POSITIVE WAKE–UP–CALL CONTAGION:

NEW PROSPECTS FOR LATIN AMERICAN BONDS MARKET AFTER THE GREEK DEBT CRISIS

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Abstract

Recently, Latin American countries have experienced a series of upgrades in their sovereign credit ratings that are reflecting the region's appeal for sovereign portfolio managers around the globe. Paradoxically, Latin American economies have shown strong economic fundamentals during the whole last decade and did not experienced any significant local common shock during 2009 - 2012, years in which credit agencies started upgrading the ratings of the region. Given these facts a valid question that springs up is which circumstances triggered the change in perception over the region's creditworthiness during the last years. In this document I intend to explore a possible explanation to this change in risk perception, which consists in a *positive wake–up-call contagion* generated after the 2009 Greek debt crisis. The thesis will follow the methodology proposed in Giordano, Pericolli and Tomassino (2012), in which an analysis of contagion was conducted exclusively over developed European countries. Estimations show robust evidence of *positive wake – up – call contagion* towards the Latin American region. This outcome confirms that pricing of Latin American sovereign bonds in international financial markets is finally acknowledging the efforts of Latin American economies in correcting fiscal imbalances, implementing inflation targeting regimes and creating capital buffers to counter the effects of new coming local and international crises.

I. Introduction

Recently, Latin American countries have experienced a series of upgrades in their sovereign credit ratings that are reflecting the region's appeal for sovereign portfolio managers around the globe. For instance, Mexico's creditworthiness qualification was upgraded in 2013 by Standard & Poors (S&P), Colombia got the investment grade from S&P, Fitch and Moody's in 2011, Brazil's profile was upgraded in September 2009 by Moody's and in 2008 by S&P, and Chile reached a AA- level in its sovereign rating in 2012 (Reuters, Scotiabank, Bakermckenzie and Bloomberg).

Indeed, even though the region has not been completely immune to the recent world financial disasters of the 2008 subprime crisis and the Eurozone debt crisis (Cárdenas and Henao (2010), Ocampo (2009)), the main credit agencies have bet positively in the region's probability of default. Paradoxically, Latin American economies have shown strong economic fundamentals during the whole last decade (International Monetary Fund – Regional Economic Report. Western Hemisphere. Time to Rebuild Policy Space May 2013) and did not experienced any significant local common shock during 2009 - 2012, years in which credit agencies started upgrading the ratings of the region. Given these facts a valid question that springs up is which circumstances triggered this behavior; what is the cause of the change in perception over the region's creditworthiness during the last years.

In this document I intend to explore a possible answer which consists in a *positive wake–up-call contagion* generated after the 2009 Greek debt crisis. My hypothesis lays on the presumption that the Greek bailout not only led to a reassessment of the fundamentals of other European economies, as suggested in Giordano, Pericoli, & Tommasino (2012), but also led to a reassessment of the fundamentals of emerging economies such as the ones located in the Latin American region.

This document contributes to the literature in two ways. The first contribution is in proposing an analysis of a *positive* rather than a *negative wake - up - call* contagion generated after the Greek

debt crisis. Usually, contagion is analyzed with a negative connotation; nevertheless, crises in a region can actually represent an opportunity for greenfield investments or the deepening of incipient existing investments in different promising countries. The latter represents a small but significant deviation from the analysis proposed in Giordano et al. (2012), the paper that first introduced the analysis of *wake –up – call* episodes within the European economies after the 2008 Greek distress. The second contribution to the literature is the especial focus on Latin American countries, nations that belong to a new promising region in which the strongest economies have enhanced their fiscal positions, implemented inflation targeting regimes and have created countercyclical mechanisms in order to avoid the effects of crises.

The rest of the document is organized as follows, chapter II presents a relevant literature review, chapter III explains the methodology used to tackle the research question, chapter IV presents the data collection process and results, and finally, chapter V concludes and presents further discussion points on the topic.

II. Literature Review

The motivation for the present thesis is related to the evaluation of the determinants of yield spreads before and after the Greek Debt crisis, analyzing whether there has been a significant change in the market's assessment of macroeconomic fundamentals in the Latin American region. In the next paragraphs I will highlight how the existing literature has addressed the topic, which models have been used, the choice of variables and finally, how contagion behavior has been analyzed.

Indeed, the assessment of determinants of sovereign bond yield spreads has been a vastly studied subject among academics. Theoretical models presented in the literature argue that foreign funding for small and open economies comprise two elements: a risk free world interest rate and a country risk premium, the latter being a function of the country's probability of default. The determinants of the probability of default are related to solvency and liquidity variables, characteristics that show whether an economy is capable of servicing its debt. Such framework is

proposed in Edwards (1986), one of the seminal papers on the topic that leaded the research by extending the analysis of risk default premium of international bank loans to the government bonds market. His main findings provide support for the positive relationship between high debt ratios and high risk premiums in emerging markets.

Since then and despite the little theoretical guidance about which specific variables should be included in an empirical model of risk premium (Ebner (2009)), a large number of studies have assessed different explanatory variables as determinants of yield spreads. The variables can be grouped, as proposed in Min (1998), in four categories: a) macroeconomic fundamentals, b) liquidity and solvency variables, c) external market conditions and shocks, and d) dummy variables. Regarding the first category, measures of economic soundness have been evaluated using proxy variables such as investment to GNP ratio, imports to GDP ratio, index of real effective exchange rate, volatility of terms of trade and inflation rate (Edwards (1986), Baldacci, Mati & Gupta (2008), Bellas, Papaioannou & Petrova (2010), Eichengreen & Mody (1998), Min (1998), Hilscher & Nosbusch (2010)). These variables capture the long term capacity of a country to repay its liabilities. Meanwhile, liquidity and solvency conditions have been evaluated including variables such as the GDP growth, international reserves to GNP ratio, current account to GNP ratio, volatility of terms of trade, debt service ratio, inflation rate, consumer price index and industrial production level (Edwards (1986), Sachs (1981), Baldacci et al. (2008), Ebner (2009)). Additionally, market conditions or the so called global risk appetite, have also been incorporated using proxies such as the VIX volatility index[1], Moody's index, S&P index, the US policy interest rate and the VDAX-NEW, which measures the implicit volatility of the German stock index DAX over a period of 30 days (Hilscher & Nosbusch (2010), Baldacciet al. (2008), Mody (2009), Kamin & Von Kleist (1999), Ebner (2009)). Other types of variables used, especially in emerging markets literature, include the country's history of default, interest rates of different maturities and political instability indexes (Hilscher & Nosbusch (2010), Reinhart, Rogoff & Savastano (2003), Bellas et al. (2010), Eichengreen & Mody (1998), Min (1998), Baldacci et al. (2008)).

[1] VIX is the short name of The Chicago Board Options Exchange Market Volatility Index. According to Giordano et al. (2012) VIX is regarded as a good indicator of the level of fear or greed in U.S. and global capital markets.

Recently, the literature has given particular attention to the behavior of yield spreads before and after the subprime crisis of 2007 and the European debt crisis of 2008. Caceres, Guzzo and Segoviano (2010) evaluate whether the fluctuations in yield spreads of the European economies after 2007 are caused by global risk aversion, changes in fundamentals or contagion from other countries. Their results show that the behaviour of fundamentals was essentially the driven force of the movements of swap yield spreads after the crisis. In line with this result Constâncio (2012) finds that contagion effects of the Greek debt crisis accounted for an increase of 25 to 45% in the yield spreads in Portugal and Ireland. Meanwhile, Sgherri and Zoli (2009) and Arghyrou and Kontonikas (2012) show that after 2007/08, markets "enlarged the weight" given to national fiscal variables and expectations of debt performance as determinants of yield spreads. As a consequence, nowadays markets are differentiating more between bonds from strong economies and weaker ones within the European Union.

