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DO MARKET-BASED INDICATORS ANTICIPATE RATING AGENCIES? EVIDENCE FOR INTERNATIONAL BANKS

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Abstract

This paper analyzes the ability of credit default swap spreads, bond spreads and stock prices to anticipate the decisions of the main rating agencies, for the largest international banks. Conditional on negative rating events, all the three indicators show significant abnormal changes before both announcements of review and actual credit rating changes, but rating actions still seem to convey new information to the market. Results for positive rating events are less clear-cut with the market indicators generally showing abnormal behaviors only in conjunction with the events. As for the predictive power of the financial indicators examined, the CDS market is particularly useful for negative events and stock prices for positive events. However, all indicators also send many false signals and are to be interpreted with care.

JEL classification: G14, G21.

Keywords: *Credit derivatives*, *credit default swaps*, *option-adjusted spreads*, *credit ratings*.

Contents

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1. Introduction[1]

Over the past few years, after the collapse of large companies such as Enron and Parmalat, rating agencies have been strongly criticized for having failed to lower their credit ratings quickly enough. Some observers argued that market-based indicators, and especially those derived from the credit derivatives market, are much better than rating agencies in evaluating the "true" credit worthiness of debtors and that too often "markets" are able to anticipate rating announcements:

> *"The derivatives market is quick to spot companies that have any credit weakness. Indeed, measured over a year, it is better at predicting defaults than rating agencies, which can be slow to downgrade companies."*
>
> John Gapper, Financial Times, May 25, 2004

On the other hand, FitchRatings (2003) shows some evidence that

> *"... having now had the opportunity to observe CDS spreads over the full cycle of decline and rebound, it is worth noting that CDS spreads also widened dramatically for many other investment-grade companies in 2002, only to completely reverse course one year later. Now that the credit markets have begun to stabilize, it is easy to observe that, despite a number of successes, market-based indicators, in addition to being quite volatile, also sent many false positives."*

From a theoretical point of view it is not clear if "markets" or rating agencies have some comparative advantages. In fact, while market-based indicators can react immediately to news, rating agencies need some time for processing new information.

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However, rating agencies can usually access confidential business data, not available to the market as a whole[2]. Hence the evaluation of the two sentences mentioned above is mainly a matter of empirical research. Indeed, the literature on the relationship between market-based indicators and credit ratings given by specialized agencies is quite large. Several papers explored the links between credit ratings and stock prices (Pinches and Singleton, 1978; Griffin and Sanvicente, 1982; Holthausen and Leftwich, 1986; Glascock et al., 1987; Cornell et al., 1989; Goh and Ederington, 1993 and 1999; Dichev and Piotrosky, 2001; Vassalou and Xing, 2003), credit ratings and bond prices (Katz, 1974; Grier and Katz, 1976; Hettenhouse and Sartoris, 1976; Weinstein, 1977; Wansley et al., 1992; Cantor et al., 1997; Hite and Warga, 1997; Steiner and Heinke, 2001; Dynkin et al., 2002) and credit ratings and stock and bond prices (Hand et al., 1992; Kliger and Sarig, 2000; Gropp et al., 2002). Results did not reach a complete consensus, but there seems to be a widespread agreement that market-based indicators generally react to rating agencies' announcements, sometimes even in advance, and that the reaction is greater for negative events than for positive events.

Recently, in parallel with the development of the credit derivatives market[3], a few papers began exploring the relationship between the credit default swap (CDS) market[4] and rating events. Hull et al. (2004) analyze events from Moody's, finding

[2]Gonzales et al. (2004) give a survey on the role of credit agencies in modern financial markets.

[3]According to the International Swap and Derivatives Association (ISDA), the notional value of credit derivatives outstanding at the end of the year was USD 8.4 trillion in 2004, compared with 3.8 trillion a year before and just USD 1.0 trillion in 2001. An overview of the credit derivatives market can be found in Rule (2001) and Committee on the Global Financial System (2003).

[4]Credit default swaps are over-the-counter financial instruments that allow people to transfer the credit risk related to one or more reference entities. The buyer of a CDS pays a premium, generally with quarterly or semiannual frequency, on a specified notional amount for a given period of time and, if a credit event related to one of the reference entities occurs during the life of the contract, the holder of the CDS has the right to receive the notional amount of the contract and the obligation to deliver the same notional value of debt securities issued by the reference entity for which the credit event occurred (physical settlement). In some cases, the buyer of the CDS has the right to receive the difference between the notional and the market value of defaulted debts (cash

that reviews for downgrade contain significant information for CDS spreads, while downgrades and negative outlooks do not; moreover the CDS market anticipates all the three types of events and provides useful information for estimating the probability of negative events; results for positive events are much less meaningful. Norden and Weber (2004) examine both the CDS and the stock markets and events from the three main international rating agencies; they argue that both markets anticipate negative rating events. Zhu (2004) find that CDS spreads increase (decrease) faster than bond spreads before a rating downgrade (upgrade), but the discrepancy is almost fully removed shortly after the rating event. Despite of the predictive power of the CDS market, Micu et al. (2004) find that rating events still have short-term impacts on credit spreads.

The growing attention of the literature towards the credit derivatives market is due to the characteristics of these contracts, that make them potentially more efficient than other financial instruments in establishing the "right" price of credit risk. For instance, the short selling of credit risk, which is straightforward with a CDS, is limited in the bond market by the low level of liquidity of the repo market, especially for high yield issues, and by the short maturity of the repo contracts. Blanco et al. (2005) confirm that, even if in the long run both CDS and bond markets reflect firm-specific variables equally, CDS spreads are better integrated with those factors in the short run. Also Zhu (2004) find that credit risk tends to be priced equally in the two markets in the long run, but the derivatives market seems to lead the cash market in anticipating rating events and in adjusting the prices.

The main characteristics of this paper, whose aim is to further investigate the relationship between market-based indicators and rating events, are the followings:

- Rating events from the three main international rating agencies (Moody's

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settlement). Usually, CDSs offer protection against credit events such as bankruptcy, failure to pay and restructuring; for sovereign issuers, repudiation and moratoria are also included. According to the British Bankers' Association (2004), currently nearly a half of the credit derivatives market is represented by single-name CDSs, which are contracts that insure against the credit risk associated with a single debtor.

Investors Service, Standard & Poor's CreditWire and FitchRatings) are taken into account;

- Indicators from three financial markets, the credit default swap, the bond and the stock markets, are used;
- The focus is on the largest international banks.

Using information from the three main rating agencies is particularly important from a methodological point of view. As shown by Micu et al. (2004), results can be substantially different if one controls for rating changes that have been preceded by other rating events. Also Hull et al. (2004), in the work that inspired this paper, decided to drop those cases that were preceded by other events, in order to control for contamination; on the other hand they only used data from Moody's, thus leaving the door open to cross-agencies contaminations. Indeed, since it would be difficult to defend the predominance of a rating agency on the others, it seems natural to use simultaneously data from all the three rating agencies that are unanimously recognized to be the most important.

The decision to use market-based indicators coming from credit derivatives, bond and stock markets probably do not require a long explanation. As it has been said before, CDSs should theoretically be the most efficient instruments for evaluating the credit worthiness of a firm, but the comparison with indicators coming from other markets is a task that is certainly worth to pursue.

The choice of focusing on a particular industry, the one constituted by the largest international banks, could seem too much restrictive and not necessary. It is undoubtedly true that by doing so the number of rating events that are used cannot be as large as in previous papers, and this could lead to results that are less precise. However, the banks in the sample are among the companies with the greatest amounts of debt outstanding, so that the economical relevance of any of the company studied in this paper is much larger than that of the average firm used in works with larger samples; it is thus interesting to check whether previous findings in the literature still hold for the banking sector only or not. Moreover, focusing on firms which have almost surely liquid CDSs, bonds and stocks probably mitigates other issues arising when using tons of data of illiquid instruments of unknown firms. Another potential criticism is that most of the banks have very high credit ratings and, moreover, in many countries the banking system is also perceived to have a more or less explicit public guarantee. Essentially, since banks are considered to be "too big to fail" the CDS market for these companies would be less relevant. It is just the case to remember that CDSs offer protection not only against the bankruptcy of the reference entity, an issue that is certainly not credible for a large bank in almost all countries in the world, but also against the failure to pay and the restructuring, events that do not seem to be so unlikely for a bank that should face serious financial difficulties. The fact that banks usually maintain high credit ratings only make the task of verifying if financial indicators are so sensible to reflect small variations in credit worthiness more challenging, and interesting.

The following section contains the description of the data set. Following Hull et al. (2004), I analyze how CDS spreads, OASs and stock prices change conditional on rating events in Section 3 and I estimate the probability that rating events occur given the changes of the market-based indicators in Section 4. Section 5 concludes.

2. The data set

The data set refers to the largest[5] 42 publicly listed international banks, from 11 countries. Four years of daily CDS spreads, option-adjusted spreads (OASs) and stock prices were downloaded from Bloomberg[6], for the period from August 2001 to

[5]By market capitalization.

