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Sovereign rating news and stock markets

What has been the role of the financial and economic crisis?

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Thesis submitted to obtain
the degree of

MASTER OF ECONOMICS
Major Financial Economics

Promotor: Prof. Dr. P. Casini

Academic year 2012-2013

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Abstract

This paper examines the impact of sovereign rating news of Fitch on domestic stock markets. Consistent with prior literature, it reports that long-term downgrades generate significant stock market reactions while this is not the case for upgrades. In addition, stock markets do not seem to attach much informational value to short-term rating changes. Moreover, rating outlook changes generate significant reactions while stock markets seem to anticipate rating watch changes. During the current financial and economic crisis, stock markets also react stronger to long-term downgrades and negative outlook changes. This suggests that rating agencies generate panic among investors and exacerbate the negative market sentiment in the crisis. Finally, multiple-notch rating changes or rating news from emerging markets do not cause significantly higher stock market reactions.

1 Introduction

Since many years, rating agencies play an important role in financial markets, as they serve as the dominant source of credit risk information. The fact that institutional investors often have governance rules based on these ratings is an indication of the importance of credit ratings (Ferreira and Gama (2007)). More recently, this importance has even increased due to the use of credit ratings in the determination of minimum capital requirements in the Basel Capital Accord (Basel Committee (2003)). Despite their importance, rating agencies have been subject to a lot of criticism during history. Henry Waxman, a member of the U.S. House of Representatives once stated: "The story of the credit rating agencies is a story of colossal failure." (Opp et al., (2013), p.46). According to Radelet and Sachs (1998), rating agencies were partly responsible for the East Asian crisis of 1997, as their tardy downgrading of sovereigns led to an increased withdrawal of capital. In 2007, at the beginning of the financial crisis, rating agencies were accused of both an inadequate assessment of the risk of collateralized loan obligations and of too tardy downgrades of bank bonds. During the European sovereign debt crisis, policy makers such as the German chancellor Angela Merkel criticised the rating agencies as well, mainly because of incorrect and untimely downgrades of European sovereign bonds (Hill and Faff (2010)).

The importance of credit ratings has led to numerous studies analyzing the response of financial markets to changes in ratings. When these ratings are only based on publicly available information, markets should not react significantly to rating events if they are semi-strong efficient. If rating changes do have a significant impact, this implies that markets are not semi-strong efficient or that rating agencies possess private information about the rated entities (Brooks et al. (2004)). In this large body of literature, there is one trend that seems to be confirmed by the majority of the authors. Rating downgrades namely cause a significant reaction of stock and bond markets, while this is not the case for upgrades. This result holds both for corporate and sovereign ratings (see e.g. Brooks et al. (2004); Hill and Faff (2010); Holthausen and Leftwich (1986); Liu et al. (1999); Pukthuanthong-Le et al. (2007)).

This paper focuses on the impact of sovereign rating changes on domestic stock markets. The sovereign ceiling principle implies that in practice, private ratings almost never exceed sovereign ratings. Therefore, a sovereign rating change also affects corporate ratings. As many authors find that stock prices respond to corporate rating changes (see e.g. Holthausen and Leftwich (1986) or Hsueh and Liu (1992)), sovereign rating events should have an indirect effect on domestic stock markets. In case of a sovereign downgrade, interest rates on government bonds are likely to go up (see e.g. Kaminsky and Schmukler (2002) or Pukthuanthong-Le et al. (2007)). To neutralize the adverse budgetary effect of this rise in interest, policy makers may increase taxes. This policy response has a negative impact on the profitability of domestic companies, which in turn may cause unfavourable movements in the domestic stock market (Kaminsky and Schmukler (2002)).

While there already exist some studies that investigate the impact of sovereign rating changes on national stock markets (Brooks et al. (2004); Hill and Faff (2010); Hooper et al. (2008); Pukthuanthong-Le et al. (2007)), this paper is the first to include data from the financial and economic crisis that started in 2006. Using rating data from Fitch, it examines the stock market response to sovereign rating news over a period of twelve years, ranging from 2000 until 2012. By means of an event study methodology, the

effects of both long-term rating changes, short-term rating changes, rating outlook changes and rating watch changes[1] are analyzed. Consistent with previous work, this paper examines pre-event, event and post-event stock market reactions[2]. The event study is implemented using the standardized cross-sectional technique of Boehmer et al. (1991), which is robust to event-induced increases in the variance of stock returns. The result of Hooper et al. (2008), who show that sovereign rating changes increase the domestic stock market volatility, constitutes an argument in favour of the use of this technique. In order to examine the influence of the recent financial and economic crisis on these effects, the sample is divided in a pre-crisis and a crisis period, on which the event study methodology is applied as well. This specific comparison between the pre-crisis and crisis period forms the major contribution of this paper to the literature, as there are no studies investigating this difference up to today. In a final step, this paper analyses the cross-sectional determinants of the cumulative abnormal returns in the [0,+1] window by means of an ordinary least squares regression.

The main results of this paper can be summarized as follows. First, the event study over the entire sample period shows that stock markets react significantly negatively to long-term sovereign downgrades, while this is not the case for upgrades. This is consistent with the literature and can be explained by an asymmetric loss function of the rating agencies or by governments only leaking positive information (Hooper et al. (2008)). Long-term downgrades also generate significantly negative stock market reactions in the pre-event window. This can be interpreted as a sign of information leakage or market anticipation of the downgrade (Hill and Faff (2010)). The combination of the two former results could be interpreted as evidence that stock markets only partially anticipate downgrades. Nonetheless, it is possible that rating agencies base themselves on private information as well. Rating agencies could however also confirm negative trends, leading to panic reactions and herd behaviour on stock markets. Second, short-term rating changes do not seem to generate any significant reactions. This suggests that stock markets attach less informational value to short-term ratings. Third, stock markets respond significantly negative to both positive and negative rating outlook changes. However, in the case of the negative changes, there seems to be a positive market recovery effect after the announcement. Rating watch changes, both positive and negative, generate significantly negative pre-event returns. Fourth, long-term downgrades generate significantly negative abnormal event period returns only during the crisis, implying that the negative reactions over the entire sample period are driven by stock returns in the crisis. This suggests that rating agencies can increase panic among investors and exacerbate negative market trends by downgrading sovereigns during the crisis. Fifth, stock markets do not show significant reactions to negative outlook changes in the [-10,-1] and [0,+1] window before the crisis, while they do so during the crisis. This result confirms the hypothesis of rating agencies exacerbating negative market tendencies in the crisis. Finally, the cross-sectional regression analysis shows that multiple-notch rating changes or rating events in emerging markets do not have a stronger impact on domestic stock markets. A dummy variable representing the current crisis is not significant either, which contrasts with the findings of the event study.

The remainder of this paper is structured as follows. Section 2 gives an overview of the literature concerning the impact of corporate and sovereign rating events on bond and stock markets. In section 3, a detailed description of the data is given. Section 4 explains

[1] This paper only works with foreign currency ratings, not with local currency ratings.

[2] Pre-event, event and post-event stock market reactions are measured by the cumulative abnormal returns over the [-10,-1], [0,+1] and [+2,+10] time windows. Day 0 represents the day of the rating event.

the empirical methodology of the event study and the regression analysis. The results of the empirical analysis are discussed in section 5. Finally, section 6 summarizes this paper.

2 Literature overview

The impact of rating agency actions on financial markets is an extensively studied subject in the literature. These studies can be divided into different categories, according to the instrument that is rated and to the financial market on which the rating action is supposed to have an effect. The first paragraph of this literature overview discusses the impact of corporate bond rating actions, both on corporate bond markets and on corporate stock markets. In the second paragraph, the reaction of sovereign bond and national stock markets on sovereign credit rating actions is reviewed.

2.1 Impact of corporate bond rating actions

2.1.1 Corporate bond markets

The first studies concerning the impact of bond rating actions on corporate bond prices were conducted in the 70's. At that moment of time, the literature concerning stock market efficiency was already extensive. This was however not the case for bond markets; the main goal of these studies was therefore to build an event-oriented procedure to test for market efficiency and to fill this gap (see e.g. Katz (1974)). If all the information that is available to the public is incorporated into security prices, a market can be considered as being semi-strong form efficient. An event study, investigating whether the announcement of a rating change generates significant abnormal bond price changes, can thus help to evaluate the efficiency of bond markets (Grier and Katz (1976)).

The evidence found by these studies is however mixed. Weinstein (1977) concludes that there is no significant price reaction to the announcement of a rating change during the month of the rating announcement. He neither finds a significant reaction during both six months before and after the announcement. A comparable result is found by Wakeman (1984) and Clauretie and Wansley (1985); they do not find any evidence of significant price reactions during the month of the announcement either. Weinstein (1977) finds an explanation for these results in the study of Kaplan and Urwitz (1977). They show namely that it is easy to predict a rating based on publicly available information. This means that rating changes do not contain any additional information for bond markets, hence leading to the absence of price reactions. In contrast to these results, Katz (1974) shows that prices react significantly to rating change announcements. He also finds that prices are fully adjusted only after six weeks, concluding that bond markets are inefficient and only slowly absorb new information. Grier and Katz (1976) report that downgrades lead to significantly negative abnormal price changes and that bonds with longer maturities react stronger to downgrades.

Nevertheless, the former studies are based on monthly data. It is therefore very plausible that rating events are 'contaminated' by other events, which can make the evidence inconclusive. Liu et al. (1999) try to solve this problem by making use of weekly data. Next to that, they do not test for actual rating change announcements, but for the refinement of Moody's rating system from e.g. Aa to Aa1 or Aa2. They argue that using this methodology, it is possible to test whether issued ratings have an impact that is independent from publicly available information such as earnings announcements and other financial news. They find that in general, negative rating refinement announcements have a stronger effect than positive rating refinement announcements. Another technique is applied by Hand et al. (1992), who distinguish between rating events which are

contaminated by other 'Wall Street Journal stories' and rating events that are not contaminated. Negative rating change announcements in the non-contaminated sample have a much stronger effect than their positive equivalents; neither of these events do however have a significant impact. Negative Credit Watch announcements do lead to significant abnormal returns, while this is not the case when the announcements are positive. Heinke and Steiner (2001) obtain the same results, using daily data, when it comes to Credit Watch announcements. Nonetheless, they report significantly negative reactions to actual rating downgrades. Downgrades from the investment class to the speculative class have a significantly stronger effect, as this can force institutional investors to sell because of investment restrictions[3] (see also Hite and Warga (1997)). Their study shows that the issuer type is an important determinant of the price reaction as well. An example are bank bonds, for which the availability of credit information is much higher than for corporate bonds because of prudential regulation, leading to lower price reactions.

May (2010) provides an explanation for the mixed evidence found by the previously mentioned studies. The bulk of these studies namely uses NYSE data, which is characterised by infrequent or thin trading and thus low quality for research. He uses data from over-the-counter markets, where bond trading is much more frequent, and concludes that both upgrades and downgrades cause significant price reactions. The reaction to upgrades is however economically insignificant. While the general evidence concerning the impact of rating changes resulting from event studies is thus somewhat mixed, there seems to be a trend of stronger reactions to negative events compared to positive events. Bussière and Ristiniemi (2012) use a dynamic model and confirm this trend. Their model reveals that yield spreads rise with more than thirteen percent in reaction to downgrades, while upgrades only lead to a yield spread drop of three percent.

2.1.2 Corporate stock markets

Because of the earlier mentioned problem of thin trading in bond markets, many authors use stock markets to evaluate the impact of a rating action announcement as trading in these markets is much more frequent (Barron et al. (1997); Ederington and Goh (1993)). Compared to bond market studies, the results of studies evaluating stock markets follow a clearer pattern. Almost all authors find significant abnormal stock returns in response to downgrades announcements and insignificant abnormal returns in the case of upgrades (Barron et al. (1997); Davidson et al. (1987); Ederington and Goh (1999); Hand et al. (1992); Holthausen and Leftwich (1986); Lianto and Matolcsy (1995); May (2010)).

