Do fiscal imbalances deteriorate sovereign debt ratings?*

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Abstract

We use sovereign debt rating estimations from Afonso, Gomes and Rother (2009, 2011) for Fitch, Moody's, and Standard & Poor's, to assess to what extent the recent fiscal imbalances are being reflected on the sovereign debt notations. With macro and fiscal data up to 2010, and macro and fiscal projections, we obtain the expected rating for several OECD countries. The answer to the title question is yes, but in a diverse way for each country. Our average model predictions point to a heterogeneous behaviour of rating agencies across countries.

JEL: C23; E44; G15.
Keywords: credit ratings; sovereign debt; rating agencies.

1. Introduction

Afonso, Gomes and Rother (2009, 2011) have shown that four fundamental variables have a consistent short-run impact on sovereign ratings, determining roughly the rating ladder: the level of per capita GDP, real GDP growth, the public debt level and the government budget balance.[1] In addition to undermining economic growth, as shown by Reinhart and Rogoff (2010), it seems reasonable to think that high fiscal imbalances can increase the likelihood of sovereign defaults.

In this study we use the estimated models for sovereign debt rating from Afonso, Gomes and Rother (2009, 2011), for Fitch, Moody's, and Standard & Poor's (S&P), to

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[1] For other relevant variables see, for instance, Cantor and Packer (1996), Afonso (2003), and Bissoondoyal-Bheenick (2005).

assess to what extent the deterioration of fiscal imbalances since 2008 in several OECD countries is being reflected on the sovereign debt ratings. For that purpose we use macro and fiscal data up to 2009, and macro and fiscal projections, to make a prediction for the expected rating for several OECD countries up until 2012. The countries covered in the analysis are: Belgium, Canada, France, Germany, Greece, Ireland, Italy, Japan, Portugal, Spain, the U.K., and the U.S.

We find that most of the deterioration of sovereign creditworthiness over the past two year is due to the increase of government deficits and debt, rather than the poor economic performance. Moreover, our rating predictions point to an under rating of Greece, Ireland and Portugal relative to the average country prediction. On the other hand, the rating agencies seem to be more lenient with the UK, and the US.

2. Methodology

Afonso, Gomes and Rother (2011) initially estimated rating models with panel data, using both linear estimation methods and ordered response models.

Linear estimation

The equation to estimate is

$$R_{it} = \beta(X_{it} - \overline{X}_i) + (\eta + \beta)\overline{X}_i + \lambda Z_i + \varepsilon_i + \mu_{it}, \qquad (1)$$

where we have: R_{it} – quantitative variable, obtained by a linear transformation; X_{it} is a vector containing time varying variables and Z_i is a vector of time invariant variables. The time average of the explanatory variables, $\overline{X}_i$, is also included as an additional time-invariant regressor. The index i (i=1,…,N) denotes the country, and the index t (t=1,…,T) indicates the period. Additionally, it is assumed that the disturbances μ_{it} are independent across countries and across time.

Equation (1) has an interesting economic interpretation. $\delta = \eta + \beta$ can be interpreted as a long-term effect (e. g. if a country has a permanent high unemployment what is the effect on the rating) while β is a short-term effect (e. g. if a country manages to reduce unemployment this year what is the impact on the rating). This distinction is useful for policy purposes as it can tell what a country can do to improve its rating in the short to medium-term. Alternatively, we can understand δ as the coefficient of the cross-country determinants of the credit rating. This equation can be estimated using random effects if

we consider ε_i an error term uncorrelated with the regressors. Alternatively, we can estimate the short-run coefficients by using fixed effects.

The cardinal transformation of the ratings was done following a correspondence with the qualitative codes, using a linear scale with numerical equivalents between 1 and 17. Therefore, the maximum sovereign rating takes the value 17 (corresponding to AAA for S&P and Fitch, and Aaa for Moody's) and the lower limit of one, that encompasses all rating notations below B- (for S&P and Fitch) and below B3 (for Moody's).

