Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Banking & Finance 28 (2004) 2813–2843
Journal of BANKING & FINANCE
www.elsevier.com/locate/econbase

Informational efficiency of credit default swap and stock markets: The impact of credit rating announcements

Lars Norden [a,*], Martin Weber [a,b]

[a] Department of Banking and Finance, University of Mannheim, L 5.2, 68131 Mannheim, Germany
[b] Centre for Economic Policy Research (CEPR), London, UK

Available online 10 August 2004

Abstract

This paper analyzes the response of stock and credit default swap (CDS) markets to rating announcements made by the three major rating agencies during the period 2000–2002. Applying event study methodology, we examine whether and how strongly these markets respond to rating announcements in terms of abnormal returns and adjusted CDS spread changes. First, we find that both markets not only anticipate rating downgrades, but also reviews for downgrade by all three agencies. Second, a combined analysis of different rating events within and across agencies reveals that reviews for downgrade by Standard & Poor's and Moody's exhibit the largest impact on both markets. Third, the magnitude of abnormal performance in both markets is influenced by the level of the old rating, previous rating events and, only in the CDS market, by the pre-event average rating level of all agencies.

JEL classification: G14; G20
Keywords: Credit ratings; Credit default swaps; Informational efficiency; Event study

* Corresponding author. Tel.: +49 621 1811536; fax: +49 621 1811534.
E-mail addresses: norden@bank.bwl.uni-mannheim.de (L. Norden), weber@bank.bwl.uni-mannheim.de (M. Weber).

0378-4266/$ - see front matter
doi:10.1016/j.jbankfin.2004.06.011

1. Introduction

Rating agencies are important institutions which mitigate problems of asymmetric information between participants of the capital market. Lenders consider a firm's rating to not only decide on credit approval but also to use for pricing, monitoring and risk provision purposes. Furthermore, in the near future, external ratings will be recognized as one possible approach for banks to determine regulatory capital (see Basel Committee on Banking Supervision, 2004).

Given the importance of rating agencies, one might think that rating announcements have a significant impact on the market. In particular, markets for financial claims that relate to an entity's credit risk should react significantly if credit ratings reveal new information. Some examples of credit risk sensitive markets are those for stocks, bonds, and related derivatives. A particular example of derivatives markets is the heavily growing credit default swap (CDS) market. [1] In a credit default swap, a protection seller assumes the credit risk of a reference entity against a fixed annual credit spread which has to be paid periodically by the protection buyer. If a pre-defined credit event (for example, bankruptcy of the reference entity) occurs, the protection seller has to pay the notional amount of the swap and receives in exchange the defaulted asset under physical delivery settlement terms. Under cash settlement, the protection seller has to pay the loss amount incurred by the protection buyer. If no credit event occurs, the contract terminates at maturity. Taking into account the different characteristics of these credit risk sensitive markets, one may ask how they respond to credit rating announcements. This question contributes to market efficiency research and it is also of interest for market participants and credit risk managers. If markets exhibit different responses to rating announcements, traders may take the opportunity to exploit these price differentials. Moreover, since credit risk managers always try to improve their early warning systems, they can complement ratings and model-based assessments with information implied in prices from different markets. [2] In particular, if some (or all) market prices anticipate rating announcements, credit risk managers can act earlier against unfavorable changes of credit quality.

In this paper, we apply traditional event study methodology to examine whether and how stock and CDS markets responded to rating announcements during the years 2000–2002. We leave the bond market aside because its prices reflect not only issuer risk, but also several aspects of issue risk. Rating announcement events are collected from the three major rating agencies: Standard & Poor's, Moody's and Fitch. Moreover, two different types of rating announcement events are taken into

[1] See Tavakoli (2001) and Bank for International Settlements (2003) for an overview of credit derivatives. Fitch Ratings (2003) presents results of a global survey of the CDS market. According to British Bankers' Association (2002) the global CDS market has increased from $ 180 billion in 1997 to $ 1952 billion in 2002.

[2] See Breger et al. (2003). They derive "market-implied ratings" from bond market data and show that these indicators can be used to predict the dynamics of agency ratings.

account: Actual rating changes and reviews for rating changes. Whereas some considerable research has been performed on the relationship between rating announcements and bond/stock returns (see, for example, Holthausen and Leftwich, 1986; Dichev and Piotroski, 2001), there is very little knowledge of credit derivatives markets (see Hull et al., 2004). One important reason for this is that the latter is relatively young and small in comparison to other markets so that reliable data for research purposes is scarce. We do not know of any previous study that analyzes the stock and CDS market response to announcements of three different rating agencies for the same firms in a comparative framework.

Our findings reveal that both markets anticipate not only rating downgrades, but also reviews for downgrade by all three agencies if taken separately. Both markets do not exhibit any significant response to positive rating events. Most importantly, in a combined analysis of different rating events within and across agencies, we find that the stock market exhibits a significantly negative abnormal return on days of reviews for downgrade by Standard & Poor's and Moody's, whereas actual downgrades are not associated with abnormal performance. Corresponding results have been found for the CDS market, except that days of downgrades by Moody's also show significant spread changes. No abnormal performance with regard to rating events by Fitch has been detected in either of the markets. The magnitude of abnormal performance in both markets is influenced by the level of the old rating, previous rating events and, only in the CDS market, by the pre-event average rating level by all agencies.

The remainder of this paper is organized as follows. Section 2 provides an overview of related literature and proposes a set of hypotheses. Section 3 describes our data set and explains the event study methodology. Section 4 presents univariate and multivariate results for the stock and CDS market response to rating announcement events. The final section concludes.

2. Overview of related research and hypotheses

In the context of credit ratings, empirical tests of market efficiency examine price adjustments before, at and after rating announcements, applying traditional event study methodology. If credit ratings convey new information to the market, prices should react after a rating event. On the other hand, it might be possible that credit ratings only reflect information that is already known by the market, which would imply that prices do not react to the rating event at all. In this case, market prices respond permanently to current firm news, whereas credit ratings react with a time lag or do not change at all due to practical reasons such as infrequent reviews, insufficient staff or particular rating policies (for the latter issue see Löffler, 2003). Previous research has analyzed the impact of credit rating announcements on stock prices, bond prices or both. More recently, academics have started to examine the relationship between CDS spreads and rating announcements as well. In Table 1 we briefly report sample characteristics and the main results of related studies.

Table 1
Overview of related studies

Market	Study	Data	Main results
Stock	Pinches and Singleton (1978)	1959–1972, Moody's, 207 firms, monthly abnormal stock returns during [−30, 12]	Anticipation before rating changes, no abnormal reaction afterwards
Stock	Griffin and Sanvicente (1982)	1960–1975, Moody's and S&P, 180 rating changes, monthly abnormal stock returns during [−11, 1]	No anticipation but negative reaction after downgrades
Stock	Holthausen and Leftwich (1986)	1977–1982, Moody's and S&P, 1014 rating changes, 256 additions to S&P Credit Watch, daily abnormal stock returns during [−300, 60]	Significantly negative reaction after downgrades, no significant abnormal performance for upgrades
Stock	Glascock et al. (1987)	1977–1981, Moody's, 162 rating changes, daily abnormal stock returns during [−90, 90]	Significantly negative abnormal stock returns before and around downgrades, reversal after day zero (publication date)
Stock and Bond	Hand et al. (1992)	1977–1982/1981–1983, Moody's and S&P, 1100 rating changes and 250 additions to S&P Credit Watch, window spanning stock and bond returns	Significantly negative abnormal stock and bond returns for downgrades and unexpected additions to S&P Credit Watch, no significant abnormal returns for upgrades
Stock	Goh and Ederington (1993)	1984–1986, Moody's, daily abnormal stock returns during [−30, 30]	Significantly negative returns for downgrades due to earnings deterioration, positive abnormal returns for downgrades due to increased leverage
Stock	Followill and Martell (1997)	1985–1988, Moody's, 64 reviews and actual rating changes, daily abnormal stock returns during [−5, 5]	Significantly negative returns at reviews for downgrade, negligible abnormal performance around actual downgrades
Stock	Dichev and Piotroski (2001)	1970–1997, Moody's, 4727 rating changes, daily abnormal stock returns	Significantly negative returns during the first month after a downgrade, no significant reaction for upgrades
Stock	Vassalou and Xing (2003)	1971–1999, Moody's, 5034 rating changes, monthly abnormal returns of stock portfolios during [−36, 36]	Stock returns in rating event studies should be adjusted by size, book-to-market and default risk, increase of default loss indicator before and decrease after downgrades
Bond	Katz (1974)	1966–1972, S&P, 115 bonds from 66 utilities, monthly yield changes during [−12, 5]	No anticipation, abnormal performance during 6–10 weeks after downgrades

Table 1 (*continued*)

Market	Study	Data	Main results
Bond	Grier and Katz (1976)	1966–1972, S&P, 96 bonds from utilities and industrials, monthly bond returns during $[-4,3]$	Anticipation only for industrials, price changes after downgrades stronger
Bond	Hettenhouse and Sartoris (1976)	1963–1973, S&P and Moody's, 46 bonds from utilities, monthly yield changes during $[-6,6]$	Little anticipation before downgrades, no reaction to upgrades
Bond	Weinstein (1977)	1962–1974, Moody's, 412 bonds from utilities and industrials, monthly abnormal bond returns during $[-6,7]$	Early anticipation but no abnormal performance during 6 months before the event and no reaction afterwards
Bond	Wansley et al. (1992)	1982–1984, S&P, 351 bonds, weekly abnormal bond returns during $[-12,12]$	Significantly negative returns in the week of downgrades, no significant response to upgrades
Bond	Hite and Warga (1997)	1985–1995, S&P and Moody's, 1200 rating changes, monthly abnormal bond returns during $[-12,12]$	Significantly negative abnormal returns during 6 months before downgrades
Bond	Steiner and Heinke (2001)	1985–1996, S&P and Moody's, 546 rating changes, 182 watch listings, daily abnormal bond returns during $[-180,180]$	Significantly negative abnormal returns starting 90 days before downgrades and negative watch listings, evidence for overreaction directly after the event
CDS	Hull et al. (2004)	1998–2002, Moody's, rating changes, reviews and outlooks, adjusted CDS spread changes during $[-90,10]$	Significantly positive adjusted CDS spread changes before negative rating events

Considering findings from these studies, we propose the following set of hypotheses. Firstly, if rating announcements reveal new information to the market, we will expect a significant negative (positive) stock (CDS) market reaction at or after rating downgrades (and the opposite for positive rating events). However, since empirical evidence is relatively mixed, it may be possible that we will not observe any abnormal performance around or after rating events, but in anticipation of the event (see, for example, Steiner and Heinke, 2001; Hull et al., 2004).

