Lisbon School of Economics & Management
Universidade de Lisboa

MASTER

MONETARY AND FINANCIAL ECONOMICS

MASTER'S FINAL WORK

DISSERTATION

DETERMINANTS OF SOVEREIGN DEBT RATINGS IN THE OECD

DIOGO JANUÁRIO PIMENTEL

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SUPERVISION:

ANTÓNIO AFONSO

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ABSTRACT

This dissertation studies the determinants of sovereign debt rating in the OECD from the two main rating agencies, Moody's and S&P, between 1995-2019. The econometric model applied was the linear and ordered models to explain the explanatory variables. The results show that GDP per capita, Investment, General Public Debt, Unemployment, Government Revenue, and Governance may have a steady impact on sovereign ratings.

JEL: C23; C25; E44; F44; G24; H63

Keywords: Sovereign debt ratings; ratings agencies; linear models; ordered models

GLOSSARY

CPI – Consumer Price Index

EU – European Union

FDI - Foreign Direct Investments

GDP – Gross Domestic Product

GFCF – Gross Fixed Capital Formation

OECD – Organization for Economic Cooperation and Development

OLS – Ordinary Least Squared

S&P – Standard & Poor´s

WB – World Bank

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1. INTRODUCTION

Sovereign credit ratings are the assessments or relative likelihood of the issuer's home country that a borrower will default in its obligation (Cantor, Packer, 1996). Credit ratings are essential to determine a country's financial ability to meet its commitment. According to Afonso et al. (2011), sovereign credit ratings are important in three ways: (1) they serve as a critical determinant of the interest rates a country faces in the international financial markets and therefore of its borrowing costs, (2) they have a constraining impact on the ratings assigned to domestic banks or companies and (3) some institutional investors have lower bounds for the risk they can assume in their investments so they can choose their bond portfolio composition taking into account the credit risk perceived via the rating notations.

Besides what has been said above, Sovereign ratings not only affect bond yields. According to Chen et al. (2016), it affects the growth rate of real per capita gross domestic product responds substantially to changes in sovereign rating revisions via the interest rate and capital flows channels.

According to Cai et al.(2018), sovereign credit ratings of donor and recipient are essential drivers of bilateral FDI flows. Mostly, FDI flows from low-rated donor countries to high-rated recipient countries.

The influence that rating agency has, we should always expect the most straightforward rating quality and transparent methodology. Eijffinger (2012) concluded that rating agencies are lagging markets in their judgment. Their business model is inconsistent as they face significant conflicts of interest and are very opaque in their methodologies. The lack of competition renders the large three rating agencies (Moody; Fitch; S&P) with too strong market position.

Therefore, to understand the determinants of credit rating assignments, where we can demand our policymakers what to do differently, it is necessary to know which affects sovereign credit ratings. This dissertation aims to test the determinants of foreign currency sovereign credit ratings in the 37 Organization for Economic Cooperation and Development (OECD) countries. In this analysis, I researched sovereign debt ratings using rating data from the two main international rating agencies: Moody's and Standard & Poor's (S&P). I have compiled a comprehensive data set on sovereign debt ratings, macroeconomics data, and quantitative and qualitative variables for the 37 Organization for Economic Cooperation and

Development (OECD) countries. I followed the two main strands of literature regarding the econometric strategy: the linear regression methods on a linear transformation of the ratings and my specification through an ordered response framework where the rating scale determined the cut-off points.

My main contribution to the existing literature is the main dataset employed and updating if the agency's rating continues using the same determinants as before. The number of countries utilized (37 countries), reaching four continents and operating data of the last 25 years, where happens several crises like the 1997 Asian Crisis, the 2008-09 economic and financial crisis or the European sovereign debt crisis having a large a dataset improving the quality of my models. In addition, the variables used, where I applied all kinds of variables, not only the usual economic and financial indicators but also qualitative variables.

I find that several essential variables may have a steady impact on sovereign ratings. These are GDP per capita, Investment, General Public Debt, Unemployment, Government Revenue, and Governance. Of these variables, the most important are Unemployment and Governance, confirming that qualitative variables may be as important as the others type of variables.

The remainder of this study is organized as follows. Chapter 2 presents the review of the ratings systems and literature. Chapter 3 describes the explanatory variables and the methodology used. Chapter 4 explains the data and illustrates the results. Finally, chapter 5 will be the conclusions.

2. RATING SYSTEMS AND LITERATURE

2.1. REVIEW RATING SYSTEM

I used sovereign credit ratings available by the two leading international rating agencies, Moody's and Standard & Poor's (S&P). Even though these agencies do not use identical qualitative codes, there is a connection between each agency rating level, as displayed in Table 1. S&P utilizes a similar qualitative letter rating in descending order from AAA to CCC-, while Moody's framework goes from Aaa to Caa3.

Table 1

2.2 LITERATURE REVIEW

A country's sovereign credit rating is vital to its financial system development and openness. The sovereign credit rating reflects the country's perceived willingness and capability to repay its sovereign debts. Thus, such credit ratings are often interpreted as a rating agency's view of the ex-ante risk of sovereign debt repudiation.

Any decision determined by the rating agencies will influence sovereign bond yield. According to Afonso et al. (2012), there are significant responses of state bond yields spreads to changes in rating notations and outlook, particularly within the case of negative announcements (Kenourgios et al., 2020). Additionally, many responses of state yield to declarations that are not anticipated at 1-2 months scope, but there is bi-directional causality among ratings and spreads within 1-2 weeks. There are spillover effects, especially from lower-rated countries to higher-rated countries, and persistence impacts for recently downgraded countries.

Sovereign ratings affect not only government bond yields but also change economic growth. Chen et al. (2016) examined a sample of Standard & Poor's sovereign rating changes for 103 countries over the 31-year 1982-2012. The growth rate of real per capita gross domestic product responds substantially to changes in sovereign rating revisions via the interest rate and capital flows channels. A narrower sovereign bond yield spreads and increased capital inflows are related to upgrades, which stimulate a re-rated country's economic performance, and therefore, the converse holds for downgrades. They saw that a one-notch upgrade (downgrade) causes a rise (decline) of about 0.6% (0.3%) in a re-rated country's five-year average annual growth rates. Besides economic growth, sovereign rating

matters for Foreign Direct Investments. According to Cai et al.(2018), sovereign credit ratings of donor and recipient are essential drivers of bilateral FDI flows where mostly, FDI flow from low-rated donor countries to high-rated recipient countries

As seen above, rating agencies influence should always expect the simplest rating quality and transparent methodology. Eijffinger (2012) determined that this is not the case as he saw the role of credit rating agencies during the 2010-11 EU sovereign debt crisis. The author concluded that rating agencies are lagging markets in their judgment. Their business model is imperfect as they face significant conflicts of interest and are very opaque in their methodologies. The lack of competition renders the large three rating agencies (Moody; Fitch; S&P) with too strong market position.

