The Colombian Sovereign Spread and its Determinants

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Abstract

The surge in Colombian sovereign international bond issues during the 1990s has created an increasing need for the Colombian Government and the Banco de la República to understand the dynamics and the determinants of the sovereign spread. This is the first comprehensive study of the Colombian sovereign spread and its determinants. It shows that contagion and spillovers play an important part in the determination of the spread, particularly in the short term. A study of daily spread changes between 1998 and 2003 using an OLS regression framework finds contagion, changes in the US stock market and changes in the Colombian exchange rate to significantly influence the spread. A study of the long-term determinants of the spread uses a Johansen framework of multivariate cointegration together with monthly data from 1998 to 2002, and finds exports, the exchange rate, the economic growth rate and the US T-Bill rate as significant explanatory variables of the spread. A weakness of the study, as with all single-country studies, is that the time period is too short to study variables published only with annual frequency, and some such variables have, indeed, by cross-country studies been shown to significantly influence the spread. Such variables include, for example, the debt ratio and the debt-service ratio.

* The opinions expressed here are those of the author and not necessarily of the Banco de la República, the Colombian Central Bank, nor of its Board of Directors. I express my thanks to Mauricio Avella, and Luis Fernando Melo for helpful comments and suggestions. Any remaining errors are my own.

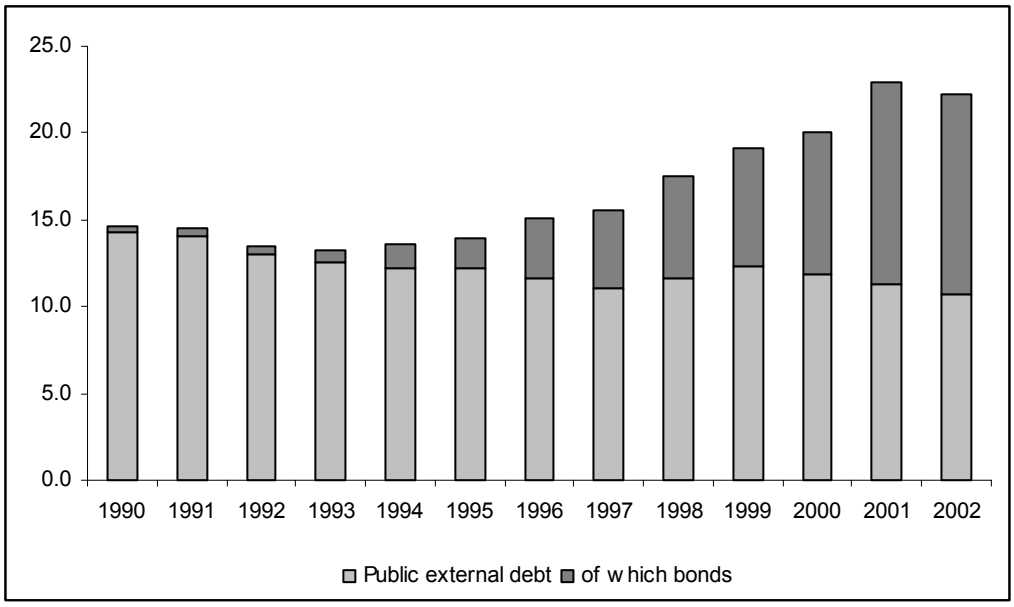
Contents

1 Introduction

In line with many other emerging markets, Colombian sovereign bond issues surged during the 1990s. By the end of 2002, Colombia had a total outstanding public external debt[1] of USD 22.2 billion. Of this some USD 11.5 billion was bonds, a figure that increased rapidly during the 1990s, both in absolute terms an in relation to total public external debt, as illustrated by figure 1.1.

The increasing importance of international bonds as a public debt instrument has generated a rising need for both the Colombian Government and the Banco de la República to understand what factors determine bond yields and, therefore, also spreads.

Figure 1.1: Colombian external public debt 1990 – 2002 (USD billion)



Source: Banco de la República

[1] Debt denominated in other currencies than the Colombian peso.

This is the first comprehensive study of the Colombian sovereign spread, i.e. the spread between the yield of Colombian sovereign issues and that of US Treasuries of the same maturity. We are here both studying the short-term determinants and the longer-term determinants of the sovereign spread, using data from the beginning of 1998 up until mid 2003.

For the study of the short-term determinants we are using daily data in differential form together with an OLS regression framework. The results of this study suggest that the daily spread changes are influenced by the change in the spread of other emerging markets, the change in the S&P 500 stock market index, and by the change in the Colombian exchange rate.

The study of the long-term determinants of the spread uses a Johansen framework of multivariate cointegration together with monthly data. Exports, the exchange rate, the economic growth rate and the US T-Bill rate all shows up as significant explanatory variables of the sovereign spread.

A weakness of this study, as well as of most single country studies of emerging market spreads, is that the time period studied is relatively short, in this case spanning 1998 to 2003. This implies that many potential explanatory variables have to be omitted from the study, since they are only published with annual frequency. Some such variables have been found to have a significant impact on the spread in cross-country studies. These include, for example, debt ratios and debt-service ratios.[2] The time period does, furthermore, not include a full business cycle, so the effect of cyclical variables on the spread cannot be properly studied.

In addition the paper also discusses the rating history of Colombia as well as the influence of contagion and spillovers on the Colombian spread. With the surge in emerging market debt issues, the demand for sovereign credit ratings has increased

[2] Such as the debt-to-GDP ratio, the debt-to-exports ratio and the debt-service-to-GDP ratio. See, for example, Rowland (2004), and Rowland and Torres (2004).

substantially during the 1990s. We are in this paper discussing the Colombian sovereign rating history based on the ratings by Standard & Poor's and Moody's, the two main credit rating agencies, and what lead them to upgrade or downgrade Colombia's rating.

Contagion and spillovers has played an important part in the determination of the Colombian spread. Between mid-2002 and mid-2003 the correlation between the daily Colombian spread and that of emerging markets in general was as high as 0.94. The correlation has, nevertheless, varied significantly over time, and has during periods even been negative.

The paper is organised as follows: Chapter 2 discusses emerging market debt in general. It analyses valuation of emerging market issues in order to build an understanding for potential determinants of the spread. This chapter also discusses the relevant literature of the area. Chapter 3 continues by discussing the Colombian sovereigns spread. Colombia's rating history is also examined, and a section is devoted to the identification of the potential determinants of the spread. In chapter 4 the influence of contagion on the spread is analysed. Chapters 5 and 6 continue with the empirical studies of the determinants of the spread. In chapter 5 the explanatory variables of the daily spread changes are determined, and in chapter 6 a Johansen framework is used to identify some long-term determinants of the spread. Chapter 7 concludes the paper.

2 Determinants of Emerging Market Sovereign Spreads

In order to identify the potential determinants of the sovereign spread, it is important to understand how emerging market bonds are valued. Section 2.1 starts by discussing emerging market debt in general and some fundamental definitions. This section also examines the recent spread history of emerging market debt. In section 2.2 the process of valuation of emerging market debt is discussed. Section 2.3 contains a survey of the literature on the determinants of emerging market sovereign spreads.

2.1 Emerging Market Sovereign Debt

Emerging market debt was hardly traded at all before the 1990s.[3] While banks held 97 percent of all emerging market debt at the end of the 1980s, their share had fallen to less than two thirds by the mid-1990s.[4] The change was initiated by Mexico launching its Aztec bond in March 1988.[5] This was followed by the Brady Plan in 1989, which was a programme initiated by the US government, to allow emerging markets to issue bonds in exchange for rescheduled bank loans. The so-called Brady bonds were partly collateralised by US Treasuries. The first country to reach a Brady agreement was Mexico, and Mexico has since then been used as a benchmark for pricing emerging market debt. A total of 17 countries have taken advantage of the programme, with a cumulative face value of USD 170 billion of Brady bonds issued.[6]

[3] Latin America had large traded debt issues in the 1920s. However, with the Great Depression and following debt defaults, Latin American traded debt almost completely disappeared. See, for example, Eichengreen and Portes (1986).
[4] Eichengreen and Mody (1998), p. 7.
[5] This was a 20-year USD 2.6 billion issue in exchange for rescheduled bank loans. Its principal was fully collateralised with special purpose bonds issued by the US Treasury.
[6] See Sachar-Brauer and Chen (2001) for an introduction to Brady bonds.

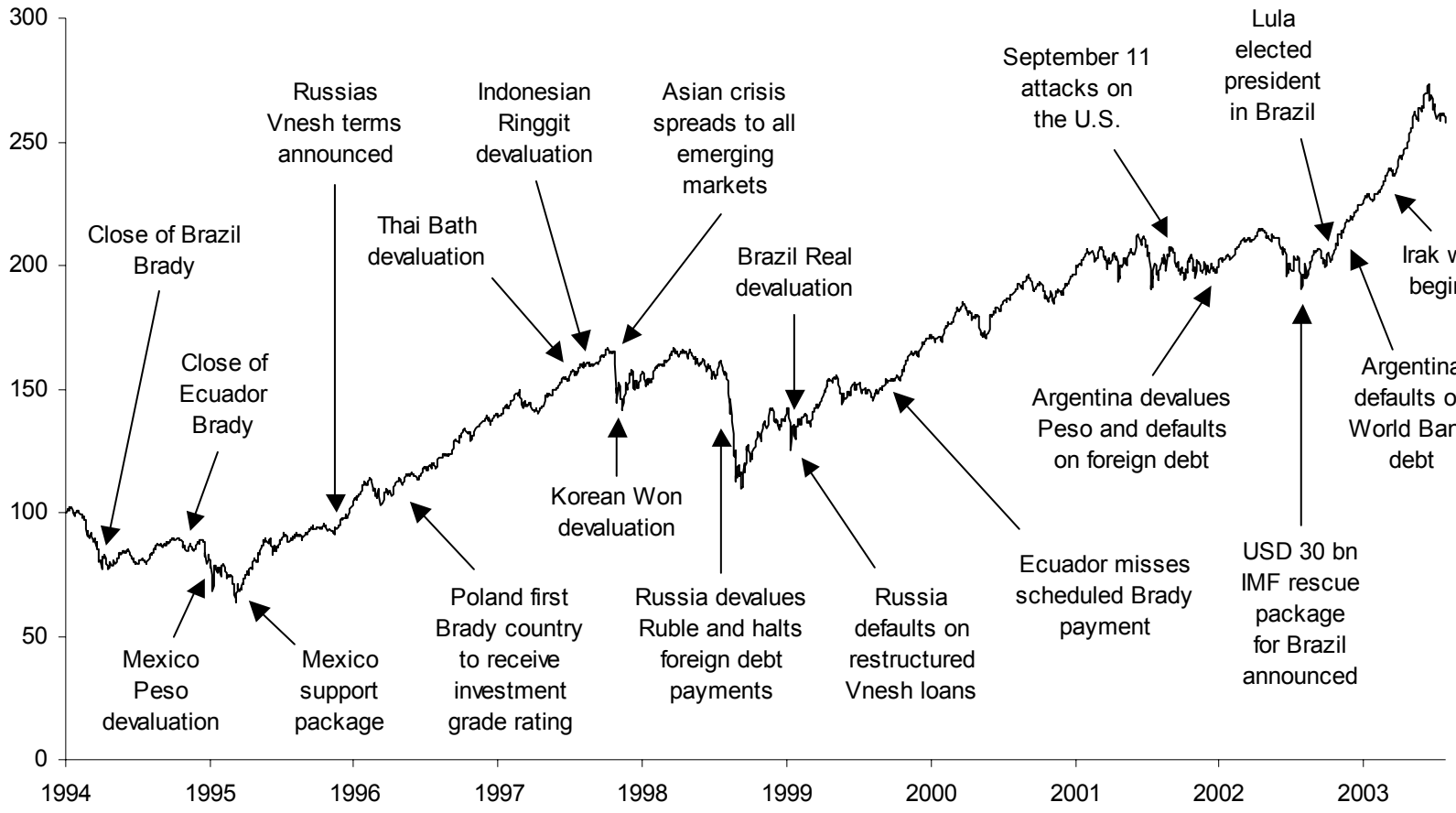
The Brady bonds transformed the market from sovereign debt ownership concentrated in the hands of a few creditor banks and dealers to ownership distributed more widely through an actively traded and liquid Brady bond market. This also opened the doors for emerging market eurobond issues. Emerging market bonds are today a common component of the portfolios of institutional fixed income investors.

Colombia has in modern times not defaulted on its sovereign debt, and has, therefore, never issued any Brady bonds.[7] It has, nevertheless, a number of outstanding eurobond issues.

Figure 2.1 shows the development of JP Morgan's EMBI Global total-return index from 1994 and up until now. Figure 2.2 shows the EMBI Global spread composite from 1998 up until present.

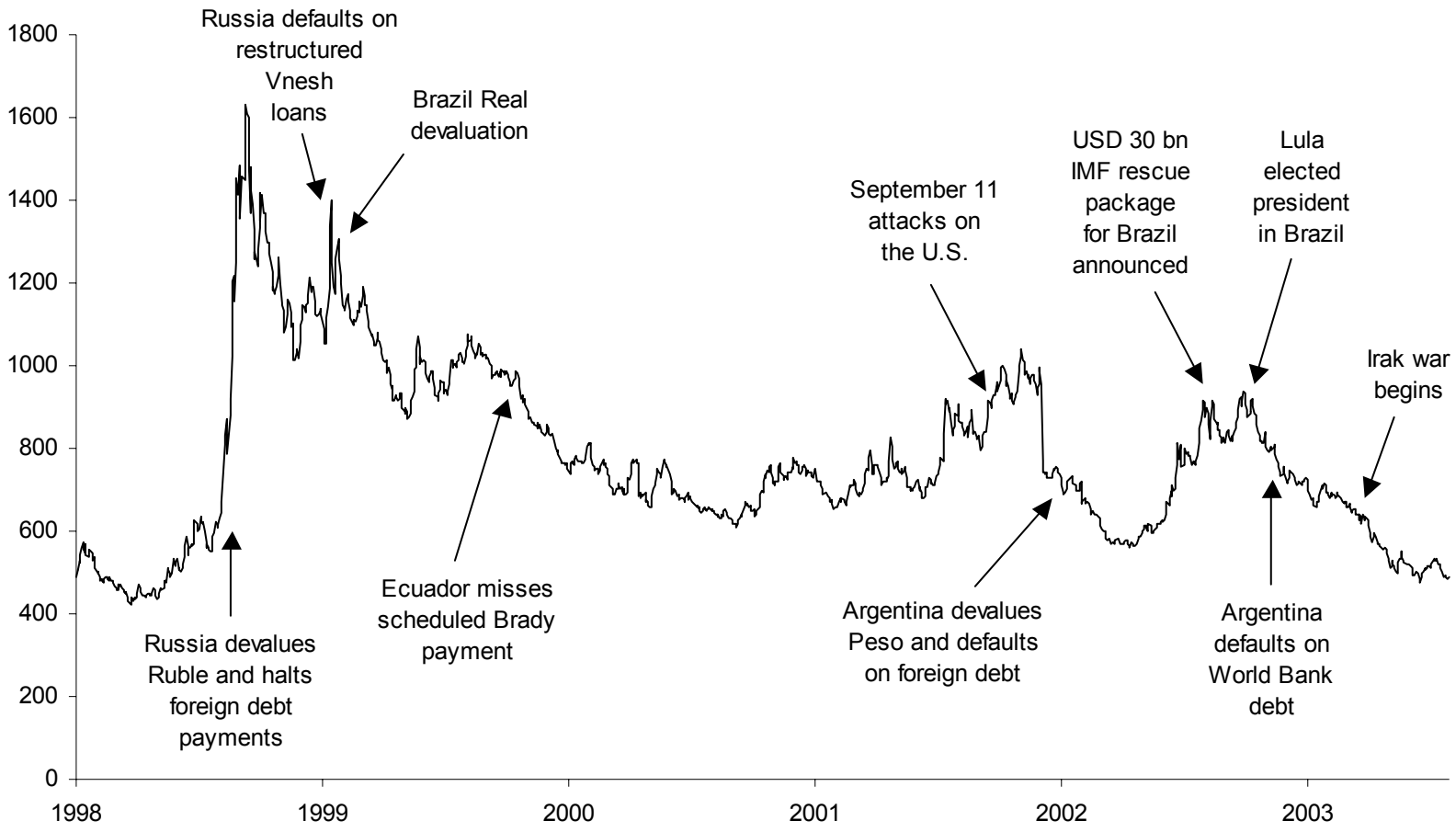
[7] Colombia did, indeed, default on its sovereign debt in the 1930s together with most other Latin American sovereign issuers, but has not defaulted since then.

