Info2*), which exhibit a fraction of 10.61% before negative rating events, but only 5.78% in the full sample. The results are particularly strong be-

Table 5
Abnormal CDS spread changes conditional on public information.
Panel A reports the magnitude of daily abnormal CDS spread changes (*ASC*) for the full sample and for an uncontaminated 20-day window before negative rating announcements. Panel B reports the relative frequency of private information-based trading days. The latter are either days with no negative rating-related news from news wires and very large abnormal CDS spread changes (*Info1*) or days with no rating-related news from news wires and very large abnormal CDS spread changes (*Info2*). Large abnormal CDS spread changes are those that exceed the 90%-percentile in the full sample (2.32 basis points per day). All variables are explained in Appendix A1. The analysis is based on an international sample of 95 firms from the period 2000–2006. ***, **, * denote statistical significance at the 0.01, 0.05, and 0.10-level.

Panel A: Magnitude of abnormal CDS spread changes

Full sample	(1) All days	p-val. (*t*-test)	(2) Days with negative news	p-val. (*t*-test)	(3) Days with no negative news	p-val. (*t*-test)	(4) Days with no news	p-val. (*t*-test)
Mean	0.0252	0.1248	0.2941	0.0000***	-0.0028	0.8644	0.0017	0.9419
Median	0.0000		0.0000		0.0000		0.0000	
P90	2.3261		2.8359		2.2814		2.2496	
Firm-day observations	148,580		14,072		134,508		84,795	
Uncontaminated 20-day window before reviews for downgrade and downgrades								
Mean	0.4158	0.0003***	1.7366	0.0008***	0.2510	0.0273**	0.2966	0.0497**
Median	0.0000		0.1136		0.0000		0.0000	
P90	4.9475		11.5644		4.6172		4.0863	
Firm-day observations	7310		811		6499		4145	

Panel B: Relative frequency of private information-based trading days

	(1) *Info1* Percentage of firm-day observations (no negative news, ASC > P90(ASC) in full sample)	p-val. (binomial)	(2) *Info2* Percentage of firm-day observations (no news, ASC > P90(ASC) in full sample)	p-val. (binomial)
Full sample	8.97		5.78	
Uncontaminated 20-day window before:				
Review for downgrade or downgrade	16.68	0.000***	10.61	0.000***
Review for downgrade	16.91	0.000***	10.85	0.000***
Downgrade unpreceded	16.32	0.000***	10.00	0.000***
Downgrade preceded	17.63	0.000***	11.10	0.000***
Downgrade IG-IG	16.45	0.000***	10.32	0.000***
Downgrade IG-NIG	23.87	0.000***	16.67	0.000***

fore downgrades to non-investment grade ratings (23.87% for *Info1* and 16.67% for *Info2*), which have a large price impact and constrain many institutional investors in the bond market. We carry out binomial tests that compare the fractions from the full sample with those in from the pre-event window. The differences are economically and statistically highly significant. Hence, these results further support the view that private-information based CDS trading is more frequent prior to negative rating announcements. We also performed the analysis with firms' stock returns and find that the clustering of days that are consistent with private-information based trading is more pronounced in the CDS market than in the stock market. We summarize the findings in Section 5.

We conducted the same tests as in Table 5 for positive rating announcements (reviews for upgrade, rating upgrades) by the three agencies. We find that the ASCs during the uncontaminated 20-day window before positive rating events are not significantly different from zero, the ASCs are significantly positive on days with positive news, and, most important, insignificant on days with no positive news or no news. Strikingly, the fraction of private information-based trading days (*Info1, Info2*) in the 20-day window before positive rating announcements is significantly lower than in the full sample. *Info1* (no positive news and strongly negative ASCs) exhibits a relative frequency of 7.66% in the full sample and 5.63% in the 20-day window. *Info2* (no news and strongly negative ASCs) displays 5.61% in the full sample and 3.30% in the 20-day window. These additional findings indicate that insider trading in the CDS market is asymmetric. It is more likely to happen before credit quality deteriorations than before credit quality improvements. One explanation is that, under certain conditions, lenders might gain more from buying protection well in advance of credit quality deteriorations (i.e., either market value gain of the CDS or the par value compensation payment in the case of a borrower default) than from selling protection well in advance of credit quality improvements (market value gains). However, the net gains of combined positions of CDS and loans depend on the specific strategies and the timing.

