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The Effect of Credit Rating Actions on European Government Bonds

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ABSTRACT

This thesis examines the effect of credit rating announcements released by the three major rating agencies (Fitch, Moody's, and Standard & Poor's) on European government bonds from 17/01/1991 until 05/04/2013, by looking at one key area, and three interrelated topics. Firstly, I evaluate the impact of credit rating announcements on European government bond returns. Secondly, I appraise their effect on the slope of the sovereign yield curve. Thirdly, I assess the implications of the European sovereign debt crisis on the credit rating announcement effect. Fourthly, I analyse how rating changes influence government bond abnormal returns, depending on the country's membership of the Eurozone or not, and whether the country is in the "Peripheral area" or not.

My empirical analysis shows the following results: (i) I provide strong evidence supporting the fact that both upgrades and downgrades are anticipated by the financial market; (ii) I confirm that the reaction to rating announcements is asymmetric; however, this occurs only around the event window, i.e. downgrades present significant abnormal returns while upgrades do not; (iii) I find no existence of any significant abnormal returns on the post-announcement window; (iv) regarding the slope, there seems to be some evidence of significant abnormal returns on the post-announcement window, thus paving the way for an investment opportunity, i.e. a Flattener 10s30s, (v) it seems that the European sovereign debt crisis did not play any significant role on the announcement effect. Nevertheless, the volatility of abnormal returns increased sharply after the crisis; (vi) while on the one hand, the presence of a country in the Eurozone does not seem to be a penalizing factor; on the other hand, Peripheral countries experience statistically significant negative abnormal returns after and on the event date, but not prior to it.

Key words**:** credit ratings; announcements; sovereign debt crisis; European government bonds; slope of the sovereign yield curve; abnormal returns.

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1 Introduction

The aim of my thesis is to answer to one main research question and to three related issues. Firstly, I attempt to investigate the impact of credit rating announcements made by the three major rating agencies (i.e. Fitch, Moody's and Standard & Poor's) on European government bond returns using a database from 17/01/1991 to 05/04/2013. Secondly, I seek to explain the effect of credit rating announcements on the European government bond slope. Thirdly, I analyse the implications of the European sovereign debt crisis on the credit rating announcement effect. In other words, I want to discover whether the European sovereign debt crisis affects the market attitude towards rating agencies. Fourthly, I analyse how rating changes influence government bond abnormal returns, depending on the country's membership of the Eurozone or not, and whether the country is in the "Peripheral area" or not. This matter can be rephrased in two questions. Firstly, do investors react differently to a rating change whether a country is within or outside the Eurozone? Secondly, is there a different investor reaction to a rating change whether a country is in the Peripheral area or not?

In order to achieve my research goals, I collected a dataset composed by the credit rating announcements by the three major rating agencies (Fitch, Moody's, and Standard & Poor's) on the main European sovereigns and the European government bond yields. My base analysis ranged from 17/01/1991 to 05/04/2013. Subsequently, I divided my sample according to two criteria: a temporal criterion and a geographical criterion. Thus, I first split my sample into two sub-samples ranging from 17/01/1991 to 09/05/2010 and from 09/05/2010 to 05/04/2013. I considered May 9 2010 as a watershed date since it is the foundation date of the European Financial Stability Facility (EFSF)[1]. Additionally, I subdivided it based upon the country's membership of the Eurozone or not, and the country presence in the "Peripheral area" or not.

My research provides five main contributions to the existing academic literature. Firstly, I collect an updated dataset, which provides with fresh evidence of the rating announcement effect covering the financial crisis and European sovereign debt crisis time frames. Secondly, I give a perspective on the European government bond market, not scrutinized by the mainstream literature that focuses on U.S. stock market returns. Thirdly, I evaluate the effect of credit rating announcements on the slope of the sovereign yield curve. Fourthly, I

[1] Assuming that capital markets are efficient, the introduction of this rescue facility would be beneficial to the financial stability of the Eurozone by lowering the borrowing costs for the countries facing financial challenges.

conduct an analysis of the rating announcement effect in light of the European sovereign debt crisis. In other words, I attempted to test whether the European sovereign debt crisis represented a further challenge to the rating agencies, by diminishing their credibility on the eyes of investors. Fifthly, I aim at testing whether the Eurozone itself and the Peripheral area represent destabilizing elements, which raise investors' concerns.

This introductory chapter is structured as follows: section 1.1 provides an overview of credit rating agencies, credit ratings, and rating announcements; section 1.2 deals with the rating agencies loss of credibility; and section 1.3 depicts the European sovereign debt crisis.

1.1 Credit Ratings and Rating Announcements

Credit rating agencies can be defined as "commercial firms that assess the ability of companies, institutions and governments to service their debts" (Ryan, 2012). While credit ratings "are opinions of the credit quality of individual obligations or of an issuer's general creditworthiness." (Moody's Investors Service, 2009). In other words, a credit rating is an independent evaluation of an entity's ability to make debt payments in a timely fashion, synthetized in the form of a simple scale: *appendix 1* depicts the rating scale of the three main rating agencies. A rating action may take the form of an upgrade or a downgrade. There are other two tools used by rating agencies: rating watch and rating outlook. The former indicates the heightened probability of a rating change and the likely direction of such a change, whilst the latter indicates that the direction a rating is likely to move over a one-to-two-year period (Fitch Rating, 2013). An increase (decrease) to a credit rating signals to the market that the creditworthiness of the country has changed, and its probability of default has increased (decreased). The crucial point is to assess the importance assigned by the market and investors to this signal of creditworthiness.

The impact of rating change actions can be deduced from the market's reaction to the announcement. The hypothesis I will test is that whether a significant change in government bond yields, and thus returns, occurs as a consequence of the announcement. This would imply that Rating Agencies provide the market with private information.

1.2 Rating Agencies' Credibility Issue

Credit rating agencies were perceived as honourable institutions that deliver superior information. If they lose their status as trustworthy players, confidence in their announcements may diminish and thus, weakening the market impact of rating changes.

The Financial Crisis of 2007-2008, and then the European sovereign debt crisis of 2011-2012 have seriously undermined the Big Three's credibility since they all failed to predict Lehmann Brother's collapse[2] and they issued overly aggressive ratings in the Eurozone.

Before the financial crisis, credit rating agencies failed to react in a timely fashion to changing market conditions, but they played a pivotal role in worsening the credit crisis. They boosted the evaluation of complex instruments, failing to fully understand their complexity, such as mortgage-backed securities (MBS) and collateralized debt obligations (CDO); they did not discover the housing-bubble and subsequently they did not react promptly in downgrading them. Moreover, other sources of concern are conflicts of interest, lack of transparency and oligopolistic behaviour.

Afterward, in light of the dramatic increase in sovereign yield spreads during the Euro sovereign debt crisis, the controversial debate about the credibility of the three main rating agencies has reawakened.

According to Ferri, Liu, and Stiglitz (1999) rating agencies behave pro-cyclically upgrading bonds during boom phases and downgrading them during crisis periods. Do rating agencies, as illustrated by these researchers, have the 'tremendous power to influence market expectations' or they are simply reacting to public domain information?

Thus, I investigate how market reacted to these failures during the financial crisis and the European sovereign debt crisis, by calculating the European sovereign bond abnormal returns generated around credit rating announcements, before and during the European sovereign debt crisis. The difference in these abnormal returns should demonstrate the reputational crisis of credit rating agencies.

In spite of their credibility crisis, credit rating agencies still play a pivotal role in the market since when the investment grade boundary[3] is overcome the issuer can have problematic aftermaths as many investors are prohibited from investing in sub-investment grade bonds. Hence, a downgrade below BBB- or Baa3 can cause a strong selling-pressure since investors must close their positions in order to comply with this rule.

1.3 The European Sovereign Debt Crisis

2 Lehman Brothers' rating was above investment grade until the day the bank filed for Chapter 11. Ratings by Moody's, S&P and Fitch were respectively A2, A and A+.

[3]The boundary from investment grade to "junk" status (Baa3 for Moody's and BBB- for Standard & Poor's and Fitch)

Although the sovereign crisis is not endogenous to the Eurozone, but originated as a consequence of the 2007-2008 financial crisis, it proved to be especially damaging for two categories of countries. Firstly, for those whose public debt was already high before the outbreak of the crisis (Greece, Italy, and Portugal). Secondly, for those who recorded large deficits to rescue their respective banking sectors and avoid their disordered collapse after the deflation of credit-fuelled housing bubbles (Cyprus, Ireland and Spain).

Since the worsening of the financial crisis in September 2008 (Lehmann Brother's collapse), all Eurozone government bond yield spreads to the German Bund have been characterised by highly persistent processes with upward trends for countries with weaker fiscal fundamentals (De Santis, 2012). Concretely, higher risk aversion has boosted the demand for the German Bund and other Core Bonds, such as Austria, Finland, and the Netherlands; and conversely it has reduced the demand for Peripheral Bonds, i.e. Cyprus, Greece, Italy, Ireland, Portugal, Spain and Slovenia.

In this respect, a clear lesson emerging from the crisis is that a close bond between the banking industry and sovereign risk can seriously endanger the financial stability, especially when it is encouraged by a flawed regulatory framework.

Another lesson to be learnt, that the construction of the Euro area as a whole is based on some major weaknesses. Firstly, its inability to ensure the strict application of rules aimed at preventing member countries from conducting loose fiscal policies, leading to an unsustainable rise in government debt and deficit levels. Secondly, the incompleteness of its structure as a monetary union, without a fiscal union, which impaired its capacity to promptly and effectively respond to the crisis. This absence of appropriate preventive and curative instruments resulted in a generalised crisis, with spill-overs from one country to another, that is, contagion.

At the same time, the crisis showed how the debate around the alternative solutions has inevitably a fundamental political dimension. Many of the proposed solutions call for a stronger fiscal integration of Euro area member countries. However, it remains crucial to not produce detrimental incentives on the adoption of rigorous fiscal measures as the potentially arising moral hazard problem would eventually build the basis for the next crisis. As such, any solution to the Eurozone debt crisis will not be definitive unless it is effective in preventing the contagion and in providing the right incentives for fiscal discipline.

On the back of this debate, I want to answer to my two last research questions. Firstly, I will investigate whether the European sovereign debt crisis affects the market attitude towards rating agencies; and secondly, I will analyse the divergent market reactions to rating changes depending on if the European country is a member of the Eurozone or not and if it is in the 'Peripheral area' or not.

2 Literature Review

This chapter describes, in a chronological order, the evidence in the existent literature on the informational value of credit rating change.

Whereas the prevailing literature deals with U.S. stock market returns at a company level, there are relatively few works on bond market, and almost a non-existent body of work done specifically on the European sovereign bond market.

Notably, most of the research scrutinizes the activity either of Moody's or Standard & Poor's whilst Fitch lies substantially behind since the credit rating industry has historically been dominated by just these two agencies (Becker and Milbourn, 2008) and Fitch only gained prominence in the marketplace during the past 15 years.

The informational value of credit rating changes is a well-debated topic; however, the findings are controversial and they evolved with time.

Weinstein (1977), Pinches and Singleton (1978), Kaplan and Urwitz (1979), and Wakeman (1981) may be considered as the pioneers of this field of literature. The first two works failed to find any significant results of price changes around the announcement date; whilst the second two asserted that ratings did not provide new information to the market, since credit rating agencies only dealt with information that was already in the public domain.

Conversely, subsequent scientists showed that Rating Agencies did in fact convey some new information, for example: Ederington and Yawitz (1991). Furthermore, Griffin and Sanvincente (1982); Wansley and Clauretie (1985); Holthausen and Leftwich (1986); and Cornell et al. (1989) provided the literature with even more revealing results, characterising the subsequent stream of papers extensively. They found an asymmetrical behaviour in common stock price reaction. In other words, the price impact is significant with respect to downgrades in the order of roughly 2%, but not with respect to upgrades. Despite these findings, Stickel (1986), working on preferred stocks, found evidence that was consistent with price effect for both upgrades and downgrades.

Later researchers dealt with this issue; however, they only fine-tuned the results.

Beneficial for the analysis was the introduction of daily data. For instance, Hand, Holthausen and Leftwich (1992) examined daily excess bond and stock returns associated with two kinds of announcements: firstly, additions to Standard & Poor's Credit Watch list between 1981 and 1983, and secondly, actual rating changes made by Moody's or Standard & Poor's between 1977 and 1982. Additions to Standard & Poor's Credit Watch list did not present significant average excess bond returns. Actual rating changes generated more significant results only for downgrades, stronger for stocks than bonds, while there was a weaker and not significant effect for upgrades. Thereby, this asymmetric effect between downgrades and upgrades was confirmed. Moreover, they dealt with the concepts of "expected" and "contaminated" rating change. If the yield to maturity of the bond under scrutiny was greater (lower) than a benchmark they stated that market implied that the bond had greater (smaller) default risk than comparable bonds. Thereby, a downgrade was viewed as expected (unexpected). An announcement was defined as "contaminated" if it occurred simultaneously with news disclosures from sources such as the Wall Street Journal.

Goh and Ederington (1993) analysed the reaction of common stock returns to bond rating changes. They argued that the significant negative stock response to downgrades should not be expected for all downgrades for two reasons. Firstly, some rating changes were anticipated by investors; and secondly, downgrades should be 'good news' for stockholders, because wealth was transferred from bondholders to stockholders. More specifically, they made a demarcation between downgrades triggered by an increase in financial leverage and those caused by deterioration in fundamentals, such as earnings, cash flows, or company's financial prospects. They found that downgrades triggered by deterioration in fundamentals produced a negative stock price return (-1.18%), whereas there was no statistically significant reaction to downgrades associated to an increase in financial leverage.

Klinger and Sarig (2000) found that "rating information does not affect firm value, but that debt value increases (decreases) and equity value falls (rises) when better (worse) than expected ratings are announced", thus corroborating Goh and Ederington (1993) findings. Jorion, Liu, and Shi (2005) considered the investors' behaviour towards such announcements in the U.S. prior and after the SEC's Fair Disclosure Regulation (October 2000). This regulation was aimed at preventing selective disclosure by public companies to a restricted number of market participants, such as analysts, brokers, or institutions. It ruled that "the issuer shall make public disclosure of that information [...] simultaneously, in the case of an intentional disclosure; and [...] promptly, in the case of a non-intentional disclosure"[4]. However, there is an exception: public companies were permitted to disclose private and price-sensitive information to credit rating agencies. Therefore, after October 2000 credit rating agencies should be seen as a vehicle of new, fresh, and potentially price-sensitive information in the U.S. market. Providing evidence consistent with the existing literature, they showed there was an asymmetric behaviour towards announcements made before the regulation. Precisely, downgrades generated significant negative abnormal returns (-3.06%), whereas upgrades did not. Consequently, after October 2000 the reaction to announcements was still asymmetric but both the impact of downgrades and upgrades were statistically significant and they sharply increased, respectively by -4.85% and 1.17%.

In a following study, Hooper, Hume, and Kim (2008) ascertained that rating agencies provide the stock market with new tradable information. Furthermore, they further confirmed previous literature about the asymmetric effects of rating announcements. Interestingly, this paper dealt with sovereign credit rating change. While research to date was keen to analyse the impact of rating changes at the company level, this paper uses a panel of 42 Countries, covering the major regions throughout the world during the period of 1995-2003.

In an almost contemporary work, Ferreira and Gama (2007) found asymmetric spill over effects of one country's rating events on others' stock market returns.

Calderoni, Colla, and Gatti (2009) used a pan-European sample of more than 500 credit rating changes released by Moody's over the period 2002-2007. Their findings corroborated existing literature on U.S. markets. Indeed, the stock price reaction to rating changes is asymmetric. Controlling for the prior credit quality and the magnitude of the rating change, they showed that this asymmetry was mitigated. Furthermore, taking into account that information asymmetries were less severe in UK market and in the financial sector, they found a larger effect for downgrades on non-UK issuers and non-financial companies.

Subsequently, May (2010) found that the corporate bond market inferred some new information both from downgrades and upgrades, being highly statistically significant at 1% level. The former generated an average two-day abnormal bond return of -0.64%, while the latter of +0.21%. Consistent with the existing literature, the reactions to upgrades was

[4] Regulation Fair Disclosure - Reg. FD

smaller in absolute value showing again an asymmetric behaviour, while it differentiated from most of the previous works since he found significance also for upgrades.

In a very recent study, Michaelides et al. (2012) analysed the effect of sovereign debt rating changes on daily stock market returns. They found evidence that sovereign debt rating downgrades negatively affected the local stock market prior to the announcement and surprisingly, in a slight positive manner after the announcement; whilst upgrades generated a positive stock market response around the announcement dates.