Figure 2.1: EMBI Global total-return index 1994 – 2003 (31 December 1993 = 100)



Source: JP Morgan, Vine (2001), p. 396, and own analysis

Figure 2.2: EMBI Global Spreads 1998 – 2003 (basis points)



Source: JP Morgan, and own analysis

2.2 Valuation of Emerging Market Issues

When analysing emerging market bonds, it is completely crucial to understand how these bonds are priced by investors, as well as the fundamental differences between sovereign and corporate debt.

Corporate debt, particularly high yield debt,[8] can be priced using option theory. We let D represent the market value of the corporation's debt, which is the promise to pay the face value F of the debt in t years. We, furthermore define S as the market value of the firm's common stock and A as the current market value of its assets. The Modigliani-Miller theorem states that,[9]

$$A = D + S \tag{2.1}$$

Given this structure, the firm's common stock can, indeed, be interpreted as a call option on its assets with an exercise price of F and an expiration time t. When the debt matures, the stockholders have the choice either to pay the face value F of the bond to the creditors, which would represent to exercise the call option, or to default on the debt and let the creditors take control of the assets of the firm, which would represent not exercising the option. Option pricing theory can now be used to value the common stock S of the company,[10] and the value of the debt can be calculated using equation (2.1).

The valuation of sovereign debt is not as straight forward, which has to do with the difference in default procedures involving corporate and sovereign debt respectively. A firm normally defaults on its debt when the value of its common stock falls to zero, and the firm, therefore, turns insolvent. It goes into bankruptcy proceedings whereby control of its assets is transferred to its creditors. If the firm is liquidated, the assets are sold and the proceedings divided by the creditors according to well-defined rules.

[8] High yield is also referred to as speculative grade as well as, informally, as junk bonds.
[9] Modigliani and Miller (1958) in their seminal paper stated that the value of a firm should be independent of its capital structure.

The default of a sovereign debtor is much more complicated.[11] Sovereign default risk is related to both the issuer's ability to pay and its willingness to pay, as illustrated by figure 2.3. A sovereign does, furthermore, not have a well-defined asset base, and the creditors normally have very limited possibility to take control of any assets of the sovereign.[12] When a sovereign defaults, its debt is normally restructured through lengthy negotiations with its creditors, and the outcome of any such negotiations can be hard to predict. No clear framework for sovereign default proceedings is in place, and a sovereign default is normally a very complicated affair.[13]

Even if outright sovereign defaults driven strictly by political considerations are very rare,[14] the perceived willingness of a sovereign government to pay plays an important role in assessing the default risk and, thereby, also the value of sovereign debt. A sovereign default is largely a political decision. In relation to the Russian default of 1998, Deutche Bank wrote: "We continue to maintain that a default depends far more on Russia's willingness to pay versus its ability to pay its debt".[15] When a sovereign defaults, the government has normally traded off the cost of servicing the current debt

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[10] Normally the Black and Scholes option pricing model. See, for example, Hull (2002) for a derivation.

[11] The complexity of strategic issues involved in lending to a sovereign nation has been discussed in a rich theoretical literature started by Eaton and Gersovitz (1981). See also Eaton, Gersovitz and Stiglitz (1986), as well as, for a less formalised analysis, Eaton and Taylor (1986).

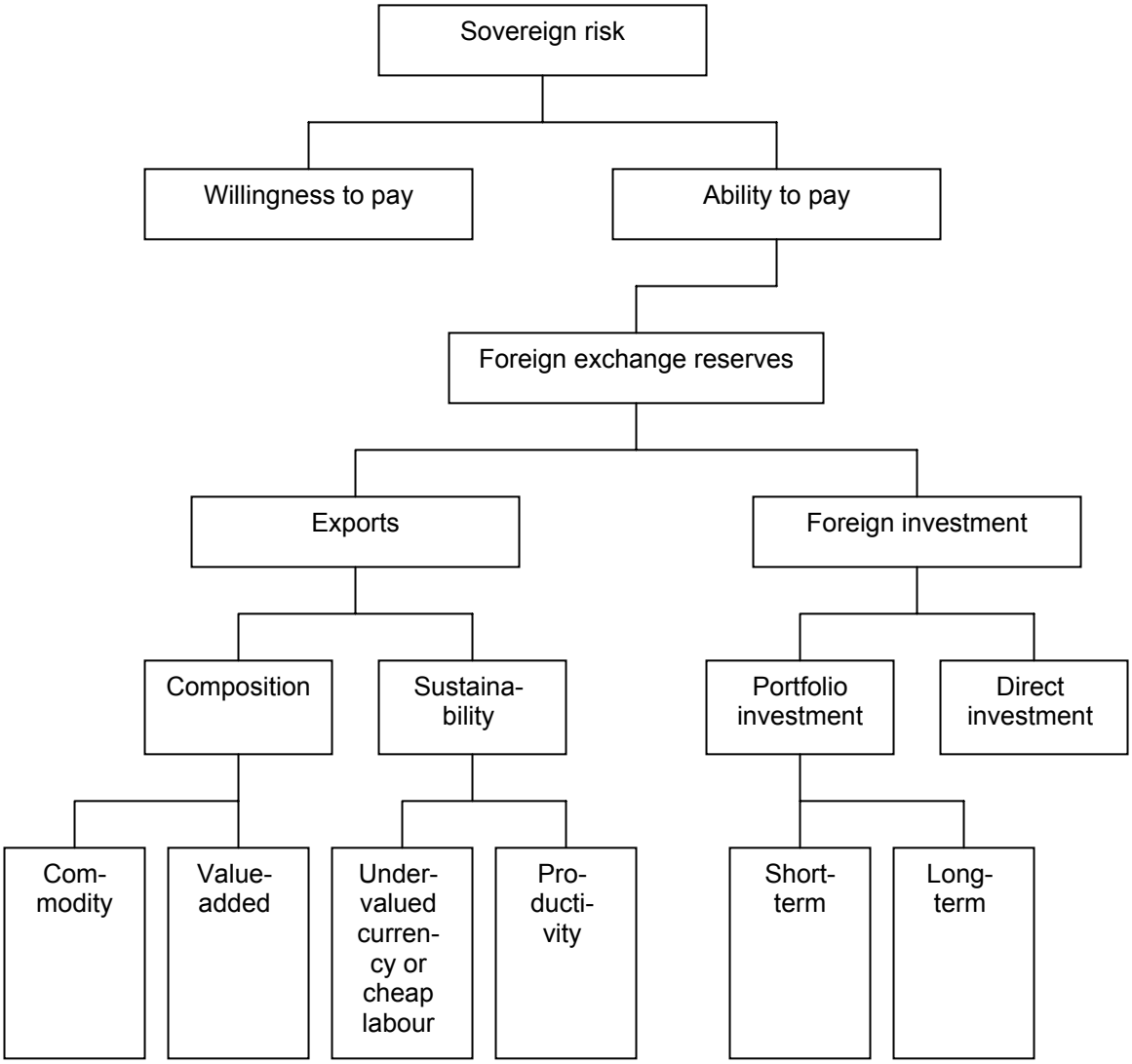
[12] For this reason, option-pricing models are not very useful in valuing sovereign debt. Claessens and van Wijnbergen (1993), nevertheless, use option theory to price the bonds of the Mexican Brady deal. The value of the asset base A for a sovereign is not well defined, and Claessens and van Wijnbergen assume a stochastic behaviour for the value correspondent to A. They assume a Brownian motion even if there is no clear evidence for such behaviour of the underlying stochastic element. The model does, furthermore, neither take into account the behaviour of fundamental economic variables, nor any contagion effects. In spite of this, the paper offers some interesting theoretical insights.

[13] The IMF, among others, has been promoting the definition of a framework of clear sovereign restructuring proceedings, but so far no such framework has been agreed upon. Even if such a framework would be implemented, it would not cover bonds currently outstanding, only new issues. See Krueger (2002) for a suggestion and discussion of such a framework.

[14] In this century, there have been only four major cases of sovereign default driven strictly by politics or ideology. In 1917, the Bolshevik government of Russia repudiated foreign obligations of the tsar. In 1934, Adolf Hitler repudiated much of Germany's obligations under the Versailles Treaty. Japan followed a similar path in 1941, as did communist China in 1949. Vine (2001).

[15] Deutche Bank Research (1998), p. 3.

Figure 2.3: Analysis of sovereign risk



Source: Vine (2001), p. 525.

against the costs of repudiation, of having assets abroad seized and of having international trade impeded.[16] These costs are generally not evaluated in strict economic terms, but rather in political terms relating to the governments popularity, its chances to continue to stay in power, as well as other personal incentives of individual politicians. A sovereign, furthermore, rarely makes an outright default, but instead forces a restructuring or renegotiation of its debt, and the same debt may, indeed, be repeatedly restructured.[17] The government generally also trades off the costs of defaulting on internal versus external debt. The government's willingness to pay is, furthermore, in general very difficult to estimate.

The sovereign's ability to pay is more predictable. Figure 2.3 shows the principle for the analysis of the ability to pay as suggested by Vine (2001).[18] The foreign exchange reserves are the ultimate foreign currency funds with which the foreign debt is serviced. A country that receives a large part of its foreign exchange reserves through foreign investment is highly dependent on capital inflows and has only a limited ability to de-leverage. Prices on debt of countries with this characteristic tend experience high volatility. If a large part of foreign investment comes as portfolio investment, which tend to be short-term, this also increases the volatility. Direct foreign investment, on the other hand, tends to be longer-term, and also has the added benefit of improving the productivity of the country's private sector.

The analysis of exports can provide perhaps the most meaningful insight of the country's ability to pay and its long-term outlook. Exports are a key source for building foreign exchange reserves, and export revenues can provide an opportunity for a country to de-leverage. A country that receives a large part of its foreign exchange reserves through exports is generally a more stable credit than a country that relies heavily on capital inflows. Analysis of the composition and sustainability of exports is, therefore, important. The composition of exports addresses whether a country exports value-added goods or commodities, where the latter generally are much more exposed to price

[16] See Bulow and Rogoff (1989a), Eaton and Gersovitz (1981), and Gibson and Sundaresan (1999).
[17] See Bulow and Rogoff (1989b)
[18] Vine (2001), pp. 523ff.

fluctuations adding to the volatility of the credit profile. The sustainability addresses whether a country exports because of high productivity or because of cheap labour or an undervalued currency. Generally, countries that have invested in productivity should outperform in terms of exports.

Another important factor when evaluating a country's creditworthiness is the composition of its imports, specifically the proportions of consumption, intermediate and capital goods. The credit condition of a country that imports primarily capital goods financed with long-term money, such as for example the Asian tigers,[19] would generally be stronger than that of a country that imports primarily consumption goods financed with short-term money, such as for example Mexico in 1994.

Other indicators analysed by investors when valuing debt includes inflation, the fiscal deficit and the gross domestic product. The rate of inflation is an indicator of the government's discipline as well as its control over fiscal and monetary policy.[20] A large fiscal deficit is problematic since it needs to be financed either through domestic or foreign borrowing. If the gross domestic product is contracting, this normally leads to a fall in government revenues, further aggravating the fiscal deficit. The government might try to increase revenues through tax increases, which would lead to further economic hardship.

In addition, there are many other indicators that influence sovereign creditworthiness. Such indicators include political and social stability in the country, unemployment, law and order, cooperation between central and provincial governments as well as between the different branches of the government, distribution of wealth, and respect for foreign investors and for international law. Another factor that directly influence the perceived credit risk is the country's history of honouring debt obligations.[21]

[19] Hong-Kong, Singapore, South Korea and Taiwan.
[20] High inflation has in many cases been used by governments to finance large fiscal deficit.
[21] See, for example, Hajivassiliou (1989), and Özler (1993) for a discussion on the past history of repayments.

The ability of investors to discriminate among emerging market sovereigns and to price risk appropriately has been controversial, to say the least. Some observers emphasise the cost involved in acquiring and processing the information relevant to assess a borrower's creditworthiness.[22] Investors, therefore, price debt on the basis of incomplete information about the borrowers' economic and financial circumstances. This practice generates herding and market volatility.[23]

Emerging market bonds are normally priced as a spread over the US Treasuries curve. However, most emerging market sovereign issues are not investment grade, and they, therefore, carry a significant risk. "Because of the magnitude and nature of this risk, we believe a large percentage of emerging market issuers should *not* be priced in terms of spread to Treasuries, but in terms of *absolute yield*, like domestic high-yield issuers."[24] Pricing the bonds off US Treasuries have, indeed, had some obscure effects, such as for example the large yield compression of emerging market debt generated by the fall in US interest rates in 1993. This caused large losses for some investors. The practice of pricing emerging market debt off US Treasuries has, nevertheless, continued, and this paper will, therefore, study the spread rather than the absolute yield.

2.3 Review of Previous Studies

Despite the explosive growth of emerging market debt, there have been few studies of the determinants of emerging market sovereign spreads. This is mainly due to the short time series that exist, but also due to the turbulence that these markets have gone through, particularly since the Russian crisis in 1998. Most studies in the area are cross-country studies, since many of the fundamental variables determining the sovereign spread only exist with annual frequency.

[22] See, for example, Calvo and Mendoza (1995), and Chari and Kehoe (1997).
[23] See Kinoshita and Mody (1997) for a discussion on herding.
[24] Vine (2001), p. 532.

A few studies on individual countries have, nevertheless, been conducted. These are, however, restricted to studying variables that are published with monthly frequency. Table 2.1 summarises these studies.

Budina and Mantchev (2000) studied the determinants of the prices of the Bulgarian Brady bond issues of 1994,[25] using monthly data from July 1994 to July 1998 in a cointegration framework. 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. The Mexican exchange rate was included to investigate whether Mexico's economic crisis of 1995 had any contagion effects, which the results suggest it had. In the short run, the Asian crisis of 1997 had a negative impact on the bond prices, and the introduction of a currency board exchange rate regime in 1998 had a positive impact. The authors did, however, not find any significant influence from variables such as consumer price inflation, the change in foreign reserves to imports ratio, or the fiscal deficit.

Nogués and Grandes (2001) conducted an investigation into the determinants of the spread of Argentina's floating rate bond (FRB), one of Argentina's Brady bond issues. They used monthly data from January 1994 to December 1998 and an estimation technique developed by Pesaran, Shin and Smith (2001) to control for stationarity and to check for the existence of a long run structural relationship. Again they include a Mexican variable, in this case the EMBI total-return index for Mexican Brady bonds, to investigate whether the Mexican crisis had any significant spill-over effect, which they concluded it had. In addition they found the debt-service to export ratio, the GDP growth rate,[26] the fiscal balance and the 30-year US Treasury yield all to have significant impact on the spread with the right sign, as shown in table 2.1. They, furthermore, reported a significant impact of the resignation of Domingo Cavallo as Minister of Economy in 1996.