H1 (Information content of rating changes): Markets do not anticipate, but react directly after rating changes because they reveal new information.

Secondly, we have to take into account the fact that rating agencies announce reviews for rating changes, which are frequently succeeded by actual rating changes.

For example, if a review for downgrade is succeeded by an actual downgrade 60 days later, we will expect a significant price reaction around the review date and, also important to note, no such reaction around the downgrade date. This reasoning is based on the following two assumptions: (i) markets have to consider reviews as reliable and (ii) the time interval between a review and the corresponding rating change is not too long. However, as in the case of actual rating downgrades, one can also argue that rating reviews are anticipated by markets because even reviews still lag the original firm events.

H2 (Information content of rating reviews): Markets do not exhibit an abnormal reaction before reviews for rating changes, but react directly after a review announcement.

Thirdly, we expect an asymmetric reaction to positive and negative rating events as found in earlier studies. Possible explanations for significant abnormal returns in the case of negative events (and not for positive events) are, for example, information-processing biases (see Dichev and Piotroski, 2001), or a disciplinary effect on the firm's management (see Vassalou and Xing, 2003).

H3 (Asymmetric price adjustment): No significant abnormal reaction around upgrades, significant negative abnormal reaction around downgrades.

Finally, we presume that both markets do not react identically because stocks and CDS differ in several ways (for example cash vs. derivatives, risk-return profile, exchange vs. OTC, market participant structure, etc.). Although the CDS market is relatively small and young in comparison to the stock market, it may lead the stock market with respect to rating events:

H4 (Relationship between CDS and stock markets): CDS spreads respond earlier to rating events than stock prices.

One argument for this hypothesis is that there might be a smaller fraction of noise traders in the CDS market because the trading motivation is more frequently and directly related to credit risk (hedging or diversification purposes, see British Bankers' Association, 2002). In addition, potential insider information from banks' credit departments might play an important role: internal rating assessments change more often than external ones due to their construction (point-in-time vs. through-the-cycle). Since banks usually rely on a combination of external and internal rating information in the case of large borrowers, banks' trading activities might move CDS prices earlier than the stock market. However, a significant counter-argument is that equity volatility represents an important input factor for CDS pricing models (see, for example, Houweling and Vorst, 2002 and Finger, 2002). This point can be one reason for a close link between both markets.

3. Description of the data set and methodology

3.1. The data set

Our data set consists of market-wide CDS spreads, corresponding stock prices and credit rating data. CDS data was gratefully provided by a large European bank, which is among the world's top 25 credit derivatives counterparties. It covers the time period from July 2, 1998 to December 2, 2002 and more than 1000 reference entities (Corporates, Financials, and Sovereigns). It includes 567,090 quotes and transaction spreads, as well as information about maturity, notional, currency and seniority of the swaps. We proceed in the following manner to construct our CDS sample: First, we exclude all quotes on sovereigns because we want to compare CDS spreads with stock prices. Second, we calculate the mid spread of bid and offer quotes if both are available. We are well aware that there is no guarantee that transaction spreads would lay in the middle of bid and offer quotes, but we think that our proceeding is, at least, a first way of making use of quote data. Third, we take the mean per day if multiple mid spreads and/or transaction spreads were observed on a given day. Fourth, since the number of CDS spread observations per firm is relatively low in 1998 and 1999, we select all firms with at least 100 daily senior CDS spread observations for a maturity of five years in each of the years 2000–2002. We focus on five-year quotes because this is the benchmark maturity in the CDS market. Fifth, as Hull et al. (2004) have done, we linearly interpolate daily mid CDS quotes to close gaps in time series, except over event days. This procedure leads to a final sample of 60,827 CDS spread observations of 90 firms from Europe (58), the United States (24) and Asia (8) (see Appendix A for the sample composition). It covers 80% (74%) of the world's top 20 (35) most actively traded corporate reference entities in terms of frequency of occurrence (see Fitch Ratings, 2003). The industry composition of the sample is 22 financials, 10 telecoms, 8 automotives, 7 utilities, 5 chemicals, 5 retailers, and 33 firms from other industries. We then merge the CDS data with time series of daily common stock closing prices obtained from Thomson Financial DataStream. Additionally, we add time series for three stock market indices (Stoxx 50, S&P 500, and Topix 100).

Finally, we collect rating announcement events of the three major rating agencies (Moody's, Standard & Poor's, and Fitch Ratings) for the sampled firms from Bloomberg. Rating announcement events consists of actual rating changes and reviews for rating changes (watchlistings). We apply certain priority rules to select a rating that reflects the issuer's creditworthiness as accurately as possible. [3] Then, we construct two aggregated rating systems. The first is created by mapping Standard & Poor's, Moody's and Fitch's credit ratings with modifiers on a numerical 17 grade scale (AAA/Aaa = 1, AA+/Aa1 = 2, ..., CCC/Caa1 and below = 17). The second, less fine,

[3] Moody's: 1. Issuer rating, 2. Senior unsecured, 3. Long term foreign currency debt, 4. Long term local currency debt. Standard & Poor's: 1. Long term foreign currency issuer credit, 2. Long term local currency issuer credit. Fitch Ratings: 1. Senior unsecured, 2. Long term foreign currency debt, 3. Long term debt, 4. Long term local currency debt.

Table 2
Frequency of ratings, rating reviews and rating change announcements
Panel A: Number of firms rated by agency

Date	SMF	SM0	S0F	0MF	S00	0M0	00F	000
January 2000	42	32	2	4	6	0	1	3
December 2002	59	27	3	1	0	0	0	0

Panel B: Number of rating events by direction and agency

Agency event	Reviews for downgrade	Actual downgrades	Reviews for upgrade	Actual upgrades
S&P	62 (50)	88	4 (1)	12
Moody's	59 (45)	63	10 (7)	14
Fitch	28 (21)	47	3 (1)	7
Total	149	198	17	33

The code "SMF" means that a fir is rated by all three agencies, "SM0" denominates firms only rated by S&P and Moody's (and not by Fitch) and "00F" gives the number of firms exclusively rated by Fitch (Panel A).
Absolute frequencies correspond to rating review and rating change announcements of 90 firms in the period January 1, 2000 to December 2, 2002. Numbers in brackets in the second and fourth column indicate how many reviews are followed by an actual rating change (Panel B).

results from a mapping of all three agencies' ratings on a six grade scale (AAA = 1, AA = 2, ..., B = 6). Table 2 presents ratings, rating reviews and rating change announcements by agency.

As can be seen from panel A, the large majority of all 90 firms is rated by Standard & Poor's or Moody's, whereas a smaller fraction is rated by Fitch. [4] At the end of the sampling period, 59 firms are rated by all three agencies and 27 additional firms by only S&P and Moody's. Panel B presents the number of reviews for rating changes and actual rating changes by agencies. Negative rating events clearly dominate with 149 of 166 reviews and 198 of 231 actual rating changes. Additionally, the fraction of downgrades relative to all rating changes is relatively high and fairly similar across agencies (S&P: 88%, Moody's: 82%, Fitch: 87%), indicating a general deterioration of credit quality over the sampling period.

Furthermore, reviews are frequently linked with rating changes because a large number of reviews for downgrade are directly followed by actual downgrades by each of the agencies. The median (25%-quantile) time in days between reviews for downgrade and actual downgrades is 69 (40) for Standard & Poor's [5], 67 (43) for Moody's and 104 (34) for Fitch. Rating transition matrices by rating agencies (not reported here) reveal that the fraction of within-class rating changes is almost the

[4] The number of firms rated by S&P is 82 (89), Moody's 78 (87) and Fitch 49 (63) at the beginning (end) of the sampling period. These numbers can be obtained by summing the absolute frequencies for which the code at the top of the column contains the letter (S, M or F) of the corresponding agency.

[5] This time interval is comparable to the study of Holthausen and Leftwich (1986). They report a mean resolution time of 61.7 trading days for S&P Credit Watch.

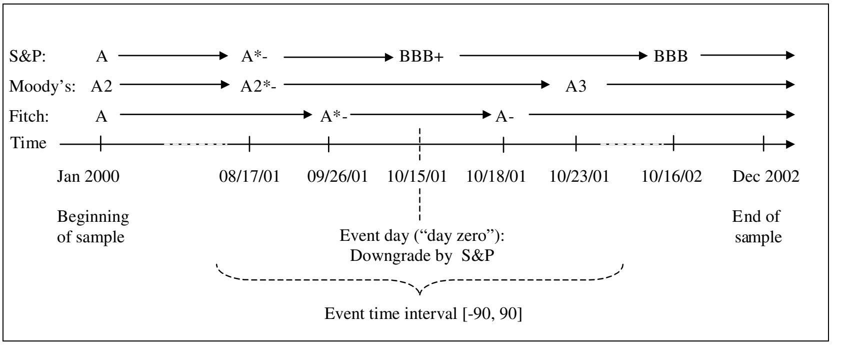

Fig. 1. Example of rating events (General Motors Corp.).
This figure shows rating announcements by three agencies for General Motors Corp. in calendar time. Rating symbols that are followed by a star indicate a day of a review for rating change. The sign that succeeds the star shows the direction of a potential rating change. For example, "A*–" as observed on August 17, 2001 for S&P represents the announcement of a review for downgrade of the current rating A. Subsequently, rating event days are called "day zero" and analyzed in an event time interval covering a period of 90 days before and 90 days after the event day.

same for all agencies (S&P: 61/100 = 61%, Moody's: 44/77 = 57%, Fitch: 32/54 = 59%). Finally, percentages of rating changes by two or more grades are relatively low (S&P: 18/100 = 18%, Moody's: 18/77 = 23%, Fitch: 9/54 = 17%).

3.2. Methodology

In this section, we explain the structure and methodology of our analysis. Fig. 1 gives an example for which we will explain how we proceed.

