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António Afonso
ISEG - UL, Universidade de Lisboa
REM - Research in Economics and Mathematics
UECE - Research Unit on Complexity and Economics
aafonso@iseg.utl.pt
André Albuquerque
ISEG - UL, Universidade de Lisboa
andre.malbuq@gmail.com

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Sovereign Credit Rating Mismatches

António Afonso
André Albuquerque

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ABSTRACT
We study the factors behind ratings mismatches in sovereign credit ratings from different agencies, for the period 1980-2015. Using random effects ordered and simple probit approaches, we find that structural balances and the existence of a default in the last ten years were the least significant variables. In addition, the level of net debt, budget balances, GDP per capita and the existence of a default in the last five years were found to be the most relevant variables for rating mismatches across agencies. For speculative-grade ratings, a default in the last two or five years decreases the rating difference between S&P and Fitch. For the positive rating difference between S&P and Moody's, and for investment-grade ratings, an increase in external debt leads to a smaller rating gap between the two agencies.
Keywords: Sovereign ratings; split ratings; panel data; random effects ordered probit.

JEL Classification: C23; C25; E44; F34; G15; H63.

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1. Introduction

Credit rating agencies play a crucial role in reducing information asymmetries in the financial markets and provide a fundamental input to the financial institutions risk assessment required by regulators. In fact, capital requirements are calculated notably by applying to the institution financial assets a weighting factor depending on the associated credit rating. Sovereign credit ratings summarise in an ordinal qualitative scale a complex and thorough analysis of the ability a country has to service its debt. Since institutional investors nowadays are only allowed to acquire financial assets above a certain rating, countries willing to issue debt are in practice obliged to pay for a credit rating.

With the globalization of financial markets and the proliferation of credit ratings, rating agencies assigning different credit ratings to the same country became more frequent. Our contribution is twofold: first, we set up the possible pairs of rating mismatches across the three main Nationally Recognized Statistical Rating Organizations (NRSROs) for 105 countries, highlighting persistent split ratings. Second, we analyse the rating differences between S&P, Moody's and Fitch in the light of a random-effects probit framework and using as explanatory variables a set of economic variables found in the literature as important determinants of sovereign ratings.

Our ordered probit results found, for every dataset used, that the level of net debt, budget balances, GDP per capita, and a default in the last five years contribute in more than 20% of the regressions to the overall rating differences. On the other hand, the structural balance did not significantly contribute to the rating differences here considered. The structural balance and the default in the last ten years were the least significant across all our regressions, In addition, for speculative-grade ratings, we find that a default in the last two or five years decreases the rating difference between S&P and Fitch. For the positive rating difference between S&P and Moody's for investment-grade ratings, an increase in external debt leads to a smaller rating gap between the two agencies.

From a policy perspective, the economic implications of our results imply that sovereigns and fiscal policy makers might learn which determinants matter most for each rating agency, allowing for a better ex-ante fine-tuning of the rating process.

The remainder of the paper is organized as follows: section two provides the literature review; section three explains the methodology; section four discusses the results of the analysis; and section five is a conclusion.

2. Literature Review

Amstad and Packer (2015) define sovereign ratings as "opinions about the creditworthiness of sovereign borrowers that indicate the relative likelihood of default on their outstanding debt obligations". These ratings, like the ratings about other types of credit, try to assess both the ability and willingness of the borrower to pay. To accomplish this, qualitative factors, like institutional strength and the rule of law, and quantitative factors, like measures of fiscal and economic strength, the monetary regime, foreign exchange reserves, are analysed to rate a sovereign issuer. Kiff et al. (2012) state that ratings are not only about credit risk but also convey information about credit stability (changes in credit risk), and the assessments represented by ratings are medium-term outlooks that should not change due to the impact of cyclical components. Rating agencies minimize rating volatility by assessing through the cycle: a rating should be changed only to reflect a shift in fundamental factors (and consequently a change in basic creditworthiness), and not as a response to a recession or a global liquidity shortage, for example.

Bhatia (2002) affirms that the widespread use by investors of the credit ratings attributed by Standard & Poor's (S&P), Moody's Investors Service (Moody's) and Fitch Ratings (Fitch) reflects their utility for the market. This usefulness results from the simplicity and comparability of the rating systems used by those rating agencies, condensing detailed analysis into brief indicators, and from the "perceived analytical strength and independence of the agencies themselves."

A sovereign credit rating normally serves as the "ceiling" of the ratings within its territory, since the sovereign bond yields are considered riskless and therefore used as a benchmark against which returns on domestic investments are compared. In parallel, each sovereign creditworthiness is compared with the most trustworthy issuers (rated with an 'AAA' rating), and among those is the German government, whose bonds are regarded as one of the global risk-free benchmarks. Given the increasing integration of the capital markets, the growing issuance of bonded debt and the regulatory role of sovereign ratings on investors risk management, changes in sovereign ratings can have profound implications.

Both the Asian crisis in 1997 and the global financial crisis of 2007-08 highlighted flaws in the rating systems. In the first case, a rating approach based only on macroeconomic fundamentals was the culprit, revealing the importance of contingent liabilities and the international liquidity position of the issuers (Bhatia, 2002). In the latter case, and according to Brunnermeier (2009), one of the deciding factors contributing to the latest financial crisis was the fact that structured debt products (collateralized debt obligations (CDO)), had always a tranche reaching the 'AAA' rating, even if the underlying default risk was not equivalent to the default risk associated with a 'AAA' bond rating. Fund managers were attracted to buying these structured products offering seemingly high expected returns with an acceptable level of risk, and when the quality of the securitized assets deteriorated (signalled by a spike in the default rate of the so-called subprime mortgages), every holder inevitably faced losses and eventually had to write-down a significant part of their mortgage-related securities.

In the wake of the global financial crisis and the European sovereign debt crisis, Amstad and Packer (2015) highlight the changes in the sovereign risk methodologies used by the major rating agencies. These rating methodologies explain which factors drive the evaluation of the likelihood of default. A common principle to these revisions is that agencies tried to adopt assessment systems more reliant on quantitative inputs, to make ratings more transparent and replicable.

For instance, the Moody's rating methodology (Moody's Investors Service, 2015) explains its sovereign credit risk assessment on the "interplay" of four key factors: economic strength, institutional strength, fiscal strength and susceptibility to event risk. In addition, each factor usually encompasses one or more indicator, like the average real GDP growth and volatility, nominal GDP, GDP per capita, inflation level and volatility, etc.

Al-Sakka and ap Gwilym (2010) associate the growing importance of credit rating agencies to the increasing number of issuers and debt products, and globalization, but also to the requirements applied to financial institutions and banks. The first ones are only allowed to trade debt securities rated by NRSRO, whereas the latter, stemming from the Basel II Accord, usually employ external credit ratings to assess their credit risks and to determine capital adequacy requirements.

