Understanding the Determinants of Government Debt Ratings: Evidence for the Two Leading Agencies

António Afonso[(*)]

Department of Economics and
Research Center on the Portuguese Economy (CISEP),
Instituto Superior de Economia e Gestão,
Universidade Técnica de Lisboa,

R. Miguel Lúpi, 20,
1249-078 Lisbon, Portugal

This version: February 2002

Abstract

I conduct an analysis of the possible determinants of sovereign credit ratings assigned by the two leading credit rating agencies, Moody's and Standard and Poor's, by using both a linear and a logistic transformation of the rating scales. Of the large number of variables that can be used, the set of explanatory variables selected in this study is significant in explaining the credit ratings. Namely, six variables appear to be the most relevant to determine a country's credit rating: GDP per capita, external debt, level of economic development, default history, real growth rate and inflation rate.

Keywords: Credit ratings; sovereign debt

JEL classification: C21; G15

[(*)] Tel.: +351 21 392 2807; Fax: +351 21 396 6407; e-mail: aafonso@iseg.utl.pt

Contents

1 - Introduction

The relevance of rating the creditworthiness of sovereign borrowers arises from the fact that national governments are by far the largest issuers on capital markets and also because those country ratings are seen as a ceiling to public and private sector issues. The financial literature devoted to modelling sovereign credit rating is rather sparse. Nevertheless, some examples of this line of research are Cosset and Roy (1991), Moon and Stotsky (1993), Lee (1993), Cantor and Packer (1997) and Larrain, Helmut and Maltzan (1997).

This paper studies the factors that seem to play an important role in determining sovereign debt rating. For that purpose, I collected information concerning several quantitative and qualitative variables for a universe of 81 developed and developing countries, and also the ratings assigned to those countries by Standard & Poor's and Moody's in June 2001. With this sectional sample an attempt is made to replicate the effective ratings given by those two agencies. This is done using both a linear and a logistic transformation of the rating levels.

The organisation of the paper is as follows. The next section describes briefly the more commonly used rating notation systems for sovereign public debt; the rating model estimated in this paper is discussed in section three; the results are reported in section four and section five contains a summary and conclusions.

2 - Rating systems

The rating classification of sovereign public debt is, somehow, an assessment of the economic, financial and political situation of an economy, giving also a measure of the country development. In fact, higher default risk premiums are associated with lower rating and higher government yields, increasing therefore the financing cost of the government. While there is a large number of credit rating agencies, the more well known are Moody's Investment Service, Standard & Poor's (S&P), Duff Phelps Credit Rating Co. and Fitch IBCA, Inc.[1] There seems also to be a kind of duopoly

[1] S&P's history can be traced back to 1860 (see Kunczik (2001)).

between the first two agencies, responsible for around 80 per cent of the credit rating market.[2] Table 1 presents, as an example, the rating levels and a summary description, given by Moody's, of the government bonds that receive those classifications. Under the conventions used, the notation *AAA* and *Aaa* are the highest rating classification assigned respectively by S&P and by Moody's.

Table 1 – Standard & Poor's and Moody's rating systems

Characterization of debt and issuer (source: Moody's)	**Rating**	
	S&P	**Moody's**
Bonds, which are Aaa, are judged to be of the best quality. They carry the smallest degree of investment risk and are generally referred to as "gilt edged." Interest payments are protected by a large or by an exceptionally stable margin and principal is secure. While the various protective elements are likely to change, such changes as can be visualized are most unlikely to impair the fundamentally strong position of such issues.	AAA	Aaa
Bonds, which are rated Aa, are judged to be of high quality by all standards. Together with the Aaa group they comprise what are generally known as high-grade bonds. They are rated lower than the best bonds because margins of protection may not be as large as in Aaa securities or fluctuation of protective elements may be of greater amplitude or there may be other elements present which make the long-term risk appear somewhat larger than the Aaa securities.	AA+	Aa1
	AA	Aa2
	AA-	Aa3
Bonds, which are rated A, possess many favourable investment attributes and are to be considered as upper-medium-grade obligations. Factors giving security to principal and interest are considered adequate, but elements may be present which suggest a susceptibility to impairment some time in the future.	A+	A1
	A	A2
	A-	A3
Bonds, which are rated Baa, are considered as medium-grade obligations (i.e., they are neither highly protected nor poorly secured). Interest payments and principal security appear adequate for the present but certain protective elements may be lacking or may be characteristically unreliable over any great length of time. Such bonds lack outstanding investment characteristics and in fact have speculative characteristics as well.	BBB+	Baa1
	BBB	Baa2
	BBB-	Baa3
Bonds, which are rated Ba, are judged to have speculative elements; their future cannot be considered as well assured. Often the protection of interest and principal payments may be very moderate, and thereby not well safeguarded during both good and bad times over the future. Uncertainty of position characterizes bonds in this class.	BB+	Ba1
	BB	Ba2
	BB-	Ba3
Bonds, which are rated B, generally lack characteristics of the desirable investment. Assurance of interest and principal payments or of maintenance of other terms of the contract over any long period of time may be small.	B+	B1
	B	B2
	B-	B3
Bonds, which are rated Caa, are of poor standing. Such issues may be in default or there may be present elements of danger with respect to principal or interest.	CCC+	Caa1
	CCC	Caa2
	CCC-	Caa3
Bonds, which are rated Ca, represent obligations, which are speculative in a high degree. Such issues are often in default or have other marked shortcomings.	CC	Ca
Bonds, which are rated C, are the lowest rated class of bonds, and issues so rated can be regarded as having extremely poor prospects of ever attaining any real investment standing.	C	C

[2] A more complete reference about rating agencies may be found in the Asian Development Bank site, http://aric.adb.org/links/crerat.asp and also in BIS (2000).

In this study, I used the rating classifications of S&P and Moody's, in June 2001, for a sample consisting of 81 countries. In this country sample, there are 29 developed countries and 52 developing countries.[3] The rating classifications for external government debt, for each country, are presented in Table 2.

Table 2 – External debt rating classifications: June 2001

Country	Rating		Country	Rating	
	S&P	**Moody's**		**S&P**	**Moody's**
Argentina	B	B2	Lithuania	BBB-	Ba1
Australia	AA+	Aa2	Luxemburg	AAA	Aaa
Austria	AAA	Aaa	Malaysia	BBB	Baa2
Barbados	A-	Baa2	Malta	A	A3
Belgium	AA+	Aa1	Mexico	BB+	Baa3
Belize	BB	Ba2	Mongolia	B	
Bolivia	B+	B1	Morocco	BB	Ba1
Botswana	A	A2	Netherlands	AAA	Aaa
Brazil	BB-	B1	New Zealand	AA+	Aa2
Bulgaria	B+	B2	Norway	AAA	Aaa
Canada	AA+	Aa1	Oman	BBB	Baa2
Chile	A-	Baa1	Pakistan	B-	Caa1
China	BBB	A3	Panama	BB+	Ba1
Colombia	BB	Ba2	Papua New Guinea	B+	B1
Costa Rica	BB	Ba1	Paraguay	B	B2
Cyprus	A	A2	Peru	BB-	Ba3
Czech Republic	A-	Baa1	Philippines	BB+	Ba1
Denmark	AAA	Aaa	Poland	BBB+	Baa1
Dominican Repub.	B+	B1	Portugal	AA	Aa2
Egypt	BBB-	Ba1	Qatar	BBB+	Baa2
El Salvador	BB+	Baa3	Romania	B-	B3
Estonia	BBB+	Baa1	Russia	B-	B3
Finland	AA+	Aaa	Senegal	B+	
France	AAA	Aaa	Singapore	AAA	Aa1
Germany	AAA	Aaa	Slovakia	BB+	Ba1
Greece	A	A2	Slovenia	A	A2
Hong Kong	A+	A3	South Africa	BBB-	Baa3
Hungary	A-	A3	Spain	AA+	Aa2
Iceland	A+	Aa3	Suriname	B-	
India	BB	Ba2	Sweden	AA+	Aa1
Ireland	AA+	Aaa	Switzerland	AAA	Aaa
Israel	A-	A2	Taiwan	AA+	Aa3
Italy	AA	Aa3	Thailand	BBB-	Baa3
Jamaica	B+	Ba3	Trinidad & Tobago	BBB-	Baa3
Japan	AA+	Aa1	Tunisia	BBB	
Jordan	BB-	Ba3	Turkey	B-	B1
Kazakhstan	BB	Ba2	UK	AAA	Aaa
Korea	BBB	Baa2	EUA	AAA	Aaa
Kuwait	A	Baa1	Uruguay	BBB-	Baa3
Latvia	BBB	Baa2	Venezuela	B	B2
Lebanon	B+	B1			

Source: S&P, available at http://www.standardandpoors.com;
Moody's, available at http://www.moodys.com.

