La metodología de rating "through the cycle": aplicación para la estimación de ratings soberanos

Pena, Alejandro and Rodríguez, Analía
Banco Central del Uruguay

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The Rating Agencies' Through-the-cycle Methodology: an application to sovereign ratings

Alejandro Pena Sánchez
Analía Rodríguez Dupuy (*)

Abstract

This paper analyses the through-the-cycle rating concept; basically, we try to specify its main characteristics, focusing on the differences with point-in-time ratings. We also discuss the effects of this methodology on the prediction power of default probabilities, on the stability of those ratings, and their impact on the capital requirements that emerge from Basel II, in terms of their potential procyclicality. On the other hand, we argue how predictable rating changes are, and the ability of the agencies to look through the cycle when assigning qualifications. Based on that, we conclude about the way that economical fundamentals must be incorporated in rating calculations. We estimate a panel data model with random effects ordered probit, using data for the period 1997-2007.

(*) Any opinion expressed in this paper are those of the authors and do not correspond to the institutional opinion of the Central Bank of Uruguay.

I. Introduction

A sovereign rating is an assessment about a government's ability and willingness to repay its debt both in principal and interests on time.

This paper attempts to identify sovereign rating's fundamentals for the two main agencies: Standard and Poors and Moody's. For that purpose, we have constructed a vast database, which contains the credit ratings for 104 countries, as well as the fundamentals of those ratings for the period 1997-2007.

The document is organized as follows. Section II discusses the through-the-cycle approach used by the agencies to assign sovereign ratings. Specifically, we analyze the methodology's ability to predict default probabilities, the stability of resulting ratings and the potential procyclical effects that capital requirements could have because of it. Moreover, we discuss about how predictable rating changes are, and if agencies help when looking through the cycle. In section III we present the methodology and data used to estimate sovereign ratings. In particular, we use a panel data random effects ordered probit. We consider macroeconomic variables as well as institutional ones, like quality of public institutions. The results are showed in section IV. Finally, conclusions driven from the analysis are presented in section V.

II. Through-the-cycle ratings

II.1 What is a through-the-cycle rating?

Credit ratings are used for different purposes; they are used for debt pricing, to calculate capital requirements, and to calibrate internal ratings used by financial institutions, particularly banks.

When using credit ratings, two conditions should be satisfied. The first one is to have a deep knowledge of the nature of through-the-cycle (TTC) ratings, and what kind of information they attempt to provide. The second is to be aware of how well agencies reflect the information they want to give to the agents.

Among all critics made to rating agencies, the fact that they fail to reveal information properly, because of their slow reaction, is the most frequent. Altman and Kao (1992) as well as Lando and Skodeberg (2002) have pointed that there is a positive autocorrelation between rating changes (a downgrade is followed by successive downgrades and vice versa). One possible explanation is that agencies are dosing bad news, therefore benefiting debt issuers, who are in fact their clients. Another widespread critic is related to their performance during Asian crisis (1997-1999).

Given that beliefs about rating agencies, two questions arise. The first rising question is up to what extent the criticism does not derive form the methodology used to calculate credit ratings. The second question we attempt to answer is if rating agencies can, in fact, look through the cycle. When providing information, their limited ability to provide added valued to information could explain why they "arrive late".

To shed some light on those issues, we based on the articles of Loffler (2004), Altman and Rijken (2005) and Loffler (2005), as well as some concepts published by Standard and Poors (2006).

It is important to begin by presenting a first definition of through-the-cycle (TTC) rating, and its differences with point-in-time (PIT) ones.

A TTC rating attempts to measure the credit quality in a long time horizon, incorporating the cyclical aspects of the economy. Agencies affirm that countries with solid economic fundamentals – with investment grade qualifications – rarely will be affected by cyclical

factors, unless the cycle is substantially different from what one could expect from the history.

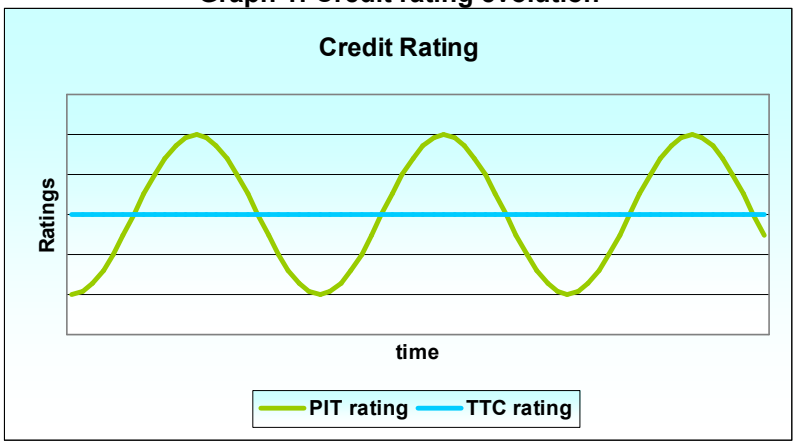
A PIT rating evaluates credit quality in a short time horizon, usually one year. This methodology is used by many banks when applying scoring methods (like discriminant analysis or logit models). They are all based on the arbitrage that should exist between debt markets and equities markets. The KMV model is an example of PIT rating. It is based on the *expected default frequency* (EDF) calculation, with a one-year horizon. The EDF depends on the capital structure of the firm, the assets return volatility and the current value of those assets. The academic precedent of KMV is Merton model of 1974. The Moody's purchase of KMV model is a sign of TTC and PIT methods complementary.

If we calculate ratings with a TTC perspective, a first problem emerge: how to distinguish if an issuer's fundamental change if transitory or permanent. Taking into account that ratings are forward looking, and that economic cycles don't appear exactly in the same way, the work of agencies must deal with an important difficulty. Treat a shock as permanent when it was transitory could lead to wrong decisions when assigning a credit rating.

In the same way, considering a negative shock as transitory when it is in fact permanent will lead to a show reaction of the agency, derived from the use of TTC methodology. That kind of situations results in comments such as "they are always late, far from market fundamentals, and they are also procyclical". In section II.5 we discuss this point.

In line with the previous considerations, how does a credit rating evolve during the cycle?

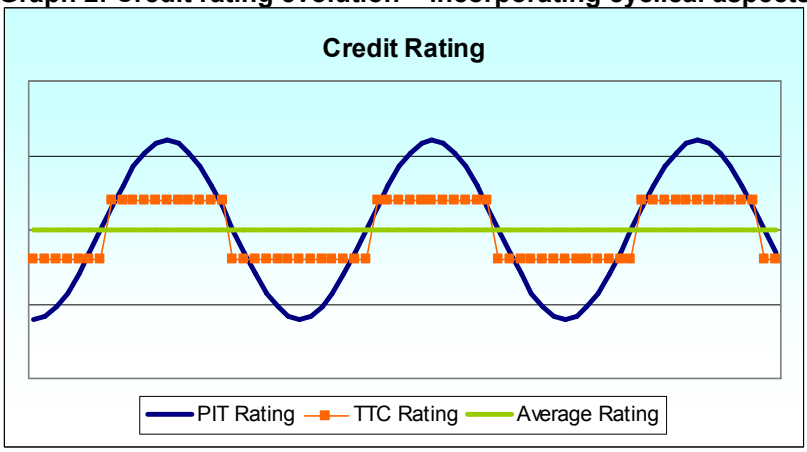
Graph 1: Credit rating evolution



In a context in which the cycle's amplitude was not excessively large, and the investor had an investment grade qualification, the TTC rating will not be affected by the short term conditions. In contrast, a PIT rating will suffer discrete changes.

If the cycle's size is important, and the investors were rated below investment grade, TTC ratings could incorporate, gradually, the cycle phase in which the economy is.

Graph 2: Credit rating evolution – incorporating cyclical aspects



In theory, TTC rating could be established as the average rating, if we were certain about the nature of the cycle, and about the fact that it will repeat the same characteristics in the future, as Graph 2 shows. The problem is the uncertainty about the size of the cycle, particularly in non-investment-grade countries with pronounced cycles. In this case,

agencies opt for a gradual incorporation of the cycle, as they doubt, unlike investment-grade countries, about the ability of the country to pay its obligations on time.

Therefore, an economic policy implication for developing countries is the smoothing of the cycle, through the adoption of anti-cyclical policies. Even there is consensus about this point, it is difficult to implement because of its potential political costs. Besides the benefits associated with these policies, such as reducing output volatility, it has a strong impact on the value of the debt and their rating.

II.2 Default prediction power

Credit ratings are used to infer default probabilities, by observing historical frequencies of defaults for every notch. We can find an application of this in CreditMetrics model, and also in the Basel II accord in which ratings are used as an input to calculate regulatory capital.

It is widely accepted that default probabilities that emerge from TTC methodology could be significantly improved. As mentioned before, Moody's purchase of KMV shows that agencies adhere to that vision. There exists consensus about the advantage that PIT measures have in measuring short term default probabilities. However, that measures present great volatility. In contrast, TTC ratings are more stable, although short term default probabilities are substantially improvable.

There is therefore a trade off for all rating's user. On the one hand, investors want ratings to reflect recent changes in default risk, even if they are likely to be reversed within a year. On the other hand, they want to keep their portfolio rebalancing as low as possible, so they need some stability in ratings. From a regulator point of view, there is a desire that institutions have enough capital to cover inspected losses related to credit risk, but, at the

same time they do not want capital requirements to be procyclical. If that were the case, banks expand credit in good times and contract them in recession, thus amplifying economic cycle. This could lead to a liquidity crisis, like recent sub prime crisis in US mortgage market.

Procyclicality could affect institutions which establish lines limit based on expected losses instead of exposures. They could be highly volatile, given the high volatility that default probabilities present. As a consequence, in bad times, default probabilities are higher and banks must reduce exposures to accomplish their limits. If that were the case for all financial system, we would confront an illiquidity situation, so the cycle has been amplified.

Reaching this point, it must be remembered that both approaches are complementary. One needs short term default probabilities to properly manage risk, but also should evaluate long term credit risk and its volatility along time. Thus, we need short term default probability but also its future pattern.

To mention an example, in a currency swap o interest rate swap, credit risk exposures are low in short term, but time pattern is highly volatile. In interest rate swaps it can be shown, under some assumptions, that the maximum exposure occurs in T/3, where T is maturity of the swap. Then the exposure decreases because of the mean reversion property.

In a currency swap, there's no mean reversion, as notional values that are exchanged at the end of the life of the swap are different, so exchange rate risk prevails. Exposures increases continuously over time, and the peak exposure occurs at the end of the life of the swap.

Previous examples show the importance of having an indicator of long-term default probability, as well as its variability over time.

II.3 Rating changes are predictable

As we have mentioned before, statistical analysis found that there exists positive autocorrelation in rating changes.