Third, we investigate which factors influence the probability of private information-based trading in a multivariate analysis. For this purpose, we estimate multivariate probit regression models with *Info1* and *Info2* as dependent variables.[17] Explanatory variables are the measure of news intensity (*All news*), a dummy variable that equals one on all days during the [−20, −1]-window before different types of negative rating announcements (*Pre-review for downgrade or downgrade, Pre-review for downgrade,* etc.), and the number of bank relationships (*Bank relationships*). We expect significantly positive coefficients for the various pre-event intervals and for the number of *Bank relationships* because a higher number of major bank lenders is associated with more potential insiders. We expect negative coefficients for *All news* because the probability of $Info1 = 1$ or $Info2 = 1$ should be lower for firms that exhibit high news intensity.

Moreover, we include various control variables: the firm's credit rating assigned by Moody's (*Rating Moody's*), dummy variables indicating firms from the financial industry (*Financial*), telecommunication industry (*Telecommunication*), U.S. firms (US), the existence of at least one split rating in pair-wise comparisons of the firm's credit ratings (*Split rating*), the relative CDS bid-ask spread as liquidity measure (*Bid ask spread*), and year fixed effects. We expect

[17] The results are similar for panel data regression models with firm fixed effects. Alternatively, we added industry fixed effects instead of the *Telecommunication* and *Financial* dummy variables and obtain similar results.

a positive coefficient for the rating level (*Rating Moody's*) because gains from CDS trading in riskier firms are higher than from trading in low-risk firms. We also expect a positive coefficient of split ratings (*Split rating*) because the marginal value of private information might be especially high when there is disagreement in public information. We expect negative coefficients for firms from the financial industry (*Financial*), and for the liquidity measure (*Bid ask spread*). Private information-based CDS trading is less likely if the amount of firm-specific public information is high, i.e., for financial institutions because informational advantages from lending to other banks are relatively unlikely. It is also less likely in times of low liquidity since the opportunity cost of being unable to exploit private information is higher than in times of high liquidity (i.e., price impact and risk of no execution is high when liquidity is low). Table 6 reports the results.

Panel A of Table 6 presents the results for *Info1*. We find significantly positive coefficients for the pre-event intervals for the aggregate negative rating announcements in column (1), for reviews for downgrade, unpreceded and preceded downgrades in column (2) and for downgrades to investment and non-investment grade in column (3). These results indicate that there is a significantly higher probability of days with no negative rating related news from news wires and very large abnormal CDS spread changes prior to various types of negative rating announcements. Furthermore, the coefficient of *Bank relationships* is significantly positive. Note that in unreported analyses, we consider the dummy variables *Bank relationships tercile 2* and *Bank relationships tercile 3* (and *Bank relationships tercile 1* as reference category) instead of the continuous variable and obtain a highly significant and positive coefficient for the dummy variable for the upper tercile (p-val. = 0.012). Hence, the effect is not completely linear and driven by firms with a very high number of major bank lenders. The control variables that are statistically significant display coefficients with the expected signs. We note that these findings are consistent with all previous results, in particular with Table 5 and Fig. 5.

In Panel B of Table 6 we report the corresponding results for *Info2*. We obtain similar results for the pre-event intervals. The coefficient of *Bank relationships* is no longer statistically significant, but if we use the dummy variables *Bank relationships tercile 2* and *Bank relationships tercile 3* (and *Bank relationships tercile 1* as reference category) instead, we obtain a significantly positive coefficient for the dummy variable for the upper tercile in unreported analyses (p-val. = 0.086). Detailed results using the tercile split of *Bank relationships* are available on request. Furthermore, the negative coefficient of the variable *All news* becomes now highly significant and that the coefficient of the variable *US* changes the sign. The first one is plausible since it is a direct consequence of the change in the dependent variable: firms with high news intensity are on average less likely to exhibit days with no news. The different sign of the dummy variable for firms from the U.S. can be explained by the fact that these U.S. firms display a lower number of days with no news.