As Eijffinger (2012) said that the rating agencies are opaque in their methodologies, several studies work out the determinants of the sovereign rating. However, there are several differences within the literature. One major division turns on the relative importance of political as against economic factors influencing credit ratings. Some argue against the inclusion of political variables due to measurement problems. Others found that including political variables added explanatory power to their models.

One of the first studies on sovereign studies was written by Cantor & Packer (1996). Their study explores the determinants and impact of the sovereign rating assigned by the two leading agencies, Moody's, and Standard & Poor's, employing a sample of 49 countries at a specific point in time. They considered eight economic variables: income per capita, growth of GDP, inflation, fiscal balance, external debt balance, external debt, and the indicators for economic growth levels and default history to research the determinants of rating using the ordinary least square method. They found that the credit agencies have a similar weightage of variables in sovereign credit rating evaluation.

Afonso (2003) also conducted a paper to research the determinants of the sovereign credit rating of 81 countries assigned by the same two leading credit rating agencies. The author uses a linear and a logistic transformation of the rating scale. The variables that have statistically significant explanatory power for the rating levels are GDP per capita, the real rate of growth, inflation rate, external debt as a percentage of exports, the level of economic development, and default history. This paper was similar in explaining the determinants with

Afonso et al.(2007) and Jošić & Mlinarić(2018), adding government debt, the government effectiveness indicators and unemployment, respectively.

Bissoondoyal-Bheenick (2005) was one of the first researchers that concluded current economic and financial indicators alone do not determine ratings. In addition, the importance of economic variables is not the same across different rating categories. Economic variables do not carry the same significance for the highly rated countries with an extended financial stability history compared to the low-rated sample of nations with structural changes. Butler & Fauve (2006) were more precise in determining the qualitative determinants where they found that the quality of a nation's legal and political institutions, like the rule of law, political stability, the voice of the people, corruption control (Mellios & Paget-Blanc, 2006), government effectiveness or regulatory quality plays an essential role in determining these ratings, maybe more critical than macroeconomics effects such GDP. Additionally, Chee et al. (2015) discovered that economic freedom is crucial in deciding sovereign credit ratings. Finally, Afonso & Jalles (2019) revealed that even the person within the position of finance minister of a country has importance for sovereign rating. The existence of a more focused delegation-oriented fiscal framework, the Minister of Finance been a woman and a degree within the areas of finance or hard sciences looks to performance a more robust notation than a minister with a law background.

Afonso et al. (2011) divided the determinants into two between short-run and long-run of a variable on the sovereign rating level. The authors use linear and ordered response models, employing an ordered, probit and random effects called probit estimation for the period 1995-2005 from the three leading international rating agencies. Determinants that have a short-run impact on a country's credit rating are GDP per capita, GDP growth, government debt, and government balance meanwhile, government effectiveness, external debt, foreign reserves, and default history are long-run determinants.

Not all agencies' ratings have an equivalent sovereign rating for a particular country. Afonso & Albuquerque (2017) worked the reasons behind that difference in sovereign credit rating. They used random effects ordered, and simple probit approaches for the period 1980-2015. The authors concluded that structural balances and the existence of a default within the last tens of years were the least significant variables where the extent of net debt, GDP per capita, budget balances, and the existence of a default within the previous five years were observed to be the most relevant variables clarifying the rating divergences between

agencies. They also found differences between speculative-grade ratings and good-investment grades. For example, a default in the last two or five years decreases the rating difference between S&P and Fitch. There is a positive rating difference between S&P and Moody's for investment-grade rating, where a rise in external debt leads to a smaller rating gap between these two agencies.

One of the questions that put more curiosity for researchers is whether the rating agency's methodologies were applied before and after the 1997 Asian Crisis or before and after the 2008-09 economic and financial crisis. Afonso et al. (2007) estimate a panel linear regression model separately for the period 1996-2000 and 2001-2006, concluding that the majority estimated coefficients are similar across subperiods apart from the current account that was more important in 1996-2000 and then, a decline within the relevance after the Asian crisis while external reserves were possibly more important later. Some papers provided empirical evidence that the credit rating agencies changed their sovereign credit rating assessment after the start of the European debt crisis or the 2008-09 financial crisis. Reusens & Croux (2017) found that after the financial crisis, the importance of the financial balance, economic development, and external debt increased substantially, and the effect of eurozone membership switched from positive to negative. In addition, GDP growth gained much importance for highly indebted countries, and government debt became more important for countries with low GDP growth rates. Amstad & Packer (2015) also agrees that the debt to GDP ratio, the GDP growth rate, and the exchange rate regime's flexibility has become more critical in recent years. Lastly, Ewa (2020), being a euro area member, negatively affected countries' rating during the crisis, returning to positive in the post-crisis period but with a much weaker effect than before 2008.

Finally, to estimate the best procedure to calculate the determinants of sovereign ratings under an ordered response framework, Afonso et al. (2009) concluded that the main efficient method is the random effects ordered probit estimation. They compared three procedures: ordered probit ordered logit and random effects ordered probit. The last one was the best because a substantial number of variables show up as significant that were not appeared using the opposite two methods, even predicting the rating, all were very similar. Still, the random effects ordered probit outperformed the other models.

3. METHODOLOGY

3.1. EXPLANATORY VARIABLES

Building on the evidence provided by the current literature (Afonso et al., 2007; Cantor & Packer, 1996; Mellios & Paget-Blanc, 2006; Reusens & Croux, 2017), I selected a set of main macroeconomic and qualitative variables that might decide sovereign ratings.

Current account– uncertain impact: a higher current account deficit could suggest an economy's inclination to consume beyond its means, undermining long-term sustainability. Alternatively, it could reflect a rapid accumulation of fixed investment, leading to higher growth and improved sustainability over the medium term.

GDP per capita – a positive impact on rating: Economies that are more prosperous are expected to have more steady institutions to prevent government over-borrowing and be less vulnerable to exogenous shocks.

Investment (GFCF)- positive impact: higher investment could mean a higher business activity in the future, high trust in the economy, and finally, higher GDP growth in the present and the future.

Budget balance – positive impact: large budget deficits absorb domestic savings and suggest macroeconomic disequilibria, negatively influencing the rating level. Continuous deficits may demonstrate problems with governance for policymakers.

General Government debt – negative impact: a higher stock of General government debt implies a higher interest duty and should correspond to a higher risk of default.

Unemployment – negative impact: a nation with lower unemployment tends to have more flexible labor markets, making it more prepared for changes in the economic environment. Additionally, lower unemployment reduces the fiscal duty of unemployment and social benefits while increasing labor taxation.

Government Revenue- uncertain impact: a higher government revenue may indicate that the government collects enough revenue to provide goods and services to its citizens and companies and fulfill their redistributive role but also could indicate a higher tax burden for

companies and citizens, decreasing their purchasing power and less capacity of raising taxes in times of crises.

Government expenditure – uncertain impact: on the one hand, a smaller government could mean fewer taxes for companies and citizens, but lower services provided by the government, and the other hand, a big government might provide more goods and services but a lower capacity of increase it in times of crises.