[25] Note that they study the bond prices rather than the spread.
[26] The GDP was transformed from quarterly to monthly data using a cubic Spline function.

Table 2.1. 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 does, indeed, have a negative impact on the spread, and vice versa.

Rojas and Jaque (2003) studied the development and identified the determinants of the Chilean sovereign spread. They used monthly data from April 1999 to July 2002, and found significant impact on the spread of the debt-to-reserves ratio, exports, economic activity as well as of US interest rates, as shown in table 2.1. All the parameter estimates were of the right sign. The result of their estimation might, however, be questionable, since they used an OLS regression technique on data that can be assumed to be non-stationary. This implies that the validity tests of the parameter statistics are not valid.

Using an OLS regression technique on non-stationary variables can, furthermore, lead to spurious regressions.

Studies of individual countries suffer from the weakness that they are limited to data, which is published monthly. To study the full set of explanatory variables, of which many only are published yearly, a cross-country study must be conducted. Such a study, on the other hand, suffers from the weakness of mixing data from countries with very different characteristics, which might seriously bias the results. Panel data estimation techniques go some way in dealing with this problem and are, therefore, preferable to simple pooled data techniques. Table 2.2a and 2.2b summarises the results of the main cross-country studies of the spread.

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.

Rowland (2004) is a follow-up study to Rowland and Torres (2004). He investigated the determinants of the sovereign spread using an OLS-regression technique. By using the spread as of one recent date (29 July 2003), he was able to increase the number of countries studied to 29. However, this study only found three significant determinants of the spread, the GDP growth rate, the GDP per capita and the inflation rate.

Table 2.2a. 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 (+)
Rowland (2004)	
OLS regression on pooled data 29 emerging market sovereign issuers Data as of 29 Jul 2003	GDP growth rate (-) GDP/Capita (-) CPI inflation (+)
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 Investors) (-) Debt/GDP (+) Debt service/Exports (+)

Table 2.2b. Cross-country studies of the sovereign spread (continued…)

Regression Technique and Data Sample	Significant explanatory variables
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 (-)

Goldman Sachs published a study (Ades et. al. (2000)) into the determinants of emerging market spreads, which used monthly data from 15 emerging market economies from January 1996 until May 2000 together with a panel data technique.[27] The reason for using monthly data is that they developed the model to value emerging market debt, and they needed to be able to update these valuations monthly. As a strategic investment tool, the model was reported to outperform the EMBI Global total-return index. The authors found a number of variables to have a significant impact on the sovereign spread, such as the GDP growth rate, total external amortizations as a ratio of foreign reserves, the external-debt-to-GDP ratio, the fiscal balance, the exports-to-GDP ratio, real exchange rate misalignment, international interest rates, and the default history of the country.

Other cross-country studies include Eichengreen and Mody (1998), and Min (1998), which are summarised in table 2.2a and 2.2b. They are using an OLS regression technique on pooled data and include both sovereign and corporate emerging market issues.

[27] They used linear interpolation to transform annual and quarterly data to monthly data where needed, which from an econometric standpoint is highly questionable.

With the surge in international sovereign lending, the demand for sovereign ratings by international credit rating agencies has also increased. If the ratings are assumed to properly measure the credit risk, one could expect the determinants of the ratings to be similar to the determinants of the spreads. A seminal paper is Cantor and Packer (1996), which investigated the determinants of ratings of the two main rating agencies, Moody's and Standard & Poor's, for a cross section of countries. 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. Afonso (2002) complemented the work of Cantor and Packer by not only using the linear transformation of the ratings but also a logistic transformation. He used information from 81 developed and developing countries in year 2000.[28] He concluded that using the logistic transformation improves the overall adjustment of the model and consequently the predictive power of the determinants, especially for the countries placed at the top end of the rating scale. The sharp increase in the number of countries rated, allowed Rowland (2004) to investigate the determinants of sovereign credit ratings using a sample of developing countries exclusively. He used the credit ratings from 51 developing countries as of end-July 2003. His results were very similar to those of Cantor and Packer despite the fact that he studied developing countries only. The results of these studies are summarised in table 2.3.

[28] Inflation, GDP growth and budget balance were averages of 1998-2000.

Table 2.3. 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 49 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 (-)
Rowland (2004)	
OLS regression on pooled data 51 developing countries Data as of end-July 2003	GDP per capita (+) GDP growth rate (+) Inflation rate (-) Debt/Current account receivables (-) Foreign reserves/GDP (+)

Note: 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. These studies, furthermore, use the credit ratings of Standard & Poor's and Moody's.

Another set of literature has studied the impact of sovereign credit rating changes on the spread. These studies have found rating announcements to have a significant influence on emerging market sovereign spreads.[29] Cantor and Packer (1996) conclude that "rating announcements have a highly significant impact on speculative-grade sovereigns but a statistically insignificant effect on investment-grade sovereigns".[30]

[29] See, for instance, Cantor and Packer (1996), Hand, Holthausen and Leftwich (1992), and Larraín, Reisen and von Maltzan (1997).
[30] Cantor and Packer (1996), p. 47.

One interesting observation when surveying the earlier studies is that, of the 11 studies listed in table 2.1, 2.2 and 2.3, only two find the fiscal balance (or fiscal deficit) to have a significant impact on the spread or on the credit ratings. The rest of studies find the fiscal balance not to be a significant explanatory variable.[31] This finding might reflect endogeneity in fiscal policy. Countries trying to improve their credit standing may opt for more conservative fiscal policies. Because of this, the fiscal deficit might not show a systematic relationship with the spread, although rating agencies and investors may assign substantial weight to the deficit when analysing the creditworthiness of the country.

[31] Rojas and Jaque (3002) do not include the fiscal balance in the set of possible explanatory variables and do, therefore, not test the significance of this variable.

3 The Colombian Sovereign Spread

The objective of this paper is, indeed, to identify the determinants of the Colombian sovereign spread and to study its dynamics. This chapter introduces the spread of Colombian sovereign issues and its recent history. Section 3.1 discusses the Colombian sovereign spread between early 1997 and mid-2003. The yield of Colombian sovereign debt, and, therefore, also the spread, should be determined by the risk of default together with the level of compensation the market demands to take on this risk. One measure of a country's default risk is the sovereign credit ratings assigned to it by the main rating agencies. Section 3.2 discusses the credit rating of Colombia and the underlying analysis done by the major rating agencies. Section 3.3 identifies the main potential determinants of the sovereign spread. These variables will be used in the empirical analysis in chapters 5 and 6.

3.1 The Colombian Spread 1997 – 2003

We will throughout this paper use the EMBI[32] Global composites, as calculated by JP Morgan, to represent the sovereign spread over US Treasuries. The EMBI Global composites are weighted averages of the spreads of US dollar-denominated individual bonds issued by a particular emerging market country.[33] Some studies have selected a benchmark bond for each country studied 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

[32] Emerging Market Bond Index.

[33] 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 include, in addition to Brady bonds and eurobonds, US dollar-denominated traded loans and local market debt instruments issued by 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

composite, 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 easy.

The Colombian sovereign spread, represented by the EMBI Global Colombia composite, is graphed in figure 3.1, for the time period from early 1997 to mid-2003. It is obvious from the graph that the spread during this period was subject to two large shocks. The first of these occurred in late 1998, and was driven by the Russian crisis, induced by the Russian devaluation of the rouble and the default on parts of its outstanding debt in August 1998. This had a significant impact on the Colombian spread as illustrated by figure 3.2. The second shock occurred in late 2002. This was mainly due to the uncertainty surrounding the Brazilian election in October 2002, when Luiz Ignácio Lula da Silva was elected president of the country. He had, in earlier presidential campaigns, threatened to default on the Brazilian debt, but had this time around committed himself to service the debt fully. Fears of his intentions did, nevertheless, remain, and the Brazilian spread reached almost 2500 basis points in September 2002. Colombia was heavily influenced by the uncertainties surrounding Brazil, as shown by figure 3.3. In late September and early October, the Colombian spread exceeded 1000 basis points for the first time since the Russian crisis.

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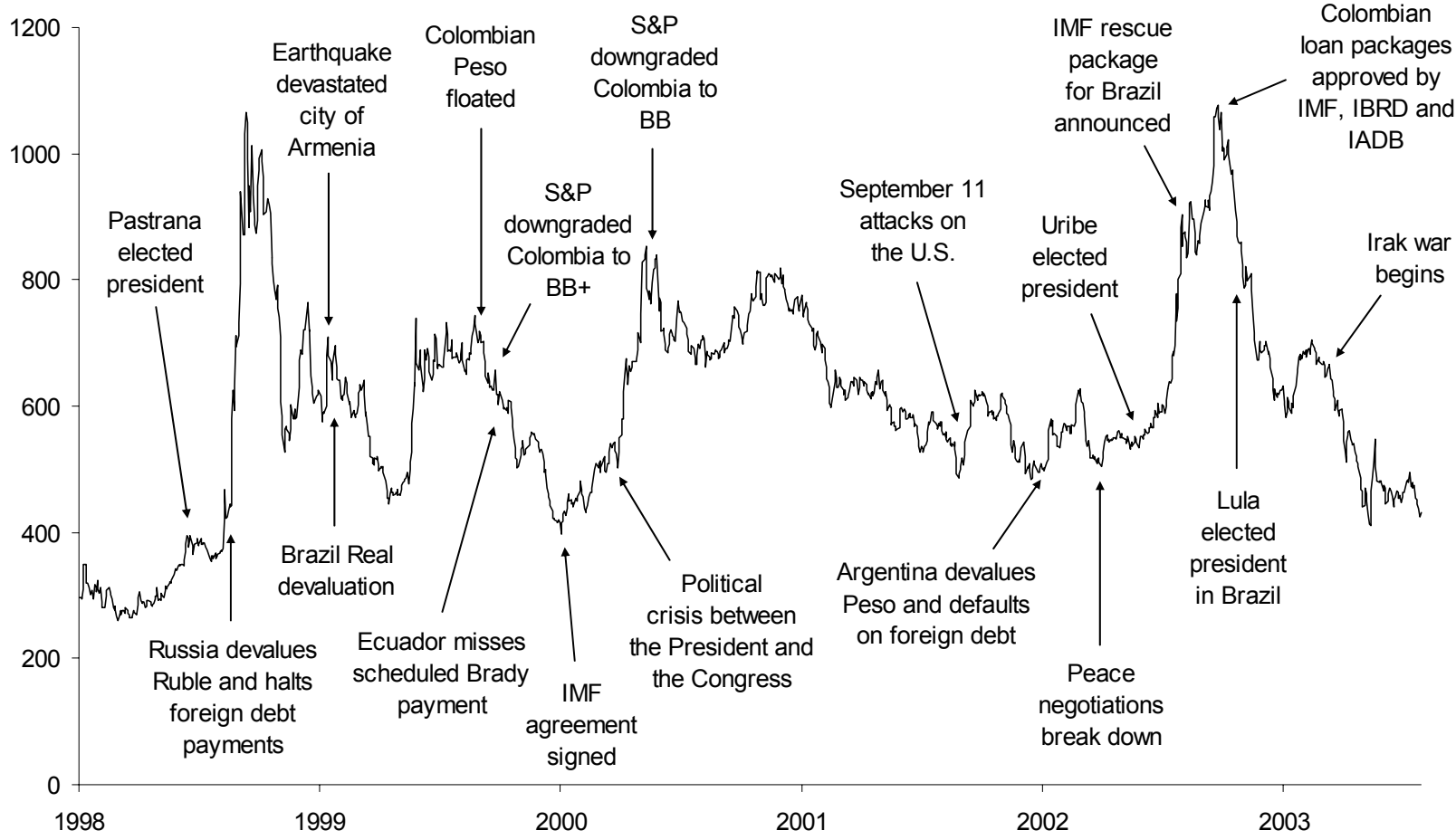
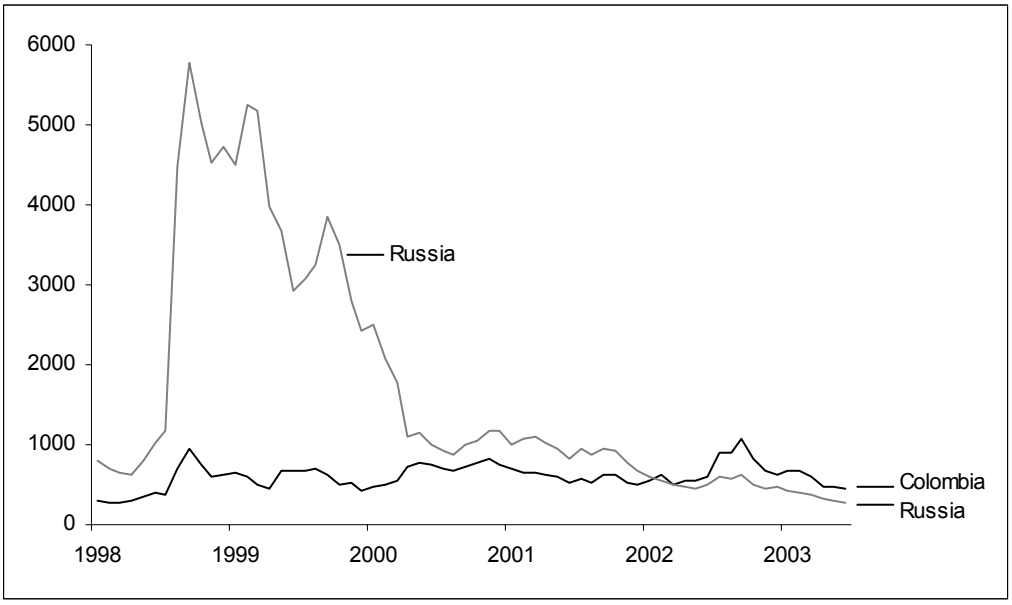
market capitalisation of the individual issues. See JP Morgan (1999) for a further discussion on how the index is defined.

