Credit Rating Agencies’ Function on Bond Markets: Price Stability Vs Information Transmission

Jean-Noël ORY* and Philippe RAIMBOURG**

November 2008

* Université de Metz, France
** Université Paris 1 Panthéon-Sorbonne and ESCP-EAP, France
Corresponding author:
Pr. Ph. Raimbourg
Université Paris 1 Panthéon-Sorbonne
17, rue de la Sorbonne
75005 Paris France
Tel 00 33 1 40 46 27 62
E-mail: philippe.raimbourg@univ-paris1.fr

Credit Rating Agencies' Function on Bond Markets: Price Stability Vs Information Transmission

The relation that may exist between rating announcements and bond spreads is unclear. Many event studies have been dedicated to that problem. Norden and Weber (2004 – p. 2816-2817) give a synthesis of these studies. It appears that upgradings have little effect on bond prices, while downgradings may correspond to a change in bond spreads; but, in many cases, the change in bond spreads is prior to the downgrading. Such results cast doubts on the utility and the function of credit rating agencies on bond markets, which usually are supposed to transmit information about issuer default risk.

Theoretical analyses of the credit rating agencies' role are not numerous. Boot, Milbourn and Schmeits (2006) propose an interesting study about their function. They suggest their role is to provide a "focal point" to investors, which allows an equalization of investor information and a coordination of their expectations. Moreover, they put forward the idea that credit rating agencies play an important role in monitoring issuing firms through their credit watch procedure. That is the reason why they expect an inscription on a watch list to be the most informative action of an agency. However, this analysis is carried out without taking into account the moral hazard problem which is inherent to the rating activity, since the clients of the agencies are simultaneously the rated firms.

This paper aims to re-examine the function of credit rating agencies on bond markets. The first part of the paper presents the model while the second part is dedicated to an empirical study.

I. A Model of CRA Credibility and Announcement Strategy

We consider a financial market where several credit rating agencies operate. Two types of investors buy bonds: informed investors who are able to evaluate the risks of default by debt issuers, and uninformed investors who formulate their own expectations on the basis of the bond credit ratings and bond prices. If enough informed investors, trading a particular security, are present in the market, observed prices will reflect the effective default probability of issuer. Otherwise, it is hazardous to deduce default probability from the observation of bond prices.

Issuers are characterized by their level of default risk, which may be weak for "good issuers" or high for "bad issuers". "Good" or "bad" qualities are known to the issuers as well as to informed investors. In contrast, they are not known to uninformed investors, but may be discovered by the rating agency, at a cost covering their investigation.

Uninformed investors receive information from two sources:

- the credit-rating agency.
- the financial market, which may reflect the views of informed investors, provided bond markets are liquid;

The rating agency thus provides a service to uninformed investors:

- either the supply of information relating to the default risk of an issuer;
- or, if a spread modification can be observed, the confirmation (or refutation) that the observed spread modification matches with a change in the issuer default risk[1].

The investigation effort of the agency, as well as the reliability of its ratings, depends on the kind of issues the agency rates. We use the superscript A to indicate a homogenous set of issues. The reliability of the agency with respect to A issues, C^A, may reach a maximum $\overline{C}^A$: at this level of reliability, uninformed investors have absolute confidence in the evaluations of the agency. c^A_i is the *a priori* probability in period i that the rating agency reliability, according to uninformed investors, is equal to its maximum value $\overline{C}^A$, for A issues.

It is assumed that the agency can choose between three ways of communicating revisions in its ratings:

- by establishing a rating rapidly and disseminating it to the financial market before any other rating agency or informed investors (via bond prices) communicate their own views of risk to the market;
- by establishing a rating once price changes or any other rating agency announcement have occurred; in case of several ratings, the agency has to choose between to give the same rating as the first one, or another rating;

[1] This function of credit rating agencies is sometimes put forward by agencies which argue that if they are slow to react to changes in an issuer default risk that is because they wish to avoid frequent reversals of credit ratings (cf Löffler, 2002).

- by giving a warning to the financial markets prior to changing the rating (inclusion of the issue on a watchlist) and hence try to anticipate any change in spreads or any announcement by another agency.

Communicating a rating action to the market by the agency (the publication of an initial rating, a change in rating, the inclusion on a watchlist, or any other event) may lead to the following reactions:

- no change in spreads, if the event is judged as being uninformative or if the credibility of the agency is low;
- a change in spreads prior to the rating action communication, if the latter is late and expected by informed investors;
- a change in spreads after the communication, if it is rapid.

The strategy of the agency is twofold: the agency has to choose its investigation effort, and the way of communicating revisions in its ratings. The following will be studied:

- the ways credibility vis-à-vis uninformed investors is acquired;
- the utility of ratings for informed investors;
- the demand for ratings from the issuers;
- the agency's strategy.

A – The ways to acquire credibility vis-à-vis uninformed investors

1- The acquisition of credibility in the case of a communication of rating revisions prior to any other information transmission

In this case, the agency's function on bond markets is the transmission of information to uninformed investors.

Let $c^A{}_0$ be the agency's initial credibility, which is the probability of the agency to benefit from uninformed investors' absolute confidence. When this parameter is lower than one, uninformed investors estimate the probability of an exact valuation of the default risk to be equal to e^A.

Uninformed investors observe spreads on the financial market in order to deduce the default risk of the issuer. This observation is noisy: default probability cannot always be deduced from the observation of spreads. Let λ be the probability, according to uninformed investors, that the observed spreads allow a reliable deduction of default probability. Parameter λ is common knowledge of the whole financial market, but rating agencies and informed investors know perfectly well what the meaning of any spread modification is.

For uninformed investors, at time 0, the *a priori* probability that the rating is wrong is equal to the probability of an incorrect evaluation, given that the agency is not absolutely reliable, that is:

$$(1 - c^A_0)\,(1 - e^A)$$

And the probability that the credit rating is not wrong is:

$$1 - (1 - c^A_0)\,(1 - e^A)$$

In period 1, if the issuer has not yet defaulted, the credibility of the agency is:

$$c^A_1 = p\,(\,C^A = \overline{C}^A \mid \text{ the credit rating is not wrong }\,)$$

and using Bayes'relationship:

$$c^A_1 = c^A_0 \;/\; [1 - (1 - c^A_0)\,(1 - e^A)]$$

In period i, if the issuer has not yet defaulted, the credibility of the agency is:

(1) $$c^A_i = c^A_0 \;/\; [1 - (1 - c^A_0)\,(1 - (e^A)^{\,i})]$$

The credibility c^A_i evolves between an initial value of c^A_0 and a limit value equal to 1.

2 – The acquisition of credibility in the case of a communication of a rating revision after a change in the spreads

In this case, the function of the agency is not to provide the markets with information, but to certify, for uninformed investors, that movements in spreads are significant and reflect changes in default risks. Rating agencies help uninformed investors to select, among all spread changes, the ones which are significant: the volatility of spreads, in this case, contrasts with the constancy of the ratings.

When a spread change is significant, we assume that the agency rating revision is consistent with this spread change.

According to uninformed investors, a spread change is significant with a probability λ. In such a case, the credit rating is consistent with the spread change and is not wrong. When the spread change is not significant (which occurs with a probability $(1 - \lambda)$), the probability that the rating is wrong is equal to the probability of an incorrect evaluation, given that the agency is not absolutely reliable. Hence, the probability, according to uninformed investors, that the rating is wrong:

$$(1 - \lambda)\,(1 - c^A_0)\,(1 - e^A)$$

and the probability that the rating is not wrong:

$$1 - (1 - \lambda)\,(1 - c^A_0)\,(1 - e^A)$$

In period j, if the issuer has not yet defaulted, the credibility of the agency is:

(2) $c^A_j = c^A_0 \ / \ \{1 - (1 - c^A_0)[\ 1 - (-1)^j\ ((1 - e^A)\ (1-\lambda) - 1)^j\ ]\ \}$

The credibility c^A_j evolves between c^A_0 and 1.

3 – The acquisition of credibility in the case of an inclusion on a watchlist

The agency announces that the issuer is included on a watchlist with a positive or a negative outlook. This case is not very different from the previous ones. However, given that an inclusion on a watchlist is less informative than a change in rating, it may be considered that when confidence is not absolute, investors will expect the probability of an exact appreciation to be equal to f^A (with $f^A > e^A$). We keep unchanged relations (1) and (2), but we substitute parameter e^A by parameter f^A.

B – The utility of ratings for informed investors

It is assumed that informed investors have the capacity to evaluate issuers' risks equally to that of the rating agency. The communication of a rating does not therefore provide them with any real information. However, the revision of ratings may be of some use to such investors: a new rating may indeed provide profitable arbitrage opportunities with respect to uninformed investors.

This may be the case when a wrong evaluation allows informed investors to profit from selling or buying decisions by uninformed investors. Such situations, however, are not very profitable, as spreads end up by revealing the agency's error, its reputation collapses, which in turn prevents such scenarios from repeating themselves.

