The impact of Currency Mismatch on Emerging Markets Sovereign Spread

By

MATEO MEJIA, Pilar Del Carmen Dolores

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

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Professor Sang Moon HAHM, Supervisor _____

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ABSTRACT

This paper assesses the effect of currency mismatch on emerging market sovereign spread for the period 2004-2012. We have constructed a dataset from 15 emerging countries, composing currency mismatch as the ratio of loans in foreign currency-to-deposits in foreign currency and estimate the effect on sovereign spread measure by EMBI Global index. We find that currency mismatch, as interacting with solvency indicators, is positively associated with emerging markets sovereign spreads. These results suggest that monetary policy makers in emerging economies should consider the prevention of currency mismatches in the domestic financial system in order to reduce sovereign spread.

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I. Introduction

The issuances of sovereign bonds from emerging countries have increased dramatically since the 1990s. These bonds are considered one of the most important instruments for the financing of economic development. Through the years, global capital markets have witnessed a surge in investment in emerging markets. This increase has prompted investors to focus increasing attention on variables that may affect the repayment of the debt instruments issued by these economies. In addition, one must consider that the risk scattered in the world economy as the proportion of emerging countries´ debt is increasing in hand of foreign investors. Therefore, policy makers need to identify factors that affect the risk regarding sovereign bonds since they are determinants for economic sustainability of emerging countries and a trigger of risk spillover.

Much research has been done to address this issue suggesting that macroeconomic stability is one of the signals that gives confidence to investors. According to Haque, Kumar et al., a country's risk is comprised of macroeconomic, financial, debt-servicing and political factors in order to provide investors with the country's ability and willingness to service external debt obligations.[1] This argument follows the economic principle that accumulated deficits and economic growth give a better insight about countries´ sovereign spread. Nowadays, tracing economic policies has become an exercise to detect weaknesses in decision-making that affects emerging countries´ capability to meet their obligations. In this regard, vulnerabilities related to assurance of debt payment associated with emerging economies directly affect the amount of capital they attract.

Furthermore, Prat argues that "…external and domestic currency mismatch indicators in the banking sector are an important factor to take into account alongside specific fundamental variables and external factors in spread determination models."[2] The Latin America financial crisis during the 90s and the 1997 Asian crisis made evident that vulnerability in the financial system causes higher risk and triggers crisis in emerging markets. As part of the monetary and payment system, financial institutions play a significant role in determining the value of the national currency and levels of depreciation. In this sense, it is imperative to include financial exposure of exchange rate risk as a factor undermining the profitability of emerging markets debt.

Based on the findings, this research aims to identify main determinants affecting emerging countries´ sovereign risk. A panel data framework is used in order to address this issue, considering economic variables related to sovereign risk such as: external debt, short term debt, total foreign reserves, exports, economic growth, among others. In order to provide a measure of financial system vulnerabilities, the model will also consider currency mismatch in other depository corporations' balance sheets as a vulnerability of domestic financial market. The research is conducted on a sample of 15 emerging countries for the period 2004-2012. This study claims that the presence of currency mismatches in the financial system, together with solvency problem, increase emerging markets´ sovereign spread.

The remainder of this study is organized in five main sections. Section II discusses the literature review related to sovereign risk. Section III.A introduces the methodology to

be conducted in this study, whereas; Section III.B defines the database to be used. Section IV presents the results of the study. Finally, Section V presents the conclusion of the paper.

II.   Literature Review

Sovereign Spread volatility in emerging economies has significant macroeconomic consequences: a rise of risk affects investment and consumption decisions, bearing negative effects on economic growth.[3] Higher country´s risk implies higher government bond yields and higher debt-servicing costs. Arising from the negative consequences that result from an increase in sovereign spread, researchers aim to identify which factors determine a country´s risk. As suggested by Haque, Kumar et al., country information about political and economic developments influence the country´s debt-servicing obligations. [4] Additionally, the authors argue that external factors have limited the influence in the obligations of a country´s debt-servicing.[5] Nonetheless, they acknowledge that "after 1980s there is evidence that external financial market developments can influence a country's access to international financial markets." [6]In this regard, the ability of a country to grow economically, the liquidity of the economy and external factors seem to be the main determinants behind changes in sovereign spreads.

Csonto and Ivaschenko furthered this idea by testing whether countries with stronger economic and financial indicators tend to have lower volatility in sovereign spread.[7] The authors used fixed effects panel estimation for a database consisting of 18 emerging markets around the world. They found that "country-specific fundamentals and global factors are important determinants of spreads on foreign currency denominated sovereign debt."[8] In addition, the authors argue that stronger financial indicators lower

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volatility in global risk aversion toward a country.[9] These findings suggest that emerging countries should focus on improving economic fundamentals in order to reduce sovereign spread.

Regarding the impact of external conditions on sovereign spread, Arora and Cerisola found that global liquidity conditions have direct positive effects on emerging markets sovereign bond spreads.[10] Nowadays, the availability of financing in emerging countries has been affected by changes in international monetary policy due to greater capital market integration. The authors concluded that "a rise in U.S. rates could raise emerging market spreads through its effects on the ability of debtor countries to repay loans."[11] Kamin and Kleist attributed the decrease in emerging market spreads during the 1990s to declines in industrial country interest rates.[12] In addition, they suggest that industrial country interest rates may have an impact on emerging market sovereign spreads over the long term.[13] Nonetheless, Özataya, Özmenb and Gülbin argue that US interest rate is insignificant to measure sovereign spread volatility.[14] Evidence of a significant relationship between external factors and sovereign spreads volatility in emerging markets is still inconclusive.

Another point to be considered is how sovereign spreads will be affected when investors rebalance their portfolios´ risk. According to Beber, Brandt and Kavajecz, investors will "flight-to-quality" and "flight-to-liquidity" in times of weak economic performance.[15] In other words, investors will consider acquiring less risky and more liquid financial instruments during times of economic distress. The authors concluded that credit quality and liquidity affects sovereign spread in different time and reason.[16] They found

that bond valuation is affected by credit quality while, in times of market stress, liquidity is more relevant explaining changes in the valuation of fixed-income instruments.[17] Based on this claim, we can argue that liquidity indicators are important factors affecting sovereign spreads´ volatility.

According to Aizenman, Jinjarak and Park, risk spread is explained mainly by inflation, state fragility, external debt, trade openness, fiscal balance, among others economic fundamentals.[18] Additionally, the authors claim that "indicators of fiscal and monetary space became more important in explaining sovereign credit default risks."[19] This argument has been debated among economists due to the importance that monetary policy has taken to overcome crisis. Asian and Latin American countries are an example of how important monetary policy and financial system can be in an economy; they have been growing despite the global recession with massive fiscal expenditure and monetary stimulus.[20] It is evident that contemporary financial systems are key elements to modern economies due to their ability to allocate scarce resources in a more efficient way. As Elson notes, "the soundness and stability of the financial system is an essential ingredient of the appropriate macroeconomic framework for development."[21] Due to the important role played by the financial system in the economic development of countries, contemporary research of sovereign spreads have focused on analyzing the effect of financial vulnerabilities in measuring a country´s sovereign spread.

Mody investigates the links between sovereign bond spreads and financial vulnerabilities. For a sample of European countries, he found that domestic financial sector plays an important role in determining European countries' sovereign spread.[22] The author

explains that "sovereign spreads of a Eurozone country tended to rise when the prospects of its domestic financial sector worsened", suggesting a link between domestic financial market vulnerabilities and a larger contingent liability on public finances.[23] Mody noted that, after the rescue of Bear Stearns and Lehman Brothers, a closer relationship between possible bank failures and public finances was evidenced.[24] The lack of financial vulnerability's indicators in determining risk was evidenced after the *Great Recession* of 2008. Evidently, in order to improve the effectiveness of the forecasting model of sovereign spread, policy makers should take into consideration that a country's ability to serve its debt will be subject to financial vulnerabilities.

François, Hübner and Sibille proposed an inter-sectorial sovereign model of default risk that takes into account interactions between the public, private, and banking sectors.[25] The authors argue that sovereign crises can be triggered by three scenarios: shocks on the private sector, shocks on the banking sector and shocks on the public sector. Regarding the banking system, after testing the proposed model on the Brazilian economy, they found that higher levels of deposits as a percentage of GDP put financial institutions under stress, which will make external debt more risky.[26]

As an extension of the analysis of the role of financial vulnerabilities as a determinant in changes in sovereign spread, the study of Bellas, Papaioannou, and Petrova claims that financial fragility is strongly correlated with changes in sovereign spread. They applied pooled mean group (PMG) estimator of Pesaran and Smith on a data set covering 14 emerging countries between the first quarter of 1997 and the second quarter of 2009.[27] The authors found that, in the short run, financial vulnerabilities (measured by Emerging

Markets Financial Stress Index) is a crucial determinant of sovereign spread (measured by Emerging Markets Bond Index Global).[28] Furthermore, Prat developed the panel fixed effect estimation for 25 emerging countries and concluded that currency mismatch, as an indicator of financial vulnerability, is an important determinant of markets spreads.[29] In this regard, the recent empirical studies regarding sovereign spread suggest that financial vulnerabilities adversely affect the ability of a country to service its debt obligations.