Inflation – uncertain impact: higher inflation will reduce the government debt in domestic currency, leaving more resources to cover the foreign debt. In addtion, it is symptomatic of problems at the macroeconomic policy level, mainly caused by deficits' monetary financing.

Long-Term Interest Rate- negative impact: a sharper interest rate will mean higher interest payments, reducing the government's capability to fulfill its obligations.

GDP growth – positive impact: higher real GDP growth strengthens the government's ability to repay outstanding obligations.

World Bank Governance Indicators – positive impact: Six indicators like Control of Corruption, Government Effectiveness, Political Stability and Absence of Violence, Regulatory Quality, Rule of Law and Voice and Accountability. High quality of governance should positively affect the ability to service debt obligations.

Eurozone- positive impact: being part of the eurozone monetary union gives credibility and trust since there are rules of belonging (Stability and Growth Pact) and certainty of an independent monetary policy.

Interest payments (% of expenditure)- negative impact: a higher share of interest payments in % of government expenditure could mean high-interest rates or high public debts that could be used in other productive areas, reducing the government's ability to invest where is needed.

Default history – negative impact: previous sovereign defaults may imply a higher probability of getting default again.

Reserves in Months of Imports – uncertain impact: higher foreign reserves should shield the government from defaulting on its foreign currency obligations. On the other hand, it

could mean that the government has confidence that it would not default. Also, it could mean that we are in a high-open economy.

3.2 METHODOLOGY

3.2.1 LINEAR REGRESSION

We will follow a similar approach developed by Afonso et al. (2011) regarding the determination of sovereign rating. We will start through the generalization of the cross-section specification to panel data,

$$R_{it} = \beta X_{it} + \lambda Z_i + a_i + \mu_{it}, \quad (1)$$

where we have: R_{it} – quantitative variable, achieved by a linear transformation; X_{it} is a vector including time-varying variables that include the time-varying explanatory variables described above and Z_i is a vector of time-invariant variables. The index i (i=1,…, N) represents the country, the index t (t=1,…, T) signals the period and a_i holds for the individual effects for each country i. Additionally, We assume that the disturbances μ_{it} are independent across countries and across time. We use three ways to estimate this equation: pooled OLS, fixed effects, or random effects estimation.

3.2.2 ORDERED REGRESSION

Under the same methodology as Afonso et al. (2011), We also estimate the determinants of sovereign debt ratings under a limited dependent variable framework. The ordered regressions is a natural approach for this problem because the rating is a discrete variable and reflects the order in terms of the probability of default. Each rating agency continuously evaluates a country's creditworthiness, embodied in an unobserved latent variable R^*. The underlying variable gets a linear form and depends on the same set of variables as before,

$$R_{it} = \beta X_{it} + \lambda Z_i + a_i + \mu_{it}, \quad (1)$$

We use three ways to estimate this equation: Ordered Probit, Ordered Logit, and Random Effects Ordered probit. Since there is a restricted number of rating categories, the rating agencies will have sixteen cut-off points that get each rating category's limits. The final rating will then be given by the following set of equations.

$$R_{it} = \begin{cases} AAA & if \quad R_{it}^{*} > c_{16} \\ AA+ & if \quad c_{16} > R_{it}^{*} > c_{15} \\ AA & if \quad c_{15} > R_{it}^{*} > c_{14} \\ AA- & if \quad c_{14} > R_{it}^{*} > c_{13} \\ A+ & if \quad c_{13} > R_{it}^{*} > c_{12} \\ A & if \quad c_{12} > R_{it}^{*} > c_{11} \\ A- & if \quad c_{11} > R_{it}^{*} > c_{10} \end{cases}$$

$$R_{it} = \begin{cases} BBB+ & if \quad c_{10} > R_{it}^{*} > c_{9} \\ BBB & if \quad c_{9} > R_{it}^{*} > c_{8} \\ BBB- & if \quad c_{8} > R_{it}^{*} > c_{7} \\ BB+ & if \quad c_{7} > R_{it}^{*} > c_{6} \\ BB & if \quad c_{6} > R_{it}^{*} > c_{5} \\ BB- & if \quad c_{5} > R_{it}^{*} > c_{4} \\ B+ & if \quad c_{4} > R_{it}^{*} > c_{2} \\ B & if \quad c_{3} > R_{it}^{*} > c_{2} \\ B\ - & if \quad c_{2} > R_{it}^{*} > c_{1} \\ <CCC+ & .if \quad c_{1} > R_{it}^{*} \end{cases}$$

4. EMPIRICAL ANALYSIS

4.1 DATA

I built a rating database with sovereign foreign currency rating, attributed by the two leading rating agencies, S&P and Moody's. I cover a period 1995- 2019, because this is the period that I have enough data to build models. The rating of a specific year is the rating attributed on the 31st of December. I group the ratings in 21 categories where the D observations are given the value one, while AAA observations receive the value 21.

The countries selected were the 37 members of OECD (actually there are now 38 countries, Costa Rica joined this year): Australia; Austria; Belgium; Canada; Chile; Colombia; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Israel; Italy; Japan; Korea; Latvia; Lithuania; Luxembourg; Mexico; Netherlands; New Zealand; Norway; Poland; Portugal; Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Turkey; United Kingdom and United States.

Current Account, Budget Balance, Government Debt, Government Revenue, Government Expenditure are a percentage of GDP. GDP per capita is in Dollars, and Investment is in millions of Dollars. Unemployment is in percentage of Active population. Inflation is determined by the consumer price index (CPI). Interest rate is in percentage of 10 years of interest of government debt. GDP growth is in percentage of GDP regarding the previous year. Governance is the average of the 6 World Bank indicators (Voice and Accountability; Political Stability and Absence of Violence; Government Effectiveness; Regulatory Quality; Rule of Law; and Control of Corruption) stretching between -2.5 and 2.5. Interest payments are in percentage of Government Expenditure, and finally, Reserves are in number of months of imports that the national reserves can cover. Regarding the dummy variables like Eurozone, I anticipated two years of each adhesion to the single currency because the agencies will take into account. In addition, the default variable is regarding the last ten years that a country failed with its obligation.

Table 2 sums up what had been said, and the sources used.

(Table 2)

The final data set includes 37 countries with 16 variables making a total of 925 observations. One of the limitations in our analysis is to deal with an unbalanced panel data set due to problems with data availability. Table 3 shows the descriptive statistics of all variables included in the data set.

(Table 3)

Before estimating the model, I estimate the correlation between the variables included in the model. This is a simple method to find multicollinearity because a high correlation (higher than 0,7) is a sign of multicollinearity (Hair et al., 2013). When this happens, it might produce several impacts on the estimation, such as affecting the regression model's predictive ability and the analysis of the regression coefficients and statistical significance tests. Other impacts might be the difficulty of understanding the real effects of each independent variable (Hair et al., 2013). One solution for this issue would be dropping those variables (Wooldridge, 2012) and that was what I did. Initially, I wanted more variables but because of high correlation (Table 5), variables like GDP forecast growth rate (Because of the variable "GDP growth") or the six individual variables of WB governance indicators, demanding I had to create a new variable that is an average between them ("Governance"). For the analysis, I do not report multicollinearity issues between the variables. The strongest correlation is between Interest Payments and Government Debt, which is positive 0,65.

