

Determinants of sovereign spread in Costa Rica

Jonathan Garita

Jorge León

Research Document DI-XX-2015

Economic Research Department

Economic Division

June, 2015

The ideas expressed in this paper are of the authors and not necessarily represent the view of the Central Bank of Costa Rica.

Reference: DEC-DIE-DI-XX-YYYY

Determinants of sovereign spread in Costa Rica

Jonathan Garita[‡]

Jorge León[§]

Abstract

Determinants of sovereign spread in Costa Rica are analyzed using macroeconomic variables derived from theory. A quarterly panel data set from 2002 to 2014 is used to estimate an Arellano-Bond specification model. Additionally, a VAR model is estimated to identify transmission effects of shocks in risk perception in Latin American and Central America on Costa Rica's sovereign spread. Macroeconomic fundamentals associated with fiscal and external imbalances, local inflation and domestic interest rates explain EMBI spread of Costa Rica and of the countries in the sample. External factors related with international stock market volatility and global risk perception also have a role on EMBI spread determination. Furthermore, there is a contemporaneous and positive effect of a perturbation in Latin America spread on Costa Rica's EMBI spread.

Palabras clave: Riesgo Soberano, Bonos, Mercados Financieros, Transmisión.

Clasificación JEL: G15.

Resumen

El documento analiza los determinantes del spread soberano para Costa Rica, considerando variables derivadas de la teoría macroeconómica. Se utiliza un panel de datos de 2002 a 2014 para estimar una especificación de Arellano-Bond. Se estima, además, un modelo VAR para identificar el efecto traspaso de choques en la percepción de riesgo en Latinoamérica y Centroamérica sobre el spread soberano costarricense. Fundamentales macroeconómicos asociados con desbalances fiscales y externos, niveles de inflación y tasas de interés locales explican el spread del EMBI de Costa Rica y de los países seleccionados. Factores globales relacionados con la volatilidad en los mercados financieros internacionales y percepción de riesgo internacional también toman parte en la determinación del spread del EMBI. Además, se identifica un efecto traspaso contemporáneo y positivo de una perturbación en Latinoamérica sobre el spread del EMBI costarricense.

Key Words: Sovereign Risk, Bonds, Financial Markets, Transmission.

JEL Classification: G15

[‡]Economic Research Department, Central Bank of Costa Rica. Email: garitagj@bccr.fi.cr

[§]Economic Research Department, Central Bank of Costa Rica. Email: leonmj@bccr.fi.cr

Determinants of sovereign spread in Costa Rica

Contents

1	Introduction	1
2	Recent emission of bonds	4
3	Literature Review	6
4	Framework of Sovereign Spreads	7
5	Empirical Specification	8
6	Data and Estimation Results	10
6.1	Determinants of sovereign risk	10
6.2	Transmission of Sovereign Risk	16
7	Conclusion	21

List of Figures

1	Government debt and primary balance	4
2	Government External Debt	5
3	EMBI Spread for Central America	12
4	EMBI spread for selected regions	17
5	Impulse-response functions for Costa Rica, Latin America and non Latin America EMBI spreads (Months)	19
6	Impulse-response functions for Costa Rica and Latin America excluding Central America EMBI spreads (Months)	20
7	Impulse-response functions for Costa Rica and Central America EMBI spreads (Months)	21

List of Tables

1	Credit Rating of Central America	6
2	Country list	10
3	Data sources	11
4	Descriptive statistics for domestic factors (Averages)	13
5	Descriptive statistics of external factors (Averages)	14
6	Expected Signs of the Variables	14
7	Results. Dependent variable: EMBI spread	15

Determinants of sovereign spread in Costa Rica

1 Introduction

The main objective of this paper is to analyze the importance of macroeconomic fundamentals in the determination of Costa Rican sovereign spread¹ of Costa Rica in particular and that of Central America (CA) in general. This is a rather difficult task given the particular characteristics of the sovereign bonds emissions in CA. In general, regional sovereign bonds issuance is characterized by small amounts per issue, irregular issue frequency and chronic illiquidity. The scarcity of issuance makes it almost impossible to estimate a complete and representative yield curve. In addition, the lack of liquidity in secondary markets makes hard for prices to adjust to changes in macroeconomic fundamentals as quickly as in other markets.

Given these difficulties and in order to provide a comparative analysis, the Emerging Markets Bond Index (EMBI) spread of each country was used to measure the sovereign bond spreads. This indicator is measured by an index that includes sovereign and quasi-sovereign (guaranteed by the sovereign) instruments that satisfy certain liquidity criteria in their trading. Particularly, a country's spread is calculated as the average of the spreads of all bonds that satisfy the inclusion criteria, weighted by the market capitalization of the instruments. The selection of this variable was based on its comparability, the continuity of the time series and historical consistency.

The case of Costa Rica is a good illustration of the region. Costa Rica was relatively absent from the international bonds markets since 2004. At regional level only Dominican Republic, Panama and El Salvador have been active in the international bonds markets in the last ten years. It is worth noting the absence of Nicaragua during the whole period.

Costa Rica the lack of bond issuance can be explained in part by the fact that the central government must have the Congress approval to issue bonds in foreign financial markets. This situation makes it

¹The sovereign spread is the difference between the interest rate on a US Treasury issue and a similar issue of another government. Like any other credit spread, it is supposed to compensate investors for default risk.

very cumbersome for the government to finance its fiscal gap in international markets, while increasing the fiscal pressures in the local market. This reluctance could be traced to the aftermath of the eighties debt crisis and the abrupt depreciation that occurred afterwards.

More recently, after the international financial crisis of 2008, the government decided to follow a countercyclical fiscal policy to ameliorate the negative effects of the global economy downturn². As a result of the increase in government spending -that was not matched by tax increases- Costa Rica moved from a fiscal surplus in 2007 to a structural fiscal deficit that has continue from 2009 until the present.

The continuous and growing fiscal deficit and the pressure it generated the local financial market, together with a moderation in economic growth, provided the incentives for the government and Congress to agree to finance part of the debt by issuing bonds in the international markets. With the bill "Ley para la Emisión de Títulos Valores en el Mercado Nacional" of September 2012, the government was allowed issue up to four billion U.S. dollars.

As a result of the approval of this law, emissions of one billion dollars have been made in every year from 2012 to 2015. The return of Costa Rica to the international bonds markets has created a lot of interest from foreign and local investors, but it has also increased the importance of the behavior of the sovereign spread as a key macroeconomic variable. In particular, sovereign spread is used as a measurement of how the international markets perceive the country's fiscal and macroeconomic sustainability.

Therefore the evolution of the local sovereign spread has become an integral part of the macroeconomic policy analysis. This paper provides the policymakers with a tool to analyze the determinants of credit spread changes for Costa Rica using variables derived from structural and macroeconomic theory.

Main economic literature converges to point as determinants of sovereign risk the inflation (as a measurement of macroeconomic stability), socio-political stability indicators such as Polity IV index and the Index of Economic Freedom, public debt level, volatility of terms of trade, fiscal deficit and external imbalance. According to Aizenman et al. (2013), the relative importance of these macroeconomic variables has changed through time:

- Before the 2008 crisis: Degree of trade openness, economic fragility.
- During the 2008 crisis: External debt to GDP, and inflation.
- After the 2008 crisis: inflation and public debt to GDP

²The fiscal discipline of previous years allowed the government to have some space to use fiscal policy for the first time in recent history as a counter balance to the economic contraction of main trade partners such as the U.S. and the European Union.