[3] As reported by the IMF (2001) classification.

Only countries with rating notation between AAA (Aaa) and B- (B3) were selected, in order to avoid lower quality bonds, eventually with more speculative characteristics. One should notice that this sample has around 29 per cent of countries with rating classification equal or above AA (using for instance the S&P notation), and that 56 per cent of the selected countries had an assigned rating below the A- notch, as one may confirm by Table 3. Also, there are around 35-37 per cent of countries whose rating falls below the investment grade cut off (starting at BB+ or Ba1).

Table 3 – Comparing sovereign foreign currency ratings assigned by S&P and Moody' s (June 2001)

Rating categories	S&P (% of sample)	Moody's (% of sample)
AAA (Aaa)	14	16
AA+ or AA (Aa1 or Aa2)	15	12
Between AA- and A- (Between Aa3 and A3)	16	16
Between BBB+ and BBB- (Between Baa1 and Baa3), investment grade cut off	19	22
BB+ and lower (Ba1 and lower), speculative grade begins	37	35
Number of countries	**81**	**77**

Obviously, some transformation between qualitative information and cardinal variables is always needed before doing some empirical estimation.[4] In order to get appropriate data to implement empirical estimations, it is necessary to perform a numerical transformation of the rating notches into numbers. Therefore, one may construct a variable *RATING* that takes numeric values between 1 and 16, defined according to the notation levels of the two rating agencies, using a linear transformation. For instance, to the rating level B- (B3), corresponds the value 1 for the variable *RATING*, to the rating level AAA (Aaa), corresponds the maximum value of 16 for the variable *RATING*. The correspondence between the rating levels and the values given to the *RATING* variable is presented in Table 4.

[4] For instance Cantor and Packer (1996) use also 16 levels while Larrain *et al.* (1997) use 20 levels, taking therefore into account the C notches of the rating scales.

Table 4 – Linear transformation of the rating levels

	Rating levels								
S&P	B-	B	B+	BB-	BB	BB+	BBB-	BBB	BBB+
Moody's	B3	B2	B1	Ba3	Ba2	Ba1	Baa3	Baa2	Baa1
RATING	1	2	3	4	5	6	7	8	9
	Rating levels								
S&P	A-	A	A+	AA-	AA	AA+	AAA		
Moody's	A3	A2	A1	Aa3	Aa2	Aa1	Aaa		
RATING	10	11	12	13	14	15	16		

According to the qualitative notations and the cardinal transformation reported, one may notice a few points. All the EU-15 countries had at the time (June 2001) a rating level of at least A (A2), which was the notation attributed to Greece, with most of the countries with ratings between AAA (Aaa) or AA (Aa). Also, and considering the classification of developed countries used by the IMF, all these countries have a rating level equal to or above A. In other words, the rating level appears clearly correlated with the development of the country.

Another point to mention is that the rating levels given by the two agencies are quite similar. In fact, the difference between the two classifications is never higher than 2 points, according to the cardinal classification used in this paper, except for the following countries: Barbados, China, Kuwait, Taiwan and Turkey. For the entire country sample, one may also see that Moody's gives a better rating than S&P to only 11 countries, and that S&P assigns better ratings to only 17 countries. In terms of the cardinal classification used in this paper, this means, for this country sample, an accumulated difference of 13 and 21 points respectively for Moody's and for S&P. These differences suggest probably both the use of different explanatory factors and different weights by each agency in their rating methodologies. There could be also some attempt by the agencies to gain market share, by giving some countries a notch more than the competitors. [5]

Additionally, for the EU-15 countries, the notations of the two agencies are basically the same, except for a difference of one point in four countries. Moody's assigns to

[5] For instance, with data for 252 US municipal government debt, Moon and Stotsky (1992) mention that there was some tendency for S&P to give a better rating than Moody's.

Ireland and Finland a better rating than the one proposed by S&P, while S&P gives Italy and Spain better ratings than Moody's does. Even if "split rating" at a letter grade commonly occurs, this may give conflicting information to potential investors.

3 – Rating determinants

To assess the credit risk of governments is not an easy task. One must take into account both solvency facts and aspects such as the stability of the political system, social cohesion and the degree of interdependence with international economic and financial systems.[6] It is also worthwhile noticing that sovereigns, unlike corporate issuers, are less likely to face claims from creditors if the circumstance of a default arises. This is true even if governments have an incentive to make payments, resulting from the possibility of capital market autarky.

Among the factors that might influence the attribution of a higher or lower rating level to each sovereign issuance, one may mention for instance the political stability of the country, the level of external debt, the evidence on previous issuances and eventual defaults, information about the public accounts, indicators of economic performance and the degree of the country development.[7]

After a first analysis, where was assessed the correlation of several variables with the cardinal variable *RATING*, and the plausibility of the economic relations, the following variables were selected: per capita GDP; inflation rate; GDP real growth rate; development indicator; default indicator; external debt-exports ratio (this variable is only relevant for developing countries); government deficit as a percentage of GDP. Variables such as the current account deficit as a percentage of GDP, central government spending as a percentage of GDP or the debt-to-GDP ratio, turned out to be poorly correlated with the rating classifications.[8]

[6] See for instance Bulow and Rogoff (1989) and also Bulow (1992) for the differences between corporate and sovereign default.
[7] The rationale for several of these factors is discussed namely by Edwards (1984), Haque *et al.* (1996), Cantor and Packer (1996) while Haque, Mark and Mathieson (1998) assess the importance of political factors. One may also see for instance the criteria definition used by Moody's (2001).
[8] Nevertheless, both the current account deficit and the debt-to-GDP ratio were used in the estimations but with no significant result.

In what follows, some theoretical and intuitive explanations are given about the contribution of the aforementioned set of explanatory variables, to the determination of sovereign debt ratings.

GDP per capita is supposedly a measure of the country development and can be seen as an indicator of the tax basis available in the economy. Also, countries high lower GDP per capita may be less able to solve debt service problems by implementing austerity measures. Therefore, the bigger GDP per capita the more likely is the attribution of a higher rating level.

Inflation rate has two opposite effects on the existing stock of government debt. In one hand, an increase of inflation improves the public debt dynamics by reducing the real value of government debt, in the other hand a rise in inflation contributes negatively to the debt dynamics because it makes it necessary for the government to pay higher nominal interest rates.

Also, high inflation may signal excess demand or labour market distortions. Additionally it may also imply some lack of capacity for a country to finance its public expenditures using only public revenues and issuing public debt. Economic history has already several episodes were countries resorted to printing money in order to meet their borrowing requirements. One should therefore expect to see a negative relation between the level of the rating and inflation rate.

Economy real growth allows, on its own, *ceteris paribus*, for a relative decrease of the country indebtedness, making it easier to face future debt service related payments, decreasing also the cyclical component of the primary budget balance.[9] Besides this, a growing economy is more likely to absorb excess labour supply, to decrease unemployment, increase living standards and to downplay possible social conflicts and political instability.[10] One should therefore expect economic growth to be positively correlated with the rating levels.

[9] For instance, Alesina *et al.* (1992) found a significant negative correlation between industrial production rate and the interest rate differential between government debt and private debt.
[10] Bayoumi *et al*. (1995) mention for the US a positive correlation between the unemployment rate and the credit spreads of US public debt.