(Table 4)

4.2 LINEAL PANELS RESULTS

4.2.1 RESULTS

The results produced by the panel regressions point to broadly similar regression models across the two rating agencies (see Tables 6 and 7). Given the analytical facts above, the discussion will concentrate on the Pooled OLS estimations. This is supported by the fact that Hausmann (1978) tests reported at the end of each table point to reject random effects regarding fixed effects. Also, we can see that pooled OLS has a higher r-squared than fixed effects. More variables and all its variables have the expected sign. Meanwhile, fixed effects have some variables with the opposite sign like GDP per capita and Budget Balance for S&P and GDP per capita for Moody's. Nonetheless, I also report the fixed effects and random effects results for completeness and comparison purposes.

(Tables 6 and 7)

I describe the results of two models for each rating agency, the unrestricted and the restricted model. While the unrestricted model integrates all variables discussed above, the restricted model contains only the variables found to have a statistically significant impact, a process did by Afonso et al. (2007). Even though the sequence of excluding individual variables in moving from the unrestricted to the restricted regression can influence the final specification, the restricted models presented in the tables are robust to alternative exclusion procedures. As can be seen from the insights detailed toward the finish of each table, the explanatory power of the models is high with R-square values around 70 percent, and it remains nearly steady, moving from the unrestricted to the restricted versions. At the same time, the number of observations increases significantly. In addition, the variables found to be substantial in the unrestricted model mostly remain significant with the identical sign in the restricted edition.

The restricted models show a similar set of explanatory variables across agencies. Moody only adds the Current Account and has a negative impact. A current account deficit indicates foreigners' willingness to cover current accounts through loans and foreign investment, which means that a negative account deficit is associated with high trust borrowers or good economic prospects.

Eurozone dummy has no explanation for both agencies; meanwhile, if a nation has defaulted its debt on the past ten years, it will be penalized by at least six notches.

For the real side, GDP per capita and investment are very significant for both agencies so much that for Moody's, Investment is the most important variable.

Regarding the fiscal variables, for both agencies, government expenditure has a higher explanatory rating than government revenue, and the variables have a positive sign. If a one percentage point increase in the government expenditure raises both agencies by 0,1 notches, for government revenue just between 0,02 and 0,04, the agencies appreciated a more significant state. For government balance has similar value with government revenue, but it needs to be cautious of the dependence of other variables. Surprisingly, general government debt doesn't seem more important than the previous variables. An increase of 5 percentage points increases of debt decrease for both agencies 0,1 notches. Lastly, Governance is the most crucial variable for S&P and one of the most important for Moody's. An improvement of 1 point in this variable will increase 1,2 notches for the two agencies.

Concluding, unemployment is one of the most critical variables, an increase of 5 percentage points will decrease both ratings one notch. Finally yet importantly, we have inflation, wherefore both agencies have a negative meaning that higher inflation for devaluating debts is not a great idea where an increase of 5 percentage points will put down by one notch on the rating.

4.2.2 PREDICTION ANALYSIS

My prediction analysis will concentrate on two elements: the prediction for the rating of each observation in the sample and the projection of movements in the ratings through time.

Prediction with the pooled OLS model was made by rounding the fitted value to the closest integer between 1 and 21.

Table 8 presents an overall summary of the prediction errors.

(Table 8)

The first conclusion is that the Pooled OLS is the method with the best fit, confirming what has been said above. On average, it correctly predicts 32 percent of all observations for the two agencies, 65 percent of the predicted ratings be within one notch, and 84 percent within two notches.

Table 9 presents the total number of sample upgrades (downgrades), the expected number of upgrades (downgrades), the number of upgrades (downgrades) that were exactly predicted by the several models, and the number of upgrades (downgrades) that the several models correctly predicted.

(Table 9)

The Pooled OLS model correctly predicts 37% of downgrades and upgrades. In addition, it predicts more than 20% of the exact downgrades and upgrades. Here, we can notice that the model has lower efficiency rates compared with the others but a slightly higher efficiency regarding upgrades.

The most visible difference among the table is not the number of correctly predicted changes but the total number of predicted changes. The models predict substantially more changes than the changes made by the agencies. For instance, for S&P, while it predicts around 58 upgrades and 49 downgrades, while the Pooled OLS predicts 86 upgrades and 53 downgrades. This strengthens the idea that rating agencies lag behind markets, along the lines discussed in Eijffinger (2012).

4.3 ORDERED RESULTS

4.3.1 RESULTS

Ordered models should provide further perception into the determinants of sovereign ratings. As discussed, they create estimates of the threshold values between rating notches, letting an estimation of the shape of the rating curve.

Like I did on the previous sub-chapter for linear estimation, for ordered also happens the same. Therefore, there are the results for each rating agency of a restricted and unrestricted model. While the unrestricted model integrates all variables discussed above, the restricted model contains only the variables found to have a statistically significant impact (Afonso et al., 2007). Even though the sequence of excluding individual variables in moving from the unrestricted to the restricted regression can affect the final specification, the restricted models presented in the tables are robust to alternative exclusion procedures. There is not an unrestricted model for random affected ordered probit because it was impossible to calculate it on STATA. So, to come up with the model presented, I had to figure each variable and then select those with high explanatory power. All variables could have a statistically substantial influence on each other.

The results from the ordered estimations confirm the findings highlighted above. The core variables associated in the linear regressions also show up with the same sign. In addition, the ordered models suggest the significance of more explanatory variables, particularly for S&P. On the contrary of the linear models, on the ordered models, the variable current account does not appear to be significant; meanwhile, for the variable Reserves, for S&P seems on all three models with different signs between each other (positive for ordered probit and negative of the others two models). Making unclear which sign this variable should be like in chapter 3.1, where there was not an expected sign. Also, we can see that on these models, variables like Interest Payments or Long-Term interest Rate shows to be significant, where for Moody's, an increase of Interest Payments a three percentage points leads to the rise of at least 0,5 notches.

(Tables 10 and 11)

4.3.2 PREDICTION

Like I did in the previous sub-chapter, my prediction analysis will concentrate on two elements: the prediction for the rating of each observation in the sample and the projection of movements in the ratings through time.

Unlike the linear models, here, for the ordered models, I will fit the predicted value and match it up to the cut-off points to determine the expected rating, as shown on the equation (1).

Table 12 presents an overall summary of the prediction errors.