Here we present some possible explanations:

- Bad news is announced in a parsimonious way, to benefit debt issuers, who are after all their clients.
- Agency treated a shock as transitory; as there is uncertainty about the permanence of the shock, analysts could suggest reflecting it partially in credit rating. Then, when they are certain about the shock permanence, the downgrade is done completely. The correlation is positive.
- If the company is expanding to risky sectors, she may need to have a higher leverage. Even when the analyst is aware of that higher risk, it won't be totally incorporated in credit rating if the horizon of analysis is shorter than the company's strategy horizon. Therefore, one should expect to see successive downgrades.

To conclude, rating's positive autocorrelation could be seen as a result of the method used to calculate them, or also as an agency problem, which arises from the behavior or agencies which react slowly to adverse information, to benefit clients. There is no definition about which effect prevails.

II.4 Can agencies look through the cycle?

Something widely recognized by agencies is that looking through the cycle is not an easy task. It could be the reason why they don't use that approach to calculate internal ratings. From an academic point of view, it is difficult to distinguish between a cyclical and a

permanent component of a cycle, for example in stock prices, even when considering large high-frequency time series.

Taking into account previous sections analysis, it seems that the added value of rating agencies is to look through the cycle. So a pertinent question is how efficiently they can do that.

This particular issue was studied by Loffler (2005). The author proposes a strategy to analyze agencies ability to look through the cycle, which can be summarized as follows:

- Estimating one-year default probabilities from market data.
- Based on that, estimate long-run trend of those default probabilities, using Hodrick-Prescott filter.
- Then, verify if agency's ratings help to explain the long-run trend estimated before.
- He concludes that ratings do help to identify long-run trend in default probabilities, so agencies can effectively look through the cycle.

The paper verifies that ratings explains a three-year centered moving average computed over months -18 to +18 even after controlling for an uncentered moving average computed over months -18 to 0. Finally, he founds that the low variability in TTC ratings is in line with the low variability in long-term trends.

II.5. Rating agencies: are they always late?

"Rating agencies are always late, procyclical and are not in accordance with market fundamentals"

If we want to analyze that criticism properly, it could be useful to make some considerations:

- The fact that they are not in accordance with market fundamentals is something that is at the core of their methodology. If they look through the cycle, they don't want to measure current default probabilities.
- Their late reaction could be attributed to the problems that this approach has when taking it to practice. As we have mentioned, considering a shock as transitory when it was permanent could be a serious problem. Also agency problems arise because of the nature of the relationship between rating agencies and issuers.
- If they are late, because of considering a shock as transitory when it was permanent, then they will be necessarily procyclical. In that case, they still are less procyclical than PIT measures.

II.6 Impacts of TTC approaches to estimate sovereign ratings

Taking in consideration previous sections, some aspects about sovereign rating estimation can be established:

- Current information is important to explain credit ratings, but is not enough.
- Given that ratings are forward looking and through the cycle, one must analyze how the economy is going to performance in the future, and during economic cycles.
- To deal with previous point, we have only historical information. One must infer from previous cycles how the next ones are going to be.
- Related to the first aspect, to estimate long-term trend of the economy we need its past trend. That's why when estimating sovereign ratings it is usual to take the average of macroeconomic fundamentals, as an indicator of future trend of the economy.
- In view of what we said in section II.1, investment-grade countries should be treated different from non-investment ones. In particular, cyclical effects won't affect the former while they do will have an impact in the last ones.

The next sections will incorporate all this aspects, when estimating sovereign rating models.

III. Determinants of sovereign ratings

III.1. Methodology: random effects ordered probit

As we have mentioned before, sovereign ratios are an assessment about the willingness and the ability of a government to repay his obligations on time, both principal and interests. Ratings are ordinal, and offer a qualitative measure of relative likelihood a country will default on its obligations. Considering that the relationship between rating notches is not linear, using traditional OLS methods could be inappropriate, as they assume that the difference between qualifications AAA y AA+ is the same as the difference between BBB- y BB+. For that reason, we choose an ordered probit context, where the cut-off points that divide each category are estimated by the model. We also use panel data techniques. Its main advantage is that it allows for more sample variability than cross-section or time series analysis, by considering both temporal and spatial dimensions. Thus, by containing information on both intertemporal dynamics and the individuality of entities, it also controls the called unobserved heterogeneity; unobservable factors that affect a country's credit rating will impact in its qualification in every period.

We could start by noticing that each agency makes an evaluation of a country's creditworthiness that depends on a set of variables, stated in the next equation.

$$R_{it}^{*} = \beta X_{it} + \lambda Z_{i} + a_{i} + u_{it}$$

where R_{it}^{*} is the evaluation of the agency about the creditworthiness of a country i in period t, and is an unobserved latent variable. X_{it} contains time varying explanatory

variables that will be described below and Z_i are time invariant regressors, in general dummy variables. The term a_i is the unobserved effect for each country, which could be thought as variables that agencies consider when assigning a rating, but can not be measured directly. As an example, think about country's reputation or structural characteristics that result in higher or lower ratings, independently of macroeconomic fundamentals. Lastly, disturbances u_{it} are assumed to be independent across time and countries.

Agencies define several cut-off points that define the rating category assigned to a country. The final rating will then be given by:

$$R_{i,t} = \begin{cases} AAA \ if \ R^*_{i,t} > \mu_{16} \\ AA+ \ if \ \mu_{15} < R^*_{i,t} \leq \mu_{16} \\ AA \ if \ \mu_{14} < R^*_{i,t} \leq \mu_{15} \\ AA- if \ \mu_{13} < R^*_{i,t} \leq \mu_{14} \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ B- if \ \mu_1 < R^*_{i,t} \leq \mu_2 \\ CCC \ if \ R^*_{i,t} \leq \mu_1 \end{cases}$$

There are two approaches to estimate model's parameters:

1) Fixed effects model, where a_i are treated as parameters to be estimated along with β, without specifying any assumption about the relationship between a_i and X_{it}.
2) Random effects model, where a_i are consider as a random variable, specifying a density function.

In the first case, joint estimation of a_i and β results in the incidental parameters problem; as the number of groups tends to infinity, the number of parameters to be estimated

increases as well, so estimators are not consistent. The second approach assumes that the correlation between the observed explanatory variables and the unobserved effect is zero.

$E(a_i / X_i) = E(a_i) = 0$

The choice depends on whether a_i could be thought as having non correlation with the explanatory variables. Taking into account that fixed effects estimator is not consistent, random effects estimation seems to be more attractive. That estimation implies complex calculations, but econometric software Stata incorporates a command to estimate parameters in a relatively fast and precise way (Fréchette, 2001).

So the random effects model supposes:

[1] $\Pr ob[R_{i,t} = j / a_i] = F[d_{i,t} / a_i] - F[c_{i,t} / a_i]$

[2] R_{it} are independent conditional on X_i, a_i

[3] $a_i / X_i \approx N(0, \sigma_a^2)$

Assumption [3] implies that a_i and x_{it} are independent, and a_i is normally distributed. Under assumptions [1] to [3], β, σ_a^2 and the cut-off points (μ_j) can be estimated by conditional maximum likelihood. As Wooldridge (2002) points out, because the a_i are not observed, they cannot appear in the likelihood function. Instead we find the joint distribution of (R_{i1}, R_{i2},…., R_{iT}) conditional on $\mathbf{x}_i$, a step that requires to integrate out a_i. Since a_i distributes normal $(0, \sigma_a^2)$,

$$f(R_{i1},.....,R_{iT}) / x_i;\theta) = \int_{-\infty}^{\infty} \left[\prod_{t=1}^{T} F[d_{i,t} / a_i] - F[c_{i,t} / a_i] \right] (1/\sigma_a) \phi(a_i / \sigma_a) da_i$$

where $c_{i,t} = \mu_{j-1} - \beta' X_{i,t} - a_i$ y $d_{i,t} = \mu_j - \beta' X_{i,t} - a_i$

The vector of parameters θ includes β, σ_a^2 and the cut-offs, μ_j. The likelihood function can be maximized with respect to β, σ_a^2 and the cut-offs, to obtain $\sqrt{N}$-consistent asymptotically normal estimators. Butler and Moffitt (1982) describe a procedure for approximating the integral before. A more detailed analysis is presented in Appendix I.

If one can not assume that correlation between the unobserved effect and the regressors is zero, the relationship between them could be modeled. Chamberlain (1980) allowed for correlation between a_i and x_{it}, assuming a conditional normal distribution with linear expectation and constant variance,

$$a_i / X_i \approx N(\varphi + \overline{X}\xi, \sigma_b^2)$$

Where $\overline{X}$ is the average of x_{it}, $t=1...T$ and σ_b^2 is the variance of a_i in equation $a_i = \varphi + \overline{X}\xi + b_i$. Afonso, Gomes and Rother (2007) postulate this kind of model when identifying rating determinants. They state that the expected value of the country-specific error is a linear combination of the time averages of the regressors X_i

$$E(a_i / X_{it}, Z_i) = \eta \overline{X}_i$$

Starting from the initial equation,

$$R_{it}^* = \beta X_{it} + \lambda Z_i + a_i + u_{it}$$

where $a_i = \eta \overline{X}_t + \varepsilon_i$, we obtain:

$$R_{it} = \beta X_{it} + \lambda Z_i + \eta \overline{X}_i + \varepsilon_i + u_{it}$$

If we add and subtract $\beta\overline{X}_i$ in the previous equation, we obtain the next expression:

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

We can identify short-run effects, β, which includes the effect of cyclical or temporal deviations respect to historical averages (trend). We also estimate long-term effect, η+β, in which there are structural factors that determine the long-run trend in credit rating. In terms of the discussion stated in section II, this model gathers the through the cycle characteristic of rating estimations, as well as cyclical factors that could affect the rating assignment.

In this paper we estimate a random effects ordered probit model, using the stata command *reoprob* that Fréchette (2001) has developed. In next section we describe the explanatory variables to be included in the model; these variables are selected to reflect the TTC character of credit ratings, and to take into account short-term factors that agencies could look at as well. We also differentiate between developed and advanced economies, given that agencies seem to consider different variables for each one. As an example, reserves and external debt, which are relevant for emerging countries, are not so important when assigning advanced economies rating. Lastly, we estimate a model which allows for correlation between regressors and the unobserved, like proponed by Afonso, Gomes y Rother (2007).

III.2. Data

A set of variables have been selected to measure ability and willingness to pay of a country as well as indirect factors that also affect that concepts. When assigning a credit rating, Standard & Poor's[1] considers the following factors:

[1] Calificaciones Crediticias Soberanas: Un resumen, 2006

- Political institutions and trends, and their impact in effectiveness and transparency of political environment, public security and geopolitical issues.
- Economic structure and growth perspectives.
- Income flexibility and public expenditure pressure, fiscal deficit, general government debt and contingent claims of financial system and public enterprises.
- Monetary flexibility
- External liquidity and non resident liabilities of both public and private sector.

In the same line, Moody's[2] recognizes that quantitative measures are only a part of the input into sovereign rating decisions; they are necessarily backward looking, while sovereign analysis requires forward looking evaluation of default probability over a medium to long-term horizon. In addition, qualitative aspects are unavoidable: as Moody's states "sovereign risk analysis is an interdisciplinary activity in which the quantitative analytical skills of the analysts must be combined with sensitivity to historical, political and cultural factors that do not easily lend themselves to quantification".