Ordered response models

Although estimating the determinants of ratings using linear regression methods have, in general, a good predictive power, as ratings are a qualitative ordinal measure, ordered response models are more suited. The rating agency makes a continuous evaluation of a country's credit-worthiness, embodied in an unobserved latent variable R_{it}^{*}. The latent variable has a linear form and depends on the same set of variables as before,

$$R_{it}^{*} = \beta(X_{it} - \overline{\mathrm{X}}_i) + \delta\overline{\mathrm{X}}_i + \lambda Z_i + \varepsilon_i + \mu_{it}\,. \qquad (2)$$

There are several cut-off points to draw up the boundaries of each rating category, and the final rating notation is given by

$$R_{it} = \begin{cases} AAA\ (Aaa) & if \quad R_{it}^{*} > c_{16} \\ AA+\ (Aa1) & if \quad c_{16} > R_{it}^{*} > c_{15} \\ AA\ (Aa2) & if \quad c_{15} > R_{it}^{*} > c_{14} \\ \vdots & \\ < B-(B3) & if \quad c_1 > R_{it}^{*} \end{cases}. \qquad (3)$$

The difference between the cut off points determines a non-linearity is the effect of variables (i.e. it might be easier to move from AA to AA+, then the subsequent move to AAA). The parameters of equation (2) and (3), notably β, δ, λ and the cut-off points c_1 to c_{16} are estimated using maximum likelihood. As we have panel data, the generalization of ordered probit is not simple, since instead of one error term, we now have two. We cannot use fixed effects because of the incidental parameter problem (the maximum likelihood estimator is inconsistent with small T). One possibility is to use a random effects ordered probit estimation, which considers both errors ε_i and μ_{it} to be normally distributed, and maximizes the log-likelihood accordingly. The other alternative is to perform the traditional ordered probit estimation, but considering that the error term is autocorrelated.

Summary of results

Afonso, Gomes and Rother (2011) estimated such models for a panel of 130 countries for the period 1995-2006. But, since we are focussing on a sub-set of developed OECD economies we have re-estimated the baseline specifications using only the countries with investment grade, rated BBB- and above.[2] As already mentioned, in this paper we are going to focus on the short-run contribution of the macro elements (log of GDP per capita PPP, real GDP growth, unemployment rate, inflation rate), and of the fiscal elements (government debt, fiscal balance).

Table 1 shows the effect on the rating of changes in the fiscal and macro variables, for the three agencies and for the two methodologies. The first conclusion is that, individually, changes in only one macro or fiscal variable have a small effect on a country's sovereign rating. For instance, a reduction in GDP growth by 3 percent only reduces a country's rating by 0.10 to 0.40 notches. However, given their interdependence, the effects should not be interpreted in isolation, but analysed jointly.

Table 1 – Estimated effects of fiscal and macro variables

	Fitch			S&P			Moody's		
Effect of:	LM	OM	Avg	LM	OM	Avg	LM	OM	Avg
↓ 5% GDP per capita	-0.07	-0.12	-0.09	-0.06	-0.09	-0.07	-0.08	-0.15	-0.11
↓ 3% GDP growth	-0.17	-0.22	-0.19	-0.21	-0.03	-0.12	-0.38	-0.15	-0.27
↑ 5% Inflation	-0.22	-0.26	-0.24	-0.27	-0.25	-0.26	-0.45	-0.16	-0.30
↑ 5% Unemployment rate	-0.11	-0.21	-0.16	0.12	-0.01	0.05	-0.32	-0.37	-0.35
↑ 10% Gov. Debt	-0.09	-0.17	-0.13	-0.23	-0.36	-0.30	-0.13	-0.16	-0.15
↑ 5% Gov. Deficit	-0.29	-0.43	-0.36	-0.23	-0.27	-0.25	-0.37	-0.76	-0.57

Note: LM – Linear models is the average of the Fixed Effects and Random Effects estimations. OM – Ordered response models is the average of the Ordered Probit and Random Effects Ordered Probit estimations. Fraction of a notch: for the ordered response models, it is in fraction of the average size of the categories between BBB- and AAA.

We can also see from Table 1 that roughly the rating agencies tend to put more weight on the fiscal variables. An increase of 5 percentage points in the fiscal deficit would

[2] We used the same dataset as Afonso et al. (2011), which includes macro variables (GDP per capita, real GDP growth, unemployment rate and inflation),fiscal variables (government debt, budget balance and government effectiveness), external variables (external debt, current account balance and foreign reserves), regional dummies and a dummy if the country has previously defaulted. The sample ran from 1996 to 2006. For the linear models, we estimate the regression considering only a subset of countries with a rating of at least BBB-. It included 38, 45 and 43 countries for Moody's, S&P and Fitch (314, 367 and 337 observations in total). For the ordered models, we keep all countries, but we bundled the countries with especulative grade together (bellow BBB-). In terms of prediction, the linear models correctly predict the rating between 74% and 86% of the sample and above 98% of predictions lie within one notch. For the ordered models, 45% of the predictions are accurate and around 75% are within one notch of the observed rating. The results are not shown, as they are similar to Afonso et al. (2011), but are available upon request.

reduce the rating between 0.25 notches (for S&P) and 0.57 (for Moody's). It is also possible to observe that the rating agencies give more emphasis to different variables. Moody's and Fitch give more emphasis to the government deficit, whereas S&P focus somewhat more in government debt.