(Table 12)

The random effects ordered probit has the worse value between the three models, and I cannot conclude between ordered probit and ordered logit who is the method with the best fit because they have similar values. We can find out that for Moody's, the models have a superior efficiency rate than for S&P, even we can check that for ordered probit and ordered logit, they achieve correctly 50% of rating, more than 70% within one notch and 86% within two notches. We can also conclude that the ordered models perform higher prediction values than the linear models for all models and both agencies. They correctly reach at least 40% of the rating, more than 60% within one notch, and 70% within two notches meanwhile, for the linear models, that does not happen.

Table 13 presents the total number of sample upgrades (downgrades), the expected number of upgrades (downgrades), the number of upgrades (downgrades) that the several models exactly predicted, and the number of upgrades (downgrades) that the several models correctly predicted.

(Table 13)

The three models have very similar values of at least 45% of the downgrades correctly, and 20% of the downgrades exactly predicted. The upgrades movements have slightly better values, with 25% of the upgrades exactly predicted. Even for Ordered Logit, it achieves for S&P more than half of the upgrades predicted. We can find out that the random effects ordered probit predicts more movements than the other two models. In addition, we can compare between the linear models and the ordered models and conclude that the linear models predict more movements than the ordered and deduce that the linear way might be better capturing the lag of the agencies Eijffinger (2012) than the ordered way. With that conclusion, like what had been said in the linear models, the ordered models predict substantially more changes than the changes made by the agencies. On average, the models predicted 65 downgrades meanwhile S&P and Moody's downgraded 47 ratings. In addition, they predicted 82 upgrades where the agencies rating upgraded 59 ratings.

5. CONCLUSIONS

This dissertation's objective was to study the determinants of sovereign debt rating from Moody's and S&P for the last 25 years (1995-2019) by the 37 countries of the OECD.

Regarding the econometric approach, I used linear regression methods where I suppose that the pooled OLS is the best model to determine the rating. I also applied an ordered regression method where could not determine which model between Ordered Probit and Ordered Logit is allegedly the best model.

I find that several essential variables may have a steady impact on sovereign ratings. These are GDP per capita, Investment, General Public Debt, Unemployment, Government Revenue, and Governance. Of these variables, the most important are Unemployment and Governance, confirming that qualitative variables may be as important as other variables.

The models correctly predict almost 40% of the rating used, more than 60% within 1 notch and almost 80% within 2 notches. They also predict correctly almost half of the downgrades and more than one-third of the upgrades. I considered it satisfactory since agencies use more variables than I did and more qualitative variables. They also use, in some sense, forecast variables.

The critical policy implication of this result is that if we can better understand the most important determinants that the rating agencies use to determine the rating of a country, we may also be to try to improve some indicators.

The main difficulty in studying this topic was the lack of information. I expected the OECD countries, which are supposed to be the more developed countries, to have data for all the variables, but that has not been the case. Still, I gathered a large dataset.

Further research can consider more countries, especially the developing countries. Maybe with more variables, qualitative and quantitative (if we are not in the presence of multicollinearity). Also, implement more forecast indicators in the model and create an average of the most important variables to eliminate short-run impacts.

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Table 1– S&P and Moody's rating systems and linear transformations.

	Characterization of debt and issuer (source : Moody's)	Rating		Linear Transformations	
		S&P	Moody's	Scale 21	Scale 17
	Highest quality	AAA	Aaa	21	17
Investment grade Rating	High quality	AA+	Aa1	20	16
		AA	Aa2	19	15
		AA-	Aa3	18	14
	Strong payment capacity	A+	A1	17	13
		A	A2	16	12
		A-	A3	15	11
	Adequate payment capacity	BBB+	Baa1	14	10
		BBB	Baa2	13	9
		BBB-	Baa3	12	8
Speculative-grade Rating	Likely to fulfil obligations, ongoing uncertainty	BB+	Ba1	11	7
		BB	Ba2	10	6
		BB-	Ba3	9	5
	High credit risk	B+	B1	8	4
		B	B2	7	3
		B-	B3	6	2
	Very high credit risk	CCC+	Caa1	5	1
		CCC	Caa2	4	
		CCC-	Caa3	3	
	Near default with possibility of recovery	CC	Ca	2	
	Default	SD D	C	1	

Source: Moody's (2021) and S&P (2021)

Table 2 – Summary of the explanatory variables

Variable	Definition	Source	Expected Sign
Current Account	Current account balance as percentage of GDP	OECD	+/-
GDP per capita	Nominal GDP per capita in US dollars	OECD	+
Investment	Gross capital formation as percentage of GDP	OECD	+
Budget Balance	Government balance as percentage of GDP	OECD	+
General Debt GDP	General Government Debt over GDP	OECD	-
Unemployment	Unemployment Rate	OECD	-
Government Revenue	General Government Revenue as percentage of GDP	OECD	+/-
Government Expenditure	General Government Expenditure as percentage of GDP	OECD	+/-
Inflation	Average annual consumer price inflation rate	OECD	+/-
Long term interest Rate	10 years of government bonds	OECD	-
GDP Growth	Annual growth rate of real GDP	OECD	+
Governance	The mean of the 6 Worldwide Governance Indicators of World Bank	WB and author's calculations	+
Euro Zone	Dummy: 1 if be part of Euro zone	ECB	+
Interest Payment expenses	Interest payments as percentage of expense	WB	-
Default last 10 years	Dummy: 1 if country defaulted in the past 10 years	Moody's	-
Reserves in months of imports	Total reserves in moths of imports	WB	+/-

Table 3 - Descriptive Statistics.

Variable	Obs.	Mean	Std. Dev.	Min.	Max
Current Account	809	-0.187	5.490	-22.614	16.458
GDP per capita	925	51543.290	16232.760	5501.044	120670.500
Investment	925	240966.100	512873.400	51.695	4454940
Budget	868	-1.815	4.153	-32.065	18.632
General Debt	793	70.821	41.086	6.649	238.726
Unemployment	859	7.701	3.986	1.900	27.492
Revenue GDP	860	41.443	7.538	19.869	59.208
Spending GDP	726	43.828	7.572	20.996	65.103
Inflation	922	3.690	7.519	-4.478	89.113
Long term interest rate	793	4.355	2.611	-0.489	22.498
GDP Growth	923	2.793	3.087	-14.839	25.163
Governance	777	1.058	0.724	-1.701	1.970
Euro Zone	925	0.318	0.466	0.000	1.000
Interest payments	811	6.738	4.666	0.145	39.293
Default 10 years	925	0.00973	0.0982	0.000	1.000
Reserves	887	3.341	3.074	0.00998	19.586

