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Unpacking the Impact of CRAs Watch Announcement on EU Sovereign Bond Yields: Empirical Examination of Ex Ante and Post Ante Effects of the CRAII Regulation

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Abstract. The paper aims to analyze whether if, there is a correlation relationship between Credit Rating Agencies' (CRAs) watch announcements on EU sovereign bond yields and EU sovereign bond yields after the implementation of CRA II regulation. In theory, the role of rating agencies is to provide key information to investors regarding the risk associated with in investing in sovereign bonds… However, it remains unclear whether CRAs influence EU sovereign bond yields. Sovereign bond yields are collected for Austria, Germany, Belgium, Finland, France, the Netherlands, Ireland, Italy, Spain and Portugal. This country sample represents the empirical analysis of our study. Data used for this analysis includes information on European sovereign bond yields, credit watch announcements from Standard & Poor's Financial Services, Moody's Investors Service and Fitch Ratings and interest rate volatility are all extrapolated from Bloomberg Database. European sovereign bond yields are collected from 1940 until 2015. Our study conducted multiple linear regressions tests in order to determine if evidence exists whether there a change in yield is determined by a watch announcement made by the big three credit rating agencies before and after the introduction of the CRA II Regulation and hence, whether CRAs do influence yields with their watch announcements. According to the F-test and p-value results, the study of sovereign bonds with ten and five-year maturities shows statistical significance in both situations at a 95% and 99% confidence level. With 0 for all regression analyses, interest rate volatility is also statistically significant.

Keywords: Credit rating agencies, sovereign bond yields, contagion effect, risk, sovereign debt.

INTRODUCTION

By giving the highest ratings to dangerous financial instruments during the U.S. subprime mortgage crisis, the key companies in the credit rating sector Standard & Poor's Financial Services, Moody's Investors Service, and Fitch Rating significantly contributed to the collapse of capital markets. As the real estate bubble collapsed and the crisis spread into a global recession, European economies were battered. Credit rating agencies (CRAs) downgraded governments and yields of sovereign bonds rose to a record high. Governments could no longer meet their debt obligations, which subsequently led to the intervention by the European Union (EU). Resulting from those events, the EU introduced several regulations in order to prevent future crises. As CRAs played a major role in the development of the financial crisis, the EU introduced the CRA II Regulation for making credit rating agencies less influential for investors.

The role of CRAs as gatekeepers of the debt market, has triggered a plethora of research interest in the past and in particular, rating agencies were under the spotlight during the global financial meltdown due to their failure to properly rate financial products [1]. Further studies [10, 38, 39] have attempted to examine CRAs rating actions of economies and financial markets raising some concern about how ratings are conducted. In Europe, the sovereign rating actions have been consistent and

insightful because of the influence of "sovereign ceiling". However, sovereign rating and sovereign ceiling are interrelated because sovereign rating addressed the likelihood of how the government will commit to its debt obligations, whereas the later indicates the possible tendency of the government interfering with the private sector debt service. Historically, the CRAs have come under intense scrutiny and regulatory debate on whether their rating actions do have the propensity to increase the dynamics of crises. Research critics have continuously viewed that CRAs have a tendency to assign inflated ratings [15]. This means that the CRAs assess the possible probability that will result in issuers defaulting on bonds. Kräussl [29] conducted a rigorous event study whereby he focused on the emerging market during the Asian financial meltdown of 1997–1998. The aim of his study was evaluate the extent and impact of sovereign credit ratings on these economies. In his findings, he concluded that the regression results showed that CRAs have a significant influence on "the size and volatility" when it comes to lending within the emerging markets. Evidently, Kraus [29] also showed within his empirical findings that results were far much stronger when it comes to government downgrades.

It is paramount to note that the risk assessment conducted and assigned by CRAs under the directive of individual central governments have increased significantly, which means the investor uncertainty is greatly reduced due to risk exposure. Thus, CRAs have brought the contagion risk to the fore.

In our paper, we make an attempt to analyze whether there is a relationship between CRA's watch announcements on EU sovereign bond yields and EU sovereign bond yields after the implementation of CRA II regulation credit rating watch announcement effects on EU sovereign bond yields before *(ex-ante*) and after (*post-ante*) the CRA II Regulation. In our study, we focus on the CRA II Regulation, as this was the first regulation implemented in the EU for supervising and regulating CRAs uniformly on a European-wide level.

Furthermore, the issue of sovereign credit ratings have enabled a significant number of national governments to access the international bond markets, despite the fact that a number of these governments had historically suffered from debt default, which subsequently led to downgrading.

In Europe, during the sovereign debt crisis, the rating agencies´ actions spotlighted the potential of spill over effects or broadly termed as contagion. Caselli et al. [19] contend that because to their current holdings of sovereign debt, collateral, and implicit government guarantees, banks are significantly impacted by sovereign rating actions both domestically and globally.

The following empirical research seeks to quantify the degree to which the main three credit rating agencies continue to influence European sovereign bond yields following the implementation of the CRA II Regulation. The key focus here is the *impact* and *influence* of credit watch announcements on foreign currency in the *long term.* For the analysis, the authors rely on the statistical analysis conducted by Cantor and Packer [18] and Bradley and Gulati [16] in order to build a robust statistical analysis tool.

The remainder of the essay is structured as follows: The research goals section of the article provides a clear explanation of the paper's goals and objectives. Section 3 gives and overview discussion on the related literature, pertaining to the topic under study. Section 4 discusses the methodology adopted for this study followed by the main research findings and Section 5 draws the conclusions of the study.

LITERATURE REVIEW

The unleashing of the European sovereign debt crisis in 2009 contributed to a significant level of research interest because of factors related to the sovereign rating outcomes as well as actions upon capital markets and institutions. A spectrum of studies has focused on two areas such as own country effects and spillover effects on banks [8] as well as bond markets [3]. Using information on the yield on EU sovereign bonds and the spread between Credit Default Swaps (CDS), Afonso et al. [3] conducted an event study analysis to examine how governments react to yield spread before and after the rating announcements from the rating agencies (Standard and Poor's, Moody's, and Fitch). Using an event study methodology, Afonso et al. [3] discovered that changes in rating notations as well as future outlooks significantly affected government bond yield spreads, especially when the announcements were seen as being unfavourable. This means that when examining the impact of domestic micro factors on their influence on bond yield spread, the findings showed that there was a significant increase during periods of financial crisis, in particular with reference to international investors who discriminate between countries with unfavourable economic climate.

This is primarily caused by a confluence of strong risk aversion and significant current account deficits, which tend to amplify the impact of deteriorating public finances on the yield spread on government bonds.

When examining credit watch announcements, previous studies (e.g. Kräussl, [29]), indicate that they are not anticipated at a one to two months horizon, but they find a bi-directional causality between ratings and spreads within one to two weeks. Moreover, according to their analysis, [3] there is a spillover effect especially from those countries that have a lower rating to those that have a a higher rating and there it is also observed that a persistence effect is present for those countries that may have been

recently downgraded. By analysing the effect of CRAs' announcement on the value of the Euro currency as well as yields from the following nations, Baum et al. [11] provided consistent evidence in their study: Germany, Italy, Spain, and France. Their findings revealed interesting findings whereby, a common pattern existed on long-term sovereign bonds during the Eurozone debt crisis between 2011 and 2012. Baum et al. [11] adopted an event study by employing a GARCH model for their analysis. The choice of the GARCH model is fundamental because it allows the authors to deal with the most common financial data time series, which can reveal characteristics such as thick tails.

Using GARCH, modelling is a sound technique because it is considered relatively more sensitive approach when measuring risk in a normal distribution. However, such technique allows the researcher to capture both heavy tails of return series as well as factors related to volatility clustering.

