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Euro Crisis: Have been the European Countries downgraded in excess?

Joana Soares Costa
152411021

ABSTRACT

This dissertation studies the determinants of the European debt ratings through macroeconomic data and whether those ratings were excessively downgraded during the Euro debt crisis. The results show that, according to previous studies, most of the assigned ratings matched predicted ratings during the crisis period. Ratings are also found to be strongly influenced by changes in the variable gross debt. However, only Portugal and Ireland have been downgraded excessively during the crisis period and Moody's is the credit rating agency which has higher downgrades. Furthermore, the empirical finds show non-sticky ratings.

Keywords: rating, credit rating agencies, linear transformation, logistic transformation, inertia of ratings

Professor Joni Kokkonen
Supervisor

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1. Introduction

Have the European countries' ratings been downgraded in excess in the past four years resulting in a deepening of the current European crisis? Since 2008, the year considered by experts as the beginning of the crisis, certain countries of the European Union, such as Ireland, Greece and Portugal, have faced consecutive downgrades of their sovereign credit ratings. Consequently, by 2011, these same countries had also their sovereign debt rating downgraded to non-investment grade indicating high risk for investors and therefore, they were categorized as not being able to meet their obligations due to their economic development. Nevertheless, countries rarely default on outstanding bonds due to the international emergency credit and some of the European countries already confirmed and partly implemented it.

The three main credit rating agencies, Fitch, Standard and Poor's and Moody's, have an established reputation in the industry since investors pay in order to have access to their credit reports. However, none of agencies clearly specify what their valuation bases are, neither do they shed some light on the procedures taken in assigning a rating. Furthermore, nowadays credit rating agencies have been strongly criticized by the media, international politicians and also regulators due to constant downgrades of the sovereign debt rating of some European countries. In particular, Goodhart (2008) claims that the ratings given occasionally by the agencies are not the most correct, but in fact, these ratings have a huge impact on the economy. This argument may help to understand the reason why some European Union countries reached a tricky and unstable situation, contradicting the results that the macroeconomic factors would suggest. Therefore, this issue raises the question of whether the credit rating agencies have overreacted as far as the Euro debt crisis is concerned.

The aim of this dissertation is to perform an empirical study on the behavior of sovereign credit ratings in order to find out if the sovereign credit ratings of the European countries were excessively downgraded during the Euro crisis. This study is focused on sixteen European Union countries and on the ratings assigned in the last fourteen years by the three major credit rating agencies. This research is based on a match of macroeconomic variables from different previous studies (e.g. Cantor and Packer (1996), Afonso (2003) and Gärtner, Griesbach and Jung (2011)). Firstly, one tries to understand how sovereign debt ratings are set through a match between historical ratings and macroeconomic factors. Then, ratings are predicted for all the observations based on a previous match and compared to actual ratings. The predicted rating is compared with the assigned rating in order to find out whether credit agencies underreacted/overreacted in both periods, from 1998 to 2008 (pre-crisis period) and from 2008 onwards (crisis period). Finally, the existence of inertia in ratings will be tested. Inertia of ratings measures how fast ratings converge to their predictions and therefore the aim of using this method is to understand whether the ratings capture the crisis and if they are exposed to business cycle.

This analysis follows the study of Mora (2006) who analyzes the East Asian Crisis of 1997, through an analysis of three different of periods; prior, during and after the crisis. Mora (2006) finds no evidence of excessive downgrades during the crisis period and she holds the conclusion that before the crisis predictions were below actual ratings. Mora (2006) also explores the arguments of Ferri, Liu and Stiglitz (1999). Ferri, Liu and Stiglitz (1999) have reached slightly different conclusions from Mora (2006) as they argue that, during the East Asian crisis assigned ratings for some countries were excessively downgraded to lower notches than those which the economy would have suggested. They also conclude that ratings assigned to some Asian countries before the crisis were higher while during the crisis the predicted ratings were similar or even lower than the assigned ratings.

The main contributions of this dissertation to the existing literature consist of three key topics:

First, the use of European Union Countries: whereas previous studies perform analyzes based on OECD countries as in the case of Gärtner, Griesbach and Jung (2011), this dissertation only studies European Union Members, due to the current crisis European countries are facing;

Second, the use of recent data: Afonso, Gomes and Rother (2007) have focused their analysis on specific periods up to 2005; The data used in this study are up to 2011, which already includes the crisis period;

Third, the analysis of two specific sub-periods: the pre-crisis period (from 1998 up to 2007) and the crisis period (from 2008 up to 2011). With the purpose of analyzing the differences in both downgrades and upgrades in ratings and also the comparison between assigned ratings and predicted ratings among three credit rating agencies.

The empirical results in this dissertation suggest that macroeconomic factors such as GDP per Capita, Inflation, Gross Debt and Government Primary Surplus are important when assigning a rating; the predicted ratings of certain countries, namely, Portugal and Ireland exceed the assigned ratings in the crisis period which leads to an over-conservative position of the credit rating agencies which does not occur in Greece; Assigned Ratings turn out not to be sticky as they show an immediate response to the news.

The structure of this dissertation is as follows: section 2 describes the data used briefly, section 3 the methodology, sections 4, 5, 6, 7 and 8 corresponds to the empirical analysis and conclusions are reported in section 9.

2. Data

The sample used for this study consists of annual data from 16 out of 27 countries in the European Union for a period of fourteen years, from 1998 to 2011. The remaining countries will not be part of the sample, either because there were some countries which have no available data for some of the macroeconomic variables, or because their ratings have remained constant during the period in question, as is the case of Germany, France and the Netherlands. Therefore the sample is comprised of the following countries: Belgium, Cyprus, Czech Republic, Estonia, Finland, Greece, Hungary, Ireland, Italy, Malta, Poland, Portugal, Slovak Republic, Slovenia, Spain and Sweden.

Cantor and Packer (1996) examine the determinants of credit ratings in a cross-section of several countries in 1995 based on the assigned ratings of Moody's and Standard and Poor's. Gärtner, Griesbach and Jung (2011) also follow the study performed by Cantor and Packer (1996) to set the macroeconomic variables for their study. The basic selection of variables is equal among all three of the agencies and based on Cantor and Packer (1996), and on Gärtner, Griesbach and Jung (2011), the macroeconomic variables included in this study are as follows[1]:

Real GDP Growth Rate: gross domestic product is a measure that corresponds to the market value of final goods and services produced in a given period of time, assessed at constant prices. This is the most commonly used measure to compute the economic performance of countries. It is expected that GPD Growth Rate has a positive impact on the rating;

GDP per Capita at current prices measured in USD: GDP per capita is considered a measure of the standard of living of a person in a country given a certain period of time. It is expressed in US dollars per person. In this case the value is obtained, firstly by converting their value in national currency for dollars and hence by dividing by the total number of inhabitants in a given country. Therefore, the bigger the GDP per Capita is, the higher should the rating be;

Inflation Rate, consumer prices: the rise of the price of goods and services in an economy given a period of time is expressed by this variable. It is the percentage change in the general index year-on-year. An increase of Inflation means an increase of prices of goods and services in a certain country. So, it is expected that inflation has a negative impact on the rating, as the rating increases ceteris paribus, inflation should decrease;

General Gross Debt as % of GDP (Gross Debt): this variable includes all types of liabilities that, at a given future date, require the payment of interest and / or principal by the debtor to the creditor. It includes not only Special Drawing Rights (SDRs), but also deposits, loans, insurance, and pensions, among other types of accounts payable. Given a certain country, if the Gross Debt increases, i.e, if the

[1] All definitions in relation to the macroeconomic variables are based on the IMF definitions

sum of total debt obligations increases, ceteris paribus, the rating should decrease considering that a country with more debt has more solvency difficulties;

Current Account Balance, as % of GDP (Curr. Acc. Balance), can be expressed as the difference between savings and investment. It includes goods and services, income and current transfers. It is expected to have a positive impact on rating, the highest is the Curr. Acc. Balance, the highest is the rating;

Government Surplus, as % of GDP (Gov. Surplus), also referred as General Government Net lending/borrowing, it is computed by the difference between total revenue and total expenditure. A high deficit on the Gov. Surplus suggests that a country is having problems to balance revenues and expenditures. So, Gov. Surplus should have a positive impact on the rating;

Government primary surplus, as % of GDP (Gov. Primary Surplus), is the difference between net lending and net borrowing plus net interest payable or paid, i.e., interest expense less interest revenue. Gov. Primary Surplus should also have a positive impact on the rating of a country.

The source of these variables is chiefly the IMF World Economic Outlook database from October 2012 and OECD data. The Sovereign Credit Ratings assigned to countries were collected from the three major credit rating agencies. In all the agencies, ratings are split into two areas, investment grade and non-investment grade area. The maximum notch of each scale is respectively AAA, AAA and Aaa for Fitch, S&P's and Moody's. Moreover, the minimum notch for Fitch is D that in turn has three sublevels while for S&P's is also D and has five sublevels, and for Moody's the minimum notch is C with no sublevels. A country which has an assigned rating of D (or C in the case of a Moody's rating) is already in default on its obligations and the agency believes that it will default with lower probability of recovering the interest or the principal. Only two countries in the sample have the maximum rating within all the agencies in 2011, as it is the case of Sweden and Finland. On the other hand, countries such as Portugal, Ireland and Greece saw their rating being downgraded by several notches. The average level of the ratings in the sample lies at A+, A+ and A1, respectively, for Fitch, S&P's and Moody's.

An interesting aspect to mention is that there are 85 upgrades and 66 downgrades on the actual ratings across both the credit rating agencies and the observations for each agency. Most upgrades took place up to 2008 and in 2009 there are no upgrades (around 87% of the upgrades occurred in the pre-crisis period against the 13% occurred in the crisis period). Unlike upgrades, downgrades occurred mostly from 2009 onwards (approximately 83% of the downgrades occurred in the crisis period and 17% occurred in the pre-crisis period). For the remaining observations the rating is unchanged. These aspect support the aim of this study and also the idea that credit rating agencies could not foresee the crisis and therefore, the rating of some European Union countries might have been downgraded excessively during the crisis.

As the actual ratings correspond to the rating assigned on the last day of each year and this research is based on a year interval, many times these ratings "hide" several changes (either upgrades or downgrades) that may have occurred during a specific year. For example, both Fitch and Moody's have downgraded the rating of Portugal by three times in 2011 in a total of six notches. The rating of Greece has also been downgraded during the same year, although the rating has been more volatile showing some upgrades in the pre-crisis period in comparison to a stable rating of Portugal in the same period.

The following Table presents all variables previously mentioned and the descriptive statistics associated with each one.

Table 1 – Individual Sample Descriptive Statistics

This Table presents descriptive statistics (simple mean, Standard Deviation (St. Dev.), minimum, maximum, median and number of observations) of seven macroeconomic variables as well as Fitch, S&P's and Moody's ratings. The sample includes the sixteen countries and data from 1998 until 2011.