In line with these results, Giordano et al. (2012) find evidence of a specific type of contagion, a *wake – up – call contagion* or reassessment of the fundamentals of other European economies after the Greek debt crisis. The authors analyse three types of contagion in the Eurozone after the crisis, a *wake-up-call contagion, shift contagion* and *pure contagion*. *Wake-up-call contagion* refers to a situation in which fundamentals of a specific country are not priced correctly but an episode of crisis in another country triggers a change in investor's risk perception via a reevaluation of its fundamentals. The study stresses that under *wake-up-call contagion* a crisis that takes place in one country provides new information such that investors reevaluate their risk perception towards other countries. *Shift contagion* is a situation where the risk perception of a country changes given an increased sensitivity to common factors such as global risk aversion. Finally, *pure contagion* refers to a complete loss of confidence, irrational herding behavior and margin calls. The authors do not find evidence of the presence of these two last types of contagion.

As it is clear from the description above, much attention has been paid to the effects of the Greek debt crisis on the spreads in the Eurozone. However, less consideration has been given to the potential collateral effects on emerging and developing economies. On the one hand, according to the Global Financial Stability Report (Market Update - January 2012) issued by the

International Monetary Fund and Ocampo (2009), global financial crises can have several negative effects on the emerging economies, for instance, these economies can expect a decrease in credit, a deterioration of business climate, a decrease in foreign direct investment, a decrease in exports and a decrease in developing aid. On the other hand, the IMF's report also states that many of these economies have saved enough capital that allows them to counter the negative effects of international shocks and implement countercyclical policies to avoid any damage to their internal economies. In other words, emerging economies have learnt from past chapters of distress, have created strong institutions and have built more stable and resistant economies to local as well as to external crises.

Indeed, according to Resende & Goldfajn (2012) and Montoro y Rojas-Suarez (2012), the Latin American is one of the regions that has been most resilient to the 2008 financial crisis given their good fundamentals, their good external positions, their successful system of inflation targeting, their liquidity buffers created after the local financial crises experienced during the 90s, and given an increase in the demand from China. The authors also find statistical evidence that supports the hypothesis of Latin America as a less exposed region to external shocks. In line with these findings Goldberg (2005) finds that the relationship between U.S. bank claims to Latin American economies is not linked to the U.S. business cycle. The later signifies that crises originated in this economy are unlikely to spread to the Latin American region. Notwithstanding, Galindo, Izquierdo & Rojas-Suarez (2010) state that efforts to create a more financially integrated system between the Latin American region and international financial markets also created a channel through which the 2008 crisis spread very quickly. Indeed, after 1990 Latin American economies engaged in more liberal policies that included international financial integration. As a consequence they experienced an increase in international financial transactions and an increased number of international financial institutions such as banks with presence in the countries. The authors explain that the existence of foreign banks in countries such as the Latin Americans represents in one hand, an alternative option that diversifies risk for the local economy, but on the other hand it represents also a gate through which international crises can spread easily. The diversification of risk would be accomplished given the capital buffers owned by the parent bank which could rescue the local subsidiary in case of an internal shock. In turn, in case of an external shock foreign banks can reduce cross border lending immediately and they

can also reduce the subsidiary's lending in the local economy. The authors find statistical evidence suggesting that the presence of foreign banks amplifies external financial shocks in the local economies, thus, Latin American economies experienced a case of negative contagion after the subprime crisis of 2008. A more recent article, Martinez and Ramirez (2011), analyze the existence of contagion in the equity markets of some Latin American economies during the period of 1990 and 2008. Using a GARCH model and principal components, the authors find no evidence of financial contagion but the existence of an interdependent relationship across markets. This result means that the local markets reacted smoothly and linked to the evolution of the country's fundamentals. Regarding Government Bonds Markets, which is the main topic of interest in the present thesis, Jara, Moreno, and Tovar (2009) argue that Latin America reacted positively after the 2008 financial crisis and sovereign bonds served as a "spare tire" substituting the cutback in foreign currency lending that followed the burst of the financial crisis.

All in all, the existing literature shows nothing but mixed results. Therefore, the question whether the European sovereign debt crisis had an effect on the Latin American region is still open for debate. Knowing whether there has been a negative impact through a more financially integrated system or a positive reassessment of the better economic position of these economies is vital for future investment decision towards the region and vital for local policy makers in their efforts to attract international financial investors. In consequence, as mentioned in the introductory section of the present document, this paper will focus on the following questions: *Has the Greek debt crisis led to a positive reassessment of the fundamentals of non-European developing economies such as the Latin American?* Using Giordano et al. (2012) argot the question can be rewritten as follows: *Is there evidence of a positive wake–up-call contagion from the Greek debt crisis to the Latin American region?*

III. Methodology & Empirical Specification

As mention previously Giordano et al. (2012) provide evidence of a *wake–up-call contagion* from the Greek debt crisis to other European economies in distress. The authors argue that the

burst in the Greek financial accounts made investors more fearful towards other European economies with similar fundamentals creating a negative contagion towards the region.

In order to analyze the case for the Latin American economies, this thesis will follow the methodology used by Giordano et al. (2012) and will enlarge the sample of countries to include the major economies of Latin America. This way the analysis will focus on the following European economies: Austria, Belgium, Finland, France, Ireland, Italy, Portugal, Spain and The Netherlands; and will also add the major economies in the Latin American region: Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. These economies account for 92% of the total GDP of Latin American and the Caribbean region (Cardenas & Henao (2010)), thus, it can be considered a representative sample of the region.

Giordano et al. (2012) implements a frequently used specification were the determinants of yield spreads are grouped in two vectors, one of country specific factors (Z) – including macroeconomic fundamentals, liquidity and solvency variables – and another vector containing common factors (F)[2]:

$$s_{it} = \alpha_{i0} + \alpha_1 s_{it-1} + \beta_0 Z_{it} + \beta_1 F_t + \varepsilon_{it} \quad (1)$$

$$|\alpha_1| < 1 \,,$$

where s_{it} denotes the risk of default or yield spread, Z_{it} is a vector of country specific variables, F_t is a vector of variables which are common across countries and ε_{it} is the error term.

In order to analyze the three types of contagion explained in chapter No. 2 - *wake-up-call contagion*, *shift contagion* and *pure contagion* – the authors estimate a broader model:

[2] This categorization is compatible with the one proposed by Min (1998) and explained in the literature review. For simplification purposes the macroeconomic fundamentals and liquidity and solvency variables were grouped in one single vector. This allows a smoother analysis on contagion, which is the main purpose of this document.

$$s_{it} = \alpha_{i0} + \alpha_1 s_{it-1} + \beta_0 Z_{it} + \beta_1 F_t + \gamma_0 D_t + \gamma_1 D_t s_{it-1} + \gamma_2 D_t Z_{it} + \gamma_3 D_t F_t + \varepsilon_{it} \quad (2)$$

$$|\alpha_1|, |\alpha_1 + \gamma_1| < 1 \ ,$$

where s_{it} still denotes yield spread, Z_{it} is the vector of country specific variables, F_t is the vector of variables which are common across countries and D_t is a dummy variable taking the number of 1 since October 2009, date in which the Greek Government announced an increase on its debt to GDP ratio from 7.7 percent to 12.7 percent (Giordano et al. (2012) and Arghyrou and Tsoukalas (2011)).

Note that w*ake-up-call contagion* is captured by γ_2, the coefficients related to the interacted terms between the fundamentals and the dummy variable. This coefficient captures the extent to which the effect of fundamentals over the yield spread changes after the Greek Debt crisis. *Shift contagion* is captured by γ_3 the coefficient that accompanies the interacted terms between the dummy and common factors; this coefficient captures the extent to which the effect common cross border characteristics influencing the risk premium changes after the Greek Debt crisis episode. Finally, *pure contagion* is captured by γ_0 the coefficient of the dummy variable itself.