The degree of development of a country is in principle already taken into account when one uses information concerning the GDP per capita. However, the analysis of the data reveals that rating agencies attribute a smaller probability of default to the countries labelled as developed. This indicator has one of the highest correlations with the rating level, around 0,85 for the country sample used in this paper, being therefore reasonable to assume a positive relation between these two variables. Indeed, high-ranking countries are invariably those with higher GDP per capita.

The default history of sovereigns is an extremely important factor to assess the credibility of Governments to meet their future responsibilities. Obviously, a history of partial or total defaults ends up being penalized with lower rating levels. [11]

Eaton, Gersovitz and Stiglitz (1986, pp 482-483) define a default situation as follows: "Whenever the borrower gives resources to the lender that are less than the fixed amount he is committed to pay the lender, then there is a default." Some examples of sovereign distress in the capital markets occurred with Argentina and Brazil in 1989-90, the Mexican crisis of 1994-95 and Russia in 1997.

A significant external debt-to-exports ratio is generally associated with a greater default risk, since the source of foreign currency, exports, may not be enough to ensure the debt payments. A country where this ratio is high is more likely to be adversely affected by changes in the terms of trade or a decrease in foreign demand.[12] This indicator should then have a negative contribution for the assigned rate level, and this is particularly true for developing countries. Indeed, for most developing countries, exports are the main source of foreign exchange earnings.

Concerning public finance variables, the variable that seems to be more relevant is the budget balance. A high budget deficit suggests that a given economy is having difficulties in raising enough public revenues and/or keeping a sound control of public

[11] Eaton and Fernandez (1995) discuss the incentives that sovereigns have to reimburse their public debt while Rose (2002) sustains that sovereign default also ends up in a decline in international trade. From the large literature on sovereign risk and default Obstfeld and Rogoff (1996) provide a survey.

[12] It is also important to assess the structure of the external debt, since low external debt-to-exports ratio may not be enough if there is a lot of short-term debt. Huhne (1998) offers some insights on this point.

expenditures in order to minimize public accounts unbalances. Therefore, budget surpluses should be positively correlated with higher ratings.

Additionally, the debt-to-GDP ratio turned out to be significantly uncorrelated with the rating level, and the same was true with public expenditures as a percentage of GDP.

The general model to estimate is as follows:

$$RATING_i = a_0 + a_1 GDPPC_i + a_2 INFL_i + a_3 GDPGR_i + a_4 DEVELOP_i + a_5 DEBTX_i + a_5 DEBTX_i + a_6 DEF_i + a_7 BUDGET_i \quad (1)$$

where we have:

RATING – quantitative variable, obtained by linear (logistic) transformation,

GDPPC – per capita GDP, values for 2000, thousands of dollars;

INFL – inflation rate, average of the last 3 years (1998-2000),

GDPGR – real GDP growth rate, average of the last 3 years (1998-2000),

DEVELOP – indicator of developed country = $\begin{cases} 1, \text{developed country} \\ 0, \text{developing country} \end{cases}$,

DEBTX – external debt-to-exports ratio = $(1 - DEVELOP)(edebt / \exp)$,

with , *edebt* – external debt, values for 2000,

exp – exports, values for 2000,

DEF – indicator of default = $\begin{cases} 1, \text{with default} \\ 0, \text{without default} \end{cases}$, that assesses if the country defaulted either on interest or principal payments, since 1975,

BUDGET – budget balance as a percentage of GDP, average of the last 3 years (1998-2000).

According to what was said above, it seems therefore reasonable to anticipate the following signs for the coefficients of each variable in equation (1): $\alpha_1 > 0$ (per capita

GDP); $\alpha_2 < 0$ (inflation); $\alpha_3 > 0$ (GDP real growth); $\alpha_4 > 0$ (developed country indicator); $\alpha_5 < 0$ (external debt-to-exports ratio); $\alpha_6 < 0$ (default indicator) and $\alpha_7 > 0$ (budget balance).

4 – Estimations and results discussions

Equation (1) was estimated using OLS. An attempt was also made in order to estimate a multinomial Logit, however, the absence of a significant number of values for the dependent variable and a reduced number of sectional data, prevents the maximum likelihood convergence of the coefficients.

4.1 – Using a linear transformation

Of the several versions tried for equation (1), only the more statistically significant are presented. The estimations were carried out using the two series for the *RATING* variable, according to the ratings of S&P or Moody's, with the linear transformation constructed in section two. The results for the S&P data are reported on Table 5, and allow us to conclude that all the coefficients have the expected signs. Also, most of the coefficients are indeed statistically different from zero.

Regarding the S&P notations, the best models seem to be S2 and S3 of Table 5. The two models, vis-à-vis model S1, for instance, enhance the role of the variables that try to capture the information from the default history and from the ratio of external debt to exports. In other words, these two factors appear as highly important in determining and explaining the rating level, and are both, as expected, negatively related to sovereign credit quality. Remember also that the explanatory variable external debt-to-exports ratio is only being used for the developing countries.

The budget balance variable, as a percentage of GDP, even if it has the correct sign, is not unequivocally statistically significant, since its estimated coefficient is only different from zero at the 15 per cent level, as one may observe from the results of models S4 and S5.

Table 5 – Estimation of equation (1), S&P data, using a linear transformation

	S1	S2	S3	S4	S5
Constant (α_0)	5.4743 * (9.78)	5.8864 * (10.72)	7.0717 * (10.18)	8.2457 * (13.35)	7.2419 * (13.45)
GDPPC (α_1)	0.00014 * (3.43)	0.00014 * (3.42)	0.00013 * (3.30)	0.00011 * (2.72)	0.00012 * (2.83)
INFL (α_2)	-0.0910 * (-3.82)	-0.0913 * (-4.05)	-0.0953 * (-4.41)	-0.1039 * (-4.92)	-0.1029 * (-4.59)
GDPGR (α_3)	0.2810 ** (2.23)	0.2764 ** (2.32)	0.2228 *** (1.94)		
DEVELOP (α_4)	4.5226 * (4.22)	4.3214 * (4.25)	3.6102 * (3.45)	3.6804 * (3.47)	4.4252 * (4.24)
DEBTX (α_5)			-0.0097 * (-3.34)	-0.0102 * (-3.47)	
DEFAULT (α_6)		-2.3381 * (-2.93)			-2.2650 ** (-2.58)
BUDGET (α_7)				0.1146 (1.44)	0.1221 (1.49)
Adjust. R^2	0.8326	0.8496	0.8636	0.8601	0.8391
DW	1.772	1.821	2.010	2.062	1.896
Nº of observations	72	72	71	71	71

The t statistics are in parentheses. * - Significant at the 1% level; ** - Significant at the 5% level; *** - Significant at the 10% level.

Concerning the estimations with the rating data for Moody's, one gets rather similar results, reported on Table 6.

Table 6 – Estimation of equation (1), Moody's data, using a linear transformation

	M1	M2	M3	M4	M5
Constant (α_0)	5.3499 * (10.15)	6.8069 * (9.99)	8.1027 * (13.17)	5.9886 * (9.54)	6.9856 * (13.29)
GDPPC (α_1)	0.00016 * (4.10)	0.00015 * (4.06)	0.00014 * (3.38)	0.00014 * (3.55)	0.00014 * (3.38)
INFL (α_2)	-0.0610 * (-2.82)	-0.0674 * (-3.18)	-0.0769 * (-3.68)	-0.0601 * (-2.82)	-0.0740 * (-3.43)
GDPGR (α_3)	0.3270 * (2.82)	0.2533 ** (2.22)		0.3042 * (2.65)	
DEVELOP (α_4)	3.8960 * (3.98)	2.8584 * (2.78)	2.9496 * (2.82)	3.7900 * (3.93)	3.9753 * (3.95)
DEBTX (α_5)		-0.0123 * (-4.31)	-0.0128 * (-4.43)		
DEFAULT (α_6)	-3.1596 * (-3.86)			-3.3246 * (-4.10)	-3.3931 * (-4.00)
BUDGET (α_7)			0.1248 (1.59)	0.1371 *** (1.80)	0.1593 ** (2.01)
Adjust. R^2	0.8607	0.8707	0.8660	0.8654	0.8527
DW	1.927	1.919	1.881	2.02	1.94
Nº of observations	70	69	69	70	70

The t statistics are in parentheses. * - Significant at the 1% level; ** - Significant at the 5% level; *** - Significant at the 10% level.

