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CURRENCY VOLATILITY AND SOVEREIGN DEBT PRICES IN THE OPEN MARKET: A FOCUS ON LATIN AMERICA

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by

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ABSTRACT

CURRENCY VOLATILITY AND SOVEREIGN DEBT

PRICES IN THE OPEN MARKET:

A FOCUS ON

LATIN AMERICA

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This study characterizes the effects of currency uncertainty on the market prices of sovereign and quasi-sovereign bonds denominated in U.S. dollars for ten Latin American emerging-market economies. Previous authors analyzing sovereign debt prices have generally focused on the nexus between macro fundamentals and sovereign debt pricing, as well as global factors like U.S. interest rates. The dynamic analysis here uses a two-step procedure, where currency uncertainty is measured in the first-step using the GARCH methodology, as pioneered by Engle (1982). Preliminary results show that increases in uncertainty may have significant effects on sovereign debt returns, with the direction of the effect potentially depending on the number of lags between volatility and

prices. As one example, currency uncertainty unambiguously has a significant negative effect on prices for Colombia.

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CHAPTER 1

INTRODUCTION

Globalization has become an important buzzword, especially during the last 25 years. While generally used to refer to industrial activities, such as manufacturing, globalization also applies to capital markets. Currency and international bond markets constitute keys to understanding the global financial system. This is especially true for emerging market (EM) economies, which are singularly vulnerable to movements in these two markets. The existing literature examines the linkage between macro fundamentals and currencies and sovereign debt. However, few studies focus on the links between currency movements and sovereign debt pricing. This paper seeks to answer the question: Does currency uncertainty affect sovereign bond price returns for Latin American (LATAM) economies?

From existing theory, we would expect currency volatility and sovereign bond prices to present significant links with each other. According to Reinhart (2002), in EM economies there is a strong link between currency crises and default. It is well known that currency crises usher in periods of extreme volatility in the exchange rate; therefore it follows that currency volatility is linked to the price of sovereign debt in the open market.

Because this study does not take into consideration the direction of the currency movements when measuring volatility, the case could be made for two different

hypotheses. First, currency volatility can be interpreted as country risk by investors. Risk is associated with a higher probability of default, which is in turn associated with a decrease in bond prices. A second hypothesis would posit that currency volatility could be again interpreted as currency risk, this time leading initially to currency depreciation. However, in this second scenario, a depreciating currency could make local production more competitive in international markets, thus increasing foreign currency revenues for the country. Investors may find this reasoning attractive and allocate more capital to these countries. The latter hypothesis would be in conflict with the findings of previous research done by Grier and Smallwood (2007). They find that currency volatility negatively affects export growth for six out of the nine EM countries in their sample, and doesn't significantly affect the other three. This means that the second hypothesis is less likely to be true, as exports tend to be negatively affected by currency volatility.

Various studies relate macro fundamentals and exchange rate parities. There are also numerous studies linking macro fundamentals and global factors to sovereign debt spreads. However, there is a relative dearth of studies analyzing high frequency data, or a direct link between currency volatility and sovereign debt pricing. This paper contributes to the existing empirical literature by attempting to uncover the nexus between exchange rate uncertainty and sovereign debt returns using daily frequency data, as well as the long run effects of exchange rate volatility on sovereign debt returns for different lags.

To achieve this objective a dynamic two-step procedure is used to analyze the data available on exchange rates and sovereign debt prices on the secondary markets.

The first step generates a conditional variance time series for the exchange rates by using the GARCH method pioneered by Engle (1982). This method is generally used in the financial world to measure volatility or uncertainty given its ability to capture volatility in heteroskedastic time series.[1] GARCH is also used in previous studies to define volatility.[2] This conditional variance time series is the proxy for currency volatility. In the second step, four distinct dynamic regression models for the returns (percentage change) of average daily sovereign bond prices are generated for each country, so there are a total of 40 models. The models generally consist of the return of sovereign debt prices regressed on a constant, lags of itself, lags of the return on the exchange rate, and the contemporaneous and lagged conditional standard deviation. The four models generated for each country vary only in the number of lags allowed for the conditional standard deviation.

The results are mixed. Two of the ten countries present significant negative net effects of uncertainty on bond price returns for all four models. Three others present a significant negative effect for one model and no significant effects for any other models. Three countries present significant positive effects for at least one model and no significant negative effects for any other model. One country presents a small, but significant positive effect for the contemporaneous model and consistent negative and significant effects for the other three. Finally, one country presents no significant effects.

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[1] A heteroskedastic series is one for which variance does not remain constant at different points in time.

[2] See Arora & Cerisola (2001), Campbell & Taksler (2003) Grier & Smallwood (2007), Hilscher & Nosbusch (2010), Lastrapes (1989), among others.

In what follows, chapter 2 will present a brief review of the available related literature and research. Chapter 3 describes the data and methodology. Chapter 4 offers the findings of this research in a more elaborate manner. Finally, chapter 5 contains the concluding remarks and suggestions for future research.

CHAPTER 2

RELATED LITERATURE REVIEW

While there is little research on the specific link between currency volatility and returns on sovereign debt prices, a variety of studies focus on topics that show a direct relation. The pricing of sovereign debt, currency crises, and exchange rate volatility are some of the topics that are of interest to the effects studied on this paper.

For sovereign debt spreads most of the research available focuses on lower frequency measures and is mostly divided into two sets of explanatory variables.[3] Some papers focus on macro fundamentals, which are country specific variables, to explain movements in the spreads. Other papers focus on global factors, that is, factors exogenous to a country, for explaining changes in spreads.

Various authors have explored the explanatory power of global factors. Calvo (1993) is one of the first to look into the effects of exogenous factors on EM debt. He finds that inflows of capital to LATAM are a function of worsening conditions in developed economies rather than structural changes in these economies. It is a case of a "search for yield", where investors dare take more risk because conditions at home are largely disadvantageous. Eichengreen & Mody (1998) find that as U.S. interest rates

[3] Most papers analyzing sovereign debt pricing or sovereign credit risk use sovereign *spreads* as their dependent variable. The sovereign spread is the difference in yield between the sovereign bond and the US treasury bill of comparable maturity. It is inversely correlated with the sovereign bond's price, and, all things equal, as the spread rises the price of the bond falls.

rise, EM economies are limited in their access to capital markets; only issuers with good credit ratings are able to enter the market, thus driving the average EM spread down. Their results, however, are skewed because they use data on initial offerings only, instead of secondary market data. Arora & Cerisola (2001) find that U.S. interest rates (proxied by the federal funds rate) negatively affect the prices of EM sovereign debt. Moreover, they also estimated the effect of market volatility using an ARCH model on EM sovereign debt and found a negative and significant relation. Arora & Cerisola (2001) refer to market volatility as the volatility in their market of interest, the market for liquidity. They used the spread (difference) between the yield on the three-month T-Bill and the federal funds rate as a proxy on the condition of this market. Then they use an ARCH model to measure the conditional variance and construct a measure for volatility. This procedure is similar to the one used in this paper. Interestingly, from the LATAM countries contained in their sample, Panama was the only country which did not present a significant relationship for market volatility. This may be due to Panama's free use of the USD as official currency alongside their Balboa. This means Panama is less responsive to volatility in the U.S. liquidity markets, yet sensitive to interest rates. However, it also means that the rest of the LATAM countries in their sample, which have sovereign currencies, are responsive to volatility in the U.S. liquidity markets.

More recently, Diaz Weigel & Gemmill (2006) find that regional economic factors, as well as global economic factors are robust determinants of spreads for LATAM. Regional economic variables are the economic variables common to the region. In their study, they use regional stock market returns, regional stock market volatility, and regional investor sentiment as the main regional factors. They find that

regional economic variables the most explanatory power, and regional stock market returns are highly correlated. Longstaff et al. (2007) as well as Gonzalez-Rozada & Levy-Yeyati (2008) again find global factors to be of high importance in explaining movements in sovereign spreads, as well as forecasting them.

Much of the empirical literature on sovereign debt pricing also studies the explanatory power of macro fundamentals. Reinhart et al. (2003) introduce the concept of "debt intolerance". They argue that certain countries behave like serial defaulters, and are, to an extent, allergic to debt. They suggest that safe thresholds on external debt for some countries appear to be extremely low, around 15 percent of GDP. Hilscher & Nosbusch (2010) take the macro fundamentals research a step further. While much of the previous empirical literature used level variables, they look at macro fundamentals volatility's effect on spreads. They find that countries with more volatile fundamentals are prone to experiencing severe weakening of fundamentals and a higher probability of default. Higher probabilities of default are unequivocally associated with lower bond prices. In a different but analogous situation to the one presented on this paper, Campbell & Taksler (2003) find a strong positive link between equity volatility and corporate bond yields.[4] This paper provides evidence that suggests volatility from one asset class can significantly affect performance of another.

There is a relative wealth of empirical literature on exchange rates and exchange rate volatility, especially related to currency crashes. Extreme volatility periods are inherent to crashes. This is especially true for currency markets. According to Frankel

[4] A positive effect of equity volatility on corporate bond yields implies a fall in corporate bond prices.

