SOVEREIGN RISK RATINGS AND MACROECONOMIC FUNDAMENTALS: A PANEL DATA APPROACH

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Outline

Introduction

The main purpose of our study is to examine the determinants of sovereign risk ratings produced by rating agencies. They are one of the most important devices used in the international financial market to reduce information asymmetry.

It describes a national government's credit risk, an attempt to reflect country-specific risk factors, which may affect an entity's ability to repay its debts in full and on time (Standard & Poors, 2011).

In terms of macroeconomics, countries' indebtedness - i.e., the opportunity costs of their investments - have short-, medium-, and long-term implications for financing and economic policy, and other important decisions. For example, the importance of international credit market conditions to emerging countries such as Brazil is obvious. Because these countries are not self-sufficient in terms of financing, they become net borrowers in international financial markets.

Introduction

Objectives

To investigate patterns of agencies' criteria we will use macroeconomic fundamentals of a sample of countries based on solvency, liquidity, economic development, and stability to estimate parameters and elasticities of those relations.

Use the sovereign risks as criteria to estimate a panel data model, testing fixed and random-effects models as contribution to Rowland (2004). By using this strategy we will test the hipothesys of an eventual differentiation of the coefficients along individual units and/or over time.

Ratings Literature

A rating is an estimation of the probability of future default. Ratings are divided into two types: (1) sovereign risk ratings, which are the object of our study; and (2) corporate risk ratings, which are the risks associated with stocks issued by publicly traded companies around the world. The sovereign rating is an indicator that expresses the risk assumed by foreign investors when purchasing bonds from a particular country.

Standard & Poor's, Moody's Investors Service, and Fitch IBCA are the major rating agencies, representing approximately 80% of the ratings market, as the ratings market is concentrated and characterized by oligopolistic competition (Bone, 2009). This market structure implies that each agency processes information with different returns of scale, resulting in barriers to entry.

Ratings Literature

Table : Rating Systems

Classification	Companies			Numerical
	Moody's	S&P	Fitch	Scale
Investment Grade	Aaa	AAA	AAA	1
	Aa1	AA+	AA+	2
	Aa2	AA	AA	3
	Aa3	AA-	AA-	4
	A1	A+	A+	5
	A2	A	A	6
	A3	A-	A-	7
	Baa1	BBB+	BBB+	8
	Baa2	BBB	BBB	9
	Baa3	BBB-	BBB-	10
Speculative	Ba1	BB+	BB+	11
	Ba2	BB	BB	12
	Ba3	BB-	BB-	13
	B1	B+	B+	14
	B2	B	B	15
	B3	B-	B-	16
	Caa1	CCC+	CCC+	17

Ratings Literature

According a survey of studies there are serious microeconomic and macroeconomic problems in this market:

Cantor and Packer (1996)

Ferri, Liu and Stiglitz (1999)

Reinhart (2001)

Partnoy (2002)

Sy (2009)

Arezki et al (2011)

Gomes, Furceri and Afonso (2011)

Kiff et al (2012)

Doluca (2014)

Model

Panel data models are used when longitudinal observations are available - i.e., for individuals over a period - which yields information about possible individual heterogeneity. According to Wooldridge (2002), these models are widely used to investigate both structural changes and transition dynamics.

It has some important advantages, including the ability to mitigate collinearity problems and omitted variable bias while increasing degrees of freedom. It allows the analysis of both intertemporal dynamics and individual variable characteristics to better control for the effects omitted variables (Cameron, 2005).

Model

Estimated Model

To better understand the econometric methodology for static panel data, the basic equation that represents the estimated model is:

$$R_{i,t} = \alpha_{i,t} + \beta_{i,t} X_{i,t} + \epsilon_{i,t} \tag{1}$$

where R is the rating, x_{it} is the matrix of explanatory variables with k regressors without the constant, i=1, ..., N refers to cross-section unit (country), t=1,...,T refers to time (year), and ϵ_{it} is the error term such that $\epsilon_{it} \sim N(0, \sigma^2)$ in the absence of autocorrelation of *i.i.d.* (independently and identically distributed) residuals.

The parameter $\alpha_i \sim N(0, \sigma^2)$ is a stochastic term inherent to the individual units that captures the individual effects and may or may not be correlated with the vector of explanatory variables.

Hausman Test

If $Cov(\alpha_i, x_{ij}) \neq 0$, a fixed effects model should be estimated. The unobserved effect may be eliminated based on the assumption that $E(\epsilon_{it}|x_i, \alpha_i) = 0$. This situation is known as strict exogeneity.

Now we must chose between the random and fixed effects:

1. Random Effects

$$\hat{\beta} = \left(\sum_{k=1}^{N} X_i' \hat{\Omega}^{-1} X_i \right)^{-1} \left(\sum_{k=1}^{N} X_i' \hat{\Omega}^{-1} Y_i \right) \tag{2}$$

2. Fixed Effects

$$\hat{\beta} = \left(\sum_{k=1}^{N} \sum_{k=1}^{T} X_i X_i' \right)^{-1} \left(\sum_{k=1}^{N} \sum_{k=1}^{T} X_i Y_i \right) \tag{3}$$

Data

The sample was composed of the long-term foreign currency ratings assigned to emerging countries by Standard & Poor's from 1989 to 2011. Overall, 33 countries are considered: Argentina, Bolivia, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Egypt, El Salvador, Guatemala, India, Indonesia, Jamaica, Kazakhstan, Lebanon, Malaysia, Mexico, Mongolia, Morocco, Pakistan, Panama, Paraguay, Peru, Romania, Russia, South Africa, Thailand, the Philippines, Tunisia, Turkey, Uruguay, and Venezuela. Importantly, data access issues restricted the sample, primarily due to solvency and liquidity measures. Of the 23 ratings assigned by this agency (Table 1), 16 were included in the sample, i.e., the AAA, AA+, CCC+, CCC, C, and D ratings were included.

