

VULNERABILITY OF EMERGING MARKETS TO GLOBAL RISK SHOCKS: THE ROLE OF DEBT AND GOVERNANCE ON SOVEREIGN SPREADS^δ

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ABSTRACT

The determinants of 24 emerging markets sovereign spreads from 1998-2005 are analyzed with a panel data model. The model, corrected for heteroskedasticity and autocorrelation, determines the countries' vulnerability to global risk shocks. Total Government Debt/GDP and governance indicators, such as Regulatory Quality, successfully explained the level and sensitiveness of all sovereign spreads. While supporting the assertion that global liquidity and low risk aversion have been the main drivers for the general fall of spreads after 2003, emerging markets' responses to adverse external shocks are country specific and can be mitigated by improving debt and governance indices.

^δ The authors thank Ajax Moreira, Fabio Giambiagi and Claudio Ferraz from IPEA for their valuable input during this work, and Otavio Ladeira and his team from the Public Debt Strategic Planning of the Brazilian National Treasury Secretariat for the excellent debate on the theme.

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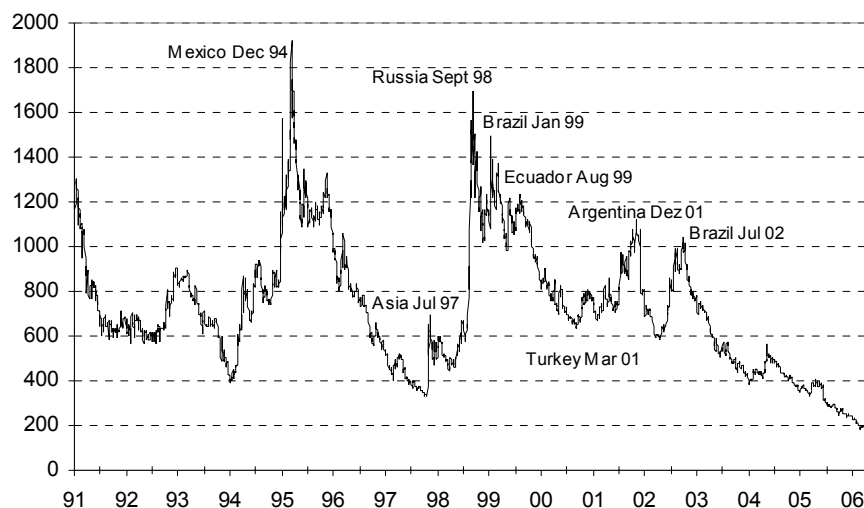
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Key words: Sovereign Spreads, Emerging Economies' Vulnerability, Global Risk Shocks, Governance Indicators

JEL: E43,G15,F01

Emerging markets have been enjoying an extremely favorable economic climate generated by high global financial liquidity in the past three years. In 2006, for example, the abundant liquidity and the overall positive economic performance of these countries led to the lowest sovereign spreads in history (measured by the EMBI+¹), falling below 200 basis points, as shown in Figure 1.

Figure 1 – Evolution of EMBI+ stripped spreads (bp)



Source: JP Morgan

Among the mechanisms contributing to this process are: a) the low interest rates in mature markets (US, UK, Europe and Japan), until recently declining due to the bursting of the dotcom bubble in 2000, b) the steep yield curve, providing incentives for carrying leveraged positions, and c) the low long-term interest rates in the US relative to the country's economic growth rate.

¹ J.P. Morgan Emerging Markets Bond Index Plus.

The favorable liquidity conditions, together with the reduced risk aversion that it creates, have encouraged global institutional investors to take strategic positions in emerging markets, thus narrowing the spreads even more. Furthermore, the average credit classification provided by international rating agencies for the countries composing the EMBI+ has gone up to the highest level ever (Ba1/BB+ as of September 2006), expanding the base of investors even more. This scenario has allowed emerging economies to finance their debt via local currency issues in the domestic and foreign markets, thus allowing them to improve the composition of their public debt by extending its maturity profile, reduce the proportion denominated in foreign currency and/or accumulate reserves.

Nevertheless, the crucial question for emerging markets is whether the current level of sovereign spreads is sustainable in the face of a potential reversal of cyclical factors such as those involving liquidity, changes in market risk perception, and uncertainties regarding a general economic slowdown triggered by high oil and commodity prices.

The empirical literature on the determinants of sovereign spreads has dramatically increased, especially after the Asian and Russian crises (1997–1998). While most studies initially concentrated on the macroeconomic fundamentals determining sovereign risk or rating, increasing attention is now being paid to the influence of external shocks related to international liquidity and investors' risk appetite. More recently, the debate has also turned to the influence of several governance indicators in determining country risk. Studies such as Calvo, Leiderman and Reinhart (1993), Dooley, Fernandez-Arias, and Kletzer (1996) and Barr and Pesaran (1997) emphasize the importance of external shocks, primarily in

international interest rates, when determining capital flows to emerging economies, since an increase in mature markets' interest rates would imply higher current and future debt financing costs. Among the contributions identifying the influence of macro-based variables on sovereign spreads, the most important to mention are the works of Min (1998), Eichengreen and Mody (1998) and Kamin and von Kleist (1999). As a general rule, these studies evidence that sovereign spreads in the 1990s declined more than the country's fundamentals were able to explain, but fail to establish a significant relationship with external shocks. More recent studies, such as Arora and Cerisola (2001) and Ferrucci (2003), establish not only the influence of macroeconomic fundamentals but also the effect of US monetary policy on sovereign spreads, finding a positive correlation between these factors. Calvo (2003) points out that domestic factors are not the sole determinants of emerging market crises and notes the country specific vulnerability, since some countries enter into deep crisis while others remain unscathed in the presence of a common external shock. McGuire and Schrijvers (2003), following Litterman and Scheinkman (1991), apply a principal component analysis, concluding that a single common factor related to investors' risk perception (measured by the VIX Index²) explains approximately 80% of the common spread variations. The analysis