Furthermore, we performed Wald tests to compare the magnitude of the coefficients of the variables of interest within regression models (the results are not reported in Table 6). When we compare the coefficients of *Pre-downgrade unpreceded* and *Pre-downgrade preceded*, we do not find a statistically significant difference in column (2) of Panel A and Panel B. However, consistent with Panel B of Table 5, we do find a large and significant difference between the coefficients of *Pre-downgrade IG-IG* and *Pre-downgrade IG-NIG* in column (3) of Panel A (p-value = 0.0018), and in column (3) of Panel B (p-value = 0.0035). Private information based trading is four times more likely prior to downgrades if the downgrade is to non-investment grade. These results support the view that any type of insider trading due to private information or information leakage from rating agencies is more likely to occur prior to rating events that have a major price impact and might constrain institutional investors in bond markets (i.e., reviews for downgrade or downgrades to non-investment grade ratings).

Overall, the evidence provided in this section is consistent with Hypothesis 3 and suggests that, in addition to trading related to public information, CDS spreads move before negative rating events because of private information-based trading. Given that private information based trading occurs some time before the rating events take place, we infer that the corresponding information is incorporated only in the CDS spreads but not the ratings or rating reviews. However, the importance of private information as a driving factor for CDS spreads is substantially smaller than that of public information.

5. Further empirical checks and robustness tests

We conduct several additional empirical checks to study whether the main results are robust and not the product of particular choices of samples, methods, or model specifications.

First, we repeat the event study and regression analyses separately for subsamples that differentiate between industrial firms vs. financial institutions, U.S. firms vs. European firms, and data from the first and second half of our sample period. In all three tests we obtain results that confirm the key findings from the full sample.

Second, we perform the analysis of the influence of public information with stock market data. For this purpose, we calculate firms' abnormal stock returns using three alternative benchmarks (the cross-sectional mean stock return of all firms in the sample; a rating-specific stock market index, which has been defined in a similar way than the CDS index; and regional stock market indices (S&P 500 for the U.S., and the Stoxx 50 for Europe). Independent of how we calculate firms' abnormal stock returns we confirm the significant influence of firms' news intensity. The differences in the stock market reaction between firms with high and low news intensity before rating events is even more pronounced, which could be explained by the presence of non-institutional investors in stock markets. Furthermore, we also repeat the analysis of the influence of private information with stock market data. We define days on which private information-based trading is likely to occur based on firms' abnormal stock returns, following the same definition as for *Info1* (days with large abnormal stock returns and no related news) and *Info2* (days with large abnormal stock returns and no news). For instance, for *Info2*, we find that the percentage of days on which private information is likely to drive market prices before negative rating events is 9.9% in the CDS market (compared to 5.7% in the full sample), but only 7.8% in the stock market (compared to 5.9% in the full sample). Thus, based on this measure, the probability of insider trading prior to negative rating events is clearly higher in the CDS market than in the stock market.

Third, larger firms are likely to exhibit larger news intensity. As discussed above, firm size (market capitalization) and the measures of news intensity exhibit a moderately positive rank correlation that ranges between 0.36 and 0.55. Thus, it is possible that the differences in the CDS spread changes between firms with high and low news intensity are largely driven by firm size. To examine this issue we estimate a two-stage model. In the first stage, we estimate a probit model with the news intensity measure (*All news*) as dependent variable and firms' market capitalization, Moody's credit rating, industry, country and year fixed effects as explanatory variables. The coefficient of firms' market capitalization is positive and significant at the 1%-level, and the adjusted McFadden R^2 of the model is 0.36 (using market capitalization as the only explanatory variable lead to an adjusted McFadden R^2 of 0.14). In the second stage, we use the residuals from the first stage regression to define the new variable "adjusted news intensity", which