Indeed, arbitrage profits can only be made repeatedly following late announcements of rating changes, without any inclusion on a watchlist, under the following circumstances:

- spreads reflect the issuer default probability, and as a result, the rating change by the agency is accurate;
- the credibility of the agency vis a vis uninformed investors is sufficient for them to follow the agency's recommendations.

The probability of a late announcement of a rating change being at the origin of arbitrage gains for informed investors in period p is:

$$(\lambda)\ c^A_p$$

assuming that uninformed investors will follow the agency's recommendations in a *prorata* manner to its credibility c^A_p in period p.[2]

C– The demand for rating by issuers

The market for credit ratings is characterized by the specificity that the beneficiaries of services provided by the agencies are not their clients: the agencies advise investors, even though their clients are the issuers. The services provided to issuers are thus indirect and pass *via* investors. We examine first the case of uninformed investors, and then that of informed investors.

1 – Uninformed investors and the demand for ratings

The rating agency's main objective is to help uninformed investors to buy or sell securities. Doing so may benefit to the issuer, in as much as it reduces uncertainty, raises the demand for securities and allows the issuer to benefit from better issue conditions. The probability for the issuer of realizing these benefits is greater, the more important the agency's role in shaping the expectations of uninformed investors. This agency's role depends, in turn, on the probability, according to uninformed investors, that the agency's ratings are accurate. The probability of the accuracy of the rating in period p may be written as:

$$c^A_p + (1 - c^A_p)\, e^A$$

It is assumed that the probability of an issuer obtaining a benefit is:

$$\alpha\, [c^A_p + (1 - c^A_p)\, e^A]$$

where α is an increasing function with respect to c^A_p and e^A, with values ranging from 0 to 1.

However, the issuer does not only expect the rating to be accurate and the benefit associated with this event. He/she also expects that the rating may be false. This makes it necessary to distinguish between issuers with a low risk of default (good issuers) and those with a high risk (bad issuers). In the first situation, the error by the agency is unfavorable to the issuer, who receives a rating which overestimates its default risk. In contrast, agency errors are favorable to high-risk issuers.

Let:

[2] It is possible to use a more general formulation $[(\lambda)\, F(c^A_p)]$ in which F is a monotonous, increasing function with values between 0 and 1.

T_G : be the gain accruing to an issuer with a low default risk (good), when the agency rating is accurate ("true"). T_G is calculated as a difference between gains resulting from an issue with an accurate rating and gains resulting from an issue without any rating; T_G is discounted.

W_G : the loss recorded by an issuer with a low default risk (good), when a wrong rating is set by the agency. W_G is calculated as a difference and discounted.

Symmetrically, the variables T_B and W_B represent gains accruing to the issuer with a high risk of default (bad), when this risk is appreciated accurately or wrongly. It is assumed that $W_B > T_B$.

The probability of an incorrect rating being established is:

$$(1 - c^A{}_p)\,(1 - e^A)$$

The expected profit (gross of the cost of acquiring the rating) resulting from the establishment of a rating, for a low-risk issuer (i.e. good issuer), is:

(3) $$E(P_G{}^{NI,\,A}) = \alpha\,[c^A{}_p + (1 - c^A{}_p)\,e^A]T_G - (1 - c^A{}_p)\,(1 - e^A)\,W_G$$

Similarly, the expected profit for a risky issuer (bad issuer) is:

(4) $$E(P_B{}^{NI,\,A}) = \alpha\,[c^A{}_p + (1 - c^A{}_p)\,e^A]T_B + (1 - c^A{}_p)\,(1 - e^A)\,W_B$$

2 – Informed investors and the demand for ratings

A rating agency may provide some utility to informed investors, by allowing them to generate arbitrage profits at the expense of uninformed investors. This can occur in case of rating revisions, provided that these revisions take place after a change in the spreads. Hence, informed investors may wish to buy, more specifically, rated securities. Such a rise in demand may encourage an issuer to ask an agency to rate its issues.

The probability that a late announcement of a rating revision may lead to arbitrage profits for informed investors depends on λ and $c^A{}_p$. It is assumed that the probability of an issuer obtaining a benefit is:

$$\beta\,[(\lambda)\;\; c^A{}_p]$$

where β is an increasing function with respect to λ and $c^A{}_p$, with values ranging from 0 to 1.

Let G be the gross gain accruing to the issuer from the specific demand of securities coming from informed investors (it is assumed that G is identical for issuers of low risk and high risk). The expected profit (gross of the acquisition of the rating) recorded by the issuer from the specific demand of informed investors may be written as:

(5) $$E(P^{I,\,A}) = \beta\,[(\lambda)\;\; c^A{}_p]\,G$$

3 – The behavior of low-risk issuers (good issuers)

Taking into account the two types of investors allows the net profit accruing to the low-risk issuer to be estimated:

(6) $E(P^A_G) = \alpha\,[c^A_p + (1 - c^A_p)\, e^A]T_G - (1 - c^A_p)\,(1 - e^A)\, W_G + \beta\,[(\lambda)\ c^A_p]\, G - Z$

where Z is the acquisition price of the rating throughout the whole life-cycle of the issue.

The first derivatives of the expected profit $E(P^A_G)$ with respect to c^A_p and to e^A are positive:

$$\partial E(P^A_G) / \partial c^A_p > 0 \quad \text{and} \quad \partial E(P^A_G) / \partial e^A > 0$$

The low-risk issuer therefore hopes that the agency's credibility increases and that the risk error (1- e^A) decreases.

For a given reliability e^A, the expected profit function makes it possible to establish a credibility threshold $c^{A\,*}_t$, reached at date t*, beyond which the low-risk issuer has an interest in demanding a credit rating. If the credibility of the agency increases continuously, the behavior of high-quality issuers will go through two stages. To begin with, the issuers will not ask for a rating, but beyond this threshold $c^{A\,*}_t$ they will become clients of the rating agency.

4 – The behavior of high-risk issuers (bad issuers)

The net profit of a high-risk issuer is:

(7) $E(P^A_B) = \alpha\,[c^A_p + (1 - c^A_p)\, e^A]T_B + (1 - c^A_p)\,(1 - e^A)\, W_B + \beta\,[(\lambda)\ c^A_p]\, G - Z$

The first derivatives of the expected profit $E(P^A_B)$ with respect to c^A_p and e^A are:

(8) $\partial E(P^A_B) / \partial c^A_p = T_B[\partial \alpha / \partial c^A_p] - (1 - e^A)\, W_B + G[\partial \beta / \partial c^A_p]$

(9) $\partial E(P^A_B) / \partial e^A = T_B[\partial \alpha / \partial e^A] - (1 - c^A_p)\, W_B$

The second term of the right hand member of each of these equations is negative, while the other terms are positive. These derivatives are positive or negative, depending on the respective values of the different parameters of these two equations (notably, T_B, G and W_B). A negative sign may lead to adverse selection phenomena.

Thus, for a given reliability e^A, if the derivative of the expected profit function $E(P^A_B)$ with respect to c^A_p is negative, then the issuer's interest in having a rating decreases as the credibility of the agency increases. There exists a credibility threshold beyond which the issuer has no interest to be rated. When the credibility of the agency is low, it attracts bad risks and conversely when its credibility is high.

Similarly, for a given credibility level c^A_p, if the derivative of the expected profit function E(P^A_B) with respect to e^A is negative, then the issuer has an interest in the reliability e^A being as low as possible, in other words that the agency implements investigation strategies which cost little and which are not very reliable.

These adverse selection phenomena explain why an oligopolistic organization of the rating sector, with an entry control, seems unavoidable, as long as the clients of the rating agencies are the issuers. High risk issuers want their issues to benefit from a nice rating. In a free-market economy, any company may begin a new rating activity, and a high risk issuer will easily find an agency to give its issues a nice rating: the inflation of the raters is the inflation of the ratings. As a result, the credibility not only of the agency, but also of the whole rating sector will decrease and the rating activity may vanish.

D– The agency's strategy concerning the investigation effort

The particularity of a rating agency is to sell to an issuer its credibility vis-à-vis investors who are interested in buying its securities. Thus, the agency's existence depends on the reputation it has with investors. This new, immaterial asset is developing over time: investors judge the credibility of an agency by comparing the agency's evaluations with those of the market, and with observed defaults. In order to make out accurate ratings, an agency has to commit investigation efforts. Two extreme cases are envisaged:

- the agency commits insufficient resources to evaluate precisely the default risk of issuers in subset A: thus, the investors expect its probability of error to be equal to $(1-e^A)$. Let K1 equal these costs. It is assumed that in case the agency is wrong in appreciating default risk, its credibility with investors fall to an expected level equal to E(c);
- in contrast, the agency commits significant resources, at the K2 level, which allows default risks of A type issues to be identified, without observing the spreads attributed by informed investors.