& Rose (1995), crashes tend to occur when output growth is low, domestic credit is high, and foreign interest rates are high. Kaminsky, Lizondo & Reinhart (1997) posit that an early warning system for currency crises can be derived as a function of exports, deviations from trend on the real exchange rate, the ratio of broad money (M2) to international reserves, output, and local equity prices. Keeping in mind that currency crises translate into periods of extreme volatility, it is possible to make a connection between previous studies on currency crises and the present study. The key to this connection is the assertion that in EM economies there is a strong link between currency crises and default (Reinhart, 2002).

Bulow & Rogoff (1989) as well as Hilscher & Nosbusch (2010) highlight the importance of a country's terms of trade in explaining sovereign debt prices.[5] Hilscher & Nosbusch (2010) also measure the effect of the volatility of terms of trade on spreads, which they found to be positive (bond prices fall when terms of trade become more volatile).[6] Terms of trade are directly related to exchange rates, this brings us one more nexus between exchange rates and sovereign debt. Finally, Reinhart (2002) states that the some of the indicators that are useful in predicting currency crises are also useful in predicting debt crises. This is evidence of a bridge between currency and sovereign debt pricing, which supports the pursuit of a study linking currency to sovereign debt pricing in a direct way.

[5] Terms of trade measure the price of a country's exports relative to its imports and they are directly affected by the exchange rate.
[6] Recall that a higher spread derives from a higher yield and, as it was previously mentioned, a higher yield implies a decrease in bond price.

CHAPTER 3

DATA AND METHODOLOGY

The 10 countries included in the study are Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Mexico, Peru, Uruguay, and Venezuela. These represent the most relevant economies of Latin America and have independent currencies.

3.1 Data

As stated before, the interest of this paper is to research the effects of currency volatility on sovereign debt prices for LATAM countries. The variables in question are the prices of sovereign debt and the nominal exchange rate against the U.S. Dollar. All data are studied in daily frequency and the lengths of the datasets range between 15 years (dataset start date: 3/19/1999) and roughly 4 years and 7 months (dataset start date: 7/30/2009). The change in the lengths of the datasets is due to the availability of data.

To the effects of this paper, sovereign debt has been defined as all sovereign and quasi-sovereign bonds – bonds issued by a government or a government owned entity – in circulation as of 3/21/2014 except for zero coupon bonds and floating coupon bonds. The variable that was ultimately used in the models is the average price of all outstanding bonds at that point in time. The data was obtained from Reuters Datastream. All data are available in the UTA Library or upon request.

Nominal exchange rate data are widely available. The data used in this project were obtained mostly from Reuters Datastream. However, to better reflect reality, data on Venezuela had to be obtained from other sources. Venezuela, which nominally maintains a peg against the USD, also features a very active and singular parallel market for currency exchange. The data on parallel market exchange rate was incorporated to the time series starting on the first date for which a historical observation was found, 3/1/2005. At that point in time the parallel exchange rate stood at 2.74 Venezuelan "Bolivares Fuertes" (VEF) per USD vis-à-vis the 2.578VEF/USD official exchange rate. There are two main parallel market quote databases that survived in websites that are widely used for reference in Venezuela, DolarParalelo and DolarToday. Both report slightly different closing prices for most days, so for any date when prices were reported for both an average of the two prices was used. Otherwise, whichever price was available was reported. All other countries' nominal exchange rates were downloaded directly from Datastream.

3.1.1 Conditional Variance and Conditional Standard Deviation

It is well established in the literature that GARCH models are useful in analyzing financial data, especially financial time series, which are generally heteroskedastic. Heteroskedastic series are those for which variance changes over time. In order to obtain a conditional variance series for the exchange rate returns a two-step procedure is performed. First, an autoregressive specification for the time series "exchange rate returns" (ERR) must be found to serve as base. This is done for all ERR series in a consistent manner by estimating an auto regression, establishing the

maximum possible number of lags equal to 30. Through this procedure, an appropriate autoregressive model can be obtained. This autoregressive model will have the form:

Equation (1) $\Delta spot_t = \mathsf{C} + \varphi_1(\Delta spot_{t-1}) + \cdots + \varphi_k(\Delta spot_{t-k}) + \varepsilon_t$

Here, $\Delta spot_t$ denotes daily ERR, C denotes a constant, φ_k is a parameter of the kth lag, $\Delta spot_{t-k}$ represents daily ERR k periods ago, and ε_t represents the innovation of the current period. In order to determine which base model to use, we test for residual autocorrelation by examining the correlogram of the residuals and compare competing models on the basis of their estimated AIC values.

Uncertainty is estimated simultaneously on a GARCH modeling framework. Uncertainty will then be defined by:

Equation (2) $E(\varepsilon_t^2 | I_t) = h\Delta spot_t$

Here, $h\Delta spot_t$ is conditional variance, the proxy used for uncertainty.

The conditional variance equation for ERR can be written as follows:

Equation (3) $h\Delta spot_t = K_{\Delta spot} + \alpha_{\Delta spot}\left(\varepsilon^2_{\Delta spot_{t-1}}\right) + \beta_{\Delta spot}(h\Delta spot_{t-1})$

Here, $h\Delta spot_t$ is the conditional variance of ε_t, $\alpha_{\Delta spot}$ is the ARCH parameter, $\varepsilon^2_{\Delta spot_{t-1}}$ is the squared innovation of the previous period in the variance equation, and $\beta_{\Delta spot}$ is the GARCH coefficient. All ten countries show significant GARCH effects in their exchange rate returns series at the 10% test level or better for a z-test, in which $t - stat \sim N(0,1)$. Using the newly constructed GARCH variable a conditional variance series can be generated. As our uncertainty variable we will use $\sqrt{h\Delta spot_t}$ for the remainder of the study.

3.2 The Experimental Design

Given the above results, it is now possible to describe exactly how the test for the effects of ERR uncertainty on "sovereign debt price returns" (SDR) will be carried on. As for ERR, a baseline specification for SDR must be found. This feat is achieved calculating a vector auto regression (VAR) with the desired endogenous variables and setting the maximum number of lags equal to 30. Then we discern between the available models through the examination of the correlogram of the residuals and the value of the estimated AIC. The base representation will include lags of SDR and ERR, and the conditional standard deviation of ERR ($\sqrt{h\Delta spot}$). To account for potential time varying volatility in the SDR equation, conditional variance of SDR will also be modeled as a GARCH process. Therefore, the SDR model is given by:

Equation(4)

$$\Delta price_t = \mathrm{C} + \sum_{i=1}^{p}(\theta_{1i}\Delta price_{t-i} + \theta_{2i}\Delta spot_{t-i}) \sum_{i=0}^{k}(\theta_{3i}\sqrt{h\Delta spot}_{t-i}) + \varepsilon_{\Delta price_t}$$

where: $E\left(\varepsilon^2_{\Delta price_t} \middle| I_t\right) = h\Delta price_t$

Equation (5) $h\Delta price_t = K_{\Delta price} + \alpha_{h\Delta price}\ \ \varepsilon^2_{h\Delta price_{t-i}} + \beta_{h\Delta price}\ \ h\Delta price_{t-i}$

Here, I_t denotes the available information set and the rest of the notation is as above. In this second step, k is allowed vary up to a maximum value of 10.

CHAPTER 4

RESULTS

We wish to determine the possible effects of ERR uncertainty on sovereign debt prices over time. Following Grier and Smallwood (2007), we use a testing framework that allows lags of the uncertainty measures to enter the equation. As stated in the introduction, each country has four distinct models; these models present different lag lengths of the uncertainty measures: a contemporaneous model, a one lag model, a five lag model, and a ten lag model.

To determine the effects of exchange rate uncertainty, the test statistics associated with the null hypothesis that the relevant parameters do not belong in the model are calculated. Referring to equation (4), the null hypothesis that ERR uncertainty does not affect SDR, can be tested through a partial F-test with the null hypothesis: $\theta_{31} = \cdots = \theta_{3k} = 0$. The coefficients are tested using a Wald joint coefficients test at the 10% level, where the test statistic is distributed as follows: $F \sim (k, T - 2p - k - 1)$, where k is the number of variables restricted in the joint significance test, T is the total number of observations, and p is the number of lags. This approach permits the isolation of long term and short term effects of ERR uncertainty.

It is possible that the short term effects of ERR uncertainty may be insignificant while the long term ERR uncertainty of lagged variables may be significant as investors

adjust their expectations given the new set of information. Finally, it is possible to quantify the importance of the different uncertainty variables and their lags by calculating the equilibrium effect of a one standard deviation increase in the uncertainty variable on SDR. This long run effect of ERR uncertainty is given by:

$$Equation\ (6)\ Long\ Run\ Effect = \frac{\sum_{i=1}^{k} \theta_{3i}}{(1-\sum_{i=1}^{p} \theta_{1i})} \sigma_{h\Delta spot}$$

Here, $\sigma_{h\Delta spot}$ denotes the unconditional standard deviation of the uncertainty measure associated with the ERR, $k \in \{0,1,5,10\}$ and the remaining variables are defined as in equation (4).

The results are presented in Table 4.1. Given that there are four distinct models which differ on the lag lengths of the ERR uncertainty variable for each country, it seems proper to provide a concise view of the results for the reader. This summary is presented in visual form in Figure 4.1.