[6]Credit default swap spreads refer to 5-year contracts written on senior debts and are denominated in euro for all banks except for American and Japanese banks, where they are denominated in US dollars. Option-adjusted spreads refer to bonds with fix coupons, no embedded options, and maturities as close as possible to 5 years; option-adjusted spreads for bonds without embedded options represent, in basis points, by how much the benchmark yield curve has to be shifted in order to make the present value of the cash-flows of the securities, discounted using the shifted curve, equal to their market values; Bloomberg uses yield curves on government bonds as

July 2005. Missing data were replaced with interpolated values and, in order to have comparable data among indicators, only those days for which the three indicators were all available were kept, for a total of 36,575 daily quotes for any indicator. Table 1 gives a few descriptive statistics of the data set. Since all banks included in the sample always maintained an investment grade status, both CDS spreads and OASs were rather small on average, with overall means equal to just about 30 and 70 basis point, respectively. On the other hand, all the three indicators had substantial fluctuations, with large ratios between maximum and minimum values. From Bloomberg I got also a set of 512 rating events from Moody's, Standard & Poor's and Fitch [7]. The set of events includes both reviews for rating changes and actual rating changes, but excludes those cases in which a rating confirmation followed an announcement of review, since these events cannot be properly classified as either reviews for rating changes or actual rating changes. Events related to the same bank that happened in the same day were grouped together, for a total of 167 days in which an event occurred for some bank. Notice that the different "intensity" of the rating events is not taken into account; this means that, for any bank, rating events occurred in the same day, from one or more agencies, for one or more rating types and for one or more notches were considered as one rating event only. On the other hand, cases in which two or more rating agencies took decisions in the same day and cases in which rating changes occurred for more than one notch were rather rare, thus preventing any meaningful specific statistical analysis.

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benchmarks. Stock prices are end-of-day prices.

[7]Throughout the paper, I will refer to *negative rating events* for reviews for downgrade and actual downgrades, to *positive rating events* for reviews for upgrade and actual upgrades, and to *rating events* for negative and positive rating events. The following rating types were included in the data set: 1) for Moody's, issuer rating, bank financial strength, long-term debt in national currency, long-term debt in foreign currency, long-term bank deposits, short-term debt, senior secured debt, senior unsecured debt, junior subordinated debt and subordinated debt; 2) for S&P, long-term foreign issuer credit, long-term local issuer credit, short-term foreign issuer credit and short-term local issuer credit; 3) for Fitch, short-term debt, senior secured debt, senior unsecured debt, junior subordinated debt and subordinated debt. Unfortunately, I was not able to find historical data for the potentially important rating type "outlook".

3. Abnormal price changes conditional on rating events

The purpose of this set of tests is to verify if market-based indicators behave abnormally during some time intervals related to rating events. In order to define what an "abnormal movement" is, for any of the three market-based indicators, a daily market index is constructed as the average of the price changes of the indicators during every day in the sample[8]. Since the market index should not be contaminated by the effects of rating events, only daily price changes which referred to banks for which a credit event did not happen either in the previous or in the following 126 days[9] (or 6 months) were used. Then, for any bank the abnormal price change (APC) of a market-based indicator during a day is defined as the difference between the actual price change of that indicator and the corresponding market index[10]. Another fundamental definition is that of the cumulative abnormal price change (CAPC) of an indicator in the interval $[n_1, n_2]$, which is the sum of the APCs for that indicator in the days included in the interval, where n_1 and n_2 are days from the credit event[11].

[8]Price changes are defined as simple changes for CDS spreads and OASs and as log-returns for stock prices. The market index was calculated only when at least five prices were available. I also used a market index based on the median instead of the average value, with results remarkably similar to the ones reported below.

[9]When speaking of "days" I will always mean "working days".

[10]It is worth noting that the APCs for the OASs are (almost) independent of the risk-free benchmark curve used to calculate the OASs. In fact, one could argue that using OASs calculated using, for instance, the swap curve instead of the yield curve on government bonds would potentially make a difference. Notice that if all OASs referred to bonds denominated in the same currency, the benchmark curve would not be relevant at all, since APCs are defined as differences between OASs and averages of OASs calculated with respect to the same benchmark curve. Actually, in the data set there are both OASs calculated on bonds denominated in euros and OASs calculated on bonds denominated in US dollars; hence, APCs could indeed be sensible to differences in the relative movements of yield curves on government bonds and other potential benchmark yield curves in the two currencies. All in all, since I analyzed movements of the indicators during short period of times, I do not believe that a particular choice for the benchmark curve would really make a relevant difference.

[11]Both n_1 and n_2 can be negative or positive, for days preceding or following the credit event,

All tests described in this subsection are applied to the interval [-40,5] and to the subintervals [-40,-2], [-1,1] and [2,5] in order to verify abnormal movements of the markets before, in concomitance and after rating events. To avoid contamination of the data, only those events that were neither preceded, in the previous 40 days, nor followed, in the following 5 days, by other rating events for the same bank are included in the sample. Table 2 shows the numbers of rating events, divided by rating agency, that are analyzed.

In order to verify if CAPCs were significantly greater or smaller than zero, a standard t-test could be used. However, since the distribution of the CAPCs could be non-normal and the number of observations is sometimes small, I preferred to use the bootstrap technique suggested by Efron e Tibshirani (1993) to determine the relevant confidence intervals. Let $\tilde{s}_i = s_i - \bar{s}$, where $s_1, s_2, \ldots, s_n$ are the sample values of the CAPCs and $\bar{s}$ is the sample mean. The null hypothesis is that the distribution of the CAPCs corresponds to the distribution in which the $\tilde{s}_1, \ldots, \tilde{s}_n$ can occur with the same probability (the null distribution). Drawing with replacements for many times a sample with n elements from the null distribution and computing $t^n = \sqrt{n}(\bar{s}^n/\hat{\sigma}^n)$, where $\bar{s}^n$ and $\hat{\sigma}^n$ are the sample mean and standard deviation, it is possible to find the empirical distribution of t under the null hypothesis[12]. By comparing t with the desired percentile of this distribution one can decide if the null hypothesis has to be rejected or not for a given confidence level.

I also run a test based on the sign of the CAPCs. Under the null hypothesis that 50 per cent of the CAPCs are positive, and the remaining 50 per cent are negative, the probability $\pi(n;N)$ of having n positive (or negative) CAPCs over N observations is given by

$$\pi(n;N) = \frac{1}{2^N}\binom{N}{n},$$

where $\binom{N}{n} = \frac{N!}{n!(N-n)!}$. In a one-sided test, the p-value associated with the realization of n positive (or negative) CAPCs over N observations is given by $\sum_{i=n}^{N} \pi(i;N)$.

respectively.

[12] I drew 100,000 random samples to run this test.

Figures 1.a-c show the average CAPCs for negative rating events in the intervals [-40,5], that is from 40 days before to 5 days after the rating events. From the figures it is possible to see that all market-based indicators moved in the expected directions, even if the overall behavior is sometimes rather different, and that they seem to lead the events. The statistical results reported in Table 3 give support to the visual feeling: CAPCs in the intervals [-40,5] are always highly significant, except for OASs conditional on reviews for downgrade and stock prices conditional on downgrades. The later results, however, are heavily influenced by a Japanese bank which was put under review for downgrade in November 2002 and was downgraded at the end of January 2003. In the intervals [-40,5], the OASs and the stock prices of this bank had two astonishing CAPCs of -90 basis points and 44 percentage points, respectively for the two events, profiting from the actions of the Bank of Japan which was supporting the Japanese banking sector at that time. Without those events all indicators would behave in a very similar way, showing significant CAPCs in the intervals [-40,-2], thus supporting the hypothesis that these markets are indeed able to move in advance with respect to rating agencies, but also in concomitance and, for OASs, after the events. The later results signal that, even if the markets move in advance with respect to the rating events, the decisions of the rating agencies still convey new information to the agents.

As in previous studies, results for positive events are less clear-cut (figures 2.a-c and Table 4) also for the banking sector. In the intervals [-40,5] the indicators always moved in the expected directions on average, but generally not in a very significant way. In particular CDS spreads only seem to react in concomitance or after the events, showing an apparently poor ability to anticipate rating agency. Actually, as it will become apparent with the second set of tests, the fact that CDS spreads did not move significantly before the recorded positive events does not mean that this market is not useful to predict this kind of rating events. To conclude the analysis of positive events, it seems interesting to point out that market indicators almost always react to positive rating news, that is in the interval [-1,-1], thus showing once again that rating actions provide genuine new information.

As said in the introduction, one of the main features of this paper is to use rating events from three rating agencies. It is thus interesting to analyze if markets react in the same way to news coming from the three agencies or if there are peculiarities. Figures 3.a-c and 4.a-c report the average CAPCs for rating events coming from one rating agency at a time. The wide differences in the behavior of the market indicators seem to give a clear support to the choice of not focusing on one rating agency only; actually, final results would be significantly different depending on which rating agency one decides to work on. However, it is useful to remember that when working with just one rating agency the numbers of events included in the samples are very small and results can be severely biased. For this reason, the results of (not useful) formal tests are not reported for the single agencies and it is preferable to leave the figures only to highlight possible drawbacks of previous works that did not use information from several agencies.

