Determinants of Spread, Credit Ratings and Creditworthiness for Emerging Market Sovereign Debt: A Follow-Up Study Using Pooled Data Analysis

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Abstract

The study presented here is a follow-up study to Rowland and Torres (2004), who used a panel data framework together with data from 16 emerging market issuers to identify the determinants of the spread and the creditworthiness. Since many new issuers of emerging market sovereign debt have emerged recently, we can by using data from one single point in time, end of July 2003, expand our country set to 29 for the analysis of the spread and around 50 for the analysis of the credit ratings and the creditworthiness. We will use an OLS regression framework for the empirical analysis. The study identifies some seven variables that play a role in determining ratings, creditworthiness and spreads. These include the GDP per capita, the economic growth rate, the inflation rate, external-debt ratios, debt-service ratios, the level of international reserves, and the openness of the economy. Emerging market policy makers and investors should pay extra attention to these variables when defining economic policies and evaluating bond issues.

Contents

1 Introduction

The study presented in this paper is a follow up study to *Determinants of Spread and Creditworthiness for Emerging Market Sovereign Debt: A Panel Data Study* by Peter Rowland and José Luis Torres.[1] They are using a panel data framework and a cross section of 16 countries to identify the determinants of the sovereign spread as well as of the sovereign creditworthiness represented by the Institutional Investor's creditworthiness index.

By using spread data from a recent single point in time instead of time series data for several years, we are able to increase the cross section of countries from the 16 used by Rowland and Torres to 29, since a number of countries lately has been added to the JP Morgan EMBI Global composite, used both in this study and by Rowland and Torres to represent the sovereign spread for the individual countries.

The study presented here uses the framework of the seminal paper by Richard Cantor and Frank Packer, *Determinants and Impact of Sovereign Credit Ratings*.[2] We will identify the determinants of the sovereign spread, the sovereign credit ratings of Standard & Poor's and Moody's, and of the Institutional Investor's creditworthiness index using data from 29 July 2003 as well as in the case of the creditworthiness index, from March 2001. In contrast to Cantor and Packer, who uses the whole spectrum of rated countries, we will only use the subset defined by the rated developing countries.

The paper is organised as follows: Chapter 2 defines the sovereign spread, credit ratings and creditworthiness measures used in the study. Chapter 3 discusses the potential explanatory variables and defines the datasets used. In chapter 4 the estimations and the results are presented, and chapter 5 concludes the paper.

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[1] Rowland and Torres (2004).
[2] Cantor and Packer (1996).

2 Credit Ratings, Creditworthiness and the Sovereign Spread

We start by defining credit ratings, creditworthiness and the sovereign spread, and identifying the relationship between them. The spread, credit ratings and creditworthiness are defined and discussed in sections 2.1, 2.2 and 2.3 respectively, and section 2.4 discusses how the three are related. The relevant previous studies in the area are briefly surveyed in section 2.5, which also discusses more in detail the results of Rowland and Torres (2004) and Cantor and Packer (1996), which both are highly relevant for the study conducted here.

2.1 The Sovereign Spread and the JP Morgan EMBI

The yield spread of a US dollar denominated bond is typically defined as the difference in yield between that bond and a benchmark US Treasury bond of a similar maturity[3] and is normally expressed in basis points.[4] The return on emerging market issues is normally expressed as their spread rather than their absolute yield.[5]

In line with Rowland and Torres (2004), we will throughout this paper use the EMBI[6] Global spread composites, as calculated by JP Morgan, to represent the sovereign spread for the different countries studied. The EMBI Global composites are weighted averages of the spreads of US dollar-denominated individual bonds issued by a particular emerging market country.[7] Some studies have selected a benchmark bond for each country studied

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[3] Normally the latest issued US Treasury of that maturity. It can alternatively be defined as the spread to the US Treasury yield curve at the exact maturity of the emerging market bond.
[4] One basis point is 1/100 of a percent.
[5] The return of high-grade US corporate issues is normally expressed as the spread over US Treasuries, while that of high-yield (speculative grade) corporate issues normally is expressed as the absolute yield. However, Vine (2001) questions whether it is wise to express the return of emerging market sovereign issues as a spread rather than a yield, since these are generally speculative-grade issues, and expressing their return as a spread ties them to the US Treasury yield, with which they have little in common.
[6] Emerging Market Bond Index.
[7] The EMBI Global composite, which was introduced in August 1999, is the most comprehensive emerging markets debt benchmark. It followed the EMBI and EMBI Plus, where the former is a pure Brady bond composite, and the latter includes eurobonds as well. The EMBI Global includes, in addition to Brady bonds and eurobonds, US dollar-denominated traded loans and local market debt instruments issued by

and used its spread, others have looked at the spreads of several individual bonds. Since we are in this study looking at the spread related to the risk of a sovereign issuer rather than the spreads of individual bonds, the EMBI Global suits our purpose better than using individual bonds. The EMBI Global, furthermore, controls for floating coupons, principal collateral, rolling interest guarantees, and other unusual features of the bonds, and it is computed for all the main emerging market sovereign issuers, making comparisons easier.

2.2 The Credit Ratings of Moody's and Standard & Poor's

> The rating classification of sovereign public debt is, somehow, and assessment of the economic, financial and political situation of an economy, given also a measure of the country development. In fact, higher default risk premiums are associated with lower rating and higher government yields, increasing therefore the financing cost of the government.[8]

To ease their own access to international capital markets, as well as the access of other issuers domiciled within their borders, governments generally seek to get rated. This is because rated securities are generally preferred over un-rated securities by many investors, in particular in the United States. Sovereign ratings are also of importance because they affect the ratings of other issuers of the same nationality. Private companies, local governments and provincial governments seldom receive ratings higher than that of their country of domicile.[9]

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sovereign and quasi-sovereign entities. Only issuers from low- and middle-income countries are included in the index, and only issues with a time to maturity of 2.5 years or more and a current face value outstanding of at least USD 500 million. The index is calculated as an average weighted by the current market capitalisation of the individual issues. See JP Morgan (1999) for a further discussion on how the index is defined.

