Do rating grades convey important information: German evidence?[*1]

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Abstract

In this paper we investigate the impact of credit rating changes on German stock market. We evaluate daily abnormal stock returns of companies listed on the Frankfurt Stock Exchange (HDAX). Rating upgrades and downgrades are made by three rating agencies: Moody's, Standard and Poor's, and Fitch Ratings. We find that rating announcements are largely anticipated, i.e. German market adjusts stock prices long before the rating changes have been made. Additionally, we report that the market, along with anticipating the rating change, reacts stronger to downgrades compared to upgrades.

Keywords: Credit Rating, Stock market, Event study

JEL classification: C10, E44, F41,

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1. INTRODUCTION

Investment decisions are challenging due to high costs and time required to analyse projects. As a result, rating announcements are treated as signals which stem from informational asymmetry existing between debt issuers and investors. Therefore, credit ratings are decisive to market agents during their decision process. For example, institutional investors distinguish between investment and non-investment grade ratings as it is essential when considering investment portfolios. Financial intermediaries use credit ratings to set lending interest rates and to control the level of required capital. Hence, the ratings made by credit agencies have significant impact on the rating issuers.

However, do changes in credit ratings convey important information to the market? In this paper we attempt to answer this question. To do this we examine ratings for informational content in the German market during the recent financial crisis. Specifically, we investigate the price impact of upgrades and downgrades made by three agencies – Moody's Investors Service, Standard & Poor's and Fitch Ratings. The data are daily stock prices of companies listed on the Frankfurt Stock Exchange. It is divided into two periods: pre-crisis (2002-2007) and post-crisis (2009-2015). We intentionally exclude 2008 because there was a decline in the global stock market with capital injections and government bailouts which could contaminate our data.

The decision on the Frankfurt Stock Exchange is based on liquidity and intensity of trading. It is a large stock exchange with high turnover velocity in its premium segments. Thus, it fits our required criteria. There are previous research focusing on German market, for example on stock performance after inclusion in Dow Jones sustainability index (Oberndorfer et al, 2013), short-term stock overreaction, (Lobe and Rieks, 2011) and credit ratings as a measure of innovation (Czarnitzki and Kraft, 2004). However, to the best of our knowledge there is no research on HDAX stocks reaction to rating upgrades and downgrades. Studies investigating rating changes concentrate either on stocks of financial industries or banks, or in case of Dichev and Piotroski (2001) on the US bond market.

To calculate the impact of rating announcements on stock returns we use the event study methodology. We define an event date as a public announcement of rating change by rating agencies and examining an event window. In this paper the event window starts 60 business days prior a rating announcement and ends 20 business days after the announcement. Decision on 60 pre-event days is based on the fact that rating agencies usually act upon material information and announce an actual downgrade following a negative review within three months. We use paired samples test for significance of the mean difference between cumulative abnormal returns and cumulative normal returns. Hence, rating changes convey important information if the event dates indicate significant market reaction.

The remainder of the paper organized as follows. Literature review is given in section 2. Section 3 presents methodology employed in the paper. In section 4 we present data description and sampling procedures. Empirical findings are given in Section 5. The final section concludes

2. LITERATURE REVIEW

Rating agencies have a privileged access to confidential information. Companies are reluctant to reveal private information to the public, even positive ones (e.g. R&D projects), to prevent competitors from obtaining sensitive information. However, they share confidential information with rating analysts who incorporate it into the rating assessments. By doing so, companies indirectly communicate important information through credit rating to the market participants. Additionally, according to Calvo and Mendoza (2000), high costs of generating new information make market agents rely on rating agencies. Therefore, they function as intermediaries that reduce informational asymmetry.

However, Gropp and Richards (2001) argue that rating agencies lack in timeliness. They simply reflect the information that is already known to the market. In addition, there is a potential conflict of interest and they may act in the interest of the issuers. The rating agencies are also blamed for pro-cyclical behaviour (see e.g. Schumacher, 2014). For example, the agencies failed to spot several corporate defaults, such as e.g. Enron and Worldcom, downgrading only after their defaults. More recently, they are singled out for the recent financial crisis, due to inability to foresee subprime mortgage securities defaults. All three rating agencies – Moody's, Standard and Poor's and Fitch graded these securities as safe (see for example White, 2010).

Nonetheless, the agencies justify their sluggishness by consistency of the rating grades and that they cannot be changed just because of short-term fluctuations. (see also Gibson et al (2015, p.3) for another reason of such sluggishness). It is intended to reflect fundamental position of the issuers' creditworthiness, which only partially depends on the temporary fluctuations. Because of "rating stickiness" and lack of capacity to provide early warning of risks, the agencies have introduced rating reviews. While the rating changes (upgrade and downgrade) represent fundamental change of an issuer's financial stability, the reviews indicate that current short-term events may affect ratings in the long-run. By avoiding frequent rating changes the agencies trade-off between accuracy and stability of rating grades.

2.1 Price pressure hypothesis and behavioural aspect of rating announcements

Many empirical studies investigate the impact of credit ratings on stocks. The early studies include Pinches and Singleton (1978), Griffin and Sanvicente (1982), Holthausen and Leftwich (1986), and Glascock, et al (1987). They find mixed evidence of the effect of rating changes. For example, Pinches and Singleton (1978), report that rating changes are anticipated by market participants; and there is no abnormal reaction following an announcement. In contrast, Griffin and Sanvicente (1982), using the same approach show no rating anticipation; whilst Holthausen and Leftwich (1986) and Glascock et al (1987) report negative reaction for downgrades.

Interestingly, Goh and Ederington (1993) and Richards and Deddouche (1999) find that 'stock prices either do not respond to rating changes or respond in the opposite direction to what would be expected if announcements conveyed value-relevant information' (ibid, p.1). Therefore, downgrades can be good news if associated with an increase in leverage of companies. It shifts wealth from bondholders to shareholders which have positive effect on shares. Whereas downgrades associated with deteriorating firm prospects result in negative effect on stocks.

Several studies find asymmetric responses to positive and negative rating events. For example, Holthausen and Leftwich (1986) examining daily abnormal returns as a reaction to Moody's and Standard and Poor's rating changes, find significant negative returns after downgrades and no abnormal performance for upgrades. Results by Hand et al. (1992) confirm such asymmetric reaction to rating changes. Similarly, Dichev and Piotroski (2001) find no abnormal return following upgrades. They also find substantial negative abnormal returns after downgrades following Moody's bond rating changes during 1970 to 1997. They explain that downgrades are regarded by the market participants as "strong predictors of future deteriorations in earnings", whereas it is not the case for upgrades.

According to Norden and Weber (2004), the information-processing biases can also contribute to this phenomenon. This idea is supported by Ederington and Goh (1998) who argue that companies voluntarily release good news but reluctant to release negative information. This leads to bias towards negative information content of ratings and creates significant abnormal returns in the case of downgrades (but not for upgrades). Furthermore, Jorion and Zhang (2007) suggest that the agencies allocate more resources to identify problems in credit quality of the issuers due to the "higher reputational cost of failing to detect looming credit problems." This again implies smaller information contained in rating upgrades compared to downgrades.

In addition, there is a price pressure due to changes in rating grade, indirectly imposed by financial regulatory authorities. To be more precise, institutional investors such as insurance companies, pension and mutual funds are restricted from holding assets below investment rating grade (see for example Trusted Sources, 2011). The threshold of investment-grade debt, below which investments are often labelled speculative, corresponds to a rating of Baa3 from Moody's and BBB – from S&P and Fitch. And each negative rating event which brings the issuer closer to the investment threshold will trigger risk of selling its securities by institutional investors. Taking into account that these institutions keep large amount of capital in debt securities, shift of these securities put a downward pressure on issuers' stock prices.