In their study, they apply a combination of an event study methodology, which employ two types of analysis univariate and multivariate and further employs Granger causality tests using a panel framework supported by impulse response tests. Interestingly, their findings showed no evidence for Granger causality from bond yields to CRAs rating announcements. There was also further evidence of inference because when there are CRAs announcements, evidently this influenced "crisis-time capital allocation" within the the Eurozone markets. Symbolically, this means that when there are downgrade events, this subsequently reduced the currency value of the Euro, hence affecting sovereign bond yields.

The three main rating agencies use rating scales with the best quality issuers receiving a triple A notation (AAA). Agiakloglou and Deligiannakis [5] examine both the short run and long run relationship between government bond yields as revealed CDS by employing Granger causality techniques for eight European countries. By encapsulating a wide range of factors, these credit risk assessments have been identified in literature as critical tools essential for defining and evaluating a rigorous investment assessment deigned to identify opportunities in particular in the rising emerging markets. However, these emerging markets show tendency problems related to asymmetric information, which can be very high.

Theoretically, rating agencies play a pivotal role whereby they disseminate valuable information to potential investors by conducting in-depth risk evaluation of sovereign bonds. But it's still not quite obvious how CRAs affect risk pricing so widely [13]. The minimal information value of credit rating announcements on the market pricing of sovereign bonds is evaluated in their study. Empirically, they employ a dynamic macroeconomic model with a sample of 56 countries using monthly data. The findings revealed that watch or the outlook status play a key role in ensuring accuracy related to the determining of the information provided by CRAs is credible and henceforth, information value of credit rating changes is presented.

Previous literature [18, 24, 25, 28, 34] found evidence that CRAs do have an influence on bond yields, specifically when a downgrading is announced. It is expected that the CRA II Regulation stem the influence and impact on credit watch announcements of the major players in the credit rating industry. The adoption of the CRA II Regulation in May 2011 is anticipated to have an impact on sovereign bond rates, according to the authors. Regulations on credit rating agencies adopted in 2013 and 2015 are not considered due to a lack of data on watch announcements. Hence, focus of this empirical analysis is the CRA II Regulation introduced in May 2011.

Thus, factors that affect sovereign bond yields are typically associated with aggregate risk. It is fundamental to note that this aggregate risk is typically influenced by government actions on monetary policy changes, geopolitical dynamics and uncertainty, factory related to risk aversion and more country specific risks as well as the contagion effect risk.

Broadly speaking, contagion is one of the mechanisms by which financial instability becomes so widespread that a crisis reaches systematics dimensions. The other two mechanisms that constitute sources of systematic risk are the unwinding of financial imbalances and the occurrence of severe macro shocks. However, there are two ideas underlining the definition of contagion risk. First, the wider spreading of instability would usually not happen without initial shock. Second, the transmission of the initial instability goes beyond what could be expected from the normal relationship between markets or intermediaries, for example in terms of speed, strength or scope.

In his study, de Santis [35] empirically correlates that contagion effects within the euro area are closely linked to CRAs rating and adopts a framework of a structural vector error correction model. He contended that the evolution of spreads for nations like Portugal, Ireland, Greece, and Spain was significantly influenced by country-specific credit ratings (PIGS). This means that any downgrade can be able to generate a portfolio shift resulting in a significant impact on bond yields. Eijffinger [24] echoes this sentiment by explicitly declaring, "Downgrading sovereigns or even the announcements of a possible future downgrade may jeopardise the achievement of implemented austerity measures". This has increased the momentum of debate surrounding the methods, timing and measures employed by these rating agencies resulting in the EU adopting new regulatory measures under the European Securities and Markets Authority (ESMA), but the controversy remains unabated. Further criticism has also been associated with the use of market power dominance of the big three rating agencies as well as entry barriers for prospective new rating agencies entering the market.

In their study, Silvapulle et al. [36], they investigate the contagion effect in the daily bond yield spread of five peripheral EU countries as a result of the euro-debt crisis. The authors utilize a robust semiparametric copula method, which enables them to detect and capture the contagion effects when observing daily sovereign yield spread. Their research findings showed that there was contagion effect which was shown by a significant increase in the tail dependence during two events, thus, the pre-crisis (1999 to 2008) and the post crisis event from 2008–2013.

However, it is imperative to note that sovereign debt market has its shortcomings when it comes to rating sovereign debt. The common denominator of indicators includes general proxies like GDP per capita, GDP growth rate, debt history, government debt, and external debt, although the top three agencies very frequently disagree on grading sovereign debt due to the disparities in rating indicators [24].

For instance, when Greece's rating was lowered from BAA1 to BA2 on July 5, 2005, this precipitated changes in spreads for nations with poorer fiscal fundamentals, such as Ireland, Portugal, Italy, Spain, Belgium, and France. This spillover effect meant negative outlook, which in turn implied a rise in risk whereby the "private sector participation could become a precondition for additional rounds of official lending to Portugal as well" [35]. Greece being the epicentre of sovereign debt crisis, this resulted in the other countries being impacted with different rating degrading.

Since the subprime mortgage crisis, literature on how CRAs' announcements do influence sovereign bond yields did emerge. Recently, in their study, Kenourgios et al. [28] examined the effect of credit rating announcements on ten-year sovereign bond yields using samples from "traditional" and "new" global emerging economies as well as the developing countries that were severely impacted by the global financial crisis. By adopting panel regression as an instrument and conducting several robustness tests, they concluded that heterogeneous effects existed across different types of credit events, different country groups as well as the CRAs. This showed that the downgrades and negative outlooks by the big three rating agencies were more informative, thus resulting in the increase of bond yields of the group of countries both during time of announcement and after. However, it is crucial to recognise the importance of rating agencies due to their substantial influence on funding costs and institutional investors' desire to hold particular types of financial instruments [28]. The other study from Baum et al. [12] highlights the impact of CRA announcements on sovereign bond yields of France, Italy, Germany, and Spain and how this affected the Euro currency reaction against major trading currencies. By employing an event study using 2010–2012 as time parameter, Baum et al. [12] used GARCH models to analyse the yield behaviour post announcement. Evidently, they came to the conclusion that announcements of CRA downgrades, watch lists, and outlooks had no effect on the value of the Euro, although they did see a rise in exchange rate volatility. Baum et al. [12] found evidence about the impact of CRAs' announcements on the value of the Euro and the yields of French, Italian, German and Spanish long-term sovereign bonds during the culmination of the Eurozone sovereign debt. Specifically, their estimates revealed effects existed from those yields that have been downgraded and other volatilities of French, Italian and Spanish yield bonds. However, the strongest effect was observed for the negative outlook announcements that showed also increase in the yields of German bonds.

Results show that CRAs downgrade announcements showed negative effects on the value of the Euro currency and subsequently its volatility. This is because sovereign ratings provide financial markets with new information, which might trigger market panics and overreactions, in particular when the announcement is negative. Moreover, Baum et al. [12] demonstrate that downgrading from CRAs increased the yields of French, Italian and Spanish bonds but lowered the German bond yield. No evidence of Granger causality from bond yields to rating announcements could be proven. The authors conclude that credit rating announcements significantly influenced crisis-time capital allocation in the Eurozone.

The effect of credit rating releases from Moody's Investors Service on government bond rates was examined by Liu et al. [30] using an event study. Their overall findings illustrate that bond markets do respond to the announcement of downgrading. This tends to have a greater impact on security prices than upgrading. Barron et al. [9] analysed the impact of new ratings, credit rating changes and commercial paper ratings on UKUK*United Kingdom* common stock returns. By adopting, a market model such as the Capital Asset Pricing Model (CAPM) and a panel approach and concluded on the following findings: First, credit rating agencies do provide information to the capital market in the United Kingdom (UK). Second, significant excess stock returns are associated with bond rating downgrades and positive credit watch announcements. Third, rating changes affecting short-term debt have no statistically significant impact, as is the case for new long-term debt ratings.

Abad et al. [2], in their empirical study, conducted an analysis on liquidity shocks on the US corporate bond market which was induced by the information content of the changes in credit ratings and regulatory market constraints. Interestingly, the analysis revealed an interesting pattern, whereby the market anticipates rating changes, because trading activity sows down days before an event occurs.