As shown in this chapter, there is a profusion of U.S. literature, corroborating the hypothesis that downgrades, and by some extent even upgrades, provide the market with new and potentially price-sensitive information, determining statistically significant abnormal returns for security prices. The aim of my work is to investigate whether there are significant yield reactions associated with the announcement of credit ratings changes even for European government bond setting.

The remainder of this paper will address this issue. Precisely, chapter 3 will describe the dataset; chapters 4 and 5 will describe respectively the methodology and the model I employed for my analysis; chapter 6 will clearly state the hypotheses and the testing procedure; chapter 7 will present my empirical results; and chapter 8 will draw my concluding remarks and will pave the way for future works.

3 Dataset

My sample is represented by rating changes for a panel of European countries rated by Fitch, Moody's and Standard and Poor's from 1991 to 2013. Notably, my sampling period covers quite a long time frame (22 years), but at the same time it is particularly updated. Indeed, it ends just a short time before the submission date of this work. Contrariwise, the existing literature concludes usually from two to ten years before the publication dates.

The focus is on more than one Rating Agency, since according to Cantor and Packer (1996) the impact of one agency's announcement is greater if the announcement confirms the other agency's rating or another previous rating announcement. Although there are 34 registered rating agencies in the "Official Journal of the European Union"[5], and over one hundred national and regional rating agencies all around the world which could issue

5 The list is published by ESMA as of 20th March 2013

ratings, the reliance on the so called “Big Three” is driven by the fact they represent the great majority of the global market share[6].

Historical ratings and rating change dates were obtained from Fitchrating.com with respect to the first rating agency, while with regard to the remaining two they were hand collected from the Bloomberg database[7]. Rating Agencies’ websites, Factiva database, the Financial Times (ft.com) and the Wall Street Journal (wsj.com) were used to analyse the reasons behind each rating change.

Table 1 shows my original sample composition. The total amount of rating actions collected is equal to 392[8], corresponding to 198 downgrades and 194 upgrades. Specifically, Fitch announced 60 downgrades and 67 upgrades during my sample period, Moody’s 64 downgrades and 60 upgrades, and Standard & Poor’s 74 downgrades and 67 upgrades.

Table 1: Original sample of rating actions: descriptive statistics (from 1991 to 2013)

	Downgrade Announcements	Upgrade Announcements	Rating Change Announcements
Fitch Ratings	60	67	127
Moody's Investors Service	64	60	124
Standard & Poor's	74	67	141
Grand Total	198	194	392

As fully expected and reflecting the economic cycle, rating changes tend to cluster over time. On the one hand, *Figure 1* provides evidence of downgrade clustering during the financial crisis and the European debt crisis time frames. Indeed, from 2008 to 2013 credit rating agencies announced 156 downgrades, almost 80% of the total number of downgrades in my sample period. On the other hand, from 1998 to 2004 the same figure shows a concentration of upgrades, amounting to more than 60% of the upgrade sample.

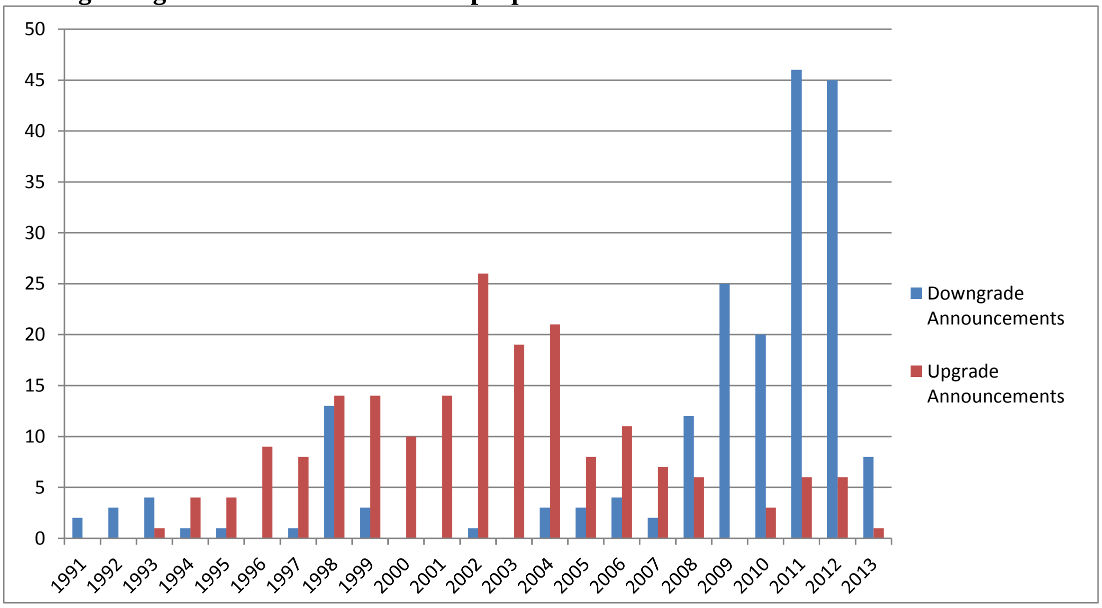
Further remarkable evidence provided by the figure is that the frequency of rating changes seems to increase over the sample period.

6 Roughly 95% according to “The Economist”

7 They cannot be downloaded neither from Bloomberg nor from other sources.

8 Between the conclusion of my empirical analysis and the submission of this work, other three countries were subjected to a rating action. Precisely, UK was downgraded by Fitch from ‘AAA’ to ‘AA+’ on April 19 2013, Slovenia was downgraded by Moody’s from ‘Baa2’ to ‘Ba1’ on April 30 2013, and Greece was upgraded by Fitch from ’CCC’ to ‘B-’ on May 14 2013.

Figure 1: Rating change distribution over the sample period



Moreover, in order to include an event in the sample, I require non-missing information both on bond yields and prices. For this reason my clean sample leaves out 146 events, thus it is constituted by 246 rating announcements, corresponding to 150 downgrades and 96 upgrades. *Table 2* describes my adjusted sample composition.

Table 2: Adjusted sample of rating actions: descriptive statistics (from 1991 to 2013)

	Downgrade Announcements	Upgrade Announcements	Rating Change Announcements
Fitch Ratings	46	34	80
Moody's Investors Service	49	29	78
Standard & Poor's	55	33	88
Grand Total	150	96	246

Table 3 divides the rating actions by the number of notches the rating was respectively lowered or raised.

Table 3: Rating changes classified by notches

Number of Notches	Number of Downgrades	Number of Upgrades
9	0	1
6	1	2
5	1	0
4	4	0
3	14	1
2	33	7
1	97	85
Grand Total	150	96

I matched credit ratings of Standard & Poor's with comparable ratings of Moody's and Fitch according to the Bank for International Settlements (BIS)[9] setting stated in the Basel Committee's consultative document "The New Basel Capital Accord".

[9] Bis.org

Subsequently, I transformed the rating variables into numbers, assigning a numerical rating that goes from 23 to 1, respectively from the highest credit quality (AAA) to the lowest creditworthiness in my sample (D).

Further to the rating changes, my sample is constituted by European Government Bond Yields and Prices. Precisely, the former are Redemption Yields, i.e. Yield to Maturity (YTM); the latter are Clean Prices, which differ from Dirty Prices because these exclude any interest accrued since the most recent coupon payment, or the issue date. The relationship between Clean and Dirty Prices is as follows:

$$Clean\ Price = Dirty\ Price - Accrued\ Interest \quad (1)$$

I used the 10 year and 30 year constant maturity prices and yields since these are, as well as the 5 year maturity, the most liquid ones. Furthermore, they are also the most widely used by practitioners: therefore, they are the most employed in actual trading strategies. Additionally, they show a considerable long modified duration. By maximising the duration I would increase the likelihood of detecting excess bond returns, however my goal is to reach the right balance between duration and information, i.e. liquidity.

These time series were downloaded from DataStream. Since a precise measure of accrued interest was not available from this data provider, I transform daily redemption yields into daily returns by computing the duration of the bond and multiplying it by variations in yields. In order to perform this log-linear approximation a stepwise approach is required.

Firstly, I compute log yields for the bond:

$$ly_d = \ln\left(1 + \frac{(lag(yield\ ))}{(100 * 252)}\right) \quad (2)$$

Where *ln* is the natural logarithm, *lag* is the lag operator, ly_d is the daily log-yield, and *252* is the average number of trading days in one year.

Secondly, I approximate the bond durations (*Dur*) by assuming that coupons are equal to the yield to maturity:

$$Dur = 252 * \frac{1 - \left(1 + \left(\frac{yield}{100}\right)\right)^{-10}}{(1 - \left(1 + \left(\frac{yield}{100}\right)\right))^{-1}} \quad (3)$$

Thirdly, I calculate returns following this formula:

$$\ln(R_d) = \text{lag(Dur)} * \text{lag(ly\_d)} - (\text{lag(Dur)} - 1) * \text{ly\_d} \quad (4)$$

Where $\ln(R_d)$is the daily log return, *lag* is the lag operator, and *Dur* the duration.

Then, I employed the Clean Bond Prices to double check the correctness of my dataset[10].

I decided to employ bond data and not CDS data for two reasons. Firstly, the main advantage of CDS versus bonds is that they are more liquid. However, while it would have been a serious issue for corporate bonds[11], it is not the case for sovereign bonds. Secondly, the CDS market is a relatively new one and the length of the sample period would have been considerably shortened.

Moreover, I used daily data since according to Bessembinder et al. (2009) daily bond data can significantly increase the power of tests.

In order to perform my analysis I utilized two key pieces of software: MATLAB and Microsoft Excel, with the support of Visual Basic.

The following chapter aims at describing the methodology applied to conduct the event study in this paper.

4 Event Study Methodology

In this paper I applied the Standard Event Study Methodology explained by MacKinlay (1997) and Mitchell and Netter (1994).

Event studies have a long history. Some well-known examples are: Dolley (1933), pioneer of the event study theory, analysed the price effect of stock splits; Ball and Brown (1968) dealt with the information content of earnings; and Fama, Fisher, Jensen, and Roll (1969) considered the effects of stock splits after removing the effects of simultaneous dividend increases. Although there is no unique structure in conducting this methodology, I followed the guideline of the "seven steps" structure proposed by Campbell, Lo, and MacKinlay (1997), which in my view is the most comprehensive one.

Thus, according to these guidelines: first, I described the dataset I used which has been already presented in the previous chapter. Second, I defined the event, the event date, the event window and the estimation period. Third, I depicted the Normal and Abnormal Return. Fourth, I selected the model and defined the estimation procedure. Fifth, I introduced the hypotheses and the testing procedure. Sixth, I showed my empirical results. Seventh and final, I presented my interpretation of the results and my conclusions.

[10] I discovered 4 outliers out of 139,282 returns.

[11] The average bond only trades 52 days a year and conditional on trading, only 4.62 times per day (Bessembinder et al., 2008).

The first point has already been presented in the previous chapter, while the second and the third points are covered in this chapter. The following four topics represent four stand-alone chapters that as a whole complete the work and answer the research questions.

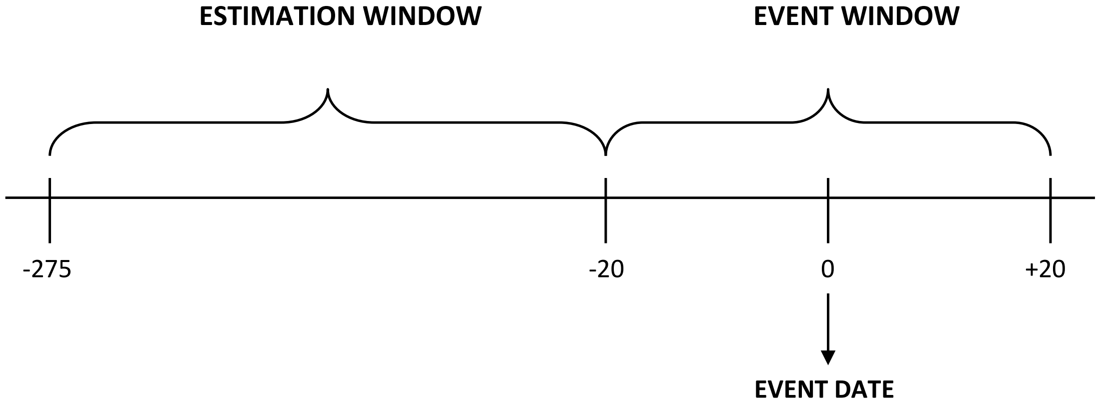
4.1 Event, Event Date, Event Window and Estimation Period

The "Event", as already presented in the previous paragraphs, is the rating change announcement. The "Event Date" is defined as the press release date by Rating Agencies of a downgrade or an upgrade (hereafter t=0); whereas my "Event Windows" are [day 0; day +1], [day -5; day +1], [day -1; day +5], [day -20; day +1], [day -1; day +20], and [day -20; day +20]. With respect to the first event window [day 0; day +1], the choice of the announcement day and the trading day immediately after is quite straightforward. This is performed to capture the yield effects of a press release which is held after the market closure. With regard to the other four event windows, the choice of extending it up to 20 trading days prior to and after the announcement date was to investigate respectively the possibility of an acquisition of such information by the market prior to the actual announcement or the case of a potential over-reaction or under-reaction by investors. Moreover, analysing both pre-announcement and post-announcement windows I can evaluate respectively the cumulative intensity of this leakage of information and this behavioural phenomenon.

Finally, I have to define the "Estimation period", which is a normal period without any other significant specific perturbing events. My estimation window lasts 255 trading days [-275 days; -20 days], approximately equivalent to a calendar year. I decided to use an estimation period slightly longer than the length commonly used in the stock literature, because the variance of bond returns is lower than the one of stock returns. Even if from a theoretical standpoint the estimation period should be a period without any other significant specific perturbing events, in practice the estimation windows are very likely to be contaminated, at least partially.

Figure 2 displays the estimation window [-275; -20], the event window [-20; +20], and the event date.

Figure 2: The estimation window [-275; -20], the event window [-20; +20], and the event date [0].



4.2 Normal and Abnormal Returns

Bruner (2004) dealt with a different kind of event study, i.e. Merger's announcement, and depicted three ways to test whether an event has an impact on the security returns or not. I adapted his approaches to my case study:

1) Is the price of the bond statistically different from before to after the announcement? This comparison is widely used; however, this is a naïve approach. It does not take into account that other factors might have generated this price change, unconnected to the announcement. Random noise, especially in the short-run, drives security prices and for this reason, this simple approach is clearly unreliable.
2) Is the return on the bond statistically different than the one of a benchmark? Using a market index, or a sample of comparable bonds that did not experience any rating announcement in the sample period, controls for the possibility that the actual returns were determined by other idiosyncratic factors, rather than by the rating announcements, thus reinforcing the study. However, benchmarks are still imperfect, since it is unreasonable to think about a constant sensitivity equal to one.
3) Is the return on the bond statistically different to what it would have been without the rating announcement? According to Bruner (2004) and a number of other researchers this would be the "gold standard" test.

Since this third approach is proved to be the superior one, I will develop my research based upon this method. Before conducting the core of my event study, I have to determine the abnormal and the normal bond returns related to the rating announcement. The log abnormal returns (AR_{it}) are defined as the difference between the actual ex-post (realized) log return of the bond (R_{it}) and a normal log return of the bond over the event window (NR_{it}) or benchmark:

$$\ln(AR_{\mathrm{it}}) = \ln(R_{\mathrm{it}}) - \ln(NR_{it}) \quad (5)$$

where AR_{it} is the abnormal log return for observation i on day t, R_{it} is the daily log return calculated over the event window, and NR_{it} is the daily normal log return, i.e. the return that would have been realized, had no event occurred.

Whilst computing the first part of the RHS is quite straightforward, the second part may involve some problems, indeed normal returns require the choice of an appropriate asset pricing model, or factor model. The following section is designated at explaining this issue.
Further to use normal returns and abnormal returns, I will employ average abnormal returns (AAR), cumulative abnormal returns (CAR), and cumulative average abnormal returns (CAAR).
The average abnormal return (AAR) aggregates abnormal returns across rating change events (N) in the sample to compute the simple cross-sectional average abnormal return at each time t. By taking the average, I removed the idiosyncratic component of returns which is due to the security specific information, and not due to the rating change event. The average abnormal log return (AAR) is defined as follows:

$$\ln(\mathrm{AAR_t}) = \frac{1}{N}\sum_{\mathrm{i=1}}^{\mathrm{N}} \ln(\mathrm{AR_{i,t}}) \quad (6)$$

The cumulative abnormal log return (CAR) sums abnormal returns across time, for all the trading days (T) in the event window. The cumulative abnormal log return (CAR) is computed as:

$$\ln(\mathrm{CAR_t}) = \sum_{\mathrm{t=1}}^{\mathrm{T}} \ln(\mathrm{AR_{i,t}}) \quad (7)$$

The cumulative average abnormal log return (CAAR) can be identified either as the sum of AARs over the T trading days in the event window or the average of CARs computed for all rating change events (N). The two alternative equivalent formulas are:

$$\ln(CAAR_T) = \sum_{t=1}^{T} \ln(AAR_t) \quad (8)$$

$$\ln(CAAR_N) = \frac{1}{N}\sum_{i=1}^{N} \ln(CAR_i) \quad (9)$$

The CAAR is a useful statistical tool further to the AAR and the CAR because it permits to recognise the aggregate effect of abnormal returns. Moreover, when the event's effects are not only on the event date itself but also around it, i.e. during the event window, the introduction of the CAAR is extremely beneficial for the analysis.

