The Impact of Credit Rating Announcements on Eurozone Sovereign Credit Default Swap Spreads

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March 2012

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Acknowledgements

First of all, I wish to acknowledge Cass Business School for its provision of the magnificent resources and facilities – with particular reference to its Bloomberg Terminals – that allowed me to so easily access all the information needed to complete this dissertation.

More importantly, I would also like to take this opportunity to express my gratitude to Natasha Todorovic, Senior Lecturer in Investment Management at Cass Business School, for supervising this dissertation. Her dedication and flexibility in doing so have been astounding, and it has been an enormous pleasure working with her.

Finally, I would like to thank the two people I am proud to call my parents. I am immensely grateful for all they have done to open the most incredible academic and professional doors for me, and I feel blessed to have role models like them to look up to.

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Abstract

Using event study techniques, this paper examines the impact of credit rating announcements on sovereign Eurozone credit default swap (CDS) spreads; the main objective being to determine whether credit rating announcements provide new and significant information on Eurozone member nations' creditworthiness.

Credit rating announcements include review announcements and changes in credit rating by Standard & Poor's, Moody's, and Fitch for sixteen out of seventeen Eurozone member countries from January 1st 2009 until February 15th 2012. CDS data consists of 12,721 daily spread quotes for five-year single-name contracts linked to the sixteen countries analysed. Adjusted spread observations are computed for each country using country-specific CDS spreads and equally weighted indices of the respective other fifteen countries. The impact of credit rating announcements on adjusted spread observations is then measured over a two-day [-1,1] event window around the announcements, and the Student's t-test is used to determine whether the adjusted spread changes deviate from zero with statistical significance.

The most significant results are obtained for cancelled negative review announcements, straight multi-notch downgrades, and multi-notch downgrades following negative review announcements. Additionally, significant evidence is found to prove that negative credit rating announcements to or within speculative grade ratings have a much stronger impact on sovereign CDS spreads than credit rating announcements within investment grade ratings. Moreover, CDS markets are found to have a slower reaction to credit rating announcements that decrease spreads than to announcements that increase them, and some minor evidence is found that rating announcements by Standard & Poor's and Moody's have a more profound impact on spreads than announcements by Fitch. On the other hand, straight single-notch downgrades, negative reviews, and single-notch downgrades following negative reviews are found not to have a significant impact on sovereign CDS spreads.

1 Introduction

This paper uses event study methodology to analyse the impact of different types of credit rating announcements on Eurozone members' Credit Default Swap spreads from January 1st 2009 until February 15th 2012. The objective of this is to determine whether credit rating announcements present significant new information regarding the creditworthiness of Eurozone countries. Credit rating announcements from three ratings agencies are examined, namely Standard & Poor's Ratings Services (S&P), Moody's Investor Service (Moody's), and Fitch Ratings (Fitch).

The rest of Section 1 is dedicated to the rationale of the report, providing general information on rating agencies, credit ratings, and setting the research framework. After that, Section 2 examines existing literature of comparable nature, giving indications of what conclusions might reasonably be expected, and what data and methodology are appropriate for this study. Section 3 details the data that was collected for this study, and how it was treated to obtain the empirical results explained in Section 5. Section 6 concludes and critically evaluates the report, and sections 7 and 8 are respectively assigned to references and appendices.

1.1 Rationale

Rating agencies have come under much pressure over the previous years for the quasi-official role they failed to fulfil in the build-up to the global financial crisis. Under the Basel II Accord, which was agreed in 2004 and implemented widely throughout the Eurozone and the rest of the world, many financial institutions' lending and investing activities became largely governed by the credit rating of the entity or instrument that was being lent to, or invested in. In most cases, the boundary between investment grade and speculative grade was a crucial one, as many large institutions were prohibited from investing in instruments with a speculative grade credit rating.

Evidently this placed a lot of power in the hands of the rating agencies, and the agencies subsequently granted many extremely high-risk financial derivatives the best possible credit rating in order to earn more fee revenue. The high and inaccurate credit ratings of these derivatives enabled them to be bought and sold by practically any party around the world, completely bypassing the risk management function of the Basel II Accord. Many of these derivatives were based on mortgages and/or consumer loans, so when the US housing bubble burst several years later and these instruments lost most or all of their value, the fact that these derivatives had been spread through the global financial system ensured that a worldwide financial meltdown followed.

Since then, there has been much debate on the role of credit rating agencies, with many calls made to reduce the financial system's reliance on them. In 2010, the Financial Stability Board published a report titled, "Principles for reducing reliance on credit rating agency ratings," but the Basel III Accord that was agreed to in 2011 made no significant change to the reliance on credit rating agencies. In the interest of the debate about the reliance on rating agencies, a study regarding the extent to which financial markets still rely on credit rating announcements to price credit risk will prove valuable. The Eurozone debt crisis is an ideal platform for this.

In late 2009 Greece was the first country to admit it was in an extremely weak financial state, and in 2010 it received a bailout in order to avoid having to default on its debt. Ireland and Portugal followed, and although no other Eurozone members have been bailed out, both Spain and Italy have seen themselves come close. Even the creditworthiness of core Eurozone members such as Germany and France has been called into question recently, and these events provide a large set of credit rating announcements.

Over the nine-year period from the start of 2000 until the end of 2008, there were 54 rating announcements by S&P, Moody's, and Fitch. Contrastingly, from the beginning of 2009 until the 15th of February 2012, there were 163 rating announcements; more than three times as many over less than half the time. This surge in rating announcements is illustrated in Figure 1, and is simultaneously the reason why the chosen timeframe of the study commences on January 1st 2009.

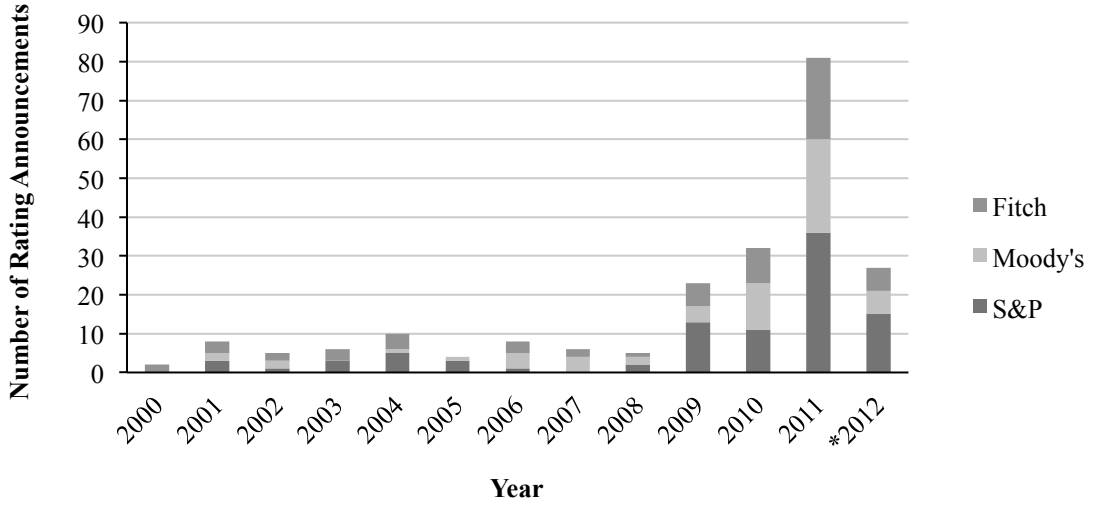

Figure 1: Number of rating announcements per year
Data Source: Bloomberg
* = Incomplete year

Because debt crises are relatively infrequent in developed countries, and rating announcements related to them are therefore relatively scarce, most previous comparable research has focused on the impact of rating announcements on corporate CDS spreads. Aside from a handful of studies conducted over the past three years, this paper provides a unique analysis on the impact of rating announcements on sovereign CDS spreads in the context of a developed economic crisis environment. Additionally, the large total number of rating announcements allows different announcement types to be studied separately without suffering the consequences of statistically unreliable sample sizes.

The findings of this study may also present useful information for market participants actively managing, monitoring, trading on, or hedging against credit risk, and also on research as to what extent markets are efficient. More importantly, they may clarify the extent to which credit rating announcements have informational value, and have implications for policymakers with regards to what extent credit rating agencies should be included in (recommended) regulation of the Eurozone's financial industry.

1.2 Rating Agencies and Credit Ratings

Rating agencies are independently operated firms that assess the financial strength of corporate and sovereign entities, with the aim of determining their ability to meet interest and principal payments on outstanding debt and the likelihood of default. The credit rating they issue reflects their opinion as to the rated entity's creditworthiness, or a specific debt issue if the credit rating is issue-specific. Separate ratings are also issued for local and foreign currency debt, where applicable. Ratings are established based on publicly and non-publicly available data, and sovereigns' creditworthiness is continuously tracked.

Three rating agencies, namely Standard & Poor's Ratings Services (S&P), Moody's Investor Service (Moody's), and Fitch Ratings (Fitch) heavily dominate the global rating agency market. They account for a combined total of 2.7 million ratings on corporate, municipal, and sovereign debt, as well as other structured products. Based on revenue, these three firms have a combined market share of approximately 97%, as shown in Figure 2.

