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Sovereign Risk: Global and Local Factors

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Photography on the title page: “Presentes" (Present), set of sculptures from the Costa Rican artist Fernando Calvo Sanchez, 1983. Collection of the Central Bank of Costa Rica.

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Abstract

Determinants of sovereign spread in Costa Rica are analyzed through different macroeconomic variables derived from theory. A quarterly panel data set, from 2002 to 2014, is used to estimate an Arellano-Bond specification model. A VAR model is also estimated to identify transmission effects from shocks of Latin

America's and Central America's risk perception on Costa Rica's sovereign spread. Macroeconomic fundamentals such as fiscal and external imbalances, local inflation and domestic interest rates help explain the EMBI spread of Costa Rica and other countries in the sample. External factors related with international stock market volatility and global risk perceptions also have a role determining this spread.

Furthermore, our findings show a contemporaneous and positive effect from a perturbation in Latin America's spread over Costa Rica's EMBI spread.

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

JEL codes: G15.

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Riesgo soberano: factores globales y locales.

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Resumen

El documento analiza los determinantes del diferencial soberano para Costa Rica, considerando variables derivadas de la teoría económica. 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 diferencial soberano costarricense. Los resultados indican que los determinantes macroeconómicos asociados con desbalances fiscales y externos, inflación y tasas de interés locales explican el margen del EMBI de Costa Rica y de otros países seleccionados. Destaca además el efecto que tienen factores globales relacionados con la volatilidad de los mercados financieros y la percepción global de riesgo a nivel internacional.

Finalmente, se identifica un efecto traspaso contemporáneo y positivo de una perturbación en el margen de Latinoamérica sobre el respectivo de Costa Rica.

Palabras clave: Riesgo soberano, Bonos, Mercados financieros, Transmisión.

Clasificación JEL: G15.

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Sovereign Risk: Global and Local Factors

1 Introduction

The main objective of this paper is to analyze the importance of macroeconomic fundamentals in determining Costa Rica's sovereign spread[1] 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 bond issuances are characterized by smalls volumes (per issue), irregular maturity dates and chronic illiquidity. The scarcity of bonds makes it almost impossible to estimate a complete and representative yield curve. In addition, the low liquidity in secondary markets obstructs the correct price constructions as it is challenging for prices to adjust to variations 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 includes sovereign and quasi-sovereign (state-guaranteed) 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 example of the region; it was a country relatively absent from the international bond market since 2004. At Central American 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 as issuer during the same period.

For Costa Rica, the lack of bond issuance can be partially explained by the fact that the central government must get the Congress' approval in order to issue bonds in foreign financial markets. There-

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

fore, it is difficult for the government to finance its fiscal deficit through international markets, providing incentives to fiscal pressures on the local market. This reluctance could be traced to the aftermath of the eighties debt crisis and the abrupt depreciation that occurred as a consequence.

After the international financial crisis of 2008, Costa Rica's government applied a countercyclical fiscal policy to ameliorate the negative effects of the global economy downturn[2]. As a result, government spending increased was not matched by tax increases and Costa Rica moved from a fiscal surplus in 2007 to a structural fiscal deficit that has been continuous since 2009.

The unceasing and growing fiscal deficit has translated into pressures on the local financial market. This context, along with a moderation of economic growth, provided incentives for the government and Congress to agree in external financing, issuing bonds in international markets. With the bill No. 9017[3] of September 2012, the government was allowed to issue sovereign bonds for a volume up to four billion U.S. dollars within the next four years.

As a result, bond issues of one billion U.S. dollars have been made every year, from 2012 until 2015. The return of Costa Rica to the international bond market caught interest from foreign and local investors, and increased the relevance of the sovereign spread's behavior as a key macroeconomic variable. Specifically, sovereign spread may be perceived as a diagnostic measurement from international markets on the country's fiscal and macroeconomic sustainability.

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

Main economic literature converges to point out, as determinants of sovereign risk, inflation levels (as a measurement of macroeconomic stability), socio-political stability indicators such as Polity IV index and the Index of Economic Freedom, public debt level, terms of trade volatility, fiscal deficit and external imbalance. According to Aizenman & Marion (2004), the relative importance of macroeconomic fundamentalshas changed through time:

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

Global factors were the main drivers of the spreads before the crisis, but after such episode, local factors related to the absorbing capacity of external shocks became more relevant. It is important

[2]The 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.