[8] Afonso (2002), p. 3.
[9] See Cantor and Packer (1996), p. 38.

Table 2.1. The rating systems of Standard & Poor's and Moody's

	Rating	
S&P	Moody's	Characterisation of debt and issuer

Investment-grade ratings

AAA	Aaa	Bonds, which are Aaa, are judged to be of the best quality. They carry the smallest degree of investment risk and are generally referred to as *gilt edged*. Interest payments are protected by a large or by an exceptionally stable margin and principal is secure. While the various protective elements are likely to change, such changes as can be visualized are most unlikely to impair the fundamentally strong position of such issues.
AA+ AA AA-	Aa1 Aa2 Aa3	Bonds, which are rated Aa, are judged to be of high quality by all standards. Together with the Aaa group they comprise what are generally known as high-grade bonds. They are rated lower than the best bonds because margins of protection may not be as large as in Aaa securities or fluctuation of protective elements may be of greater amplitude or there may be other elements present which make the long-term risk appear somewhat larger than the Aaa securities.
A+ A A-	A1 A2 A3	Bonds, which are rated A, possess many favourable investment attributes and are to be considered as upper-medium-grade obligations. Factors giving security to principal and interest are considered adequate, but elements may be present which suggest a susceptibility to impairment some time in the future.
BBB+ BBB BBB-	Baa1 Baa2 Baa3	Bonds, which are rated Baa, are considered as medium-grade obligations (i.e., they are neither highly protected nor poorly secured). Interest payments and principal security appear adequate for the present but certain protective elements may be lacking or may be characteristically unreliable over any great length of time. Such bonds lack outstanding investment characteristics and in fact have speculative characteristics as well.

Speculative-grade ratings

BB+ BB BB-	Ba1 Ba2 Ba3	Bonds, which are rated Ba, are judged to have speculative elements; their future cannot be considered as well assured. Often the protection of interest and principal payments may be very moderate, and thereby not well safeguarded during both good and bad times over the future. Uncertainty of position characterises bonds in this class.
B+ B B-	B1 B2 B3	Bonds, which are rated B, generally lack characteristics of the desirable investment. Assurance of interest and principal payments or of maintenance of other terms of the contract over any long period of time may be small.
CCC+ CCC CCC-	Caa1 Caa2 Caa3	Bonds, which are rated Caa, are of poor standing. Such issues may be in default or there may be present elements of danger with respect to principal or interest.
CC	Ca	Bonds, which are rated Ca, represent obligations, which are speculative in a high degree. Such issues are often in default or have other marked shortcomings.
C	C	Bonds, which are rated C, are the lowest rated class of bonds, and issues so rated can be regarded as having extremely poor prospects of ever attaining any real investment standing.

Source: Moody's

Even if there are a large number of credit rating agencies, the market is totally dominated by Moody's Investors Service, and Standard & Poor's. The two are in between them responsible for around 80 percent of the credit rating market.[10] Even if the two agencies use different symbols in expressing the ratings, they use the same rating scale, as shown in table 2.1.

2.3 Institutional Investor's Creditworthiness Index

Institutional Investor's Creditworthiness Index is a survey-based measure of the perceived creditworthiness of a large number of countries.[11] This index has been computed and published twice a year since 1979 in the March and September issues of the Institutional Investor magazine. The survey represents the responses of between 75 and 100 bankers, that are asked to rate each country on a scale of 0 to 100 with regards to what they perceive as the default risk of the country, where 100 represents no risk of default. Institutional Investor then computes the average of these individual ratings weighted by its perception of each bank's credit analysis sophistication and level of global prominence.

2.4 Relationships between Credit Ratings, Creditworthiness and the Spread

Figure 2.1 illustrates a simplified model describing the relationships between the fundamental determinants, the creditworthiness, the market sentiment and the sovereign spread.[12] The creditworthiness of a country should, by definition, reflect the medium to long-term risk that the country will default on its outstanding sovereign debt. This risk depends on a number of economic variables, but also on political and social factors, such as, for example, the stability of the current political system. In this study we will deal
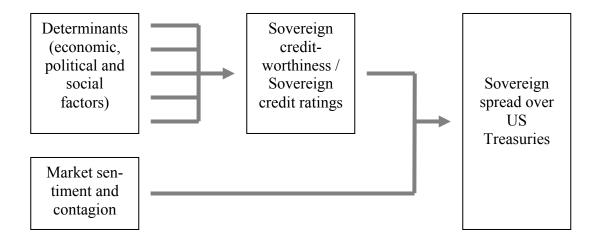
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[10] Afonso (2002), p. 4.
[11] See also Erb, Harvey and Viskanta (1996).
[12] This section is based on the discussion in Rowland and Torres (2004).

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only with the economic variables, since political and social factors normally are difficult to quantify and measure.

Figure 2.1: Relationships between creditworthiness and spread in a simplified model

The sovereign credit ratings as defined by Standard & Poor's and Moody's as well as the Institutional Investor's creditworthiness index are all different measures of the sovereign creditworthiness and should in principle be determined by the same variables. One could, nevertheless, argue that the credit rating agencies are doing a more thorough analysis of the countries than the bank's credit analysts in general, and that the credit ratings, therefore, should be a better measure of the creditworthiness than the creditworthiness index computed by Institutional Investors.