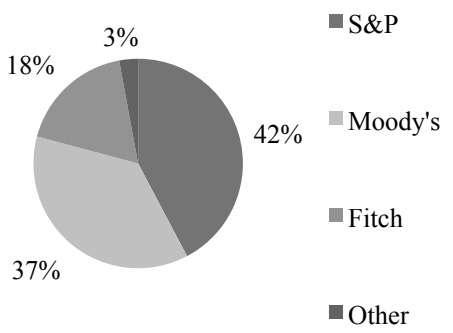

Figure 2: Rating agency market share (2011)
Data Source: Bloomberg

Although every rating agency has its own system of credit ratings, there is a widely accepted comparison between different risk categories, shown in Figure 3. Any rating of BBB or better classifies as investment grade. In this category, methods of rating determination are broadly similar, and ratings are easily compared. Below any BBB rating, debt is considered to be speculative grade, and ratings are less easily compared. For instance, S&P and Fitch only reflect default risk in their speculative grade ratings, whereas Moody's also takes expected recovery values in case of a default into account

	S&P	**Moody's**	**Fitch**	
Investment Grade	AAA	Aaa	AAA	Highest quality
	AA+	Aa1	AA+	High quality
	AA	Aa2	AA	
	AA-	Aa3	AA-	
	A+	A1	A+	Strong payment capacity
	A	A2	A	
	A-	A3	A-	
	BBB+	Baa1	BBB+	Adequate payment capacity
	BBB	Baa2	BBB	
	BBB-	Baa3	BBB-	
Speculative Grade	BB+	Ba1	BB+	Likely to fulfil obligations; on going uncertainty
	BB	Ba2	BB	
	BB-	Ba3	BB-	
	B+	B1	B+	High credit risk
	B	B2	B	
	B-	B3	B-	
	CCC+	Caa1	CCC+	Very high credit risk
	CCC	Caa2	CCC	
	CCC-	Caa3	CCC-	
	CC	Ca	CC	Near default with possibility of recovery
	C		C	
Default Grade	SD	C	DDD	Default
	D		DD	
			D	

Figure 3: Comparison between rating systems of S&P, Moody's, and Fitch
Information Source: Bank for International Settlements

These credit ratings are long-term credit ratings (rating agencies have separate systems for short-term credit ratings) and they are not influenced by events whose effect on credit quality is thought to be short-term. In contrast, financial markets continuously adapt to new information that may indicate a change in a firm's creditworthiness, which would imply that

financial markets are very likely to lead credit ratings. For this reason, rating agencies introduced rating reviews and changes in outlook to warn investors of possible future rating actions. An outlook indicates a rating agency's projection of credit rating over a short-term, often two-year horizon and signals a change in creditworthiness, albeit one that is not yet warranted to change an entity's credit rating. An outlook can be positive, negative, or stable.

More serious is a rating review. Fitch refers to it as *RatingAlert*, Moody's as *Watchlist*, and S&P as *CreditWatch*. It indicates a high chance that an entity will be up- or downgraded as a result of a significant event that has taken place, but of which the effects are not yet entirely clear. Rating agencies aim to resolve a review within 90 calendar days of the announcement. Reviews and changes in outlooks do not always lead to rating changes, and conversely, rating changes are not necessarily preceded by reviews or changes in outlooks.

1.3 Credit Default Swaps

A Credit Default Swap (CDS) contract is a form of over-the counter (OTC) insurance against default, whereby credit exposure is swapped for a series of fixed payments over the life of the contract. The CDS spread is the cost, in basis points, of insuring the debt of a reference entity against default. The protection buyer makes periodic payments to the protection seller based on the determined CDS spread and notional value of protection. In return, the seller agrees to compensate the buyer if a default, or credit event occurs. The official structure is that in the case of a credit event, the buyer of the CDS contract delivers the debt obligation with an impaired value to the seller, and the seller pays the par value of the debt obligation to the buyer.

The construction of CDS contracts is such that its price – the CDS spread – purely reflects the credit risk of reference entities, making them extremely suited for a study on the informational content of credit rating announcements. There are other types of derivative contracts that insure against default, but in terms of contract standardization and data availability, CDS contracts present a stronger case than any other derivative contract.

One of the most interesting features of CDS contracts is that the protection buyer does not need to own, or have any claim on, the underlying security. If this is the case, the entering of a CDS contract is known as a 'naked' CDS.[1] This means that any market participant can bet on the creditworthiness of an issuer, and it has meant that the CDS contracts have become popular instruments throughout the first decade of the 21st century.

[1] As of December 1st 2011, naked CDS positions on sovereign nations are banned by the European Parliament

1.4 Framework for Rating Events

Thirteen different event classes based on four different event categories are determined, and these will provide the starting point for the event study.[2] They are shown in Figure 4. Single-notch rating changes, up or down, are defined as a change to the next consecutive rating in Figure 3.[3] Multi-notch rating changes, up or down, are defined as a change of more than one notch.[4]

Event Categories	Event Classes
Negative events	Negative watch
	Single-notch downgrade
	Single-notch downgrade after negative review
	Multi-notch downgrade
	Multi-notch downgrade after negative review
Positive events	Positive watch
	Single-notch upgrade
	Single-notch upgrade after positive review
	Multi-notch upgrade
	Multi-notch upgrade after positive review
Cancelled events	Cancelled negative review
	Cancelled positive review
Neutral events	New rating

Figure 4: Event categories and classes

Negative rating events are generally expected to increase a reference entity's CDS spread as they indicate an increase in the likelihood of default, and therefore the cost of insuring against a credit event should be higher. The opposite is true for positive rating events, while expectations for cancelled rating events are split: cancelled negative review announcements are expected to decrease CDS spreads as they represent a positive surprise, while cancelled positive view announcements should increase CDS as they represent a negative surprise.

[2] No downgrades after positive reviews; no upgrades after negative reviews
[3] E.g. downgrade by S&P from AAA to AA+
[4] E.g. downgrade by S&P from AAA to AA

2 Literature Review

There have been many studies on the impact of credit rating announcements on financial markets, and this section provides an overview of most important ones and their findings. This creates a context within which the results of this study can be analysed, so as to provide a more meaningful interpretation of the empirical findings of this study. Due to the close link between bond and CDS markets, research covering the impact of rating announcements on bond markets is briefly presented to provide a broad and more historical backdrop. Afterwards, more recent research specific to CDS market responses is presented in greater detail and will lay the groundwork of this study. To provide a basis for critical evaluation of the empirical findings, several further CDS market related research papers are also considered.

2.1 Bond Market Response Studies

Especially prior to the existence of widely traded Credit Default Swaps, much research has been dedicated to analysing the impact of rating announcements on bond markets. One of the first widely accredited pieces of literature on this topic is Katz (1974), which finds that there is no anticipation of rating changes, and a six to ten week lag before full adjustment occurs. Hand et al. (1992) also studies the effect of rating announcements on bond returns and finds negative abnormal returns immediately after a downgrade or negative review, but no abnormal returns for upgrades or positive reviews. The difference in time lag of the impact between these studies also immediately highlights the improvement in availability of information and market efficiency over the gap of almost twenty years between these two papers.

Wansley et al. (1992) and Steiner and Heinke (2001) further confirm a strong negative effect of rating downgrades on bond prices closely around the time of the announcement. Wansley et al. (1992) also determines that the significance of the price impact is correlated with the number of notches the rating is changed by, and with abnormal returns prior to the announcement. Furthermore, Hite and Warga (1997) find that downgrades to and within the non-investment grade category cause larger negative abnormal returns for bonds than downgrades within the investment grade category, which is confirmed by Goh and Ederington (1999) and by Dynkin et al. (2002). Furthermore, Covitz and Harrison (2003) estimate that approximately 75% of bond spread adjustment occurs in the six months before a rating announcement, indicating significant anticipation.

2.2 CDS Markets

As CDS contracts evolved to become an extremely widely traded type of financial instrument over the past decade, the number of studies related to them has grown correspondingly. Not surprisingly, many of these studies are aimed at determining the impact of credit rating announcements on both corporate and sovereign CDS spreads.

2.1.1 Corporate CDS Market Response Studies

One of the first and most acknowledged pieces of literature on this topic is Hull et al. (2004), which studies the extent to which rating announcements by Moody's are anticipated by corporate debt CDS spreads from 1998 to 2002. It finds that negative outlook announcements, negative reviews, and downgrades are anticipated by the CDS market, but only negative reviews present significant new information to the market. Furthermore, positive rating announcements had much less significant effects, although it is acknowledged that this may have been due to a small sample size. The event study methodology used in this paper is adopted by several ensuing comparable studies.

Another highly regarded source of information is a working paper by The Bank for International Settlements (BIS), Micu et al. (2006), which studies the impact of rating announcements on corporate CDS spreads from 2001 to 2005. Contrary to Hull et al. (2004), it finds that all types of negative rating announcements, including reviews and changes in outlook, contain pricing-relevant information. More closely resembling Hull et al. (2004), however, was the finding that the effects of positive rating announcements were mixed and less significant. Furthermore, the BIS report also finds that a large part of the price adjustment occurs prior to the rating announcements, but nonetheless finds significant changes even when rating announcements are preceded by similar announcements. Additional observations include the fact that price impact is greater for entities with a rating close to the threshold investment grade level. The paper largely uses a different method, but it is notable that when they apply more traditional event studies on adjusted CDS spread changes, they obtain results in line with those by Hull et al. (2004).

Ramakrishnan (2008) and Galil and Soffer (2008) also test the response of CDS spreads to rating announcements. Similar to Micu et al. (2006), Galil and Soffer find that spreads react significantly to rating announcements even if there is similar earlier action by a different rating agency. They follow up on this result through the investigation of causalities, and find that the clustering of rating announcements indicates significant developments in a firm's creditworthiness. Like other studies thus far, Ramakrishnan (2008) determines that negative

ratings events have a significant impact, but only up to and on the announcement day. In contradiction to Hull et al. (2004), the paper also finds that positive rating changes have a significant impact on CDS spreads, but only after the announcement. This suggests that markets are quick to anticipate bad news, but are slow to accept good news. Overall, both studies conclude that the informational content of rating announcements must be recognized.

2.1.2 Sovereign CDS Market Response Studies

In an important paper by the European Central Bank, Afonso et al. (2011) use event study methodology on EU sovereign CDS spreads, as well as bond yield data to analyse reactions to rating changes and outlook changes by the same three major rating agencies as in this study. They detect significant adjustments of spreads to changes in rating and outlook, particularly in the case of downward and/or negative rating adjustments, within two days of the announcement. They also observe spill over effects, especially from lower rated countries to higher rated countries, and on top of this see persistence effects for recently downgraded sovereign entities.

Brandstack (2010) examines the impact of rating announcements by S&P, Moody's, and Fitch on US corporate CDS spreads. The study finds that rating announcements do indeed cause adjusted CDS spreads to deviate from zero, but that this statistical significance is achieved not only at the time of rating announcements, but also prior to them. The report also concludes that negative rating announcements have a more significant effect on adjusted CDS spreads than positive ones, in line with the results of aforementioned studies on the effect of rating announcements.