This figure shows the credit ratings of General Motors Corp. from S&P, Moody's and Fitch by calendar time. Dates on the time axis indicate days of rating announcement events. Concretely, we observe three reviews for downgrade (rating symbols followed by a star and negative sign such as "A*–" on August 17, 2001 for S&P) and four actual downgrades within the sampling period. We define a day on which a particular type of rating event occurs as event time day zero (for example the downgrade by S&P to BBB+ on October 15, 2001) and create event time indicator variables which cover the period of 90 days before and 90 days after the event. This procedure is repeated for the same type of rating events for all sampled firms and each rating agency respectively. However, note that event time intervals may be contaminated by other rating events. [6] In the case of General Motors Corp., the $[-90, 90]$-event time window around the S&P downgrade on October 15, 2001 also includes five other rating events that may induce a market reaction as well.

[6] Contamination may exist due to same-type events by a given agency, other event types by the same rating agency or same/other events by other agencies.

We start with the first rating event for each firm in our sampling period and only analyze subsequent event time windows that include one observation of a particular event type (one actual rating change or one review for a rating change respectively). This means that the maximum overlap between two subsequent event time windows is 90 event time days. [7] The overlap of event time windows is no problem for the following two reasons. First, as most of the previous studies for the stock market have shown, we expect a potential market reaction to be most significant closely around day zero. Therefore, the impact of overlapping event time window edges should not be problematic. Second, the number of overlapping event time windows is relatively small. [8] However, note that the omission of all overlapping episodes and incomplete time series would create a sample that includes firms with a small number of events (typically only one). This selection rule would severely affect the representativeness of our initial sample.

For all event time intervals, we calculate mean abnormal stock returns (also known as excess returns or prediction errors) and mean adjusted CDS spread changes for each agency and event type separately. Following Brown and Warner (1980, 1985) we calculate abnormal returns (AR) as index-adjusted and market-model adjusted log stock returns in the following manner:

$$\text{Stock-index adjustment}: \mathrm{AR}_{it} = R_{it} - R_{\mathrm{m}t}, \tag{1}$$

$$\text{Market-model adjustment}: \mathrm{AR}_{it} = R_{it} - \alpha_i - \beta_i R_{\mathrm{m}t} \tag{2}$$

with AR_{it}: abnormal log return for stock i on day t, R_{it}: raw log return for stock i on day t, $R_{\mathrm{m}t}$: log stock market index return. Market-model parameters α_i and β_i were estimated using daily closing stock returns and stock market index returns from 1999. In both adjustment methods, raw stock returns of European firms are adjusted using the Stoxx 50, those of US firms are adjusted using the S&P 500, and those of Asian firms using the Topix 100. In addition, we calculate cumulative abnormal stock returns (CARs) for each firm-event observation by adding daily stock ARs. Note that cumulating is only implemented for time series which start at event time day −90.

CDS spread changes before day zero are adjusted by changes of a CDS spread index of the same rating class as the company's old rating. From day zero, we adjust CDS spread changes by the CDS spread index changes of the new rating class. [9]

$$\text{CDS index adjustment:} \quad \mathrm{ASC}_{it} = \begin{cases} (\mathrm{CDS}_{it} - \mathrm{CDS}_{it-1}) - (I_{\mathrm{o}t} - I_{\mathrm{o}t-1}) & \text{if } t < 0, \\ (\mathrm{CDS}_{it} - \mathrm{CDS}_{it-1}) - (I_{\mathrm{n}t} - I_{\mathrm{n}t-1}) & \text{if } t \geqslant 0 \end{cases} \tag{3}$$

[7] We also allow for incomplete event time windows, i.e. we do not leave out events with a time series of less than 181 successive stock returns or CDS spread changes.

[8] The number of overlapping [−90, 90]-event time windows from subsequent downgrades (reviews for downgrade) of the same firm is 7 (2) for S&P, 6 (3) for Moody's and 4 (2) for Fitch.

[9] Note that our approach differs from that of Hull et al. (2004). They still adjust raw CDS spread changes after day zero by changes of the CDS index of the "old" rating category.

with ASC_{it}: abnormal CDS spread change for firm i on day t, CDS_{it}: observed CDS spread for firm i on day t, I_{ot}: CDS spread index for rating class o (=old) on day t and I_{nt}: CDS spread index for rating class n (=new) on day t. Daily CDS spread index levels correspond to the equally weighted cross-sectional mean of all CDS spreads for a certain rating class in our sample and were constructed for the rating classes AAA, AA, A, and BBB. CDS spread index changes are the daily differences between index levels in basis points. Note that this adjustment controls for the average default risk in a certain rating class and for maturity because it relies exclusively on five-year CDS-quotes. [10] Due to data restrictions we could not calculate CDS spread indices for modified credit ratings (within major rating class grades). As for the stock market, we also calculate cumulative adjusted CDS spread changes (CASCs) by adding daily ASCs from day −90 up to any subsequent event time day t.

4. Comparative event study: Analyzing stock returns and CDS spread changes

4.1. Univariate results: Market reaction by event type and agency

In this section, we report results for the stock and CDS market response to actual rating downgrades and reviews for downgrade by each of the three agencies. [11] As explained above, analyses in this section are carried out separately for each rating agency, ignoring any within agency contamination (from other event types) and across agency contamination (from same or other event types). Overall, we find mixed evidence with respect to hypotheses H1 and H2. On the one hand, the stock and CDS market already exhibit abnormal performance 60–90 days before actual downgrades and reviews for downgrade. On the other hand, both markets show a significant announcement window effect but no significant reaction afterwards. The market response to rating events by Fitch is considerably weaker than in the case of the other two agencies. Eventually, the CDS market reacts earlier than the stock market with respect to reviews for downgrade by S&P and Moody's which is partial support for H4.

[10] Alternatively, we adjusted individual CDS spread changes by changes of an average rating-specific credit spread level derived from the iBoxx-bond indices (see iBoxx Indices, 2003). Since results are similar to the CDS index adjustment, we see this procedure as a test of robustness. However, the adjustment of CDS spread changes by bond spread changes may be problematic for some reasons (for example because of a maturity mismatch, different seniority levels, a CDS-basis (see O'Kane and McAdie, 2001)). Therefore, we base the subsequent analyses on the adjustment method as given by Eq. (3).

[11] We only report results for negative rating events since market reactions to positive events exhibit basically the expected sign (positive abnormal stock returns and negative adjusted CDS spread changes before rating upgrade announcements) but are mainly insignificant. This result seems to be due to the small number of upgrade observations per rating agency. It can be regarded as anecdotal evidence in favor of hypothesis H3.

Table 3
Stock market reaction around rating events

Rating agency		[−90, −61]	[−60, −31]	[−30, −2]	[−1, 1]	[2, 30]	[31, 60]	[61, 90]
Panel A: Mean abnormal stock returns around downgrades								
	AR (%)	−0.1526	−0.2406	−0.2325	−0.4299	0.0004	−0.0859	−0.0605
	t-test *p*-val.	0.0172	0.0000	0.0016	0.0725	0.5024	0.0691	0.1144
S&P	% of ARs < 0	61.76	66.18	61.76	55.88	43.94	55.93	55.17
	Sign test *p*-val.	0.0341	0.0052	0.0341	0.1981	0.8661	0.2175	0.2559
	Sign rank *p*-val.	0.0343	0.0001	0.0040	0.0754	0.2421	0.1336	0.2345
	n	68	68	68	68	66	59	58
	AR (%)	−0.1647	−0.2954	−0.2148	−0.5317	0.0348	−0.1230	−0.0605
	t-test *p*-val.	0.0431	0.0007	0.0080	0.0244	0.6627	0.1075	0.2676
Moody's	% of ARs < 0	63.46	69.23	55.77	57.69	44.89	53.19	45.65
	Sign test *p*-val.	0.0352	0.0039	0.2442	0.1659	0.8042	0.3854	0.7693
	Sign rank *p*-val.	0.0575	0.0006	0.0265	0.0630	0.1197	0.2165	0.4585
	n	52	52	52	52	49	47	46
	AR (%)	−0.1587	−0.2217	−0.1878	−0.1213	0.0612	−0.0876	0.0875
	t-test *p*-val.	0.0049	0.0035	0.0089	0.3264	0.8945	0.1812	0.9053
Fitch	% of ARs < 0	70.73	63.41	65.85	58.54	45.95	52.94	45.45
	Sign test *p*-val.	0.0058	0.0586	0.0298	0.1744	0.7443	0.4321	0.7566
	Sign rank *p*-val.	0.0036	0.0075	0.0100	0.1576	0.1371	0.2834	0.1209
	n	41	41	41	41	37	34	33
Panel B: Mean abnormal stock returns around reviews for downgrade								
	AR (%)	−0.1088	−0.0815	−0.3030	−1.6335	−0.0245	−0.0387	0.0208
	t-test *p*-val.	0.0582	0.0804	0.0019	0.0024	0.3603	0.3373	0.6065
S&P	% of ARs <0	64.44	51.11	60.00	60.00	53.33	44.18	42.50
	Sign test *p*-val.	0.0362	0.5000	0.1163	0.1163	0.3830	0.8198	0.8659
	Sign rank *p*-val.	0.0271	0.1730	0.0157	0.0069	0.3954	0.3768	0.1394
	n	45	45	45	45	45	43	40
	AR (%)	−0.1596	−0.0930	−0.3116	−1.4319	−0.0792	−0.0037	−0.0078
	t-test *p*-val.	0.0348	0.0663	0.0003	0.0008	0.1072	0.4832	0.4612
Moody's	% of ARs <0	62.50	54.17	68.75	68.75	59.09	45.24	45.00
	Sign test *p*-val.	0.0557	0.3327	0.0066	0.0066	0.1456	0.7796	0.7852
	Sign rank *p*-val.	0.0251	0.1092	0.0009	0.0009	0.1578	0.4825	0.2638
	n	48	48	48	48	44	42	40
	AR (%)	−0.0097	−0.2421	−0.4294	−0.8258	−0.0201	−0.0093	0.0624
	t-test *p*-val.	0.4579	0.0064	0.0000	0.1573	0.4181	0.4706	0.7533
Fitch	% of ARs <0	52.00	68.00	96.00	56.00	52.00	36.36	42.86
	Sign test *p*-val.	0.5000	0.0539	0.0000	0.3450	0.5000	0.9331	0.8083
	Sign rank *p*-val.	0.3991	0.0141	0.0000	0.1374	0.4518	0.3306	0.2380
	n	25	25	25	25	25	22	21

The null hypothesis under the *t*-test is mean-AR $\geqslant 0$, under the Wilcoxon sign test is median-AR = 0 and under the Wilcoxon sign rank test is median-AR $\geqslant 0$.