	Average	St. Dev.	Min.	Max.	Median	Obs.
GDP per capita	21707,76	13141,35	3791,14	59617,19	19250,16	224
Inflation	3,21	2,24	-2,58	14,18	2,79	224
Gross debt	57,25	30,57	3,69	165,41	51,46	224
Curr. acc. balance	-3,29	5,33	-15,95	9,13	-3,55	224
GPD growth rate	2,79	3,33	-13,90	10,65	3,43	224
Gov. surplus	-2,99	4,33	-30,95	8,06	-3,16	224
Gov. primary surplus	-0,93	4,14	-27,86	7,86	-0,61	224
Fitch Rating	A+	-	CCC	AAA	A+	224
S&P's Rating	A+	-	CC	AAA	A+	224
Moody's Rating	A1	-	Ca	Aaa	A1	224

3. Methodology

3.1. Sovereign Ratings Conversion: Linear and Logistic Approaches

Assigning a rating to a sovereign debt is making an assessment of a country in certain aspects, whether they are economic, financial or even political. So ratings provided by credit rating agencies have some power to describe a country's financial situation since there are investors willing to pay for these assessments, namely, country's probability of default.

In order to perform an analysis of the ratings, it is common in the literature to convert ratings into a numerical scale through several different approaches. In this study two approaches are used: a linear transformation and a logistic transformation. Although agencies do not have equal qualitative codes and Fitch and S&P's have more rating levels than Moody's, it is possible to perform a match between the rating level of each agency and the numerical scale. In the first approach, the linear transformation, ratings were converted into a linear scale of 21 grading notches following, for example, Afonso, Gomes and Rother (2007). Each level of the rating agencies' scale corresponds to a notch with the exception of the lowest notch of Fitch and S&P's, which incorporates three and five levels and/or sublevels.

One is the lowest level of the scale, which corresponds to DDD,DD, D for Fitch, CI, R, SD, D, NR for S&P's and C for Moody's. It is the level in which a country is already in default on its obligations, and credit rating agencies predict that it will default on most of its obligations. At the top of the scale, the maximum level 21 corresponds to AAA, AAA and Aaa for Fitch, S&P's and Moody's scale respectively. Countries which have the maximum rating are considered as stable and reliable countries. Ratings between 1 and 11 are included in the non-investment grade area, also identified as junk bonds, and, from 12 to 21, ratings are integrated in the investment grade area. Since it is a linear scale, it is assumed that differences between two notches are linear, i.e., the difference between two sequential notches is always identical. However, given a lower level of the scale, e.g. Ca on Moody's scale, as the economic and financial situation of a country shows some improvements, the rating can be rapidly upgraded to Caa3 or even to an upper level. On the opposite, given a higher level of the scale, for example Aa2, the requirements are stricter in order to upgrade to Aa1 or Aaa. In order to proper model this specification a non-linear conversion was performed through the logistic transformation. Afonso (2002) also applied these two approaches to his study.

Equation (1) below is the conventional logistic form

$$\mathrm{R} = \frac{e^{\beta X}}{1+e^{\beta X}} \tag{1}$$

in which β is a vector that includes the parameters of the exogenous variables and X the value of each macroeconomic variable assigned to each parameter. Hence the logistic transformation is given by

$$L_i = \ln\left[\frac{R_i}{1-R_i}\right] = \beta X \tag{2}$$

where L_i is the logit of R_i. Equation (2) is linear in X and in the parameters, and can be estimated by ordinary least squares (OLS). R_i is computed through equation (3) in which the number of categories is the total number of notches in the linear model, i.e. 21 and i corresponds to a category of the linear model

$$R_i = \frac{2i-1}{2*Number\ of\ categories} \tag{3}$$

The logistic transformation converts the linear scale into a probability which assumes values between 0 and 1, in which zero represents countries with less solvency capacity and one those countries with high solvency capacity.

The following Figure 1 is an example of the conversion of Moody's levels into numerical scales and it clearly shows the relationship between the two approaches that will be analyzed in the following sections. The logistic approach clearly intensifies the distance between ratings as being lower at the top and at the bottom of the scale while the intermediate ratings have longer distances. Table 2 shows the relationship between the numerical scales, both Linear and Logistic and the respective correspondent notch of each credit rating agency. One may also see that Fitch and S&P's include several sub-levels in the lowest notch of the scale.

Figure 1 - Moody's Ratings - Linear and Logistic Transformations

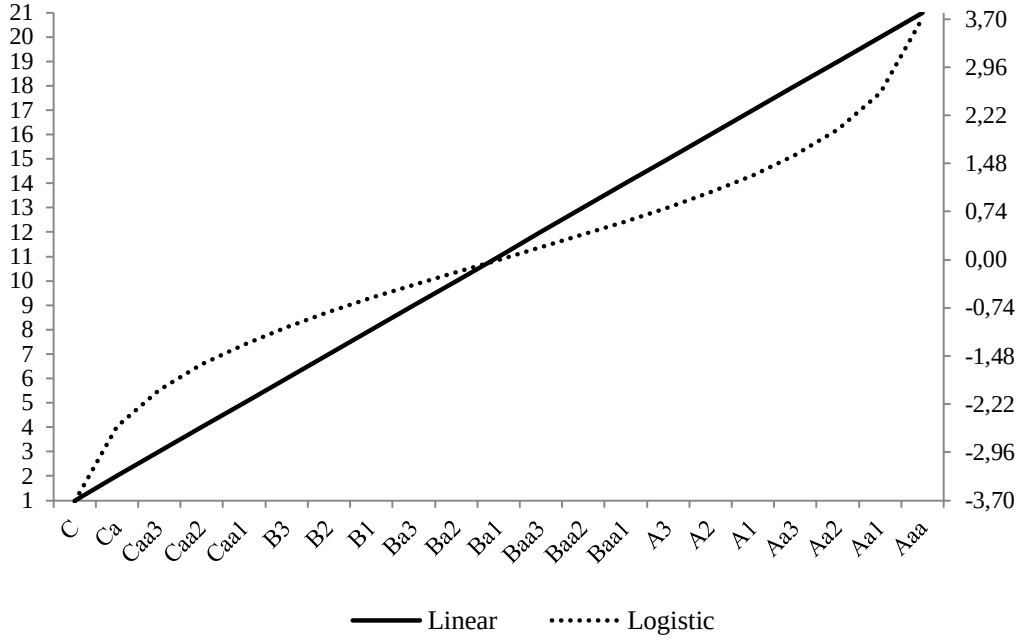


Table 2- Linear and Logistic Transformation

Reported are the conversion of ratings into a numerical scale for Fitch, S&P's and Moody's. Ratings are grouped in 21 notches, from 1 to 21 in the Linear Scale and from -3,71 to 3,71 within the Logistic Scale.

Transformation		Rating Agencies		
Linear	Logistic	Fitch	S&P's	Moody's
1	-3,71	DDD , DD , D	CI , R , SD , D , NR	C
2	-2,56	CC , C	CC , C	Ca
3	-2,00	CCC-	CCC-	Caa3
4	-1,61	CCC	CCC	Caa2
5	-1,30	CCC+	CCC+	Caa1
6	-1,04	B-	B-	B3
7	-0,80	B	B	B2
8	-0,59	B+	B+	B1
9	-0,39	BB-	BB-	Ba3
10	-0,19	BB	BB	Ba2
11	0,00	BB+	BB+	Ba1
12	0,19	BBB-	BBB-	Baa3
13	0,39	BBB	BBB	Baa2
14	0,59	BBB+	BBB+	Baa1
15	0,80	A-	A-	A3
16	1,04	A	A	A2
17	1,30	A+	A+	A1
18	1,61	AA-	AA-	Aa3
19	2,00	AA	AA	Aa2
20	2,56	AA+	AA+	Aa1
21	3,71	AAA	AAA	Aaa

3.2. Benchmark Model for explaining the ratings

With the purpose of testing if the sovereign debt ratings were excessively downgraded, it is imperative to know the benchmark against which one will compare ratings. Thus, a regression of ratings is computed as function of the macroeconomic variables derived mainly from Cantor and Packer (1996) and Gärtner, Griesbach and Jung (2011). Later, a comparison is made between predictions and actual ratings. According to Ferri, Liu and Stiglitz (1999), credit rating agencies do not have a clear set of custom criteria in order to determine a rating and their changes, but they assign this component to the sensitivity of each agency has to rely on the economic capabilities of a country.

The rating assigned to a country *i* in year *t* can be expressed as:

$$Rating_{i,t} = \alpha + \beta X_{i,t} + \varepsilon_{i,t} \quad (4)$$

Where $Rating_{i,t}$ is the dependent variable, α is the constant, β a vector of the coefficients, $X_{i,t}$ a vector of the macroeconomic variables described in the previous section and $\varepsilon_{i,t}$ corresponds to an error term.

4. Empirical Results using Linear Transformation

The aim of this section is to identify explanations for the way credit rating agencies create their ratings based on the benchmark model. Firstly, the results obtained from the linear model, outlined in section 3, will be analyzed among the three agencies, and after, the results of the logistic model are analyzed. Equation (4) is estimated using a pooled OLS (Ordinary Least Squares) regression, both through a linear and logistic transformation of the ratings.

Among all the several regressions tried for equation (4), Table 3 reports the results of an unrestricted linear model and a restricted linear model obtained for each credit rating agency. The unrestricted linear model includes all the variables discussed in section 2 while the restricted linear model only includes the most statistically significant macroeconomic variables.

Table 3- Linear Model Estimation

The dependent variable sovereign debt rating as function of macroeconomic variables. Columns (2), (4) and (6) are specifications of the model for Fitch, S&P's and Moody's respectively. Definitions of each of the variables can be found on section 2. All regressions are estimated by OLS. P-values in parenthesis.

Sovereign Debt Ratings: Linear Model[2]

	Fitch		S&P's		Moody's	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	16,72***	16,84***	17,25***	17,53***	18,50***	18,52***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
GDP per capita	1,25E-04***	1,27E-04***	1,13E-04***	1,11E-04***	1,00E-04***	1,00E-04***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Inflation	-0,27***	-0,28***	-0,32***	-0,31***	-0,38***	-0,38***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Gross Debt	-0,02***	-0,02***	-0,02***	-0,02***	-0,03***	-0,03***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Gov. Primary Surplus	0,19***	0,22***	0,20***	0,20***	0,24***	0,25***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Curr. Account Balance	0,03		0,07***	0,06**	0,02	
	(0,28)		(0,01)	(0,02)	(0,52)	
GDP Growth Rate	0,04		0,06		0,02	
	(0,32)		(0,18)		(0,60)	
Adjusted R^2	0,60	0,60	0,61	0,61	0,58	0,58

[2]Since the variables Gov. Surplus and Gov. Primary Surplus have a correlation of almost 90%, Gov. Surplus variable does not appear in these models due to multicollinearity problems. However, models were created in which the variable Gov. Surplus is included and since it turns out not to be statistically significant at a 10% level, these models are not presented in this table. Finally, the fact that Gov. Surplus is not introduced in these models does not affect the results. The same applies for the logistic transformation models of Table 4.

The explanatory power of the models is quite similar, not only between credit rating agencies but also between model restrictions, as the Adjusted R-Squared is between 58% and 61%. Moody's is the agency which has the lower Adjusted R-squared whereas S&P's has the highest Adjusted R-Squared.

According to what was mentioned in section 2, there was an expected sign for each coefficient of each macroeconomic variable. One may confirm that, on the one hand, GDP per capita, Gov. Primary Surplus, Curr. Account Balance and GDP Growth Rate have a positive impact on the ratings. On the other hand, Inflation and Gross Debt have a negative impact on the ratings.