3. Rating forecasts

3.1. Forecast approach and data

In order to make our country specific forecasts we use the estimation results up to 2006, together with macro and fiscal data up to 2009, and notably the autumn 2010 projections from the European Commission, to make predictions for the annual expected ratings up to 2012.

Up until 2006 we use the in-sample prediction. As an example of the out-of-sample prediction for the changes in the ratings, using the linear model is given by (4),

$$\hat{R}_{it} = \hat{\beta}_1 \Delta Ypc_{it} + \hat{\beta}_2 \Delta Y_{it} + \hat{\beta}_3 \Delta U_{it} + \hat{\beta}_4 \Delta \pi_{it} + \hat{\beta}_5 \Delta D_{it} + \hat{\beta}_6 \Delta B_{it} + \hat{R}_{it\text{-}1}, \qquad (4)$$

where *Ypc* is per capita GPD, *Y* is the real growth rate of GDP, π is the inflation rate, *U* is the unemployment rate, *D* is debt-to-GDP ratio, and *B* is the government budget balance ratio. Notice that we use in (4) only the estimated coefficients of the explanatory variables for which we have available macro and fiscal forecast data for the period 2010-2012.[3] We then round the number to the nearer integer to have a rating prediction.

With the ordered probit framework we estimate the value of the latent variable in a similar way,

$$\hat{R}^{*}_{it} = \hat{\beta}_1 \Delta Ypc_{it} + \hat{\beta}_2 \Delta Y_{it} + \hat{\beta}_3 \Delta U_{it} + \hat{\beta}_4 \Delta \pi_{it} + \hat{\beta}_5 \Delta D_{it} + \hat{\beta}_6 \Delta B_{it} + \hat{R}^{*}_{it-1}, \qquad (5)$$

and then compare the value with the estimated cut-off points to assess the rating. [4]

In this context, Figure 1 shows the recent developments of the government debt ratio and of the budget balance ratio for the countries under analysis, which illustrates the significant post 2007-2008 fiscal deterioration, with increasing government budget deficits and rising government indebtedness.

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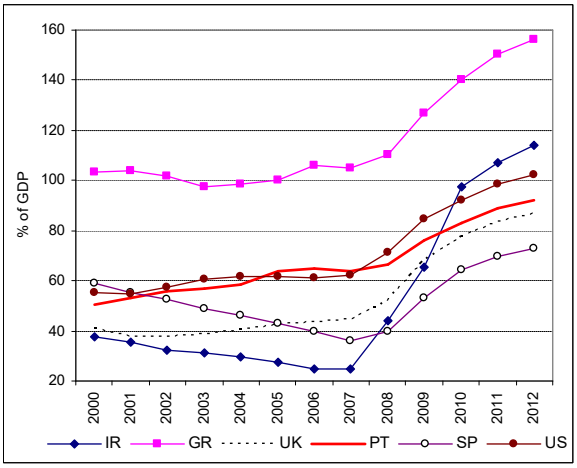
[3] For instance, the estimated coefficients for the average of the random effects specification for Moody's are: $R_{it} = 1.151\Delta Ypc_{it} + 13.532\Delta Y_{it} - 0.073*\Delta U_{it} - 6.329*\Delta \pi_{it} - 0.015*\Delta D_{it} + 6.793*\Delta B_{it} + R_{it\text{-}1}$.

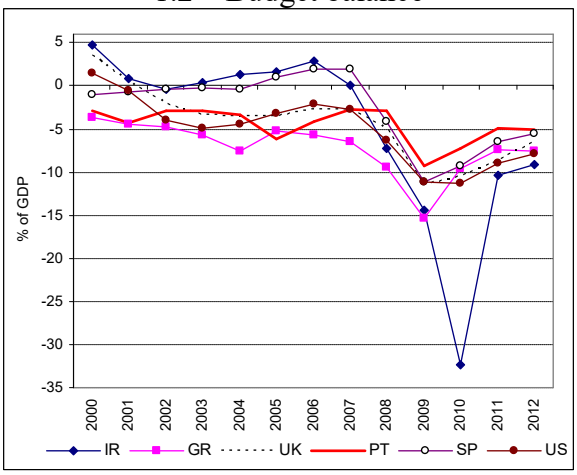
[4] For instance, the estimated coefficients for the average of the random effects orderd probit specification for Moody's are: $\hat{R}^{*}_{it} = 3.913\Delta Ypc_{it} + 9.483\Delta Y_{it} - 0.047*\Delta U_{it} - 4.369*\Delta \pi_{it} - 0.034*\Delta D_{it} + 17.946*\Delta B_{it} + \hat{R}^{*}_{it-1}$. We then compare the value of the latent variables with the cut-off points: 2.83, 5.25, 6.40, 7.73, 9.03, 10.33, 12.10, 13.49, 15.17 and 16.40.