The spread between the yield of a particular emerging market sovereign issue and a US Treasury of comparable maturity, relates to the higher yield that investors demand to take on the larger default risk that the emerging market issue carries over the US Treasury. At a certain point in time, two emerging market issues of similar default risk, which implies that the issuers are of similar creditworthiness, should trade at equal spreads over US Treasuries. However, the same issue might trade at different spreads at different points in time, even if the creditworthiness of the issuer remains the same. This is because
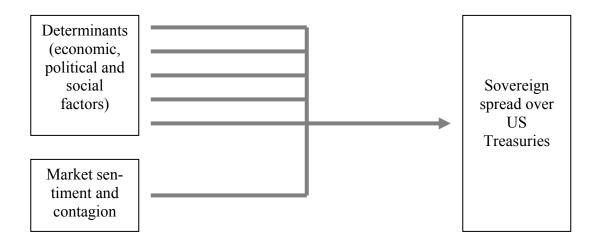
investors might demand a different spread at different points in time to take on the same risk. This is because of changes in what we here refer to as the *market sentiment*, which we define as the compensation demanded by investors on average to take on a unit of risk, and this is directly related to the risk averseness of investors. Contagion and spill-over also plays an important part, in the sense that investors tend to group issuers with similar characteristics together, so that an increase in the spread of one such issuer translates into a spread increase of the others.

Both market sentiment and contagion are time dependent variables, and since we are in this study only using data from a specific point in time, we can assume that both market sentiment and global emerging market contagion will have the same effect on all countries studied.[13] These variables will, consequently, only influence the result when time series data is used, and we will thus assume that neither contagion nor market sentiment will have any systematic influence on the results.

If the sovereign creditworthiness in figure 2.1 is omitted, the model simplifies to that illustrated in figure 2.2. The sovereign spread is then directly determined by a number of economic variables together with the market sentiment.

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[13] It is, nevertheless, possible to envisage that regional contagion could play a part and, indeed, have a significant influence on the results even in this study. Regional contagion is, however, difficult to model and to measure in the context of this study, and it has, therefore, been omitted.

Figure 2.2: Determinants of the spread in a simplified model

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┌────────────────┐
│  Determinants  │─────────────────┐
│   (economic,   │─────────────────┤       ┌──────────────┐
│ political and  │─────────────────┤       │              │
│     social     │─────────────────┤       │  Sovereign   │
│    factors)    │─────────────────┼──────▶│ spread over  │
└────────────────┘                 │       │     US       │
                                   │       │  Treasuries  │
┌────────────────┐                 │       │              │
│ Market sen-    │─────────────────┘       └──────────────┘
│ timent and     │
│  contagion     │
└────────────────┘
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2.5 Previous Studies

Rowland and Torres (2004) present an extensive survey of the literature on the determinants of the sovereign spread and sovereign credit ratings, which is summarised in tables 2.2, 2.3 and 2.4.

Table 2.2. Single-country studies of the sovereign spread

Country, Regression Technique and Data Sample	Significant explanatory variables
Budina and Manchew (2000)	
Bulgaria Cointegration framework Monthly data from Jul 1994 to Jul 1998	Gross foreign reserves (-) Exports (-) REER (+) Mexico's nominal exchange rate (+)
Nogués and Grandes (2001)	
Argentina Estimation technique: Pesaran et. al. (2001) Monthly data from Jan 1994 to Dec 1998	EMBI total-return index Mexico (-) External debt service/Exports (+) GDP growth rate (-) Fiscal balance (-) 30-year US Treasury yield (-)
Rojas and Jaque (2003)	
Chile OLS regression technique Monthly data from Apr 1999 to Jul 2002	Short-term debt/Reserves (+) Total external debt/Reserves (+) Exports (-) Economic activity (-) US Federal Funds rate (+)

Note: Budina and Mantchev (2000) use the bond price rather than the spread as the dependent variable. They concluded that, in the long run, gross foreign reserves and exports had a positive effect on bond prices, and the real exchange rate and Mexico's nominal exchange rate depreciation had a negative effect. We have in this table switched the signs on the explanatory variables, to make them comparable to the other studies. If a variable has a positive impact on the bond price, it has a negative impact on the spread, and vice versa.

Table 2.3a. Cross-country studies of the sovereign spread

Regression Technique and Data Sample	Significant explanatory variables
Rowland and Torres (2004)	
Panel data technique 16 emerging market sovereign issuers Annual data from 1998 to 2002	GDP growth rate (-) Total external debt/GDP (+) Total external debt/Exports (+) Foreign reserves/GDP (-) Exports/GDP (-) Debt service/GDP (+)
Goldman Sachs (Ades et. al. (2000))	
Panel data technique 15 emerging market sovereign issuers Monthly data from Jan 1996 to May 2000	GDP growth rate (-) Total external amortizations/Reserves (+) Total external debt/GDP (+) Fiscal balance/GDP (-) Exports/GDP (-) REER misalignment (+) LIBOR (+) Default history (+)
Eichengreen and Mody (1998)	
OLS regression on pooled data Issue spread, 998 emerging market bonds Both corporate and sovereign issues Period: 1991-1996	Issue size (-) Private placement (+) Credit worthiness (Institutional Investor) (-) Debt/GDP (+) Debt service/Exports (+)
Min (1998)	
OLS regression on pooled data Dummy variable model Issue spread, 505 emerging market bonds Both corporate and sovereign issues Period: 1991-1995	Private issuer (+) Total external debt/GDP (+) Foreign reserves/GDP (-) Debt service/Exports (+) Growth rate of imports (+) Growth rate of exports (-) Net foreign assets (-) CPI inflation rate (+) Terms-of-trade index (-) Nominal exchange rate adjusted by CPI (+) Maturity (-) Issue size (-)

Table 2.3b. Cross-country studies of the sovereign spread (continued…)

Regression Technique and Data Sample	Significant explanatory variables
Edwards (1983)	
Panel data technique Random effects components, pooled data Loans granted to 19 developing countries Public and publically guaranteed loans Eurocredit Market 1976-1980	Reserves/GNP (-) Debt/GNP (+) Debt service/Exports (+) Investment/GNP

Table 2.4. Cross-country studies of the determinants of credit ratings

Regression Technique and Data Sample	Significant explanatory variables
Cantor and Packer (1996)	
OLS regression on pooled data 35 developed and developing countries Data as of 29 Sep 1995	GDP per capita (+) GDP growth rate (+) Inflation rate (-) External debt (-) Economic development (+) Default history (-)
Afonso (2002)	
OLS regression on pooled data Linear and logistic transformation of credit ratings 81 developed and developing countries Data as of June 2001	GDP per capita (+) GDP growth rate (+) Inflation rate (-) External debt/Exports (-) Economic development (+) Default history (-)

Note: Both these studies investigate the determinants of the credit ratings. The parameter estimates will, therefore, have the opposite sign of the determinants of the spread. If a variable has a positive impact on the credit rating, it should have a negative impact on the spread and vice versa. Both studies, furthermore, use the credit ratings of Standard & Poor's and Moody's.