The determinants of sovereign credit ratings are an object of study since the seminal work of Cantor and Packer (1996), a cross sectional OLS estimation which identified per capita income, GDP growth, inflation, external debt, level of economic development and default history as important determinants of sovereign ratings assigned by Moody's and S&P. This methodology was also used by Afonso (2003), which also included a logistic and an exponential transformation of the ratings, in addition to the linear transformation already used. Mulder and Monfort (2000) and Eliasson (2002) generalized the OLS approach to panel data, both using a linear transformation of the ratings.

On the other hand, and to overcome the limitation of OLS regressions with a linear transformation of the ratings, Bissoondoyal-Bheenick (2005) used an ordered probit model for a period of five years and 95 countries.[1]

Afonso et al. (2008) analysed the determinants of sovereign ratings from the three main agencies by using a linear regression framework (random effects estimation, pooled OLS estimation and fixed effects estimation) versus an ordered probit response framework.[2] In addition, Afonso et al. (2011) confirm that logistic and exponential transformations to ratings provide little improvement over the linear transformation, not finding evidence of the so-called "cliff effects" (when investors adjust their portfolio composition to select only investment grade securities). This work also highlights the difference between short- and long-term determinants, concluding that GDP per capita, GDP growth, government debt and budget balance have a short-term impact, whereas government effectiveness, external debt, foreign reserves and default history influence ratings in the long-run.

In addition, Amstad and Packer (2015) used several explanatory variables as proxies for fiscal, economic and institutional strength, monetary regime, external position and default history and concludes that a small set of factors can largely explain the rating scale. Finally, Vu et al. (2017) report that political risk can contribute to explain rating mismatches in a country sample during the period 1997-2011.

3. **Methodology**

To understand which factors may explain split sovereign ratings and if some of those factors are considered more relevant by certain agencies, we propose to analyse the collected dataset using a random-effects ordered probit model regression framework.

[1] An OLS regression with a linear transformation of the ratings assumes a constant distance between adjacent rating notches. However, ratings represent a qualitative ordinal assessment of a sovereign credit risk, thus the distance between two adjacent ratings may not be the same

[2] Instead of assuming a rigid shape of the ratings scale, this model estimates the threshold values between rating notches, defining the shape of the ratings curve.

The source of the information used to create the dependent variables were the rating changes for long-term sovereign foreign currency ratings obtained from Bloomberg for the three main credit rating agencies (Standard & Poor's, Moody's, and Fitch Ratings). For each country and for each year, we selected the last rating change of the year as that country's year rating. In addition, we filled the years without any rating change by extending the rating of the previous year and rating withdrawals by the rating agencies were ignored, since the rating given before the withdrawal keeps its relevance for the markets.

The qualitative rating given by the rating agencies were then converted into a numerical scale, from 0 to 21, where 21 corresponded to the 'AAA' from S&P and Fitch and 'Aaa' from Moody's and 0 corresponded to a (selective) default.

Our six dependent variables – $Diff\_UP_{it}^{SF}$, $Diff\_DW_{it}^{SF}$, $Diff\_UP_{it}^{MF}$, $Diff\_DW_{it}^{MF}$, $Diff\_UP_{it}^{SM}$ and $Diff\_DW_{it}^{SM}$ – represent the difference in ratings between the credit rating agencies considered in this work, as follows:

$Diff\_UP_{it}^{SF}$ – difference between the ratings given by S&P and Fitch, when S&P rating was higher or equal than Fitch's rating;
$Diff\_DW_{it}^{SF}$ – difference between the ratings given by S&P and Fitch, when S&P rating was lower or equal than Fitch's rating;
$Diff\_UP_{it}^{MF}$ – difference between the ratings given by Moody's and Fitch, when Moody's rating was higher or equal than Fitch's rating;
$Diff\_DW_{it}^{MF}$ – difference between the ratings given by Moody's and Fitch, when Moody's rating was lower or equal than Fitch's rating;
$Diff\_UP_{it}^{SM}$ – difference between the ratings given by S&P and Moody's, when S&P rating was higher or equal than Moody's rating;
$Diff\_DW_{it}^{SM}$ – difference between the ratings given by S&P and Moody's, when S&P rating was lower or equal than Moody's rating.

As an example, let R_{it}^{X} represent the rating from credit rating agency *X* for the country *i* in year *t* and consider the dependent variable $Diff\_UP_{it}^{SM}$, representing the difference between S&P and Moody's ratings: $Diff\_UP_{it}^{SM} = R_{it}^{S} - R_{it}^{M}$, when $R_{it}^{S} \geq R_{it}^{M}$. If $Diff\_UP_{it}^{SM} > 0$, then S&P considers country *i*, in time *t*, more capable of fulfilling its debt obligations than what is assessed by Moody's.

3.1. Explanatory Variables

In this paper we selected the explanatory variables according to the existing literature on the determinants of sovereign ratings (see Cantor and Packer, 1996, Afonso, 2003, and, for ordered response models, Afonso et al., 2008, and Afonso et al., 2011). Accordingly, the predictors that had better explanatory power for the rating scaled are the level of GDP per capita, real GDP growth, external debt, government debt and the government budget balance.

In addition to these predictors[3], this study also considered as explanatory variables the government structural balance, inflation and the default history of a country. The list of explanatory variables used in this work (the Appendix describes the data) is as follows:

Budget balance. Successive budget deficits may signal problems with the implemented policies;
Structural balance. Changes in the non-cyclical, or structural component, may be indicative of discretionary policy adjustments;
Gross debt. Summation of all liabilities that will require payments of interest and/or principal by the government, might signal rating deterioration;
Net debt. Net debt is calculated as gross debt minus the financial assets a government holds;
GDP growth rate. GDP per capita. A higher value strengthens the government ability to pay its debt;
Inflation. It helps governments by reducing the real stock of outstanding debt in domestic currency, but a consistent high value is associated with macroeconomic imbalances;
External debt. In addition, called foreign debt, represents the total debt a country (its government, corporations and citizens) owes to foreign creditors. It does not include contingent liabilities;
Four dummy variables for a default within the last year, last 2 years, last 5 years, and last 10 years. The definition of default by Beers and Mavalwalla (2016) here used is consistent with the literature on sovereign defaults. In fact, one considers that "a default has occurred when debt service is not paid on the due date, payments are not made within the time frame specified under a guarantee or, absent an outright payment default, creditors face material economic losses on the sovereign debt they hold."