In total, 40 models were estimated; 21 out of these 40 models showed significant effects of currency uncertainty on sovereign debt price returns at least at the 10% test level. The analysis shows five countries for which significant effects are unambiguously negative. These are: Colombia, Chile, Peru, The Dominican Republic, and Costa Rica. There are three countries where the significant models are unambiguously positive[7], Brazil, Argentina, and Uruguay. One country, Venezuela, for which all coefficients are significant but the sign depends on which lag length is being examined. For Venezuela the contemporaneous volatility coefficient seems to be positive, while the remaining three lag length structures' coefficients are significant and

[7] That is, taking into consideration significant coefficients only.

negative. Lastly, Mexico presents no significant effects for currency uncertainty on sovereign bond price change at any lag structure. It appears as though currency uncertainty represents added risk for a majority of the countries.

The findings on Colombia and Peru are particularly interesting. For all lag structures these show significant negative effects, the long run effects of currency volatility on sovereign bond returns for Colombia and Peru are, indisputably, negative.

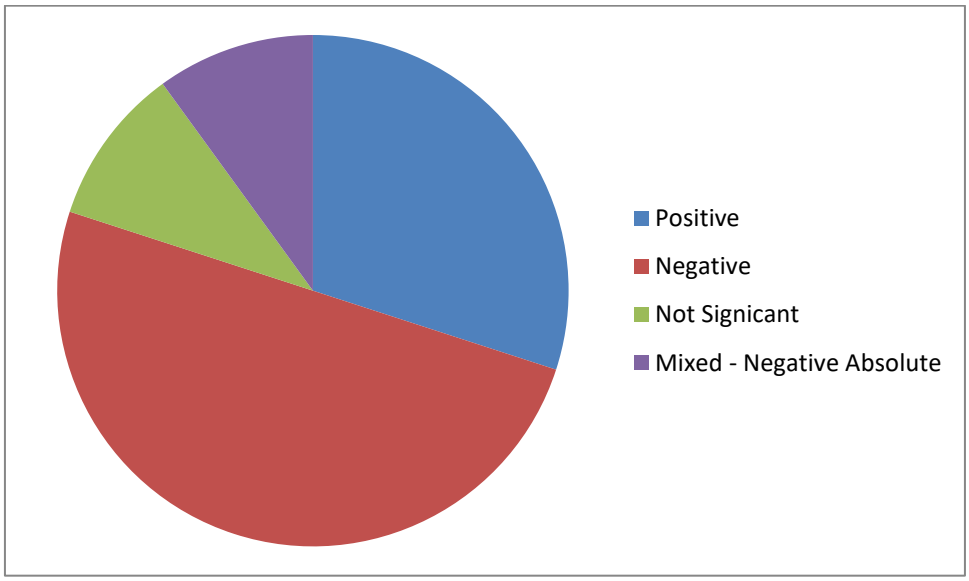
To resolve mixed cases, it is the long run coefficient's sign on the longest significant lag structure that is definitive. This coefficient represents the long run equilibrium effect of currency uncertainty on sovereign debt price. Now, the proportion changes to six negative absolute equilibrium effects, three positive, and one country with no significant effects. See Figure 1 below for visual representation.

It seems that for the countries with the largest economies (with the exception of Uruguay) currency volatility does not represent as much a risk in regard to their sovereign debt prices. This could be due to increased reliance on internal consumption. However, it is important to highlight that the countries which don't suffer devaluations in sovereign debt as a consequence of currency volatility have a common denominator; these countries have well diversified portfolios of exports. In 2011, none of these four countries seemed to rely on any single product for more than 17% of their exports[8]. In financial terms, these countries didn't suffer of "portfolio concentration". This is a possible refinement for future research.

[8] See Observatory for Economic Complexity – MIT.
http://atlas.media.mit.edu/explore/tree_map/hs/export/cri/all/show/2011/

All in all, this paper has uncovered a relatively significant nexus between currency volatility and sovereign debt price returns on the open market for Latin American countries. After modeling these stochastic series, it is appropriate to assert that sixty percent of the countries in the sample are prone to declines in the market value of their sovereign debt in the presence of currency volatility. The findings of this paper are consistent with previous literature which relates volatility of global factors or macro fundamentals to sovereign debt prices[9]. In general, uncertainty risk is negative for sovereign securities. The main difference is that this study uses high frequency data, and directly analyzes the effects of currency volatility such debt instruments.

Figure 4.1 – Currency volatility effects on Sovereign Debt Returns



[9] See Hilscher & Nosbusch (2010), Arora & Cerisola (2001)

Table 4.1
Summary of results – Long run effects and significance tests

Country	Contemp. Volatility Coefficient[10]	p-value	L-R est. 1[11]	Wald test p-val	L-R est. 5[12]	Wald test p-val2	L-R est. 10[13]	Wald test p-val3	Sign	GDP in billions
Brazil	**0.02741**	0.12561	**0.03227**	0.08938	**0.04158**	0.13643	**0.04516**	0.00158*	Positive	$ 2,190.0
Mexico	**0.00457**	0.66176	**0.00595**	0.41379	**0.00193**	0.38448	**0.00643**	0.46035	NS	$ 1,327.0
Argentina	**0.01864**	0.69202	**0.03621**	0.00015*	**0.04141**	0.67456	**0.03692**	0.00228*	Positive	$ 484.6
Colombia	**-0.11356**	0.00000*	**-0.10440**	0.00001*	**-0.08212**	0.00021*	**-0.07532**	0.00018*	Negative	$ 369.2
Venezuela	**0.02547**	0.00000*	**-0.00393**	0.00000*	**-0.01134**	0.00000*	**-0.00792**	0.00000*	Mix/Negative	$ 367.5
Chile	**-0.04484**	0.59414	**-0.06143**	0.41718	**-0.03766**	0.37417	**-0.01884**	0.00238	Negative	$ 281.7
Peru	**-0.56626**	0.00000*	**-0.60747**	0.00000*	**-0.34204**	0.00000*	**-0.28796**	0.00000*	Negative	$ 210.3
Dominican Republic	**-0.10383**	0.31428	**-0.10513**	0.59089	**-0.04808**	0.07893	**-0.03199**	0.10872	Negative	$ 59.3
Uruguay	**0.08616**	0.08616	**0.09366**	0.07650	**0.09859**	0.17161	**0.09703**	0.32135	Positive	$ 57.1
Costa Rica	**-0.00213**	0.84427	**0.01337**	0.49218	**0.00785**	0.33684	**-0.00070**	0.05410	Negative	$ 48.5

*Coefficients are jointly significant at the 10% test level or better.

[10] These are coefficients for the model with no lags of the uncertainty variable.
[11] These are coefficients for the model with one lag of the uncertainty variable.
[12] These are coefficients for the model with five lags of the uncertainty variable.
[13] These are coefficients for the model with ten lags of the uncertainty variable.

CHAPTER 5

CONCLUDING REMARKS

Most of the empirical research related to sovereign debt pricing is based on low frequency data, and analyzes the effects of macro fundamentals such as exports, GDP growth rates, FDI, trade terms, etc. The results of this paper prove that in a high frequency setting there are high frequency variables that can be used to assess risk. Refined versions of this study could lead to new risk management techniques in the financial industry. It also adds to the existing literature by testing a relationship that had not been tested before.

The evidence in this paper is generally assertive of the hypothesis that currency volatility will be interpreted as risk and investors will reduce their exposure to sovereign debt of the country in question. This seems to be true even though the securities evaluated are uniquely denominated in USD. We also find that, in general, the long run effects of volatility are negative including those models with longer lag structures, and longer lag structures tend to have smaller effects for the countries that see negative effects. On the other hand, the countries that see positive effects have similar values for their coefficients across lag structures. This finding suggests that investors may overreact at first when it comes to certain economies, and then focus on other drivers for their decisions.

Lastly, these findings have important implications for Latin American public administrations. It is evident that a majority of these countries could obtain better financing terms if they reduced currency volatility.

5.1 Future research

Firstly, refining this study in order to subsequently expand it to more EM economies is a good start, or making a distinction on how currency volatility affects countries with different export structures. Other related studies could include: A study of currency volatilities on Credit default swap spreads for each country. Studies focusing on volatility tolerance by investors are another great option; how long will the market players tolerate currency volatility before they liquidate their debt positions. Studies could be done on the effects of currency volatility on macro-fundamentals. A further refinement on this study adding an asymmetric component are also viable – Does negative volatility affect price more robustly that positive volatility?

These are only a small part of the wide array of paths this discipline could open. Ultimately, what we seek is to understand human behavior when offered different choices; after all, that is why economics is a social science.

APPENDIX A

FULL TABLE OF RESULTS

APPENDIX A

Tables containing the full output of all models for each country, see attached.