As Moody's points out, economic and financial variables can vary according to the level of development of a country. The weight assigned to each variable depends on whether they are looking to an advanced economy, with a story of institutional stability, or at a developing country where is still undergoing structural changes.

Data is divided into four broad categories:

- Economic structure and performance
- Government finance
- External payments and debt
- Monetary, external vulnerability and liquidity indicators

[2] Moody's Statistical Handbook - Country Credit- Nov 2007

Finally, as we are evaluating long-run creditworthiness, when there is more uncertainty, we will take into account specific risk factors associated with the aspects that we measure, which may affect the economy in long term. Basically, we want to include a measure of indicators' volatility, as a forward looking variable which capture the magnitude of cyclical variations of the economy over time.

We have identified the following variables as possible determinants of sovereign ratings:

a. *GDP per capita*: indicator of a country's development, they give an indication of the relative command over resources in international commerce possessed by the average individual. If GDP per capita is low, it is more likely that the country won't pay its debt. We take three-year average of this variable, in US dollars. Source: Moody's (2007).

b. *Real GDP (% change):* a country that cannot grow fast enough to absorb a growing labor force, reduce unemployment, alleviate poverty, and provide its citizens with rising living standards can be subject to deepening social conflict and political instability. Highly indebted countries with large external financing requirements need higher GDP growth to keep pace with their debt service burden. We only find relevant this variable in case we are analyzing developing economies, as the real GDP growth loses relevance to GDP per capita in an advanced country. Three-year average will be taken. Source: Moody's (2007).

c. *Inflation rate*: it can be seen as an indicator of public policies quality, and could indicate difficulties in financing public expenditure. Also it affects debt dynamic as the government faces a higher nominal interest rate. We take three-year average of CPI percentage of change. Source: Moody's (2007).

d. *Government primary balance/GDP*: the ability of government to extract revenues from the population of taxpayers and users of services are key factors to determine

if they will be able to make full and timely payments of interests and principal of outstanding debt. High fiscal deficits indicate difficulties in obtaining resources, and so a higher default probability. A three-year average is taken. Source: Moody's (2007).

e. *Current account balance / GDP:* large and persistent current-account deficits can lead to a buildup of external debt, thus generating more vulnerabilities and a higher default probability. As in previous variables, we consider a three-year average. Source: Moody's (2007).

f. *External debt/ GDP*: the higher this ratio, higher debt burden relative to the ability of generating income. There is a direct relationship between this indicator and default risk. We consider this variable only in case of being a developing country, as it was the case for real GDP change, and we took three-year average. Source: Joint External Debt Hub.

g. *Public debt/ GDP*: we consider total government debt, held by residents and non residents, as total public indebtedness could help explaining why some countries default on their external debts at seemingly low debt thresholds[3]. Three-year average is taken, and only for emerging countries. Source: World Bank.

h. *Official Foreign Exchange Reserves / GDP*: indicates a country's liquidity; the higher the level of reserves, the higher the likelihood of repaying on time. We will take the current value of this ratio, based on the idea that what it matters at the moment of assigning credit rating is actual liquidity level, and like real GDP growth and external debt we consider liquidity only for developing countries. Source: Moody's (2007).

[3] See article by Reinhart y Rogoff (2008).

i. *Dollarization ratio*: is measured as the percentage of total deposits in domestic banks that is denominated in foreign currency. According to Moody's, dollarization reflects public's perception of the credibility of government fiscal and monetary policies and can itself be a source of additional risk. The relationship between this ratio and default probability is therefore direct. We consider this variable to be relevant only in case of emerging economies, and we took three-year average. Source: Moody's (2007).

j. *Credit history*: it will be measured by a dummy variable which will take the value of 1 since the year in which the country defaulted on its debt and 0 if the country have never defaulted on its obligations. Sources: Moody's, S&P

k. *Overall risk score*: is a quantitative assessment of the risk that an economy will face in a two-year horizon. Several risks are considered, each one with an assigned weight: a) political risk (22%), b) economic policy risk (28%), c) economic structure risk (27%) and d) liquidity risk (23%). This index is constructed by the Economist Intelligence Unit[4]. It can be seen that it is a forward looking variable, which is relevant when evaluating future creditworthiness. Given the nature of this indicator, it is reasonable to take its current value in the estimation.

l. *Political stability index*: reflects the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism. This indicator is provided by World Bank[5], and take values between 0 and 100; the higher the value, the better the situation in terms of political stability. Thus we expect a positive influence of this index on credit ratings.

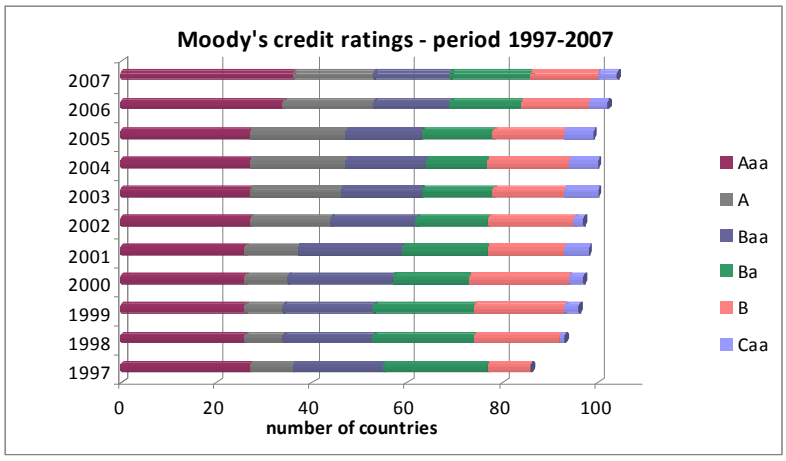
[4] EUI Data services, The Economist
[5] Worldwide Governance Indicators, World Bank, http://www.govindicators.org

m. OECD membership: dummy variable which take value of 1 in case the economy is an OECD member.

n. European Union membership: dummy variable which take value of 1 in case the economy belongs to that zone, and 0 in other case.

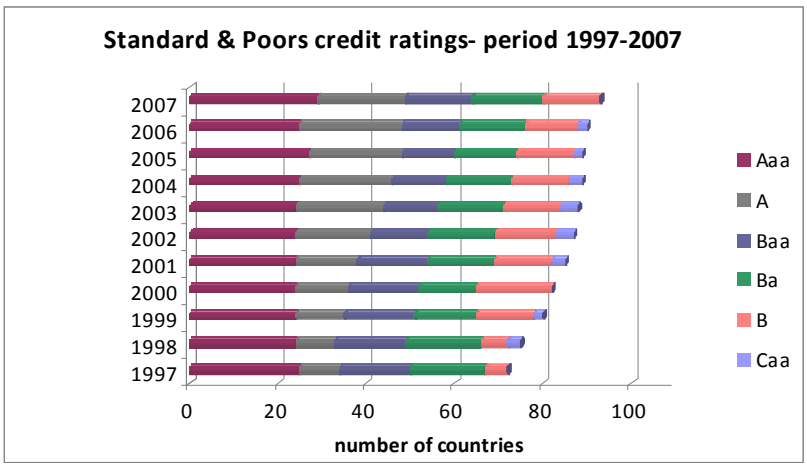
We have an unbalanced panel, which includes observations from 1997 to 2007; the graph below shows the number of countries considered in each year, with their correspondent Moody's credit rating.

Graph 3



As we can see in Graph 3, the number of countries with sovereign rating increases with time. The same happens with Standard and Poor's ratings, as presented in Graph 4.

Graph 4



In general the ratings attributed by the three main agencies are quite similar. Table 1 shows rating differences between Moody's, Standard & Poors and Fitch. As we can see, nearly 90% of ratings differ in only one notch, and almost all observations have a distance of two notches vis-à-vis the other two agencies. It is also interesting to notice that S&P y Fitch have much closer ratings.

Table 1: Rating comparison between the three main agencies

Difference (notches)	S&P-Moodys	S&P-Fitch	Moody's-Fitch
-5	1	0	0
-4	10	0	1
-3	11	0	3
-2	59	26	38
-1	169	130	155
0	479	475	479
1	155	108	169
2	38	12	59
3	3	0	11
4	1	0	10
5	0	0	1
Total	926	751	926
1 notch	86,72%	94,94%	86,72%
2 notches	97,19%	100,00%	97,19%

IV. Results

IV.1. Results for Moody's ratings

IV.1.1. Ordered probit model

In this section we present the results obtained by the estimation of the equation stated in previous section, by fitting a random effects ordered probit model, using stata software. Table 2 shows the estimation output.

The first part of the table reports coefficients associated with each variable, their Standard deviation and their significance level. As Table 2 shows, all coefficients are highly

significant. In the low part of the table cut-off points are presented, which will determine the assigned rating in each case.

It is remarkable how the smoothing character of TTC ratings is confirmed by the estimation: inflation rate, primary balance, GDP per capita, external and public debt, dollarization and real GDP variation resulted significant taken as three-year averages. If during the last three years a country has shown high levels of inflation, the rating will be lower; at the same time, a positive primary balance over the three previous years is associated with a higher rating; GDP per capita also presents a direct relationship with ratings. So we can conclude that agencies smooth cycles when assigning a sovereign rating, as three-year average for variables are more explicative. It should also be mentioned that when incorporating current values of variables, much of them become non significant, and the whole model has a lower prediction power.