3.2. Ordered Probit Regression Framework

We use a random effects ordered probit panel model, similar to what Afonso et al. (2011) used to identify the determinants of sovereign debt credit ratings and what Al-Sakka and ap Gwilym (2010) used to analyse the impact of split ratings on sovereign rating changes. According to Afonso et al. (2011), the ordered probit random-effects estimations consider the existence of an additional cross-country error term and therefore yield better results using panel data when compared with linear regression methods or fixed-effects probit estimations.

Our approach considers the discrete, ordinal nature of rating differences between credit rating agencies. The negative and positive rating differences for each pair of agencies was analysed separately, due to expected symmetrical reading if the dependent variable is positive

[3] Regarding government debt, we have analysed both gross and net government debt separately.

or negative by construction, comparable to what Al-Sakka and ap Gwilym (2010) expected with rating migrations.

Consider our ordered probit regression setting, when we are regressing $Diff\_UP_{it}^{SM}$ as the dependent variable. (In this case, all observations have the rating from S&P higher or equal than the rating from Moody's.) If the resulting coefficient of an explanatory variable, say, real GDP growth, is positive and significant, we conclude that an increase in real GDP growth will contribute to a bigger difference between S&P and Moody's ratings.[4] In a similar way, if the coefficient of the level of public debt is negative, we may conclude that an increase in the level of public debt, will contribute to a smaller difference between the ratings given by S&P and Moody's.[5] In practice, a positive coefficient has a symmetrical reading if it is related to a UP or a DW variable.

Our specification is defined as follows, and the value of our y_{it} dependent variable depends on whether we are considering the ordered probit or the simple probit approach:

$$y_{it} = \beta_1 \Delta GD_{it} + \beta_2 NGDP_{RPCH_{it}} + \beta_3 NGDPDPC_{it} + \beta_4 PCPIPCH_{it} + \beta_5 \Delta ED_{it} + yDefaultZ_{it} + \varepsilon_{it};\ \varepsilon_{it} \sim N(0,1), \tag{1}$$
$$i = 1, \dots C \text{ (countries)},\ t = 1, \dots Y \text{ (years)},$$

where y_{it} is an ordinal variable equal to either $Diff\_UP_{it}^{AB}$ or $Diff\_DW_{it}^{AB}$.

In our ordered probit model, $Diff\_UP_{it}^{AB}$ ($Diff\_DW_{it}^{AB}$) = 1 or 2 if the rating from agency A is higher (lower) than the rating from agency B by one or more-than-one-notch, respectively, for sovereign i in year t, and 0 otherwise.

ΔGD_{it} may assume the variation value of the budget balance, gross debt, net debt or structural balance of country i in year t, depending on the chosen specification. $NGDP_{RPCH_{it}}$ – growth rate of GDP for country i in year t; $NGDPDPC_{it}$ – GDP per capita variation for country i in year t; $PCPIPCH_{it}$ – IPCH percentage change (inflation) for country i in year t; ΔED_{it} – external debt variation for country i in year t as percentage of GNI; and $DefaultZ_{it}$ – dummy variable taking the value of 1 if country i in year t had defaulted in the last Z years, and 0 otherwise.

In the scope of the ordered probit framework, our six dependent variables were defined as to only having values of 1, 2 or 0, representing a rating gap of 1-notch, 2-or-more-notches or the inexistence of a rating gap, respectively. Equations 2 and 3 explain how the target variables were created:

$$Diff_{UP_{it}^{AB}} = \begin{cases} 1, \ if \ |R_{it}^{\alpha} - R_{it}^{\beta}| = 1 \\ 2, \ if \ |R_{it}^{\alpha} - R_{it}^{\beta}| \geq 2, \\ 0, \ otherwise \end{cases} \quad \text{when } R_{it}^{\alpha} \geq R_{it}^{\beta}; \tag{2}$$

[4] This could be interpreted as an increase in real GDP growth contributing to a higher S&P rating or a lower Moody's rating.

[5] In this case this could be interpreted as an increase in the level of public debt contributing to a lower S&P rating or a higher Moody's rating.

$$Diff_{DW_{it}^{AB}} = \begin{cases} 1,\ if\ |R_{it}^{\alpha} - R_{it}^{\beta}| = 1 \\ 2,\ if\ |R_{it}^{\alpha} - R_{it}^{\beta}| \geq 2, \qquad \text{when } R_{it}^{\alpha} \leq R_{it}^{\beta}; \\ \quad 0,\ otherwise \end{cases} \qquad 3$$

where A and B and α and $\beta \in \{SF, MF, SM\}$, and α (A) $\neq \beta$ (B).

Independently of the ordered or simple probit setup, when an observation has equivalent ratings from the considered rating agencies, the value of both $Diff\_UP_{it}^{AB}$ and $Diff\_DW_{it}^{AB}$ target variables is zero. Therefore, for each agency pair considered, both target variables use the same observations with no rating difference.[6]

Four different specifications of predicting variables were considered to overcome the correlation between some of the variables, using the four-abovementioned measures of fiscal developments: budget balance, structural balance, gross debt, and net debt. Within each specification, the four different default dummies were also combined.

4. Empirical Analysis

4.1. Data

Concerning the dependent variables, all the sovereign rating changes[7] were downloaded from Bloomberg and converted into the already mentioned numerical scale. Afterwards, we created six dependent variables, two variables for each rating agency pair, with the value of each variable reflecting the numerical rating difference between the ratings given by those specific agencies (comparable to what Livingston et al. (2008) did with the split rated issues).

The initial objective of this work was to study rating differences from 1970 onwards. However, and due to the inexistence of both macroeconomic values for many countries on those early years and ratings from at least two of the three selected agencies, our observations happened to comprehend only the period between 1980 and 2015. We only have observations with a rating from Fitch from 1994 onwards. Therefore, we have an unbalanced panel and by using first differences in the explanatory variables, one ensures stationarity. Naturally, the number of regressions reported varies according to the time span of the several variables and according to the existence of ratings for each pair of agencies for a specific country i in year t.

From 1990 and until 2000, we observe a bigger increase in the number or countries rated by at least two agencies, whereas from 2000 onwards the pace of this increase slowed, ending with 105 countries in our dataset with ratings from at least two of the main rating agencies.[8]

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[6] An observation with $R_{it}^{\alpha} = R_{it}^{\beta}$ will make $Diff\_UP_{it}^{AB} = Diff\_DW_{it}^{AB} = 0$, so it has to be considered on the regressions of both target variables.

[7] We used the sovereign issuer ratings for foreign currency denominated debt.