During the two weeks after the event, they find that there is a price pressure and the volume of trading is significantly high. Furthermore, the price converges to the

fundamental values and this is followed by high trading activity rising too especially during the fortnight. Finally, the migration movement of investment as well as the different speculative grade categories results in further liquidity shocks.

Concerning econometric approach related to the topic under study, there are two strands in the literature [4]. The first one, researchers employ linear regression models on a numerical representation of the ratings. With statistical techniques of multiple regression analysis, Cantor and Packer [18] conducted a rigorous systematic analysis by observing the determinants as well as impact factors on sovereign credit ratings. This analysis, focused on a cross section study with a sample of 45 countries assigned by Standard & Poor's Financial Services and Moody's Investors Service. The authors discover that rating releases, in particular, have an immediate impact on market price for issuers that are below investment grade. Afonso et al. [4] made additional attempts by utilising the Ordinary Least Squares (OLS) approach for the numerical depiction of credit ratings. The second strand of literature in econometric approach uses ordered response models such as Hu et al. [26], Bissoondoyal-Bheenick [14] and Depken et al. [22].

The statistical methods used to analyse sovereign bond yields differ greatly. Hand et al. [25] examined the correlation between daily excess bond and stock returns and S&P watch list announcements, as well as actual S&P and Moody's rating changes. In using regression analysis and panel analysis, they found evidence that common stock prices do respond to credit watch announcements and bond rating changes. The evidence from the findings reflects a consistency with responses from stock prices from all the credit rating announcements with the exception of the actual rating upgrades. Moreover, the evidence is consistent with price effects for both, upgrades and downgrades in terms of determining the effect of preferred stock rating changes on preferred stock returns. Alsakka and ap Gwilym [7] investigated the behaviour of sovereign watch list and outlook signals by the big three credit rating agencies by employing an ordered probit modelling approach. Their results show that actions of different credit rating agencies imply different policies. In addition, the authors found evidence of a negative outlook momentum, but neither watch list momentum nor positive momentum could be validated. In addition, their analysis shows that there is interdependence among the three major players, S&P, Moody's, and Fitch ratings, regarding sovereign outlook and watch list actions.

Evidently, it is observed that the impact shows a stronger effect in particular to the multiple-notch sovereign rating downgrades and are more visibly within the PIIGSPIIGS *Portugal, Italy, Ireland, Greece, Spain*[1] states. Furthermore, the authors find differences in rating policies across the big three and they show evidence of interdependence in bank rating actions. S&P tends to be the more independent and Moody's appears to be more cautious but is by far the most likely to assign multiple-notch downgrades.

Katz [27] makes evidence on the price adjustment process of bonds to rating reclassifications with the help of a regression analysis. The author finds that there is no anticipation at all to a rating reclassification. Also, there appears to be a lag of between six and ten weeks subsequent to a rating reclassification before a 100% adjustment to the new rating class prevails. With a panel model and a spline regression, Binici et al. [13] conducted an analysis by examining how the impact of credit rating changes influence sovereign bond yields within the EU. Their study also looked at macroeconomic and financial variables that account for the different effects over time whenever there is a change in credit rating.

The authors find evidence for changes of ratings are informative, economically important, and highly statistically significant in fixed assets panel models. In their 2011 study, Candelon et al. examined the effects of news about sovereign ratings on European financial markets between 2007 and 2010. In using an event study, it is proved that sovereign rating downgrades have statistically and economically significant spillover effects across countries as well as financial markets. However, this depends on the type of announcements; the source the country is experiencing the downgrade and the rating agency.

Reduced to nearly speculative economies (like Greece), other Euro zone nations have systematic spillover effects. Treepongkaruna and Wu [37] also reviewed realised volatility in the stock and currency markets. Their study analysed during periods of financial crisis, how asymmetric effects of different types of sovereign rating announcements on stocks and currency movement, degree of skewness, correlation relationships.

The findings shows interesting insight on how the currency and stock markets tend to respond in an hterogenous way to credit rating announcements and they concluded that actually, the stock markets showed a more tendency of responsiveness in comparison to currency market. Evidence is found that rating events have significant and asymmetric impacts on higher moments of both asset market returns. By using an event study, Norden and Weber [32] analysed the response of stock and CDS markets to rating announcements by the three major players in the credit rating industry during 2000–2002. Moreover, the authors conducted a study by carrying out an examination on the degree of how strongly these markets respond to a credit rating announcement by observing abnormal returns as well as the CDS spreads that have been adjusted. Norden and Weber [32] find that both markets not only anticipate rating outcomes as a result of a downgrade, but also reviews for downgrade by big three credit rating agencies. It is imperative that a combination of different trading events within the different agencies that reviews

[1] PIIGS countries are Portugal, Italy, Ireland, Greece and Spain.

for downgrade by S&P and Moody's exhibit the largest impact on both markets. Furthermore, the analysis shows that the magnitude of abnormal performance in both markets is influenced by the level of the old rating, previous rating events and, only in the CDS market, by the pre-event average rating level by all agencies. Kräussl [29], researched with specific focus on the event study and panel regression, the role played by credit rating agencies when examining the impact on an international financial market platform, particularly whether sovereign credit ratings have an impact on the financial stability in emerging market economies. Due to their significant effect on the two important aspects of lending to developing markets, i.e., size and market volatility, his findings demonstrate the trustworthiness of CRAs. Additionally, the findings demonstrate a notable degree of strength in the case of government downgrades as well as adverse sovereign credit rating actions, including credit watches and rating outlooks. Comparatively speaking, the projected changes in sovereign credit ratings made by market participants have less of an influence on the financial markets of emerging nations. Chung et al. [21] analysed credit watch and rating actions during the credit rating process. They concluded that watch actions are frequently triggered by very specific well-known events unlike rating actions.

Christopher et al. [20] made further attempts by investigating the permanent and transitory effects of sovereign credit ratings by examining the effects of time varying stock and bond market correlations. They used a sample of nineteen emerging countries from January 1994 to July 2007. In their findings, they concluded that stock and bond market co-movements within a region exhibit a tendency of heterogeneity when there is information dissemination on sovereign rating. Contrary, sovereign rating outlooks were found are negatively related to regional bond market co-movements reflecting the existence of contagion effects.

Ory et al. [33] used a case-by-case study, also called binary-logit model in order to focus on downgradings and negative watches. Main goal is to characterise series that react to rating changes and to quantify as well as explain the importance of reactions. They find that in 50% of cases downgrades and negative watches have no impact but lead to financial market reactions only for industrial and commercial corporate issuers. The reaction of a negative rating action depends on the economic climate, in particular when the economy slows down. In addition, there are reactions when the initial rating is low (less or equal to BBB-/Baa3). Lastly, reactions are stronger when there are negative announcements from S&P and Fitch Ratings, when comparing to Moody's.

Previous research on how CRAs' announcements do have an impact on government bond yields show that especially when there is a negative announcement yields do respond. Our empirical analysis brings new evidence for the scientific literature in investigating the impact of CRAs' watch announcements before and after the introduction of the CRA II Regulation in Europe. As this regulation first tried to reduce CRAs' influence in the European Union on the capital market, the study aims to illustrate whether there is still a relationship between European sovereign bond yields and watch announcements from S&P, Moody's, and Fitch ratings. In finding evidence on whether the CRA II Regulation did reduce or not the influence of CRAs' watch announcement, the authors bring an important contribution to the empirical analysis on sovereign debt and the impact of the big three credit rating agencies after the first regulations on CRAs came into force within the EU.

Hence, the authors set up the hypothesis that there is a relationship between sovereign bond yields, the introduction of the CRA II Regulation, before or after an announcement, watch announcements and the rating grade of a government.

DATA AND METHODOLOGY

A majority of studies that examine and analyse the determinant of bond yield spread employ simple linear regression models because these models assume that there is a constant relationship between a set of explanatory variables and bond yield spreads. For this reason, our paper follows this logic.