Table 2: Estimation for Moody's

Random Effects Oredered Probit

Log likelihood = -978.02334

Number of obs = 784
LR chi2(13) = 774.74
Prob > chi2 = 0,0000

rating	Coef.	Std. Err.	z	P>|z|	95% Conf.	Interval
eq1						
pr_infl	-0.0212584	0.0044123	-4.82	0.000	-0.0299065	-0.0126104
default	-2.045386	0.1605276	-12.74	0.000	-2.360015	-1.730758
pr_bce gob	0.0439442	0.0109456	4.01	0.000	0.0224912	0.0653973
pr_gdppc	0.002116	0.0000105	20.13	0.000	0.000191	0.0002322
overallrisk	0.0384583	0.0054116	7.11	0.000	0.0278517	0.0490649
miembroOECD	1.340319	0.1469886	9.12	0.000	1.052226	1.628411
polstability	0.0262533	0.0027849	9.43	0.000	0.0207951	0.0317115
ue	1.342494	0.1476182	9.09	0.000	1.053167	1.63182
deudaext	-0.0215754	0.0021557	-10.01	0.000	-0.0258005	-0.0173502
deudapca	-2.077392	0.1927691	-10.78	0.000	-2.455213	-1.699572
liquidez	2.677184	0.4412461	6.07	0.000	1.812357	3.54201
pr_dolarizac	-0.0120771	0.0020901	-5.78	0.000	-0.0161736	-0.0079806
crecimientoreal	0.1331479	0.0157207	8.47	0.000	0.1023359	0.1639599
_cut1						
_cons	-2.950313	0.3841195	-7.68	0.000	-3.703173	-2.197453
_cut2						
_cons	-1.702831	0.3590259	-4.74	0.000	-2.406509	-0.9991534
_cut3						
_cons	-0.4847677	0.3427856	-1.41	0.157	-1.156615	0.1870796
_cut4						
_cons	0.909901	0.3443818	2.64	0.008	0.2349251	1.584877
_cut5						
_cons	1.627715	0.3460817	4.70	0.000	0.9494072	2.306023
_cut6						
_cons	2.383957	0.352715	6.76	0.000	1.692648	3.075265
_cut7						
_cons	3.48188	0.3625066	9.61	0.000	2.77138	4.19238
_cut8						
_cons	4.593652	0.3756784	12.23	0.000	3.857336	5.329969
_cut9						
_cons	5.451542	0.3940634	13.83	0.000	4.679192	6.223892
_cut10						
_cons	6.582655	0.4154291	15.85	0.000	5.768429	7.396881
_cut11						
_cons	7.292742	0.42322	17.23	0.000	6.463246	8.122238
_cut12						
_cons	8.630856	0.4464978	19.33	0.000	7.755736	9.505976
_cut13						
_cons	9.663565	0.4673775	20.68	0.000	8.747522	10.57961
_cut14						
_cons	11.01071	0.5082483	21.66	0.000	10.01456	12.00686
_cut15						
_cons	12.40735	0.5450525	22.76	0.000	11.33907	13.47564
_cut16						
_cons	13.21913	0.5632134	23.47	0.000	12.11525	14.323
rho						
_cons	0.845485	0.0110496	76.52	0.000	0.8238283	0.8671418

Another aspect to be remarked is that *deudaext, deudapca, dolarización* and *crecimientoreal* where included only for developing countries; this is based in the discussion presented in section II, where we claimed that agencies look at different variables when analyzing advanced economies, which are more stable. So we included those variables multiplied by a dummy which took value of 1 when the economy is defined as emerging and zero when it was an advanced economy[6]. By this segmentation, the variables we mention before resulted more significant that in the case of being consider for the entire sample. The hypothesis of a different treatment for emerging countries is thus reinforced.

Exceptions to the three-year average variables are liquidity, overall rating score (*overallrisk)* and the political stability index (*polstability)*. In the first case, one can think that liquidity (measured as the level of reserves as a proportion of GDP) matters in current terms, as it reflects directly the ability to pay during the period. The overall rating score (*overallrisk)* is forward looking indicator, so it seems logical to consider it in its current level. Finally, the political stability index reflects actual political risk so it is reasonable to take it in current values and not smoothing it by including minor risks that a country may has suffered in the past.

Lastly, dummy variables of OECD and EU membership where significant and with a positive coefficient, thus indicating that the sole fact of being a member of that groups leads to higher ratings.

Last raw of Table 2 report the value of rho, the correlation coefficient of composite errors (0.85). As we mentioned above, rho indicates that there exists a positive and high correlation in credit ratings, thus reaffirming the TTC methodology used by agencies,

[6] We used de International Monetary Fund classification of emerging countries, stated in the *World Economic Outlook Report, April 2008.*

which generates a slow reaction to shocks, driven by de uncertainty about the permanence of them. The value of rho is also related to higher predictability of ratings; if we observe a downgrade, it is expectable to observe subsequent downgrades.

Moreover, rho can be seen as the relative importance of the unobserved effect[7]. Thus estimation results are indicating that the importance of the unobserved is high. Non-measurable aspects of a country affect strongly its qualification. To mention an example, see the cases of Brazil, Russia, India and China (BRIC) that we present in Table 3. Model predictions are below ratings assigned by Moody's, which could be a signal that unobserved effects are prevailing. The hypothesis[8] for these countries is that they have an important growth potential, and they may become among the four most dominant economies by the year 2050. This could help explaining why Moody's credit rating is above our estimations. Brazil is the only one classified below our estimations, and this could be attributed to the fact that it is a Latin-American country, which counts as a negative factor. Nevertheless, in 2008 Brazil has reached investment grade in S&P rating (Baa3 note in Moody's)

Table 3: BRIC countries

	Brazil		China		India		Russia	
	Moody's	Ord. Prob.	Moody's	Ord. Prob.	Moody's	Ord. Prob.	Moody's	Ord. Prob.
1999	B2	Ba1	A3	Baa3	Ba2	Ba2	Ba3	Caa
2000	B1	Ba1	A3	Baa3	Ba2	Ba3	B3	Caa
2001	B1	Ba1	A3	Baa3	Ba2	Ba2	Ba3	B2
2002	B2	Ba1	A3	Baa3	Ba2	Ba3	Ba2	B1
2003	B2	Ba1	A2	Baa3	Ba1	Ba2	Baa3	B1
2004	B1	Ba1	A2	Baa3	Baa3	Ba2	Baa3	B1
2005	Ba3	Ba1	A2	Baa2	Baa3	Ba1	Baa2	Ba3
2006	Ba2	Baa3	A2	Baa2	Baa2	Ba1	Baa2	Ba2
2007	Ba1	Baa3	A1	Baa2	Baa2	Ba1	Baa2	Ba1

[7] See Appendix I.
[8] Goldman Sachs, 2003

Finally, relative weights of each variable in final qualification are presented in next table. We differentiate between advanced and emerging economies.

Table 4: Relative weights for Moody's ratings

Variable	Developing	Advanced
pr gdp 3	16,3%	0,0%
pr infl 3	-4,2%	-0,4%
DEFAULT	-9,4%	0,0%
pr deuda pca/GDP prom 3	-23,8%	0,0%
pr bce primario gob./GDP 3	1,2%	0,5%
reservas/pib	13,9%	0,0%
pr dolarizacion 3	-8,3%	0,0%
pr GDP per capita 3	24,5%	44,6%
pr extdebt	-28,9%	0,0%
overall score	72,5%	22,1%
miembro OECD	3,8%	8,2%
political stab	36,7%	18,8%
UE?	5,7%	6,1%
Total	100,0%	100,0%

From Table 4 we conclude that few variables are enough to categorize an advanced economy; the most important are GDP per capita, as a direct indicator of the ability to pay. In developing countries, variables related to macroeconomic fundamentals and political stability have a positive influence and higher weights; GDP per capita has a lower weight than it has in advanced economies. The most important negative factors are debt indicators, dollarization ratio, credit history and inflation rate.

The previous analysis has two limitations. The first one is that the relative weight is influenced by the selected sample. If there were too many countries that defaulted on their debts during 1999-2007, the weight assigned to that variable will be higher. Anyway, we have selected a broad sample that is representative enough to consider the weights as valid. A second limitation is that coefficient signs are ambiguous out of the scale extremes. That is, estimated signs are valid if we consider $P(R=1/x)$ or $P(R=17/x)$, but for intermediate results the direction of the effect is not clear.

IV.1.2. Prediction power

The model predicted actual ratings within three notches in 94.3% of all observations. Next matrix shows the differences between predicted and real ratings assigned by Moody's for the entire sample. Appendix II contains a matrix for every year of analysis.

Table 5: Fitted vs. Actual ratings for Moody's – period 1999-2007

rating Moody's	rating estimado - probit ordenado																	
	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	104	27	18	11	0	0	0	0	0	0	0	0	0	0	0	0	0	160
Aa1	17	5	4	3	2	1	0	0	0	0	0	0	0	0	0	0	0	32
Aa2	2	3	9	15	1	0	0	0	0	0	0	0	0	0	0	0	0	30
Aa3	2	2	7	4	3	11	4	1	0	0	0	0	0	0	0	0	0	34
A1	1	0	2	8	6	11	6	1	1	0	0	0	0	0	0	0	0	36
A2	0	0	0	5	8	18	14	7	2	4	0	0	0	0	0	0	0	58
A3	0	0	1	1	11	18	4	5	2	2	2	0	0	0	0	0	0	46
Baa1	0	0	0	0	0	6	9	11	10	13	3	0	0	0	0	0	0	52
Baa2	0	0	0	0	0	3	17	12	2	6	6	4	1	0	0	0	0	51
Baa3	0	0	0	0	0	0	0	5	9	10	20	8	6	2	0	0	0	60
Ba1	0	0	0	0	0	0	1	4	8	7	5	11	7	18	1	0	0	62
Ba2	0	0	0	0	0	0	0	0	5	11	11	5	11	6	0	0	0	49
Ba3	0	0	0	0	0	0	0	0	0	4	5	5	3	10	6	0	1	34
B1	0	0	0	0	0	0	0	0	0	6	15	5	7	20	3	5	0	61
B2	0	0	0	0	0	0	0	0	0	1	9	6	6	17	7	1	4	51
B3	0	0	0	0	0	0	0	0	0	0	2	3	6	10	10	5	1	37
Caa	0	0	0	0	0	0	0	0	0	0	4	3	4	6	11	6	8	42

IV.2. Results for Standard and Poor's ratings

IV.2.1. Ordered probit model

We estimated the same model presented in IV.1, using S&P credit ratings. Results are reported in the following table.

Table 6: Estimation for Standard and Poor's

Random Effects Oredered Probit

Log likelihood = -852.3496

Number of obs = 722
LR chi2(13) = 730.32
Prob > chi2 = 0,0000

rating	Coef.	Std. Err.	z	P>|z|	95% Conf.	Interval
eq1						
pr_infl	-0.0173308	0.0044655	-3.88	0.000	-0.0260831	-0.0085786
default	-0.9884433	0.2047952	-4.83	0.000	-1.389835	-0.5870521
pr_bce gob	0.0509758	0.0117885	4.32	0.000	0.0278707	0.0740808
pr_gdppc	0.001621	0.00000975	16.63	0.000	0.000143	0.0001812
overallrisk	0.0744385	0.0060448	12.31	0.000	0.0625909	0.0862862
miembroOECD	2.068894	0.1646576	12.56	0.000	1.746171	2.391617
polstability	0.0454842	0.0044008	10.34	0.000	0.0368587	0.0541097
ue	1.747541	0.1514906	11.54	0.000	1.450624	2.044457
deudaext	-0.0393246	0.0036703	-10.71	0.000	-0.0465183	-0.0321309
deudapca	-2.739734	0.250942	-10.92	0.000	-3.231572	-2.247897
liquidez	5.520121	0.5388487	10.24	0.000	4.463997	6.576245
pr_dolarizac	-0.0286078	0.0024714	-11.58	0.000	-0.0334517	-0.023764
ecimientoreal	0.1516054	0.0203948	7.43	0.000	0.1116323	0.1915785
_cut1						
_cons	-1.931375	0.4054163	-4.76	0.000	-2.725976	-1.136774
_cut2						
_cons	-0.6557382	0.3764501	-1.74	0.082	-1.393567	0.0820905
_cut3						
_cons	0.5404365	0.3813125	1.42	0.156	-0.2069223	1.287795
_cut4						
_cons	1.580577	0.3962216	3.99	0.000	0.8039966	2.357157
_cut5						
_cons	2.704466	0.4310089	6.27	0.000	1.859704	3.549228
_cut6						
_cons	4.038832	0.4345022	9.3	0.000	3.187224	4.890441
_cut7						
_cons	5.118375	0.4246512	12.05	0.000	4.286074	5.950676
_cut8						
_cons	6.402558	0.4306125	14.87	0.000	5.558573	7.246543
_cut9						
_cons	7.590334	0.4520891	16.79	0.000	6.704256	8.476413
_cut10						
_cons	8.567809	0.477089	17.96	0.000	7.632731	9.502886
_cut11						
_cons	10.12095	0.5104188	19.83	0.000	9.120546	11.12135
_cut12						
_cons	12.42014	0.5898821	21.06	0.000	11.26399	13.57629
_cut13						
_cons	14.14658	0.6520214	21.7	0.000	12.86865	15.42452
_cut14						
_cons	15.0938	0.6588152	22.91	0.000	13.80254	16.38505
_cut15						
_cons	15.83079	0.6755453	23.43	0.000	14.50674	17.15483
_cut16						
_cons	17.69715	0.7295665	24.26	0.000	16.26722	19.12707
rho						
_cons	0.8054669	0.0139438	57.77	0.000	0.7781376	0.8327962

All coefficients are significant, and have the expected signs. It is noticeable that the coefficient associated with liquidity is higher that in Moody's case, and also coefficients of institutional variables. This estimation also reports a high value of rho, so the same comments made for Moody's are valid.