Several studies have found support for the price pressure hypothesis. Steiner and Heinke (2001) find that downgrades from investment grade to speculative grade elicit a larger widening of credit spreads. Hand et al. (1992) find that the reaction of investment-grade bonds to rating downgrades is larger than that of speculative-grade bonds. On the other hand, Jorion and Zhang (2007) show that the effect of investment grade threshold is overstated. They introduce a prior rating into their model following which the investment grade effect disappeared.

However, Kliger and Sarig (2000) suggest that the impact of rating announcements is greater for firms with high leverage (which are typically rated speculative grade) than for firms with low leverage (which are typically rated investment grade). Explanation for this effect might be in payment conditions of many financial contracts which are used to be linked to credit ratings (Micu et al. 2006). Such contracts specify that a rating downgrade empowers creditors to demand immediate repayment of debt which in turn can negatively influence the debtor's financial stability and put downward pressure on share prices.

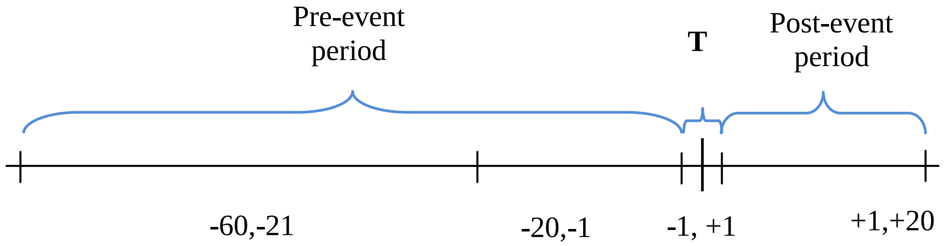
3. METHODOLOGY

For this research we employ event study methodology. This methodology investigates the impact of news on stock prices. Depending on the type of information, announcements increase or decrease the value of stocks on the market. Quintessentially, it involves estimating the direction and size of the abnormal return attributable to unanticipated information, see further Pham (2015), Chi and Tang (2008), Hall and Kenjegaliev (2009), Campbell et al (1997), McWilliams and Siegel (1997), Corrado and Zivney (1992), Corrado (1989), Ball and Tourus (1988), Brown and Warner (1980, 1985) and Dyckman et al (1984). In this paper an event date is upgrade or downgrade announcement made by three rating agencies.

3.1 Cumulative abnormal return

The event window in the paper is subdivided into four time intervals: 60 to 21 business days before a rating announcement [-60,-21]; 20 to one day before the announcement [-20,-1]; a day of the announcement and the following day [0,+1]; and 2 to 20 days after the announcement [+2,+20] (see Figure 1). If the rating announcement is fully anticipated, then equity prices should adjust prior to the announcement, in either [-60,-21] or [-20,-1] intervals.

Figure 1 Event window



In case if a rating announcement has informational value and results in a price pressure, then it should have price impact in [0,+1] interval. For example, Micu et al. (2006) state that this two-day interval should be applied because the announcement might have been made after markets closed for the day. Additionally, the price adjustment can also be delayed and its impact might be evident during [+2,+20] interval.

Stock price reaction is a significant change in a stock return over the analysed period. To identify if these changes are caused by general upward (or downward) trend in the market or credit rating announcements we, firstly, calculated the abnormal return.

It is the difference between the realized return on the security and expected return, see equation 1:

$$AR_{kt} = (R_{kt} - \hat{R}_t) \qquad (1)$$

where

AR_{kt} – abnormal return (residual) for security k at time t;

R_{kt} – actual daily return for security k at time t;

$\hat{R}_t$ – expected/normal return at time t.

The actual daily return is the ratio of the closing stock price P_t at day t to the preceding day's closing stock price minus 1 (equation 2):

$$R_{kt} = \frac{P_t}{P_{t-1}} - 1 \qquad (2)$$

In the next step we obtain a normal return $\hat{R}_t$ for each day, within the event period of each rating change announcement. Normally, it should represent the return which would have been expected if no event took place within the event window. Usually its computation involves economic model (e.g CAPM) and based on the stock prices preceding the event window. However, rating changes reflect the current financial conditions of the credit issuer. Therefore, estimates of the model for expected returns based on the past observations do not reflect expected returns within the event period. On the other hand, market index can be used to proxy expected return during the event window (see for example Brown and Warner, 1985). Considering that this study examines the data on the Frankfurt Stock Exchange, we assume that the expected return is the return on the market index HDAX. Hence, HDAX index can be seen as a normal return against which you set actual returns.

Once the abnormal stock returns for all securities are calculated, the residuals are averaged across the firms to produce the average residual for each day (equation 3). Such averaging help to cancel out the "noise" in the stock returns across the firms.

$$AAR_t = \frac{\sum AR_{kt}}{L} \qquad (3)$$

where

AAR_t – average residual across all the firms in the sample for day t;

AR_t – abnormal return (residual) for security k at time t;

L – number of rating announcements in the sample

Following that, abnormal returns are summed up over the analysed period. Thus a cumulative average abnormal return (CAAR) can be shown as

$$CAAR_t = \sum_{t=1}^{T} AAR_t \tag{4}$$

where T – number of days over which AAR_t is accumulated

This equation reflects the average total effect of the rating announcements across all firms over the examined period. It captures a multi-day period which helps to identify the price changes that absorb the new information if rating changes have an anticipated nature. In a similar spirit, we compute cumulative average normal returns (CANR). After calculating CAAR and CANR we test the mean difference for significance.

3.2 Paired samples test

To test for significance of abnormal returns we conduct a paired sample test. This procedure consists in testing whether the mean of cumulative abnormal returns is significantly different from the mean of cumulative normal returns. It is employed for each interval of the event window, both for upgrades and downgrades. Hays (1973) note that the paired samples test can be applied when each variable is nominally independent of each other but both variables have distinct dependent score, while the scores are not necessarily independent.

If two variables matched in pairs the difference between the means is an unbiased estimate of the population difference:

$$E(\mathrm{M}_j^{CAAR} - M_j^{CANR}) = \mu_j^{CAAR} - \mu_j^{CANR} \tag{5}$$

Where M_j^{CAAR}, M_j^{CANR} are means of cumulative average abnormal returns and cumulative average normal returns, respectively, with the sub-event window j, where $j = [-60,-21],\ [-20,-1],\ [0,+1]$ and $[+2,+20]$ and $E(\mathrm{M}_j^{CAAR}) = \mu_j^{CAAR}$ and $E(M_j^{CANR}) = \mu_j^{CANR}$.

