Credit Rating Agencies and Unsystematic risk. There is a linkage?*

Pilar Abad[a] and M. Dolores Robles-Fernández[b]

[a] Universidad Rey Juan Carlos and RFA-IREA

[b] Universidad Complutense de Madrid

(June 2011)

Abstract

This study analyzes the effects of different credit rating announcements on systematic an unsystematic risk of Spanish Stock Market firms from 1988 to 2010. We use an extension of the event study dummy approach. We find effects in both kinds of risk indicating that rating agencies provide information to the market. The improvement rating announcements imply a lower level of risk and have a similar effect over systematic and unsystematic risk. On the other hand, the deterioration rating announcements imply a rebalance in both kinds of risks with higher beta risk joint to lower level of diversifiable risk. These findings are very important in portfolio management.

Keywords: Credit rating agencies, Rating changes, Event study, Stock Returns, Systematic risk, Non-systematic risk,

JEL Classification: G12, G14, G24, C22

* The information provided by Fitch and Moody's is appreciated. Any errors are solely the responsibility of the authors. This paper is based upon work supported by the Government of Spain and FEDER under grants ECO2008-02752/ECON, ECO2009-10398/ECON, the Junta de Comunidades de Castilla-La Mancha (PCI08-0089) and Banco de Santander (UCM940063).

Corresponding author: M. Dolores Robles Fernández, Department of Economics, University Complutense. Campus de Somosaguas, 28223, Madrid. E-mail: mdrobles@ccee.ucm.es

1. Introduction

Substantive changes in the performance of a firm, whatever their causes, should trigger alteration of investor valuation and total risk. Under the assumption that the CAPM is the suitable model for asset pricing, the systematic risk (non-diversifiable or beta risk) can be viewed as a measure of organizational effectiveness. The unsystematic (or diversifiable) risk is very important to investors as well. For example, it is crucial in derivatives valuation, because their value is a function of total risk of the underlying securities (Hilliard and Savickas, 2002) or in portfolio management when the portfolios are underdiversified (Goyal, Santa-Clara, 2003, Angelidis, Tessaromati, 2009).

A research area that is well developed is what effect rating changes have on stock prices (see Dichev and Piotroski (2001) or Abad-Romero and Robles-Fernandez, 2007), while the analysis of the effect on risk is almost unexplored. In fact, we only find the studies of Abad-Romero and Robles-Fernandez (2006) and Impson, Karafiath and Glascock (1992) that analyze the effect of rating changes on systematic risk in stock markets. However, the relationship between unsystematic risk and credit rating changes seemingly has not been researched. In this context, this paper studies the effects of rating actions on risk of the re-rated firms with special emphasis on their unsystematic risk. Our main purpose is to extend the research on the effect of bond rating changes on stock markets, filling this gap in the empirical literature.

In general, our contention is that firm total risk should be associated with bond rating (as a proxy of the rating agencies' valuation of a firm's prospects). Both risk and rating provide evidence associated with the organization's worth. It must be expected that any rating change will be related to a higher level of uncertainty about the firm. In this sense, we expect that any rating change must be accompanied by a risk change. Any increase in total risk of the firm may be caused by a higher systematic risk, a higher idiosyncratic risk or a higher level of both.

Rating agencies are currently in the eye of the storm after their failure to predict the crises at firms such as WorldCom in 2002 or Lehman Brothers in 2008, or their central role in the sub-prime mortgage crisis. In these cases credit rating agencies failed to reflect early enough in the ratings the worsening market conditions, and to adjust their credit ratings in time following the deepening market crisis. The role of agencies as providers of information is a central mater to the market participants and regulators. Crouchy, Jarrow and Turnbull (2008) indicate that agencies did not monitor the raw data, even though it was common knowledge that lending standards were declining and fraud was increasing; agencies were tardy in recognizing the implications of the declining state of the sub-prime market.

In this context, we focus on the announcement of rating changes effects on both systematic and unsystematic risks of the re-rated firms. Instead of a traditional two-step event study, we present an extension of the dummy variable regression approach, allowing for changes in the parameters of the market model, where the volatility of returns is specified as a constant process or with an autoregressive conditional heteroskedasticity model. We analyze rating changes over the Spanish companies listed in the Electronic Continuous Stock Market. We distinguish between different types of rating action announcements (effective rating changes, credit watch placements and outlook notices) in order to analyze their informative content. We use daily returns of the re-rated companies between June 1988 and December 2010.

In the next section we present the evolution and characteristics of the rating changes in the Spanish market. The modeling and testing strategies are described in Section 3. The main results are presented in Section 4. The paper closes with some conclusions in Section 5.

2. Rating action announcement on Spanish Stock Market

Our initial sample of announcements contains a set of 482 rating actions corresponding to the "Big Three" rating agencies (Fitch-IBCA, Moody's and Standard and Poor's) during the period from June 1988 to December 2010. These actions include effective rating changes, rating reviews and outlook reports[1]. Fitch and Moody's provide us with their announcement dates. We also examine Reuters to find the S&P's rating announcement dates and complementary information.

Table 1 presents the rating action announcements grouped into six different types of announcement (effective upgrades, effective downgrades, review for upgrades, review for downgrades, positive outlook reports, and negative outlook reports) and into three different rating agencies. We use the previous information to distinguish between contaminated and uncontaminated rating changes. As is usual in the literature, we consider rating changes to be contaminated if, during the previous 30 trading days, any firm-specific rating event that may cause abnormal behavior took place. 92 rating changes in our sample are contaminated, more than 21% in the case of negative rating announcements and more than 16% in the case of positive announcements. After filtering for contaminated events, our final sample has 389 rating action announcements.

[Insert Table 1]

Focusing on the agency, Table 1 also shows the distribution of rating action per rating agency. 42.5% of the rating actions are by Moody's, 30.7% by Fitch and the remaining 26.8% by S&P. Furthermore, the distribution of

[1] Reviews or additions to the watch list occur after special events (e.g., changes in regulation, unexpected changes in management, or merger announcements), indicating that the rating is under review for a likely change in a short period of time. Outlooks indicate the creditworthiness trend in a medium-term timeframe.

contaminated announcements is 47% from Moody's, 34 from Fitch and 19% from S&P.

[Insert Figure 1]

Figure 1 presents the distribution of rating actions per year and per type of announcement (positive or negative). In general, the yearly number of rating announcements increases during the sample period. The yearly number of rating changes increases during whole period, with a slight decline in 2004. But the most important evidence that shows this figure is that after the recent crisis (.com in 2001 and subprime crisis in 2008) there was a significant increase in rating changes with a high percentage of negative rating announcement (88% in 2002 and 98% in 2009).

Figure 2 depicts the number of rating action according to the sector of the issuing firm. As can be seen, the majority of changes affected the financial sector (49.5%). In Spain, this sector concentrates the majority of firms that issue corporate bonds. The following sector is the energy sector, accounting for 30.3% of the changes, followed by telecommunications and consumer cyclical with 8.1%, and capital goods with 7.7%.

3. Modeling and testing strategy

Firm total risk should be associated with bond ratings because both are a measure of firm wealth. Therefore, we expect that rating changes must be followed by changes on risk. Any movement in total risk of the firm may be caused by a change in systematic risk, in idiosyncratic risk or both. In the first case, we expect that rating changes will be accompanied by changes in the market beta; in the second case, we expect changes in volatility. In both cases, the change must be in the opposite direction (positive for downgrades and negative for upgrades). In the third case, both kinds of risk must change in an undetermined direction, because there must be a risk rebalancing.

In order to test this hypotesis, we consider the possibility that debt rating change could exert a destabilizing influence on beta, the measure of the firm's systematic risk, by specifying the following model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_{s,i} D_{s,t} + \lambda_{s,i} D_{s,t} R_{mt} + \varepsilon_{it} \tag{1}$$

where R_{it} is the return on stock i at time t from day -250 to day $+T$;[2] R_{mt} is the return on the market index at time t, which we calculate an Equal Weight Index (EWI); $D_{s,t}$ is a dummy variable taking on the value of one for the days in the event window $s=(L,\ T)$ and zero otherwise; α_i represents the average daily amount by which the stock outperformed the benchmark portfolio on days -250 through L and $\alpha_i + \gamma_{s,i}$ is the average daily amount by which the stock outperformed the benchmark portfolio on days L through T.[3] Similarly, β_i is the stock's beta with respect to the benchmark portfolio on days -250 through L, and $\beta_i + \lambda_{s,i}$ is the stock's beta with respect to the benchmark portfolio on days L through T. Finally, ε_{it} is the error term, and $\mathrm{var}(\varepsilon_{it})$ is the unsystematic risk of the firm i. The model must be estimated for each firm and for the whole sample.