5 Model selection

The literature presents a vast number of methods to describe a security's normal returns. According to Campbell, Lo, and MacKinlay (1997) there are two categories in which models can be classified: Statistical and Economic models.

On one hand, the first category concerns the behaviour of asset returns, without relying on any economic assumptions. Additionally, the basic statistical assumption involves independently and identically distributed normal returns with mean μ and variance-covariance matrix Σ for all t.

On the other hand, the second category has an economic background, but at the same time is based upon statistical theory. Furthermore, they restrict the parameters of statistical models to provide more constrained returns.

Further to this classification, Henderson and Glenn (1990) and other researchers, described common choices for modelling the normal return. There are three prevalent categories, with a number of differences: first, "the constant mean return"; second, "the single-index model"; and third, "the multi-index model".

5.1 The constant mean return model

The first category of models is constituted by the "constant mean return model", which assumes that the mean return of a given bond, or more broadly a return of a given security, is constant through time. Thus during the event window the bond is expected to have the same return of the estimation period.

$$R_{it} = \mu_i + \varepsilon_{it} \quad (10)$$

$$\text{With } E[\varepsilon_{it}] = 0 \text{ and } Var[\varepsilon_{it}] = \sigma^2_{\varepsilon_i}$$

Where μ_i is the sample mean of historical bond returns and ε_{it} is an error term.

This model was introduced for calculating abnormal bond returns by Handjinicolaou and Kalay (1984) with the name "mean-adjusted model" and nowadays is still the most commonly used method in the literature, for both daily and monthly bond data. The abnormal return is computed as the difference between the historical return on the bond and the return on a risk-free bond, i.e. the three-month German bill or the three-month German FIBOR. The log excess return (ER) for bond i during period t is calculated as the actual bond's log return (R_{i}), minus the log return on the German security (R_{Ger}):

$$\ln(\mathrm{ER}) = \ln(R_{\mathrm{i}}) - \ln(R_{\mathrm{Ger}}) \quad (11)$$

The mean expected excess log return (EER) for bond i is equal to the average $\ln(\mathrm{ER})$ for the previous *t* periods (the estimation period):

$$\ln(EER_{\mathrm{i}}) = \left(\frac{1}{\mathrm{T}}\sum_{\mathrm{t}=-1}^{-\mathrm{T}} \ln(ER_{\mathrm{i,t}})\right) \quad (12)$$

Despite it is not really accurate, over short time intervals it is less likely to be incorrect. Although it is a naïve model and generates sub-optimal results, according to Brown and Warner (1985) this simple model produces results comparable to those of more sophisticated models, because more sophisticated models often do not dramatically diminish the variance of abnormal returns.

5.2 The single-index model

The second class of models is represented by the "single index model" or single factor model. It greatly simplifies the estimation of the covariance matrix with respect to the classical Markowitz (1952) procedure. The main assumption behind a factor model is that the returns on two securities will be correlated only through common responses to the factor. What is not explained by the factor model is considered to be security specific. The single index model, on the other hand, uses the market index as a proxy for the common factor. It relates returns on each security to the returns on the common market index, by dividing returns into two components α_i and $\beta_i R_{mt}$. The first equation represents the single factor model, while the second one expresses the single index model:

$$R_{it} = E(R_{it}) + \beta_i F_t + \varepsilon_{it} \quad (13)$$

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (14)$$

With $E[\varepsilon_{it}] = 0$ and $Var[\varepsilon_{it}] = \sigma^2_{\varepsilon_i}$

Where F_t is a zero mean factor, R_{mt} is the return on the market portfolio, β_i is the slope coefficient and measures the security's sensitivity to market movements, α_i is the intercept and ε_{it} is the residual or the security specific disturbance. The key assumption of the single index model is Cov(ε_i ; ε_j) = 0 for all i ≠ j.

An extremely popular and widely used version of the single index model is the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965). However, the CAPM is an equilibrium model, where the expected return of a given security is a linear function of its covariance with the return of the market portfolio, and the single index model is not. The former uses the market portfolio, while the latter employs a broad market index, as an approximation of the market portfolio. Although the CAPM does not fully withstand empirical results, it was widely used because of the insight it offered and because its accuracy was deemed acceptable for important applications (Bodie, Kane and Marcus, 2011). However, due to these deviations in empirical results, the use of the CAPM in event studies has almost ceased (Campbell, Lo, and MacKinlay, 1997) and the CAPM is replaced by other single index or market models. Moreover, Bouquist, Racette, and Schlarbaum (1975) and Gultekin and Rogalski (1985) argued that the CAPM is not fully effective in describing bond returns, showing that the beta of a risk-free bond is not stationary, since it is proportional to its duration.

Another component of this class of models is the "non-risk adjusted market model". It can be considered as a special case of the single index market model with $\alpha_i = 0$ and $\beta_i = 1$. With this model, the bond will yield, without any announcements, the same return as the market portfolio. In this case the estimation period is not required, because parameters are fixed, thus they do not need to be estimated. Therefore, although it may lead to biased results, it is particularly useful when there is not enough data for an estimation period.

A slightly different model is the “control portfolio return model” or “matching portfolio return model”. In this case, a portfolio of comparable bonds, not subject to any events, is picked. The similarity between the bond and its peers is evaluated both ex-ante, dealing with bond in similar rating classes, and during the estimation period.

5.3 The multi-index model

The final group of models is characterized by the “Multifactor model” or “multi-index model”. This model differs from the single-index approach since it considers that security’s returns are sensitive to more than one index or factor. Using a Multi-factor model allows the direct use of economic forces that systematically affect the security’s return, while in the single-index model the market portfolio’s return proxies the whole effect of macro factors. Theoretically, these should provide a superior description of security returns. Indeed, they are more effective at explaining historical covariances than the single index model. However, it may well be that a factor model that is satisfactory today, will not hold up to future scrutiny. The first equation represents the multi factor model, while the second one expresses the multi index model:

$$R_{\text{it}} = E(R_{\text{it}}) + \sum_{k=1}^{K} \beta_{\text{ik}} F_{\text{kt}} + \varepsilon_{\text{it}} \quad (15)$$

$$R_{\text{it}} = \alpha_{\text{i}} + \sum_{k=1}^{K} \beta_{\text{ik}} I_{\text{kt}} + \varepsilon_{\text{it}} \quad (16)$$

With $E[\varepsilon_{\text{it}}] = 0$ and $Var[\varepsilon_{\text{it}}] = \sigma^2_{\varepsilon_{\text{i}}}$

where I_{kt} is the index k at time t. The rest of the notation has already been introduced in the single index case.

A well-known application of the multifactor model is the Arbitrage Pricing Theory (APT), introduced by Ross (1976). Similar to the CAPM, the APT forecasts a security market line linking expected returns to risk. However, it relies on different assumptions. These are the three main propositions: firstly, securities can be described by a factor model; secondly, there are sufficient securities to diversify away the idiosyncratic risk; thirdly, well-functioning security markets do not allow for the persistence of arbitrage opportunities. Although the APT has a number of advantages, Brown and Weinstein (1985) state that the use of APT complicates the implementation of an event study, with little practical advantage relative to the unrestricted market model. Thus, there seems to be no sufficient reason to use an economic model rather than a statistical model in an event study.

Among the multi-factor model universe, I will consider three alternative models for bond returns.

Gultekin and Rogalski (1985) found that "at least two factors are linearly related to mean bond portfolio returns"[12], suggesting that a two-factor model may be a good model to start with. Thus, the first one is the two-factor model proposed by Fang and Woo (1991):

$$R_{it} = \alpha_i + \beta_{i1} I_{1t} + \beta_{i2} I_{2t} + u_{it} \quad (17)$$

$$u_{it} = \rho_i + u_{it-1} + e_{it} \quad (18)$$

With I ρ_i I ≤ 1

Var (u_{it}) = $\frac{\sigma_i}{(1-\rho_i^2)}$

Where:

R_{it} = Bond return I for i=1,…,n at period t=1,…,T;

I_{1t} = Percentage change of short-term interest rate at time period 1;

I_{2t} = Percentage change of long-term interest rate at time period t;

u_{it} = First-order autoregressive (AR(1)) error for bond I at time t;

e_{it} = White noise with zero mean and (constant) finite variance σ i

The second model is an extension of the renowned Fama-French three-factor stock return model (Fama and French, 1992) which includes these three factors: the market risk premium factor, small minus big factor, and high minus low factor. Further to these three classical factors this five-factor bond model, proposed by the two authors in 1993, adds two additional ones: first, the slope of the Treasury yield curve (*TERM*), calculated as the spread between a long term constant maturity rate and short term constant maturity rate; and second, the default premium (*DEF*), calculated as the difference between yield to maturity

[12] Gultekin, N., B., and Rogalski, R., J. (1985) Government bond returns, measurement of interest rate risk, and the arbitrage pricing theory. Journal of Finance 40, p 60

on a long term Baa corporate bond index and long term sovereign constant maturity rate. This bond model is presented as follows:

$$R_{\text{Bond pt}} - R_{\text{f t}} = \alpha + \beta\,(R_{\text{mt}} - R_{\text{ft}}) + sSMB_{\text{t}} + hHML_{\text{t}} + tTERM_{\text{t}} + dDEF_{\text{t}} + \varepsilon_{\text{pt}} \quad (19)$$

Challenging this model, Hahn and Lee (2006) discovered that changes in the default spread (Δdef) and changes in the term spread (Δterm) are positively correlated respectively with SMB and HML factors. For this reason, when in the model there are Δdef and Δterm, the Fama-French SMB and HML factors are redundant in explaining the size and book-to-market effects. Therefore, size and value premiums seem to be a reward for greater exposure to the factors of credit market conditions (ΔDef) and interest rates (ΔTerm).

The two researchers use the negative of changes in the default spread as an alternative macroeconomic proxy for the risk underlying SMB. Their explanation is as follows: "Since SMB is the return differential between the portfolios of small and large firms, increases (decreases) in the default spread would be associated with lower (higher) contemporaneous returns on SMB on average" (Hahn and Lee, 2006).

Hahn and Lee use changes in the term spread as an alternative macroeconomic proxy for the risk underlying HML. Their explanation is as follows. "Interpreting the effect captured by HML as an involuntary leverage effect, in the sense that firms with high book-to-market ratios (market leverage high relative to book leverage) have a large amount of market imposed leverage. Since declining interest rates are likely to have a greater positive effect on firms with heavier debt burden than on less levered firms, we can expect increases (decreases) in the term spread to be associated with higher (lower) returns on HML on average" (Hahn and Lee, 2006).

Therefore, the Hahn and Lee (2006) model can be expressed as:

$$R_{\text{Bond pt}} - R_{\text{f t}} = \alpha + \beta_1\,(R_{\text{mt}} - R_{\text{ft}}) + \beta_2 \Delta TERM_{\text{t}} + \beta_3 \Delta DEF_{\text{t}} + \varepsilon_{\text{pt}} \quad (20)$$

The third model is a six-factor model suggested by Elton, Gruber, and Blake (1995):

$$R_{\text{Bond pt}} - R_{\text{f t}} = \alpha + \beta_1\, UGDP_{\text{t}} + \beta_2 UCPI_{\text{t}} + \beta_3 DRP_{\text{t}} + \beta_4 R_{\text{BondM t}} + \beta_5 R_{\text{mt}} + \beta_6 Term_{\text{t}} + \varepsilon_{\text{t}} \quad (21)$$

Where:

$R_{\text{Bond pt}}$ = the average bond return at time t

UGDP = the unexpected change in gross domestic product

UCPI = the unexpected change in the consumer price index

DRP = the default risk premium

R_{BondM} = the return on the Lehman corporate bond index

R_{mt} = the excess return on the CRSP value weighted stock index

Term = the slope of the term structure.

However, I have to exclude the two macroeconomic factors (unexpected change in gross domestic product and unexpected change in the consumer price index) as they are no longer available, but Gutierrez, Maxwell, and Xu (2007) found that removing these factors does not substantially reduce the model's goodness of fit.

5.4 Model choice and estimation

After overviewing the different models, I decided to focus on two models for my analysis. The former is a simple factor index model, where the factor is constituted by the excess log return on the 10 year constant maturity German Bund. Although it is a naïve model, it is a broadly used method in the literature. Indeed, this simple model generally produces results comparable to those of more sophisticated models and it does not lower significantly the goodness of fit.

The latter is a multi-factor model, precisely the three-factor bond return model by Hahn and Lee (2006). I employ both the pure Hahn-Lee model by regressing the change in the Term and Default spread factors and a modified Hahn-Lee model which regresses the level instead of the change in the above mentioned factors, similarly to the original Fama-French five factor model. The three factors employed in developing the model are as follows. Firstly, the market risk premium factor is provided by the excess log return on the STOXX Europe 50. This is a European stock index, which covers 50 stocks from 18 European countries; thus, it better represents the European market than the Euro STOXX 50, which covers only the Eurozone countries. Secondly, the term spread factor (ΔTerm) is provided by the difference between the 10 year constant maturity German Bond excess log return and the 2 year constant maturity German Bond excess log return. Thirdly, the default spread factor (ΔDef) is given by the difference between the Moody's Seasoned Baa Corporate Bond Yield (DBAA) and the 10 year constant maturity German Bond excess log return.

I estimated the parameters of the model via OLS, as follows:

$$\widehat{\beta_{OLS}} = (X'X)^{-1}X'Y \quad (22)$$

The parameters are respectively $\hat{\beta}_0$ and $\hat{\beta}_1$ in the single factor model case while $\hat{\beta}_0, \hat{\beta}_1, \hat{\beta}_2$ and $\hat{\beta}_3$ in the three factor model case. The R squared and the Adjusted R squared for the Single Factor Model are respectively 16.34% (Mean R2), and 15.30% (Mean Adjusted R2); whereas for the Multi Factor Model are respectively 46.82% (Mean R2), and 46.16% (Mean Adjusted R2). The OLS estimation is the prevailing procedure in the existing literature, e.g. Hand et al. (1992), Goh and Ederington (1993), Kramer (2001), and Pynnönen (2005). This is due to the fact that OLS estimators are the best linear unbiased estimators (BLUE). However, this holds only under some assumptions[13]. Thus, if these assumptions are violated the OLS is not any more BLUE. Indeed, when dealing with event studies OLS estimators might be affected by the presence of serial correlation and conditional heteroskedasticity in the error terms. Although these two violations would both imply the OLS estimators to be inefficient[14], they are still consistent and unbiased. Consistency and unbiasedness are indeed the properties required when computing normal returns in event studies. Moreover, a number of researchers showed that, in an event study, the advantages of using the GLS estimators are empirically not important and there is very little evidence that they deliver a superior outcome (for example, Glenn and Henderson, 1990).

The empirical results will be presented in the chapter seven, while in the following chapter I formulate the main hypotheses I test with my empirical analysis.

6 Hypotheses and Testing Procedure

In this chapter, I will be testing the main hypotheses of this empirical work. On the one hand, receiving insights from the existing literature, I test whether two meaningful general findings still apply to my dataset or not, i.e. the effect of rating announcement on European

[13] The assumptions are as follows (Brooks, 2008): firstly, the errors have zero mean; i.e. $E(\varepsilon_t) = 0$. Secondly, the variance of the errors is constant (homoskedasticity) and finite over all the values of x_t; that is $var(\varepsilon_t) = \sigma^2 < \infty$. Thirdly, the errors are linearly independent of one another; i.e. $cov(\varepsilon_i, \varepsilon_j) = 0$. Fourthly, there is no relationship between the error and the corresponding *x;* that is $cov(\varepsilon_t, x_t) = 0$. Fifthly, the errors are normally distributed; i.e. $\varepsilon_t \sim N(0, \sigma^2)$.

[14] They no longer have the minimum variance among the class of unbiased estimators

government bond and their asymmetric reactions; on the other hand, I will enrich the existing literature by dealing with four fresh issues.