[3]Law for Issuing Securities in the International Market

to highlight that the crisis had its origin in advanced economies, but 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 toxic assets influenced by the subprime collapse and by the massive fiscal and monetary stimulus that most of these economies implemented as a response.

Emerging markets in general and Latin American 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 international excess savings, elements which led to a drop in interest rates of sovereign bonds from the region, providing some relief in terms of financing their fiscal deficit and current account.

The two gear global economy that resulted from the crisis was represented, on one hand, with emerging markets growing faster and a moderation of their risk perception and, on the other, by affecting developed economies with low interest rates. This situation generated incentives for a change of direction of capital flows.

The decoupling hypothesis was popular at the beginning, but as emerging markets began to reduce their levels of economic growth, it has lost its moment. 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.

Given this context, the development and understanding of the determinants of sovereign risk for Costa Rica has taken greater importance in recent years, mainly to the volatility of international financial markets since the global financial crisis of 2008 and the increment of public debt that is externally financed.

Costa Rica is a small and open economy with significant imbalances which turn this economy to be dependent on external financing for both growth and macroeconomic stability. Fiscal sustainability has become the main source of vulnerability in the short term, as public debt maintains an increasing rate due to the persistence of a primary deficit. This document pretends to give evidence on the eventual implications of a passive scenario (in which an adjustment on public finances is not implemented) on the sovereign spread -and therefore the cost of external funding- as it is positively correlated with a deterioration of fiscal indicators.

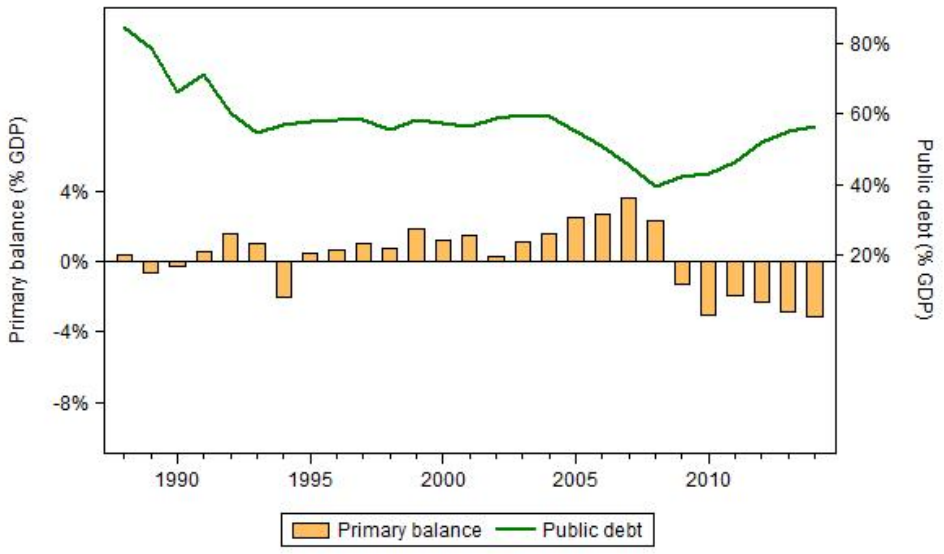
The document is organized as follows: section 2 reviews the recent bond issuance by Costa Rica's government in the international markets; section 3 provides a brief discussion on recent economic literature regarding sovereign spread macroeconomic fundamentals; section 4 describes a simple model of determining bonds spreads; section 5 gives empirical support for the model, while Section 6 describes the data used and the estimation results. Finally, section 7 summarizes the main conclusions.

2 Recent issuance of Costa Rica's sovereign bonds

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

Specifically and as Figure 1 shows, government finances have deteriorated significantly over the last six years, placing doubts on fiscal sustainability. The ratio of total debt to GDP increased from 39,0% in 2008 to 56,0%, with the particularity that the country's primary balance, which excludes interest payments from expenditure, turned negative after 2008[4]. This suggests that 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: Costa Rica: Government debt and primary balance



Source: Ministry of Finances, Costa Rica.