These results (at least when it comes to downgrades) are consistent with the private information hypothesis, arguing that rating agencies own private information regarding the issuing firm. Rating agencies obtain this information via different private sources such as contact with company managers. According to this hypothesis, rating changes have surprise effects and result in significant price changes (Hsueh and Liu (1992)). Holthausen and Leftwich (1986) provide two possible explanations for the asymmetry in price reactions to rating downgrades and upgrades. On the one hand, rating agencies may have an asymmetric loss function. When a rating agency downgrades a company too late, this may be much more harmful to its reputation than when it is untimely in upgrading a company. Therefore, upgrades may be not as timely as downgrades and thus contain less information that is not yet known to the market. On the other hand, the incentives of a company's management to release information could neither be

[3] For many institutional investors, the rule holds that they are only allowed to invest in investment-grade bonds (cfr. supra).

symmetric. As managers leak positive information to the market early in comparison to negative information, this may lead to a lower (higher) informational effect of upgrades (downgrades) (see also Ederington and Goh (1999)). Holthausen and Leftwich (1986) mention the example of accounting earnings reports, which are on average published early if they are good news and published late in the case of bad news (Chambers and Penman (1984)). Ederington and Goh (1999) also argue that the reputation of rating agencies depends on the identification of credit problems, leading to higher efforts spent and thus higher informational value in the case of downgrades.

Ederington and Goh (1993) however conclude that stock markets do not react significantly to all kinds of downgrades. According to their study, downgrades only generate significant price reactions when they are due to an impairment of financial prospects. In the case of downgrades following an increase in leverage, no significant abnormal returns are experienced by the stock market. Norden and Weber (2004) also find that the pattern of significant (insignificant) price reactions to downgrades (upgrades) only holds for announcements by Standard and Poor's and Moody's. When it comes to downgrades or upgrades by Fitch, no significant abnormal returns are reported. Comparable to bond markets, stock markets react more strongly when a company is downgraded into speculative grade as well. Stock markets, however, both experience a larger impact from downgrades of companies with speculative-grade debt and react significantly to positive and negative Credit Watch announcements (Ederington and Goh (1999); Holthausen and Leftwich (1986)). While the majority of the studies concerning the impact of rating actions on stock returns applies an event study methodology using daily returns, there are a few studies that examine longer-term returns. Using monthly returns, Dichev and Piotroski (2001) and Griffin and Sanvicente (1982) reach the same conclusions, namely that downgrades generate significant abnormal returns in the month of the announcement while this is not the case for upgrades.

2.2 Impact of sovereign bond rating actions

2.2.1 Sovereign bond markets

Sovereign bond ratings, by nature, are different from corporate bond ratings. As already mentioned earlier, rating agencies can obtain private information from corporate issuers and use this as a basis for their rating actions. Examples of such private information are debt issuance, acquisition, new products and expansion plans. This is however not the case when it comes to sovereign debt ratings. These ratings are namely mainly based on information that is publicly available, such as political or fiscal constraints and debt or foreign-reserve levels. Therefore, market reactions to sovereign rating changes should in theory be smaller than to corporate rating changes (Larraín et al. (1997)). The findings of Larraín et al. (1997) are consistent with this theory, since they conclude that neither downgrades nor upgrades generate significant abnormal bond price reactions. Kaminsky and Schmukler (2002) and Pukthuanthong-Le et al. (2007), in contrast, do find significant reactions in response to downgrades, which is more consistent with the evidence concerning corporate bond ratings. Reisen and von Maltzan (1999) obtain evidence of significant reactions both in response to downgrades and upgrades. As shown by Kaminsky and Schmukler (2002), both positive and negative changes in rating outlooks have a significant impact on sovereign bond risk premia. This also contrasts with the results obtained by Larraín et al. (1997), who find that only negative rating outlook changes cause a significant bond market reaction.

Next to the traditional event study approach to determine the market impact of a rating change, Reisen and von Maltzan (1999) also apply a test for Granger causality between rating changes and sovereign yield spreads. Using this test, they are able to determine whether sovereign rating changes lead or lag financial markets. Important in this context is the notion of the 'sovereign rating ceiling', which implies that credit ratings of companies do not exceed the rating of their domestic country's sovereign debt. Although rating agencies have relaxed this policy over the course of time, Borenzstein et al. (2007) still obtain evidence of a significant 'ceiling effect' in emerging markets. Ferri and Liu (2002) also show that in emerging countries, there exists a significantly positive correlation between sovereign and private ratings. Reisen and von Maltzan (1999) argue that rating agencies have the ability to moderate boom-bust cycles in emerging-market lending if rating changes have a market impact and if they lead financial markets. During times of a boom, an early downgrade would help to limit euphoric expectations and excessive private short-term capital flows. The latter can possibly increase financial vulnerability and nourish credit booms in countries that are importers of capital. Under this scenario, rating agencies can clearly play an important dampening role, which is impossible when their rating changes have no market impact. Under the worst possible scenario, rating changes do have a market impact but lag financial markets. In this case, an upgrade would enhance the excessive inflows of capital in a boom. A downgrade can in such a scenario lead to panic on financial markets, resulting in a withdrawal of capital and soaring sovereign yield spreads. Since the event study of Reisen and von Maltzan (1999) reveals that rating changes have a significant market impact, they conclude that rating agencies do have the potential to dampen boom-bust cycles. Their Granger causality test however shows that, after controlling for fundamental determinants, rating actions and bond yield spreads move interdependently. Therefore, they conclude that rating agencies have not exploited their smoothing potential of independently producing early rating changes. If rating agencies would have exploited this potential, they could have been able to reduce the excessive capital inflows which preceded several currency crises such as the Mexican Tequila crisis of 1994.

The impact of a sovereign rating change is often not limited to the domestic sovereign yield spread. Arezki et al. (2011) argue that sovereign rating events may have spillover effects on other countries' sovereign yield spreads. A potential spillover channel is the holding of sovereign debt by banks, which is especially the case in Europe. A downgrade of a foreign country's debt, leading to an increased yield, could therefore negatively impact the profitability of banks holding sovereign debt. During the most recent financial crisis, numerous banks have been nationalized. This means that foreign downgrades could have a negative impact on the domestic government debt, resulting in increased domestic yield spreads. Both Arezki et al. (2011) and Gande and Parsley (2005) find evidence of significantly negative spillover effects when it comes to downgrades. This implies that when a sovereign rating downgrade occurs, investors will also tend to withdraw funds from surrounding markets (Christopher et al. (2012)). According to Gande and Parsley (2005), rating upgrades however do not cause significant spillover effects. Usually, spillovers are symmetric; nevertheless, they can also be differential, implying that a sovereign rating downgrade can have a negative effect on another country's sovereign yield spread. Gande and Parsley (2005) show that these differential spillover effects mainly occur when countries have negatively correlated trade or capital flows. Arezki et al. (2011) postulate that governments have three possible ways to limit spillover effects. First, when another country experiences a downgrade, the government should communicate effectively to address concerns about potential weaknesses perceived by financial markets. Second, policy makers should prepare plans to cope with instability in

the financial sector. Finally, they should review how appropriate credit ratings actually are in the regulation of financial markets.

Given the results of the previously mentioned studies, it can be concluded that sovereign rating actions do provide new information to sovereign bond markets. Hence, these markets cannot be classified as being semi-strong efficient. This conclusion is confirmed by Cantor and Packer (1996). They find that, after controlling for publicly available information such as GDP growth and fiscal balance, sovereign ratings still have a significant impact on sovereign yield spreads.

2.2.2 National stock markets

As already mentioned earlier, the sovereign ceiling principle implies that, in practice, private ratings almost never exceed sovereign ratings. A change in a country's sovereign rating therefore affects corporate ratings. It is also shown by many authors that private rating changes (especially downgrades) affect a company's stock price (cfr. supra). Sovereign rating changes should therefore in theory have an indirect impact on domestic stock markets through this indirect sovereign ceiling channel. Nevertheless, there exists another more direct channel through which sovereign rating changes could affect domestic stock markets. When a country gets downgraded, it is likely that interest rates on government bonds go up (cfr. supra), which has an adverse budgetary effect. In order to neutralize this effect, governments may opt to increase corporate taxes. This has a negative impact on the profitability of domestic companies, which in turn may lead to unfavourable stock market movements (Kaminsky and Schmukler (2002)).

There exist different studies that confirm these theoretical predictions, at least when it comes to downgrades. Brooks et al. (2004), Hill and Faff (2010) and Pukthuanthong-Le et al. (2007) find significant abnormal stock market returns[4] in response to downgrades and insignificant reactions to upgrades. Hooper et al. (2008) provide two possible explanations for this phenomenon, similar to the explanation for the significant (insignificant) reactions to downgrades (upgrades) in the case of private ratings. First, policy makers may have an incentive to leak positive information to the market, while they rather keep negative information secret as long as possible. Hence, downgrades could contain more information in comparison to upgrades. Second, rating agencies may also have an asymmetric loss function when it comes to sovereign ratings. If they downgrade a country's sovereign debt too early or when it is not justified, this may lead to an unnecessary reaction of financial markets, which in turn can have a devastating impact on the rated country's economy. This is however much less of a problem for sovereign rating upgrades. Because of a fear of losing access to important information, or even worse, losing demand for their services and fee income, the incentive to downgrade in a timely way is much higher for downgrades.

Although sovereign downgrades seem to generate significant stock market responses, changes in rating outlooks or rating watches appear to be more timely and informative than actual rating changes (Hill and Faff (2010)). Concerning downgrades, they also show that abnormal returns are significantly negative in the pre-event window. Leakage and dissemination of rating-related information could explain these abnormal returns. This outcome could however also mean that rating agencies confirm crises with their downgrades. Another remarkable result is the difference in stock market reactions to rating actions of different rating agencies (Brooks et al. (2004); Hill and Faff (2010)). Downgrades of Moody's seem to have less negative effects than those of Standard and

[4] More specifically, these authors study the impact of a sovereign rating change on the return of the domestic stock market index.

Poor's and Fitch. This is potentially due to a reputation effect; financial markets may namely attach not as much informational value to ratings of Moody's as to those of Standard and Poor's and Fitch. Compared to other rating agencies, rating actions by Standard and Poor's have also a larger effect in non-advanced economies[5]. While it could be expected that a multiple-notch downgrade generates stronger market reactions, Brooks et al. (2004) show that this is not the case. Rating changes do not only have an impact on the magnitude of stock market returns. According to Hooper et al. (2008), both sovereign rating upgrades and downgrades have a significant effect on the domestic stock market volatility.

Comparable to sovereign bond markets, stock markets also experience spillover effects in response to foreign countries' rating changes. Ferreira and Gama (2007) find that sovereign rating downgrades generate significantly negative spillover effects, with an average magnitude of 51 basis points. Again, spillover effects do not seem to be significant in the case of upgrades. Spillover effects seem to be inversely related to geographical distance; spillovers between two emerging markets are more pronounced as well. In addition, Kaminsky & Schmukler (2002) find that during periods of crisis, spillovers are amplified.

3 Data

This paper uses data concerning credit ratings from the American rating agency Fitch; the data is directly obtained via its official website[6]. Brooks et al. (2004) define a credit rating as an assessment of the overall creditworthiness of an issuer when it comes to its capacity and willingness to fulfill its financial obligations. Fitch issues both long-term and short-term ratings[7]. As to long-term ratings, Fitch uses a 22-notch scale. Obligors with the highest credit quality receive an AAA-rating, while a D-rating is given to the least creditworthy counterparties (which are in default or likely to default)[8]. The rating categories of AA to CCC are further divided into three subcategories. The category of AA ratings is e.g. divided into AA+, AA and AA- ratings; the same classification holds for all categories up to CCC. If an asset has a rating of BBB- or higher, it is classified as investment-grade. Speculative-grade assets, in contrast, have a rating that is lower than BBB-. Short-term ratings are divided into six categories, from F1+ to D, where F1+ indicates the highest possible creditworthiness[9].