Global factors were the main drivers of the spreads before the crisis, but after such episode, local factors related to the capacity to absorb negative external shocks became more relevant. It is important to highlight the fact that the crisis had its origin in advanced economies, but that the local factors were the main determinants of how the sovereign spreads reacted.

In general, emerging markets were able to cope with the crisis fairly well. This was in part because emerging markets were not as exposed to the toxic assets that generated by the subprime collapse and by the massive fiscal and monetary stimulus that most of these economies implemented in such period.

Emerging markets in general and Latin America in specific were able to implement countercyclical fiscal policies to reduce the impact of the global slowdown, with relative success. The contraction of the U.S. economy was accompanied by an aggressive monetary policy and coupled with an international excess savings, led to a drop in interest rates on sovereign bonds in the region, providing some relief in terms of financing the fiscal deficit and current account.

The two gear global economy that came after the crisis, where emerging markets were growing faster and the moderation of risk perception of emerging countries, gave the incentive for a change of direction of the capital flows.

The decoupling hypothesis was popular at the beginning, but recently the emerging markets begun to reduce its levels of economic growth. According to the IMF (2012) sound macroeconomic policies are able to explain most of the difference in growth levels between developed and emerging markets from 1990 to recent years.

As a commodity net exporter, Latin America was shield at the beginning. This is not the case of Central America, which instead is a net importer of commodities, mainly oil and other main inputs of production.

The development and understanding of the determinants of Sovereign Risk for Costa Rica has taken greater importance in recent years due to the volatility of international financial markets since the global financial crisis of 2008 and the rising of public debt that is externally financed.

Being Costa Rica a small open economy with fiscal and structural deficits on current account, it makes the country dependent on external financing for both growth and for macroeconomic stability.

Even with the international financial crisis of 2008, the general perception of credit risk in emerging markets has improved. As a result the inflows of capital have become larger, making a sudden stop even more risky for those economies.

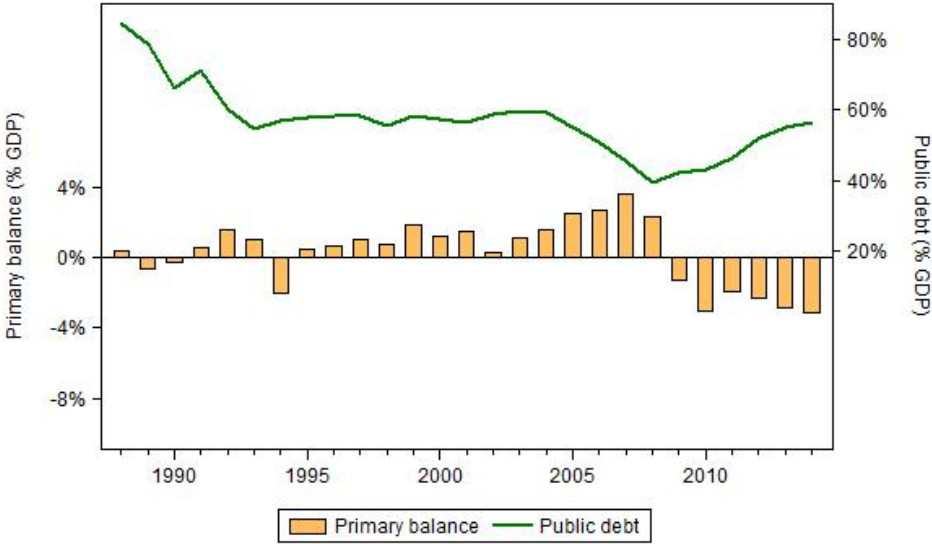
The document is organized as follows. Section 2 reviews the recent emission of bonds by Costa Rica in the international markets. Section 3 provides a brief comments related with recent economic literature regarding sovereign spread macroeconomic fundamentals. Section 4 describe a simple model of determination of bonds spreads. Section 5 is the empirical specification of the model. While Section 6 describes the data used and the estimation results. Finally, section 7 summarizes the main conclusions.

2 Recent emission of bonds

Costa Rica was absent from international markets from 2004 to 2012 because, as a general policy, the government decided to rearrange the debt by decreasing the share that the foreign part represented, basically paying out the foreign debt with issuance of domestic debt. Nevertheless, after the international financial crisis, the combination of very low international interest rates and a mounting fiscal deficit created enough incentives for the government to finance part of the deficit in the external markets.

Specifically and as Figure 1 shows, government finances have deteriorated significantly over the last six years, putting fiscal sustainability in doubt. The ratio of total debt to GDP increased from 39,0% in 2008 to 56,0% of GDP, with a particularity that the country's primary balance, which excludes interest payments from expenditure, turned negative after 2008³. This suggests the government has a shortfall that makes it difficult to reduce current levels of indebtedness, as the country have to borrow to cover its interest payments.

Figure 1: Government debt and primary balance



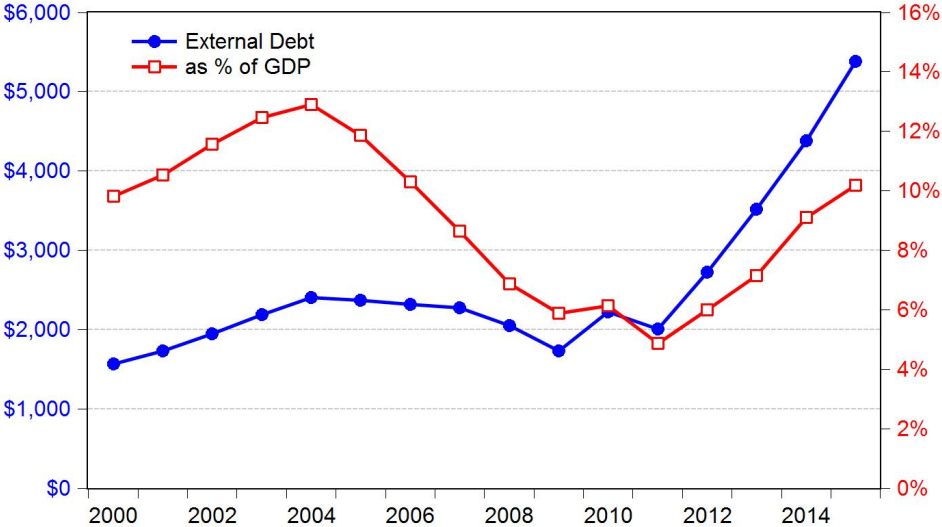
On July 2012, lawmakers passed a bill authorizing the issuance of up to US\$4 billion in debt bonds. In September of that year, the President signed the bill into law, known as " Law for Issuing Securities in the International Market"⁴. The first emission was issued on November 16, 2012, a 10-year bond for US\$ 1,000 million with an effective rate of 4.25%. The transaction was considered a success by government

³In fact and according to IMF's World Economic Outlook database, April 2015, Costa Rica's primary deficit in 2014 is one of the highest in Latin America, only surpassed by Honduras, Ecuador, Haití and Venezuela.