Of these previous studies, two are of particular relevance for this study: Rowland and Torres (2004) itself, and Cantor and Packer (1996).

Rowland and Torres (2004) investigated the determinants of the spreads of 16 emerging market sovereign issuers, using a panel data technique. They used annual data from 1998 up until 2002, and concluded that the GDP growth rate, the external-debt-to-GDP ratio, the external-debt-service-to-GDP ratio, the debt-to-exports ratio, the reserves-to-GDP ratio and the exports-to-GDP ratio all had significant influence on the spread with the expected sign. Argentina, Russia and Ecuador were all excluded from the data sample, since these countries defaulted during the period, and their bonds, therefore, traded at excessive spreads. The authors continued to investigate the determinants of the sovereign creditworthiness as defined by the Institutional Investor's creditworthiness index. Again they found the GDP growth rate, the debt-to-GDP ratio, the reserves-to-GDP ratio, and the debt-to-exports ratio to have significant impact on the creditworthiness. CPI inflation and a default dummy was also found to be significant determinants of the creditworthiness, while, in contrast to the spread regressions, the exports-to-GDP and debt-service-to-GDP ratios were not found to significantly impact the creditworthiness. The results are summarised in table 2.5.

Table 2.5. Significant explanatory variables as identified by Rowland and Torres (2004)

Model	Growth	Debt / GDP	Reserves / GDP	Debt / Exp	Inflation	Exports / GDP	Debt service / GDP	Default
Spread I	●	●				●		
Spread II	●		●	●			●	
CWI I	●	●	●					●
CWI II	●			●	●			●
Total	4	2	2	2	1	1	1	2

Note: Rowland and Torres (2004) identified four different models, where the dependent variable in the first two models were the sovereign spread and in the last two the creditworthiness index (CWI) as computed by Institutional Investor.

Cantor and Packer (1996) investigated the determinants of ratings for a cross section of sovereign bonds. They used a linear transformation on the ratings and found with OLS estimations that the per-capita income, GDP growth rate, inflation rate, external debt, economic development and default history all are significant in explaining the ratings of 49 developed and developing countries in September 1995. A regression of the spreads of the most liquid Eurodollar bonds of 35 countries and eight economic determinants, showed that while the determinants explained about 86 percent of the spread variation, the credit ratings alone could explained as much as 92 percent, implying that ratings appeared to provide additional information to that contained in macroeconomic country statistics. Table 2.6 summarises the results yielded by the study.

We will in this study use the same econometric framework as Cantor and Packer (1996), but instead of using the full spectrum of rated countries, we will only use the subset defined by developing countries.

Table 2.6. Determinants of sovereign credit ratings according to Cantor and Packer (1996)

Explanatory Variable	Dependent Variable	
	Rating Moody's	Rating S&P
Constant	3.408	-0.524
	(1.38)	(-0.22)
GDP per capita	**1.027**	**1.458**
	(4.04)	**(6.05)**
GDP growth rate	0.130	**0.171**
	(1.54)	**(2.13)**
Inflation rate	**-0.630**	**-0.591**
	(-2.70)	**(-2.67)**
Fiscal balance / GDP	0.049	0.097
	(0.82)	(1.71)
Current account balance / GDP	0.006	0.001
	(0.54)	(0.05)
External debt / Exports	**-0.015**	**-0.011**
	(-5.36)	**(-4.24)**
Developed country (dummy)	**2.957**	**2.595**
	(4.18)	**(3.86)**
Default since 1970 (dummy)	**-1.463**	**-2.622**
	(-2.10)	**(-3.96)**
No of observations	49	49
Adjusted R^2	0.905	0.926
Standard error	1.325	1.257

Note: T-statistics are in parentheses. Parameter estimates that are significant at the 5 percent level are indicated in bold.

3   Determinants of Ratings, Creditworthiness and Spreads

This chapter defines and discusses the possible explanatory variables of the credit ratings, the creditworthiness and the spread, while the empirical analysis is presented in the next chapter. Section 3.1 identifies a number of potential determinants, which will be used in the empirical analysis, and section 3.2 defines the data set used for the analysis.

3.1   Potential Determinants

The sovereign creditworthiness, and thereby also the sovereign spread, is determined by a large number of factors.[14] In their statements on rating criteria, the main rating agencies list numerous economic, political and social factors that underlie their sovereign credit ratings.[15] Most of these factors are, however, not quantifiable,[16] and we will, therefore, limit this study to those economic factors that are quantifiable and regularly published, which is in line with most earlier studies.

A number of fundamental economic variables can be envisaged to influence the sovereign creditworthiness and the sovereign spread,[17] and a number of such variables have, indeed, been identified by earlier studies as determinants, as summarised in table 2.2, 2.3 and 2.4 in the previous chapter. Based on these earlier studies, and in particular on Rowland and Torres (2004) and Cantor and Packer (1996), we have identified a number of variables as potential determinants, and we have divided these variables into solvency variables, liquidity variables, and dummy variables.[18]

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[14] This section is mainly based on the discussion in Rowland and Torres (2004).
[15] See Standard & Poor's (2002), Moody's (1991, 1995), and Fitch (2002).
[16] Cantor and Packer (1996), p. 39.
[17] See also Pilbeam (1992), pp. 404ff for a textbook discussion on this subject.
[18] Rowland and Torres (2004) also include the 3-month US T-Bill rate to represent external shocks. This does, however, only make sense when studying time series data, and we are, therefore, not including any variable to representing external shocks in this particular study.