Relative weights are shown in next table, considering the division between emerging and advanced economies.

Table 7: Relative weights for S&P ratings

Variable	Developing	Advanced
pr gdp 3	10,8%	0,0%
pr infl 3	-2,0%	-0,2%
DEFAULT	-2,6%	0,0%
pr deuda pca/GDP prom 3	-18,2%	0,0%
pr bce primario gob./GDP 3	0,8%	0,5%
reservas/pib	16,5%	0,0%
pr dolarizacion 3	-11,4%	0,0%
pr GDP per capita 3	10,9%	26,2%
pr extdebt	-30,5%	0,0%
overall score	81,3%	32,7%
miembro OECD	3,4%	9,7%
political stab	36,8%	25,0%
UE?	4,3%	6,1%
Total	100,0%	100,0%

In general, we obtained similar results that in Moody's estimation.

To asses an advanced country's creditworthiness a few variables are enough. We observe that overall risk score is the most important, followed by GDP per capita and political stability index.

In emerging economies, we found that risk factors associated with macro economical fundamentals (real GDP growth, reserves, GDP per capita) and the quality of political institutions contribute positively to credit rating. Negative factors are indebtedness indicators and dollarization ratio, as in the case of Moody's.

IV.2.2. Prediction power

In this case, the model predicted actual ratings within three notches in 93.4% of all observations, a slightly lower percentage than in Moody's estimations. Next table shows the results for the entire period[9]:

Table 8: Fitted vs. Actual ratings for S&P – period 1999-2007

rating S&P \ rating estimado - probit ordenado	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	68	43	11	7	2	0	0	0	0	0	0	0	0	0	0	0	0	131
Aa1	12	13	6	10	1	2	0	0	0	0	0	0	0	0	0	0	0	44
Aa2	0	3	7	9	4	4	0	0	0	0	0	0	0	0	0	0	0	27
Aa3	2	6	2	4	0	8	1	0	0	0	0	0	0	0	0	0	0	23
A1	3	8	0	2	7	5	0	1	0	0	0	0	0	0	0	0	0	26
A2	0	0	0	4	25	27	5	3	1	2	0	0	0	0	0	0	0	67
A3	0	0	0	0	11	24	22	8	1	0	0	0	0	0	0	0	0	66
Baa1	0	0	0	0	0	15	8	4	6	5	1	0	0	0	0	0	0	39
Baa2	0	0	0	0	2	5	7	5	12	5	3	4	0	0	0	0	0	43
Baa3	0	0	0	0	0	1	4	6	11	5	10	3	3	0	0	0	0	43
Ba1	0	0	0	0	0	1	1	2	4	3	5	4	13	4	1	0	0	38
Ba2	0	0	0	0	0	0	0	1	1	9	5	13	13	11	0	0	0	53
Ba3	0	0	0	0	0	0	0	1	2	4	12	9	3	9	2	0	0	42
B1	0	0	0	0	0	0	0	1	3	5	5	6	8	5	5	1	0	39
B2	0	0	0	0	0	0	0	0	1	2	7	7	7	11	4	3	3	45
B3	0	0	0	0	0	0	0	0	0	2	3	3	7	4	8	4	7	38
Caa	0	0	0	0	0	0	0	0	0	1	1	2	2	2	3	3	6	20

IV.3. Asymmetrical treatment of cycles: the region

In this section we make a brief comparison of predicted ratings obtained in the ordered probit regression with Moody's actual ratings for Uruguay, Argentina and Brazil. Next table presents the results.

[9] See Appendix II which contains per-year results.

Table 9: Rating comparison within the region

	Argentina		Brazil		Uruguay	
	Moody's	Ordered Probit	Moody's	Ordered Probit	Moody's	Ordered Probit
1999	B1	Baa3	B2	Ba1	Baa3	Ba1
2000	B1	Ba1	B1	Ba1	Baa3	Ba1
2001	Caa	B1	B1	Ba1	Baa3	Ba1
2002	Caa	B3	B2	Ba1	B3	B1
2003	Caa	Caa	B2	Ba1	B3	B1
2004	Caa	Caa	B1	Ba1	B3	B1
2005	B3	B2	Ba3	Ba1	B3	Ba3
2006	B3	B1	Ba2	Baa3	B1	Ba1
2007	B3	Ba3	Ba1	Baa3	B1	Ba1

As we can see from Table 9, credit rating for Argentina did not change during the next three years after 2001's crisis. Estimations are in line with this pattern, although it presents a lag in the initial downgrade prediction. This could be attributed to the three-year average of variables we took in our model, thus having the crisis stronger impact some years later. In that sense, we confirm the TTC hypothesis, and also we notice how agencies react immediately when something as strong as Argentinean crisis emerge. Moreover, as agencies do not know the deepness of the cycle they maintained Argentina's credit rating although the economy was performing well, thus generating differences with estimated ratings. Therefore, unobserved effects may explain the bias towards lower ratings: Argentina's reputation as a debtor is playing a major role when assessing its creditworthiness.

According to the model, Brazil could have obtained investment grade in 2006. Again, uncertainty about the character of shocks (in terms of their permanence) made that Brazil's investment grade come in 2008, when S&P assigned a BBB- to that country. They have probably considered that stability and growth are consolidated for this economy, and also Brazil's reputation as a debtor, which is far better than Argentinean one.

Lastly, the model predicted Uruguayan's loss of investment grade before Moody's downgrade. The reputation effect can help explaining why that agency downgraded Argentina while maintaining Uruguayan credit rating at investment grade levels. It appears

again the relevance of emerging countries cycles, given that Uruguay has shown a sustained growth during last years and Moody's continues assigning a B1 category, which could be higher according to economic fundamentals. Doubts may come from the fact that Uruguay's GDP growth is above its long-term trend during last five years, so can we think about a permanent change in cycle's pattern or it is only temporal? The answer to this question is implicit in TTC methodology.

Giving previous results, one can establish the hypothesis that there exists an asymmetrical behavior of agencies when looking at emerging economies cycles. In the low phase of the cycle, given that they have been historically deep, agencies do not hesitate to downgrade countries and do not wait until being sure about the permanence of the shock; in the case of Uruguay during1999-2001 the rating was not downgraded because the starting point was investment grade and having that category implies that the country can successfully face adverse shocks. In contrast, when being in a high phase of the cycle agencies do not reflect that immediately in credit rating, until they are certain about the change in long-run default probabilities.

IV.4. Modeling unobserved effects

We have constructed a database with the same variables presented in section III.2, in the same way they are presented in the article of Afonso, Gomes and Rother (2007). We took averages for all the period, as well as current deviations from that historical trend. We also maintained our differentiation between advanced and developing countries.

Results are presented in Table 10, and they are in line with previous estimations. Primary balance was not significant, neither in its historical average nor its deviation from that.

External debt only was significant in historical terms (average). Lastly, we included real GDP growth for all the observations.[10] Signs are the expected ones.

This model also reflects the TTC character of ratings, incorporating PIT elements as well (given by deviations from historical averages). Predicted ratings lie within three notches in 95% of the observations. Table 11 presents the comparison for the entire period.

Finally, we also observed a high value of rho, so the same comments we did before about it are pertinent.

[10] When we included GDP growth only for emerging countries, the model showed a lower prediction power.

Table 10: Modeling short-term and long-term effects – Moody's

Random Effects Oredered Probit

Log likelihood = -1185.7683

Number of obs = 939
LR chi2(13) = 955.64
Prob > chi2 = 0,0000

rating	Coef.	Std. Err.	z	P>|z|	95% Conf. Interval	
eq1						
pr_infl	-0.0776872	0.0058741	-13.23	0.000	-.0892002	-0.0661741
default	-2.059023	0.1530492	-13.45	0.000	-2.358994	-1.759052
pr_gdppc	0.0001929	0.00001	19.26	0.000	0.0001733	0.0002126
gdppc	0.0001837	0.0000132	13.97	0.000	0.0001579	0.0002095
pr_overallrisk	0.0446077	0.0075619	5.90	0.000	0.0297867	0.0594288
overallrisk	0.0886686	0.0138571	6.40	0.000	0.0615091	0.1158281
miembroOECD	2.453632	0.1710623	14.34	0.000	2.118356	2.788908
pr_polstability	0.0328529	0.0030041	10.94	0.000	0.026965	0.0387408
polstability	0.024366	0.0057997	4.20	0.000	0.0129989	0.0357332
ue	1.981594	0.1499131	13.22	0.000	1.68777	2.275419
liquidez	4.472347	0.8418351	5.31	0.000	2.822381	6.122314
pr_liquidez	4.975547	0.4960219	10.03	0.000	4.003362	5.947732
pr_deudaext	-0.0369748	0.0024973	-14.81	0.000	-0.0418694	-0.0320801
deudapca	-2.242422	0.333687	-6.72	0.000	-2.896437	-1.588407
pr_deudapca	-0.4924737	0.2284561	-2.16	0.031	-0.9402394	-0.044708
dolarizacion	-0.0081952	0.0042203	-1.94	0.052	-0.0164668	0.0000763
pr_dolarizacion	-0.0090983	0.0021839	-4.17	0.000	-0.0133786	-0.004818
var gdp	0.0458673	0.0122825	3.73	0.000	0.021794	0.0699406
pr_var gdp	0.0686704	0.0245879	2.79	0.005	0.020479	0.1168618
_cut1						
_cons	-2.299454	0.5102547	-4.51	0.000	-3.299534	-1.299373
_cut2						
_cons	-1.36915	0.4998201	-2.74	0.006	-2.34878	-0.3895211
_cut3						
_cons	-0.3180306	0.4980558	-0.64	0.523	-1.294202	0.6581409
_cut4						
_cons	0.945916	0.4998809	1.89	0.058	-0.0338326	1.925664
_cut5						
_cons	1.784683	0.5038805	3.54	0.000	0.7970959	2.772271
_cut6						
_cons	2.607389	0.510089	5.11	0.000	1.607633	3.607145
_cut7						
_cons	3.801927	0.5144784	7.39	0.000	2.793568	4.810286
_cut8						
_cons	5.105915	0.520107	9.82	0.000	4.086524	6.125306
_cut9						
_cons	5.894664	0.5314844	11.09	0.000	4.852974	6.936354
_cut10						
_cons	6.847084	0.5419829	12.63	0.000	5.784817	7.909351
_cut11						
_cons	7.497589	0.5453972	13.75	0.000	6.42863	8.566547
_cut12						
_cons	8.738879	0.5648395	15.47	0.000	7.631813	9.845944
_cut13						
_cons	9.820345	0.5794421	16.95	0.000	8.684659	10.95603
_cut14						
_cons	11.51524	0.6049493	19.04	0.000	10.32956	12.70092
_cut15						
_cons	13.0703	0.6308774	20.72	0.000	11.8338	14.30679
_cut16						
_cons	14.10008	0.6477357	21.77	0.000	12.83054	15.36962
rho						
_cons	0.7478912	0.0156212	47.88	0.000	0.7172743	0.7785081