This research will revise how domestic financial system vulnerabilities, such as currency mismatch, affect a country´s sovereign spread. Taking into account the model suggested by Prat, this study will use currency mismatch attached to the balance sheet of the other depository corporations as a determinant of a country´s sovereign spread. The use of currency mismatch as a determinant of sovereign spread gives a better insight of the consequences that will arise in the economy after real exchange rate depreciation. As Galai and Wiener say, "currency mismatch is often singled out as an important factor of financial crises, particularly in developing economies." [30] Considering this approach, currency mismatch should be considered as one of the determinants affecting sovereign spread of emerging countries.

III. Methodology

A. Theoretical framework and variables selection

Based on the literature review, this study will develop the model of equilibrium sovereign yields proposed by Edwards (1984) and suggested by Ferrucci (2003).[31] The model analyzes the determinants of the spread between the interest rate charged to an emerging country and a risk free debt instrument yield, assuming rational expectations.[32] In this sense, international financial community takes into account all available information about the risk characteristic of emerging countries when granting loans; and these perceptions are captured by the spread between emerging countries sovereign yield and risk free debt yield.[1] The model gives an insight of the sustainability of a given level of external debt, determined by liquidity and solvency indicators and macroeconomic fundamentals. Assuming markets are competitive and agents are rational and neutral lenders, Edwards developed a simple log-linear relationship of spread´s determinants: [33]

$$(1) \qquad \log s_{it} = \alpha + \sum_{j=1}^{J} \beta_{jit} x_{jit} + v_{it}$$

where s_{it} is the sovereign spread of a country i at time t, α is the intercept coefficient, β_{jit} is the slope coefficient of the explanatory variable j for the country i at a time t, x_{jit} is the set of possible determinants of sovereign spread by country i and time t, and v_{it} is the error term. We will make use of the Emerging Market Bond Index Global (EMBI Global)

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[1] When traders have rational expectations, equilibrium price will be equal to the optimum forecast of its fundamental value. In addition, prices will change in reaction to changes in expected future returns or in risk, liquidity or information costs.

calculated by the financial service firm JP Morgan. The index represent emerging markets´ sovereign premium; measures the excess return that the market requires of a dollar denominated bond issued by emerging economies' governments compared with US Treasury bond.

For the selection of the explanatory variables, we will follow the framework used by Ferrucci who related the sovereign borrowing of a small open economy with its consumption choices. The author claim that small open economies try "to smooth its consumption path over time by borrowing from abroad when domestic resources are scarce and paying back its debts when resources are abundant."[34] In this regard, he concluded that the ability of a country to generate domestic and foreign exchange resources to service its external obligations will affect their sovereign spread.[35] For this study, we have categorized the explanatory variables in liquidity indicators, solvency indicators and external factors, using variables suggested previously in the literature review.

For liquidity indicators we refer to a country's ability to pay its short-term debt obligations. The set of variables consider in this category will be factors that directly affect the demand for local and foreign currency. We will include country´s short-term debt, current account balance, foreign exchange reserves, among others. In addition, we will consider the currency mismatch as a variable that influence a country's liquidity due to potential deterioration of the balance sheet if a depreciation of the local currency occurs. The set of variables explaining a country's long term ability to pay its obligations are the solvency indicators of a country. Low stock of public debt, los external indebtedness

economic capacity to growth and high trade openness are considered to be key factors affecting country´s solvency in the long-run.

In regards of external factors, we will consider variables affecting international flow of capital to emerging markets which may have influence over the accumulation of foreign exchange reserves in emerging countries. Global liquidity variables, such as TED Spread, oil prices and world economic growth, are going to be taken into account in order to control external factors influencing emerging markets creditworthiness and external competitiveness that may deteriorate their trade balance. As suggested in the literature, the rate of inflation is included to control for the quality of macroeconomic policy in emerging countries. High levels of inflation are directly related to high government spending and large probability of country´s default.

The model to be considered is expression (1), where s_{it} is measured by EMBI Global. A panel framework will be used due to the heterogeneity between region and countries, we consider that unobserved heterogeneities for country i (a_i) are constant over time and correlated with the explanatory variables. Based on these assumptions, we run a Panel Fixed Effect estimation and Panel Random Effect estimation as the methods that better fit our interest of study. If we assume that the unobserved heterogeneity of a country is uncorrelated with the error term $\left[Corr(a_i, u_{it}) \neq 0\right]$, Fixed Effect estimation is more proper to apply. However, if it is assumed that the unobserved heterogeneity of a country is serially correlated $\left[Corr(a_i, u_{it}) = 0\right]$, Random Effect estimation is more proper to apply. The decision between the methodologies is done with the Hausman Test.

Based on the assumptions of rational expectations, we assume that:

(2) $\qquad E\left(u_{it} \mid X_{it}, X_{it-1},..., X_{i1}, \alpha_i\right) = 0$

(3) $\qquad E\left(u_{it} \mid X_{it}, Y_{it-1},..., X_{i1}, \alpha_i\right) = 0$

In this sense, the distribution of the error term does not depend on past values of explanatory variable, past values of the dependent variables or the unobserved time invariant characteristics define by α_i. Due to the heterogeneity between region and countries, we consider that unobserved heterogeneities for country i (a_i) are constant over time. In addition, each cross section unit is allowed to have time trend by adding time specific effect. To assess the independent effect of currency mismatch on emerging markets sovereign spread we will estimate regression as follow:

(4) $\qquad \log embi_{it} = \alpha + \beta_{cmit} cm_{it} + Z_{it}\beta + \mu_t + \alpha_i + u_{it}$

where $\log embi_{it}$ is the logarithm of Emerging Market Bond Index Global for country i in time t, cm_{it} stands for currency mismatch of the financial system for country i in time t, Z_{it} is a vector of control variables for country i in time t, μ_t is the time specific effect for time t, α_i is the time invariant individual specific for country i, and u_{it} is the error term for country i in time t.

While currency mismatch in the financial system represents an exchange rate risk, this risk can be weighed by monetary policy mechanisms. However, we suspect that in the presence of large accumulation of short-term debt and/or low levels of foreign exchange reserves, the presence of currency mismatches in the financial system will increase the

probability of default of a country resulting in higher levels of sovereign spread. Taking into consideration this assumption, we aim to estimate a model with interaction terms as follow:

$$(5) \quad \log embi_{it} = \alpha + \beta_{cmit} cm_{it} + \beta_{(cm*stdresv)it}(cm*stdresv)_{it} + Z_{it}\beta + \mu_t + \alpha_i + u_{it}$$

$$(6) \quad \log embi_{it} = \alpha + \beta_{cmit} cm_{it} + \beta_{(cm*stdexp)it}(cm*std\exp)_{it} + Z_{it}\beta + \mu_t + \alpha_i + u_{it}$$

where stands $cm_{it} * stdresv_{it}$ stand for the interaction term of currency mismatch and short term debt as a ratio of foreign reserves for country i in time t, $cm_{it} * std\exp_{it}$ stands for the interaction term of currency mismatch and short term debt as a ratio of exports for country i in time t, Z_{it} is a vector of control variables for country i in time t, and v_{it} is the error term for country i in time t.

The vector of control variables to be consider cover a wide range of important domestic liquidity and solvency indicators in emerging markets, and external factors considered to be relevant when analyzing changes in a country's borrowing cost. A list the control variables that potentially influence the sovereign spread of emerging markets are outlined in Table 1, along with the data sources, description of each variable and expected sign.

For robustness check, we will develop a Quantile Regression with the aim to describe the relationship between emerging markets sovereign spread and currency mismatch at different points of the conditional distribution of the dependent variable. In this regard, we will estimate the impact of currency mismatch, and other covariates, on the

entire distribution of emerging markets sovereign spread. This methodology provides us with estimators that are asymptotically normally distributed, as in OLS. On the other hand, quantile regression is less sensitive to outliers in the sample, which may affect estimates for panel analysis.