Table 6
The probability of CDS trading based on private information.
This table reports results from probit regression models for *Info1* in Panel A and for *Info2* in Panel B. Explanatory variables are the news intensity (*All news*), dummy variables indicating the [−20, −1] event time interval before reviews for downgrade, downgrades unpreceded by reviews and downgrades preceded by reviews by any of the three rating agencies (*Pre-review for downgrade or downgrade*, etc.), dummy variables indicating the [−20, −1] event time interval before downgrades to investment grade ratings or non-investment grade ratings (*Pre-downgrade IG-IG, Pre-downgrade IG-NIG*), the number of bank relationships (*Bank relationships*), and controls. All variables are explained in Appendix A1. The analysis is based on an international sample of 95 firms from the period 2000–2006. P-values in all regressions are based on robust standard errors clustered on firms. ***, **, * denote coefficients that are statistically significant at the 0.01, 0.05, and 0.10-level.

Panel A: Trading on days with no negative news and large CDS spread changes

Dep. Var.:	(1) *Info1*			(2) *Info1*			(3) *Info1*		
	Coeff.	p-val.		Coeff.	p-val.		Coeff.	p-val.	
All news	0.0017	0.964		0.0017	0.964		0.0008	0.982	
Pre-event interval									
Pre-review for downgrade or downgrade	0.1662	0.000	***						
Pre-review for downgrade				0.1857	0.000	***	0.1851	0.000	***
Pre-downgrade unpreceded				0.1020	0.009	***			
Pre-downgrade preceded				0.1522	0.000	***			
Pre-downgrade IG-IG							0.1163	0.000	***
Pre-downgrade IG-NIG							0.4730	0.000	***
Number of bank relationships									
Bank relationships	0.0095	0.087	*	0.0098	0.077	*	0.0097	0.078	*
Controls									
Rating Moody's	0.2979	0.000	***	0.2984	0.000	***	0.2959	0.000	***
Financial	−0.0660	0.135		−0.0621	0.160		−0.0637	0.148	
Telecommunication	0.0258	0.640		0.0244	0.652		0.0262	0.628	
US	0.1048	0.006	***	0.1013	0.008	***	0.1016	0.007	***
Split rating	0.0761	0.010	***	0.0751	0.010	***	0.0751	0.010	***
Bid ask spread	−1.2212	0.000	***	−1.2032	0.000	***	−1.2108	0.000	***
Const.	−2.0466	0.000	***	−2.0562	0.000	***	−2.0453	0.000	***
Year fixed effects	Yes			Yes			Yes		
Number of observations	123,230			123,230			123,230		
Pseudo-R^2	0.1098			0.1103			0.1104		

Panel B: Trading on days with no news and large CDS spread changes

Dep. Var.:	(1) *Info2*			(2) *Info2*			(3) *Info2*		
	Coeff.	p-val.		Coeff.	p-val.		Coeff.	p-val.	
All News	−0.2181	0.001	***	−0.2182	0.001	***	−0.2192	0.001	***
Pre-event interval									
Pre-review for downgrade or downgrade	0.1398	0.001	***						
Pre-review for downgrade				0.1811	0.001	***	0.1782	0.001	***
Pre-downgrade unpreceded				0.0730	0.210				
Pre-downgrade preceded				0.1194	0.033	**			
Pre-downgrade IG-IG							0.0833	0.060	*
Pre-downgrade IG-NIG							0.4305	0.000	***
Number of bank relationships									
Bank relationships	0.0096	0.187		0.0098	0.176		0.0098	0.176	
Controls									
Rating Moody's	0.3680	0.000	***	0.3692	0.000	***	0.3668	0.000	***
Financial	−0.0856	0.161		−0.0819	0.184		−0.0835	0.172	
Telecommunication	−0.0544	0.616		−0.0552	0.610		−0.0537	0.620	
US	−0.1140	0.044	**	−0.1168	0.039	**	−0.1164	0.038	**
Split rating	0.0404	0.324		0.0394	0.336		0.0397	0.332	
Bid ask spread	−0.6656	0.000	***	−0.6508	0.000	***	−0.6593	0.000	***
Const.	−2.4186	0.000	***	−2.4269	0.000	***	−2.4165	0.000	***
Year fixed effects	Yes								
Number of observations	118,678			118,678			118,678		
Pseudo-R^2	0.1189			0.1193			0.1194		