We can write the variance of the relationship in Equation (1) as:

$$\mathrm{var}(R_{it}) = \delta_i^2\,\mathrm{var}(R_{mt}) + \mathrm{var}(\varepsilon_{it}) \tag{2}$$

where δ_i is $\beta_i + \lambda_{s,i}$ in the event window and β_i outside. Equation (2) shows the total risk of asset i can be partitioned into two parts: systematic risk,

---

[2] Returns are calculated as $R_{it} = Ln\left(\frac{P_{it} + d_{it}}{P_{it-1}}\right)100$, where P_{it} is the price of the stock of firm i on day t and d_{it} is the dividend formally announced on day t. The data on stock prices from Spanish Electronic Continuous Stock Market are daily closing prices corrected for stock splits, equity offerings and merger effects.

[3] Model (1) allows for changes in the constant component of expected returns as well as for changes in beta risk. So, we endow the model with more flexibility to avoid that misspecifications of the mean return could affect the variance of the error term. Results for the constant component of model (1) are not shown in this paper to save space but are available upon request.

$\delta_i^2\,\mathrm{var}(R_{mt})$, which is a measure of how the asset covaries with the economy, and unsystematic risk, $\mathrm{var}(\varepsilon_{it})$, which is independent of the economy.

To analyse the effect of rating change announcements on firm risk, we have to consider the two components of risk in Equation (2). The hypothesis that a debt rating change conveys information to the market about a change in the firm's systematic risk implies that $\lambda_{s,i} \neq 0$. Analysing the statistical properties of $\mathrm{var}(\varepsilon_{it})$ on the event window and outside we can explore the effect of rating changes on unsystematic risk.

a) Test on systematic risk

In order to draw inferences for the systematic component of risk, the estimated $\lambda_{s,i}$, or Cumulative Change in Beta (CCB) for firm *i* on event window *s*, is used to find the Cumulative Average Change in Beta (CACB) for a specific event window *s*.

$$CACB_s = \frac{1}{N}\sum_{i=1}^{N}\lambda_{s,i} \tag{3}$$

where N is the number of rating changes in the sample.

The null hypothesis of zero abnormal performance due to rating action announcements implies that CACB must be zero. To test the statistical significance of the CACB we use a standard *t* test. Non-normality (skewness, fat tails) can affect the properties of this parametric tests. In order to overcome this problem we compute two nonparametric tests. First, we use the Fisher-sign test. This test counts the number of times that CCB is positive. Under the null, the test statistic follows a binomial distribution with p=0.5. Second, the Wilcoxon-signed-rank test is computed. This test assumes that there is information in the magnitudes as well as the signs. To calculate them, we take the series of CCB and rank it from smallest to largest by absolute value. Then we add all the ranks associated with positive values. We report *p*-values for the asymptotic normal approximation to the test. See Sheskin (1997) for details.

b) Test on unsystematic risk

We consider different scenarios about $\mathrm{var}(\varepsilon_{it})$. In a first step, we assume constant variance in model (1), $\mathrm{var}(\varepsilon_{it}) = \sigma_i^2$, and test the structural change hypothesis, i. e. the rating action announcement cause a change in the variance level. To test this hypothesis we compute the Variance Ratio (VR1) for asset i as $VR1_{i,s} = \dfrac{\hat{\sigma}^2_{i,s}}{\hat{\sigma}^2_{i,o}}$ where $\hat{\sigma}^2_{i,s}$ and $\hat{\sigma}^2_{i,o}$ are the sample mean variance estimated on the event window and outside respectively. VR1 =1 indicates that the event has no effect while for VR1 $>$ 1, implies an event-induced increase in unsystematic volatility. Therefore, if the volatility of the event window significantly exceeds the one implied by the model, an event impact on unsystematic volatility is observed. The null hypothesis of no abnormal performance due to rating changes implies that VR1 must be equal to one. To test this hypothesis we compute for each event in our sample a standard F test and two nonparametric tests: Siegel-Tukey and Bartlett tests.

We also define the Average Variance Ratio (AVR1) as:

$$AVR1_s = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\sigma}^2_{i,s}}{\hat{\sigma}^2_{i,o}} \tag{4}$$

and we test AVR1=1 hypothesis by using the Fisher-sign and Wilcoxon-signed-rank tests.

In the second scenario we assume time-dependent variance ($\mathrm{var}(\varepsilon_{it}) = h_{it}$) in model (1) that can be modeled by an appropriate GARCH model. The most general model that we consider is a GJR-GARCH model:

$$\begin{aligned}
&\varepsilon_{it} \sim N(0, h_{it}) \\
&h_{it} = \omega_{i0} + \omega_{i1}\varepsilon^2_{it-1} + \omega_{i2}h_{it-1} + \omega_{i3}S^-_{t-1}\varepsilon^2_{it-1}
\end{aligned}$$

To test the hypothesis that the rating action announcement cause a change in the variance level, we compute the Variance Ratio (VR2) for asset i as $VR2_{i,s} = \dfrac{\bar{\hat{h}}_{i,s}}{\bar{\hat{h}}_{i,o}}$ where $\bar{\hat{h}}_{i,s}$ and $\bar{\hat{h}}_{i,o}$ are the sample mean of conditional variance estimated on the event window and outside respectively.[4] We also define the Average Variance Ratio (AVR2) as:

$$AVR2_s = \frac{1}{N}\sum_{i=1}^{N}\frac{\bar{\hat{h}}_{i,s}}{\bar{\hat{h}}_{i,o}} \tag{5}$$

and we test AVR2=1 hypothesis by using the Fisher-sign and Wilcoxon-signed-rank tests.

At an event day t, two different types of factors may determine the level of unsystematic volatility: security specific factors that are captured by the model formulated above as well as event specific factors that are ignored here. Following Hilliard and Savickas (2002), their impact can be measured by the ratio λ of the cross-sectional variance the estimated residuals of the market model and its conditional variance implied by the GARCH process:

$$\lambda_t = \frac{1}{N-1}\sum_{i=1}^{N}\frac{\left(\hat{\varepsilon}_{i,t} - 1/N\sum_{j=1}^{N}\hat{\varepsilon}_{j,t}\right)^2}{(N-2)/N\,\hat{h}_{i,t} + 1/N^2\sum_{j=1}^{N}\hat{h}_{j,t}} \tag{6}$$

In this context, the estimator of the Average Variance Ratio ($AVR2^{\lambda}$) in the event window is:

$$AVR2_s^{\lambda} = \frac{1}{T-L}\sum_{t=L}^{T}\lambda_t \tag{7}$$

We compute the adjusted tests proposed by Hilliard and Savickas (2002) to test the null hypothesis of zero abnormal performance due to rating changes ($\lambda=1$ and $AVR2^{\lambda}=1$).

[4] In this case we do not test hypothesis of zero abnormal performance due to rating changes (VR2 =1) at individual level because the distribution of the mean variance ratio is unknown.

Finally, in the third scenario, we take into account the possibility that debt rating change could have a direct effect on the idiosyncrasic risk. We complete the variance model with the dummy variable, $D_{s,t}$, defined above, which indicate when day t is in the event window:

$$\begin{aligned} &\varepsilon_{it} \sim N(0, h_{it}) \\ &h_{it} = \omega_{i0} + \omega_{i1}\varepsilon_{it-1}^2 + \omega_{i2}h_{it-1} + \omega_{i3}S_{t-1}^{-}\varepsilon_{it-1}^2 + \delta_{s,i}D_{s,t} \end{aligned} \tag{8}$$

If a debt rating change have new information about firm's idiosyncratic risk, then $\delta_{s,i} \neq 0$. In order to test the hypothesis of no abnormal performance due to rating action announcements we use the estimated $\delta_{s,i}$ or Cumulative Change in Idiosyncratic Risk (CCIR) for firm i on event window s, to find the Cumulative Average Change in Idiosyncratic Risk (CACIR) for a specific event window s.

$$CACIR_s = \frac{1}{N}\sum_{i=1}^{N}\delta_{s,i} \tag{9}$$

To test the statistical significance of the CACIR we use again the *t-ratio* test, the Fisher-sign test and the Wilcoxon-signed-rank test.