On July 2012, Congress passed a bill authorizing the issuance up to US$4 billion in external debt bonds. In September of that year, the President signed the bill 9070[5] into law. The first tract was

[4] In 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.

[5] Law for Issuing Securities in the International Markets

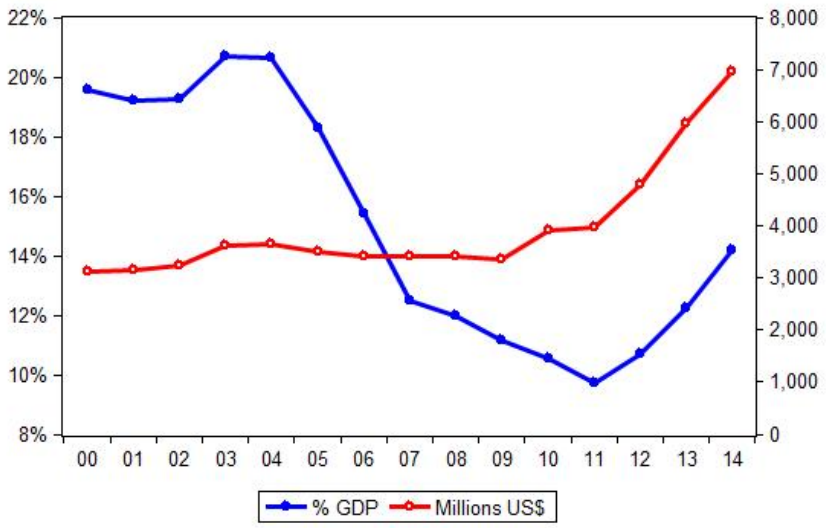
issued on November 16th, 2012: a 10-year bond for US$ 1,000 million with an effective rate of 4.25%. The transaction was considered a success by government officials, as it recorded the lowest interest rate that Costa Rica has achieved in international financial markets.

The second issuance took place on April 23rd, 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 with two simultaneous bonds of US$ 500 million each and achieved rates of 5.625% for a maturity of 30 years and 4,375% for 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 million and a maturity of 30 years; it reached reached an effective rate of 7.0%, clearly higher than the 5.625% of the April 2013 issue, also for 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, once more, it was for an amount of US$ 1,000 million with a 30-year maturity and it reached an effective rate of 7.158%. For that occasion, Costa Rica benefited from favorable international market conditions of 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 managed to allocate the total volume at 7.158%.

Figure 2: Costa Rica: Public Sector External Debt



Source: Ministry of Finances, Costa Rica.

As it is shown in figure 2, the issuance of the US$4 billion approved by Law 9070 lead to an increase in Costa Rica's external debt relative weight in total debt structure, from 10.5% of GDP and 21.0% of total debt in 2011 to 14.2% of GDP and 25.0% of total debt in late 2014. As mentioned, the main objective of these issuances was taking advantage of the decline in international interest rates, with the purpose of maximizing the maturity profile of debt with maturities up to 30 years, as well as maintaining a broader 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

Source: Ministry of Finances, Costa Rica. As may, 2015.

The credit rating by many agencies of Costa Rica's debt is "non investment grade speculative", one notch below investment grade. In Central America region, only Panama has a better grading. On table 1, the most recent ratings of the region as well as their 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 sovereign bond's spread.

Still, there is almost no literature related to the sovereign spread for Central America. Only Ayala, Blazsek & de Paz (2014) has done an empirical study for Guatemala and Panama analyzing the default risk.

The determinants of credit risk spread for emerging markets have been divided in the economic literature between country-specific and global factors. As Baldacci, Gupta & Mati (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 & Díaz-Maureira (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 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 Thuraisamy, Gannon & Batten (2010) that analyze sovereign risk behavior of Brazil, Chile, Colombia, Mexico and Venezuela found a statistically significant effect of the exchange rate factor on their spreads.