At the same time such pairing changes the standard error of the difference. The variance of the sample means can be expressed as

$$\sigma_j^{diff} = E(\mathrm{M}_j^{CAAR} - M_j^{CANR} - \mu_j^{CAAR} + \mu_j^{CANR})^2 \tag{6}$$

And it is identical to

$$\sigma_j^{diff} = E\left[(\mathrm{M}_j^{CAAR} - \mu_j^{CAAR}) - (M_j^{CANR} - \mu_j^{CANR})\right]^2 \tag{7}$$

Therefore, after rearrangement of Eq. (7) we get

$$\sigma_j^{diff} = E(\mathrm{M}_j^{CAAR} - \mu_j^{CAAR})^2 + E(M_j^{CANR} - \mu_j^{CANR})^2 - 2E(\mathrm{M}_j^{CAAR} - \mu_j^{CAAR})(M_j^{CANR} - \mu_j^{CANR}) \quad (8)$$

The first term in Eq. (8) is simply $\sigma^2_{\mathrm{M}_j^{CAAR}}$ and the second is $\sigma^2_{\mathrm{M}_j^{\mathrm{CANR}}}$ while the third term is $Cov(\mathrm{M}_j^{CAAR}, M_j^{CANR})$, i.e. covariance of the means. In case if two variables are independent then $Cov(\mathrm{M}_j^{CAAR}, M_j^{CANR}) = 0$. However, in our case they are not and the expectation is not ordinarily zero. Hence,

$$\sigma_j^{diff} = \sigma^2_{\mathrm{M}_j^{CAAR}} + \sigma^2_{\mathrm{M}_j^{\mathrm{CANR}}} - 2Cov(\mathrm{M}_j^{CAAR}, M_j^{CANR}) \quad (9)$$

Hays (1973) argue that instead of cumbersome computation of $Cov(\mathrm{M}_j^{CAAR}, M_j^{CANR})$ you can think of the data as one sample of pairs and each pair j, $j = [-60,-21],\ [-20,-1],\ [0,+1]$ and $[+2,+20]$, is associated with a difference in

$$D_j = (y_{\mathrm{t},\ j}^{CAAR} - y_{\mathrm{t},\ j}^{CANR}) \quad (10)$$

Where $y_{\mathrm{t},j,CAAR}$ is an observation at time t in the paired sample j in $CAAR$ and $y_{\mathrm{t},j,CANR}$ is an observation at time t in the sample j in $CANR$. In this case we can use an ordinary test statistics for a single mean employing the scores D_j. That is

$$M_{D_j} = \frac{\sum_t D_{\mathrm{t},j}}{N_j} \quad (11)$$

Where N_j is a number of observations in each sub-sample j, $j = [-60,-21],\ [-20,-1],\ [0,+1]$ and $[+2,+20]$.

And

$$s^2_{D_j} = \frac{\sum_t D^2_{tj}}{N_j - 1} - \frac{N_j(\mathrm{M}_{D_j})}{N_j - 1} \quad (12)$$

Then the paired samples test statistic can be found by

$$\mathfrak{I}_j^{N_j - 1} = \frac{M_{D_j} - E(M_{D_j})}{\frac{s_{D_j}}{\sqrt{N_j}}} \quad (13)$$

With $N_j - 1$ degrees of freedom in the paired sub-sample j, $j = [-60,-21],\ [-20,-1],\ [0,+1]$ and $[+2,+20]$.

The hypothesis is about the true value of $E(M_{D_j}) = \mu_{D_j} = \mu_j^{CAAR} - \mu_j^{CANR} = 0$ and hence you can test hypothesis about a difference provided that the observation in each sub-samples are matched pairwise. In a similar spirit you can find confidence intervals employing M_D and $\frac{s_D}{\sqrt{N}}$. If we cannot reject the null it will suggest that mean of the differences between abnormal returns and normal returns is not significant, which in turn implies rating changes carry scant informational value for investors and vice versa for alternative hypotheses. Table 3 shows summary of hypotheses raised in the paper.

Table 1. The summary of hypotheses

$H_0 : \mu_{D_j} = 0$	Rating changes do not carry informational content
	Informational content hypotheses
$H_a : \mu_{D_j} \neq 0$	Rating changes do carry informational content. *(this is parsimonious hypothesis since the market could react opposite of what you expect after upgrade or downgrade)*

4. DATA AND SAMPLING PROCEDURES

The focus of the research is the constituents of HDAX index. Daily stock prices are extracted from Thomson DataStream for two periods: period one - from Jan./01/2002 to Sept./01/2007 and period two - from Jan./01/2009 to May/01/2015. The rating change announcements are retrieved from Bloomberg global database. The event dates are selected based on the announcements relating to the senior unsecured debt credit rating or long-term issuer credit rating. This type of credit ratings is chosen because they tend to reflect the major changes in a company's performance or in economic environment that might affect the issuer in the long run. As practice shows, such changes are most likely to bring up a reaction of both strategic and portfolio investors who hold securities or contemplating the purchase of securities.

Each firm are rated by 1.93 and 2.40 agencies on average, for the first and the second periods respectively. It is likely that a trigger event may initiate a simultaneous reaction of two or all three rating agencies. Thus, we remove some announcements from the analysis whenever the sum of rating changes for a particular issuer in a 10-day window interval around a rating announcement is greater than one. We do this to control for other events that might have an impact on stock prices around the day of the announcement (additionally some of the events are eliminated due to data availability).

The total number of rating announcements in the final samples equals to 131 (36 issuers) and 93 (36 issuers), respectively. The sample sizes in this research are in line with those reported in the literature. Glascock *et al* (1987), for example, examined 162 rating changes; in Followill and Martel (1997) the estimation is performed with 64 rating announcements. The selection process and final result of data sampling are available from the authors. Table 2 provides information on the samples breakdown for upgrades and downgrades announced by each of the three rating agencies. Negative announcements of all rating announcements in the final samples account for 54% for the first period and 52% for the second period; the majority of rating changes is made by Standard & Poor's.

Table 2 Number of announcements with rating changes

	Period before financial crisis (01.01.2002-01.09.2007)			**Period after financial crisis (01.01.2009-01.05.2015)**		
	Upgrades	Downgrades	**Total**	Upgrades	Downgrades	**Total**
	1	*2*	*3*	*4*	*5*	*6*
	Raw sample					
Fitch Ratings	19	22	**41**	21	25	**46**
Moody's Investors Service	21	21	**42**	23	34	**57**
Standard & Poor's	38	40	**78**	53	39	**92**
Total	78 48%	83 52%	**161**	97 50%	98 50%	**195**
	Final sample					
Fitch Ratings	14	20	**34**	9	8	**17**
Moody's Investors Service	17	17	**34**	13	20	**33**
Standard & Poor's	29	34	**63**	23	20	**43**
Total	60 46%	71 54%	**131**	45 48%	48 52%	**93**

Source: Bloomberg, authors' calculations

5. EMPIRICAL FINDINGS AND ANALYSIS

This section presents empirical results of our research. Figures 2, 3 and 4, 5 show the movement of the average abnormal returns (AAR) observed around rating upgrades and downgrades. Figures 6 and 7 reflect behaviour of the cumulative average abnormal returns (CAAR). Details of statistical properties and results of testing procedures are given in tables 3 and 4 (for rating upgrades) and in tables 5 and 6 (for rating downgrades). AAR is computed using Eq. 3, CAAR - Eq. 4 and $\Im_j^{N-1}$ - Eq. 13.

Figures 2 and 3 cover period from 2002 to 2007 and show that the abnormal stock returns have a chaotic behaviour within the event window. They oscillate between

0.7 and -0.5 during rating upgrades and between -0.5 and 0.5 during rating downgrades (Figure 2 also shows a reduction in AR after the event date). Similar picture can be observed from figures 4 and 5 for the period from 2009 to 2015. Variability ranges from 0.8 and -0.5 for upgrades and slightly higher for downgrades during post-crisis period: 0.9 and -1.2. The prevailing number of returns has a positive sign for rating upgrades and the majority of returns for downgrades have a negative sign.