Once more all the coefficients have the expected sign, and the budget balance now turns out to be statistically different from zero, at least at a level of 10 and 5 per cent, respectively in models M4 and M5. Nevertheless, the models without the budget balance variable and with GDP real growth rate seem to be statistically more adequate. It is interesting to point also to the significance of the explanatory variable *DEVELOP* in all models of tables 5 and 6, corroborating, as expected, the initial idea that the so-called developing countries have lower credit ratings. Inflation has also rather meaningful information to explain the rating levels, with low inflation countries getting a better notation from both agencies, in all versions of the model.

After several simulations with all the estimated models, models S3 and M2 were selected as the more suitable in replicating the ratings given by the two agencies. The estimated ratings are quite similar, with both models presenting an absolute percentage average error of around 30 per cent.

Table 7 reports the predicted errors from model S3 for 71 countries of the initial sample. With this model, the maximum prevision error is 4 notches, and this occurs only for 3 countries: Chile, Pakistan and Paraguay. For Chile the model under-predicts the rating and for the other two countries it delivers an over-prediction of the rating level. For the developed countries, one can also notice that the absolute prediction error is always equal to or below 2 notches. Also, the absolute prediction errors obtained from this model do not go beyond 1 notch for 42 of the 71 countries.

For the EU-12 countries one may also mention some results. The maximum absolute error is 2 notches, with zero error for 4 countries: Belgium, Finland, Italy and Luxemburg. The model assigns a better rating to only two countries: Ireland (1 notch more) and Greece (2 notches more). Also, the model suggests a lower rating for the 6 remaining countries of the EU-12: France, Netherlands and Portugal (minus 1 notch), Austria, Germany and Spain (minus 2 notches).[13]

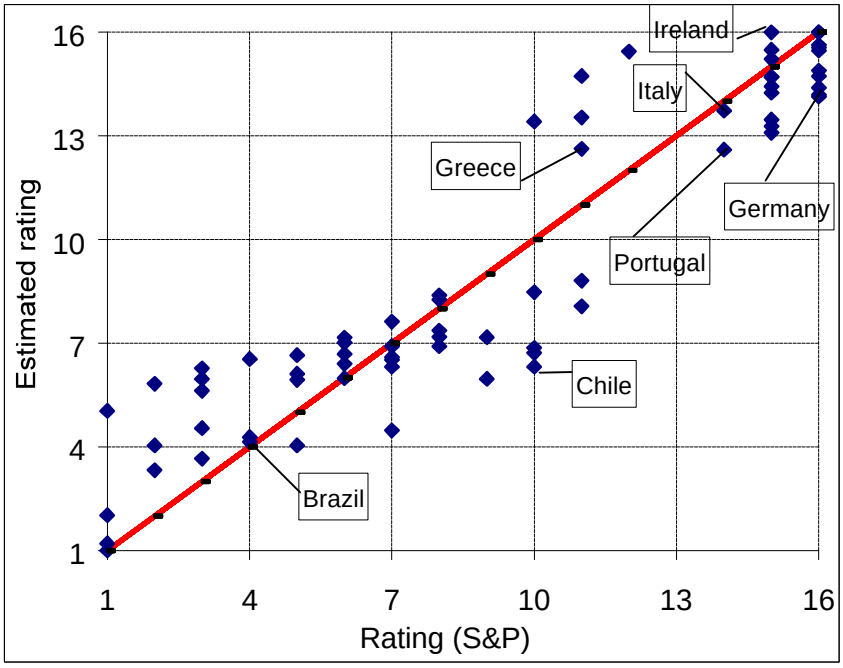
[13] The prediction errors from the same model with Moody's data, model M2, are quite identical, and therefore are not presented here.

Table 7 – Prediction errors: model S3 from Table 5, linear transformation

Country	Rating (R) S&P		Prediction (P)	Error = P – R	Country	Rating (R) S&P		Prediction (P)	Error = P – R
Argentina	B	2	3	1	Lithuania	BBB-	7	7	0
Australia	AA+	15	14	-1	Luxembourg	AAA	16	16	0
Austria	AAA	16	14	-2	Malaysia	BBB	8	7	-1
Barbados	A-	10	8	-2	Malta	A	11	9	-2
Belgium	AA+	15	15	0	Mexico	BB+	6	7	1
Bolivia	B+	3	4	1	Morocco	BB	5	6	1
Brazil	BB-	4	4	0	Netherlands	AAA	16	15	-1
Bulgaria	B+	3	6	3	New Zealand	AA+	15	13	-2
Canada	AA+	15	14	-1	Norway	AAA	16	16	0
Chile	A-	10	6	-4	Pakistan	B-	1	5	4
China	BBB	8	8	0	Panama	BB+	6	7	1
Colombia	BB	5	4	-1	P. New Guinea	B+	3	5	2
Cyprus	A	11	14	3	Paraguay	B	2	6	4
Czech Rep.	A-	10	7	-3	Peru	BB-	4	4	0
Denmark	AAA	16	15	-1	Philippines	BB+	6	6	0
Egypt	BBB-	7	7	0	Poland	BBB+	9	6	-3
El Salvador	BB+	6	7	1	Portugal	AA	14	13	-1
Estonia	BBB+	9	7	-2	Romania	B-	1	1	0
Finland	AA+	15	15	0	Russia	B-	1	2	1
France	AAA	16	15	-1	Singapore	AAA	16	16	0
Germany	AAA	16	14	-2	Slovakia	BB+	6	6	0
Greece	A	11	13	2	Slovenia	A	11	8	-3
Hong Kong	A+	12	15	3	South Africa	BBB-	7	7	0
Hungary	A-	10	7	-3	Spain	AA+	15	13	-2
Iceland	A+	12	15	3	Sweden	AA+	15	15	0
India	BB	5	7	2	Switzerland	AAA	16	16	0
Ireland	AA+	15	16	1	Taiwan	AA+	15	13	-2
Israel	A-	10	13	3	Thailand	BBB-	7	6	-1
Italy	AA	14	14	0	Trin. and Tob.	BBB-	7	8	1
Jamaica	B+	3	6	3	Tunisia	BBB	8	7	-1
Japan	AA+	15	15	0	Turkey	B-	1	1	0
Jordan	BB-	4	7	3	UK	AAA	16	14	-2
Kazakhstan	BB	5	6	1	USA	AAA	16	16	0
Korea	BBB	8	8	0	Uruguay	BBB-	7	4	-3
Latvia	BBB	8	7	-1	Venezuela	B	2	4	2
Lebanon	B+	3	6	3					

Figure 1 illustrates the prediction power of model S3, leading also to some additional conclusions. For instance, two countries with the same effective rating level, as Portugal and Italy, are set apart by 1 notch by the model, with Italy getting a better estimated rating. One of the reasons for this simulation result is the fact that GDP per capita is in Portugal roughly half of its Italian counterpart, respectively 11266 and 21816 US dollars for Portugal and for Italy (with 2000 figures).

Figure 1 – Rating prediction with model S3 from Table 7



Also, and considering now two EU-12 countries with similar a GDP per capita, Portugal and Greece (11780 US dollars), it is possible to see that the model assigns them, in round figures, the same rating, while the effective ratings are set apart by 3 notches, with Greece having the lower rating. In this case, the circumstance that Greece did not make it to euro group from the start may have affected negatively the rating of its sovereign debt.

GDP per capita is rather influential in the estimated models. Nevertheless, notice for instance that the S3 model predicts 2 notches below the effective rating level for Austria and Germany, two countries with similar GDP per capita, respectively 23142 and 24091 dollars. Also, there is a prediction of only 1 notch below the effective rating for France and Netherlands, countries where the GDP per capita is respectively 26919 and 27851 dollars. GDP real growth rate must be playing here an important role since the average real growth rate, between 1998 and 2000, was 3,2 per cent in France and only 2,2 per cent in Germany.