As Cimadomo, Claeys & Poplawski Ribeiro (2014) discuss, not only actual macroeconomic fundamentals have an effect on sovereign spreads. According to these authors, forecasters and market experts's expectations on future evolution of sovereign bond spreads are significantly influenced by the expected behavior of macro and fiscal variables. As a result, a deterioration in the expected fiscal outlook -in terms of a less favorable forecast for the government balance- increases expected spreads. Consequently, these findings support the claim that anchoring expectations about the future path of fiscal policy (and other macroeconomic fundamentals) is a key factor to ease financial markets' concerns about the long-term fiscal sustainability. A sound, stable and credible macro-fiscal framework implemented by fiscal authorities is significantly relevant to stabilize expectations of the evolution of sovereign spreads, reducing the country's expected risk premium.

4 Framework of Sovereign Spreads

Consider a zero coupon bond, 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. 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. The relationship between these prices can be described as:

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

Where $Pr(T < \tau | t < \tau)$ is the probability of the bond to default at any time τ, while $R(t)$ is the recovery rate in case of default. If we assume that $R(t) = 0$, we obtain:

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

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

$$D_t = B_t(1 - p_t) \tag{4.3}$$

If the returns of the bonds are $D_t = e^{[-(T-t)r_t]}$ for the risky bond and $B_t = e^{[-(T-t)r_{f,t}]}$ for the risk free bond (with $r(t)$ representing the annual log yield to maturity), then we can obtain a relationship of prices as a function of the log yield spread between these bonds ($s_t = r_t - r_{f,t}$).

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

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

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

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

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

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

5 Empirical Specification

As the standard practice in empirical literature, the baseline model specification for the panel data[6] 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 reserves 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) and the TED spread.

Several advantages and limitations are presented when using panel data sets is presented, as Hsiao (2014) discusses. Briefly, the main advantages of this methodology over single cross-sections or time series data the following: a) more accurate inference of model parameters, b) greater capacity for

[6] Panel data are repeated measures on individuals (i) over time (t).

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. Panel data models have already been used in the literature to examine sovereign spread determinants [7].

The present document is interested in the estimation of parameters of the general specification:

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{i,t} + \gamma Z_t + \epsilon_{i,t}, i = 1, \dots N; t = 1, \dots T. \tag{5.1}$$

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 & Bond (1991) to estimate specification 5.1. More precisely, Arellano and Bond propose an estimation method based on the first difference of the model. 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 variables. This technique enables to control for 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, contemporaneous endogeneity is a potential problem that must be taken into consideration for a robust estimation. For instance, local interest rates can be affected by the previous and present level of the sovereign spread. The Arellano-Bond specification considers the lags of the dependent variable and the lagged values of the regressors as instruments to deal with the problem of endogeneity.

Because we only have 42 countries ($N = 42$) and 52 time periods ($T = 52$) in the sample, only one lag was considered in order to minimize the number of instruments[8]. A two-step GMM method was chosen because it provides a more efficient estimation 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 also estimated, following the suggestion of Windmeijer (2005).

For a consistent estimation, the Arellano-Bond estimator requires the error $\varepsilon_{i,t}$ to 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, there is no second-order correlation. Similarly, a Sargan Test (a test of

[7] For instance, Aizenman, Jinjarak & Park (2013) use panel data to assess the relative importance of various economic fundamentals in accounting for the sovereign credit default swaps (CDS)

[8] According 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.

over-identifying restrictions for the instruments) was considered in order to check for the overall validity of the instruments included and, thereby, confirm the absence of autocorrelation between the error terms and these instruments.

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

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

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 of the lag operator, x_t represents a m-dimensional vector of exogenous variables which includes the constant and u_t is a vector of innovations.

6 Data and results

6.1 Determinants of sovereign risk

The sample considers 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 included. 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			

Source: Author's compilation

The sample includes 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)[9] spread estimated for each country was used as a measure of the

[9]Emerging Markets Bond Index is a benchmark index estimated by J.P. Morgan for measuring the total return per-

yield spread over U.S. Treasuries. However, for some countries, the EMBI was not available for all years of the sample[10]. 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 quarterly information for the countries in the sample. Another caveat is that variables associated with socio-political and institutional stability could not included in the estimations since most of the representative indicators are annual and have not been updated since 2013.