The first class of hypotheses is composed as follows:

First, I aim at testing the impact of credit rating announcements on European government bond returns. In order to achieve my goal, I test the following three Null Hypotheses for both downgrades and upgrades:

i) *H_0: The average abnormal return (AAR_t) on day t of the event window is equal to zero.*

While the alternative hypothesis (H_1) is that AAR_t are smaller than zero in case of downgrades, conversely, greater than zero in case of upgrades.

The test statistic is a 'one sample T-test' and it is calculated as follows:

$$T_{statistic} = \frac{AAR_t}{\frac{S_t}{\sqrt{N}}} \qquad (23)$$

where AAR_t are independent and identically distributed and the T-statistic follows a Student's T distribution with N-1 degrees of freedom. Although daily bond returns show some evidence of departure from normality, with positive skewness and excess kurtosis (Bessembinder et al., 2008), the statistic asymptotically follows a standard normal distribution.

The standard error is computed as:

$$S_t = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(AR_{it} - \frac{1}{N}\sum_{i=1}^{N} AR_{it})^2} \qquad (24)$$

ii) *H_0: The cumulative abnormal return (CAR_i) on event i over the event window is equal to zero.*

Whereas the alternative hypothesis (H_1) is that CAR_i are smaller than zero in case of downgrades, conversely, greater than zero in case of upgrades.

The test statistic is again a 'one sample t-test' and it is calculated as follows:

$$T_{statistic} = \frac{CAR_i}{\frac{S_i}{\sqrt{N}}} \qquad (25)$$

where CAR_i are independent and identically distributed and the T-statistic follows a Student's T distribution with T-1 degrees of freedom.

The standard error is computed as:

$$S_i = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(AR_{it} - \frac{1}{T}\sum_{t=1}^{T} AR_{it})^2} \quad (26)$$

iii) *H_0: The cumulative average abnormal return (CAAR) is equal to zero.*

Whilst the alternative hypothesis (H_1) is that CAAR are smaller than zero in case of downgrades, conversely, greater than zero in case of upgrades.

The test statistic is still a 'one sample t-test' and it is computed as follows:

$$T_{statistic} = \frac{CAAR}{\frac{S}{\sqrt{N}}} \quad (27)$$

where the T-statistic, once again, follows a Student's T distribution with N-1 degrees of freedom.

The standard error is computed as:

$$S = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(CAR_i - \frac{1}{N}\sum_{i=1}^{N} CAR_i)^2} \quad (28)$$

Second, I aim at verifying whether upgrades and downgrades are truly perceived as different credit rating announcements. In order to test this hypothesis, I make use of the two-sample un-pooled Welch (1947) test, with unequal variances. I state the Null Hypothesis as:

H_0: The difference between CAAR from upgrades and CAAR from downgrades is equal to zero

While the alternative hypothesis (H_1) is that $CAAR_{up}$minus $CAAR_{down}$ is different from zero.

The test statistic is computed as follows:

$$W_{test} = \frac{CAAR_{up} - CAAR_{down}}{\sqrt{\frac{S_{up}^2}{N_{up}} + \frac{S_{down}^2}{N_{down}}}} \quad (29)$$

Where the Welch's t-test follows a Student's T distribution with (N_{up} + N_{down} -2) degrees of freedom.

Conversely, the second class of hypotheses is composed of four issues that are relatively new to the literature.

Third, I try to test the impact of credit rating announcements on the slope of the yield curve. Precisely, the bonds I object of this test are the 10 year constant maturity bond and the 30 year constant maturity government bonds. In order to develop this test, I will formulate the following Null Hypothesis:

H_0: The difference between $CAAR_{30year}$ and $CAAR_{10year}$ is equal to zero.

While the alternative hypothesis (H_1) is that $CAAR_{30year}$ minus $CAAR_{10year}$ is different from zero.

The test statistic is a two-sample un-pooled Welch (1947) test, with unequal variances and it is computed as follows:

$$W_{test} = \frac{CAAR_{30year} - CAAR_{10year}}{\sqrt{\frac{S_{30year}^2}{N_{30year}} + \frac{S_{10year}^2}{N_{10year}}}} \quad (30)$$

Where the Welch (1947) test follows a Student's T distribution with (N_{30year} + N_{10year} -2) degrees of freedom.

Fourth, I will be analysing the implications of the European sovereign debt crisis on the credit rating announcement effect. In other words, I want to discover whether the reaction to a rating change is different before and after the European sovereign debt crisis. Therefore, I will test the following Null Hypothesis:

H_0: The difference between $CAAR_{Pre\text{-}crisis}$ and $CAAR_{Post\text{-}crisis}$ is equal to zero

While the alternative hypothesis (H_1) is that $CAAR_{Pre\text{-}crisis}$ minus $CAAR_{Post\text{-}crisis}$ is different from zero.

The test statistic is a two-sample un-pooled Welch (1947) test, with unequal variances and it is computed as follows:

$$W_{test} = \frac{CAAR_{Pre-crisis} - CAAR_{Post-crisis}}{\sqrt{\frac{S^2_{Pre-crisis}}{N_{Pre-crisis}} + \frac{S^2_{Post-crisis}}{N_{Post-crisis}}}} \quad (31)$$

Where the Welch (1947) test follows a Student's T distribution with ($N_{Pre-crisis}$ + $N_{Post-crisis}$ -2) degrees of freedom.

Moreover, I will perform the Goldfeld-Quandt (1965) test for equality of two variances. Thus, I will test the following Null Hypothesis:

H_0: The difference between $\sigma_{Pre\text{-}crisis}$ and $\sigma_{Post\text{-}crisis}$ is equal to zero

Whereas the alternative hypothesis *(H_1) is that $\sigma_{Pre\text{-}crisis}$ is lower than $\sigma_{Post\text{-}crisis}$*

Specifically, this is a test for homoscedasticity[15] and it is calculated as the ratio of the two residual variances where the larger of the two variances is placed in the numerator:

$$GQ_{statistic} = \frac{S^2_{Post-crisis}}{S^2_{Pre-crisis}} \quad (32)$$

where $S^2_{Pre-crisis}$ and $S^2_{Post-crisis}$ are the sample variances of AARs respectively prior to and after May 9 2010. The more this ratio deviates from 1, the stronger the evidence for unequal population variances.

Fifth, I attempt to verify the divergent investors' behaviour towards rating agencies announcements depending on whether the European country belongs to the Eurozone or not. Essentially, do investors react differently to a Rating Change whether a country is within or outside the Eurozone? Does the Euro represent a source of concern by itself? Therefore, I will test the following Null Hypothesis:

H_0: The difference between $CAAR_{Eurozone}$ and $CAAR_{Non\text{-}Eurozone}$ is equal to zero

While the alternative hypothesis (H_1) is that the difference between $CAAR_{Eurozone}$ and $CAAR_{Non\text{-}Eurozone}$ is different from zero.

The test statistic is a two-sample un-pooled Welch (1947) test, with unequal variances and it is computed as follows:

[15] Another test for homoscedasticity widely used in the literature is the White (1980) test.

$$W_{test} = \frac{CAAR_{Eurozone} - CAAR_{Non-Eurozone}}{\sqrt{\frac{S^2_{Eurozone}}{N_{Eurozone}} + \frac{S^2_{Non-Eurozone}}{N_{Non-Eurozone}}}} \quad (33)$$

The Welch (1947) test follows a Student's T distribution with ($N_{Eurozone}$ + $N_{Non-Eurozone}$ -2) degrees of freedom.

Sixth and final, I seek to prove the divergent investors' behaviour towards rating agencies announcements depending on whether the European country is considered a "Peripheral country" or not. The definition of Peripheral country corresponds to the one of PIIGS: this acronym stands for Portugal, Ireland, Italy, Greece, and Spain[16]. Therefore, I will test the following Null Hypothesis:

H_0: The difference between $CAAR_{Peripheral}$ and $CAAR_{Non\text{-}Peripherals}$ is equal to zero
While the alternative hypothesis (H_1) is that the difference between $CAAR_{Peripheral}$ and $CAAR_{Non\text{-}Peripherals}$ is different from zero.

The test statistic is a two-sample un-pooled Welch (1947) test, with unequal variances and it is computed as follows:

$$W_{test} = \frac{CAAR_{Peripherals} - CAAR_{Non-Peripherals}}{\sqrt{\frac{S^2_{Peripherals}}{N_{Peripherals}} + \frac{S^2_{Non-Peripherals}}{N_{Non-Peripherals}}}} \quad (34)$$

The Welch (1947) test follows a Student's T distribution with ($N_{Peripherals}$ + $N_{Non-Peripherals}$ -2) degrees of freedom.

Next chapter depicts the empirical evidence I established, then chapter eight concludes.

7 Empirical Results

In this chapter I describe my empirical findings, focusing on the following topics. Firstly, I describe the impact of downgrades and upgrades on European government bond returns. Specifically, sub-section 7.1.1 covers upgrades, sub-section 7.1.2 deals with downgrades, sub-section 7.1.3 compares upgrades and downgrades, and sub-section 7.1.4 highlights the

[16] This term was introduced by the Financial Times' Investment Editor James Mackintosh in February 2010.

differences among the three credit rating agencies. Secondly, section 7.2 tries to test the impact of credit rating announcements on the slope of the yield curve. Thirdly, section 7.3 attempts to explain whether the European sovereign debt crisis plays a role on the credit rating announcement effect or not. Fourth, section 7.4 explains the different investor reaction towards countries within or outside the Eurozone, and towards 'Peripheral' countries and 'Non-Peripheral' ones.

As explained in chapter five, I employed the three-factor bond return model by Hahn and Lee (2006) as the normal performance model. Moreover, I also compared these results with two other models. The former is a slightly different version of the Hahn and Lee model[17], and the latter is a single factor model, which provides a naïve, but consistent benchmark.

7.1 Impact of Downgrades and Upgrades on European Government Bonds

7.1.1 Upgrades

Firstly, I present my findings on the sample of 96 upgrades. Tables 4, 5, and 6 show the cumulative average abnormal returns, the T-statistics, and the P-values with respect to upgrades for the six event windows under analysis. The results in table 4 come from the three-factor Hahn-Lee bond return model (2003) regressed on the changes of Term and Default Spreads; while the results in table 5 derive from the same model, but regressed on the levels of Term and Default Spreads; and the results in table 6 stem from the single index model.

Table 4: CAAR's, T-test, and P-values for upgrades. Normal returns are obtained using the Hahn & Lee three factor model (with changes).

THREE FACTOR MODEL WITH CHANGES: UPGRADES						
Event window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	0,505%	**0,976%**	-0,140%	0,279%	**0,546%**	0,111%
T-test	0,997	**2,117**	-0,360	1,181	**2,361**	0,948
P-value	32,12%	**3,69%**	71,94%	24,06%	**2,03%**	34,55%

[17]This modified Hahn-Lee model uses as regressors the levels of the Term and Credit factors, instead of their changes.

Table 5: CAAR's, T-test, and P-values for upgrades. Normal returns are obtained by means of the three factor model (with levels).

THREE FACTOR MODEL WITH LEVELS: UPGRADES						
Event window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	0,756%	**1,146%**	-0,117%	0,220%	**0,487%**	0,075%
T-test	1,249	**1,988**	-0,331	0,924	**2,117**	0,637
P-value	21,46%	**4,97%**	74,17%	35,76%	**3,69%**	52,57%

Table 6: CAAR's, T-test, and P-values for upgrades. Normal returns are obtained by means of the single factor model.

SINGLE FACTOR MODEL: UPGRADES						
Event window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	0,760%	**1,199%**	-0,126%	0,225%	**0,547%**	0,098%
T-test	1,201	**2,041**	-0,348	0,945	**2,476**	0,836
P-value	23,28%	**4,40%**	72,84%	34,69%	**1,51%**	40,53%

Credit rating agency upgrades seem to have a weak impact on European government bond returns. The null hypothesis of zero cumulative average abnormal return cannot be rejected for all the event windows. Indeed, on the one hand, it can be rejected for the pre-announcement event windows [-20; +1] and [-5; +1] at 5% confidence level. On the other hand, the results are not statistically significant on the announcement window [0; +1], for the post-announcement event windows [-1; +20] and [-1; +5], and for the broader event window [-20; +20].

Thus, there is some evidence of positive cumulative abnormal return only prior the event date. Precisely, according to the three factor model with levels, the cumulative average abnormal return is 48.7 bps during the event window [-5; +1], and 97.6 bps during the event window [-20; +1]. As figures 3 and 4 confirm, upgrades seem to be anticipated by the market, possibly implying either that credit rating agencies follow the market rather than being information vehicles, or that some information is released earlier than the actual event date. Nevertheless, they provide the market with a very limited amount of new information, and this new information is priced in very quickly, according to the efficient market hypothesis.

Figure 3: Average Abnormal Returns for Upgrades

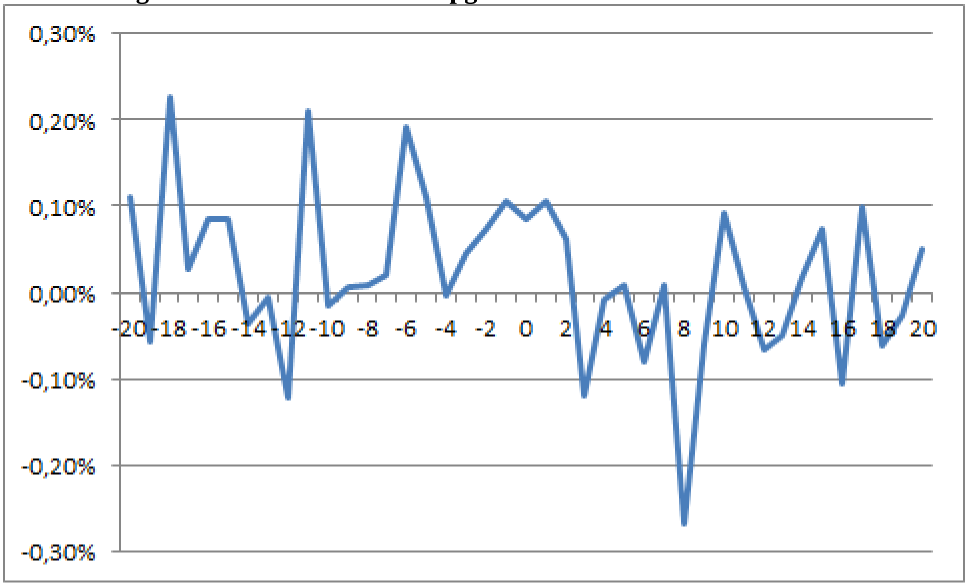
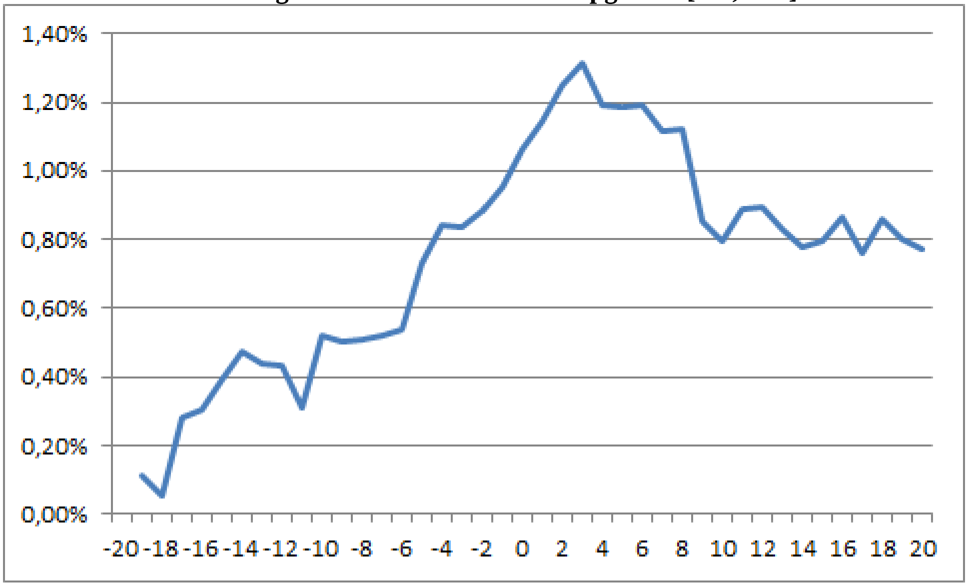


Figure 4: Cumulative Average Abnormal Returns for Upgrades [-20; +20]



These findings are consistent with the existing literature. Indeed, the impact of upgrades is considered almost insignificant by a number of researchers, such as Calderoni, Colla, and Gatti (2009).