Table 4 – Correlation Matrix of Variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)	1.000															
(2)	0.504	1.000														
(3)	-0.129	0.1693	1.000													
(4)	0.541	0.328	-0.197	1.000												
(5)	-0.0881	-0.0348	0.308	-0.382	1.000											
(6)	-0.2622	-0.406	-0.139	-0.445	0.429	1.000										
(7)	0.302	0.0863	-0.209	0.0964	0.0867	-0.0747	1.000									
(8)	0.1803	-0.0381	-0.159	-0.177	0.394	0.223	0.307	1.000								
(9)	-0.441	-0.284	-0.0244	-0.0412	-0.257	0.117	-0.236	-0.189	1.000							
(10)	-0.319	-0.542	-0.0856	-0.290	0.0643	0.436	-0.142	0.0799	0.360	1.000						
(11)	-0.138	-0.0200	-0.0346	0.248	-0.248	-0.184	-0.0832	-0.378	0.101	-0.251	1.000					
(12)	0.366	0.348	0.0743	0.274	-0.1190	-0.355	0.361	0.124	-0.136	-0.245	-0.0783	1.000				
(13)	0.124	0.219	-0.140	-0.114	0.356	0.214	0.304	0.333	-0.220	-0.195	-0.166	0.0569	1.000			
(14)	-0.251	-0.315	0.367	-0.369	0.650	0.257	-0.0708	0.0979	0.0753	0.410	-0.0546	-0.179	-0.0061	1.000		
(15)	-0.0799	-0.0932	-0.0525	-0.0880	0.403	0.561	0.0644	0.160	-0.135	0.373	-0.187	-0.160	0.148	0.109	1.000	
(16)	0.1775	-0.113	-0.134	0.151	-0.201	-0.110	-0.214	-0.246	-0.0102	0.0224	0.0204	0.155	-0.557	-0.0338	-0.0857	1.000

(1) Current Account; (2) GDP per capita; (3) Investment; (4) Budget Balance; (5) General Debt; (6) Unemployment; (7) Revenue GDP; (8) Spending GDP; (9) Inflation; (10) Long Term Interest Rate; (11) GDP Growth; (12) Governance; (13) Euro Zone; (14) Interest Payment; (15) Default 10 years; (16) Reserves

Table 5 - Correlation Matrix of Excluded variables.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
(1)	1.000							
(2)	0.947	1.000						
(3)	-0.111	-0.111	1.000					
(4)	-0.118	-0.117	0.940	1.000				
(5)	-0.0769	-0.0743	0.650	0.624	1.000			
(6)	-0.0876	-0.0873	0.851	0.921	0.554	1.000		
(7)	-0.141	-0.141	0.960	0.957	0.703	0.900	1.000	
(8)	-0.148	-0.148	0.845	0.917	0.672	0.939	0.905	1.000

(1) GDP Growth Forecast; (2) GDP Growth; (3) Control of Corruption; (4) Government Effectiveness; (5) Political Stability and Absence of Violence/Terrorism; (6) Regulatory Quality; (7) Rule of Law; (8) Voice and Accountability.

Table 6 - Linear Estimation for S&P.

	S&P					
	Pooled OLS		Fixed Effects		Random Effects	
	1	**2**	**3**	**4**	**5**	**6**
Current Account	-0.0193 (-0.77)	-	-0.0121 (-0.71)	-	-0.00434 (-0.26)	-
GDP per capita	3.030e-5*** (3.92)	4.090e-5*** (6.61)	-2.700e-5*** (-3.77)	-2.54e-5*** (-4.74)	-2.200e-5*** (-3.13)	-2.310e-5 (-3.82)
Investment	1.880e-6*** (10.78)	1.49e-06*** (9.01)	3.520e-7 (1.19)	-	6.680e-7** (2.44)	5.330e-7 (2.25)
Budget Balance	0.0392 (1.44)	0.0416* (1.75)	-0.0291 (-1.05)	-0.0462*** (-3.54)	-0.0122 (-0.48)	-0.0498 (-3.66)
General Debt GDP	-0.0350*** (-6.68)	-0.0233*** (-9.20)	-0.0293*** (-6.38)	-0.0335*** (-11.81)	-0.0362*** (-8.30)	-0.0361 (-12.68)
Unemployment	-0.252*** (-7.11)	-0.230*** (-8.82)	-0.144*** (-5.61)	-0.226*** (-11.84)	-0.138*** (-5.46)	-0.207 (-10.39)
Government Revenue	0.0664*** (5.37)	0.0415*** (3.61)	0.0299 (1.38)	0.040** (2.26)	0.0364* (1.85)	0.0447 (2.59)
Government Expenditure	0.104*** (6.81)	0.0886*** (6.66)	-0.00815 (-0.30)	-	0.0214 (0.91)	-
Inflation	-0.201*** (-3.45)	-0.212*** (-5.43)	-0.0273 (-0.92)	-0.0728*** (-2.96)	-0.0296 (-0.97)	-0.0783 (-3.06)
Long term interest Rate	-0.0388 (-0.62)	-	-0.204*** (-5.44)	-0.192*** (-6.73)	-0.212*** (-5.58)	-0.195 (-6.59)
GDP Growth	0.0236 (0.73)	-	-0.0119 (-0.71)	-	-0.00469 (-0.28)	-
Governance	1.193*** (8.78)	1.335*** (9.86)	3.294*** (5.96)	3.532*** (8.20)	2.510*** (7.40)	2.768 (8.73)
Euro Zone	0.366 (1.48)	-	0.729** (2.92)	-	0.703*** (2.86)	-
Interest Payment expenses	-0.0882* (-1.80)	-	-0.0151 (-0.47)	-	-0.00460 (-0.14)	-
Default last 10 years	-4.168*** (-4.44)	-5.806*** (-7.28)	-3.449*** (-5.73)	-2.175*** (-4.38)	-3.608*** (-5.99)	-2.518 (-5.00)
Reserves in months of imports	-0.0641 (-1.42)	-	-0.0243 (-0.58)	-	-0.0282 (-0.69)	-0.0838 (-2.91)
Constant	13.289*** (12.31)	13.163*** (17.14)	18.339*** (12.51)	18.294*** (20.37)	17.538*** (14.67)	18.895 (22.14)
R^2	0.790	0.714	0.596	0.4373	0.655	0.4725
Observations	435	540	435	582	435	566
Hausman Test	-	-	-	-	30.190 (0.007)	36.850 (0.000)

Notes: The t statistics are in parentheses. ***, **, * - statistically significant at the 1, 5 and 10 percent.

Table 7 - Linear Estimation for Moody's.

