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Identification of Driving Factors for Emerging Markets Sovereign Spreads

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Abstract

The objective of this paper is to identify the relationship between sovereign yield spreads and macroeconomic variables in emerging markets. We find that the correlation between spreads and GDP is negative. Real effective exchange rate depreciation enlarges spreads and increasing in risk aversion influences spreads. US treasury yields impact on spreads is changing over time. More recently lower US treasuries yields have driven spreads wider. Last commodity prices are associated with a reduction in emerging market debt spreads.

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1. Introduction

Sovereign yield spreads in the emerging markets are highly volatile. For example, over the period 1994 to 2005, the variance of the Emerging Market Bond Index (i.e., the EMBI, constructed by J. P. Morgan) yield was three times higher than that of the U.S. Treasure bill yield. Part of this volatility is due to events in international financial markets, rather than events in the emerging countries themselves. As to this case, sovereign spreads turn to be the key for emerging countries since they constitute the floor for the cost of external capital. It is important to identify the main driving forces of sovereign spreads. The major factors can be divided into the domestic factors, namely, domestic economic fundamentals and the external factors, such as international interest rates, global economic growth, and global investor's attitude to risk, which is usually referred to as global risk aversion (see, for example, Ferrucci (2007), Garcia-Herrero and Ortiz (2006), Hilscher and Nosbusch (2004, 2007), Jarrow et al. (2005), Mauro et al. (2002), McGuire and Schrijvers (2003), Moser (2006), Paolo et al. (2000), and Sueppel (2005)). In this paper, we propose a methodology to define the fair values for sovereign debt considering both domestic and external factors that drive the volatility of sovereign bond spread and we design a backtesting to verify performance of the method we proposed. We investigate emerging market (noted as EM in this paper) country bond index spreads for 12 countries (i.e., Argentina, Brazil, Colombia, Indonesia, Mexico, the Philippines, Russia, South Africa, Turkey, Ukraine, Uruguay and Venezuela) from 1999 to 2008 [1].

2. Data Description

We use the USD Bank of America Merrill Lynch Emerging Market Sovereign Bond Indices for 12 important emerging sovereign issuers for the sample period of January 1999-October 2008. Each index is a market-weighted average of bond spreads of all outstanding debt of the respected country. The spread (bond yield minus USD swap rate) of each bond is weighted according to the outstanding amount of that bond and then the average is taken over all bonds. The 12 issuers were chosen based on market capitalization and reliability of data. The 12 issuers have the biggest market value of sovereign debt in emerging markets and are included in CDX.EM which is the only and the most liquid tradable credit instrument in emerging markets universe. The CDX.EM index weights have been constant for the last 2 years; however, they could change in the future. We use the current weights for the entire sample.

Our model relies on three key variables (i.e., gross domestic product (GDP), real effective exchange rate (REER), and global investors' risk aversion (RAV)) to explain the evolution of spreads in the long run. For the GDP and real effective exchange rate (REER)[2] data, we use the databank of Bank of America Merrill Lynch. Global investors' risk aversion (RAV) is considered

[1] The Bank of America Merrill Lynch EM Bond Index starts from January 1999 except for Argentina starting from July 2005 and Indonesia from Octorber 1999

[2] Effective exchange rate is weighted average of a basket of foreign currencies, and it can be viewed as an overall

as the indicator of global investors' risk aversion sentiment. RAI is an index constructed by Bank of America Merrill Lynch by combining several financial market factors[3]. It helps to detect contagion and liquidity squeezes in external markets on emerging market debt. The index was built in two stages. First, we used event study to find out the best ingredients and classified them under volatility and credit factors. Second, we found the best weight on each series through a trading simulation, which showed that the best fit was with equal weighting of the risk factors. Expected relation with spreads: Higher level of global investor risk aversion leads to wider spreads.