2.1.3 Related CDS Market Studies

Previous studies, such as Callen et al. (2007), have uncovered a relationship between CDS spreads for corporate and sovereign entities, and their respective credit ratings. More specifically, entities with better credit ratings tend to have lower CDS spreads, and entities with poorer credit ratings tend to have higher CDS spreads. This is a logical finding, as poorer credit ratings indicate a weaker ability to repay its debt and the cost of insuring this debt against default should therefore be higher, and vice versa. Nevertheless, it confirms that the research framework introduced in Section 1 is appropriate.

Norden and Weber (2004) do not directly examine the impact of rating announcements on CDS spreads, but instead attempts to uncover the empirical relationship between CDS, bond, and stock markets from 2000 to 2002 in order to determine whether different markets reflect credit risk related information sooner than others. Although the paper carries less relevance to this study, it does find that the CDS market is more important than the bond market in price discovery. Additionally, they state that CDS contracts on sovereign reference entities represent the most liquid segment of the CDS market, and evaluate that it would be interesting to "analyse the informational efficiency of the CDS market in critical times," further supporting the grounds for choosing CDS contracts and the rationale behind this study.

Jacobs et al. (2010) research the effect of rating announcements on United States corporate CDS spreads and obtain results similar to previous studies. However, they also attempt to find other factors that determine CDS spreads, and find that the VIX Index, five-year T-note, and Implied put volatility are better estimators of the CDS spread. Albeit apparent, this indicates that CDS spreads are also influenced by factors other than credit ratings.

In an International Monetary Fund working paper, Arezki et al. (2011) study the spill over effects of sovereign credit rating announcements on European financial markets, and find that sovereign downgrades have a statistically significant impact on financial markets across different countries. They also relate the sign and magnitude of the effect to the type of announcement, the country to which the announcement relates, and the rating agency from which the announcement originates. Additionally, they find that announcements that bring countries to a speculative grade credit rating are found to have systematic spill over effects across Eurozone members, implying that rating agencies can induce financial instability.

3 Data

This section contains a detailed description of data used in this paper, which consists of two main types: credit event and CDS spreads. Data is collected for sixteen out of seventeen Eurozone members[5] listed below for the period beginning January 1st 2009 and ending February 15th 2012.

- Republic of Austria
- Kingdom of Belgium
- Republic of Cyprus
- Republic of Estonia
- Republic Finland
- French Republic
- Federal Republic of Germany
- Hellenic Republic[6]
- Republic of Ireland
- Republic of Italy
- Republic of Malta
- Kingdom of The Netherlands
- Portuguese Republic
- Slovak Republic
- Republic of Slovenia
- Kingdom of Spain

The Grand Duchy of Luxembourg is not included in the study as neither credit rating nor CDS spread data is available.

3.1 CDS Spreads

End-of-day Bloomberg Generic Average Price (CBGN) five-year senior debt CDS spreads were downloaded from Bloomberg for the sixteen sovereigns under analysis. The spreads fall under the Bloomberg Generic Price (BGN) class, and are composed by Bloomberg using prices supplied to them by independent parties, with the objective of producing consensus prices.[7] Five-year senior debt contracts are the most widely traded CDS instruments, and the data collected is for Dollar-denominated ones.[8] These contracts are chosen due to the fact that Euro-denominated debt is most commonly insured using Dollar-denominated CDS contracts so that, in the event of a credit event, any fall in the value of the Euro against the Dollar will most likely increase the value of the CDS payout, increasing the offset against losses.

[5] Eurozone members as of February 15th 2012
[6] (Greece)
[7] Bloomberg statement on BGN Price Series as Appendix C
[8] United States Dollar (USD/$)

As mentioned, CDS spreads for Luxembourg are unavailable for the examined period. Additionally, spread quotes for Malta are unavailable until March 24th 2010, and CBGN quotes for Greek spreads are unavailable after September 15th 2011 due to the pure fact that spreads are too high for a consensus quote to be established. [9] For all other countries CDS spreads are available on a daily basis for the full period under consideration, eliminating the need for linear extrapolation of spreads or other proxy methods as implemented by Norden and Weber (2004) and Brandstack (2010) respectively. In total, 12,721 CDS spread observations are included in the study. This is one-third of the total number of spread observations used by the European Central Bank (2011), but nonetheless more than sufficient for analysis.

3.1.1 Descriptive Statistics

Figure 5 shows the development of average Eurozone CDS spreads over the period studied. Although the average spread increases heavily to over 200bps in early 2009, possibly due to spill over effects of the Icelandic banking crisis which erupted in the second half of 2008, it falls to approximately 100bps towards September as market sentiment settled.

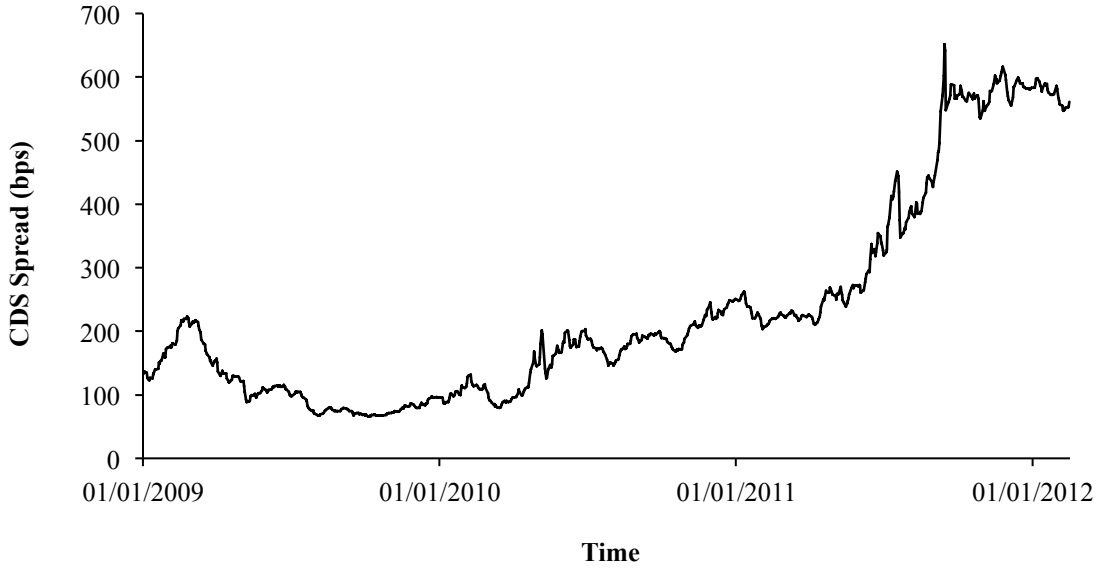

Figure 5: Average Eurozone CDS Spread

The start of the Eurozone debt crisis, at least in terms of average CDS spread, can be observed during the late months of 2009, when concerns about Eurozone members' debt levels grew following the Dubai sovereign debt crisis, and when Greece admitted its debt levels had reached 113% of GDP. Despite a €110bn Greek bailout, Figure 5 shows the crisis

[9] These inconsistencies do not lead to the exclusion of any rating announcements from the study

further accelerating in 2010, as worries about Portugal, Spain, and Ireland began to grow. An €85bn Irish rescue package in November 2010 and establishment of the European Stability Mechanism in February 2011 appear to briefly settle markets, but the average CDS spread spikes to nearly 700bps in mid 2011 as Portugal asks the EU for financial assistance, rumours about a Greek exit from the Eurozone surface, and Italy and Spain see their borrowing costs spike as the state of their finances comes under closer scrutiny. Although falling back slightly from the 2011 high, the average cost of insuring Eurozone sovereign debt against default remains at close to 600bps. This represents a more than six-fold increase from the low point in 2009, a more than twelve-fold increase from the 44.83bps 2008 average spread, and a more than hundred-fold increase from the 5.41bps 2007 average spread, illustrating the substantiality of average spread changes during the period under examination.

Behind the scenes of the average spread, however, individual country spreads differ greatly, which is highlighted most clearly by comparing Greek and German CDS spreads. German debt is commonly considered the safest sovereign debt within the Eurozone, and the cost of insuring its debt varies only between 18.73bps and 119.16bps during the timeframe. In stark contrast, Greek spreads reach 5,047.45bps on September 15th 2011, up from 230bps on January 1st 2009.

3.2 Rating Events

Records of rating announcements by S&P Ratings Services (S&P), Moody's Investor Service (Moody's), and Fitch Ratings (Fitch) are collected from Bloomberg for the sixteen Eurozone countries. Issuer-specific ratings, as opposed to issue-specific ones, are used as each country included in the sample has numerous different outstanding debt issues and issuer-specific ratings reflect the reference entities' overall ability to repay their borrowings. All ratings considered are long-term local currency ratings as long-term ratings are most-commonly used for sovereign reference entities, and the majority, if not all, of each country's debt is Euro-denominated. The data includes announcements of changes in credit rating, as well as placements on review. As for similar studies such as Brandstack (2010) and Galil and Soffer (2008), outlook revision announcements are not included in the study for the reason that this information is not freely obtainable from Bloomberg, any other database, or the rating agencies themselves without charge.

Initially there are 163 rating announcements. However, five S&P rating announcements regarding Belgium, France, Germany, Italy, and The Netherlands are eliminated from the sample because no change in rating or placement on review occurs. The only information

held by the announcements is that S&P's credit ratings are no longer solicited by the respective countries from that point onward, and are therefore deemed irrelevant to the study.

As will be elucidated in Section 5, the reaction of CDS spreads to rating events is primarily measured over a two-day window [-1,1] where the rating event occurs at day zero. In determining the effect of rating announcements it is key that CDS spread contamination over the event window is reduced to avoid biased results, meaning rating announcements whose event windows overlap with those of others are eliminated. For this reason, a further 26 rating announcements are excluded from the sample for the reason that they occur on the same day, or within two trading days of another announcement by any of the three rating agencies regarding the same reference entity. This leaves a total of 132 rating announcements for analysis, which is well in line with sample sizes of 167 and 71 in comparable studies by the European Central Bank (2011) and the International Monetary Fund (2011). A full list of all rating announcements included is available as Appendix A, and a list of those eliminated due to overlapping event windows is included as Appendix B.