As a measure of volatility in international financial markets, two indicators were considered. The first 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; high VIX readings mean that investors are seeing significant risk of an abrupt movement in stock markets, whether downward or upward. The second 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 perceive a higher risk of default on the loans, so they charge 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 such as real exchange rates, terms of trade or industrial production were not included in econometric estimations due to lack of monthly and quarterly data availability.

formance 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.

[10]Despite this, the constructed panel data was balanced.

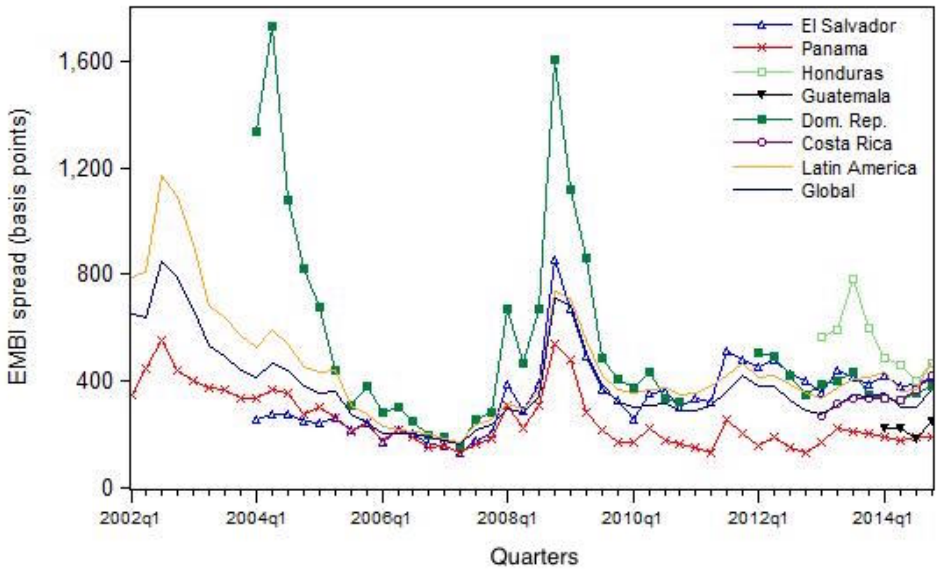
Table 3: Data sources

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

Source: Compiled by authors

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 bonds, 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 their 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 that the average level recorded in 2002-2007. Inflation and interest rates have declined over the last decade, more intensely during the last four years. Reserves 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 the pre-crisis period, we observe that these emerging countries have experienced a real appreciation. Along with it, their fiscal indicators 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
(On Average)

	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 compilation.

For the case of Costa Rica, it can be observed that its economy grew faster before and after the financial crisis period, but during the crisis period, its economic growth rate moderated with greater intensity than the sample average. In addition, Costa Rica has been characterized for having significantly higher inflation levels and nominal interest rates, even though both variables tended to converge to the regional average during the last four years. Although this country kept lower reserve levels than the rest of the countries in the sample, the GDP ratio was adequate according to the estimation of the optimal amount of reserves for Costa Rica (See Segura & Funk (2012)) . This country is also distinguished for being politically and socially stable and by having a high and unchanging 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 other countries in the sample. Costa Rica reduced significantly its fiscal imbalance the years before the crisis. However, the situation reversed during the 2010-2014 period, when the public debt and fiscal deficit returned to historical levels.

Table 5: Descriptive Statistics of External Factors
(On Average)

	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 the external factors, Table 5 summarizes the average levels of the main variables, considered for this research and that affect sovereign risk globally. In particular, we observe that during the crisis , as expected, 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, an indicator of perceived credit risk in the United States. However, such elements returned to pre-crisis values during the 2010-2014 period. Furthermore, international interest rates recorded historical low values after the crisis. Commodity prices variation diminished sharply during the crisis and remained 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 balance/GDP	(-)
Economic growth	(-)	Reserves/GDP	(-)
Global EMBI	(+)		

Source: Author's compilation.

Following the results obtained by authors such as Aizenman et al. (2013), Agosin & Díaz-Maureira (2012) and Cimadomo et al. (2014), and also 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 measures (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 our dependent variable and economic growth and foreign reserves level (See Figure 6).

Table 7: Results. Dependent variable: EMBI spread

VariableSpecification	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: $+p < 0.1; **p < .0.5; ***p < .01.$

Source: Author's estimation.