Concerning the models estimated using Moody's data, the prediction errors from model M4 are reported on Table 8.

Table 8 – Prediction errors: model M4 from Table 6, linear transformation

Country	Rating (R) Moody's		Prediction (P)	Error = P – R	Country	Rating (R) Moody's		Prediction (P)	Error = P – R
Argentina	B2	2	3	1	Lithuania	Ba1	6	6	0
Australia	Aa2	14	14	0	Luxembourg	Aaa	16	16	0
Austria	Aaa	16	14	-2	Malaysia	Baa2	8	7	-1
Barbados	Baa2	8	8	0	Malta	A3	10	7	-3
Belgium	Aa1	15	14	-1	Mexico	Baa3	7	7	0
Bolivia	B1	3	3	0	Morocco	Ba1	6	6	0
Brazil	B1	3	6	3	Netherlands	Aaa	16	15	-1
Bulgaria	B2	2	7	5	New Zealand	Aa2	14	13	-1
Canada	Aa1	15	14	-1	Norway	Aaa	16	16	0
Chile	Baa1	9	7	-2	Pakistan	Caa1	1	3	2
China	A3	10	8	-2	Panama	Ba1	6	4	-2
Colombia	Ba2	5	5	0	P. New Guinea	B1	3	5	2
Cyprus	A2	11	13	2	Paraguay	B2	2	6	4
Czech Rep.	Baa1	9	6	-3	Peru	Ba3	4	3	-1
Denmark	Aaa	16	16	0	Philippines	Ba1	6	6	0
Egypt	Ba1	6	7	1	Poland	Baa1	9	7	-2
El Salvador	Baa3	7	7	0	Portugal	Aa2	14	12	-2
Estonia	Baa1	9	7	-2	Romania	B3	1	2	1
Finland	Aaa	16	16	0	Russia	B3	1	1	0
France	Aaa	16	14	-2	Singapore	Aa1	15	16	1
Germany	Aaa	16	14	-2	Slovakia	Ba1	6	6	0
Greece	A2	11	12	1	Slovenia	A2	11	8	-3
Hong Kong	A3	10	14	4	South Africa	Baa3	7	6	-1
Hungary	A3	10	7	-3	Spain	Aa2	14	13	-1
Iceland	Aa3	13	16	3	Sweden	Aa1	15	15	0
India	Ba2	5	6	1	Switzerland	Aaa	16	16	0
Ireland	Aaa	16	17	1	Taiwan	Aa3	13	13	0
Israel	A2	11	13	2	Thailand	Baa3	7	5	-2
Italy	Aa3	13	13	0	Trin. and Tob.	Baa3	7	8	1
Jamaica	Ba3	4	5	1	Turkey	B1	3	2	-1
Japan	Aa1	15	14	-1	UK	Aaa	16	14	-2
Jordan	Ba3	4	7	3	USA	Aaa	16	16	0
Kazakhstan	Ba2	5	6	1	Uruguay	Baa3	7	6	-1
Korea	Baa2	8	8	0	Venezuela	B2	2	4	2
Latvia	Baa2	8	7	-1					
Lebanon	B1	3	5	2					

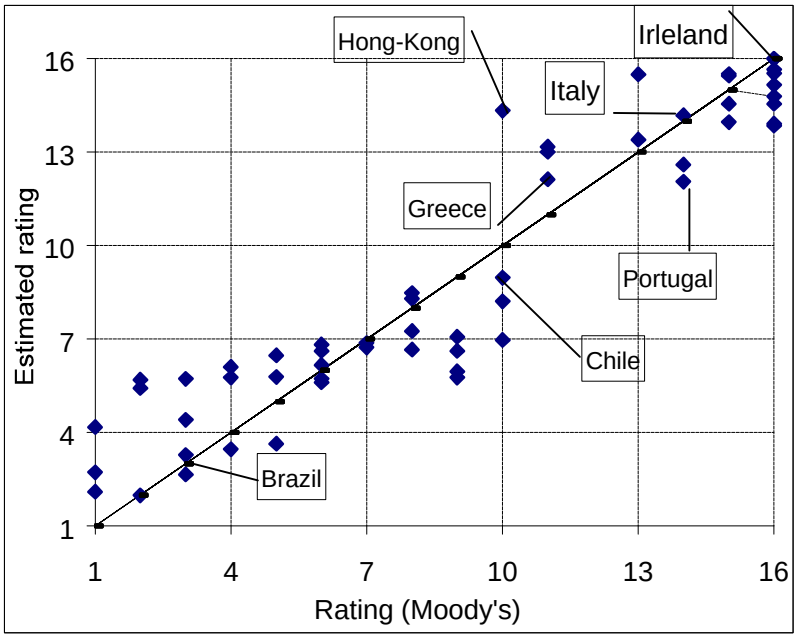
The differences between this model (Moody's data) and model S3 (S&P data), besides the rating data, is that model M4 uses the default variable instead of the external debt-to-exports ratio and introduces also the budget balance as a regressor. The results are similar to the ones already reported for model S3, even with the same absolute percentage average error of around 30 per cent, even if the maximum prediction error is now 5 notches (for Bulgaria). Furthermore, only for three countries is the prediction error equal to 4 notches: Hong Kong and Paraguay.

Considering the biggest prediction errors from both models (S3 and M4), the set of countries that pop up includes Chile, Pakistan, Paraguay, Bulgaria and Hong Kong. If the first four countries have low credit ratings, and probably the estimated models aren't performing that well at the low end of the rating scale, the differences in the case of Hong Kong, with both models assigning a better rating than the effective one, there may be other determinants not considered in the models. For instance, one may recall that on July 1, 1997, Hong Kong was returned to the People's Republic of China and became a Special Administrative Region of China.

Concerning now the estimated ratings for the EU-12 countries, there are only minor changes from the results of the previous model. The prediction error is null for 4 countries: Denmark, Finland, Italy and Luxembourg. This model assigns a higher rating than the effective rating to the same two countries: Ireland and Greece (plus 1 notch). Also a lower rating is estimated for 6 countries: Belgium, Netherlands and Spain (minus 1 notch), Austria, France, Germany and Portugal (minus 2 notches).

Figure 2 illustrates the prediction ability of the estimated model using Moody's data and allows assessing more clearly the several comments offered above.

Figure 2 – Rating prediction with model M4 from Table 8



Additionally I constructed the *RATING* variable as the arithmetic average of the ratings assigned by the two agencies, still using the linear transformation. Since the estimation results using the rating data in such a way are not substantially different from the ones already reported, these results are not presented in the text.

4.2 – Using a logistic transformation

The models estimated so far, based on a linear transformation of the rating levels, show some lack of accuracy for the countries located on the top end of the rating scale. Another approach was therefore attempted, by using a logistic transformation of the ratings, instead of the usual linear transformation.

The idea underlying the use of the logistic transformation is that at the bottom of the scale, and since the rating level is low, ratings can rise rather quickly, as the sovereigns deliver some improvements. At the top end of the rating scale however, the increase of an additional notch is slower, since the requisites of sovereign quality are now more demanding.