Figure 3.1: The Colombian sovereign spread 1998 – 2003 (basis points)



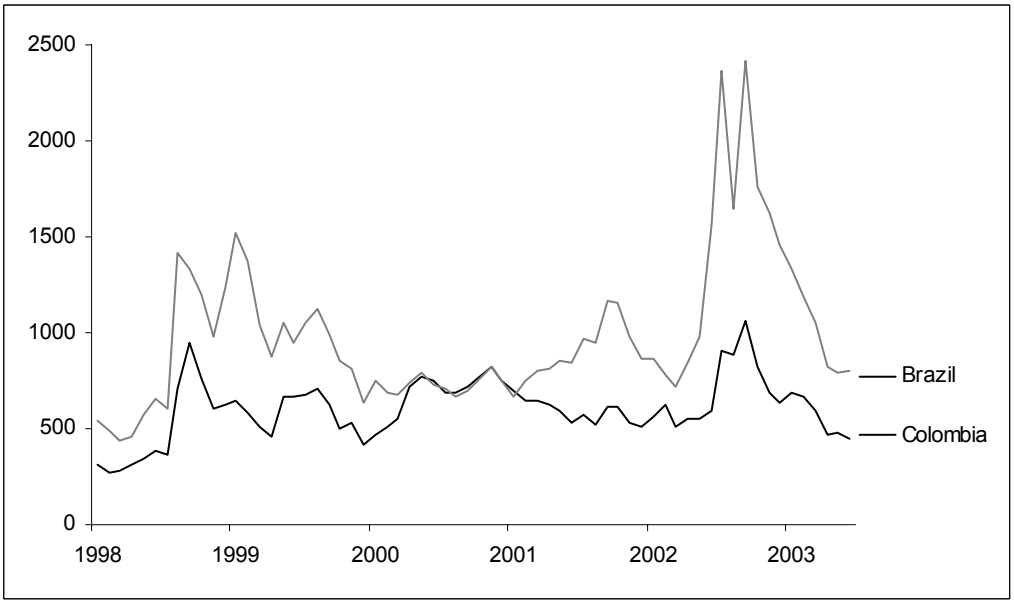
Source: JP Morgan EMBI Global for Colombia, and own analysis

Figure 3.2: The Colombian spread versus Russia (basis points)



Source: JP Morgan EMBI Global spread composites

Figure 3.3: The Colombian spread versus Brazil (basis points)



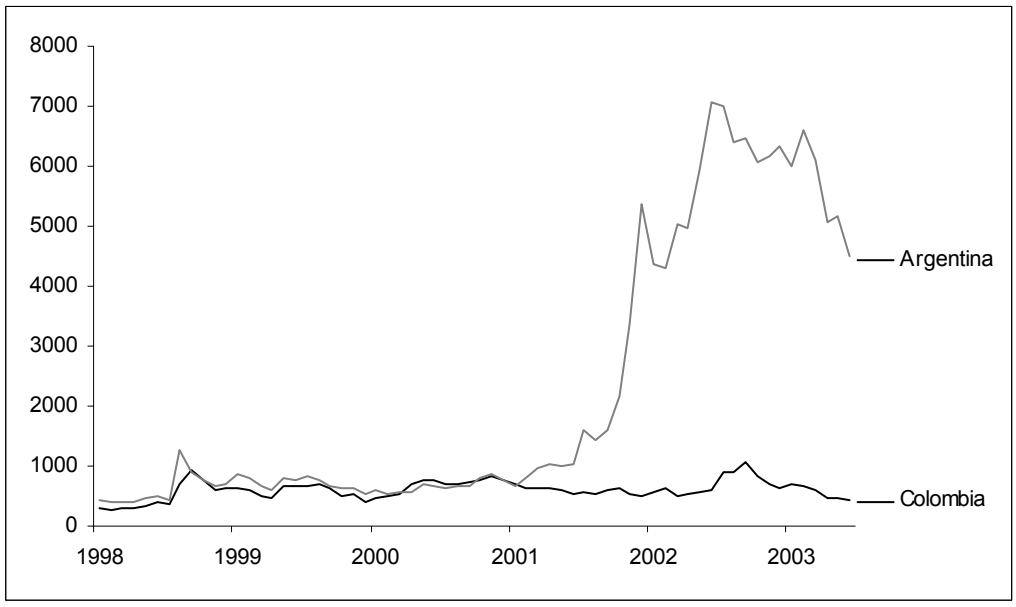
Source: JP Morgan EMBI Global spread composites

An interesting question is why Colombia was so influenced by the events in Brazil, while the Argentine default of end-2001 was hardly felt at all. In December 2001, Argentina defaulted on USD 132 billion of its debt, by far the largest sovereign default in history.[34] This was followed by political chaos on a dimension hard to predict. Fernando de la Rua was replaced as President of the country by Adolfo Rodrigues Saa, who had to resign only a week later after widespread riots and infighting within his Peronist party. Eduardo Duhalde took over the presidency in early January 2002. The Argentine peso, which had been fixed to the US dollar at a parity rate of one to one for over a decade, was devalued. What was to follow was an unprecedented economic collapse. In August 2002, The Economist wrote: "The economic crisis that struck Argentina last year has deepened into one of the worst and most intractable such calamities in living memory".[35]

Argentina had, however, been largely decoupled from the rest of emerging markets, and its collapse had little influence on the sovereign spread of other countries, including Colombia. As shown by figure 3.4, the Argentine default, which led to a sharp increase in the spread of its bonds, had little influence on the Colombian spread.

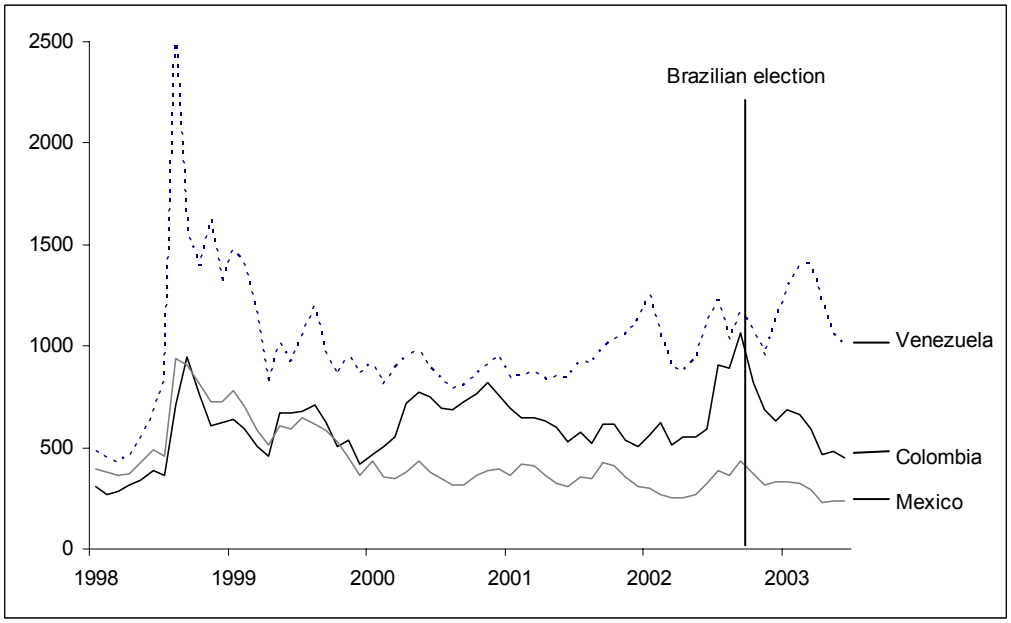
[34] Economist (2003).
[35] Economist (2002).

Figure 3.4: The Colombian spread versus Argentina (basis points)



Source: JP Morgan EMBI Global spread composites

Figure 3.5: The Colombian spread versus Mexico and Venezuela (basis points)



Source: JP Morgan EMBI Global spread composites

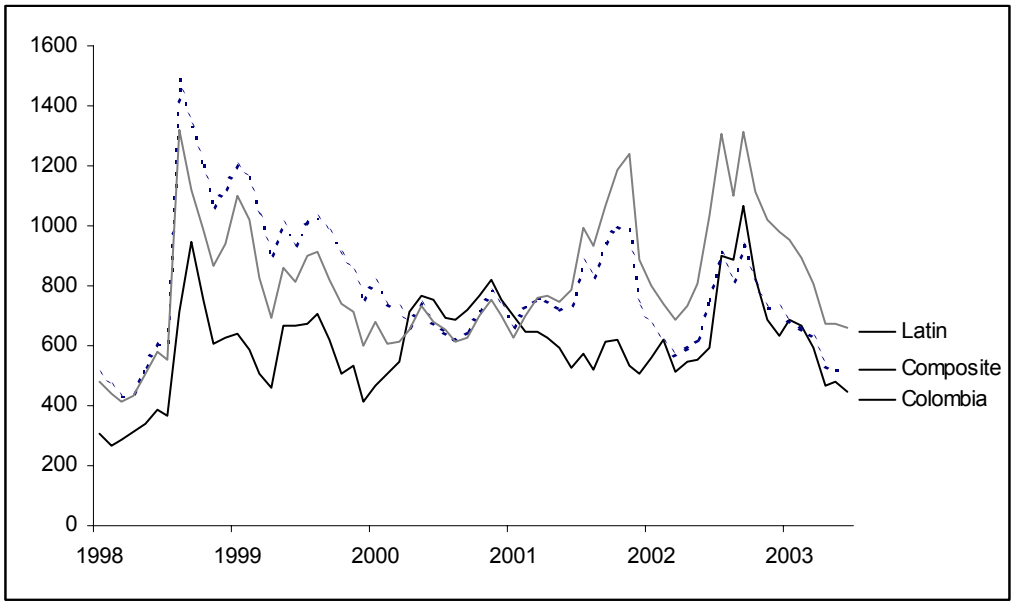
The Brazilian election in late 2002, on the other hand, had a severe impact on Colombian spreads, while hardly effecting the sovereign spreads neither of Mexico nor of Venezuela, as shown in figure 3.5.[36] The reason why Colombia was so severely affected was the perceived structural similarities of the economies of Brazil and Colombia.[37] Both countries had debt-to-GDP ratios of close to 50 percent,[38] compared to 22.9 percent in Mexico. Both Colombia and Brazil were, furthermore, running large fiscal deficits. In 2002, the Colombian fiscal deficit reached 5.6 percent of GDP, and in Brazil the corresponding figure was 5.5 percent, while in Mexico only 1.8 percent. This lead many analysts to conclude that if Brazil defaulted on its debt, Colombia would be forced to do so as well. It was not until the approval of an IMF agreement with Colombia in late September, when spreads started falling.

Figure 3.6 graphs the Colombian spread against the Latin American composite as well as the global emerging markets composite. Contagion is apparent in the graph, and this particularly during the Russian crisis in late 1998 and during the Brazilian presidential election in late 2002. Again, the increase in the Latin American as well as the global composite in late 2001, due to the Argentine crisis, seems to have had very limited effects on the Colombian spread. We will return to the issue of contagion in chapter 4.

Table 3.1, finally, summarises some statistics on the spreads of Colombia and other Latin American countries. An interesting observation is that issues from both Peru and Panama have been trading at tighter spreads than Colombia, even if those countries have similar credit ratings.[39]

[36] Note that the sharp increase in Venezuelan spreads during the Russian crisis in late 1998 actually had more to do with the election Hugo Chavez as president of the country and his talk about halting the servicing of Venezuela's foreign debt. Venezuela, nevertheless, continued to service its debt, but spreads have remained high due to political instability and uncertainties surrounding Chavez's intentions.
[37] Fitch (2002b), indeed, concluded that Colombia was more vulnerable to a crisis in Brazil than any other major emerging market.
[38] In 2002, Colombia had a debt-to-GDP ratio of 47.0 percent, and for Brazil the figure was 49.9 percent.
[39] Peru is, in fact, rated one notch lower than Colombia by both Standard and Poor's and Moody's, while Moody's rate Panama one notch above Colombia.

Figure 3.6: The Colombian spread versus Latin America and global emerging markets (basis points)



Source: JP Morgan EMBI Global spread composites

Table 3.1: Sovereign spread of selected Latin American economies (basis points)

	Ratings		Spread	Spread during past 12 months			
Country	S&P	Moody's	26/7/03	Mean	Max.	Min.	Std. Dev.
Colombia	BB	Ba2	431	674	1076	411	182
Argentina	SD	Ca	4775	5866	7167	4314	715
Brazil	B+	B2	769	1363	2451	683	503
Chile	A-	Baa1	117	169	260	116	35
Dominican Rep	B+	Ba2	611	534	789	416	90
Ecuador	CCC+	Caa2	1088	1528	2200	1029	306
El Salvador	BB+	Baa3	327	374	434	294	28
Mexico	BBB-	Baa2	224	310	442	206	62
Panama	BB	Ba1	350	431	561	340	62
Peru	BB-	Ba3	435	599	893	370	150
Venezuela	B-	Caa1	859	1143	1474	849	150

Source: JP Morgan EMBI Global spread composites, Standard and Poor's, Moody's, and own analysis

3.2 Colombia's Credit Rating

Colombia is currently rated BB with a stable outlook by Standard & Poor's and with a negative outlook by Moody's,[40] the two main rating agencies. The rating systems and terminologies used by the two agencies are summarised in the appendix.

Table 3.2: Credit rating history of Colombia (long-term foreign currency ratings)

Standard & Poor's		Moody's	
22 Jun 1993	BBB-/Stable		
21 Sep 1994	BBB-/Positive		
		25 May 1995	Ba1/Positive
		19 Sep 1995	Baa3/Stable
7 Oct 1997	BBB-/Stable		
		30 Sep 1998	Baa3/Negative
11 Jun 1999	BBB-/Negatve		
		11 Aug 1999	Ba2/Stable
21 Sep 1999	BB+/Stable		
10 Apr 2000	BB+/Negative		
23 May 2000	BB/Negative		
		27 Mar 2002	Ba2/Negative
14 Jul 2003	BB/Stable		

Source: Standard & Poor's, and Moody's

The credit-rating history of Colombia is presented in Table 3.2. The last time Colombia was upgraded, was in September 1995, when Moody's increased its rating from Ba1 to Baa3. The agency motivated its decision in the following way:

[40] Colombia is rated Ba2 by Moody's, which corresponds to the BB rating by Standard & Poor's. We will in this paper use the terminology of Standard & Poor's unless we specifically refer to Moody's.

> The Colombian economy has grown strongly in 1993 and 1994. Moody's expects that this growth pattern will continue during the next two years. In 1995, we expect GDP growth to exceed 5% for the third year in a row. At the same time, fiscal performance has remained strong. Exports have also expanded in 1994, and are set to rise at a rapid pace as the Cusiana and Cupiagua oil fields come on stream. Colombia may triple its oil exports by the end of the century. As a result, Colombia's debt/GDP and debt/exports ratios have fallen considerably. Finally, Colombia was nearly unaffected by the crisis of confidence that followed the Mexican devaluation in December of 1994, and the government has continued its broad-based reform program.[41]

Colombia has since then, together with a number of other emerging market economies, seen its credit rating downgraded. In August 1999, Colombia was downgraded by Moody's by two notches from Baa3 to Ba2. Standard & Poor's followed by a one-notch downgrade from BBB- to BB+ in September 1999. These downgrades were particularly serious, since they implied a downgrade from investment-grade to speculative-grade ratings. A consequence of this is that portfolio managers who are restricted to holding investment-grade securities, would not be able to invest in Colombian sovereign bonds.

> Moody's said that the rating decision reflects the country's weaker economic fundamentals indicated by a deterioration in both the external and fiscal accounts. A direct result of major macroeconomic imbalances, Colombia's external indebtedness has increased at a rapid pace since the mid-1990s. Consequently, the debt-servicing burden has also gotten heavier.[42]

The agency continues:

> Despite all the difficulties presently facing the country, a major strength remains Colombia's long track record of sound financial and economic management. Although there has been a deterioration in a number of traditional ratios used to measure creditworthiness, the overall accumulated debt burden remains below that of other more highly indebted Latin American countries.[43]

[41] Moody's (1995b).
[42] Moody's (1999).
[43] Moody's (1999).

Standard & Poor's added in their motivation:

> The downgrade reflects the Colombian government's weakened capacity to implement effective economic policies, given the debilitating impact of the conflict with the country's insurgency groups. The protracted conflict, in turn, has exacerbated this year's recession, reduced the country's medium-term growth prospects, and weakened the domestic banking system.[44]

In May 2000, Standard & Poor's downgraded Colombia a further notch to its current BB rating. The agency wrote:

> The downgrade reflects the expectation that the government's fiscal adjustment will fall short, due to deteriorated relations with Congress and poorer growth prospects stemming from continued guerrilla violence. … The Pastrana Administration, in an effort to reduce corruption and reform the state, has strained relations with Congress by threatening to hold a referendum for its dissolution. Without a robust fiscal adjustment and better growth, Colombia's gross public-sector debt (currently at 52% of GDP…) will continue to approach the double-'B' median of 63%.[45]

Colombia is currently rated BB by both Standard & Poor's and Moody's. Standard & Poor's, nevertheless, changed its outlook from negative to stable in July 2003, referring to improved fiscal performance, higher growth prospects and an improvement in the security situation.[46]

[44] Standard & Poor's (1999).
[45] Standard & Poor's (2000).
[46] See Standard & Poor's (2002b, 2003)

> Standard & Poor's expects passage of the economic measures in the fall 2003 national referendum, given the overwhelming popular support that President Alvaro Uribe commands… The freeze in spending and pension measures included in the referendum are crucial to further fiscal consolidation, which is needed to stabilize the government's adverse debt dynamics. With these measures, the general government deficit is expected to decline to 3.6% of GDP in 2003 from 5.2% in 2002, and the general government debt to stabilize at 53% of GDP… Additionally, after five years of lacklustre growth averaging just 0.4%, the country's economic growth prospects have improved. Growth is now projected at 2.5% in 2003 and over 3.0% in 2004. Improved growth prospects largely reflect the success of President Uribe's strategy of improving national security while maintaining macroeconomic stability.[47]

Moody's has, nevertheless, decided to keep the negative outlook for the time being.