Data used for the analysis such as information on European sovereign bond yields, credit watch announcements from Standard & Poor's Financial Services, Moody's Investors Service and Fitch Ratings and interest rate volatility are all obtained from Bloomberg Database. Interest rate volatility refers to the variance of changes in the level of yield curves. This means interest rate volatility has a significant effect on bond prices.

Country Sample Selection

Sovereign bond yields are collected for Austria, Germany, Belgium, Finland, France, the Netherlands, Ireland, Italy, Spain and Portugal. All these countries are part of the empirical analysis. Other European countries are not included in the analysis due to a lack of data at the time of the analysis on credit watch announcements of Standard & Poor's Financial Services, Moody's Investors Service and Fitch Ratings Table 1.

As a first step, the authors search for evidence whether there is a positive or negative change in watch

Table 1. Bond characteristics of European sovereign bonds used in the analysis.

Bonds Before CRA II Regulation	Bonds After CRA II Regulation
Issue date starting from 2006	Issue date starting after May 2011
Bonds issued in Euro	Bonds issued in Euro
Coupon type: fixed	Coupon type: fixed
10- and 5-year sovereign bonds	10- and 5-year sovereign bonds

Source: Authors.

announcement. For this purpose, all countries named above are analysed individually for sovereign bonds with a maturity of ten and five years. For each country, the dates and direction[2] of watch announcements are collected. Later, the corresponding bonds are determined for the time of the watch announcement. As a last step the change in yield before and after the announcement was made is calculated in order to find evidence on whether yields and watch announcements follow the same directions therefore, the variables "yields before a watch announcement" are subtracted from the variables "yield at the time of a watch announcement" in order to get the searched variable "change in yield". The following formula shows how the change in yield is calculated for each country:

$$\textit{change in yield} = \textit{yield at time of watch announcement} - \textit{yield before watch announcement}$$

In the appendices, the tables for five- and ten-year sovereign bonds can be found which picture first results concerning the change in yield after a credit watch announcement was made.

Nevertheless, this is the case particularly for sovereign bonds issued from countries with the worst ratings such as Portugal and Ireland. Interesting to note is that the change in yield is also positive for Germany, Finland and the Netherlands, which are rated with the best ratings. Countries such as Belgium, France, Italy, and Spain have a negative change in yield, even though the watch announcements made are negative as well. These tables might show first results that yields do not always respond in the same way as credit watch announcements are made. The impression rises that in some cases investors do trust in credit rating watch announcements as sovereign bond yields do respond to watch announcements. In the next step, a linear regression will follow in order to obtain evidence whether yields are related to credit watch announcements. Particularly whether there is evidence of a response of sovereign bond, yields on credit watch announcements before and after the CRA II Regulation came into force.

In the next steps, two multiple linear regressions are conducted. In order to find evidence about whether (there is a relationship between the change in yield and watch announcements) a change in yield is determined by a watch announcement made by the big three CRAs before and after the introduction of the CRA II Regulation, a regression analysis is applied. In a first step, a separate simple linear regression is undertaken in order to control interest rate volatility during the period of credit watch announcements. Illustrations on interest rate volatility for Germany, Belgium, Finland, France, the Netherlands, Italy, Spain, Portugal, Ireland, and Austria for five- and ten-year government bonds are shown in the appendices. As can be seen in the diagrams there are daily fluctuations. Purpose of this analysis is to find evidence whether yields of sovereign bonds are affected by interest rate volatility. In doing so the authors aim to control the result of the main regression analysis, which then needs to be considered for interpreting the results of the main multiple linear regression. Interest rate volatility could bias the results, as this is a major fact, which has an impact on government bond yields. Hence, a separate regression analysis is realised in order to find evidence on whether interest rate volatility influences the yields on sovereign bonds. For this, two individual analyses are executed for five- and ten-year government bonds. The daily yields at the time a watch announcement is made is used as dependent variable. The independent variable is the daily volatility of five- and ten-year government bonds. Data on interest rate volatility is extrapolated from Bloomberg Database for 10 to 15 days before and after watch, announcements are made. Governments included in the analysis are Germany, Belgium, Finland, France, the Netherlands, Spain, Italy, and Portugal for five-year sovereign bonds and Germany, Belgium, Finland, France, the Netherlands, Spain, Italy, Portugal, Ireland, and Austria for ten-year sovereign bonds. There is a lack of data at the time of the analysis for Ireland and Austria for five-year sovereign bonds, which is the reason why those are not used in the first analysis. Data on sovereign bonds are denominated in Euro, have a fixed coupon type, and are issued between 2009 and 2014 which is consistent with the main multiple linear regression and data on watch announcements. The analysis conducted at a 95% and 99% confidence level for each five- and ten-year sovereign bonds. The simple linear regression contains a data sample of 1,499 data for five-year sovereign bonds and 3,762 data for ten-year sovereign bonds. Hence, for each, five- and ten-year sovereign bonds the following formulas can be build:

$$\textit{yield at announcement 5 year} = \beta^{\circ} + \beta \textit{volatility 5 year sovereign bonds}$$

$$\textit{yield at announcement 10 year} = \beta^{\circ} + \beta \textit{volatility 10 year sovereign bonds}$$

For this, the multiple linear regression is divided into two separate analyses. The main analysis is carried out separately for five- and ten-year sovereign bonds respectively. The dependent variable Y represents the daily yields of European sovereign bond yields each 20 days before[3] and after a watch announcement was made. Data for the watch announcements are taken from the watch lists for each country from Bloomberg Database as well as data on European sovereign bond yields. Bond characteristics are

[2] Particularly whether a downward or upward announcement was made.

[3] Hand and Holthausen use a time window of 11 days before announcement up to 60 days after the announcement; Cantor and Packer use a two-day time window before and after the announcement hence a 20 days is used as an average compared to previous literature.

the same as explained before with a fixed coupon type and denominated in Euro. For bonds issued before May 2011 when the CRA II Regulation was implemented, the year 2006 is chosen as issue date, for having a comparable timeframe for the analysis. Bonds issued after the CRA II Regulation was introduced are gathered from May 2011 on. The multiple linear regression is done for European sovereign bonds with a maturity of five and ten years separately. Data on five-year sovereign bonds are available[4] for Germany, Belgium, Spain, Finland, France, the Netherlands, Italy, and Portugal. The sample contains 1,499 daily sovereign bond yields. For ten-year sovereign bonds, data are obtained for Germany, Belgium, Spain, Finland, France, the Netherlands, Italy, Portugal, Ireland, and Austria. The data sample includes 3,762 daily sovereign bond yields. The multiple linear regressions are calculated at a 95% and 99% confidence level for each regression analysis.

Data on credit watch announcements are obtained from Bloomberg Database. Those range from 1993 until 2014. As the CRA II Regulation was implemented in May 2011, data on watch announcements are used from 2006 until 2014 for having a comparable timeframe before and after the introduction of the CRA II Regulation. Credit watch announcements on foreign currency long-term debt from Standard & Poor's Financial Services, Moody's Investors Service and Fitch Ratings are used. This is because an issuer's foreign currency rating will differ from its local currency rating when the obligor has a different capacity to meet its obligations denominated in its local currency, vs. obligations denominated in a foreign currency (disclosure.spglobal.com, 2021). A first overview on the credit watch announcements frequency made by Standard & Poor's Financial Services, Moody's Investors Service and Fitch Ratings is shown in the following Table 2.