3.2.1 Descriptive Statistics

Out of the three rating agencies, S&P is the most active one, accounting for a total of 63 announcements. Moody's ranks second with 37 announcements, and Fitch a close third with 32. Figure 6 shows a breakdown of rating events per country and rating agency. For countries with more than nine related credit events, the distribution of announcements is relatively similar and each rating agency accounts for approximately the same number of announcements.

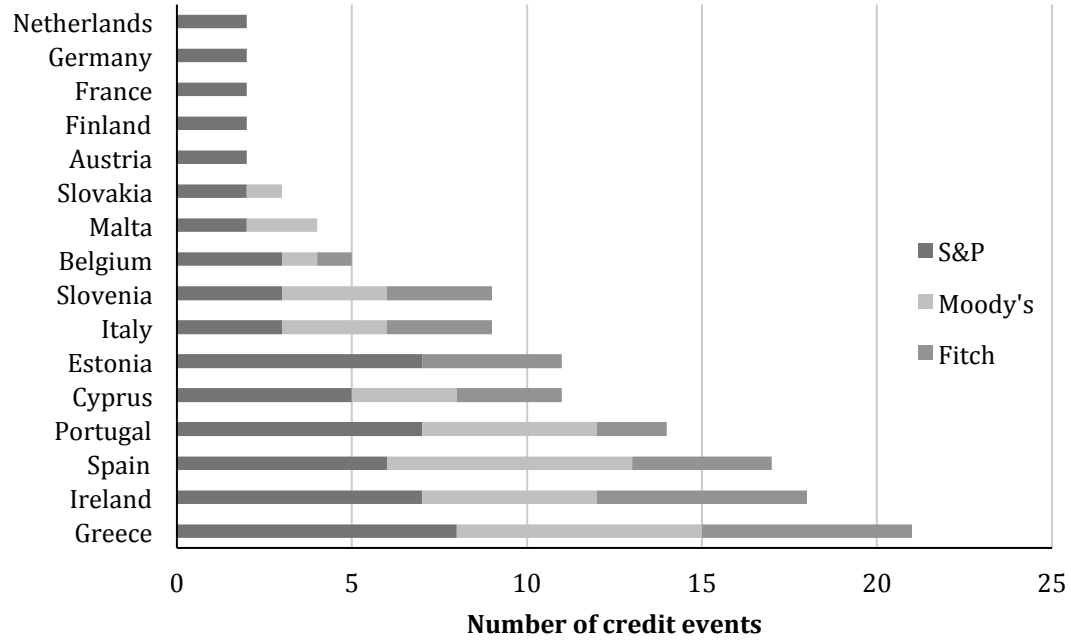

Figure 6: Breakdown of all rating announcements (1)

With 21 related rating events, Greece faces the most rating activity, and other countries that played a large role in the debt crisis, such as Ireland, Spain, and Portugal, follow closely. The Eurozone's most stable economies like The Netherlands and Germany, on the other hand, each faced only two announcements by S&P, neither of which was a downgrade.

Negative events make up 89% of the total, neutral events account for 7%, and a mere 4% of rating events are positive which are all related to Estonia. The proportion of negative events for S&P and Fitch is similar to that of the total, whereas Moody's stands out by not having made a single neutral or positive announcement in over three years. Figure 7 shows a breakdown of rating events by rating agency, as well as by event class, providing a more detailed view of how rating agencies converse with markets. There were no multi-notch upgrades preceded by a positive review, no cancelled reviews, nor any new ratings.

An important note to make regarding the classification of results is that in at least one case for each rating agency, negative rating announcements combine a rating downgrade and a negative review announcement. Where this is so, the credit event is classified as the relevant downgrade, meaning 'negative review' only counts unaccompanied negative review announcements. Nevertheless, combined announcements are used to determine whether the subsequent credit event classifies as a downgrade following a negative review announcement, or whether no action is taken following a negative review. The implication of this is that the sum of credit events in the 'after negative review' category is greater than the counted

number of negative review announcements. Additionally, there are several negative review announcements still pending at the end of the timeframe of this study.

Event class	S&P	Moody's	Fitch	Total
Negative review	21	10	7	**38**
Single-notch downgrade	10	11	7	**28**
Single-notch downgrade after negative review	13	4	5	**22**
Multi-notch downgrade	3	4	4	**11**
Multi-notch downgrade after negative review	6	8	5	**19**
Positive review	-	-	1	**1**
Single-notch upgrade	1	-	1	**2**
Single-notch upgrade after positive review	-	-	1	**1**
Multi-notch upgrade	1	-	-	**1**
Multi-notch upgrade after positive review	-	-	-	**0**
Cancelled negative review	8	-	1	**9**
Cancelled positive review	-	-	-	**0**
New rating	-	-	-	**0**
Total	**63**	**37**	**32**	**132**

Figure 7: Breakdown of all rating announcements (2)

Proportionally, S&P makes the most negative review announcements (33%) versus Moody's (27%) and Fitch (22%), indicating that it is most eager to warn markets of a potential downgrade. Correspondingly, the majority of S&P's downgrades come after a negative review announcement (59%), compared to 44% and 47% for Moody's and Fitch respectively. However, S&P also makes the most negative review announcements that ultimately lead to no action being taken, which means that out of all three agencies, a negative review announcement by S&P (with or without an accompanying downgrade) is only 70% likely to result in a rating downgrade, while this is 91% likely for Fitch, and 100% sure for Moody's based on the timeframe of this study. Resolution of a negative review announcement generally occurs well within the three-month target generally set by the rating agencies. On average, S&P, Moody's and Fitch respectively take 54, 76, and 69 calendar days to convert a negative review announcement into a single-notch downgrade. For multi-notch downgrades, these respective figures are 58, 70, and 52.

Assuming that credit ratings by the agencies move relatively harmonious, the fact that S&P is the most active rating company can be partially explained by the fact that 72% of its rating downgrades are single-notch adjustments, whereas Moody's and Fitch more frequently adjust ratings in bigger steps with single-notch changes accounting for 56% and 57% respectively. For all three agencies, however, multi-notch rating downgrades are more often preceded by

negative review announcements, while the opposite is true for single-notch downgrades. Additionally, Figure 8 shows a detailed breakdown of multi-notch rating changes.

Multi-notch rating changes	**S&P**	**Moody's**	**Fitch**	**Total**
Double-notch downgrade	2	3	1	**6**
Double-notch downgrade after negative review	5	4	3	**12**
Triple-notch downgrade	0	0	2	**2**
Triple-notch downgrade after negative review	2	2	2	**6**
Quadruple-notch downgrade after negative review	0	2	1	**3**
Quintuple-notch downgrade after negative review	0	1	0	**1**
Double-notch upgrade	1	0	0	**1**
Total	**10**	**12**	**9**	**31**

Figure 8: Breakdown of multi-notch rating changes

More often than not, double-notch and triple-notch downgrades are preceded by negative watch announcements, and there is not a single quadruple-notch or quintuple-notch downgrade that was not heralded by a negative watch announcement.

4 Methodology

This section covers the methodology applied to the data described in the previous section. It first covers the details of the event study, and subsequently describes the statistic methods released on event study results to determine whether they carry statistical significance.

Although event classes are established in Section 1, one adjustment is made in the form of grouping all positive review announcements and rating upgrades into a single class known as positive rating events. Although the sample size for this class remains the smallest of all, it does at least enable relatively reliable statistical calculations to be made.

Event class	S&P	Moody's	Fitch	Total
Negative review	21	10	7	**38**
Single-notch downgrade	10	11	7	**28**
Multi-notch downgrade	13	4	5	**22**
Single-notch downgrade after negative review	3	4	4	**11**
Multi-notch downgrade after negative review	6	8	5	**19**
Positive rating events	2	0	3	**5**
Cancelled negative review	8	0	1	**9**
Total	**63**	**37**	**32**	**132**

Figure 9: Adjusted event classes

4.1 Event Study

The effect of rating announcements on CDS spreads will primarily be analysed over an event window of two days [-1,1], where rating events occur at time zero. In addition to this, the announcement day itself [-1,0] and day after the announcement day [0,1] are also separately examined, following the European Central Bank's approach.

In some similar previous studies, related to corporate as well as sovereign reference entities, and CDS spreads as well as bond yields, a much wider event window has been used. Brandstack (2010) used a 180-day event window (-90,90), and The Bank of International Settlements (2006) uses an asymmetrical 80-day event window (-60,20).

However, a crucial difference is that in these studies the number of rating events relative to the number of entities being studied, and/or the length of the time period being studied, is much lower than it is in this case. Due to such high density of rating events, using an event window wider than [-1,1] would have forced the elimination of such a portion of rating announcements that much of the study would have lost its statistical value. On top of this, both Hull et al. (2004) and the European Central Bank (2011) use a narrow two-day event window to study announcement effects. They largely come to the same conclusions as

research that uses a wider event window, confirming that the use of a narrow [-1,1] event window is appropriate. However, this window does dictate that anticipation effects are not included in the study.

As for any event study, CDS spreads have to be compared to a measure of expected spread in order to determine any abnormal movements. Simultaneously, this handles potential macroeconomic spill over effects across different reference entities, which is very likely due to the interdependence of Eurozone markets.

The Bank For International Settlements (2006) and the International Monetary Fund (2011) adopt traditional event study methodology, which uses the difference between modelled and actual CDS spreads to determine abnormal spread changes. However, such CDS spread models must be based on periods where no rating announcement takes place, of which there is a definitive lack over the period of time considered. Additionally, CDS spread movements prior to 2009 are extremely unrepresentative of movements over the timeframe of this study, and therefore models based on historic CDS spreads will not cope with the large increase in average spreads illustrated in Figure 5. Therefore, the event study is based purely on observed spreads.