⁴In Spanish "Ley para la Emisión de Títulos Valores en el Mercado Nacional" or "Ley 9070"

officials, because it recorded the lowest interest rate that Costa Rica has achieved in international financial markets.

Figure 2: Government External Debt



The second issuance took place on April 23, 2013, and marked another milestone for Costa Rica in the international financial market. For the first time Costa Rica: (i) came to the market through a strategy of two simultaneous bonds of US\$ 500 million each and achieved rates of 5.625% for 30 years and 4.375% in 12 years; (ii) the transaction was announced and executed on the same day; (iii) placed a 30-year bond and (iv) had a positive acceptance by investors, with an order book that added more than 10 times the offered amount.

The third issuance was placed on April 2014. It was a US\$1 billion-30 years bond that reached an effective rate of 7.0%, clearly higher than the 5.625% of the April 2013 issue, also 30 years. Again the new bond placement received a strong demand from international investors, receiving offers up to US\$4 billion.

The fourth and final issuance was on April 2015 and again was for US\$ 1,000 million with a 30-year maturity and it reached an effective rate of 7.158%. This time, Costa Rica benefited from favorable international market conditions in the last two weeks and a significant demand for emerging market instruments. The offered amount outweighed orders by more than 3.5 times. Moreover, the initial rate stood at 7.32% and finally managed to locate at 7.158%

As it is shown in figure 3, the issuance of the US\$4 billion approved by the Law 9070 lead to an increase in Costa Rica's external debt importance in total debt structure, from representing around 4.0%

of GDP and % of total debt in 2011 to 10% of GDP and % of total in late 2014. As we previously mention, the main objective was taking advantage of the decline in international interest rates, with the purpose of maximizing the maturity profile of debt with maturity up to 30 years, as well as maintaining a broad base of investors and a permanent international interest in Costa Rican debt.

Table 1: Credit Rating of Central America

Country	Standard and Poor's Rating	Outlook	Moody's Rating	Outlook	Fitch Rating	Outlook
Costa Rica	BB	Stable	Ba1	Stable	BB+	Negative
Dominican Republic	BB-	Stable	B1	Stable	B+	Stable
El Salvador	B+	Stable	Ba3	Stable	BB-	Negative
Guatemala	BB	Stable	Ba1	Negative	BB	Stable
Honduras	B	Stable	B3	Positive		
Nicaragua			B3	Stable		
Panama	BBB	Stable	Baa2	Stable	BBB	Stable

Data at May 2015

The credit rating of Costa Rica by the main agencies is "non investment grade speculative", just below the investment grade. Only Panama has a better grading. On table 1 the most recent ratings of the region as well as its outlook are presented.

3 Literature Review

The literature on the determinants of sovereign bond yields and spreads has expanded substantially in recent years, specially for European countries and emerging markets. Most of this literature studies the effects of fiscal (and other) economic fundamentals on the realized spread of sovereign bonds.

There is almost no literature related to the sovereign spread for Central America. Only Ayala (2014) does a empirical study for Guatemala and Panama analyzing the default risk.

The variation in credit risk spread for emerging markets has been divided in the economic literature between country-specific and global factors. A number of papers have emphasized the importance of global factors for emerging markets: Calvo et al. (1993), and more recently Calvo (2002), Herrera and Perry (2002), Grandes (2003), Diaz Weigel and Gemmill (2006), García-Herrero and Ortiz (2006), Longstaff et al. (2007), and González-Rozada and LevyYeyati (2008).

As Baldacci et. al (2011) comment, factors that have helped the reduction of spreads are: (i) sound macroeconomic policies (stabilization of inflation); (ii) favorable commodity prices; (iii) adequate international liquidity conditions; and (iv) development of capital markets.

Nevertheless, Agosin et al (2012) affirm that even emerging markets with stable economical and political fundamentals were severely affected by the 2008 financial crisis, suggesting that changes in sovereign risk perception do not respond exclusively to variation in country-specific fundamentals, since there are global factors that commonly affect in sovereign risk. Consequently, international financial markets conditions are fundamental in determining market access and the price a country has to pay to borrow internationally, independently of the quality of its economic policies or its future perspectives.

Studies such as Thuraishamy et al.(2008) that analyze the behavior of Brazil, Chile, Colombia, Mexico and Venezuela found a statistically significant effect of the exchange rate factor on sovereign spreads.

Not only does the determinants of sovereign spread have an immediate effect, but as Ciamodo et al. (2014) show, spreads are sensitive to actual or expected macroeconomic fundamentals and how future government bond spreads expectations are formed by market experts. They also studied whether expectations on macro and fiscal fundamentals matter for market experts perception of future sovereign risk premium.

Aizenman and Marion (2012) show that other factors, such as increased sovereign risk and high taxation costs associated with large inelastic fiscal liabilities may lead to larger reserve accumulation.

4 Framework of Sovereign Spreads

Consider a two zero coupon bonds, with unit face value paid on the same future date T . Suppose that one of these bonds has a default risk associated with it and that this bond is traded at time t at a price of D_t . If we assume that the second bond is a risk free bond, which means that it has zero default risk probability, and that at time t it is valued at price B_t , then relationship between the prices of these two bonds can be described as:

$$D_t = B_t Pr(T < \tau | t < \tau) + R_t B_t Pr(T \geq \tau | t \geq \tau) \quad (4.1)$$

Where R_t is the recovery rate in case of default. If we assume that $R_t = 0$ we obtain:

$$D_t = B_t [1 - Pr(T \geq \tau | t < \tau)] \quad (4.2)$$

Which means that the price of the risky bond, is equal to the price of the risk free bond given the probability of default (p_t). This relation is known as the zero recovery rate assumption.

$$D_t = B_t (1 - p_t) \quad (4.3)$$

If the returns of the bonds are such that $D_t = e^{[-(T-t)r_t]}$ and $B_t = e^{[-(T-t)r_{f,t}]}$ for the risky bond

and risk free bond respectively, we can obtain a relationship of prices as a function of the yield spread ($s_t = r_t - r_{f,t}$).

$$D_t = B_t e^{[-(T-t)(r_t - r_{f,t})]} = B_t e^{[-(T-t)s_t]} \quad (4.4)$$

Combining equation 4.4 with the zero recovery rate assumption in equation 4.3 we have:

$$p_t = 1 - e^{[-(T-t)s_t]} \quad (4.5)$$

The equation 4.5 relates the default probability of the risky bond with the yield spread. This expression can be rearranged as:

$$e^{[-(T-t)s_t]} = 1 - p_t \quad (4.6)$$

This relationship allows to model the yield spread as a function of macroeconomic fundamentals that the economic theory and markets indicate as determinants of the default probability.

5 Empirical Specification

As is standard practice in the empirical literature, the baseline model specification for the panel data⁵ estimation is composed by two groups of explanatory variables. The first group is represented by a vector of country specific variables that determine sovereign risk, such as inflation, current account balance, public debt, fiscal deficit, economic growth, real exchange rate, interest rate, foreign reserve level and institutional framework. The second can be interpreted as a vector of global factors that affect the sovereign risk of emerging countries, as it is the case of volatility in international stock markets (VIX index), TED spread.

An analysis of the advantages and limitations of using panel data sets is presented by Hsiao (2003). The main advantages over single cross-sections or time series data the following: a) more accurate inference of model parameters, b) greater capacity for capturing the complexity of economic relationships, c) more informative results, d) the ability to control for individual unobserved heterogeneity, and e) the simpler computation and statistical inference. This methodology has already been used in the literature to examine sovereign spread determinants.