We investigate the existence of a structural change in both kind of risks (systematic and non-systematic) by analysing three kinds of event windows. We analyse the impact of rating changes by looking at: (a) five symmetric windows around the announcement date: (-1, 1), (-5, 5), (-10, 10), (-15, 15) and (-30, 30); (b) four post-event window: (1, 5), (1, 10), (1, 15) and (1, 30) and (c) four pre-event window: (-5, -1), (-10, -1), (-15, -1) and (-30, -1). Thus, we can detect possible effects and determine the time when they happen.

4. Empirical result

4.1. Improvements in credit quality

We first consider the impact of the different improvement in credit quality rating actions, i.e., actual rating changes, rating reviews and outlook assignments, on the systematic and non-systematic risk. We analyze the different scenarios of volatility, i.e. constant volatility (Table 2), GJR-GARCH volatility (Table 3) and dummy GJR-GARCH volatility approach (Table 4). In Table 2 we present the results for the systematic risk (left panel) and for the non-systematic risk (right panel). As can be seen in the Systematic risk panel, for any kind of rating actions the mean and median of estimated change in beta is significant in a few windows. In large windows the mean estimated change in beta is significant negative indicating decreases in systematic risk and the median is significant negative too in the larger windows.

[Insert Table 2]

In the case of unsystematic risk, when we consider the Effective Upgrades the average variance ratio (AVR1) is greater than one in the three largest symmetric and previous event windows. However, this evidence of change in variance at individual level is not clear, because F-test rejects the null in a slightly bigger percentage than the 50% but the Siegel-Tukey's percentage of rejection are always lower than the 50% and the Bartlett percentage is sometimes bigger than 50% and sometimes lower. Conversely, the median variance ratio is lower than one in all windows, indicating a decrease in the unsystematic risk level, and this effect is always significant with both nonparametric test.

In the case of Positive Outlook Reports, the results for the average variance ratio are similar: there are no evidences of changes in variance. However, the median variance ratio is always significantly lower than one and decreasing with the size of the window. Results for median and median variance ratio are similar for Reviews for upgrades, but the median is significant lower than one just in the narrower windows.

Table 3 shows results for rating actions that imply an improvement of credit quality of the firms in the second scenario, i.e., when we assume a time-dependent variance estimated from the GJR-GARCH model. The mean estimated change in beta risk is significantly negative only in the case of Positive Outlook Reports in the [-10,10], [-10,-1] and [1,10] windows and in the Effective Upgrades in the largest window (see left panel).

[Insert Table 3]

Respect to the Unsystematic risk (right panel of Table 3), in the case of the three kind of improvement in credit rating the average variance ratio (AVR2) is greater than one, but there are no evidence of change in variance at individual level. The proportion of times that the VR2 is greater than one is always lower than 50%. However, the median variance ratio is always lower than one. In the case of Effective Upgrades and Positive Outlook Reports, the median variance ratio is significant with the sign test, the rank test of both in all windows, except the largest window. This result indicates a decrease in the unsystematic risk level. In the case of Review for upgrades, the result is the same, but the median is significant only in the windows of days before and after the event, and the largest symmetric window. Finally, despite the fact that the λ is lower than one, we do not reject the null hypothesis of zero abnormal performance due to rating changes with the tests proposed by Hilliard and Savickas (2002): the proportion of rejection (λ=1) are always lower than the 20% with the three rating actions and the cumulative H-S test never rejects the null hypothesis ($AVR2^{\lambda}$=1).

Table 4 shows the results for the third scenario or dummy conditional volatility approach, where the effect of rating action on unsystematic risk is captured by a dummy variable's parameter in the GJR-GARCH model.[5] As can be seen in the Systematic risk panel, for any kind of rating actions the mean of estimated change in beta is not significant for all event windows, except in same three windows for negative outlooks in the second scenario. In these windows the

[5] In scenarios with conditional variance we estimate models by QML. We consider all the models nested by the GJR-GARCH (including ARCH and GARCH of different orders) and estimate the best model for each event in the sample.

mean of estimated change in beta is significant and negative. However, the nonparametric test detects effects in the median of estimated change in beta in the three different rating actions. In the case of Effective Upgrades, the effect is always significant and negative in all windows, except the largest window where the effect is significantly positive. For Positive Outlooks, the effect is significantly negative in general, except in the largest window of post event days. For Positive Reviews the effect is in general significant and positive in larger windows and significantly negative in narrower windows regardless of the symmetric or non-symmetric type. In general, we detect decreases in diversifiable risk.

[Insert Table 4]

Respect to the non-systematic risk (see right panel of Table 4), in the case of Effective Upgrades, the Cumulative Average Change in Idiosyncratic Risk the(CACIR) is negative and significant with a t-ratio or the nonparametric test in the previous windows and in the narrowest symmetric and post-event windows. In the case of Reviews for Upgrade the effect is similar except in post-event windows. The median CCIR is also negative in the case of Effective Upgrades and Positive Outlook for symmetric and non-symmetric windows and is clearly significant with nonparametric test. In the case of Reviews for Upgrade the result about the median is the same but just in three cases, the narrowest symmetric, previous and post-event windows.

Overall, we find announcements which improve the credit quality have a statistically significant impact on risk. We detect a significant reduction in non-systematic risk regardless of the kind of announcement and scenario, which is clearer in the case of Effective Upgrades and Positive Outlook Reports. Respect to idiosyncratic risk, the evidence is not so clear. We detect a reduction in beta risk but only in a few windows and clearer in the more flexible scenario (the dummy GJR-GARCH approach). This evidence indicates that there is a reduction in the net risk, because we detect a lower level of both kinds of risk: diversifiable a non-diversifiable.

4.2. Deteriorations in credit quality

First we analyze results for the constant volatility approach. Table 5 shows results for rating actions that imply deterioration on credit quality of the firms. As can be seen in the Systematic risk panel, for any kind of rating actions the mean of estimated change in beta is positive for all event windows. This may indicate increases in systematic risk. In the case of Effective Downgrades, the effect is only significant in the [-15,15] symmetric window, the [-30,-1] and in the three biggest windows of days after the event. For negative outlooks, this effect is significant in all the windows but the [-1,1], and in the case of watchlisting is significant for three symmetric, and several previous and posterior windows. These results may indicate that Reviews for Downgrades are the more informative rating action. However, nonparametric test do not detect any effect, although the median is always positive.

[Insert Table 5]

In the case of unsystematic risk, results are shown in the right panel of Table 5. In the case of Effective Downgrades, the average variance ratio is greater than one in the fourth biggest symmetric event windows and in two of the previous ones. The evidence of change in variance at individual level we find is not clear, because F-test rejects the null in a slightly bigger percentage than the 50% but the Siegel-Tukey's percentage of rejection are always lower than the 50% and in the case of Bartlett test this percentage is bigger than 50% for the biggest windows. Conversely, the median of variance ratio is lower than one in all windows, indicating a decrease in the unsystematic risk level, and the effect is always significant with the sign test, the rank test or both.

Results for the average variance ratio are almost the same in the cases of Outlooks and watchlistings. AVR1 is in general bigger than one, with not clear evidence of structural change with the three individual tests. For Review for Downgrades, the median of the variance ratio is always lower than one and significant in the [-1, 1] window and the asymmetric previous windows. These evidences seem to point to a decrease in volatility indicating some degree of anticipation by the market. For the Review for downgrades, AVR1 is bigger than one except for the asymmetric five days windows. F and Bartlett test rejects the null mainly in the bigger symmetric event windows. The median of the variance ratio is over one for symmetric windows except [-1,1]. The rank test rejects the null in these cases, indicating an increase in volatility around the announcement of inclusion in the credit watch list.