Solvency Variables

The solvency variables relate to the country's long-term ability to pay its debt. The term *solvency variable* might be slightly misleading, since insolvency of a sovereign issuer is not a well-defined concept. We have, nevertheless, in line with many other studies decided to use this term, since it is intuitive. Variables belonging to this group include a country's real growth rate, fiscal and current account balances, as well as its stock of external debt. We have chosen to include the following variables in this study:

- *GDP per capita:* A high GDP per capita implies a large potential tax base and, therefore, also a greater ability of the government to repay debt. This variable also serves as a proxy for the level of economic development, which might influence the default risk.

- *Real GDP growth rate:* A high economic growth rate normally generates a stronger fiscal position. A high growth rate, therefore, suggests that the country's debt burden will become easier to service over time.

- *Fiscal balance as a percentage of GDP:* A large fiscal deficit (i.e. a large negative fiscal balance) indicates that the government lacks the ability or the will to increase taxes to cover current expenses including its debt service. A weak fiscal position also implies a higher likelihood that external shocks may generate a default.

- *Current account balance as a percentage of GDP:* A large current account deficit indicates that the economy relies heavily on funds from abroad. Persistent current account deficits generates a growth in foreign indebtedness, which may become unsustainable in the long term.

- *Debt-to-GDP ratio:* The higher the debt burden, the larger the transfer effort the country will need to make over time to service its obligations. A higher debt burden, therefore, corresponds to a higher risk of default. This measure does, however, not say everything about the debt service burden imposed on the country, since this also depends on the maturity structure as well as on the yield of the debt.

- *Debt ratio:* This is defined as the external debt divided by the current account receipts. Current account receipts is a major source of foreign exchange, and countries with large current account receipts are normally less vulnerable to external shocks when it comes to servicing their debt.

Note that to make variables comparables between different countries we normally use the ratio of the variable to the nominal GDP.

Liquidity Variables

The liquidity variables relates to the country's short-term ability to pay its debt. Even if a country has the long-term capability to service its debt, it may lack the necessary funds to service its debt in the short therm. The foreign-currency debt has to be serviced out of the international reserves, so the debt service and the international reserves are the two most crucial variables in this category. Exports is another important variable, since exports normally accounts for a significant part of foreign exchange earnings, and since exports in this sense is a much more stable source of foreign exchange than, for example, foreign investment flows, which can vary widely from year to year. The debt service is, furthermore, directly dependent on the composition of the debt. A large fraction of short-term debt will increase the current debt service when this debt is maturing.

We have chosen to include the following liquidity variables in the study:

- *International reserves as a percentage of GDP:* The foreign debt has to be serviced out of the international reserves. For this reason, low reserve levels sharply increase the risk of default.

- *Debt-service-to-GDP ratio:* The debt service is dependent on the level of the debt, but also on its composition and yield. A high debt-service burden indicates that the country might face problems in servicing its obligations. Large amortizations might be difficult to roll over, particularly in times when international risk appetite is low or global liquidity conditions are tight.

- *Debt-service ratio:* This is defined as the debt-service divided by the current account receipts. As discussed earlier, current account receipts is a major source of foreign exchange, and countries with large current account receipts are normally less vulnerable to external shocks when it comes to servicing their debt.

- *Openness:* This is defined as the sum of exports and imports divided by the GDP. Again, large exports normally implies a lower default risk.

- *Inflation rate:* A high rate of inflation is indicative of structural problems in the government's finances. Many governments have resorted to inflationary finance of the fiscal deficit when they have been unable or unwilling to raise taxes or to cut spendings to bring down the deficit. The rate of inflation can, therefore, be used as a measure of government discipline. Public dissatisfaction with a high inflation rate might, furthermore, generate political instability.

Dummy Variables

Theoretical models of creditworthiness or spread determination often include regional or country specific dummy variables, which take the value one if a certain condition is fulfilled and the value zero otherwise. We have in this study decided to include only one dummy variable:

- *Default history:* We have chosen to set this variable to one for the countries that have defaulted since 1975 and zero otherwise. Other things being equal, a country that has defaulted on its debt in the recent past is widely perceived as a higher credit risk.[19]

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[19] See, for example, Eaton (1996), and Özler (1993).

3.2 The Data Set Used for the Estimations

For the empirical analysis we use the rating classifications of Standard & Poor's and Moody's, and the EMBI Global spread composites as of end-July 2003.[20] The rating classifications for external debt together with the sovereign spread are presented in table 3.1 for the different countries studied. As shown by the table, we have a sample of 50 countries when assessing the determinants of the credit ratings (note that Nigeria is excluded, since it is not rated by neither of the agencies). When studying the spread, on the other hand, the sample size falls to 29 countries. We have, furthermore, not included Argentina in the sample, since it was in structural default in end-July 2003, and its bonds traded at a very high spread.[21]

For the study of the determinants of the creditworthiness, we use the Institutional Investor's creditworthiness index as of March 2001, for all the 51 countries listed in table 3.1.

The explanatory variables included in the study were discussed in section 3.1. Those are defined in table 3.2 together with their sources and their expected sign in the spread regression.

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[20] Standard & Poor's ratings are as of 31 July 2003, Moody's ratings are as of 25 July, and the sovereign spreads are as of 29 July 2003.
[21] Argentine sovereign issues traded at a spread of 4,775 basis points on 29 July 2003.