Next to these actual ratings, Fitch also issues rating outlooks and rating watches. Fitch defines a rating outlook as a reflection of the direction in which the long-term rating is likely to move over a one- or two-year period. Rating outlooks indicate financial or other trends which have not yet attained the necessary level to cause a rating change, but that could do so when these trends continue. It is however not necessary that an issuer has a positive or negative outlook status for its rating to be changed. According to Fitch, a rating watch reflects both an increased probability of a change in rating and the direction in which the rating is likely to evolve. Rating watch changes are mainly event-driven and

[5] Hill and Faff (2010) refer to advanced economies as classified by the International Monetary Fund.
[6] The URL of the official website of Fitch is http://www.fitchratings.com.
[7] A short-term rating considers the creditworthiness of a sovereign on a time horizon of thirteen months.
[8] If the rating NR is included, which is given to issuers that are not publicly rated, the rating scale consists of 23 notches.
[9] When it comes to short term ratings, the category NR for non-rated issuers also exists.

have a focus that is more short-term than rating outlooks. It is neither necessary that an issuer is placed on e.g. a positive watch status before a rating upgrade can occur.

Fitch issues long-term ratings, rating outlooks and rating watches both in local and foreign currencies; short-term ratings are only issued in foreign currencies. A local currency rating gives an indication of the ability of a country to meet its debt obligations, denominated in local currency terms. These ratings are based on political stability, inflation, fiscal and monetary policy, economic prosperity and local currency debt repayment history. Foreign currency ratings represent a country's ability to meet debt obligations that are denominated in a foreign currency. In general, these ratings are based on the same criteria as local currency ratings. Nevertheless, foreign currency ratings emphasize more on the balance of payments, economic policies, political risk and global integration (Brooks et al. (2004)). Therefore, this paper studies the reaction to foreign currency rating changes. Since the bulk of the literature also uses foreign currency ratings, this provides a better basis for comparison with previous work.

This paper uses a sample period of approximately twelve years, ranging from 21 September 2000 until 24 August 2012. Table 1 gives an overview of the number of the different rating actions executed by Fitch during this period. The rating events are classified into two periods, namely the periods before and during the current financial and economic crisis. The benchmark date for the beginning of the current crisis is 1 October 2006, which is consistent with Arezki et al. (2011). Table 1 also shows a comparison between single/multiple notch rating changes and between non-emerging/emerging markets. To determine the emerging market status of a country, this paper uses the emerging market classification of the International Monetary Fund. Taking into account table 1, it becomes clear that during the crisis (pre-crisis) period, more downgrades (upgrades) have occurred. This is consistent with the expectation of lower creditworthiness of countries and thus lower credit ratings during periods of crisis. A similar result is obtained by Hill and Faff (2010). When it comes to rating outlooks, the same trend seems to hold as there are much more negative rating outlook changes in the crisis. Single-notch rating changes also occur more often than multiple-notch rating changes, which is intuitive. It is however noteworthy that multiple-notch downgrades are more frequent than multiple-notch upgrades. This suggests that the probability of a 'severe' rating change is higher in the case of downgrades. Finally, the overview reveals that there are more positive events for emerging markets, which is remarkable as there are much less emerging countries (21) than non-emerging countries (38) in the dataset. A possible explanation is that the stronger economic growth of the emerging markets has resulted into higher perceived creditworthiness and thus into higher ratings.

Table 1: Summary of rating data

Table 1 presents summary statistics concerning the different types of rating events. For each type of rating event, the total number is shown together with a comparison between the pre-crisis/crisis period, between single/multiple notch rating changes and between non-emerging/emerging markets.

	Long-term rating change			Short-term rating change			Rating outlook change			Rating watch change		
	Upgrade	Downgrade	Total	Upgrade	Downgrade	Total	Positive	Negative	Total	Positive	Negative	Total
Pre-crisis	74	26	100	21	7	28	50	27	77	5	11	16
Crisis	38	60	98	17	38	55	43	71	114	4	17	21
Single notch	99	61	160	38	43	81	/	/	/	/	/	/
Multiple notch	13	25	38	0	2	2	/	/	/	/	/	/
Non-emerging market	43	48	91	14	27	41	31	49	80	4	20	24
Emerging market	69	38	107	24	18	42	62	49	111	5	8	13
Total	112	86	198	38	45	83	93	98	191	9	28	37

In order to study the impact of rating changes on stock markets, stock market data is obtained from Datastream. More specifically, this paper uses daily United States dollar returns of national stock market indices of the respective countries that are included in the sample. The MSCI World Market Index is used as a proxy for the world market (benchmark) return in the event study (cfr. Brooks et al. (2004)). An overview of the countries that are part of the sample with their stock market index can be found in Appendix 1.

4 Methodology

4.1 Event study

In order to determine the impact of a sovereign rating change on the respective domestic stock market, this paper applies an event study methodology. Simple daily returns are calculated from the daily stock price data. To compute abnormal returns, it is necessary to calculate 'normal' returns first. Therefore, the traditional market model is used:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \ (1)$$

where R_{it} is the return of country i's stock market index on day t and R_{mt} represents the return of the MSCI World Market Index on day t. An ordinary least squares regression is applied to calculate the parameters of the market model, α_i and β_i. The regression uses an estimation window ranging from 120 to 21 days before the rating event, which is consistent with the approach of Brooks et al. (2004). The normal return of country i's stock market index on day t, NR_{it}, equals:

$$NR_{it} = \alpha_i + \beta_i R_{mt} \ (2)$$

The abnormal return is then equal to:

$$AR_{it} = R_{it} - NR_{it} \ (3)$$

where R_{it} and AR_{it} represent the return and abnormal return of country i's stock market index on day t. Average abnormal returns (AAR's) are obtained by taking the average over the different countries for each day in the event window. Comparable to Brooks et al. (2004) and Hill and Faff (2010), this paper makes use of an event window from ten days before until ten days after the rating event.

This paper focuses on three non-overlapping periods in the event window. It measures the pre-event, event and post-event reaction by means of the cumulative abnormal returns (CAR's) over the respective time windows [-10,-1], [0,+1] and [+2,+10][10] (cfr. Brooks et al. (2004)); Hill and Faff (2010)). The window [0,+1] is chosen as event period since there exists some doubt concerning the time of day at which Fitch announces a rating action. More precisely, if the announcement takes place late in the day or after trading has closed, measuring just the abnormal return on day t will result in imprecise results (Brooks et al. (2004)). The analysis of the stock market index reaction in the pre-event window [-10,-1], allows to check if the market potentially anticipates the rating event or if there is information leakage about the rating event (Hill and Faff (2010)). Finally, the [+2,+10] window CAR reveals whether stock markets show signs of correction after the rating event.

[10] Here, day 0 represents the day of the rating event.

Consistent with Brooks et al. (2004) and Hill and Faff (2010), this paper uses the standardized cross-sectional technique of Boehmer et al. (1991) to evaluate the significance of the cumulative average abnormal returns (CAAR's) over the different time windows. First, the abnormal returns for each day of the event window are standardized to obtain the standardized abnormal returns (SAR's) in the following way:

$$SAR_{it} = \frac{AR_{it}}{\hat{\sigma}_i \sqrt{1 + \frac{1}{T} + \frac{(R_{mt} - \overline{R_m})^2}{\sum_{t=1}^{T}(R_{mt} - \overline{R_m})^2}}} \quad (4)$$

where $\hat{\sigma}_i$ represents the standard deviation of the returns of country i's national stock market index during the estimation period. T is the number of days in the estimation period (120 in this case) and $\overline{R_m}$ is the average return of the MSCI World Market Index in the estimation period. It is possible to obtain the cumulative standardized abnormal returns (CSAR's) by adding up the SAR's over different days of the event window. Next, it is necessary to calculate the cross-sectional standard deviation of the SAR's over the different countries for the different days in the event window:

$$\sigma_{SAR_t} = \sqrt{\frac{\sum_{i=1}^{N}(SAR_{it} - \sum_{i=1}^{N}\frac{SAR_{it}}{N})^2}{N(N-1)}} \quad (5)$$

where N is the number of countries in the sample. Averaging the SAR's over the different countries results in the average standardized abnormal returns (ASAR's); this can be applied for the each day in the event window. The standardized cross-sectional test statistic to determine the significance of the CAAR's over the different time windows thus becomes[11]:

$$t = \frac{\sum_{i=1}^{N}\frac{CSAR_{i,[-10,-1]}}{N}}{\sigma_{CSAR_{[-10,-1]}}} \quad (6)$$

$$= \frac{\sum_{i=1}^{N}\frac{CSAR_{i,[-10,-1]}}{N}}{\sqrt{\sigma^2(CSAR_{[-10,-1]})}} \quad (7)$$

$$= \frac{\sum_{i=1}^{N}\frac{CSAR_{i,[-10,-1]}}{N}}{\sqrt{\sigma^2(SAR_{-10} + SAR_{-9} + \cdots + SAR_{-1})}} \quad (8)$$

$$= \frac{\sum_{i=1}^{N}\frac{CSAR_{i,[-10,-1]}}{N}}{\sqrt{\sigma^2(SAR_{-10}) + \sigma^2(SAR_{-9}) + \cdots + \sigma^2(SAR_{-1}))}} \quad (9)$$

The application of the standardized cross-sectional method of Boehmer et al. (1991) has an important advantage. They argue that is possible that an event can cause an increase in the variance of stock market returns. In addition, they find that when this happens, the traditional event study methodologies often unfairly reject the null hypothesis of the abnormal return being zero. Their standardized cross-sectional test however avoids this problem. Hooper et al. (2008) prove that both sovereign upgrades and downgrades have

[11] Here, the example for the CAR over the time window [-10,-1] is given. In the calculation, this paper assumes a sample drawn from independently distributed returns (cfr. e.g. Mitchell, Mulherin and Winston (2004)).

a significant effect on the domestic stock market volatility (cfr. supra). It is therefore certainly useful to apply the method of Boehmer et al. (1991) in this study.

The event study methodology is applied to the different kinds of rating events: long-term rating changes, short-term rating changes, rating outlook changes and rating watch changes. In each case, this paper makes a distinction between positive and negative events. First, this is executed for the entire sample period; this allows a comparison with the existing literature. Afterwards, the sample is divided into the period before and during the current crisis in order to evaluate the impact of the crisis on the stock market reactions. The event study is carried out with the statistical software package STATA[12].

4.2 Regression analysis

In a second phase, a cross-sectional analysis is executed to examine the determinants of the CAR's in the [0,+1] window; this happens by means of a traditional Ordinary Least Squares regression, executed in STATA. The regressions are performed for the different types of rating events, for the entire sample period of 2000 until 2012. Due to a lack of observations, the analysis is however not conducted for positive rating watch changes. The estimated model looks as follows:

$$CAR\_[0,+1]_i = \beta_0 + \beta_1 EM\_MARK_i + \beta_2 CRISIS_i + \beta_3 CAR\_[-10,-1]_i + \beta_4 MULT\_NOTCH_i + \varepsilon_i \quad (10)$$

where EM_MARK_i is a dummy variable equal to one if the rating event happens in a country that is classified as an emerging market. Kaminsky and Schmukler (2002) namely argue that problems of asymmetric information and transparency are higher in emerging market countries. In theory, this should lead to higher stock market reactions in response to rating events. The dummy variable $CRISIS_i$ takes the value of one if the rating event happens in the crisis period. This variable is another check to see whether the current financial and economic crisis has aggravated the impact of rating event announcements. Consistent with Brooks et al. (2004) and Hill and Faff (2010), the model also includes the pre-event period CAR, represented by the variable $CAR\_[-10,-1]_i$. If a rating event is unanticipated, there should only be a significant stock market reaction in the event window [0,1] and the coefficient of $CAR\_[-10,-1]_i$ should be insignificant (Hill and Faff (2010)). $MULT\_NOTCH_i$ is a dummy variable that is equal to one if the rating event involves a multiple-notch upgrade of downgrade announcement. It is only included in the regressions for long-term rating upgrades and downgrades. Following Brooks et al. (2004) and Heinke and Steiner (2001), the strength of the rating change can potentially influence the magnitude of the stock market reaction.

Except from the regression for short-term downgrades, the Breusch-Pagan test reveals that in all other regressions, the assumption of homoskedastic error terms is violated. If this is the case, this paper uses robust White standard errors to correct for heteroskedasticity.

[12] A part of the STATA code is based on the Princeton University event study manual for STATA. The URL of this manual is http://dss.princeton.edu/online_help/stats_packages/stata/eventstudy.html. The entire STATA code is available on request.