Finally, it is interesting to mention that there are three variables, GDP per Capita, Inflation and Gov. Primary Surplus, out of the seven variables, which are statistically significant at a 1% level across the three agencies, and all of them also have the expected sign. Inflation also has a more significant impact on ratings than Gov. Primary Surplus. Surprisingly, GDP Growth Rate turn out not to be statistically significant at a 10% level which contradicts the result obtained by Gärtner, Griesbach and Jung (2011).

5. Empirical Results using Logistic Transformation

The logistic transformation in section 3.1. admits rating values between -3,71 and 3,71 and also has the same 21 notches as the Linear Model. This method of ratings' transformation is an alternative method to linear model so as to clearly demonstrate that, in order to reach the top of the rating scale, the requirements are always more stringent. The results are given in Table 4.

What is interesting to point out with this analysis is that among the two different transformation models and for the three credit rating agencies, there are four variables statistically significant at a 1% level in the unrestricted model: GDP per Capita, Inflation, Gross Debt and Gov. Primary Surplus and all of them have the expected sign. Furthermore, the use of the logistic transformation improves the overall explanatory power of the model for the three agencies and these facts lead to the conclusion that, under this model, rating predictions may be more accurate and more credible.

Table 4 reports not only the results obtained from the unrestricted logistic model across the three credit rating agencies, but also a restricted model. The Adjusted R-Squared is now between 68% and 71%. Moody's has the lowest Adjusted R-Squared and the S&P's the highest as it happened in the linear model. In addition, most variables under Fitch and S&P's ratings still have a similar impact rather than Moody's ratings. This fact support the study of Magazzino and Bozic (2012) in which Fitch and S&P's are more correlated between each other (around 99%) than with Moody's (around 97%).

Table 4 – Logistic Model Estimation

The dependent variable sovereign debt rating as function of macroeconomic variables. Columns (2), (4) and (6) are specifications of the model for Fitch, S&P's and Moody's respectively. Definitions of each of the variables can be found on section 2. All regressions are estimated by OLS. P-values in parenthesis.

Sovereign debt Ratings: Logistic Model

	Fitch		S&P's		Moody's	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	1,33***	1,33***	1,41***	1,48***	1,85***	1,87***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
GDP per capita	5,80E-05***	6,00E-05***	5,40E-05***	5,30E-05***	5,10E-05***	5,00E-05***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Inflation	-0,06***	-0,06***	-0,07***	-0,07***	-0,10***	-0,09***
	(0,01)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Gross Debt	-0,01***	-0,01***	-0,01***	-0,01***	-0,01***	-0,01***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Gov. Primary Surplus	0,07***	0,08***	0,07***	0,08***	0,09***	0,09***
	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
Curr. Account Balance	0,02**		0,03***	0,03***	0,02**	0,02**
	(0,06)		(0,00)	(0,00)	(0,02)	(0,02)
GDP Growth Rate	0,01		0,01		0,01	
	(0,38)		(0,33)		(0,60)	
Adjusted R^2	0,69	0,68	0,71	0,71	0,68	0,68

In contrast to the linear model for Moody's, the variable Gross Debt in the logistic model is statistically significant to explain both the unrestricted and the restricted models. In addition, GDP Growth Rate is not statistically significant for the analysis of the ratings as in the linear model. Results obtained for both linear and logistic model are in line not only with Cantor and Packer (1996) but also with the study of Afonso (2002). Both Cantor and Packer (1996) and Afonso (2002) conclude that through a linear transformation of ratings, GDP per Capita and Inflation are two of the most significant variables to explain ratings. However, they also conclude that GDP Growth Rate also has a strong impact on the ratings, which is not the case here, since it is not a statistically significant variable in any of the models and their specifications. A possible explanation of this difference comes from the sample used, since both previous studies have a wide variety of different countries and this study is focused only on European countries.

In short, a model that converts the ratings to a non-linear scale explains a rating better. Though, both models show that most of the macroeconomic variables presented in this study are important to assign a rating. Thus, it raises the question of whether ratings can be predicted simply based on macroeconomic data or if they depend on some other non-macroeconomic factors.

6. Predicted Ratings Vs Assigned Ratings

Previous sections have shown that macroeconomic variables are a key element on the assignment of a rating. Thus, this section has the purpose of analyzing predictions in order to better understand how well a rating can be predicted. The prediction analysis and the comparison to assigned ratings are conducted through two different approaches. In order to compare assigned ratings, a prediction of ratings is conducted with an OLS regression through an out-of-sample approach. The rating of each year t is computed based on information from the past years.

Firstly, prediction results are analyzed for each credit rating agency throughout the sample, and secondly, a specific country analysis is performed in the following section. Since the restricted model has more explanatory power, all predictions were conducted through the restricted model (columns (2), (4) and (6)) common to both tables of the linear and logistic models following the method of Afonso, Gomes and Rother (2003). The analysis of rating predictions is split into pre-crisis and crisis periods, assuming 2008 to be the year of the trigger of the crisis. These periods are therefore from 1998 to 2007, prior to crisis, and from 2008 to 2011, since the crisis.

It is questioned and analyzed in the previous literature if the ratings assigned by rating agencies are procyclical, that is, if macroeconomic factors are likely to improve in economic boom periods. Amato and Furfine (2003) study the hypothesis of ratings being procyclical under the S&P's classification and conclude that changes in ratings are highly sensitive to the business cycle. However, Ferri, Liu and Stiglitz (1999) conclude that within the East Asian crisis, the actual ratings were above the predictions in most of the years in the pre-crisis period while, in 1997, during the crisis period, the actual ratings match the predictions in most of the cases. Therefore, the main purpose of predicting a rating in this case is to determine whether actual ratings are above the predicted ratings prior to crisis and if they were excessively downgraded in order to have the actual ratings below the predicted ratings during the crisis period. Hu et al. (2002) study a way of analyzing this claim by constructing a table in which it is possible to see the number of observations correctly predicted. So, Table 5 reports the results for all the observations among the three agencies and the two models.

Panel A of Table 5 displays a summary of prediction errors for both linear and logistic models and also across the three credit rating agencies.

Table 5 - Summary of Prediction Error Notches

This table displays an overall summary of the prediction error notches, using the restricted model. Panel A displays the results of the linear and the logistic model for Fitch, S&P's and Moody's. Prediction errors for each sub-period, pre-crisis and crisis period are presented on Panel B and C for the logistic and linear model respectively, highlighting also the results for each credit rating agency.

Panel A: Summary of Prediction Error Notches according to models and credit rating agencies

		Obs.	Prediction Error Notches* (prediction rating - assigned rating)							% Correctly Predicted	% Within one nocth**	% Within two notches***
			>3	2	1	0	-1	-2	<-3			
Logistic	Fitch	208	11	7	**30**	**103**	**38**	8	11	49,52%	82,21%	89,90%
	S&P's	208	8	4	**34**	**96**	**38**	14	11	50,48%	83,65%	89,90%
	Moody's	195	12	9	**38**	**98**	**17**	7	13	51,28%	81,03%	86,67%
Linear	Fitch	208	10	8	**13**	**114**	**46**	8	9	54,81%	83,17%	90,87%
	S&P's	208	9	2	**22**	**123**	**37**	9	6	60,10%	88,94%	93,75%
	Moody's	195	14	10	**9**	**120**	**24**	9	9	67,18%	80,51%	88,72%

Panel B: Summary of Prediction Error Notches according to Logistic Model

Logistic Model		Obs.	Prediction Error Notches* (prediction rating - assigned rating)							% Correctly Predicted	% Within one nocth**	% Within two notches***
			>3	2	1	0	-1	-2	<-3			
Pre Crisis	Fitch	144	4	6	**21**	**77**	**22**	5	9	53,47%	83,33%	90,97%
	S&P's	144	4	3	**21**	**73**	**26**	8	7	50,69%	83,33%	90,97%
	Moody's	135	4	7	**22**	**72**	**12**	6	11	53,33%	78,52%	88,15%
Crisis	Fitch	64	7	1	**9**	**26**	**16**	3	2	40,63%	85,94%	90,63%
	S&P's	64	4	1	**13**	**23**	**12**	6	5	35,94%	85,94%	92,19%
	Moody's	60	8	2	**16**	**26**	**5**	1	2	43,33%	78,33%	88,33%

Panel C: Summary of Prediction Error Notches according to Linear Model

Linear Model		Obs.	Prediction Error Notches* (prediction rating - assigned rating)							% Correctly Predicted	% Within one nocth**	% Within two notches***
			>3	2	1	0	-1	-2	<-3			
pre crisis	Fitch	144	4	6	**10**	**85**	**29**	3	7	59,03%	86,11%	92,36%
	S&P's	144	3	1	**12**	**92**	**28**	3	5	63,89%	91,67%	94,44%
	Moody's	135	7	4	**3**	**93**	**15**	5	8	68,89%	82,22%	88,89%
Crisis	Fitch	64	6	3	**2**	**29**	**17**	5	2	45,31%	75,00%	87,50%
	S&P's	64	6	1	**11**	**24**	**14**	6	2	37,50%	76,56%	89,60%
	Moody's	60	9	5	**6**	**35**	**2**	3	0	58,33%	71,67%	85,00%

* Prediction Error Notches are computed through the difference between the predicted rating and the assigned rating, ** Prediction Error within +/- 1 notch,
*** Prediction Error within +/- 2 notches

Through a comprehensive analysis of the results, both rating models correctly predict, on average, 55% of all observations. With one error notch, the percentage of prediction according to both conversion models increases to approximately 83% (and 90% within two notches). In addition, the linear model turns out to be the best model to predict ratings as far as it predicts around 60% of all the observations and more than 82% within one notch.

Through Panel B and C of Table 5, one can further analyze the differences between pre-crisis and crisis period. During the pre-crisis period, predictions show some changes and by the linear model, predictions are correct in almost 64% of the observations while the logistic model predicts only 55% of the observations correctly, although the logistic model is the one that has more explanatory power. Nevertheless what turns out to be interesting is that during the pre-crisis period, on average, 21% and 11% of the observations were predicted above the assigned ratings computed by the logistic model and the linear model respectively. From 2008 onwards (the crisis period), the percentages are fairly higher, being 33% and 25% for the logistic model and the linear model. On the other hand, considering the negative notches, i.e., predictions which are below assigned ratings, results are similar, as for the crisis period the percentage of observations is, on average, 26% and 28%, respectively for the logistic model and the linear model. Before the crisis the percentage of observations predicted below the actual ratings decreases to 22% and 24% for the logistic model and the linear model.

In short, these results seem not to show a clear evidence that the credit rating agencies were overly conservative and they are consistent to those obtained in the previous literature, as is the case of Mora (2006) in her analysis of the East Asian crisis. Mora (2006) concludes that the pre-crisis period has a lower percentage of predictions above the actual rating compared to the crisis period. When analyzing the percentage of predictions below the assigned ratings, results remain in line with the previous literature. In the pre-crisis period, the predictions below the assigned ratings are lower than in the crisis period for the linear and the logistic model in her analysis, while within the European countries sample this percentage is similar in the linear model for both periods and higher for the crisis period in the logistic model.