Table 3 reports the abnormal stock market response to rating downgrades (panel A) and reviews for downgrade (panel B) by agencies and event time intervals. [12] We calculate time series means of the individual abnormal returns in each time interval and apply cross-sectional *t*-tests, non-parametric Wilcoxon sign tests (binomial test) and Wilcoxon sign rank tests to analyze whether ARs are significantly smaller than zero.

In panel A, mean ARs are significantly below zero in the intervals $[-90, -61]$, $[-60, -31]$ and $[-30, -2]$ at a 5%-level for all agencies and most of the tests. In addition, we observe a significant announcement window effect with abnormal returns of −0.43% for S&P and −0.53% for Moody's. The reported percentages of negative abnormal returns of roughly 60% in pre-event time are close to Hand et al., 1992), who detect 60% negative abnormal returns in the $[0, 1]$-interval for rating downgrade announcements. Moreover, the stock market does not exhibit significant abnormal returns within post-event time intervals for all three agencies in most of the cases.

Panel B reveals that the stock market reacts to reviews for downgrade by S&P and Moody's mainly in the intervals $[-90, -61]$ and $[-30, -2]$. Within the announcement window, we find abnormal stock returns for two of three agencies that are significant at the 1%-level (S&P: −1.63%, Moody's: −1.43%). Note that the magnitude of the abnormal returns is considerably higher than in the case of actual downgrades for all agencies. This finding might be a consequence of the nature of rating reviews: as opposed to actual downgrades, reviews only indicate the direction of a potential change but not its magnitude. Hence, some market participants might expect a change by one notch, while others anticipate a change by two or more notches.

A graphical representation of cumulative abnormal stock returns (CARs) around rating downgrades is given in Fig. 2.

It can be seen that mean CARs fluctuate around zero in the event time interval $[-90, -80]$, then continuously decrease, reaching approximately −20% around day zero for S&P and Moody's and −15% for Fitch. After the day of the downgrade, CARs still decrease in the case of S&P and Moody's but less strongly than before the event, whereas those for downgrades by Fitch slightly increase directly after the event. All mean CARs become significantly smaller than zero between day −70 and −60.

Similar to the stock market analysis, we test the CDS market reaction to both event types. Table 4 summarizes mean adjusted CDS spread changes (ASCs) and corresponding *p*-values of *t*-tests, Wilcoxon sign and sign rank tests.

As can been seen from panel A, for S&P (Moody's) mean ASCs are significantly larger than zero at a 5% level (10%-level) in all pre-event time intervals according to all three statistical tests. Mean ASCs for Fitch are significant within $[-90, -61]$ and $[-30, -2]$ intervals. The CDS market reaction in the $[-1, 1]$-interval is significantly larger than zero according to all tests for S&P (6.76 bps) and Moody's (3.74 bps), clearly indicating an announcement effect. Similar to the stock market response,

[12] Since index-adjustment of stock returns according to Eq. (1) and market-model adjustment according to Eq. (2) lead to very similar results, we stick to the latter method in the remainder.

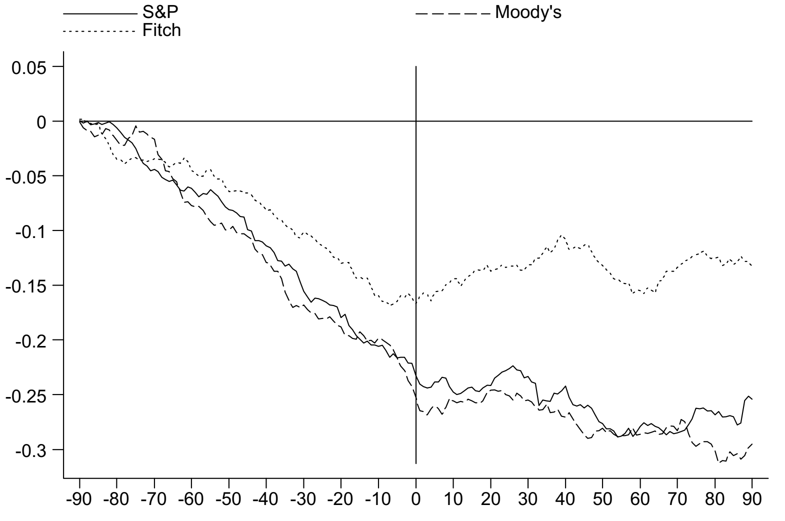

Fig. 2. Mean cumulative abnormal stock returns around downgrades.

the CDS market exhibits no significant abnormal performance within most of the post-event time intervals.

For reviews for downgrade, panel B reports ASCs in the announcement window for S&P (8.57 bps) and Moody's (4.95 bps) that are significant at the 1%-level which is support for H2. In addition, the percentage of positive ASCs reaches a maximum of roughly 75% within the interval $[-30, -2]$, indicating a pronounced reaction shortly before the event. As found for the stock market, the CDS market reaction to reviews for downgrade is economically larger than that to actual downgrades. Furthermore, there is no significant CDS reaction in most of the time intervals after the review for downgrade.

The mean cumulative CDS market response to rating downgrades is displayed in Fig. 3.

Mean cumulative abnormal CDS spread changes (CASCs) quickly become positive and reach 97 basis points for S&P (64 basis points for Moody's and 72 basis points for Fitch) one day after the rating downgrade. [13] After day zero, CASCs for downgrades by S&P and Moody's decline to roughly 50–60 basis points. CASCs for Fitch's downgrades continue to increase and reach their maximum in the interval $[60, 90]$. The mean CASCs are significantly larger than zero for all three agencies in all event time intervals before the announcement day. On day one, 77% of the CASCs in the case of S&P and Moody's downgrades are positive and 86% in the case of Fitch. In contrast, as CASCs clearly decline during the 30 days after the event and

[13] Analyzing a different CDS data set Hull et al. (2004) report a mean CASC of approximately 70 basis points for downgrades by Moody's.

Table 4
CDS market reaction around rating events

Rating agency		[−90, −61]	[−60, −31]	[−30, −2]	[−1, 1]	[2, 30]	[31, 60]	[61, 90]
Panel A: Mean adjusted CDS spread changes around downgrades								
	ASC (bps)	0.3372	0.7054	1.0096	6.7559	−0.4936	0.7119	0.1296
	t-test *p*-val.	0.0026	0.0005	0.0042	0.0418	0.8729	0.1296	0.2541
S&P	% of ASCs > 0	67.74	68.25	68.25	66.67	54.83	49.06	58.82
	Sign test *p*-val.	0.0036	0.0026	0.0026	0.0056	0.2629	0.6081	0.1312
	Sign rank *p*-val.	0.0028	0.0000	0.0005	0.0552	0.4493	0.1749	0.1324
	n	62	63	63	63	62	53	51
	ASC (bps)	0.3544	0.4355	0.6953	3.7441	0.6128	0.3713	0.6814
	t-test *p*-val.	0.0036	0.0134	0.0980	0.0046	0.1262	0.3110	0.1005
Moody's	% of ASCs > 0	65.90	63.64	60.87	71.74	52.28	67.50	51.35
	Sign test *p*-val.	0.0244	0.0481	0.0676	0.0023	0.4402	0.0192	0.5000
	Sign rank *p*-val.	0.0101	0.0115	0.0351	0.0006	0.1693	0.0831	0.1507
	n	44	44	46	46	44	40	37
	ASC (bps)	0.8278	0.0411	1.0863	0.6601	0.0437	0.3460	−0.0474
	t-test *p*-val.	0.0125	0.4437	0.0136	0.2837	0.4052	0.0864	0.5528
Fitch	% of ASCs > 0	67.50	55.00	75.61	56.09	54.05	57.57	50.00
	Sign test *p*-val.	0.0192	0.3179	0.0007	0.2664	0.3714	0.2434	0.5700
	Sign rank *p*-val.	0.0009	0.1665	0.0012	0.1009	0.3227	0.1282	0.4405
	n	40	40	41	41	37	33	32
Panel B: Mean adjusted CDS spread changes around reviews for downgrade								
	ASC (bps)	0.1532	0.3259	0.5577	8.5681	−0.6213	0.1524	0.4940
	t-test *p*-val.	0.1510	0.1047	0.0015	0.0653	0.8426	0.3843	0.0368
S&P	% of ASCs > 0	48.84	57.14	76.19	69.05	40.47	52.50	54.29
	Sign test *p*-val.	0.6196	0.2204	0.0005	0.0098	0.9179	0.4373	0.3679
	Sign rank *p*-val.	0.1412	0.2172	0.0001	0.0002	0.0568	0.3534	0.0702
	n	42	42	42	42	42	40	35
	ASC (bps)	0.4820	0.3863	0.6420	4.9549	0.5812	−0.9726	−0.0694
	t-test *p*-val.	0.0155	0.0084	0.0007	0.0089	0.1220	0.9396	0.6218
Moody's	% of ASCs > 0	55.00	67.50	74.42	74.42	56.41	43.24	57.57
	Sign test *p*-val.	0.3179	0.0192	0.0010	0.0010	0.2612	0.8380	0.2434
	Sign rank *p*-val.	0.1057	0.0047	0.0005	0.0001	0.2774	0.0909	0.4467
	n	40	40	43	43	39	37	33
	ASC (bps)	0.2508	0.5749	0.6847	2.0976	−0.3757	0.4769	−0.0788
	t-test *p*-val.	0.0676	0.0063	0.1055	0.1737	0.7167	0.2550	0.6254
Fitch	% of ASCs > 0	59.09	70.83	79.17	62.50	52.17	50.00	55.56
	Sign test *p*-val.	0.2617	0.0320	0.0033	0.1537	0.5000	0.5881	0.4073
	Sign rank *p*-val.	0.0655	0.0185	0.0013	0.0725	0.4757	0.3544	0.4813
	n	22	24	24	24	23	20	18

The null hypothesis under the *t*-test is mean-ASC $\leqslant 0$, under the Wilcoxon sign test is median-ASC $= 0$ and under the Wilcoxon sign rank test is median-ASC $\leqslant 0$.