	Model	Contemporaneus - No lag		One lag		Five lags		Ten Lags	
Country	Joint Coefficients Significance	Not Significant		Significant		Not Significant		Significant	
Argentina	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	0.018639124	0.692023242	-0.194545839	0.000154562	-0.084381368	0.36404386	-0.190533085	0.000590464
	1			0.230756011	2.65766E-05	0.140704736	0.157777412	0.277416389	0.000256397
	2					-0.042649921	0.558832329	-0.157008874	0.06158182
	3					-0.017778037	0.855992979	0.021410416	0.789958065
	4					-0.053667039	0.639731227	-0.007162088	0.930919114
	5					0.099179929	0.246456409	0.05470249	0.529579728
	6							-0.018943391	0.81928035
	7							0.02279515	0.779641996
	8							0.055907014	0.423156083
	9							0.03254314	0.689775436
	10							-0.054202223	0.381134814
	Net	0.018639124		0.036210172		0.0414083		0.036924938	
	AIC	4.225380313		4.20734934		4.227036983		4.211488141	
	ARCH coefficient	0.330536477		1.522314285		0.351914063		1.508528607	
	GARCH coefficient	0.619125148		0.034737002		0.60421772		0.0349785	
Brazil	Joint Coefficients Significance	Not Significant		Significant		Not Significant		Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	0.027413107	0.125609962	-0.06951191	0.185074207	-0.068903511	0.202288891	-0.071630908	0.187656225
	1			0.101782701	0.065305005	0.017381606	0.823736864	0.008471768	0.915560701
	2					-0.023376462	0.761837349	-0.020088247	0.800726041
	3					0.119231083	0.150724396	0.11334862	0.179326473
	4					0.006278117	0.941924787	0.021376168	0.807276943
	5					-0.009031031	0.891099672	-0.095253042	0.307955713
	6							0.067244997	0.41785731
	7							-0.113968292	0.135225661
	8							0.093041085	0.286739096
	9							0.243810457	0.003242935
	10							-0.201188085	0.000381575
	Net	0.027413107		0.032270791		0.041579801		0.045164522	
	AIC	1.337548146		1.336973202		1.335213716		1.329946246	
	ARCH coefficient	0.083131521		0.085785818		0.082038785		0.086160894	
	GARCH coefficient	0.92927239		0.927514493		0.930111108		0.927291896	
Chile	Joint Coefficients Significance	Not Significant		Not Significant		Not Significant		Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	-0.044842583	0.594136463	0.172529945	0.355361186	0.195734575	0.231448827	0.14788116	0.374614985
	1			-0.233957112	0.213433077	-0.437080738	0.086199134	-0.387921247	0.125763136
	2					0.469057312	0.071871391	0.477557039	0.061684266
	3					-0.30949687	0.220025197	-0.306813847	0.227754889
	4					0.266565479	0.300544816	0.26906148	0.290215949
	5					-0.222435954	0.265092853	-0.129742948	0.627910988
	6							0.100698472	0.716387449
	7							0.114743555	0.683169689
	8							-0.750891456	0.002598234
	9							0.012199037	0.965662235
	10							0.434387008	0.049245068
	Net	-0.044842583		-0.061427168		-0.037656196		-0.018841747	
	AIC	0.655294896		0.655813771		0.675915781		0.675894204	
	ARCH coefficient	0.058527418		0.059658019		0.189038133		0.217868162	
	GARCH coefficient	0.856493517		0.854721211		0.304444523		0.212303007	
Colombia	Joint Coefficients Significance	Significant		Significant		Significant		Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	-0.113556577	0.000002	-0.172849901	0.033344655	-0.115632009	0.099827881	-0.098777943	0.163126931
	1			0.068447825	0.414391604	-0.205613213	0.15065902	-0.230266285	0.110834515
	2					0.307608341	0.065991594	0.355193794	0.033114763
	3					0.032145234	0.853134021	0.019310514	0.907757424
	4					-0.257556232	0.099289845	-0.30109393	0.047387319
	5					0.156932791	0.142908916	0.351793552	0.009430745
	6							0.122344302	0.417307252
	7							-0.496370877	0.002094883
	8							0.239646917	0.102748607
	9							-0.132928753	0.345794733
	10							0.095828331	0.350736235
	Net	-0.113556577		-0.104402076		-0.082115086		-0.075320377	
	AIC	1.282414183		1.259097075		1.196163751		1.182812582	
	ARCH coefficient	0.310535482		0.360866652		0.586005629		0.618352715	
	GARCH coefficient	0.733207205		0.704218932		0.530547158		0.509750587	
Costa Rica	Joint Coefficients Significance	Not Significant		Not Significant		Not Significant		Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	-0.002130351	0.844272006	0.005733371	0.805496127	0.002971885	0.899997924	-0.008657492	0.703854476
	1			0.007641191	0.739846241	0.022880749	0.414054037	0.020843843	0.436869403
	2					-0.022689003	0.347427071	-0.017340257	0.413219958
	3					-0.010723224	0.681040624	-0.008226107	0.682477143
	4					-0.024409034	0.334438213	-0.05980079	0.02393538
	5					0.039814691	0.043299119	0.027813199	0.2932324
	6							0.028252289	0.206852615
	7							-0.016035655	0.498508901
	8							0.023798936	0.302937652
	9							0.036593125	0.123397501
	10							-0.027939336	0.159906475
	Net	-0.002130351		0.013374563		0.007846065		-0.000698242	
	AIC	-7.628418945		-7.632976661		-7.624131014		-7.622882193	
	ARCH coefficient	1.608379052		1.54642798		1.441142431		1.645884142	
	GARCH coefficient	0.062267625		0.081744367		0.098016886		0.131026584	

Dominican Republic	Joint Coefficients Significance	Not Significant		Not Significant		Significant		Not Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	-0.103830249	0.314282045	-0.012102376	0.985216665	-0.00026073	0.99968836	-0.006968519	0.991951422
	1			-0.093032252	0.885719136	-0.167449398	0.8553154	-0.127124878	0.892449373
	2					-0.330707777	0.672026143	-0.392763862	0.617507501
	3					-0.886238574	0.257997161	-0.849877608	0.28659025
	4					0.753439647	0.410406121	0.853101728	0.364587752
	5					0.583140233	0.418834929	0.55678487	0.585083049
	6							-0.384495565	0.732851664
	7							0.954164933	0.332613902
	8							-0.681842564	0.386353102
	9							-1.19591507	0.1242142
	10							1.242943738	0.031302244
	Net	-0.103830249		-0.105134628		-0.0480766		-0.031992798	
	AIC	1.453334894		1.454972581		1.444122059		1.429554958	
	ARCH coefficient	0.146899779		0.146687441		0.14052401		0.118034426	
	GARCH coefficient	0.840581957		0.840714436		0.844958822		0.861041328	
Mexico	Joint Coefficients Significance	Not Significant		Not Significant		Not Significant		Not Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	0.004569169	0.661758819	-0.05193921	0.216486474	-0.053364259	0.215473938	-0.046109605	0.297557112
	1			0.057885494	0.187543333	0.060828916	0.381634704	0.05003892	0.491910436
	2					0.050769379	0.53443471	0.058383312	0.487260749
	3					-0.008210875	0.918818575	-0.001109368	0.989333491
	4					0.001066652	0.990295036	-0.00054117	0.995167238
	5					-0.049163302	0.455857766	-0.164278182	0.088109209
	6							0.06972557	0.471418246
	7							-0.005692249	0.955864163
	8							0.017896857	0.867012906
	9							-0.019776513	0.842781538
	10							0.047894336	0.522096058
	Net	0.004569169		0.005946285		0.00192651		0.00643191	
	AIC	-0.198853744		-0.201107414		-0.206490889		-0.208379456	
	ARCH coefficient	0.074926381		0.074378043		0.073910818		0.075834383	
	GARCH coefficient	0.927198666		0.927435702		0.926947932		0.924995466	
Peru	Joint Coefficients Significance	Significant		Significant		Significant		Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	-0.566261301	0.000000	-0.788015814	0.0000	-0.537812627	0.00014	-0.486823144	0.000917783
	1			0.180544297	0.0749	0.647567719	0.00131	0.656614944	0.000801789
	2					0.508099123	0.02116	-0.061312634	0.760685636
	3					-1.118334596	0.00000	-0.145931043	0.476283528
	4					-0.336018801	0.26442	0.426962777	0.067964348
	5					0.49446256	0.00875	-1.163136878	3.50E-06
	6							0.28106378	0.259503904
	7							0.856200224	9.39E-08
	8							-0.802848703	2.75E-06
	9							0.500026543	0.059052167
	10							-0.34877932	0.029337444
	Net	-0.566261301		-0.607471517		-0.342036621		-0.287963453	
	AIC	2.171229989		2.182337721		2.185142102		2.176293887	
	ARCH coefficient	3.93987384		3.682084898		2.790046789		3.649554471	
	GARCH coefficient	0.0203669		0.032744783		0.097936432		0.011968643	
Uruguay	Joint Coefficients Significance	Significant		Significant		Not Significant		Not Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	0.08615749	0.042325507	-0.051986553	0.673244176	-0.055295601	0.677165218	-0.032922137	0.808438106
	1			0.145649354	0.243726242	0.074764947	0.747747175	0.048736424	0.836795193
	2					0.248329898	0.232152491	0.25813272	0.224786579
	3					-0.322171115	0.047952831	-0.344938077	0.049345511
	4					0.148983788	0.354207064	0.126997936	0.45293229
	5					0.003976705	0.974104491	0.150778646	0.509778476
	6							-0.086597361	0.679283962
	7							-0.079207107	0.713813429
	8							-0.074006375	0.738467004
	9							0.248678458	0.084839706
	10							-0.118622043	0.258875179
	Net	0.08615749		0.093662801		0.098588623		0.097031083	
	AIC	0.201124433		0.200920379		0.203566551		0.206876279	
	ARCH coefficient	0.195494866		0.196986767		0.202675235		0.207206059	
	GARCH coefficient	0.868389773		0.868036543		0.865210712		0.86199904	
Venezuela	Joint Coefficients Significance	Significant		Significant		Significant		Significant	
	Theta		Individual P-values		Individual P-values		Individual P-values		Individual P-values
	0	0.025470596	0.00000	-3.180898031	0.00000	-1.186855226	0.000000	-1.020349303	0.00000
	1			3.176970037	0.00000	-2.206228625	0.000446	-2.452303303	0.00003
	2					1.744930661	0.034502	1.82505219	0.02012
	3					-0.657724939	0.285959	-0.626531917	0.34876
	4					-0.724250245	0.266615	1.074468328	0.13585
	5					3.018789094	0.000000	-0.969421207	0.13061
	6							2.251177734	0.00739
	7							-1.660528834	0.03527
	8							2.209443674	0.00047
	9							0.725727025	0.07529
	10							-1.364655071	0.00000
	Net	0.025470596		-0.003927994		-0.011339279		-0.007920684	
	AIC	1.919258352		1.869788277		1.853403142		1.845810312	
	ARCH coefficient	0.618125539		0.451502623		0.554079383		0.567323946	
	GARCH coefficient	0.486709651		0.542198972		0.470941733		0.472348251	