[Insert Table 6]

In Table 6 we present results for the GJR-GARCH volatility approach. Results for the systematic risk are similar to those find in the constant variance approach. We find positive mean estimated change in beta in all windows an all kind of rating events, indicating an increase of market risk. The effect is not significant for Effective Downgrades, but is always significant in the case of Negative Outlooks Reports excluding the [-1,1] window. For Reviews for downgrade, the effect is significant except for five windows. However, though the estimated median VR2 is positive all the times, we never reject the null hypothesis with the two nonparametric tests.

As we can see in the Unsystematic risk panel of Table 6, the estimated average variance ratio is positive independently of the kind of rating action and almost in the whole set of windows. However, the percentage of times the variance ratio is greater than one is lower clearly lower than 40% in the case of Effective Downgrades, and around 50% for outlooks and watchlistings. The median of variance ratio is significantly lower than one in every event window with the two non parametric tests. Despite the fact that the VR2 estimated by the Hilliard and Savickas (2002) is lower than one in all cases, the two H-S test applied fail to detect any effect of downgrades on diversifiable risk.

For Negative Outlook Reports, the median VR2 is lower than one except for [-30,30], [-15,15] and [1,15] window. Nonparametric test only detect lower levels of volatility in the smallest symmetric window, the three smallest pre-event windows and the smallest post-event window. In this case, $AVR2^{\lambda}$ is lower than one for all windows except for the fourth biggest symmetric ones. The H-S tests do not reject the hull hypothesis in any case.

To end with the second approach, for Review for donwgrades, as in the constant volatility case, we find some evidence of an increase in volatility after the inclusion in the watch list. In this case, the median VR2 is positive and significant in all symmetric windows and for three pre-event windows. H-S tests also fails to reject the null in this case.

Finally, we analyze the dummy GJR-GARCH approach (Table 7) where the effect of the rating action announcement on unsystematic risk is captured by δ parameter in equation (8). In this case we also find increments in systematic risk as CACB3 are positives in general. They are non significant for Effective Downgrades, clearly significant in the case of Negative Outlook Reports except for [-1,1],and only significant in several symmetric and asymmetric windows for Review for downgrades.

[Insert Table 7]

When we look at the Unsystematic risk panel of Table 7, we find that in the case of Effective Downgrades CACIR estimation is positive but non significant in general, while it is negative and clearly significant in [-1,1] and narrower pos-event windows. Nevertheless, the median CCIR is negative except for [-30, 30] and the null hypothesis is rejected in the big majority of cases with nonparametric tests. For Negative Outlook Reports, the mean value of the estimated δ is negative for [-1,1] and every asymmetric windows. The median CCIR is also negative in general, and significant for the same set of event windows than in the case of CACIR. In the case of watchlistings, the findings are mixing. We find positive significant CACIR in the symmetric windows except for [-1,1] and in the post-event windows. This could indicate a recovery is in diversifiable risk before the inclusion in the credit watch list to diminish in latter days. Results for the median CCIR also agree with this explanation as their take positive significant values in the biggest symmetric windows but negative significant values in [-1,1] and in the majority of the asymmetric ones.

Summarizing, after the analysis of the effects of rating actions indicating a deterioration in credit quality in the three different scenarios for volatility behavior of returns we find increments in systematic risk that are clearly detected in the more flexible scenario, the dummy GJR-GARCH approach. The Negative Outlook Reports are related with sharply rises in beta risk. There are noticeably decreases in non systematic risk in the case of Effective Downgrades, but this result is less robust to the scenario considered in the case of Negative Outlook Reports and Review for downgrades.

5. Conclusions

This study shows that credit rating agencies announcements are related to changes in total risk of the re-rated firms. The evidence indicates there are effects in both systematic and unsystematic risks. When a firm suffers a decrease in its rating we find a rebalance in both kinds of risks with higher betas joint to lower levels of diversifiable risk. However, when an agency raises the rating of a firm, we observe lower levels of both risks. These findings are very important in portfolio management. Under perfect diversification hypothesis, downgrades of stocks in the portfolio convey a rise in the portfolio risk. Nevertheless, several authors point out that many investors are undiversified (i. e. Campbell, Lettau, Malkiel, Xu, 2001). In this case, the net effect of downgrades of individual stocks in the total portfolio risk is indeterminate.

References

Abad-Romero, P., Robles-Fernandez, M.D., (2007), "Bond rating changes and stock returns: evidence from the Spanish stock market", Spanish Economic Review, 9, 79–103.

Abad-Romero, P., Robles-Fernandez, M.D., (2006), "Risk and returns around bond rating changes: new evidence from the Spanish stock market." *Journal of Business Finance & Accounting,* 33(5) & (6), 885–908

Angelidis, T., Tessaromati, N., (2009), "Idiosyncratic risk matters! A regime switching approach." *International Review of Economics and Finance* 18, 132–141

Brooks, L.D., Ingram, R. W., Copeland, R. M. (1983), "Credit Risk, Beta, and Bond Ratings." *Nebraska Journal of Economics & Business*, Winter83, 22, Issue 1. P. 3

Campbell, J., Lettau, M., Malkiel, B., Xu, Y., (2001), "Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk." *Journal of Finance,* 56, 1-43.

Crouchy, M.G., Jarrow, R.A., and Turnbull, S.M. (2008), "The Subprime Credit Crisis of 2007", *The Journal of Derivatives*, 4, 81–110.

Dichev, I. D., Piotroski, J. D., (2001), "The long-run stock returns following bond rating changes," *The Journal of Finance*, 56 (1), 173-203.

Goyal, A., Santa-Clara, P., (2003), "Idiosyncratic risk matters!." *Journal of Finance,* 58, 975-2007.

Hilliard, J.E., Savikas, R., (2002), "On the statistical significance of event studies on unsystematic volatility." *Journal of Financial Research*, 25, 447-462.

Impson, C.M., Karafiath, I., Glascock, J., (1992), “Testing Beta Stationarity across Bond Rating Changes,” *The Financial Review,* 27 (4), 607-618.

Sheskin, D. J. (1997), Handbook of Parametric and Nonparametric Statistical Procedures (CRC Press, Boca Raton).

Table 1. Rating action announcements: distribution by sector and type

	Agency			
	Fitch	**Moodys**	**Standard & Poor's**	**Total**
Negative rating announcements				
Effective Downgrade	70 (19)	59 (16)	42 (10)	171 (45)
Negative Outlook Assignment	5 (0)	20 (3)	15 (0)	40 (3)
Review for Downgrade	32 (9)	49 (10)	35 (4)	116 (23)
Positive rating announcements				
Effective Upgrade	31 (5)	38 (8)	19 (2)	88 (15)
Positive Outlook Assignment	4 (0)	16 (5)	5 (0)	25 (5)
Review for Upgrade	6 (0)	23 (3)	13 (2)	42 (5)
Total	148 (33)	205 (45)	129 (18)	482 (96)