The estimated CAAR is plotted in figures 6 and 7. According to these figures, positive rating changes lead to increase in CAAR, and vice versa for negative rating changes. They also show that price adjustment occurs gradually long before the rating announcement: starting around day -30 for rating upgrades and earlier for rating downgrades – around day -58. During the event, most of the abnormal returns statistically insignificant while post-announcement periods show return reversal. One exception is rating upgrade for 2009 - 2015 period. Here you can see that event period is statistically significant. At the same time, there is no return reversal although CAAR slightly decreases after day 15. Results of the testing procedures are given below.

Figure 2 Average abnormal returns around rating upgrades
Period before financial crisis (01.01.2002-01.09.2007)

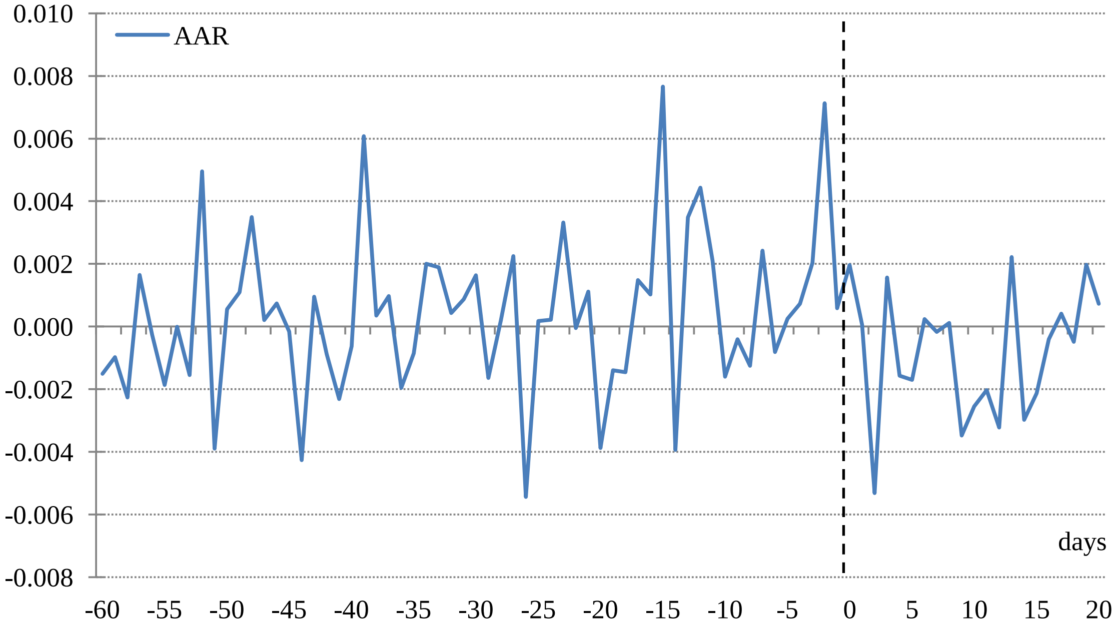


Figure 3 Average abnormal returns around rating downgrades
Period before financial crisis (01.01.2002-01.09.2007)

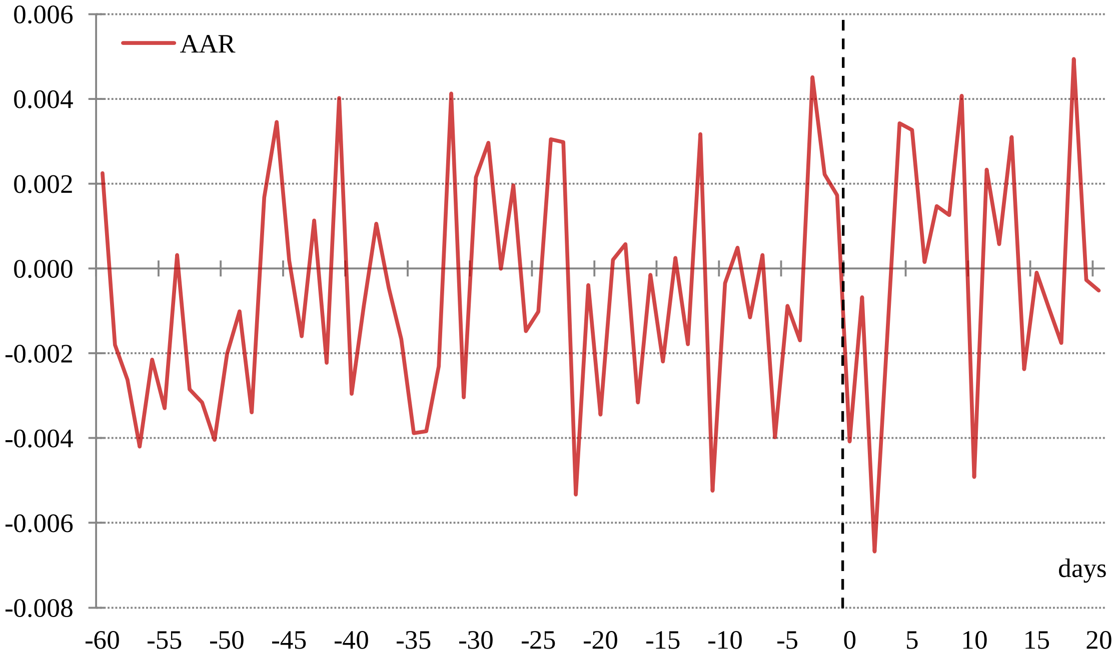


Figure 4 Average abnormal returns around rating upgrades
Period after financial crisis (01.01.2009-01.05.2015)