7.1.2 Downgrades

This section illustrates my findings on the sample of 150 downgrades. Tables 7, 8, and 9 show the cumulative average abnormal returns, the T-statistics, and the P-values with respect to upgrades for the six event windows under analysis. The results in the table 7 come from the three-factor Hahn-Lee bond return model (2003) regressed on changes;

whilst the results in the table 8 derive from the same model, but regressed on the levels of Term and Default Spreads; and the results in the table 9 stem from the single index model.

Table 7: CAAR's, T-test, and P-values for downgrades. Normal returns are obtained by means of the Hahn & Lee three factor model (with changes).

THREE FACTOR MODEL WITH CHANGES DOWNGRADES						
Event window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	-0,007%	**-1,063%**	0,543%	-0,143%	**-0,737%**	**-0,414%**
T-test	-0,010	**-1,836**	0,963	-0,505	**-1,802**	**-2,031**
P-value	99,23%	**6,83%**	33,72%	61,41%	**7,36%**	**4,40%**

Table 8: CAAR's, T-test, and P-values for downgrades. Normal returns are obtained using the three factor model (with levels).

THREE FACTOR MODEL WITH LEVELS: DOWNGRADES						
Event window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	-0,394%	**-1,214%**	0,246%	-0,235%	**-0,969%**	**-0,476%**
T-test	-0,511	**-1,982**	0,430	-0,769	**-2,278**	**-2,020**
P-value	61,01%	**4,93%**	66,78%	44,32%	**2,42%**	**4,52%**

Table 9: CAAR's, T-test, and P-values for downgrades. Normal returns are obtained using the single factor model.

SINGLE FACTOR MODEL: DOWNGRADES						
Event window	CAAR [-20;+20]	CAAR [-20; 0]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	-0,871%	**-1,733%**	0,096%	-0,424%	**-1,177%**	**-0,680%**
T-test	-1,137	**-2,911**	0,169	-1,305	**-2,721**	**-2,490**
P-value	25,74%	**0,42%**	86,60%	19,39%	**0,73%**	**1,39%**

With regard to downgrades some fresh evidence is added to the literature. Although the tables show statistically significant CAARs for the event windows [0; +1] [-5; +1], and [-20; +1], the null hypothesis of zero cumulative average abnormal returns cannot be rejected for the other three event windows [-20; +20] [-1; +20], and [-1; +5]. In this regard, the p-values for the event window [0; +1] are quite low: in the order of 4.4% for the two three factor model and 1.39% for the single factor model. The cumulative average abnormal returns are -41.4 bps and -47.6 bps for the both the three factor models and -68 bps for the single factor model. Thus, downgrades seem to have a visible negative impact on European government bonds returns; however, this negative impact is processed almost immediately, and there is no room for possible forward-looking investment strategies, fully in line with the efficient market hypothesis. Although downgrades do not have an impact on the post-announcement window returns, the second moment, i.e. the variance, increases sharply from before to after the downgrades. Precisely, it almost doubles in presence of a downgrade.

Conversely, the same evidence is not provided by upgrades, which do not exhibit any significant increase in volatility.

Figures 5 and 6 offer a visual representation respectively of the Average Abnormal Return and for the Cumulative Average Abnormal Return.

Figure 5: Average Abnormal Return for Downgrades

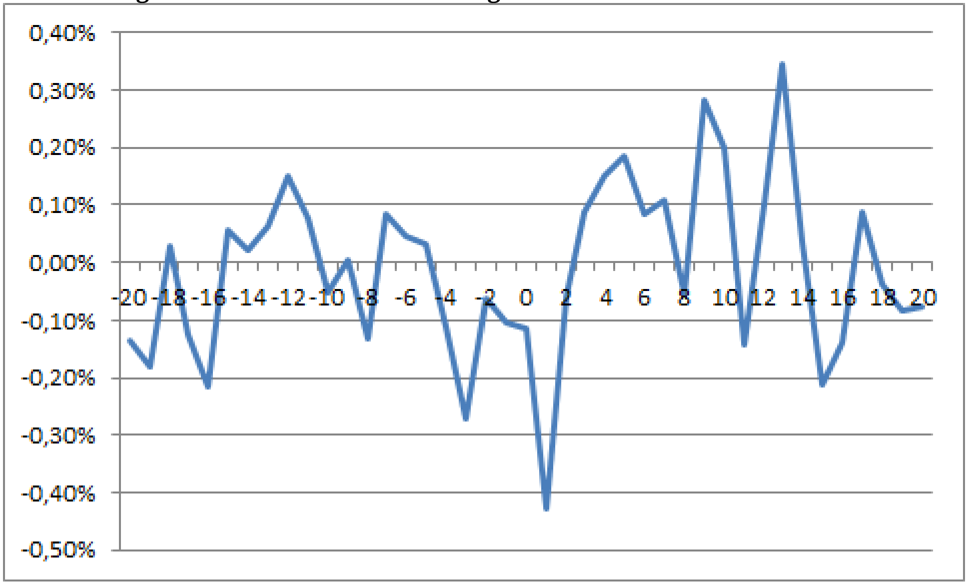
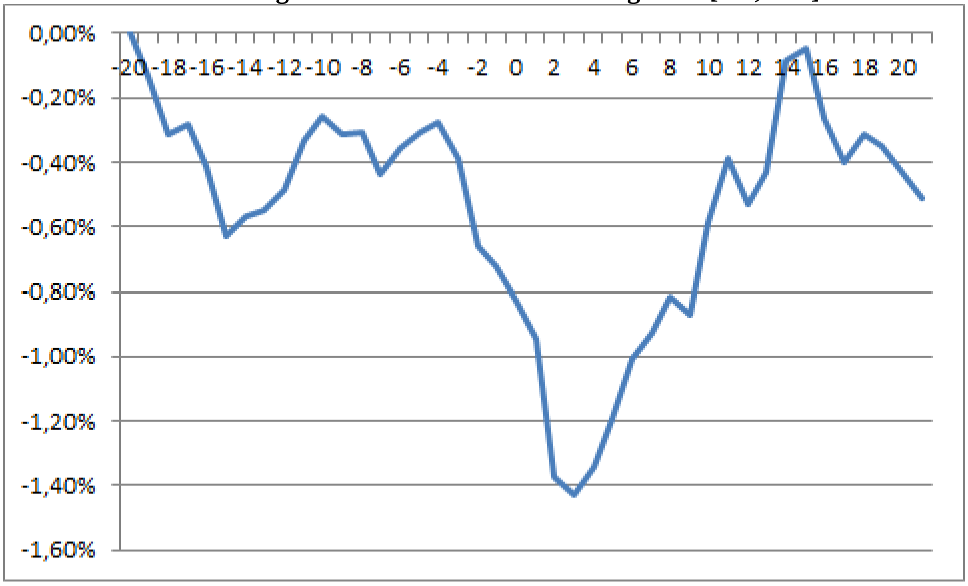


Figure 6: Cumulative Average Abnormal Return for Downgrades [-20; +20]



These findings about the event window [0; +1] are consistent with the existing literature, for instance Holthausen and Leftwich (1986), Hand et al. (1992), and Linciano (2004). My work provides further evidence of the asymmetric market reaction to rating changes, but this is only around the announcement date. On the one hand, a downgrade generates a negative CAAR, which is clearly statistically significant; on the other hand, an upgrade produces a positive CAAR whose reaction is much less distinguishable.

Rating downgrades seem to have a strongly negative information content, while rating upgrades seem to provide positive, but much weaker information content. A possible explanation for companies would be that they are keen to release positive news, whereas less willing to release negative ones. Thus, the role of the information vehicle is left in the hands of rating agencies, carrying some private information in case of downgrades. In this respect, Jorion, Liu, and Shi (2005) corroborated the hypothesis that rating agencies carry private information by studying the investors' behaviour towards such announcements in the U.S. prior and after the SEC's Fair Disclosure Regulation. However, this explanation does not completely hold for Government Bond since the private information area is much narrower.

7.1.3 Upgrades versus Downgrades

In this section, I investigate whether a downgrade generates a cumulative average abnormal return which is not only different from zero, but also different from the one generated by an upgrade for all event windows. Therefore, I performed a two-sample un-pooled Welch (1947) test, with unequal variances. Tables 10, 11, and 12 illustrate the findings.

Table 10: Welch test for the difference between downgrades and upgrades.

THREE FACTOR MODEL WITH LEVELS						
Event Window	**CAAR [-20;+20]**	**CAAR [-20;+1]**	**CAAR [-1;+20]**	**CAAR [-1;+5]**	**CAAR [-5;+1]**	**CAAR [0;+1]**
Mean Downgrades	-0,394%	**-1,214%**	0,246%	-0,235%	**-0,969%**	**-0,476%**
Mean Upgrades	0,756%	**1,146%**	-0,117%	0,220%	**0,487%**	**0,176%**
Standard Deviation Downgrades	0,0943	**0,0750**	0,0699	0,0375	**0,0521**	**0,0231**
Standard Deviation Upgrades	0,0593	**0,0565**	0,0347	0,0233	**0,0225**	**0,0117**
T-Test	-0,8361	**-1,9849**	0,3921	-0,8369	**-2,2212**	**-2,1199**
P-Value	40,390%	**4,830%**	69,530%	40,350%	**2,730%**	**3,500%**

Table 11: Welch's t-test for the difference between downgrades and upgrades.

THREE FACTOR MODEL WITH CHANGES						
Event Window	**CAAR [-20;+20]**	**CAAR [-20;+1]**	**CAAR [-1;+20]**	**CAAR [-1;+5]**	**CAAR [-5;+1]**	**CAAR [0;+1]**
Mean Downgrades	-0,007%	**-1,063%**	0,543%	-0,143%	**-0,737%**	**-0,414%**
Mean Upgrades	0,505%	**0,976%**	-0,140%	0,279%	**0,546%**	**0,210%**
Standard Deviation Downgrades	0,0946	**0,0709**	0,0690	0,0346	**0,0501**	**0,0200**
Standard Deviation Upgrades	0,0496	**0,0451**	0,0382	0,0231	**0,0227**	**0,0116**
T-Test	-0,4007	**-2,8991**	0,8638	-1,3508	**-2,8568**	**-2,9638**
P-Value	68,900%	**0,410%**	38,850%	17,800%	**0,460%**	**0,330%**

Table 12: Welch's t-test for the difference between downgrades and upgrades.

SINGLE FACTOR MODEL						
Event Window	**CAAR [-20;+20]**	**CAAR [-20;+1]**	**CAAR [-1;+20]**	**CAAR [-1;+5]**	**CAAR [-5;+1]**	**CAAR [0;+1]**
Mean Downgrades	-0,871%	**-1,733%**	0,096%	-0,424%	**-1,177%**	**-0,680%**
Mean Upgrades	0,760%	**1,199%**	-0,126%	0,225%	**0,547%**	**0,198%**
Standard Deviation Downgrades	0,0938	**0,0729**	0,0693	0,0398	**0,0530**	**0,0268**
Standard Deviation Upgrades	0,0620	**0,0576**	0,0355	0,0233	**0,0217**	**0,0116**
T-Test	-1,1661	**-2,4790**	0,2388	-1,1529	**-2,6381**	**-2,6110**
P-Value	24,470%	**1,390%**	81,150%	25,010%	**0,890%**	**0,960%**

The difference between the CAAR of a downgrade and the CAAR of an upgrade, as expected, is statistically significant for the following three event windows: [0; +1] [-5; +1], and [-20; +1] while it is not statistically significant for the other three event windows [-20; +20] [-1; +20], and [-1; +5]. In other words, while downgrades and upgrades do involve different information before and around the announcement date, they do not vehicle any different information after the announcement date.

7.1.4 Comparison among Rating Agencies

In this section, I investigate how reliable credit rating agencies are in relative terms, i.e. I attempt to test whether there is a credit rating agency among the Big Three which provides the market with more information. Table 13 shows that among the three rating agencies, the market seems more willing to follow actions made by Fitch in case of downgrades. This result sounds slightly unexpected since the credit rating industry has historically been dominated by Moody's and Standard and Poor's, while Fitch acquired a pivotal role in the marketplace only during the past 15 years and it still lags behind in terms of market share.

With respect to upgrades, the market seems more willing to follow actions made by Standard & Poor's.

Table 13: Average CARs for downgrades and upgrades divided by rating agency.

	Fitch Ratings	**Moody's Investors Service**	**Standard & Poor's**
DOWNGRADES	-0,878%	-0,059%	-0,677%
UPGRADES	0,064%	0,134%	1,084%

However, these differences are not statistically significant. For instance, the difference between Fitch Ratings and Moody's has a p-value approximately equal to 13%. Thus, is difficult to draw clear-cut conclusions from these numbers. Whereas the null hypothesis of zero mean difference cannot be rejected, downgrades made by Fitch are more often statistically significant than the other two rating agency. Furthermore, the same evidence holds for the upgrades issued by Standard & Poor's.

7.2 Impact of Downgrades and Upgrades on the Slope of the Yield Curve

From this evidence, it seems to be difficult to exploit any investment opportunities from a rating announcement because the significant impact is mostly during the pre-announcement window, and furthermore, when the CAAR is statistically significant on the event window [0; +1], i.e. in the case of a downgrade, this abnormal return disappears immediately. The question is whether it is possible to pinpoint a profitable trade in response to a credit rating announcement. To this aim, I investigate the effect on the slope of the yield curve. Precisely, the bonds I analyse are the 10 year constant maturity and the 30 year constant maturity government bond. Thus, I consider non parallel shifts in the term structure of interest rates. Tables 14, 15, and 16 exhibit my findings for downgrades: there is evidence of positive CAARs for the following event windows [-20; +20], [-1, +20], and [0; +1]. Precisely, the most remarkable finding is the statistically significant positive CAAR on the post-announcement window [-1, +20] with p-values of 4.58%, 7.784%, and 5.53% for the three models. This would imply that is possible to make a relative trade: precisely, a Flattener 10s30s, i.e. going short on the 10 year bond and, at the same time, going long on the 30 year one. Moreover, further evidence of a sharp increase in volatility after a downgrade is found. Appendices 6 and 7 display respectively the average abnormal returns and the cumulate average abnormal returns with respect to downgrades.

Table 14: Welch's t-test for the effect on the slope (Downgrades).

DOWNGRADES: MULTI INDEX MODEL WITH LEVELS						
TRADING STRATEGY: FLATTENER 10s30s (long 30y, short 10y)						
Event Window	**CAAR [-20;+20]**	**CAAR [-20; +1]**	**CAAR [-1;+20]**	**CAAR [-1;+5]**	**CAAR [-5;+1]**	**CAAR [0;+1]**
Mean	**2,339%**	-0,192%	**2,576%**	0,985%	0,018%	**1,143%**
T-Test	**-1,9241**	0,3881	**-2,0327**	-1,4877	-0,0427	**-1,9010**
P-Value	**5,835%**	69,911%	**4,582%**	14,126%	96,605%	**6,137%**

Table 15: Welch's t-test for the effect on the slope (Downgrades).

DOWNGRADES: MULTI INDEX MODEL WITH CHANGES						
TRADING STRATEGY: FLATTENER 10s30s (long 30y, short 10y)						
Event Window	**CAAR [-20;+20]**	**CAAR [-20; +1]**	**CAAR [-1;+20]**	**CAAR [-1;+5]**	**CAAR [-5;+1]**	**CAAR [0;+1]**
Mean	**1,975%**	0,594%	**2,447%**	0,804%	0,918%	**0,967%**
T-Test	**-1,6986**	-0,7550	**-1,7892**	-0,9896	-1,0915	**-1,7162**
P-Value	**9,372%**	45,274%	**7,784%**	32,575%	27,874%	**9,043%**

Table 16: Welch's t-test for the effect on the slope (Downgrades).

DOWNGRADES: SINGLE INDEX MODEL						
TRADING STRATEGY: FLATTENER 10s30s (long 30y, short 10y)						
Event Window	CAAR [-20;+20]	CAAR [-20; +1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	**2,141%**	0,740%	**2,533%**	0,777%	0,954%	**1,028%**
T-Test	**-1,7861**	-0,9100	**-1,9486**	-1,0293	-1,1488	**-1,7684**
P-Value	**7,835%**	36,592%	**5,530%**	30,684%	25,449%	**8,129%**

Tables 17, 18, and 19 depict the evidence with respect to upgrades. Although there is no evidence on the pre-announcement and post-announcement windows, there is a high statistically significant CAAR on the event window [0; +1], with p-values of 0.35%, 0.31%, and 0.35% for the three models. A potential investment strategy could be a steepener 10s30s, i.e. going long on the 10 year bond and going short on the 30 year one. Despite there is such a high significant CAAR, a potential investment strategy on the announcement date is less obvious. It would be interesting to deal with intraday data, investigating whether this price impact occurs prior or after the news is released. Appendices 8 and 9 exhibit respectively the average abnormal returns and the cumulate average abnormal returns with regard to upgrades.