4. Rating events conditional on abnormal price changes

Norden and Weber (2004), using tests similar to those described in the previous subsection, argue that CDS and stock markets are able to anticipate the decisions of the rating agencies. However, such a conclusion do not seem conceptually correct since it is based only on tests that are conditional on the realization of a particular event and that do not control for those cases in which CAPCs gave false signals, that is cases in which CAPCs were significantly different from zero and were not followed by rating events. In other words, to have a complete view of the relationships between market-based indicators and rating events it is also necessary to verify the facts reported in the second sentence quoted in the Introduction of this paper, which is exactly what the set of tests described in this subsection aims to do.

In order to verify if market indicators are really useful to estimate the probability that a rating event occurs, I calculated CAPCs on intervals of 40 and 120 days (*predictive windows*)[13] and I checked if in the following 40 days (*observation window*) there was some rating event. I then estimated a probit model $P = \Phi(\alpha + \beta'\mathbf{x})$ using

[13] I will report results for both predictive windows, since they are sometimes different.

a maximum likelihood estimator[14]. In this model P is the probability that a rating event occurs, Φ is the cumulative standard normal distribution, α and β are the parameters to be estimated and $\mathbf{x}$ is a set of explanatory variables. I first estimated the parameters using the CAPCs of every one of the three market indicators as exogenous variables. Then, in order to verify if one of the market indicators is more useful than the others in predicting rating events, I also estimated the probit model using CDS spreads, OASs and stock prices together (Model A). In both cases, predictive windows which included rating events of any type were not considered. Even if this approach considerably reduces the size of the sample, it avoids biases related to the fact that rating actions by one rating agency could be anticipated by other decisions of the same rating agency or by the other rating agencies. Then, to asses how useful rating decisions are in order to predict other following rating events, I estimated a probit model using as explanatory variables only two dummy variables, that takes value 1 or zero if a positive or negative rating events occurred or not during the predicting windows (Model B). At the end, to check if markets add information to those provided by rating agencies, I estimated a probit model in which both market-based indicators and dummy variables for rating events are used (Model C).

Given that probit models could be criticized for assuming a particular functional form for the relationship between the probability that a rating event occurs and the exogenous variables, also a non-parametric test based on the percentiles of the distribution of the single CAPCs was used. As before, I calculated the CAPCs on intervals of 40 and 120 days and I verified if in the following 40 days a rating event occurred. Observations were then divided into two classes: class G, containing the greatest CAPCs, that is the CAPCs greater than a given percentile q, and class S, containing the smallest CAPCs, that is the CAPCs smaller than the q percentile. For both classes I calculated the number of rating events associated with them. Under the null hypothesis that the probability that a rating event belongs to class G is equal to $1 - q/100$ (and that $q/100$ is, therefore, the probability to belong to

[14]Results were confirmed by a logit model.

class S), the probability $\pi(n;N)$ of having exactly n events in class G, when the total number of events is N, is given by

$$\pi(n;N) = \left(\frac{q}{100}\right)^{N-n}\left(1-\frac{q}{100}\right)^{n}\binom{N}{n}.$$

In a one-sided test, the p-value associated with n CAPCs belonging to class G when the total number of events is N is equal to $\sum_{i=n}^{N}\pi(i;N)$. The p-value associated with n CAPCs belonging to class S is instead equal to $\sum_{i=0}^{n}\pi(N-i;N)$. In order to check the robustness of the results, I applied a bootstrap technique, calculating the statistics described above 1,000 times on random samples drawn with replacements from the original set of time intervals. From the empirical distributions of the statistics obtained in this way it was easy to determine the relevant confidence intervals.

When using one market indicator at a time, estimated parameters for probit models have always the expected signs and are significant, in both predictive windows (Table 5.a). However, the measures of fit (McFadden, 1974 and Estrella, 1998) show that the performance of CDS spreads is relatively much better than for the other two indicators, and that OASs have indeed a poor capacity to predict negative events. The tests on percentiles give further support to this analysis: results for CDSs are always greatly significative whereas, when the predictive window is equal to 120 days, stock prices and OASs give many false signals in several cases. Hence, if a relatively high movement for stock prices and OASs is observed in the future, it should be borne in mind that in many cases in the past this fact did not mean that a negative rating event was approaching, that is the credit worthiness of the underlying bank was not decreasing in the judgment of the rating agencies. The clear predominance of CDS spreads to convey information on future negative events when a large predictive window is used is confirmed when all the three indicators are used simultaneously to predict the events (Table 5.b, Model A): the estimated coefficients of the probit model are not significant for OASs and stock prices and the overall fit of the model to the data is remarkably similar to the case in which CDS spreads only are used.

All results presented up to now have been obtained limiting the analysis to those events that were not preceded during the predictive window by other rating events. That is the above mentioned results are conditional on the fact that events were not anticipated in any way by one or more rating agencies. However, results of Model B show that signals coming from the rating agencies are very useful in predicting other negative rating events. The presence of a negative (positive) event in the predictive window increases (decreases) the probability of observing a negative event in the observation window. This happens both because rating agencies anticipate themselves by giving to the market the announcements of future reviews and also because often one rating agency anticipate the others in the decisions or, said in other words, all rating agencies generally do the same things but with some leads and lags. When adding the market indicators to the rating decisions (Model C) the overall fit of the model to the data increases considerably, thus showing that all the three indicators add information to that provided by the rating agencies.

As for the capacity of market-based indicators to predict positive events, the estimated parameters for probit models when the indicators are used separately are always significant, but the measures of fit are smaller than for the corresponding cases for negative events, with the exceptions of OASs and stock prices when the predictive window is 120 days long (Table 6.a). Also the values of the tests on percentile are usually smaller than their counterparts for negative events, but still significant. When the three indicators are used together, the coefficient of the CDS spreads is no longer significant in Model A with the shorter predictive window and in Model C with both windows (Table 6.b).

Having established that market indicators are indeed useful in predicting rating events, another the question is: how often the market is correct? Or, said in other words, how to interpret the reported measures of fit? In fact the pseudo-R^2s of binary models are not easily interpretable as measures of fit (cfr. Estrella, 1998). Hence, I calculated the following ratios to verify the capacity of probit models to predict rating events:

i) $\frac{\#\{P_Y \cap R_Y\}}{\#\{P_Y\}}$;

ii) $\frac{\#\{P_N \cap R_Y\}}{\#\{P_N\}}$.

where P_Y and P_N represent those cases in which the model predicted a rating event to occur and not to occur, respectively, R_Y and R_N represent cases in which a rating event was actually recorded and was not, respectively, the intersection symbol means that both cases were realized and the symbol # stands for "number of elements of the set". In words, i) is the percentage of cases in which the model predicted a rating event and a rating event actually occurred and ii) represents the percentage of cases in which the model predicted that there would be not rating events but a rating event actually occurred. In order to define when the model predicted a rating event I picked out as a threshold the probability level that makes the number of predicted events equal to the number of realized events. Given that the total number of cases in which the model predicted an event N_{P_Y} is set to be equal to the number of realized events N_{R_Y}, which is smaller than the number of cases in which there were no events N_{R_N}, it is possible to calculate the probability that in n cases the predictions were correct under the null hypothesis that the model randomly predicted the rating events as

$$\pi_1(n; N_{P_Y}, N_{R_Y}, N_{R_N}) = \frac{\binom{N_{R_Y}}{n}\binom{N_{R_N}}{N_{R_Y}-n}}{\binom{N_{R_Y}+N_{R_N}}{N_{R_Y}}}.$$

It is thus possible to calculate also the p-value associated with the number n of correct predictions of the probit model as $\sum_{i=n}^{N_{R_Y}+N_{R_N}} \pi_1(n; N_{P_Y}, N_{R_Y}, N_{R_N})$. Analogously, the probability that in n cases there is a rating event out of N_{P_N} cases in which the model predicts that there will be no events (where N_{P_N} is set to be equal N_{R_N}) is

$$\pi_2(n; N_{P_Y}, N_{R_Y}, N_{R_N}) = \frac{\binom{N_{R_Y}}{n}\binom{N_{R_N}}{N_{R_N}-n}}{\binom{N_{R_Y}+N_{R_N}}{N_{R_N}}}$$

and the p-value associated with the null hypothesis that a random model is the true model is $\sum_{i=0}^{N_{R_Y}} \pi_2(n; N_{P_Y}, N_{R_Y}, N_{R_N})$.

Table 5.c shows that, when the predictive window is equal to 120 days, 11 times out of 100 the prediction of a negative events received from the CDS market was indeed correct and only 2 times up to 100 the prediction of no negative events was actually followed by a negative events. These results are statistically significant, that

is we can confidentially reject the hypothesis that they are generated by a random model. However, it also means that nothing happened in the 89 per cent of the cases in which the CDS market predicted a negative event!!! The performance of OASs and stock prices are even worse and also combining the three indicators together do not substantially improve the results. On the other hand, when combining market indicators and rating actions, the predictive power of the model significantly increases, with about 40 per cent of correct predictions of negative events.