Turning now to how accurate models are in predicting changes in ratings. Table 6 reports the total number of upgrades/downgrades as well as the predicted upgrades/downgrades and also the number of correctly predicted upgrades/downgrades. On average, around 26% of the upgrades are correctly predicted and around 48% of the downgrades are correctly predicted within both models[3]. The most interesting difference between the two models is the number of total changes. Actually, the logistic model predicts both more upgrades and downgrades and the highest results can be observed for Fitch and S&P's. Fitch predicts more upgrades (49 upgrades) and in turn S&P's is the agency that predicts more downgrades (52 downgrades). Moody's predicts both less upgrades (35 upgrades) and downgrades

[3] One may know that this analysis only takes into account the upgrades/downgrades at the end of the year and it does not capture the several upgrades/downgrades that may occur during a year.

(36 downgrades) despite their downgrades being more pronounced than those of Fitch and S&P's, i.e, in most cases Moody's downgrades correspond to more than 1 notch. These results reinforce previous studies, such as Afonso (2003) that the credit rating agencies may have smoothed the ratings according to the premises of Altman and Rijken (2004).

Table 6 – Upgrades and Downgrades Prediction

Displayed below are the total number of upgrades/downgrades as well as the predicted number of upgrades/downgrades and those which are correctly predicted. These results emerge from a prediction performed through the linear and logistic models and they are performed for the three credit rating agencies.

		Assigned Rating upgrades	Predicted Rating upgrades	Upgrades Correctly Predicted t	% of Accuracy	Assigned Rating downgrades	Predicted Rating downgrades	Downgrades Correctly Predicted t	% of Accuracy
Linear	Fitch	30	45	8	27%	19	45	10	53%
	S&P's	24	45	7	29%	26	51	10	38%
	Moody's	17	31	4	24%	19	38	10	53%
Logistic	Fitch	30	49	9	30%	19	44	9	47%
	S&P's	24	47	8	33%	26	52	11	42%
	Moody's	17	35	8	24%	19	36	11	58%

A way of analyzing the differences between the predicted ratings and the assigned ratings is through a distribution of distance, also applied by Mora (2006). She observes that the distribution of distance in the crisis period has no bias, that is, the mean is not statistically different from 0. Within the European crisis, results reported on Table 7 support Mora's results in the crisis period, the mean is zero for Fitch and S&P's. As an exception Moody's has a mean of 0,75 and 0,92 respectively for the logistic and the linear model. In relation to the pre-crisis period, results are similar to those obtained in the crisis period. Therefore, both pre-crisis and crisis distributions are centered in zero and not skewed as Ferri, Liu and Stiglitz (1999) suggested in their study which may lead to a non-excessive downgrade on the ratings of the European countries.

Table 7 – Distribution of Distance of Predicted Rating from Actual Rating

This table presents some basic statistics of the distribution of distance variable. This variable is defined as Predicted Rating – Assigned Rating. The Kolmogorov-Smirnov test is performed in order to test the equality of the distribution functions. The distribution functions are defined as Pre-crisis distribution and Crisis distribution. P-values in parenthesis.

Distribution of Distance				
	Mean			Kolmogorov-Smirnov Test
	Pre-crisis	Crisis	Sample	Crisis relative to Pre-crisis
Logistic				
Fitch	-0,35*	0,13	-0,21	0,48***
	(0,08)	(0,89)	(0,61)	(0,00)
S&P's	-0,45**	-0,27	-0,39	0,42***
	(0,03)	(0,31)	(0,29)	(0,00)
Moody's	0,74*	0,75***	0,97***	0,29***
	(0,07)	(0,00)	(0,00)	(0,00)
Linear				
Fitch	-0,37*	-0,03	-0,26*	0,56***
	(0,07)	(0,89)	(0,09)	(0,00)
S&P's	-0,32	-0,23	-0,29*	0,44***
	(0,11)	(0,31)	(0,06)	(0,00)
Moody's	-0,24	0,92***	0,12	0,42***
	(0,20)	(0,00)	(0,44)	(0,00)

Additionally, the Kolmogorov-Smirnov test is performed in order to test whether the two distributions are equally distributed mainly due to the fact that both pre crisis and crisis distributions are right skewed in the logistic model for Moody's. Results are reported on Table 7 and one may see that among the three agencies the Kolmogorov-Smirnov test rejects the hypothesis of the pre-crisis distribution and crisis distribution being the same. The outcome of the distribution of distance is in line with Mora's results and they contradict a crisis distribution skewed to the right supported by Ferri, Liu and Stiglitz (1999) and also, given a crisis distribution centered in zero, there is no evidence for the procyclicality supported by Ferri, Liu and Stiglitz (1999).

7. Country Specific Analysis

This section reports a country specific analysis with the purpose of comparing predictions to actual ratings. Tables 8 to 13 display the predictions errors of the countries across the three rating agencies. One prediction error corresponds to the difference between the predicted rating and the assigned rating by one notch.

Predictions were achieved using both the linear and the logistic models yielding in fairly similar results. However, as the logistic model showed to have more explanatory power[4] and given the difference between the linear transformation and the logistic transformation explained in section 3.1., only the logistic model will be discussed in this section. Rating predictions are performed annually and the predicted rating is the rating which should be assigned to a country at the end of each year t. As Afonso, Gomes and Rother (2007) apply in their study, the overall countries of the sample are divided into two groups, one group includes those countries which became members of the European Union (EU) up to 2003, named the oldest members of the European Union (Belgium, Finland, Greece, Ireland, Italy, Portugal, Spain and Sweden) and the second group includes those countries which have become members of the European Union from 2004 onwards, named the newest members (Cyprus, Czech Republic, Estonia, Hungary, Malta, Poland, Slovak Republic and Slovenia).

Both Tables 8 and 9 show the assigned ratings and the predicted ratings for Fitch and also for both oldest countries (Table 8) and newest countries (Table 9). In most of the countries the assigned rating tracks the predicted rating throughout the sample as the sample average of prediction error is zero for most of the countries. However, Table 8 includes some of those countries that are facing financial problems nowadays, such as Greece, Ireland, Portugal and Spain. With respect to these countries, prediction errors are fairly sharp in the crisis period with the exception of Spain.

[4] R^2 of 0,69 , 0,71 and 0,68 for Fitch , S&P's and Moody's in the Logistic Transformation compared to R^2 of 0,60, 0,61 and 0,58 for Fitch , S&P's and Moody's in the Linear Transformation

Table 8 - Summary of Fitch Prediction Error according to Logistic Transformation Model

Comparison of Fitch Assigned Ratings and respective Predictions for the oldest members of the European Union: Greece, Ireland, Portugal, Spain, Italy, Belgium, Finland and Sweden, and from 1999-2011. Sample means of the Assigned Ratings, Predictions and Prediction Errors for the whole sample and for the sub-periods, Pre-crisis and Crisis period.

Year	Greece			Ireland			Portugal			Spain		
	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error
1999	BBB+	BBB	-1	AAA	AAA	0	AA	AA	0	AA+	AA	-1
2000	A-	BB	-5	AAA	AAA	0	AA	AA	0	AA+	A-	-5
2001	A	BBB+	-2	AAA	AAA	0	AA	AA	0	AA+	AA+	0
2002	A	A	0	AAA	AAA	0	AA	AA	0	AA+	AAA	1
2003	A+	A-	-2	AAA	AAA	0	AA	AA	0	AA+	AA+	0
2004	A	AA-	2	AAA	AAA	0	AA	AA	0	AA+	AAA	1
2005	A	BBB+	-2	AAA	AAA	0	AA	AA	0	AA+	AAA	1
2006	A	A	0	AAA	AAA	0	AA	AA	0	AA+	AAA	1
2007	A	A-	-1	AAA	AAA	0	AA	AA	0	AA+	AAA	1
2008	A	A+	1	AAA	AAA	0	AA	AA	0	AA+	AAA	1
2009	BBB+	AA	5	AA-	AAA	3	AA	AA	0	AA+	AA+	0
2010	BBB-	BB	-2	BBB+	AA-	4	A+	AA	2	AA+	AA+	0
2011	CCC	B+	4	BBB+	A+	3	BB+	BBB+	3	AA-	AA-	0
Total Avg	BBB+	BBB+	0	AA	AA+	1	AA-	AA-	0	AA	AA	0
Pre-crisis Avg	A-	BBB+	-1	AAA	AAA	0	AA	AA	0	AA+	AA+	0
Crisis Avg	BB+	BBB	2	A	AA	3	A	A+	1	AA	AA	0
Year	Italy			Belgium			Finland			Sweden		
	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error
1999	AA-	AA-	0	AA-	AA-	0	AA+	AA+	0	AA	AA-	-1
2000	AA-	AA-	0	AA-	AA-	0	AA+	AA+	0	AA	BBB+	-5
2001	AA-	AA-	0	AA-	AA-	0	AA+	AAA	1	AA	A	-3
2002	AA	AA-	-1	AA	AA-	-1	AA+	AAA	1	AA+	AA+	0
2003	AA	AA+	1	AA	A+	-2	AA+	AAA	1	AA+	AAA	1
2004	AA	AA	0	AA	AA	0	AA+	AA+	0	AA+	AA+	0
2005	AA	AA	0	AA	AA+	1	AA+	AAA	1	AA+	AA+	0
2006	AA-	AA	1	AA+	AA	-1	AA+	AAA	1	AA+	AAA	1
2007	AA-	AA-	0	AA+	AA	-1	AA+	AAA	1	AA+	AAA	1
2008	AA-	AA-	0	AA+	AA	-1	AA+	AAA	1	AA+	AAA	1
2009	AA-	AA-	0	AA+	AA	-1	AA+	AA+	0	AA+	AA+	0
2010	AA-	AA-	0	AA+	AA	-1	AA+	AA+	0	AA+	AAA	1
2011	A+	A+	0	AA	AA	0	AA+	AA+	0	AA+	AAA	1
Total Avg	AA-	AA-	0	AA	AA-	-1	AA+	AA+	0	AA	AA	0
Pre-crisis Avg	AA-	AA-	0	AA-	AA-	0	AA+	AA+	0	AA+	AA	-1
Crisis Avg	A+	A+	0	AA	AA	0	AA+	AA+	0	AA+	AA+	0