5 Results

5.1 Event study

5.1.1 Analysis of entire sample period: 2000-2012

Table 2 gives an overview of the results of the event studies for the different rating events for the entire sample period of 2000-2012. More detailed results with the AAR's and CAAR's and their respective test statistics for each day of the event window can be found in Appendix 2.

When it comes to long-term rating changes, national stock markets seem to react significantly over the [0,+1] window only to downgrades and not to upgrades. This is consistent with the findings of Brooks et al. (2004), Hill and Faff (2010) and Pukthuanthong-Le et al. (2007). As mentioned earlier, there are two explanations for this phenomenon (Hooper et al. (2008)). On the one hand, it is possible that rating agencies have an asymmetric loss function. A too early or unjustified downgrade could cause an unnecessary reaction of financial markets. This in turn can negatively affect the economy of the rated country. In the case of upgrades, rating agencies do not face this problem. Their incentive to downgrade in a timely and correct manner is thus much higher, as they want to avoid losing access to important information or even losing demand for their services. On the other hand, governments may want to leak information, on which sovereign ratings are based, to the market if this information is positive. This incentive does however not exist for negative information, possibly implying that downgrades contain less information compared to upgrades. In addition, the pre-event window return for long-term rating downgrades is significantly negative, which is similar to the result obtained by Hill and Faff (2010). This result has also multiple explanations. Possibly, information concerning a downgrade could be leaked and disseminated, leading to significant pre-event returns. Nonetheless, it could also be that the significantly negative pre-event return indicates that investors anticipate downgrades (Hill and Faff (2010)). Given that sovereign ratings are mainly based on publicly available information (Kaminsky and Schmukler (2002)), this is certainly a reasonable option. Although markets could anticipate a downgrade, the actual announcement seems to generate significantly negative returns in the [0,+1] window as well. This could mean that national stock markets do not absorb all available information, which could be a sign that these markets are not completely semi-strong efficient; it could however also be that all information on which the downgrade is based is not publicly available. Nevertheless, the significant abnormal return in the [0,+1] window could even occur if financial markets would already have absorbed all information on which the downgrade is based. This would be the case if a downgrade causes panic and herd behaviour among investors, leading to a selling trend. Surprisingly, the CAAR over the [-10,-1] window is significantly negative for long-term rating upgrades. Since abnormal returns for the [+2,+10] window are not significant, both for upgrades and downgrades, stock markets do not seem to correct significantly after the rating events.

Market reactions in response to short-term rating changes are very different from the reactions to long-term rating changes. More specifically, both for the pre-event period, the event period or the post-event period, there are no significant stock market responses. This holds both for upgrades and downgrades, suggesting that national stock markets attach more informational value to long-term rating changes than to short-term rating changes.

Previous literature (e.g. Hill and Faff (2010)) finds that rating outlook changes have a stronger effect than actual rating changes. This paper only partly confirms these results. As opposed to long-rating upgrades, positive rating outlook changes do generate significant reactions in the [0,+1] window. In contrast to the expectations, this response is positive. Although both negative outlook changes and long-term downgrades have a significantly negative impact on domestic stock market returns, the reaction is larger in magnitude for long-term downgrades (abnormal return of -0,87 percent versus -0,61 percent). Table 2 also reveals that the [+2,+10] return in the case of negative outlook changes is significantly positive. This suggests that during the post-event period, there exist a 'recovery trend' in stock markets after the negative reaction in the event period.

Table 2: Event study results for 2000-2012

Table 2 presents the results of the event study for the entire sample period of 2000 until 2012. For each type of rating event, the CAAR and corresponding test statistic are mentioned for the [-10,-1], [0,+1] and [+2,+10] time window. * and ** denote respectively significance at the five and one percent level.

	Long-term rating change				**Short-term rating change**			
	Upgrade		**Downgrade**		**Upgrade**		**Downgrade**	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-10,-1]	-0,57%	-2,6779**	-2,12%	-2,6613**	0,05%	-0,2068	-1,61%	-1,2495
[0,+1]	0,28%	1,2346	-0,87%	-2,0689*	-0,37%	0,1138	-0,33%	-0,9700
[+2,+10]	0,01%	-1,0120	0,36%	-0,1292	-0,85%	-1,1408	-0,95%	-0,4349
	Rating outlook change				**Rating watch change**			
	Positive		**Negative**		**Positive**		**Negative**	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-10,-1]	-0,49%	-1,1931	-1,28%	-1,3730	-2,29%	-1,9675*	-4,03%	-2,6656**
[0,+1]	-0,39%	-1,7485*	-0,61%	-2,2821*	-0,43%	-0,8499	-1,40%	-0,3609
[+2,+10]	-0,37%	-0,6353	1,70%	2,5463**	0,67%	0,8948	-2,03%	-0,7759

Rating watch changes, both positive and negative, do not seem to have a significant effect on stock markets in the [0,+1] and [+2,+10] window. Comparable to long-term downgrades, negative rating watch changes generate significant market reactions in the pre-event period. Nonetheless, the CAAR's in this period for rating watches are almost double as large as for long-term downgrades (-4,03 percent versus -2,12 percent). This suggests that stock markets anticipate these events or that information about the negative rating watch change is leaked to the market. The fact that the [0,+1] window reaction is not significant, confirms this potential explanation. Consistent with long-term upgrades, positive rating watch changes also lead to significantly negative pre-event period returns, which is a remarkable result.

5.1.2 Comparison of the pre-crisis and crisis period

The results of the event study for the pre-crisis period and the crisis period are respectively presented in table 3 and 4. More detailed results can be found in Appendices 3 and 4. A first important result concerns the stock market reaction to long-term rating downgrades in the [0,+1] period. While this response is significantly negative during the crisis period, this is not the case for the pre-crisis period. This shows that the significantly negative reaction in the entire sample period is driven by the reaction during the crisis. Hill and Faff (2010) find a similar result; they namely report that the significantly negative reaction to long-term downgrades is due to crisis-period returns. Ex ante, the current crisis could affect the impact of rating changes on stock markets in two possible ways. On the one hand, rating downgrades can increase panic among investors and exacerbate negative market trends, leading to a more negative reaction than during the pre-crisis period. On the other hand, rating agencies also have been subject to a lot of criticism during the current crisis. An example is the criticism the rating agencies received because of their inadequate assessment of the risks concerning collateralised loan obligations (Hill and Faff (2010)). It is therefore also possible that, during the current crisis, stock markets attach less informational value and react in a less heavy way to rating events. The results of this paper concerning long-term downgrades seem to be in favour of the first explanation.

Table 3: Event study results for the pre-crisis period

Table 3 presents the results of the event study for the pre-crisis period. For each type of rating event, the CAAR and corresponding test statistic are mentioned for the [-10,-1], [0,+1] and [+2,+10] time window. * and ** denote respectively significance at the five and one percent level.

	Long-term rating change				**Short-term rating change**			
	Upgrade		**Downgrade**		**Upgrade**		**Downgrade**	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-10,-1]	-0,73%	-1,2738	-3,87%	-2,5148**	-0,14%	-0,5158	-4,74%	-1,7311*
[0,+1]	0,15%	1,2486	-0,86%	-1,3407	-1,17%	-0,6764	2,02%	0,6481
[+2,+10]	0,04%	0,3609	3,03%	1,1122	-1,44%	-1,1391	0,64%	-0,5206
	Rating outlook change				**Rating watch change**			
	Positive		**Negative**		**Positive**		**Negative**	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-10,-1]	-1,37%	-1,9071*	-1,64%	0,4786	-1,84%	-0,8708	-5,08%	-1,9729*
[0,+1]	-0,51%	-1,4349	-0,24%	-0,1671	-0,13%	-0,1846	-1,72%	0,0525
[+2,+10]	0,06%	0,2293	1,07%	2,2898*	-0,12%	-0,1599	5,36%	1,0033

Both in the pre-crisis and crisis period, long-term downgrades cause significantly negative abnormal returns in the pre-event period. Nevertheless, the CAAR over this window is much more negative in pre-crisis period (-3,87 percent versus -1,34 percent), suggesting that stock markets anticipate long-term downgrades more or that more information is leaked in the pre-crisis period. Another remarkable result is the CAAR in the [+2,+10] in the case of long-term upgrades. While it is not significant in the pre-crisis period, it seems

to be significantly negative during the current crisis. In other words, during the crisis, there seems to exist a significant market correction effect after a long-term upgrade.

During the pre-crisis period, stock markets seem to react significantly negative in response to short-term rating downgrades in the pre-event period. In the current crisis, this is however not the case. This is consistent with the comparison for long-term rating downgrades; stock market anticipation or information leakage seems to be higher during the pre-crisis period for short-term rating downgrades as well. In addition, short-term rating upgrades have a significantly positive impact during the [0,+1] time window. Comparable to the reactions to long-term downgrades, this forms evidence against the hypothesis of a lower informational value attached to rating events during the current crisis.

Table 4: Event study results for the crisis period

Table 4 presents the results of the event study for the crisis period. For each type of rating event, the CAAR and corresponding test statistic are mentioned for the [-10,-1], [0,+1] and [+2,+10] time window. * and ** denote respectively significance at the five and one percent level.

	Long-term rating change				**Short-term rating change**			
	Upgrade		**Downgrade**		**Upgrade**		**Downgrade**	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-10,-1]	-0,26%	-2,8037**	-1,34%	-1,7734*	0,28%	0,2578	-1,00%	-0,7639
[0,+1]	0,52%	0,4274	-0,87%	-1,6617*	0,62%	1,6719*	-0,79%	-1,2115
[+2,+10]	-0,04%	-2,1665**	-0,83%	-0,4843	-0,12%	-0,3225	-1,26%	-0,3685
	Rating outlook change				**Rating watch change**			
	Positive		**Negative**		**Positive**		**Negative**	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-10,-1]	0,58%	0,7357	-1,13%	-1,9538*	-2,85%	-1,7648*	-3,36%	-2,1131**
[0,+1]	-0,24%	-1,0104	-0,76%	-2,6154**	-0,82%	-0,9932	-1,19%	-0,4775
[+2,+10]	-0,88%	-1,5967	1,95%	1,8317	1,66%	1,5427	-6,81%	-1,0371

While negative rating outlook changes generate a significantly negative event period stock market return during the current crisis, this is not the case in the period before the crisis. The same conclusion as with long-term downgrades can thus be drawn, namely that the negative reaction in the entire sample period seems to be driven by the crisis period. A similar trend is visible for the [-10,-1] time window CAAR's as they are only significantly negative during the current crisis. In the pre-crisis period, this CAAR is significantly negative in the case of upgrades, which is a surprising result.

When it comes to positive rating watch changes, table 3 and 4 reveal a difference in the pre-event period CAAR between the pre-crisis and crisis period. This CAAR is namely only significantly positive during the crisis, implying that this significant CAAR in the entire sample period is driven by the crisis period result. Negative rating watch changes, in contrast, generate significant market reactions in this time window both before and during the current crisis. The magnitude of this CAAR is however larger in the pre-crisis period (-5,08 percent versus -3,36 percent).

The former results make clear that in the case of many sovereign rating events, domestic stock markets seem to react in a significant way. If sovereign credit ratings are only based on publicly available information, this implies that these markets cannot be regarded as being semi-strong form efficient. Another explanation is the possession of private information by the rating agencies, which becomes available to the public by means of a rating event, explaining the significant stock market reactions (Brooks et al. (2004)).

5.2 Regression analysis

Table 6 presents the results of the regression analysis, conducted to examine the cross-sectional determinants of the [0,+1] time window CAR's. Except from the regression for short-rating changes, the R^2 of all regressions are extremely low.

The variable $MULT\_NOTCH_i$ is not significant in the long-term rating change regressions. Hence, the magnitude of the impact of long-term rating events is not influenced by the strength of rating change, which is consistent with the findings of Brooks et al. (2004). Ex ante, it could be expected that rating events in emerging markets generate stronger market responses (cfr. supra). The results of the cross-sectional analysis however prove that this is not the case, as the coefficient of EM_MARK_i is not significant in any of the regressions. The $CRISIS_i$ dummy neither has a significant coefficient. While the event study analysis suggests that the current crisis does influence the stock market response to rating events, the regression analysis therefore does not support this conclusion. The coefficient of $CAR\_[-10,-1]_i$ is significant only in the case of short-term rating upgrades. If the pre-event period CAR of a short-term upgrade is positive, the negative coefficient implies that the magnitude of the market impact in the [0,+1] window is attenuated and vice versa.