The fact noticed above that CDS spreads are not particularly useful in predicting positive events is confirmed by the fact that the performance of Model A in terms of percentage of correct predictions is worse than for the case in which only stock prices are used (Table 6.c), thus suggesting that CDS spreads, and perhaps OASs that had not an excellent performance either, only add noise to the information content of stock prices. Overall, one should be able to correctly predict about 30 per cent of positive rating events using both market-based indicators and information from previous rating actions.

5. Conclusions

The paper analyzes the relationship between three market-based indicators and rating events for a sample of international banks. All indicators are found to contain useful information to anticipate rating actions from the main international agencies, especially for negative events. It has to be said, however, that all indicators give also many false signals. Overall, CDS spreads seem to be relatively more efficient than OASs and stock prices in anticipating negative rating events, whereas information from stock prices is more valuable for predicting positive events. The bond market seem to provide the less reliable indicators of future rating events, especially for negative events when a large predictive windows is used: 99 per cent of the cases in which the OASs would had predicted the arrival of a negative rating event were wrong signals. The performance of the bond market improves significantly for positive events. In order to explain this fact, it is probably useful to remember that OASs contain not only a premium for expected losses due to defaults but also premia related to tax effects, liquidity of the bond market and special difficulties concerning the diversification of risks of bond portfolios [15]. My conjecture, whose empirical verification is left for future work, is that the low liquidity of the bond market is the best candidate for explaining this finding. In fact, when market perceives that a rating event is approaching, probably both the interest for bonds and their liquidity tend to increase, thus reducing the liquidity premium. In case of negative events, the reduction of the liquidity premium can partly offset the increase of the premium related to expected losses, thus leaving the overall OASs almost unchanged. In case of positive events, instead, both premia move in the same direction, and this can explain why the relationship between the bond market and rating events look stronger with this kind of events.

[15] For more on these points, cfr. Amato and Remolona (2003) and references therein.

Tables and Figures

Table 1

MAIN CHARACTERISTICS OF THE DATA USED IN THE PAPER													
No.	**Name**	**Country** (1)	**Currency** (2)	**CDS spreads** (3)			**OASs** (3)			**Stock prices** (4)		
				Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
1	Abbey National	GB	EUR	22	10	67	56	10	124	95	71	121
2	ABN Amro Holding	NL	EUR	24	12	66	35	6	81	73	35	102
3	Banca Intesa	IT	EUR	20	11	47	60	28	136	82	44	119
4	Banca Monte dei Paschi di Siena	IT	EUR	27	15	90	41	0	77	85	56	121
5	Banca Nazionale del Lavoro	IT	EUR	23	17	41	34	19	45	69	29	120
6	Banco Bilbao Vizcaya Argentaria	ES	EUR	17	8	46	45	3	87	82	49	103
7	Banco Comercial Portugues	PT	EUR	18	9	52	75	23	133	73	42	101
8	Banco Espirito Santo	PT	EUR	15	8	31	35	9	63	86	56	108
9	Banco Santander Central Hispano	ES	EUR	12	8	27	20	10	27	77	38	102
10	Bank of America	US	USD	24	13	76	31	-6	71	86	47	115
11	Barclays	GB	EUR	48	18	182	50	16	109	85	25	188
12	Bayerische Hypo- und Vereinsbank	DE	EUR	49	15	226	49	3	113	80	29	149
13	Bear Stearns Companies	US	USD	30	9	138	46	14	97	82	48	102
14	BNP Paribas	FR	EUR	21	9	65	35	17	67	80	50	106
15	Citigroup	US	USD	30	12	85	45	9	93	109	59	195
16	Commerzbank	DE	EUR	28	12	83	88	21	233	98	72	113
17	Crédit Agricole	FR	EUR	19	8	59	33	-2	68	87	51	110
18	Credit Suisse Group	CH	EUR	24	13	50	42	27	62	82	39	128
19	Deutsche Bank	DE	EUR	17	9	36	72	16	230	87	66	103
20	Dexia	BE	EUR	16	8	36	46	24	85	97	71	122
21	Fortis	BE	EUR	15	8	35	16	4	26	90	56	112
22	Goldman Sachs Group	US	USD	16	9	26	38	21	51	86	62	104

(1) Home countries of the banks: BE=Belgium, CH=Switzerland, DE=Germany, ES=Spain, FR=France, GB=United Kingdom, IT=Italy, JP=Japan, NL=The Netherlands, PT=Portugal, US=United States. - (2) Reference currency of the CDS contracts used in the paper. - (3) Basis points. - (4) Stock prices levels. Data are normalized to be equal to 100 in the last day included in the data set.

Table 1 cont.

MAIN CHARACTERISTICS OF THE DATA USED IN THE PAPER

No.	Name	Country (1)	Currency (2)	CDS spreads (3) Mean	CDS spreads (3) Min	CDS spreads (3) Max	OASs (3) Mean	OASs (3) Min	OASs (3) Max	Stock prices (4) Mean	Stock prices (4) Min	Stock prices (4) Max
23	HBOS	GB	EUR	15	8	29	41	23	74	107	61	170
24	HSBC Holdings	GB	EUR	29	11	63	79	21	166	76	51	104
25	JPMorgan Chase	US	USD	22	10	49	65	39	117	104	49	185
26	Lehman Brothers Holdings	US	USD	26	14	76	85	43	196	99	58	120
27	Lloyds TSB Group	GB	EUR	28	15	65	91	43	183	88	58	109
28	Merrill Lynch	US	EUR	45	18	128	114	51	224	96	44	124
29	Mitsubishi Tokyo Financial Group	JP	EUR	24	13	42	71	39	132	86	63	103
30	Mizuho Financial Group	JP	USD	33	14	81	97	49	186	83	55	111
31	Morgan Stanley	US	USD	45	22	99	95	42	196	94	55	119
32	Royal Bank of Scotland Group	GB	EUR	49	23	126	100	40	210	85	48	109
33	SanPaolo IMI	IT	EUR	46	22	98	120	56	223	82	55	106
34	Société Générale	FR	EUR	50	30	133	75	42	127	91	67	110
35	Standard Chartered	GB	EUR	51	24	118	107	45	215	68	41	102
36	Sumitomo Mitsui Financial Group	JP	USD	49	21	115	103	41	204	73	43	105
37	UBS	CH	EUR	26	14	73	108	57	228	88	38	122
38	UFJ Holdings	JP	USD	48	16	162	143	69	269	70	12	108
39	UniCredito Italiano	IT	EUR	40	15	98	115	54	259	76	22	114
40	Wachovia	US	USD	86	16	223	219	68	451	69	15	136
41	Washington Mutual	US	USD	15	8	38	21	4	51	77	47	100
42	Wells Fargo	US	USD	37	13	170	76	21	247	84	38	136
	All sample			31	8	226	71	-6	451	85	12	195

(1) Home countries of the banks: BE=Belgium, CH=Switzerland, DE=Germany, ES=Spain, FR=France, GB=United Kingdom, IT=Italy, JP=Japan, NL=The Netherlands, PT=Portugal, US=United States. - (2) Reference currency of the CDS contracts used in the paper. - (3) Basis points. - (4) Stock prices levels. Data are normalized to be equal to 100 in the last day included in the data set.

Table 2

NUMBER OF EVENTS USED TO STUDY ABNORMAL PRICE CHANGES CONDITIONAL ON RATING EVENTS (1)

	Total	Moody's	S&P	Fitch
Negative rating events	35	8	17	12
of which:				
Reviews for downgrade	14	4	9	3
Downgrades	21	4	8	9
Positive rating events	45	20	21	6
of which:				
Reviews for upgrade	14	7	7	2
Upgrades	31	13	14	4

(1) These data are used in figures 1 to 4 and tables 3 and 4. In the total, rating events of the same type occurred in the same day from different rating agencies are considered as one credit event only.