equals one if the absolute value of the residuals exceeds its sample median, and zero otherwise. This variable reflects the component in the unadjusted news intensity that is left unexplained by firm size, risk, and the other variables. The analysis based on the adjusted news intensity measures yields qualitatively similar results. This result suggests that there is a differential effect of public information about firms that goes beyond firm size and risk. This is also consistent with the positive but not perfect correlation between firm size and the news intensity measures.

Fourth, we investigate whether the clustering of private-information based trading before negative rating announcements is due to industry contagion effects (e.g., Jorion and Zhang, 2007). To examine this issue, we calculate which fraction of observations for which *Info1* (*Info2*) equal one coincides with negative news stories

about non event-firms from the same industry (but potentially different countries). We find that the relative frequency of these cases is lower in the window before negative rating announcements than in the full sample, which rules out that intra-industry information spillover can serve as an alternative explanation.

Fifth, the liquidity in the CDS market varies across firms and time (e.g., Longstaff, Mithal, Neis, 2005; Tang and Yan, 2012; Bongaerts, de Jong and Driessen, 2011). Since the multivariate analysis in Section 4.3 indicates that private information-based CDS trading is more likely during the month before rating announcements and when liquidity in the CDS market is high, we revisit the dynamics of CDS market liquidity before rating events. For this purpose, we compute the absolute bid-ask spread (difference between bid and ask CDS spread) and the percentage bid-ask spread of CDS (absolute bid-ask relative to mid, stated in %) and repeat the baseline event study. This analysis yields that mean cumulative changes of absolute bid-ask spreads increase during the [−90, 0] window and then remain relatively stable. Interestingly, the speed of this increase is lower than the increase of cumulative abnormal mid CDS spread changes, leading to a steady and almost monotonic decrease of the percentage bid-ask spread. The mean cumulative changes of the percentage bid-ask spread of CDS, stated in percentage points, in the interval [−90, 0] prior to reviews for downgrade (downgrades) amounts to −3.8 (−1.0) for S&P, −4.5 (−3.3) for Moody's, and −6.1 for Fitch (−4.8). For comparison, the mean percentage bid-ask spread of CDS in the full sample is 22%. In other words, the CDS market is more liquid on days that are closer to the rating announcement because bid-ask spreads widen at a lower speed than the mid CDS spread levels. This rating event-related liquidity effect has not been documented in earlier studies and is consistent with the finding from Table 6 that insider trading is more likely to happen when liquidity in the CDS market is high.

6. Conclusion

We investigate how public and private information affects CDS spreads prior to credit rating announcements. We consider firms' overall news intensity and the contents of daily corporate news stories as direct indicators of public information to shed light on the informational efficiency of the CDS market, the impact of credit rating announcements and insider trading.

First, we show that abnormal CDS spreads of firms with high news intensity change earlier and more strongly before rating announcements than those of firms with low news intensity. Second, the contents of daily corporate news significantly affect the direction in which CDS spreads change prior to negative rating announcements. Third, we provide evidence that under certain conditions private information also affects CDS spreads. The anticipation of negative rating events is stronger for firms with a higher number of bank relationships. Moreover, there is a significant clustering of days with no or no related news but large abnormal CDS spread changes before negative rating events, especially when liquidity is high. This effect is not found before positive rating events. These findings are consistent with the view that private information about credit quality deteriorations, but not about credit quality improvements, as well as leakage of upcoming rating actions influence CDS spreads.

This study has several implications. We provide direct evidence that the CDS market quickly and accurately incorporates public information. Moreover, private information-based trading of institutional investors moves CDS spreads into the right direction prior to negative rating events, improving the overall price discovery process. This finding should not be overlooked in the discussion about the regulation and organization of the CDS market and the potential use of CDS spreads for market discipline vis-à-vis banks. In addition, the results of this study inform us about the role of credit rating agencies. The evidence suggests that the impact of credit rating announcements on the CDS market differs across event types and agencies. Especially, reviews for downgrade (watch listings) announced by S&P and Moody's convey important information to markets that has not fully been incorporated in CDS spreads prior to these announcements.