In order to analyse whether there has been a *positive wake-up-call contagion* in the Latin American Economies, equation (2) is calculated using the fixed effects estimator for the complete panel and also for a panel using only Latin American countries. Giordano et al. (2012) use the Least Squares Dummy Variable (LSDV) technique, which controls for country time invariant effects; nevertheless, the same estimator for the coefficients can be obtained using the fixed effects estimator which avoids the unpleasantness of calculating a coefficient for each country dummy variable that LSDV technique requires (Verbeek (2012) Pag.377). The technique is appropriate for the purpose of this paper since it allows analysing to what extent s_{it} differs from $\bar{s_i}$, differences within the countries (Verbeek (2012) Pag.379).

The literature warns about the typical presence of heteroskedasticity and autocorrelation in these types of equations. For this reason equation (2) will be estimated using Heteroskedasticity and Autocorrelation Consistent Standard Errors (HAC) or robust standard errors, which are more

accurate when the form of heteroskedasticity and autocorrelation is unknown (Verbeek (2012) Pag.103). Problems of dynamic inconsistency that generates overestimated coefficients, is expected not to be an obstacle in this particular estimation. Verbeek (2012 Pag. 397), shows that this endogeneity noise represents a major obstacle when both the number of cross sections and time period are small. However, he also states that a short sample period is consider to be T=10, which is not the case for the estimations presented in this thesis. Finally, a number of robustness checks are also conducted in order to analyse the stability of the results. These checks include instrumental variables and an alternative dummy crisis variable that takes into consideration the effects of the subprime crisis of 2008.

IV. Data & Results

Data

In line with Giordano et al. (2012) the analysis considers monthly observations of the 17 countries in the sample – 17 European and 7 Latin American - for the period of January 2000 to December 2012. This accounts for a total of 2652 observations for each one of the variables. The specific variables that were used are listed in Table No. 1:

Table No. 1

	Variable	Description
s_{it}	Yield Spread	Yield spread of the 10 year sovereign reference bond
Z_{it}*	Government Debt	Debt/GDP: a measure of liquidity (Edwards (1986)), or a macroeconomic fundamental (Giordano et al. (2012)).
	Private Debt	Private Debt / GDP: a measure of the degree of domestic leverage of a country.
	GDP growth	An indicator of a economy's soundness and prospects of dynamism
	Current account surplus	Current Account / GDP: a measure of the degree of external leverage of a country.
	Liquidity	Bid-Ask spread: a measure of liquidity, a small gap signals a liquid market.
F_t	VIX	Propensity of investors to bear the credit risk

*Following Giordano et al. (2012), macroeconomic variables are differenced with respect to its corresponding benchmark.

The independent variable was built upon the yield of the 10 years maturity sovereign reference bond with respect to Germany and the US, for the European and Latin American countries respectively[3]. Macroeconomic fundamentals considered in Giordano et al. (2012) are the GDP growth and the current account balance as measures of soundness, dynamism and capacity of a country to repay its debts; the level of debt to GDP is considered in the model as a measure of indebtness, a high indebted economy is usually associated with instability and an increased probability of defaulting in its financial obligations; and finally, the private debt ratio to GDP is included as a measure of domestic leverage.

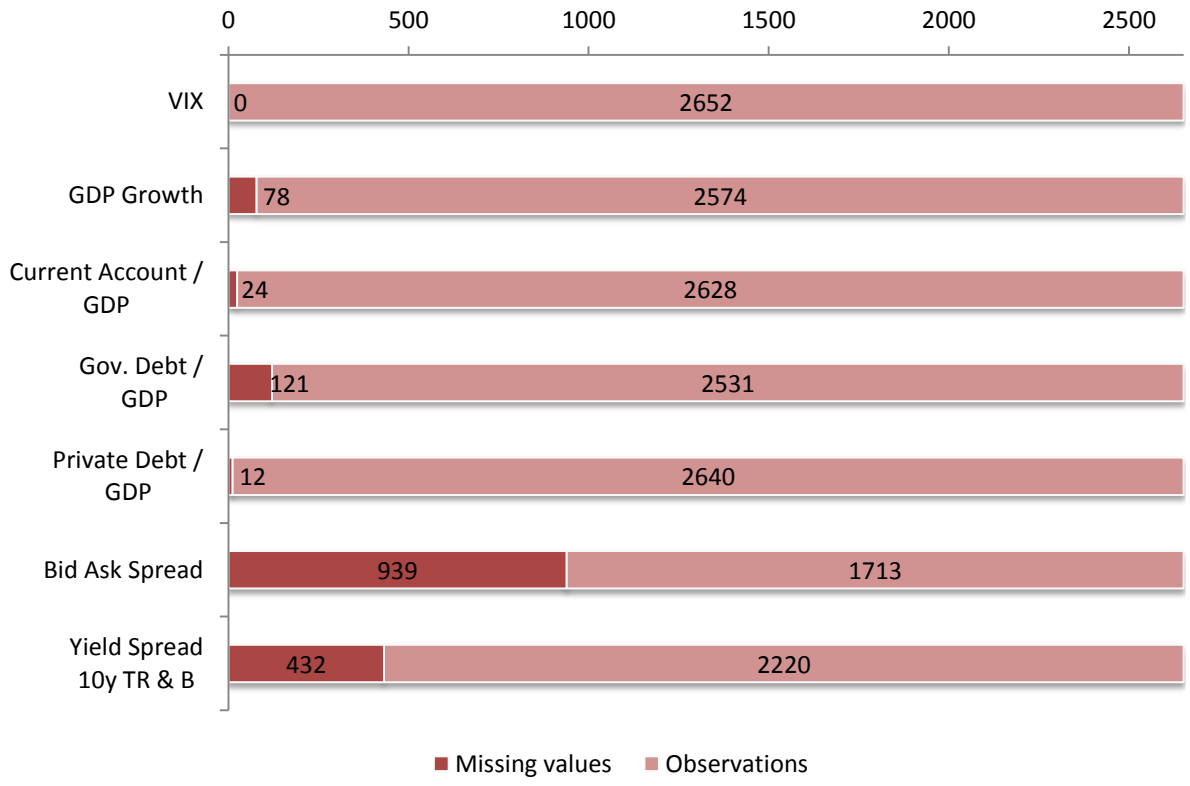
Information of macroeconomic variables was obtained from different sources including The Interamerican Development Bank, Eurostats, OECD and The World Bank. In most of the cases macroeconomic data is issued quarterly, for this reason a transformation was performed in order to obtain the monthly series; following Giordano et al. (2012) quarterly observations were left constant within the quarter. For financial variables such as Bid-Ask Spread and the VIX, data was taken from Bloomberg and was found published in a monthly basis. The Bid – Ask Spread was calculated using information available for the Bid Price and Ask Price of the 10 years maturity sovereign reference bond for each country, except for Argentina since this is a security that is not reported in Bloomberg's data base. Regarding the dependent variable, monthly information of the Mid Yield of the 10 years maturity sovereign reference bond was taken from Bloomberg. Missing values were completed with information available in Thomson Reuters Government Bid Yield 10Y Index, which provides information of the local currency reference bond of each month. Data for Argentina is entirely taken from TR, meanwhile, 65 observations were completed in the case of Brazil, 50 in the case of Chile, 78 in the case of Colombia, 78 in the case of Mexico, 28 in the case of France, 22 for Ireland, 9 for Portugal and 56 in the case of

[3] Germany is one the strongest markets in Europe and is the one of the largest in the world, thus, it is reasonable to use this country as a benchmark for the European economies. Meanwhile, despite the differences in size and level of development, the proximity and economic ties between Latin American economies and the United States make this country a wiser benchmark for the region.

Venezuela. Despite the efforts of constructing the most comprehensive panel set, data is still highly limited for the Latin American economies; in consequence the panel compiled is uneven[4].