Data sample is comprised of 15 non-dollarized emerging market countries for the period 2004 to 2012, of which 4 are in Latin America, 4 in Asia, 5 in Europe, and 2 in Africa.[36] We will consider annual frequency. We have limited the sample set to countries included in the EMBI Global, data availability of fundamental macroeconomic variables and accessibility of the financial indicators of each country. The set of control variables for models (4), (5) and (6) cover a wide range of important domestic liquidity and solvency indicators, and external factors in emerging markets considered to be relevant when analyzing changes in a country's borrowing cost. In order to control the size of the economy, the variables will be usually specified as ratio of a fundamental economic variable. A list the control variables that potentially influence the sovereign spread of emerging markets are outlined in Table 2, along with the data sources, description of each variable and expected sign.

Common limitations of cross-country estimation are the problem of attrition bias due to endogeneity, and due to presence of missing values in the sample. Studies involving different countries usually face this problem due to the different data frequencies and/or variables presented between countries. On the other hand, definition of loans and deposits may not be homogeneous across countries and is therefore subject to measurement error. With the purpose of controlling the presence of attrition in our sample, we selected a

random sample representing no more than 30% missing values of the total sample. However, we confirm our findings using quantile regression which considers heterogeneous variances on a mechanism in which currency mismatch affects emerging markets sovereign spread.

Table 1: Data and Sources

| Dependent Variables	Description	Data Source
Emerging Market Bond Index Global (EMBI Global)	Sovereign Premium. Measures the excess return that the market requires of a dollar denominated bond issued by emerging economies' governments, compared with US Treasury bond.	JP Morgan
Credit Default Swap (CDS)	Financial swap designated to insure bondholders against default	

Explanatory Variables	Description	Expected Sign	Data Source
Current Account Balance (% GDP)	Saving/Deficit of the economy	-	World DataBank (WDI Indicators)
Exports of goods and services (% GDP)	Demand of local currency	-	World DataBank (WDI Indicators)
GDP growth (annual %)	Long term solvency	-	World DataBank (WDI Indicators)
GNI growth (annual %)		-	World DataBank (WDI Indicators)
Imports of goods and services (% GDP)	Demand of foreign currency	+	World DataBank (WDI Indicators)
Short-term debt (% Total External debt)	Ability of a counry to service short term obligations	+	World DataBank (WDI Indicators)
Short-term debt (% exports of goods, services and primary income)		+	World DataBank (WDI Indicators)
Short-term debt (% total foreign reserves)		+	World DataBank (WDI Indicators)
Total Debt Service (% GNI)	Ability of a country to service total obligations	+	World DataBank (WDI Indicators)
Total Debt Service (% exports of goods, services and primary income)		+	World DataBank (WDI Indicators)
Total Foreign Reserves (% total external debt)	Short term liquidity	-	World DataBank (WDI Indicators)
Total Foreign Reserves in months of Imports		-	World DataBank (WDI Indicators)
Trade (% GDP)	Demand of local/foreign currency	-	World DataBank (WDI Indicators)
Inflation, consumer prices (annual %)	Proxy of economic management quality	+	World DataBank (WDI Indicators)
TED Spread	External Factor of global liquidity	+	FRED
Currency Mismatch Ratio of foreign currency deposits to foreign currency loans	Financial system vulnerability to local currency depreciation	+	Central Bank

Source: Author's compilation

B. Descriptive Analysis

Emerging countries have been a source of investment in the global capital markets. For policy makers, is important to understand how sovereign spread determinants would affect their access to global capital markets to finance the economic development of the country. Throughout the period of study, there have been substantial changes in the path of emerging countries sovereign spreads. We can distinguish periods of decline in sovereign spread between the years 2004-2007, and increasing sovereign spread from 2007, as depicted in Figure 1. Identify what are the determinants behind changes in sovereign spread is important when defining a management strategy of debt in emerging countries and our main purpose in this study is verify if currency mismatch in the financial system influences changes spread.

Figure 1: Emerging Market Bond Index Global (EMBI Global)
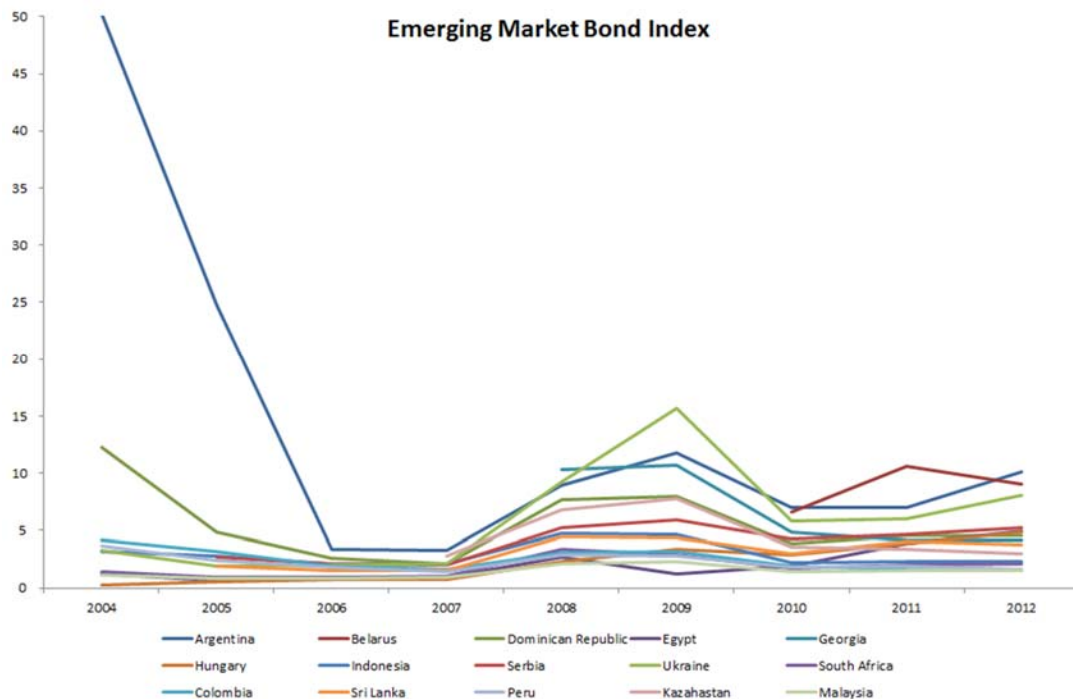
Source: JP Morgan

For the period 2004-2012, the emerging economies considered in this study paid an average risk premium of 4.25% over U.S. Treasury Bills return. Regarding currency mismatch, our variable of interest, the sample has on average 10% of deposits in foreign currency over loans on foreign currency, which result in a currency mismatch in the financial system. In respect to the external debt, the sample is characterized by an average of short-term debt representing 19% and 58% of exports and international reserves, respectively, and a total debt service of 9.8% on average.

Table 2: Descriptive Statistics

Data Set					
Variables		**Mean**	**Standard Deviation**	**Min**	**Max**
embi	*Emerging Market Bond Index Global (EMBI Global)*	4.253	5.441	0.261	50.219
cm	*Currency Mismatch*	1.101	0.593	0.226	3.121
stdresv	*Shor term debt (%foreign reserves)*	58.020	57.304	6.612	350.799
stdexp	*Shor term debt (%exports)*	19.159	9.543	2.086	68.050
resvimp	*Foreign exchange reserves in months of imports*	4.891	2.364	0.711	12.488
totdgni	*Total Debt Service (%GNI)*	9.825	15.791	1.261	90.697
tradegdp	*Trade (%GDP)*	83.139	42.899	33.701	210.374
cagdp	*Curren Account (%GDP)*	-2.765	6.918	-21.955	16.847
gdpg	*GDP growth*	5.160	3.757	-14.800	12.344
infl	*Inflation*	8.430	8.240	-0.944	59.220
ted	*Ted Spread*	0.554	0.410	0.210	1.550

Source: Author's calculations

However, from the variables´ peak levels we can notice that the sample studied has come to register levels above 300% of short term debt as a proportion of international reserves. Moreover, total external debt service has registered a maximum of 90.67% of the Gross National Income, a situation that generates a serious liquidity problem. On the other hand, deposits in foreign currency have come to represent three times loans in foreign currency in the financial system, resulting in an increase demand of foreign currency. Having described this situation, it is clear that at high levels of debt service and to a large accumulation of short-term debt, the presence of currency mismatch in the financial system

would expose the economy to a higher level of risk. The exchange rate pressure derived from presence of currency mismatch in the financial system would affect and limit the sovereign bond´ risk management of a country, a situation that would increase a country´s probability of default.

We have noted that some variables, such as EMBI Global, Short Term Debt (% foreign reserves), Total Debt Service (% GNI) and Current Account (% GDP) are characterized by having a higher (or approximate) standard deviation in respect to their mean. This shows the difference between the regions included in our study, reason why it is relevant understand the economic fundamentals characteristic of every regions.