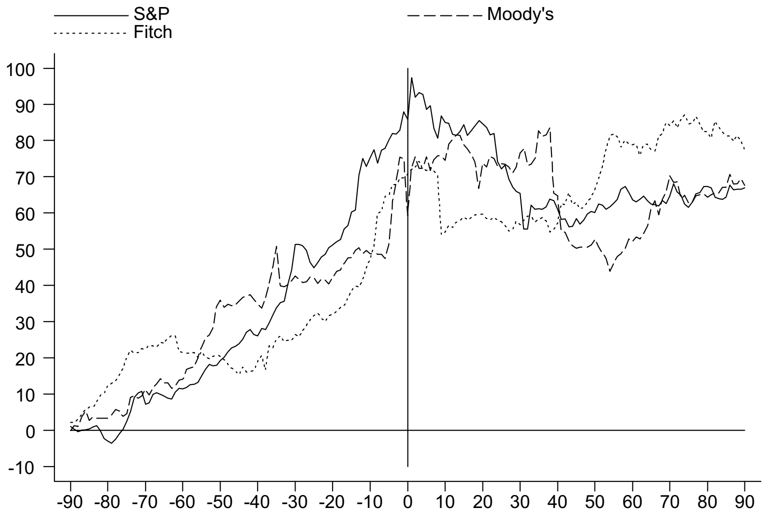

Fig. 3. Mean cumulative adjusted CDS spread changes around downgrades (in bps).

remain at roughly 50–60 basis points afterwards, there might have been an overreaction in the CDS market. [14] Note that spikes in Fig. 3 might result from a varying number of observations, rating actions by other agencies or other credit risk relevant news releases. [15] Overall, the observed CDS market response to downgrades is partially consistent with hypothesis H1 because, although abnormal performance is found within the announcement window, significantly positive ASCs already occur before day zero.

Differentiating both market reactions by the geographic origin of the firm (US vs. non-US), we find a smaller stock market reaction around downgrades of US firms than for European firms for all three agencies (Europe: CARs on day zero about −20% to −25% with slightly decreasing CARs afterwards, US: CARs on day zero between −10% and −15% with stable or increasing CARs afterwards). Analyzing the stock market response to reviews for downgrade across regions, we observe a slightly weaker reaction for the US than for Europe. However, a Wilcoxon rank sum test (Mann–Whitney *U*-Test) reveals that these regional differences in CARs are not significant at the 10%-level. In the CDS market, the response is quite similar across regions for S&P (CASCs around 90 basis points on day one). For Moody's and Fitch, we detect a strong increase around day zero for European reference enti-

[14] See Steiner and Heinke (2001). They detect an overreaction around rating downgrade announcements in the international bond market.

[15] For robustness purposes, we also carried out the same analysis for a subsample of our data with complete event window time series of 181 days and no overlaps. The shape of the cumulative market response is much smoother but very similar to the one obtained on the basis of all data. However, the magnitude of the market reaction is lower than in the entire sample.

Table 5
Mean cumulative response by rating level and magnitude of rating change

	Old rating			New rating			Magnitude of downgrades		
	⩽Median old rating	>Median old rating	*p*-value	⩽Median new rating	>Median new rating	*p*-value	One notch	Two or more notches	*p*-value
Panel A: Mean stock CARs (in %)									
S&P	−11.37	−33.39	0.0115	−11.28	−31.84	0.0116	−15.58	−37.62	0.0367
Moody's	−14.10	−34.94	0.0657	−14.02	−32.98	0.0853	−13.73	−40.02	0.0042
Fitch	−11.41	−24.43	0.0160	−15.39	−20.99	0.1718	−13.07	−35.47	0.0068
Panel B: Mean CDS CASCs (in bps)									
S&P	28.43	178.92	0.0006	27.02	173.43	0.0003	73.72	153.74	0.0784
Moody's	10.97	123.53	0.0131	11.25	109.09	0.0286	45.05	71.28	0.0391
Fitch	31.25	107.91	0.0334	36.22	127.64	0.0286	69.80	74.34	0.4192

Numbers correspond to mean stock CARs and mean CDS CASCs in the interval $[-1,1]$. "Old rating ⩽ median old rating" indicates that the rating before a downgrade is better or equal to the median rating before a downgrade. On the basis of a two-sample Wilcoxon rank-sum test (Mann–Whitney *U*-test) we test the null hypothesis that CARs/CASCs are smaller if old/new ratings are equal or better than the median rating and smaller for one notch changes than for multiple notch changes.

ties (CASCs around 60–80 basis points). For US firms we find a weaker anticipation and somehow erratic spread changes after day zero. [16]

Furthermore, we investigate whether CARs and CASCs depend on the level of the old and new rating and the magnitude of downgrades. One would expect lower (higher) stock CARs and CDS CASCs for relatively good (bad) old ratings. The reason for this is that the distance between the average implied probabilities of default of two adjacent rating categories increases as credit quality deteriorates. To examine this issue, we split downgrades by each agency according to the median old and median new rating level. [17] Moreover, we distinguish between downgrades by one notch and two or more notches. Results are presented in Table 5.

Consistent with our expectation, we find that mean CARs for relatively bad old ratings are more pronounced than those for relatively good old ratings for all agencies (see panel A). If we distinguish by the new rating (the rating class to which a firm belongs after the downgrade), the difference is only significant for S&P and Moody's. Additionally, consistent with Holthausen and Leftwich (1986), stock CARs clearly depend on the magnitude of the downgrade because CARs for downgrades by two or more rating classes are economically and statistically smaller than those for downgrades by only one rating class in the case of all three agencies. As shown

[16] This might also result from the fact that our sample includes a lower number of US firms than European firms.

[17] Due to a too small number of observations in some rating classes, we have to restrict our level dependence analysis to a median split. We cannot distinguish between downgrades within investment grade and downgrades to non-investment grade since the latter group in our sample is too small.

in panel B, we also find a significant level effect for CDS spread changes for all three agencies. CDS CASCs are only significantly larger for changes by two or more notches in the case of S&P and Moody's. [18] A repetition of the same analysis for a sample without events with extreme abnormal performance basically confirms our previous results. [19]

Finally, we compare both market reactions in the following two ways. First, we calculate Spearman's rank correlation coefficient between stock CARs and CDS CASCs for various event time intervals to analyze how strong both markets are linked. Rank correlation between stock CARs and CDS CASCs is significantly negative for both event types in most of the time intervals. [20] It becomes stronger if one moves from day −90 towards day zero and gets slightly weaker after day zero. For example, for downgrades by S&P and Moody's Spearman's rank correlation on day one is $\rho_{SP} = -0.74$. Moreover, correlation is generally not as strong in the case of reviews for downgrade, but still remains significantly negative. Interestingly, the expected inverse relationship between CARs and CASCs is relatively strong with regard to S&P and Moody's, but clearly less pronounced for Fitch.

Second, as the levels of stock CARs and CDS CASCs are not directly comparable, we transform these measures in run up-time series. In our study, run up is defined as the mean CAR (CASC) for stocks (CDS) on event time day t divided by the mean CAR (CASC) on day zero. [21] This procedure leads to the results displayed in Fig. 4.

Each of the three graphs (Fig. 4a–c) shows the run up in % for both markets and both event types by agencies. First, comparing run up within a market and between event types, it can be seen that the abnormal performance of the stock market starts earlier and is more steady before downgrades than before reviews for downgrade. For the latter, roughly two-third of the run up occur within 30 days before the event. The CDS market, for example, anticipates 71% (58%) of day zero CASCs before downgrades by S&P (Moody's) until day −10 and even more before reviews for downgrade. Second, comparing run up within event types and between markets, we observe on the one hand that the stock market anticipates downgrades more steadily than the CDS market. On the other hand, and important to note, anticipation of reviews for downgrade starts earlier in the CDS than in the stock market for all agencies. Since reviews for downgrade often precede actual downgrades, empirical findings suggest that the CDS market reacts earlier than the stock market, which is in line with hypothesis H4.

[18] The level dependence analysis of both markets around reviews for downgrade yields similar results.

[19] In this test of robustness, we drop some event time series from France Telecom SA, Ericsson AB, British Airways PLC, Household Finance Corp., Vivendi Universal SA and KPN NV.

[20] Examining rank correlation between stock ARs and ASCs results in coefficients that are closer to zero but still statistically different from zero. The inverse relationship is strongest and most significant around day zero.

[21] Run up is also calculated for median stock CARs (CDS CASCs) on event time day t and on day zero. Results are similar to those reported on a mean-basis.

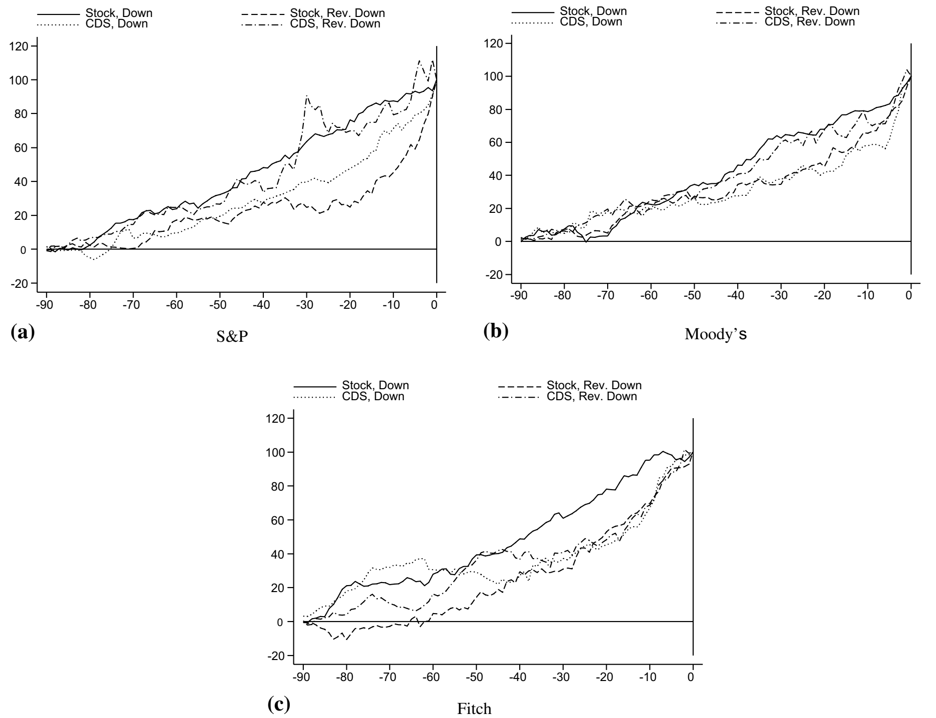

Fig. 4. Run up in % for S&P, Moody's and Fitch.
Run up is defined as the mean CAR (CASC) for stocks (CDS) on event time day t divided by the mean CAR (CASC) on day zero.