Graph No. 1 helps describing the nature of the missing data. As it can be analyzed missing values are present mostly in financial variables. The dark red bar in the graph represents the total missing data for each variable out of the 2652 observations possible in the complete panel. It can be inferred that country specific variables and the common factor – VIX – present almost full information; unfortunately, the Bid-Ask liquidity variable is only available in 65% of the total possible number of observations and for the yield spread this figure rises only to 84%.

Chart No. 1



The lack of information can be explained by the limitations of Latin American countries where 432 observations are missing out of the 1092 total Latin American observations possible, this

[4] Appendix 1 explains in more detail the characteristics of the data collected and compiled.

means that 39% of the data of the dependent variable is missing for the Latin American economies.

Furthermore, table No. 2 presents the expected signs of the estimations of equation (2) with the information available in the uneven panel compiled, along with a brief description and the intuition behind its consideration in the model:

Table No. 2

Variable	**Description and Intuition**	**Expected Sign Complete Panel**	**Expected Sign LA Panel**
Yield Spread (First Lag)	Accounts for the influence of previous period information on current yield spreads. Captures persistence in the yield spreads.	+	+
GDP Growth	Controls for the dynamic performance of an economy.	-	-
Current Account / GDP	Controls for the ability of a country to pay its liabilities. It is also a proxy for the net foreign assets of a country.	-	-
Gov Debt /GDP	Controls for the stock of debt of the country. Gives signals to the market about the financial position of the country.	+	+
Private_Debt / GDP	Controls for the level of domestic leverage of a country.	+	+
Bid – Ask Spread	Controls for the liquidity level of the market. A narrow gap corresponds to a liquid market and low spread requirements.	+	+
VIX	Controls for global risk.	+	+
Dummy	Dummy variable that takes the value of 1 after October 2009, the burst of the Greek debt crisis, and zero else. Attempts to capture the case of *pure contagion*.	+	+
Yield_Spread(First Lag)*D	Attempts to capture whether the persistence of the variable changes after the burst of the Greek Debt Crisis.	+	-
GDP_G*D	Attempts to capture *wake – up – call contagion.*	-	-
Current_Account/GDP*D	Attempts to capture *wake – up – call contagion.*	-	-

Variable	Description and Intuition	Expected Sign Complete Panel	Expected Sign LA Panel
Gov Debt/GDP*D	Attempts to capture *wake – up – call contagion.*	+	-
Private Debt/GDP*D	Attempts to capture *wake – up – call contagion.*	+	-
Bid – Ask Spread*D	Attempts to capture *wake – up – call contagion.*	-	-
VIX*D	Attempts to capture *shift contagion.*	+	-

Note that the expected signs of the interacted terms with the dummy, corresponding to the Greek debt crisis, differ between the estimation with the complete panel and the estimation with the Latin American Panel. This divergence appears because markets started evaluating the regions differently. In the case of the Latin American panel the behavior of sovereign bonds markets should reflect the effects of a *positive wake –up – call contagion*, a tightening of yield spreads caused by a reassessment of fundamentals. The latter would be represented by negative coefficients of the interacted terms between the fundamentals and the dummy crisis variable. Meanwhile, and in addition to the data availability obstacle presented for the Latin American region previously discussed, the complete panel presents a slight over representation of European economies – 10 European vs. 7 Latin American economies. In consequence, the coefficients of the interacted terms are expected to be dragged, to some extent, by the behavior of the European markets showing the traditional case of *wake – up –call contagion*. Hence, coefficients of the interacted terms in the complete panel should reaffirm and deepen the expected signs of the variables with no interaction.

Results

Table No. 3 below presents the results for the estimations based on the complete panel (Model 1) and the Latin American panel (Model 2). These estimations are based on 1604 observations for the complete panel and 170 observations for the Latin American Panel, as only lines with complete information for all the variables were included in the estimation. Argentina for example was excluded from the analysis since it does not have any reporting data for the Bid – Ask spread variable.

Table No. 3

Dependent variable: Yield Spread

Variable	Model 1 HAC - FE	Model 2 HAC - FE
Constant	.0000 (.0005)	.0268 (.0120) *
Yield Spread (Lag1)	.9014 (31.11) ***	.4306 (.0463) ***
GDP Growth	-.00782 (.0062)	.0028 (.0036)
Current Account % GDP	.0074 (.0036) *	.1009 (.0647)
Gov Debt % GDP	.0011 (.0019)	.0330 (.0048) ***
Private Debt % GDP	.0004 (.0007)	.0062 (.0024) *
Bid-Ask Spread	.0032 (.0020)	.0091 (.0016) ***
VIX	.0049 (.0013) ***	.0647 (.0455)
D	-.0019 .0019	-.0098 (.0143)
No. observations	1604	170
R-squared	.9704	.4699
R-squared adj	.9382	.7388
Prob(F-statistic)	.0000	-
Rho coefficient	.5072	.9688

Variable	Model 1	Model 2
Yield Spread(lag1)*D	.0323 (.0250)	-.2384 (.0694) **
GDP Growth*D	-.0010 .0089	-.0014 (.0097)
Current Account %GDP*D	-.0261 .0042 ***	-.1411 (.0678) *
Gov Debt % GDP*D	.0019 (.0008) **	-.0573 (.0072) ***
Private Debt % GDP*D	-.0004 .0006	-.0082 (.0029) **
Bid-Ask Spread*D	-.0033 (.0020)	-.0091 (.0016) ***
VIX*D	.0034 (.0070)	-.0432 .0444

Standard errors in parenthesis; *** Significant at 1%, ** Significant at 5%, * Significant at 10%
A Hausman test was conducted in order to confirm that the correct model is in fact a fixed effects model rather than a random effects model. A Wald test for heteroskedasticity and a Wooldridge test for autocorrelation were also conducted; they confirm the need to correct for the presence of heteroskedasticity and autocorrelation

The foremost finding lays in the results of Model 2 which provide evidence of *positive wake – up – call contagion* towards the Latin American region. This can be inferred from the significant and negative sign of the coefficients of the interacted terms between the crisis dummy and the current account to GDP ratio, the government debt to GDP ratio, the private debt to GDP ratio and the Bid-Ask spread. Additionally, and in line with the results reported in Giordano et al. (2012), *wake – up – call contagion* is also found in the results for the complete panel – Model 1. Furthermore, in line with the results presented in Giordano et al.(2012), the estimations do not provide evidence of *pure contagion* nor *shift contagion*.

An interesting finding in Model 2 is that the common factor is not significant. This suggests that Latin American countries were isolated from international financial markets, probably because the region was deleveraged since the economic and financial crisis experienced during the 90s.

Another interesting finding corresponds to the magnitudes of the coefficients in Model 2. First of all, note that this model presents significant coefficients and expected signs for the government to GDP ratio, the private debt to GDP ratio and the Bid-Ask spread. These results indicate that markets evaluated the LA region according to their fundamentals even before the crisis. Secondly, note that partial elasticities between yield spreads and each of the fundamentals provide a negative result[5]. This discovery indicates that after the Greek debt crisis markets considered that yield spreads in the LA merited a net decrease.

Results of Model 1 present high persistence of the dependent variable, a strong sensitivity to common shocks and a high sensitivity to fundamentals only after the Greek debt crisis[6]. The signs of the significant coefficients are the expected, except for the current account to GDP ratio which has small but positive sign; nevertheless, the *wake – up - call contagion* effects corrects the effect and gives a negative partial elasticity for the yield spreads with respect to this variable.

[5] Partial elasticities should be considered as follows: $\delta yield\_spread/\delta$"fundamental" $\big|_{D=1}$.

[6] Similar result were obtained by Arghyrou and Kontonikas (2012), in which a marked shift after the European debt crisis from a convergence trade model to a macro-fundamentals and international risk driven model is found.