Table 3: Descriptive Statistics by Region

BY REGION											
Latin America						**Europe**					
Variable		Mean	Std. Dev.	Min	Max	Variable		Mean	Std. Dev.	Min	Max
embi	Emerging Market Bond Index Global (EMBI Global)	6.091	8.806	1.409	50.219	embi	Emerging Market Bond Index Global (EMBI Global)	4.884	3.495	0.261	15.684
cm	Currency Mismatch	1.379	0.519	0.522	2.434	cm	Currency Mismatch	0.770	0.266	0.261	1.281
stdresv	Shor term debt (%foreign reserves)	43.161	30.890	12.931	134.613	stdresv	Shor term debt (%foreign reserves)	94.095	81.358	7.069	350.799
stdexp	Shor term debt (%exports)	19.488	11.171	10.196	68.050	stdexp	Shor term debt (%exports)	24.452	8.659	2.086	39.805
resvimp	Foreign exchange reserves in months of imports	6.201	3.023	1.793	12.488	resvimp	Foreign exchange reserves in months of imports	3.772	2.060	0.711	8.980
totdgni	Total Debt Service (%GNI)	4.502	2.042	1.967	10.474	totdgni	Total Debt Service (%GNI)	17.528	24.118	1.647	90.697
tradegdp	Trade (%GDP)	47.652	11.687	33.701	83.883	tradegdp	Trade (%GDP)	112.182	30.111	73.345	180.501
cagdp	Curren Account (%GDP)	-1.903	3.478	-9.869	3.628	cagdp	Curren Account (%GDP)	-7.755	6.402	-21.955	2.942
gdpg	GDP growth	6.173	2.770	0.850	10.671	gdpg	GDP growth	3.992	5.270	-14.800	12.344
infl	Inflation	6.835	8.183	1.442	51.461	infl	Inflation	10.923	10.958	-0.944	59.220
ted	Ted Spread	0.554	0.414	0.210	1.550	ted	Ted Spread	0.554	0.413	0.210	1.550
Asia						**Africa**					
Variable		Mean	Std. Dev.	Min	Max	Variable		Mean	Std. Dev.	Min	Max
embi	Emerging Market Bond Index Global (EMBI Global)	2.824	1.638	0.833	7.740	embi	Emerging Market Bond Index Global (EMBI Global)	1.923	1.204	0.673	4.955
cm	Currency Mismatch	1.459	0.732	0.401	3.121	cm	Currency Mismatch	0.853	0.579	0.226	1.818
stdresv	Shor term debt (%foreign reserves)	37.682	19.077	14.242	114.608	stdresv	Shor term debt (%foreign reserves)	38.231	28.899	6.612	80.357
stdexp	Shor term debt (%exports)	14.874	5.155	6.178	28.935	stdexp	Shor term debt (%exports)	14.502	8.891	4.382	25.785
resvimp	Foreign exchange reserves in months of imports	4.877	1.449	1.859	7.245	resvimp	Foreign exchange reserves in months of imports	4.960	1.752	2.488	7.365
totdgni	Total Debt Service (%GNI)	9.460	9.035	1.752	30.677	totdgni	Total Debt Service (%GNI)	1.940	0.469	1.261	2.822
tradegdp	Trade (%GDP)	96.281	53.476	45.512	210.374	tradegdp	Trade (%GDP)	58	8	43	75
cagdp	Curren Account (%GDP)	2.293	7.602	-9.543	16.847	cagdp	Curren Account (%GDP)	-2.755	2.921	-7.362	2.452
gdpg	GDP growth	6.088	2.249	-1.514	10.700	gdpg	GDP growth	4.202	2.141	-1.526	7.156
infl	Inflation	7.187	4.668	0.583	22.564	infl	Inflation	7.876	4.034	1.385	18.317
ted	Ted Spread	0.554	0.414	0.210	1.550	ted	Ted Spread	0.554	0.420	0.210	1.550

Source: Author's calculations

From the information presented in Table 3, we see that countries in Latin America and Europe considered in this study are characterized by having higher sovereign risk,

registering averages higher than the average of the whole sample considered. Note that Latin America is the region with the highest sovereign risk´ average for the period studied. Regarding the saving capacity of a country, we can observe that countries in Asia and Africa have, on average, a current account surplus, unlike the Latin American and European regions which have a current account deficit. With respect to external debt, Latin America, Asia and Africa do not have, on average, significant difference of Short Term Debt and Total Debt Service levels. However, Europe is characterized by having a relatively higher average in the variables related to external debt compared to the other regions.

Regarding our variable of interest, currency mismatches, we can note that Latin America and Asia registered averages above the sample mean. In contrast, Europe and Africa are characterized by higher levels of foreign currency loans compared to foreign currency deposits in the financial system. Even if we consider the highest levels of currency mismatch indicator in these regions there is not tendency to significantly move far from the sample average of the period studied. This feature of the sample is supported by empirical evidence regarding the financial crisis Asian and Latin American countries in the early nineties, which exhibited high levels of currency mismatches before detonating the financial crisis.

Although Figure 2 shows a weak relationship between currency mismatch and emerging markets sovereign spread, we can distinguish a positive relationship. Note that the largest proportion of countries contains currency levels equal or above 1, which means that a large proportion of countries have higher levels deposits in foreign currency as a

proportion of total loans in foreign currency. By specifying the model, we suspected that the presence alone of currency mismatch may not result in an increase of a country´s risk. In this extent, we take into account the possibility that a country´s economic condition determine whether a higher degree of currency mismatch will increase borrowing cost or not.

Figure 2: Correlation between Currency Mismatch and Logarithm of EMBI Global

Source: Author's calculation

IV.   Empirical Results

Section II explains why currency mismatch should be considered as one determinant of emerging markets´ sovereign spread. Financial stability could be harmed by high level of currency mismatch, resulting in a exposure of exchange rate risk in the financial system; a higher probability of exchange rate risk on overall will produce an increase in sovereign spread. Section III delimitates if currency mismatch is present in the financial system of the countries considered in this study and what are their economic fundamentals. This section investigates whether the theoretical mechanism proposed in

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Section III.A is statistical relevant explaining changes in emerging markets sovereign spread. In other words, we investigate whether currency mismatches have a statistical significant effect on changes in emerging markets sovereign spread.

Throughout the empirical analysis, we will present the Fixed Effect regressions results because, based on the Hausman test, it is preferred to use Fixed Effect in all proposed models. We have also estimated Fixed effects with cluster standard error in order to check the robustness of our results. All the regressions contain the Currency Mismatch indicator, our variable of interest.

Prior estimating the models proposed in the Section III.A, we verify the correlation matrix of the variables to be used in the study. We conclude that the model specification does not present multicollinearity problem (table 4). We distinguish a positive relationship between currency mismatch and the country´s sovereign spread.

Table 4: Variables Correlation Matrix

|	logembi	cm	stdresv	stdexp	resvimp	totdgni	tradegdp	cagdp	gdpg	infl	ted
logembi	1.000										
cm	0.095	1.000									
stdresv	0.288*	-0.159	1.000								
stdexp	0.402*	-0.204	0.539*	1.000							
resvimp	-0.157	0.105	-0.581*	-0.135	1.000						
totdgni	0.060	-0.100	0.048	0.163	-0.084	1.000					
tradegdp	0.012	0.156	-0.105	-0.106	-0.108	-0.109	1.000				
cagdp	-0.295*	0.522*	-0.236	-0.232	0.3986*	0.055	-0.075	1.000			
gdpg	-0.220	0.146	0.153	-0.114	-0.074	-0.361*	0.095	0.005	1.000		
infl	0.332*	-0.076	0.307*	0.124	-0.2893*	-0.074	0.013	-0.173	-0.058	1.000	
ted	0.060	-0.056	0.011	-0.037	-0.124	-0.038	-0.050	-0.136	0.005	0.129	1.000

Significant at 1% significance level.
Source: Author's calculations

In addition, we want to validate that the dependent variable specification follows a normal distribution and meets the strong assumptions made about rational expectations.

Based on the Histogram, Boxplot and Normal quantile plot presented in Figure 1, we conclude that the Logarithm of Emerging Market Bond Index Global (EMBI Global) follows a normal distribution with few outliers. The First difference and Sequence plot in Figure 3 display the observed logarithm of EMBI Global in a time sequence, which allows us to confirm the assumption (1). In this sense, the assumption of rational expectations in which the dependent variable, Log EMBI Global, follows a random walk is satisfied in our model. Therefore, we can conclude that the dependent variable meets assumptions (2) and (3) made in Section II.