6 Conclusion

This paper examines the impact of sovereign rating events on domestic stock markets. More specifically, the reactions to changes in long-term ratings, short-term ratings, rating outlooks and rating watches are analyzed for the period of 2000 until 2012 by means of an event study methodology. It also studies how the current financial and economic crisis affects these reactions by dividing the sample in a pre-crisis and crisis period; the event study methodology is consequently applied on these subsamples as well. This comparison forms the major contribution to the literature. Finally, this paper also performs a regression analysis to investigate the cross-sectional determinants of the stock market reactions.

Consistent with the existing literature, the event study over the entire sample period reveals that stock markets react significantly negative to long-term downgrades but not to upgrades. This can be due to governments who only have an incentive to leak positive information, or to rating agencies having an asymmetric loss function. Next, long-term downgrades also cause significantly negative pre-event returns, suggesting that markets anticipate these events or that information is leaked before the actual rating event. The combination of these two results could mean that stock markets only partially anticipate long-term downgrades or that rating agencies do use private information in their assessments of sovereign creditworthiness. If stock markets however would absorb all information on which ratings are based, this could also imply that rating agencies

Table 6: Results regression analysis

Table 6 gives an overview of the results of the estimation of the regression model (10):

$$CAR\_[0,+1]_i = \beta_0 + \beta_1 EM\_MARK_i + \beta_2 CRISIS_i + \beta_3 CAR\_[-10,-1]_i + \beta_4 MULT\_NOTCH_i + \varepsilon_i$$

where EM_MARK_i, $CRISIS_i$, $CAR\_[-10,-1]_i$ and $MULT\_NOTCH_i$ respectively represent an emerging market status dummy, a dummy for rating events in the crisis period, the cumulative abnormal return over the [-10,-1] time window and a dummy for multiple notch rating changes. $MULT\_NOTCH_i$ is only included in the case of long-term rating changes. Except from the case of short-term downgrades, results from estimation with robust White standard errors are reported. * and ** denote respectively significance at the five and one percent level.

	Long-term rating change				**Short-term rating change**			
	Upgrade		**Downgrade**		**Upgrade**		**Downgrade**	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Constant	0,0011	0,4800	-0,0023	-0,2500	-0,0081	-0,8500	0,0094	0,0264
EM_MARK	0,0012	0,3400	-0,0081	-0,7600	-0,0008	-0,1000	0,0107	0,0185
CRISIS	0,0022	0,4000	-0,0048	-0,3900	0,0198	1,5200	-0,0206	0,0247
CAR_[-10,-1]	-0,0460	-0,9100	0,0322	0,3200	-0,5760	-1,7000*	-0,0352	0,1158
MULT_NOTCH	0,0172	1,3300	0,0011	0,0600	/	/	/	/
R²	0,0351		0,0097		0,2097		0,0507	
	Rating outlook change				**Rating watch change**			
	Positive		**Negative**		**Positive**		**Negative**	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Constant	0,0001	0,0300	-0,0034	-0,5600	/	/	-0,0059	-0,6200
EM_MARK	-0,0054	-1,2100	-0,0045	-0,5300	/	/	-0,0337	-0,8400
CRISIS	-0,0026	-0,5200	0,0008	0,0900	/	/	-0,0090	-0,4200
CAR_[-10,-1]	0,0140	0,3000	0,0613	0,5900	/	/	-0,1502	-0,3400
R²	0,0128		0,0152		/		0,0303	

generate panic and herd behaviour among investors with their downgrading. In contrast to long-term ratings, short-term rating changes do not have a significant effect on stock markets. This suggests that stock markets attach less informational value to short-term ratings. Stock markets do however seem to respond significantly to rating outlook changes. Nonetheless, there exists a positive market recovery effect after the announcement of a negative outlook change. Rating watch changes, both positive and negative, only generate significantly negative returns in the pre-event period. The comparison of the pre-crisis and crisis period shows that long-term downgrades only cause significant reactions during the crisis. This result suggests that by downgrading sovereigns in the current crisis, rating agencies can increase panic on stock markets and exacerbate negative market trends. Stock markets neither react significantly in the [-10,-1] and [0,+1] windows before the crisis, but do so in the current financial and economic crisis. This confirms the hypothesis of rating agencies exacerbating negative market

sentiments. Finally, the cross-sectional regression analysis reveals that rating events in emerging markets or multiple-notch rating changes do not cause significantly stronger stock market reactions, which is contrary to the expectations. In contrast with the results from the event study, the variable representing the crisis neither has a significant effect.

For each sample country, this paper selects a corresponding domestic stock market index. This forms a first limitation of the study, since the selection of different indices could possibly alter the results. Another limitation concerns the rating data, that are only derived from Fitch. Both Brooks et al. (2004) and Hill and Faff (2010) show that stock markets react differently to rating news of different rating agencies. Hence, the results of this paper cannot be extrapolated to other rating agencies. Further research is therefore needed to answer the question whether the current crisis has attenuated or strengthened the reaction of stock markets to sovereign rating news. As most studies only suggest possible explanations for stock market responses to sovereign news, further research could also dig deeper and try to explain the exact origins of these reactions.

Bibliography

Arezki, R., Candelon, B., & Sy, A. (2011). *Sovereign Rating News and Financial Markets Spillovers: Evidence from the European Debt Crisis* (IMF Working Paper No. 11/68). Accessed through http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1802981

Barron, M., Clare, A., & Thomas S. (1997). The Effect of Bond Rating Changes and New Ratings on UK Stock Returns. *Journal of Business Finance & Accounting 24*(3), 497-509

BIS. (2003). Basel Committee on Banking Supervision, Consultative document: Overview of the New Basel Capital Accord. BIS, Basel.

Boehmer, E., Musmeci, J., & Poulsen, A. (1991). Event-Study Methodology under Conditions of Event-Induced Variance. *Journal of Financial Economics, 30*, 253-272.

Borenzstein, E., Cowan, K., & Valenzuela, P. (2007). *Sovereign Ceilings 'Lite'? The Impact of Sovereign Ratings on Corporate Ratings in Emerging Markets* (IMF Working Paper No. 07/75). Accessed through http://papers.ssrn.com/sol3/papers.cfm?abstract_id=979029

Brooks, R., Faff, R., Hillier, D., & Hillier, J. (2004). The National Market Impact of Sovereign Rating Changes. *Journal of Banking & Finance, 28*, 233-250.

Bussière, M., & Ristiniemi, A. (2012). *Credit Ratings and Debt Crises* (Banque de France Working Paper No. 396). Accessed through http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2144235

Chambers, A., & Penman, S. (1984). Timeliness of Reporting and the Stock Price Reaction to Earnings Announcements. *Journal of Accounting Research, 22*, 21-47.

Christopher, R., Kim, S., & Wu, E. (2012). Do Sovereign Credit Ratings Influence Regional Stock and Bond Markets Interdepencies in Emerging Countries? *Journal of International Financial Markets, Institutions & Money, 22*, 1070-1089.

Clauretie, T., & Wansley, J. (1985). The Impact of Credit Watch Placement on Equity Returns and Bond Prices. *Journal of Financial Research, 8*, 31-42.

Davidson, W., Glascock, J., & Henderson, G. (1987). Announcement Effects of Moody's Bond Rating Changes on Equity Returns. *Quarterly Journal of Business and Economics, 26*(3), 67-78.

Dichev, I., & Piotroski, J. (2001). The Long-Run Stock Returns Following Bond Ratings Changes. *The Journal of Finance, 51*(1), 173-203.

Ederington, L., & Goh, J. (1993). Is a Bond Rating Downgrade Bad News, Good News or No News for Stockholders? *The Journal of Finance, 48*(5), 2001-2008.

———, & ——— (1999). Cross-Sectional Variation in the Stock Market Reaction to Bond Rating Changes. *The Quarterly Review of Economics and Finance, 39*(1), 101-112.

Ferreira, M., & Gama, P. (2007). Does Sovereign Debt Ratings News Spill Over to International Stock Markets? *Journal of Banking & Finance, 31*, 3162-3182.

Ferri, G., & Liu, L. (2002). Do Global Credit Rating Agencies Think Globally? The Information Content of Firm Ratings around the World. *Journal of Banking & Finance, 25*, 115-148.

Fitch. (2013). *Definitions of Ratings and Other Forms of Opinion.* Consulted via http://www.fitchratings.com/web_content/ratings/fitch_ratings_definitions_and_scales.pdf.

Gande, A., & Parsley, D. (2005). News Spillovers in the Sovereign Debt Market. *Journal of Financial Economics, 75*(3), 691-734.

Grier, P., & Katz, S. (1976). The Differential Effects of Bond Rating Changes Among Industrial and Public Utility Bonds by Maturity. *The Journal of Business, 49*(2), 226-239.

Griffin, P., & Sanvincente, A. (1982). Common Stock Returns and Rating Changes: A Methodological Comparison. *The Journal of Finance, 37*(1), 103-119.

Hand, J., Holthausen, R., & Leftwich, R. (1992). The Effect of Bond Rating Agency Announcements on Bond and Stock Prices. *The Journal of Finance, 47*(2), 733-752.

Heinke, V., & Steiner, M. (2001). Event Study Concerning International Bond Price Effects of Credit Rating Actions. *International Journal of Finance and Economics, 6*, 139-157.

Hill, P., & Faff, R. (2010). The Market Impact of Relative Agency Activity in the Sovereign Ratings Market. *Journal of Business Finance & Accounting, 37*(9), 1309-1347.

Hite, G., & Warga, A. (1997). The Effect of Bond-Rating Changes on Bond Price Performance. *Financial Analysts Journal, 53*(3), 35-51.

Holthausen, R., & Leftwich, R. (1986). The Effect of Bond Rating Changes on Common Stock Prices, *Journal of Financial Economics, 17*, 57-89.

Hooper, V., Hume, T., & Kim, S. (2008). Sovereign Rating Changes – Do They Provide New Information for Stock Markets? *Economic Systems, 32*, 142-166.

Hsueh, L., Liu, Y. (1992). Market Anticipation and the Effect of Bond Rating Changes on Common Stock Prices. *Journal of Business Research, 24*, 225-239.

Kaminsky, G., & Schmukler, S. (2002). Emerging Market Instability: Do Sovereign Ratings affect Country Risk and Stock Returns? *The World Bank Economic Review, 16*(2), 171-195.

Kaplan, R., & Urwitz G. (1977). Statistical Models of Bond Ratings: A Methodological Inquiry. *The Journal of Business, 52*, 231-261.

Katz, S. (1974). The Price and Adjustment Process of Bonds to Rating Reclassifications:A test of Bond Market Efficiency. *The Journal of Finance, 29*(2), 551-559.

Larraín, G., Reisen H., & von Maltzan, J. (1997). *Emerging Market Risk and Sovereign Credit Ratings* (OECD Working Paper No. 124). Accessed through http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.139.1534&rep=rep1&type=pdf

Lianto, T., & Matolcsy, Z. (1995). The Incremental Information Content of Bond Rating Revisions: The Australian Evidence. *Journal of Banking & Finance, 19*, 891-902.

Liu, P., Seyyed F., & Smith, S. (1999). The Independent Impact of Credit Rating Changes – The Case of Moody's Rating Refinement on Yield Premiums. *Journal of Business Finance & Accounting, 26*(3), 337-363.

May, D. (2010). The Impact of Bond Rating Changes on Corporate Bond Prices: New Evidence from the Over-The-Counter Market. *Journal of Banking & Finance, 34*, 2822-2836.

Mitchell, M., Mulherin J., & Weston, J. (2004). *Takeovers, Restructuring, and Corporate Governance*. New Jersey: Pearson Prentice Hall.

Opp, C., Opp, M., & Harris, M. (2013). Rating Agencies in the Face of Regulation. *Journal of Financial Economics, 108*(1), 46-61.