4.2. Multivariate results: Market reaction to different rating events within and across agencies

In this section, we go three steps beyond previous analyses: Firstly, we simultaneously analyze different rating event types for firms rated by a given agency. Secondly, we examine the combined impact of different rating event types by different agencies on stock and CDS markets. This is necessary because the potential informational overlap within and across agencies may influence the timing and the magnitude of a market reaction. Thirdly, we investigate which factors influence the magnitude of abnormal performance during the announcement window.

Subsequently, we analyze the impact of reviews for downgrade and actual downgrades on both markets for a given agency. For this purpose, we analyze the relationship between daily raw stock returns R_{it} (raw CDS spread changes, ΔCDS_{it}) and the corresponding stock market index returns R_{mt} (CDS spread index change, ΔI_{rt}) and event time dummy variables D_{it} and RD_{it} in six separate pooled regressions. The event time dummy variables are defined as follows: D27 takes the value one on trading days 2–7 after an actual downgrade, RD_27 marks the trading days 7–2 before a review for downgrade and RD101 indicates the $[-1,1]$-interval around reviews for downgrade. This regression specification allows the interpretation of the estimated dummy variable coefficients as abnormal stock returns (CDS spread changes) that are due to the presence of rating events. Moreover, we add control variables for industry (TEL: Telecommunication vs. non-telecommunication) and region (US vs. non-US). In all subsequent regression models we rely on the Huber/White-sandwich estimator of variance and allow for residuals that are not independent within firms. Note that we use short event time intervals for the dummy variables to reduce problems due to an overlap between reviews and actual downgrades within a given agency. Additionally, the use of short event time intervals permits us to analyze the entire data set, since we no longer have to drop overlapping event time windows from the same firm. Table 6 summarizes regression results for both markets by agency.

Panel A for the stock market shows that the impact of reviews for downgrade is much higher than that of actual downgrades in the case of all agencies. It turns out that coefficients of the dummy variables RD101 (except for Fitch) and RD_27, which indicate time intervals around and before the review for downgrade (and not the actual downgrade), are highly significant. The coefficient of RD101 for S&P (Moody's) is -1.44% (-1.18%), while that for Fitch is not significant. This finding is consistent with Followill and Martell (1997) who analyze the stock market response to rating events by Moody's. Moreover, these results explain what is behind findings from Section 4.1: Stock markets react before and on days of reviews for downgrade. Since the latter are frequently announced some time before actual downgrades, we have found one source of the abnormal market performance within the $[-90,0]$-interval before actual downgrades.

Panel B reports results for a corresponding analysis of the CDS market. As found for the stock market, the coefficients RD101 and RD_27 are economically and statistically significant. The coefficient of RD101 is 9 basis points for S&P and roughly 5 basis points for Moody's and Fitch. Additionally, we also observe abnormal CDS spread changes around actual downgrades indicated by a significant dummy D101 for S&P and Moody's. This finding differs from the stock market regression. Note that the abnormal reaction of the CDS market during the $[-1,1]$-interval around reviews is economically larger than around actual downgrades. This observation is in line with results from Section 4.1 and Hull et al. (2004) for rating announcements by Moody's.

Overall, the regression results for the stock market do not support hypothesis H1, but provide partial evidence in favor of hypothesis H2 because we find abnormal performance around reviews for downgrade and no reaction around actual downgrades for all three rating agencies. The results for the CDS market partially support H1 and H2 because we observe abnormal CDS spread changes around both event types at least for S&P and Moody's. For both markets, we find support for the view that stock prices and CDS spreads already react before reviews for downgrade.

We now turn to the following question: Can we detect abnormal market performance around different rating events within and across agencies in a simultaneous

Table 6
Regression results of within agency analysis
Panel A: Stock market regressions by agency

Dep. Var. R_{it}	Standard & Poor's			Moody's			Fitch		
	Coeff.	Robust st. error	*p*-value	Coeff.	Robust st. error	*p*-value	Coeff.	Robust st. error	*p*-value
R_{mt}	0.8904	0.0592	0.000	0.8863	0.0604	0.000	0.8459	0.0716	0.000
D27	0.0014	0.0016	0.379	−0.0004	0.0013	0.733	−0.0001	0.0016	0.995
D101	−0.0044	0.0029	0.136	−0.0044	0.0038	0.246	0.0009	0.0024	0.684
D_27	−0.0004	0.0018	0.836	−0.0029	0.0023	0.204	0.0017	0.0010	0.112
RD27	−0.0007	0.0014	0.647	−0.0003	0.0013	0.829	−0.0001	0.0019	0.958
RD101	−0.0144	0.0060	0.020	−0.0118	0.0040	0.004	−0.0108	0.0067	0.116
RD_27	−0.0071	0.0026	0.009	−0.0053	0.0022	0.021	−0.0066	0.0021	0.003
TEL	−0.0012	0.0002	0.000	−0.0011	0.0002	0.000	−0.0010	0.0003	0.002
US	0.0003	0.0001	0.051	0.0002	0.0001	0.132	0.0002	0.0002	0.300
Const.	0.0001	0.0001	0.406	0.0001	0.0001	0.254	0.0001	0.0001	0.553
n		42448			42280			27739	
R^2		0.2534			0.2510			0.2485	

Panel B: CDS market regressions by agency

Dep. Var. ΔCDS_{it}	Standard & Poor's			Moody's			Fitch		
	Coeff.	Robust st. error	*p*-value	Coeff.	Robust st. error	*p*-value	Coeff.	Robust st. error	*p*-value
ΔI_{rt}	0.8337	0.1443	0.000	0.9541	0.1808	0.000	0.7624	0.1639	0.000
D27	−0.3915	1.5112	0.796	0.4596	1.2693	0.719	−0.0658	0.6549	0.920
D101	6.0060	3.0106	0.051	3.3970	1.2131	0.007	−0.0246	0.9049	0.978
D_27	1.2661	0.6551	0.058	2.0595	1.4086	0.149	0.6652	0.8292	0.427
RD27	1.6601	2.6023	0.526	1.2849	0.6788	0.063	1.0434	0.8795	0.242
RD101	9.0784	4.7516	0.061	5.2531	2.4652	0.037	4.7206	2.1741	0.036
RD_27	1.9275	0.7195	0.010	1.7940	1.0143	0.082	1.8653	0.9428	0.054
TEL	0.1137	0.1750	0.518	0.0414	0.1560	0.792	−0.0259	0.0860	0.764
US	−0.0097	0.0793	0.903	0.0238	0.0604	0.695	0.0196	0.0723	0.788
Const.	0.02774	0.0233	0.239	0.0301	0.0255	0.243	0.0803	0.0467	0.093
n		38418			37890			25592	
R^2		0.0447			0.0851			0.0548	

Dependent variables are the daily raw stock return R_{it} and the daily raw CDS spread change ΔCDS_{it} respectively. Independent variables are stock market returns R_{mt} and rating-specific CDS spread index changes ΔI_{rt} as well as dummies that take the value one within time intervals around events (e.g. D101 indicates the $[-1, 1]$-interval around a downgrade, D_27 indicates the $[-7, -2]$-interval before a downgrade and RD101 the $[-1, 1]$-interval around a review for downgrade). Additionally, dummy variables TEL (firm belongs to the telecommunication sector) and US (firm from the United States of America) are added to control for industry and region specific effects. Regressions are based on the Huber/White-sandwich estimator of variance and allow for residuals that are not independent within firms.

analysis? To analyze this issue, we estimate two separate regression models. The first one examines the stock market response and includes the daily raw stock return as the dependent variable and a corresponding stock market return as the independent variable. Moreover, we include event dummy variables that indicate $[-1,1]$-time windows around reviews for downgrade (RS, RM, RF) and actual downgrades (DS, DM, and DF) by the three agencies and control variables for industry (TEL: Telecommunication vs. non-telecommunication) and region (US vs. non-US). In the second model, we regress daily raw CDS spread changes on CDS index spread changes and event dummy variables as defined above. Table 7 presents the regression results.

It turns out that the announcement of reviews for downgrade by S&P and Moody's has an economically and statistically significant impact on the stock market. Stock returns on days around reviews for downgrade of these agencies are roughly 1% lower than on other days, which represents support for H2. Note that reviews by Fitch are not associated with significant abnormal stock returns. Moreover, stocks do not display a significant abnormal performance on days around actual downgrades since all corresponding dummy coefficients (DS, DM, and FM) are not significantly different from zero.

Results for the CDS market are consistent with those for the stock market. Days around reviews for downgrade by S&P and Moody's exhibit significant abnormal

Table 7
Regressions results of within and across agency analysis

	Stock market regression (Dep. Var. R_{it})			CDS market regression (Dep. Var. Δ CDS$_{it}$)		
	Coeff.	Robust st. error	*p*-value	Coeff.	Robust st. error	*p*-value
R_{mt}	0.8641	0.0571	0.000			
ΔI_{rt}				0.8358	0.1440	0.000
RS	−0.0121	0.0062	0.058	7.2751	4.3015	0.096
DS	−0.0037	0.0034	0.285	3.9134	2.5511	0.130
RM	−0.0099	0.0048	0.046	7.2272	3.4860	0.043
DM	−0.0035	0.0024	0.152	6.2861	2.5721	0.018
RF	−0.0015	0.0091	0.868	−0.9270	3.8645	0.811
DF	0.0014	0.0021	0.504	−1.1441	0.8315	0.174
TEL	−0.0011	0.0002	0.000	0.0684	0.1710	0.691
US	0.0003	0.0001	0.063	0.0258	0.0703	0.715
Const.	0.0001	0.0001	0.506	0.0243	0.0233	0.300
n		45432			38418	
R^2		0.2478			0.0471	

Dependent variables are the daily stock raw return R_{it} and the daily CDS raw spread change ΔCDS_{it} respectively. Independent variables are stock market returns R_{mt} and CDS spread index changes ΔI_{rt} respectively, as well as dummies that take the value one in the time interval $[-1,1]$ around the following events: RS (review for downgrade by S&P), DS (downgrade by S&P), RM (review for downgrade by Moody's), DM (downgrade by Moody's), RF (review for downgrade by Fitch), DF (downgrade by Fitch). Additionally, dummy variables TEL (firm belongs to the telecommunication sector) and US (firm from the United States of America) are added to control for industry and region specific effects. Regressions are based on the Huber/White-sandwich estimator of variance and allow for residuals that are not independent within firms.