The present document estimates parameters of models of the form:

$$Y_{i,t} = \tau Y_{i,t-1} + \beta X_{i,t} + \gamma Z_t + \varepsilon_{i,t}, i = 1, \dots, N; t = 1, \dots, T. \quad (5.1)$$

⁵Panel data are repeated measures on individuals (i) over time (t).

With Y_i representing the dependent variable and the respective lag (EMBI spread of each country i); $X_{i,t}$ country specific variables related with economic activity performance, fiscal and external balance, inflation, institutional stability and other important macroeconomic fundamentals and Z_t external factors associated with global financial volatility.

This study conducted an Arellano-Bond specification model, a Generalized Method of Moments (GMM) for panel data analysis suggested by Arellano and Bond (1991) to estimate model 5.1. More precisely, Arellano and Bond (1991) propose an estimation method based on the first difference of the model (to avoid the individual effects and time invariant variables). In comparison to the fixed and random effect model, this dynamic panel data model has the advantage of taking into account autoregressive properties to estimate an endogenous relationship between the dependent and explanatory variable. This technique enable to control the unobserved heterogeneity resulting from country-specific factors and the possible simultaneity between these individual effects and the regressors.

Due to the close relationship between the variables considered for the analysis, contemporaneously endogeneity is a potential problem that must be taken into consideration for a robust estimation. For instance, local interest rates can be affected by previous and present level of the sovereign spread. The Arellano-Bond specification considers lags of dependent variable and lagged values of the regressors as instruments to deal with the problem of endogeneity.

Because we only count with 42 countries ($N = 42$) and 52 time periods ($T = 52$), only one lag was considered in order to minimize the number of instruments.⁶ A two-step GMM method was used because a more efficient estimation is possible since the model is over-identified. According to Cameron and Trivedi (2010), standard errors reported for the two-step GMM estimator are downward biased in finite samples, so robust standard errors were estimated, following the suggestion of Windmeijer (2005).

For consistent estimation, the Arellano-Bond estimator requires that the error $\varepsilon_{i,t}$ be serially uncorrelated. For such purpose, a test of autocorrelation was conducted under the null hypothesis that $cov(\Delta\varepsilon_{i,t}, \Delta\varepsilon_{i,t-k}) = 0$, ie, no second-order correlation. Similarly, a Sargan Test (a test of over-identifying restrictions for the instruments) was considered in order to check overall validity of instruments and, thereby, confirm the absence of autocorrelation between the error terms and the instruments.

As for the model used to identify sovereign risk transmission across regions, a n -dimensional vector autorregressive model was considered:

$$y_t = \phi_y(L)y_{t-1} + \phi_x x_t + u_t \quad (5.2)$$

Where y_t represents the dependent variable, Costa Rica's EMBI spread, $\phi_y(L) = \sum_{j=1}^J \phi_{y,j} L^{j-1}$ is a polynomial in the lag operator, x_t represents a m -dimensional vector of exogenous variables which

⁶According to Cameron and Trivedi (2010), if too many instruments are used, then asymptotic theory provides a poor finite-sample approximation to the distribution of the estimator.

includes the constant and u_t is a vector of innovations.

6 Data and Estimation Results

6.1 Determinants of sovereign risk

A sample of 42 emerging countries, of which 17 are from Latin America, 11 from Europe, 7 from Africa and 7 from Asia. Table 2 provides the list of countries that were considered. The country selection was based on data availability, especially that of fundamental variables and external shocks.

Table 2: Country list

Latin America		Europe		Africa	Asia
Argentina	Jamaica	Belgium	Turkey	Côte d'Ivoire	China
Bolivia	Mexico	Belarus	Ukraine	Egypt	Georgia
Chile	Panama	Croatia		Gabon	India
Colombia	Paraguay	Hungary		Ghana	Iraq
Costa Rica	Peru	Lithuania		Guinea	Lebanon
Dominican Republic	Trinidad & Tobago	Poland		Nigeria	Malasya
Ecuador	Uruguay	Romania		South Africa	Vietnam
El Salvador	Venezuela	Russia			
Honduras		Serbia			

The sample included quarterly data from 2002Q1 to 2014Q4. Table 3 summarizes the variables considered in this paper and the respective source and periodicity. In particular, the J.P. Morgan's Emerging Market Bond Index (EMBI) spread estimated for each country was used as a measure of the yield spread over U.S. Treasuries⁷. However, for some countries, the EMBI was not available for all the years of the period of study⁸. Because we wanted to keep homogeneity in the information, we did not include other spreads or sovereign risk indicators for such countries.

In addition, annual data was considered for the fiscal indicators, since it was not possible to have homogeneous and quarterly information for the countries in the sample. Variables associated with socio-political and institutional stability were not included in the estimations since most of the representative indicators are annual and have not been updated since 2013.

⁷Emerging Markets Bond Index is a benchmark index estimated by J.P. Morgan for measuring the total return performance of international government bonds issued by emerging market countries that are considered sovereign (issued in something other than local currency) and that meet specific liquidity and structural requirements. In order to qualify for index membership, the debt must be more than one year to maturity, have more than \$500 million outstanding, and meet stringent trading guidelines to ensure that pricing inefficiencies don't affect the index.

⁸Despite this, the constructed panel data was balanced.

As a measure of volatility in international financial markets, two indicators were considered. The first one is the Chicago Board Options Exchange (CBOE) stock market volatility or VIX index, which is constructed using the implied volatilities of a wide range of S&P 500 index options and high VIX readings mean that investors are seeing significant risk of an abrupt movement in stock markets, whether downward or upward. The second one is the TED spread, defined as the difference between the yield on the 3-month Treasury Bill (T-bill) and the value of the eurodollar futures contract, which is based on the 3-month LIBOR rate. Therefore, when the TED spread is increasing, it is a sign that either agents in US financial markets are perceiving a higher risk of default on the loans, so they are charging a higher interest rate to offset this risk or that investors are flocking to buy T-bills because they believe the stock market is faltering.

Other macroeconomic fundamentals were not included in econometric estimations due to lack of availability of monthly and quarterly data.