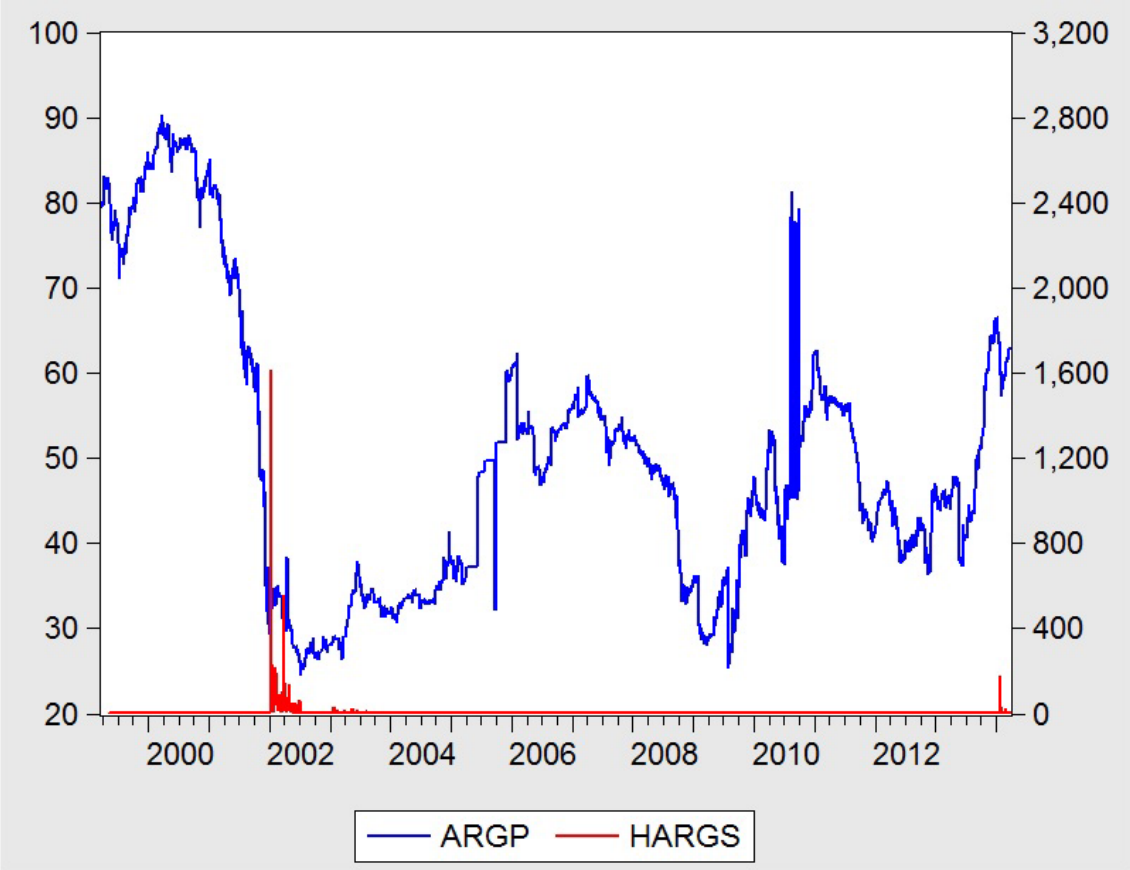
APPENDIX B

GRAPHIC REPRESENTATIONS

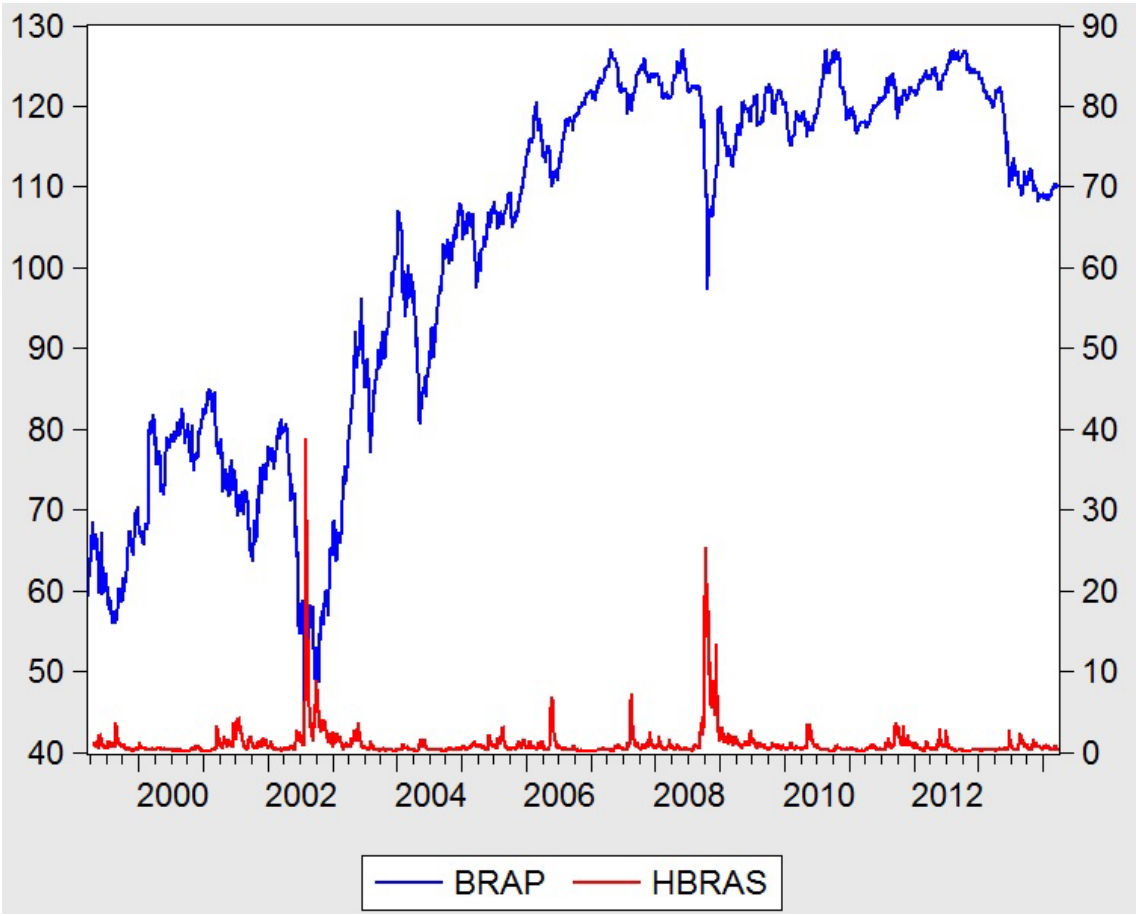
APPENDIX B

Graphic representations of average sovereign debt prices on the open market (argp, brap, chilep, colp, costap, drp, mexp, perup, urugp, venep) against the conditional variances of their currencies which proxy currency uncertainty (hargs, hbras, hchiles, hcols, hcostas, hdrs, hmexs, hperus, hurugs, hvenes)