> The negative outlook incorporates concerns about the ability of the Uribe administration to reverse recent trends that have contributed to a continued deterioration in the fiscal accounts… The outlook also reflects the major challenges that the current administration will face in order to stabilize public debt ratios in an environment that is likely to be characterized by weak GDP growth. Additional complications include the financial demands that will be placed on the budget as a result of the anticipated increase in defence-related spending. Export prospects for traditional products will continue to be affected by low commodity prices and domestic supply problems. Nontraditional exports will be negatively affected by the deterioration of economic conditions in the Andean region and modest growth prospects in the US.[48]

[47] Standard & Poor's (2003).
[48] Moody's (2003).

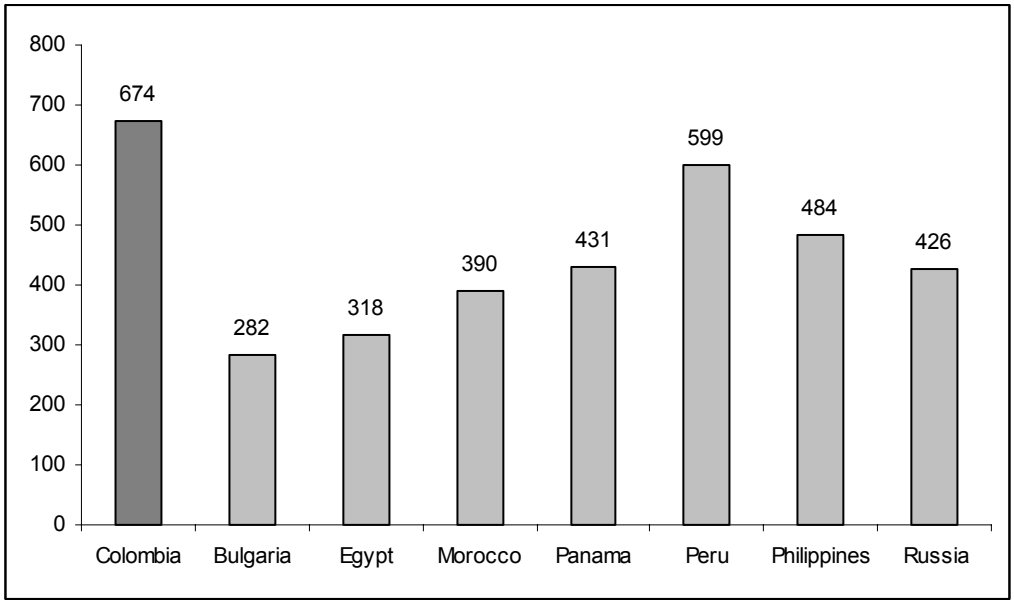
Moody's, furthermore, motivate their current Ba2 rating:

> Colombia's Ba2 foreign-currency country ceiling reflects a high external debt burden evidenced by a debt-to-exports ratio of 220%, with external debt service absorbing 45% of current account receipts. The rating is constrained by weak overall export performance. The upward trend observed in the public debt-to-GDP ratio and the presence of economic conditions that have led to sub-par growth in recent years are additional elements that constrain Colombia's rating. The rating is supported by the presence of a stable macroeconomic environment characterized by low single-digit inflation, declining interest rates, and a manageable current account deficit. Additional support for the rating is derived from the government's dedicated effort to improve the debt profile.[49]

Other BB-rated countries include Bulgaria, Morocco, Panama, Philippines and Russia. All these countries have, however, traded at tighter spreads than Colombia, as illustrated in figure 3.7. Even Peru, which is rated BB- by both Standard & Poor's and Moody's, has been trading at a tighter spread, even if this is not the case right now. This supports the negative outlook that Moody's and, until recently, also Standard & Poor's had assigned to Colombian sovereign debt. It also reflects the fact that Colombia, together with Peru, was severely affected by the uncertainties surrounding the Brazilian election in the second half of 2002. As seen in table 3.3, none of the countries saw their spread rising to more than 615 basis points, apart from Colombia and Peru, who saw their spreads increasing to 1,076 and 893 basis points respectively. Panama, the only other Latin American country in the sample, only saw its spread rising to 561 basis points.

[49] Moody's (2003). See also Moody's (2002).

Figure 3.7: Sovereign spread of selected BB-rated economies, average between Aug 2002 and Jul 2003 (basis points)



Source: JP Morgan EMBI Global spread composites

Table 3.3: Sovereign spread of selected BB-rated economies

	Ratings		Spread	Spread during past 12 months			
Country	S&P	Moody's	26/7/03	Mean	Max.	Min.	Std. Dev.
Colombia	BB	Ba2	431	674	1076	411	182
Bulgaria	BB+	Ba2	227	282	415	220	54
Egypt	BB+	Ba1	148	318	514	148	92
Morocco	BB	Ba1	249	390	568	225	103
Panama	BB	Ba1	350	431	561	340	62
Peru	BB-	Ba3	435	599	893	370	150
Philippines	BB	Ba1	395	484	565	386	38
Russia	BB	Ba2	276	426	615	263	106

Source: JP Morgan EMBI Global spread composites, Standard and Poor's, Moody's, and own analysis

3.3 Potential Determinants of the Spread

The sovereign spread is determined by a large number of factors. Factors that directly influence the spread is a country's creditworthiness and general emerging market sentiment. The latter refers to the general risk averseness of international investors and their willingness to take on risk at a certain point in time. Investors might, indeed, demand a different spread at different points in time to take on the same risk. In this way, the same issue might trade at different spreads at different points in time, even if the creditworthiness of the issuer remains the same. Another factor that plays an important part in pricing of emerging market sovereign bond issues is contagion. Investors have a tendency 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. Contagion will be dealt with in detail in the next chapter.

Since the creditworthiness of a country is crucial when pricing its bonds, the determinants of the creditworthiness should also determine the spread. In their statements on rating criteria, the main rating agencies list numerous economic, political and social factors that underlie their sovereign credit ratings.[50] Most of these factors are, however, not quantifiable,[51] 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.

Rowland and Torres (2004) identifies a number of fundamental economic variables that can be envisaged to influence the sovereign creditworthiness and the sovereign spread. In line with some other earlier studies they divide these variables into solvency variables, liquidity variables, variables representing external shocks and dummy 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

[50] See Standard & Poor's (2002a), Moody's (1991, 1995a), and Fitch (2002a).
[51] Cantor and Packer (1996), p. 39.

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.

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 at a specific point in time. 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.

The *variables representing external shocks* relates to those that capture external shocks to the economy. The important role played by international interest rates in determining international capital flows to emerging markets has been emphasised by a number of studies.[52]

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. This set of variables does, however, only make sense in cross-country studies, and we will therefore not use them here.

Table 3.4, 3.5 and 3.6 lists the potential determinants of the spread identified by Rowland and Torres (2004), with some additions made for this particular study.[53]

[52] See, for example, Arora and Cerisola (2001), Barr and Pesaran (1997), Calvo, Leiderman and Reinhart (1993), and Dooley, Fernandez-Arias and Kletzer (1996).
[53] Variables added include Growth of industrial production, together with all variables representing external shocks (table 3.6) apart from the US T-Bill rate, which was included in Rowland and Torres (2004).

Table 3.4. Potential determinants of the sovereign spread: Solvency variables

Variable (unit of measure)	Rationale	Data Frequency
Real GDP Growth (%)	A high 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.	Quarterly
Growth of industrial production (%)	This can be used as a proxy for GDP growth with the advantage that it is less seasonal and that it is published with monthly frequency.	Monthly
Fiscal balance/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.	Monthly
Current account/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.	Quarterly
External debt/GDP (%)	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 that much about the annual debt service burden imposed on the country, which also depends on the maturity structure as well as on the yield of the debt.	Quarterly
CPI Inflation (%)	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.	Monthly

Source: Rowland and Torres (2004), with the exception of Growth of industrial production that has been added.

Table 3.5. Potential determinants of the sovereign spread: Liquidity variables

Variable (unit of measure)	Rationale	Data Frequency
Reserves/GDP (%)	The foreign debt has to be serviced out of the international reserves. For this reason, low reserve levels sharply increases the risk of default.	Monthly
Debt service/GDP (%)	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.	Annually
Exports/GDP (%)	Exports is a major source of foreign exchange, and countries with large exports are normally less vulnerable to external shocks when it comes to servicing their debt.	Monthly
Short-term debt/Reserves (%)	If a country has a large proportion of short-term debt that has to be rolled over, this might generate difficulties, particularly in times of tight global liquidity conditions.	Annual
Maturity of external debt (yrs)	This is another measure of the composition of the debt. A short time to maturity implies a large proportion of short-term debt.	Annual

Source: Rowland and Torres (2004).

Note: Rowland and Torres (2004) also include the debt-service-to-reserves ratio and debt-service-to-exports ratio. These are only published with annual frequency and are, therefore, omitted here.

Table 3.6. Potential determinants of the sovereign spread: Variables representing external shocks

Variable (unit of measure)	Rationale	Data Frequency
USD/COP exchange rate	If the exchange rate is depreciating, the debt burden measured as the debt-to-GDP ratio will increase, and so will the debt-service ratios. The debt will, therefore, be more difficult to service and the default risk will increase.	Daily
3-month US T-Bill rate (%)	The interest rate yielded by the 3-month US Treasury Bill is a liquid US dollar interest rate, and we, therefore, regard it as good proxy for global liquidity conditions. Some other studies have used the London Inter-Bank Offering Rate (LIBOR), but these two rates should be closely correlated, so the choice between the two are of less importance.	Daily
S&P 500 stock market index	A weak stock market might lead investors to look for alternative sources of high return. On the other hand, a fall in the stock market might also lead to a flight to quality. These two effects have the opposite impact on emerging market bonds, and in general, the latter has been the dominant.	Daily
EMBI Global Mexico	Mexico was the first country to issue Brady bonds, and it has also the largest weight in the different EMBI composites. For this reason, the Mexican issues are normally used as benchmarks when pricing other emerging market debt, and it might, therefore, have an influence also on Colombian spreads.	Daily
EMBI Global	The EMBI Global spread composite for emerging markets world wide can be used as a measure of general market sentiment. It might also have a significant influence on the Colombian spread through contagion.	Daily

Source: Rowland and Torres (2004) together with own intuition.

Figure 3.8 to 3.11 graphs some of the variables for Colombia, Brazil, Mexico and Argentina for the period 1999 to 2002. Note that Colombia, Brazil and Mexico are rated BB, B+, and BBB-, and that Argentina was rated BBB- 1999 and 2000 and BB up until March 2001. Argentina defaulted in December 2001.

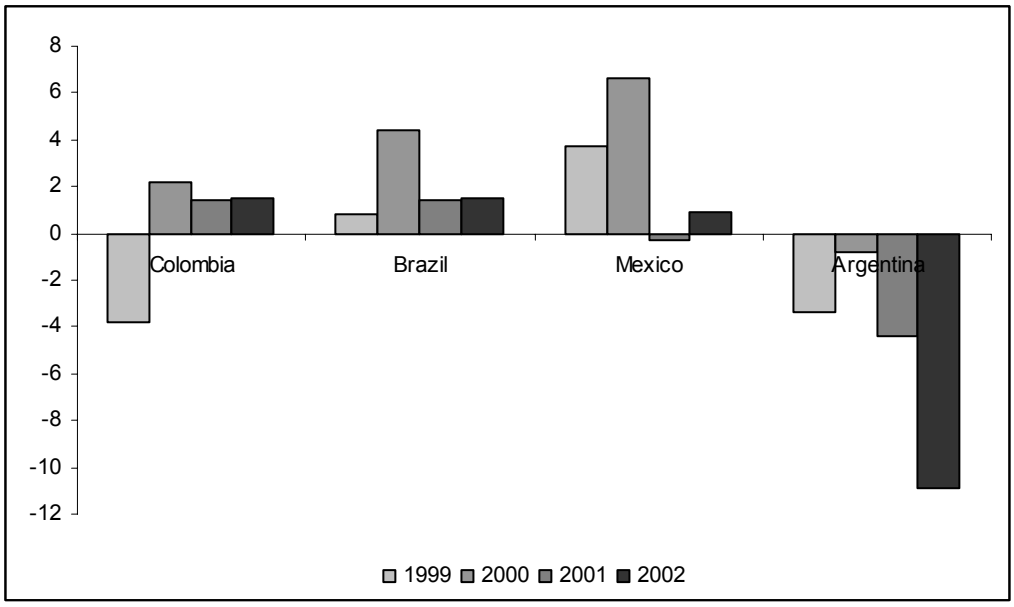
As illustrated by figure 3.8, Colombia had a lower average GDP growth rate than both Mexico and Brazil for the period. Argentina, on the other hand, had by far the worst GDP development of the four countries.

Figure 3.9 illustrates the debt-to-GDP ratio of the four countries. It is apparent that Colombia and Brazil has similar levels of debt to GDP, while Mexico has a significantly lower level. Argentina's debt-to-GDP level was initially held down by an overvalued exchange rate, but increased dramatically when the exchange rate was floated in early 2002.

The Colombian international reserves are standing at a very healthy level, as shown by figure 3.10. At around 12 percent, Colombia has the highest reserves-to-GDP ratio of the four countries.

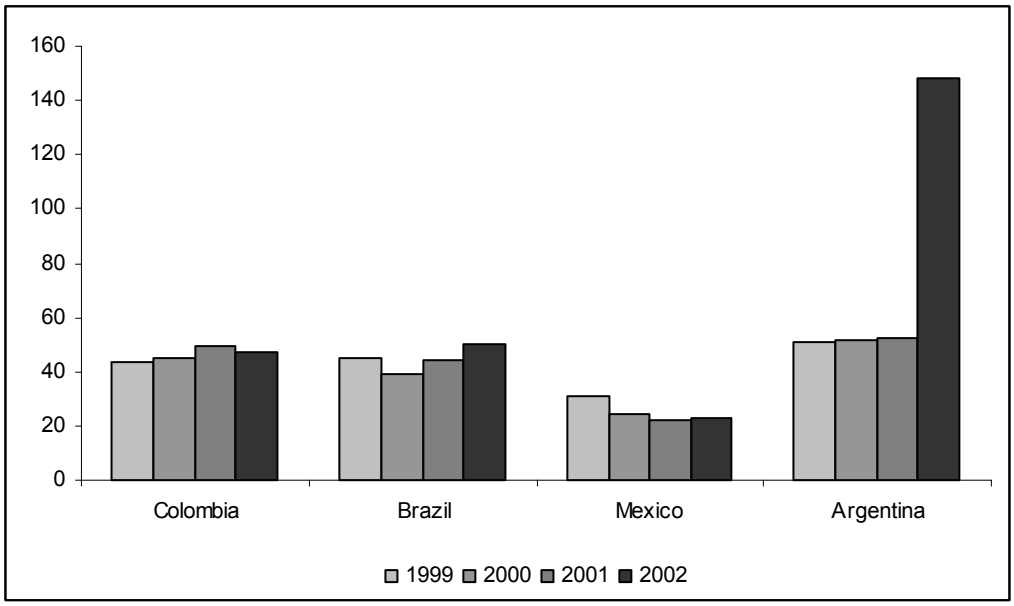
Colombia is, on the other hand, running a high fiscal deficit. Even if the fiscal deficit as a percentage of GDP is standing at the same level as in Brazil, it is significantly higher than in both Mexico and Argentina. Even if the Argentine fiscal deficit was significantly reduced in 2002 by the fact that Argentina did not service its debt, it was, indeed, considerably lower than the Colombian deficit for the preceding years as well.