Note: Contaminated rating changes in parentheses

Figure 1. Rating action announcements: distribution by year

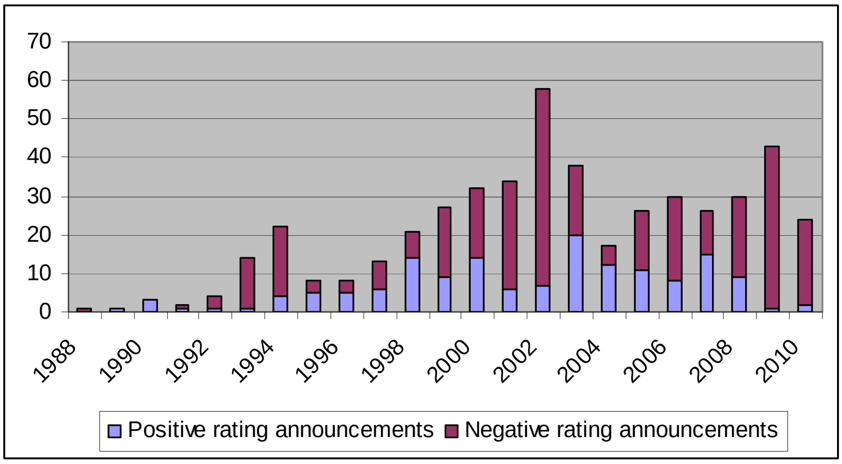

Figure 2. Rating action announcements: distribution by sector's issuer

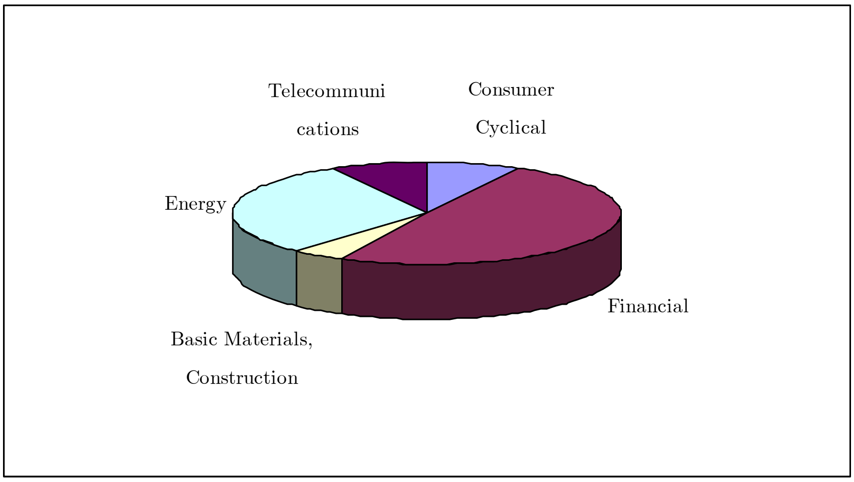

Table 2. Improvements in credit quality: Constant volatility approach

Systematic risk	Unsystematic risk

Window	CACB1	M-CCB1	AVR1	F-test	S-T test	B test	M-VR1	Sign test	Rank test
Effective Upgrades (N=73)									
[-30,30]	-0.057	-0.011*	1.484	57.5%	47.9%	56.2%	0.884	46*	1.034
[-15,15]	0.020	0.102	1.665	47.9%	31.5%	46.6%	0.741	49*	2.298*
[-10,10]	-0.038	0.068	1.842	52.1%	34.2%	49.3%	0.695	53*	3.436*
[-5,5]	0.042	0.081	0.730	52.1%	23.3%	49.3%	0.533	52*	3.826*
[-1,1]	-0.032	0.034*	0.382	67.1%	41.1%	45.2%	0.091	66*	5.800*
[-30,-1]	-0.029	0.003	0.963	53.4%	34.2%	50.7%	0.831	44	2.655*
[-15,-1]	0.049	0.070	0.906	53.4%	27.4%	52.1%	0.574	53*	3.463*
[-10,-1]	0.054	0.140	0.791	52.1%	32.9%	46.6%	0.520	59*	4.266*
[-5,-1]	0.074	0.129	0.476	64.4%	23.3%	49.3%	0.240	61*	5.349*
[1,30]	-0.035	0.006	1.812	58.9%	43.8%	60.3%	0.748	47*	2.073*
[1,15]	0.117	0.235	2.108	57.5%	41.1%	46.6%	0.541	52*	3.595*
[1,10]	-0.094	0.085	2.366	52.1%	31.5%	42.5%	0.485	57*	4.794*
[1,5]	0.062	0.173	0.516	56.2%	34.2%	38.4%	0.273	61*	5.399*
Positive Outlook Reports (N=37)									
[-30,30]	-0.064	-0.068	0.812	64.9%	29.7%	64.9%	0.639	31*	3.530*
[-15,15]	-0.109	-0.018	0.882	54.1%	24.3%	54.1%	0.676	29*	2.987*
[-10,10]	-0.250*	-0.278	0.886	56.8%	18.9%	45.9%	0.572	31*	3.606*
[-5,5]	-0.292	-0.183	1.053	54.1%	21.6%	40.5%	0.576	28*	2.942*
[-1,1]	-0.908	0.007	0.427	54.1%	37.8%	40.5%	0.102	33*	3.938*
[-30,-1]	-0.084	-0.021	0.870	62.2%	40.5%	54.1%	0.617	31*	3.379*
[-15,-1]	-0.162	-0.075	1.005	51.4%	21.6%	45.9%	0.603	29*	2.987*
[-10,-1]	-0.264*	-0.079	0.953	54.1%	21.6%	40.5%	0.491	30*	3.847*
[-5,-1]	-0.780	-0.345	0.857	43.2%	29.7%	32.4%	0.393	31*	3.817*
[1,30]	-0.054	-0.034	0.645	64.9%	16.2%	59.5%	0.564	34*	4.179*
[1,15]	-0.064	-0.003	0.583	51.4%	24.3%	40.5%	0.542	34*	4.662*
[1,10]	-0.393*	-0.219	0.518	48.6%	10.8%	43.2%	0.511	35*	4.722*
[1,5]	-0.454	-0.220	0.388	54.1%	24.3%	35.1%	0.268	36*	4.737*
Review for upgrades (N=20)									
[-30,30]	-0.037	-0.093	1.101	70.0%	60.0%	65.0%	0.802	14	0.728
[-15,15]	-0.094	-0.054	1.200	70.0%	55.0%	60.0%	0.679	12	0.205
[-10,10]	-0.239	-0.441	1.249	50.0%	25.0%	50.0%	0.732	12	0.616
[-5,5]	-0.392	-0.099	1.483	30.0%	30.0%	30.0%	0.720	14	0.915
[-1,1]	-5.818	-0.254	1.062	65.0%	25.0%	40.0%	0.123	17*	2.333*
[-30,-1]	-0.037	-0.011*	0.854	60.0%	50.0%	55.0%	0.704	14	1.699*
[-15,-1]	-0.174	0.001*	0.886	50.0%	25.0%	35.0%	0.702	14	0.952
[-10,-1]	-0.628	0.005	0.772	40.0%	30.0%	40.0%	0.652	15*	1.549
[-5,-1]	-0.765	-0.352	0.471	50.0%	40.0%	30.0%	0.306	18*	3.155*
[1,30]	0.023	-0.029	1.253	65.0%	40.0%	65.0%	0.822	13	0.616
[1,15]	0.093	-0.091	1.303	60.0%	55.0%	55.0%	0.601	14	1.587
[1,10]	-0.091	-0.153	1.400	40.0%	25.0%	35.0%	0.554	16*	2.296*
[1,5]	-0.307	0.243	1.337	45.0%	25.0%	40.0%	0.419	16*	2.184*

Note: In all cases, * indicates rejection of the H_0 that no effects due to rating actions at least to a 10% significance level. M-CCB1 is the median CCB1, and in this case * indicates rejection of H_0 with the sign test and + indicates the same but with the rank test. F-test, ST-test and B-test are respectively F-variance ratio, Siegel-Tukey and Bartlett tests and the figures show the proportion of times that H_0 is rejected individually. M-VR1 is the median of the variance ratio.