Costs K1 and K2 largely reflect structural costs and are incurred independently of the level of earnings, especially if the latter are zero. Using the most reliable strategy in a given period has the following advantages:

a) It raises the agency's credibility in the eyes of investors. This credibility responds to equations (1) and (2) above. If the agency adopts the most reliable strategy incurring costs K2, then the rise in credibility relative to issuers in subset A is:

$$\Delta c^A / \Delta t$$

If the agency adopts the strategy of lower reliability, then the rise in credibility is only:

$$e^A \, \Delta c^A / \Delta t$$

b) It may raise the expected profits of issuers and hence their demand for ratings. The gains which low-risk issuers (good) and high-risk issuers (bad) can expect are given by equations (6) and (7). The first derivatives of the expected profit $E(P^A_G)$ and $E(P^A_B)$ with respect to c^A_p are:

$$\partial E(P^A_G) / \partial c^A = T_G[\partial \alpha / \partial c^A] + (1 - e^A) W_G + G[\partial \beta / \partial c^A]$$

$$\partial E(P^A_B) / \partial c^A = T_B[\partial \alpha / \partial c^A] - (1 - e^A) W_B + G[\partial \beta / \partial c^A]$$

The first equation is always positive, while the second one is positive or negative according to the values of e^A and W_B. Two situations arise: the derivative is positive for high-risk issuers, or it is negative, but high-risk issuers are very few: the expected profit of all issuers, and hence their demand for rating, rises with the credibility of the agency. The derivative is negative for high-risk issuers and the high-risk issuers are more numerous than the low-risk issuers: in this situation, demand from all issuers decreases with the credibility of the agency.

c) It allows the agency to surely receive the gains resulting from the sale of the ratings. Let z be the agency periodical gains stemming from the sale of a rating, and N^A the number of issuers of type A; the differential profit resulting from the adoption of the reliable strategy, compared to the less reliable strategy, is for each period:

$$N^A [(z - K2) - e^A (z - K1)]$$

Three situations may be identified.

1) On markets where issuers' demand decreases with agency credibility.

In this specific case, demand from all issuers falls with the credibility of the agency; this may occur, for example, for a regional agency working on an emerging market which is particularly risky, or for a specialized agency operating in a risky segment of the securities market. Then, the agency has an interest in adopting a low-reliability strategy, at cost K1, in order not to make the issuers run away. Investors will expect the agency to adopt this low-reliability strategy, so that the development of the agency is likely to be strongly limited. This result is similar to the one characterizing a free-market organization of the rating sector.

2) On markets where issuers' demand increases with agency credibility and where the probability of an error (in case of reduced investigation efforts) is high.

If the issuer demand for ratings rises with the credibility of the agency, and:

(10) $$(z - K2)/ (z - K1) > e^A$$

that is the probability of an error $(1 - e^A)$ is high, then the agency has an interest in following a high-reliability strategy, and will have no interest in changing it.

3) On markets where issuer demand increases with agency credibility and where the probability of an error (in case of reduced investigation efforts) is low.

Lastly, if the issuers' demand for rating rises with the credibility of the agency and:

(11) $$(z - K2)/ (z - K1) < e^A$$

and if the development outlook of the agency is sufficiently high, then the agency has an initial interest in raising the demand by issuers and hence its credibility. The expected profit stemming from this rise in demand (variable N^A) could more than compensate the cost of this high reliability strategy which is:

$$(z - K2) - e^A (z - K1)$$

However, the credibility of the agency vis-à-vis investors evolves according to equations (1) or (2), both of which define increasing functions but at a diminishing rate. If we consider equation (1), the increase in credibility between period (i) and period (i+1) is:

(12) $$c^A_{i+1} / c^A_i = 1 / [1 - (1 - c^A_i) (1 - e^A)]$$

The credibility c^A_i increases over time with a decreasing rate. The same result stands for equation (2):

(13) $$c^A_{j+1} / c^A_j = 1 / [1 - (1 - c^A_i) (1 - e^A) (1- \lambda)]$$

The credibility c^A_j increases too with a decreasing rate. We notice that credibility c^A_j increases at a slower rate than c^A_i , that is when the agency communicates its rating revisions prior to any other information transmission.

When the agency adopts a strategy of reliability over successive periods, the increase in the resulting credibility falls over time and tends to 0. The increase in the issuer demand for ratings falls to 0 in the same way, and the agency may have an interest in adopting a strategy of lesser reliability. For this, constraint (11) must be satisfied for an infinite number of periods, that is, ρ being the agency discounting rate:

(14) $$(z - K2) \{\text{Lim } (t\to\infty) \sum_{i=1}^{t} (1+\rho)^{-i} \} < (z - K1) \{\text{Lim } (t\to\infty) \sum_{i=1}^{t} [(e_A)^i (1+\rho)^{-i}] \}$$

(15) $$(z - K2) / (z - K1) < (e_A \rho) / (1 + \rho - e_A)$$

Constraint (15) is stronger than constraint (11), and takes the latter's place[3].

Thus, when issuers' demand increases with agency credibility and when the probability of an error (in case of reduced investigation efforts) is low, and/or the cost discrepancy (K2-K1) is high, and/or the cost of capital ρ is high[4], then constraint (15) may be fulfilled and the agency has an interest in modifying its investigation strategy. At first, the agency chooses the most expensive and most reliable strategy, which allows a strong increase of its credibility and market share. However, once a high level of credibility has been reached, the investment in reputation is no longer profitable and the agency then switches to the lower cost strategy.

Situations (2) and (3), characterized by an issuer demand increasing with credibility, mostly concern developed countries, where low-risk issuers are numerous. Situation (2) is typical of a young rating agency in a developed country, which has poor database and track records to assess the default risk of an issuer; its probability of error is high if it does not investigate a lot. In contrast, situation (3) distinguishes mature rating agencies working in a developed country: even if their investigation efforts are low, their probability of error, when rating an issuer, is not very important because they already have rated similar companies. Thus, situations (2) and (3) are more or less typical of the life cycle of a rating agency working on a developed country. It should also be noted that the efforts made in investigation, K2 and K1 (along with the resulting reliability in valuations), must be situated in the oligopolistic context in which agencies operate. These variables may partly be interpreted as indicators of labor productivity by the teams of analysts working in the agency. Then, a change in strategies relative to the investigation effort may seem to reflect a fall in labor productivity, once the agency has succeeded in creating an oligopolistic barrier.

E– The agency's strategy for communicating rating revisions

Three distinct situations have been identified concerning the agency's investigation strategies. Each of these strategies is associated with a specific communication policy.

1) On markets where issuer demand decreases with agency credibility.

When the agency is operating on relatively risky markets (or market segments), it is likely that it will have an interest in adopting a low-reliability strategy, in terms of investigation efforts. Instead of seeking to raise its credibility vis-à-vis investors, the agency's objective is

[3] This constraint implicitly assumes that the expected level of credibility E(c), after an error has occurred, is 0. The constraint could be softened by assuming that E(c) > 0.

[4] We notice that the low reliability strategy is all the more attractive since the cost of capital ρ is high.

to leave it unchanged, while minimizing the risks of being contradicted by informed investors. The policy of communicating rating revisions belatedly to the markets (i.e. after spreads have been modified) is the only policy which will meet these objectives: the agency's credibility remains at its initial level and, by drawing on the evolution of spreads to support its evaluation of default risks, the agency greatly reduces its error probability.

2) On markets where issuer demand increases with agency credibility and where the probability of an error (in case of reduced investigation efforts) is high.

The second situation arises when the agency works with relatively low-risk issuers, and when the reliability e^A of its evaluations is quite low (in the case when the investigation effort is low). Then, the agency's interest is to implement substantial investigation efforts, leading to a high reliability of its evaluations, and to have these efforts be known, by adopting a policy of communicating rating revisions prior to changes in spreads. This will lead to the result of increasing the agency's credibility rapidly in the eyes of investors.

3) On markets where issuer demand increases with agency credibility and where the probability of an error (in case of reduced investigation efforts) is low.

Lastly, the third situation occurs when the agency works with relatively low-risk issuers and the reliability e^A of its evaluations is quite high. This case is interesting, because it leads to a change of behavior. To begin with, the agency may be expected to implement a high-reliability, high-cost strategy. Then, once its credibility is strong, the agency will cut its investigation efforts, thus exposing itself to non-negligible risks of error. During the first period, the communication policy which optimally copes with the agency's interests will be to communicate rating revisions to the market rapidly, thus greatly increasing the agency's credibility. During the second period, the agency has an interest in communicating rating revisions belatedly to the markets or in communicating the issuers included on the watchlist, prior to actually communicating rating revisions. This will allow the agency to increase its credibility (albeit at a slower rate), while protecting itself against the risks of an incorrect evaluation (first because $f^A > e^A$, and then because the communication of the rating revisions can occur after any spread change), which would wipe out all previous efforts made.

G– The credit rating agency's function on bond markets

Our conclusion is that credit rating agencies choose jointly a strategy relative to investigation efforts and communication policy. This strategy depends on the level of issuer default risk, as well as the experience of the agency on its market (or segment of market) and its cost structure. The function of the credit rating agency depends, in turn, on the strategy chosen.

On risky financial markets (or risky segments of financial markets), credit rating agencies choose to communicate their rating revisions lately, after any variation in bond spreads. Their investigation efforts are low and their ratings depend on the informed investor evaluations expressed through bond spreads. Their function on such markets is to confirm (or refute) that the changes in observed spreads do indeed correspond to changes in the issuer default risks, and are not due to market fluctuations.