	Moody's					
	Pooled OLS		Fixed Effects		Random Effects	
	1	**2**	**3**	**4**	**5**	**6**
Current Account	-0.0563** (-2.05)	-0.0448* (-1.90)	-0.0248 (-1.22)	-0.0411*** (-2.74)	-0.0211 (-1.08)	-0.0532*** (-3.09)
GDP per capita	2.660e-5*** (3.16)	3.300e-5*** (4.51)	-4.260e-5*** (-4.96)	-4.430e-5*** (-5.74)	-3.390e-5*** (-4.07)	-4.060e-5*** (-5.07)
Investment	2.170e-6*** (11.38)	1.710e-6*** (9.50)	1.620e-6*** (4.54)	1.630e-6*** (5.11)	1.740e-6*** (5.47)	1.820e-6*** (5.82)
Budget Balance	0.0654** (2.19)	0.0583** (2.04)	-0.0286 (-0.86)	-	0.00180 (0.06)	-
General Debt GDP	-0.0422*** (-7.36)	-0.0266*** (-9.44)	-0.0491*** (-8.91)	-0.0477*** (-10.12)	-0.0561*** (-10.89)	-0.0614*** (-15.53)
Unemployment	-0.260*** (-6.69)	-0.261*** (-8.81)	-0.100*** (-3.25)	-0.0935*** (-3.50)	-0.0996*** (-3.30)	-0.143*** (-5.43)
Government Revenue	0.0665*** (4.92)	0.0229* (1.78)	0.0329 (1.27)	0.0760*** (3.36)	0.0364 (1.60)	-
Government Expenditure	0.138*** (8.26)	0.101*** (6.64)	0.000343 (0.01)	-	0.0477* (1.77)	0.0496** (2.51)
Inflation	-0.114* (-1.79)	-0.238*** (-5.05)	0.0305 (0.85)	-	0.0322 (0.88)	-
Long term interest Rate	-0.0753 (-1.09)	-	-0.319*** (-7.08)	-0.269*** (-6.94)	-0.317*** (-6.97)	-0.330*** (-8.58)
GDP Growth	-0.0101 (-0.29)	-	-0.0543*** (-2.72)	-	-0.0418** (-2.06)	-0.0549*** (-2.68)
Governance	0.883*** (5.94)	1.206*** (7.74)	3.566*** (5.40)	4.332*** (7.10)	2.287*** (6.16)	2.623*** (7.57)
Euro Zone	0.223 (0.82)	-	-0.211 (-0.71)	-	-0.103 (-0.35)	-
Interest Payment expenses	-0.0551 (-1.03)	-	-0.0183 (-0.47)	-	0.00169 (0.04)	-
Default last 10 years	-5.990*** (-5.83)	-7.748*** (-8.80)	-5.347*** (-7.44)	-5.422*** (-8.68)	-5.687*** (-7.96)	-4.392*** (-7.17)
Reserves in months of imports	-0.00456 (-0.09)	-	-0.0849* (-1.71)	-0.122* (-3.23)	-0.0660 (-1.38)	-
Constant	12.675*** (10.73)	14.388*** (16.26)	19.983*** (11.38)	17.296*** (14.82)	18.889*** (13.78)	21.175*** (21.74)
R^2	0.768	0.693	0.587	0.493	0.648	0.563
Observations	436	510	436	509	436	498
Hausman Test	-	-	-	-	32.300 (0.003)	33.920 (0.000)

Notes: The t statistics are in parentheses. ***, **, * - statistically significant at the 1, 5 and 10 percent.

Table 8 - Linear summary of prediction error.

	Estimation Procedures	Obs.	Prediction Error (Notches)							%Correctly Predicted	% Within 1 notch *	% Within 2 notches **
			<-3	-2	-1	0	1	2	>3			
S&P	P-OLS	541	52	38	59	182	100	73	37	34%	63%	84%
	Fixed Effects	583	84	30	53	180	70	66	100	31%	52%	68%
	Random Effects	567	80	30	49	132	116	55	105	23%	52%	67%
Moody's	P-OLS	510	56	35	56	154	125	54	30	30%	66%	83%
	Fixed Effects	509	66	34	54	158	54	67	76	31%	52%	72%
	Random Effects	498	69	26	46	136	88	58	75	27%	54%	71%

Table 9– Linear movement prediction.

	Estimation Procedures	Sample Downgrade	Predicted Downgrade	Downgrade Exactly	Downgrade Similar	Sample Upgrade	Predicted Upgrade	Upgrade Exactly	Upgrade Similar
S&P	P-OLS	49	53	7 (14%)	14 (29%)	58	86	15 (26%)	21 (36%)
	Fixed Effects	49	63	13 (27%)	22 (45%)	62	62	17 (27%)	19 (31%)
	Random Effects	49	77	15 (31%)	26 (53%)	61	81	13 (21%)	17 (28%)
Moody's	P-OLS	48	65	12 (25%)	22 (46%)	53	91	14 (26%)	20 (38%)
	Fixed Effects	43	68	10 (23%)	22 (51%)	53	59	12 (23%)	16 (31%)
	Random Effects	50	77	15 (30%)	30 (60%)	50	60	8 (16%)	12 (24%)

Table 10 - Ordered Estimation for S&P.

	S&P				
	Ordered Probit		Ordered Logit		Random Effects Ordered Probit
	1	**2**	**3**	**4**	**5**
Current Account	0.00301 (0.16)	-	-0.00994 (-0.29)	-	-
GDP per capita	4.210e-5*** (4.97)	2.640e-5*** (4.21)	8.340e-5*** (4.69)	1.058e-4*** (6.87)	-
Investment	1.030e-06*** (7.89)	9.760e-7*** (8.01)	1.860e-6*** (6.64)	1.470e-6*** (5.92)	-8.420e-7** (-2.30)
Budget Balance	0.0508** (2.34)	0.0334** (1.99)	0.0925** (2.44)	0.0838*** (2.75)	-
General Debt GDP	-0.0292*** (-7.05)	-0.219*** (-10.88)	-0.0572*** (-7.10)	-0.0566*** (-9.42)	-
Unemployment	-0.124*** (-5.00)	-0.109*** (-6.38)	-0.216*** (-4.66)	-0.222*** (-6.17)	-0.308*** (-14.66)
Government Revenue	0.0337*** (3.77)	0.0186** (2.31)	0.0567*** (3.57)	0.0222* (1.71)	-0.0819*** (-3.58)
Government Expenditure	0.0684*** (6.04)	0.0561*** (5.98)	0.117*** (5.84)	0.137*** (7.59)	-
Inflation	-0.0861** (-2.22)	-0.0621* (-1.90)	-0.158** (-2.32)	-0.198*** (-4.76)	-0.0937*** (-5.23)
Long term interest Rate	-0.00866 (-0.19)	-0.0521* (-1.65)	-0.0243 (-0.31)	-	-
GDP Growth	0.00170 (0.08)	-	-0.00582 (-0.15)	-	-0.0266* (-1.74)
Governance	0.523*** (5.28)	0.728*** (8.45)	0.863*** (4.86)	0.754*** (4.65)	4.692*** (10.01)
Euro Zone	0.216 (1.17)	0.419*** (2.56)	0.494 (1.46)	-	-
Interest Payment expenses	-0.00928 (-0.27)	-	0.0455 (0.68)	0.134*** (2.95)	-
Default last 10 years	-8.403 (-0.04)	-	-27.353 (-0.03)	-	-
Reserves in months of imports	-0.0586* (-1.81)	0.0751*** (2.96)	-0.0943* (-1.66)	-0.121*** (-2.90)	-0.118*** (-3.64)

Continuation of Table 10.