Table 11: Predicted vs. Actual ratings– long-term and short term distinction. (Moody's, 1999-2007)

rating Moody's	rating estimado - probit ordenado																
	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	103	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114
Aa1	17	3	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	26
Aa2	5	1	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	16
Aa3	3	3	2	8	0	1	1	0	0	0	0	0	0	0	0	0	0	18
A1	1	2	7	7	5	8	2	0	1	0	0	0	0	0	0	0	0	33
A2	0	0	6	8	10	6	6	7	2	2	2	0	0	0	0	0	0	49
A3	0	0	0	8	15	3	3	3	0	4	0	0	0	0	0	0	0	36
Baa1	0	0	0	3	0	5	4	16	9	2	0	0	0	0	0	0	0	39
Baa2	0	0	0	0	3	3	13	7	3	3	3	0	0	0	0	0	0	35
Baa3	0	0	0	0	0	0	0	7	3	3	6	10	5	0	0	0	0	34
Ba1	0	0	0	0	0	0	0	6	4	6	12	10	5	9	0	0	0	52
Ba2	0	0	0	0	0	0	0	0	3	5	15	7	11	1	0	0	0	42
Ba3	0	0	0	0	0	0	0	0	0	1	1	3	6	5	0	0	0	16
B1	0	0	0	0	0	0	0	0	0	0	9	3	5	10	3	4	0	34
B2	0	0	0	0	0	0	0	0	0	0	6	2	12	5	8	1	4	38
B3	0	0	0	0	0	0	0	0	0	0	0	0	2	9	5	3	3	22
Caa	0	0	0	0	0	0	0	0	0	0	4	3	3	1	2	9	13	35

V. Conclusions

In this paper we have analyzed the determinants of sovereign ratings, using data from the two main agencies for the period 1997-2007. We have found three main indicators of TTC characteristic. First, variables were significant taken as three-year averages. Althoug some exceptions appeared, they were specifically for emerging countries where cycle's deepness affect short-term ability to pay. Secondly, the variable overall risk was highly significant, measuring potential risk in a two-year horizon. This is a forward looking variable, which can be seen as a proxy of the economy's volatility. Notice the resemblance between this risk store and the volatility presented in Merton's model (1974) to measure default probability. Finally, parameter ρ took values between 0.75 y 0.85 in estimations; this could be interpreted as the relative importance of the unobserved effect, associated with individual aspects which affect qualifications, thus reflecting the subjective aspect of rating assessment. Another interpretation of ρ is correlation between error terms; a high value of this parameter is consistent with the TTC methodology, as it is not an easy task to identify the permanence of the shock. In general, with negative shocks and emerging economies, agencies react faster than in case of positive ones; the treatment is thus asymmetrical. This may explain why we said that rating changes are predictable; it is enough to observe previous movements.

The existence of a TTC methodology also impacts from a regulatory point of view. Capital requirements used in standardized approach of Basel regulation are based in external ratings calculated by these agencies; in this sense, capital requirements will be TTC as well. The transition to internal models like proponed in Basel II Accord (Internal Rating Based Approach - IRB) could lead to more volatile requirements, given that the principal input for the IRB model, that is default probability, is usually estimated by institutions using PIT models. Moreover, capital requirements would become procyclical, increasing in recessions and thus deepening credit crunch. There is a trade-off between rating stability

and proper reflect of current risk. Considering that TTC and PIT approaches are complementary, one possible solution will be using PIT default probabilities when managing credit risk, while using a TTC one in case of calculating capital requirements, avoiding amplifying cyclical effects. As we can see, when analyzing transition to Basel II application it becomes really useful to have a deep knowledge of each approach.

In relationship with rating determinants, there are three aspects to be remarked. Firstly, we have found traditional macro economic fundamentals as determinants of sovereign ratings. On the one hand, GDP per capita, primary balance, liquidity and real GDP growth with a positive influence and on the other hand inflation, indebtedness and dollarization having a negative impact. As we mentioned before, these variables were taken as three-year averages, thus reaffirming TTC hypothesis[11]. Besides those variables, we have identified a strong impact of institutional factors, measured in the political stability index. The relative weight assigned to that variable was of 36.7% in case of emerging economies, and 18.8% for advanced ones. Additionally, we found the overall risk score, a forward looking variable which reflect general risk of a country, having a high weight in developing (72.5%) as well as advanced economies (22.1%). Credit history captured in *default* variable negatively affects ratings; previous defaults increase default probability in future. Lastly, estimation indicates that being a member of EU and OECD gives a higher credit rating.

An important contribution of this paper is to have estimated a model in which we can differentiate variables according to the kind of country we are analyzing (in terms of its development). In contrast to other papers where separated models are estimated, the inclusion of a dummy variable to distinguish developing economies allows for incorporating the entire simple in a single model, thus increasing model's precision and providing a better understanding of which variable impacts which kind of countries, or which one affects all of them.

For emerging economies, two remarkable economic policy implications arise. On the one hand, dollarization's negative impact suggests that agencies perceive bimonetary countries as particularly vulnerable to exchange rate movements. Moody's claims that this risk is evaluated when analyzing Baa1 or less categorized countries, as it increases credit and liquidity risk from a banking system perspective. As a mitigating factor, we can mention the level of reserves, which becomes a crucial variable for emerging countries[12]. Second implication relates to the cyclical component of GDP variations, and its relevance when assigning credit ratings. The need for anti cyclical policies has been reinforced by the analysis.

Predicted ratings for Uruguay are near investment grade. Moody's assign a B1 qualification (three notches below our predictions) while S&P gives Uruguay a slightly higher note, BB- (two notches below). As we have pointed out, uncertainty about the size of the cycles makes that despite the excellent evolution of Uruguayan economy during last years, its sovereign rating remains in relative low levels. Based on IMF projections for Uruguay[13], we obtained a prediction for the credit rating in next years. Basically, with real GDP growth of 3.8% and 3.2% for years 2008 and 2009 respectively, an inflation ratio of 6.2% and 5.5%, a decrease in external debt ratio to 45.1% and 41.7%, and a primary balance of 4%, the model predicts the achievement of investment grade for years 2008 and 2009. The maintenance of the good evolution of macro economical indicators and the consolidation of economic growth are thus crucial, as they will reduce agencies uncertainty about the cycle. Given that Moody's rating is far below investment grade, we can not affirm that Uruguay will obtain it in next years. The same exercise has been done for S&P ratings, obtaining similar results: prediction indicates that investment grade would be achieved in 2009.

[11] Liquidity is the exception as we are interested in current ability to pay.
[12] A more detailed analysis can be found in Moody's (2003) document.
[13] Fondo Monetario Internacional - Febrero 2008 – IMF Country Report Nro 08/45

Finally, given the high costs associated with rating assignment and its in situ revision, agencies use similar models to the one we presented in this paper to monitor credit risk. They have even published some of them – Moody's (2004). In that sense, all the research done in this area can help in knowing how agencies form their opinion, and may give a useful tool in case of arguing with them about an assigned rating.

Appendix I: Some issues related to the estimation approach

I.1 The likelihood function

The model we want to estimate can be written as follows:

$$R_{i,t}^{*} = \beta' X_{it} + \varepsilon_{it} \quad i = 1,2,.....N \quad ;t = 1,2,.....T$$

$$\varepsilon_{i,t} = u_{i,t} + a_i$$

$$a_i \approx N[0;\sigma_a^2]$$

$$u_{i,t} \approx N[0;1]$$

It is assumed that $a_i \; and \; u_{i,t}$ are independent and identically distributed, and both are uncorrelated with regressors X_{it}.

Under those assumptions:

$$Var[\varepsilon_{i,t}] = 1 + \sigma_a^2$$

We named the correlation between individual's errors as ρ. In this case, we can define ρ as follows:

$$Corr[\varepsilon_{i,t}\, \varepsilon_{i,s}] = \rho = \frac{\text{cov}[u_{i,t} + a_i; u_{i,s} + a_i]}{\sqrt{1+\sigma_a^2}\sqrt{1+\sigma_a^2}} = \frac{\sigma_a^2}{1+\sigma_a^2}$$

In that way, ρ measures the relative importance of the variance of the unobserved effect with respect to total variance, that is, $1+\sigma_a^2$.