On low-risk financial markets (or low-risk segments of financial markets), credit rating agency strategy depends on its experience on these markets (or segments of market) and its cost structure.

When an agency wants to enter a new market and begin a new activity, it chooses a high-reliability strategy and communicates its rating revisions prior to any spread variation, in order to increase its credibility vis-à-vis investors. The function of the credit rating agency is to transmit information to uninformed investors concerning the default risk of the issuers.

By contrast, when its position on these markets (or segments of markets) is well set up, and if the cost discrepancy (K2-K1) is high enough compared to the probability of rating accuracy (e^A), and if the cost of capital ρ (mainly, the shareholder profitability requirement) is high, the agency has no longer interest to choose a high reliability strategy which appears to be too costly. A low-reliability strategy seems more adequate, provided that the agency communicates its evaluations belatedly or first through watchlists (with a low probability of error) and then through a rating action (most of time after a change in the bond spreads). Once again, the function of the credit rating agency is actually not to transmit information, but rather to certify that the change in bond spreads do correspond to a change in the issuer default risk.

This certification function is important on bond markets, because, if the agency ratings are trustworthy, they will stop any interrogation stemming from the uninformed investors after a change in spreads (that is, they will stop any noise trading which may be profitable to the informed investors) and they will stabilize bond prices (at a new level if the change in spreads do correspond to a change in the issuer default risk). Downgradings (or upgradings) being more informative than an inscription on a watchlist, we expect the price stabilization effect of downgradings (or upgradings) to be more effective.

II. Determining the Informative Events and Dating the Reactions

A – Objective

The aim of this empirical analysis is to define the role of the rating agencies in the various markets (or market segments) in which they work. We will study the three major, international agencies: Moody's, Standard and Poor's and Fitch. Their function on the bond markets may be:

- to transmit information about the issuer default risk,
- to certify the evaluations provided by informed investors and thus to stabilize the bond prices and reduce the spread volatility.

Given that the three agencies carry out simultaneously their activity on different financial markets segments (different geographical areas, risky issuers or not, different types of debt), they play the two different roles listed above at one and the same time. Our analysis will be completed over time. We will examine each of the three agencies' rating revisions, event by event and issuer by issuer, the idea being to search for spread series showing structural changes. Several situations may exist:

- there is no reaction, which is synonymous with an event providing no information or with the agency having no credibility;
- spreads change prior to the rating action (upgrading, downgrading or watch list) ;
- spreads change after the rating action.

Taking into account simultaneously the issuer's characteristics and risk level will then make it possible to identify the agency's function on its market.

B – The data

The study covers Continental Europe and the United Kingdom, i.e. a region where rating was introduced recently (Continental Europe) and a region where it is older (the UK). Thirteen countries are examined: 12 members of the euro area (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain) and the UK.

The study begins with the launching of the euro on 1st January 1999, and ends seven years later, on 31st December 2005. Therefore, this period covers the Internet bubble and its collapse, which was a period rich in terms of "rating actions". The three main agencies (Fitch, Moody's and Standard and Poor's) in the two regions are taken into account. The main "rating actions" by these agencies are covered: upgradings, downgradings, inclusions on watchlists with a view to upgrading or downgrading.

The average spreads are calculated for all issuers concerned by rating actions. For corporate issuers, all straight senior unsecured bond issues with fixed income are included. For banking and finance issuers, a sample of such issues is taken into account; this sample is constituted in order to cover the yield to maturity curve of these issuers. For issues in euros, spreads are calculated using the German Government bond rates as the risk free rates (when the redemption date is not exactly identical for both issues, a linear interpolation is used). For issues in pounds sterling, the Datastream index of returns on UK Government Bond Series is used. Consequently, mean spread of each issuer is calculated.

Given the fact that the market price of default risk evolves over time, it is necessary to take the business cycle into account when analysing the impact of rating actions on the level of spreads. We chose to examine relative spreads, and not absolute spreads. Thus, for each issuer, the following difference is observed over time:

Issuer' spread – Merrill Lynch average spread of issues with the same rating

The Merrill Lynch index for spreads is established for the euro area and the sterling area. It covers corporate and banking issuers, according to the rating (it should be noted that no corporate/banking distinction is made for speculative grade issues). We consider the issuer rating before the rating action. Thus, if a corporate issuer in the euro area experiences a downgrading from *Aa* to *A*, for example, we examine the gap between the spread of the issuer and the average spread on corporate issues in the euro area, with a *Aa* rating during the whole period of the study. It is expected that the initial gap of the spread is close to zero, but then rises once investors have reacted to the downgrading.

C – The observation window

For each issuer, the gap in the spread is measured for a window of 121 trading days starting 60 days before the rating action and ending 60 days after.

Such a time span raises the problem of an eventual contamination by an event from some others. However, contamination can only result from other rating actions. Indeed, the rate of return on a fixed income bond is only likely to be affected by the following: a modification in the risk free rate; a change in the market price of the risk of default; a change in the risk of default of the bond. By calculating the spread of the bond as the gap between the rate of return on the bond and the rate on government bonds with similar characteristics, the first factor is neutralized. The second factor is neutralized by studying relative spreads instead of absolute spreads. Therefore, the only cause for the variation in the gaps in spreads is the magnitude of default risk in a given bond, and this level of risk is normally measured by the rating agencies.

So, there may be contamination in the study, due to the interference of two rating actions. In fact, this occurs quite frequently: first because an agency may include an issuer on a watchlist quite shortly before announcing an upgrading or a downgrading; then, since agencies' decisions are relatively consistent, so that a rating action from one of them is generally followed by similar actions from the other agencies.

We assume that there's a contamination between two rating actions when they are less than 70 trading days apart. When such contamination occurs, the reaction is attributed to the first event of the whole contaminated events, other events being considered as unsignificant.

D – Identifying informative and non-informative events

Our methodology implies to identify and separate the events that are neither followed nor preceded by any reaction from the investors (the non informative events), from the informative events.

To begin with, unit root tests are carried out on the relative spreads, following Dallocchio, Hubler, Raimbourg, Salvi (2006). An ADF test (Dickey-Fuller (1979 and 1981)) and a Phillips-Perron[5] test (1988) are used jointly. The ADF test relies on the following equation:

$$y_t = \alpha + \rho\, y_{t-1} + \beta t + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \quad (17)$$

[5] In contrast with ADF test, Phillips Perron (1988) test offers a non parametrical correction in order to deal with error heteroscedasticity.

where y_t is the series of the relative spreads, *(t)* a linear trend and *k* the number of lags included in the estimated equation, in order to deal with a possible autocorrelation, and to increase the test reliability (Dickey et Fuller, 1981 ; Saïd et Dickey, 1985). The number of lags *k* is chosen in order to minimize the Schwarz information criterion[6]. A hypothesis of non-stationarity (which corresponds to a unit root, i.e. $\rho = 1$) is tested against a hypothesis of stationarity (with ρ less than 1). A stationary series is characterized by the fact that it is not durably affected by an exogenous shock. A non stationary series reacts to an exogenous shock and has a permanent memory process.

A series comes out to be stationary when it does not have a unit root (considering the *p-value* at 5% level - Mc Kinnon, 1996). In this case, since the series does not react to the rating action, the rating event is considered as *non-informative*.

However, since Perron (1989), classical unit-root tests are known to bias results in favour of the unit root hypothesis. Indeed, when ADF or Perron (1988) tests conclude that series are apparently non-stationary, they may in fact have experienced a break (or a structural change) and be stationary, before or after this change. Actually, a structural change means a break in level and/or in trend. In many cases, such breaks are the cause of the presence of unit root in the ADF or Phillips-Perron tests.

For all the series identified by ADF or Phillips-Perron tests as *non-stationary*, it is therefore important to find a possible structural change that may explain such non-stationarity. Then, according to Perron (1997) the series may:

- be confirmed to have a unit root (without any structural change)
- be stationary, with the presence of a break (structural change)
- have a unit root, with a structural change.

The first case did not occur in our sample. But the last two cases testify that there is a structural change[7]. Without any contamination problem, we'll consider this break as the effect of a modification of the bond risk appreciation by the investors; this modification may occur before or after the agency's rating action.

Perron (1989) suggests introducing a dummy variable which has a non-zero value the day of the structural change. However, this method, supposes to know *a priori* when the structural change takes place. Subsequently, other methods considering the date of a possible break as unknown and endogenous have been developed. This is especially the case in Zivot

[6] Schwarz Information Criterion (SIC) : $ln\,(\sigma^2_\varepsilon) + [\,(k.ln(T))\ / T\,]$
σ being the volatility of residuals, k the number of lags and T the number of observations.
[7] in the third case, this means a change in the drift of the process.

and Andrews (1992), Banerjee, Lumsdaine and Stock (1992), Perron and Vogelsang (1992). In this paper, we use the Perron (1997) test, which allows series to be non-stationary, with a structural change.