Figure 1.a

Average cumulative abnormal price changes in case of negative rating events

(basis points for CDS spreads and OASs, percentage points for stock prices)

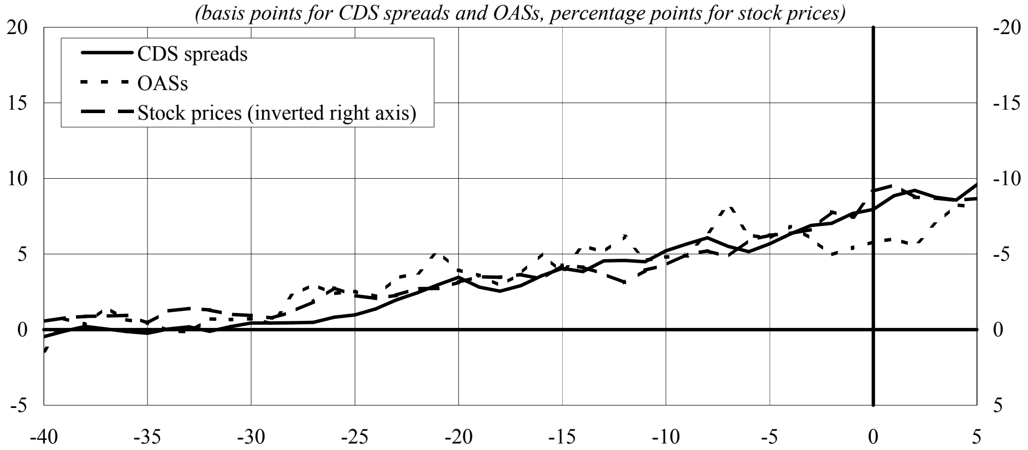

Figure 1.b

Average cumulative abnormal price changes in case of reviews for downgrade

(basis points for CDS spreads and OASs, percentage points for stock prices)

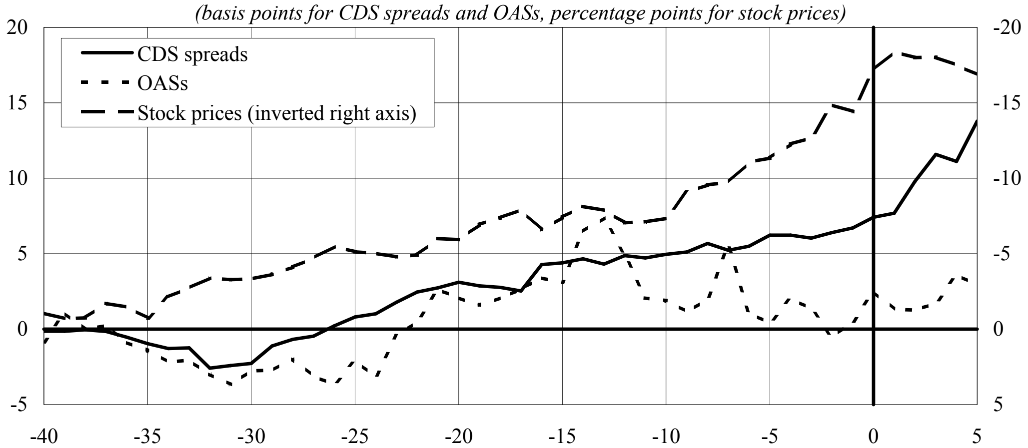

Figure 1.c

Average cumulative abnormal price changes in case of downgrades

(basis points for CDS spreads and OASs, percentage points for stock prices)

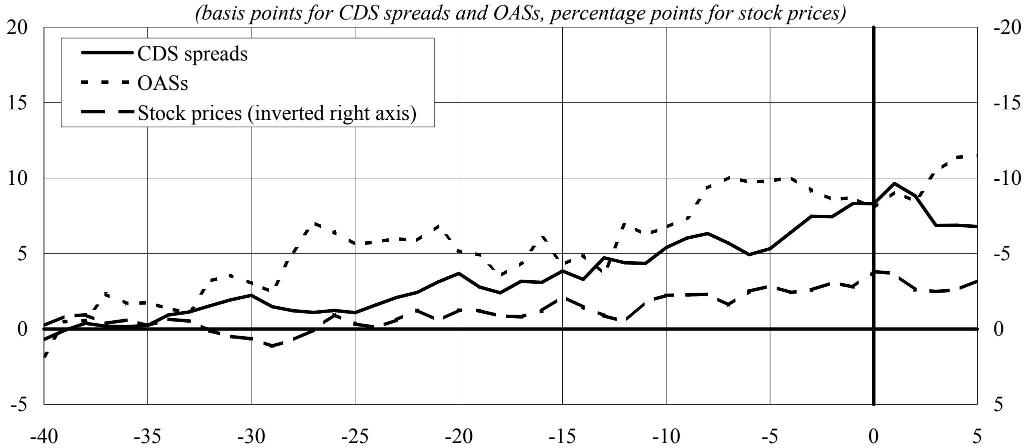

Table 3

ABNORMAL PRICE CHANGES CONDITIONAL ON ...	Time windows			
	[-40,-2]	[-1,1]	[2,5]	[-40,5]
... NEGATIVE RATING EVENTS (1)				
CDS spreads				
Average CAPCs (2)	**7.0**	**1.8**	0.7	**9.6**
	(0.00)	(0.01)	(0.36)	(0.00)
Positive CAPCs (3)	**74.3**	57.1	48.6	**77.1**
	(0.00)	(0.25)	(0.63)	(0.00)
OASs				
Average CAPCs (2)	4.9	1.1	**2.1**	**8.1**
	(0.12)	(0.18)	(0.05)	(0.04)
Positive CAPCs (3)	**80.0**	62.9	57.1	**80.0**
	(0.00)	(0.09)	(0.25)	(0.00)
Stock prices				
Average CAPCs (2)	**-7.8**	**-1.8**	0.9	**-8.7**
	(0.00)	(0.04)	(0.22)	(0.00)
Negative CAPCs (3)	62.9	62.9	48.6	**71.4**
	(0.09)	(0.09)	(0.63)	(0.01)
... REVIEWS FOR DOWNGRADE (1)				
CDS spreads				
Average CAPCs (2)	**6.4**	**1.3**	6.1	**13.8**
	(0.00)	(0.05)	(0.08)	(0.00)
Positive CAPCs (3)	**78.6**	64.3	57.1	**78.6**
	(0.03)	(0.21)	(0.40)	(0.03)
OASs				
Average CAPCs (2)	-0.5	1.8	1.6	2.9
	(0.43)	(0.14)	(0.26)	(0.42)
Positive CAPCs (3)	**78.6**	64.3	64.3	**78.6**
	(0.03)	(0.21)	(0.21)	(0.03)
Stock prices				
Average CAPCs (2)	**-14.9**	**-3.5**	1.5	**-16.9**
	(0.00)	(0.04)	(0.18)	(0.00)
Negative CAPCs (3)	**78.6**	71.4	50.0	**85.7**
	(0.03)	(0.09)	(0.60)	(0.01)
... DOWNGRADES (1)				
CDS spreads				
Average CAPCs (2)	**7.4**	**2.2**	**-2.8**	**6.8**
	(0.05)	(0.03)	(0.05)	(0.05)
Positive CAPCs (3)	**71.4**	52.4	42.9	**76.2**
	(0.04)	(0.50)	(0.81)	(0.01)
OASs				
Average CAPCs (2)	**8.6**	0.5	**2.4**	**11.5**
	(0.00)	(0.38)	(0.05)	(0.00)
Positive CAPCs (3)	**81.0**	61.9	52.4	**81.0**
	(0.00)	(0.19)	(0.50)	(0.00)
Stock prices				
Average CAPCs (2)	-3.1	-0.6	0.5	-3.3
	(0.20)	(0.30)	(0.41)	(0.21)
Negative CAPCs (3)	52.4	57.1	47.6	61.9
	(0.50)	(0.33)	(0.67)	(0.19)

(1) P-values are shown in parentheses. Numbers in bold type are significant at the 5 per cent level. - (2) CDS spreads and OASs changes are in basis points, stock prices changes are in percentage points. P-values are calculated using bootstrap techniques. - (3) Percentages. P-values are calculated under the null hypothesis that positive and negative CAPCs occur with the same probability.

Figure 2.a

Average cumulative abnormal price changes in case of positive rating events

(basis points for CDS spreads and OASs, percentage points for stock prices)

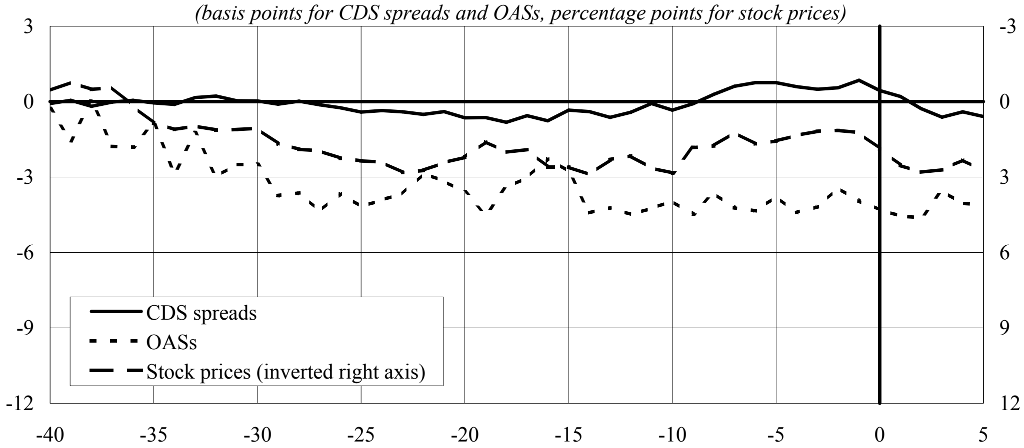

Figure 2.b

Average cumulative abnormal price changes in case of reviews for upgrade

(basis points for CDS spreads and OASs, percentage points for stock prices)