Table 2 shows how many watch announcements were recently made by the big three CRAs. Furthermore, the years of the announcements are listed. The last two columns show how often a credit watch announcement was followed by an actual rating which represented the direction of the watch announcement (right) and which did not represent the direction of the watch announcement (wrong). Moody's Investors Service was the rating agency with the most watch announcements, but mainly during the time before the European sovereign debt crisis hit and the CRA II Regulation was introduced. Standard & Poor's Financial Services follows Moody's Investors Service in terms of the number of watch announcements made. Moreover, Standard & Poor's Financial Services is the credit rating agency with the most wrong announcements, particularly during the European sovereign debt crisis. This shows that the CRA did put countries on watch, but the actual rating made by the company went in the other direction. Fitch Ratings announced the less credit watches but with a trend of least wrong announcements. During the European sovereign debt crisis, Standard & Poor's Financial Services and Fitch Rating were the most active CRAs in terms of watch announcements. After the CRA II Regulation came into force, further credit watch announcements were made by all three credit rating agencies, with Standard & Poor's Financial Services being the most active. Moody's Investors Service watch announcements after the CRA II Regulation was introduced, was mainly concentrated on struggling economies such as Portugal.

Table 2. Frequency credit watch announcements standard & poor's financial services, moody's investors service and fitch ratings.

	Watch Announcement	Year	Right	Wrong
Standard & Poor's	17	2009, 2011, 2012, 2013	13	4
Moody's	18	1992, 1993, 1996, 1997, 1998, 2001, 2009, 2010, 2011, 2014	16	2
Fitch Ratings	10	2006, 2011, 2009, 2014	9	1

Source: Authors based on Bloomberg.

[4] Including the independent variables explained in the following.

Data on the country, the rating before the watch announcement and the direction of the watch announcements are collected. Countries included in the analysis and for which data are available are Germany, Belgium, Spain, Finland, France, the Netherlands, Italy, Portugal, Ireland, and Austria with all data containing negative watch announcements, except for Portugal in 2014, which is positive.

For the analysis, the credit watch announcements of the big three CRAs are coded in the following way 0 for a negative watch announcement and 1 for a positive watch announcement for each CRA:

$$\text{Credit watch announcement} = \begin{cases} 0 = \text{negative watch announcement} \\ 1 = \text{positive watch announcement} \end{cases}$$

The data sample on watch announcements covers the European sovereign debt crisis and includes struggling countries with watch announcements ranging between speculative and investment grade. As previous literature such as Afonso et al. [3] and Cantor and Packer [18] found evidence that watch announcements, especially negative ones, do have a major impact when the country which is put on watch from investment grade to speculative grade, this will be considered in the analysis as well. This is done with the help of two independent variables. First, a variable called before/after announcement coded with 0 for data concerning the period before an announcement is

Table 3. Coding variable announcement grade.

Rating	Before Announcement	After Negative Announcement	After Positive Announcement
AAA/Aaa	1	2	1
AA+/Aa1	2	3	1
AA/Aa2	3	4	2
AA−/Aa3	4	5	3
A+/A1	5	6	4
A/A2	6	7	5
A−/A3	7	8	6
BBB+/Baa1	8	9	7
BBB/Baa2	9	10	8
BBB−/Baa3	10	11	9
BB+/Ba1	11	12	10
BB/Ba2	12	13	11
BB−/Ba3	13	14	12

Source: Authors.

made and 1 covering the period after the announcement is made:

$$\text{Before/after announcement} = \begin{cases} 0 = \text{before watch announcement} \\ 1 = \text{after watch announcement} \end{cases}$$

The second independent variable is called "announcement grade". Announcement grades covering the period before an announcement is made represent the rating of the government before a watch announcement. Data on these ratings are taken from the watch announcement lists from Bloomberg Database. Announcement grades covering the period after watch announcements are calculated by taking the previous ratings and adding or subtracting 1, depending on which direction the watch is announced. For the ratings, an ordinal scale is used as Bradley and Gulati [16] did in their analysis. In addition, Cantor and Packer [18] made use of a numerical scale for coding the ratings in their analysis. Which is the reason why we made use of a numerical scale in order to code the ratings, as well. The following Table 3 summarises the coding for the variable announcement grade

Statistical Results

Simple linear regression on interest rate volatility

In the appendices, the detailed simple linear regression on interest rate volatility can be found. In this study, the main findings are presented in Table 4 below.

Independent variable for dependent variable yields of sovereign bonds is interest rate volatility at time of watch announcements. Results are shown for ten- and five-year sovereign bonds. 95% confidence level is reported as * and 99% confidence level as **

Table 4. Summary statistics of interest rate volatility.

	Five-year Sovereign Bonds	Ten-year Sovereign Bonds
F-test	2,614.57*	3,934*
	2,614.57**	3,934.41**
p-value	0*	0*
	0**	0**
Interest rate volatility	0*	0*
	0**	0**

Source: Authors.

Table 5. Summary statistics multiple linear regression on credit rating agencies.

	Five-year Sovereign Bonds	Ten-year Sovereign Bonds
F-test	694.89*	1209.45*
	694.887**	1209.45**
p-value	0*	0*
	0**	0**
CRA II	1.8662E-05*	0.0024*
	1.8662E-05**	0.0024**
Before/after	1.0012E-34*	0.00013*
announcement	1.0012E-34**	0.00013**
Watch	0.003*	0.041*
	0.003**	0.041**
Announcement grade	4.955E-262*	0*
	4.955E-262**	0**

Source: Authors.

Overall analysis for ten- and five-year sovereign bonds show statistical significance in both cases at a 95% and 99% confidence level, reported in the F-test and p-value. Interest rate volatility is also statistically significant with 0 for all regression analysis. This result indicates that interest rate volatility has a statistically significant influence on each sovereign bond maturing after five or ten years. Due to high fluctuations during the European sovereign debt crisis, which is the timeframe of the analysis, this needs to be considered in interpreting the results of the main multiple linear regression.

Multiple linear regression on CRAs

The full statistical results of the multiple linear regressions for each five- and ten-year sovereign bonds can be found in the appendices. In this section, the most important findings are explained in the following Table 5.

Multiple linear regression on CRAs

The full statistical results of the multiple linear regressions for each five- and ten-year sovereign bonds can be found in the appendices. In this section, the most important findings are explained in the following Table 5.

Independent variables for dependent variable yield are 0 for no CRA II Regulation and 1 if there is one, before/after

announcement is coded 0 for before and 1 for after, watch is coded 0 if it is negative and 1 if it is positive, announcement grade ranges from 1 for the best rating and 14 for the worst. Results are shown for ten- and five-year sovereign bonds. 95% confidence level is reported as * and 99% confidence level as **

For five-year sovereign bonds, at both confidence levels the overall multiple regression analysis is statistically significant reflected in the F-test with 694.89 and the p-value with 0 for each confidence level. The results for the single variables at both confidence levels show that the only variable being statistically significant is watch with 0.003 smaller than 0.05 and 0.003 smaller than 0.01. The remaining variables within the multiple linear regression for five-year sovereign bonds are all not statistically significant with results all being greater than 0.05 or greater than 0.01, the confidence levels. Hence, the variable watch is the only variable within the statistical analysis having a relation to the dependent variable yield. The result shows that there is a relation between credit watch announcements and European sovereign bond yields. Thus, evidence is found that bond yields do respond to watch announcements.

Overall analysis for ten-year sovereign bonds is statistically significant with an F-test of 1209.45 at a 95% and 99% confidence level. All independent variables at a 95% confidence level are statistically significant with each result being smaller than 0.05. At a 99% confidence level, each variable except watch (0.041 greater than 0.01) is statistically significant as well, in presenting results smaller than 0.01. The results indicate that at a 95% confidence level, each variable does have a statistically significant relationship to the dependent variable yield. Hence, sovereign bond yields are influenced by all variables, the CRA II Regulation, before or after an announcement was made, the watch announcement and the rating grade. At a 99% confidence level, the same result is obtained with the exception that the variable watch is not statistically significant. Nevertheless, as explained before, the variables announcement grade and before/after announcement do reflect the watch announcement indirectly in including the rating a government might obtain after a watch announcement was made. As these two variables are statistically significant, the authors conclude that even at a 99% confidence level, the ten-year sovereign bond yields do respond to watch announcements made by Standard & Poor's Financial Services, Moody's Investors Service and Fitch Rating. The null hypothesis cannot be rejected as yields are impacted by credit rating agencies' watch announcements before and after the CRA II Regulation came into force.