Perron (1997) proposes two different models, the Additive Outlier model (AO) and the Innnovational Outlier model (IO). Given that the latter allows the break in the relative spreads to occur gradually, with or without a shift in the level or in the trend, it seemed more appropriate for our study. Thus, we use the Innnovational Outlier 2 model[8]. The relative spread data series may therefore be estimated as following:

$$y_t = \alpha + \theta DU_t + \beta t + \gamma DT_t + \delta D(T_b)_t + \rho\, y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t$$

where T_b is the (unknown) date of the structural break, DU_t denotes the dummy variable for the change in level ($DU_t = 1$ if $t > T_b$, or 0 otherwise), DT_t denotes the dummy variable for the change in trend ($DT_t = T_t$ if $t > T_b$, or 0 otherwise), $D(T_b)_t$ is the so called *crash dummy* supposed to capture a possible and sudden shift in the series ($D(T_b)_t = 1$ if $t = T_b+1$, or 0 otherwise).

As the results of the test may strongly depend on the number *k* of lags, we chose to select it endogenously, using the method proposed by Ng and Perron (1995), and Ben and Papell (1998). First, the test is performed by taking into account the maximum number of lags[9]; if it is significant[10], the procedure stops; if not, this is repeated by lowering *k* by one, until the rejection "that additional lags are insignificant" occurs.

E – Dating the structural changes

Our main objective is to date the structural changes in the series of the relative spreads. The estimation procedure is the following:

- it is assumed that the possible date of breakpoint T_b, occurs within a window surrounding the rating action by +/- 45 trading days[11]. Then, all the possible breakpoint dates are checked, with the variable T_b being given successively all the possible values (91) within the window [-45, +45];
- for each of these 91 available equations, we select the optimal number of lags *k*, as described above;

[8] IO1 model only allows a shift in the level.

[9] We use Hayashi (2000) criterion to specify the maximum value of *k*: k_{max} . For a number of observations T, k_{max} is equal to the entire part of: $12(T/100)^{1/4}$.

[10] As suggested by Perron (1997), we use a level of 10%.

[11] According to Norden and Weber (2004) paper (cf table 1, p. 2816-2817), it seems a reasonable period.

- then, each equation is estimated using OLS, and only two equations are selected (where the coefficients of the dummies DU_t and DT_t are the most significant). These two equations allow the structural change to be dated.

Perron (1997) suggests two different procedures for identifying the date T_b of a structural change:

- following Zivot and Andrews (1992) and Barnerjee, Lumsdaine and Stock (1992), by minimizing the *t-statistic* of the lagged variable coefficient ρ. This is the way to give the most important weight to the alternative hypothesis of stationarity.
- by maximizing the *t-statistic* of the dummy variable associated with a break in the trend or the intercept (the direction of the variation may or may not be taken into account).

Given the importance of dating the structural changes in this research, we chose to apply the second method (taking into account the direction of variation[12]). If both dates of break (for the trend or the intercept) are significant, we select the earliest from the both, which denotes the date of the investors' first reaction. If only one date of break is significant (either for the trend, either for the intercept), we select this date. If none of the observed dummies is significant, the series does not exhibit a structural break.

To illustrate this approach, let's consider the upgrading of the French company Elf Aquitaine as an example. On 30th August 2005, Moody's has upgraded this company, so that the situation before and after the upgrading changed is the following:

Rating before Aug. 30th 2005	***Rating after Aug. 30th 2005***
Aa2 No watch Outlook positive	Aa1 No watch Outlook stable

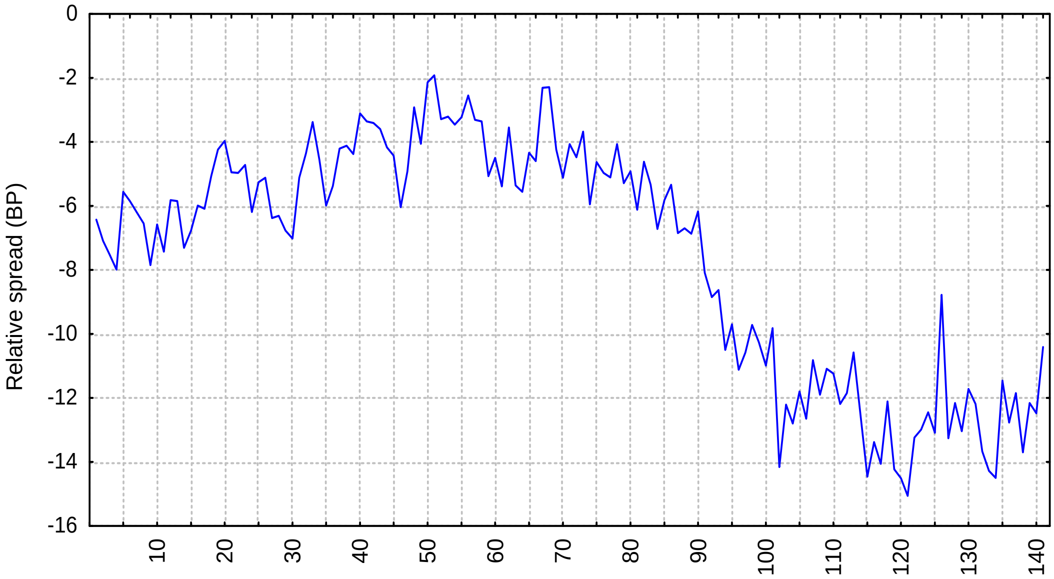
The relative spread of the bonds issued by this company during the 141 trading day period covering the date of the rating action is shown on the Figure 1 below:

Figure 1

[12] The date T_b of a break is determined by observing the maximum *t-statistic* in case we expect an increase in the relative spread (downgrading or watch negative) and the minimum *t-statistic* in case of upgrading or watch positive.

Relative spread (in BP) of issues by Elf Aquitaine for the period covering 30th August 2005

(compared to the Merrill Lynch index of corporate issues with the same initial rating)



The event occurs at day 71. A fall in the relative spread of “Elf Aquitaine issues” can be observed around this date (more or less 8 BP). The result of the Perron (1997) test is the following:

Variable	t stat	Observation
DU_t	-2.600949	97
DT_t	-3.062734	58

The dummy variable for the trend *(DT_t)* is significant: the series shows a break in the trend at day 58 (i.e. 13 trading days before the rating action) which indicates the beginning of the relative spread decrease.

The dummy variable for the intercept *(DU_t)* is also significant and, in this case, rather indicates when the relative spread decrease stops: at date 97, i.e. 26 trading days after the rating action, the Elf Aquitaine relative spread is reaching a new level and then tends to be stabilized. Therefore, in this example, the date 58 would be selected.

III. Empirical Analysis

A – The data

The study covers twelve countries of Continental Europe (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain) and the United Kingdom. The study begins with the launching of the euro on 1st January 1999, and ends seven years later, on 31st December 2005.

The average spreads were calculated for all issuers concerned by rating actions of one of the three major international agencies. Then, relative spreads were estimated, using the Merrill Lynch spread index according to ratings.

The database includes 868 rating actions, which can be split according to the *kind of action* and the *rating agency*, as shown in table 3.

Table 3 – Description of the database: repartition of the events according to the action and the rating agency

	Moody's	Standard and Poor's	Fitch
Downgradings and negative watches	268	289	78
Upgradings and positive watches	100	100	33
Total	368	389	111

Most of the rating actions concern the euro zone, as stated by table 4.

Table 4 – Description of the database: repartition of the events according to the currency

	Euro issues	Sterling issues
Downgradings and negative watches	455	180
Upgradings and positive watches	186	47
Total	641	227

B – The uninformative vs informative CRA actions

The first results of our analysis concern the distinction between informative events and non informative ones. A *non informative event* is an event for which we statistically observe no reaction on bond prices during the period surrounding the date of the event, that is an event for which the series of spreads is stationary.

First, we characterize the events for which there is a reaction in the spreads and then, those for which there is no reaction.

a) Considering downgradings and watchlists with negative outlook, about one out of two events (precisely, 49 %) is uninformative for the investors; whereas for 51% of the events, we can observe a structural change in the spread series.