Table 17: Welch's t-test for the effect on the slope (Upgrades).

UPGRADES: MULTI INDEX MODEL WITH LEVELS						
TRADING STRATEGY: STEEPENER 10s30s (long 10y, short 30y)						
Event Window	CAAR [-20;+20]	CAAR [-20; +1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	-0,520%	-1,418%	-1,603%	-2,248%	-2,375%	**0,545%**
T-Test	-0,1916	-0,5604	-0,5873	-1,0131	-0,8272	**3,4602**
P-Value	85,064%	58,350%	56,571%	32,709%	42,109%	**0,350%**

Table 18: Welch's t-test for the effect on the slope (Downgrades).

UPGRADES: MULTI INDEX MODEL WITH CHANGES						
TRADING STRATEGY: STEEPENER 10s30s (long 10y, short 30y)						
Event Window	CAAR [-20;+20]	CAAR [-20; +1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	-0,954%	-1,579%	-2,028%	-2,423%	-2,628%	**0,461%**
T-Test	-0,3532	-0,6289	-0,7155	-1,0436	-0,8822	**3,5225**
P-Value	72,883%	53,885%	48,529%	31,319%	39,157%	**0,308%**

Table 19: Welch's t-test for the effect on the slope (Downgrades).

UPGRADES: SINGLE INDEX MODEL						
TRADING STRATEGY: STEEPENER 10s30s (long 10y, short 30y)						
Event Window	CAAR [-20;+20]	CAAR [-20; +1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean	-0,620%	-1,129%	-1,960%	-2,279%	-2,205%	**0,579%**
T-Test	-0,2375	-0,4231	-0,7855	-1,0514	-0,7853	**3,4607**
P-Value	81,550%	67,823%	44,441%	30,974%	44,449%	**0,349%**

7.3 Implication of the European Debt Crisis on the credit rating announcement effect

In this section, I present my findings with regard to the implications of the European sovereign debt crisis on the credit rating announcement effect. As I have already specified in chapter 1, I considered May 9 2010 as a turning date since it is the foundation date of the EFSF.

Although there is some weak evidence that the $CAAR_{Post\text{-}crisis}$ is lower in absolute value than the $CAAR_{Pre\text{-}crisis,}$ the null hypothesis that this difference is zero cannot be rejected. Consequently, by performing a two-sample un-pooled Welch (1947) test, with unequal variances with unequal variances is not possible to discover any significant structural change in the dynamic of returns.

Therefore, it seems that the European debt crisis did not play any significant role on the credibility of the credit rating agencies. Whilst on the one hand, they lost some of their credibility; they still play a pivotal role from a regulatory point of view. However, this analysis paves the way for the application of some structural break models.

Nevertheless, by executing a Goldfeld-Quandt (1956)-test for equality of two variances the null hypothesis of equal variance can be rejected. Therefore, a statistically significant GQ-test for the variance implies that the volatility of AAR surge significantly after the debt crisis. Table 20, 21, and 22 clear up the findings.

Table 20: Goldfeld-Quandt (1956)-test for equality of two variances, respectively for downgrades and upgrades. Normal returns are obtained by means of the three factor model (with levels).

	DOWNGRADES: THREE FACTOR MODEL WITH LEVELS		UPGRADES: THREE FACTOR MODEL WITH LEVELS	
	Pre-Crisis	*Post-Crisis*	*Pre-Crisis*	*Post-Crisis*
Mean	-0,4509%	-0,4949%	0,0630%	0,9672%
Variance	0,00028	0,00073	0,00002	0,00091
Num of Obs	64	86	84	12
DoF	63	85	83	11
GQ test	2,6396		36,6421	

Table 21: Goldfeld-Quandt (1956)-test for equality of two variances, respectively for downgrades and upgrades. Normal returns are obtained by means of the Hahn & Lee three factor model (with changes).

	DOWNGRADES: THREE FACTOR MODEL WITH CHANGES		UPGRADES: THREE FACTOR MODEL WITH CHANGES	
	Pre-Crisis	*Post-Crisis*	*Pre-Crisis*	*Post-Crisis*
Mean	-0,4274%	-0,4042%	0,1077%	0,9232%
Variance	0,00027	0,00050	0,00003	0,00086
Num of Obs	64	86	84	12
DoF	63	85	83	11
GQ test	1,8102		27,6110	

Table 22: Goldfeld-Quandt (1956)-test for equality of two variances, respectively for downgrades and upgrades. Normal returns are obtained by means of the single factor model.

	DOWNGRADES: SINGLE INDEX MODEL		UPGRADES: SINGLE INDEX MODEL	
	Pre-Crisis	*Post-Crisis*	*Pre-Crisis*	*Post-Crisis*
Mean	-0,2145%	-0,9908%	0,0865%	0,9808%
Variance	0,00016	0,00107	0,00002	0,00090
Num of Obs	60	90	84	12
DoF	59	89	83	11
GQ test	6,7155		37,7506	

7.4 Eurozone vs. Non-Eurozone and Peripheral Countries vs. Non-Peripheral Countries

In this section, I present two issues which involve two categories of countries.

First, I aim at capturing the divergent investors' behaviour towards rating agency announcements, depending on if the European country belongs to the Eurozone or not. Hence, the question concentrates on investigating whether the Euro by itself represents a source of market turmoil. To this aim, I eliminate all the announcements released prior to the introduction of the single currency (January 1 1999)[18], then I divided my sample into two sub-samples: the former includes Eurozone countries while the latter comprises non Eurozone ones.

My findings are meaningful, because I have discovered that the Euro does represent neither an additional source of concern nor a potential benefit for a country. Since the differences between $CAAR_{Eurozone}$ and $CAAR_{Non\text{-}Eurozone}$ are not statistically significant for all event windows even at a 10% confidence level, it is clear-cut to conclude that the Single Currency does not further penalize their members. Since no result is statistically significant, I report in

[18] The Single Currency came into existence on January, 1st 1999, as a virtual currency. Euro banknotes and coins were officially introduced as a legal tender on January, 1st 2002.

tables 23 and 24 only the findings with regard to upgrades and downgrades for the three factor model with levels. The remaining two models show similar results.

Table 23: Welch's t-test for the difference between Eurozone and Non-Eurozone (Upgrades).

UPGRADES: THREE FACTOR MODEL WITH LEVEL						
Event Window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean Non-Eurozone	0,0156	0,0146	0,0022	0,0018	0,0032	0,0003
Mean Eurozone	0,0028	0,0112	-0,0032	0,0052	0,0068	0,0040
Standard Deviation Non-Eurozone	0,0658	0,0612	0,0274	0,0173	0,0116	0,0061
Standard Deviation Eurozone	0,0629	0,0623	0,0481	0,0335	0,0324	0,0171
T-Test	0,6249	0,1717	0,4447	-0,4142	-0,5033	-1,0200
P-Value	30,581%	70,924%	52,248%	61,386%	0,5446	0,2086

Table 24: Welch's t-test for the difference between Eurozone and Non-Eurozone (Downgrades).

DOWNGRADES: THREE FACTOR MODEL WITH LEVELS						
Event Window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean Non-Eurozone	-0,0046	-0,0186	0,0090	0,0055	-0,0148	-0,0011
Mean Eurozone	-0,0048	-0,0104	-0,0018	-0,0053	-0,0075	-0,0072
Standard Deviation Non-Eurozone	0,0997	0,0912	0,0644	0,0332	0,0551	0,0155
Standard Deviation Eurozone	0,0970	0,0727	0,0751	0,0403	0,0541	0,0261
T-Test	0,0096	-0,3624	0,5945	1,1264	-0,4946	1,1789
P-Value	98,963%	70,685%	54,633%	13,903%	0,5791	0,1494

Second, I examine the divergent investors' behaviour towards rating agencies announcements depending on whether the country is considered a 'Peripheral country' or not. The definition of Peripheral country corresponds to the one of PIIGS, the acronym which stands for Portugal, Ireland, Italy, Greece, and Spain[19].

As shown in tables 25, 26, and 27 the event windows [-1; +20], [-5; +1], and [0; +1] are always statistically significant while the [-20; +20], [-1; +5], and [-20; +1] are not. This seems to show that PIIGS are perceived more risky and thus, the market fails to immediately adjust to the new information and the selling pressure persists over time. However, the fact that these markets, apart from the case of Italy and partially Spain, are much less liquid and efficient than the European average helps at explaining this significant spread in returns after the announcement.

[19] This term was introduced by the Financial Times' Investment Editor James Mackintosh in February 2010.

Table 25: Welch's t-test for the difference between Peripheral countries and Non- Peripheral countries (Downgrades).

DOWNGRADES: THREE FACTOR MODEL WITH LEVELS						
Event Window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean Non-PIIGS	0,0070	-0,0110	**0,0145**	**0,0045**	-0,0080	**-0,0015**
Mean PIIGS	-0,0110	-0,0128	**-0,0057**	**-0,0074**	-0,0112	**-0,0072**
Standard Deviation Non-PIIGS	0,0907	0,0792	**0,0558**	**0,0316**	0,0437	**0,0147**
Standard Deviation PIIGS	0,0974	0,0733	**0,0780**	**0,0408**	0,0578	**0,0274**
P-Value	25,055%	88,486%	**6,862%**	**4,899%**	70,223%	**9,349%**

Table 26: Welch's t-test for the difference between Peripheral countries and Non- Peripheral countries (Downgrades).

DOWNGRADES: THREE FACTOR MODEL WITH CHANGES						
Event Window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean Non-PIIGS	0,0130	-0,0108	**0,0205**	**0,0046**	-0,0066	**-0,0014**
Mean PIIGS	-0,0084	-0,0102	**-0,0048**	**-0,0057**	-0,0081	**-0,0062**
Standard Deviation Non-PIIGS	0,0947	0,0738	**0,0560**	**0,0301**	0,0433	**0,0144**
Standard Deviation PIIGS	0,0949	0,0701	**0,0759**	**0,0373**	0,0550	**0,0230**
P-Value	17,974%	96,366%	**2,134%**	**6,662%**	85,627%	**9,621%**

Table 27: Welch's t-test for the difference between Peripheral countries and Non- Peripheral countries (Downgrades).

SINGLE INDEX MODEL: DOWNGRADES						
Event Window	CAAR [-20;+20]	CAAR [-20;+1]	CAAR [-1;+20]	CAAR [-1;+5]	CAAR [-5;+1]	CAAR [0;+1]
Mean Non-PIIGS	0,0008	-0,0191	**0,0149**	**0,0037**	-0,0103	**-0,0027**
Mean PIIGS	-0,0152	-0,0162	**-0,0086**	**-0,0097**	-0,0128	**-0,0096**
Standard Deviation Non-PIIGS	0,0890	0,0752	**0,0551**	**0,0319**	0,0438	**0,0179**
Standard Deviation PIIGS	0,0969	0,0718	**0,0764**	**0,0438**	0,0587	**0,0312**
P-Value	29,759%	81,337%	**3,046%**	**3,255%**	76,436%	**9,150%**

8 Conclusions

The aim of this work was to analyse the impact of the information supplied by credit rating agencies on the financial market. In this conclusion, I summarize my main findings, and I pave the way for further research conducted upon the work I have started here.

Firstly, there is strong evidence supporting that both upgrades and downgrades are anticipated by the financial market. Especially in case of upgrades, this implies that rating agencies do not drive the market conveying new price-relevant information, but they are market followers. It seems to be that rating agencies react, often with some delay, to the information provided by the financial market. By rephrasing, while market movements do cause rating agencies adjustments, they do not cause the market reaction.

Secondly, consistent with a large chunk of the existing literature, I provide further evidence that the reaction to rating announcements is asymmetric; however, this asymmetry is clear-cut only around the announcement date [0; +1]. Indeed, downgrades supply price-relevant information, while upgrades do not exhibit any significant positive CAAR around the announcement date.

Thirdly, even in case of downgrades such price-relevant information is almost immediately processed by market players, and accordingly to the efficient market hypothesis there is no room for exploiting any abnormal returns after the event date. Indeed, all the post-event windows are not statistically significant.

Fourthly, downgrades generate a persistent surge in volatility after the event date. Therefore, also the volatility reaction may be seen as asymmetric, since the same does not hold for upgrades.

Fifthly, I exhibit that downgrades are perceived as different from upgrades only on pre-announcement windows and on the announcement window while the market does not evaluate them differently afterwards.

Sixthly, another result is that, among the three rating agencies the market seems to rely slightly more on Fitch in case of downgrades and on Standard & Poor's in case of upgrades. However, these results, having very little statistical significance, are difficult to be evaluated precisely and overall a rating action is perceived almost in the same extent, regardless the name of the credit rating agency which released it.

Seventhly, investigating the impact of the credit rating announcement on the slope of the sovereign yield curve there seems to be some evidence against the efficient market hypothesis. Actually, it could be possible to exploit an investment opportunity by going short on the 10 year bond and going long on the 30 year bond, i.e. by performing a Flattener 10s30s.

Eighthly, it seems that the European sovereign debt crisis did not play a significant role on the credibility of the credit rating agencies. Whilst they lost some of their credibility, they still play a pivotal role from a regulatory point of view. Indeed, although there is some weak evidence that the $CAAR_{Post\text{-}crisis}$ seems to be lower in absolute value than the $CAAR_{Pre\text{-}crisis}$, the null hypothesis that this difference is zero cannot be rejected. Nevertheless, the volatility of AAR has increased sharply after the debt crisis.

Finally, on the one hand the presence of a country in the Eurozone does not seem to be a penalizing factor; on the other hand, if a country is labelled as a PIIGS it has to pay higher costs when it is downgraded. Moreover, the so called PIIGSs experience statistically significant negative abnormal returns even after the event date.

While the results of this paper are in large extent conclusive, there are still grounds for further research. This work encourages the following new studies in six directions.

First, further research should investigate the existence of spill over effects. In presence of a rating announcement, I would compute the CAARs not only for the country subject to the action, but also for all the other European countries.

Second, further research should also address a liquidity issue: there might be some 'extreme' values in the dataset due to the scarce bond liquidity of some smaller markets. The idea is to weight each effect by the size of the debt outstanding. By doing so I would try to replicate the portfolio allocation of the median institutional investor, in order to study the real impact on her or his portfolio.

Third, additional research should focus on testing investment strategies in light of my findings, and evaluating whether these are still profitable even after having taken into account transaction costs.

Fourth, it would be remarkable to examine in more detail the effect of a rating action on volatility and on volume, with particular reference to the investment grade threshold.

Fifth, a potential beneficial improvement for the analysis would be the use of intraday data. While the time span covered would be shorter, due to limited availability of high frequency data, the improvement in the quality of the measurement would allow a better understanding of the exact moment and the magnitude of the market reaction to the rating action, increasing the effectiveness of the analysis.

Fifth, a further research proposal would test more accurately whether and when there were changes in the investors' perception of credit rating agencies, it may be pursued by applying structural break models.

Sixth, another remarkable research path is the study of the determinants of sovereign credit ratings though using an ordered probit model.