Table 3.1. External debt rating classifications and the sovereign spread, end-July 2003

Country	Rating S&P	Rating Moody's	Sovereign Spread (bp)
Bolivia	B	B3	–
Botswana	A	A2	–
Brazil	B+	B2	769
Bulgaria	BB+	Ba2	227
Chile	A-	Baa1	117
China	BBB	A3	44
Colombia	BB	Ba2	431
Costa Rica	BB	Ba1	–
Croatia	BBB-	Baa3	135
Czech Republic	A-	A1	–
Dominican Republic	B+	Ba2	611
Ecuador	CCC+	Caa2	1088
Egypt	BB+	Ba1	148
El Salvador	BB+	Baa3	327
Estonia	A-	A1	–
Guatemala	BB-	Ba2	–
Hungary	A-	A1	35
India	BB	Ba1	–
Indonesia	B-	B3	–
Jamaica	B	B1	–
Jordan	BB	Ba3	–
Kazakhstan	BB+	Baa3	–
Korea	A-	A3	102
Latvia	BBB+	A2	–
Lebanon	B-	B2	417
Lithuania	BBB+	Baa1	–
Malaysia	BBB+	Baa1	130
Mexico	BBB-	Baa2	224
Morocco	BB	Ba1	249
Nigeria	Not rated	Not rated	926
Oman	BBB	Baa2	–
Pakistan	B	B3	–
Panama	BB	Ba1	350
Papua New Guinea	B	B1	–
Peru	BB-	Ba3	435
Philippines	BB	Ba1	395
Poland	BBB+	A2	26
Romania	BB-	B1	–
Russia	BB	Ba2	276
Saudi Arabia	A	Baa2	–
Slovak Republic	BBB	A3	–
Slovenia	A+	Aa3	–
South Africa	BBB	Baa2	156
Thailand	BBB-	Baa3	113
Trinidad & Tobago	BBB	Baa3	–
Tunisia	BBB	Baa2	149
Turkey	B	B1	646
Ukraine	B	B2	266
Uruguay	B-	B3	690
Venezuela	B-	Caa1	859
Vietnam	BB-	B1	–

Table 3.2. Data and data sources

Data Series (unit of measure)	Definition	Source	Expected Sign in Spread Regression
Dependent Variables			
EMBI Global country index	29 Jul 2003	JP Morgan	+
Standard & Poor's rating	31 Jul 2003, linearly transformed	S&P	–
Moody's rating	25 Jul 2003, linearly transformed	Moody's	–
Creditworthiness index	March 2001	Inst. Investor	–
Explanatory Variables			
GDP per capita (USD)	2002	Moody's	–
Real GDP Growth (%)	Average 1999-2002	Moody's	–
Fiscal balance/GDP (%)	Average 2000-2002	Moody's	–
Current account/GDP (%)	Average 2000-2002	Moody's	–
External debt/GDP (%)	2002	Moody's	+
External debt/CA receipts (%)	2002	Moody's	+
Annual CPI inflation rate (%)	Average 2000-2002	Moody's	+
Reserves/GDP (%)	End-2002	Moody's	–
Debt service/GDP (%)	2002	Moody's	+
Debt service/CA receipts (%)	2002	Moody's	+
[Exports + Imports]/GDP (%)	Average 2000-2002	Moody's	–
Default history (dummy)	One if defaulted after 1975	S&P	+

Note: Since Nigeria is not rated, Moody's does not publish data on Nigeria. The data sources for Nigeria were instead IMF *International Financial Statistics* together with the Economist Intelligence Unit. The explanatory variables used in the regression for the creditworthiness index are for the time two years before what is stated in the table, since creditworthiness data is as of March 2001.

4   Estimation and Results

In this chapter we assess the significance of the potential explanatory variables in determining the sovereign spread, the credit ratings and the creditworthiness for the set of countries defined in the previous chapter. The sovereign spread, credit ratings and creditworthiness are studied in sections 4.1, 4.2 and 4.3 respectively.

4.1   Determinants of the Sovereign Spread

In line with Cantor and Packer (1996) we use OLS regression to identify the significant explanatory variables and their parameter estimates. We are using the spread of the 29 countries listed in table 3.1 in the previous chapter. A standard model of the spread represented by the EMBI Global composite, *EMBIG*, is a linear relationship of the form,

$$EMBIG_i = \alpha + \sum_{k=1}^{K} \beta_k X_k + u_i \tag{4.1}$$

or

$$\log(EMBIG_i) = \alpha + \sum_{k=1}^{K} \beta_k X_k + u_i \tag{4.2}$$

where $i = 1, 2, \dots , N$ are the number of countries, α is a constant, X_k are the different explanatory variables and β_k their parameter estimates, and u_i are the error terms. It is, however, not clear from theory which of the two forms stated by equations (4.1) and (4.2) should be used. The spread is a difference between two yields, which are not exponential in their nature, suggesting that equation (4.1) should be used. Many earlier studies, nevertheless, use the form stated by equation (4.2), since the spread has been shown to behave somewhat exponentially. A similar increase in one of the explanatory variables normally generates a larger increase in the spread if the spread is large than if it is small. We have in this study chosen to use both the equations.

Repeated regressions leads us to conclude that only two or three variables are significant determinants of the spread. The results are presented in table 4.1. Using the logged spread produces three significant explanatory variables, GDP per capita, the growth rate, and the inflation rate, while using the non-logged variable produces only two explanatory variables, the growth rate and the inflation rate. Finally, none of the regressions suffers from heteroskedasticity.[22]

Table 4.1. Determinants of the sovereign spread

| | Dependent Variable | |
Explanatory Variable	*EMBIG*	log(*EMBIG*)
Constant	359.04	6.113
	(5.08)	(17.92)
GDP per capita	–	-0.000138
		(-2.13)
GDP growth rate	-45.363	-0.1597
	(-2.96)	(-2.82)
Inflation rate	14.620	0.03146
	(4.21)	(2.42)
No of observations	29	29
Adjusted R^2	0.553	0.454
Standard error	193.26	0.716
Durbin-Watson	1.667	1.404

Note: T-statistics are in parentheses. All parameter estimates are significant at the 5 percent level. *EMBIG* stands for the EMBI Global spread composite. Note also that the adjusted R-squared for the two estimations cannot be directly compared, since the two equations contain different sets of explanatory variables.