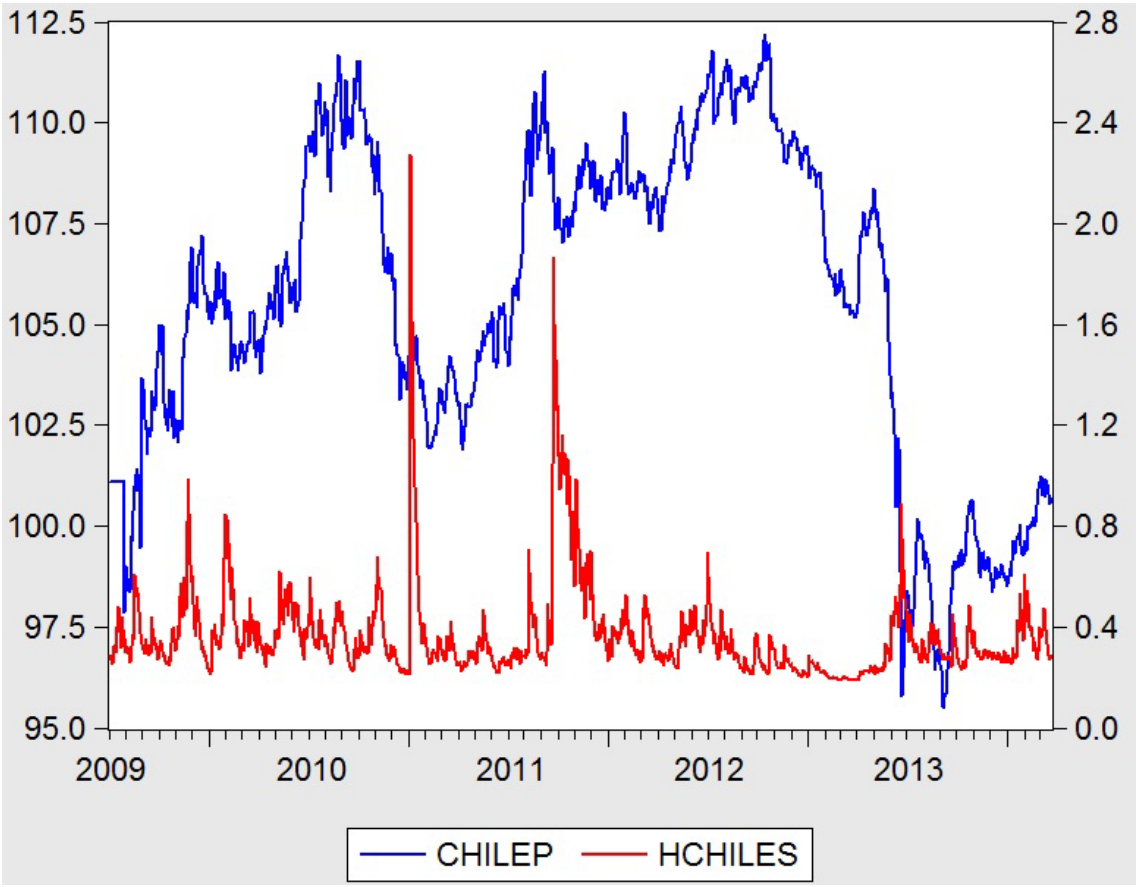
Argentina Price (Blue) vs. Argentina Currency Volatility (Red)



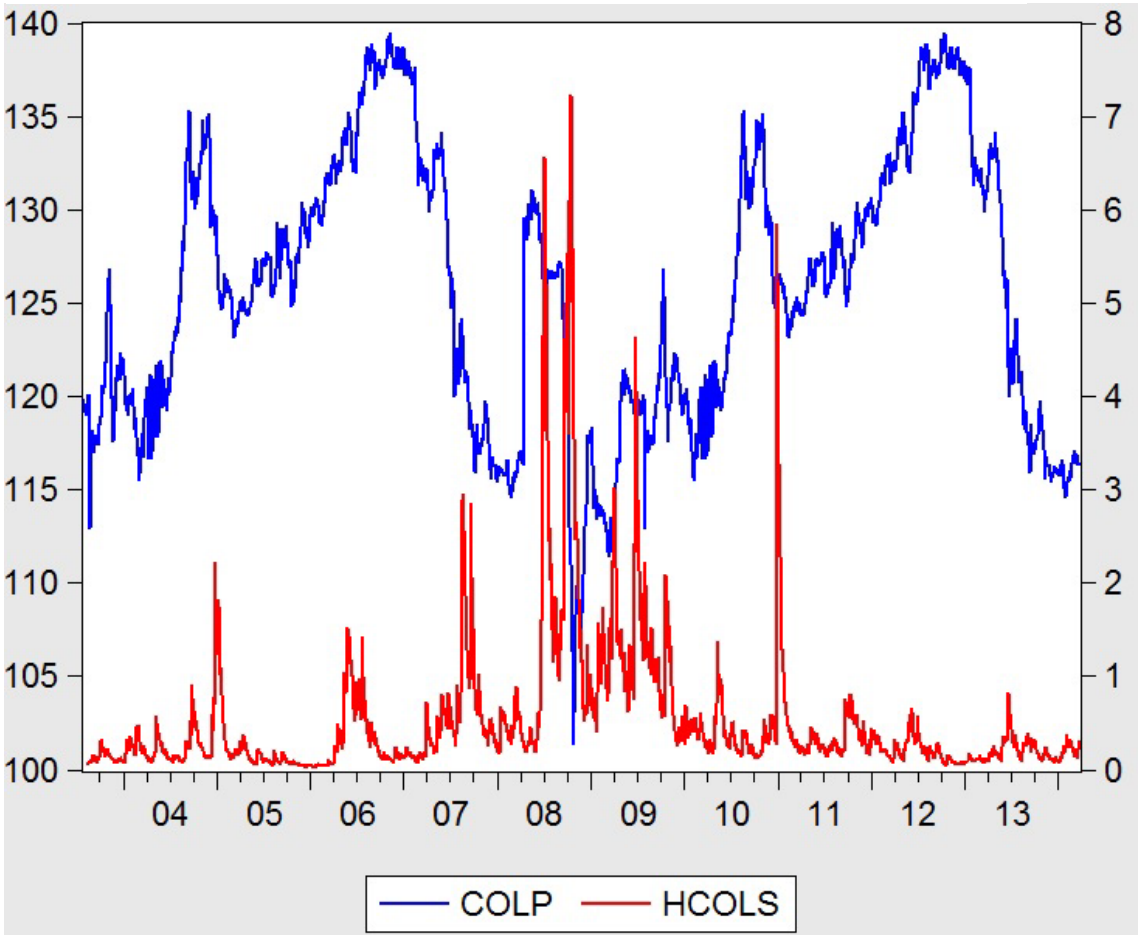
Brazil Price (Blue) vs. Brazil Currency Volatility (Red)



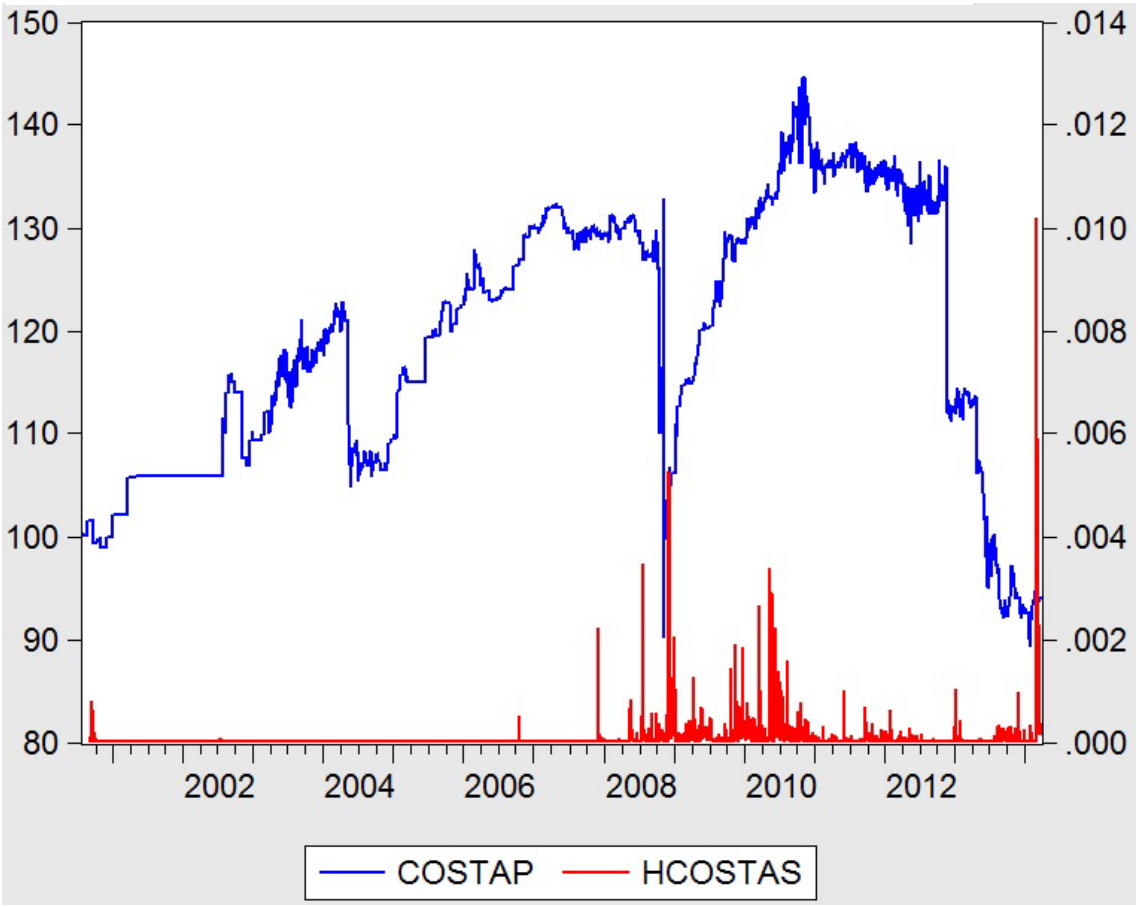
Chile Price (Blue) vs. Chile Currency Volatility (Red)