Independent variables for dependent variable yield are 0 for no CRA II Regulation and 1 if there is one, before/after announcement is coded 0 for before and 1 for after, watch is coded 0 if it is negative and 1 if it is positive, announcement grade ranges from 1 for the best rating and 14 for the worst. Results are shown for ten- and five-year sovereign bonds. 95% confidence level is reported as * and 99% confidence level as **

For five-year sovereign bonds, at both confidence levels the overall multiple regression analysis is statistically significant reflected in the F-test with 694.89 and the p-value with 0 for each confidence level. The results for the single variables at both confidence levels show that the only variable being statistically significant is watch with 0.003 smaller than 0.05 and 0.003 smaller than 0.01. The remaining variables within the multiple linear regression for five-year sovereign bonds are all not statistically significant with results all being greater than 0.05 or greater than 0.01, the confidence levels. Hence, the variable watch is the only variable within the statistical analysis having a relation to the dependent variable yield. The result shows that there is a relation between credit watch announcements and European sovereign bond yields. Thus, evidence is found that bond yields do respond to watch announcements.

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Results Empirical Analyses on Credit Rating Agencies

Results obtained, that indicate a relationship between European sovereign bond yields and credit rating watch announcements are consistent with previous literature such as Afonso et al. [3] and Cantor and Packer [18]. The reason why results obtained for five-year sovereign bonds, which show a statistical significance only for the variable watch is twofold is: First, as mentioned before,

data on five-year sovereign bonds with the chosen bond characteristics and the independent variables include a data sample of half of the size compared to data used for ten-year sovereign bonds. The number of data included in an empirical analysis could have a great impact on the results. For future analysis, it is recommended to undertake a similar empirical analysis in some years when more data is available.

Second, interest rate volatility is statistically significant for both, five- and ten-year sovereign bonds. Longstaff and Schwartz [31] found evidence that interest rate volatility is higher for ten-year sovereign bonds than for five-year government bonds. There are several reasons for interest rate volatility such as actions undertaken by central banks, economic conditions, or inflation. One of these reasons, the economic conditions are also reflected in CRAs' watch announcements as this represents a main part of the evaluation of a rating made by the big three CRAs Standard & Poor's Financial Services, Moody's Investors Service and Fitch Rating. Hence, the authors conclude that watch announcements influence yields and thus, could trigger in some way interest rate volatility. As the findings of the main multiple linear regression on credit rating agencies indicate, that watch announcements, yields before/after an announcement and the changing announcement grade do impact yields of ten-year sovereign bonds. This could be seen as a picture of the economic conditions within governments and hence, as a reason for interest rate volatility and which explains the statistical significance for ten-year sovereign bonds as well. Kräussel [29] found evidence that CRAs have substantial influence on the size and volatility of emerging markets lending, particularly when there is a downgrade or a negative watch announcement. This is consistent with the findings found for a higher statistical significance for ten-year sovereign bonds, which do also include more data on watch announcements than the analysis for five-year sovereign bonds.

Another fact which needs to be mentioned for the different results, is that watch announcements made by Standard & Poor's Financial Services, Moody's Investors Service and Fitch Rating are made for a long-term time horizon due to the focus on foreign currency long term debt obligations. Hence, as ten-year sovereign bonds cover a long-term period, yields on ten-year sovereign bonds do respond to watch announcements made by the big three credit rating agencies more strongly, as the results of the empirical analysis indicate.

DISCUSSION AND CONCLUSION

In this study, the authors assessed the impact of CRAs' watch announcements on European government bonds as a regulatory result of the European sovereign debt crisis.

Aim of the research was to find the evidence on whether the introduction of the new regulation does have an impact on European sovereign bond yields up to date. Thus, whether there is still a relationship between credit rating watch announcements and EU sovereign bond yields after the introduction of the CRA II regulation. In other words, whether evidence can be found that credit rating agencies' watch announcements do no longer impact yields after having introduced the CRA II Regulation. The following analysis and findings are documented in the study:

- There is a change in sovereign bond yields after watch announcements are announced and after the introduction of the CRA II Regulation in May 2011.
- Analysis for controlling interest rate volatility shows statistical significance for five- and ten-year sovereign bonds.
- Analysis for finding evidence on whether sovereign bond yields do still respond to CRAs' watch announcements after the inclusion of the CRA II Regulation.

Evidence is found that European sovereign bond yields do still respond to CRAs' watch announcements made by the big three CRAs. Evidence is found that CRAs do still have influence on European Union government bond yields even though the European Union aims to control this through regulations on CRAs, such as the CRA II Regulation That means: according to our analysis the CRA II regulation does not fulfill its main goal to reduce the power of credit rating agencies. Since the CRA II Regulation was implemented in the European Union, several new and stricter regulations on CRAs came into force. These are known as CRA III and CRA IV Regulations. These do concentrate more on reducing the influence and importance of CRAs on capital markets and hence, European sovereign bond yields as well. In order to find evidence on whether the regulations do reduce the power of CRAs in the European Union it is recommended to undertake a similar empirical analysis in future when more data are available for analysing the impact of the following, stricter rules on CRAs. As evidence is found that the CRA II Regulation did not have an impact on the influence of the major CRAs Standard & Poor's Financial Services, Moody's Investors Service and Fitch Rating.

Still, through the research, the authors bring an empirical contribution to the scientific literature by finding evidence that even after the implementation of the CRA II regulation, CRAs do still influence sovereign bond yields is indeed recognised and priced on capital markets.

AUTHOR CONTRIBUTIONS

Conceptualization; Data curation; Formal analysis; (Samunderu and Layher) Funding acquisition (N/A) Investigation; Methodology (Samunderu and Layher) Project administration (Samunderu) Resources; Software (Layher) Supervision (Samunderu) Validation;

Visualization; Roles/Writing – original draft (Samunderu and Layher) Writing – review & editing (Samunderu).

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APPENDIX A

Change in Yield After Watch Announcements for Five and Ten Year Sovereign Bonds

	Watch	Yield at Watch Announcement	Yield Before Watch Announcement	Change in Yield 5 Year
DE	negative	0,68	0,629	0,051
DE	negative	0,926	0,879	0,047
DE	negative	−0,29	−0,276	−0,014
DE	negative	1,416	1,359	0,057
DE	negative	0,195	0,182	0,013
DE	negative	1,951	1,876	0,075
BE	negative	3,111	3,283	−0,172
BE	negative	3,211	3,375	−0,164
BE	negative	3,306	3,463	−0,157
BE	negative	3,386	3,532	−0,146
BE	negative	3,465	3,604	−0,139
BE	negative	3,55	3,682	−0,132
BE	negative	3,62	3,746	−0,126
BE	negative	3,595	3,875	−0,28
BE	negative	3,657	3,931	−0,274
BE	negative	3,723	3,983	−0,26
BE	negative	3,76	4,027	−0,267
BE	negative	3,812	4,076	−0,264
BE	negative	3,866	4,127	−0,261
BE	negative	3,911	4,169	−0,258
BE	negative	3,169	3,271	−0,102
BE	negative	3,273	3,376	−0,103
BE	negative	3,343	3,449	−0,106
BE	negative	3,365	3,474	−0,109
BE	negative	3,487	3,598	−0,111
BE	negative	3,567	3,679	−0,112
ES	negative	4,206	4,346	−0,14
ES	negative	5,037	5,212	−0,175
ES	negative	4,432	4,565	−0,133
ES	negative	4,369	4,908	−0,539
ES	negative	5,152	5,617	−0,465
ES	negative	4,527	5,071	−0,544
FI	negative	1,258	1,237	0,021
FI	negative	1,619	1,587	0,032
FR	negative	0,036	0,044	−0,008
FR	negative	0,072	0,077	−0,005
FR	negative	0,243	0,278	−0,035
FR	negative	2,822	2,943	−0,121
NL	negative	0,832	0,79	0,042
IT	negative	6,162	6,194	−0,032
IT	negative	6,614	6,604	0,01
IT	negative	5,93	6,491	−0,561
IT	negative	6,15	6,922	−0,772
IT	negative	2,522	2,511	0,011
IT	negative	4,463	4,504	−0,041
PT	negative	9,645	9,448	0,197
PT	negative	8,032	7,871	0,161
PT	negative	8,06	8,032	0,028
PT	negative	6,064	6,195	−0,131
PT	negative	16,607	16,827	−0,22
PT	positive	11,624	11,297	0,327