Moreover, results show that the lagged variable is strongly significant in all estimations, but the marginal effect of the crisis on this variable is zero in Model 1 and negative in Model 2. This means that in Model 1 the crisis did not change the perception of the markets regarding historic information, but in Model 2, for Latin American countries the persistence of the variable was lessened. Finally, in Model 1 the coefficient of the lagged dependent variable reaches the 0.9 levels. Given this outcome and the possibility of having a non-stationary yield spread variable, a unit root test is conducted using the Maddala-Wu (1999) and the Im, Shin and Pesaran (2003) approaches. Results show that the null hypothesis of unit root can be rejected for both models. Stationarity does not seem to be an obstacle in the estimations.

Robustness checks

Five robustness checks were also performed in order to check the stability of the results presented in Table No. 3.

The first and second robustness checks comprise the use of the second and third lag as instrumental variables (IV) for the lagged yield spread, in order to avoid some correlation existing when using the first lag as explanatory variable. Results for Model 1 regarding *wake-up-call contagion* - the coefficients of the interacted terms between the fundamentals and the dummy crisis variable - remain the same but the coefficient of the interacted private debt to GDP ratio is now significant. Nevertheless and in contrast to the results of the base model (HAC-FE), the dummy variable shows a significant coefficient with an unexpected negative sign, indicating that the crisis tightened yield spreads. This result could be reflecting the fact that by October 2009 yield spreads were already significantly wide due to the subprime crisis of 2008, instead since that month yield spreads slightly tightened due to Government interventions that started to take place since that date (Caceres, Guzzo and Segoviano (2010)). In the case of the Latin American panel the third lag was not a good IV estimator[7], thus, the second lag was the only IV correction used. Results also show significant coefficients for the dummy variable, and for the interacted terms with the government debt to GDP ratio, the Bid – Ask spread and the VIX.

[7] The third lag appear not be significant as an explanatory variable of the yield spread variable.

These results suggest the existence of the three types of contagion in the Latin American region, a result not obtained in the base model.

The third robustness check considered a shorter period of time and takes out the first observations in which most of the missing values were present. With observations comprehending the period between March 2006 and December 2012, estimations were conducted and conclusions over Model 1 remain unchanged, but some additional fundamentals appear to be significant: private debt to GDP ratio, Bid-Ask spread and its interacted term. Meanwhile, the Latin American panel shows again evidence of the three types of contagion.

The fourth robustness check intends to capture the effects of the subprime crisis of 2008. This led to a global financial crisis that affected heavily European markets, as well as the emerging world. For this purpose, the dummy variable was changed in order to take the value of 1 since September 2008, date of the bankruptcy of Lehman Brothers (BIS Papers No. 54, December 2010). Results are also very stable regarding the three types of contagion and compared to the original results (base model). However, the current account to GDP ratio loses significance in the complete panel, while the interacted term of the current account to GDP ratio with the dummy loses its significance in the Latin American panel estimation.

The previous robustness checks show that results regarding the existence of a *positive wake-up-call contagion* – the coefficients of the interacted terms between the dummy crisis and fundamentals – in the Latin American region are very stable. On the other hand, results about the existence of *pure contagion* – the coefficient of the dummy variable - and *shift contagion* – the coefficients of the interacted term between the dummy crisis and the VIX – are sensible to instrumental variables corrections.

Conclusions

The present thesis explores a possible explanation to the recent sovereign credit rating upgrades experienced by Latin American economies. This consists in a *positive wake – up – call contagion* triggered by the 2009 Greek debt crisis. The hypothesis was inspired by the work of Giordano et al. (2012), a document that proposes the analysis of three types of contagion – (1) *wake – up – call contagion*, (2) *shift contagion* and (3) *pure contagion* - experienced within the Euro zone and caused by the Greek debt outbreak. This way, the present document follows their proposed methodology, extending the original sample of countries to add the major Latin American economies. Thus, I set out to analyze contagion with a positive connotation in regions such as the Latin American. Results provide support for an episode of *positive wake – up – call contagion* within the Latin American region, and indeed the Greek debt crisis provoked a tightening in Latin American yield spreads via a reassessment of country specific variables. This confirms that pricing of Latin American sovereign bonds in international financial markets changed. Nowadays, international financial markets are acknowledging the efforts of Latin American economies in correcting fiscal imbalances, implementing inflation targeting regimes and creating capital buffers to counter the effects of new coming local and international crises[8]. I believe these results are most valuable for fund managers and other fixed income investors. They suggest that Latin American sovereign bonds represent a new trendy investment choice that provides an option for risk diversification purposes. Results are also relevant for Latin American policy makers since they show that strict economic efforts are being priced in international financial markets. Findings of *positive wake – up – call contagion* are robust, in contrast to findings of *pure* and *shift* contagion that were not stable in the robustness checks conducted. Nonetheless, a warn is raise regarding the scarce availability of data in the Latin American panel, in which estimations are conducted over 170 observations out of a total of 1092 observations possible in the time period selected. Further analysis on the topic can consider a time varying coefficients methodology, as proposed in Bernoth & Erdogan (2010); it can also consider enlarging the sample of countries in order to analyse the behaviour of the rest of the emerging markets' yield

[8] Results about the Latin American region refer to Brazil, Chile, Colombia, Mexico, Peru and Venezuela. Argentina was excluded from the analysis due to lack of information available.

spreads, for example from Asian economies which have shared past episodes of crisis with Latin America and have also built stronger economies since.

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Appendix

No. 1 Data Collection Details

The data collection was a challenging exercise given the uneven availability of data. For the Latin American countries variables are not always reported quarterly, in some cases they are not reported at all. The presence of these economies in international financial markets is also limited; that limitation is reflected on the scarce financial information available. The following charts describe in detail the data found and used for the purpose of this research.

Yield Spread		
	European Countries	**Latin American Countries**
Source	Thomson Reuters (TR) – Data Stream	Thomson Reuters (TR) – Data Stream
Variable found	TR Government Benchmark Bid Yield 10Y	TR Government Benchmark Bid Yield 10Y
Periodicity	Monthly	Monthly
Transformations		Missing data from TR was completed with data found in Bloomberg.
Missing values	0 / 2652	432 / 1092
Other details		Information for Perú is not found in TR, Bloomberg was used instead.

Bid – Ask Spread		
	European Countries	**Latin American Countries**
Source	Bloomberg	Bloomberg
Variable found	BID Price – Ask Price of the 10Y monthly reference sovereign bond for each country	BID Price – Ask Price of the 10Y monthly reference sovereign bond for each country
Periodicity	Monthly	Monthly
Transformations	Spread calculated with respect to the corresponding benchmark, Germany for European economies and US for Latin America	Spread calculated with respect to the corresponding benchmark, Germany for European economies and US for Latin America
Missing values	63 / 2652	876 / 1092
Other details		Information for Argentina was not found

GDP		
	European Countries	**Latin American Countries**
Source	OECD	IADB
Variable found	Total, current prices_millions of national currency	Total, current prices_millions USD
Periodicity	Quarterly	Quarterly
Transformations	Conversion from EUR to USD. Exchange rate available at European Central Bank.	
Missing values	0 / 2652	0/1092
Other details		Venezuela reports annual data. It was left constant within the months.
* USA GDP was taken from OECD data base		

GDP growth		
	European Countries	**Latin American Countries**
Source	OECD	IADB
Variable found	Growth rate compared to same quarter previous year	Total, current prices_millions USD
Periodicity	Quarterly	Quarterly
Transformations		Calculated growth rate with respect to the same quarter in the previous year.
Missing values	57 / 2652	21 / 1092
Other details		Venezuela reports annual data. It was left constant within the months.
* USA GDP was taken from OECD data base		

Current Account % GDP		
	European Countries	**Latin American Countries**
Source	OECD	IADB
Variable found	Current Account Balance: % of GDP	Current Account Balance: % of GDP
Periodicity	Quarterly	Quarterly
Transformations		
Missing values	21 / 2652	3 / 1092
* USA current account was taken from OECD data base		