When investigating the short-run dynamics of spreads (i.e., spreads deviation from their fundamental value due to investor sentiment, market momentum or institutional factors), we include: (1) Monthly change in commodity price, which is measured by the broad Bank of America Merrill Lynch Commodity index [4] and we deflate the price of commodities by using the US CPI and (2) 10-year US Treasury yield, which is used as a benchmark for valuing EM bonds.

Aggregation for market view: We also show aggregate results by creating a basket weighted by the country weights in a commonly used index of sovereign credit default swaps called CDX Emerging Markets (CDX.EM)[5]. The CDX.EM is the most liquid tradable instrument in the market giving the investors a broad exposure to emerging markets credit risk[6].

3 Description of the Methodology

The long-term equilibrium relationship between the country's spreads, it's macro fundamentals (GDP and $REER$), and global investors' level of risk aversion (RAV) can be represented by

measure of the country's external competitiveness. A nominal effective exchange rate (NEER) is weighted with the inverse of the asymptotic trade weights. A real effective exchange rate (REER) adjusts NEER by appropriate foreign price level and deflates by the home country price level.

[3]Bank of America Merrill Lynch Risk Aversion Index (RAI) is constructed using an ARCH(1, 1) model applied to 1m implied volatility of USD-JPY, VIX (US equity market volatility), (US Treasuries implied volatility, 10 years US Treasuries bond spreads (USD swap rates - UST yields), US corporate credit spreads (high grade minus high yield), and bond to equity returns. The residuals of all series are calculated individually using and then aggregated into a single number defined as Risk Aversion Index (RAI). In this paper, we use the RAI as the proxy for the Global investors' risk aversion (RAV).

[4]The Bank of America Merrill Lynch Commodity Index contains six market sectors identified by Bank of America Merrill Lynch, including: Energy, Base Metals, Precious Metals, Grains & Oil Seeds, Livestock and Soft Commodities & Others. Each market sector contains a minimum of two and a maximum of four commodity futures contracts, selected by liquidity. The index is constructed to reflect a broad view of commodities' markets.

[5]The CDX Emerging Markets Index is an aggregate index of sovereign credit default swap of selected emerging market countries. The index is composed of sovereign issuers only and is regarded as an indicator for sovereign credit risk in emerging markets universe. The composition of the EM Index is determined by a consortium of 16 member banks. All entities are domiciled in 3 regions: Latin America; Eastern Europe, the Middle East, and Africa; and Asia. The composition of the index is revised every 6 months in March and September.

[6]It is also referred as the emerging markets default risk.

following equation,

$$\ln[S_{i,t}] = \ln[\mu] + \alpha \ln[GDP_{i,t}] + \beta \ln[REER_{i,t}] + \gamma \ln[RAV_{i,t}] + \varepsilon_{i,t}, \tag{1}$$

Where $\varepsilon_{i,t}$ is the error term, or the difference between Market spreads and what is indicated by its fundamentals. We apply unit root test and cointegration test to validate above model. If the sovereign spreads, the macro fundamentals (GDP and REER) and the investors' global risk aversion are cointegrated, then by the Granger representation theorem (see Engle and Granger (1987)), we can model them as being in an error-correcting relationship. The error-correction mechanism prevents the integrated variables from drifting apart without bound. The error correction model (ECM) can be expressed as follows:

$$\Delta Y_{i,t} = a_{i,t} + \sum_{s=1}^{m} Z_{i,s}\, \Delta Y_{i,t-s} + b\, \varepsilon_{i,t-1} + D_i\, x_i + u_{i,t}. \tag{2}$$

4. Empirical Results

4.1 Results and findings

The performance of EM model shown by Table 1 suggests that in aggregate, sovereign external debt (EXD) spreads overshot the model value and are attractive, with an excess market spread of 329 basis points (i.e., 0.01% also noted as bp) over the model equilibrium spread. This is in contrast to the beginning of the credit crisis in late 2007 and early 2008, as risk aversion and de-leveraging dominated almost all credit markets except EM, which at that time, was thought to have decoupled. Note that we marked the one-standard deviation level in the charts of deviations for a clearer view of when the strong signals appear.