Figure 3: Logarithm of Emerging Market Bond Index Global (EMBI Global) diagnostic
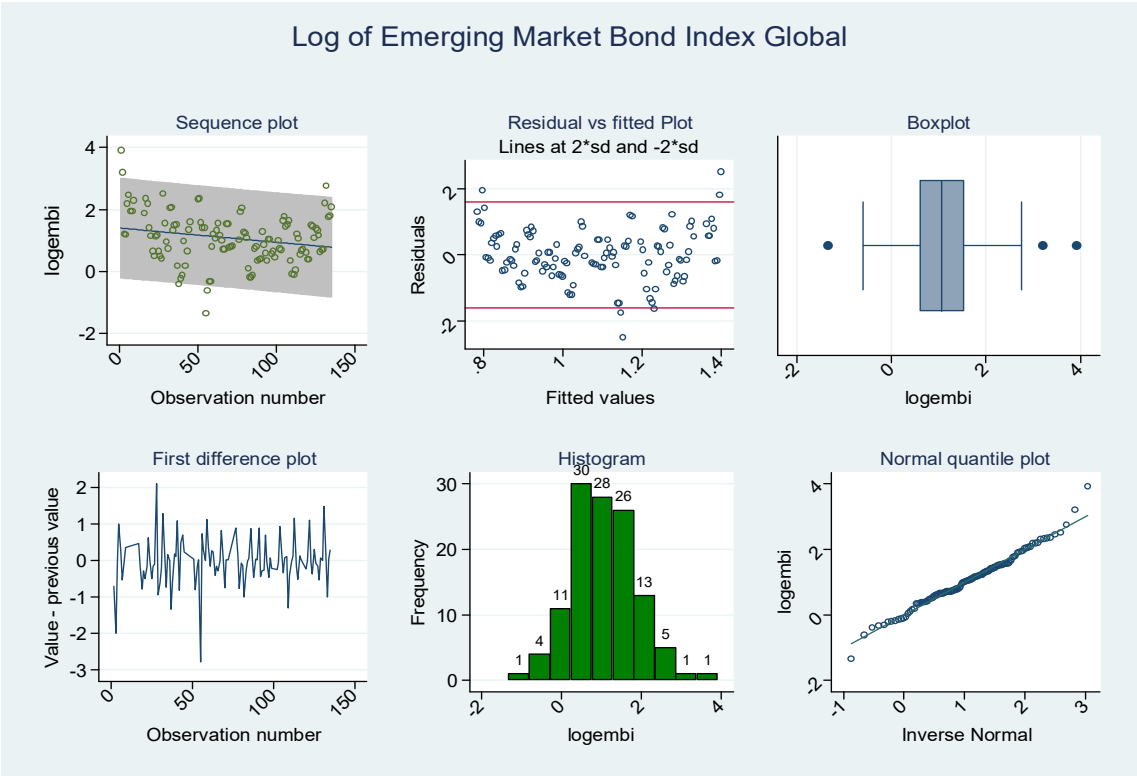
Source: Author's calculations

We construct a basic model for equation (4) taking into account the currency mismatch indicator and various macroeconomic related with liquidity and solvency indicators. For the

external factors, we consider the TED Spread in all the specifications. Throughout the empirical analysis, we will present the Fixed Effect regressions results because, based on the Hausman test, it is preferred to use Fixed Effect in all proposed models. We have also estimated Fixed Effect cluster standard error in order to check the robustness of our results. In table 5 we present the baseline results.

Table 5: Emerging Markets Sovereign Spread (2004-2012)

	(1)	(2)	(3)	(4)
Currency Mismatch	0.264	0.112	0.264	0.112
	(0.181)	(0.156)	(0.191)	(0.200)
Short-Term Debt (%foreign reserves)	0.011***		0.011**	
	(0.002)		(0.003)	
Short-Term Debt (%exports)		0.020***		0.020**
		(0.005)		(0.005)
Foreign Reserves (%imports)		-0.159***		-0.159***
		(0.034)		(0.019)
Debt Service of total External Debt (%GNI)	0.027***	0.017***	0.027**	0.017***
	(0.005)	(0.004)	(0.005)	(0.001)
GDP growth	-0.050***	-0.047***	-0.050**	-0.047**
	(0.017)	(0.014)	(0.010)	(0.014)
Inflation	0.013*	0.010	0.013	0.010
	(0.007)	(0.007)	(0.010)	(0.006)
TED	0.372***	0.471***	0.372	0.471
	(0.138)	(0.117)	(0.280)	(0.266)
Trade (%GDP)	-0.004	0.002	-0.004	0.002
	(0.006)	(0.005)	(0.012)	(0.006)
_cons	0.319	0.803*	0.319	0.803**
	(0.477)	(0.434)	(0.489)	(0.196)
R^2	0.74	0.80	0.74	0.80
N	102	94	102	94

Note: Dependent variable is the logarithm of the Emerging Market Bond Index Global calculated by JP Morgan. All regressions control for time-specific characteristics; includes year dummies. Standard Errors in parenthesis for columns 1 and 2. Cluster Standard Errors by Regions in parenthesis for columns 3 and 4.

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Source: Author's calculations

From the perspective of liquidity, solvency and external indicators, the results obtained confirm the expected sign. In particular, emerging market sovereign spread will be wider when illiquidity indicators are greater and solvency indicators are lower. For the sample consider, we found that short-term debt have a positive and statistical significant

effect on emerging markets sovereign spread. A short-term liquidity problem will arise from higher short-term debt, resulting in debt- service difficulties for emerging countries. This argument is consistent with both specifications used: short-term debt (% foreign reserves) and short-term debt (% exports). Similarly, if the Debt Service of Total External Debt increases more than the country´s disposable income the greater will be sovereign spread for emerging markets. On the other hand, a greater accumulation of international reserves will reduce sovereign spread in emerging markets, on the grounds that a greater accumulation of foreign currency will lower the threat of short-term liquidity problems a country might face. In respect of economic growth, a decline in GDP growth will result in a long-term insolvency problem and, hence, lower sovereign spread. For other variables, results are not statistical significant. For instance, Trade Openness did not have a consistent sign between the models, and the effect resulted to be statistically not different from zero, which is consistent with the results obtained on previous literatures. Moreover, after clustering standard errors by region, the TED Spread as an indicator of external factors loses significance.

In respect of our variable of interest, the indicator for currency mismatch, we confirm the expected sign. However, it shows a statistical not significant effect on emerging markets sovereign spread. The decline in the financial institutions' creditworthiness will be produced when a country´s financial system experience currency mismatch in the balance sheet. As a result, there will be more chance for larger currency depreciation and a greater likelihood to get into a financial crisis. We can take the example of Tequila Crisis, in which the high levels of deposits in foreign currency relative to loans in foreign currency increased the dependence on the government to intervene the foreign

exchange market, undermining the effectiveness of monetary policy. From the issues raised regarding currency mismatch, we propose that this indicator of financial vulnerability has an impact on emerging markets sovereign spread. As propose in the Methodology section, we suspect that the effect of our variable of interest is closely related to other macroeconomic fundamentals, specifically Short term debt. Based on our surmise, the equations considering interactions effect are estimated, and results are presented in Table 6.

Table 6: Emerging Markets Sovereign Spread (2004-2012), Model with Interaction term

	(5)	(6)	(7)	(8)
Currency Mismatch	-0.200	-0.201	-0.200	-0.201
	(0.218)	(0.216)	(0.174)	(0.190)
Short-Term Debt (%foreign reserves)	-0.002		-0.002	
	(0.004)		(0.001)	
Short-Term Debt (%exports)		-0.005		-0.005
		(0.013)		(0.006)
Foreign Reserves (%imports)		-0.169***		-0.169***
		(0.034)		(0.014)
Currency Mismatch * Short-Term Debt (%foreign reserves)	0.009***		0.009**	
	(0.003)		(0.002)	
Currency Mismatch * Short-Term Debt (%exports)		0.017**		0.017***
		(0.008)		(0.001)
Debt Service of total External Debt (%GNI)	0.023***	0.017***	0.023**	0.017***
	(0.005)	(0.004)	(0.004)	(0.002)
GDP growth	-0.058***	-0.048***	-0.058***	-0.048**
	(0.016)	(0.014)	(0.007)	(0.014)
Inflation	0.007	0.007	0.007	0.007
	(0.007)	(0.007)	(0.007)	(0.004)
TED	0.358***	0.474***	0.358	0.474
	(0.130)	(0.115)	(0.270)	(0.281)
Trade (%GDP)	-0.002	0.003	-0.002	0.003
	(0.006)	(0.005)	(0.011)	(0.005)
_cons	0.970**	1.313***	0.970	1.313**
	(0.486)	(0.492)	(0.606)	(0.335)
R^2	0.77	0.82	0.77	0.82
N	102	94	102	94

Note: Dependent variable is the logarithm of the Emerging Market Bond Index Global calculated by JP Morgan. All regressions control for time specific characteristics (includes year dummies). Standard Errors in parenthesis for columns 5 and 6. Cluster Standard Errors by region in parenthesis for columns 7 and 8.