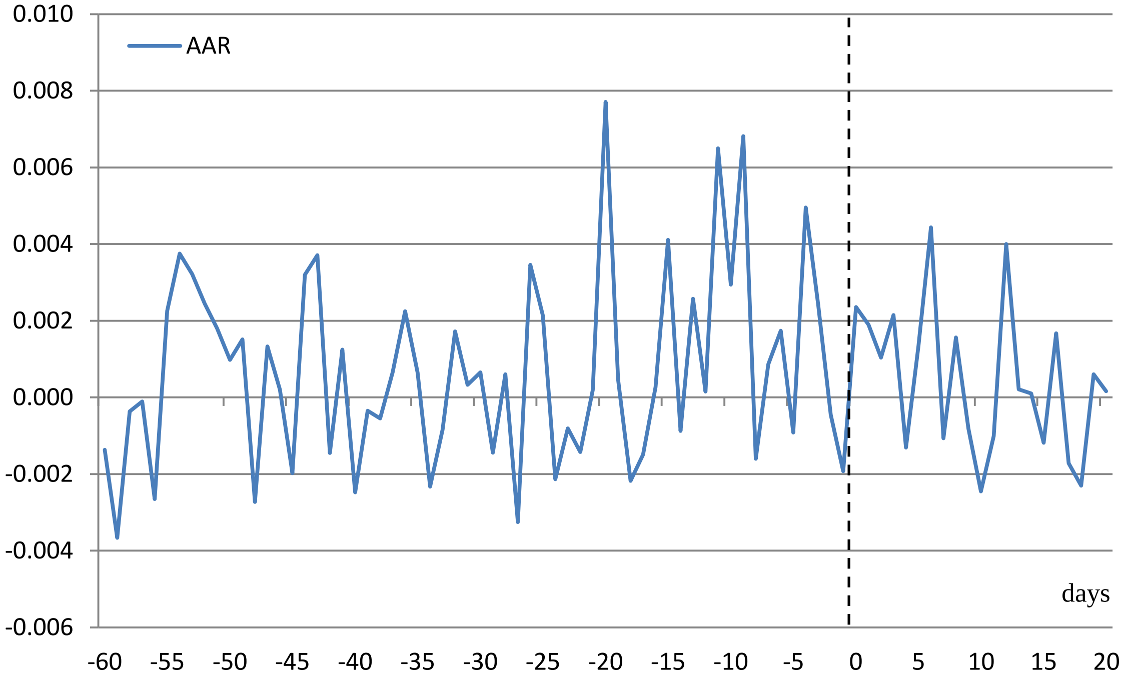
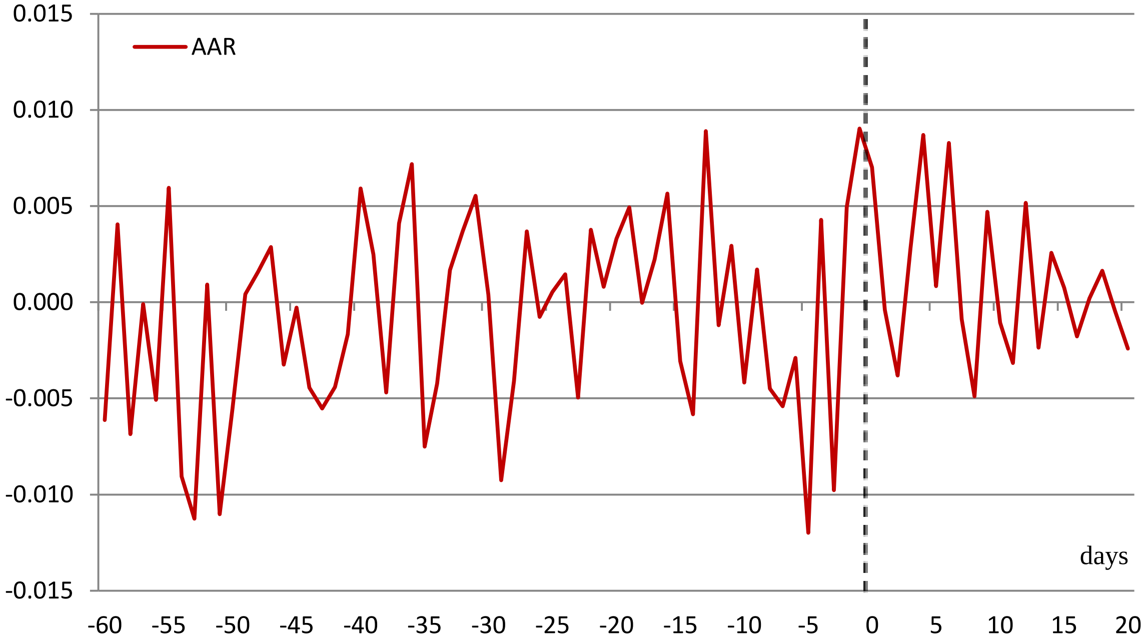


Figure 5 Average abnormal returns around rating downgrades
Period after financial crisis (01.01.2009-01.05.2015)



5.1 Significance of CAAR for rating upgrades

Tables 3 and 4 provide statistical properties of CAAR during rating upgrade. The event window is broken into four pairs: $[-60,-21]$, $[-20,-1]$, $[0,+1]$ and $[+2,+20]$. According to these tables, there is a market reaction to rating changes. Results in tables 3 and 4 give ground for not accepting H_0 at 1% level for three pairs out of four for both pre- and post-crisis periods, that is $\mu_{D_{[-60,-21]}} \neq 0$, $\mu_{D_{[-20,-1]}} \neq 0$ and $\mu_{D_{[+2,+20]}} \neq 0$. The reaction starts approximately 58 days before the rating change announcement; the peak of price adjustment with more than 73% of all positive CAAR takes place within $[-20,-1]$ time interval. Abnormal stock returns at this period reach 1.86 and 3.2.

As it can be observed from the tables, upgraded rating has a small positive abnormal return of about 0.20 and 0.33 units at the event date [0,+1]; paired samples tests are also insignificant during both periods (for the post-crisis data with a small margin). Thus, the hypothesis that $H_0 : \mu_{D_{[0,+1]}} = 0$ cannot be rejected within 2-day period of the rating announcement which suggests that a discrepancy between *CAAR* and *CANR* is not substantial, that is $M_{D_{[0,+1]}} = \bar{\mu}_{D_{[0,+1]}} = \bar{\mu}^{CAAR}_{[0,+1]} - \bar{\mu}^{CANR}_{[0,+1]} \approx 0$. In this respect, our results are similar to those obtained by Dichev and Piotroski (2001), Holthausen and Leftwich (1986) and Hand *et al* (1992) who found no abnormal returns during and following the upgrades.

These findings correspond with results obtained by Pinches and Singleton (1978), Goh and Ederington (1999), Partnoy (2001). According to these authors rating changes are largely anticipated in a way that information leakage makes market participants become aware of all the important news regarding the issuer. Thus, market agents take appropriate actions long before any rating agency incorporates them into the upgraded rating assessments. If ever credit ratings carried any new positive information, previously unknown to the public, the market participants would have reacted on the date the rating change announced.

This argues that the credit rating agencies have restricted ability to add information to the market by their modified assessment of obligors' credit risk. To put it another way, the market, existing in semi-strong form of efficiency have access to all available information and absorbs it immediately as the news become public. However, we cannot rule out that in some instances it could be confidential, inside information which for various reasons become public. The rating agencies, in contrast, are sluggish to integrate this information in their rating assessments.

The possible explanation is that the companies try to release good news to the public domain as soon as possible and, thus, induce an increase in share prices. In such a case it might be challenging for rating analysts to catch up with rapid spread of the information because the change in issuer's credit rating must be preceded by an improvement in business or external factors on a proven sustainable basis. Plus, there is an administrative side for releasing the rating to the public domain.

Figure 4 shows a surprising downward movement of the CAAR for rating upgrade during a pre-crisis period. The CAAR made up -1.88 units within [+2, +20] days after the upgrade announcement and $M_{D_{[+2,+20]}} = -.027$ (table 3). It is negative, and according to $\Im^{18}_{[+2,+20]}$, significant and gives ground for not accepting $H_0 : \mu_{D_{[+2,+20]}} = 0$ at 1% level. Other researchers also found a statistically significant return reversal following the announcement (e.g. Glascock *et al*, 1987). For the post-crisis period, pair 4 is also significant albeit (as expected) it is positive, $M_{D_{[+2,+20]}} = .011$ without sharp downward movement.

Lastly on a rating upgrade, comparison between pre- and post crises periods, given in table 5, show that the mean difference of abnormal returns are significant during the first time interval, $[-60, \ -20]$, with $M_{D_{[-60,-20]}} = .013$. It is statistically significant at 1% level. Table 5 also shows that the next two pairs are not statistically significant; while pair 4 belonging to interval $[+2, +20]$ is significant with $M_{D_{[+2,+20]}} = .018$ and $\Im^{18}_{[+2,+20]} = 7.972$. Observation of tables 3 and 4 shows that within the first and last pairs, M_{D_j}'s are higher in pre-crisis period than during post-crisis and the outcome of the test in table 5 indicates this..