Figure 3.8: Real GDP growth rate (%)



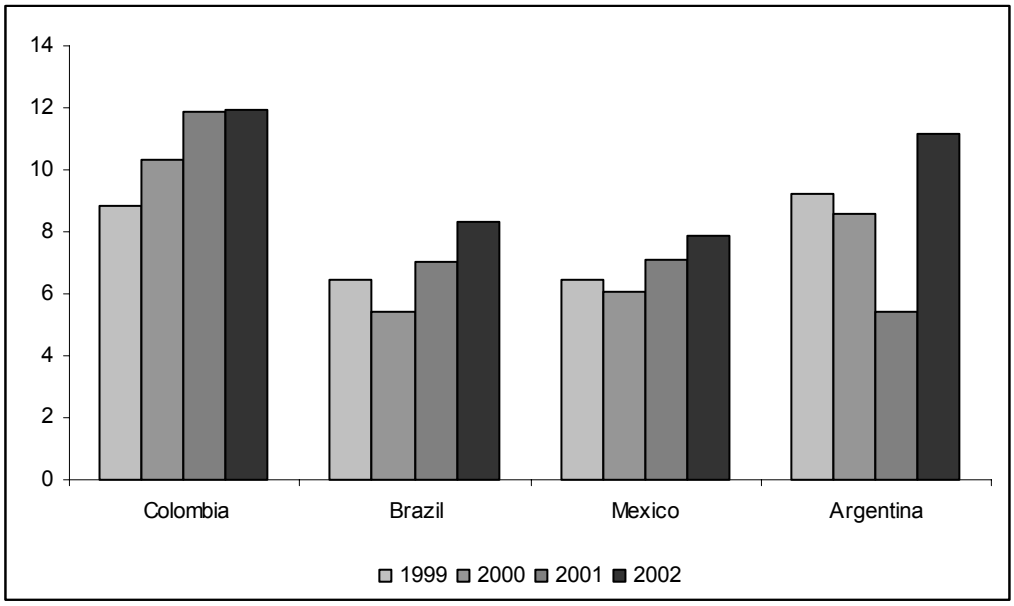
Source: Moody's

Figure 3.9: External debt to GDP (%)



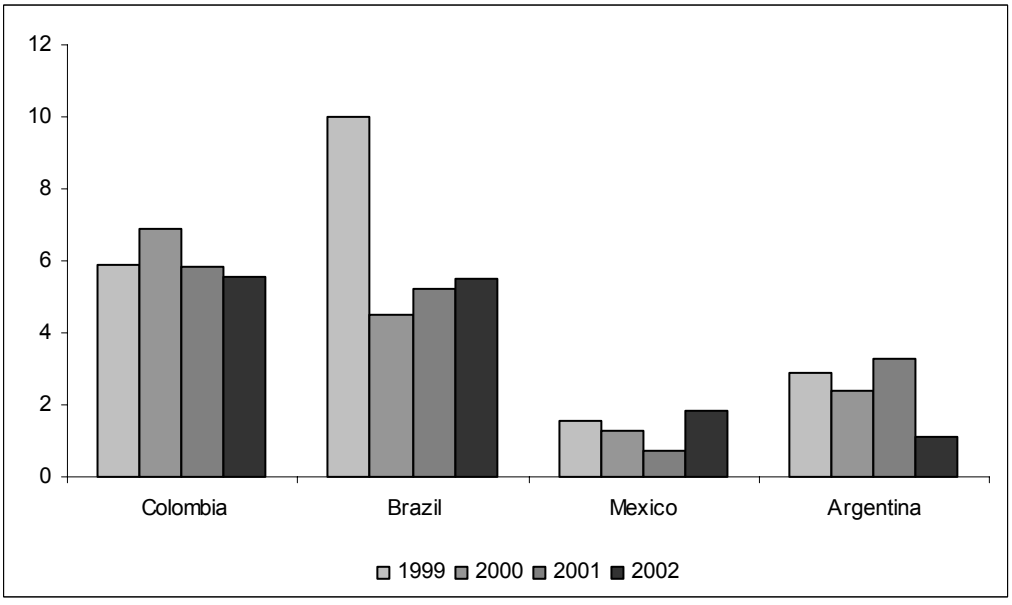
Source: Moody's

Figure 3.10: Foreign exchange reserves to GDP (%)



Source: Moody's

Figure 3.11: Fiscal deficit to GDP (%)



Source: IMF International Financial Statistics

4 Contagion and the Colombian Spread

One potential determinant of the Colombian spread is the spread of bonds of other similar sovereign issuers. As we saw in figure 3.1 in the previous chapter, the Colombian spread reached 1,000 basis points twice between early 1997 and mid-2003. In both these occasions, the surge in the spread was due to foreign events that influenced the Colombian spread. In the first occasion it was because of the Russian crisis, and in the second occasion because of the Brazilian election and the perceived risk of a Brazilian default. These events quickly affected the Colombian spread through contagion. The influence of contagion on the Colombian spread will be examined in this chapter, which starts by defining and discussing the concept of contagion in section 4.1. Section 4.2 analyses the influence of contagion and spillovers on the Colombian spread, and section 4.3 studies how this has changed over time.

4.1 Contagion

Contagion is a relatively new concept in economics.[54] Before the 1990s only limited research had been done in the area. However, interest in contagion surged during the second half of the 1990s, when financial crises spread across emerging markets, affecting countries with apparently healthy fundamentals and whose policies only a few months earlier had been praised by market analysts and multilateral institutions alike.[55] Since then, an extensive literature on the subject has emerged.[56]

The international propagation of financial shocks is not a new phenomenon. "What is new, or at least surprising, is that shocks originating is a particular country affect, in a very severe and unexpected way, nations that are very distant and that appear to be largely unrelated to the shock originator."[57] Examples of this type of situations include

[54] See, for instance, Edwards (2000) for a discussion.
[55] See, for example, Masson (1998).
[56] See, for instance, Dornbusch, Park and Claessens (2000), for a review of this literature.
[57] Edwards (2000), pp. 874f.

the transmission of the Asian crisis of 1997, which started in Thailand and propagated throughout emerging markets, and the Russian crises of 1998, which sent Latin American sovereign spreads skyrocketing.

Contagion has in the literature been defined in a number of different ways. A broad definition is that contagion is any transmission of shocks across countries. A more restricted definition, and maybe a more useful one, is that contagion is an international transmission of shocks that exceeds what was originally expected. Edwards (2000) discusses some different definitions of contagion:

> In order to formalise this definition we can distinguish between three mechanisms through which economic shocks are propagated across countries. The first one corresponds to global disturbances that affect all (or most) countries in the world. The oil shocks of 1973 and 1979 are good examples of these aggregate disturbances, which Masson (1998) has called international *monsoons*. The second mechanism corresponds to shocks coming from a related country. Some authors have referred to this phenomenon as *spillovers* (Masson (1998)) or as *fundamentals-based contagion* (Kaminsky and Reinhart (1999)). This would be the case, for example, when a crisis in a trade partner reduces greatly the demand for our exports. … This channel does not appear to be particularly important in the case of emerging economies. The third mechanism includes all instances not covered by the two previous cases, and corresponds to our definition of contagion. That is, contagion is defined as a residual, and thus as a situation where the extent and magnitude of the international transmission of shocks exceeds what was expected by market participants.[58]

Contagion and other spill-over effects can explain a significant part of sovereign spreads, and in this sense they are complimentary to fundamentals in identifying the determinants of spreads. We will in the next two sections look at how the sovereign spreads of other markets have influenced Colombian sovereign spreads.

[58] Edwards (2000), pp. 879f.

4.2 The Colombian Spread, Contagion and Spillovers

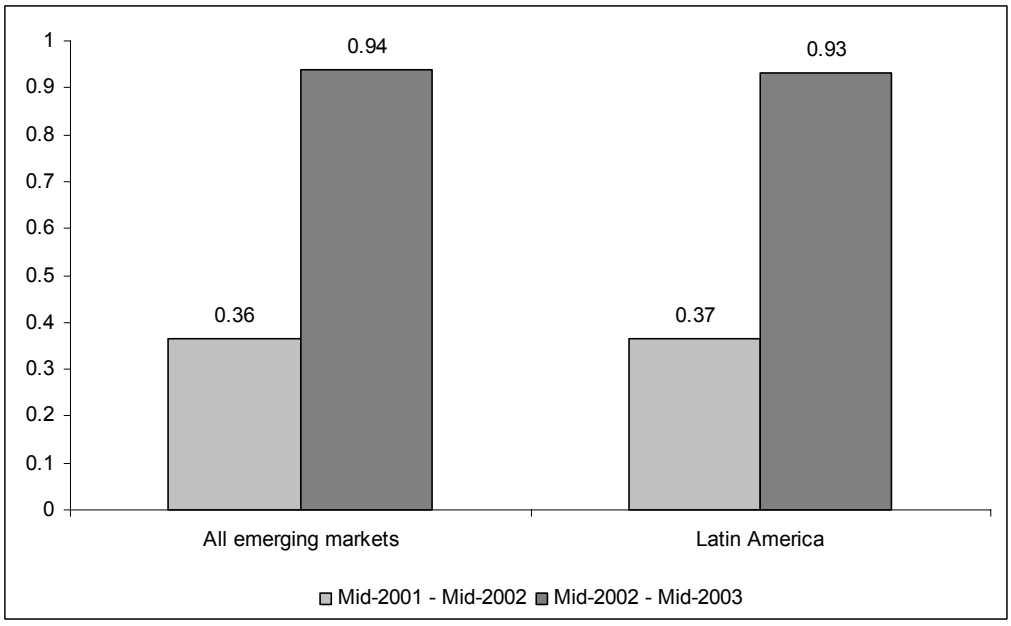
Figure 4.1 illustrates the correlation between the Colombian daily spread and the global emerging market composite as well as the Latin American composite for the past two 12-month periods. It is apparent that for the past 12 months (mid-2002 to mid-2003), Colombian spreads experienced a very high correlation with both global emerging markets and with Latin American markets. The correlation coefficient was as high as 0.94 between Colombia and global emerging markets and 0.93 between Colombia and Latin American markets. The correlations with European emerging markets and with Asian emerging markets were lower,[59] with correlation coefficients standing at 0.90 and 0.42 respectively.

Another interesting observation from figure 4.1 is that correlation has changed significantly over time. During the period mid-2001 to mid-2002 the correlation was much lower. This period did indeed include the Argentine default, which had a significant impact on both the global emerging market spread composite and on the Latin American spread composite, since Argentina was an important country in those aggregates. The Argentine default did, however, only have a very limited effect on the Colombian spread as discussed in the previous chapter.

If we study the daily spread correlation between Colombia and some other Latin American countries, the pattern looks very similar, as illustrated by figure 4.2. The Colombian spread experienced a high correlation with both the Mexican and the Brazilian spread during the past 12 months (mid-2002 to mid-2003). The correlation coefficients between the Colombian daily spread and that of Mexico and Brazil were 0.96 and 0.92 respectively. Colombia even showed a relatively high correlation with the Argentine spread, with a correlation coefficient of 0.66, even if Argentina was in structural default throughout the period. Venezuela is the only country of the four in the figure whose spread was de-coupled from the Colombian spread.

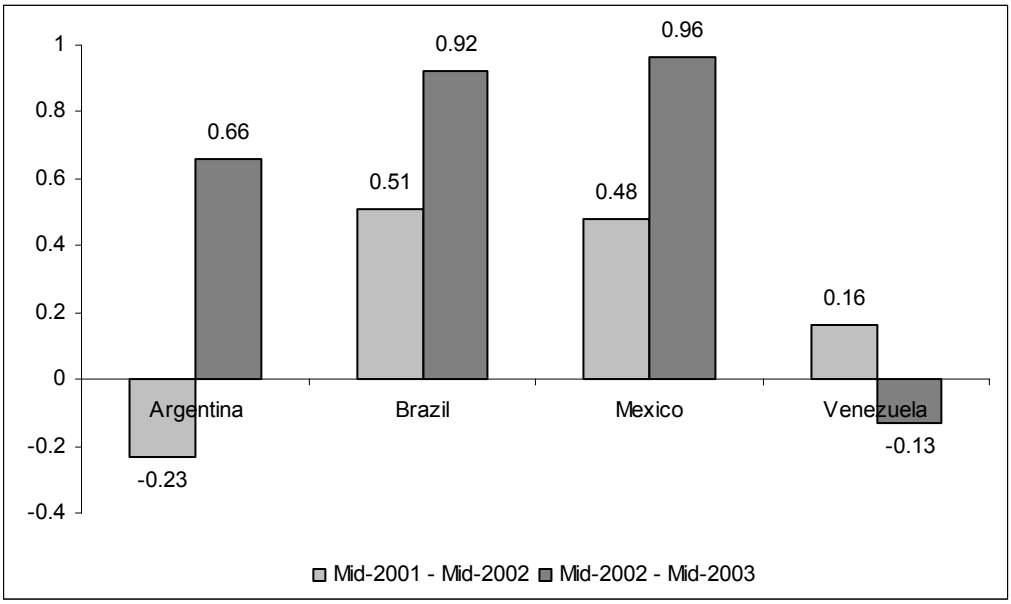
[59] This has not been graphed here.

Figure 4.1. Emerging market daily spread correlation with Colombia



Source: JP Morgan EMBI Global spread composites, and own calculations

Figure 4.2. Daily spread correlation with Colombia of selected countries



Source: JP Morgan EMBI Global spread composites, and own calculations

During the previous 12-month period (mid-2001 to mid-2002) the pattern again is similar to that of figure 4.1. The correlations between the Colombian spread and those of Mexico and Brazil are much lower than during the proceeding 12 months (mid-2002 to mid-2003). Again Venezuela seems de-coupled from Colombia, and so does Argentina. Note that Argentina defaulted in the end of 2001, and as discussed in the previous chapter, this had very limited effect on Colombian spreads.