In order to separate the informative events from the other ones, we performed a factor analysis (multi-correspondence), followed by a cluster analysis. Different variables were included in the analysis, such as: the rating before the event, the year of the event, the number of notches in case of a downgrading, the country of the issuer, the "specific industry" of the issuer, the reaction to the rating event (stationarity or structural change). Figure 2 plots the different events (311 uninformative events in grey – *reaction =1* - and 324 informative events in black – *reaction =2*) as well as the specific industry; this variable (spi2) goes from 1 to 7 with:

Spi2 = 1 : banking and insurance sector

Spi2 = 2 : heavy industry: capital goods, chemicals and packaging, building materials, oil, metal and mining

Spi2 = 3 : utilities, local authorities and transportation

Spi2 = 4 : telecom and high tech

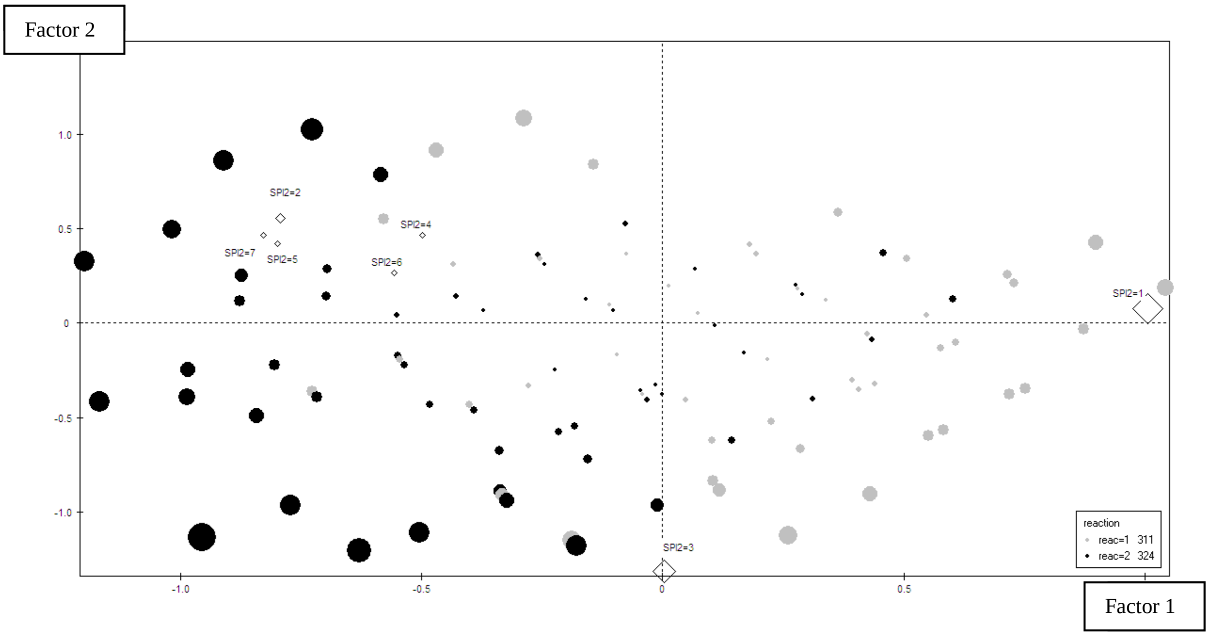
Spi2 = 5 : automotive

Spi2 = 6 : retail, media and entertainment

Spi2 = 7 : other sectors

Factor 1 and factor 2 operate a satisfactory separation between the uninformative events (most of them on the right) and the informative ones (most of them on the left).

Figure 2



Looking for the variables that explain factor 1 and factor 2 may give a characterization of informative and uninformative events. The events are uninformative, mostly when the initial rating of the issuer is above or equal to A2 (A), and when the downgrading is only of one notch; mainly banks and financial companies (spi2 = 1) from the Euroland are associated with such uninformative events; the reaction is not so clear for utilities and local authorities (spi2 = 3), despite a global proportion of 58% of uninformative events in this category. On the contrary, events are informative when the initial rating of the issuer is equal to or lower than A3 (A -) or when it is at least a two notch downgrading; mostly, this corresponds to corporate companies, in particular, belonging to the telecommunication and automotive sectors (spi2= 4 or spi2=5), or to heavy industry (spi2=2), when the issuer is initially classified as "speculative", in the sterling zone, but also in the Euroland.

Both the factor analysis and a test of independence of Chi-square prove that there is no significant difference (5% level) between the informative aspect of downgrading and the one of negative watch.

Besides, table 5 shows an important difference between investors' reactions in the UK and in the Euroland.

Table 5 – Proportion of uninformative downgradings (and negative watch)

according to the currency **

	Uninformative downgradings (and negative watch)	Informative downgradings (and negative watch)
Euro issues	58 %	42 %
Sterling issues	26 %	74 %
All issues	49 %	51 %

**Hypothesis H0 is rejected by χ^2 test at the 5% level: the reaction of sterling issues to downgrading or negative watch is more important than the reaction of euro issues.

We also point out some differences relative to the rating agencies. Table 6 gives the proportion of uninformative events according to the rating agency and the broad economic sector.

Table 6 – Proportion of uninformative downgradings and negative watches according to the sector and the rating agency

	Moody's	Standard and Poor's	Fitch
Banking sector	70 % **	54 % **	61 %
Corporate sector	38 %	36 %	29 %
Local authorities and transportation	68 %	56 %	78 %

** significant at the 5 % level (*z-test comparison of proportions)*

The reaction to a negative watch is quite the same as the one to a one-notch downgrading as stated by table 7, the reaction to a two-notch (and more) downgrading being more important.[13]

Table 7 – Proportion of uninformative one-notch downgradings, two-notch downgradings and negative watches

	One-notch downgradings	Two-notches and more downgradings	Negative watches
Uninformative events	57 %	25 %	48 %
Informative events	43 %	75 %	52 %

[13] Chi-square independence test allows rejecting the hypothesis of independence between the proportion of informative and the kind of rating grade action. This conclusion is explained by the fact that the proportion of reaction to a "2 notches or more" downgrading is much higher than the one to a "1 notch" downgrading or "watchnegative". The independence hypothesis can't be rejected at the 5% level between "one notch downgrading" and "watchlist."

If we look at the repartition of rating actions according to the period covered by the study, it appears that the proportion of negative watches increases along time, whereas the part of downgradings decreases (cf table 8).

Table 8 – Repartition of downgradings and negative watches over the years

	1999	2000	2001	2002	2003	2004	2005
Negative Watches	37 %	40 %	37 %	37 %	48 %	41 %	70 %
Downgradings	63 %	60 %	63 %	63 %	52 %	59 %	30 %

(Hypothesis H0 of independance is rejected by χ^2 test at the 5% level)

b) Considering the upgradings and watchlists with positive outlook, the results are somewhat different. First of all, events are mostly uninformative: a little more than two thirds of the whole events (precisely, 71 %) transmit no information to the investors, whereas only 29 % cause a structural change in the spread series.

We carried out a multi correspondence analysis to characterize the informative and the uninformative events.

An upgrading, or a positive watch, is rather an uninformative event when the initial rating of the issuer is equal to or higher than A3 or A- (it was the case of many banks within the Euroland) or when the upgrading is not very important compared to the issuer level of risk (it was the case of issuers belonging to the automotive sector whose initial rating was equal to or lower than Ba1 or BB+).

On the contrary, upgradings (or positive watches) are informative in case of speculative corporate issuers upgraded by two notches or more (it concerned issuers from the retail and media sectors), in case of banks with an initial rating equal to or higher than A3 or A- upgraded by Fitch, and in case of UK corporate companies belonging to the Telecom sector whose initial rating was between Baa1 or BBB+ and Baa3 or BBB- (concerning the same issuers inside the Euroland, the spread reaction was unclear).

We notice an important difference between events relative to sterling issues and euro issues, as stated by table 9.

Table 9 – Proportion of uninformative upgradings (and positive watches) according to the currency **

	Uninformative upgradings (and positive watches)	**Informative upgradings (and positive watches)**
Euro issues	76 %	24 %
Sterling issues	49 %	51 %
All issues	71 %	29 %

(** Hypothesis H0 of independence is rejected by the 5% level χ^2 test: the reaction of sterling issues to upgradings or positive watches is more important than the reaction of euro issues)

Positive watches are very few, and the repartition of rating actions between positive watches and upgradings is in the benefit of upgradings (positive watches: 27 % / upgradings: 73 %).

C – The « pre event » and « post event » informative series

In order to point out the common features and differences between the pre-event and post-event reactions, we perform a cluster-analysis, including in the analysis the same variables than previously, and another variable whose object is to operate a distinction between five possibles periods of reaction to the event (that, the date of the structural change in the series of spreads) :

- the reaction happens very closely around the event (+/- 2 days)
- the reaction happens between -3 and -9 days prior to the event
- the reaction happens 10 days or more prior to the event
- the reaction happens beetwen 3 days and 9 days after the event
- the reaction happens 10 days or more after the event

The study of the issuers experiencing a downgrading action or a watch negative gives the following results (in the seven clusters built in the analysis, the period of the reaction is very significant):

- The reaction « around the event » mostly concerns issuers whose activity is in industry (76% of the cases, versus 0% of financial issuers, and among them, a significant proportion of « telecom » and « heavy industry » companies), whose rating before the event is *A-* to *BBB*, experiencing a « 2 notches and more » downgrading action, and whose issues are mainly in sterling.

- In majority, two kinds of issuers seem to experience a reaction in the bond spreads between 3 and 9 days prior to the event : « industrial » with a very low rating (< BBB-), or « banking and financial » with a high rating, with an over-representation for the issues in sterling.

- The reactions occuring more than 10 days before the event are mainly associated with industrial issuers[14] with a very low rating (BBB- and below), whose issues are in euros, with an over representation of Moody's rating action.

[14] We also notice in the cluster an over represenation of the « retail, consumer and media/entertainment » issuers, amongst those whose activity is in the industrial sector.

- The reactions occuring between 3 days and 10 days after the event offer a high propotion of issuers rated Aa- to A, with an over representation of the banking and financial issuers, and issuers rated by Fitch.

- The reactions occuring more than 10 days after the event are less homogeneous and don't allow any particular comment.