Table 3 Descriptive statistics and paired samples t-test for cumulative average abnormal stock returns around rating upgrade announcements†
Pre-crisis period (01.01.2002-01.09.2007)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference: Lower	95% Confidence Interval of the Difference: Upper			
Pair 1	Preannouncement period 1: Av Abnormal return - Av Normal return	-.01955	.00972	.00154	-.02265	-.01644	-12.723**	39	.000
Pair 2	Preannouncement period 2: Av Abnormal return - Av Normal return	-.00549	.00404	.00090	-.00738	-.00360	-6.083**	19	.000
Pair 3	Preannouncement period 3: Av Abnormal return - Av Normal return	-.00127	.00075	.00053	-.00801	.00547	-2.392	1	.252
Pair 4	Preannouncement period 4: Av Abnormal return - Av Normal return	-.02697	.01071	.00246	-.03213	-.02180	-10.971**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

Table 4 Descriptive statistics and paired samples t-test for cumulative average abnormal stock returns around rating upgrade announcements †
Post-crisis period (01.01.2009-01.05.2015)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Preannouncement period 1: Av Abnormal return - Av Normal return	-.00453	.00452	.00071	-.00598	-.00309	-6.338**	39	.000
Pair 2	Preannouncement period 2: Av Abnormal return - Av Normal return	.01194	.00783	.00175	.00828	.01561	6.824**	19	.000
Pair 3	Preannouncement period 3: Av Abnormal return - Av Normal return	.00630	.00214	.00152	-.01296	.02557	4.156	1	.150
Pair 4	Preannouncement period 4: Av Abnormal return - Av Normal return	.01067	.00460	.00106	.00845	.01289	10.092**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

Table 5 Descriptive statistics and paired samples t-test for the difference between pre- and post-crisis periods for CAAR around rating upgrade announcements †

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	AvAbnormalreturnPreannouncementperiod1_pre - AvAbnormalreturnPreannouncementperiod1_post	.0127599	.0060858	.0009622	.0108136	.0147062	13.261**	39	.000
Pair 2	AvAbnormalreturnPreannouncementperiod2_pre - AvAbnormalreturnPreannouncementperiod2_post	.0002173	.0062855	.0014055	-.0027245	.0031590	.155	19	.879
Pair 3	AvAbnormalreturnPreannouncementperiod3_pre - AvAbnormalreturnPreannouncementperiod3_post	-.0058816	.0022390	.0015832	-.0259985	.0142354	-3.715	1	.167
Pair 4	AvAbnormalreturnPreannouncementperiod4_pre - AvAbnormalreturnPreannouncementperiod4_post	.0183304	.0100232	.0022995	.0134994	.0231614	7.972**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

Figure 6 Cumulative average abnormal returns around rating upgrades and downgrades
Pre-crisis period (01.01.2002-01.09.2007)

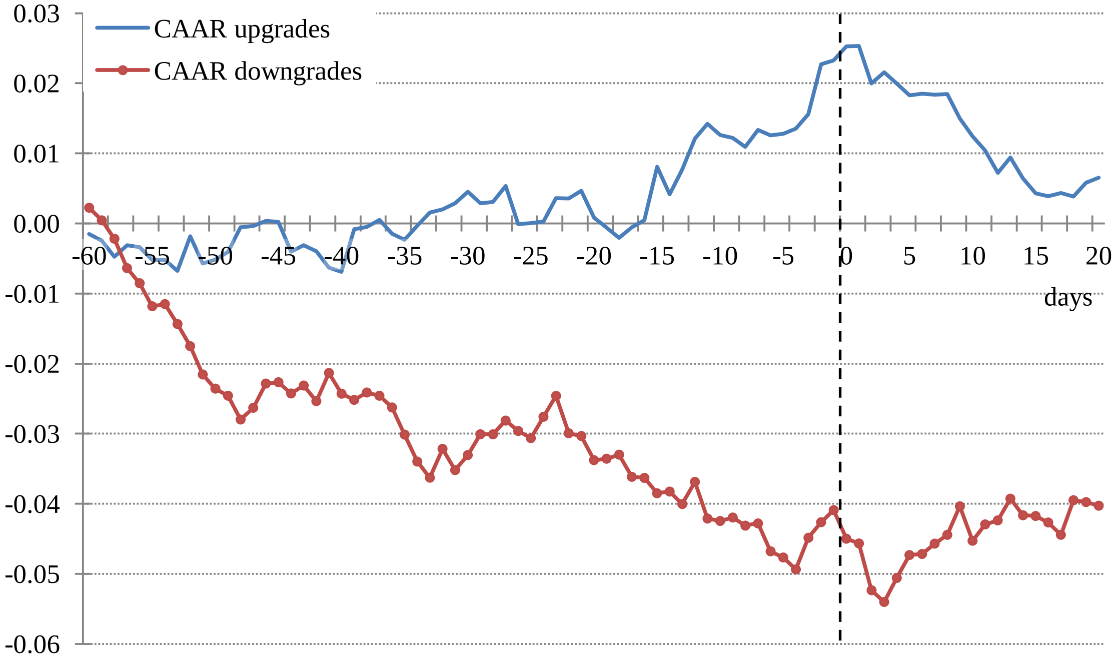
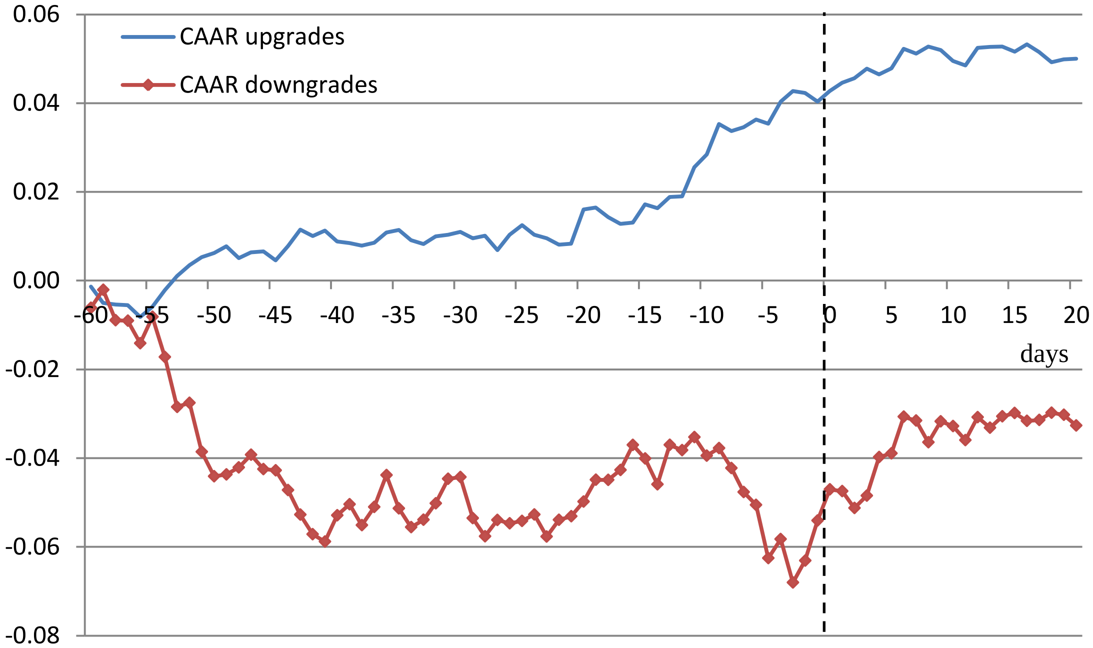


Figure 7 Cumulative average abnormal returns around rating upgrades and downgrades
Post-crisis period (01.01.2009-01.05.2015)



5.2 Significance of CAAR for rating downgrades

Tables 6 and 7 give statistical properties of M_D for four pairs $[-60,-21]$, $[-20,-1]$, $[0,+1]$ and $[+2,+20]$ and paired samples test, $\Im_j^{N-1}$, during rating downgrades. According to these tables, the strongest market reaction occurs within the pre-announcement window, inside [-60,-21] interval where CAAR equals to -3.03 and -5.3 for pre- and post-crisis periods respectively. This accounts for approximately 75% (pre-crisis) and 163% (for post-crisis) of total abnormal returns for the whole time interval. The mean differences for this pair are $M_{D_{[-60,-21]}} = -.028$ for the period between 2002-2009 and higher for the period between 2009-2015 where $M_{D_{[-60,-21]}} = -.055$. Paired samples tests are statistically significant for both periods. One possibility is that the information affecting the rating downgrades had become publicly available during that period. Another explanation - rating agencies themselves could reveal their plans on possible change in the credit rating through previously announced negative rating reviews.