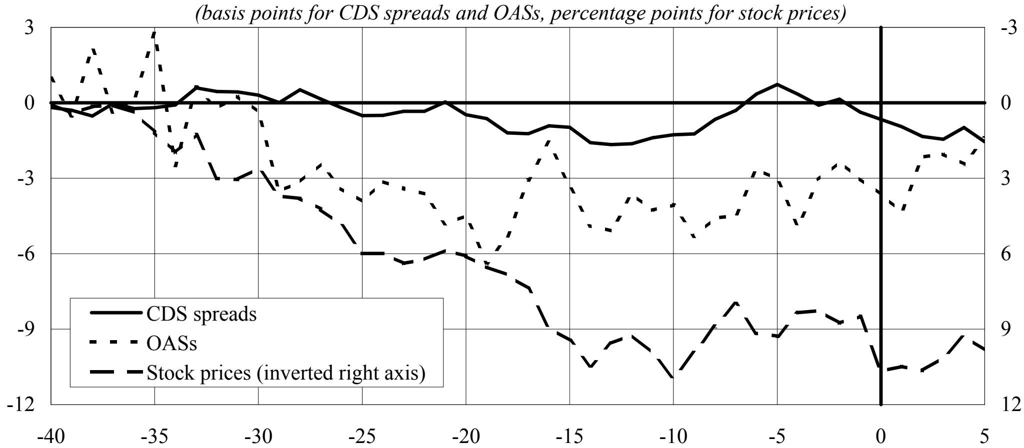

Figure 2.c

Average cumulative abnormal price changes in case of upgrades

(basis points for CDS spreads and OASs, percentage points for stock prices)

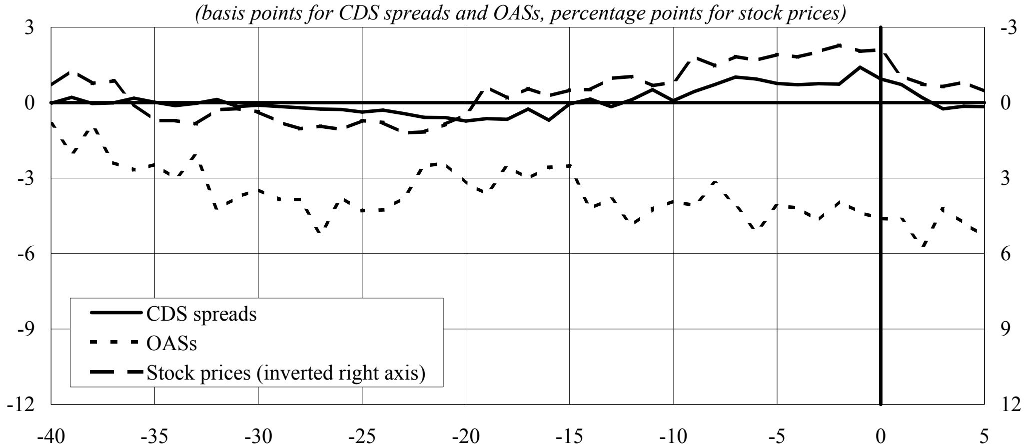

Table 4

ABNORMAL PRICE CHANGES CONDITIONAL ON ...				
	Time windows			
	[-40,-2]	[-1,1]	[2,5]	[-40,5]
... POSITIVE RATING EVENTS (1)				
CDS spreads				
Average CAPCs (2)	0.5	**-0.3**	**-0.8**	-0.6
	(0.23)	(0.04)	(0.00)	(0.23)
Negative CAPCs (3)	42.2	62.2	**71.1**	60.0
	(0.88)	(0.07)	(0.00)	(0.12)
OASs				
Average CAPCs (2)	**-3.4**	**-1.1**	0.4	**-4.1**
	(0.03)	(0.05)	(0.31)	(0.01)
Negative CAPCs (3)	**66.7**	**64.4**	53.3	**71.1**
	(0.02)	(0.04)	(0.38)	(0.00)
Stock prices				
Average CAPCs (2)	1.1	**1.4**	0.2	**2.7**
	(0.26)	(0.00)	(0.25)	(0.04)
Positive CAPCs (3)	51.1	48.9	57.8	57.8
	(0.50)	(0.62)	(0.19)	(0.19)
... REVIEWS FOR UPGRADE (1)				
CDS spreads				
Average CAPCs (2)	0.1	**-1.1**	**-0.6**	-1.6
	(0.46)	(0.00)	(0.00)	(0.27)
Negative CAPCs (3)	42.9	71.4	**92.9**	71.4
	(0.79)	(0.09)	(0.00)	(0.09)
OASs				
Average CAPCs (2)	-2.3	**-2.0**	**2.9**	-1.4
	(0.20)	(0.05)	(0.02)	(0.33)
Negative CAPCs (3)	57.1	64.3	42.9	64.3
	(0.40)	(0.21)	(0.79)	(0.21)
Stock prices				
Average CAPCs (2)	**8.7**	**1.7**	-0.6	**9.7**
	(0.01)	(0.04)	(0.12)	(0.01)
Positive CAPCs (3)	71.4	42.9	42.9	71.4
	(0.09)	(0.79)	(0.79)	(0.09)
... UPGRADES (1)				
CDS spreads				
Average CAPCs (2)	0.7	-0.0	**-0.9**	-0.2
	(0.08)	(0.49)	(0.00)	(0.39)
Negative CAPCs (3)	41.9	58.1	61.3	54.8
	(0.86)	(0.24)	(0.14)	(0.36)
OASs				
Average CAPCs (2)	**-4.0**	-0.7	-0.7	**-5.3**
	(0.05)	(0.18)	(0.30)	(0.01)
Negative CAPCs (3)	**71.0**	64.5	58.1	**74.2**
	(0.01)	(0.07)	(0.24)	(0.01)
Stock prices				
Average CAPCs (2)	**-2.3**	**1.2**	**0.6**	-0.5
	(0.05)	(0.01)	(0.05)	(0.34)
Positive CAPCs (3)	41.9	51.6	64.5	51.6
	(0.86)	(0.50)	(0.07)	(0.50)

(1) P-values are shown in parentheses. Numbers in bold type are significant at the 5 per cent level. - (2) CDS spreads and OASs changes are in basis points, stock prices changes are in percentage points. P-values are calculated using bootstrap techniques. - (3) Percentages. P-values are calculated under the null hypothesis that positive and negative CAPCs occur with the same probability.

Figure 3.a

Abnormal cumulative changes of stock prices for various rating agencies in case of negative rating events

(percentage points; inverted ordinate axis)

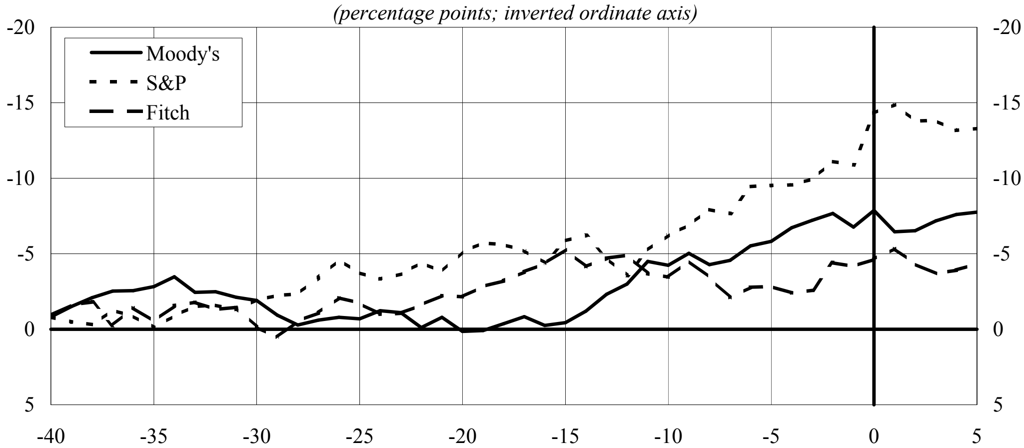

Figure 3.b

Abnormal cumulative changes of CDS spreads for various rating agencies in case of negative rating events

(basis points)

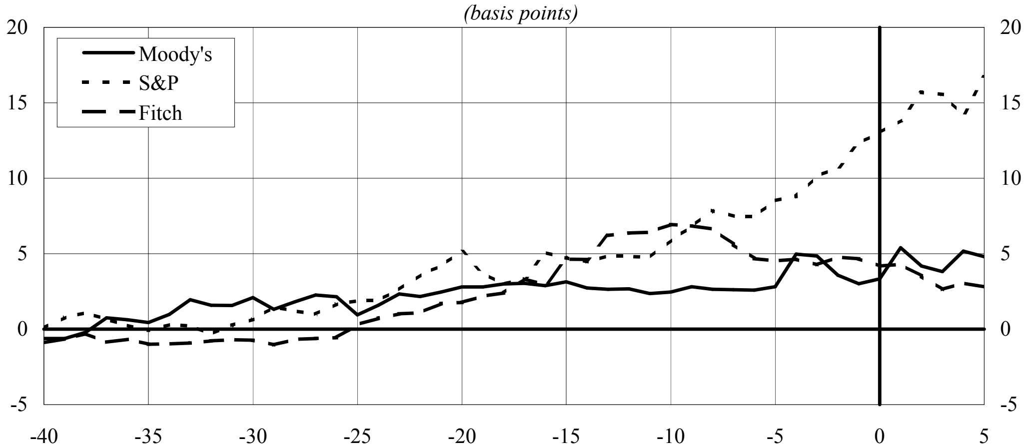

Figure 3.c

Abnormal cumulative changes of OASs for various rating agencies in case of negative rating events