Government Debt % GDP		
	European Countries	**Latin American Countries**
Source	Eurostat	IADB, OECD

Government Debt % GDP		
	European Countries	**Latin American Countries**
Variable found	Government consolidated gross debt	Total Public Debt: % of GDP
Periodicity	Quarterly	Monthly, Quarterly, Annually
Transformations	Divided the variable to GDP current prices	
Missing values	9 / 2652	112 / 1092
* USA Government Debt was taken from OECD		

Private Debt % GDP		
	European Countries	**Latin American Countries**
Source	Eurostat	IADB
Variable found	Private debt in % of GDP - non consolidated - annual data*	Credit to the Private Sector: millions of U$S- end of period
Periodicity	Quarterly data	Monthly
Transformations		Divided the variable by GDP current US Dollars.
Missing values	12 / 2652	0 / 1092
** USA private debt was taken from The World Bank		

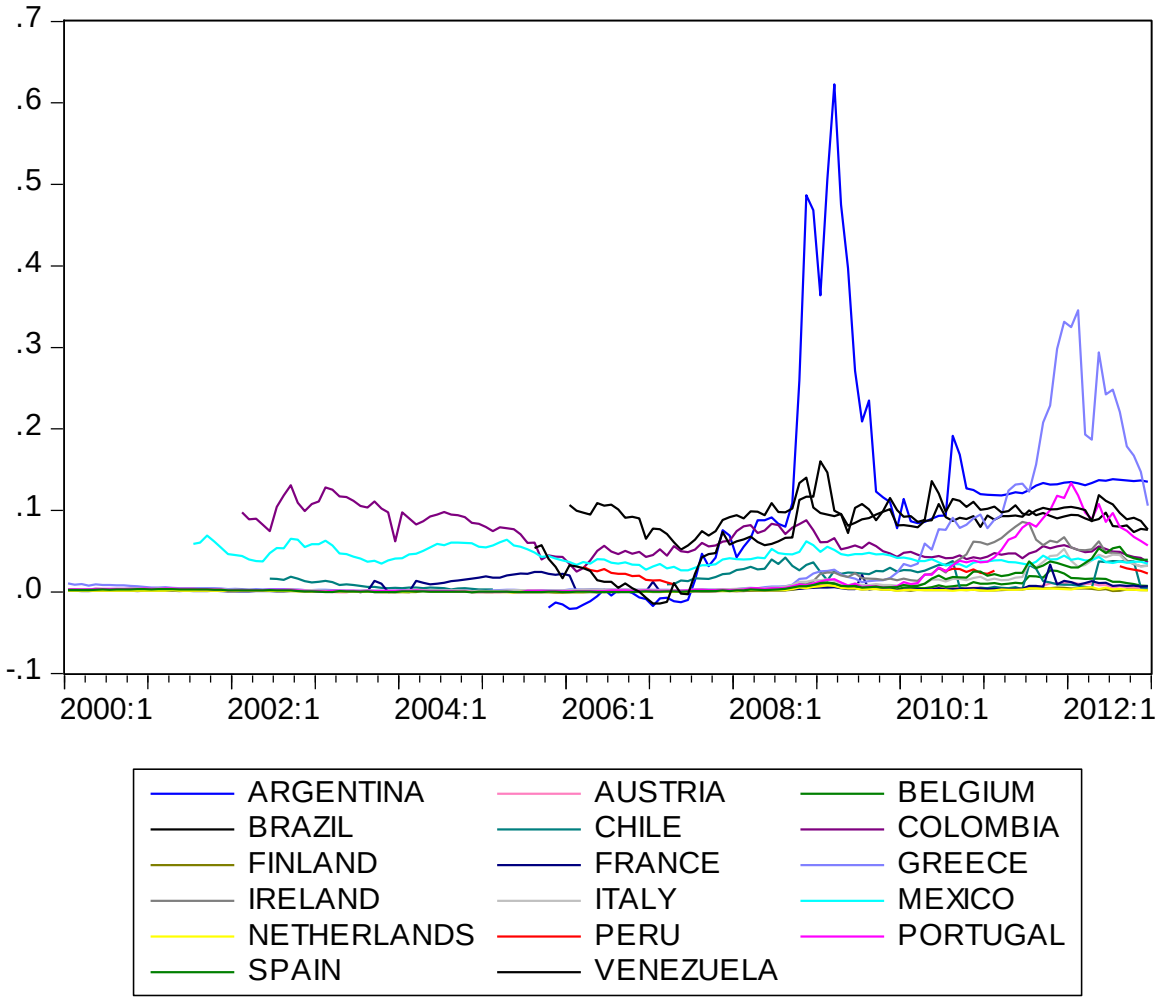
* *The private sector debt is the stock of liabilities held by the sectors Non-Financial corporations (S.11) and Households and Non-Profit institutions serving households (S.14_S.15). The instruments that are taken into account to compile private sector debt are Securities other than shares (F.3) and Loans (F.4), that is, no other instruments are added to calculate the private sector debt.* (Eurostats http://epp.eurostat.ec.europa.eu/tgm/web/table/description.jsp).

External Debt on Bonds and Notes / Total Gross External Debt		
	European Countries	**Latin American Countries**
Source	The World Bank	
Variable found	External Debt on Bonds and Notes and Total Gross External Debt	
Periodicity	Quarterly	
Transformations	Division of the variables found	
Missing values	432 / 1092 for Latin America	
Other details	No data is available for Venezuela	

VIX	
	European Countries & Latin American Countries
Source	Bloomberg
Variable found	VIX Index
Periodicity	Monthly
Transformations	No
Missing values	0

No. 2. Graphs and Descriptive Statistics

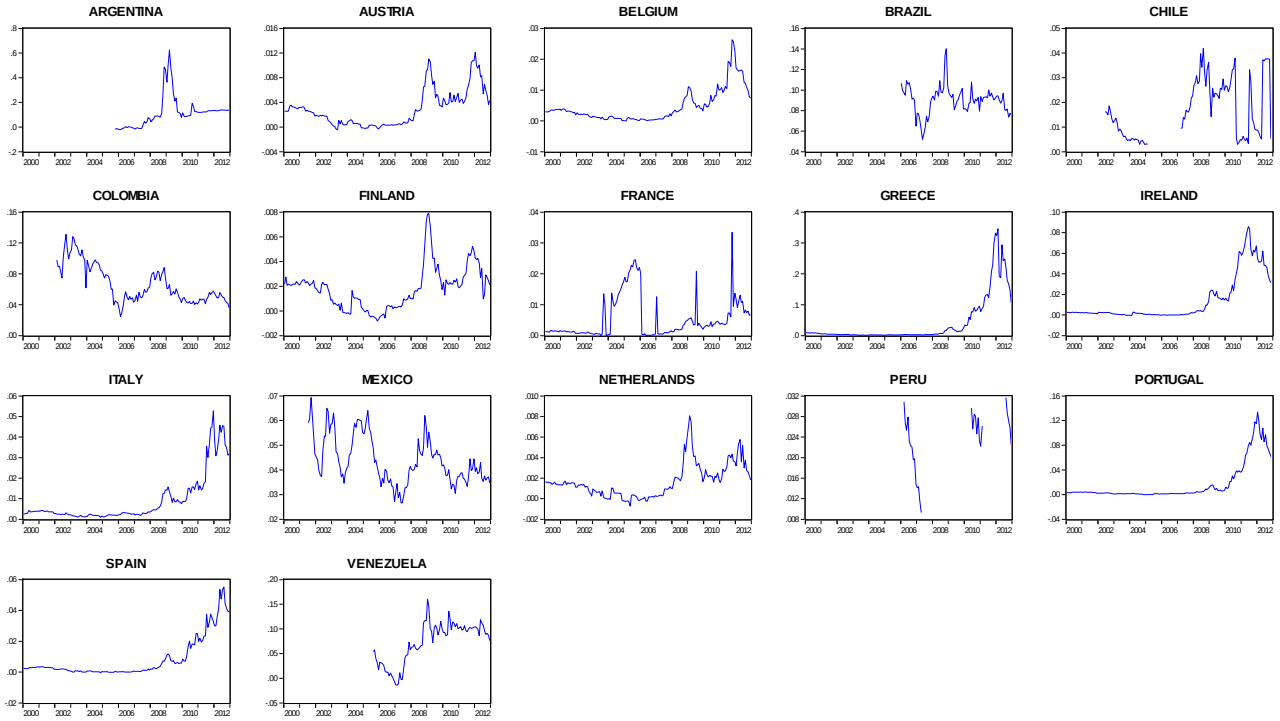
Graph No. 1
Yield Spreads in Latin America - 10Y Government Bonds Yield Spreads