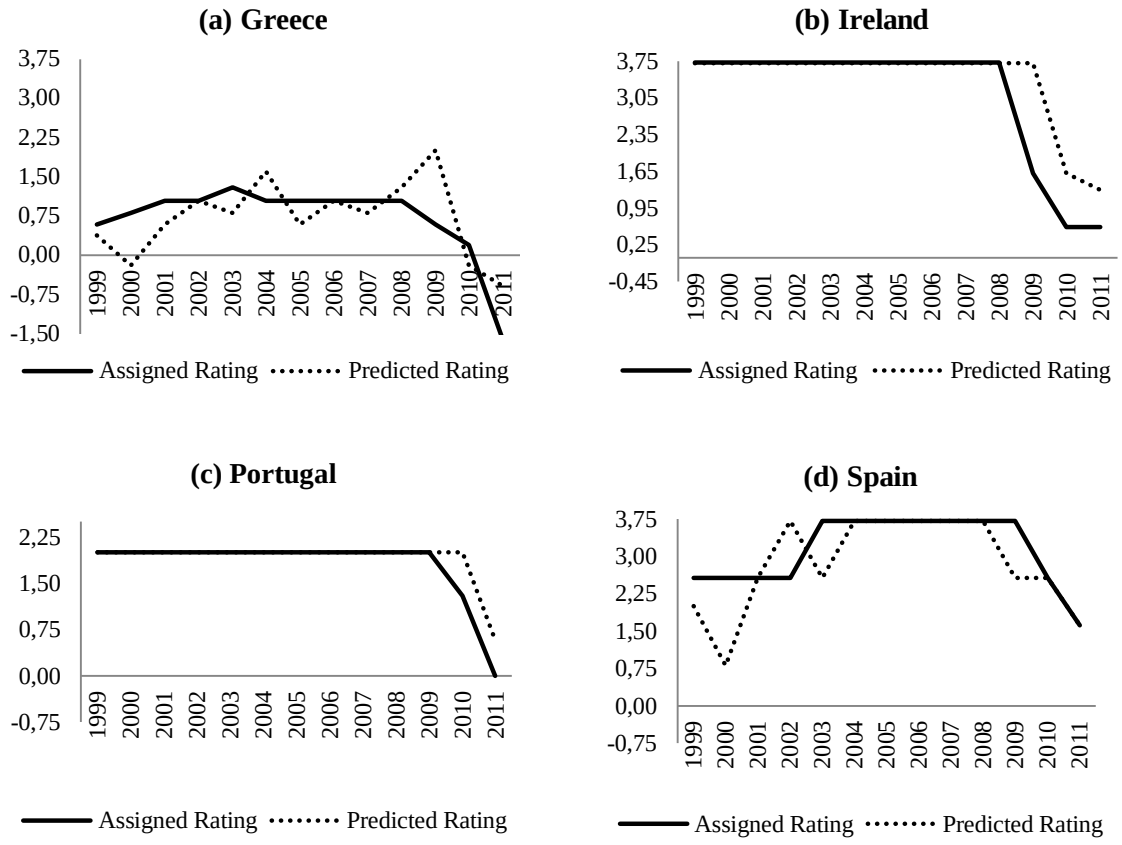
Table 9 - Summary of Fitch Prediction Errors according to Logistic Transformation Model

Comparison of Fitch Assigned Ratings and respective Predictions for the newest members of the European Union: Cyprus, Czech Republic Estonia, Hungary, Malta, Poland, Slovak Republic and Slovenia, and from 1999-2011. Sample means of the Assigned Ratings, Predictions and Prediction Errors for the whole sample and for the sub-periods, Pre-crisis and Crisis period.

Year	Cyprus			Czech Republic			Estonia			Hungary		
	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error
1999	A-	A-	0	BBB+	BBB+	0	BBB	BBB	0	BBB+	BBB	-1
2000	A-	A-	0	BBB+	BBB+	0	BBB+	BBB	-1	A-	BB-	-6
2001	A-	A-	0	BBB+	BBB+	0	A-	AA-	3	A-	DDD	-14
2002	A-	A-	0	BBB+	BBB+	0	A-	BBB	-2	A-	A	1
2003	A-	A-	0	A-	BBB+	-1	A-	A+	2	A-	AA	4
2004	A-	A-	0	A-	A+	2	A	AA	3	A-	A-	0
2005	A-	A-	0	A	A-	-1	A	AA+	4	BBB+	BBB+	0
2006	A	A-	-1	A	A	0	A	BBB	-3	BBB+	BBB+	0
2007	A	A	0	A	A	0	A	A+	1	BBB+	BBB+	0
2008	A	A	0	A+	A+	0	A-	A	1	BBB-	BB+	-1
2009	A	A-	-1	A+	A	-1	BBB+	AA	5	BBB-	BB	-2
2010	A	A-	-1	A+	A	-1	A	BBB	-3	BBB-	BBB-	0
2011	A+	A-	-2	A+	A+	0	A+	A+	0	BBB-	BB+	-1
Total Avg.	A-	A-	0	A-	A-	0	A-	A	1	BBB	BBB-	-2
Pre-crisis Avg.	A-	A-	0	BBB+	BBB+	0	A-	A	1	BBB+	BBB-	-2
Crisis Avg.	AA	A-	-1	A+	A	-1	A-	A	1	BBB-	BB+	-1
Year	Malta			Poland			Slovak Republic			Slovenia		
	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error	Fitch Rating	Prediction	Pred. Error
1999	A	A	0	BBB+	BBB+	0	BB+	BB+	0	A	A-	-1
2000	A	A	0	BBB+	BBB+	0	BB+	BB+	0	A	BB	-6
2001	A	A	0	BBB+	BBB+	0	BB+	BB+	0	A	A	0
2002	A	A	0	BBB+	BBB+	0	BBB-	BB+	-1	A	AA-	2
2003	A	A	0	BBB+	BBB+	0	BBB-	BBB+	2	A+	A	-1
2004	A	A	0	BBB+	BBB+	0	A-	BBB+	-1	AA-	A+	-1
2005	A	A	0	BBB+	BBB+	0	A	A-	-1	AA-	AA-	0
2006	A	A	0	BBB+	BBB+	0	A	A+	1	AA	AA-	-1
2007	A+	A	-1	A-	BBB+	-1	A	AA-	2	AA	AA+	1
2008	A+	A+	0	A-	A-	0	A+	AA-	1	AA	AA	0
2009	A+	A	-1	A-	BBB+	-1	A+	A	-1	AA	BB+	-8
2010	A+	A	-1	A-	BBB+	-1	A+	A	-1	AA	AA	0
2011	A+	A+	0	A-	A-	0	A+	A+	0	AA-	AA	1
Total Avg.	A	A	0	BBB+	BBB+	0	BBB+	BBB+	0	A+	A	-1
Pre-crisis Avg.	A	A	0	BBB+	BBB+	0	BBB	BBB	0	A+	A	-1
Crisis Avg.	A+	A	-1	A-	BBB+	-1	A+	A	0	AA-	A+	-2

Gärtner, Griesbach and Jung (2011) analyze these countries grouped, nowadays called PIGS, and find that between 2009 and 2010 the rating of a country that belongs to this group is lower than one that does not belong to that group. They also associate this group to the serious economic growth problems these countries are facing since 2007. Thus, Figure 2 below presents the predicted ratings and the assigned ratings for Greece, Ireland, Portugal and Spain and it helps to understand more closely the differences between assigned ratings and the predicted ratings in some of the countries with crisis. Predictions do not fall as much as the assigned ratings for all the four countries and prediction errors are more pronounced on the last few years mainly for Greece, Ireland and Portugal.

Figure 2 – Fitch Assigned Ratings and Predictions according to the logistic model



As one may observe on Figure 2(b) and 2(c) the assigned rating of Ireland and Portugal track the predictions quite well until 2008, i.e the assigned rating matches the predicted rating. From 2008 onwards, although predictions follow the same trend of the assigned ratings, the assigned rating of these countries clearly falls more than the predicted rating which leads to a larger prediction error. In this case, some of the macroeconomic variables clearly affect the ratings since some of them such as Gross Debt and Gov. Primary Surplus show a large decline from 2008 up to 2011. For this reason, and given the fact that ratings are assigned not only according to macroeconomic data but also include a country's

political situation and the judgment of each credit rating agency, one should expect a downgrade on the assigned ratings of Portugal and Ireland from 2009 onwards. However, the effective downgrades turn out to be higher than the model's predictions as Portugal has an average prediction error of one notch and Ireland has an average prediction error of three notches in the crisis period. Moreover, in 2010 when Ireland asked for international aid, its assigned rating was downgraded by four notches, from AA- to BBB+ and the assigned rating is four notches below the predicted rating. On the other hand, the assigned rating of Portugal was downgraded for the first time in 2010 but it was only in 2011, this country, hit by a severe economic and financial crisis, was forced to ask for international financial assistance and the assigned rating was downgraded by six notches from A+ to BB+. Therefore, there is evidence that for these countries the assigned rating is more prone to a downgrade than the predicted rating.

In contrast, Greece and Spain show some volatility on predicted ratings being the sharpest in Greece, mainly due to several variations in some macroeconomic variables such as Gross Debt, Inflation and Gov. Primary Surplus. The assigned rating of Greece seems to be more stable than the predicted rating but it is always at higher notches, which clearly indicate that there are other possible macroeconomic factors which may influence the rating or also the judgment to assign a rating to Greece may be different from the other countries. On the other hand, on average, actual ratings match the predicted ratings for Italy, Belgium, Finland and Sweden in the pre-crisis period as well as in the crisis period (Table 8).

With respect to the newest countries reported on Table 9, assigned ratings have been upgraded since 1998 as Afonso, Gomes and Rother (2007) also observed. In general, all of them show a good macroeconomic performance, in particular a gradual increase of GDP per Capita. Furthermore, Afonso, Gomes and Rother (2007) highlight the fact that all of these countries have a positive credibility effect of joining the European Union which cannot be observed in the predicted ratings. Therefore, there are slightly differences between assigned ratings and predicted ratings over the years but non-macroeconomic factors are not being considered and may influence our results. Estonia, Hungary and Slovenia have shown several changes across the whole sample, also showing that in the crisis period predictions are quite different from the assigned ratings.

In general, Fitch predictions turn out to be more expressive on downgrades and upgrades while assigned ratings turn out to be more constant. Even though, most predictions of the countries follow the same pattern of the assigned ratings with the exception of Greece, Hungary and Slovenia which show some volatility in their predictions. However, the main differences arise from Portugal and Ireland. Both countries have an excessive downgrade of their ratings between 2008 and 2011.

Table 10 – Summary of S&P's Prediction Errors according to Logistic Transformation Model

Comparison of S&P's Assigned Ratings and respective Predictions for the oldest members of the European Union, Greece, Ireland, Portugal, Spain, Italy, Belgium, Finland and Sweden, and from 1999-2011. Sample means of the Assigned Ratings, Predictions and Prediction Errors for the whole sample and for the sub-periods, Pre-crisis and Crisis period.