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Source: Author's calculations

The signs and interpretation for the control variables are similar from the analysis in Table 5. We were able to verify in the model specifications presented in columns 5-8 the interaction of currency mismatch with an indicator of short-term liquidity, in this case

short-term debt, has a statistical significant effect on sovereign spread. We can notice that the coefficient corresponding to currency mismatch and short term debt are not statistically significant. Nonetheless, based on the economic theory they should be considered as determinants of sovereign spread. In addition, the set of variables (currency mismatch, short term debt and the interaction term of both variables) result to be jointly significant for our model. This argument is consistent with both specifications used: short-term debt (% foreign reserves) and short-term debt (% exports). Holding the level of short-term debt constant for both specifications, increases of deposits in foreign currency relative to loans in foreign currency will have a positive effect on sovereign spread. Similarly, in the presence of currency mismatch in the financial system, a greater accumulation of short term debt will result in a wider sovereign spread in emerging economies. The effect of short-term debt in emerging markets sovereign spread is greater in magnitude after controlling for currency mismatch in comparison with the results obtained in Table 5.

An important point worth noting is the negative sign for the coefficients of the levels of short-term debt and currency mismatch. While it is true that the variables are not statistically significant, we believe that the analysis should be taken into consideration due to the relevance of the interaction term. With respect of Short Term Debt, the marginal effect after controlling for currency mismatch will result in a higher sovereign spread considering the minimum currency mismatch level present in our sample. Nonetheless, this is not the case for the coefficient for currency mismatch. After controlling for short-term debt, the higher currency mismatch indicator, the wider will be the sovereign spread in emerging economies. However, this effect will be contrary if the accumulation of Short Term Debt is relative small. According to Ranciere, Tornell and Vamwakidis (2010),

currency mismatch in country's financial system is a threat of exchange risk for the economy, but it is also an engine of economic growth.[37] While it is true that financial institutions face a greater risk from the vulnerability incurred in accepting currency mismatches in their balance sheets, in stable economic times with high levels of liquidity and solvency currency mismatch could relax borrowing constraint and promotes competition in the financial system.

It seems that when a country has liquidity problems, the ways of action will be limited in the presence of currency mismatches in the financial sector. Indeed, a greater accumulation of foreign currency deposits relative to total foreign currency loans could trigger liquidity problems even if the accumulation of short-term debt is not considered as an alarming level. The results ultimately show the importance of considering currency mismatch as a determinant of emerging markets sovereign spread.

For robustness check, we conduct the quantile regression in order to have a more comprehensive behavior of the interaction term (currency mismatch and short term debt) based on the estimation of conditional quantile function. Results are presented in table 7 and table 8.

Table 7: Determinants of Emerging Markets Sovereign Spread (2004-2012), Quantile Regression

	25	50	75	95
Currency Mismatch	0.043	-0.196	-0.484*	-0.254
	(0.394)	(0.370)	(0.284)	(0.251)
Short-Term Debt (% foreign Reserves)	0.001	-0.004	-0.003	-0.000
	(0.011)	(0.006)	(0.005)	(0.008)
Currency Mismatch * Short-Term Debt (% foreign Reserves)	0.008	0.012**	0.013***	0.011**
	(0.008)	(0.005)	(0.003)	(0.004)
Debt service of total External Debt (% GNI)	0.004	0.008	0.002	0.002
	(0.011)	(0.007)	(0.008)	(0.010)
Trade (% GDP)	-0.007	-0.008**	-0.008***	-0.009***
	(0.006)	(0.003)	(0.003)	(0.002)
GDP Growth	0.005	0.010	-0.034	-0.034
	(0.061)	(0.062)	(0.030)	(0.022)
Inflation	0.018	0.015	0.005	0.006
	(0.018)	(0.014)	(0.017)	(0.012)
TED	3.664	2.702	2.053	7.259**
	(8.199)	(4.240)	(2.839)	(3.350)
_cons	-0.459	0.482	1.424	0.019
	(2.900)	(1.578)	(0.933)	(0.930)

Note: Dependent variable is the logarithm of the Emerging Market Bond Index Global calculated by JP Morgan. Bootsrap Standard Errors in parenthesis.

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Source: Author's calculation

Table 8: Determinants of Emerging Markets Sovereign Spread (2004-2012), Quantile Regression

	25	50	75	95
Currency Mismatch	-0.334	-0.717	-0.545	-0.185
	(0.390)	(0.552)	(0.414)	(0.542)
Short-Term Debt (% foreign Reserves)	-0.008	-0.018	-0.010	-0.011
	(0.027)	(0.031)	(0.018)	(0.024)
Currency Mismatch * Short-Term Debt (% exports)	0.028	0.043*	0.030*	0.026
	(0.019)	(0.023)	(0.016)	(0.022)
Foreign Reserves (months of imports)	-0.052	-0.072*	-0.066*	-0.101*
	(0.046)	(0.040)	(0.034)	(0.053)
Debt service of total External Debt (% GNI)	0.001	-0.001	-0.003	-0.009
	(0.005)	(0.007)	(0.008)	(0.011)
GDP Growth	0.049	-0.010	-0.028	-0.023
	(0.052)	(0.055)	(0.042)	(0.049)
Inflation	0.022	0.014	0.016	0.027
	(0.032)	(0.035)	(0.029)	(0.024)
TED	-10.969	-13.306*	-5.052	-8.782
	(7.354)	(6.937)	(7.298)	(6.303)
_cons	4.498	6.461**	3.885	5.428**
	(2.874)	(2.767)	(2.525)	(2.429)

Note: Dependent variable is the logarithm of the Emerging Market Bond Index Global calculated by JP Morgan. Bootsrap Standard Errors in parenthesis.

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Source: Author's calculation

From the quantile regression we can notice that an increase of currency mismatch accompanied by an accumulation of short-term debt differently affect emerging markets sovereign spread. The results indicate that the effect of the interaction term has a larger positive impact on 50th and 75th quantiles in sovereign spread of emerging economies. In other words, an increase of currency mismatch with an accumulation of short term debt will not significantly affect very low/very high levels of emerging markets sovereign spread. In addition, the size of the regression coefficients varies by quantile, which highlights how the interaction term may affect sovereign spread in emerging markets.

These findings verified the results obtained from the estimation of panel data, suggesting that variation of the level of currency mismatch in the financial system will positively affect emerging markets sovereign spread when there is a short term debt accumulation. Therefore, factors affecting the demand for currency in the financial market will have a significant effect on the sovereign spread in the presence of liquidity problems and should be considered when formulating economic policies in order to reduce sovereign spread.

V.   Policy Implications

The emerging economies effort to access global capital markets will be undermined by sovereign spread volatility. This issue has prompted policy makers to pay increasing attention to determinants that affect the capacity of a country to service its debt. This research aims to contribute to the analysis of the determinants of the sovereign spread in emerging economies. As a contribution to the literature, we analyze the relationship of currency mismatch in the domestic financial sector and emerging markets' sovereign spread.

Our empirical results verified the analysis of previous literature regarding the role play of economic fundamentals in determining emerging country's sovereign spread. Additionally, our empirical results imply that the presence of currency mismatch in the country's financial system will aggravate the premium that emerging countries have to pay due to the risk associated to their debt instrument. Currency mismatch is often singled out as an important factor of financial crises, particularly in developing economies as evidenced in the Tequila and Asian financial crisis during the decade of the nineties. When the financial system takes more debt in foreign currency, it exposes to an additional source of uncertainty due to depreciation. And in this line, monetary policy becomes severely constrained due to the effects it can have on the entire economy if further depreciation of the local currency results in a greater likelihood of a financial crisis.   In addition, continuous currency depreciation will worsen the liquidity risk, not only in the financial system, but also in the economy at a macro level. This research claims that monetary policies in emerging economies should consider the prevention of currency mismatch in the

domestic financial system in order to reduce sovereign spread. In this respect, at the time of rebuilding the ratio of short-term debt to foreign reserves and the ratio short term debt to exports, we suggest that policy makers must account for the levels of currency mismatch in order to achieve more effective impact of the debt policies proposed.

Due to the assumptions made in the model specification and data limitations, the results have to be interpreted with caution. Nevertheless, the estimation allows us to determine the main relationship in regards to currency mismatch and emerging economies´ sovereign spread. Further studies including financial vulnerabilities, such as currency mismatch, must be taken into account for optimal analysis of borrowing cost and determinants of sovereign spread in emerging economies. Improvements to this study involve building other indicators of currency mismatch that allows us to define currency mismatch for the resident sector of the economy. What is intended to do is to isolate the risk taken by financial institutions when incurring in currency mismatches from individuals and companies whose revenues are in local currency. On the other hand, increasing the size of the sample studied in term of countries would be a relevant to consider; nonetheless we aware the limitation of this suggestion due to the limited country's information available regarding the deposits and loans disaggregated by currency and economic sector.