If one assumes that the functional form that describes the relationship between the creditworthiness rating, R_i, normalized to grade each of the countries on a scale of zero to one with zero representing the least creditworthy countries and one representing the most creditworthy countries, and the set of explanatory variables, X (the same exogenous variables used in (1)), is the standard conventional logistic form

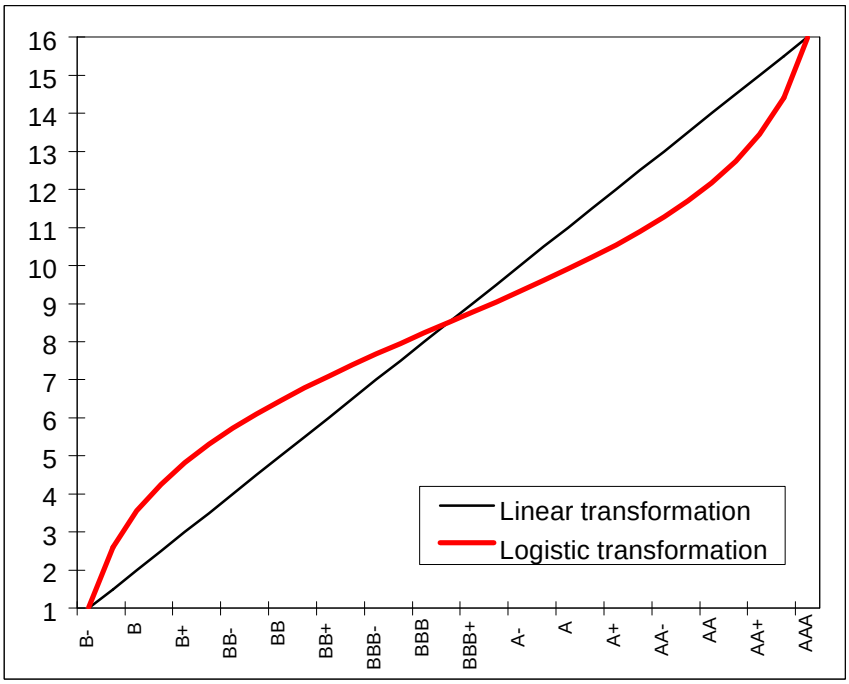
$$R = \frac{e^{b'X}}{1+e^{b'X}}, \qquad (2)$$

where the vector b' includes the parameters of the exogenous variables. The logistic transformation then becomes

$$L_i = \ln\left[R_i/(1-R_i)\right] = b'X, \qquad (3)$$

where L_i is the logit of R_i. This equation is not only linear in X, but also linear in the parameters and can be estimated using ordinary least squares. Figure 3 compares the linear and the logistic transformations.

Figure 3 – Comparison of ratings transformations (S&P notation)



The estimation results of equation (3), using the logistic transformation, for the S&P ratings are reported on Table 9.

Table 9 – Estimation of equation (3), S&P data, using a logistic transformation

	S6	S7	S8	S9	S10
Constant (α_0)	-0.9082 * (-4.33)	-0.7600 * (-3.67)	-0.3903 (-1.43)	-0.0058 (-0.02)	-0.2904 (-1.46)
GDPPC (α_1)	0.0000726 * (4.58)	0.0000699 * (4.61)	0.0000679 * (4.48)	0.0000614 * (3.88)	0.0000627 * (3.97)
INFL (α_2)	-0.0473 * (-5.30)	-0.0474 * (-5.57)	-0.0490 * (-5.77)	-0.0513 * (-6.25)	-0.0506 * (-6.11)
GDPGR (α_3)	0.0844 ** (1.79)	0.0827 ** (1.84)	0.0665 (1.47)		
DEVELOP (α_4)	1.2037 * (3.00)	1.1313 * (2.95)	0.8764 ** (2.13)	0.9014 ** (2.19)	1.1496 * (2.97)
DEBTX (α_5)			-0.00309 * (-2.71)	-0.00318 * (-2.80)	
DEFAULT (α_6)		-0.8404 * (-2.79)			-0.8321 ** (-2.56)
BUDGET (α_7)				0.0449 (1.45)	0.0521 *** (1.71)
Adjust. R^2	0.8410	0.8557	0.8582	0.8581	0.8515
DW	1.738	1.733	1.8696	1.9558	1.8519
Nº of observations	72	72	70	70	71

The t statistics are in parentheses. * - Significant at the 1% level; ** - Significant at the 5% level; *** - Significant at the 10% level.

All the estimated coefficients have again the expected sign. The results in terms of the prediction errors from model S7 (logistic) are reported in Table 10, and are not very different from the errors produced by model S3 (linear).

Table 10 – Prevision errors: model S7 from Table 9, logistic transformation

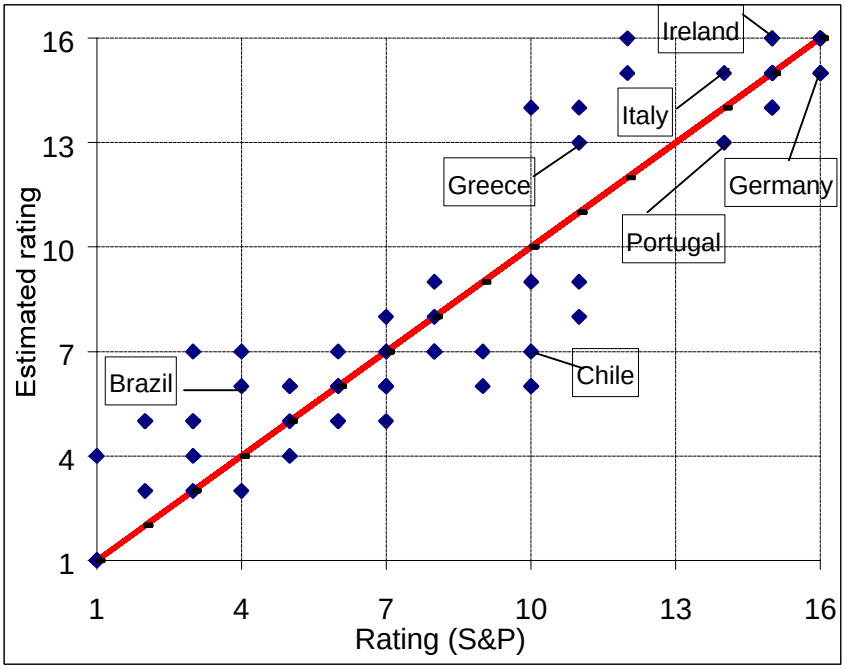
Country	Rating (R) S&P		Prediction (P)	Error = P – R	Country	Rating (R) S&P		Prediction (P)	Error = P – R
Argentina	B	2	5	3	Lithuania	BBB-	7	6	-1
Australia	AA+	15	15	0	Luxembourg	AAA	16	16	0
Austria	AAA	16	15	1	Malaysia	BBB	8	7	-1
Barbados	A-	10	9	-1	Malta	A	11	9	-2
Belgium	AA+	15	15	0	Mexico	BB+	6	6	0
Bolivia	B+	3	3	0	Morocco	BB	5	6	1
Brazil	BB-	4	6	2	Netherlands	AAA	16	15	-1
Bulgaria	B+	3	5	2	New Zealand	AA+	15	14	-1
Canada	AA+	15	15	0	Norway	AAA	16	16	0
Chile	A-	10	7	-3	Pakistan	B-	1	4	3
China	BBB	8	8	0	Panama	BB+	6	5	-1
Colombia	BB	5	4	-1	P. New Guinea	B+	3	4	1
Cyprus	A	11	14	3	Paraguay	B	2	5	3
Czech Rep.	A-	10	6	-4	Peru	BB-	4	3	-1
Denmark	AAA	16	16	0	Philippines	BB+	6	5	-1
Egypt	BBB-	7	7	0	Poland	BBB+	9	6	-3
El Salvador	BB+	6	7	1	Portugal	AA	14	13	-1
Estonia	BBB+	9	7	-2	Romania	B-	1	1	0
Finland	AA+	15	15	0	Russia	B-	1	1	0
France	AAA	16	15	-1	Singapore	AAA	16	16	0
Germany	AAA	16	15	-1	Slovakia	BB+	6	6	0
Greece	A	11	13	2	Slovenia	A	11	8	-3
Hong Kong	A+	12	15	3	South Africa	BBB-	7	6	-1
Hungary	A-	10	6	-4	Spain	AA+	15	14	-1
Iceland	A+	12	16	4	Sweden	AA+	15	15	0
India	BB	5	6	1	Switzerland	AAA	16	16	0
Ireland	AA+	15	16	1	Taiwan	AA+	15	14	-1
Israel	A-	10	14	4	Thailand	BBB-	7	5	-2
Italy	AA	14	15	1	Trin. and Tob.	BBB-	7	8	1
Jamaica	B+	3	5	2	Tunisia	BBB	8	7	-1
Japan	AA+	15	16	1	Turkey	B-	1	1	0
Jordan	BB-	4	7	3	UK	AAA	16	15	-1
Kazakhstan	BB	5	5	0	USA	AAA	16	16	0
Korea	BBB	8	9	1	Uruguay	BBB-	7	6	-1
Latvia	BBB	8	7	-1	Venezuela	B	2	3	1
Lebanon	B+	3	7	4					

The maximum prediction error, 4 notches with the logistic transformation, now occurs for the Czech Republic, Hong Kong, Hungary, Israel and Lebanon. Nevertheless, the logistic transformation does improve the adjustment for the top end of the rating scale

and for the entire sample, since the absolute percentage average error is now around 23 per cent (recall the 30 per cent figure for the model S3, using the linear transformation).