[8] Countries in the sample: Angola, Albania, United Arab Emirates, Argentina, Armenia, Australia, Austria, Azerbaijan, Belgium, Bulgaria, Bahrain, Bosnia and Herzegovina, Belarus, Belize, Brazil, Barbados, Canada, Switzerland,

The distribution of the sovereign ratings on our dataset show that S&P is the agency which assigns more countries a rating of 'AA-' or above, and that the great majority of our observations are equal or above 'B-'. A higher degree of agreement on the top of the rating scale may explain the number of observations that had a rating of 'AAA' from all three agencies.

Our independent variables were obtained from datasets from the IMF (World Economic Outlook), World Bank (World Development Indicators), Bank of Canada (Database of Sovereign Defaults), and from the Quarterly External Debt Statistics dataset developed in collaboration between the World Bank and the IMF. Details on how those variables were created can be found in the Appendix.

4.2. Ordered Probit: Full Sample Analysis

We started by running the ordered probit regression with the full dataset. This dataset was composed by more than 850 observations for each dependent variable, comprised a period of at least 22 years (36 years only for the rating agency pair S&P and Moody's) and 69 or more countries. More than 65% of our observations for each of our target variables had no rating difference, whereas a rating difference of 1-notch was found at least in 19% of the observations. A rating difference of two or more notches can only be found 3.5%[9] of the times when analysing comparable ratings from S&P and Fitch; on the other hand, 9%[10] of the observations about the rating differences between S&P and Moody's have a 2-notch rating difference. This shows how S&P and Moody's disagree more when compared with the other rating agency pairs. Table 1 summarizes the full dataset.

Chile, China, Côte d'Ivoire, Cameroon, Colombia, Costa Rica, Czech Republic, Germany, Denmark, Dominican Republic, Ecuador, Egypt, Spain, Estonia, Ethiopia, Finland, Fiji, France, Gabon, United Kingdom of Great Britain and Northern Ireland, Georgia, Ghana, Greece, Guatemala, Honduras, Croatia, Hungary, Indonesia, India, Ireland, Iraq, Iceland, Israel, Italy, Jamaica, Jordan, Japan, Kazakhstan, Kenya, Korea (Republic of), Kuwait, Lebanon, Libya, Sri Lanka, Luxembourg, Morocco, Mexico, Mali, Mongolia, Mozambique, Malaysia, Namibia, Nigeria, Netherlands, Norway, New Zealand, Oman, Pakistan, Panama, Peru, Philippines, Papua New Guinea, Poland, Portugal, Paraguay, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, El Salvador, Serbia, Slovenia, Sweden, Seychelles, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, Uruguay, United States of America, Viet Nam, South Africa, Zambia.

[9] This value was obtained by calculating the average of the percentages of a rating difference of two or more notches between S&P and Fitch, when the first gave a higher rating than the latter ($Diff\_UP_{it}^{SF}$) and when the first gave a lower rating than the latter ($Diff\_DW_{it}^{SF}$).

[10] This value was obtained by calculating the average of the percentages of a rating difference of two or more notches between S&P and Moody's, when the first gave a higher rating than the latter ($Diff\_UP_{it}^{SM}$) and when the first gave a lower rating than the latter ($Diff\_DW_{it}^{SM}$).

Table 1: Summary of the full dataset, divided by the six target variables

	$Diff\_UP_{it}^{SF}$	$Diff\_DW_{it}^{SF}$	$Diff\_UP_{it}^{MF}$	$Diff\_DW_{it}^{MF}$	$Diff\_UP_{it}^{SM}$	$Diff\_DW_{it}^{SM}$
No. of countries	87	87	70	69	82	82
No. of years	22	22	22	22	36	36
First and last year	1994-2015	1994-2015	1994-2015	1994-2015	1980-2015	1980-2015
No. of observations	1149	1194	903	851	1103	1165
Observations with:						
Rating difference = 0	898 (78%)	898 (75%)	606 (67%)	606 (71%)	764 (69%)	764 (66%)
Rating difference = 1	221 (19%)	248 (21%)	223 (25%)	187 (22%)	247 (22%)	286 (25%)
Rating difference = 2	30 (3%)	48 (4%)	74 (8%)	58 (7%)	92 (8%)	115 (10%)
Observations with a value:						
GDP per capita	1149 (100%)	1194 (100%)	903 (100%)	851 (100%)	1103 (100%)	1165 (100%)
Real GDP growth rate	1148 (100%)	1194 (100%)	903 (100%)	851 (100%)	1103 (100%)	1165 (100%)
External debt	841 (73%)	897 (75%)	685 (76%)	648 (76%)	701 (64%)	808 (69%)
Gov. gross debt	1096 (95%)	1135 (95%)	865 (96%)	807 (95%)	1018 (92%)	1065 (91%)
Gov. net debt	1046 (91%)	1085 (91%)	822 (91%)	770 (90%)	954 (86%)	1004 (86%)
Budget balance	1112 (97%)	1153 (97%)	877 (97%)	824 (97%)	1057 (96%)	1104 (95%)
Structural balance	1064 (93%)	1100 (92%)	842 (93%)	774 (91%)	970 (88%)	1028 (88%)
Inflation	1147 (100%)	1191 (100%)	901 (100%)	848 (100%)	1100 (100%)	1160 (100%)
Default in the:						
Last year	312 (27%)	321 (27%)	164 (18%)	211 (25%)	268 (24%)	258 (22%)
Last two years	349 (30%)	363 (30%)	190 (21%)	247 (29%)	311 (28%)	297 (25%)
Last five years	419 (36%)	446 (37%)	248 (27%)	313 (37%)	379 (34%)	375 (32%)
Last ten years	522 (45%)	539 (45%)	331 (37%)	366 (43%)	448 (41%)	454 (39%)

Source: Rating agencies and own calculations.

Running the ordered probit regression for the full dataset, when the ratings from S&P are higher or equal to Fitch own ratings ($Diff\_UP_{it}^{SF}$ dependent variable), we get significant values for both budget balance and net debt variables. When budget balance increases, we expect the rating difference to decrease. For the net debt-predicting variable the opposite occurs: when its value increases, the rating difference increases as well (see Table 2).