Appendix

Table A.1: Literature Review Summary

| Author	Year	Emerging Countries	Period	Major Findings
Haque, Kumar et al.	1996	60	1980-1993	Country information about political and economic developments influence the country's debt-servicing obligations
Kamin and Kleist	1999	-	1991-1997	Industrial country interest rates may have an impact on emerging market sovereign spreads over the long term.
Arora and Cerisola	2001	11	1994-1999	Global liquidity conditions have direct positive effects on emerging markets sovereign bond spreads
Prat	2007	25	1993-2005	Currency mismatch, as an indicator of financial vulnerability, is an important determinant of markets spreads
Beber, Brandt and Kavajecz	2009	-	2003-2004	Bond valuation is affected by credit quality while, in times of market stress, liquidity is more relevant explaining changes in the valuation of fixed-income instruments.
Mody	2009	10	2005-2008	Sovereign spreads of a Eurozone country tended to rise when the prospects of its domestic financial sector worsened
Bellas, Papaioannou and Petrova	2010	14	1997.I-2009:II (quarter)	Financial fragility is strongly correlated with changes in sovereign spread
Csonto and Ivaschenko	2013	18	2001-2013 (monthly)	Country-specific fundamentals and global factors are important determinants of spreads on foreign currency denominated sovereign debt
Aizenman, Jinjarak and Park	2013	20	2004-2012	Risk spread is explained mainly by inflation, state fragility, external debt, trade openness, fiscal balance, among others economic fundamentals.

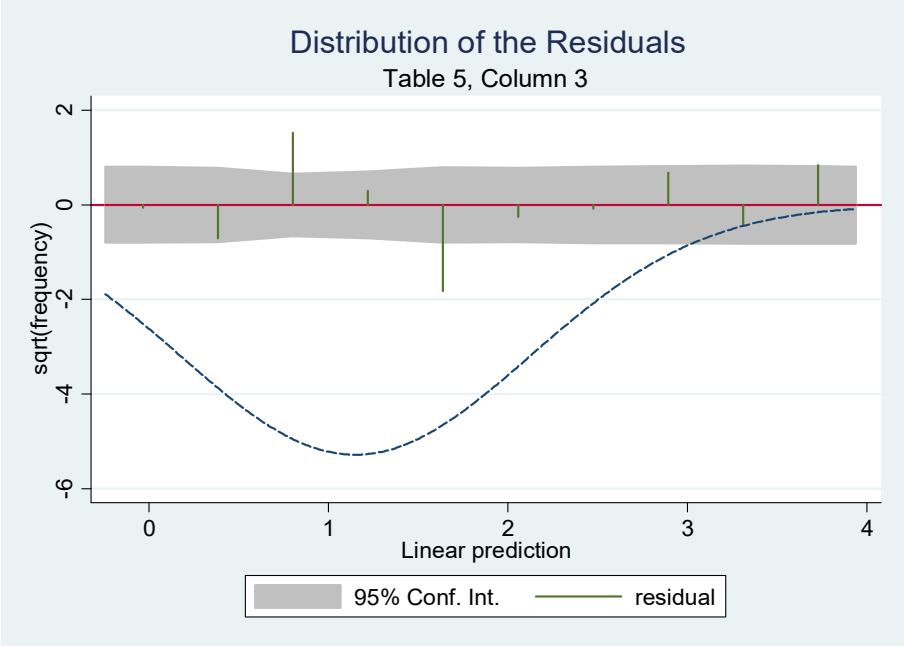*Source: Author's compilation*

Figure A.1: Correlation Matrix
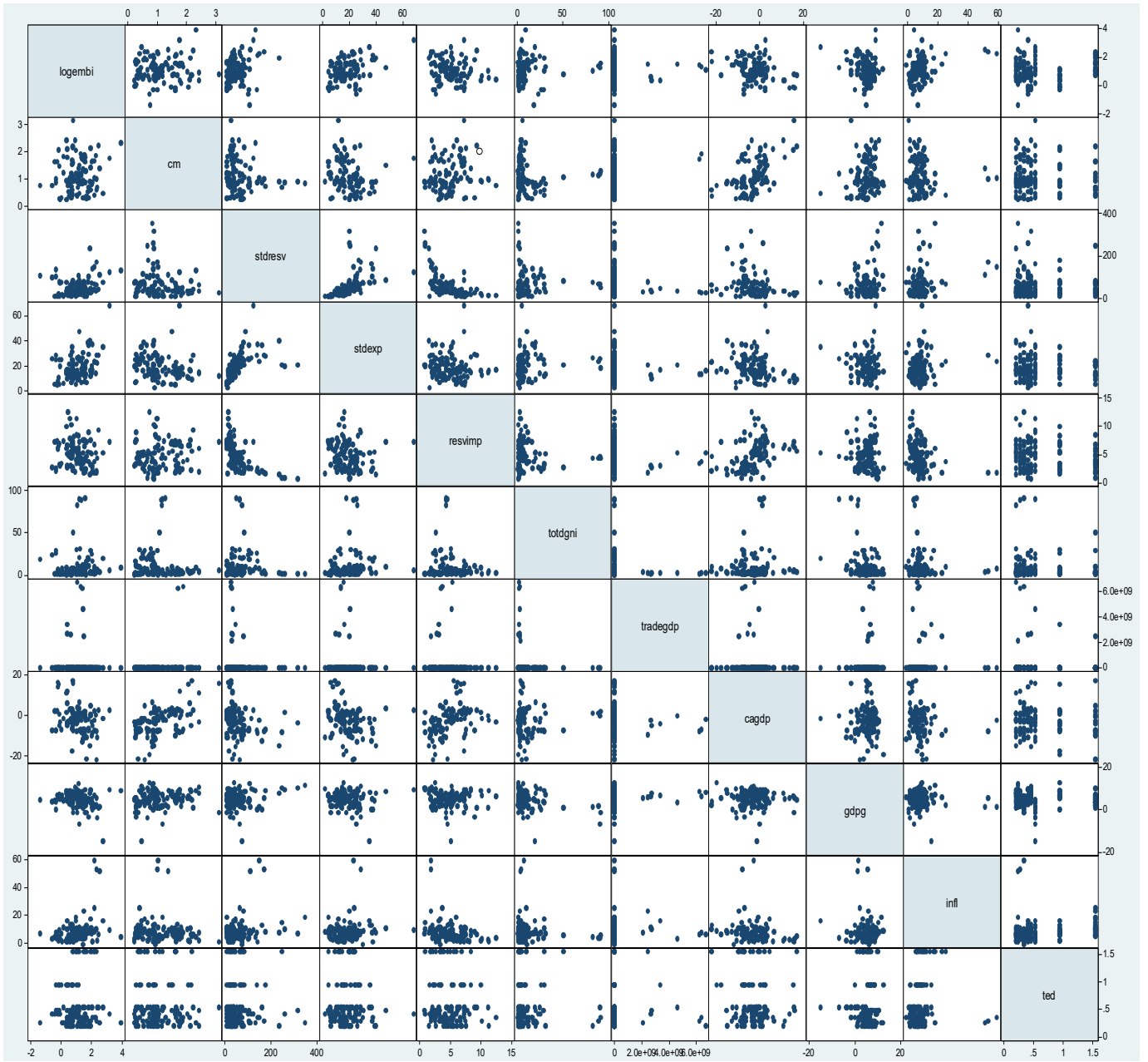
Source: Author's calculations