In the next interval, $j = [-20,-1]$, a rating change exert strong impact on the stock market during pre-crisis period. However, there is a weak influence of rating downgrade in post-crisis period. In the former case share prices are adjusting up until the event date. However, in the latter one it is relatively stable until the day -9 after which CAAR sharply falls, this can be observed in figure 7. The mean differences for each of the periods are $M_{D_{[-20,-1]}} = -.015$ and $M_{D_{[-20,-1]}} \approx .001$, respectively. Percentage changes in CAARs within this event window are equalled to -1.06 and -0.10. The interval $[-20,-1]$ during pre-crisis period shows statistical significance at 1% level, with $\Im_{[-20,-1]}^{19} = -7.595$, while during post-crisis period it is not significant $(\Im_{[-20,-1]}^{19} = .209)$. Thus, in case of 2002-2007 period, $H_0 : \mu_{D_{[-20,-1]}} = 0$ is not accepted for the window preceding the downgrade announcements and vice versa for 2009-2015 period. The result of pre-crisis period for $j = [-20,-1]$ corresponds to findings by Jorion and Zhang (2007), Nordon and Weber (2004), Goh and Ederington (1999) and Hand *et al* (1992) in terms of the anticipated character of the rating downgrades.

CAAR at the announcement date [0, +1] during pre-crisis period is -0.48. It is statistically significant at 1% level for pre-crisis period with $M_{D_{[0,+1]}} = -.006$. Thus, you can reject $H_0 : \mu_{D_{[0,+1]}} = 0$ with 99% degree of confidence for 2002-2007 period. The result indicates that the rating downgrade announcements do carry important information to the market. Similar results are obtained by Dichev and Piotroski (2001), Nordon and Weber (2004) and Jorion and Zhang (2007) who discover significant negative abnormal stock returns around downgrade announcements. However, some researchers, e.g. Hand *et al* (1992) and Holthausen and Leftwich (1986) show that downgrades do not carry information relevant to the market agents.

For post-crisis period, within the interval $[0,+1]$ (pair 3) the sign of CAAR and the mean difference of M_D are positive with $CAAR = .66$ and $M_{D_{[0;+1]}} \approx .009$. Despite you can reject H_0 at 5% significance level, it shows that downgrades, during 2009-2015, have the impact on CAAR opposite of what would you expect from negative announcement (which we assume is bad news). The explanation of this result possibly lies in the fact that the research is conducted on German market during recovery period and that the market agents expect strong growth in future, despite current financial difficulties. There is also possibility that this is an evidence of insider trading that incorporates private information or the effect of rating outlooks and reviews.

Figure 6 over the post-announcement window [+2, +20] shows bouncing up of CAAR between +2 and +7 days after the downgrade announcement with relatively stable movement afterwards for both pre- and post-crisis periods. In spite of the downgrade event, CAAR during this segment of the window are positive and equal to 0.54 and 1.48, accordingly. The results of the paired samples test on $M_{D_{[+2,+20]}}$ indicate 1% significance level for pre-crisis, $\Im^{18}_{[+2,+20]} = -4.759$, and 5% significance level for post-crisis, $\Im^{18}_{[+2,+20]} = 9.194$. Therefore, you cannot accept $H_0 : \mu_{D_{[+2,+20]}} = 0$ that the mean difference between *CAAR* and *CANR* is zero. Similar pattern is observed by Richards and Deddouche (1999) and Goh and Ederington (1993).

Finally, statistical comparison between abnormal returns during pre- and post-crises for downgrades given in table 8 shows different results compared to table 5. In this case all four pairs are significant at 1% level. Here, signs of the means are not expected to be negative because comparison for pre-crisis and post-crisis samples in both cases is done on rating downgrades. The first interval in the window event shows negative mean difference between abnormal returns between pre- and post-crises periods. At the same time for the rest three intervals it is positive. The explanation is that in case of $[-60, -21]$ abnormal returns are higher for post-crisis period compared to the pre-crisis period and vice versa for intervals $[-20, -1]$, $[0, +1]$ and $[+2, 20]$.

Table 6 Descriptive statistics and paired samples t-test for cumulative average abnormal stock returns around rating downgrade announcements†
Pre-crisis period (01.01.2002-01.09.2007)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
		1	2	3	4	5	6	7	8
Pair 1	Preannouncement period 1: Av Abnormal return - Av Normal return	-0.02830	0.01594	0.00252	-0.03339	-0.02320	-11.229**	39	.000
Pair 2	Preannouncement period 2: Av Abnormal return - Av Normal return	-0.01490	0.00877	0.00196	-0.01900	-0.01079	-7.595**	19	.000
Pair 3	Preannouncement period 3: Av Abnormal return - Av Normal return	-0.00640	0.00009	0.00006	-0.00719	-0.00560	-101.879**	1	.006
Pair 4	Preannouncement period 4: Av Abnormal return - Av Normal return	-0.00529	0.00485	0.00111	-0.00763	-0.00296	-4.759**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

Table 7 Descriptive statistics and paired samples t-test for cumulative average abnormal stock returns around rating downgrade announcements †
Post-crisis period (01.01.2009-01.05.2015)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference: Lower	95% Confidence Interval of the Difference: Upper			
Pair 1	Preannouncement period 1: Av Abnormal return - Av Normal return	-0.05514	0.02557	0.00404	-0.06332	-0.04696	-13.637**	39	.000
Pair 2	Preannouncement period 2: Av Abnormal return - Av Normal return	0.00066	0.01403	0.00314	-0.00591	0.00722	.209	19	.837
Pair 3	Preannouncement period 3: Av Abnormal return - Av Normal return	0.00879	0.00027	0.00019	0.00638	0.01120	46.316*	1	.014
Pair 4	Preannouncement period 4: Av Abnormal return - Av Normal return	0.01523	0.00722	0.00166	0.01175	0.01871	9.194**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

Table 8 Descriptive statistics and paired samples t-test for the difference between pre- and post-crisis periods for CAAR around rating downgrade announcements †

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	AvAbnormalreturnPreannouncementperiod1_pre - AvAbnormalreturnPreannouncementperiod1_post	-.0188867	.0093977	.0014859	-.0218922	-.0158812	-12.711**	39	.000
Pair 2	AvAbnormalreturnPreannouncementperiod2_pre - AvAbnormalreturnPreannouncementperiod2_post	.0163572	.0084622	.0018922	.0123968	.0203177	8.644**	19	.000
Pair 3	AvAbnormalreturnPreannouncementperiod3_pre - AvAbnormalreturnPreannouncementperiod3_post	.0112466	.0002011	.0001422	.0094396	.0130536	79.081**	1	.008
Pair 4	AvAbnormalreturnPreannouncementperiod4_pre - AvAbnormalreturnPreannouncementperiod4_post	.0114710	.0034954	.0008019	.0097862	.0131557	14.305**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

6. Rank of average abnormal returns and rank test

The disadvantage of the paired samples test is that it relies on normal distributional assumptions. Therefore, for robustness check we conduct the nonparametric rank test similar in spirit to Corrado (1989). Corrado employs a nonparametric rank test for excess performance. This test has similarities with the parametric tests. However, as opposed to the ordinary tests, the rank of the abnormal returns are used.