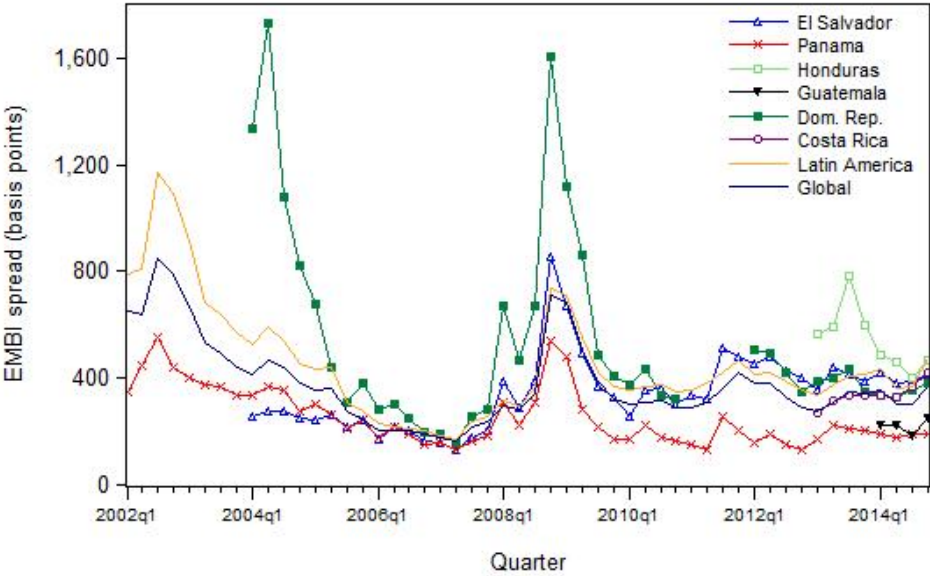
Table 3: Data sources

Indicator	Variable (abbreviation)	Source	Units and periodicity
Sovereign bond spread	Emerging Market Bond Index spread by country (EMBI)	Bloomberg	Basis points, quarterly
Economic activity performance	Real Gross Domestic Product variation (Economic growth)	International Financial Statistics (IFS)	Annual % change, quarterly
Fiscal space	Flow: Fiscal deficit % GDP (Deficit/GDP)	IMF World Economic Outlook, April 2015	% nominal GDP, annual
	Stock: Public debt % GDP (Debt/GDP)	IMF World Economic Outlook, April 2015	% nominal GDP, annual
External balance	Current account balance (CA/GDP)	International Financial Statistics (IFS)	% GDP, quarterly
Local inflation	Consumer price index (Inflation)	International Financial Statistics (IFS)	Annual % change, quarterly
International reserves	International reserves as % GDP (Reserves/GDP)	International Financial Statistics (IFS)	% GDP, quarterly
External indicators	Global Emerging Markets Bonds Index (Global EMBI)	Bloomberg	Basis points, quarterly
	CBOE Volatility index (VIX)	FRED, Federal Reserve Bank of St. Louis	Index, quarterly
	TED spread	FRED, Federal Reserve Bank of St. Louis	Percent, quarterly
Domestic interest rate	Nominal average interest rate (Local interest rate)	International Financial Statistics (IFS)	Annual Percent, quarterly

Figure 3 shows the behavior of the EMBI spread for all the sample and the respective values for

Central American countries. More specifically, a decline in the EMBI spread can be interpreted as greater investors confidence in the country's sovereign issuance, as they perceive less default risk. As we can observe, from 2002 to 2007, emerging countries -especially Latin American countries- experienced a consistent reduction in sovereign risk. However, with the financial crisis, all emerging economies suffered an increase in sovereign vulnerability perception. The situation moderates in the post-crisis period, but the EMBI spreads still remain slightly above from the pre-crisis levels for most of the countries in the sample.

Figure 3: EMBI Spread for Central America



Source: Bloomberg.

Table 4 provides descriptive statistics for the main variables. Considering domestic factors, it can be observed that economic growth in these emerging economies moderated markedly during the Financial Crisis and, even though it has risen during the post-crisis period, it is still lower than the average level recorded in 2002-2007. Inflation and interest rates have declined over the last decade, more intensely during the last four years. Reserve levels have remained relatively stable and state fragility slightly improved after 2007, on average. External imbalances have widened in these economies, as the deficit in current account is higher than the historical levels in the period of study. With respect to the pre-crisis period, we observe that emerging countries have experienced a real appreciation. Fiscal indicators in emerging countries have deteriorated most likely as a result of the massive fiscal stimulus put in place

to boost the aggregate demand during the global crisis.

Table 4: Descriptive statistics for domestic factors
(Averages)

	2002-2007		2008-2009		2010-2014	
	All countries	Costa Rica	All countries	Costa Rica	All countries	Costa Rica
EMBI	473	n.d.	526	n.d.	377	335
GDP Growth	5.6	6.0	2.0	0.9	4.0	4.3
Local interest rate (%)	15.4	22.5	14.1	17.8	12.3	16.3
Inflation	8.0	10.9	8.4	10.6	6.7	4.7
Deficit/GDP	-1.8	-2.6	-3.0	-1.9	-3.5	-5.2
Debt/GDP	56.2	36.7	44.6	26.0	48.0	34.2
CA/GDP	-0.3	-5.0	-2.0	-5.7	-2.6	-4.8
REER	114.3	118.9	103.1	113.6	99.4	94.4
Reserves/GDP	14.7	11.0	19.5	14.0	19.5	13.1
PoliIV	8.3	1.0	7.7	1.0	7.2	1.0

Source: Author's estimation.

In case of Costa Rica, it can be observed that its economy grew faster than the countries in the sample, but it also was more affected by the financial crisis. In addition, Costa Rica has been characterized for having significantly higher inflation and nominal interest rates than the rest of the emerging countries, but those two variables tended to converge to the regional average during the last four years. Even though the country keeps lower reserve levels than the rest of the countries in the sample, the GDP ratio is relatively comfortable. The country is also distinguished by political and social stability and by a high and stable current account deficit, around 5,0% of nominal GDP. During the post-crisis period, Costa Rica has recorded a more intense real appreciation than the country sample. As for the fiscal variables, it deserves a special attention the fact that Costa Rica reduced significantly its fiscal imbalance until the years before the crisis. However, the situation reverses during the 2010-2014 period, when the public debt and fiscal deficit return to historical levels.

Table 5: Descriptive statistics of external factors
(Averages)

	2002-2007	2008-2009	2010-2014
EMBI	473	526	377
Commodity price var.	12.5	3.9	5.0
Commodity_Price Index	93	147	177
U.S. 10 year bond rate	4.4	3.4	2.5
LIBOR 6 months	3.2	2.1	0.5
TED spread	0.4	1.0	0.2
VIX	18.0	32.1	18.6

Source: Author's estimation.

As for external factors, Table 5 summarizes the average levels of the main variables that affect sovereign risk globally. In particular, we observe that during the crisis there was a significant increase in the volatility in stock markets, as measured by the VIX index, along with an increment in the TED spread, and indicator of perceived credit risk in the United States. However, such elements returned to pre-crisis values over the 2010-2014 period. Furthermore, international interest rates recorded historical low values during the years after the crisis. Commodity prices variation diminished sharply during the crisis and it remains so during the post-crisis period.

Table 6: Expected Signs of the Variables

Variable	Sign	Variable	Sign
VIX	(+)	TED spread	(+)
Debt/GDP	(+)	Deficit/GDP	(+)
Local Inflation	(+)	Local Interest Rate	(+)
Local interest rate	(+)	CA/GDP	(-)
Economic growth	(-)	Reserves/GDP	(-)
Global EMBI	(+)		

Following the results obtained by authors as Aizenman and Marion (2012), Agosin et al. (2012) and Ciamodo et al. (2014), as well as macroeconomic theory on determinants of sovereign risk, a positive relationship is expected between the EMBI spread of each country and explanatory variables such as the financial market volatility (VIX and TED spread), fiscal and external imbalances, local inflation, domestic interest rate and global EMBI. On the opposite, we expect a negative relationship between the dependent variable and economic growth and foreign reserve level (See Figure 6).