Figure A.2: EMBI Global Diagnostic (without logarithm)
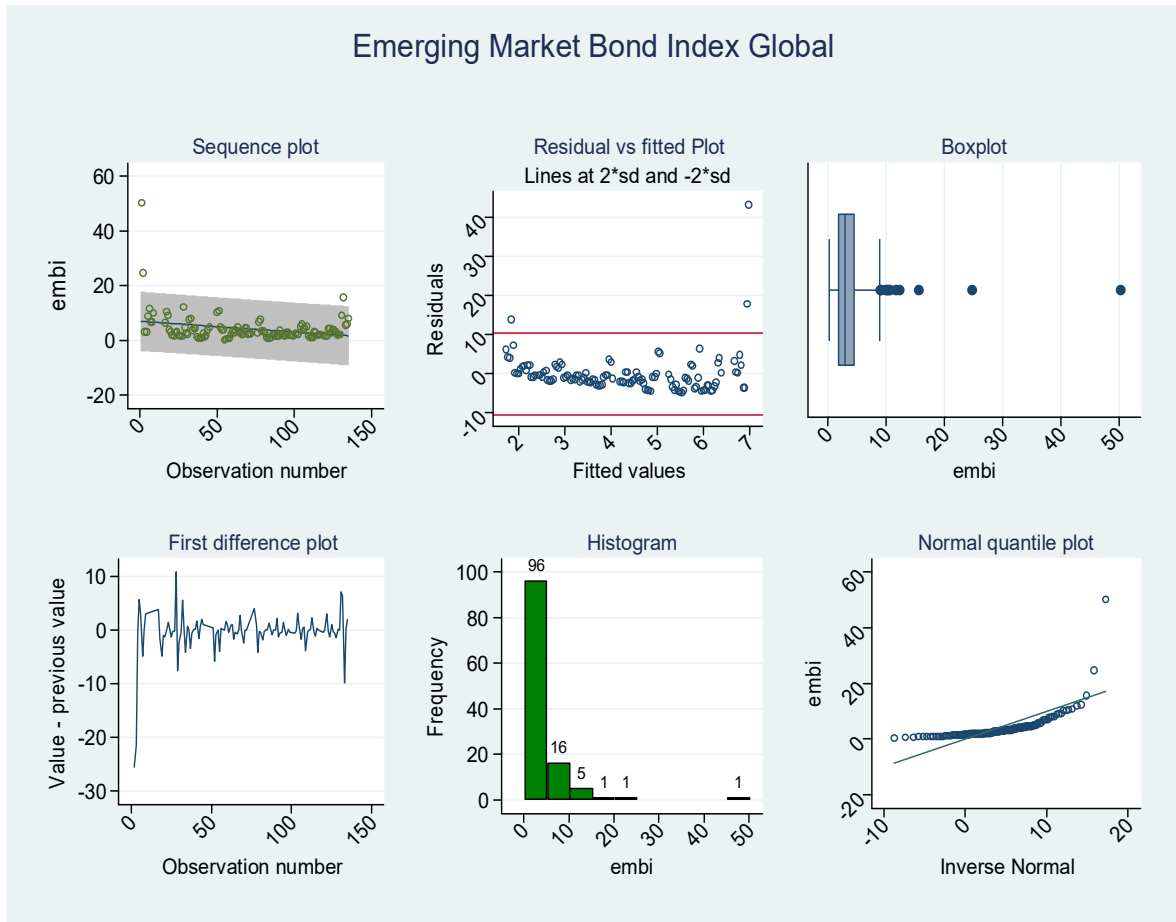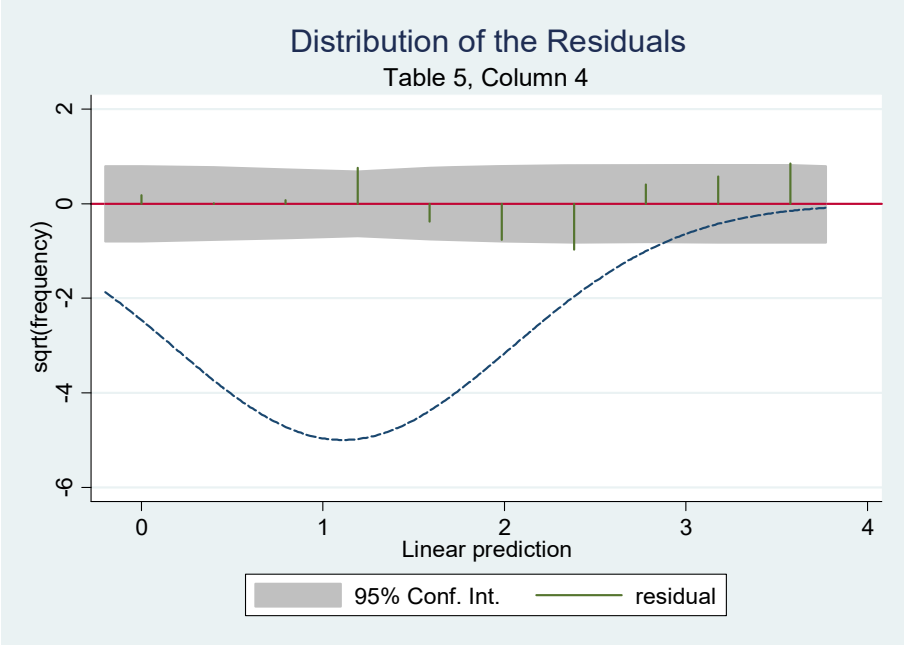

Source: Author's calculations
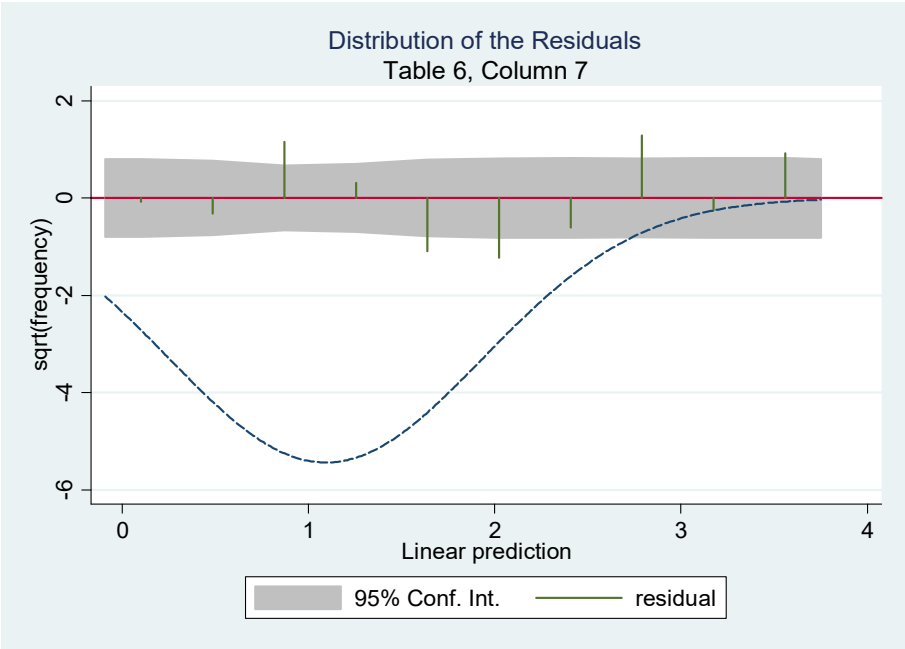
Figure A.3: Distribution of the Residuals

Source: Author's calculations
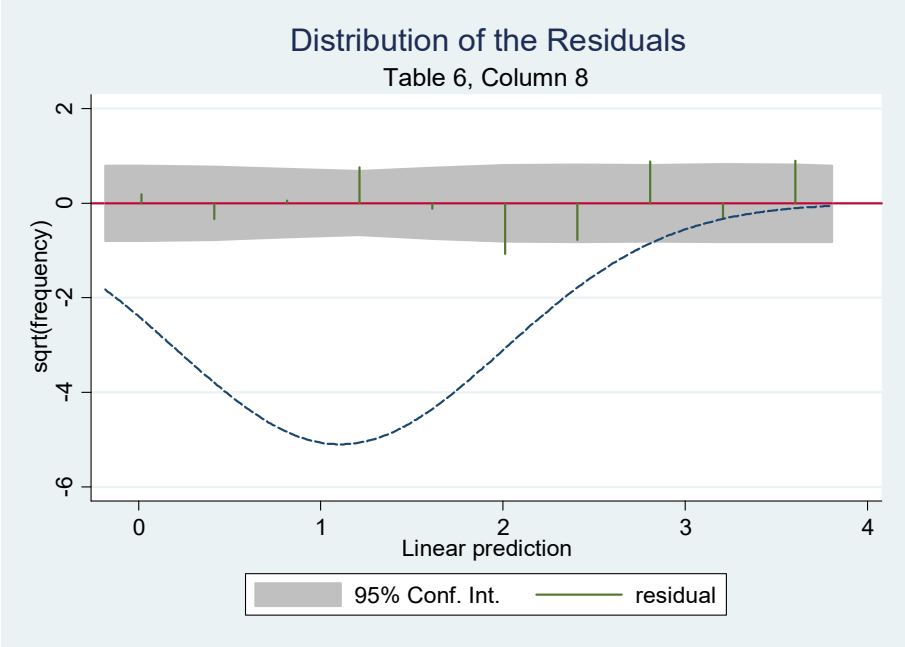
Figure A.4: Distribution of the Residuals

Source: Author's calculations

Figure A.5: Distribution of the Residuals

Distribution of the Residuals
Table 6, Column 7

Source: Author's calculations

Figure A.6: Distribution of the Residuals

Distribution of the Residuals
Table 6, Column 8

Source: Author's calculations

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