Table 2: Summary of the regressions of the ordered probit full dataset

	Significant variables	Marginal Effect Rating difference = 1	Marginal Effect Rating difference = 2
$Diff\_UP_{it}^{SF}$	(-) Budget balance (4/4) (+) Net debt (4/4)	-0.001% 0.0004%	-0.00008% 0.00003%
$Diff\_DW_{it}^{SF}$	(-) GDP per capita (16/16) (-) External debt (16/16) (+) Default last 1Y (1/4) (+) Default last 2Y (1/4) (+) Default last 5Y (4/4)	-0.3% -0.1% 12.3% 11.5% 10.1%-10.5%	-0.03% -0.01% 1.9% 1.7% 1.3%-1.5%
$Diff\_UP_{it}^{MF}$	(-) GDP growth (9/16) (+) External debt (16/16)	-0.9%--1% 0.1%-0.2%	-0.2% 0.03%-0.04%
$Diff\_DW_{it}^{MF}$	(-) Gross debt (2/4) (+) Net debt (4/4) (+) Default last 2Y (3/4) (+) Default last 5Y (4/4)	-0.2% 0.0003% 10.8%-11.4% 11.3%-12.1%	-0.05%--0.06% 0.00007% 2.9%-3% 3%-3.2%
$Diff\_UP_{it}^{SM}$	(+) Default last Y (1/4) (+) Default last 2Y (4/4) (+) Default last 5Y (1/4) (+) Default last 10Y (1/4)	6.1% 8.1%-11.4% 12.9% 12.7%	2% 2.7%-3.5% 3.9% 3.6%
$Diff\_DW_{it}^{SM}$	(+) Budget balance (4/4) (+) Gross debt (4/4) (+) GDP growth (4/16) (-) GDP per capita (8/16)	0.005% 0.2% 0.8% -0.3%	0.002% 0.07% 0.2% -0.08%-0.09%

Notes: First parenthesis, coefficient signs; second parenthesis, number of significant regressions and total number of run regressions.

Regarding the $Diff\_DW_{it}^{SF}$ dependent variable (ratings from S&P being lower or equal to Fitch ratings), GDP per capita, external debt and the dummy default-in-the-last-5-years variables have statistically significant coefficients on all specifications. One can then conclude that if GDP per capita or external debt decrease the rating difference between those two rating agencies increases. The coefficients of the dummy default-in-the-last-5-years are also significant (and positive), showing that a default in the last five years increases the rating difference between S&P and Fitch in this case.

Analysing the rating difference between Moody's and Fitch, when the rating given by Moody's is higher than Fitch's rating ($Diff\_UP_{it}^{MF}$), we find significant values for two dependent variables, GDP growth (negative coefficient on two specifications) and external debt level (positive coefficients on all specifications). These results show that when GDP growth increases, the rating difference between these two agencies becomes smaller, whereas when the level of external debt increases, the gap between these two agencies increases.

When Moody's rating is lower than the rating from Fitch (Diff_DWitMF), we find that the dummy variable representing a default in the last five years has a positive coefficient in all specifications. For this reason, if a default in the last five years occurred, the rating difference in this setting between Moody's and Fitch increases as well.

The variables gross debt and net debt also have significant values of opposite signs: the gross debt contributes negatively for the rating difference, reducing the rating difference when its value increases, while the net debt has positive coefficients, so its increase is expected to positively influence the magnitude of the rating difference. We need to better understand the opposite signs of these two variables, since they should be correlated to a certain degree. The separate regressions of the investment and speculative ratings may shed some light into this topic.

The results from regressing our dependent variable Diff_UPitSM (when the S&P rating is higher than Moody's rating) display significant results only for the dummy default variables. The dummy default-in-the-last-2-years has positive coefficients on all specifications, meaning that if a country defaults in the last two years, the rating gap between S&P and Moody's will grow.

The results from regressing the last set of specifications, when the rating from S&P is lower than the rating from Moody's (Diff_UPitSM is the dependent variable), show that the budget balance, gross debt, GDP growth, and GDP per capita variables all contribute to the rating difference. Those first three variables have statistically significant and positive coefficients, meaning that when one of those variables increase, the rating difference between S&P and Moody's (Diff_UPitSM) will increase as well. The coefficient of the GDP per capita variable is negative, so when its value increases, the rating gap between S&P and Moody's becomes smaller. Overall, there does not seem to be a best proxy for government debt in the context of the empirical analysis.

4.3. Differentiation Between Investment and Speculative Ratings

We now report the ordered probit regression results when the observations were divided into two subsets, depending on the value of the average rating given by the rating agency pair. The observations with a numeric average rating of 12 or more (corresponding to 'BBB-' for S&P and Fitch or to 'Baa3' for Moody's) were grouped in the investment-grade subset, whereas those with a numeric rating less than 12 were grouped in the speculative-grade subset. In addition, the average rating is computed using the full sample since we want to divide the countries into "investment" and "speculative" categories. Therefore, some countries throughout the sample period may change from an "investment" category to a "speculative" category and vice-versa.

4.3.1. Investment-Grade Subset

When compared with the full dataset, the investment-grade dataset had observations for a smaller number of countries, between 49 and 57 different countries. The adopted criteria of considering only those observations with an investment-grade average rating reduced as expected the number of observations for each target variable (all target variables had less than 800 observations). It is important to note a higher percentage of observations with the same rating (when compared with the full dataset) from each rating agency in this setting, reflecting a greater coherence between the studied rating agencies when considering investment-grade sovereigns. This may be explained by Livingston et al. (2007) opaqueness idea that associates bond split ratings with the opaqueness of the issuer. In this case, investment-grade sovereign issuers disclose more detailed information, allowing rating agencies to better evaluate their ability to service debt and therefore rating agencies will agree more often about a country's rating in this context, leading to more observations with a rating difference of 0.

Our regression, when the S&P rating is higher than the rating from Fitch (Diff_UPitSF dependent variable), only yield significant results for one of the specifications (only one of the regressions show the budget balance variable as significant). This specification shows a positive correlation between government net debt and the observed rating difference, when the ratings from S&P and Fitch are investment-grade (see Table 3).

Table 3: Summary of the regressions of the ordered probit investment-grade subset

	Significant variables	Marginal Effect Rating difference = 1	Marginal Effect Rating difference = 2
$Diff\_UP_{it}^{SF}$	(-) Budget balance (1/4) (+) Net debt (4/4)	-0.0005% 0.0003%	-0.00002% 0.00001%
$Diff\_DW_{it}^{SF}$	(-) GDP per capita (15/16) (+) Default last 1Y (1/4)	-0.2% 12.6%	-0.005%--0.007% 0.52%
$Diff\_UP_{it}^{MF}$	(+) GDP per capita (12/16) (-) Inflation (16/16)	0.4% -2.0%--2.3%	0.05%-0.06% -0.2%--0.3%
$Diff\_DW_{it}^{MF}$	(-) Gross debt (1/4)	-0.1%	-0.02%
$Diff\_UP_{it}^{SM}$	(-) External debt (16/16)	-0.2%--0.3%	-0.04%
$Diff\_DW_{it}^{SM}$	(+) Budget balance (4/4) (+) Gross debt (4/4) (+) GDP growth (8/16) (-) Default last 1Y (4/4) (-) Default last 2Y (4/4)	0.004% 0.2% 1.1%-1.3% -10.9%--11.8% -8.4%--9.3%	0.0008% 0.04% 0.2%-0.3% -1.6%--1.8% -1.3%--1.5%

Note: See notes to Table 2.