9 Appendix

Appendix 1: The three rating scales and their numerical transformations

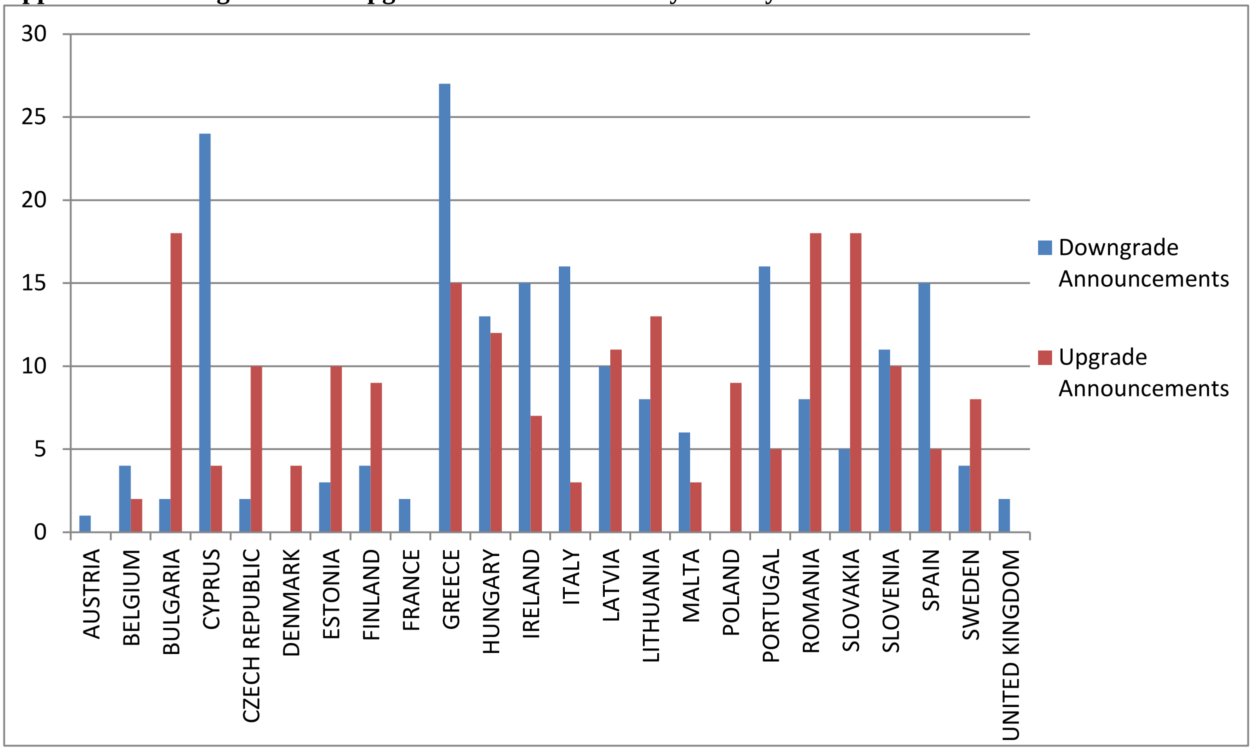
	FITCH		S&P		MOODY'S	
Investment Grade	AAA	23	AAA	23	Aaa	23
	AA+	22	AA+	22	Aa1	22
	AA	21	AA	21	Aa2	21
	AA-	20	AA-	20	Aa3	20
	A+	19	A+	19	A1	19
	A	18	A	18	A2	18
	A-	17	A-	17	A3	17
	BBB+	16	BBB+	16	Baa1	16
	BBB	15	BBB	15	Baa2	15
	BBB-	14	BBB-	14	Baa3	14
Non-Investment Grade	BB+	13	BB+	13	Ba1	13
	BB	12	BB	12	Ba2	12
	BB-	11	BB-	11	Ba3	11
	B+	10	B+	10	B1	10
	B	9	B	9	B2	9
	B-	8	B-	8	B3	8
	CCC+	7	CCC+	7	Caa1	7
	CCC	6	CCC	6	Caa2	6
	CCC-	5	CCC-	5	Caa3	5
	CC	4	CC	4	Ca	4
	C	3	C	3	C	3
	RD	2	SD	2	/	/
	D	1	D	1	/	/

Appendix 2: Actual European Sovereign Ratings as of May 15 2013

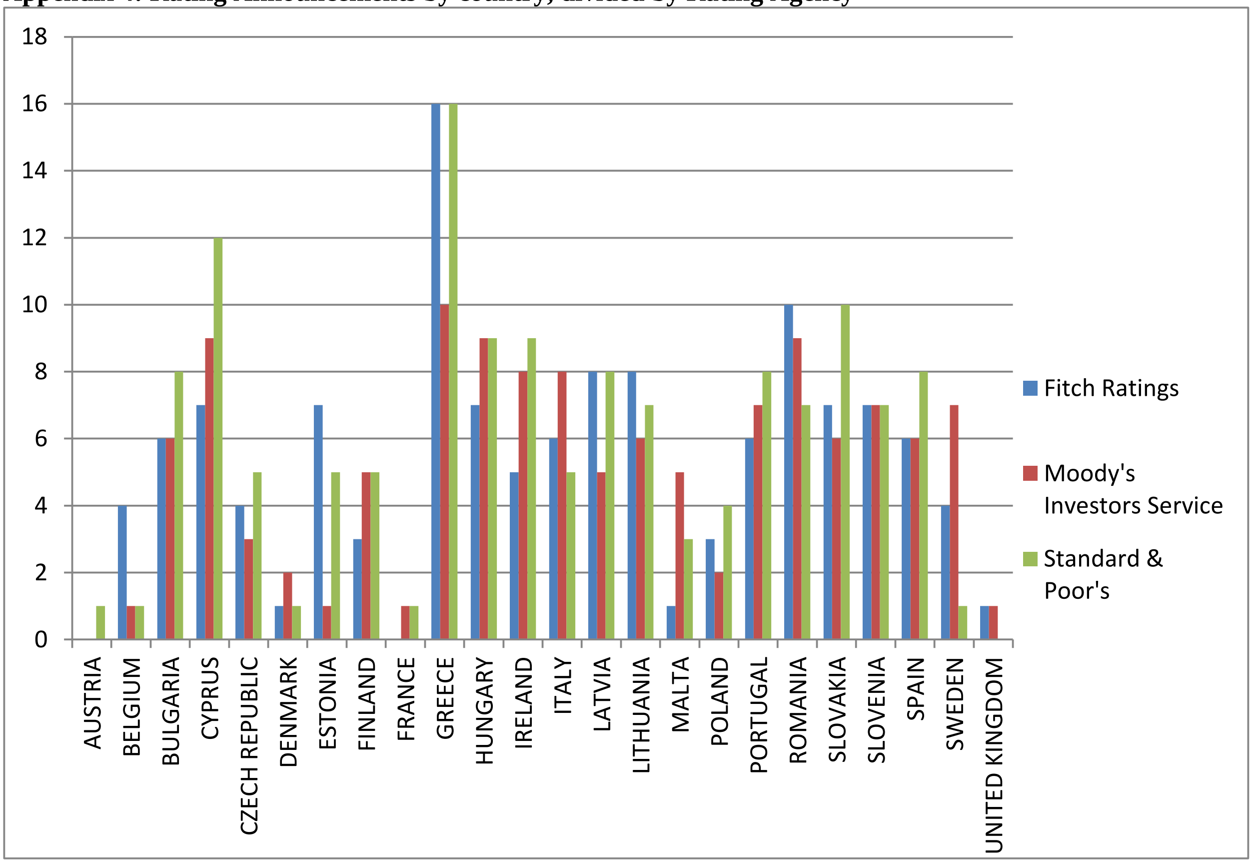
	Moody's	*S&P*	*Fitch*
Austria	Aaa	AA+	AAA
Belgium	Aa3	AA	AA
Bulgaria	Baa2	BBB	BBB-
Cyprus	Caa3	CCC	B
Czech Republic	A1	AA-	A+
Denmark	Aaa	AAA	AAA
Estonia		AA-	A+
Finland	Aaa	AAA	AAA
France	Aa1	AA+	AAA
Germany	Aaa	AAA	AAA
Greece	C	B-	B-
Hungary	Ba1	BB	BB+
Ireland	Ba1	BBB+	BBB+
Italy	Baa2	BBB+	BBB+
Latvia	Baa2	BBB	BBB
Lithuania	Baa1	BBB	BBB+
Luxembourg	Aaa	AAA	AAA
Malta		BBB+	A+
Netherlands	Aaa	AAA	AAA
Poland	A2	A-	A-
Portugal	Ba3	BB	WD
Romania	Baa3	BB+	BBB-
Slovakia	A2	A	A+
Slovenia	Ba1	A-	A-
Spain	Baa3	BBB-	BBB
Sweden	Aaa	AAA	AAA
United Kingdom	Aa1	AAA	AA+

Source: Bloomberg

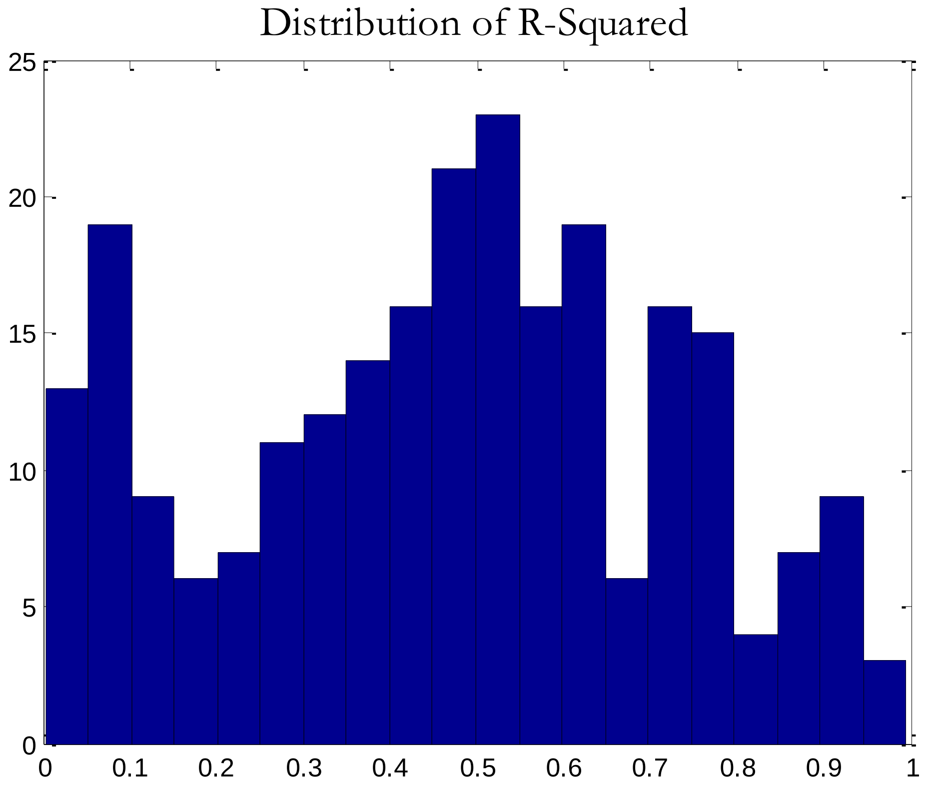
Appendix 3: Downgrades and Upgrades Announcements by country



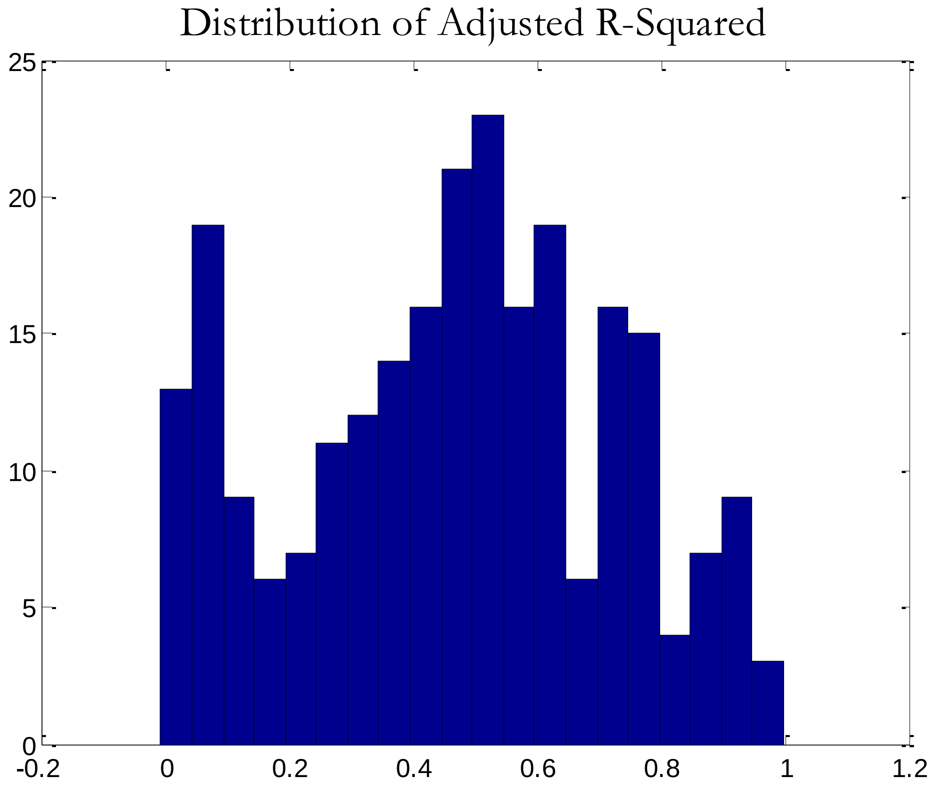
Appendix 4: Rating Announcements by country, divided by Rating Agency



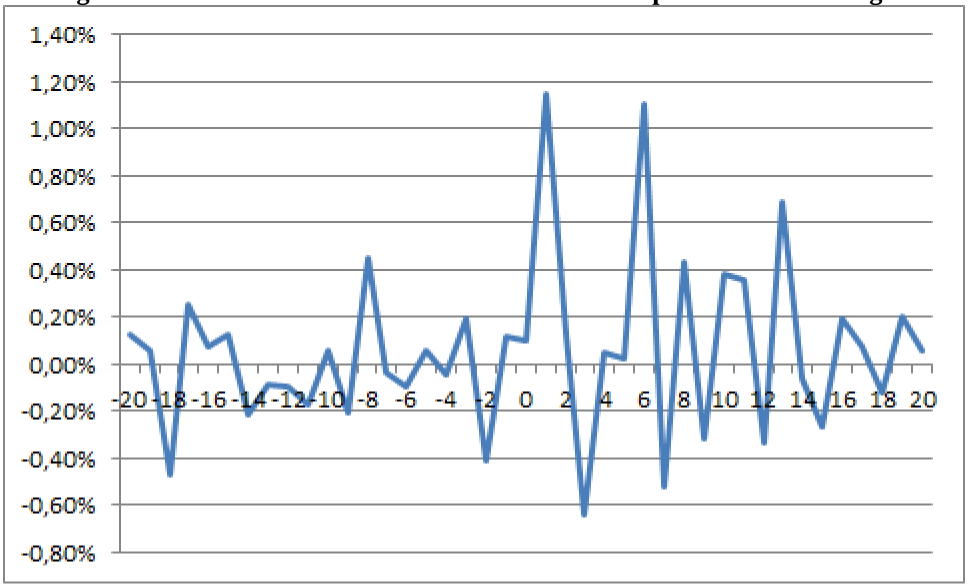
Appendix 5: Distribution of R-Squared (Hahn and Lee three factor model)



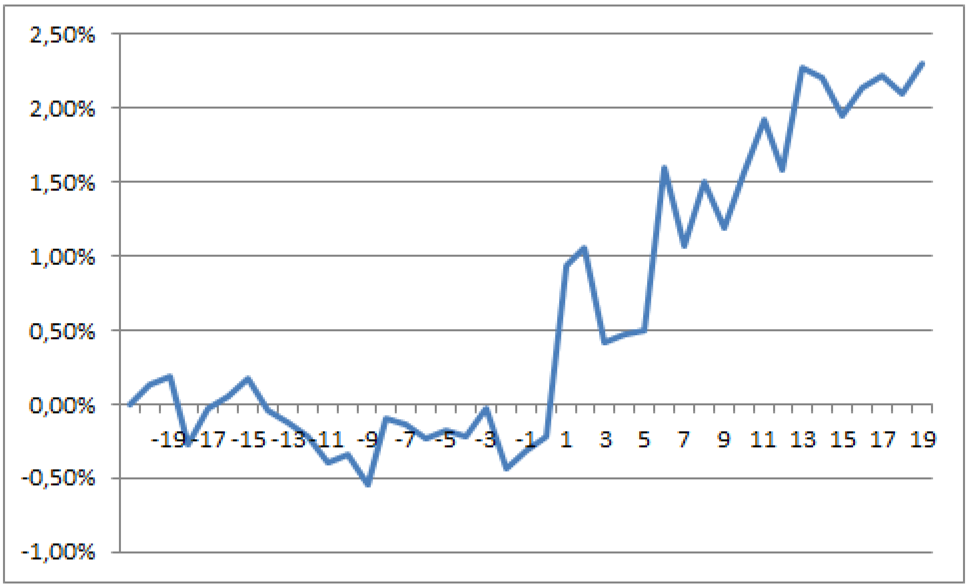
Appendix 6: Distribution of Adjusted R-Squared (Hahn and Lee three factor model)