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

As for country-specific macroeconomic fundamentals, results show that local imbalances explain, directly, the EMBI spread: a deterioration of the fiscal indicator and current account balance is associated with an increase in sovereign spread, increasing 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. The foreign reserves 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. For the economic growth variable, the estimator has the expected sign, as higher economic dynamism is associated with a lower sovereign risk perception, but the statistical significance is not consistently present through 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 a higher 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 larger proportion of local funds to finance its deficit.

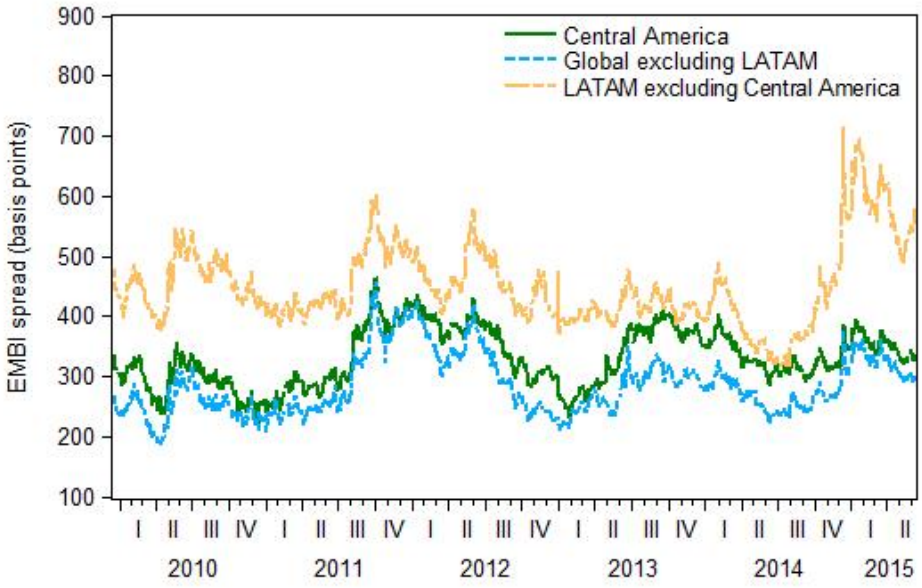
Regarding external factors, the estimations suggest that volatility in foreign financial markets, measured either by the VIX index or the TED spread, are directly related with EMBI spread: the higher uncertainty in such markets restricts external funding conditions. Global EMBI estimator also resulted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

Lastly, the dummy variable for financial crisis turned statistically significant with a negative sign. During 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 these emerging economies, evidenced in their rapid recovery and greater dynamism showed after 2007.

6.2 Transmission of Sovereign Risk

As Figure 4 describes, the EMBI spread daily behavior clearly suggests a co-movement between the sovereign spread of Central American countries, the EMBI spread of Latin America (excluding Central American countries) and the rest of emerging markets in the index. 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 on those economies with significant imbalances, as it is the case of the Central American ones.

Figure 4: EMBI Spread for Selected Regions



Source: J.P. Morgan.

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

As this research is more interested in the very short term response of an external shock on Costa Rica's EMBI spread, 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 autoregressive (VAR) model was conducted to relate the exposure of Costa Rica to changes in sovereign risk from other regions. Four country groups were considered: Latin American, other emerging economies (excluding Latin America), Central America excluding Costa Rica and Latin America excluding Central America. The dependent variable is Costa Rica's EMBI spread and the explanatory variables are the average EMBI spreads of the regions just described.