For instance, for a sub-set of the developed countries, that are usually the best rated sovereigns (EU-15 plus Japan, US, Australia, New Zealand, Singapore, Norway and Switzerland) model S3 gives an accumulated prediction error of 20 points while model S7 reduces this margin to 13 points. Also, for the EU-15 countries, prediction errors from model S3 add up to 15 points and model S7 now delivers a sum of only 10 points (see Table 7 and Table 11). Figure 4 supplements the previous analysis by depicting the aforementioned prediction differences for model S7.

Figure 4 – Rating prediction with model S7 from Table 9



The estimation results using both the logistic transformation and data from Moody's, are presented on Table 11.

Table 11 – Estimation of equation (3), Moody's data, using a logistic transformation

	M6	M7	M8	M9	M10
Constant (α_0)	-1.2883 * (-5.58)	-1.0805 * (-4.99)	-0.6197 ** (-2.09)	-0.4887 (-1.51)	-0.8403 * (-3.25)
GDPPC (α_1)	0.0000889 * (5.10)	0.000086 * (5.42)	0.0000859 * (5.22)	0.0000807 * (4.69)	0.000079 * (4.87)
INFL (α_2)	-0.0267 * (-2.72)	-0.0269 * (-3.03)	-0.0293 * (-3.18)	-0.0288 * (-3.12)	-0.0266 * (-3.03)
GDPGR (α_3)	0.1185 ** (2.26)	0.1149 ** (2.41)	0.0913 *** (1.84)	0.0861 *** (1.73)	0.1063 ** (2.25)
DEVELOP (α_4)	0.9325 ** (2.11)	0.8119 ** (2.02)	0.4475 (1.00)	0.4606 (1.03)	0.7719 *** (1.94)
DEBTX (α_5)			-0.00415 * (-3.34)	-0.00461 * (-3.22)	
DEFAULT (α_6)		-1.2990 * (-3.86)			-1.3610 * (-4.07)
BUDGET (α_7)				0.0349 (1.03)	0.0516 (1.64)
Adjust. R^2	0.8105	0.8439	0.8371	0.8373	0.8479
DW	1.7203	1.9987	1.8655	1.8723	2.0558
Nº of observations	70	70	69	69	70

The t statistics are in parentheses. * - Significant at the 1% level; ** - Significant at the 5% level; *** - Significant at the 10% level.

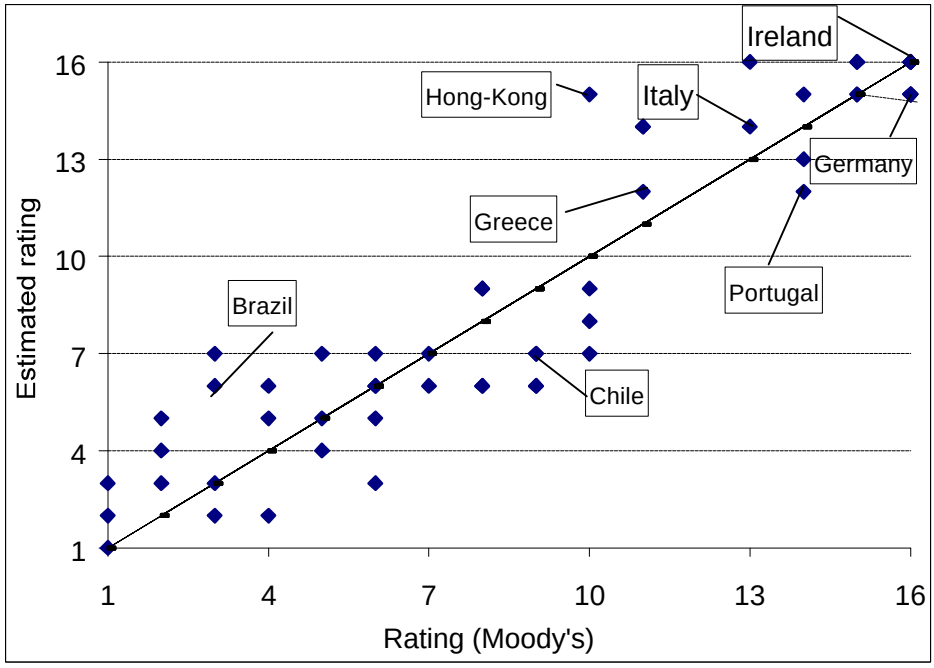
The logistic transformation applied to the Moody's data gives as a maximum prediction error of 5 notches for one country, Hong Kong, and of 4 notches for another single country, Lebanon. All other countries get estimated ratings equal or below 3 points. Once again, the use of the logistic transformation improves the overall adjustment of the model. This is true since the absolute percentage average error for model M7 (logistic) is around 25 per cent, better than the absolute percentage average error of 30 per cent that was associated with model M4 (linear). Table 12 reports the prediction errors for each country, with model M7 of Table 11.

Table 12 – Prevision errors: model M7 from Table 11, logistic transformation

Country	Rating (R) Moody's		Prediction (P)	Error = P – R	Country	Rating (R) Moody's		Prediction (P)	Error = P – R
Argentina	B2	2	3	1	Lithuania	Ba1	6	6	0
Australia	Aa2	14	15	1	Luxembourg	Aaa	16	16	0
Austria	Aaa	16	15	-1	Malaysia	Baa2	8	6	-2
Barbados	Baa2	8	9	1	Malta	A3	10	9	-1
Belgium	Aa1	15	15	0	Mexico	Baa3	7	7	0
Bolivia	B1	3	2	-1	Morocco	Ba1	6	6	0
Brazil	B1	3	6	3	Netherlands	Aaa	16	15	-1
Bulgaria	B2	2	5	3	New Zealand	Aa2	14	13	-1
Canada	Aa1	15	15	0	Norway	Aaa	16	16	0
Chile	Baa1	9	7	-2	Pakistan	Caa1	1	3	2
China	A3	10	8	-2	Panama	Ba1	6	3	-3
Colombia	Ba2	5	4	-1	P. New Guinea	B1	3	3	0
Cyprus	A2	11	14	3	Paraguay	B2	2	4	2
Czech Rep.	Baa1	9	6	-3	Peru	Ba3	4	2	-2
Denmark	Aaa	16	16	0	Philippines	Ba1	6	5	-1
Egypt	Ba1	6	7	1	Poland	Baa1	9	7	-2
El Salvador	Baa3	7	6	-1	Portugal	Aa2	14	12	-2
Estonia	Baa1	9	6	-3	Romania	B3	1	2	1
Finland	Aaa	16	15	-1	Russia	B3	1	1	0
France	Aaa	16	15	-1	Singapore	Aa1	15	16	1
Germany	Aaa	16	15	-1	Slovakia	Ba1	6	6	0
Greece	A2	11	12	1	Slovenia	A2	11	9	-2
Hong Kong	A3	10	15	5	South Africa	Baa3	7	6	-1
Hungary	A3	10	7	-3	Spain	Aa2	14	13	-1
Iceland	Aa3	13	16	3	Sweden	Aa1	15	15	0
India	Ba2	5	7	2	Switzerland	Aaa	16	16	0
Ireland	Aaa	16	16	0	Taiwan	Aa3	13	14	1
Israel	A2	11	14	3	Thailand	Baa3	7	5	-2
Italy	Aa3	13	14	1	Trin. and Tob.	Baa3	7	8	1
Jamaica	Ba3	4	5	1	Turkey	B1	3	2	-1
Japan	Aa1	15	16	1	UK	Aaa	16	15	-1
Jordan	Ba3	4	6	2	USA	Aaa	16	16	0
Kazakhstan	Ba2	5	5	0	Uruguay	Baa3	7	6	-1
Korea	Baa2	8	9	1	Venezuela	B2	2	3	1
Latvia	Baa2	8	6	-2					
Lebanon	B1	3	7	4					

In line with the other models analysed, Figure 5 illustrates also the prediction accuracy of model M4.