Variable $R_{i,t}$ can take values from 0 to J – in present model, we have J=17.

$$R_{i,t}=\begin{cases}0\ si\ R_{i,t}^{*}\le\mu_0\\ 1\ si\ \mu_0<R_{i,t}^{*}\le\mu_1\\ 2\ si\ \mu_1<R_{i,t}^{*}\le\mu_2\\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\\ J-1\ si\ \mu_{J-2}<R_{i,t}^{*}\le\mu_{J-1}\\ J\ si\ \mu_J<R_{i,t}^{*}\end{cases}$$

Thus we can state that:

$$\Pr ob\left[R_{i,t}=j\right]=\Pr ob\left[\mu_{j-1}<R_{i,t}^{*}\le\mu_j\right]=\Pr ob\left[\mu_{j-1}<\beta' X_{i,t}+\varepsilon_{i,t}\le\mu_j\right]=$$
$$\Pr ob\left[\mu_{j-1}-\beta' X_{i,t}<\varepsilon_{i,t}\le\mu_j-\beta' X_{i,t}\right]$$

Defining $c_{i,t}=\mu_{j-1}-\beta' X_{i,t}-a_i$ y $d_{i,t}=\mu_j-\beta' X_{i,t}-a_i$ in case $R_{i,t}=j$, and taking $\mu_{-1}=-\infty\ and\ \mu_J=+\infty$, we can write previous probability as:

$$\Pr ob\left[R_{i,t}=j/a_i\right]=\Pr ob\left[\mu_{j-1}<R_{i,t}^{*}\le\mu_j\right]=\Pr ob\left[\mu_{i-1}<\beta' X_{i,t}+\varepsilon_{i,t}\le\mu_j\right]=$$
$$\Pr ob\left[\mu_{j-1}-\beta' X_{i,t}-a_i<u_{i,t}\le\mu_j-\beta' X_{i,t}-a_i\right]=\int_{c_{i,t}}^{d_{i,t}} f\left[u_{i,t}\right]du_{i,t}=F\left[\mu_j-\beta' X_{i,t}-a\right]-F\left[\mu_{j-1}-\beta' X_{i,t}-a_i\right]=$$
$$F\left[d_{i,t}/a_i\right]-F\left[c_{i,t}/a_i\right]$$

Likelihood function can be expressed as:

$$L=\sum_{i=1}^{n} Ln\left[P\left[R_i\right]\right]\ en\ \ donde\ \ \ P\left[R_i\right]=P\left(R_{i,1},R_{i,2}.....R_{i,T}\right)$$

Then: $P(R_i/a_i)=\int_{c_{i,1}}^{d_{i1}}\int_{c_{i,2}}^{d_{i,2}}.....\int_{c_{i,T}}^{d_{i,T}} f\left[u_{i,1}u_{i,2}....u_{i,T}\right]du_{i,1}du_{i,2}....du_{iT}$

The difficulty in this problem is the evaluation of the T-fold integrals. Moreover, previous probability is conditional on the value of the unobserved $a_{i,}$. Thus we integrate out $a_{i,}$, taking into account that $a_i \approx N[0;\sigma_a^2]$.

Considering that $u_{i,t}$ is identically distributed across time, we have:

$$P(R_i) = \int_{-\infty}^{+\infty} \int_{c_{i,1,}}^{d_{i,1}} \int_{c_{i,2}}^{d_{i,2}} ..... \int_{c_{i,T}}^{d_{i,T}} f[u_{i,1}\, u_{i,2} .....u_{i,T} / a_i] f[a_i] da_i du_{i,1} du_{i,2} .....du_{i,T} =$$

$$\int_{-\infty}^{+\infty} \int_{c_{i,1,}}^{d_{i,1}} \int_{c_{i,2}}^{d_{i,2}} ..... \int_{c_{i,T}}^{d_{i,T}} \int_{-\infty}^{+\infty} f[u_{i,1} / a_i] f[u_{i,2} / a_i] ....f[u_{i,T} / a_i] f[a_i] da_i\, u_{i,1} du_{i,2} .....du_{i,T} =$$

$$\int_{-\infty}^{+\infty} f[a_i] \amalg_{t=1}^{T} [F[d_{i,t} / a_i] - F[c_{i,t} / a_i]] da_i$$

We know that $a_i \approx N[0;\sigma_a^2]$, so we can standardize $f[a_i]$ in previous equation. Taking $z_i = \frac{a_i}{\sigma_a}$ we can write:

$$P(R_i) = \int_{-\infty}^{+\infty} \frac{1}{\sigma_a} f\left[\frac{a_i}{\sigma_a}\right] \amalg_{t=1}^{T} [F[d_{i,t} / a_i] - F[c_{i,t} / a_i]] da_i$$

Where f (.) and F (.) represent normal density function and normal cumulative distribution function respectively.

Using results from Butler and Moffitt (1982), Frechette (2001b) shows that one can compute first derivatives of likelihood function with respect to the model's parameters $\beta, \mu_{j,} \rho$.

This can be improved upon since the first derivatives can also be approximated by Gauss-Hermite quadrature.

Moreover, likelihood function which took the form:

$$L = \sum_{i=1}^{n} Ln[P[R_i]]$$

With:

$$P(R_i)=\int_{-\infty}^{+\infty}\frac{1}{\sigma_a}f\left[\frac{a_i}{\sigma_a}\right]\Pi_{t=1}^{T}\left[F\left[d_{i,t}/a_i\right]-F\left[c_{i,t}/a_i\right]\right]da_i$$

The likelihood function can also be approximated by the Gauss Hermite quadrature.

I.2 Parcial derivatives

In general, derivative with respect to the estimating parameters θ can be expressed as in the following way:

$$\frac{\delta L}{\delta\theta}=\frac{\delta\sum_{i=1}^{N}\ln\left[P\left[R_i\right]\right]}{\delta\theta}=\sum_{i=1}^{N}\frac{1}{P\left[R_i\right]}\frac{\delta P\left[R_i\right]}{\delta\theta}$$

Using Leibnitz integral rule:

$$\frac{\delta P(R_i)}{\delta\beta}=\int_{-\infty}^{+\infty}\frac{1}{\sigma_a}f\left[\frac{a_i}{\sigma_a}\right]\sum_{i=1}^{T}\frac{f_{i,t}^{j-1}-f_{i,t}^{j}}{F_{i,t}^{j}-F_{i,t}^{j-1}}x_{i,t}\,\Pi_{t=1}^{T}\left[F\left[d_{i,t}/a_i\right]-F\left[c_{i,t}/a_i\right]\right]da_i$$

$$\frac{\delta P(R_i)}{\delta\mu_j}=\int_{-\infty}^{+\infty}\frac{1}{\sigma_a}f\left[\frac{a_i}{\sigma_a}\right]\sum_{i=1}^{T}\frac{f_{i,t}^{j}1\{y_{i,t}=j\}-f_{i,t}^{j-1}1\{y_{i,t}=j-1\}}{F_{i,t}^{j}-F_{i,t}^{j-1}}x_{i,t}\,\Pi_{t=1}^{T}\left[F\left[d_{i,t}/a_i\right]-F\left[c_{i,t}/a_i\right]\right]da_i$$

$$\frac{\delta P(R_i)}{\delta\rho}=\int_{-\infty}^{+\infty}\frac{1}{\sigma_a}f\left[\frac{a_i}{\sigma_a}\right]\sum_{i=1}^{T}\frac{f_{i,t}^{j-1}-f_{i,t}^{j}}{F_{i,t}^{j}-F_{i,t}^{j-1}}\frac{\sqrt{1-\rho}}{\sqrt{2\rho}[1-\rho]}\Pi_{t=1}^{T}\left[F\left[d_{i,t}/a_i\right]-F\left[c_{i,t}/a_i\right]\right]da_i$$

Notice that $f_{i,t}^{j}=f\left[\mu_j-\beta' x_{i,t}\right];F_{i,t}^{j}=F\left[\mu_j-\beta' x_{i,t}\right]$ and that function $1\{y_{i,t}\}$ takes value of 1 if the expression in parenthesis is true and 0 if it is false.

When deriving with respect to rho, one must take into account that:

$$\rho = \frac{\sigma_a^2}{1+\sigma_a^2} \Rightarrow \sigma_a^2 = \frac{\rho}{1-\rho}$$

I.3 Optimization routine

Gauss-Hermite quadrature is used to calculate integrals of the form:

$$\int_{-\infty}^{+\infty} \exp\left[-x^2\right] f\left[x\right] dx$$

The next approximation formula is used:

$$\int_{-\infty}^{+\infty} \exp\left[-x^2\right] f\left[x\right] dx = \sum_{i=1}^{n-1} w_i f\left[x_i\right] + E_n$$

E_n is an error term.

As we can observe, likelihood function obtained before has this form, and also its derivatives with respect to interest parameters.

The evaluation points of f(x) are the roots of the Hermite polynomial. After calculating those roots (x_i), weights w_i are obtained by solving a linear equation system (such as Vandermonde's).

Appendix II – Predicted vs. Actual ratings

Moody's – 1999

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	7	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Aa1	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Aa2	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Aa3	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	4
A1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A2	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
A3	0	0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	5
Baa1	0	0	0	0	0	1	3	2	1	1	0	0	0	0	0	0	0	8
Baa2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	4
Baa3	0	0	0	0	0	0	0	0	0	2	3	1	1	0	0	0	0	7
Ba1	0	0	0	0	0	0	1	1	3	3	0	2	2	1	0	0	0	13
Ba2	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	4
Ba3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	4
B1	0	0	0	0	0	0	0	0	0	1	2	0	2	2	1	0	0	8
B2	0	0	0	0	0	0	0	0	0	0	1	0	2	3	0	1	1	8
B3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	3
Caa	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	3

Moody's – 2000

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	8	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Aa1	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Aa2	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Aa3	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	4
A1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A2	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	5
A3	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	4
Baa1	0	0	0	0	0	2	1	1	1	2	0	0	0	0	0	0	0	7
Baa2	0	0	0	0	0	0	3	2	0	1	0	0	0	0	0	0	0	6
Baa3	0	0	0	0	0	0	0	0	1	2	4	1	1	0	0	0	0	9
Ba1	0	0	0	0	0	0	0	2	1	1	0	1	1	2	0	0	0	8
Ba2	0	0	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	5
Ba3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3
B1	0	0	0	0	0	0	0	0	0	1	3	2	1	2	0	1	0	10
B2	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	1	6
B3	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	5
Caa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3

Moody's – 2001

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	8	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	13
Aa1	3	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Aa2	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Aa3	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	4
A1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
A2	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0	0	5
A3	0	0	0	0	1	1	2	0	0	1	0	0	0	0	0	0	0	5
Baa1	0	0	0	0	0	2	1	0	1	2	0	0	0	0	0	0	0	6
Baa2	0	0	0	0	0	2	1	2	0	1	1	0	0	0	0	0	0	7
Baa3	0	0	0	0	0	0	0	1	1	2	4	0	1	0	0	0	0	9
Ba1	0	0	0	0	0	0	0	1	1	0	1	1	1	2	0	0	0	7
Ba2	0	0	0	0	0	0	0	0	0	2	1	2	1	0	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	5
B1	0	0	0	0	0	0	0	0	0	1	2	1	0	2	0	1	0	7
B2	0	0	0	0	0	0	0	0	0	0	1	0	1	3	1	0	1	7
B3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Caa	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	2	6

Moody's – 2002

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	9	5	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Aa1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa3	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3
A1	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	5
A2	0	0	0	0	0	3	2	1	0	0	0	0	0	0	0	0	0	6
A3	0	0	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	6
Baa1	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	5
Baa2	0	0	0	0	0	0	2	2	0	0	1	0	0	0	0	0	0	5
Baa3	0	0	0	0	0	0	0	1	0	2	4	1	0	0	0	0	0	8
Ba1	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	0	0	5
Ba2	0	0	0	0	0	0	0	0	0	2	1	0	2	1	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	0	4
B1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	2	0	6
B2	0	0	0	0	0	0	0	0	0	0	2	0	1	2	1	0	1	7
B3	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1	0	0	5
Caa	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	3