With the EMBI daily spread data, we estimated 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

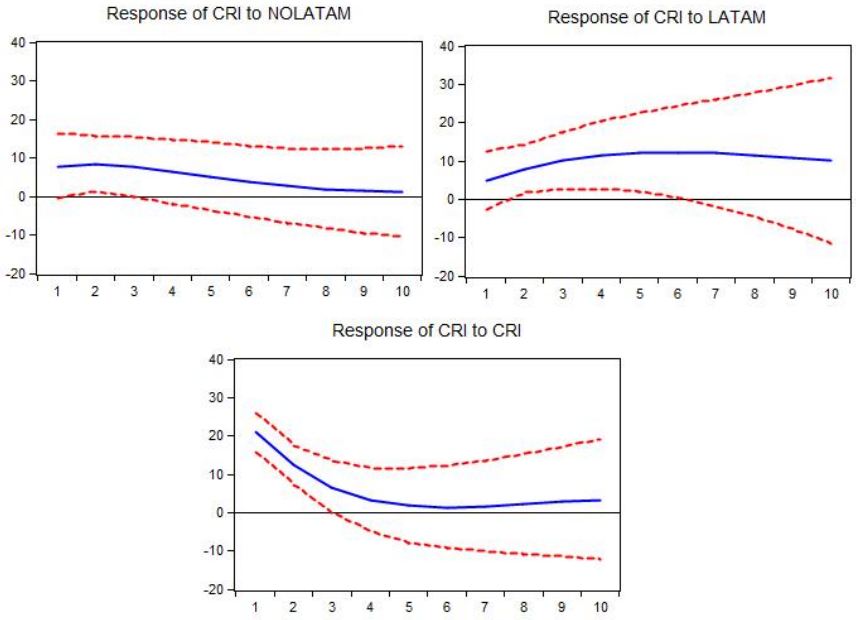
and important limitation for the present study, since we only have 67 observations [11]. Regular monitoring is strongly recommended to evaluate the robustness of this results as more information becomes available. Finally, we considered the VIX index as an exogenous variable that measures global volatility 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 pointed out that adding one lag was the best choice. All the VAR models estimated satisfied the stability conditions.

The first specification considered was a VAR model using the average EMBI of Latin American countries (LATAM) and other emerging countries (NOLATAM) as explanatory variables. 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, which indicates if one time series is useful in forecasting another, concluded 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 may concluded that there exists Granger-causality between LATAM and Costa Rica. Therefore, there is evidence of a propagation effect from a shock in Latin America's EMBI spread to Costa Rica's EMBI spread, with a delay of a month and which tends to persist for 5 months, approximately. Such effect is close to 10 basis points for each variation of one standard deviation.

[11] An econometric model such as a VAR requires relatively long time series

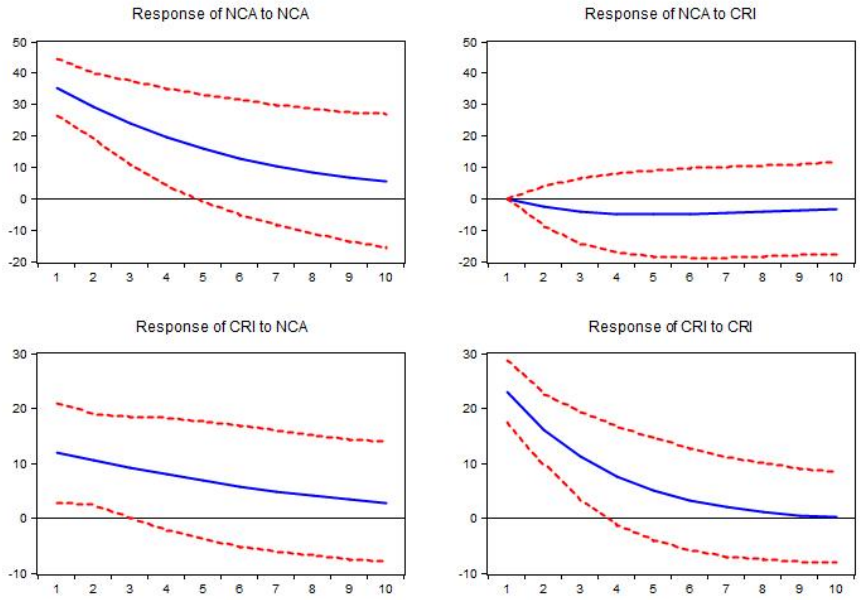
Figure 5: Impulse-response functions for Costa Rica, Latin America and non-Latin America EMBI spreads
(Months)



The red lines indicate the 5% confidence bounds based on bootstrap exercise with 1000 replications.
Source: Author's estimation.