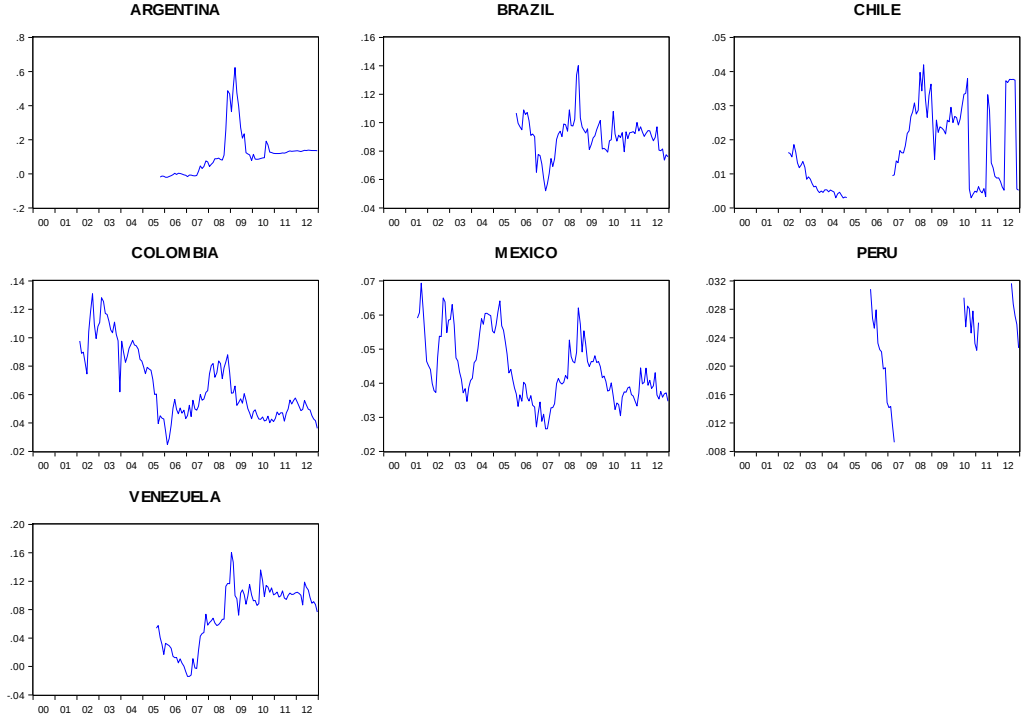
*10Y Government Reference Bond Yield Spreads with respect to the U.S.

Source: Bloomberg and Thomson Reuters Index

Graph No. 2
10Y Government Bonds Yield Spreads



Graph No. 3
10Y Government Bonds Yield Spreads - Latin American Economies



Descriptive Statistics - Complete Panel

Table 4.

	YIELD SPREAD	GDP Growth	Current Account % GDP	Gov. Debt % GDP	Private Debt % GDP	BID ASK SPREAD	VIX
Mean	0.0258	0.0350	-0.0110	0.1435	0.0157	-0.4450	0.2171
Median	0.0041	0.0115	0.0030	0.1280	0.0260	-0.0850	0.2027
Maximum	0.6227	0.4884	0.2419	1.3020	2.7884	0.0000	0.5989
Minimum	-0.0206	-0.6893	-0.2430	-0.7903	-1.5681	-87.3490	0.1042
Std. Dev.	0.0470	0.1077	0.0790	0.4025	0.8138	3.0685	0.0830
Skewness	4.4939	-0.2427	-0.0993	0.0524	0.0616	-18.4148	1.5489
Kurtosis	37.639	12.1690	3.3265	2.5554	2.5508	433.1906	6.7175
Jarque-Bera	118460.8	9042.025	16.0057	22.006	23.8634	13305753	2587.570
Probability	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000
Sum	57.442	90.3380	-29.0466	363.4191	41.5389	-762.3870	575.9719
Sum Sq. Dev.	4.9054	29.8700	16.4175	410.0777	1747.876	16120.06	18.2856
Observations	2220	2574	2628	2531	2640	1713	2652

Descriptive Statistics - Panel Latin America

Table 5.

	YIELD SPREAD 10Y	GDP Growth	Current Account % GDP	Gov. Debt % GDP	Private Debt % GDP	BID ASK SPREAD	VIX
Mean	0.0624	0.0772	0.0519	-0.1506	-0.5374	-2.3143	0.2171
Median	0.0497	0.0766	0.0381	-0.2049	-0.6556	-0.3880	0.2027
Maximum	0.6227	0.4884	0.2419	1.1281	2.7884	0.0000	0.5989
Minimum	-0.0206	-0.6893	-0.0114	-0.7903	-1.5681	-87.349	0.1042
Std. Dev.	0.0591	0.1546	0.0486	0.3539	0.7990	8.3394	0.0830
Skewness	4.1384	-1.0008	1.6370	0.8344	1.2030	-6.6293	1.5489
Kurtosis	31.6729	7.5122	5.9687	4.2933	4.4233	57.2216	6.7175
Jarque-Bera	24492.78	1087.392	886.3169	182.0253	355.5843	28042.01	1065.470
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	41.23526	82.71145	56.58540	-147.6729	-586.9370	-499.9060	237.1649
Sum Sq. Dev.	2.3033	25.6066	2.5716	122.6705	696.5998	14952.37	7.5293
Observations	660	1071	1089	980	1092	216	1092

No. 3. Hausman Test for Fixed or Random Effects

	Model 1	Model 2
Chi2	63.53	138.99
Prob>chi2	0.0000	0.0000

The null hypothesis that states that the errors are not correlated with the independent variables is rejected. Controlling for fixed effects is correct for both Model 1 and 2.

No. 4 Wald Statistic for Heteroskedasticity

	Model 1	Model 2
Chi2	49169.99	861.17
Prob>chi2	0.0000	0.0000

The null hypothesis of homoskedasticity is rejected for both models at a 1% significance level.

No. 5 Wooldridge Test for Autocorrelation

	Model 1	Model 2
F	62.409	28.756
Prob>F	0.0000	0.0030

The null hypothesis of non existence of serial correlation is rejected for both models at a 1% significance level.

No. 6 Im-Pesaran-Shin Unit Root Test

	Model 1 Im, Shin and Pesaran	**Model 1 Maddala and Wu**	**Model 1**	**Model 2 Im, Shin and Pesaran**	**Model 2 Maddala and Wu**	**Model 2**
Variable	Yield Spread	Yield Spread	Resid	Yield Spread	Yield Spread	Resid

Statistic	-1.4501	44.9715	-1.7285	-2.1469	22.07	-3.0555
P-value	0.0735	0.0988	0.0420	0.0159	0.0771	0.0011

The results of the unit root tests show that the null hypothesis of unit root can be rejected for both models. Stationarity does not represent an obstacle in the estimations.