(basis points)

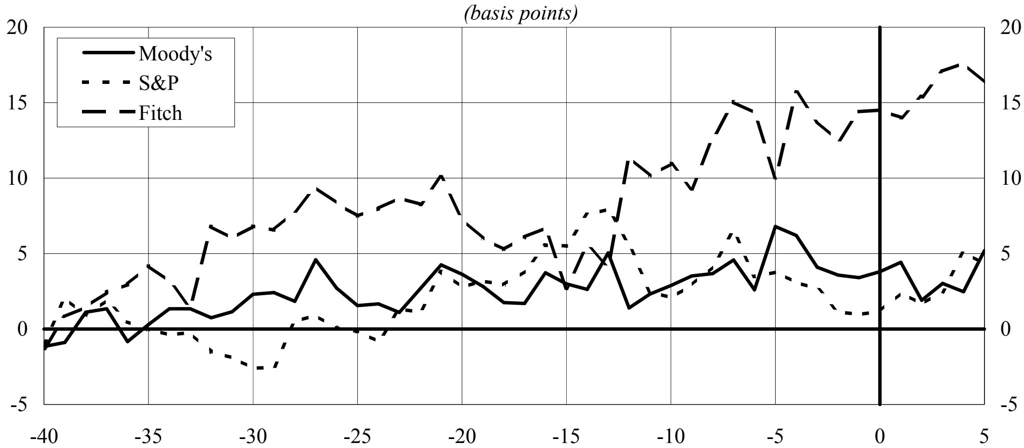

Figure 4.a

Abnormal cumulative changes of stock prices for various rating agencies in case of positive rating events

(percentage points; inverted ordinate axis)

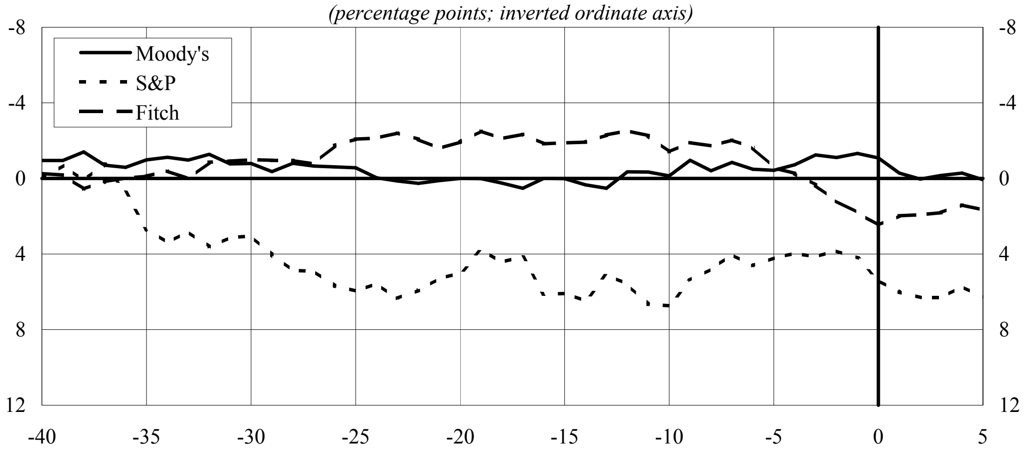

Figure 4.b

Abnormal cumulative changes of CDS spreads for various rating agencies in case of positive rating events

(basis points)

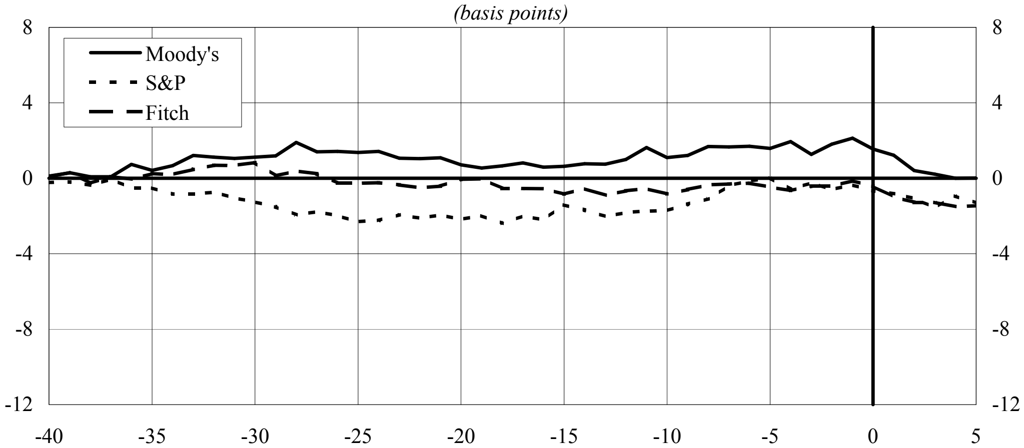

Figure 4.c

Abnormal cumulative changes of OASs for various rating agencies in case of positive rating events

(basis points)

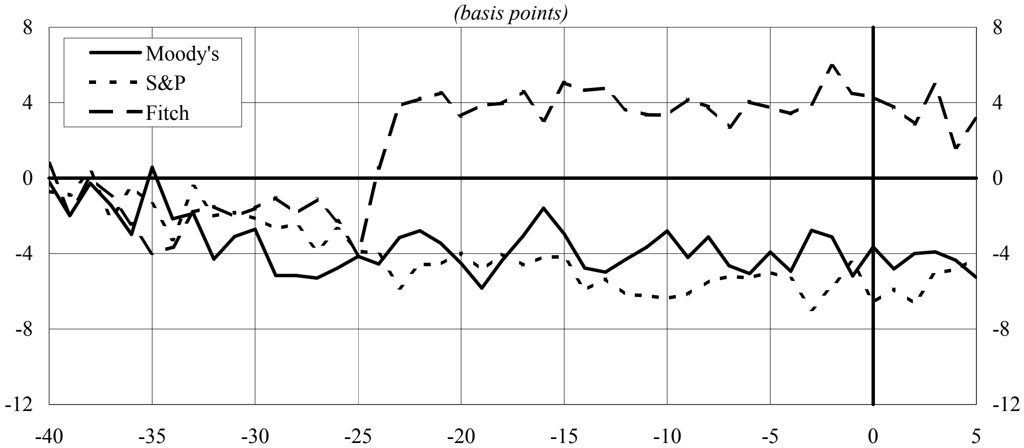

Table 5.a

PREDICTING NEGATIVE RATING EVENTS: I (1)			
Case [-40,40]	**CDS spreads**	**OASs**	**Stock prices**
Probit model (2)			
α	-1.7709	-1.7128	-1.7466
	(0.00)	(0.00)	(0.00)
β	0.0424	0.0080	-0.0245
	(0.00)	(0.00)	(0.00)
McFadden pseudo-R^2	0.0659	0.0070	0.0348
Estrella pseudo-R^2	0.0242	0.0025	0.0127
Percentiles (3)			
q=50	69.50-74.33	58.26-63.43	59.47-64.55
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=75	53.60-58.58	37.43-42.56	38.54-43.92
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=90	33.36-38.15	18.34-22.62	27.10-31.97
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=99	10.59-13.42	2.33-4.16	5.39-7.76
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
Case [-120,40]	**CDS spreads**	**OASs**	**Stock prices**
Probit model (2)			
α	-1.9679	-1.9206	-1.9317
	(0.00)	(0.00)	(0.00)
β	0.0275	0.0021	-0.0110
	(0.00)	(0.01)	(0.00)
McFadden pseudo-R^2	0.0419	0.0010	0.0135
Estrella pseudo-R^2	0.0107	0.0002	0.0034
Percentiles (3)			
q=50	53.65-61.49	49.92-57.88	48.04-55.77
	(0.05-0.00)	(0.53-0.00)	(0.84-0.00)
q=75	36.58-44.65	30.66-38.54	28.48-35.61
	(0.00-0.00)	(0.00-0.00)	(0.03-0.00)
q=90	26.55-33.57	10.88-16.22	14.29-20.29
	(0.00-0.00)	(0.25-0.00)	(0.00-0.00)
q=99	6.85-10.92	0.00-0.00	4.93-8.77
	(0.00-0.00)	(1.00-1.00)	(0.00-0.00)

(1) P-values are shown in parentheses. - (2) Parameters of the model $P = \Phi(\alpha + \beta x)$, where x is the cumulative abnormal price change (CAPC) in an interval of 40 or 120 days, P is the probability that a negative rating event occurs in the following 40 days and Φ is the standard normal CDF. - (3) 95-percent confidence intervals of the percentage of negative rating events occurred during the 40 days following the time intervals, of length 40 or 120 days, during which the CAPCs have been greater than the q percentile (or smaller than the $(100 - q)$ percentile for stocks). P-values are calculated under the null hyphotesis that a negative rating event occurs with probability $(100 - q)/100$.