Table 7: Results. Dependent variable: EMBI spread

Variable \ Specification	A	B	C
EMBI ($t - 1$)	0.550**	0.563**	0.558**
Debt/GDP	15.760**	15.283**	17.243**
Deficit/GDP	30.026**	23.990**	32.978**
CA balance/GDP	-15.378**	-16.424**	-15.622**
Economic Growth	-2.601+	-4.260*	-0.513
Local interest rate	5.550**	5.435**	7.531**
Inflation	3.069**	2.965**	3.798**
Reserves/GDP	-1.352	-0.036	-2.672
TED spread	132.972**	207.655**	
VIX			14.592**
Dummy financial crisis		-118.705**	-45.198**
Global EMBI	0.616**	0.607**	
Obs.	1027	1027	1027

Legend: + $p < 0.1$; ** $p < .05$; *** $p < .01$.

Source: Author's estimation.

Table 7 summarizes the main results. Different specifications were estimated in order to verify robustness of the estimators and the respective statistical significance. Specification *A* can be follow as the baseline. Specification *B* adds a dummy variable that indicates the financial crisis period (2007Q3-2009Q2). Specification *C* substitutes the TED spread for the VIX index as a proxy of international financial markets volatility.

As for country-specific macroeconomic fundamentals, results show that local imbalances explain, directly, the EMBI spread: a deterioration in fiscal indicator and current account balance is associated with an increase in sovereign spread, raising funding costs in international financial markets. Local inflation is also directly related with the dependent variable, suggesting the importance of monetary and macroeconomic policies oriented to control inflation levels. Foreign reserve level estimator is negative, as theory suggests, since an accumulation of reserves imply that the country has more resources to face exogenous shocks, such as volatile capital flows and to preserve domestic financial stability. However, such parameter was not statistically significant in all the estimations. In case of economic growth, the estimator has the expected sign, as higher economic dynamism is associated with less sovereign risk perception, but the statistical significance is not consistently present in the different specifications. Finally, local interest rates and previous values of country's EMBI spread seem to have a statistically significant and positive role in the EMBI spread determination. In general, the direct relationship between local interest rate and sovereign spread can be interpreted as follows: rises in local interest rates are intrinsically related with demand pressures in domestic financial markets, reflecting less available local

resources and more dependence of domestic agents on external funding. In economies with an important fiscal gap, higher interest rates can reflect a crowding out effect, as the government requires a large fraction of local funds to finance its deficit.

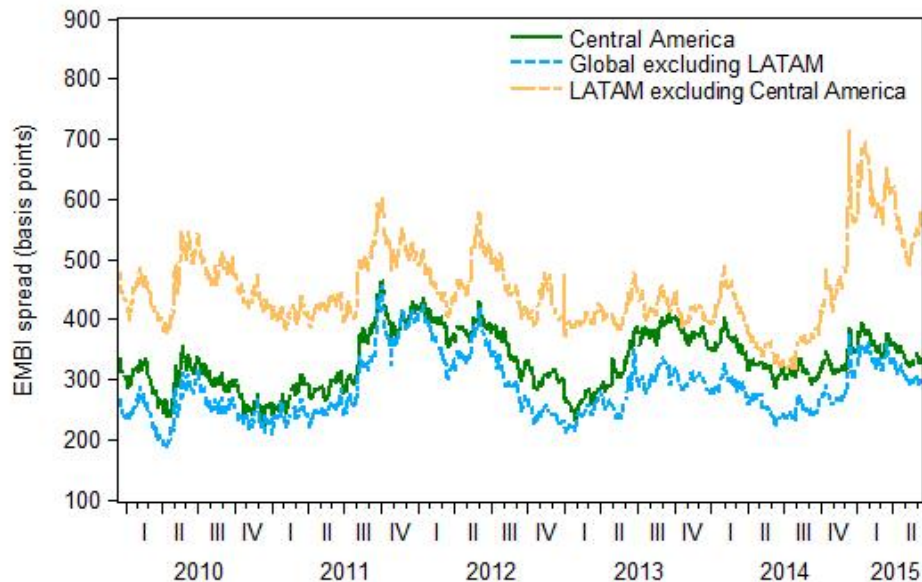
Regarding external factors, the estimations suggest that volatility in foreign financial markets, measured either by the VIX index or the TED spread, are directly related with EMBI spread, as higher uncertainty in such markets restricts external funding conditions. Global EMBI estimator also resulted statistically significant and with a positive sign, meaning that exogenous shocks that globally affect risk perception will deteriorate the country's sovereign spread. Such evidence of a common exogenous factor in the evolution of sovereign spread for the selected countries shows that changes in international conditions that affect availability of foreign capital will increase directly the costs associated with external funding, making it more difficult for emerging countries that are most dependent of foreign resources to finance their imbalances.

Lastly, the dummy variable for financial crisis resulted statistically significant with a negative sign. With the international financial crisis, risk perception on emerging countries declined as a result of the strong deterioration in advanced economies and the important resilience showed by the emerging economies, together with the rapid recovery and the greater dynamism shown by these countries after 2007.

6.2 Transmission of Sovereign Risk

As Figure 4 describes, EMBI spread daily data clearly suggests a co-movement between the sovereign spread of Central America and the EMBI spread of Latin American and non Latin American countries. Strong trade and financial linkages with advanced economies and across these countries are some of the most important factors that explain such symmetric behavior. More precisely, shocks that affect trade flows and access to international financing for emerging countries have an almost immediate impact on sovereign spreads, especially in those economies with important imbalances, as it is the case of Central America.

Figure 4: EMBI spread for selected regions



Source: Author's estimation.

The present section assess the propagation effects of sovereign spread shocks originated in Latin America and Central America to Costa Rica's EMBI spread. For such purposes, Panama and Dominican Republic were considered as part of the Central America region.

This paper is more interested in the very short term response of an external shock on Costa Rica's EMBI spread. Consequently, the role of specific factors in the transmission of sovereign risk and the elements that explain differences in the potential effect of an external shock are not analyzed. Furthermore, we do not evaluate the impact of a specific country event on Costa Rica's sovereign risk, we only study the impact of an observed change in the EMBI spread average of a particular region, such as Latin America or the rest of Central America.

For such purposes, a vector autoregression (VAR) model was conducted to relate the exposure of Costa Rica to changes in sovereign risk in other regions. Four country groups were considered: Latin American, Non Latin America, Central America excluding Costa Rica and Latin America excluding Central America. The dependent variable consists of Costa Rica's EMBI spread and as explanatory variables, the average EMBI spread of the described regions.