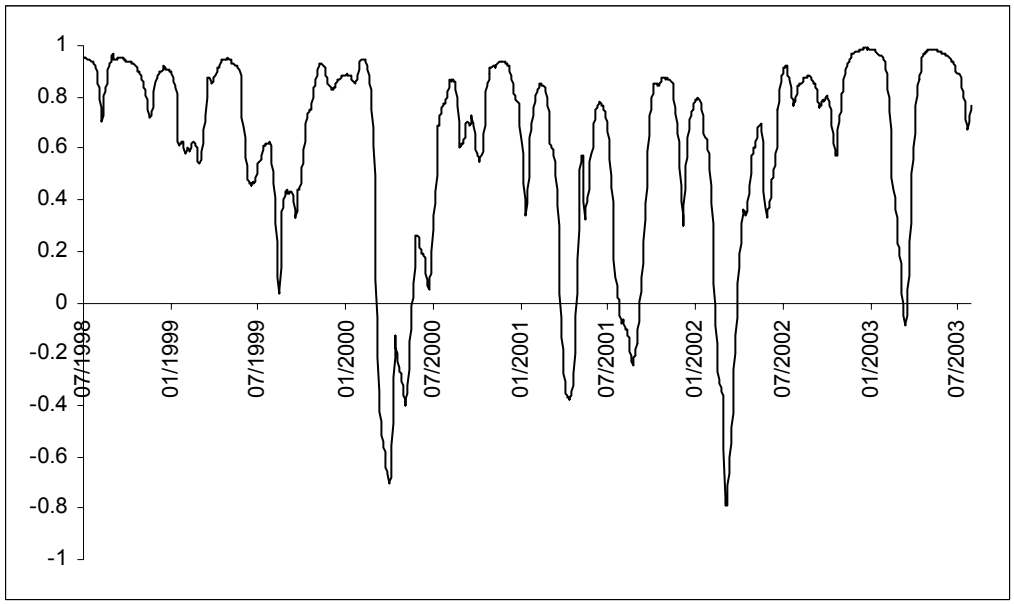
4.3 Changes in Cross-Country Spread Correlation over Time

The figures in the previous section (figure 4.1 and 4.2) showed that the correlation between the daily Colombian spread and that of a number of other Latin American countries as well as of emerging markets in general was very high during the past 12 months (mid-2002 to mid-2003). The figures also suggested that this correlation has changed considerably over time.

We will in this section study how the cross-country spread correlation has changed over time. For this purpose we compute the rolling 60-day correlation coefficient between the Colombian spread and that of some selected countries.

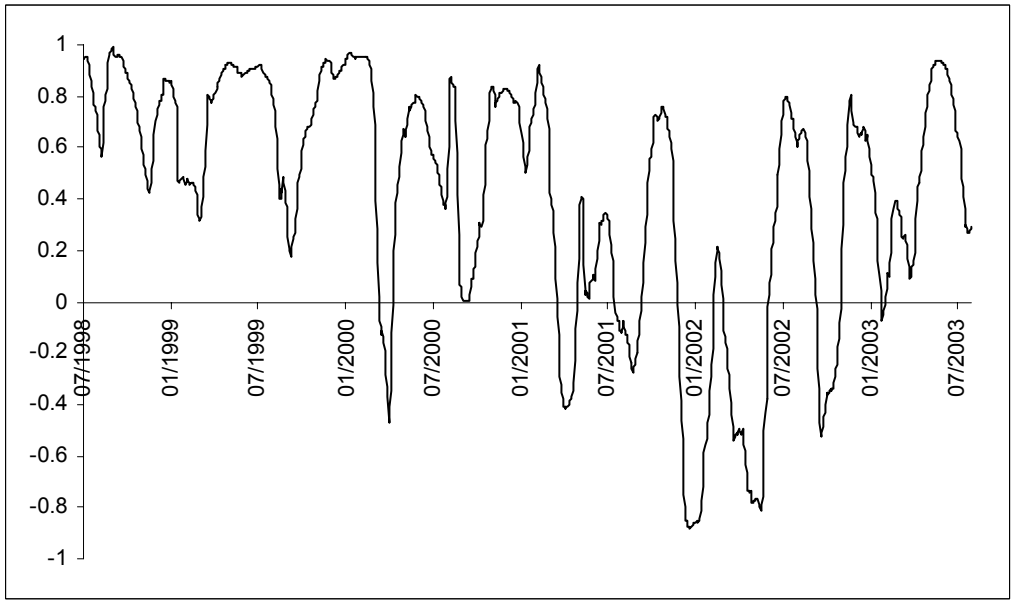
Figure 4.3 shows the 60-day rolling correlation between the Colombian spread and that of the global emerging market composite as defined by the JP Morgan EMBI Global. The figure shows that there has indeed been significant correlation for large time periods. In fact, the correlation coefficient exceeded 0.70 for 55 percent of the time period studied. This suggests that spillovers and contagion plays an important part in determining the Colombian spread.

Figure 4.3. Changes in global emerging market spread correlation with Colombia (60-day rolling correlations)



Source: JP Morgan EMBI Global spread composites, and own calculations

Figure 4.4. Changes in spread correlation between Colombia and Argentina (60-day rolling correlations)



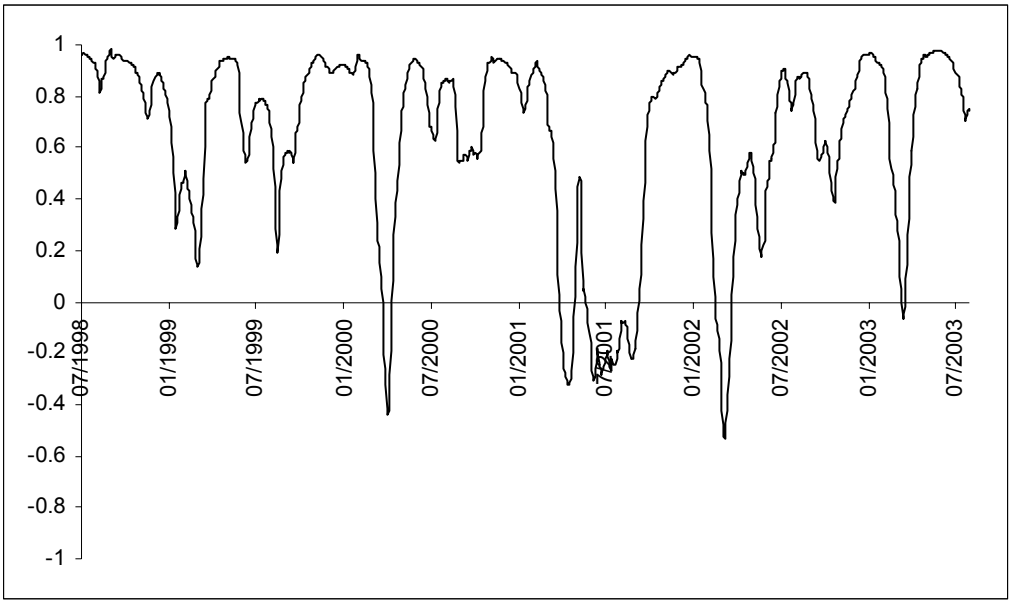
Source: JP Morgan EMBI Global spread composites, and own calculations

We continue by studying the 60-day rolling correlation between the Colombian spread and that of three other Latin American countries: Argentina, Brazil and Mexico. Figure 4.4 shows the correlation between the Colombian and Argentine spread. It is apparent that while there was significant correlation up until early 2001, the relationship between the Colombian and Argentine spread broke down thereafter. This is in line with the conclusion of the previous chapter that Argentina de-coupled from the rest of the emerging markets during its crisis.

Figure 4.5 and 4.6 show the rolling correlation between the Colombian spread and those of Brazil and Mexico respectively. An interesting observation is that the correlation seems to have broken down around March 2001, which might be explained by the crisis between President Pastrana and the Congress leading to a surge in the Colombian spread at that time. This dip in correlation is also visible in figures 4.3 and 4.4. A further observation from figures 4.5 and 4.6 is the apparent breakdown in correlation during 2001, which might be related to a general de-coupling of emerging markets initiated by the Argentine crisis. After mid-2002 correlation has once again increased to high level, and this particularly between the spreads of Colombia and Mexico, as illustrated in figure 4.6. In general, Colombian spreads seem to be more influenced by Mexican spreads than by Brazilian spreads, even if the correlation with the latter is considerable. The correlation coefficient between Colombian and Mexican spreads exceeded 0.70 during 61 percent of the time period studied, while between Colombia and Brazil this figure was only slightly lower at 59 percent.

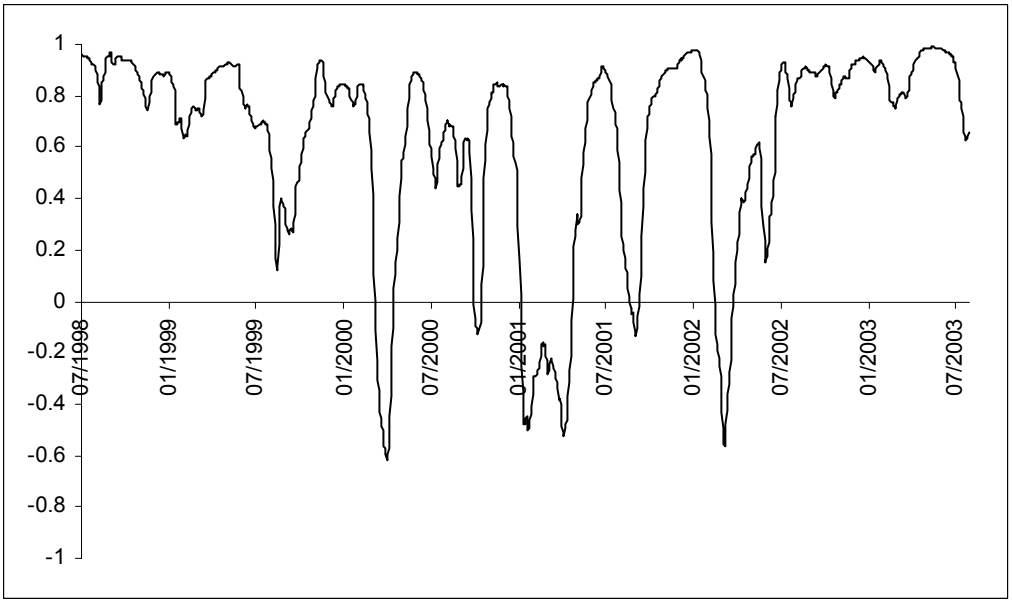
We can, consequently, conclude that contagion and spillovers from other emerging markets play a very important role in determining the Colombian spread.

Figure 4.5. Changes in spread correlation between Colombia and Brazil (60-day rolling correlations)



Source: JP Morgan EMBI Global spread composites, and own calculations

Figure 4.6. Changes in spread correlation between Colombia and Mexico (60-day rolling correlations)



Source: JP Morgan EMBI Global spread composites, and own calculations

5 Short-Term Determinants of the Spread

We concluded in the previous chapter that contagion and spillovers from other emerging markets played an important role in determining the Colombian sovereign spread. In this chapter we will study the short-term determinants of the spread, including spillovers. We start by discussing the potential determinants in section 5.1. Section 5.2 defines the data set that will be used in the empirical study, and section 5.3 continues by presenting the regressions and discussing the results of the study.

5.1 Potential Determinants of Daily Spread Changes

Some emerging market fixed income traders have suggested to me that the emerging market country spreads are to a large extent determined by news and events coming out of the country. However, during periods when no such news are emerging, the spreads are almost exclusively determined by the spread of emerging markets in general as well as by the US stock market.

It is possible to envisage two ways in which the US stock market could influence emerging market spreads. First, a weak stock market might lead investors to look for alternative sources of high return, and in such a case, high-yield bonds, both US corporate high-yield issues and emerging market issues, could provide an attractive alternative. A falling stock market should, consequently, lead to an increase in emerging market bond prices and, thus, a fall in the spread. Second, a falling stock market might lead to a flight to quality, where investors look for low-risk alternatives until the stock market has stabilised. This would lead investors to sell emerging market debt and to invest in higher-grade alternatives. A falling stock market would, in this case, lead to a fall in emerging market bond prices and, thus, a rise in the spread. The two effects, accordingly, have the opposite impact on emerging market bonds, and in general, the latter has been the dominant.

Another factor that could influence emerging market bond spreads in the short term is the international interest rate, which is a good proxy for global liquidity conditions. The international interest rate has, indeed, turned out as a significant determinant of the spread in some earlier studies.[60] We have here decided to use the 3-month US Treasury Bill rate as a measure of the interest rate. Some other studies have used the London Inter-Bank Offering Rate (LIBOR), but these two should be closely correlated, so the choice between the two is of less importance.

To investigate the influence of spillovers and contagion on the Colombian spread, we have, furthermore, chosen to use two measures of emerging market spreads: The EMBI Global emerging market composite and the EMBI Global Mexico composite. The former is a natural choice since it includes all emerging markets and, therefore, should be a good measure of general emerging market sentiment. The latter has been chosen since Mexican issues are normally used as benchmarks when pricing other emerging market debt. Mexico was the first country to issue Brady bonds, and it has the largest weight in the different EMBI composites, and for this reason it is generally used as a benchmark. The Mexican spread might, furthermore, have a larger influence on the Colombian spread since it is a Latin American country and, therefore, has more similarities with Colombia than, for example, the Asian economies included in the EMBI Global emerging market composite.

The variables discussed above were, moreover, identified in chapter 3 as potential determinants of the Colombian spread, and of the variables identified in chapter 3, these were, furthermore, the only ones that exist with daily frequency.

In addition we have decided to include the USD/COP exchange rate as a potential explanatory variable. An exchange rate depreciation leads to worsening debt-to-GDP and debt-service-to-GDP ratios, which might generate long-term problems in servicing the debt. The depreciation of the Argentine peso during 2002, for example, lead to a deterioration of the Argentine debt-to-GDP ratio from 52.0 percent in the beginning of

[60] See, for example, Nogués and Grandes (2001), and Ades, Kaune, Leme, Masih and Tenengauzer (2000).

the year to an unsustainable 148.5 percent in the end of the year. Nevertheless, care has to be taken when analysing the exchange rate, since it is a potentially endogenous variable. A change in the Colombian spread might very well lead to an exchange rate adjustment. The variables explaining the spread might, furthermore, also have a strong influence upon exchange rate.

Finally, we have decided to study the daily spread changes rather than the levels of the variables, to avoid problems of non-stationarity. This will be further discussed in the next section.

5.2 The Dataset

For the empirical analysis we use daily data from 1 January 1998 to 15 May 2003. As discussed earlier we use the EMBI Global Colombia spread composite as a measure of the Colombian sovereign spread. As potential explanatory variables we use the S&P 500 stock market index,[61] the 3-month US Treasury Bill rate, the EMBI Global Mexico composite and the EMBI Global emerging market composite.[62]

Table 5.1 presents the unit-root tests for the different variables, and it is apparent from the table that all the variables can be assumed to be integrated of order one, I(1). Note also that we are using the logarithmic values of the exchange rate and the S&P 500, since both these series are exponential. Since all variables are I(1) we decided to use the first differentials of the variables in the regression. Since these are stationary, we can use a standard OLS regression technique.[63]

[61] The S&P 500 is generally regarded as the best US stock market index. It is a weighted average of the share prices of the 500 largest US companies. Another widely cited index is the Dow Jones Industrial Average. This does, however, only include 30 large traditional US companies, not necessarily the largest, and it is a non-weighted average.
[62] Data sources are JP Morgan for the EMBI Global composites and Datastream for the S&P 500 and the US T-Bill rate.
[63] By testing the time series for cointegration, we can conclude that these are not cointegrated. In the next chapter we will, nevertheless, develop a cointegration model, using another dataset.

Table 5.1. Unit root tests for the time series
(using daily data from 1 Jan 1998 to 15 May 2003)

Variable	Level	First Difference
EMBIG Colombia	ADF(1) = -2.71	ADF(0) = -33.40
EMBIG emerging markets	ADF(10) = -2.62	ADF(9) = -9.69
EMBIG Mexico	ADF(10) = -1.75	ADF(9) = -11.67
S&P 500 (logged)	ADF(0) = -1.46	ADF(0) = -38.00
3-month T-Bill rate	ADF(1) = 0.23	ADF(0) = -34.05
Exchange rate (logged)	ADF(0) = -1.36	ADF(0) = -35.15

Note: The Augmented Dickey-Fuller test is used to test for unit roots. The value in parentheses is the order of the lag used, which is decided by using the Schwartz information criteria. The null hypothesis in each case is that the variable is integrated of order one and, thereby, non-stationary. The 5 percent rejection region for non-stationarity for the Dickey-Fuller statistic is ADF < -2.89. Note furthermore that EMBIG stands for the EMBI Global spread composite.