CDS spread changes of approximately seven basis points. In addition, actual downgrades by Moody's are associated with significant abnormal CDS spread changes of six basis points, whereas those of S&P and Fitch remain insignificant. Interestingly, the magnitude of the coefficients for RS and RM is very close to each other in both markets, indicating consistently a similar impact of S&P and Moody's. Furthermore, regressions clearly show that neither stock prices nor CDS spreads respond to Fitch's rating announcements if we control for S&P and Moody's rating actions. This finding sheds doubt on the informational content of Fitch's ratings. Eventually, we do not detect any serious industry or regional influence since the control variables TEL and US are only statistically significant for the stock market (with coefficients near zero), but not for the CDS market.

For robustness purposes, we carry out previous regressions on a subsample that does not include observations from firms with extreme CDS spread changes. [22] We investigate the reasons for these extreme spread changes (data errors, other events, etc.) but one should keep in mind that these observations do not necessarily represent typical outliers, since the firms are actively traded underlyings in the CDS market (see Fitch Ratings, 2003). For the stock market, the coefficient of reviews for downgrade by Moody's (RM) is significant at the 10%-level and amounts to −0.54% whereas the coefficient for reviews for downgrade by Fitch (RF) becomes significant at the 5%-level and amounts to −1.48%. For the CDS market, estimated coefficients of reviews for downgrade by S&P (RS) and Moody's (RM) decline to roughly two basis points and remain significant at the 10%- and 5%-level respectively. The significant impact of Moody's downgrades (DM) disappears. Overall, results suggest that previous findings are relatively robust to the omission of extreme observations. In particular, reviews for downgrade by Moody's have a statistically and economically significant impact on both markets.

Finally, we try to explain which factors influence the degree of abnormal performance in both markets. For this purpose, we estimate cross-sectional multivariate regressions on the mean abnormal reaction (ARs, ASCs) during the $[-1, 1]$-interval for both event types and both markets. We constrain this analysis to abnormal performance because cumulative abnormal performance is more sensitive to contamination and might result from various sources. Building on univariate results from Section 4.1 and prior evidence from Hand et al., 1992 and Steiner and Heinke (2001), we include the following explanatory variables in the regression:

- The same set of dummy variables as before (RS, DS, RM, DM, RF, DF, TEL, US).
- A dummy variable LEV that indicates the rating level on the day before the rating event (1 if worse than median rating, 0 otherwise).

[22] We drop all observations from France Telecom SA, Ericsson AB, British Airways PLC, Household Finance Corp., Vivendi Universal SA, and KPN NV. These firms show a small number of daily adjusted CDS spread changes that exceed +50 basis points or fall below −50 basis points on days without rating events.

- A dummy variable MORE that catches the magnitude of the rating change (0 for one-notch changes, 1 for changes by two or more notches).
- A dummy variable PREV that reflects the time between any previous rating event and the event of interest (1 if no other rating events were observed during the previous 12 months, 0 otherwise). If there were no other rating events before, we would expect markets to react stronger. [23]
- The dummy variable PRES1 (PRES2) is set to 1 if a firm's rating from a particular agency is better than the average of all available ratings on the day before a downgrade (review for downgrade) by that agency and 0 otherwise. [24] If an agency exhibits a better rating than the average before a downgrade, markets may not react as strong as if they would if a agency moves away from the average.

We expect significantly negative coefficients for the variables LEV, MORE, PREV and significantly positive ones for PRES1 and PRES2 for the stock market and conversely-signed coefficients for the CDS market. Results are reported in Table 8.

For the stock market, we find that reviews for downgrade by S&P and Moody's have an impact on abnormal performance that is significant at the 5%-level. Moreover, abnormal stock returns significantly depend on the level of the old rating (LEV) and are more pronounced if no other rating event by any agency was observed during the 12 preceding months (PREV). For the CDS market, we find mainly comparable results: The coefficient of LEV is economically and statistically significant and exhibits the expected sign, whereas MORE is not significant in both markets. [25] In contrast to the stock market only rating events by Moody's (and not S&P) have a significant impact on the magnitude of ASCs. Moreover, the coefficient of PREV is also significant but it does not display the expected positive sign. [26] Interestingly, variables PRES1 and PRES2 exhibit highly significant coefficients with the expected sign, which was not found for the stock market. This result suggests that CDS spreads react less strong to events that move individual agency ratings closer to the average rating. Consistent with earlier findings, rating event dummies for Fitch have no significant impact on abnormal performance in both markets. For subsets of our data (without cases that exhibit extreme values, for firms that are rated by S&P and Moody's but not by Fitch), we find similar results. Essentially, LEV and PREV remain significant for the stock market and LEV, PRES1 and PRES2 for the CDS market.

[23] In a preliminary analysis, we included the time lapse (in days) since the last previous rating event of a given firm and obtained similar findings. We decided to retain the dummy variable since the magnitude of its coefficient can directly be interpreted as a contribution to abnormal performance.

[24] The null hypothesis that the number of ratings by a given agency below and above the average rating by all agencies is equal can be rejected at the 1%-level (Wilcoxon rank sum test) for each of the agencies on the day before a downgrade and review for downgrade. Overall, on days before rating events the rating of a given agency is either better than the average rating or equal to the average but only in a few cases worse than the average.

[25] Instead of the dummy variable MORE, we alternatively included a dummy set that indicates the explicit number of notches changed $(1, 2, \ldots, 4)$. However, since most of the downgrades are one-notch changes, we do not detect any significant influence.

[26] Note that this result disappears if one removes cases with extreme abnormal performance.

Table 8
Cross-Sectional analysis of abnormal performance

	Stock market regression (Dep. Var. AR_{it})			CDS market regression (Dep. Var. ASC_{it})		
	Coeff.	Robust st. error	p-value	Coeff.	Robust st. error	p-value
RS	−0.0118	0.0045	0.010	9.2604	6.1981	0.136
DS	−0.0039	0.0044	0.370	8.4733	6.5390	0.196
RM	−0.0086	0.0042	0.047	13.4987	6.2846	0.033
DM	−0.0029	0.0041	0.474	10.9317	6.3953	0.089
RF	0.0024	0.0068	0.723	4.2181	5.7569	0.464
DF	0.0020	0.0040	0.604	4.3185	5.0348	0.392
LEV	−0.0077	0.0033	0.021	9.0215	2.3617	0.000
PREV	−0.0084	0.0042	0.046	−5.8583	2.9658	0.049
MORE	−0.0066	0.0055	0.233	1.6984	3.3495	0.613
PRES1	0.0002	0.0030	0.958	−6.7721	2.1651	0.002
PRES2	−0.0032	0.0057	0.573	−10.7189	3.6591	0.004
TEL	−0.0013	0.0038	0.721	−1.4913	3.1424	0.636
US	0.0007	0.0029	0.817	3.3851	2.6940	0.210
Const.	0.0048	0.0040	0.226	−6.1539	5.0717	0.226
n		281			256	
R^2		0.1261			0.2011	

Dependent variables are the mean abnormal stock return AR_{it} (mean adjusted CDS spread change ASC_{it}) in the $[-1, 1]$-event time interval. Independent variables are dummies that mark agencies and event types. Additionally, LEV indicates rating events for "old" ratings that are worse than the median rating, PREV is one if no other rating event by any agency was observed during the previous 12 months and MORE takes the value one for downgrades by more than one notch. PRES1 (PRES2) is set to one if the rating of a particular agency is better than the average of all available ratings on the day before the downgrade (review for downgrade) by that agency. Moreover, dummy variables TEL (firm belongs to the telecommunication sector) and US (firm from the United States of America) are added to control for industry and region specific effects. Regressions are based on the Huber/White-sandwich estimator of variance that provides heteroscedasticity-consistent standard errors.

5. Summary and conclusion

In this analysis, we examine the stock and CDS market response to credit rating announcements during the period 2000–2002. Since in both markets credit risk-sensitive claims are traded, we question whether rating announcements by Standard & Poor's, Moody's and Fitch carry new information to the markets or not.

First, we find that both markets anticipate rating downgrades by all three agencies. Anticipation starts approximately 90–60 days before the announcement day. This result is consistent with Hull et al. (2004), who show that CDS spread changes have predictive power for downgrades by Moody's and with Hite and Warga (1997), who find anticipation of S&P's and Moody's downgrades in the corporate bond market. Second, as previous studies for the stock market have shown, we observe a significant abnormal performance in the expected direction around negative rating events but insignificant market reactions around positive events. Third, cumulative abnormal stock returns decline quite evenly before downgrades, whereas in the case of reviews for downgrade most of the reaction appears within 30–10 days before the event. In the latter case, the CDS market tends to react earlier than the stock market. Fourthly, in a simultaneous analysis of different rating events within and across agencies, we find that reviews for downgrade by Standard & Poor's and Moody's are associated with significant abnormal performance in both markets, whereas actual downgrades are not. Neither reviews for downgrade nor actual downgrades by Fitch exhibit a significant impact on the stock and CDS markets. Fifthly, a cross-sectional analysis reveals that the level of the old rating as well as previous rating events significantly influence the magnitude of abnormal performance in both markets, whereas the difference between the old rating and the average rating by all agencies only has a significant impact on the CDS market.

The strong abnormal pre-announcement performance of both markets may also relate to the sample composition: Our objective is to examine credit ratings of firms that are liquid reference entities in the credit derivatives market but we do not analyze representative samples of each agency's rating universe. In our opinion, it seems plausible that markets for credit risk transfer anticipate announcements by rating agencies because reference entities are subject to permanent market monitoring.

We believe that further research should develop a more specific methodology to capture the differences in the time interval between two different rating events and its influence on market prices. In addition, reasons for rating reviews and rating changes (for example, whether they are earnings- or capital structure-related) should be taken into account as well as, if publicly available, the timing of the original firm news that induced the rating change. Finally, although our empirical findings suggest that the stock and CDS market indicate a decline in credit quality in advance to rating agencies, one should take into account the fact that credit ratings exhibit a considerably lower volatility than market prices. Therefore, credit ratings still can be useful yardsticks for longer-term investors. The relationship between rating volatility and prediction accuracy should be addressed in further research.

Acknowledgments

We wish to thank Richard Cantor, Evan Gatev, Gunter Löffler and Steven Ongena, and participants of the Financial Intermediation Research Society's Conference on Banking, Insurance and Intermediation in Capri, Italy, as well as participants of the 7th Conference of the Swiss Society for Financial Market Research in Zürich, Switzerland. In addition, we are grateful to two members of the credit derivatives department from the bank who provided the CDS data. Financial support of the German National Science Foundation is gratefully acknowledged.