Hull et al. (2004) and Galil and Soffer (2008) create equally weighted CDS spread benchmark indices for each reference entity based on their credit ratings, as studies like Callen et al (2007) determine a relationship between an entity's credit rating and its CDS spread. However, with only sixteen countries in the sample, all with increasingly different credit ratings as the Eurozone debt crisis unfolds, this method is not feasible. Nevertheless, instead of using simple equally weighted indices of all country CDS spreads as Afonso (2007) and Brandstack (2010) do, this study uses separate indices for each country based on the respective other fifteen countries in the study. This most accurately reflects the average Eurozone CDS spread, while avoiding an underestimation of the rating announcement effect that would occur if countries' own CDS spreads are included in the indices against which they are benchmarked. By using CDS spread indices, it is assumed that all countries' CDS spreads are equally sensitive to their respective indices.

4.1.1 Adjusted Spreads

For all spread observations that fall within a rating event window, Adjusted Spread Observations (ASO) are calculated as the difference between the reference entity's CDS spread on any particular day (x), and the average Eurozone CDS spread index (I) on that same day calculated excluding the reference entity's own spread.

$$ASO(x) = CDS(x) - I(x) \qquad \textit{Equation 5.1}$$

Subsequently, Adjusted Spread Changes (ASC) for all rating events over the different event windows is calculated as the difference between the ASO on day y and the ASO on day x.

$$ASC(x,y) = ASC(y) - ASC(x) \qquad \textit{Equation 5.2}$$

With distinction made between announcements by different rating agencies, Average Adjusted Spread Changes (AASC) are then calculated for all different event classes and provide the first set of results for Section 5.

4.2 Hypothesis Testing

4.2.1 Hypothesis Setting

The null hypothesis of statistical tests is based on the assumption that if rating events have no impact on the market, AASCs should not deviate from zero with statistical significance.[10] The null hypothesis is therefore formulated as follows:

$$H_0: \mu_{ASC} = 0 \qquad \textit{Null hypothesis}$$

Conversely, if rating events do have an impact on the market, AASCs should be significantly different from zero. Based on the direction in which CDS spreads are expected to react following rating events, it is known whether AASCs should be significantly greater than or smaller than zero. Negative rating events are expected to increase spreads, meaning the alternative hypothesis (A) is formulated as:

$$H_1: \mu_{ASC} > 0 \qquad \textit{Alternative Hypothesis A}$$

In contrast, positive rating events and no action after negative review announcements are expected to decrease spreads, meaning the alternative hypothesis (B) is formulated as:

$$H_1: \mu_{ASC} < 0 \qquad \textit{Alternative Hypothesis B}$$

[10] This assumption is based on evidence from Section 4.2.3

4.2.2 Student's t-Test

To test whether the null hypothesis of event study results can be rejected in favour of any one of the alternative hypotheses, the Student's t-test is used. The t-test relies on the t-distribution, which is used in the hypothesis testing of small sample data sets, and is the same method used by the European Central Bank (2011) and Brandstack (2010). As not only the significance but also the direction of rating announcement effects are hypothesized, the one-tailed t-test is chosen. This concerns the upper tail of the t-distribution for alternative hypothesis A, and the lower tail for alternative hypothesis B.

The t-test determines whether the mean of a particular set of ASC results ($\bar{x}$) is significantly different from the null hypothesis mean (μ_0), which in this case is zero. The standard deviation of the set of ASC observations (σ) is adjusted for the number of observations over which it was calculated by dividing it by the square root of the sample size (n). Subsequently, the t-statistic for a t-distribution with $(n-1)$ degrees of freedom is calculated as in Equation 5.3 below.

$$t(n-1) = \frac{\bar{x} - \mu_0}{\sigma \,/\, \sqrt{n}} \qquad \textit{Equation 5.3}$$

AASC t-statistics are evaluated at the 10%, 5%, and 1% confidence intervals. A key feature of the t-test is that it assumes data is normally distributed, which will be more closely examined in the next subsection.

The use of hypothesis testing naturally results in the possibility of Type I and Type II errors. A Type I error exists when the null hypothesis is rejected in favour of the alternative hypothesis, when in fact the null hypothesis is true. Conversely, a Type II error is made when the null hypothesis is accepted, when in fact the alternative hypothesis is true. These constitutions are summarized in Figure 10.

		True Situation	
		***H_0* True**	***H_0* False**
Decision	**Accept *H_0***	Correct Decision	Type II Error
	Reject *H_0*	Type I Error	Correct Decision

Figure 10: Possible outcomes of hypothesis testing

4.2.3 Normality Check

The null and alternative hypotheses, as well as the t-test, assume that AASC observations are normally distributed. As sample sizes are too small for the Central Limit Theorem to apply, the validity of this assumption is of crucial influence on the validity of statistical tests, and is therefore examined more closely using all ASC values for the main [-1,1] event window.

In a normal distribution, 68.2% of data lies within one standard deviation of the mean. ASC [-1,1] values are notably more centred on the mean, as 95.9% of values lie within this range. This is largely the result of outliers in both tails of the distribution (as shown in Figure 12). However, in terms of (the lack of) skew and kurtosis the entire ASC dataset closely resembles a normal distribution, as is illustrated by the bell-shaped histogram in Figure 11.[11] The mean of all ASC observations is zero basis points.

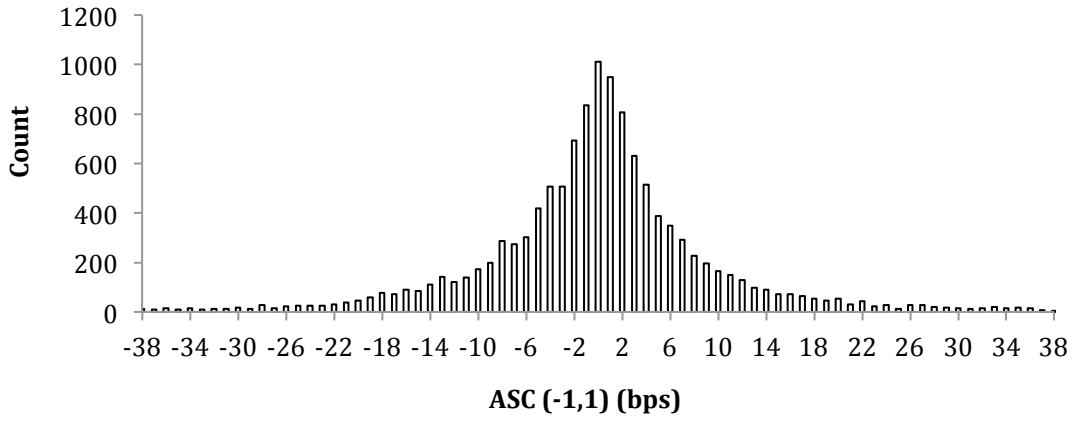

Figure 11: Distribution of ASC [-1,1] observations

Complementary to the distribution plot in Figure 11, Figure 12 shows a normal probability plot of ASC [-1,1] values. If observed ASC values were perfectly normally distributed, they would lie on the theoretical line, which shows the expected normal scores based on the mean and standard deviation of the ASC results. The normal probability plot is therefore an informal, yet more accurate way of testing whether results are approximately normally distributed than a simple histogram.

Beyond three standard deviations from the mean, the tails of the distribution show some extreme values and are distinctly heavier than those of a perfect normal distribution, especially including outliers. Nevertheless, the normal probability plot confirms that ASC observations closely follow a normal distribution up to the three standard deviation boundary on either side of the mean.

[11] For visual clarity, only ASC [-1,1] values up to one standard deviation from the mean are shown

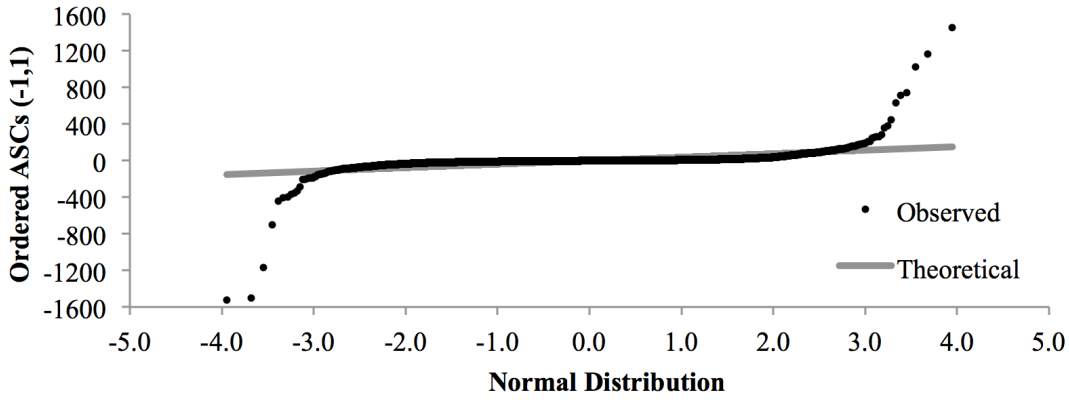

Figure 12: Normal probability plot of ASC [-1,1] observations

Normal probability theory states that the distribution of a sample ($\bar{x}$) drawn from a normally distributed population with mean μ and standard deviation σ will also be normally distributed with mean μ and standard deviation $\sigma/\sqrt{n}$, which powerfully justifies the use of the t-test to analyse the statistical significance of AASC observations. As the mean of all ASC observations is zero basis points, the null hypothesis is therefore also immediately justified.

5 Empirical Results

The section below covers the empirical results obtained through from the data and methodology in the previous sections. The following subsections display and analyse the results for all event classes, distinguishing between announcements by the different rating agencies. Additionally, results for the impact of negative rating announcements within investment grade credit ratings, and to and within speculative grade credit ratings are analysed. In all cases, AASC results are shown for the full event window, the announcement day, and the day following the announcement. Additionally, corresponding t-statistics can also be found in the tables, tested for significance at the 10%, 5%, and 1% confidence intervals (CI).