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[22] A White's test was used to test for heteroskedasticity. The null-hypothesis of homoskedasticity could not be rejected. Test statistics obtained were $\chi^2(5) = 8.13$ and $\chi^2(9) = 5.61$ for the two regressions respectively.

4.2 Determinants of Sovereign Credit Ratings

We continue by identifying the significant explanatory variables of the credit ratings. In line with Cantor and Packer (1996) we use a linear transformation to assign numerical values to the credit ratings as follows: B-/B3 = 1, B/B2 = 2, B+/B1 = 3, and so on through AAA/Aaa = 16. Countries rated below B-/B3 are omitted (only Ecuador in our sample). We then use the transformed ratings instead of *EMBIG* and re-estimate equation (4.1) using OLS regression as before. We now use a sample of 49 countries, as defined by table 3.1 in the previous chapter (note that Nigeria is excluded, since it is not rated). The results are presented in table 4.2.

It is apparent from the results that for Standard & Poor's ratings, the regression yields five significant explanatory variable, GDP per capita, growth rate, inflation rate, debt ratio, and reserves-to-GDP ratio. For Moody's ratings, however, only GDP per capita, the debt ratio and the reserves-to-GDP ratio (at the 10-percent level) are significant explanatory variables. None of the regressions, furthermore, sufferes from heteroskedasticity.[23]

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[23] A White's test was used to test for heteroskedasticity. The null-hypothesis of homoskedasticity could not be rejected. Test statistics obtained were $\chi^2(20) = 19.49$ and $\chi^2(20) = 21.05$ for the two regressions respectively.

Table 4.2. Determinants of the sovereign credit ratings

Explanatory Variable	Dependent Variable	
	Rating Moody's	Rating S&P
Constant	4.229	4.041
	(3.66)	(4.47)
GDP per capita	0.000658	0.000632
	(4.94)	(5.91)
GDP growth rate	0.2681	0.2482
	(1.63)	(2.00)
Inflation rate	-0.06664	-0.08885
	(-1.62)	(-2.71)
Debt/CA receivables	-0.009473	-0.009138
	(-3.13)	(-3.80)
Reserves/GDP	0.03960	0.04080
	(1.92)	(2.46)
No of observations	48	49
Adjusted R^2	0.583	0.689
Standard error	2.167	1.739
Durbin-Watson	1.802	1.665

Note: T-statistics are in parentheses.

Comparing the results with those presented by Cantor and Packer (1996), shows that the two sets of results are not that different, even if Cantor and Packer also included developed countries in their data set. GDP per capita and the debt ratio are significant in both the studies. Both studies furthermore yield the growth rate as a significant explanatory variable for the S&P ratings but not for Moody's ratings. The inflation rate is found to be a significant explanatory variable for both ratings by Cantor and Packer but only for the S&P ratings in the current study. Cantor and Packer do, furthermore, not in their study include the reserves-to-GDP ratio, which is here found to significantly determine both ratings. A difference is, however, that Cantor and Packer finds the default

history to significantly influence the credit ratings, which is not the case in the current study.

In line with Cantor and Packer (1996) we also find that ratings have considerable power to explain sovereign yields. If the regression presented in table 4.1 in the previous section is re-estimated using the logged spread but adding the ratings according to Standard & Poor's and Moody's respectively, all previously significant explanatory variables turns insignificant, as shown by table 4.3.[24]

Table 4.3. Determinants of the sovereign spread

Explanatory Variable	Dependent Variable	
	log(*EMBIG*)	log(*EMBIG*)
Constant	6.896	6.860
	(24.85)	(22.20)
Rating	Moody's	S&P
	-0.2584	-0.2462
	(-5.77)	(-4.68)
GDP per capita	0.000017	-0.0000005
	(-0.34)	(-0.01)
GDP growth rate	-0.01138	-0.03622
	(-0.24)	(-0.73)
Inflation rate	0.008419	0.005510
	(0.77)	(0.44)
No of observations	26	27
Adjusted R^2	0.726	0.676
Standard error	0.469	0.523
Durbin-Watson	2.440	2.417

Note: T-statistics are in parentheses. EMBIG stands for the EMBI Global spread composite.

[24] None of the regressions suffer from heteroskedasticity. A White's test was used to test for heteroskedasticity. The null-hypothesis of homoskedasticity could not be rejected. Test statistics obtained were $\chi^2(14) = 15.71$ and $\chi^2(14) = 9.64$ for the two regressions respectively.

4.3 Determinants of the Creditworthiness

We finally identify the determinants of the Institutional Investor's creditworthiness index by re-estimating equation (4.1) inserting the creditworthiness index as the dependent variable instead of the *EMBIG*. We are using the creditworthiness index from March 2001, and the same explanatory variables as before but from two years earlier.[25] The results are presented in table 4.4.

Table 4.4. Determinants of the sovereign credit ratings

	Dependent Variable
Explanatory Variable	Creditworthiness index
Constant	48.174
	(10.44)
GDP per capita	0.000359
	(2.40)
Inflation rate	-0.2593
	(-2.40)
Debt/GDP	-0.1951
	(-2.75)
Openness	0.1233
	(2.04)
No of observations	51
Adjusted R^2	0.360
Standard error	10.486
Durbin-Watson	2.064

Note: T-statistics are in parentheses. Openness is defined as the ratio of exports plus imports to GDP.

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[25] The explanatory variables were defined in table 3.2 in the previous chapter.

These results are very different from the ones yielded by the credit-rating regressions. GDP per capita and the inflation rate are still significant as explanatory variables. However, the growth rate, the debt-to-current-account-receivables ratio and the reserves-to-GDP ratio are not significant. Instead the debt-to-GDP ratio and the openness turn up as significant determinants of the creditworthiness.[26]

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[26] The regression does not suffer from heteroskedasticity. A White's test was used to test for heteroskedasticity. The null-hypothesis of homoskedasticity could not be rejected. The test statistic obtained was $\chi^2(14) = 7.50$.