D) Rating action and spread magnitude

Considering now the whole pre event and post event informative series, we try to identify the different variables that explain the magnitude of the reaction.

The explained variable is the *change in the relative spread after the break* (in basis points, period of observation: from the date of the break to 60 trading days after the rating change, as explained in Part II).

The variables expected to influence the amplitude of this change are included in an OLS model:

- the relative mean-spread on the period prior to the reaction, (in basis points)
- a sample of dummies relative to the agency (reference : *Moody*'s)
- a dummy variable relative to the currency of the issue (reference : *euro*)
- a sample of dummies relative to the rating existing before the rating action (reference : the highest rating level in our classification : *Aaa to Aa*, or equivalent for S&P)
- a sample of dummies according to the magnitude of the rating action (*negative watch*, *one*, *two* or *more than two notches* in case of downgrading ; *one notch* being the reference)
- a sample of dummies relative to the outlook/watch resolution after the rating grade action (*no outlook/watch after*, being the reference, opposed to the existence of either *a negative watch* or an *outlook negative* after the event)
- a sample of dummies relative to the *date of the reaction*, classified as explained above (five classes, *reaction around the event* – i.e +/- 2 days – being the reference)
- a sample of dummies relative to the *specific industry* of the issuer (the *automotive* activity being the reference)
- a sample of dummies according to the country of the issuer (*UK* is the reference)
- a sample of dummies according to the year of the event *(2002* is the reference)
- some cross-dummies, in case they appear significant (*rating before* crossed with *negative watch*).

The estimated equation was tested and controled for the presence of multicolinearity, heterosedasticity (White and Arch-LM test) and autocorrelation (DW and Q-Ljung/Box test) in the residuals.

The detailed output of the model is included in annex 1, the list of the significant variables appears in the table below, and the synthesis which can be drawn is the following.

Table 10 - Significant variables explaining the magnitude of the variation in the relative spread (after the break)

Significant variables	sign of the coefficient	p-value
- level of the relative spread prior to the event	+	**
- rating before the event		
• *A- to BBB (if downgrade)*	+	**
• *BBB- and below*	+	**
magnitude of the rating action		
• *three notches and more*	+	***
- neg watch after event	+	***
- neg outlook after event	+	*
- currency : sterling	-	**
- agency : Fitch	+	***
		***
- datation of the reaction		
• *more than 10 days before*	-	**
- countries : France	-	***
- specific industry:		
• *heavy industry*	+	**
• *automotive*	+	*
• *retail,consumer, media/entertainment*	+	**
- *year of the event:*		
• *2004*	-	**
• *2005*	-	**

* 10% level
** 5% level
*** 1% level

Firstly, the results suggest that the increase in the relative spread of the bonds affected by a downgrade or a watch negative depends in a positive way from the level of the relative spread before the event. That is to say, when there is a gap between the issuer's mean-spread and the average level of the class it belongs to (i.e, the Merryl Lynch index), this gap is accentuated after the negative event.

Then, it seems the magnitude of the reaction is significatively less important when this reaction occurs prior to the the event date (especially more than 10 days before : 61 basis points less than when the reaction occurs +/- 2 days around the event)

Thirdly, there is strong evidence that the magnitude of the variation depends of the severity of the rating grade action, and from the risk level of the issuer before this event. Thus, whereas the reaction to a *two notches* downgrading doesn't appear different from the one to a *one notch* downgrading, it is much stronger when the issuer is affected by a *three notches and* *more* downgrading (145 BP more); besides, the importance of the reaction in case of a *watchnegative* is not significatively different from the reaction to a *one notche* downgrading, except in case the issuer is *BBB- or below* before the rating action (223 BP More). The result appears quite similar if we focus on the incidence of the rating level of the issuer: the spread variation appears much more important in case the issuer is rated *A*- or below[15]. Moreover, the reaction is more important when the issuer incurs a negative watch or a negative outlook following the rating action itself.

The activity of the issuer is not neutral, since it seems that the issuers in “heavy industry”, “retail, consumer, and media/entertainment” and “telecom” are penalized. If we focus on the currency of the issues, the amplitude of the reaction is less important in case the issuer’s issues are in sterling (*ceteris paribus*, 54 BP minus than in euro). The market seems to react more when the rating action comes from the Fitch agency than from Moody’s (95 BP more). Considering the different countries, it seems the reaction is the same, except in one case (France, where it’s lower). At last, the reaction appears lower for the last two years of the study (2004/05).

E – Rating action and spread volatility

Once again, we will concentrate on informative events, first on downgradings and negative watches, and then on upgradings and positive watches.

a) When investors become aware of a fall in an issuer credit quality, not only the mean relative spread increases, but the relative spread volatility raises as well.

Table 11 states, for the whole pre event and post event informative series, the proportion of series for which there is an increase or a decrease in the spread volatility at the date of the reaction.

Table 11 – Spread volatility and market reaction

Proportion of events for which the spread volatility increases at the date of reaction	56,4 % **
Proportion of events for which the spread volatility decreases at the date of reaction	27,6 % **

**significant at the 5 % level (unilateral Fisher test)

[15] The difference in the spreads’ reaction, relatively to an issuer rated *Aaa* to *Aa*, is respectively 117, 123 BP more important when the issuer is downgraded and rated *A- to BBB* or *BBB- and below* and even more (300 BP) when the issuer is rated *BBB- and below* and experiences a negative watch.

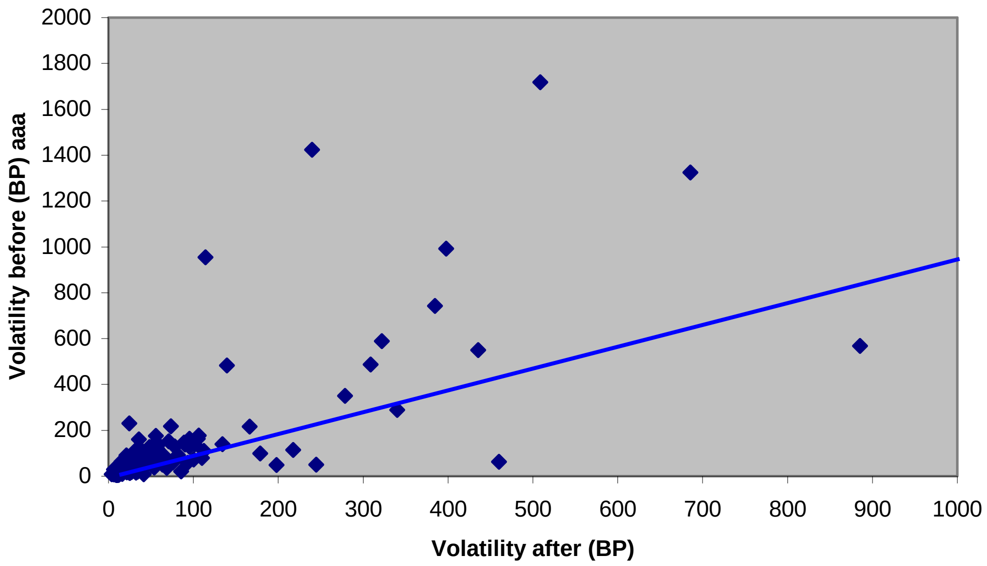
b) Concerning the sole pre event informative series, at the date of the downgrading or negative watch announcement (that is, after the investors have discerned a fall in the issuer credit quality), one may observe a decrease in the spread volatility, following the increase occurring when investors become aware of the new issuer credit quality.

In such cases, the rating action announcement seems to stop the investor worries: the informed investors notice a drop in the issuer credit quality, and the bond prices drop consequently; but uninformed investors are doubtful whether this drop in prices is reliable or not. This uncertainty causes the spread volatility to increase. The function of the rating agency is then to certify (or not) that the point of view of the informed investors is well reflected in the observed bond prices; this certification causes the volatility to decrease.

Figure 3 plots the whole pre event informative series according to the spread volatility before and after the announcement[16] .

Figure 3

Spread volatility before and after the rating announcement



Most of the events are plotted above the line and show a spread volatility which is higher before the event than after. We performed an unilateral Fisher test to appreciate the proportion of events for which the spread volatility decreases with the rating announcement. Table 12 points out the results.

Table 12 – Spread volatility and agency announcement

[16] Precisely, over the period [reaction date, announcement date[and [announcement date, announcement date + 60 days].

Proportion of events for which the spread volatility decreases with the announcement	60,6 % **
Proportion of events for which the spread volatility increases with the announcement	19,7 % **

**significant at the 5 % level

Mainly, events for which we observe a spread volatility decrease with the announcement are the ones with a high initial rating (equal to or higher than A3 or A -) and which experience a one-notch downgrading. On the opposite, when the initial rating is between Baa1 (or BBB+) and Baa3 (or BBB -), or in case of a negative watch, we mainly observe an increase in the spread volatility.

c) Concerning upgradings and positive watches, the analysis of the evolution of spread volatilities is inconclusive; this may be due to the fact that an upgrading is a good news for the investors.