Figure 1 – General government debt and budget balance ratios (% of GDP)

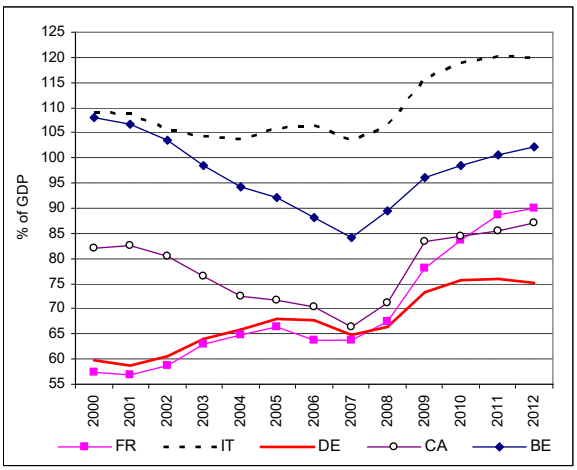
1.1 – Debt ratio



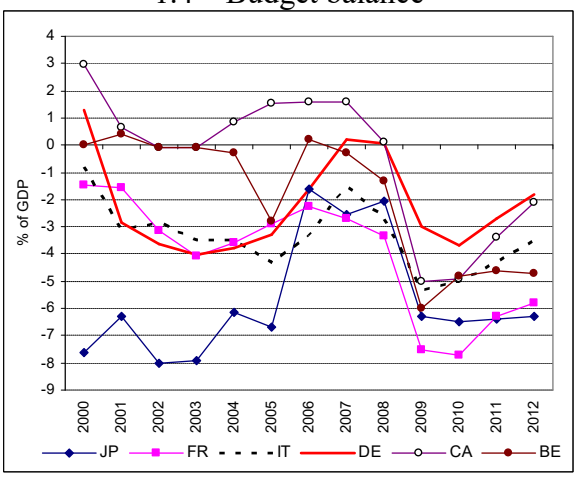
1.2 – Budget balance



1.3 – Debt ratio



1.4 – Budget balance



Source: European Commission AMECO database and autumn 2010 Economic Forecasts. The debt ratio for Japan, not shown to facilitate the scale in the chart presentation, is 142% and 194% respectively in 2000 and 2011. BE - Belgium, IR - Ireland; GR - Greece, PT - Portugal, SP - Spain, FR - France, IT - Italy, DE - Germany, CA - Canada.

3.2. Country specific forecast

In Figure 2 we report the set of effective country ratings, up until April 2011, together with the illustration of the average rating prediction that we computed using the four model specifications for the three rating agencies, for each country.