Moody's – 2003

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	10	4	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Aa1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa3	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3
A1	0	0	0	1	1	2	1	1	0	0	0	0	0	0	0	0	0	6
A2	0	0	0	0	1	2	1	2	0	1	0	0	0	0	0	0	0	7
A3	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	6
Baa1	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	0	0	5
Baa2	0	0	0	0	0	0	2	2	0	1	1	1	0	0	0	0	0	7
Baa3	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	5
Ba1	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	0	0	6
Ba2	0	0	0	0	0	0	0	0	0	2	1	0	1	1	0	0	0	5
Ba3	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	4
B1	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	1	0	5
B2	0	0	0	0	0	0	0	0	0	0	2	1	0	3	1	0	0	7
B3	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	3
Caa	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	1	2	7

Moody's – 2004

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	13	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Aa1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa3	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3
A1	0	0	0	2	0	2	2	0	0	0	0	0	0	0	0	0	0	6
A2	0	0	0	0	2	1	0	3	0	1	0	0	0	0	0	0	0	7
A3	0	0	1	0	2	3	0	0	1	0	0	0	0	0	0	0	0	7
Baa1	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	4
Baa2	0	0	0	0	0	0	2	2	0	2	0	1	0	0	0	0	0	7
Baa3	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0	6
Ba1	0	0	0	0	0	0	0	0	0	1	0	1	1	2	0	0	0	5
Ba2	0	0	0	0	0	0	0	0	1	0	1	1	1	2	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2
B1	0	0	0	0	0	0	0	0	0	0	4	0	0	2	1	0	0	7
B2	0	0	0	0	0	0	0	0	0	1	1	0	0	2	3	0	0	7
B3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	3
Caa	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0	2	6

Moody's – 2005

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	15	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Aa1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa3	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	3
A1	1	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	6
A2	0	0	0	2	1	1	2	1	1	0	0	0	0	0	0	0	0	8
A3	0	0	0	0	3	1	0	1	1	0	0	0	0	0	0	0	0	6
Baa1	0	0	0	0	0	0	2	2	1	2	0	0	0	0	0	0	0	7
Baa2	0	0	0	0	0	0	2	1	0	0	0	1	1	0	0	0	0	5
Baa3	0	0	0	0	0	0	0	0	1	0	2	1	0	0	0	0	0	4
Ba1	0	0	0	0	0	0	0	0	2	0	0	2	0	2	0	0	0	6
Ba2	0	0	0	0	0	0	0	0	1	0	2	0	2	0	0	0	0	5
Ba3	0	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	4
B1	0	0	0	0	0	0	0	0	0	2	0	0	0	3	1	0	0	6
B2	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	4
B3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	0	5
Caa	0	0	0	0	0	0	0	0	0	0	2	0	1	0	2	1	0	6

Moody's – 2006

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	17	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
Aa1	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	4
Aa2	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Aa3	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	5
A1	0	0	1	0	2	2	1	0	0	0	0	0	0	0	0	0	0	6
A2	0	0	0	1	0	1	5	0	1	1	0	0	0	0	0	0	0	9
A3	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	4
Baa1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	5
Baa2	0	0	0	0	0	0	2	0	0	1	1	1	0	0	0	0	0	5
Baa3	0	0	0	0	0	0	0	0	2	1	1	1	1	0	0	0	0	6
Ba1	0	0	0	0	0	0	0	0	1	0	1	1	0	2	0	0	0	5
Ba2	0	0	0	0	0	0	0	0	0	3	1	1	0	1	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	4
B1	0	0	0	0	0	0	0	0	0	0	1	0	1	4	0	0	0	6
B2	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
B3	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3	0	0	6
Caa	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	4

Moody's – 2007

rating Moody's \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	17	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	22
Aa1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Aa2	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Aa3	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	5
A1	0	0	1	2	1	1	0	0	1	0	0	0	0	0	0	0	0	6
A2	0	0	0	0	1	4	2	0	0	1	0	0	0	0	0	0	0	8
A3	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	3
Baa1	0	0	0	0	0	1	0	1	1	2	0	0	0	0	0	0	0	5
Baa2	0	0	0	0	0	1	1	1	0	0	2	0	0	0	0	0	0	5
Baa3	0	0	0	0	0	0	0	2	2	0	0	1	1	0	0	0	0	6
Ba1	0	0	0	0	0	0	0	0	0	2	3	0	0	2	0	0	0	7
Ba2	0	0	0	0	0	0	0	0	1	1	2	0	1	1	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	4
B1	0	0	0	0	0	0	0	0	0	0	2	0	1	3	0	0	0	6
B2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	3
B3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	1	0	5
Caa	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	4

Standard and Poors – 1999

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	2	7	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	11
Aa1	3	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	10
Aa2	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
Aa3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
A2	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0	0	5
A3	0	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	5
Baa1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Baa2	0	0	0	0	0	3	0	1	3	0	0	0	0	0	0	0	0	7
Baa3	0	0	0	0	0	0	0	2	1	1	3	0	1	0	0	0	0	8
Ba1	0	0	0	0	0	1	0	0	1	0	1	1	2	0	0	0	0	6
Ba2	0	0	0	0	0	0	0	0	1	1	0	2	1	0	0	0	0	5
Ba3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
B1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	4
B2	0	0	0	0	0	0	0	0	0	0	0	3	1	1	0	1	0	6
B3	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	3
Caa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2

Standard and Poors – 2000

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	4	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	11
Aa1	3	2	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	10
Aa2	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
Aa3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
A2	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	5
A3	0	0	0	0	1	2	3	0	0	0	0	0	0	0	0	0	0	6
Baa1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
Baa2	0	0	0	0	0	1	1	0	3	0	1	0	0	0	0	0	0	6
Baa3	0	0	0	0	0	0	0	2	2	0	3	0	1	0	0	0	0	8
Ba1	0	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	0	5
Ba2	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	4
Ba3	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	4
B1	0	0	0	0	0	0	0	0	1	1	0	2	0	1	2	0	0	7
B2	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
B3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	2	6
Caa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Standard and Poors – 2001

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	6	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Aa1	2	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Aa2	0	1	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	5
Aa3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
A2	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	6
A3	0	0	0	0	0	4	1	1	0	0	0	0	0	0	0	0	0	6
Baa1	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3
Baa2	0	0	0	0	0	0	2	0	2	0	1	0	0	0	0	0	0	5
Baa3	0	0	0	0	0	1	1	0	2	1	2	0	1	0	0	0	0	8
Ba1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	3
Ba2	0	0	0	0	0	0	0	0	0	1	0	3	1	1	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	1	1	1	1	0	2	0	0	0	6
B1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	3
B2	0	0	0	0	0	0	0	0	0	0	1	2	0	2	1	1	0	7
B3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	3
Caa	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	3

Standard and Poors – 2002

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	7	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Aa1	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Aa2	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Aa3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
A1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
A2	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	6
A3	0	0	0	0	1	4	3	1	0	0	0	0	0	0	0	0	0	9
Baa1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	3
Baa2	0	0	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	5
Baa3	0	0	0	0	0	0	1	0	3	0	1	0	0	0	0	0	0	5
Ba1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	3
Ba2	0	0	0	0	0	0	0	0	0	1	1	3	1	2	0	0	0	8
Ba3	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	0	0	4
B1	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	5
B2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	4
B3	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	5
Caa	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	4

Standard and Poors – 2003

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	7	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	15
Aa1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Aa2	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Aa3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
A1	0	1	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	6
A2	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0	0	0	4
A3	0	0	0	0	1	5	2	1	1	0	0	0	0	0	0	0	0	10
Baa1	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
Baa2	0	0	0	0	1	0	1	0	2	2	0	1	0	0	0	0	0	7
Baa3	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2
Ba1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	4
Ba2	0	0	0	0	0	0	0	0	0	1	1	1	2	3	0	0	0	8
Ba3	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	3
B1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3
B2	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0	0	1	6
B3	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	1	5
Caa	0	0	0	0	0	0	0	0	0	0		1	0	0	1	0	2	4

Standard and Poors – 2004

Estimated rating – ordered probit

rating S&P	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	8	6	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Aa1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa3	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4
A1	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	4
A2	0	0	0	0	4	1	1	0	0	1	0	0	0	0	0	0	0	7
A3	0	0	0	0	2	4	2	2	0	0	0	0	0	0	0	0	0	10
Baa1	0	0	0	0	0	2	1	1	1	1	0	0	0	0	0	0	0	6
Baa2	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	3
Baa3	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	3
Ba1	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	4
Ba2	0	0	0	0	0	0	0	0	0	0	2	0	2	3	0	0	0	7
Ba3	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	4
B1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3
B2	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	1	5
B3	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	5
Caa	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	3

Standard and Poors – 2005

Estimated rating – ordered probit

rating S&P	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	10	5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Aa1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Aa3	1	2	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	7
A1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
A2	0	0	0	0	5	3	1	0	1	0	0	0	0	0	0	0	0	10
A3	0	0	0	0	2	1	4	2	0	0	0	0	0	0	0	0	0	9
Baa1	0	0	0	0	0	2	1	0	1	1	0	0	0	0	0	0	0	5
Baa2	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	4
Baa3	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	3
Ba1	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	4
Ba2	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	4
Ba3	0	0	0	0	0	0	0	0	0	1	3	1	0	1	0	0	0	6
B1	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	3
B2	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	1	0	5
B3	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	5
Caa	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2

Standard and Poors – 2006

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	11	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Aa1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Aa3	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
A1	1	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	5
A2	0	0	0	2	4	3	1	1	0	0	0	0	0	0	0	0	0	11
A3	0	0	0	0	2	1	4	0	0	0	0	0	0	0	0	0	0	7
Baa1	0	0	0	0	0	2	1	1	1	2	1	0	0	0	0	0	0	8
Baa2	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	4
Baa3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Ba1	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	0	0	4
Ba2	0	0	0	0	0	0	0	0	0	2	1	1	1	1	0	0	0	6
Ba3	0	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	5
B1	0	0	0	0	0	0	0	1	1	0	0	1	2	0	0	0	0	5
B2	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	4
B3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	3
Caa	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2

Standard and Poors – 2007

rating S&P \ Estimated rating – ordered probit	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	Total
Aaa	13	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Aa1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Aa2	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Aa3	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	5
A1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
A2	0	0	0	2	5	3	1	2	0	0	0	0	0	0	0	0	0	13
A3	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	4
Baa1	0	0	0	0	0	1	3	1	2	1	0	0	0	0	0	0	0	8
Baa2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2
Baa3	0	0	0	0	0	0	0	1	0	3	1	0	0	0	0	0	0	5
Ba1	0	0	0	0	0	0	0	0	1	1	0	1	2	0	0	0	0	5
Ba2	0	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0	0	5
Ba3	0	0	0	0	0	0	0	1	1	0	2	2	1	0	0	0	0	7
B1	0	0	0	0	0	0	0	0	0	1	2	1	1	0	1	0	0	6
B2	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	0	0	4
B3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	3
Caa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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