Table 3. Improvements in credit quality: GJR-GARCH volatility approach

Systematic Risk	Unsystematic Risk

Window	CACB2	M-CCB2	AVR2	%>1	M-VR2	Sign-t	R-test	AVR2$^{\lambda}$	% λ=1	CHS-test
Effective Upgrades (N=73)										
[-30,30]	0.004	-0.002*	1.164	49.3%	0.995	37	0.291	1.003	3.3%	1032.1
[-15,15]	0.118	0.125	1.100	39.7%	0.925	44	2.369*	0.994	3.2%	807.5
[-10,10]	0.098	0.133	1.347	31.5%	0.903	50*	2.996*	0.934	9.5%	513.0
[-5,5]	0.111	0.124	0.830	34.2%	0.894	48*	3.507*	0.817	18.2%	1496.9
[-1,1]	0.007	0.065	0.910	28.8%	0.885	52*	3.705*	0.387	0.0%	389.8
[-30,-1]	0.011	0.006*	1.020	41.1%	0.961	43	1.726*	0.898	3.3%	1306.7
[-15,-1]	0.059	0.079	1.034	39.7%	0.948	44	1.908*	0.834	6.7%	886.5
[-10,-1]	0.097	0.163	1.008	30.1%	0.844	51*	3.507*	0.744	0.0%	387.8
[-5,-1]	0.176	0.309	0.837	26.0%	0.850	54*	3.986*	0.548	0.0%	526.4
[1,30]	-0.003	0.028	2.044	37.0%	0.932	46*	1.875*	0.953	6.7%	753.3
[1,15]	0.084	0.162	2.606	30.1%	0.908	51*	2.666*	0.858	6.7%	447.8
[1,10]	-0.058	0.141	2.958	31.5%	0.880	50*	3.051*	0.797	10.0%	208.1
[1,5]	0.107	0.094	0.858	27.4%	0.850	53*	3.562*	0.590	0.0%	786.2
Positive Outlook Reports (N=37)										
[-30,30]	-0.041	-0.067	0.907	27.0%	0.918	27*	2.942*	0.939	6.6%	713.8
[-15,15]	-0.080	-0.097	1.017	24.3%	0.896	28*	2.61*	0.923	9.7%	465.3
[-10,10]	-0.242*	-0.163	1.014	21.6%	0.851	29*	3.349*	0.879	9.5%	318.7
[-5,5]	-0.292	-0.193	0.815	24.3%	0.805	28*	3.063*	1.073	9.1%	112.3
[-1,1]	-0.874	0.001	0.913	24.3%	0.870	28*	2.806*	0.510	0.0%	19173
[-30,-1]	-0.095	0.014	0.967	24.3%	0.861	28*	2.474*	0.924	13.3%	622.3
[-15,-1]	-0.078	-0.020	0.986	29.7%	0.904	26*	2.489*	0.943	0.0%	322.3
[-10,-1]	-0.225*	-0.080	1.207	24.3%	0.909	28*	3.002*	0.785	10.0%	182.8
[-5,-1]	-0.602	-0.163	0.852	18.9%	0.838	30*	3.5*	0.820	0.0%	183.6
[1,30]	-0.022	-0.009	0.815	16.2%	0.866	31*	3.938*	0.811	13.3%	951.1
[1,15]	-0.014	0.037	0.818	8.1%	0.844	34*	4.254*	0.733	6.7%	505.1
[1,10]	-0.321*	-0.156	0.835	10.8%	0.867	33*	4.103*	0.663	10.0%	386.3
[1,5]	-0.436	-0.167	0.976	18.9%	0.820	30*	3.032*	0.483	20.0%	764.2
Review for upgrades (N=20)										
[-30,30]	0.030	0.082	0.929	30.0%	0.942	14	1.96*	1.002	4.9%	202.7
[-15,15]	-0.060	-0.086	0.887	30.0%	0.831	14	1.587	1.314	3.2%	57.90
[-10,10]	-0.045	-0.186	1.320	45.0%	0.894	11	0.989	1.079	9.5%	100.4
[-5,5]	-0.040	0.107	1.438	35.0%	0.906	13	0.877	1.061	9.1%	173.8
[-1,1]	-4.675	-0.104	0.912	35.0%	0.901	13	1.101	0.978	0.0%	5771.0
[-30,-1]	-0.042	-0.062	0.887	30.0%	0.824	14	2.147*	1.031	13.3%	183.5
[-15,-1]	-0.104	0.227	0.830	30.0%	0.761	14	2.259*	1.026	6.7%	136.4
[-10,-1]	-0.515	-0.008	0.868	25.0%	0.759	15*	1.811*	0.945	10.0%	98.20
[-5,-1]	-0.740	-0.258	0.739	15.0%	0.719	17*	3.005*	0.599	0.0%	134.7
[1,30]	0.119	0.023	0.885	25.0%	0.790	15*	1.325	1.067	3.3%	71.10
[1,15]	-0.025	0.034	2.909	25.0%	0.800	15*	1.176	1.106	13.3%	139.5
[1,10]	-0.086	-0.109	0.987	25.0%	0.825	15*	1.400	1.089	10.0%	18.60
[1,5]	-0.382	0.450	1.025	30.0%	0.854	14	1.363	1.089	20.0%	105.0

Note: In all cases, * indicates rejection of the H_0 that no effects due to rating actions at least to a 10% significance level. M-CCB2 is the median CCB2, and in this case * indicates rejection of H_0 with the sign test and + indicates the same but with the rank test. % >1 indicate the proportion of times that the VR2 is greater than 1, M-VR2 is the median VR2. AVR2$^{\lambda}$ is the average λ in equation (6), % λ=1 is the proportion of times that the individual H-S test for H0: λ=1 is rejected and CHS-test is the cumulative H-S test.

Table 4. Improvements in credit quality: Dummy GJR-GARCH volatility approach

Systematic Risk	Unsystematic Risk

Window	CACB3	M-CCB3	CACIR	% CCIR≠0	M-CCIR	Sign test	Rank test
Effective Upgrades (N=73)							
[-30,30]	-0.028	-0.001*+	-0.624	79.5%	0.001	37	0.984
[-15,15]	0.052	0.075+	-0.676	71.2%	-0.028	44	1.853*
[-10,10]	0.046	0.081+	-0.707	71.2%	-0.029	48*	2.683*
[-5,5]	0.057	0.051+	-0.819*	64.4%	-0.068	46*	2.007*
[-1,1]	-0.001	0.096+	-1.478*	27.4%	-0.672	65*	5.954*
[-30,-1]	0.020	0.014+	-0.914*	72.6%	-0.013	42	1.380
[-15,-1]	0.061	0.030+	-0.993*	65.8%	-0.074	52*	3.244*
[-10,-1]	0.092	0.207+	-0.975*	50.7%	-0.136	52*	4.013*
[-5,-1]	0.177	0.283+	-1.444*	30.1%	-0.484	59*	5.432*
[1,30]	-0.022	0.029+	-0.252	64.4%	-0.022	46*	2.051*
[1,15]	0.158	0.182+	-0.202	63.0%	-0.068	49*	2.859*
[1,10]	-0.026	0.162	0.129	63.0%	-0.142	51*	3.942*
[1,5]	0.065	0.080+	-1.339*	39.7%	-0.298	56*	4.546*
Positive Outlook Reports (N=37)							
[-30,30]	-0.051	-0.062+	0.052	83.8%	-0.021	26*	1.494
[-15,15]	-0.072	-0.041+	-0.065	75.7%	-0.013	22	0.875
[-10,10]	-0.196*	-0.150+	0.029	73.0%	-0.025	25*	1.177
[-5,5]	-0.247	-0.185	0.187	70.3%	-0.016	24*	0.754
[-1,1]	-0.570	0.000+	-0.388	24.3%	-0.425	33*	3.696*
[-30,-1]	-0.051	-0.011+	-0.034	81.1%	-0.048	27*	2.534*
[-15,-1]	-0.157	-0.069+	-0.237*	67.6%	-0.072	24*	2.384*
[-10,-1]	-0.261*	-0.134+	-0.092	67.6%	-0.084	25*	2.338*
[-5,-1]	-0.622	-0.175+	-0.301	48.6%	-0.179	30*	3.289*
[1,30]	-0.020	0.009*+	-0.12*	81.1%	-0.019	24*	2.157*
[1,15]	-0.018	0.052*+	-0.244*	75.7%	-0.070	28*	3.364*
[1,10]	-0.311*	-0.113+	-0.297*	70.3%	-0.087	32*	4.254*
[1,5]	-0.425	-0.187+	-0.668*	21.6%	-0.334	34*	4.828*
Review for upgrades (N=20)							
[-30,30]	-0.019	0.075+	-0.769	75.0%	0.034	11	0.168
[-15,15]	0.079	-0.006+	-0.280	75.0%	0.086	13	0.989
[-10,10]	-0.034	-0.127	0.145	70.0%	0.051	12	0.616
[-5,5]	-0.306	-0.113+	-0.825	80.0%	0.034	11	0.205
[-1,1]	-5.006	-0.334+	-1.608	20.0%	-1.154	17*	2.781*
[-30,-1]	0.102	0.009+	-0.582	85.0%	0.031	11	0.691
[-15,-1]	-0.152	0.075+	-0.016	70.0%	0.037	13	1.027
[-10,-1]	-0.460	-0.002+	-0.439	65.0%	-0.074	12	0.989
[-5,-1]	-0.704	-0.164+	-2.129	40.0%	-0.381	18*	2.856*
[1,30]	0.044	0.009*+	-0.743	70.0%	-0.054	12	0.653
[1,15]	0.013	-0.035+	-0.510	75.0%	-0.113	12	1.027
[1,10]	-0.206	0.028+	-0.093	45.0%	-0.146	15*	1.885*
[1,5]	-0.734	0.158+	-1.050	35.0%	-0.252	14	1.624