Figure 2 – Average sovereign rating predictions

Figure 2.1

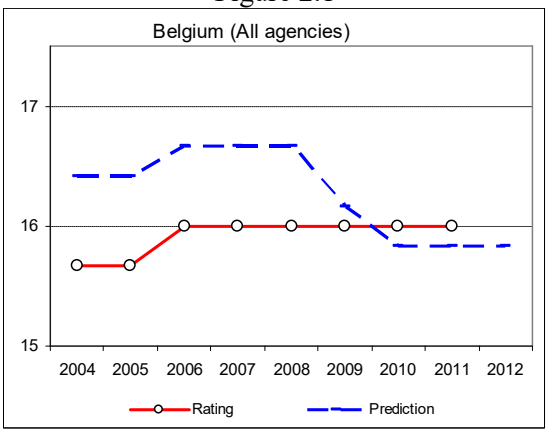


Figure 2.2

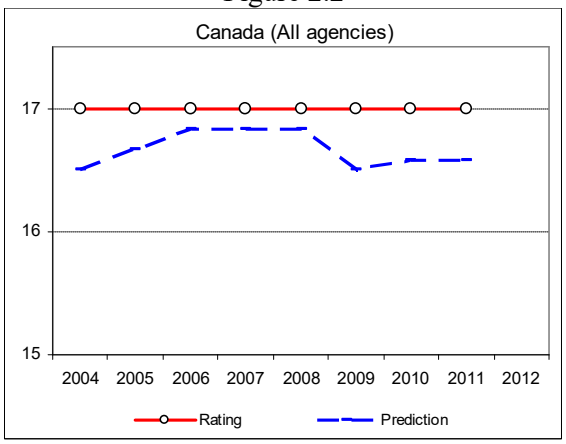


Figure 2.3

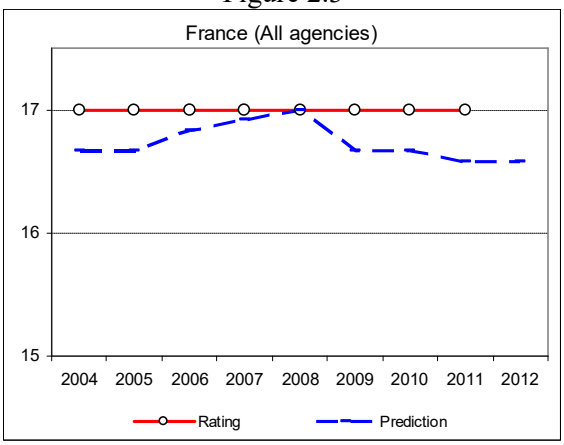


Figure 2.4

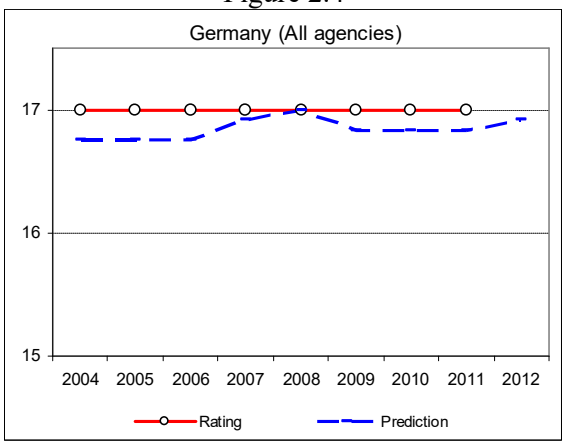


Figure 2.5

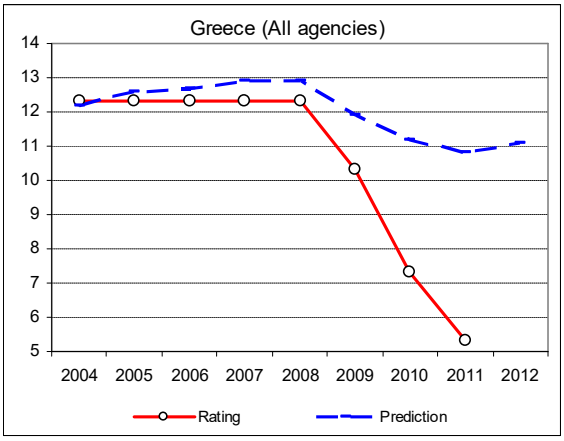


Figure 2.6

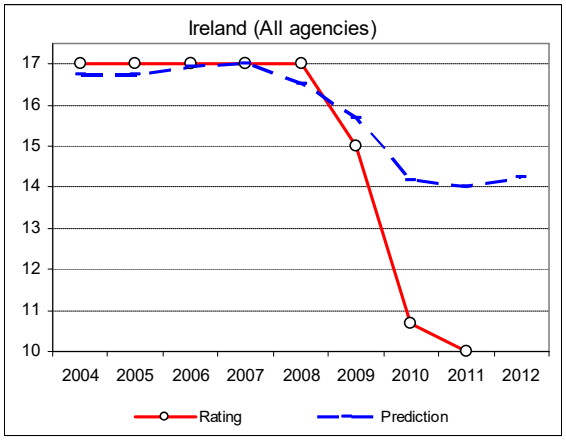


Figure 2 – Average sovereign rating predictions (cont.)