	Watch	Yield at Watch Announcement	Yield Before Watch Announcement	Change in Yield 10 Year
DE	negative	2,003	1,928	0,075
BE	negative	3,106	3,286	−0,18
BE	negative	3,679	3,808	−0,129
BE	negative	3,779	3,888	−0,109
BE	negative	3,906	3,972	−0,066
BE	negative	3,482	3,773	−0,291
BE	negative	3,892	4,152	−0,26
BE	negative	3,975	4,27	−0,295
BE	negative	4,038	4,324	−0,286
BE	negative	3,07	3,112	−0,042
BE	negative	3,506	3,586	−0,08
BE	negative	3,581	3,663	−0,082
BE	negative	3,679	3,764	−0,085
ES	negative	4,035	4,186	−0,151
ES	negative	4,452	4,571	−0,119
ES	negative	4,659	4,762	−0,103
ES	negative	4,801	4,938	−0,137
ES	negative	4,839	4,96	−0,121
ES	negative	4,936	5,059	−0,123
ES	negative	5,06	5,182	−0,122
ES	negative	6,045	6,166	−0,121
ES	negative	5,264	5,392	−0,128
ES	negative	5,605	5,724	−0,119
ES	negative	4,17	4,736	−0,566
ES	negative	4,526	5,044	−0,518
ES	negative	4,588	5,152	−0,564
ES	negative	4,721	5,241	−0,52
ES	negative	4,752	5,261	−0,509
ES	negative	4,764	5,275	−0,511
ES	negative	4,897	5,425	−0,528
ES	negative	5,869	6,36	−0,491
ES	negative	5,09	5,626	−0,536
ES	negative	5,433	6,003	−0,57
FI	negative	2,627	2,57	0,057
FI	negative	2,71	2,648	0,062
FR	negative	−0,03	−0,014	−0,016
FR	negative	0,056	0,08	−0,024
FR	negative	0,817	0,88	−0,063
FR	negative	0,928	0,995	−0,067
FR	negative	1,949	2,108	−0,159

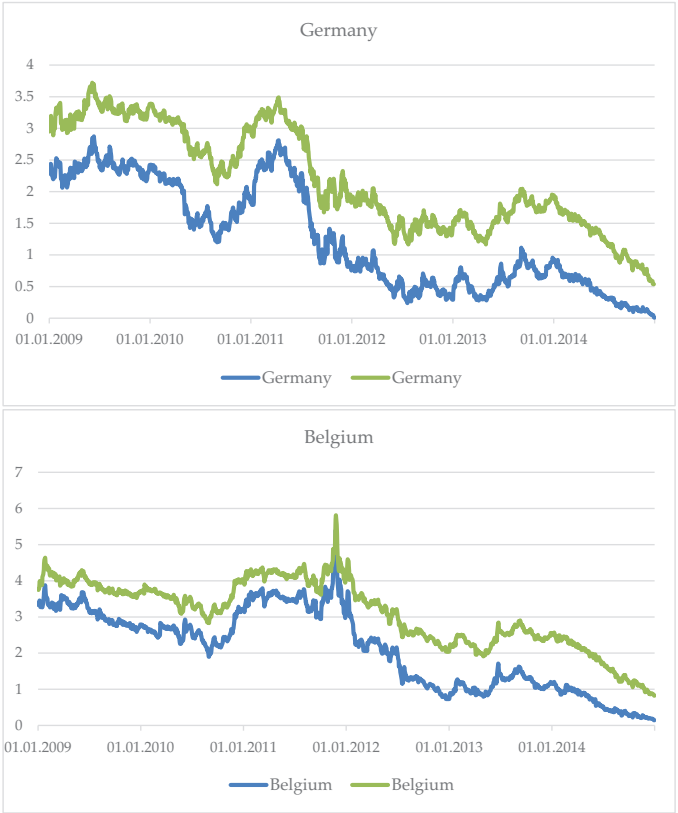
	Watch	Yield at Watch Announcement	Yield Before Watch Announcement	Change in Yield 10 Year
NL	negative	0,217	0,197	0,02
NL	negative	0,389	0,362	0,027
NL	negative	0,67	0,631	0,039
NL	negative	0,949	0,897	0,052
NL	negative	1,211	1,156	0,055
NL	negative	1,456	1,403	0,053
NL	negative	1,715	1,667	0,048
NL	negative	1,947	1,9	0,047
NL	negative	2,16	2,115	0,045
IT	negative	6,164	6,221	−0,057
IT	negative	6,469	6,489	−0,02
IT	negative	7,002	6,999	0,003
IT	negative	7,491	7,547	−0,056
IT	negative	5,916	6,746	−0,83
IT	negative	6,097	6,919	−0,822
IT	negative	6,422	7,075	−0,653
IT	negative	7,103	7,712	−0,609
IT	negative	3,879	3,937	−0,058
IT	negative	4,14	4,194	−0,054
IT	negative	4,869	4,899	−0,03
IT	negative	5,313	5,311	0,002
PT	negative	8,769	8,787	−0,018
PT	negative	8,925	8,926	−0,001
PT	negative	8,892	8,817	0,075
PT	negative	8,953	8,917	0,036
PT	negative	8,726	8,561	0,165
PT	negative	8,552	8,499	0,053
PT	negative	7,602	7,415	0,187
PT	negative	7,616	7,451	0,165
PT	negative	7,79	7,617	0,173
PT	negative	7,645	7,508	0,137
PT	negative	7,585	7,448	0,137
PT	negative	7,626	7,506	0,12
PT	negative	7,671	7,602	0,069
PT	negative	7,693	7,616	0,077
PT	negative	7,836	7,79	0,046
PT	negative	7,758	7,645	0,113
PT	negative	7,625	7,585	0,04
PT	negative	7,67	7,626	0,044
PT	negative	5,489	5,557	−0,068
PT	negative	6,114	6,09	0,024
PT	negative	6,396	6,45	−0,054
PT	negative	6,508	6,586	−0,078
PT	negative	8,087	8,084	0,003
PT	negative	6,846	6,858	−0,012
PT	negative	8,448	8,446	0,002
PT	negative	7,01	7,019	−0,009
PT	negative	14,045	14,995	−0,95
PT	negative	15,828	16,55	−0,722
PT	negative	16,02	16,749	−0,729
PT	negative	15,73	16,183	−0,453
PT	negative	16,861	16,857	0,004
PT	negative	15,229	15,673	−0,444
PT	negative	16,025	16,022	0,003
PT	negative	14,823	15,162	−0,339
PT	positive	10,508	10,284	0,224
PT	positive	10,705	10,439	0,266
PT	positive	10,71	10,482	0,228
PT	positive	10,625	10,472	0,153
PT	positive	11,757	11,756	0,001
PT	positive	10,369	10,188	0,181
PT	positive	9,944	9,942	0,002
PT	positive	10,051	9,875	0,176
IE	negative	10,062	10,177	−0,115
IE	negative	8,295	8,542	−0,247
IE	negative	8,954	8,888	0,066
IE	negative	7,394	7,439	−0,045
AT	negative	1,863	2,014	−0,151
AT	negative	2,159	2,29	−0,131
AT	negative	2,603	2,744	−0,141

Change in yield and watch announcements from Standard & Poor's Financial Services, Moody's Investors Service and Fitch Ratings for ten- and five-year sovereign bonds.