When the rating from S&P is lower than the one from Fitch ($Diff\_DW_{it}^{SF}$), the obtained results for all specifications show a negative correlation between GDP per capita and the rating difference. This means that when GDP per capita increases, the rating difference is reduced. Only one of the regressions in this setting shows a significant and positive default dummy variable (in the last year).

The regressions of our dependent variable $Diff\_UP_{it}^{MF}$ (rating from Moody's higher than the one from Fitch, with the average classified as investment-grade) showed a positive and negative correlation between the rating difference and, respectively, GDP per capita and inflation. In this case, when GDP per capita increases, the rating gap increases, whereas with an inflation increase, the rating divergence between those two agencies will diminish.

While analysing the results when we regress the $Diff\_DW_{it}^{MF}$ (rating difference when the rating from Moody's is lower than the rating from Fitch), we only find one of the regressions showing a significant coefficient for the government gross debt predicting variable.

All the regressions of the $Diff\_UP_{it}^{SM}$ target variable (rating difference when the rating from S&P is higher than the rating from Moody's, and, on average, both ratings are investment-grade) show a significant negative correlation between external debt and the rating difference, leading to a smaller rating difference when the level of external debt rises.

The last dependent variable, $Diff\_DW_{it}^{SM}$, yield significant results when regressed against our predicting variables: both budget balance and government gross debt have significant positive coefficients,[11] meaning that an increase of those variables will lead to an increase in the rating difference between S&P and Moody's, when the rating of the first is lower than the rating of the latter.

The GDP growth-predicting variable also has significant positive coefficients on two of the four regressed specifications, showing an effect on the rating difference similar to the described effect of the budget balance and government gross debt on the rating gap. We also observe statistically significant and negative coefficients for two of the default dummy variables,[12] meaning that the existence of a default in the last year or two will contribute to a smaller rating difference between S&P and Moody's in this case.

4.3.2. Speculative-Grade Subset

Finally, the results from the ordered probit regression using the same specifications are analysed, this time using a subset of the full dataset composed only by observations with a speculative-grade average rating. This speculative-grade subset has observations for at least 38 countries[13] and comprises the period from 1992 to 2015. We have much less observations (between 238 and 435 observations) for the speculative-grade dataset when compared with the investment-grade and full datasets.

[11] With a significance level of 1% for all the relevant regressions.

[12] Default in the last year and in the last two years.

[13] For the $Diff\_DW_{it}^{MF}$ target variable; the remaining target variables include observations for more than 50 countries.

Moreover, we can observe that the same rating can only be found on 70% of the observations for the $Diff\_UP_{it}^{SF}$ target variable, reaching as low as 47% of the observations for the rating differences between Moody's and Fitch, when the rating from the first is lower than the rating from the latter. This fact reflects how opaque speculative-grade sovereigns are and how difficult is for credit rating agencies to assess the real capability of these sovereigns to service their debt. This lack of transparency leads to the information available to rating agencies having poor quality and increases the probability of a split rating (Al-Sakka and ap Gwilym, 2010).

The first regressions have the $Diff\_UP_{it}^{SF}$ as the dependent variable and produce significant results for the budget balance and government net debt variables (only one of the regressions with this target variable show the dummy default-in-the-last-5-years variable as significant). The budget balance coefficient is negative, leading to a smaller rating difference between S&P and Fitch when the budget balance grows. Government net debt has the opposite effect on the described rating difference: when it increases, the rating disparity between those two agencies increases as well (see Table 4).

Table 4: Summary of the regressions of the ordered probit speculative-grade subset

	Significant variables (Coefficient sign)	Marginal Effect Rating difference = 1	Marginal Effect Rating difference = 2
$Diff\_UP_{it}^{SF}$	(-) Budget balance (4/4) (+) Net debt (4/4) (-) Default last 5Y (1/4)	-0.002% 0.2% -17.3%	-0.0001% 0.01% -2.8%
$Diff\_DW_{it}^{SF}$	(+) Net debt (4/4) (-) GDP growth (15/16) (-) External debt (15/16) (-) Default last 10Y (3/4)	0.2% -1.2%--1.3% -0.1%--0.2% -11.7%--12.7%	0.04% -0.3%--1% -0.03%--0.07% -3.8%--5.9%
$Diff\_UP_{it}^{MF}$	(+) External debt (2/16) (-) Default last Y (1/4) (-) Default last 5Y (1/4)	0.2% -13.2% -20.4%	0.05% -3.1% -5.6%
$Diff\_DW_{it}^{MF}$	(-) Gross debt (4/4) (-) Inflation (4/4) (-) Default last 10Y (1/4)	-0.3% -0.3% -11%	-0.1%--0.2% -0.1%--0.2% -10.2%
$Diff\_UP_{it}^{SM}$	(-) Net debt (4/4)	-0.2%	-0.06%
$Diff\_DW_{it}^{SM}$	(+) Budget balance (3/4) (-) GDP per capita (12/16) (-) External debt (4/16)	0.007% -0.4%--0.5% -0.2%	0.001% -0.08%--0.1% -0.05%

Note: See notes to Table 2.

Concerning the obtained results when regressing the $Diff\_DW_{it}^{SF}$ variable, it is possible to observe that government net debt, GDP growth, external debt level and the dummy default-in-the-last-10-years variables all have an effect on the rating difference between S&P and Fitch, when the rating from the first is lower than the rating from the latter. The government net debt variable has a positive coefficient, increasing the rating difference when its value increases. The remaining significant variables (GDP growth, external debt level and the dummy default variable) have negative coefficients, so when their value increases (or becomes one, in the case of the dummy variable), the rating difference between S&P and Fitch shrinks.

Only one specification yields significant results when regressing the $Diff\_UP_{it}^{MF}$ variable (rating difference between Moody's and Fitch, with a higher rating from the first agency). External debt has positive and significant coefficients on two of the regressions, therefore when its value increases, the analysed rating difference increases as well. Two of the four dummy default variables (default in the last year and in the last five years) have significant negative coefficients, thus when a default happened in the last year or in the last five years, the rating difference would get smaller.

The regression of the $Diff\_DW_{it}^{MF}$ target variable against the different specifications of predicting variables highlights the effect of government gross debt and inflation on the rating difference between Moody's and Fitch, when the first is lower than the latter (the dummy default-in-the-last-10-years variable only yielded significant and negative results for one of the regressions). Both gross debt and inflation contribute negatively to the rating gap, therefore, the rating difference will shrink if one of those variables increases.

All the ordered probit regressions run with $Diff\_UP_{it}^{SM}$ as the dependent variable show that the government net debt contributes negatively to the rating difference, when the S&P rating is higher than the rating from Moody's. As a result, when the government net debt increases, the rating gap between S&P and Moody's shrinks.