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Appendix A1
Variable names and descriptions.

Category	Subcategory	Variable name	Description
Public information	News intensity (time invariant)		The continuous variables correspond to the sum of news stories per firm during 2000–2006. Different types of news (all news, rating related news) and different sources (all sources, news wires) are considered. The dummy variables are one if the continuous variable is above the sample median, and zero otherwise.
		All news	All types of news about the firm from all sources (FACTIVA)
		News wires	News from news wires (Dow Jones News Service, Reuters, AFX and others; FACTIVA)
		Rating related news	Rating related news from all sources (including the words "rating", "downgrade" or "upgrade")
		News wire rating related	Rating related news from news wires (including the words "rating", "downgrade" or "upgrade"; Dow Jones News Service, Reuters, AFX and others; FACTIVA)
	Daily corporate news (time varying)	*Negative news before review for downgrade*	Dummy variable indicating negative news from news wires during the [−11, −2] event time interval before reviews for downgrade, and zero otherwise.
		Negative news before unpreceded downgrade	Dummy variable indicating negative news from news wires during the [−11, −2] event time interval before downgrades that are unpreceded by reviews for downgrade, and zero otherwise.

(*continued on next page*)

Appendix A1 (*continued*)

Category	Subcategory	Variable name	Description
		Negative news before preceded downgrade	Dummy variable indicating negative news from news wires during the [−11, −2] event time interval before downgrades that are preceded by reviews for downgrade, and zero otherwise.
		Cumulative news difference	Cumulative daily difference between the number of news from news wires that include the word "upgrade" and those that include the word "downgrade".
Private information		*Bank relationships*	Continuous variable: Number of major bank lenders, using the number of lead arrangers in syndicate lending at the parent company level, as reported in the Thomson Reuters LPC DealScan database. Three dummy variables that equal one for each tercile, respectively, and zero otherwise.
		Info1	Private information-based trading days defined as days with *no negative rating-related news* from news wires and very large abnormal CDS spread changes. Large abnormal CDS spread changes are those that exceed the 90%-percentile in the full sample (2.32 basis points per day).
		Info2	Private information-based trading days defined as days with *no rating-related news* from news wires and very large abnormal CDS spread changes. Large abnormal CDS spread changes are those that exceed the 90%-percentile in the full sample (2.32 basis points per day).
		Pre-review for downgrade or downgrade	Dummy variable indicating the [−20, −1] event time interval before reviews for downgrades or downgrades, and zero otherwise
		Pre-review for downgrade	Dummy variable indicating the [−20, −1] event time interval before reviews for downgrades, and zero otherwise
		Pre-downgrade unpreceded	Dummy variable indicating the [−20, −1] event time interval before downgrades that are unpreceded by reviews for downgrade, and zero otherwise
		Pre-downgrade preceded	Dummy variable indicating the [−20, −1] event time interval before downgrades that are preceded by reviews for downgrade, and zero otherwise
		Pre-downgrade IG-IG	Dummy variable indicating the [−20, −1] event time interval before downgrades from investment grade to investment grade, and zero otherwise
		Pre-downgrade IG-NIG	Dummy variable indicating the [−20, −1] event time interval before downgrades from investment grade to non-investment grade, and zero otherwise
Control variables		*Financial*	Dummy variable that equals one if the firm is from the financial industry, and zero otherwise.
		Telecommunication	Dummy variable that equals one if the firm is from the telecommunication industry, and zero otherwise.
		US	Dummy variable that equals one if the firm is from the US, and zero otherwise.
		Split Rating	Dummy variable that equals one on days when at least two agencies have assigned different ratings to the firm, and zero otherwise.
		Bid ask spread	Relative bid-ask spread of the firm's CDS
		Size	Firm size measured by the daily market capitalization in million Euro, converted with corresponding daily exchange rates

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