Pukthuanthong-Le K., Elayan, F., & Rose, L. (2007). Equity and Debt Market Responses to Sovereign Credit Ratings Announcement. *Global Finance Journal, 18*, 47-83.

Radelet, S., & Sachs, J. (1998). The East Asian Financial Crisis: Diagnosis, Remedies, Prospects. *Brookings Papers, 28*(1), 1-90.

Reisen H., & von Maltzan, J. (1999). *Boom and Bust and Sovereign Ratings* (OECD Working Paper No. 148). Accessed through http://ideas.repec.org/p/oec/devaaa/148-en.html

Wakeman, M. (1984). The Real Function of Bond Rating. In M. Jensen and C. Smith (Ed.), *The Modern Theory of Corporate Finance*. New York: McGraw-Hill Book Company.

Weinstein, M. (1977). The Effect of a Rating Change Announcement on Bond Price. *Journal of Financial Economics, 5*, 329-350.

Appendix 1: Overview of sample countries and stock market indices

Country	Stock market index	Country	Stock market index
Argentina*	Argentina Merval	**Lithuania***	OMX Vilnius
Australia	S&P ASX 200	**Luxembourg**	LuxX
Austria	ATX	**Malaysia***	FTSE Bursa Malaysia KLCI
Belgium	BEL 20	**Malta**	Malta SE MSE
Brazil*	Brazil Bovespa	**Mexico***	Mexico IPC
Canada	S&P TSX Composite	**Netherlands**	AEX Index
Chile*	Santiago SE General	**Norway**	Oslo Exchange All Share
China*	Shanghai SE All Share	**Panama**	Panama SE BVPSI
Colombia	MSCI Colombia	**Peru***	Lima SE General (IGBL)
Czech Republic	Prague SE PX	**Philippines***	Phillipine SE I
Denmark	OMXC20 Copenhagen	**Poland***	Warsaw General Index
Ecuador	Ecuador ECU	**Portugal**	PSI 20
Egypt	Egypt Hermes Financial	**Romania***	Romania BET
Estonia*	OMX Tallin	**Russia***	Russia RTS
Finland	OMX Helsinki	**Singapore**	Straits Times Index L
France	CAC 40	**Slovakia**	SAX 16
Germany	DAX 30	**South Africa***	FTSE/JSE All Share
Greece	ATHEX Composite	**South Korea**	Korea SE Composite
Hong Kong	Hang Seng	**Spain**	IBEX 35
Hungary*	Budapest BUX	**Sri Lanka**	Colombo SE All Share
Iceland	OMX Iceland All Share	**Sweden**	OMX Stockholm 30
India*	India BSE 100 National	**Switzerland**	Swiss Market SMI
Indonesia*	IDX Composite	**Taiwan**	Taiwan SE Weighed TAIEX
Ireland	Ireland SE Overall	**Thailand***	Bangkok S.E.T.
Israel	Israel TA 100	**Tunisia**	Tunisia TUNINDEX
Italy	FTSE MIB	**Turkey***	Istanbul SE National 100
Jamaica	Jamaice SE MAIN	**United Kingdom**	FTSE 100
Japan	NIKKEI 225	**United States**	S&P 500
Latvia	OMX Riga	**Venezuela***	Venezuela SE General
Lebanon	Lebanon BLOM		

Note: * indicates that the country has an emerging market status following the classification of the International Monetary Fund.

Appendix 2: AAR's and CAAR's: 2000-2012

Long-term rating change (upgrade):

	AAR	t-stat	CAAR	t-stat
-10	-0,03%	-1,5005	-0,03%	-1,5005
-9	0,02%	-0,3444	-0,01%	-1,3313
-8	-0,01%	-0,5010	-0,02%	-1,3805
-7	-0,04%	-0,0201	-0,06%	-1,1350
-6	-0,34%	-2,7572	-0,40%	-2,2758
-5	-0,20%	-2,2547	-0,61%	-2,9470
-4	0,22%	1,3285	-0,39%	-2,1914
-3	0,06%	-0,5010	-0,33%	-2,2399
-2	-0,14%	-1,3598	-0,47%	-2,5812
-1	-0,10%	-0,7271	-0,57%	-2,6779
0	0,17%	1,0410	-0,41%	-2,1883
1	0,11%	0,6885	-0,30%	-1,9050
2	-0,02%	-0,3598	-0,32%	-1,9276
3	-0,06%	-0,8521	-0,38%	-2,0909
4	0,05%	-0,1468	-0,33%	-2,0605
5	0,08%	-0,4486	-0,25%	-2,1016
6	-0,02%	-0,4367	-0,27%	-2,1465
7	0,25%	1,2607	-0,02%	-1,7053
8	0,09%	0,8449	0,07%	-1,4867
9	-0,19%	-1,4012	-0,12%	-1,8039
10	-0,17%	-1,6118	-0,29%	-2,0879

Long-term rating change (downgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,29%	1,7989	0,29%	1,7989
-9	0,07%	0,7855	0,36%	1,8974
-8	-0,35%	-1,0610	0,02%	0,7240
-7	-0,13%	-1,7805	-0,12%	-0,2836
-6	-0,68%	-1,0675	-0,80%	-0,9366
-5	-0,07%	-1,3377	-0,87%	-1,5449
-4	-0,68%	-2,0943	-1,55%	-2,2694
-3	-0,06%	-0,6694	-1,62%	-2,3625
-2	-0,50%	-2,0909	-2,11%	-2,8243
-1	-0,01%	-0,0449	-2,12%	-2,6613
0	-0,27%	-0,7219	-2,39%	-2,7338
1	-0,60%	-2,2886	-2,99%	-3,3340
2	0,15%	-0,6878	-2,84%	-3,3733
3	0,02%	-0,4294	-2,82%	-3,3359
4	-0,11%	0,0518	-2,94%	-2,6214
5	-0,32%	-0,9575	-3,26%	-2,7684
6	0,59%	1,8269	-2,67%	-2,2651
7	0,62%	2,1395	-2,05%	-1,7986
8	0,20%	0,4306	-1,85%	-1,6826
9	-0,42%	-1,6352	-2,27%	-1,9414
10	-0,36%	-0,5815	-2,63%	-1,9862

Short-term rating change (upgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,08%	0,0858	0,08%	0,0858
-9	0,24%	1,7723	0,32%	0,9313
-8	-0,11%	-0,5883	0,21%	0,3722
-7	-0,20%	-1,5456	0,01%	-0,4423
-6	-0,47%	-1,9643	-0,46%	-1,3570
-5	-0,27%	-1,1040	-0,73%	-1,7114
-4	0,12%	0,7188	-0,62%	-1,3873
-3	0,32%	1,5799	-0,30%	-0,8545
-2	0,19%	0,6658	-0,11%	-0,5434
-1	0,16%	0,7628	0,05%	-0,2068
0	0,16%	0,8414	0,21%	0,1112
1	-0,53%	-0,3852	-0,32%	-0,0988
2	0,08%	0,0752	-0,24%	-0,0723
3	-0,12%	-0,7086	-0,36%	-0,2977
4	-0,14%	-0,7182	-0,50%	-0,4541
5	-0,13%	-0,7592	-0,63%	-0,6740
6	-0,50%	-1,1405	-1,13%	-0,9399
7	-0,11%	-0,0843	-1,25%	-0,9251
8	0,10%	0,7786	-1,14%	-0,7299
9	-0,26%	-1,2243	-1,41%	-1,0119
10	0,24%	0,4392	-1,16%	-0,8750

Short-term rating change (downgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,52%	2,5884	0,52%	2,5884
-9	-0,11%	0,3613	0,41%	2,0400
-8	-0,75%	-2,1097	-0,34%	0,1257
-7	0,00%	-0,5795	-0,34%	-0,2045
-6	-0,60%	-0,7894	-0,95%	-0,7063
-5	-0,05%	-0,7891	-1,00%	-0,9993
-4	-0,16%	-0,4691	-1,16%	-1,0973
-3	0,01%	-0,4558	-1,15%	-1,1882
-2	-0,43%	-1,2219	-1,58%	-1,5055
-1	-0,02%	0,3389	-1,61%	-1,2495
0	-0,14%	-0,4134	-1,74%	-1,2993
1	-0,19%	-1,1197	-1,93%	-1,5739
2	0,33%	-0,2309	-1,60%	-1,5524
3	0,19%	0,1523	-1,41%	-1,4258
4	-0,86%	-0,3799	-2,28%	-1,2852
5	0,16%	0,8585	-2,12%	-1,1391
6	0,30%	0,2915	-1,82%	-1,0618
7	0,28%	0,6605	-1,54%	-0,9290
8	0,64%	1,4844	-0,90%	-0,6590
9	-0,76%	-1,7991	-1,66%	-0,9363
10	-1,22%	-0,6759	-2,88%	-1,1536

Rating outlook change (positive):

	AAR	t-stat	CAAR	t-stat
-10	-0,34%	-2,5062	-0,34%	-2,5062
-9	0,06%	0,2501	-0,28%	-0,7314
-8	-0,19%	-1,7072	-0,47%	-1,2987
-7	0,14%	1,1211	-0,33%	-0,9062
-6	0,08%	-0,3041	-0,25%	-0,9524
-5	-0,25%	-1,7128	-0,50%	-1,4708
-4	-0,01%	-0,0164	-0,52%	-1,4022
-3	0,02%	-0,4040	-0,50%	-1,4592
-2	-0,27%	-1,1218	-0,77%	-1,7478
-1	0,28%	1,7804	-0,49%	-1,1931
0	-0,23%	-1,1379	-0,72%	-1,4476
1	-0,16%	-1,3742	-0,88%	-1,6985
2	-0,26%	-2,2137	-1,14%	-2,1725
3	-0,12%	-0,3457	-1,25%	-2,1311
4	0,34%	2,2680	-0,91%	-1,5746
5	-0,22%	-1,5082	-1,13%	-1,9022
6	-0,09%	0,1865	-1,22%	-1,7614
7	0,20%	0,9430	-1,02%	-1,3848
8	0,11%	0,3063	-0,91%	-1,2615
9	-0,21%	-1,6273	-1,13%	-1,5023
10	-0,12%	-1,1908	-1,25%	-1,6658

Rating outlook change (negative):

	AAR	t-stat	CAAR	t-stat
-10	0,33%	2,3842	0,33%	2,3842
-9	-0,02%	0,4163	0,32%	1,9486
-8	-0,35%	-1,4519	-0,03%	0,6359
-7	-0,23%	-2,1228	-0,26%	-0,4827
-6	-0,08%	0,9710	-0,34%	-0,0156
-5	0,07%	-0,5540	-0,28%	-0,3398
-4	-0,03%	-0,0450	-0,31%	-0,3223
-3	-0,27%	-0,6171	-0,57%	-0,5848
-2	-0,36%	-1,7565	-0,93%	-1,2188
-1	-0,35%	-0,6322	-1,28%	-1,3730
0	-0,22%	-1,6405	-1,50%	-1,7913
1	-0,39%	-1,5928	-1,89%	-2,1915
2	-0,16%	-0,9329	-2,05%	-2,3609
3	-0,10%	-0,3217	-2,14%	-2,3548
4	0,55%	2,4278	-1,59%	-1,5978
5	0,25%	1,2077	-1,34%	-1,3134
6	0,14%	0,3909	-1,20%	-1,1976
7	0,50%	2,7551	-0,69%	-0,5807
8	0,07%	0,4244	-0,62%	-0,5083
9	-0,07%	-0,3542	-0,69%	-0,5724
10	0,49%	2,0457	-0,19%	-0,1272

Rating watch change (positive):