Figure 5 – Rating prediction with model M7 from Table 11



Doing again the comparison between the prediction errors of models M4 (linear) and M7 (logistic), for instance for the EU-15 countries, it is possible to say that the logistic transformation appears to perform better than the linear transformation. Indeed, the cumulative prediction errors of 15 points from model M4 are now reduced to 11 points with model M7. Therefore, using both rating notations, from S&P and from Moody's, one gets better adjustments with a logistic transformation of the qualitative data. This implies the absence of a linear transition from one notch to the next, along the rating scale.

5 – Conclusion

This study tried to understand the determinants of sovereign credit rating, using data for the two major agencies: Moody's and S&P. The variables that seem to have statistically significant explanatory power for the rating levels are: GDP per capita, external debt as a percentage of exports, the level of economic development, default history, real growth rate and the inflation rate. The GDP per capita is a rather important variable when estimating the appropriate rating level both for developed and developing countries. The external debt variable is basically relevant for developing countries. The maximum prediction errors are 4 and 5 notches, for a rather

small number of countries: Chile, Pakistan, Paraguay, Bulgaria, Lebanon and Hong Kong. These results are consistent with previous empirical work offered by the literature.[14]

For the empirical implementation of the models, I used both a linear transformation and a logistic transformation of the qualitative rating data. The results of the estimations using the logistic transformation turned out to be better for the overall sample, particularly for the countries placed on the top end of the rating scale. For instance, with data from S&P, the absolute percentage average error of the selected model is around 23 per cent if one uses the logistic transformation and around 30 per cent when using the linear transformation. The ability of the model to duplicate the actual country ratings is also more satisfactory with the logistic transformation, using data from Moody's.

Of the several fiscal variables tested, only the budget balance was moderately relevant in explaining the rating level. Future analysis could take into consideration several components of public expenditures and revenues. In fact, when facing fiscal episodes, the assessment of its success in balancing public accounts may hinge on the composition of the episode.[15] Also, taking into account implicit public pension liabilities, as part of the country global fiscal unbalance, might be perceived by capital markets as future borrowing requirements, not fully embedded in the public fiscal figures, leading therefore to added country risk.[16] Still another additional improvement for the models would be to consider the political risk of each sovereign.[17]

Finally, if one collects data on the changes of the rating levels for each country, throughout a series of years, one can pursue another approach by assessing the factors that help explain the upgrade or the downgrade of the rating notations. This is a line

[14] See Haque *et al.* (1996) and Cantor and Packer (1996).
[15] On these topics see for instance Kneller *et al.* (1999) and Afonso (2001).
[16] Holzmann *et al.* (2001) report and review some data on this issue.
[17] Haque *et al.* (1998) mention nevertheless that the introduction of political variables, as explanatory factors of the rating levels, does not give much additional information over models where those variables are not included.

of work that may be followed in future research but was outside the scope of this study. [18]

Annex – Data and sources

GDP per capita – dollars, figures for 2000, source: S&P;

Inflation rate – 1998-2000, source: IMF and EC;

GDP real growth rate – 1998-2000, source: IMF, OECD and EC;

Developed country classification – source: IMF (2001), Table B of the Statistical Appendix;

Default history – source: S&P;

External debt-to-exports ratio – figures for 2000, source: Moody's.

Budget balance as a % of GDP – 1998-2000, source: EC, OECD and IMF.

References

Afonso, A. (2001). "Non-Keynesian Effects of Fiscal Policy in EU-15," Department of Economics, ISEG-UTL, Working Paper nº 7/2001/DE/CISEP.

Alesina, A.; De Broeck, M.; Prati, A. and Tabellini, G. (1992). "Default Risk," *Economic Policy*, 15, 427-463.

Altman, E. (1997). "The Importance and Subtlety of Credit Rating Migration," *mimeo*, Stern School of Business, NY University, September.

Bayoumi, T.; Goldstein, M. and Woglom, G. (1995). "Do Credit Markets Discipline Sovereign Borrowers? Evidence from the US States," *Journal of Money, Credit, and Banking*, 27 (4), 1046-1059.

BIS (2000). "Credit Ratings and Complementary Sources of Credit Quality Information," Basel Committee on Banking Supervision, Working Papers 3, August, Bank for International Settlements.

Bulow, J. (1992). "Debt and Default: Corporate vs. Sovereign," in Newman, P; Milgate, M. and Eatwell, J. (eds.), *New Palgrave Dictionary of Money and Finance*, New York: Stockton Press, 579-82.

Bulow, J. and Rogoff, K. (1989). "Sovereign Debt: Is to Forgive to Forget?" *American Economic Review*, 79 (1), 43-50.

[18] Altman (1997) and Larrain *et al.* (1997) have some work on this line.

Cantor, R. and Packer, F. (1996). "Determinants and Impact of Sovereign Credit Ratings," *Economic Policy Review*, Federal Reserve Bank of New York, 2 (2), 37-53.

Cosset, J-C. and Roy, J. (1991). "The Determinants of Country Risk Ratings," *Journal of International Business Studies*, 22 (1), 135-142.

Eaton, J.; Gersovitz, M. and Stiglitz, J. (1986). "The Pure Theory of Country Risk," *European Economic Review*, 30 (3), 481-513

Eaton, J. and Fernandez, R. (1995). "Sovereign Debt," in Grossman, G. and Rogoff, K. (eds.), *Handbook of International Economics*, North Holland.

Edwards, S. (1984). "LDC Foreign Borrowing and Default Risk: An Empirical Investigation, 1976-80," *American Economic Review*, 74 (4), 726-734.

Haque, N.; Kumar, M.; Mark, N. and Mathieson, D. (1996). "The Economic Content of Indicators of Developing Country Creditworthiness," *IMF Staff Papers*, 43 (4), 688-724.

Haque, N.; Mark, N. and Mathieson, D. (1998). "The Relative Importance of Political and Economic Variables in Creditworthiness Ratings," FMI Working Paper 98/46, Abril.

Holzmann, R.; Palacios, R. and Zviniene, A. (2001). "Implicit Pension Debt: Issues, Measurement and Scope in International Perspective," mimeo.

Huhne, C. (1998). "How the Rating Agencies Blew it on Korea," *The International Economy*, May/June.

IMF (2001). *World Economic Outlook*, September.

Kneller, R.; Bleaney, M. and Gemmell, N. (1999). "Fiscal Policy and Growth: Evidence from OECD Countries," *Journal of Public Economics*, 74, 171-190.

Kunczik, M. (2001). "Globalization: News media, images of nations and the flow of international capital with special reference to the role of rating agencies," Deutsches Übersee-Institut, Arbeitspapier (2/2001), February.

Larrain, G.; Helmut, R. and Maltzan, J. (1997). "Emerging Market Risk and Sovereign Credit Ratings," OECD Development Centre, Technical Paper 124, April.

Lee, S. (1993). "Are the credit ratings assigned by bankers based on the willingness of LDC borrowers to repay?" *Journal of Development Economics*, 40 (2), 349-359.

Moody's (2001). *Moody's Country Credit Statistical Handbook*, 1st ed., January [available at http://www.moodys.com].

Moon, C. and Stotsky, J. (1993). "Testing the Differences between the determinants of Moody's and Standard and Poor's Ratings," *Journal of Applied Econometrics*," 8 (1), 51-69.

Obstfeld, M. and Rogoff, K. (1996). *Foundations of International Macroeconomics*, MIT Press.

Rose, A. (2002). "One Reason Countries Pay Their Debts: Renegotiation and International Trade," CEPR Discussion Paper 3157, January.