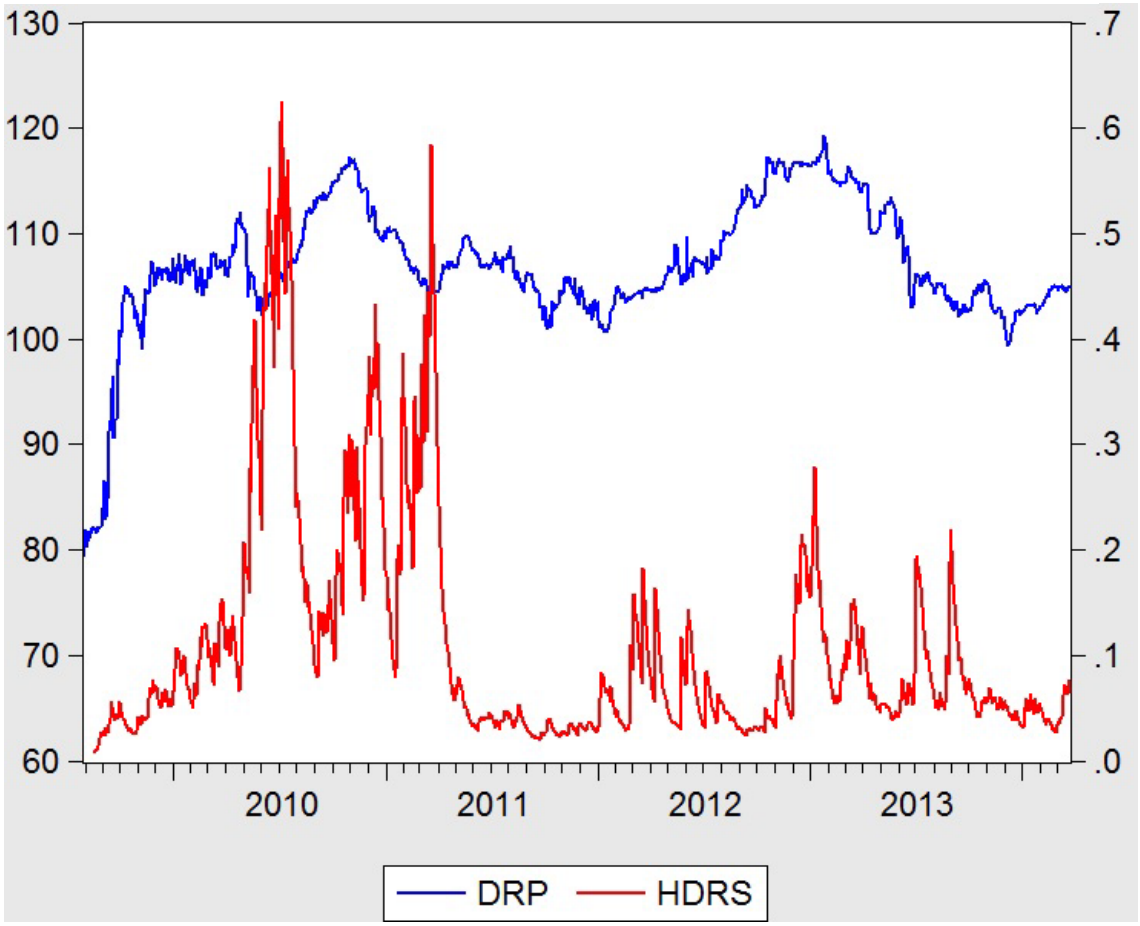
Colombia Price (Blue) vs. Colombia Currency Volatility (Red)



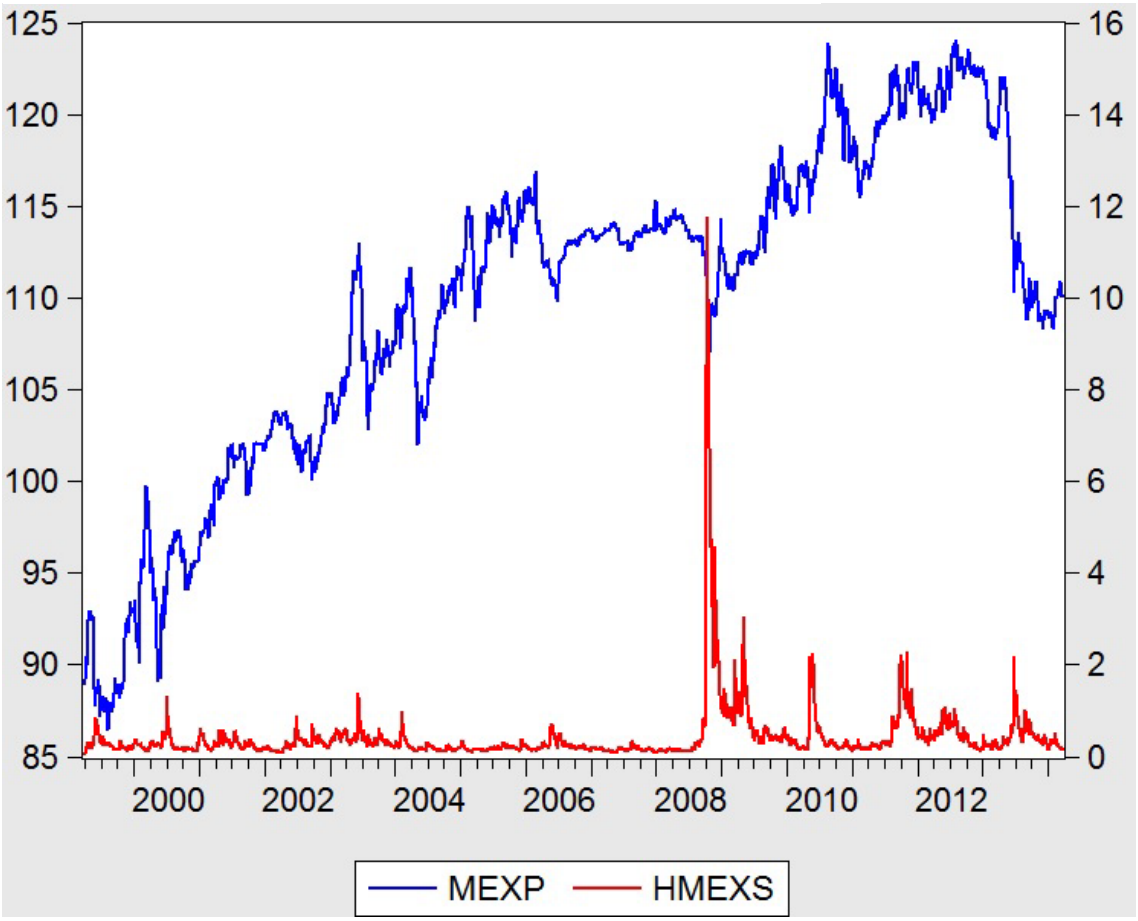
Costa Rica Price (Blue) vs. Costa Rica Currency Volatility (Red)



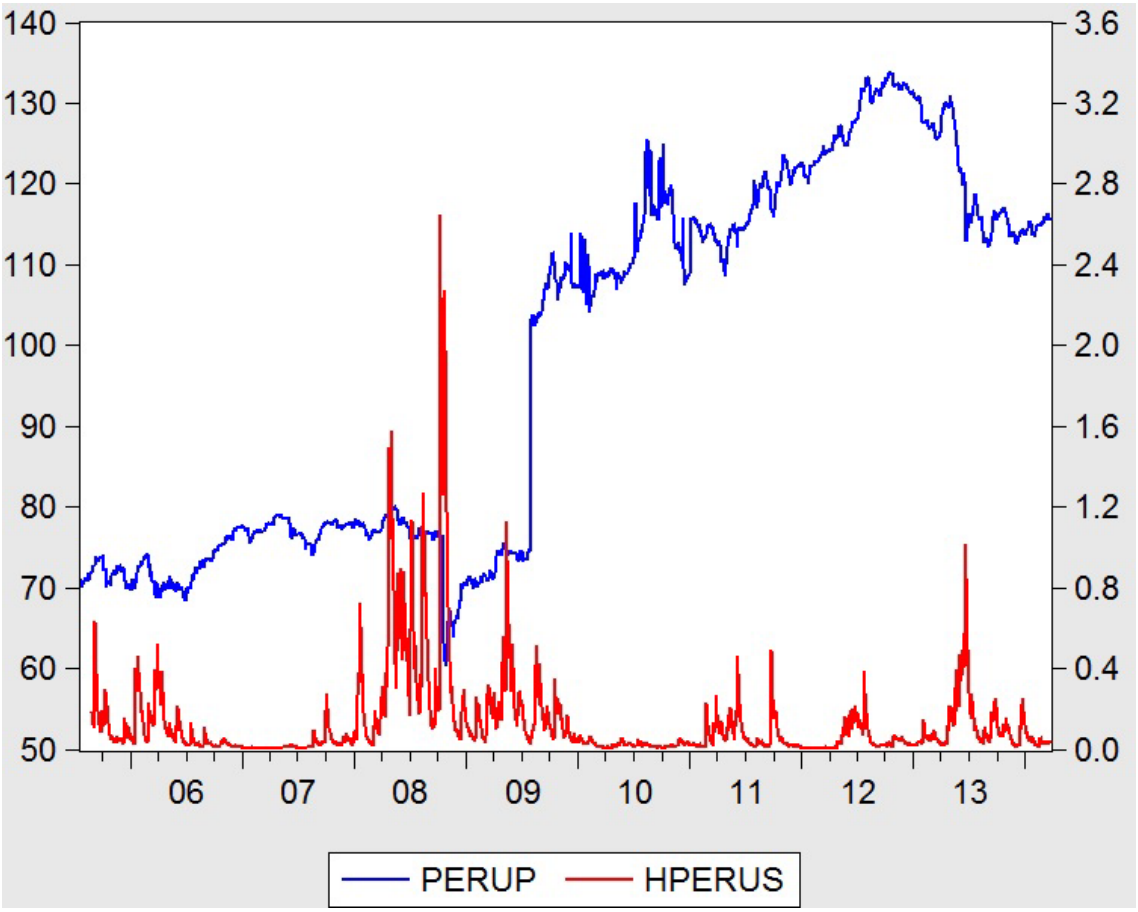
Dominican Republic (Blue) vs. Dominican Republic Currency Volatility (Red)