The country results are shown in Table 2. In general, the results confirm the long-run relationship estimated by model, as spread errors appear to be mean-reverting. The results of the Model suggest that: (1) Aggregate EXD spreads are excessively wide by over 300bp; (2) Bonds are cheap in Ukraine, Argentina, Indonesia, Turkey, Philippines, Mexico, and South Africa; and (3) Bonds are expensive in Uruguay and Colombia.

In Table 3, we report the change in the variables we investigated leads to the basis point change in EM bond index spread. We summarize our empirical finding in Figure 1.

4.3 Verification of the method

We define success ratio as the percentage of time when the model generated profitable trading signal. We evaluate how the model would have performed in the past by calculating in-sample and out-of-sample hit ratios. For the in-sample testing, we estimate model coefficients using all the data available to the present. We use these coefficients to calculate past equilibrium spreads. We compare the real direction of spread vs. the forecast direction. For example, if the model predicted that the relative spread would tighten and it actually did within a one month period, it is considered a hit. For the out-of-sample testing, we estimate model coefficients using the data available before the month for which we make a spread ratio forecast. We compare the real direction of spread vs. the forecast direction. Not all buy/sell signals are equal. We restrict our analysis to see the performance of model when we consider signals only of a certain magnitude. In this case, we test for those times when spread errors are larger than one standard deviation, calculated over the period.

We report our results in Table 4. EM indices that for the in-sample testing, the best specification model produces an average hit ratio of 60%. This means that for deviations larger then one standard deviation, the model predicted the right direction of the posterior movement in spreads more than 60% of the time. For the out-of-sample testing, in order to have a reasonably sample size to produce estimations, we initiate projections from January 2003, so that we have four years of data (except for Argentina, Indonesia and Ukraine) when we first start estimating the Model. By the end of the time series, we have 9.5 years of data. The best specification model produces an average hit ratio of 60%. We are able to further improve this ratio by starting the estimations in 2004 (59%) and 2005 (63%). However, the results for 2004 and 2005 have to be taken with caution due to the small frequency of spread errors above one standard deviation.

5. Conclusions

We selected a combination of macroeconomics and market price factors to estimate cointegration models across 12 countries. The model estimates a cointegration framework of Emerging Market bond spreads over US Treasuries against real GDP growth, real effective exchange rates (REER) and global risk aversion. In the short run we added two additional factors; monthly changes in commodity prices and 10-year US treasury yields. We then test for the presence of unit root for all countries in our sample. We apply a cointegrating test and estimate cointegrating equations. Last, we model an error correction mechanism (ECM) against the short run variables. The key findings are that, as expected, the relationship between spreads and GDP is negative. REER tends to have a different impact across countries. Overall, a REER depreciation leads to a widening of spreads in nine out of 12 countries (or 75% of the times). While in all countries an increase in risk aversion has driven spreads, this phenomenon is even more pronounced in countries with higher spread volatility such as Venezuela and Argentina. US treasury yields impact on spreads changed over time. More recently lower US treasuries yields have driven spreads wider. Last commodity prices are associated with a reduction in EM debt spreads. Our model also shows a hit ratio of 60% in terms of EM debt spreads direction of posterior movements.

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Table 1: EM bond index spread over the last 12 months - market and equilibrium. As of 18 November 2008. Weighted average using weights in the CDX.EM index, scaled up to 100%.)

	Actual market spread	Equilibrium spread	Difference
Nov 2008	**953**	**624**	**329**
Oct 2008	894	455	439
Sep 2008	477	287	190
Aug 2008	341	302	40
Jul 2008	317	286	31
Jun 2008	326	292	34
May 2008	264	258	5
Apr 2008	287	428	-141
Mar 2008	327	517	-190
Feb 2008	305	508	-203
Jan 2008	277	448	-171
Dec 2007	246	399	-153
Nov 2007	253	307	-54

Table 2: EM bonds - actual, equilibrium and deviation. Weighted average using weights in the CDX.EM index.