5.1 Negative Review Announcements

Over the main event window, negative review announcements by Moody's are the only ones that result an average increase in adjusted spreads, most of which occurs on the day after the announcement. The full event window spread change is statistically significant at the 10% confidence interval, and the reaction on the day following the announcement is significant at the 5% level. Surprisingly, S&P and Fitch show a decrease in spread over the event window and also fail to show any statistical significance on the day following the announcement and the announcement day itself. A relatively small sample size for announcements by Fitch may appear to have led to a Type II error, but a comparable result for S&P based on a more reliable sample size indicates another factor may have influenced the outcome.

Negative Reviews				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	21	-5.75 (-1.78)	-0.31 (-0.09)	-5.44 (-1.64)
Moody's	10	13.73 (1.69)*	5.73 (1.24)	8.00 (2.00)**
Fitch	7	-2.75 (-0.52)	-2.64 (-0.76)	-0.11 (-0.04)
Combined	**38**	**-0.07** **(-0.02)**	**0.85** **(0.36)**	**-0.92** **(-0.40)**

Figure 13: AASCs (t-statistics) for negative reviews
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI

Despite significant results for Moody's, overall results fail to prove that negative review announcements cause adjusted spread changes to deviate from zero with any statistical significance. Calculated using the largest event class sample size in this study, this outcome is presumed to very reliable. Nevertheless, it is very different from the findings in previous

studies, most of which do find evidence of significant spread changes as a result of negative review announcements. However, many of these studies also find that a large portion of the significant adjustment occurs during the month prior to the announcement, which is not covered by the event window of this study. It could be suggested that CDS markets anticipate negative reviews, possibly explaining why statistical significance is so limited. However, it is more likely that markets react to the same information that induces rating agencies to place a country under review, meaning negative reviews do not present new information. An alternative explanation is offered by the possibility that markets have been alerted for negative reviews by preceding changes in rating outlook, which are not included in this study.

5.2 Single-Notch Downgrades

Single-notch downgrades by S&P and Moody's both cause country CDS spreads to increase on average, with most of the spread change occurring on the announcement day for both agencies. Although the average impact of Moody's announcements is greater in absolute terms, only the announcement day effect and event window effect of announcements by S&P are significant at the 10% confidence interval. The unexpected negative average spread changes for single-notch downgrades by Fitch may be due to sampling error, but the fact that the null hypothesis is accepted for announcements by both Moody's and Fitch may signal the presence of a Type II error.

Single-Notch Downgrades				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	10	9.68 (1.55)*	7.09 (1.8)*	2.59 (0.81)
Moody's	11	18.11 (1.26)	11.32 (1.04)	6.79 (0.93)
Fitch	7	-10.23 (-0.96)	-1.52 (-0.42)	-8.71 (-1.04)
Combined	**28**	**8.02** **(1.19)**	**6.6** **(1.44)***	**1.42** **(0.38)**

Figure 14: AASCs (t-statistics) for single-notch downgrades
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI

The average effect of all single-notch downgrades combined is positive over the full event window, and significant on the day of the announcement at the 10% level meaning that overall, single-notch downgrades do appear to have some impact on the market, but at a lower statistical significance level than observed in previous studies. The fact that some significant information appears to be presented agrees with the logic that direct single-notch downgrades should be induced by sudden and important economic developments. The impact is also

immediate, suggesting CDS markets efficiently price in the new information presented by the downgrade. Nevertheless, the fact that the null hypothesis is accepted for all single-notch downgrades over the main event window again signals the possible existence of a Type II error.

A possible reason for the likely Type II errors in this event class may be Eurozone debt crisis itself. Rating agencies follow their own credit review processes, meaning that when new information becomes available there will be a time lag before an actual downgrade is announced. In prosperous or more 'normal' economic circumstances small changes in a country's creditworthiness may seem relatively irrelevant, or even go unnoticed until a rating agency imposes a downgrade, whereas Eurozone sovereigns have been under much scrutiny over the timeframe of this study. Some spread change may therefore have occurred prior to the event window, reducing the statistical significance of results.

5.3 Single-Notch Downgrades after Negative Reviews

Logically, single-notch downgrades following negative review announcements should have less impact on CDS spreads than straight single-notch downgrades, as they could have more easily been foreseen. It is indeed found that the mean effects of such announcements by S&P, Fitch, and all agencies combined are closer to the null hypothesis mean of zero than they were for straight single-notch downgrades, and that the null hypothesis cannot be rejected even at the least certain confidence interval of 10%. Despite seemingly not having affected results, it should be noted that the sample size for Fitch is relatively small and therefore statistical inferences may not be as reliable, regardless of the fact that the suitability of the t-test has been strongly supported even for small sample sizes.

The exception to the rule in this case is Moody's, whose single-notch downgrades following negative reviews result in increases in CDS spread significant at the 5% confidence interval over the event window and on the announcement day. This is especially surprising as an inspection of rating announcements in Section 3 pointed out that all negative review announcements by Moody's over the timeframe of the study resulted in a downgrade, and markets could therefore easily have spotted impending downgrades. Also judging by the small absolute change in spread, the most likely explanation is that a Type I error is made due to a small sample size.

Single-Notch Downgrades after Negative Reviews				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	13	-0.01 (0.00)	-0.88 (-0.32)	0.87 (0.28)
Moody's	4	4.1 (3.82)**	3.28 (2.74)**	0.83 (1.25)
Fitch	5	-7.67 (-0.55)	-6 (-0.62)	-1.67 (-0.36)
Combined	**22**	**-1** **(-0.26)**	**-1.29** **(-0.49)**	**0.29** **(0.14)**

Figure 15: AASCs (t-statistics) for single-notch downgrades after negative reviews
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI

Despite inconsistent findings for announcements in this event class by Moody's, the null hypothesis overall results show that single-notch downgrades provide no significant new information and have no significant impact on CDS spreads when they occur after a negative review announcement. This result is logical, in accordance with results from previous studies, and is based on a sufficiently large sample size to be considered accurate.

5.4 Multi-Notch Downgrades

Previously discussed straight single-notch downgrades were expected to significantly impact CDS spreads and present new information to the market, and to a certain extent these outcomes were confirmed. It is therefore logically expectable that straight multi-notch rating changes based on more critical information will have a greater and more significant impact.

Combined rating announcements strongly confirm this expectation, showing a substantial average increase in CDS spread over the event window that is significant at the 5% confidence interval. On top of this, spread changes on both days within the event window are significant at same 5% level, adding further statistical resilience to the results. Although not in accordance with results by Brandstack (2010), the findings do agree with those of Afonso et al. (2011).

Multi-Notch Downgrades				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	3	14.52 (0.79)	14.61 (1.01)	-0.09 (-0.02)
Moody's	4	52.93 (1.61)	8.9 (1.29)	44.03 (1.68)*
Fitch	4	26.18 (1.41)	8.63 (2.22)*	17.54 (1.18)
Combined	**11**	**32.73** **(2.32)****	**10.36** **(2.37)****	**22.37** **(1.95)****

Figure 16: AASCs (t-statistics) for multi-notch downgrades
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI

Unfortunately, the same level of significance is not observed for multi-notch downgrades separated by the originating rating agencies. The only individual result that significantly deviates from zero is the average spread change on the day after announcements by Moody's. However, the strong statistical results for combined multi-notch downgrades indicate that the decisions of insignificance of individual results are most likely Type II errors due to sampling error.

Another noteworthy observation is that the greatest absolute change in spread occurs on the day following the announcement. For straight single-notch downgrades the greatest change occurred on the day of the announcement, possibly indicating a slower reaction to straight multi-notch rating changes.

5.5 Multi-Notch Downgrades after Negative Reviews

As for single-notch rating downgrades, it is reasonably expected that multi-notch downgrades preceded by negative review announcements will have a less significant impact on CDS spreads than straight multi-notch downgrades. However, the opposite appears to be true, both for announcements by individual rating agencies as well as combined announcements.

The event window impacts of multi-notch downgrades by S&P and Moody's, heralded by negative reviews, are both large and significant at the 5% confidence interval. Most of the change transpires on the announcement day itself, which sees significance at the 10% level for S&P, and at the 5% level for Moody's. Sample sizes are not unreliably small, and similar results for both agencies seem to confirm that the findings are legitimate.

Multi-Notch Downgrades after Negative Reviews				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	6	34.69 (2.03)**	26.19 (1.92)*	8.5 (0.38)
Moody's	8	12.82 (2.09)**	12.44 (1.98)**	0.38 (0.28)
Fitch	5	6.56 (0.94)	-4.99 (-0.78)	11.55 (1.68)*
Combined	**19**	**18.08** **(2.79)***	**12.19** **(2.13)****	**5.89** **(0.86)**

Figure 17: AASCs (t-statistics) for multi-notch downgrades after negative reviews
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI

The fact that the spread impact of announcements by S&P is greatest does link to the descriptive statistics in Section 3. Out of the three agencies, S&P makes the most negative review announcements that result in no action being taken. When it does impose a downgrade after a negative review, this is most often a single-notch one. Therefore, given that a negative review announcement has been made, a multi-notch downgrade is the least likely to occur.

On top of significant CDS spread impacts for S&P and Moody's, combined results achieve significance at the 95% confidence interval on day zero, and at the 99% confidence interval over the entire event window. The latter is the most significant result thus far and indicates that multi-notch downgrades, even when they follow a negative review, present important new information to the market. An interesting observation is that multi-notch downgrades following negative reviews do seem to react faster than straight multi-notch downgrades, as more significant results occur on day zero, and fewer on day one.

Once more, however, announcements by Fitch yield distinctly different findings. The impact of multi-notch downgrades after negative reviews is significant at the 10% confidence interval on the day following the announcement, but negative on the day of the announcement. In light of the observations for S&P and Moody's, the most reasonable explanation of this is possibly that a Type I error has occurred because of the limited sample size. If this is not the case, the implications are that announcements of this class by Fitch present less significant information, and the impact on CDS spreads is lagged by one day.

5.6 Positive Rating Announcements

Because of the limited number of positive rating events, the findings presented here are far less reliable than those that have been presented so far. Although results are calculated for positive announcements by S&P and Fitch, the respective samples are unreliable and do not show any statistical significance for this reason.