Note: In all cases, * indicates rejection of the H_0 that no effects due to rating actions at least to a 10% significance level. M-CCB3 is the median CCB3, and in this case * indicates rejection of H_0 with the sign test and + indicates the same but with the rank test. Figures in the % CCIR=0 column indicates the proportion of times the δ parameter is significant in model (7), and M-CCIR is the median CCIR

Table 5. Deteriorations in credit quality: Constant volatility approach

Systematic risk	Unsystematic risk

Window	CACB	M-CACB	AVR1	F test	S-T test	B test	M-VR1	Sign-t	Rank-t
Effective Downgrades (N=126)									
[-30,30]	0.070	0.036	1.068	61.9%	49.2%	61.9%	0.769	78*	1.351
[-15,15]	0.096*	0.058	1.160	59.5%	46.0%	57.1%	0.781	82*	1.373
[-10,10]	0.082	0.076	1.134	55.6%	39.7%	54.0%	0.715	84*	2.445*
[-5,5]	0.104	0.077	1.143	51.6%	34.9%	46.8%	0.654	91*	3.421*
[-1,1]	0.225	0.189	0.488	69.8%	42.1%	44.4%	0.102	118*	7.867*
[-30,-1]	0.099*	0.045	0.983	57.1%	38.1%	56.3%	0.742	84*	2.557*
[-15,-1]	0.114	0.116	1.108	56.3%	32.5%	52.4%	0.612	84*	3.126*
[-10,-1]	0.023	0.043	1.083	47.6%	29.4%	42.9%	0.587	89*	4.022*
[-5,-1]	0.245	0.020	0.950	50.0%	24.6%	36.5%	0.354	103*	5.734*
[1,30]	0.117*	0.019	0.974	55.6%	42.9%	54.0%	0.774	79*	2.459*
[1,15]	0.161*	0.032	0.918	50.8%	31.0%	50.0%	0.615	89*	3.577*
[1,10]	0.215*	0.095	0.824	54.0%	29.4%	42.9%	0.501	97*	5.313*
[1,5]	0.132	-0.081	0.505	56.3%	22.2%	35.7%	0.279	109*	8.312*
Negative Outlook Reports (N=37)									
[-30,30]	0.245*	0.038	1.295	75.7%	40.5%	70.3%	0.870	22	0.332
[-15,15]	0.376*	0.141	1.412	59.5%	43.2%	59.5%	0.863	20	0.498
[-10,10]	0.513*	0.189	1.530	56.8%	37.8%	48.6%	0.890	22	0.407
[-5,5]	0.584*	0.394	1.711	40.5%	27.0%	29.7%	0.914	22	0.136
[-1,1]	0.120	0.057	1.009	59.5%	35.1%	35.1%	0.172	34*	4.164*
[-30,-1]	0.282*	0.289	1.128	51.4%	27.0%	43.2%	0.748	24*	1.177
[-15,-1]	0.337*	0.298	1.040	32.4%	13.5%	35.1%	0.789	25*	1.675*
[-10,-1]	0.576*	0.448	1.002	40.5%	21.6%	35.1%	0.792	25*	1.81*
[-5,-1]	0.846*	0.384	0.723	48.6%	29.7%	45.9%	0.400	27*	3.078*
[1,30]	0.265*	0.087	1.043	51.4%	35.1%	56.8%	0.726	22	0.905
[1,15]	0.427*	0.135	1.194	43.2%	32.4%	43.2%	0.768	21	0.000
[1,10]	0.514*	0.193	1.169	45.9%	40.5%	48.6%	0.787	23	0.483
[1,5]	0.603*	0.692	1.008	40.5%	27.0%	24.3%	0.458	26*	2.836*
Review for downgrades (N=93)									
[-30,30]	0.079	0.065	1.525	63.4%	46.2%	66.7%	1.138	54	3.065*
[-15,15]	0.143*	0.104	1.632	52.7%	39.8%	54.8%	1.123	51	2.51*
[-10,10]	0.18*	0.054	1.735	54.8%	38.7%	52.7%	1.092	53	2.487*
[-5,5]	0.286*	0.007	1.863	49.5%	36.6%	52.7%	1.096	48	2.188*
[-1,1]	0.733	0.195	1.665	49.5%	44.1%	44.1%	0.241	64*	2.889*
[-30,-1]	0.038	0.057	1.340	45.2%	28.0%	46.2%	1.011	47	1.866*
[-15,-1]	0.113	0.134	1.308	38.7%	31.2%	38.7%	0.863	54	0.268
[-10,-1]	0.159*	0.105	1.339	36.6%	22.6%	30.1%	0.939	50	0.215
[-5,-1]	0.296*	0.205	0.932	39.8%	21.5%	30.1%	0.543	63*	3.054*
[1,30]	0.142*	0.101	1.166	57.0%	35.5%	55.9%	0.833	57*	1.038
[1,15]	0.179*	0.136	1.149	43.0%	34.4%	45.2%	0.827	54	0.989
[1,10]	0.228*	0.205	1.059	45.2%	30.1%	52.7%	0.692	61*	1.295
[1,5]	0.326	0.045	0.980	50.5%	38.7%	43.0%	0.371	67*	2.782*

Note: In all cases, * indicates rejection of the H_0 that no effects due to rating actions at least to a 10% significance level. M-CCB is the median CCB, and in this case * indicates rejection of H_0 with the sign test and + indicates the same but with the rank test. F-test, ST-test and B-test are respectively F-variance ratio, Siegel-Tukey and Bartlett tests and the figures show the proportion of times that H_0 is rejected individually. M-VR1 is the median of the variance ratio.