IV. Conclusion

We synthetize in this conclusion the main results of our study. Most of these results are consistent with our theoretical model.

a) Most of time, rating actions are uninformative in the Euroland. Concerning upgradings and positive watches, this is true for three rating actions out of four, and concerning downgradings and negative watches, for one out of two. We notice an important difference with the UK where half of the upgradings or positive watches are uninformative, while the ratio concerning downgradings (or negative watches) is one out of four.

b) We do observe a change in the strategy of rating agencies. For the three agencies, the proportion of negative watches, compared to the proportion of downgradings, increased over time (cf table 8). This could be due to a decreasing investigation effort, originated by a high level of credibility of the rating agencies as well as by a request for a higher return on equity by the agencies' owners.

c) We can distinguish two segments on the bond market for which the CRA function is different.

First, the financial sector in the Euroland, where issuers are generally rated between Aaa (AAA) and A and where Fitch is very present. For these issuers, the investors' reaction generally arises after the rating action. In that bond market segment, the CRA function is to transmit information about issuer default risk.

Then, the corporate sector, specially corporate companies whose rating is lower than or equal to Baa3 (BBB-), for these issuers, the investors' reaction generally precedes the rating action. The CRA function is no more to transmit information, but to confirm (or not) the investors' perception of the issuer default risk, and doing so, to stabilize the bond prices and to stop any noise trading which could benefit to the informed investors.

d) Negative watches are anticipated by investors in the same proportion as downgradings. The main difference betweeen both of them is that, in case of an anticipation by investors, negative watches do not contribute to stabilize the bond prices.

e) The magnitude of the reaction to a fall of an issuer credit quality is weak:

- if the magnitude of the downgrading is not important,
- if the investors anticipated the rating action for a long time,
- if the prior spread is consistent with the prior rating (that is if the difference between Merrill Lynch spread and the issuer spread is nil).

Annex 1

Magnitude of the relative spread reaction

Output of the OLS model

Dependent Variable: VARSPR
Method: Least Squares

Sample: 1 324
Included observations: 324

	Coefficient	Std. Error	t-Statistic	Prob.
SPREL	0.097133	0.049449	1.964308	0.0505
C	-1.420424	70.37439	-0.020184	0.9839
DCCY	-54.38933	24.49460	-2.220462	0.0272
DAGY2	14.86471	24.50526	0.606593	0.5446
DAGY3	95.68419	35.30065	2.710550	0.0071
DRB2	17.27882	43.11123	0.400796	0.6889
DRB3	117.3232	49.09617	2.389661	0.0175
DRB4	123.3833	56.81121	2.171813	0.0307
DN2	49.65033	32.16102	1.543805	0.1237
DN3_4	145.3970	54.48703	2.668470	0.0081
DNWN	45.88648	69.88233	0.656625	0.5119
DSPI1	61.70969	48.09938	1.282962	0.2005
DSPI2	100.1572	45.76548	2.188487	0.0294
DSPI3	44.60175	47.44748	0.940024	0.3480
DSPI4	86.62875	47.61681	1.819289	0.0699
DSPI6	97.56654	45.61351	2.138983	0.0333
DSPI7	104.4065	55.29338	1.888229	0.0600
D99	-5.518791	63.39188	-0.087058	0.9307
D00	-53.21581	44.50127	-1.195827	0.2328
D01	-2.685961	31.23225	-0.086000	0.9315
D03	-26.95971	29.74632	-0.906321	0.3655
D04	-76.71280	39.09295	-1.962318	0.0507
D05	-117.2347	40.44867	-2.898358	0.0040
DFR	-107.3550	38.80106	-2.766806	0.0060
DGMY	-48.52591	36.07548	-1.345122	0.1796
DNETH	38.76026	34.17524	1.134162	0.2577
DSEUR	-38.79116	49.52315	-0.783293	0.4341
DCTY	-42.70623	49.13412	-0.869177	0.3855
DAFTW	299.8039	53.55717	5.597830	0.0000
DAFTO	52.58075	31.51618	1.668373	0.0963
DREAC2	-25.39266	33.43132	-0.759547	0.4481
DREAC3	-61.38715	29.10083	-2.109464	0.0358
DREAC4	-65.05195	39.35494	-1.652955	0.0994
DREAC5	-32.34838	31.95515	-1.012306	0.3122
DNWN*DRB2	-11.19821	78.73873	-0.142220	0.8870
DNWN*DRB3	-71.32687	77.06272	-0.925569	0.3554
DNWN*DRB4	177.4566	85.78405	2.068643	0.0395

R-squared	0.428013	Mean dependent var	113.7068
Adjusted R-squared	0.356266	S.D. dependent var	217.6191
S.E. of regression	174.6024	Akaike info criterion	13.27003
Sum squared resid	8749483.	Schwarz criterion	13.70179
Log likelihood	-2112.745	Hannan-Quinn criter.	13.44237
F-statistic	5.965553	Durbin-Watson stat	1.997890
Prob(F-statistic)	0.000000		

Legend :

Sprel : level of the relative mean-spread before the reaction

Dccy : dummy = 1 if issue in sterling

Drb : sample of dummies (2 if *rating before=: Aa- to A ; 3 =A- to BBB; 4= BBB- and below)*

Dn: sample of dummies (2= two notches downgrade; 3_4= three and above notches ; wn= negative watch)

DSPI : sample of dummies (1= banks and finance ; 2= heavy industry ; 3= public, utility and local auth. ; 4= telecom; 6= consumer, retail, media/entertainment; 7:other)

Dt: sample of dummies, year of the event (99=1999; 00=2000;01=2001;03=2003; 04=2004; 05=2005)

D*countries*: sample of dummies (Fr= France; gmy=Germany;Neth=Netherlands; Seur= Italy, Spain, Portugal, Greece; Dcy: other euro- zone countries)

DAFT: sample of dummies (DAFTW: negative watch after the event; DAFTO: negative outlook after the event)

DREAC:sample of dummies (2= reaction between 3 and 9 days before the rating action; 3= 10 days or more before; 4= between 3 and 9 days after; 5= 10 days or more after the rating action)

References

Banerjee A., R. L. Lumsdaine and J. H. Stock, 1992, Recursive and Sequential Tests of the Unit Root and Trend Break Hypothesis : Theory and International Evidence, *Journal of Business and Economic Statistics,* 10, 271-288.

Ben D.D and D. H. Papell, 1998, Slowdowns and Meltdowns : Post-War Growth Evidence from 74 Countries, *Review of Economics and Statistics* 28, 2, 561-571.

Boot A. W. A., T. T. Milbourn and A. Schmeits, 2006, Credit Ratings as Coordination Mechanisms, *Review of Financial Studies*, 19, 82-118.

Dallocchio, M., J. Hubler, Ph. Raimbourg and A. Salvi, 2006, Do Upgradings and Downgradings Convey Information? An Event Study of the French Bond Market, *Economic Notes* 35, 293-317.

Dickey, D. A. and W. A. Fuller, 1979, Distribution of the Estimators for Autoregresive Time Series with a Unit Root , *Journal of the American Statistical Association* 74, 427-431.

Dickey, D. A. and W. A. Fuller, 1981, Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root , *Econometrica* 49, 1057-1072.

Harvie, Ch. and M. Pahlavani, 2006, Testing for Structural Breaks in the Korean Economy 1980-2005: An Application of the Innovational Outlier and Additive Outlier Models, *Economics Working Paper Series,* 06-09, University of Wollongong, Australia.

Löffler, G., June 2002, Avoiding the Rating Bounce: why Rating Agencies are Slow to React to New Information, *Working Paper*, Goethe-Universität Frankfurt.

Mc Kinnon J.G, 1996, Numerical Distributions Functions for Unit Root and Cointegration Tests, *Journal of Applied Econometrics*, 11, 601-18.

Ng S. and P. Perron, 1995, Unit Root Tests in ARMA Models with Data Dependant Methods for the Selection of the Truncation Lag, *Journal of the American Statistical Association* 90, 268-281.

Norden, L. and M. Weber, 2004, Informational efficiency of credit default swap and stock markets: The impact of credit rating announcements, *Journal of Banking and Finance*, 28, 2813-2843.

Perron, P., 1989, The Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis, *Econometrica* 57, 1361-1401.

Perron, P., 1997, Further Evidence from Breaking Trend Functions in Macroeconomic Variables, *Journal of Econometrics* 80, 355-385.

Perron P. and T. J. Vogelsang, 1992, Nonstationnarity and Level Shifts with an Application to Purchasing Power Parity, *Journal of Business and Economic Statistics,* 10, 301-320.

Vogelsang T.J and P. Perron, 1998, Additional Tests for a Unit Root allowing for a break in the Trend Tunction an Unknown Time, *International Economic Review* 39, 3, 1037-1100.

Phillips, P. C. B. and P. Perron, 1988, Testing for a Unit Root in Time Series Regression, *Biometrika* 75, 335-346.

Saïd S.E and D. A. Dickey, 1985, Hypothesis Testing in ARMA(p,1,q) Models, *Journal of the American Statistical Association*, 80, 369-374.

Zivot, E. and D. W. K. Andrews, 1992, Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis, *Journal of Business and Economic Statistics* 10, 251-270.