Figure 2.7

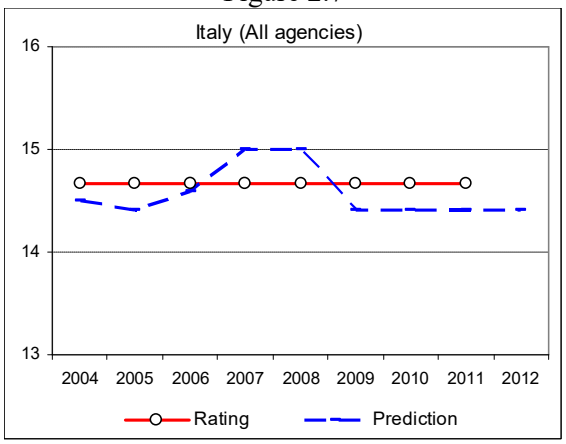


Figure 2.8

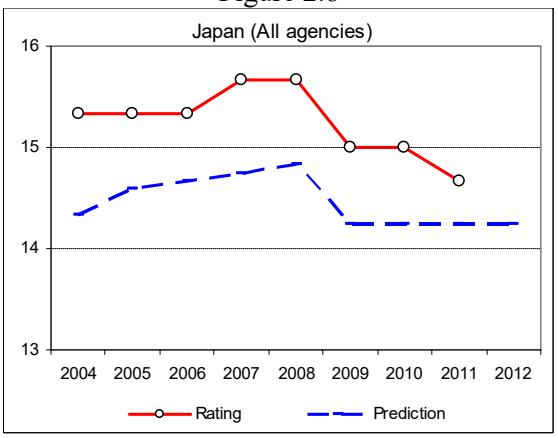


Figure 2.9

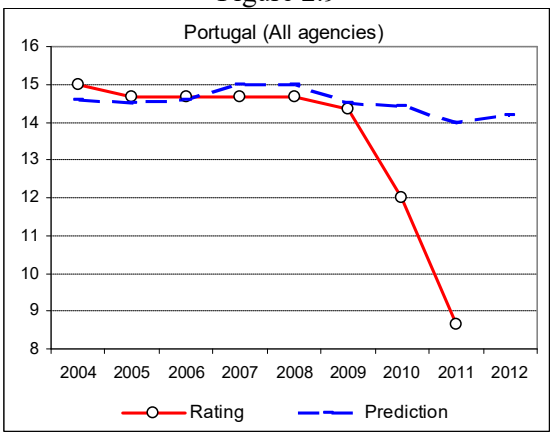


Figure 2.10

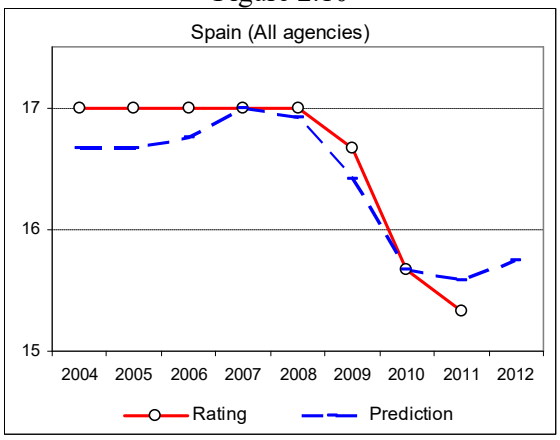


Figure 2.11

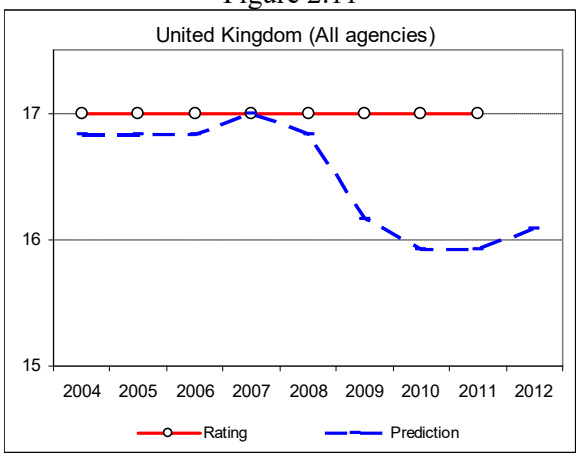
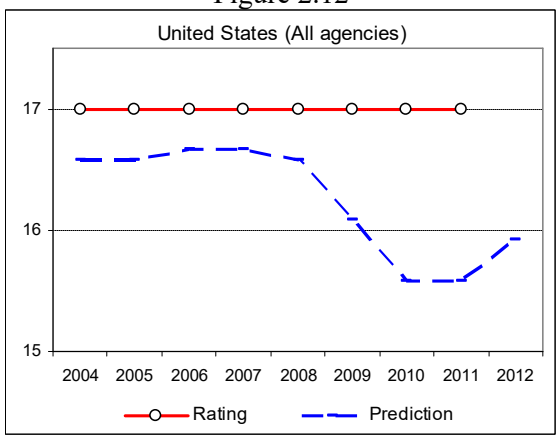


Figure 2.12



Notes: 17=AAA (Aaa), …, 1= notations below B- (B3). Vertical axis – cardinal rating.