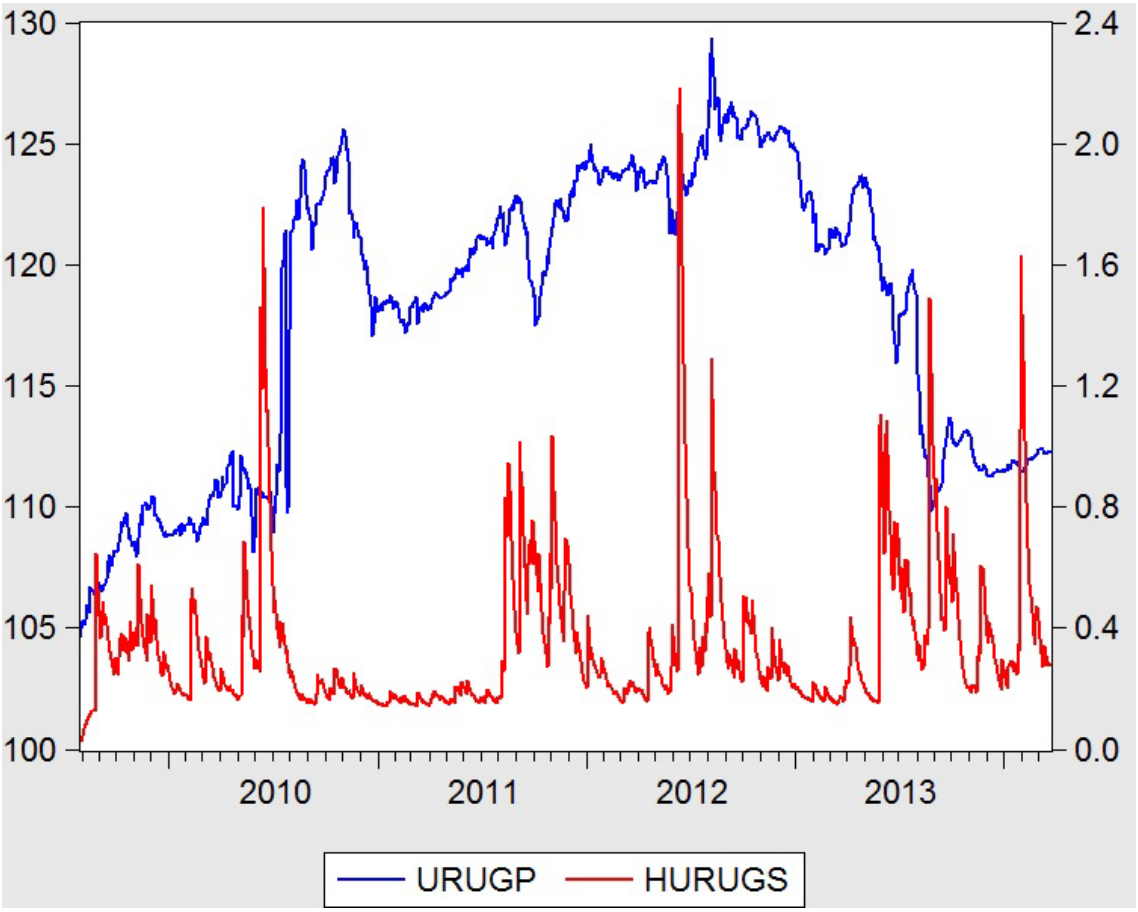
Mexico Price (Blue) vs. Mexico Currency Volatility (Red)



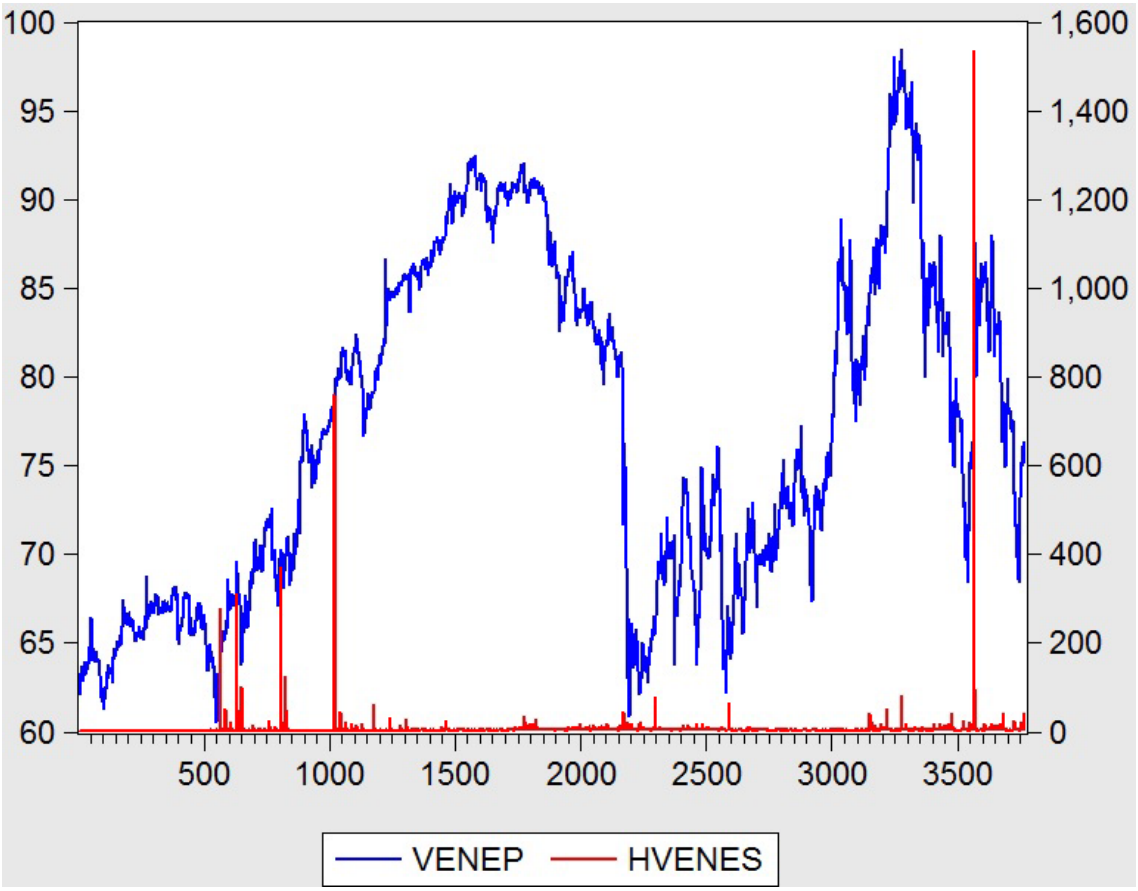
PeruPrice (Blue) vs. PeruCurrency Volatility (Red)



Uruguay Price (Blue) vs. Uruguay Currency Volatility (Red)



Venezuela Price (Blue) vs. Venezuela Currency Volatility (Red)



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BIOGRAPHICAL INFORMATION

Juan Pablo Farah Yacoub is a Venezuelan student-athlete (tennis), Goolsby scholar, and the president of the National Association for Business Economists at UT Arlington. He interned at the Fort Worth Chamber of Commerce as an international business development and research assistant, and at Goldman Sachs & Co. as a derivatives operations analyst. He is the recipient of the 2013 Goldman Sachs Scholarship for Excellence and the Maverick Leadership Award, among other awards, and will begin working at Goldman Sachs in July of 2014. Future plans include a graduate degree in financial economics, macroeconomics or international finance.