Positive Rating Announcements				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	2	-6.92 (-0.80)	3.66 (1.12)	-10.58 (-1.97)
Moody's	0		N/A	
Fitch	3	-17.07 (-1.22)	-2.7 (-1.16)	-14.37 (-1.21)
Combined	**5**	**-13.01** **(-1.53)**	**-0.16** **(-0.07)**	**-12.86** **(-1.89)***

Figure 18: AASCs (t-statistics) for positive rating announcements
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI
N/A = Not applicable due to sample size of 1 or less

Brandstack (2010) does not find that positive rating announcements cause a significant spread change to occur, and this is harmony with other previous studies. In this case, combined positive announcements do have an impact that is significant at the 10% level on day one, but it should be noted that all positive announcements in this study are related to Estonia, and therefore may display a biased result. On top of this the sample size is small, pointing to the possibility of a Type I error.

5.7 Cancelled Negative Review Announcements

Only S&P cancels negative review announcements enough times for an average spread impact to be observed, but does provide some highly significant results. Over the event window and also on day one, the decrease in average spread is significant at the 1% confidence level. When the one cancelled negative review announcement by Moody's is simultaneously considered, the spread change is also significant at the 10% level on day zero.

Cancelled Negative Review Announcements				
Rating Agency	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
S&P	8	-7.24 (-4.62)***	-2.10 (-1.14)	-5.14 (-4.37)***
Moody's	0		N/A	
Fitch	1		N/A	
Combined	**9**	**-8.62** **(-4.41)***	**-3.15** **(-1.63)***	**-5.47** **(-5.03)***

Figure 19: AASCs (t-statistics) for cancelled negative review announcements
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI
N/A = Not applicable due to sample size of 1 or less

Albeit at a lower level of significance, similar results are obtained by Brandstack (2010). Moreover, the fact that the spread impact on the day following the announcement is strongly significant matches with the results of Ramakrishnan (2008) who found that CDS markets experience a lagged response to positive announcements.

If the cancellation occurs due to newly uncovered positive material, then the cancellation announcements can most surely be said to present significant information. However, it is also possible that a cancellation occurs purely due to a lack of information to base a downgrade on. Although results would still be valid, in this case it would be misleading to conclude that cancelled negative review announcements present new significant information as the significant finding may just be the result of market surprise.

5.8 Negative Announcements: Investment v Speculative Grade

Figure 20 shows an additional breakdown by rating grade. All countries included in the study had an initial investment grade credit rating, and therefore the investment grade category shows the results for all rating events within investment grade ratings. The speculative grade category shows all rating events to and within speculative grade ratings.

Negative Announcements: Investment Grade v Speculative Grade				
Grade	**Sample Size**	**[-1,1]**	**[-1,0]**	**[0,1]**
Investment Grade	110	2.23 (1.07)	2.46 (1.61)*	-0.23 (-0.20)
Speculative Grade	17	34.14 (2.80)***	13.89 (1.94)**	20.25 (1.79)**

Figure 20: AASCs (t-statistics) for negative announcements
* = Significant at 10% CI, ** = Significant at 5% CI, *** = Significant at 1% CI

Rating events within the investment grade boundaries only show a spread impact on the announcement day that is significant at the 10% confidence interval, and in addition the absolute spread change is limited. On the other hand, ratings to and within the speculative grade category show significance at the 5% confidence level on each separate day, and at the 1% confidence level overall. On top of this, the true change in spread is much larger than for investment grade rating changes.

The fact that speculative grade rating changes have a much more significant effect than investment grade rating changes compares well to previous studies such as Micu et al. (2006) who observed the same difference in significance. Although rating events may well hold some informational value, this difference most likely originates from the regulatory restrictions imposed on speculative grade investments. For example, a downgrade from an investment grade rating to a speculative grade rating would force many institutional investors to insure their investments using CDS contracts, causing a significant average spread increase.

6 Conclusion

There is no definitive pattern as to when announcements by the different rating agencies match with overall results, which is most likely due to the smaller agency-specific sample sizes for event classes other than negative reviews and straight single-notch downgrades. It appears that the price impact of announcements by S&P and Moody's are somewhat more parallel to overall results than announcements by Fitch, which would be credible based on rating agency market shares, but this is an extremely subjective observation.

Cancelled negative reviews and positive rating events, event classes for which a decrease in spread was anticipated, both show more significant spread changes on day one than on day zero, indicating that results are in line with Galil and Soffer (2008) who found that CDS markets react slower to positive ratings events.

Straight single-notch downgrades do show a lightly significant impact on CDS spreads on day zero, but overall they fail to dispense new information. The same is true for single-notch downgrades following negative reviews, and for negative reviews themselves. Positive rating events have been found to show no statistical significance in most previous studies, but appear to deliver new information on the day after the announcement at the least certain confidence interval. However, a possibly biased and small sample does not warrant the recognition of positive rating events as being informatively significant.

However, there is substantial evidence that more ample rating announcements have a significant impact on sovereign CDS spreads. The most convincing significant results are observed for cancelled negative review announcements, demonstrating that they have a very certain effect on sovereign CDS spreads. Both straight multi-notch downgrades and those preceded by negative reviews also show reliably significant results over the event window and at least one individual day. For these announcements, it can also most certainly be concluded that new and substantial information is delivered to the market.

Additionally, there is strong evidence that rating events to and within speculative grade ratings have a much more significant effect on sovereign CDS spreads than rating events within the boundaries of investment grade rankings. From this it can be inferred that financial regulation that uses the boundary between investment and speculative grade ratings leads to a significant discrepancy in the way CDS markets react to credit rating announcements.

6.1 Limitations and Improvements

The most obvious point of evaluation, as has been mentioned in several cases, is that small sample sizes and outliers in the ASC observations may be responsible for some Type I and II errors throughout the study. However, without changing the dataset, and therefore the entire study, it is not difficult to improve on this issue.

Another point to make about the findings of this report is that distinction is made between announcement effects on the day of the announcement and the day after. A crucial point is that over a narrow event window like the one adopted here, the time at which the announcement is made on the announcement day can make a substantial difference. For example, it is reasonable to expect that more of the total spread change would occur on day one, the closer the announcement is made to market closing time. As the time of day at which rating announcements is not included in this study, it is unknown if and how announcement timing influences the results. Although rating announcement timings could be obtained, intra-day CDS spreads will be extremely difficult, if not impossible to obtain as the CDS market is an OTC market.

Furthermore, a key feature of this paper is that if a significant change in average CDS spread is observed, it is assumed that this significance is due to the rating announcement. However, Jacobs et al. (2010) uncover that, at least for corporate bond spreads, there are several other macroeconomic variables that influence CDS spreads. It is only reasonable to assume that although the specific variables may be different for Eurozone sovereign nations, the same concept applies. If all countries in this study have equal sensitivity to the same factors, then the average CDS spread indices will have coped with much of this problem. However, this is unlikely, and improvements could be made my incorporating these factors into the study. Arezki et al. (2011) expand on this topic, as they also find significant spill over effects between Eurozone nations as a result of rating announcements.

A final point that must be made is with regards to contamination effects between different rating announcements for the same country. Although rating announcements with overlapping event windows were eliminated to reduce contamination, it is of course possible that contamination occurred beyond the boundaries of the [-1,1] event window. Although Galil and Soffer (2008) find that earlier announcements by different rating agencies do not affect the significance of results, Afonso et al. (2011) do find persistence effects for recently downgraded European sovereign entities.

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8 Appendices

A Rating Announcements Included in Study (by country, by date)

Country	Date	Agency	Rating*	Announcement class
Austria	12/05/2011	S&P	AAA	Negative watch
Austria	13/01/2012	S&P	AA+	Single-notch downgrade after negative watch
Belgium	07/10/2011	Moody's	Aa1	Negative watch
Belgium	25/11/2011	S&P	AA	Single-notch downgrade
Belgium	05/12/2011	S&P	AA	Negative watch
Belgium	13/01/2012	S&P	AA	No action after negative watch
Belgium	27/01/2012	Fitch	AA	Single-notch downgrade after negative watch
Cyprus	21/07/2010	S&P	A+	Negative watch
Cyprus	16/11/2010	S&P	A	Single-notch downgrade after negative watch
Cyprus	27/01/2011	Fitch	BBB-	Single-notch downgrade after negative watch
Cyprus	24/02/2011	Moody's	A2	Multi-notch downgrade after negative watch
Cyprus	30/03/2011	S&P	A-	Single-notch downgrade
Cyprus	16/05/2011	Moody's	A2	Negative watch
Cyprus	31/05/2011	Fitch	A-	Multi-notch downgrade after negative watch
Cyprus	27/10/2011	S&P	BBB	Single-notch downgrade after negative watch
Cyprus	04/11/2011	Moody's	Baa3	Multi-notch downgrade
Cyprus	16/12/2011	Fitch	BBB	Negative watch
Cyprus	13/01/2012	S&P	BB+	Multi-notch downgrade
Estonia	24/02/2009	S&P	A	Negative watch
Estonia	08/04/2009	Fitch	A-	Single-notch downgrade
Estonia	21/04/2009	S&P	A	No action after negative watch
Estonia	10/08/2009	S&P	A-	Single-notch downgrade
Estonia	30/03/2010	Fitch	A-	Positive watch
Estonia	10/06/2010	S&P	A	Single-notch upgrade
Estonia	19/07/2010	Fitch	A	Single-notch upgrade after positive watch
Estonia	05/07/2011	Fitch	A+	Single-notch upgrade
Estonia	09/08/2011	S&P	AA-	Multi-notch upgrade
Estonia	05/12/2011	S&P	AA-	Negative watch
Estonia	13/01/2012	S&P	AA-	No action after negative watch
Finland	05/12/2011	S&P	AAA	Negative watch
Finland	13/01/2012	S&P	AAA	No action after negative watch
France	05/12/2011	S&P	AAA	Negative watch
France	13/01/2012	S&P	AA+	Single-notch downgrade after negative watch
Germany	05/12/2011	S&P	AAA	Negative watch
Germany	13/01/2012	S&P	AAA	No action after negative watch
Greece	09/01/2009	S&P	A	Negative watch
Greece	14/01/2009	S&P	A-	Single-notch downgrade after negative watch
Greece	22/10/2009	Fitch	A-	Single-notch downgrade
Greece	29/10/2009	Moody's	A1	Negative watch
Greece	16/12/2009	S&P	BBB+	Single-notch downgrade after negative watch
Greece	22/12/2009	Moody's	A2	Single-notch downgrade after negative watch
Greece	16/03/2010	S&P	BBB+	No action after negative watch
Greece	09/04/2010	Fitch	BBB-	Single-notch downgrade