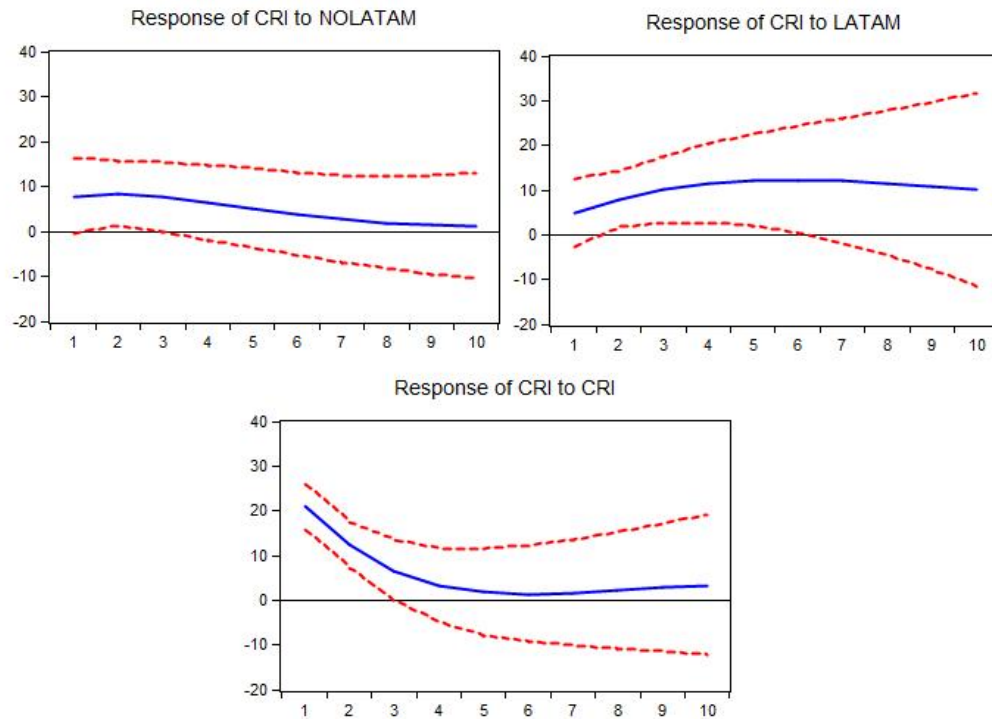
We took hand of EMBI spread daily data to estimate monthly averages for each country and then we proceeded to calculate the group averages. Such information was obtained from Bloomberg. Due to data availability, we considered the period between December, 2009 to June, 2015, which represents

and important limitation for the present study, since we only have 67 observations and econometric models such as a VAR requires relatively long time series. Regular monitoring is strongly recommended to evaluate the robustness of this results as more information is available. Finally, we considered the VIX index as an exogenous variable that measures global volatility in international financial markets.

Before the estimation, a lag exclusion Wald test and information criterion indicators were conducted and estimated to determine the optimal lag for the model. The different results point for a choice of one lag. All the VAR models estimated satisfied the stability conditions.

The first specification into consideration was a VAR model using as explanatory variables the average EMBI of Latin American countries (LATAM) and non Latin American countries (NOLATAM). Figure 5 plots the respective impulse response function, showing that a shock in Latin American and non Latin American countries generate a positive contemporaneous response in Costa Rica. Nonetheless, the Granger causality test, that indicates if one time series is useful in forecasting another, concludes that NOLATAM do not Granger-causes Costa Rica's EMBI spread, undermining the validity of the impulse response function for this case. On the contrary, we concluded Granger-causality between LATAM and Costa Rica. Therefore, there is a propagation effect of a shock in Latin America's EMBI spread on Costa Rica's EMBI spread, with a delay of a month and that tends to persist around 5 months. Such effect is close to 10 basis points for each variation of one standard deviation.

Figure 5: Impulse-response functions for Costa Rica, Latin America and non Latin America EMBI spreads (Months)

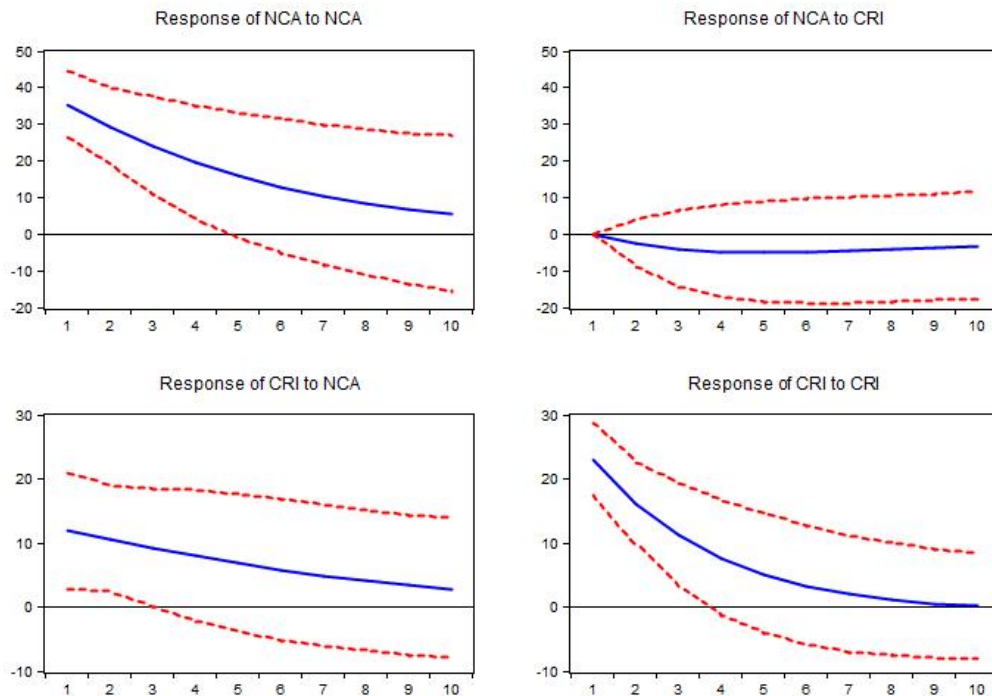


The red lines indicate the 5% confidence bounds based on bootstrap exercise with 1000 replications.

Source: Author's estimation.

As a second model, the relationship between Costa Rica and Latin American countries excluding Central America (NCA) was studied. Figure 6 reflects the impulse response functions for this specification, reporting a positive contemporaneous effect of a shock in Latin American countries excluding Central America on Costa Rica's EMBI spread. However, there is no significant effect of a shock in Costa Rica in on the rest of Latin American countries. Despite such results, Granger causality test suggests no Granger causality between such two variables in both directions. Thus, we cannot conclude a significant transmission effect between Costa Rica and the rest of the region excluding Central America and vice versa.

Figure 6: Impulse-response functions for Costa Rica and Latin America excluding Central America EMBI spreads (Months)



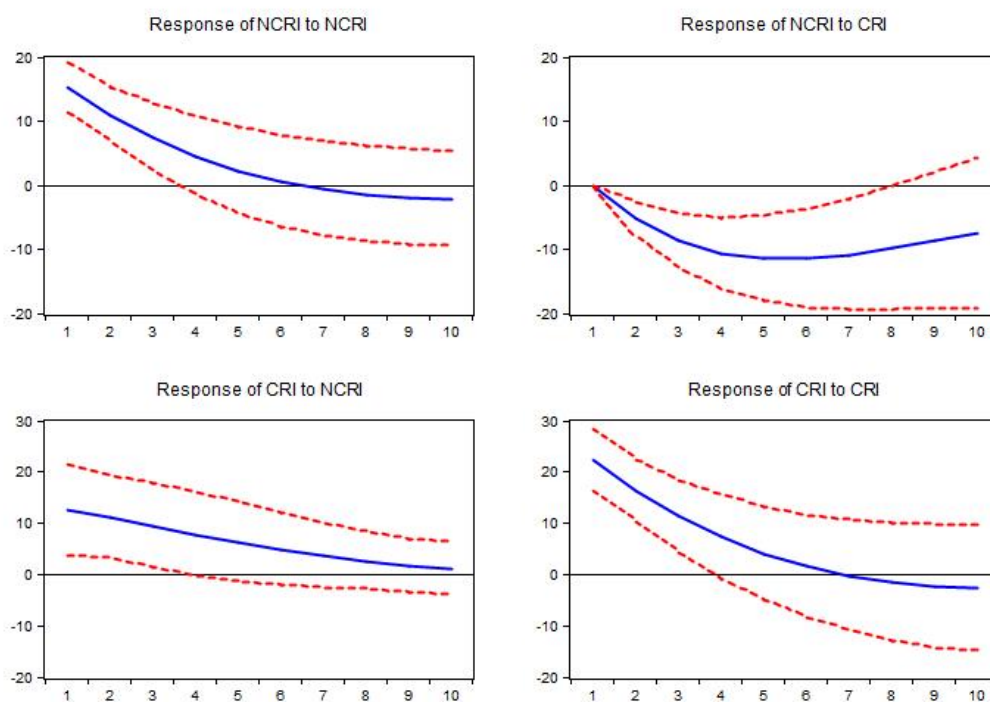
The red lines indicate the 5% confidence bounds based on bootstrap exercise with 1000 replications.