Year	Greece			Ireland			Portugal			Spain		
	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error
1999	A-	BBB	-2	AA+	AA+	0	AA	AA	0	AA+	AA	-1
2000	A-	B+	-7	AA+	AA+	0	AA	AA	0	AA+	A-	-5
2001	A	A-	-1	AAA	AA+	-1	AA	AA	0	AA+	AA+	0
2002	A	A	0	AAA	AA+	-1	AA	AA	0	AA+	AAA	1
2003	A+	A	-1	AAA	AA+	-1	AA	AA	0	AA+	AA+	0
2004	A	AA-	2	AAA	AA+	-1	AA	AA	0	AA+	AA	-1
2005	A	BBB+	-2	AAA	AAA	0	AA-	AA	1	AAA	AAA	1
2006	A	A	0	AAA	AA+	-1	AA-	AA-	0	AAA	AAA	1
2007	A	BBB+	-2	AAA	AAA	0	AA-	AA-	0	AAA	AAA	1
2008	A	A+	1	AAA	AAA	0	AA-	AA-	0	AAA	AA+	0
2009	BBB+	AA	5	AA	AAA	2	A+	A-	-2	AAA	AA+	0
2010	BB+	BB-	-2	A	AA	3	A-	A-	0	AA	AA+	1
2011	CC , C	B	5	BBB+	A	2	BBB-	BBB	1	AA-	AA-	0
Total Avg	BBB+	BBB+	0	AA	AA	0	A+	A+	0	AA+	AA	-1
Pre-crisis Avg	A-	BB+	-1	AA+	AA+	0	AA-	AA-	0	AA+	AA	-1
Crisis Avg	BB	BBB	2	A+	AA	2	A-	A-	0	AA	AA	0
Year	Italy			Belgium			Finland			Sweden		
	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error
1999	AA	AA	0	AA+	AA+	0	AA+	AA	-1	AA+	AA+	0
2000	AA	AA	0	AA+	AA+	0	AA+	AA+	0	AA+	AA+	0
2001	AA	AA	0	AA+	AA+	0	AA+	AA+	0	AA+	AA+	0
2002	AA	AA	0	AA+	AA+	0	AA+	AA+	0	AA+	AA+	0
2003	AA	AA	0	AA+	AA+	0	AA+	AAA	1	AA+	AA+	0
2004	AA-	AA	1	AA+	AA+	0	AA+	AAA	1	AA+	AA+	0
2005	AA-	AA-	0	AA+	AA+	0	AA+	AAA	1	AA+	AAA	1
2006	A+	A+	0	AA+	AA+	0	AA+	AAA	1	AA+	AA+	0
2007	A+	A	-1	AA+	AA+	0	AA+	AAA	1	AA+	AAA	1
2008	A+	A-	-2	AA+	AA+	0	AA+	AAA	1	AA+	AAA	1
2009	A+	A+	0	AA+	AA+	0	AA+	AAA	1	AA+	AA+	0
2010	A+	A+	0	AA+	AA+	0	AA+	AA	-1	AA+	AAA	1
2011	A	A+	1	AA	AA+	1	AA+	AA+	0	AA+	AAA	1
Total Avg	A+	A+	0	AA+	AA+	0	AA+	AA+	0	AA+	AA+	0
Pre-crisis Avg	AA-	AA-	0	AA+	AA+	0	AA+	AA+	0	AA+	AA+	0
Crisis Avg	A	A	0	AA+	AA+	0	AA+	AA+	0	AA+	AAA	1

Table 11 - Summary of S&P's Prediction Errors according to Logistic Transformation Model

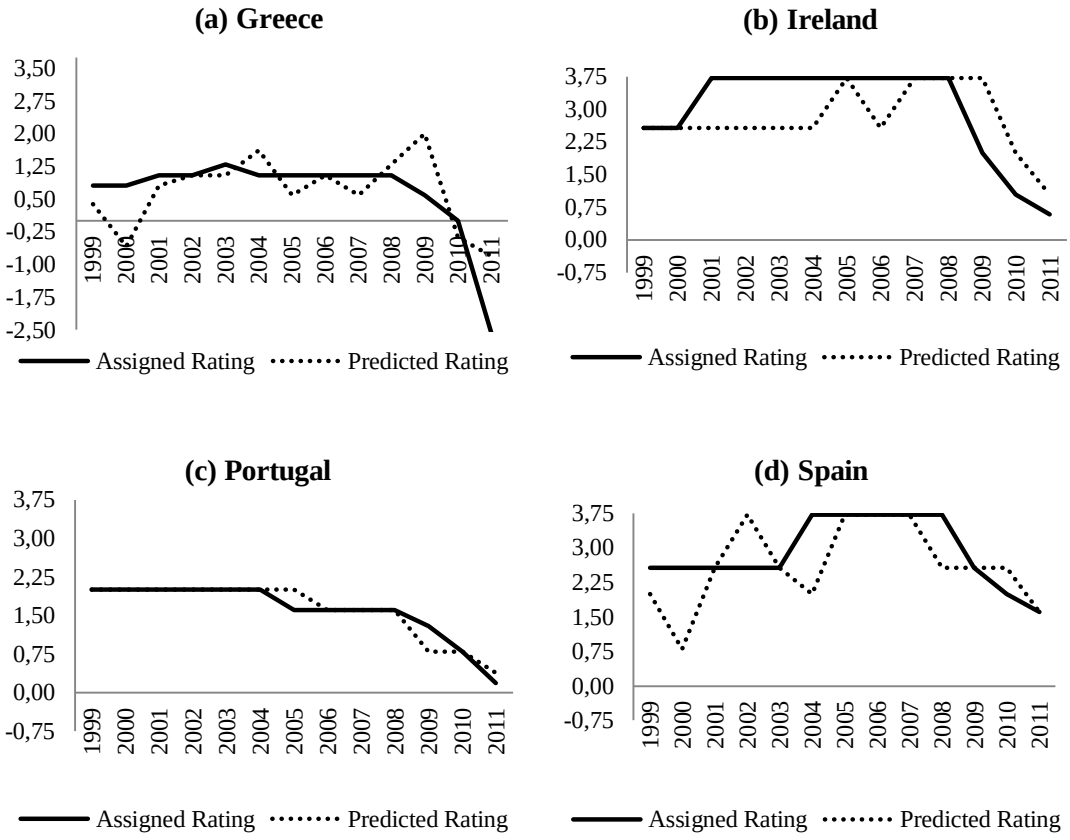
Comparison of S&P's Assigned Ratings and respective Predictions for the newest members of the European Union: Cyprus, Czech Republic Estonia, Hungary, Malta, Poland, Slovak Republic and Slovenia, and from 1999-2011. Sample means of the Assigned Ratings, Predictions and Prediction Errors for the whole sample and for the sub-periods, Pre-crisis and Crisis period.

Year	Cyprus			Czech republic			Estonia			Hungary		
	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error
1999	A	A+	1	A-	A-	0	BBB+	BBB+	0	BBB-	BBB	1
2000	A	AA	3	A-	A-	0	BBB+	BBB+	0	A-	BBB	-2
2001	A	A	0	A-	A-	0	A-	A	1	A-	BB	-5
2002	A	BBB+	-2	A-	A-	0	A-	BBB+	-1	A-	BBB+	-1
2003	A	A-	-1	A-	A-	0	A-	A	1	A-	A-	0
2004	A	BBB+	-2	A-	A-	0	A	A+	1	A-	A-	0
2005	A	A	0	A-	A-	0	A	A+	1	A-	BBB+	-1
2006	A	A	0	A-	A-	0	A	A	0	BBB+	B+	-6
2007	A	A	0	A	A-	-1	A	A	0	BBB+	BBB	-1
2008	A+	A	-1	A	A	0	A	A	0	BBB-	BBB-	0
2009	A+	A	-1	A	A-	-1	A-	A-	0	BBB-	B+	-4
2010	A	A	0	A	A-	-1	A	BBB	-3	BBB-	BB+	-1
2011	BBB-	A-	3	AA-	A-	-3	AA-	A	-2	BB+	BB+	0
Total Avg.	A-	A-	0	A-	A-	0	A-	A-	0	BBB+	BBB-	-2
Pre-crisis Avg.	A-	A-	0	A-	A-	0	A-	A-	0	BBB+	BBB-	-2
Crisis Avg.	A-	A-	0	A	A-	-1	A	A-	-1	BB+	BB	-1
Year	Malta			Poland			Slovak Republic			Slovenia		
	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error	S&P's Rating	Prediction	Pred. Error
1999	A	A+	1	BBB-	BBB-	0	BB+	BB+	0	A	A	0
2000	A	A	0	BBB+	BBB-	-2	BB+	BB+	0	A	A	0
2001	A	AA-	2	BBB+	B-	-8	BBB-	BB+	-1	A	A	0
2002	A	A-	-1	BBB+	BBB-	-2	BBB-	A	4	A	A	0
2003	A	B+	-8	BBB+	B+	-6	BBB-	A	4	A+	A	-1
2004	A	A-	-1	BBB+	AAA	7	A-	BBB+	-1	AA-	A+	-1
2005	A	A	0	BBB+	BB	-4	A	A-	-1	AA-	AA-	0
2006	A	A	0	BBB+	BBB+	0	A	A	0	AA	AA-	-1
2007	A	A	0	A-	BBB+	-1	A	AA-	2	AA	AA+	1
2008	A	A	0	A-	A	1	A+	AA-	1	AA	AA	0
2009	A	A-	-1	A-	BBB	-2	A+	A	-1	AA	BB+	-8
2010	A	A-	-1	A-	BBB+	-1	A+	A	-1	AA	AA	0
2011	A	A-	-1	A-	BBB	-2	A+	A+	0	AA-	AA	1
Total Avg.	A	A-	-1	BBB+	BBB-	-2	A-	A-	0	A+	A+	0
Pre-crisis Avg.	A	A-	-1	BBB+	BBB-	-2	BBB	BBB+	1	A+	A+	0
Crisis Avg.	A	A-	-1	A-	BBB+	-1	A+	A+	0	AA	A+	-2

As far as S&P's is concerned, assigned ratings, predictions and errors of the overall sample are reported on Tables 10 and 11. These results do not differ much from previous results. Assigned ratings are quite similar between the two agencies as well as predicted ratings. However, on the one hand, predicted ratings of Ireland now seem to be more volatile, and therefore, there are more prediction errors compared to Fitch's ratings whereas, on the other hand, Portugal turns out to have, on average, a prediction error of zero for all the specific periods.

Figure 3 shows further insights to better understand ratings behavior for Greece, Ireland, Portugal and Spain.

Figure 3 – S&P's Assigned Ratings and Predictions according to the logistic model



As one observes on Figure 3(b), the predicted rating of Ireland has been below the assigned rating until 2008 which is not consistent with Fitch results. During the crisis period, the rating of Ireland was downgraded for several notches, noticing a predicted rating fairly higher. With respect to the other countries, although Portugal and Spain turn out to have an average prediction error of zero notches for both pre crisis and crisis period, results obtained support the analysis of Afonso, Gomes and Rother (2007) as for instance, both countries had respectively an AA and AA+ from 1998 but on 2005, Spain's rating was upgrade while Portugal's rating was downgraded, contradicting, in the latter case, the

predicted rating. This is due to the fact that, although both shows a good macroeconomic performance over the years, Portugal's deficit has increased since 2000, the government debt has increased and even the government effectiveness indicator from the World Bank has declined. However, the predicted rating of Portugal adjusts to the assigned rating on the following year. Thus from 2006 to 2008 predictions match the assigned rating.

Table 11 reports the results of the newest countries of the EU and the majority of the countries have several prediction errors in both sub-periods. In particular, Poland show prediction errors over nearly the whole sample which may lead to the conclusion of Afonso, Gomes and Rother (2007) that Poland macroeconomic performance may be undervalued which, in turn, was not observed on Fitch ratings. Nevertheless, Hungary is the country which on average has a predicted rating lower than assigned rating.

As stated in the previous analysis of Fitch ratings, S&P's also show a significant downgrade on the rating of some oldest countries, although those downgrades were predicted. As an example, in the crisis period Ireland has a predicted rating always higher than the actual rating, with an average prediction error of two notches.

Finally, let us consider the case of Moody's. Moody's is, among the three agencies, the one that presents more distinct results. Tables 12 and 13 report the results obtained for both oldest and newest countries of the EU. Results suggest that Moody's is the agency that has more stable assigned ratings (around 79% of the sample has either no upgrades or downgrades) and, consequently, less frequent upgrades and/or downgrades. However, these upgrades and/or downgrades seem to be more aggressive, mainly downgrades. On average 63% of the downgrades are by two notches or more.