5.3 Estimation and Results

We use an OLS regression technique to identify the significant explanatory variables and their parameter estimates. As discussed in the previous section, we use daily time series data from 1 January 1998 to 15 May 2003. Spread data is only collected on trading days (i.e. not on Saturdays, Sundays and public holidays), which gives us a total of 1,402 observations. We, furthermore, use the first differentials of the data, which are stationary, and this allows us to use OLS estimation. A standard model of the spread is a linear relationship of the form,

$$SPREAD_t = \sum_{k=1}^{K} \beta_k X_{k,t} + e_t \qquad (4.1)$$

where $t = 1, 2, \ldots, T$ are the number of observations, $X_{k,t}$ are the time series of the different explanatory variables, β_k their parameter estimates, and e_t is an error term.

The regression results are presented in table 5.2. It is apparent that the 3-month Treasury Bill rate in the first regression is not a significant determinant of the Colombian spread. We, therefore, decided to omit this variable, and rerun the regression. In the third regression the USD/COP exchange rate has been added as an explanatory variable, and it is, indeed, significant. This regression also produces a better adjusted R-squared value. In the fourth regression the EMBI Global emerging market composite has been replaced by the EMBI Global Mexican composite. This produces a marginally better result with a slight increase in the adjusted R-squared value.

We can, consequently, conclude that in the short term, global emerging market spreads (or the Mexican spread), the S&P 500 stock market index and the USD/COP exchange rate are all significant determinants of the Colombian spread. A stock market fall, furthermore, leads to a rise in the Colombian spread, indicating that a falling stock market induces a flight to higher-grade bonds, as discussed previously. An exchange rate depreciation also leads to a rise in the spread, as predicted. However, care has to be taken when interpreting this result since the causality between the exchange rate and the sovereign spread is not clear. A rising spread might, indeed, induce a depreciation of the exchange rate. In addition, the same variables might be determinants of the spread and the exchange rate, as discussed earlier.

Table 5.2. Regression results

Explanatory Variable	Dependent Variable: EMBIG Colombia			
EMBIG emerging markets	0.4046 (20.48)	0.4062 (20.61)	0.4064 (20.97)	–
EMBIG Mexico	–	–	–	0.4919 (22.03)
3-month T-Bill rate	-7.749 (-1.04)	–	–	–
S&P 500 (logged)	-166.8 (-5.42)	-168.9 (-5.50)	-162.0 (-5.36)	-166.9 (-5.62)
Exchange rate (logged)	–	–	493.0 (6.94)	464.9 (6.62)
No of observations	1402	1402	1402	1402
Adjusted R^2	0.293	0.293	0.316	0.333
Standard error	14.70	14.70	14.46	14.28
Durbin-Watson	1.91	1.91	1.96	1.95

Note: T-statistics are in parentheses. All parameter estimates are significant at the 5 percent level with the exception of the T-Bill rate. EMBIG stands for the EMBI Global spread composite. A constant is included but not reported.

6 Long-Term Determinants Within a Johansen Framework

In this chapter we are using the Johansen framework of multivariate cointegration to investigate the long-term determinants of the Colombian spread. Section 6.1 identifies a number of potential determinants. The data set is defined and discussed in section 6.2, and likelihood estimation and results are presented in section 6.3.

6.1 Potential Long-Term Determinants

In chapter 3 we discussed a number of potential determinants of the sovereign spread. Since we are using time-series data for a relatively short period of time, we need to use data with a monthly frequency. Of the potential determinants discussed in chapter 3, the following exists with monthly frequency:

- Growth of industrial production
- Fiscal balance
- CPI inflation
- Foreign reserves
- Exports
- Exchange rate
- 3-month US T-Bill rate
- S&P 500 stock market index
- EMBI Global Mexico spread composite
- EMBI Global emerging market spread composite

Note that some of these variables were in chapter 3 expressed as a GDP ratio, for example fiscal balance to GDP. Since we are only studying one country, Colombia, and since we are not interested in comparing the variables with other countries, this is not necessary here.

6.2 The Dataset

For the analysis we will here use five years of monthly data, from January 1998 to December 2002. As before, we will use the JP Morgan EMBI Global Colombia spread composite to represent the Colombian spread. We use the set of variables identified in the previous section as potential explanatory variables with a few adjustments. We will use industrial production as well as both monthly and annual growth of industrial production as potential explanatory variables. We will furthermore use the consumer price index as a potential explanatory variable, since the definition of the inflation rate for monthly data is problematic. Month-on-month inflation is, even if seasonally adjusted, very unstable and does, therefore, not make much sense in this study. Year-on-year inflation, on the other hand, has inherent problems; a one-off price shock will, for example, translate into a higher inflation rate not just only for that month but also for the 11 following months. In addition to the USD/COP exchange rate, we are also using the real effective exchange rate index as a potential explanatory variable in line with some previous studies.[64] Table 6.1 defines the variables together with their data sources.

[64] See, for example, Budina and Manchew (2000), and Ades, Kaune, Leme, Masih and Tenengauzer (2000).

Table 6.1. Variables used in the Johansen analysis

Variable	Definition and unit of measurement	Data source
SPREADCO	EMBI Global Colombia (bp)	JP Morgan
PROD	Industrial production index	IFS
GROWTHY	Annual industrial production growth (%)	Calc from production
GROWTHM	Monthly industrial production growth (%)	Calc from production
FBAL	Fiscal balance (constant COP)	IFS
CPI	Consumer price index (logged)	IFS
RES	Gross foreign reserves (USD) (logged)	IFS
EXP	Exports (USD) (logged)	IFS
FX	USD/COP exchange rate (logged)	IFS
REER	Real effective exchange rate (logged)	IFS
TBILL	3-month US T-Bill rate	IFS
SP500	S&P 500 stock market index (logged)	Datastream
SPREADMX	EMBI Global Mexico (bp)	JP Morgan
SPREADEM	EMBI Global emerging markets (bp)	JP Morgan

Note: IFS stands for *International Financial Statistics* produced by the International Monetary Fund. The USD/COP exchange rate is the end-of-period rate. Monthly industrial production growth, fiscal balance, consumer price index, foreign reserves, and exports are all seasonally adjusted using an X11 method. All the spreads are measured in basis points (bp).

The unit-root tests for the different variables are presented in table 6.2. We can conclude from the table that all the variables are integrated of order one, I(1), apart from industrial production, month-on-month growth of industrial production and the fiscal balance. The Colombian spread is, however, a border case where the null-hypothesis that the variable is I(1) can be rejected at the 5 percent level but not at the 1 percent level. We will, nevertheless, for the analysis in this chapter assume the Colombian spread to be I(1), which is a condition for using a cointegration framework for the study.

Table 6.2. Unit root tests for the time series
(using monthly data from 1 Jan 1998 to 15 May 2003)

Variable	Level	First Difference
SPREADCO	ADF(0) = -2.99	ADF(0) = -6.89
PROD	ADF(9) = -3.79	
GROWTHY	ADF(1) = -1.60	ADF(0) = -11.53
GROWTHM	ADF(1) = -8.67	
FBAL	ADF(0) = -8.72	
CPI	ADF(2) = -1.94	ADF(1) = -3.96
RES	ADF(4) = -0.57	ADF(0) = -8.41
EXP	ADF(4) = -1.16	ADF(3) = -6.41
FX	ADF(0) = -0.89	ADF(0) = -6.02
REER	ADF(1) = -1.36	ADF(0) = -4.81
TBILL	ADF(1) = -0.08	ADF(0) = -4.91
SP500	ADF(0) = -1.03	ADF(0) = -7.67
SPREADMX	ADF(0) = -1.93	ADF(0) = -7.75
SPREADEM	ADF(0) = -2.83	ADF(0) = -8.01

Note: The Augmented Dickey-Fuller test is used to test for unit roots. The value in parentheses is the order of the lag used, which is decided by using the Schwartz information criteria. The null hypothesis in each case is that the variable is integrated of order one and, thereby, non-stationary. The 5 percent rejection region for non-stationarity for the Dickey-Fuller statistic is ADF < -2.89, and the 1 percent rejection region is ADF < -3.46.

6.3 Likelihood Estimation and Results

The Johansen estimation test procedure used here, is a method for estimating the cointegrating relationships that exist between a set of variables as well as testing these relationships. The framework was originally developed by Johansen (1988)[65] and has since then been widely used and documented.[66]

For variables to be cointegrated, they, by definition, all have to be integrated of the same order. We can of this reason conclude that, of the variables identified in the previous

[65] See also Johansen (1990, 1991, 1995).

section, industrial production, monthly production growth and the fiscal balance cannot be cointegrated with the rest of the variables, since these three variables are stationary and the rest are integrated of order one.

Using the Johansen estimation procedure together with the non-stationary variables discussed in the previous section, we test a number of potential cointegrating relationships. The maximum lag length is chosen using an information criteria, the levels and signs of the parameters of the cointegrating vector together with the performance of the model in terms of the normality assumption. In this way we are able to identify three valid cointegrating relationships,

(*SPREADCO*, *EXP*, *FX*, *TBILL*) 6.1

(*SPREADCO*, *EXP*, *REER*, *TBILL*) 6.2

(*SPREADCO*, *GROWTHY*, *FX*, *TBILL*) 6.3

Likelihood ratio tests, furthermore, leads us to assume one cointegrating vector in all of the three relationships. All the variables of the three systems are non-stationary, and none of them is excluded from the respective cointegrating vectors. The results of the estimation procedure are presented in tables 6.3, 6.4 and 6.5.

[66] See, for example, Enders (1995).

Table 6.3. Estimation results for the first cointegrating relationship
(using monthly data from Jan 1998 to Dec 2002)

Model	VEC(3): Drift	
Variables	(*SPREADCO*, *EXP*, *FX*, *TBILL*)	
Unrestricted cointegrating vector $\boldsymbol{\beta}^{T} = (\beta_{11}\ \ \beta_{12}\ \ \beta_{13}\ \ \beta_{14})$	$\boldsymbol{\beta}^{T}$ = (1.000 2677 -1462 -113.2)	
Multivariate normality		
Lütkepohl test	$\chi^2(8) = 13.42$	P-value: 0.098
Autocorrelation		
Portmanteau test	Port(12) = 158.1	P-value: 0.199
LM test	LM(12) = 22.75	P-value: 0.120

Table 6.4. Estimation results for the second cointegrating relationship
(using monthly data from Jan 1998 to Dec 2002)

Model	VEC(3): Drift	
Variables	(*SPREADCO*, *EXP*, *REER*, *TBILL*)	
Unrestricted cointegrating vector $\boldsymbol{\beta}^{T} = (\beta_{11}\ \ \beta_{12}\ \ \beta_{13}\ \ \beta_{14})$	$\boldsymbol{\beta}^{T}$ = (1.000 3706 -4091 -108.0)	
Multivariate normality		
Lütkepohl test	$\chi^2(8) = 15.61$	P-value: 0.048
Autocorrelation		
Portmanteau test	Port(12) = 140.2	P-value: 0.575
LM test	LM(12) = 13.61	P-value: 0.628

Table 6.5. Estimation results for the third cointegrating relationship
(using monthly data from Jan 1998 to Dec 2002)

Model	VEC(3): Drift	
Variables	(*SPREADCO*, *GROWTHY*, *FX*, *TBILL*)	
Unrestricted cointegrating vector $\boldsymbol{\beta}^T = (\beta_{11}\ \ \beta_{12}\ \ \beta_{13}\ \ \beta_{14})$	$\boldsymbol{\beta}^T$ = (1.000 83.36 -5336 -426.6)	
Multivariate normality		
Lütkepohl test	$\chi^2(8) = 11.69$	P-value: 0.166
Autocorrelation		
Portmanteau test	Port(12) = 151.7	P-value: 0.314
LM test	LM(12) = 16.95	P-value: 0.389

The relationship states that, in the long term, the Colombian spread is related to the exports, the production growth rate, the exchange rate as well as to the US T-Bill rate. As expected, a fall in exports leads to a rise in the spread, and so does a fall in the production growth rate, a depreciation of the exchange rate, and an increase in the US T-Bill rate.

The results of this study, furthermore, suggest that neither the consumer price index, nor the foreign reserves or the S&P 500 stock market index have a long-term influence on the Colombian spread. Moreover, neither the Mexican spread nor the global emerging market spread has a long-term relationship with the Colombian spread.

7 Conclusion

In this paper we have studied the determinants of the Colombian sovereign spread both in the short and long term. We have concluded that contagion and spillovers plays an important part, particularly in the short term. In addition we have identified a number of variables as significantly influencing the spread. The empirical study of the short-term determinants of the spread used daily data in differential form in an OLS-regression framework. For the study of the long-term determinants, we used a Johansen framework of multivariate cointegration together with monthly data. The results of these empirical studies are summarised in table 7.1.

Table 7.1: Results of the empirical studies

	Short term	Long term
Estimation technique:	OLS	Johansen
Data frequency:	Daily data (in differentials)	Monthly data
Period studied:	1 Jan 1998 – 15 May 2003	Jan 1998 – Dec 2002
Significant explanatory variables:	• Spread of other emerging markets • US stock market • Exchange rate	• Exports • Exchange rate • Economic growth rate • US T-Bill rate

A weakness of this study is that it excludes potential determinants of the spread that are published only with annual frequency. This is because the period studied is too short to include those variables. All single-country studies will suffer from this weakness until longer time series of data are available. Cross-country studies have, nevertheless, found a number of such variables to have a significant impact on the spread. Rowland and Torres (2004) and Rowland (2004) are two cross-country studies that identifies the determinants of the spread, credit ratings and creditworthiness of a number of emerging market sovereign issuers. The results of these studies are presented in table 7.2.

Table 7.2: Summary of the determinants of credit ratings, creditworthiness and spread

- 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)

Source: Rowland (2004).

Together, table 7.1 and 7.2 give us a good understanding of which variables drive the Colombian sovereign spread in the short as well as in the long term. These sets of variables should give both investors and Colombian policy makers a group of indicators to which they should pay special attention.

One interesting observation is that none of these studies have concluded that the fiscal deficit is significant in determining the sovereign spread. The fiscal deficit is often cited as an important variable both by bank analysts and by credit rating agencies when analysing the creditworthiness of a country. It is, however, failing to turn up as a significant explanatory variable in the estimations in these studies, and this result is, in fact, in line with most other empirical studies. The finding might, nevertheless, reflect endogeneity in fiscal policy. Countries trying to improve their credit standing may opt for more conservative fiscal policies, and in some cases they might have a limit on their fiscal deficit imposed by, for example, the International Monetary Fund. This might be a plausible explanation to why the fiscal deficit might not show a systematic relationship with the spread, although rating agencies and investors may assign substantial weight to the deficit when assessing the default risk of sovereign issues.

Appendix: The Rating Systems of S&P and Moody's

Table A.1. The rating systems of Standard & Poor's and Moody's

Rating		Characterisation of debt and issuer
S&P	Moody's	
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+	Aa1	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 highgrade 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.
AA	Aa2	
AA-	Aa3	
A+	A1	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.
A	A2	
A-	A3	
BBB+	Baa1	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.
BBB	Baa2	
BBB-	Baa3	
Speculative-grade ratings		
BB+	Ba1	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 characterizes bonds in this class.
BB	Ba2	
BB-	Ba3	
B+	B1	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.
B	B2	
B-	B3	
CCC+	Caa1	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.
CCC	Caa2	
CCC-	Caa3	
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

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