	AAR	t-stat	CAAR	t-stat
-10	-0,59%	-1,1055	-0,59%	-1,1055
-9	0,12%	-0,3200	-0,47%	-0,9765
-8	-0,03%	0,3833	-0,49%	-0,5945
-7	-0,14%	-0,7512	-0,63%	-0,8631
-6	-0,02%	-0,1012	-0,65%	-0,8640
-5	-0,46%	-1,0670	-1,11%	-1,3382
-4	-0,15%	-0,6328	-1,27%	-1,4511
-3	-0,25%	-0,4239	-1,52%	-1,5025
-2	-0,29%	-0,8936	-1,81%	-1,6781
-1	-0,48%	-2,0717	-2,29%	-1,9675
0	-0,48%	-1,5116	-2,77%	-2,2739
1	0,04%	0,2822	-2,72%	-2,1387
2	0,47%	1,0396	-2,25%	-1,7794
3	0,07%	0,9951	-2,18%	-1,4684
4	-0,30%	-0,7606	-2,48%	-1,6297
5	0,22%	0,4713	-2,26%	-1,2523
6	-0,10%	-0,0738	-2,36%	-1,2453
7	0,01%	-0,2849	-2,35%	-1,2766
8	0,35%	0,8111	-2,00%	-0,9300
9	0,27%	0,6438	-1,73%	-0,7591
10	-0,33%	-0,4267	-2,06%	-0,8153

Rating outlook change (negative):

	AAR	t-stat	CAAR	t-stat
-10	0,39%	1,9104	0,39%	1,9104
-9	0,33%	1,3358	0,72%	2,3295
-8	-0,66%	-1,8468	0,06%	0,7528
-7	0,40%	1,0773	0,47%	1,3080
-6	-0,72%	-1,4796	-0,25%	-0,4807
-5	-0,91%	-1,5269	-1,16%	-1,2990
-4	-0,73%	-1,7879	-1,89%	-1,6799
-3	-0,75%	-1,6359	-2,64%	-2,0329
-2	-0,28%	-1,3956	-2,92%	-2,2623
-1	-1,11%	-1,9068	-4,03%	-2,6656
0	-1,17%	-0,4407	-5,21%	-2,5371
1	-0,23%	0,0204	-5,44%	-2,4150
2	1,30%	0,5569	-4,13%	-2,0928
3	0,02%	0,1653	-4,11%	-1,9608
4	-2,14%	-0,9017	-6,26%	-2,0230
5	1,14%	1,8354	-5,12%	-1,7914
6	0,38%	0,4474	-4,73%	-1,6936
7	-0,33%	-0,2086	-5,06%	-1,7064
8	0,21%	0,4378	-4,85%	-1,6107
9	-0,56%	-0,6377	-5,41%	-1,6862
10	-2,06%	-0,8589	-7,47%	-1,8747

Appendix 3: AAR's and CAAR's: pre-crisis period

Long-term rating change (upgrade):

	AAR	t-stat	CAAR	t-stat
-10	-0,03%	-0,9250	-0,03%	-0,9250
-9	0,00%	0,1016	-0,02%	-0,5719
-8	0,03%	-0,2107	0,01%	-0,5910
-7	0,01%	0,9147	0,01%	0,0917
-6	-0,51%	-2,9129	-0,49%	-1,2138
-5	-0,14%	-0,6170	-0,64%	-1,3492
-4	0,24%	1,3547	-0,40%	-0,6829
-3	0,01%	-0,3106	-0,39%	-0,7437
-2	-0,14%	-0,9961	-0,53%	-1,0573
-1	-0,20%	-0,8825	-0,73%	-1,2738
0	0,17%	1,2822	-0,56%	-0,8314
1	-0,02%	0,4805	-0,58%	-0,6600
2	0,03%	0,4567	-0,56%	-0,4925
3	-0,24%	-1,6087	-0,80%	-0,9288
4	0,20%	1,5511	-0,60%	-0,5290
5	0,03%	-0,3629	-0,57%	-0,6113
6	0,02%	0,5850	-0,55%	-0,4901
7	0,39%	2,0572	-0,16%	0,1299
8	-0,02%	0,2181	-0,18%	0,1706
9	-0,26%	-1,4128	-0,44%	-0,2119
10	-0,11%	-0,1962	-0,54%	-0,2458

Long-term rating change (downgrade):

	AAR	t-stat	CAAR	t-stat
-10	-0,30%	-0,6550	-0,30%	-0,6550
-9	-0,10%	-1,0741	-0,40%	-1,1017
-8	-0,12%	-0,4069	-0,51%	-1,1249
-7	-0,46%	-1,1694	-0,98%	-1,6202
-6	-1,76%	-1,8246	-2,73%	-2,3708
-5	0,74%	0,5622	-2,00%	-1,7457
-4	-1,60%	-3,0888	-3,60%	-2,6076
-3	0,06%	0,3610	-3,54%	-2,3675
-2	-0,83%	-1,1864	-4,36%	-2,6393
-1	0,49%	-0,0838	-3,87%	-2,5148
0	-0,05%	0,2116	-3,92%	-2,3046
1	-0,81%	-1,9118	-4,74%	-2,8497
2	1,04%	1,4752	-3,70%	-2,2587
3	0,98%	1,4021	-2,72%	-1,6853
4	0,40%	0,8712	-2,32%	-1,4780
5	-1,06%	-1,4518	-3,38%	-1,9389
6	0,05%	0,5707	-3,33%	-1,6115
7	0,72%	1,1172	-2,61%	-1,2529
8	0,13%	-0,3460	-2,48%	-1,2998
9	0,46%	1,5668	-2,02%	-1,1072
10	0,31%	-0,4248	-1,71%	-1,1538

Short-term rating change (upgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,09%	0,0361	0,09%	0,0361
-9	0,34%	1,9805	0,42%	1,1130
-8	-0,20%	-1,0072	0,22%	0,2384
-7	-0,05%	-0,4925	0,17%	-0,0299
-6	-0,88%	-4,2907	-0,71%	-1,8190
-5	-0,38%	-0,6070	-1,09%	-1,8587
-4	0,08%	0,1757	-1,01%	-1,6797
-3	0,08%	0,3542	-0,93%	-1,4993
-2	0,60%	1,3271	-0,33%	-0,8106
-1	0,19%	0,4840	-0,14%	-0,5158
0	0,36%	1,0354	0,22%	-0,0992
1	-1,53%	-1,2780	-1,31%	-0,8340
2	-0,08%	-0,4704	-1,39%	-0,9424
3	-0,45%	-1,5206	-1,84%	-1,3961
4	-0,09%	0,0342	-1,92%	-1,3512
5	-0,32%	-0,8373	-2,25%	-1,5629
6	-0,49%	-0,1663	-2,73%	-1,5461
7	-0,12%	0,1358	-2,85%	-1,4412
8	0,09%	0,7187	-2,76%	-1,2377
9	-0,53%	-1,9038	-3,29%	-1,6747
10	0,55%	0,9121	-2,74%	-1,4028

Short-term rating change (downgrade):

	AAR	t-stat	CAAR	t-stat
-10	-0,64%	-0,9971	-0,64%	-0,9971
-9	-1,39%	-1,9546	-2,03%	-2,1399
-8	-0,91%	-1,4785	-2,94%	-2,6005
-7	-0,88%	-0,6060	-3,82%	-2,2441
-6	-1,55%	-1,3974	-5,37%	-2,6381
-5	0,93%	0,5039	-4,44%	-2,0320
-4	-1,31%	-1,3833	-5,74%	-2,4205
-3	0,04%	-0,0672	-5,71%	-2,3348
-2	-0,75%	-0,6125	-6,46%	-2,1778
-1	1,71%	1,6996	-4,74%	-1,7311
0	1,42%	1,0742	-3,33%	-1,2256
1	0,61%	-0,0424	-2,72%	-1,1385
2	1,29%	0,4970	-1,44%	-0,8947
3	1,89%	0,8244	0,45%	-0,5389
4	-0,08%	-0,5782	0,37%	-0,6133
5	-1,62%	-1,5109	-1,24%	-0,9106
6	-0,31%	-1,1157	-1,55%	-1,0485
7	-0,77%	-0,9807	-2,32%	-1,2715
8	0,56%	0,5202	-1,76%	-1,1679
9	0,67%	1,2795	-1,09%	-1,0488
10	-0,99%	-1,1000	-2,08%	-1,2163

Rating outlook change (positive):

	AAR	t-stat	CAAR	t-stat
-10	-0,41%	-1,9854	-0,41%	-1,9854
-9	-0,25%	-0,3687	-0,66%	-0,9955
-8	-0,19%	-1,5879	-0,85%	-1,3929
-7	0,05%	-0,0661	-0,80%	-1,3665
-6	-0,01%	-0,7860	-0,81%	-1,5625
-5	-0,38%	-1,3642	-1,19%	-1,8970
-4	-0,19%	-0,7564	-1,37%	-2,0328
-3	-0,12%	-1,3762	-1,49%	-2,3214
-2	-0,31%	-1,1107	-1,81%	-2,5409
-1	0,44%	2,2054	-1,37%	-1,9071
0	-0,26%	-0,8601	-1,63%	-2,0477
1	-0,25%	-1,1784	-1,87%	-2,2423
2	-0,37%	-2,1971	-2,25%	-2,6461
3	-0,05%	-0,0242	-2,30%	-2,4072
4	0,41%	1,5990	-1,89%	-2,0023
5	-0,31%	-0,9212	-2,20%	-2,1686
6	-0,05%	0,3506	-2,25%	-1,9332
7	0,60%	1,7060	-1,65%	-1,2646
8	0,33%	0,9836	-1,32%	-0,9779
9	-0,34%	-2,6198	-1,66%	-1,3143
10	-0,16%	-1,0226	-1,82%	-1,4342

Rating outlook change (negative):

	AAR	t-stat	CAAR	t-stat
-10	0,15%	1,1802	0,15%	1,1802
-9	-0,30%	-0,1868	-0,15%	0,6367
-8	-0,04%	1,1136	-0,20%	1,1357
-7	-0,15%	-0,5216	-0,35%	0,6353
-6	-0,51%	0,0087	-0,86%	0,5530
-5	-0,07%	-0,5023	-0,93%	-0,0259
-4	0,04%	1,5699	-0,89%	0,3990
-3	0,49%	0,9773	-0,39%	0,9233
-2	-0,26%	0,0375	-0,65%	0,9156
-1	-0,99%	-1,3559	-1,64%	0,4786
0	-0,11%	-0,3554	-1,75%	0,3223
1	-0,13%	0,2295	-1,88%	0,3666
2	0,01%	0,6016	-1,87%	0,4849
3	0,08%	0,5110	-1,80%	0,5858
4	0,02%	0,1746	-1,78%	0,6062
5	0,55%	2,5156	-1,23%	1,0025
6	-0,19%	-0,2334	-1,41%	0,9392
7	0,02%	0,3080	-1,40%	0,9806
8	0,14%	1,0233	-1,26%	1,0927
9	0,43%	2,3606	-0,83%	1,3819
10	0,02%	0,4474	-0,81%	1,4196

Rating watch change (positive):

	AAR	t-stat	CAAR	t-stat
-10	-0,73%	-1,1005	-0,73%	-1,1005
-9	-0,28%	-0,8282	-1,01%	-1,3772
-8	0,52%	1,2301	-0,48%	-0,0958
-7	0,30%	-0,0200	-0,18%	-0,0923
-6	0,06%	0,1802	-0,12%	-0,0324
-5	-0,65%	-0,8878	-0,77%	-0,4285
-4	0,13%	0,4468	-0,64%	-0,3303
-3	-0,01%	0,1343	-0,65%	-0,1913
-2	-0,77%	-1,8245	-1,42%	-0,6597
-1	-0,42%	-1,6181	-1,84%	-0,8708
0	-0,23%	-0,3690	-2,07%	-0,9395
1	0,10%	0,1308	-1,97%	-0,8772
2	1,04%	1,1494	-0,93%	-0,4203
3	0,37%	1,4333	-0,56%	-0,0795
4	-0,61%	-1,2104	-1,17%	-0,5169
5	1,00%	1,4438	-0,17%	0,1335
6	-0,72%	-1,3425	-0,89%	-0,1112
7	-0,15%	-0,7589	-1,04%	-0,3526
8	-0,54%	-0,7917	-1,58%	-0,5105
9	-0,04%	-0,3848	-1,62%	-0,5876
10	-0,47%	-0,8567	-2,09%	-0,7088

Rating watch change (negative):