	S&P				
	Ordered Probit		Ordered Logit		Random Effects Ordered Probit
	1	**2**	**3**	**4**	**5**
Cut 1	-11.139	-3.128	-33.438	-6.035	-11.861
Cut 2	-10.845	-2.838	-32.670	-5.287	-10.947
Cut 3	-9.726	-1.979	-30.553	-3.590	-10.677
Cut 4	-9.266	-1.768	-29.700	-3.176	-9.941
Cut 5	-5.428	-1.550	-17.024	-2.680	-9.775
Cut 6	-0.743	-0.802	-1.445	-0.993	-8.383
Cut 7	-0.268	-0.444	-0.534	-0.111	-7.461
Cut 8	0.380	0.106	0.638	0.937	-6.537
Cut 9	0.711	0.428	1.227	1.557	-5.942
Cut 10	1.112	0.815	1.929	2.357	-5.187
Cut 11	1.939	1.485	3.362	3.772	-4.171
Cut 12	2.427	1.869	4.216	4.673	-3.248
Cut 13	2.918	2.273	5.080	5.392	-2.419
Cut 14	3.192	2.546	5.560	5.976	-1.599
Cut 15	3.583	2.925	6.242	6.541	-0.490
Cut 16	4.072	3.413	7.108	7.363	0.537
R^2	0.327	0.267	0.327	0.303	-
Observations	435	488	435	486	685
Log likelihood	-597.890	-738.148	-597.601	-704.061	-853.821

Notes: The t statistics are in parentheses. ***, **, * - statistically significant at the 1, 5 and 10 percent.

Table 11 - Ordered Estimation for Moody's.

	Moody's				
	Ordered Probit		Ordered Logit		Random Effects Ordered Probit
	1	**2**	**3**	**4**	**5**
Current Account	-0.00190 (-0.10)	-	-0.0116 (-0.31)	-	-0.918*** (-5.87)
GDP per capita	3.750e-5*** (4.59)	3.390e-5*** (4.94)	8.230e-5*** (4.41)	7.060e-5*** (4.66)	-
Investment	5.95e-6*** (10.33)	5.750e-6*** (10.62)	1.100e-5*** (9.93)	1.030e-5*** (10.21)	-
Budget Balance	0.0603*** (2.72)	0.0687*** (3.58)	0.0902** (2.20)	0.109*** (3.04)	-
General Debt GDP	-0.0471*** (-9.61)	-0.0485*** (-11.25)	-0.951*** (-9.56)	-0.0921*** (-10.82)	-
Unemployment	-0.0895*** (-3.53)	-0.0806*** (-3.77)	-0.162*** (-3.50)	-0.141*** (-3.62)	-0.251*** (-11.38)
Government Revenue	0.0393*** (4.12)	0.0415*** (4.61)	0.0716*** (4.32)	0.0733*** (4..69)	-0.0971*** (-4.11)
Government Expenditure	0.0966*** (8.17)	0.102*** (9.65)	0.164*** (7.73)	0.176*** (9.16)	-
Inflation	-0.00771 (-0.19)	-	-0.100 (-0.14)	-	-0.0989*** (-4.01)
Long term interest Rate	-0.0775 (-1.62)	-0.0893** (-2.27)	-0.159* (-1.80)	-0.166** (-2.30)	-
GDP Growth	-0.00827 (-0.37)	-	-0.0308 (-0.80)	-	-0.0442*** (-2.75)
Governance	0.446*** (4.54)	0.481*** (5.30)	0.716*** (4.25)	0.793*** (5.12)	4.737*** (8.96)
Euro Zone	0.100 (0.51)	-	0.404 (1.16)	-	-0.386* (-1.66)
Interest Payment expenses	0.102*** (2.62)	0.153*** (4.49)	0.281*** (3.53)	0.327*** (4.89)	-
Default last 10 years	-7.620 (-0.03)	-	-25.266 (-0.02)	-	-
Reserves in months of imports	-0.0116 (-0.34)	-	-0.0234 (-0.39)	-	-

Continuation of Table 11.

	Moody's				
	Ordered Probit		Ordered Logit		Random Effects Ordered Probit
	1	**2**	**3**	**4**	**5**
Cut 1	-9.669	-1.802	-30.845	-4.446	-9.657
Cut 2	-9.382	-1.550	-30.270	-3.919	-9.388
Cut 3	-8.963	-1.229	-29.418	-3.223	-9.102
Cut 4	-5.055	-0.720	-15.733	-1.888	-8.883
Cut 5	-0.446	0.163	-1.019	0.130	-8.198
Cut 6	-0.145	0.412	-0.490	0.591	-7.735
Cut 7	1.310	1.770	2.189	3.094	-6.400
Cut 8	1.891	2.325	3.299	4.145	-5.517
Cut 9	2.298	2.706	4.058	4.847	-5.026
Cut 10	2.644	3.031	4.686	5.425	-4.450
Cut 11	2.929	3.335	5.189	5.961	-3.906
Cut 12	3.638	4.055	6.452	7.245	-3.143
Cut 13	4.441	4.781	7.871	8.514	-2.092
Cut 14	4.744	5.039	8.409	8.964	-1.668
Cut 15	5.102	5.337	9.050	9.490	-1.100
Cut 16	5.488	5.720	9.740	10.165	-0.633
R^2	0.370	0.351	0.372	0.352	-
Observations	436	471	436	471	665
Log likelihood	-537.811	-582.851	-535.885	-581.728	-848.477

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 1, 5 and 10 percent.

Table 12 - Ordered summary of prediction error.

	Estimation Procedures	Obs.	Prediction Error (Notches)							%Correctly Predicted	% Within 1 notch *	% Within 2 notches **
			<-3	-2	-1	0	1	2	>3			
S&P	Ordered Probit	489	43	48	69	211	64	22	32	43%	70%	85%
	Ordered Logit	487	40	41	80	202	74	21	29	41%	73%	86%
	RE Ordered Probit	736	117	51	75	289	69	78	57	39%	59%	76%
Moody's	Ordered Probit	471	49	38	63	241	42	20	18	51%	73%	86%
	Ordered Logit	471	46	39	66	241	39	23	17	51%	73%	87%
	RE Ordered Probit	666	138	43	79	254	58	31	63	38%	59%	70%

Table 13 - Ordered movement prediction.

	Estimation Procedures	Sample Downgrade	Predicted Downgrade	Downgrade Exactly	Downgrade Similar	Sample Upgrade	Predicted Upgrade	Upgrade Exactly	Upgrade Similar
S&P	Ordered Probit	46	52	10 (22%)	22 (48%)	51	81	13 (25%)	22 (43%)
	Ordered Logit	46	51	9 (20%)	19 (41%)	51	98	16 (31%)	26 (51%)
	RE Ordered Probit	56	94	11 (20%)	26 (46%)	83	111	19 (23%)	26 (31%)
Moody's	Ordered Probit	40	48	8 (20%)	18 (45%)	46	64	11 (24%)	15 (33%)
	Ordered Logit	40	48	10 (25%)	18 (45%)	46	64	11 (24%)	15 (33%)
	RE Ordered Probit	55	97	10 (18%)	25 (45%)	77	76	16 (21%)	21 (27%)