The results from regressing the $Diff\_DW_{it}^{SM}$ target variable show a positive and a negative correlation between the rating difference (when the rating from S&P is lower than the one from Moody's) and, respectively, the budget balance on one hand, and GDP per capita and external debt on the other hand. For this reason, when the budget balance increases, the considered rating gap increases; whereas, when GDP per capita or external debt increase, the same rating gap decreases.

4.4. Simple Probit Estimations

As robustness exercise, we also estimated a simple probit model, with, for instance, $Diff\_UP_{it}^{AB}$ ($Diff\_DW_{it}^{AB}$) = 1 if the rating from agency A is higher (lower) than the rating from agency B by one or more notches, for sovereign i in year t, and 0 otherwise:

$$Diff_{UP_{it}^{AB}} = \begin{cases} 1, \; if \; |R_{it}^{\alpha} - R_{it}^{\beta}| \geq 1, \\ 0, \; otherwise \end{cases} \quad \text{when } R_{it}^{\alpha} \geq R_{it}^{\beta}, \tag{4}$$

$$Diff_{DW_{it}^{AB}} = \begin{cases} 1, \; if \; |R_{it}^{\alpha} - R_{it}^{\beta}| \geq 1, \\ 0, \; otherwise \end{cases} \quad \text{when } R_{it}^{\alpha} \leq R_{it}^{\beta}, \tag{5}$$

where A and B and α and $\beta \in \{SF, MF, SM\}$, and α (A) $\neq$ β (B).

In this context, our dependent variables have a value of 1 if there is a rating difference of 1-notch or higher and a value of 0 if the ratings from the considered pair of agencies are equivalent in our numerical rating scale. The main results (available on request) essentially go through. A summary comparison between those two sets of results is presented in Table 5.

5. **Conclusion**

By regressing the rating differences of the three main rating agencies with both an ordered and a simple probit random-effects model, we find some significant results, indicating the influence of some of our explanatory variables on those rating differences.

We used an ordered probit model, due to both the existence of rating differences above two notches and Al-Sakka and ap Gwilym (2010) approach to the split ratings topic. Nonetheless, and because of a lower percentage of rating differences higher than one notch, a simple probit model was also used to find if it improved on the results previously obtained.

For the rating differences between S&P and Fitch, when the assigned rating from the first was higher than the latter, we found that, independently of the dataset (full, investment- or speculative-grade), an increase in the budget balance would decrease the rating difference whereas an increase in net debt would increase that same difference. For the speculative--grade ratings, we also found that the existence of a default in the last two or five years would decrease the rating difference between S&P and Fitch.

When the rating from S&P is lower than the one from Fitch, we find different behaviours when comparing the results from the investment- and speculative-grade datasets: in the first case, GDP per capita contributes for a smaller rating gap, whereas a default in the last year and inflation contribute for a bigger rating difference. In the latter case, only net debt has an increasing effect on the rating difference; external debt, GDP growth and the existence of a default in the last year, two or ten years reduce the rating difference.

The results of our regressions when Moody's assigns a higher sovereign rating than Fitch are less precise. On the other hand, GDP per capita and inflation respectively influence an investment-grade rating difference in a positive and negative way, external debt and a default in the last year or five years respectively increase and decrease the analogous speculative rating difference. When considering only the investment-grade regressions, our simple probit results also find the budget and structural balances and a default in the last five years as negatively correlated with the rating difference. On the other hand, for the speculative-grade results for Moody's and Fitch positive rating differences, the simple probit approach does not find external debt as significant, when compared with the ordered probit approach for the same dataset. It is also worth noting the fact that GDP growth only appears as significant for the ordered probit regressions with the full dataset.

In terms of rating differences when Moody's assigns a lower rating than Fitch, a higher level of government gross debt leads to a smaller rating difference for both investment- and speculative-grade datasets, with the exception of the simple probit regressions for speculative rating differences, which did not find gross debt significant. Our simple probit regressions with the investment-grade dataset also find that net debt positively affects the rating difference. Inflation is found to negatively influence a rating difference between Moody's and Fitch when the ratings are in the speculative category (irrespective of the chosen probit approach), and a default on the last ten years affect in the same negative way only the rating differences within the ordered probit results.

Looking at the results obtained for the positive rating difference between S&P and Moody's for the investment-grade dataset, we find that an increase in the level of external debt leads to a smaller rating gap between those two rating agencies. For the same dataset, we find that the simple probit approach also identifies GDP per capita as negatively correlated with the rating difference. For the speculative-grade dataset, both probit methods show net debt as negatively related with the rating difference. It's important to note that for this specific dependent variable, and contrary to what was seen on the regressions of the investment- and speculative- data subsets, only the regressions with the full dataset showed all four default dummy variables as significant and affecting positively the rating gap.

The last dependent variable represents the negative rating difference between S&P and Moody's (that is, a lower rating from S&P than from Moody's). Both of our probit regressions with the investment-grade dataset show a positive relation between budget balance, gross debt and GDP growth, the rating difference, and a negative relation between a default in the last year or two and the same rating difference. The simple probit results also point to the structural balance and a default in the last five years as contributing negatively to the rating difference. When considering the speculative-grade dataset, our results both show that an increase in GDP per capita leads to a smaller rating difference. Both budget balance and gross debt affect the rating difference positively, the former only for the ordered probit regressions and the latter only for the simple probit regressions. External debt also affects negatively the rating difference in our ordered probit regressions.

There are a few improvements and further questions that may be addressed in the future. One could also find a way of specifying which agency is responsible for the rating difference, or as an alternative, discover which factors, in a split rating situation, are correlated with a specific agency upgrade or downgrade.

Another question that can be further assessed is considering different periods, for instance the period before the 1997 Asian crisis, or periods before and after the 2008-2009 economic and financial crisis, possibly reflecting differences on how the rating agencies methodologies were applied in those specific periods.