	AAR	t-stat	CAAR	t-stat
-10	0,06%	0,3543	0,06%	0,3543
-9	0,60%	1,6969	0,65%	1,2681
-8	-1,38%	-4,0493	-0,72%	-0,7855
-7	0,86%	2,8896	0,14%	0,3260
-6	0,71%	0,2691	0,84%	0,4213
-5	-0,80%	-0,5054	0,04%	0,0605
-4	-0,80%	-0,9066	-0,76%	-0,4899
-3	-1,91%	-1,7565	-2,67%	-1,3608
-2	0,03%	0,1874	-2,64%	-1,1803
-1	-2,44%	-2,1607	-5,08%	-1,9729
0	-2,22%	-0,5625	-7,30%	-1,9191
1	0,49%	0,5902	-6,80%	-1,2911
2	2,90%	0,8219	-3,90%	-0,8054
3	1,73%	0,9353	-2,17%	-0,3929
4	0,97%	1,6080	-1,20%	-0,1010
5	1,74%	0,9520	0,53%	0,1301
6	-0,48%	-0,9525	0,06%	-0,0570
7	-0,54%	-0,2436	-0,48%	-0,1023
8	-0,68%	-0,9866	-1,16%	-0,2489
9	0,14%	0,6876	-1,02%	-0,1213
10	-0,43%	-1,3119	-1,44%	-0,2822

Appendix 4: AAR's and CAAR's: crisis period

Long-term rating change (upgrade):

	AAR	t-stat	CAAR	t-stat
-10	-0,03%	-1,2282	-0,03%	-1,2282
-9	0,04%	-0,8151	0,01%	-1,4702
-8	-0,08%	-0,5516	-0,07%	-1,5203
-7	-0,14%	-1,7703	-0,21%	-2,1902
-6	-0,02%	-0,7192	-0,23%	-2,2612
-5	-0,32%	-2,7161	-0,55%	-3,2002
-4	0,18%	0,3366	-0,37%	-2,8539
-3	0,16%	-0,4071	-0,21%	-2,8247
-2	-0,14%	-0,9366	-0,36%	-2,9718
-1	0,09%	-0,0891	-0,26%	-2,8037
0	0,16%	0,1504	-0,11%	-2,5405
1	0,36%	0,5032	0,25%	-2,2971
2	-0,12%	-1,3605	0,13%	-2,5754
3	0,29%	0,7202	0,43%	-2,2609
4	-0,25%	-2,2272	0,18%	-2,7511
5	0,18%	-0,2608	0,36%	-2,7006
6	-0,10%	-1,3240	0,26%	-2,9272
7	-0,02%	-0,8225	0,24%	-3,0401
8	0,32%	1,0188	0,56%	-2,7107
9	-0,07%	-0,4389	0,49%	-2,7305
10	-0,28%	-2,3889	0,21%	-3,1573

Long-term rating change (downgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,55%	2,5408	0,55%	2,5408
-9	0,15%	1,2809	0,70%	2,7572
-8	-0,45%	-0,9758	0,25%	1,3538
-7	0,01%	-1,3292	0,27%	0,6321
-6	-0,20%	-0,4096	0,07%	0,1529
-5	-0,43%	-1,6788	-0,36%	-0,8890
-4	-0,27%	-1,2117	-0,64%	-1,3244
-3	-0,12%	-0,8658	-0,76%	-1,5405
-2	-0,35%	-1,7071	-1,10%	-1,8926
-1	-0,24%	-0,0123	-1,34%	-1,7734
0	-0,36%	-0,8478	-1,70%	-1,9642
1	-0,51%	-1,5668	-2,21%	-2,3628
2	-0,25%	-1,3739	-2,46%	-2,6849
3	-0,41%	-1,1396	-2,87%	-2,9064
4	-0,34%	-0,0442	-3,21%	-2,2575
5	0,01%	-0,0146	-3,20%	-2,2238
6	0,83%	1,8099	-2,37%	-1,7956
7	0,57%	1,8117	-1,80%	-1,4313
8	0,23%	0,7467	-1,57%	-1,2800
9	-0,81%	-2,1575	-2,38%	-1,6439
10	-0,66%	-0,5420	-3,04%	-1,6945

Short-term rating change (upgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,06%	0,0802	0,06%	0,0802
-9	0,12%	0,3756	0,19%	0,2259
-8	0,00%	0,1695	0,18%	0,2824
-7	-0,38%	-1,6442	-0,19%	-0,5745
-6	0,03%	0,5714	-0,16%	-0,2180
-5	-0,14%	-1,0249	-0,30%	-0,5928
-4	0,16%	0,8816	-0,13%	-0,2948
-3	0,61%	1,8935	0,47%	0,2835
-2	-0,32%	-0,6769	0,15%	0,0547
-1	0,13%	0,6269	0,28%	0,2578
0	-0,08%	0,0960	0,20%	0,2750
1	0,71%	2,9098	0,91%	0,9395
2	0,28%	1,0968	1,19%	1,1646
3	0,27%	1,0783	1,46%	1,4241
4	-0,21%	-1,2347	1,25%	1,0875
5	0,10%	0,0242	1,36%	1,0631
6	-0,51%	-2,5431	0,84%	0,5959
7	-0,11%	-0,3458	0,73%	0,4685
8	0,12%	0,3043	0,86%	0,5231
9	0,07%	0,7020	0,92%	0,6684
10	-0,13%	-0,5554	0,79%	0,5097

Short-term rating change (downgrade):

	AAR	t-stat	CAAR	t-stat
-10	0,75%	3,0862	0,75%	3,0862
-9	0,13%	1,0413	0,88%	2,8806
-8	-0,72%	-1,8030	0,16%	0,8637
-7	0,17%	-0,3470	0,33%	0,5557
-6	-0,42%	-0,4829	-0,09%	0,0305
-5	-0,24%	-0,9788	-0,33%	-0,4450
-4	0,07%	-0,1857	-0,26%	-0,4758
-3	0,00%	-0,4493	-0,26%	-0,6134
-2	-0,37%	-1,0469	-0,63%	-0,8556
-1	-0,36%	0,0439	-1,00%	-0,7639
0	-0,44%	-0,6732	-1,44%	-0,9899
1	-0,35%	-1,1915	-1,78%	-1,2915
2	0,15%	-0,3890	-1,63%	-1,3450
3	-0,14%	-0,1401	-1,78%	-1,3221
4	-1,01%	-0,3546	-2,79%	-1,1773
5	0,51%	1,4034	-2,29%	-0,9607
6	0,41%	0,4617	-1,87%	-0,8526
7	0,48%	1,0605	-1,39%	-0,6619
8	0,66%	1,4006	-0,73%	-0,4092
9	-1,04%	-2,0030	-1,77%	-0,7224
10	-1,27%	-0,6134	-3,04%	-0,9417

Rating outlook change (positive):

	AAR	t-stat	CAAR	t-stat
-10	-0,26%	-1,5110	-0,26%	-1,5110
-9	0,44%	2,0394	0,18%	0,5445
-8	-0,18%	-0,8402	0,00%	-0,0914
-7	0,24%	1,7410	0,24%	0,6816
-6	0,19%	0,6662	0,43%	0,9101
-5	-0,10%	-1,0244	0,33%	0,3705
-4	0,20%	0,8948	0,53%	0,6901
-3	0,18%	1,1043	0,71%	1,0211
-2	-0,21%	-0,4577	0,49%	0,7269
-1	0,08%	0,1462	0,58%	0,7357
0	-0,19%	-0,7446	0,38%	0,4394
1	-0,05%	-0,7072	0,33%	0,2755
2	-0,11%	-0,9127	0,22%	-0,0006
3	-0,20%	-0,6877	0,02%	-0,2317
4	0,26%	1,6373	0,29%	0,1589
5	-0,12%	-1,3046	0,17%	-0,1808
6	-0,14%	-0,3698	0,03%	-0,2527
7	-0,30%	-1,5475	-0,26%	-0,5912
8	-0,16%	-0,9398	-0,42%	-0,8151
9	-0,06%	0,3098	-0,47%	-0,7356
10	-0,07%	-0,6550	-0,55%	-0,8520

Rating outlook change (negative):

	AAR	t-stat	CAAR	t-stat
-10	0,41%	2,0653	0,41%	2,0653
-9	0,10%	0,5808	0,51%	1,8606
-8	-0,47%	-2,0727	0,04%	0,1515
-7	-0,26%	-2,1861	-0,23%	-0,8851
-6	0,09%	1,1692	-0,14%	-0,3282
-5	0,13%	-0,2517	-0,01%	-0,4077
-4	-0,06%	-0,5979	-0,07%	-0,6604
-3	-0,58%	-2,4096	-0,65%	-1,5031
-2	-0,40%	-1,8404	-1,05%	-2,1825
-1	-0,08%	-0,1771	-1,13%	-1,9538
0	-0,26%	-1,8777	-1,39%	-2,3777
1	-0,50%	-1,8614	-1,90%	-2,8591
2	-0,22%	-1,3167	-2,12%	-3,1161
3	-0,17%	-0,5814	-2,28%	-3,1442
4	0,77%	2,5125	-1,51%	-2,2332
5	0,13%	0,2324	-1,39%	-2,1276
6	0,28%	0,5526	-1,11%	-1,9477
7	0,70%	2,9546	-0,41%	-1,2497
8	0,05%	0,0406	-0,36%	-1,2257
9	-0,27%	-1,1061	-0,63%	-1,4495
10	0,69%	2,0039	0,06%	-0,9375

Rating watch change (positive):

	AAR	t-stat	CAAR	t-stat
-10	-0,41%	-0,4688	-0,41%	-0,4688
-9	0,63%	0,0248	0,21%	-0,2696
-8	-0,71%	-1,3387	-0,50%	-0,6573
-7	-0,69%	-1,0918	-1,19%	-1,0173
-6	-0,11%	-0,5369	-1,30%	-1,0834
-5	-0,24%	-0,6998	-1,54%	-1,2625
-4	-0,51%	-0,9862	-2,05%	-1,4628
-3	-0,55%	-2,5106	-2,60%	-1,7226
-2	0,30%	0,6322	-2,30%	-1,5782
-1	-0,54%	-1,2503	-2,85%	-1,7648
0	-0,79%	-2,0644	-3,64%	-2,1134
1	-0,03%	0,2338	-3,67%	-1,9854
2	-0,24%	0,0319	-3,91%	-1,9531
3	-0,29%	0,1286	-4,20%	-1,8400
4	0,08%	0,5795	-4,12%	-1,7016
5	-0,76%	-0,6933	-4,88%	-1,8363
6	0,67%	1,9973	-4,21%	-1,6129
7	0,21%	0,9373	-4,00%	-1,4512
8	1,47%	1,4522	-2,53%	-0,8121
9	0,67%	1,4557	-1,86%	-0,5024
10	-0,15%	0,1804	-2,01%	-0,4642

Rating watch change (negative):

	AAR	t-stat	CAAR	t-stat
-10	0,61%	2,0805	0,61%	2,0805
-9	0,15%	0,5284	0,76%	1,9594
-8	-0,19%	-0,3311	0,57%	1,3342
-7	0,11%	0,6014	0,68%	1,2725
-6	-1,64%	-1,5744	-0,95%	-0,6049
-5	-0,99%	-1,4610	-1,94%	-1,3634
-4	-0,68%	-1,5594	-2,62%	-1,6219
-3	-0,01%	-0,5824	-2,63%	-1,7022
-2	-0,48%	-2,1864	-3,11%	-1,9980
-1	-0,25%	-0,7570	-3,36%	-2,1131
0	-0,50%	-0,1927	-3,86%	-1,9446
1	-0,70%	-0,7722	-4,55%	-2,0594
2	0,27%	0,0663	-4,28%	-1,9425
3	-1,09%	-0,5815	-5,37%	-2,0258
4	-4,16%	-1,0535	-9,53%	-2,1297
5	0,76%	1,5894	-8,77%	-1,9743
6	0,94%	0,9505	-7,83%	-1,7995
7	-0,19%	-0,0829	-8,02%	-1,7977
8	0,79%	0,8103	-7,24%	-1,6373
9	-1,01%	-1,0720	-8,25%	-1,7697
10	-3,12%	-0,7699	-11,36%	-1,8767

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