In the cases of Canada, France, and Germany, the average rating prediction is in line with the effective AAA rating observed in the market on April 2011. Although one or two models predicted AA+, it was not enough to imply an effective over rating. For Spain, the predictions until 2010 are also in line with the observed decline of the average rating of around 1 notch. Moreover, the effective ratings for Italy and Japan are also consistent with our predictions.

For Ireland, Greece and Portugal their effective rating is below the average model predictions. For Greece, the average prediction is around A- for the three agencies. These model predictions are above the effective rating levels observed on April 2011, which ranged from B1 for Moody's to BB+ for S&P. Nevertheless, the model predictions rightly detect the downward movement in the Greek sovereign ratings from 2008 onwards, following the economic and financial crisis and the ensuing deterioration of the fiscal scenario. However, it seems that the downgrades were much sharper than the predictions, being the predictions between four and seven notches above the effective 2011 rating respectively for Fitch and for Moody's.

For Ireland, the triple A ratings are correctly predicted up to 2008, and after that year the models correctly pick up the worsening of the fiscal and macro conditions. However, the model predictions are roughly three (Moody's) to four (S&P and Fitch) notches above the 2011 rating.

For Portugal, the average rating prediction from the models' estimations is around two notches above the effective rating average. This effective under rating vis-à-vis the model predictions is more pronounced in the case of Fitch and S&P where the deviation reaches respectively seven and six notches for 2011 (and four notches for Moody's).

Another set of countries has an effective rating above the model predictions, with a difference of one notch: the UK, and the US. The negative outlook for the UK, attributed by S&P and their warning to the US, can be seen, to some extent, as symptoms of this effective overrating.

3.3. Overview of the forecast

Table 2 further summarises the deviations of the average country prediction results vis-à-vis the effective in the beginning of April 2011 average ratings of the three rating agencies. It can be seen that for 2011 the three main rating agencies seem to be attributing too low sovereign ratings for Greece, Ireland, and Portugal, taking into account the main macro and fiscal determinants used in the model specifications of this study. Therefore,

one may see in these results some evidence of effective under rating for those countries. On the other hand, the estimated prediction results point to the existence of a relative over rating vis-à-vis the average country for the U.K. and the U.S.[5]

Table 2 – 3-agency average effective (7 April 2011) rating vis-à-vis the average model predictions

	Effective rating vis-à-vis the prediction	Notches of effective over (+) and under (-) rating
Belgium	equal	0
Canada	equal	0
France	above	0
Germany	equal	0
Greece	below	-6
Ireland	below	-4
Italy	above	0
Japan	above	0
Portugal	below	-5
Spain	equal	0
UK	above	+1
US	above	+1

Table 3 shows the importance of fiscal elements in explaining the deterioration of the ratings, as a percentage of the total elements. We can see that for most countries, the increase in government debt and in the budget deficit contributed between 50 and 120 percent to the reduction of creditworthiness.

Table 3 – Contribution of fiscal elements (2008-2011), % of total

	Fitch			S&P			Moody's		
	LM	OM	**Avg**	LM	OM	**Avg**	LM	OM	**Avg**
Canada	1.14	1.13	**1.13**	1.22	1.23	**1.23**	1.04	1.07	**1.06**
France	0.77	0.75	**0.76**	0.94	0.94	**0.94**	0.71	0.75	**0.73**
Germany	0.57	0.58	**0.58**	0.61	0.79	**0.70**	0.52	0.66	**0.59**
Greece	0.48	0.52	**0.50**	0.76	0.88	**0.82**	0.37	0.52	**0.44**
Ireland	0.80	0.76	**0.78**	0.98	0.96	**0.97**	0.73	0.76	**0.75**
Italy	0.61	0.59	**0.60**	0.83	0.86	**0.85**	0.55	0.59	**0.57**
Japan	1.23	1.26	**1.25**	1.16	1.23	**1.20**	1.11	1.24	**1.18**
Portugal	0.69	0.67	**0.68**	0.96	0.94	**0.95**	0.61	0.65	**0.63**
Spain	0.62	0.61	**0.61**	0.93	0.90	**0.91**	0.50	0.62	**0.56**
UK	0.64	0.63	**0.64**	0.79	0.81	**0.80**	0.58	0.66	**0.62**
US	1.01	0.97	**0.99**	1.22	1.11	**1.17**	0.90	0.92	**0.91**

Note: LM – Linear models is the average of the Fixed Effects and Random Effects estimations. OM – Ordered response models is the average of the Ordered Probit and Random Effects Ordered Probit estimations.