Source: Bloomberg – Authors' own analysis.

APPENDIX B

Daily Interest Rate Volatility



Source: Bloomberg – Authors' own analysis.

Simple Linear Regression Daily Yields at Watch Announcement and Interest Rate Volatility

Simple linear regression daily yields at watch announcements and interest rate volatility of 5-year sovereign bonds at 95% confidence level

Overall fit	
Multiple R	0.7974369
R Square	0.6359056
Adjusted R Square	0.6356624
Standard Error	1.7475712
Observations	1499

ANOVA

Alpha 0.05

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	1	7984.9129	7984.9129	2614.5708	0	yes
Residual	1497	4571.8459	3.0540053			
Total	1498	12556.759				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	0.5665916	0.0807399	7.0174942	3.412E-12	0.4082163	0.7249669
Interest rate volatility	0.8175541	0.0159888	51.132874	0	0.7861913	0.848917

Simple linear regression daily yields at watch announcements and interest rate volatility of 5-year sovereign bonds at 99% confidence level

Overall fit	
Multiple R	0.7974369
R Square	0.6359056
Adjusted R Square	0.6356624
Standard Error	1.7475712
Observations	1499

ANOVA

Alpha 0.01

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	1	7984.9129	7984.9129	2614.5708	0	yes
Residual	1497	4571.8459	3.0540053			
Total	1498	12556.759				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	0.5665916	0.0807399	7.0174942	3.412E-12	0.358354	0.7748293
Interest rate volatility	0.8175541	0.0159888	51.132874	0	0.7763171	0.8587912

Regression analysis daily yields at credit watch announcement and five-year sovereign bond volatility. Data obtained from Bloomberg Database; author's own work.

Simple linear regression daily yields at watch announcements and interest rate volatility of 10-year sovereign bonds at 95% confidence level.

Overall fit	
Multiple R	0.7150761
R Square	0.5113339
Adjusted R Square	0.5112039
Standard Error	2.3875528
Observations	3762

ANOVA

Alpha 0.05

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	1	22427.774	22427.774	3934.4155	0	yes
Residual	3760	21433.535	5.7004082			
Total	3761	43861.309				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	0.2254389	0.1013239	2.2249329	0.0261449	0.0267837	0.4240941
Interest rate volatility	1.0256712	0.0163519	62.724919	0	0.9936118	1.0577307

Simple linear regression daily yields at watch announcements and interest rate volatility of 10-year sovereign bonds at 99% confidence level.

Overall fit	
Multiple R	0.7150761
R Square	0.5113339
Adjusted R Square	0.5112039
Standard Error	2.3875528
Observations	3762

ANOVA

Alpha 0.01

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	1	22427.774	22427.774	3934.4155	0	yes
Residual	3760	21433.535	5.7004082			
Total	3761	43861.309				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	0.2254389	0.1013239	2.2249329	0.0261449	-0.035687	0.4865646
Interest rate volatility	1.0256712	0.0163519	62.724919	0	0.9835301	1.0678123

Regression analysis daily yields at credit watch announcement and ten-year sovereign bond volatility.

Source: Bloomberg – Authors' own analysis.

Multiple Linear Regression Credit Rating Agencies

Multiple linear regression credit rating agencies of 5-year sovereign bonds at 95% confidence level

Overall fit	
Multiple R	0.806478581
R Square	0.650407702
Adjusted R Square	0.649471712
Standard Error	1.714132564
Observations	1499

ANOVA

Alpha 0.05

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	4	8167.012648	2041.753162	694.887382	0	yes
Residual	1494	4389.74617	2.938250449			
Total	1498	12556.75882				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	2.279190433	0.227166879	10.03311065	5.70869E-23	1.833590534	2.7247903
CRA II	−0.865475138	0.20154497	−4.294203613	1.8662E-05	−1.260816301	−0.470134
before/after announcement	−1.138573621	0.090280402	−12.61152578	1.00122E-34	−1.315663425	−0.961484
Watch announcement	1.09095087	0.368664407	2.959197713	0.003132969	0.367796054	1.81410567
grade	0.843266855	0.019695417	42.81538382	4.9548E-262	0.804633248	0.8819005

Multiple linear regression credit rating agencies of 5-year sovereign bonds at 99% confidence level

Overall fit	
Multiple R	0.806478581
R Square	0.650407702
Adjusted R Square	0.649471712
Standard Error	1.714132564
Observations	1499

ANOVA

Alpha 0.01

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	4	8167.012648	2041.753162	694.887382	0	yes
Residual	1494	4389.74617	2.938250449			
Total	1498	12556.75882				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	2.279190433	0.227166879	10.03311065	5.70869E-23	1.693298855	2.865082
CRA II	−0.865475138	0.20154497	−4.294203613	1.8662E-05	−1.385284632	−0.345666
before/after announcement	−1.138573621	0.090280402	−12.61152578	1.00122E-34	−1.371417985	−0.905729
Watch announcement	1.09095087	0.368664407	2.959197713	0.003132969	0.140119603	2.0417821
grade	0.843266855	0.019695417	42.81538382	4.9548E-262	0.792469929	0.8940638

Regression analysis yield of European sovereign bonds 20 days before and after a credit watch announcement as dependent variable. Independent variables are CRA II (0 = before; 1 = after), before/after announcement (0 = before; 1 = after), watch announcement (0 = down; 1 = up) and the rating grade coded from 1-14 (1 represents best rating, 14 the worst rating). Data obtained from Bloomberg Database; author's own work

Multiple linear regression credit rating agencies of 10-year sovereign bonds at 95% confidence level

Overall fit	
Multiple R	0.750250642
R Square	0.562876025
Adjusted R Square	0.562410629
Standard Error	2.259032667
Observations	3762

ANOVA

Alpha 0.05

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	4	24688.47941	6172.1199	1209.4539	0	yes
Residual	3757	19172.82982	5.1032286			
Total	3761	43861.30923				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	2.77307937	0.114068035	24.310794	2.28E-121	2.5494381	2.9967207
CRA II	−0.289747388	0.095531919	−3.03299	0.002438	−0.477047	−0.102448
before/after announcement	−0.33826698	0.08827827	−3.831826	0.0001293	−0.511345	−0.165189
Watch announcement	0.353885903	0.173132646	2.044016	0.0410215	0.0144428	0.693329
grade	0.65766966	0.011127238	59.104482		0.6358536	0.6794857

Multiple linear regression credit rating agencies of 10-year sovereign bonds at 99% confidence level

Overall fit	
Multiple R	0.750250642
R Square	0.562876025
Adjusted R Square	0.562410629
Standard Error	2.259032667
Observations	3762

ANOVA

Alpha 0.01

	df	*SS*	*MS*	*F*	*p-value*	*sig*
Regression	4	24688.47941	6172.1199	1209.4539	0	yes
Residual	3757	19172.82982	5.1032286			
Total	3761	43861.30923				
	coeff	Std err	t stat	p-value	lower	upper
Intercept	2.77307937	0.114068035	24.310794	2.28E-121	2.4791102	3.0670485
CRA II	−0.289747388	0.095531919	−3.03299	0.002438	−0.535946	−0.043548
before/after announcement	−0.33826698	0.08827827	−3.831826	0.0001293	−0.565772	−0.110762
Watch announcement	0.353885903	0.173132646	2.044016	0.0410215	−0.092301	0.8000727
grade	0.65766966	0.011127238	59.104482		0.6289932	0.6863461

Regression analysis yield of European sovereign bonds 20 days before and after a credit watch announcement as dependent variable. Independent variables are CRA II (0 = before; 1 = after), before/after announcement (0 = before; 1 = after), watch announcement (0 = down; 1 = up) and the rating grade coded from 1-14 (1 represents best rating, 14 the worst rating).

Source: Bloomberg – Authors' own analysis.

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