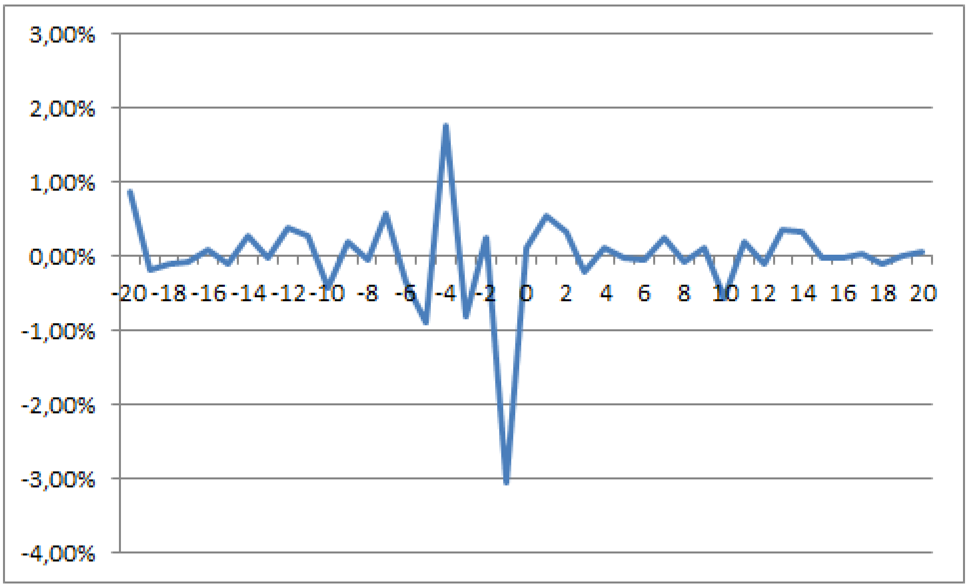
Appendix 7: Average Abnormal Return of a Bear Flattener 10s30s in presence of a downgrade



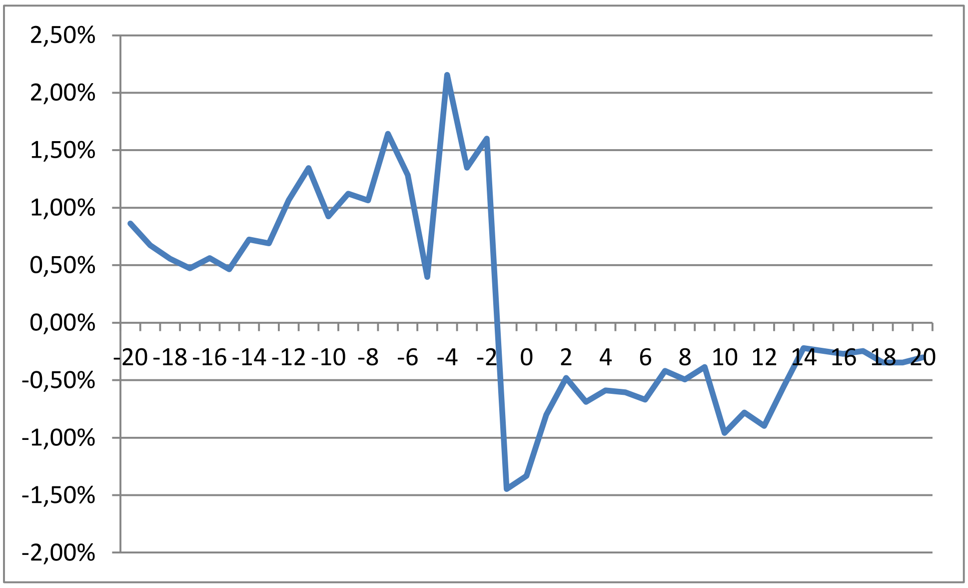
Appendix 8: Cumulative Average Abnormal Return of a Bear Flattener 10s30s in presence of a downgrade [-20;+20]



Appendix 9: Average Abnormal Return of a Steepener 10s30s in presence of an upgrade



Appendix 10: Cumulative Average Abnormal Return of a Steepener 10s30s in presence of an upgrade



10 References

1. Ball, R., and Brown, P. (1968). An Empirical Evaluation of Accounting Income Numbers, Journal of Accounting Research, 6; pp. 159-178.
2. Batchelor , R., and Manzoni, K. (2006). The Dynamics of bond yields around rating revision dates. Journal of Financial Research XXIX, No. 3, pp. 405–420
3. Beck, T., Uhlig, H., and Wagner, W. (2011). Insulating the financial sector from the European debt crisis: Eurobonds without public guarantees, VoxEU.org, 17 September 2011.
4. Becker, B., and Milbourn, T., T. (2009). Reputation and Competition: Evidence from the Credit Rating Industry. Working Paper 09-051, Harvard Business School, Cambridge.
5. Becker, B., and Milbourn, T., T. (2010). How Did Increased Competition Affect Credit Ratings? Harvard Business School Finance Working Paper No. 09-051.
6. Bessembinder, H., Kahle, K., M., and Xu, D. (2009). Measuring Abnormal Bond Performance. The Review of Financial Studies v 22 n 10.
7. Bessembinder, H., Panayides, M., and Venkataraman, K., (2009). Hidden Liquidity: An Analysis of Order Exposure Strategies in Automated Markets. Journal of Financial Economics, 94 (3), pp. 361-383.
8. Bijlsma, M., and Vallée, S. (2012). The creation of euro area financial safety nets, Bruegel Working Papers 2012/09.
9. Binder, J., J. (1998). The Event Study Methodology Since 1969 Review of Quantitative Finance and Accounting, 11; pp. 111–137
10. Bodie, Z., Kane A., and Marcus, A., J. (2011). Investments and Portfolio Management, 9th Edition. (Mc Graw-Hill).
11. Boquist, J., A., Racette, G., A., and Schlarbaum, G., G. (1975). Duration and Risk Assessment for Bonds and Common Stocks. The Journal of Finance 30 (5), pp. 1360–1365.
12. Brown, S., and Warner, J. (1980). Measuring Security Price Performance, Journal of Financial Economics 8, pp. 205-258.
13. Brown, S., and Warner, J. (1985). Using Daily Stock Returns: The Case of Event Studies. Journal of Financial Economics 14, pp. 3-31.
14. Brown, S., J., and Weinstein, M., I., (1985) Derived factors in event studies, Journal of Financial Economics, Elsevier, vol. 14; pp 491-495
15. Bruner, R., F. (2004). Does M&A pay? Applied Mergers and Acquisitions, New Jersey: Wiley Finance, pp. 30-86.

16. Calderoni, F., Colla, P., Gatti, S. (2009). Rating changes across Europe. Working paper, Bocconi University.
17. Campbell, J., C., Lo, A., W., and MacKinlay, A., C. (1997). The Econometrics of Financial Markets (CLM), New Jersey: Princeton University Press.
18. Cantor R., and Packer F. (1996). Determinants and impact of Sovereign credit ratings. Economic Policy Review, pp. 37-54.
19. Carretta, A., Farina V., Fiordelisi, F., Martelli, D., and Schwizer, P. (2011). The Impact of Corporate Governance Press News on Stock Market Returns. European Financial Management, 17, pp. 100–119.
20. Cornell, B., Landsman, W., and Shapiro, A., C. (1989). Cross-Sectional Regularities in the Response of Stock Prices to Bond Rating Changes. Journal of Accounting, Auditing and Finance, 4, pp. 460-479.
21. De Santis, A., R. (2012). Safe Haven, Credit Rating Agencies and the Spread of the fever from Greece, Ireland and Portugal, ECB Working Paper Series, N 1419.
22. Dichev, I., D., and Piotroski, J., D. (2001). The long-run stock returns following bond ratings changes. Journal of Finance 56, pp. 173-204.
23. Dieckmann, S. (2012). The Announcement Effect of the EFSF. AFA 2013, San Diego Meetings Paper.
24. Dolley, J., C. (1933). Common Stock Split-Ups, Motives and Effects. Harvard Business Review, 12; pp. 70 –81.
25. Ederington, L., and Yawitz, J., (1991). The Bond Rating Process, The Financial Handbook, 6th ed. Financial Quarterly; pp. 18-26
26. Elton, E., J., Gruber, M., J., and Blake, C., R. (1995). Fundamental economic variables, expected returns, and bond fund performance. The Journal of Finance, 50(4); pp. 1229–1256.
27. Fama, E., F., and French, K., R. (1992). The Cross-Section of Expected Stock Returns. Journal of Finance, 47 (2), pp. 427-465.
28. Fama, E., F., and French, K., R. (1993). Common Risk Factors in the Returns on Stocks and Bonds. Journal of Financial Economics, 33 (1), pp. 3–56.
29. Fama, E., Fisher, L., Jensen, M., and Roll, R. (1969). “The Adjustment of Stock Prices to New Information”, International Economic Review, 10; pp. 1-21.
30. Fang, Z., and Woo, C., K. (1991). Two Factor Model for Bond Selection. Economics Letters 37, pp. 417-421.
31. Favero, C., A., and Missale, A. (2012). Sovereign spreads in the euro zone: which prospects for a Eurobond, Economic Policy, April 2012, iss. 70, pp. 231-68.

32. Ferreira, M., and Gama, P. (2007). Does sovereign debt ratings news spill over to international stock markets? Journal of Banking and Finance 31, pp. 62-82.
33. Ferri, G., Liu, L.-G. and Stiglitz, J., E. (1999). The Procyclical Role of Rating Agencies: Evidence from the East Asian Crisis. Economic Notes, 28: 335–355.
34. Fitch Ratings (2013). Definitions of Ratings and Other Forms of Opinion.
35. Giannetti, M., and Laeven, L. (2012). Flight Home, Flight Abroad, and International Credit Cycles. American Economic Review: Papers & Proceedings 2012, 102(3): pp. 219–224.
36. Giannetti, M., and Simonov, A. (2013). On the Real Effects of Bank Bailouts: Micro Evidence from Japan. American Economic Journal: Macroeconomics, 5(1): pp.135–167.
37. Glenn, V., and Henderson, J. (1990). Problems and Solutions in Conducting Event Studies, Journal of Risk and Insurance 57, pp. 282-306.
38. Goh, J., C., and Ederington, L., H. (1993). Is a bond rating downgrade bad news, good news, or no news for stockholders? Journal of Finance 48, pp. 2001–2008.
39. Goldfeld, S., M., and Quandt, R., E. (1965). Some Tests for Homoscedasticity. Journal of the American Statistical Association 60, pp. 539—547.
40. Green, T., C. (2004). Economic news and the impact of trading on bond prices. Journal of Finance 59, pp. 1201–1233.
41. Griffin, P., A., and Sanvicente, A., Z. (1982). Common Stock Returns and Rating Changes: A Methodological Comparison, Journal of Finance 37, pp. 103-119.
42. Gultekin, G., R., and Rogalski, R., J. (1985). Alternative Duration Specifications and the Measurement of Basic Risk: Empirical Tests. Journal of Business 57 (2), pp. 241-264.
43. Gultekin, N., B., and Rogalski, R., J. (1985) Government bond returns, measurement of interest rate risk, and the arbitrage pricing theory. Journal of Finance 40, pp. 43-61.
44. Gutierrez, R., Maxwell, W., and Xu, D. (2007). Performances and Flows of Corporate-Bond Funds. Working Paper, University of Arizona.
45. Hahn, J., and Lee, H., (2006). Yield spreads as alternative risk factors for size and book-to-market. Journal of Financial and Quantitative Analysis 41, pp. 245–269.
46. Hand, J., Holthausen, R., W., and Leftwich, R., W. (1992). The effect of bond rating agency announcements on bond and stock prices. Journal of Finance 47, pp. 733–752.
47. Handjinicolaou, G., and Kalay, A. (1984). Wealth Redistributions or Changes in Firm Value: An Analysis of Returns to Bondholders and Stockholders around Dividend Announcements. Journal of Financial Economics 13, pp. 35–63.
48. Hite, G., and Warga, A. (1997). The effect of bond-rating changes on bond price performance. Financial Analysts Journal, pp. 35–51.

49. Holthausen, R., W., Leftwich, R., W. (1986). The Effect of Common Bond Rating Changes on Common Stock Prices. Journal of Financial Economics, 17 (1), pp. 57-89.
50. Hooper, V., Hume, T., and Kim, S. J. (2008). Sovereign rating changes – Do they provide new information for stock markets? Economic System 32, pp. 142-166.
51. Jorion, P., and Zhang, G. (2007). Information effects of bond rating changes: the role of the rating prior to the announcement. Journal of Fixed Income 16, pp. 45-59.
52. Jorion, P., Liu, Z., and Shi, C. (2005). Informational effects of regulation FD: evidence from rating agencies, Journal of Financial Economics, 76, pp. 309-330.
53. Kaplan, R., S., and Urwitz, G. (1979). Statistical Models of Bond Ratings: A Methodological Inquiry, Journal of Business 52, 231–261.
54. Katz, S. (1974). The price and adjustment process of bonds to rating reclassifications: a test of bond market efficiency. Journal of Finance 29, pp. 551–559.
55. Kliger, D., and O, Sarig. (2000). The information value of bond ratings. Journal of Finance 55, pp. 2879-2902.
56. Klinger, D., and Sarig, O., (2000). The Information Value of Bond Ratings. The Journal of Finance 55, pp. 2879-902.
57. Kolari, J., W., and Pynnonen, S. (2010). Event study testing with cross-sectional correlation of abnormal returns, Review of Financial Studies 23; pp. 3996-4025.
58. Kramer, L., A. (2001). Alternative Methods for Robust Analysis in Event Study Applications. Working Paper.
59. Lehnert, T., and Neske, F. (2006). On the relationship between credit rating announcements and credit default swap spreads for European reference entities. Journal of Credit Risk 2, pp. 83-90.
60. Linciano, N., (2004). The Reaction of Stock Prices to Rating Changes. Working Paper.
61. Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. Review of Economics and Statistics. 47 (1), pp. 13–37.
62. MacKinlay, A., C. (1997). Event studies in economics and finance, Journal of Economic Literature 35, pp. 13-39.
63. Markowitz, H. (1952). Portfolio Selection. The Journal of Finance, 7 (1), pp. 77-91.
64. May, A., D. (2010). The Impact of Bond Rating Changes on Corporate Bond Prices: New Evidence from the Over-the-Counter Market. Journal of Banking and Finance, Vol. 34, pp. 2822-2836.
65. Michaelides, A., Milidonis, A., Nishiotis, G., and Papakyriacou, P. (2012). Sovereign debt rating changes and the stock market. CEPR Discussion Paper No. 8743.

66. Mitchell, M., L., and Netter, J., M. (1994). The Role of Financial Economics in Securities Fraud Cases: Applications at the Securities and Exchange Commission. Business Lawyer, 49, pp. 545-590.
67. Moody's Investor Service (2009). Moody's Rating Symbols & Definitions.
68. Parnes, D. (2008). Why do bond and stock prices and trading volume change around credit rating announcements? The Journal of Behavioral Finance 9, pp. 224-231.
69. Pinches, G., E., and Singleton, J., C. (1978). The adjustment of stock prices to bond rating changes. Journal of Finance 33, pp. 29–44.
70. Prinz, A., and Beck, H. (2012). Fighting Debt Explosion in the European Sovereign Debt Crisis – Eurobonds, Leveraging EFSF and Euro-TARP, Intereconomics / Review of European Economic Policy, May 2012, v. 47, iss. 3, pp. 185-89.
71. Pynnönen, S. (2005). On regression based event study. Working Paper.
72. Reilly, F., K., and Joehnk, M., D. (1976). The association between market-determined risk measures for bonds and bond ratings. The Journal of Finance 31, pp. 1387-1403.
73. Romero, P., A., and Robles-Fernandez, M., D. (2006). Risk and return around bond rating changes: new evidence from the Spanish stock market. Journal of Business Finance & Accounting 33, pp. 885-908.
74. Ross, S. (1976). The arbitrage theory of capital asset pricing. Journal of Economic Theory 13 (3), pp. 341–360.
75. Ryan, J. (2012). The Negative Impact of Credit Rating Agencies and Proposals for Better Regulation. Working Paper FG 1, SWP Berlin.
76. Sharpe, W., F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. Journal of Finance. 19 (3), pp. 425–442.
77. Steiner, M., and Heinke, V. G. (2001). Event study concerning international bond price effects of credit rating actions. International Journal of Finance and Economics 6, 139–157.
78. Stickel, S., E. (1986). The effect of preferred stock rating changes on preferred and common stock prices. Journal of Accounting and Economics 8(3), pp. 197-215.
79. Wakeman, L., M, (1981). "The Real Function of Bond Rating Agencies" Chase
80. Wansley, J., W., and Clauretie, T., M. (1985). The impact of Credit watch placements on equity re-turns and bond prices, Journal of Financial Research 8, pp. 31-42.
81. Wansley, W., J., Glascock, J., L., and Clauretie T., M. (1992). Institutional bond pricing and information arrival. The case of bond rating changes. Journal of Business Finance & Accounting, 19.

82. Weinstein, M. (1977). The Effect of a Rating Change Announcement on Bond Price, Journal of Financial Economics, 5; pp.329-350.
83. Welch, B., L. (1947). The generalization of "Student's" problem when several different population variances are involved. Biometrika 34 (1–2): pp. 28–35.
84. White, H. (1980). A Heteroskedasticity Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, Econometrica 48, pp. 817-838.

11 Databases and Other Sources

- Bloomberg
- Datastream
- Fitchrating.com
- Moodys.com
- Standardandpoors.com
- Factiva
- Wsj.com
- Ft.com