Table 5.b

PREDICTING NEGATIVE RATING EVENTS: II (1)			
Case [-40,40]	**Model A**	**Model B**	**Model C**
Probit model (2)			
α	-1.7879	-1.7079	-1.7609
	(0.00)	(0.00)	(0.00)
β_{CDS}	0.0333		0.0203
	(0.00)		(0.00)
β_{OAS}	0.0077		0.0119
	(0.00)		(0.00)
β_{SP}	-0.0166		-0.0106
	(0.00)		(0.00)
β_{PE}		-0.0501	0.0237
		(0.15)	(0.32)
β_{NE}		1.3117	1.0883
		(0.00)	(0.00)
McFadden pseudo-R^2	0.0806	0.1128	0.1741
Estrella pseudo-R^2	0.0298	0.0550	0.0865
Case [-120,40]	**Model A**	**Model B**	**Model C**
Probit model (2)			
α	-1.9674	-1.9181	-1.9553
	(0.00)	(0.00)	(0.00)
β_{CDS}	0.0269		0.0175
	(0.00)		(0.00)
β_{OAS}	-0.0006		0.0021
	(0.28)		(0.00)
β_{SP}	-0.0012		-0.0054
	(0.24)		(0.00)
β_{PE}		-0.0709	0.0361
		(0.04)	(0.19)
β_{NE}		1.2032	0.9294
		(0.00)	(0.00)
McFadden pseudo-R^2	0.0421	0.1545	0.2246
Estrella pseudo-R^2	0.0107	0.0701	0.1043

(1) P-values are shown in parentheses. - (2) Parameters of the model $P = \Phi(\alpha + \beta'\mathbf{x})$, where $\mathbf{x}$ is a vector of cumulative abnormal price changes and two dummy variables for positive and negative events, in an interval of 40 or 120 days, P is the probability that a negative rating event occurs in the following 40 days and Φ is the standard normal CDF.

Table 5.c

PREDICTING NEGATIVE RATING EVENTS: III (1)						
Case [-40,40]	**CDS spreads**	**OASs**	**Stock prices**	**Model A**	**Model B**	**Model C**
Correct positive predictions (2)	24.82	12.14	21.75	26.32	34.61	37.62
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Incorrect negative predictions (3)	3.45	4.03	3.59	3.38	4.43	4.23
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Percentage of negative events (4)	4.38	4.38	4.38	4.38	6.35	6.35
Case [-120,40]	**CDS spreads**	**OASs**	**Stock prices**	**Model A**	**Model B**	**Model C**
Correct positive predictions (2)	11.39	0.85	8.16	11.73	23.90	42.72
	(0.00)	(1.00)	(0.00)	(0.00)	(0.00)	(0.00)
Incorrect negative predictions (3)	2.49	2.79	2.58	2.48	4.54	3.41
	(0.00)	(1.00)	(0.00)	(0.00)	(0.00)	(0.00)
Percentage of negative events (4)	2.73	2.73	2.73	2.73	5.63	5.63

(1) A negative event is assumed to be predicted if the probit model estimated a probability of occurrence greater than the threshold that makes the number of predicted events equal to the number of realized events. - (2) Percentage of correct predictions of negative events. - (3) Percentage of incorrect predictions that there would be no negative events. - (4) Percentage of negative events out of the total number of observations.

Table 6.a

PREDICTING POSITIVE RATING EVENTS: I (1)			
Case [-40,40]	**CDS spreads**	**OASs**	**Stock prices**
Probit model (2)			
α	-1.5756	-1.5727	-1.5839
	(0.00)	(0.00)	(0.00)
β	-0.0103	-0.0028	0.0117
	(0.00)	(0.00)	(0.00)
McFadden pseudo-R^2	0.0032	0.0008	0.0094
Estrella pseudo-R^2	0.0014	0.0004	0.0042
Percentiles (3)			
q=50	49.15-53.69	53.70-58.21	41.92-46.51
	(0.77-0.00)	(0.00-0.00)	(1.00-1.00)
q=75	29.27-33.61	29.25-33.61	26.71-30.83
	(0.00-0.00)	(0.00-0.00)	(0.06-0.00)
q=90	14.25-17.49	14.03-17.30	17.32-21.01
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=99	2.07-3.54	0.06-0.52	5.64-7.70
	(0.00-0.00)	(1.00-0.99)	(0.00-0.00)
Case [-120,40]	**CDS spreads**	**OASs**	**Stock prices**
Probit model (2)			
α	-1.7958	-1.7788	-1.8126
	(0.00)	(0.00)	(0.00)
β	-0.0175	-0.0074	0.0143
	(0.00)	(0.00)	(0.00)
McFadden pseudo-R^2	0.0290	0.0142	0.0494
Estrella pseudo-R^2	0.0099	0.0048	0.0169
Percentiles (3)			
q=50	71.02-76.75	67.61-73.48	56.49-62.59
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=75	47.40-53.94	42.84-49.06	34.76-40.85
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=90	23.14-28.79	21.96-27.66	24.14-29.77
	(0.00-0.00)	(0.00-0.00)	(0.00-0.00)
q=99	1.55-4.80	0.00-0.60	7.44-11.29
	(0.08-0.00)	(1.00-0.92)	(0.00-0.00)

(1) P-values are shown in parentheses. - (2) Parameters of the model $P = \Phi(\alpha + \beta x)$, where x is the cumulative abnormal price change (CAPC) in an interval of 40 or 120 days, P is the probability that a positive rating event occurs in the following 40 days and Φ is the standard normal CDF. - (3) 95-per-cent confidence intervals of the percentage of positive rating events occurred during the 40 days following the time intervals, of length 40 or 120 days, during which the CAPCs have been smaller than the $(100 - q)$ percentile (or greater than the q percentile for stocks). P-values are calculated under the null hyphotesis that a positive rating event occurs with probability $(100 - q)/100$.

Table 6.b

PREDICTING POSITIVE RATING EVENTS: II (1)			
Case [-40,40]	**Model A**	**Model B**	**Model C**
Probit model (2)			
α	-1.5855	-1.5701	-1.5865
	(0.00)	(0.00)	(0.00)
β_{CDS}	-0.0017		-0.0027
	(0.19)		(0.07)
β_{OAS}	-0.0021		-0.0019
	(0.01)		(0.01)
β_{SP}	0.0109		0.0112
	(0.00)		(0.00)
β_{PE}		0.9998	0.9988
		(0.00)	(0.00)
β_{NE}		-1.9940	-2.0183
		(0.00)	(0.00)
McFadden pseudo-R^2	0.0100	0.0737	0.0833
Estrella pseudo-R^2	0.0044	0.0373	0.0423
Case [-120,40]	**Model A**	**Model B**	**Model C**
Probit model (2)			
α	-1.8222	-1.7536	-1.7946
	(0.00)	(0.00)	(0.00)
β_{CDS}	-0.0042		-0.0020
	(0.00)		(0.06)
β_{OAS}	-0.0035		-0.0026
	(0.00)		(0.00)
β_{SP}	0.0116		0.0075
	(0.00)		(0.00)
β_{PE}		1.2138	1.1786
		(0.00)	(0.00)
β_{NE}		-0.3886	-0.2917
		(0.00)	(0.00)
McFadden pseudo-R^2	0.0537	0.1603	0.1779
Estrella pseudo-R^2	0.0184	0.0874	0.0975

(1) P-values are shown in parentheses. - (2) Parameters of the model $P = \Phi(\alpha + \beta'\mathbf{x})$, where $\mathbf{x}$ is a vector of cumulative abnormal price changes and two dummy variables for positive and negative events, in an interval of 40 or 120 days, P is the probability that a positive rating event occurs in the following 40 days and Φ is the standard normal CDF.

Table 6.c

PREDICTING POSITIVE RATING EVENTS: III (1)						
Case [-40,40]	**CDS spreads**	**OASs**	**Stock prices**	**Model A**	**Model B**	**Model C**
Correct positive predictions (2)	11.03	9.91	15.07	14.00	25.82	30.08
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Incorrect negative predictions (3)	5.50	5.57	5.25	5.32	5.41	5.10
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Percentage of positive events (4)	5.82	5.82	5.82	5.82	6.80	6.80
Case [-120,40]	**CDS spreads**	**OASs**	**Stock prices**	**Model A**	**Model B**	**Model C**
Correct positive predictions (2)	11.47	7.42	16.92	15.18	29.20	28.89
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Incorrect negative predictions (3)	3.70	3.87	3.47	3.54	5.59	5.62
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Percentage of positive events (4)	4.01	4.01	4.01	4.01	7.32	7.32

(1) A positive event is assumed to be predicted if the probit model estimated a probability of occurrence greater than the threshold that makes the number of predicted events equal to the number of realized events. - (2) Percentage of correct predictions of positive events. - (3) Percentage of incorrect predictions that there would be no positive events. - (4) Percentage of positive events out of the total number of observations.

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