5 Conclusion

The objective of this study was to identify the determinants of the sovereign spread, the sovereign credit ratings, and the creditworthiness of emerging market issues. The study uses the same econometric framework as used in the seminal paper by Cantor and Packer (1996), and differs from this study mainly in the data set used. Cantor and Packer used the data set defined by all countries rated, which in 1995 were 49, of which only 21 were developing countries. We are in this study using the data set defined by developing countries rated B- and higher, which gives us a sample size of 49.

The study is also a follow up study of Rowland and Torres (2004), who used a paned data framework and a cross section of 16 countries to identify the determinants of the sovereign spread as well as of the creditworthiness as defined by the Institutional Investor's creditworthiness index. Since a number of countries recently have been included in the EMBI Global spread composite, which was used both in this study and by Rowland and Torres to represent the sovereign spread, we have been able to increase the sample size from the 16 countries analysed by Rowland and Torres to 29. For the analysis of the creditworthiness index, we use a sample size of 51.

For the analysis of the spread and the credit ratings we use data as of end-July 2003, while the study of the creditworthiness index uses data as of March 2001. In line with Cantor and Packer, we use an OLS regression technique to identify the significant explanatory variables. The results are summarised in table 5.1.

Table 5.1. Summary of the results of this study

Dependent variable (together with some further info)	Significant explanatory variables
Log(Spread) No of countries = 29 Adjusted R^2 = 0.45	GDP per capita (-) GDP growth rate (-) Inflation rate (+)
Moody's ratings No of countries = 48 Adjusted R^2 = 0.58	GDP per capita (+) Debt/CA receivables (-) Foreign reserves/GDP (+)
Standard & Poor's ratings No of countries = 49 Adjusted R^2 = 0.69	GDP per capita (+) GDP growth rate (+) Inflation rate (-) Debt/CA receivables (-) Foreign reserves/GDP (+)
Creditworthiness (Institutional Investor) No of countries = 51 Adjusted R^2 = 0.36	GDP per capita (+) Inflation rate (-) Debt/GDP (-) Openness (+)

Note: When analysing the determinants of the credit ratings and the creditworthiness, the parameter estimates will have the opposite sign of those of the spread. If a variable has a positive impact on the credit rating or creditworthiness, it should have a negative impact on the spread and vice versa.

The results show a number of interesting things. The GDP per capita is a significant explanatory variable in all the regressions. The GDP growth rate also seems to have a significant impact, at least on the spread and on Standard & Poor's ratings, and so does the inflation rate, which also has a significant impact on the creditworthiness index. Debt to current account receivables as well as the reserves-to-GDP ratio are significant determinants for the credit ratings of both the rating agencies, but do not here seem to have a significant impact on the spread. The determinants of the creditworthiness index are, furthermore, quite different from both those of the credit ratings and those of the spread, and this regression has by far the lowest adjusted R-squared value.

Table 5.2. The results of Rowland and Torres (2004) and Cantor and Packer (1996)

Dependent variable (together with some further info)	Significant explanatory variables
Rowland and Torres (2004)	
Spread	GDP growth rate (-)
	Debt/GDP (+)
No of countries = 16	Debt/Exports (+)
Panel data technique	Foreign reserves/GDP (-)
	Exports/GDP (-)
	Debt service/GDP (+)
Creditworthiness (Institutional Investor)	GDP growth rate (+)
	Debt/GDP (-)
No of countries = 16	Debt/Exports (-)
Panel data technique	Foreign reserves/GDP (+)
	Inflation (-)
	Default dummy (-)
Cantor and Packer (1996)	
Moody's ratings	GDP per capita (+)
	Inflation rate (-)
No of countries = 49	External debt (-)
Adjusted R^2 = 0.90	Indicator for economic development (+)
	Indicator for default history (-)
Standard & Poor's ratings	GDP per capita (+)
	GDP growth rate (+)
No of countries = 49	Inflation rate (-)
Adjusted R^2 = 0.93	External debt (-)
	Indicator for economic development (+)
	Indicator for default history (-)

Note: When analysing the determinants of the credit ratings and the creditworthiness, the parameter estimates will have the opposite sign of those of the spread. If a variable has a positive impact on the credit rating or creditworthiness, it should have a negative impact on the spread and vice versa.

Table 5.2 summarises the results of Rowland and Torres (2004) and of Cantor and Packer (1996). If we compare our results to those of Rowland and Torres, there are a number of differences. While we only receive three significant explanatory variables, they receive up to six. The only common determinant of the spread of the two studies is the GDP growth rate. Also when studying the creditworthiness, Rowland and Torres receive more

significant explanatory variables. Determinants that turn up as significant in explaining the creditworthiness in both the studies include the inflation rate and the debt-to-GDP ratio. Rowland and Torres uses a panel-data framework, which takes into account the time-series properties of the data, and this gives them access to a much richer data set than the one used in this study. This is also a possible explanation to why they receive a larger number of significant explanatory variables.

The results we received in our analysis, when studying the determinants of sovereign credit ratings, are relatively similar to those received by Cantor and Packer (1996), even if they used both developed and developing economies in their study, while we limited our dataset only to developing countries. This suggests that the rating agencies use a similar framework when evaluating developed countries as when evaluating developing countries. It also suggests that this framework has not changed considerably between 1995, when Cantor and Packer did their study, and 2003, when we did our study.

Our study has, together with Rowland and Torres (2004), yielded a number of variables that consistently seem to be associated with the investor's decisions in pricing country risk. This set of variables is summarised in table 5.3, and it gives both investors and emerging market policy makers a set of indicators to which they should pay special attention.

Table 5.3. Summary of the determinants of credit ratings, creditworthiness and spread

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- GDP per capita

- GDP growth rate

- Inflation rate

- Debt ratios
    - Debt/GDP
    - Debt/Exports

- Debt service ratios (e.g. debt service/GDP)

- International reserves

- Openness of the economy (e.g. exports/GDP)

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