Observing the results from the oldest countries of the EU and, in particular the crisis period, what is interesting to point out is that the assigned rating of Greece is at higher notches than the assigned rating from the other agencies until 2009. From 2010 to 2011, the rating is downgraded by fourteen notches while Fitch and S&P's downgraded by ten and twelve notches respectively. The same applies to Ireland and Portugal where Moody's assigned rating is at lower notches compared to the other agencies.

Table 12 - Summary of Moody's Prediction Errors according to Logistic Transformation Model

Comparison of Moody's Assigned Ratings and respective Predictions for the oldest members of the European Union, Greece, Ireland, Portugal, Spain, Italy, Belgium, Finland and Sweden, and from 1999-2011. Sample means of the Assigned Ratings, Predictions and Prediction Errors for the whole sample and for the sub-periods, Pre-crisis and Crisis period.

Year	Greece			Ireland			Portugal			Spain		
	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error
1999	A2	Baa1	-2	Aaa	Aaa	0	Aa2	Aa2	0	Aa2	Aa2	0
2000	A2	B1	-8	Aaa	Aaa	0	Aa2	Aa2	0	Aa2	Aa2	0
2001	A2	A2	0	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aa2	-1
2002	A1	A3	-2	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aaa	1
2003	A1	Aa2	2	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aaa	1
2004	A1	Aa2	2	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	A2	-4
2005	A1	A1	0	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aaa	1
2006	A1	Aa3	1	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aaa	1
2007	A1	A2	-1	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aa1	0
2008	A1	Aa3	1	Aaa	Aaa	0	Aa2	Aa2	0	Aa1	Aaa	1
2009	A2	Aa1	4	Aa1	Aaa	1	Aa2	Aa2	0	Aa1	Aa1	0
2010	Ba1	Ba2	-1	Baa1	Aa1	6	A1	Aa2	2	Aa1	A1	-3
2011	Ca	B2	5	Ba1	A1	6	Ba2	Baa1	4	A1	Baa2	-4
Total Avg	A3	A3	0	Aa3	Aa1	2	Aa3	Aa3	0	Aa2	Aa2	0
Pre-crisis Avg	A2	A3	-1	Aa1	Aaa	1	Aa2	Aa2	0	Aa2	Aa2	0
Crisis Avg	Ba1	Baa2	2	A2	Aa2	4	A2	A1	1	Aa2	A1	-2
Year	Italy			Belgium			Finland			Sweden		
	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error
1999	Aa3	Aa3	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aa2	-1
2000	Aa3	Aa3	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Baa2	-7
2001	Aa3	Aa3	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	A1	-3
2002	Aa2	Aa3	-1	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2003	Aa2	Aa1	1	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2004	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2005	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aa1	0
2006	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aa1	0
2007	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2008	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2009	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2010	Aa2	Aa2	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aaa	1
2011	A2	Aa2	3	Aa3	Aa1	2	Aaa	Aaa	0	Aa1	Aaa	1
Total Avg	Aa3	Aa3	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aa2	-1
Pre-crisis Avg	Aa3	Aa3	0	Aa1	Aa1	0	Aaa	Aaa	0	Aa1	Aa2	-1
Crisis Avg	Aa3	Aa2	1	Aa2	Aa1	1	Aaa	Aaa	0	Aa1	Aaa	1

Table 13 - Summary of Moody's Prediction Errors according to Logistic Transformation Model

Comparison of Moody's Assigned Ratings and respective Predictions for the newest members of the European Union: Cyprus, Czech Republic, Hungary, Malta, Poland, Slovak Republic and Slovenia, and from 1999-2011. Sample means of the Assigned Ratings, Predictions and Prediction Errors for the whole sample and for the sub-periods, Pre-crisis and Crisis period.

Year	Cyprus			Czech republic			Hungary		
	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error
1999	A2	A2	0	Baa1	Baa1	0	Baa1	Baa2	-1
2000	A2	A2	0	Baa1	Baa1	0	A3	Ba3	-6
2001	A2	A2	0	Baa1	Baa1	0	A3	C	-14
2002	A2	A2	0	A1	Baa1	-3	A1	A2	-1
2003	A2	A2	0	A1	Aa2	2	A1	Aa1	3
2004	A2	A2	0	A1	B3	-11	A1	A1	0
2005	A2	A2	0	A1	A1	0	A1	A1	0
2006	A2	A2	0	A1	Aa3	1	A2	Aa3	2
2007	A1	A2	-1	A1	A1	0	A2	A2	0
2008	Aa3	Aa3	0	A1	Aa3	1	A3	A2	1
2009	Aa3	A1	-1	A1	Aa3	1	Baa1	Baa3	-2
2010	Aa3	A1	-1	A1	Aa3	1	Baa3	Baa2	1
2011	Baa3	A1	5	A1	Aa3	1	Ba1	Ba2	-1
Total Avg.	A2	A2	0	A2	A3	-1	A3	Baa2	-2
Pre-crisis Avg.	A2	A2	0	A2	Baa1	-1	A2	Baa1	-2
Crisis Avg.	A2	A1	1	A1	Aa3	1	Baa2	Bbaa3	0
Year	Poland			Slovak Republic			Slovenia		
	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error	Moody's Rating	Prediction	Pred. Error
1999	Baa1	Baa3	-2	Ba1	Ba1	0	A3	A3	0
2000	Baa1	Baa3	-2	Ba1	Ba1	0	A2	A3	-1
2001	Baa1	Ca	-12	Baa3	Ba1	-1	A2	A3	-1
2002	A2	Baa1	-2	A3	A2	1	Aa3	A3	-3
2003	A2	Aa3	2	A3	Aa1	5	Aa3	A3	-3
2004	A2	Aaa	5	A3	Aaa	6	Aa3	Aa1	2
2005	A2	Aa2	3	A2	Baa1	-2	Aa3	Aa3	0
2006	A2	A2	0	A1	A2	-1	Aa2	Aa2	0
2007	A2	A3	-1	A1	Aa2	2	Aa2	Aa1	1
2008	A2	A2	0	A1	Aa3	1	Aa2	Aa1	1
2009	A2	A2	0	A1	A1	0	Aa2	Aa2	0
2010	A2	A2	0	A1	A2	-1	Aa2	Aa2	0
2011	A2	A2	0	A1	A1	0	A1	Aa1	3
Total Avg.	A3	BBB+	-1	A3	A2	1	A1	A1	0
Pre-crisis Avg.	A3	Baa1	-1	Baa1	A3	1	A1	A2	-1
sis Avg.	A2	A2	0	A1	A1	0	Aa3	Aa2	1

Therefore, prediction errors turn out to be higher for Moody's and the following Figure 4 reports both assigned and predicted ratings for Greece, Ireland, Portugal and Spain to better illustrate the differences.

Figure 4 – Moody's Assigned Ratings and Predictions according to the logistic model

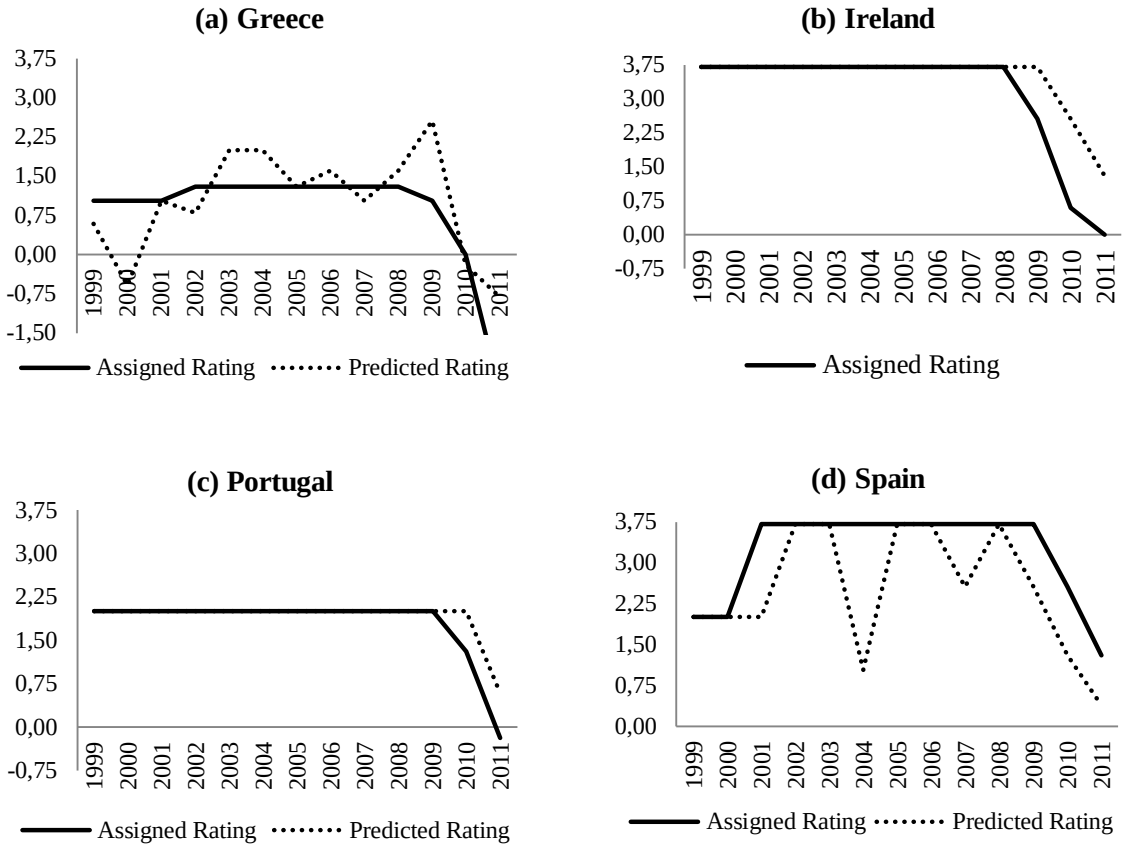


Figure 4 shows that results do not differ much from Fitch results since for Ireland and Portugal there are only prediction errors in the crisis period. Ireland has an average prediction error of four notches and Portugal an average prediction error of one notch in the crisis period. The exception is Spain where one may observe on Figure 4(d) that the predicted rating has been at lower notches compared to the assigned rating for almost the entire sample and so the predicted rating does not follow the same trend.

In the case of the newest countries, Moody's is the credit agency which has more prediction errors, although it is the credit rating agency which has a lower average prediction error. In fact, Moody's presents the strongest upgrades for these countries. As well as in S&P's ratings, Poland has several prediction errors which give more emphasis to the idea of Afonso, Gomes and Rother (2007) of the undervaluation of macroeconomic data. It is also important to point out that as the oldest countries of Moody's were downgraded by several notches, the same happened to some of the newest countries and this is something that is not so visible in the ratings assigned by the other credit rating agencies.

In short, Ireland and Portugal present similar results as the results obtained with Fitch ratings. An interesting result is the predicted rating of Spain within all the observations. The predicted rating is always at lower notches than the actual rating or even equal, but never at higher notches. This fact clearly contradicts the premise of credit rating agencies were over-conservative. However, Portugal and Ireland have excessive downgrades on the last four years.