Data

The variables used as macroeconomic determinants of ratings in this study were collected from the World Bank's annually updated World Development Indicators database. Because these observations refer to end-of-period statistics, end-of-period ratings were used for countries whose ratings were updated more than once per year. That is, when Standard & Poor's reviewed a country's rating more than once per year, only the last was used in the estimations. To simplify further reading of parameters, Table 2 summarizes the abbreviations for the variables included in the models.

Data

Table : List of Variables

Group	Variable	Notation
	Ratings	R
Solvency	Long-term debt as a percentage of GDP	LTD/GDP
Liquidity	Level of total reserves as a percentage of GDP	R/GDP
	Total external debt as a percentage of exports of goods and services	ED/EXP
	Total debt service as a percentage of exports of goods and services	TDS/EXP
Development and Economic Stability	Growth rate of GDP per capita	G-GDP
	Evolution of the level of consumer prices	CP
	Economic openness index	EOI

Results

Table : Descriptive statistics of the variables analyzed

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
Ratings	11.16727	3.208768	4	22
LTD/GDP	0.335588	0.178071	0.030401	1.280983
R/GDP	0.175027	0.14652	0.012215	1.19413
ED/EXP	1.432037	0.85142	0.235754	4.5252
TDS/EXP	0.198022	0.135956	0.019754	1.15308
G-GDP	0.031139	0.041129	-0.14385	0.161962
CP	0.148751	0.895237	-0.01408	20.75887
EOI	0.697951	0.387886	0.149329	2.204074

Results

Table : Econometric Models of Ratings

	Fixed Effects			System GMM		
	Coef.	**Stand. Error**	**t**	**Coef.**	**Stand. Error**	**z**
Rit-1				0.658875	0.04306	15.3*
LTD/GDP	5.870104	1.073168	5.47*	2.969927	1.00682	2.95*
R/GDP	-9.82986	1.419841	-6.92*	-1.02699	1.042333	-0.99
ED/EXP	-0.35054	0.273669	-1.28	0.484701	0.274583	1.77***
TDS/EXP	0.695568	1.303729	0.53	-3.32766	2.165732	-1.54
G-GDP	-6.58869	2.474802	-2.66*	-7.31202	3.368324	-2.17**
CP	0.242964	0.100207	2.42**	3.293819	1.684917	1.95**
EOI	1.01402	0.916713	1.11	-0.75857	0.319174	-2.38*
CONS	10.74337	0.678492	15.83*	3.242181	0.509467	6.36*
No. of observations=550				No. of observations=516		
R2 = 0.2267				No. of groups: 33		
F test 21.36 (0.0000)				No. of instruments: 31		
Hausman test 22.76 (0.0019)				AR(1) (0.003)		
p-values in parentheses				AR(2) (0.724)		
*not rejected at 1%,significance.				Sargan (0.233)		
**not rejected at 5%,significance.				Hansen (0.540)		

Results

The Hausman test indicates that fixed effects provide a better fit because it rejects the null hypothesis of noncorrelation between the specific effects and the explanatory variables. Comparing the results of the fixed effects model with those of the system GMM, it appears that with the inclusion of the lagged dependent variable, total reserves level as a percentage of GDP, which proxies for a country's solvency, was no longer statistically significant.

In contrast, the estimates for the EOI and total external debt as a percentage of exports of goods and services became statistically significant.

Results

The estimation of the dynamic panel was performed using a 2-step system GMM model with robust errors to address the problem of proliferation of instruments, eliminating overidentification. The overidentification restriction is due to the number of instruments, which is smaller than the number of groups investigated. The model specification tests at the 5% significance level indicated that the estimation has no second-order autocorrelation problem [AR(2)], and the Hansen test confirms the validity of the instruments used. The difference-in-Hansen test indicates that the instruments are exogenous.

Final Remarks

The macroeconomic variables that had a significant impact on sovereign risk ratings included development and economic stability proxies - i.e., the growth of GDP per capita, the evolution of the CP level and the EFI - and solvency and liquidity proxies - i.e., long-term debt as a percentage of GDP and total external debt as a percentage of exports of goods and services, respectively.

Based on the magnitude of the estimated coefficients, promoting income growth and fighting inflation, which are associated with discipline in tax policy, suggest an optimal strategy for maintaining investment-grade ratings.

Final Remarks

The growth of GDP per capita and the evolution of the CP level indicate a country's ability to generate income and thus strengthen its development process, whereas the discipline of fiscal policy indicates a country's ability to honor its financial commitments.

Efforts to improve the model specification are suggested for future studies, which can occur through more robust statistical and econometric procedures. In this sense, it is possible create controls for some variables, modeling counterfactual estimators, try Markov switching with weighted regimes determination for panel data, survival analysis, or modeling function approximation whith data panel techniques.