Greece	22/04/2010	Moody's	A3	Single-notch downgrade
Greece	27/04/2010	S&P	BB+	Multi-notch downgrade after negative watch
Greece	14/06/2010	Moody's	Ba1	Multi-notch downgrade
Greece	02/12/2010	S&P	BB+	Negative watch
Greece	16/12/2010	Moody's	Ba1	Negative watch
Greece	21/12/2010	Fitch	BBB-	Negative watch
Greece	14/01/2011	Fitch	BB+	Single-notch downgrade after negative watch
Greece	07/03/2011	Moody's	B1	Multi-notch downgrade after negative watch
Greece	29/03/2011	S&P	BB-	Multi-notch downgrade after negative watch
Greece	20/05/2011	Fitch	B+	Multi-notch downgrade
Greece	01/06/2011	Moody's	Caa1	Multi-notch downgrade after negative watch
Greece	13/06/2011	S&P	CCC	Multi-notch downgrade after negative watch
Greece	13/07/2011	Fitch	CCC	Multi-notch downgrade after negative watch
Ireland	06/03/2009	Fitch	AAA	Negative watch
Ireland	30/03/2009	S&P	AA+	Single-notch downgrade
Ireland	08/04/2009	Fitch	AA+	Single-notch downgrade after negative watch
Ireland	17/04/2009	Moody's	Aaa	Negative watch
Ireland	08/06/2009	S&P	AA	Single-notch downgrade
Ireland	02/07/2009	Moody's	Aa1	Single-notch downgrade after negative watch
Ireland	04/11/2009	Fitch	AA-	Multi-notch downgrade
Ireland	19/07/2010	Moody's	Aa2	Single-notch downgrade
Ireland	24/08/2010	S&P	AA-	Single-notch downgrade
Ireland	23/11/2010	S&P	A	Multi-notch downgrade
Ireland	09/12/2010	Fitch	BBB+	Multi-notch downgrade
Ireland	17/12/2010	Moody's	Baa1	Multi-notch downgrade after negative watch
Ireland	02/02/2011	S&P	A-	Single-notch downgrade after negative watch
Ireland	12/07/2011	Moody's	Ba1	Single-notch downgrade
Ireland	05/12/2011	S&P	BBB+	Negative watch
Ireland	16/12/2011	Fitch	BBB+	Negative watch
Ireland	13/01/2012	S&P	BBB+	No action after negative watch
Ireland	27/01/2012	Fitch	BBB+	No action after negative watch
Italy	17/06/2011	Moody's	Aa2	Negative watch
Italy	19/09/2011	S&P	A	Single-notch downgrade
Italy	04/10/2011	Moody's	A2	Multi-notch downgrade after negative watch
Italy	07/10/2011	Fitch	A+	Single-notch downgrade
Italy	05/12/2011	S&P	A	Negative watch
Italy	16/12/2011	Fitch	A+	Negative watch
Italy	13/01/2012	S&P	BBB+	Multi-notch downgrade after negative watch
Italy	27/01/2012	Fitch	A-	Multi-notch downgrade after negative watch
Italy	13/02/2012	Moody's	A3	Single-notch downgrade
Malta	06/09/2011	Moody's	A2	Single-notch downgrade
Malta	05/12/2011	S&P	A	Negative watch
Malta	13/01/2012	S&P	A-	Single-notch downgrade after negative watch
Malta	13/02/2012	Moody's	A3	Single-notch downgrade
Netherlands	05/12/2011	S&P	AAA	Negative watch
Netherlands	13/01/2012	S&P	AAA	No action after negative watch
Portugal	13/01/2009	S&P	AA-	Negative watch
Portugal	21/01/2009	S&P	A+	Single-notch downgrade after negative watch

Portugal	24/03/2010	Fitch	AA-	Single-notch downgrade
Portugal	27/04/2010	S&P	A-	Multi-notch downgrade
Portugal	05/05/2010	Moody's	Aa2	Negative watch
Portugal	13/07/2010	Moody's	A1	Multi-notch downgrade after negative watch
Portugal	30/11/2010	S&P	A-	Negative watch
Portugal	15/03/2011	Moody's	A3	Multi-notch downgrade after negative watch
Portugal	29/03/2011	S&P	BBB-	Single-notch downgrade after negative watch
Portugal	05/07/2011	Moody's	Ba2	Multi-notch downgrade
Portugal	24/11/2011	Fitch	BB+	Single-notch downgrade after negative watch
Portugal	05/12/2011	S&P	BBB-	Negative watch
Portugal	13/01/2012	S&P	BB	Multi-notch downgrade after negative watch
Portugal	13/02/2012	Moody's	Ba3	Single-notch downgrade
Slovakia	05/12/2011	S&P	A+	Negative watch
Slovakia	13/01/2012	S&P	A	Single-notch downgrade after negative watch
Slovakia	13/02/2012	Moody's	A2	Single-notch downgrade
Slovenia	23/09/2011	Moody's	Aa3	Single-notch downgrade
Slovenia	28/09/2011	Fitch	AA-	Single-notch downgrade
Slovenia	19/10/2011	S&P	AA-	Single-notch downgrade
Slovenia	06/12/2011	S&P	AA-	Negative watch
Slovenia	16/12/2011	Fitch	AA-	Negative watch
Slovenia	22/12/2011	Moody's	A1	Single-notch downgrade
Slovenia	13/01/2012	S&P	A+	Single-notch downgrade after negative watch
Slovenia	27/01/2012	Fitch	A	Multi-notch downgrade after negative watch
Slovenia	13/02/2012	Moody's	A2	Single-notch downgrade
Spain	12/01/2009	S&P	AAA	Negative watch
Spain	19/01/2009	S&P	AA+	Single-notch downgrade after negative watch
Spain	28/04/2010	S&P	AA	Single-notch downgrade
Spain	28/05/2010	Fitch	AA+	Single-notch downgrade
Spain	30/06/2010	Moody's	Aaa	Negative watch
Spain	30/09/2010	Moody's	Aa1	Single-notch downgrade after negative watch
Spain	15/12/2010	Moody's	Aa1	Negative watch
Spain	10/03/2011	Moody's	Aa2	Single-notch downgrade after negative watch
Spain	29/07/2011	Moody's	Aa2	Negative watch
Spain	07/10/2011	Fitch	AA-	Multi-notch downgrade
Spain	13/10/2011	S&P	AA-	Single-notch downgrade
Spain	18/10/2011	Moody's	A1	Multi-notch downgrade after negative watch
Spain	05/12/2011	S&P	AA-	Negative watch
Spain	16/12/2011	Fitch	AA-	Negative watch
Spain	13/01/2012	S&P	A	Multi-notch downgrade after negative watch
Spain	27/01/2012	Fitch	A	Multi-notch downgrade after negative watch
Spain	13/02/2012	Moody's	A3	Multi-notch downgrade

* Resulting rating after rating change, where applicable

B Rating Announcements Excluded from Study (by country, by date)

Country	Date	Agency	Rating*	Announcement class
Belgium	16/12/2011	Moody's	Aa3	Multi-notch downgrade after negative watch
Belgium	16/12/2011	Fitch	AA+	Negative watch
Cyprus	13/01/2011	Moody's	Aa3	Negative watch
Cyprus	17/01/2011	Fitch	AA-	Negative watch
Cyprus	27/07/2011	Moody's	Baa1	Multi-notch downgrade after negative watch
Cyprus	29/07/2011	S&P	BBB+	Single-notch downgrade
Cyprus	10/08/2011	Fitch	BBB	Multi-notch downgrade
Cyprus	12/08/2011	S&P	BBB+	Negative watch
Greece	07/12/2009	S&P	A-	Negative watch
Greece	08/12/2009	Fitch	BBB+	Single-notch downgrade
Greece	09/05/2011	Moody's	B1	Negative watch
Greece	09/05/2011	S&P	B	Multi-notch downgrade after negative watch
Greece	25/07/2011	Moody's	Ca	Multi-notch downgrade
Greece	27/07/2011	S&P	CC	Multi-notch downgrade
Ireland	05/10/2010	Moody's	Aa2	Negative watch
Ireland	06/10/2010	Fitch	A+	Single-notch downgrade
Ireland	01/04/2011	S&P	BBB+	Single-notch downgrade
Ireland	01/04/2011	Fitch	BBB+	Negative watch
Ireland	14/04/2011	Fitch	BBB+	No action after negative watch
Ireland	15/04/2011	Moody's	Baa3	Multi-notch downgrade
Portugal	21/12/2010	Moody's	A1	Negative watch
Portugal	23/12/2010	Fitch	A+	Single-notch downgrade
Portugal	24/03/2011	S&P	BBB	Multi-notch downgrade after negative watch
Portugal	24/03/2011	Fitch	A-	Multi-notch downgrade
Portugal	01/04/2011	Fitch	BBB-	Multi-notch downgrade after negative watch
Portugal	05/04/2011	Moody's	Baa1	Single-notch downgrade

* Resulting rating after rating change, where applicable

C Bloomberg Generic Prices

"The Bloomberg Generic Price (BGN) prices are calculated by using prices contributed to Bloomberg and any other information that we consider relevant. Bloomberg does not make a market in any of the securities that we price. The actual methodology we use is proprietary and depends on the type of pricing and the markets involved. The goal of the methodology is to produce "consensus" pricing. To the extent that we are not comfortable that a bond can be assigned a consensus price at any time, we will mark it "not priced". We constantly and vigorously review the performance of the system and alter it as we determine necessary to achieve our goal."