To sum up, in relation to the oldest countries the actual ratings turn out to match model predictions before the crisis in most of the cases. This fact contradicts the point of view of Mora (2006) in which ratings seem to be at higher than predictions before the crisis. During the crisis period, some of the countries are downgraded excessively falling to below the predictions, which turns out to be partially consistent with the results obtained by Ferri, Liu and Stiglitz (1999) and again contradicts Mora (2006) as the actual ratings do not track predictions but fall more than that. As examples, for Portugal, Ireland and Greece, there is evidence of assigned ratings being influenced by the business cycle as the actual rating of these countries dropped much more than model predictions. As far as the newest countries are concerned, the assigned rating differs pretty much from predictions throughout the sample, showing that the data do not follow the same pattern. Thus, for most of the countries of the sample, results are consistent with Mora's results. In her sample, Mora (2006) finds that assigned ratings track predicted ratings during the crisis period while in the pre-crisis period, assigned ratings are at higher notches than predicted ratings which leads to the inertia of ratings.

8. The Inertia of Sovereign Ratings

Based on the approach of Mora (2006) and in order to analyze the existence of inertia of ratings, one may regress the changes in a rating from the year t to the year t+1 on the lagged error term. The change is represented by $\Delta Rating_{i,t}$ in the following regression (6) and the error term, $error_{i,t-1}$, is defined as the difference between the predicted rating based on macroeconomic variables of the year t-1 and the actual rating on year t:

$$\Delta Rating_{i,t} = \alpha + \beta error_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

The idea of testing the inertia of rating through this time frame is to show that credit rating agencies tend to predict and assign ratings based, not only on the current macroeconomic results from a certain year t, but also on the results from t-1. he predicted rating of a certain year t and the assigned rating at the end of the same year should be based on the same data set. If ratings tend to react almost instantaneously to the macroeconomic data set, then there is no prediction error and the beta on equation (6) must be zero and ratings are non-sticky. On the other hand, if the ratings tended to be lagged in time,

then the beta should be positive, showing a rating change in the direction of the predictions, and ratings are sticky. Table 14 reports the results obtained from equation (6) based on previous logistic transformation regressions.

Table 14 – Inertia Regressions

This table presents regressions performed to test the existence of inertia in some countries of the European Union. The dependent variable corresponds to the changes in rating. The error terms used come from the logistic model. Columns (1), (2) and (3) only include the lagged error term while columns (4), (5) and (6) include all the macroeconomic factors as explanatory variables. P-values in parenthesis.

	ΔRating			ΔRating		
	Fitch	S&P's	Moody's	Fitch	S&P's	Moody's
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged error term	0,19	0,22	0,21	0,13	0,22	-0,06
	(0,21)	(0,11)	(0,16)	(0,58)	(0,27)	(0,83)
GDP growth rate				-0,25**	-0,30***	-0,30***
				(0,02)	(0,00)	(0,01)
GDP per capita				0,00***	0,00**	0,00
				(0,00)	(0,04)	(0,13)
Inflation				0,37*	0,20	0,32**
				(0,08)	(0,15)	(0,04)
Gross Debt				0,02**	0,03***	0,04***
				(0,05)	(0,01)	(0,01)
Curr. acc. balance				-0,22***	-0,20***	-0,07
				(0,00)	(0,00)	(0,42)
Gov. prim surplus				0,13	-0,17**	-0,33***
				(0,34)	(0,04)	(0,00)
Pseudo R-squared	0,01	0,01	0,03	0,02	0,03	0,04

Unlike what would be expected, and although the beta of the error term is positive with the exception of column (6), results show that it turns out not to be statistically significant at a 10% level for all the three credit rating agencies. This fact means that there is strong evidence that ratings have been reacting immediately to news which leads to non-sticky ratings. When observing columns (4), (5) and (6), in which the models include the first lags of each variable, one may see that some variables turn out to be significant for the three credit rating agencies, such as GDP growth rate and Gross debt. Actually, GDP growth rate turns out to have a surprisingly result not only because the coefficient is negative but also because is significant for the three credit rating agencies. This means that GDP growth rate of previous years is important to explain the changes in a rating although the effect is negative.

To summarize, as previous sections suggested the existence of inertia in ratings mainly due to the fact that actual ratings based on macroeconomic factors tend to adjust to their predicted levels during the crisis period and also because the pre-crisis distribution is skewed to the left and different from the crisis distribution, one may conclude, however, that ratings are non-sticky and in turn, there is no inertia of the EU countries' ratings from 1999 to 2011. Therefore, credit rating agencies tend to convey immediately bad news in bad times and good news in good times, contradicting the results obtained by Mora (2006).

9. Conclusions

In this dissertation, there were three main objectives: first, to understand the impact of some macroeconomic variables on ratings particularly applied in two previous studies, the ones from Cantor and Packer (1996) and Gärtner, Griesbach and Jung (2011). The results obtained are mostly in accordance with the findings of the authors previously mentioned with the exception of GDP growth rate and Gov. Surplus which turn out not to be significant to explain ratings. Thus, GPD per Capita, Inflation, Gross Debt, Gov. Primary Surplus and Curr. Account Balance play an important role in explaining a rating for the three credit rating agencies.

The second and the third objective were to find whether the credit rating agencies have underreacted or overreacted during the 2008 Euro crisis and to test the existence of inertia in ratings. There is little support for assigned ratings being excessively downgraded during the crisis period. In fact, for most of the countries the assigned rating tracks the predicted rating, showing, on average and at most, one error notch. Apart from most countries in our sample, there are some exceptions as it is the case of Ireland, Portugal and occasionally Spain, from 2008 to 2011, predictions suggest the ratings assigned to these countries were over-conservative as the predicted ratings are at higher notches than those which were assigned for the given period. Additionally, Moody's is the credit rating agency which has higher downgrades and consequently higher prediction errors mainly in the case of Ireland and Portugal. On the other hand, Greece is the only country of the oldest countries that has a high volatility in the predicted ratings showing the great economic instability of the country.

Although predictions rarely match the ratings assigned, both follow the same ascent/descent trend along the entire sample and not only during the crisis period. As both in 2009 and in 2011 the assigned rating to Greece has been below the predicted rating and in 2010 the opposite is true, one may not consider that the credit rating agencies have been over-conservative in this case. During the pre-crisis period, predicted ratings are on average one notch below the assigned ratings and the prediction errors for the newest countries turn out to be higher than those for the oldest countries. These facts are consistent with

Mora's results and inertia views. Surprisingly, one may conclude that the ratings of the European Union countries turn out not to be sticky.

One may also conclude that the credit rating agencies have been heavily influenced by the macroeconomic variable Gross Debt when assigning the European ratings, since most of the downgrades are linked to significant increases in this variable, even if there were positive changes in the remaining macroeconomic variables. Nevertheless, Gross Debt has proven to have less impact on ratings than the one accredited by the rating agencies, as supported by our econometric model and considering the differences between the assigned rating and the predicted rating of some countries, namely Greece, Ireland and Portugal, where the Gross Debt has been strongly increasing for the past four years.

For further research of this topic, there are mainly aspects that should be taken into account: the inclusion of new macroeconomic variables and also some non-macroeconomic variables such the default history and the degree of development of a country supported by Afonso (2002) and, finally, the extension of the sample period to include the post-crisis period.

10. References

Afonso, A., 2002, Understanding the determinants of sovereign debt ratings: evidence for the two leading agencies. *Journal of Economics and Finance*, 27 (1), 56-74.

Afonso, A., Furceri, D., Gomes, P., 2011, Sovereign Credit Ratings and Financial Markets Linkages. Working Paper Series, No. 1347.

Afonso, A., Gomes, P., Rother, P.,2007, Ordered Response Models for Sovereign Debt Ratings.

Afonso, A., Gomes, P., Rother, P.,2003, Short and Long-run Determinants of Sovereign Debt Credit Ratings

Altman, E.I., Rijken, H.A., 2004, How rating agencies achieve rating stability. *Journal of Banking and Finance* 28, 2679–2714.

Amato, J.D., Furfine, C.H., 2003, Are credit ratings procyclical? BIS Working Papers No 129. Federal Bank of Chicago.

Bar Isaac, Heski, and Joel Shapiro, 2010, Ratings quality over the business cycle, Working paper, NYU.

Bissoondoyal-Bheenick, E., 2005, An analysis of the determinants of sovereign ratings. *Global Finance Journal* 15 (3), 251-280.

Bolton, P., Freixas, X., Shapiro, J., 2012, The Credit Rating Games. *The Journal of Finance*. VOL. LXVII, NO. 1

Bozic, V., Magazzino, C., 2012, Credit Rating Agencies: The Importance of Fundamentals in the Assessment of Sovereign Ratings.

Cantor, R., Packer, F., 1996, Determinants and impact of sovereign credit ratings. *Federal Reserve Bank of New York Economic Policy Review* 2, 37–53.

Elkhoury, M., 2008, Credit Rating Agencies and their potential impact on developing countries. Discussion Papers No. 186.

Ferri, G., Liu, L., Stiglitz, J.E., 1999, The Procyclical Role of Rating Agencies: Evidence from the east Asian crisis. *Economic Notes* 28, 335–355.

Holden, S., Natvik, G.J., Vigier, A., 2012, An Equilibrium Model of Credit Rating Agencies. Working Paper. Norges Bank Research

Hu, Y., Kiesel, R., Perraudin, W., 2002, The estimation of transition matrices for sovereign credit ratings. *Journal of Banking and Finance* 26, 1383–1406.

Hunt, J.P., 2009, Credit Rating Agencies and the "Worldwide Credit Crisis": The Limits of Reputation, the Insufficiency of Reform, and a Proposal for Improvement.

Kiff, J., Nowak, S., Schumacher, L., 2012, Are Rating Agencies Powerful? An Investigation into the Impact and Accuracy of Sovereign Ratings, IMF Working Paper, No. 23.

Matthies, A.B., Empirical Research on Corporate Credit Ratings: A Literature Review, Discussion Paper 2013-003

Monfort, B., Mulder, C., 2000, Using Credit Ratings For Capital Requirements on Lending to Emerging Market Economies: Possible Impact of a New Basel Accord, IMF Working Paper, No. 69.

Mulder, C. Perrelli, R., 2001, Foreign Currency Credit Ratings for Emerging Market Economies, IMF Working Paper, No. 191.

Mora, N., 2006, Sovereign credit ratings: Guilty beyond reasonable doubt? *Journal of Banking and Finance* 30(7), 2041–2062

Partnoy, F., 2002, The Paradox of Credit Rating Agencies. University of San Diego

Reinhart, C.M., 2001, Do sovereign credit ratings anticipate financial crises? Evidence from emerging markets. Mimeo, School of Public Affairs, University of Maryland, College Park

Reisen, H., von Maltzan, J., 1999, Boom and Bust and Sovereign Ratings, OECD Development Centre, Working Paper No. 148.

Ryan, J., 2012, The Negative Impact of Credit Rating Agencies and proposals for better regulation. Working Paper FG 1, 2012/Nr. 01

Sgherri, S., & Zoli, E., 2009, Euro Area Sovereign Risk During the Crisis, IMF Working Paper, No. 222.

Shiu, Y., 2008, Determinants of Financial Strength Ratings: Evidence from the Lloyd's Market.

Sy, A.N.R., 2009, The Systemic Regulation of Credit Rating Agencies and Rated Markets. IMF Working Paper No.129.

Zheng, L., 2012, Are Sovereign Credit Ratings Objective? A Tale of Two Agencies, Journal of Applied Finance and Banking.