As our 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 from a shock in Latin American countries excluding Central America to Costa Rica's EMBI spread. However, there is no significant effect from a shock in Costa Rica to the rest of Latin American countries' spread. Despite such results, Granger causality test suggests no Granger causality between these 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)

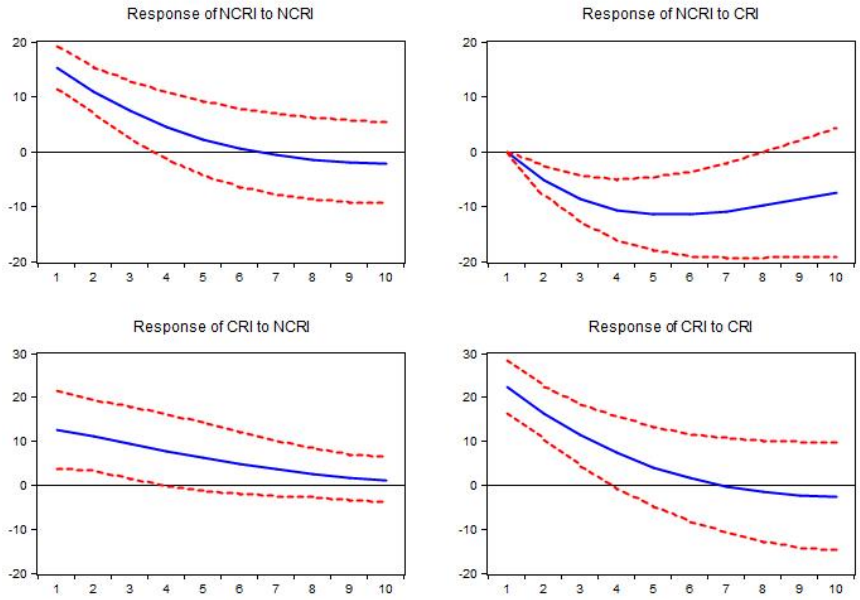


The red lines indicate the 5% confidence bounds based on bootstrap exercise with 1000 replications.
Source: Author's estimation.

Finally, the relationship between Costa Rica's sovereign risk and the other Central American (NCRI) countries was analized. 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 functions in this case do not have enough validity[12]. On the contrary, Costa Rica's EMBI spread do Granger-causes Central America's EMBI and the impulse response functions reflect a positive and contemporaneous effect, suggesting that a shock in Costa Rica has an immediate effect in the sovereign risk perception of Central America's sovereign risk and that it persists approximately three months after the perturbation.

[12]Despite 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 of 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 bond market from 2004 until 2012. With the Congress authorization in bill 9070 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.

These bonds helped to reduce part of the pressures the fiscal deficits would have had on the internal market, and also generated a lot of interest from 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 implications but because of its political implications as well. The size and liquidity of this bonds permitted 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 to identify the most important determinants of the EMBI spread for Costa Rica and other emerging countries. A panel data set from 2002 to 2014 was constructed to estimate an Arellano-Bond specification

model. The significance of the estimated coefficients turned to be in line with those expected from other empirical studies and existent economic literature.

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 becomes more expensive given a higher risk perception. Economic growth and foreign reserves levels are negatively associated with EMBI spread, but statistical significance was not conclusive. 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 perturbations that exacerbate stock market volatility and uncertainty at a global level. Explanatory variables such as the VIX index and the TED spread resulted statistically significant in the model. Similarly, global EMBI turned to be positively related with the dependent variable of the model.

Regarding propagation effects, a significant and positive transmission was identified from a shock in Latin America's sovereign risk perception on Costa Rica's EMBI spread. This means that Costa Rica is intrinsically interconnected with the region and cannot be isolated from perturbations in Latin America which increase the cost of financing through international markets. A significant propagation from a perturbation in Central America's EMBI spread to Costa Rica's spread could not be inferred, but results suggest that a perturbation in sovereign risk perception in Costa Rica has 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 their effects on sovereign spreads. As more data is collected for Costa Rica and Central America, it will be possible to estimate better and more robustly the relation of the sovereign spread between countries of the region, as well as possible contagious effects that could spread across them given country specific or global shocks.

In particular, the results of this research 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 towards 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 economic issues that prevent the country from achieving higher development levels.

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