Table 5: Comparison of the results obtained with the random-effects ordered and simple probit estimations for the full, investment-grade and speculative-grade datasets

	Full dataset		Investment-grade dataset		Speculative-grade dataset	
Significant variables	Ordered probit results	Simple probit results	Ordered probit results	Simple probit results	Ordered probit results	Simple probit results
$Diff\_UP_{it}^{SF}$	(-) Budget balance (4/4) (+) Net debt (4/4)	(-) Budget balance (4/4) (+) Net debt (4/4)	(-) Budget balance (1/4) (+) Net debt (4/4)	(+) Net debt (4/4)	(-) Budget balance (4/4) (+) Net debt (4/4) (-) Default last 5Y (1/4)	(-) Budget balance (3/4) (+) Net debt (4/4) (-) Default last 2Y (1/4) (-) Default last 5Y (1/4)
$Diff\_DW_{it}^{SF}$	(-) GDP per capita (16/16) (-) External debt (16/16) (+) Default last 1Y (1/4) (+) Default last 2Y (1/4) (+) Default last 5Y (4/4)	(-) GDP per capita (16/16) (+) Default last Y (1/4) (+) Default last 2Y (1/4) (+) Default last 5Y (4/4)	(-) GDP per capita (15/16) (+) Default last 1Y (1/4)	(-) GDP per capita (12/16) (+) Inflation (13/16) (+) Default last Y (1/4)	(+) Net debt (4/4) (-) External debt (15/16) (-) GDP growth (15/16) (-) Default last 10Y (3/4)	(+) Net debt (4/4) (-) GDP growth (15/16) (-) Default last Y (2/4) (-) Default last 2Y (2/4) (-) Default last 10Y (4/4)
$Diff\_UP_{it}^{MF}$	(-) GDP growth (9/16) (+) External debt (16/16)	(-) Structural balance (3/4) (+) External debt (16/16)	(+) GDP per capita (12/16) (-) Inflation (16/16)	(+) GDP per capita (2/16) (-) Inflation (13/16) (-) Budget balance (1/4) (-) Structural balance (4/4) (-) Default last 5Y (4/4)	(+) External debt (2/16) (-) Default last Y (1/4) (-) Default last 5Y (1/4)	(-) Default last Y (1/4) (-) Default last 5Y (1/4)
$Diff\_DW_{it}^{MF}$	(-) Gross debt (2/4) (+) Net debt (4/4) (+) Default last 2Y (3/4) (+) Default last 5Y (4/4)	(+) Net debt (4/4) (+) Default last 2Y (3/4) (+) Default last 5Y (4/4)	(-) Gross debt (1/4)	(-) Gross debt (1/4) (+) Net debt (4/4)	(-) Gross debt (4/4) (-) Inflation (4/4) (-) Default last 10Y (1/4)	(+) External debt (4/16) (-) Inflation (16/16)
$Diff\_UP_{it}^{SM}$	(+) Default last Y (1/4) (+) Default last 2Y (4/4) (+) Default last 5Y (1/4) (+) Default last 10Y (1/4)	(-) External debt (4/16) (+) Default last 5Y (1/4) (+) Default last 10Y (1/4)	(-) External debt (16/16)	(-) External debt (16/16) (-) GDP per capita (8/16)	(-) Net debt (4/4)	(-) Net debt (4/4)
$Diff\_DW_{it}^{SM}$	(+) Budget balance (+) Gross debt (+) GDP growth (-) GDP per capita	(+) Budget balance (4/4) (+) Gross debt (4/4) (+) GDP growth (4/16) (-) GDP per capita (12/16)	(+) Budget balance (4/4) (+) Gross debt (4/4) (+) GDP growth (8/16) (-) Default last 1Y (4/4) (-) Default last 2Y (4/4)	(+) Budget balance (4/4) (-) Structural balance (2/4) (+) Gross debt (4/4) (+) GDP growth (13/16) (-) Default last Y (4/4) (-) Default last 2Y (4/4) (-) Default last 5Y (4/4)	(-) External debt (4/16) (+) Budget balance (3/4) (-) GDP per capita (12/16)	(+) Gross debt (4/4) (-) GDP per capita (12/16)

Note: See notes to Table 2.

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Appendix: Data sources

Table A1: Summary of the explanatory variables

Predicting variables	Name, description	Variable original description and source	Description
BudgetBal_NGDP	Budget balance	GGR_NGDP: General government revenue (percentage of GDP) GGX_NGDP: General government total expenditure (percentage of GDP). Source: IMF (WEO)	Difference between government revenues and expenses (GGR_NGDP and GGX_NGDP).
GGSB_NPGDP	Structural balance	General government structural balance (percentage of potential GDP). Source: IMF (WEO)	
GGXWDG_NGDP	Gross debt	General government gross debt (percentage of GDP). Source: IMF (WEO)	
GGXWDN_NGDP	Net debt	General government net debt (percentage of GDP) Source: IMF (WEO)	
NGDP_RPCH	GDP growth rate	Gross domestic product, constant prices Source: IMF (WEO)	Annual percentages of constant price GDP, year-on-year changes.

NGDPDPC	GDP per capita	Gross domestic product per capita, current prices, expressed in current U.S. dollars per person. Source: IMF (WEO)	
PCPIPCH	Inflation	Inflation, average consumer prices Source: IMF (WEO)	Annual percentages of average consumer prices, year-on-year changes.
ED=ExtDebtPercGNI	External debt	GNI_USD: Gross National Income (current US$) Source: WB (WDI) ExtDebtStocksTotalUSD: External debt stocks, total (DOD, current US$) Source: WB (WDI) GrossExtDebtPosition: 0059_T1_Gross External Debt Position and External debt stocks, total (DOD, current US$) Source: JE (QEDS)	The WDI dataset has GNI values for the great majority of countries. The External Debt values existed on the WDI dataset. For OECD countries the QEDS dataset replaced the WDI dataset as the canonical source for external debt. The QEDS dataset has values from 2003 onwards, so we used the external debt values from the WDI dataset (ExtDebtStocksTotalUSD), and then we merged the values from the QEDS dataset when available (GrossExtDebtPosition). ExtDebtPercGNI was calculated using the combined values from WDI and QEDS dataset.
DefaultLastYear	Default in the last year	CRAG database has the values of debt defaulted by countries along the years, distributed by type of creditor (and the definition of 'default' used by the authors is consistent with much of the literature on sovereign defaults).	The debt value defaulted by country and year was processed and converted into a boolean variable named DefaultThisYear (1 if the country, in that year, had debt defaulted; 0 otherwise). Afterwards, the variables DefaultLastYear, DefaultLast2Years, DefaultLast5Years and DefaultLast10Years were created, assuming the value 1 if the value DefaultThisYear had the value 1 in the previous year/two years/five years/ten years, for the same country, and 0 otherwise.
DefaultLast2Years	In the last two years		
DefaultLast5Years	In the last five years		
DefaultLast10Years	In the last ten years		

Notes: The sources of information used in this work were the World Economic Outlook dataset (WEO) from the International Monetary Fund (IMF), the World Development Indicators (WDI) from the World Bank (WB) and the Quarterly External Debt Statistics dataset (QEDS) from the Joint Effort of the WB and the IMF. The variables BudgetBal_NGDP, GGSB_NPGDP, GGXWDG_NGDP, GGXWDN_NGDP, NGDPDPC and ExtDebtPercGNI are expressed in terms of their year-to-year variation.

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