Source: Author's estimation.

Finally, the relationship between sovereign risk in Costa Rica and the other Central American (NCRI) countries was analyzed. Figure 7 describes the impulse response functions for this specification. The Granger causality test discards that the average Central America's EMBI spread contains information that helps predict Costa Rica's EMBI spread, so the impulse response function in this case do not have enough validity⁹. On the contrary, Costa Rica's EMBI spread do Granger-causes Central America's EMBI and the impulse response function reflects a positive and contemporaneous effect, suggesting that a shock in Costa Rica has an immediate effect in the sovereign risk perception of Central America and that it persists approximately three months after the perturbation.

⁹Despite this, we can observe a negative contemporaneous effect of Central America's EMBI to Costa Rica's EMBI. This can be related to the fact that, during 2014, sovereign risk in Central America moderated as a result of more stable global financial conditions, while Costa Rica suffered a downgrade on its ratings due to the deterioration of fiscal indicators that affected its default risk perception.

Figure 7: Impulse-response functions for Costa Rica and Central America EMBI spreads (Months)



The red lines indicate the 5% confidence bounds based on bootstrap exercise with 1000 replications.

Source: Author's estimation.

7 Conclusion

Costa Rica was relatively absent from the international bonds markets from 2004 to 2012. But with the bill "Ley para la Emisión de Títulos Valores en el Mercado Nacional" of September 2012 the government was allowed to sell bonds in the international market by an amount of up to four billion U.S. dollars in four emissions of one billion U.S. dollar each.

This bonds not only helped to reduce the pressures the fiscal deficits would have had on the internal market, but also created a lot of interest of international investors. Another effect of these emissions has been the growing importance of the sovereign spread in Costa Rica, not only due to its economic implication but because of its political implications as well. The size and liquidity of this bonds allowed J.P. Morgan to estimate an EMBI for Costa Rica.

The aim of this paper was to produce a relatively simple and parsimonious econometric model that

would help explain the movements of the EMBI spread for Costa Rica, as well as to generate short term forecasts of this variable. Given the lack of long and comparable historical data for Costa Rica, the estimation of such a model was done using panel data, using a sample of 42 emerging markets, with quarterly data from 2002 to 2014.

The model was estimated using an Arellano-Bond specification. The coefficients and signs of the explanatory variables used in the specification were in line with those from other empirical studies and as expected according with existent macroeconomic theory.

As for country-specific factors, inflation rate, as a measurement of macroeconomic stability, determines directly the EMBI spread of the countries in the sample. In addition, fiscal deficit, public debt and current account deficit are also significantly and positively associated with the sovereign spread. Therefore, countries with episodes of high inflation will suffer from a deterioration in sovereign vulnerability perception. Similarly, economies with increasing fiscal and/or external imbalances will face more difficulties to finance such disequilibriums in international markets as funding become more expensive due to a higher risk perception. Economic growth and foreign reserve levels are negatively associated with EMBI spread, but statistical significance could not be concluded. Local interest rates have a positive and statistically significant role in the determination of sovereign spread.

As for global factors, sovereign spread in emerging countries is closely tied with international perturbation that exacerbates stock market volatility and uncertainty in a global level, as explanatory variables such as the VIX index and the TED spread resulted statistically significant in the model. Similarly, global EMBI is positively related with the dependent variable of the model.

Regarding propagation effects, a significant and positive transmission of a shock in Latin America's sovereign risk perception on Costa Rica's EMBI spread was identified. This means that Costa Rica is intrinsically related with the region and cannot isolate from perturbations in Latin American that increase the cost of financing in international markets. A significant propagation of a perturbation in Central America's EMBI spread to Costa Rica could not be inferred, but results suggest that a perturbation in sovereign risk perception in Costa Rica have a contemporaneous and positive impact on the other Central America countries' sovereign spread.

The estimated models are useful tools for helping policy-makers in their future decisions, as well as to provide a framework to analyze different policy scenarios and its effects on the sovereign spreads. As more data is collected for Costa Rica and Central America, it will be possible to estimate with more robustness the level of correlation of the sovereign spread between countries of the region, as well as possible contagious effects that could spread across the region given country specific or global shocks.

In particular, the results of this document clearly justify the importance of an urgent solution for the fiscal problem in Costa Rica. As of the first semester of 2015, fiscal deficit continues to be the main source of financial vulnerability. The absence of explicit tax and expenditure measures to cope

with financial disequilibrium is taking fiscal sustainability to an explosive path. Under a passive scenario, external financing will be more expensive every time the Government places a bond emission in international markets, since structural deficit will persist. Therefore, policy-makers will suffer from a reduction in the capacity to implement measures to solve social and economics issues that prevent the country from achieving higher levels of economic development.

References

Agosin M. and Díaz-Maureira J. "Sovereign Credit Risk in Latin America and Global Common Factors". Universidad de Chile. September, 2012.

Altman, E. and Rijken, H. "Toward A Bottom-Up Approach to Assessing Sovereign Default Risk". The Journal of Applied Corporate Finance, vol.23, No. 3, Winter, 2011.

Astrid Ayala. "Default risk of sovereign debt in Central America". Universidad Francisco Marroquín. November, 2014.

Baldacci, E., Gupta, S. and Mati, A. "Political and Fiscal Risk Determinants of Sovereign Spreads in Emerging Markets". Review of Development Economics, 15(2), 251–263, 2011.

Brutti, F., Sauré, P. "Transmission of Sovereign Risk in the Euro Crisis". Gerzensee Study Center. Working Paper 12.01. December, 2011.

Caggiano, G. and Greco L. "Fiscal and Financial Determinants of Eurozone Sovereign Spreads". Universita degli Studi di Padova. July, 2012.

Cimadomo, J., Claeys, P. and Poplawski-Ribeiro, M. "How do Financial Institutions Forecast Sovereign Spreads?". European Central Bank. Working Paper Series. No 1750. December, 2014.

Hilscher J. and Nosbusch Y. "Determinants of Sovereign Risk: Macroeconomic Fundamentals and the Pricing of Sovereign Debt". Review of Finance (2010) 14: 235–262

Thuraisamy K., Gannon, G. and Batten J. "The Dynamic of Credit Spreads on Latin America Eurobonds". March, 2008.