Appendix A. Composition of the CDS data set by firm

No.	Company name	No. of CDS spreads per year					Total observation
		1998	1999	2000	2001	2002	
1	Commerzbank AG	20	50	130	231	185	616
2	BMW – Bayerische Motoren Werke AG	1	52	190	233	181	657
3	Dresdner Bank AG	37	81	162	230	181	691
4	Volkswagen AG	2	10	179	236	183	610
5	Deutsche Bank AG	38	55	143	233	184	653
6	Siemens AG	0	2	120	235	180	537
7	Bayer AG	0	11	100	228	181	520
8	Iberdrola SA	0	13	176	222	181	592
9	Societe Generale SA	39	50	134	228	181	632
10	Renault SA	0	22	149	144	169	484
11	Tokyo Electric Power	10	30	130	139	102	411
12	Toyota Motor Corp.	0	30	138	141	102	411
13	Sony Corp.	0	42	133	168	128	471
14	Korea Development Bank	7	83	171	120	108	489
15	Koninklijke Philips Electronics NV	1	26	168	208	171	574
16	Unilever NV	0	8	141	217	178	544
17	Volvo AB	0	32	194	236	183	645
18	Merrill Lynch & Co. Inc.	9	72	193	194	133	601
19	Citigroup Inc.	7	12	165	188	138	510
20	Philip Morris Companies Inc.	0	53	171	121	135	480
21	Morgan Stanley Dean Witter & Co.	1	31	184	192	112	520
22	Goldman Sachs Group Inc.	11	81	198	197	128	615
23	BASF AG	0	1	121	215	170	507
24	BBVA Banco Bilbao Vizcaya Argentaria SA	31	46	138	235	181	631
25	Telefonica SA	1	45	202	207	183	638
26	Credit Lyonnais SA	12	35	133	190	180	550
27	Aventis SA	0	30	166	223	180	599
28	France Telecom SA	1	36	221	237	181	676
29	BNP Paribas SA	25	58	100	230	183	596
30	BT Group – British Telecom	0	16	212	238	182	648

(*continued on next page*)

Appendix A (*continued*)

No.	Company name	No. of CDS spreads per year					Total observation
		1998	1999	2000	2001	2002	
31	National Grid Group PLC	3	73	179	213	163	631
32	Sainsbury Ltd.	0	17	189	220	178	604
33	ICI – Imperial Chemical Industries PLC	0	33	132	213	182	560
34	Sanwa Bank Ltd.	30	129	175	179	131	644
35	Hitachi Ltd.	2	19	138	108	128	395
36	Investor AB	0	6	129	190	140	465
37	Ericsson AB	0	52	173	208	173	606
38	Bank of America Corp.	7	29	177	193	132	538
39	Ford Motor Credit Company	0	0	168	184	136	488
40	EON AG	0	1	132	204	174	511
41	San Paolo Imi SPA	7	23	113	220	180	543
42	Wells Fargo & Co.	0	7	139	179	127	452
43	Walt Disney Co.	2	14	161	175	133	485
44	Lehman Brothers Holdings Inc.	1	33	186	197	140	557
45	Bear Stearns Inc.	7	44	184	184	133	552
46	General Motors Acceptance Corp.	23	49	194	198	133	597
47	Diageo PLC	1	23	122	162	172	480
48	Pearson PLC	1	55	133	150	164	503
49	British Airways PLC	2	90	134	168	178	572
50	Land Securities PLC	0	19	186	194	134	533
51	Tesco PLC	0	14	186	220	178	598
52	BAE Systems PLC	0	25	185	232	180	622
53	Allied Domecq PLC	0	7	185	210	162	564
54	Marks & Spencer PLC	0	21	179	226	179	605
55	Dixons Group PLC	0	27	161	218	174	580
56	Endesa SA	0	20	165	195	182	562
57	Deutsche Telekom AG	0	36	217	215	183	651
58	Household Finance Corp.	1	21	167	181	109	479
59	Bank of Tokyo Mitsubishi Ltd.	40	127	175	184	131	657
60	Metro AG	1	3	103	108	172	387
61	Boeing Co.	15	24	163	152	126	480

Appendix A (*continued*)

No.	Company name	No. of CDS spreads per year					Total observation
		1998	1999	2000	2001	2002	
62	AT&T Corp.	0	30	175	128	124	457
63	IBM – International Business Machines Corp.	15	28	115	194	133	485
64	Carrefour SA	0	17	188	224	180	609
65	Vivendi Universal SA	0	12	159	137	169	477
66	Akzo Nobel NV	2	31	174	229	178	614
67	Nippon Steel Corp.	2	8	132	139	102	383
68	ABN Amro Holding NV	44	41	147	227	184	643
69	Repsol YPF SA	0	27	187	196	155	565
70	Reuters Group PLC	0	1	159	187	143	490
71	KPN NV	0	15	216	228	180	639
72	DaimlerChrysler AG	8	70	214	222	182	696
73	Fiat SPA	0	53	194	239	180	666
74	Suez SA – Suez Lyonnaise	0	0	164	207	172	543
75	Lockheed Martin Corporation	0	5	157	178	130	470
76	TotalFinaElf SA	0	54	168	189	152	563
77	Vodafone Group PLC	0	73	225	232	180	710
78	Nokia Oyj	1	21	166	173	163	524
79	United Utilities PLC	0	7	104	157	178	446
80	Cox Communications Inc.	0	0	157	110	132	399
81	Bank One Corp.	0	9	179	188	137	513
82	Deere & Co.	0	0	151	182	133	466
83	Hilton Hotels Corp.	0	0	132	125	104	361
84	Koninklijke Ahold NV	0	2	165	228	182	577
85	ENI - Ente Nazionale Idrocaburi SPA	0	1	160	194	169	524
86	Usinor SA	1	10	190	171	159	531
87	British American Tobacco PLC	0	44	186	141	169	540
88	Six Continents PLC – Bass PLC	0	16	177	181	160	534
89	Lafarge SA	0	4	111	149	163	427
90	Banco Santander Central Hispano	20	45	142	234	185	626

References

Bank for International Settlements, 2003. Credit risk transfer. Committee on the Global Financial System, Working Paper, January 2003.

Basel Committee on Banking Supervision, 2004 International Convergence of Capital Measurement and Capital Standards: A Revised Framework. June.

Breger, L., Goldberg, L., Cheyette, O., 2003. Market implied ratings. Risk July, 85–89.

British Bankers' Association, 2002. BBA Credit Derivatives Report 2001/2002, London.

Brown, S.J., Warner, J.B., 1985. Using daily stock returns—the case of event studies. Journal of Financial Economics 14, 3–31.

Brown, S.J., Warner, J.B., 1980. Measuring security price performance. Journal of Financial Economics 8, 205–258.

Dichev, I.D., Piotroski, J.D., 2001. The long-run stock returns following bond ratings changes. Journal of Finance 56, 173–203.

Finger, C. (Ed.), 2002. CreditGrades Technical Document. RiskMetricsGroup Inc.

Fitch Ratings, 2003. Global Credit Derivatives: Risk Management or Risk? Special Report, March 10, 2003.

Followill, R.A., Martell, T., 1997. Bond review and rating change announcements: An examination of informational value and market efficiency. Journal of Economics and Finance 21 (Summer), 75–82.

Glascock, J.L., Davidson, W.N., Henderson, G.V., 1987. Announcement effects of Moody's bond rating changes on equity returns. Quarterly Journal of Business and Economics 26, 67–78.

Goh, J.C., Ederington, L.H., 1993. Is a bond rating downgrade bad news, good news, or no news for stockholders? Journal of Finance 48, 2001–2008.

Grier, P., Katz, S., 1976. The differential effects of bond rating changes among industrial and public utility bonds by maturity. Journal of Business 49, 226–239.

Griffin, P.A., Sanvicente, A.Z., 1982. Common stock returns and rating changes: A methodological comparison. Journal of Finance 37, 103–120.

Hand, J.R., Holthausen, R.W., Leftwich, R.W., 1992. The effect of bond rating agency announcements on bond and stock prices. Journal of Finance 47, 733–752.

Hettenhouse, G.W., Sartoris, W.L., 1976. An analysis of the information value of bond-rating changes. Quarterly Review of Economics and Business 16, 65–78.

Hite, G., Warga, A., 1997. The effect of bond-rating changes on bond price performance. Financial Analysts Journal 53 (May/June), 35–51.

Holthausen, R.W., Leftwich, R.W., 1986. The effect of bond rating changes on common stock prices. Journal of Financial Economics 17, 57–89.

Houweling, P., Vorst, T., 2002. An empirical comparison of default swap pricing models. Working Paper, Erasmus University Rotterdam.

Hull, J., Predescu, M., White, A., 2004. The relationship between credit default swap spreads, bond yields, and credit rating announcements. Journal of Banking and Finance, this issue.

iBoxx Indices, 2003. Guide to the iBoxx Euro Benchmark Indices. Version 2.11, August 2003.

Katz, S., 1974. The price adjustment process of bonds to rating reclassifications: A test of bond market efficiency. Journal of Finance 29, 551–559.

Löffler, G., 2003. Avoiding the rating bounce: Why rating agencies are slow to react to new information. Working Paper, University of Ulm, Germany.

O'Kane, D., McAdie, R., 2001. Explaining the Basis: Cash versus Default Swaps. Lehman Brothers, May 2001.

Pinches, G.E., Singleton, J.C., 1978. The adjustment of stock prices to bond rating changes. Journal of Finance 33, 29–44.

Steiner, M., Heinke, V.G., 2001. Event study concerning international bond price effects on credit rating actions. International Journal of Finance and Economics 6, 139–157.

Tavakoli, J.M., 2001. Credit Derivatives and Synthetic Structures. John Wiley and Sons, New York.

Vassalou, M., Xing, Y., 2003. Equity returns following changes in default risk: New insights into the informational content of credit ratings. Working Paper, Columbia University.

Wansley, J.W., Glascock, J.L., Clauretie, T.M., 1992. Institutional bond pricing and information arrival: The case of bond rating changes. Journal of Business Finance and Accounting 19, 733–750.
Weinstein, M., 1977. The effect of a rating change announcement on bond price. Journal of Financial Economics 5, 329–350.