To apply the nonparametric rank test, the rank of the abnormal returns for the analysed period is needed. Consider a sample of observations of abnormal returns in the event window. The highest rank is given to the highest abnormal return within the event window and vice versa for the lowest rank (Lehman, 1961). The rank test transforms the excess returns into a uniform distribution across ranks. Thus, in the case of the nonparametric rank test, one should convert the given returns into its respective ranks.

Denoting K_t as the rank of the averaged excess return, AAR_t, and with the event window comprising 81 days, the following definition holds:

$$K_t = rank(AAR_t), \quad t = -60, ..., +20 \tag{14}$$

Corrado (1989) reports that the average rank is obtained by dividing the number of observed returns by two. Thus, in this case the average rank is 40.5 and a proxy for the abnormal return is

$$PAI_t = (K_t - 40.5) \tag{19}$$

Where PAI_t is a proxy for the abnormal return

The main feature of rank test consists of ranking each observation in order to bring them into a uniform distribution. Tests of the null hypothesis can be implemented using the result that the asymptotic null distribution is standard normal. The rest of the procedure of the test does not considerably differ from procedure for Eq. 13.

For the sake of clarity we conducted a paired rank test on post-crisis period only. The results of the rank test show that statistical significance of the paired samples remains similar throughout all four pairs in case of rating upgrades. For instance, the mean difference in paired ranks and test statistics are $M_{D_{[-60,-20]}} = -758.050$ and $\Im^{39}_{[-60,-20]} = -11.006$ while for the mean difference of paired samples test they are $M_{D_{[-60,-20]}} = -.004$ and $\Im^{39}_{[-60,-20]} = -6.338$. Test also indicates relatively similar outcomes with identical level of significance for each pair within intervals $[-20,-1]$, $[0,+1]$ and $[+2,+20]$.

However, in case of downgraded ratings, rank test demonstrates a result which marginally differs from paired samples test. In comparison to the latter test the mean difference of transformed abnormal returns within the event window for all pairs are negative. Statistical test for significance for the first and last intervals remain unchanged; nonetheless, significance level for intervals $[-20,-1]$ and $[0,+1]$ altered. The rank test for pair 2 shows statistical significance of 1% for this window interval, with $M_{D_{[-20,-1]}} = -478.800$ and $\Im^{19}_{[-20,-1]} = -10.054$, while paired samples test indicates no significance of the mean difference, $M_{D_{[-20,-1]}} = .0006$ with $\Im^{19}_{[-20,-1]} = .209$. Finally, according to rank test the event date does not exhibit significant difference in mean of abnormal returns, $M_{D_{[0,+1]}} = -130.750$ and $\Im^{1}_{[-0,+1]} = -4.628$, which suggest that influence of downgrade announcements does not have significant influence on the stocks of analysed companies.

Table 9 Descriptive statistics and paired ranked test for cumulative average abnormal stock returns around rating upgrade announcements †
Post-crisis period (01.01.2009-01.05.2015)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	AvAbnormalreturnPreannouncementperiod1 AvAbnormalreturnPreannouncementperiod1	-758.050	435.614	68.8766963	-897.366	-618.733	-11.006**	39	.000
Pair 2	AvAbnormalreturnPreannouncementperiod2 AvAbnormalreturnPreannouncementperiod2	-441.350	266.249	59.5351522	-565.958	-316.7415	-7.413**	19	.000
Pair 3	AvAbnormalreturnPreannouncementperiod3 AvAbnormalreturnPreannouncementperiod3	-136.750	56.922	40.2500000	-648.174	374.674	-3.398	1	.182
Pair 4	AvAbnormalreturnPreannouncementperiod4- AvAbnormalreturnPreannouncementperiod4	-512.526	222.812	51.1168034	-619.918	-405.133	-10.027**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

Table 10 Descriptive statistics and paired ranked test for cumulative average abnormal stock returns around rating downgrade announcements †
Post-crisis period (01.01.2009-01.05.2015)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	AvAbnormalreturnPreannouncementperiod1 AvAbnormalreturnPreannouncementperiod1	-644.125	408.084	64.523	-774.636	-513.613	-9.983**	39	.000
Pair 2	AvAbnormalreturnPreannouncementperiod2 AvAbnormalreturnPreannouncementperiod2	-478.800	212.975	47.622	-578.475	-379.124	-10.054**	19	.000
Pair 3	AvAbnormalreturnPreannouncementperiod3 AvAbnormalreturnPreannouncementperiod3	-130.750	39.951	28.250	-489.700	228.200	-4.628	1	.135
Pair 4	AvAbnormalreturnPreannouncementperiod4 AvAbnormalreturnPreannouncementperiod4	-555.315	266.506	61.1407303	-683.767	-426.863	-9.083**	18	.000

† Preannouncement period 1: 40-day interval [-60; -21], Preannouncement period 2: 20-day interval [-20; -1], Preannouncement period 3: 2-day interval [0; +1], Preannouncement period 4: 19-day interval [+2; +20]

Notes: * indicates significance at 5% level,
** indicates significance at 1% level

7. CONCLUSION

The result of our paper shows that changes in rating grades carry scant informational value for upgrades in the German market. Stock prices of analyzed companies do not react significantly to upgraded ratings. However, our findings show that downgraded ratings have impact. Nonetheless, in both cases adjustments to stock prices start long before the rating announcement date both for upgrades and for downgrades. It is consistent with Dichev and Piotroski (2001), Hand *et al.* (1992) and Holthausen and Leftwich (1986) who observe significant positive abnormal stock returns preceding rating upgrades and no market reaction afterwards. The result of our study also corresponds to the findings by Jorion and Zhang (2007), Nordon and Weber (2004), Goh and Ederington (1999), and Hand *et al.* (1992) in terms of the character of market reaction to rating downgrades.

Our results support the inference that rating agencies sluggish in adjusting ratings. This suggests that the Frankfurt Stock Exchange absorbs all information related to a rating issuer when it becomes publicly available. The rating agencies incorporate this information into ratings with some time lag. Therefore, the predicting power of rating agencies cannot be proved for German market. However, the importance of rating agencies should not be neglected. The shares may adjust precisely because of anticipation of future rating upgrade or downgrade, after the news become available.

The limiting factor in this paper is data. Our data mostly consists of large capitalized companies. Whilst it allows you to select companies that represent the most transparent and traded stocks, it excludes small companies. Utilising Prime All Share Index or CDAX Index is a better measure of the performance of the entire German equities market. As a final remark, the outcome of this research demonstrates that the market, along with anticipating the rating change, reacts stronger to downgrades compared to upgrades. This result confirms that adverse implications of low credit rating prompt the market participants to take negative rating announcements more seriously.

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