	Actual market spread	Equilibrium spread	Market-model spread error (bp)
Argentina	1821	897	924
Brazil	434	319	115
Colombia	576	750	-174
Indonesia	1059	462	597
Mexico	428	120	308
Philippines	668	342	326
Russia	663	589	74
South Africa	852	567	285
Turkey	762	406	356
Ukraine	2273	1102	1171
Uruguay	721	988	-267
Venezuela	1546	1445	119
Weighted Average	**953**	**624**	**329**

Table 3: A change in the variables (i.e., GDP, REER, RAV, Commodity price, and US treasuries) leads to the basis point change in EM bond index spread. Increase in REER means appreciation.

	GDP 1%	REER 1%	RAV 1 std	Commod 10%	10-y-UST 10bp
Argentina	-89	50	798	n.a.	n.a.
Brazil	n.a.	-13	104	-81	-2
Colombia	-25	8	369	n.a.	n.a.
Indonesia	n.a.	-15	366	-277	-7
Mexico	-18	-8	53	n.a.	n.a.
Philippines	-5	-14	101	-28	-14
Russia	n.a.	-16	363	-109	-8
South Africa	-11	5	479	-28	-4
Turkey	n.a.	-35	87	-93	-8
Ukraine	-29	-22	1370	-52	26
Uruguay	-14	-52	379	n.a.	n.a.
Venezuela	n.a.	-51	1367	-494	-10
Average	**-27**	**-13**	**486**	**-145**	**-3**

Table 4: EM bond index spread forecast evaluation - hit rate. Predicted on samples starting at the beginning of 1999 and reaching through the month prior to forecasted month. Argentina data prediction started in July 2005 with one year of data and Indonesia and Ukraine forecast started at the same time as other countries and hence had only two years of data. Ratio of months for which forecast indicated correct direction to total months forecasted. Ratio returns that were correctly predicted when spread error of the model was one standard deviation above mean for rolling three years of sample or as much is available at the start of the series.

	In-Sample 1999	Out-of-Sample 2003	Out-of-Sample 2004	Out-of-Sample 2005
Argentina	76%	n.a.	n.a.	n.a.
Brazil	53%	67%	57%	54%
Colombia	66%	65%	64%	67%
Indonesia	55%	48%	54%	57%
Mexico	62%	75%	67%	83%
Philippines	64%	75%	73%	78%
Russia	44%	50%	57%	50%
South Africa	68%	83%	87%	85%
Turkey	68%	46%	44%	46%
Ukraine	57%	65%	64%	60%
Uruguay	57%	41%	50%	50%
Venezuela	64%	44%	36%	60%
Average	**60%**	**60%**	**59%**	**63%**

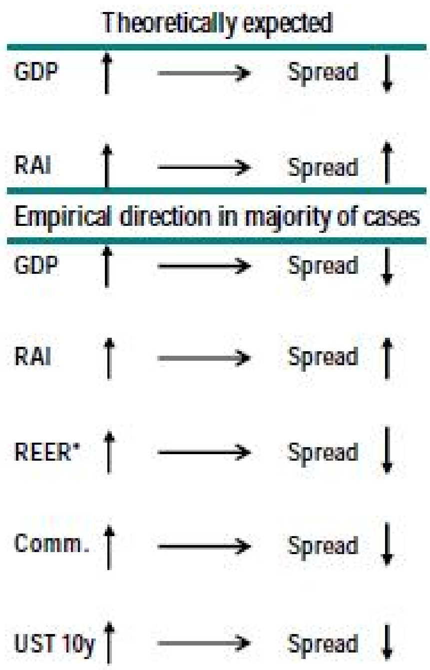

Figure 1: Model dynamics - expected and empirical effects on spreads. Not a strong theoretical prior regarding the effects of REER on spreads. Increase in REER means appreciation.