Table 6. Deteriorations in credit quality: GJR-GARCH volatility approach

Systematic Risk	Unsystematic Risk

Window	CACB2	M-CCB2	AVR2	%>1	M-VR2	Sign-t	Rank-t	AVR2$^{\lambda}$	% λ=1	CHS-test
Effective Downgrades (N=126)										
[-30,30]	0.045	0.019	1.137	38.9%	0.927	77*	1.763*	0.975	6.6%	3736.4
[-15,15]	0.063	0.090	1.077	34.1%	0.882	83*	1.831*	0.989	9.7%	2342.2
[-10,10]	0.063	0.120	1.060	35.7%	0.885	81*	3.216*	0.965	4.8%	2003.1
[-5,5]	0.102	0.022	1.181	32.5%	0.875	85*	2.958*	0.867	9.1%	1274.5
[-1,1]	0.798	0.147	1.079	24.6%	0.818	95*	4.782*	0.385	0.0%	810.0
[-30,-1]	0.101	0.046	1.149	32.5%	0.885	85*	2.873*	0.923	13.3%	1647.7
[-15,-1]	0.159	0.075	1.013	29.4%	0.829	89*	3.813*	0.948	13.3%	1400.6
[-10,-1]	0.023	0.023	1.007	30.2%	0.824	88*	4.047*	0.899	10.0%	815.9
[-5,-1]	0.283	-0.033	1.142	24.6%	0.824	95*	4.719*	0.702	20.0%	256.9
[1,30]	0.103	0.084	1.026	38.1%	0.921	78*	2.094*	0.938	10.0%	3898.0
[1,15]	0.111	0.076	1.010	31.7%	0.870	86*	2.812*	0.886	6.7%	2321.1
[1,10]	0.188*	0.081	0.971	29.4%	0.817	89*	3.572*	0.789	10.0%	1290.7
[1,5]	0.117	-0.081	0.925	23.0%	0.763	97*	5.008*	0.545	0.0%	1007.3
Negative Outlook Reports (N=37)										
[-30,30]	0.233*	0.104	1.213	54.1%	1.025	20	0.619	1.005	6.6%	1090.7
[-15,15]	0.36*	0.054	1.297	54.1%	1.015	20	0.709	1.007	6.5%	650.3
[-10,10]	0.494*	0.263	1.373	48.6%	0.996	19	0.166	1.040	19.0%	407.8
[-5,5]	0.588*	0.424	1.463	40.5%	0.956	22	0.392	1.094	9.1%	309.6
[-1,1]	-0.203	0.079	1.094	21.6%	0.885	29*	2.534*	0.431	0.0%	269.0
[-30,-1]	0.193*	0.095	1.080	40.5%	0.977	22	0.588	0.969	6.7%	1002.7
[-15,-1]	0.303*	0.268	1.054	35.1%	0.937	24*	1.177	0.889	0.0%	888.6
[-10,-1]	0.579*	0.438	0.956	32.4%	0.879	25*	2.338*	0.905	0.0%	398.7
[-5,-1]	0.837*	0.448	1.075	24.3%	0.898	28*	2.851*	0.651	0.0%	99.1
[1,30]	0.275*	0.160	1.223	43.2%	0.988	21	0.211	0.930	10.0%	629.8
[1,15]	0.443*	0.075	1.500	51.4%	1.003	19	0.694	0.894	6.7%	358.2
[1,10]	0.542*	0.296	1.641	45.9%	0.941	20	0.196	0.818	10.0%	164.8
[1,5]	0.575*	0.655	1.931	32.4%	0.907	25*	0.739	0.646	0.0%	298.3
Review for downgrades (N=93)										
[-30,30]	0.103	0.037	1.349	60.2%	1.061	56*	3.015*	1.053	3.3%	1052.5
[-15,15]	0.133*	0.039	1.438	59.1%	1.042	55*	2.46*	1.082	3.2%	374.4
[-10,10]	0.185*	0.061	1.511	59.1%	1.062	55*	3.015*	1.098	4.8%	235.8
[-5,5]	0.529*	0.169	1.510	54.8%	1.049	51	2.33*	1.090	9.1%	162.3
[-1,1]	0.782	0.262	1.246	38.7%	0.902	57*	0.034	0.764	0.0%	538.1
[-30,-1]	0.051	0.031	1.195	52.7%	1.015	49	1.165	1.105	13.3%	1516.8
[-15,-1]	0.139	0.074	1.186	41.9%	0.970	54	0.027	1.063	20.0%	583.6
[-10,-1]	0.218*	0.129	1.197	44.1%	0.967	52	0.843	1.087	10.0%	616.0
[-5,-1]	0.534*	0.180	1.127	35.5%	0.904	60*	1.218	0.805	0.0%	129.1
[1,30]	0.146*	0.077	1.292	51.6%	1.003	48	1.253	0.895	10.0%	1792.3
[1,15]	0.202*	0.144	1.437	51.6%	1.038	48	1.946*	0.836	13.3%	687.2
[1,10]	0.236*	0.244	1.545	55.9%	1.023	52	2.142*	0.726	0.0%	674.5
[1,5]	0.269	0.132	1.656	49.5%	0.993	47	1.766*	0.607	0.0%	634.0

Note: In all cases, * indicates rejection of the H_0 that no effects due to rating actions at least to a 10% significance level. M-CCB2 is the median CCB2, and in this case * indicates rejection of H_0 with the sign test and + indicates the same but with the rank test. % >1 indicate the proportion of times that the VR2 is greater than 1, M-VR2 is the median VR2. AVR2$^{\lambda}$ is the average λ in equation (6), % λ=1 is the proportion of times that the individual H-S test for H0: λ=1 is rejected and CHS-test is the cumulative H-S test.

Table 7. Deteriorations in credit quality: Dummy GJR-GARCH volatility approach

Systematic Risk	Unsystematic Risk

Window	CACB3	M-CCB3	CACIR	% CCIR≠0	M-CIR	Sign test	Rank test
Effective Downgrades (N=126)							
[-30,30]	0.049	0.038+	0.056	76.2%	0.007	68	0.757
[-15,15]	0.078	0.092	0.133	78.6%	-0.008	65	0.105
[-10,10]	0.059	0.084+	0.004	68.3%	-0.052	77*	1.609
[-5,5]	0.100	0.029+	-0.189	56.3%	-0.174	84*	3.767*
[-1,1]	0.868	0.224+	-1.635*	24.6%	-1.292	11*	8.188*
[-30,-1]	0.051	0.02+	-0.068	76.2%	-0.005	65	0.550
[-15,-1]	0.101	0.113	0.137	68.3%	-0.055	76*	1.551
[-10,-1]	-0.009	-0.003*	0.139	61.1%	-0.123	83*	3.036*
[-5,-1]	0.283	-0.045	0.443	44.4%	-0.390	97*	5.78*
[1,30]	0.094	0.056+	0.017	77.8%	-0.026	69	0.743
[1,15]	0.138*	0.082+	-0.149	65.9%	-0.073	78*	2.116*
[1,10]	0.181*	0.099+	-0.258*	51.6%	-0.199	90*	4.176*
[1,5]	0.128	-0.088+	-0.977*	38.9%	-0.506	10*	7.185*
Negative Outlook Reports (N=37)							
[-30,30]	0.208*	0.035+	0.075	73.0%	-0.033	20	0.136
[-15,15]	0.329*	0.032+	-0.007	73.0%	0.003	19	0.091
[-10,10]	0.504*	0.295+	-0.060	64.9%	-0.011	19	0.241
[-5,5]	0.526*	0.473	0.140	64.9%	0.000	19	0.151
[-1,1]	0.001	0.16+	-1.223*	18.9%	-1.079	34*	4.435*
[-30,-1]	0.197*	0.161+	-0.169	81.1%	-0.020	21	0.709
[-15,-1]	0.31*	0.289+	-0.238*	73.0%	-0.111	24*	2.429*
[-10,-1]	0.615*	0.447+	-0.302*	64.9%	-0.047	21	1.614
[-5,-1]	0.898*	0.393+	-0.612*	35.1%	-0.483	29*	3.259*
[1,30]	0.238*	0.155+	-0.048	73.0%	-0.029	24*	0.815
[1,15]	0.505*	0.067+	-0.296*	75.7%	-0.106	24*	1.931*
[1,10]	0.594*	0.183+	-0.284*	67.6%	-0.114	25*	2.037*
[1,5]	0.666*	0.773+	-0.376*	51.4%	-0.312	28*	3.425*
Review for downgrades (N=93)							
[-30,30]	0.082	0.028+	0.075	83.9%	0.024	59*	1.824*
[-15,15]	0.14*	0.070	0.347*	83.9%	0.050	52	2.663*
[-10,10]	0.176*	0.068	0.439*	80.6%	0.083	58*	2.709*
[-5,5]	0.374*	0.106	0.689*	69.9%	0.107	53	1.797*
[-1,1]	0.673	0.054+	-0.389	24.7%	-0.895	69*	3.713*
[-30,-1]	0.055	0.063	0.298*	82.8%	0.082	55*	2.786*
[-15,-1]	0.137	0.087	0.406*	81.7%	-0.002	47	1.249
[-10,-1]	0.221*	0.190	0.443*	71.0%	0.047	53	0.927
[-5,-1]	0.417*	0.218+	0.003	50.5%	-0.287	59*	3.008*
[1,30]	0.156*	0.109+	-0.162*	69.9%	-0.053	56*	1.77*
[1,15]	0.147*	0.122+	-0.049	65.6%	-0.097	61*	1.521
[1,10]	0.236*	0.18+	-0.218	52.7%	-0.251	66*	3.579*
[1,5]	0.295	0.199+	-0.653*	32.3%	-0.732	75*	4.797*

Note: In all cases, * indicates rejection of the H_0 that no effects due to rating actions at least to a 10% significance level. M-CCB3 is the median CCB3, and in this case * indicates rejection of H_0 with the sign test and + indicates the same but with the rank test. Figures in the % CCIR=0 column indicates the proportion of times the δ parameter is significant in model (7), and M-CCIR is the median CCIR