In order to analyze deeper this result, a unit root test is conducted over two different sample periods, before and after the crisis.

Unit Root Test – Before crisis period

	Model 1 HAC	Model 1 HAC	Model 2	Model 2
Variable	Yield Spread	Resid	Yield Spread	Resid
Statistic	0.9292	not available	-0.1134	not available
P-value	0.8236			
Critic. Val				
1%		-5.84		-5.79
5%		-5.29		-5.25
10%		-5.004		-4.97

* Estimations of p-values for cointegration tests considered in MacKinnon (2010)

The yield spread variable in this case has a unit root. Given this result an Engle Granger Cointegration Test is conducted but it delivers inconclusive results. A near to singular matrix does not allow the estimation of the test over the residuals.

Unit Root Test – After crisis period

	Model 1 HAC	Model 2
Var	Yield Spread	Yield Spread
Statistic	-3.4586	-3.8710
P-value	0.0003	0.001

In the case of the after crisis period, results indicate that yield spreads in the complete panel are I(0).

No. 7 Robustness Checks

Complete Panel

Table 6.

Dependent variable: Yield Spread

Variable	Model 1 HAC	Model 1 HAC IV: Lag2	Model 1 HAC IV: Lag3	Model 1 HAC Panel less observations	Model 1 HAC Dummy 2
Constant	.0000	.0001	.0002	.0031	.0004
	(.0005)	(.0004)	(.0004)	(.0011)	.0004
				**	
Yield Spread	.9014	.9857	1.033	.8222	.9275
(First Lag)	(31.11)	(.0209)	(.0243)	(.0403)	(.0277)
	***	***	***	***	***
GDP	-.00782	-.0028	.0003	-.0105	-.0100
Growth	(.0062)	(.0038)	(.0040)	(.0101)	(.0071)
Current	.0074	.0083	.0089	.0362	.0077
Account %	(.0036)	(.0036)	(.0037)	(.0107)	(.0044)
GDP	*	**	**	***	
Gov Debt %	.0011	.0004	-.0000	.0015	.0010
GDP	(.0019)	(.0010)	(.0011)	(.0020)	(.0018)
Private Debt	.0004	.0008	.0010	-.0015	.0001
% GDP	(.0007)	(.0005)	(.0005)	(.0008)	(.0008)
			*	*	
Bid-Ask	.0032	.0049	.0057	.0062	.0010
Spread	(.0020)	(.0012)	(.0013)	(.0020)	(.0018)
		***	***	***	
VIX	.0049	.0031	.0021	.0100	.0009
	(.0013)	(.0013)	(.0014)	(.0016)	(.0015)
	***	**		***	**
D	-.0019	-.0015	-.0012	-.0016	-.0007
	.0019	.0009	(.0009)	(.0021)	(.0009)
		*			
Yield	.0323	-.0397	-.0804	.0748	.0139
Spread(First	(.0250)	(.0197)	.0225	(.0397)	(.0239)
Lag)*D		**	***	*	
GDP	-.0010	-.0059	-.0091	.0042	-.0033

Variable	Model 1 HAC	Model 1 HAC IV: Lag2	Model 1 HAC IV: Lag3	Model 1 HAC Panel less observations	Model 1 HAC Dummy 2
Growth*D	.0089	(.0049)	.0051 *	(.0102)	.0102
Current Account % GDP*D	-.0261 .0042 ***	-.0213 (.0044) ***	-.0187 (.0045) ***	-.0326 (.0057) ***	-.0161 .0028 ***
Gov Debt % GDP*D	.0019 (.0008) **	.0014 (.0007) *	.0011 (.0007)	.0022 (.0010) **	.0012 (.0005) *
Private Debt % GDP*D	-.0004 .0006	-.0009 (.0004) *	-.0011 (.0004) **	.0008 (.0006)	-.0004 (.0006)
Bid-Ask Spread*D	-.0033 (.0020)	-.0049 (.0012) ***	-.0058 (.0013) ***	-.0062 (.0020) ***	-.0010 .0019
VIX*D	.0034 (.0070)	.0049 (.0032)	.0057063 (.0032) *	-.0040 (.0079)	.0018 (.0023)
No. Obs	1604	1592	1580	888	1604
R-squared	0.9704	0.9720	0.9718	0.9627	0.9718
R-squared adjusted	.9382	-	-	0.9285	0.9365
Prob(F-Stat)	0.0000	0.0019	0.0378	0.0000	0.0000
Rho coefficient	.5072	.2857	.1681	0.4254	0.3383

Latin American panel

Table 7.

Dependent variable: Yield Spread

Variable	Model 2 HAC	Model 2 HAC IV: Lag2	Model 2 HAC IV: Lag3	Model 2 HAC Panel less observations	Model 1 HAC Dummy 2
Constant	.0268 (.0120) *	.0447 (.0114) ***	-	.1027 (.0023) ***	.0271 (.0124) *
Yield Spread (First Lag)	.4306 (.0463) ***	.1334 (.1482)	-	.6585 (.0314) ***	.3919 (.0746) ***
GDP Growth	.0028 (.0036)	.0008 (.0132)	-	-.0299 (.0074)	.0044 (.0027)

Variable	Model 2 HAC	Model 2 HAC IV: Lag2	Model 2 HAC IV: Lag3	Model 2 HAC Panel less observations	Model 1 HAC Dummy 2
Current Account % GDP	.1009 (.0647)	.0053 (.0832)	-	-.1516 (.0440) **	.0974 (.0824)
Gov Debt % GDP	.0330 (.0048) ***	.0413 (.0125) ***	-	.0663 (.0075) ***	.0409 (.0193) *
Private Debt % GDP	.0062 (.0024) *	.0008 (.0042)	-	.0401 (.0015) ***	.0070 (.0036)
Bid-Ask Spread	.0091 (.0016) ***	.0123 (.0038) ***	-	.0085 (.0004) ***	.0077 (.0033) *
VIX	.0647 (.0455)	.0873 (.0262) ***	-	-.0096 (.0107)	.0685 .0446
D	-.0098 (.0143)	-.0338 (.0176) *	-	-.0825 (.0058) ***	-.01566 (.01475)
Yield Spread (First Lag)*D	-.2384 (.0694) **	-.0727 (.1105)	-	-.4956 (.0587) ***	-.1543 (.1172)
GDP Growth*D	-.0014 (.0097)	.0047 (.0159)	-	.03306 (.0085) **	-.0046 (.0074)
Current Account % GDP*D	-.1411 (.0678) *	-.0935 (.0967)	-	.1192 (.0527) *	-.1150 (.0704)
Gov Debt % GDP*D	-.0573 (.0072) ***	-.0891 .(0211) ***	-	-.0995 (.0094) ***	-.0724 (.0174) ***
Private Debt % GDP*D	-.0082 (.0029) **	-.0040 (.0038)	-	-.04218 (.0016) ***	-.0093 (.0028) **
Bid-Ask Spread*D	-.0091 (.0016) ***	-.01247 (.0038) ***	-	-.0086 (.0004) ***	-.0078 (.0033) *
VIX*D	-.0432 .04444	-.0659 (.0294) **	-	.0329 (.0131) *	-.0512 (.0435)
No. Obs	170	165	-	127	170
R-squared	0.4699	0.0595	-	0.3519	0.5283
R-squared adjusted	0.7388	-	-	0.215	0.7180

Variable	**Model 2** HAC	**Model 2** HAC IV: Lag2	**Model 2** HAC IV: Lag3	**Model 2** HAC Panel less observations	**Model 1** HAC Dummy 2
Prob(F-stat)	-	0.0000	-	-	-
Rho coefficient	0.9688	0.9769	-	0.9722	0.9639

* IV Yield Spread Lag 3: The third lag of the Yield Spread variable is not an accurate IV estimator according to its test of significance as a predictor of the 1 period lagged Yield Spread.