[5] One should be aware that we consider the minimum relevant difference between the predicted rating and the effective rating needs to be 0.5 notches.

Again, one must bear in mind that we are only using, for the prediction of the ratings, the macro and fiscal variables. Therefore, other rating determinants may actually play a role in mitigating the extent of the relative under rating or over rating situations reported in this study. Other important elements might be the maturity structure of the government debt, and the possibility that rating agencies also assess banking sector developments, which can also impinge on fiscal imbalances.[6]

Finally, the relevance of the sovereign rating notations can also be summarised in terms of the additional basis points that a sovereign issuer would have to pay, on average, above the triple A rating. Such additional premium is reported in terms of basis points in Table 4, where the end of the year yields and ratings were used. For instance, it is possible to observe that BBB rated sovereigns ended up paying in the past, and on average, around 300 basis points more than an AAA issuer.

Table 4 – Average yield spread of government bonds over sovereign AAA bonds (1996-2009)

Rating	**AAA**	**AA+**	**AA**	**AA-**	**A+**	**A**	**A-**	**BBB+**	**BBB**	**BBB-**
Basis points	0	8	3	29	71	100	159	275	312	297

Source: Reuters and for the yields and own calculations. Countries included are Belgium, Germany, Ireland, Greece, Spain, France, Italy, Netherlands, Austria, Portugal, Finland, Malta, Denmark, United Kingdom, Bulgaria, Czech Republic, Hungary, Latvia, Poland, Sweden, United States, and Canada. Japan was dropped from the calculation due to the fact that rather low yields would generate sometimes marginally negative spreads.

4. Conclusion

We used the estimated ordered response models for sovereign debt rating from Afonso, Gomes and Rother (2009, 2011), for Fitch, Moody's, and Standard & Poor's, to assess to what extent the recent fiscal imbalances in several OECD countries are being reflected on the sovereign debt notations. For that purpose we use macro and fiscal data for 2006-2009, and macro and fiscal projections for 2010-2012, to compute an out of sample prediction of sovereign ratings for twelve OECD countries.

When computing the predicted sovereign ratings we used, for each country, and for each of the three rating agencies, four estimation methods: fixed effect, random effects, ordered probit, and random effects ordered probit. In that way, we gain more robustness by averaging all the rating predictions to compare with the effective rating notation.

According to our results, we observe an overall downgrading in sovereign debt ratings from the computed predictions in the period 2010-2012. Therefore, fiscal

[6] Gerlach, Schulz and Wolff (2010) argue that when financial markets perceive a larger risk that governments will need to rescue banks, by increasing government debt, this negatively impinges on sovereign risk.

worsening, together with less optimistic macro scenarios are indeed translated into lower sovereign ratings. The importance of the fiscal variables, government debt and fiscal deficit, to explain the deterioration of the sovereign ratings, is between 50 and 120 percent of the reduction of creditworthiness.

However, the response has not been homogeneous across rating agencies. The rating predictions that we computed also point to a relative over rating, vis-à-vis the average country, of U.K. and U.S. of around one notch. On the other hand, a relative average under rating in the cases of Greece, Ireland and Portugal was uncovered, ranging between four and six notches.

How can we explain this asymmetry? Such differences can be explained if agencies are looking at other variables that are more relevant now, such as the stability of the financial system, the maturity structure of debt or political factors. One can envisage that for the average under rated country, the agencies seem to see a worse medium-term outlook not reflected in the current projection of fundamentals, while for the average over rated country, the agencies may be expecting a return to more normal fiscal and macro conditions in the medium-term.

On the other hand, rating agencies could be keener in attributing higher ratings in boom times, when investor's trust on the economy tends to rise, and the risk of rating misspecification is lower for the agencies' reputation (Bolton, Freixas and Shapiro, 2009). However, we cannot exclude that some of the sovereign ratings drop may also be prompted by an overall increase in risk aversion that trickled down to country specific ratings.

All in all, governments need to be aware of the importance of sound fiscal policies in order to decrease the risk perception of capital markets and investors vis-à-vis their levels of government indebtedness.

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