² The VIX Index, sometimes called the "investor fear gauge", was first introduced in 1993 by the Chicago Board Option Exchange to reflect the 30-day expected volatility of eight S&P100 at-the-money call and put options. It was expanded in 2003 to include a broader range of options based on the S&P500, considering various weights on options prices with diverse strike prices.

presented in the *Global Finance Stability Report* (2004) suggests that external shocks have become more important than fundamentals after September 2001 for estimating sovereign spreads, pointing to the VIX Index as the key factor for determining the spreads in the period analyzed (1994 to 2003). Finally, Kashiwase and Kodres (2005) conclude that country's rating, global risk aversion, and the US monetary policy expectations are the main drivers of sovereign spreads.

The objective of this study is to determine, based on a panel data model composed of the spreads of 24 emerging-market countries in the period 1998–2005, which sovereigns are more vulnerable to a global risk aversion shock. In order to minimize the contagion effects and market corrections in the face of possible shocks, we estimate the influence of several macroeconomic fundamentals and governance indices on the level and sensitiveness of sovereign spreads, thus providing guidance for policymakers. We also contribute to the current research on the determinants of sovereign spreads by trying to identify the relative importance of external factors versus macroeconomic fundamentals in narrowing sovereign spreads, particularly after 2003.

This study differs from others in various ways. First, the model analyzes the spreads for 24 emerging markets by means of a fixed-effects panel with daily data, while previous studies focus on a particular country or on emerging economies at an aggregate level. The panel implemented uses the HAC³ matrix proposed by Newey and West (1987) for a panel model with heteroskedasticity and autocorrelation, and allows more generality in the autocorrelation level, which is not

³ HAC stands for heteroskedastic and autocorrelation consistent.

found in other estimation routines such as PCSE (Panel Corrected Standard Errors) or FGLS (Feasible Generalized Least Squares). Second, the proposed model does not resort to autoregressive forms in order to explain the dependent variable (interest rate), a common approach for determining sovereign spreads that significantly raises the coefficient of fit (R^2). Third, the model uses macroeconomic fundamentals and governance indicators specific to each country as explanatory variables, instead of proxies for repayment capacity. These proxies, generally ratings or other holistic constructs, are usually subject to criticism regarding the methodology for scale conversion or their ability to predict currency crises in emerging economies⁴.

Additionally, the proposed model analyzes country-specific sensitivity to a global risk aversion shock. Such sensitivity is further decomposed into economic fundamentals and governance indicators, with the objective of assessing whether and to what extent the country vulnerability can be mitigated by improving such variables.

The 24 countries considered in this study made up over 97% of the market capitalization of the EMBIG⁵ in December 2005, as shown in Table 1.

⁴ See Reinhart (2002).

⁵ J.P. Morgan Emerging Markets Bond Index Global.

Table 1: EMBIG – Market Capitalization

Country	Share (%)	Country	Share (%)
Brazil	19.3	Argentina	1.6
Mexico	17.5	South Africa	1.6
Russia	13.0	Lebanon	1.6
Turkey	7.5	Ecuador	1.3
Venezuela	6.3	Indonesia	1.3
Philippines	6.1	Poland	1.2
Colombia	3.0	Uruguay	1.1
Malaysia	2.9	Nigeria	1.0
Peru	2.6	Ukraine	1.0
China	2.5	El Salvador	0.8
Panama	1.8	Bulgaria	0.5
Chile	1.8	Hungary	0.5
Total		97.8	

Source: JP Morgan

The article is organized as follows. The next section describes the variables used in the study. Section II identifies the sensitiveness of each sovereign spread to a global risk aversion shock. Sections III and IV investigate the relevance of the indebtedness and governance indicators, respectively, for determining the level of the spreads, while Section V focuses on whether country-specific vulnerability to external shocks is related to indebtedness and governance. Section VI identifies via variance decomposition the relative importance of global financial liquidity factors on narrowing sovereign spreads, particularly after 2003. Finally, the last section concludes.

I. DETERMINANTS OF THE SPREADS

The next subsections describe the variables used in this study.

A. DEPENDENT VARIABLE: SOVEREIGN RISK

The dependent variable is represented by the daily EMBIG sovereign spreads of the 24 emerging-market countries considered. As described in J.P. Morgan (2004), the EMBIG is constructed by weighting the market value of US dollar denominated Brady bonds, Eurobonds and traded loans issued by sovereign or quasi-sovereign entities. This index relaxes some liquidity criteria of the EMBI and EMBI+, including more countries and instruments in its composition. Sovereign spreads are defined as the difference, in basis points, between a risky bond issued by a sovereign entity and a risk-free instrument with similar characteristics (US government securities of the same maturity). The data used refer to stripped spreads, where the present value of the flow of collateral is removed, since collateral is equivalent to a type of insurance not subject to sovereign risk. We added dummy variables for spreads above 2500 basis points in countries that experienced either long or severe moratorium crises, such as Russia, Ecuador, and Argentina; or short ones, such in Panama, Nigeria and Venezuela.

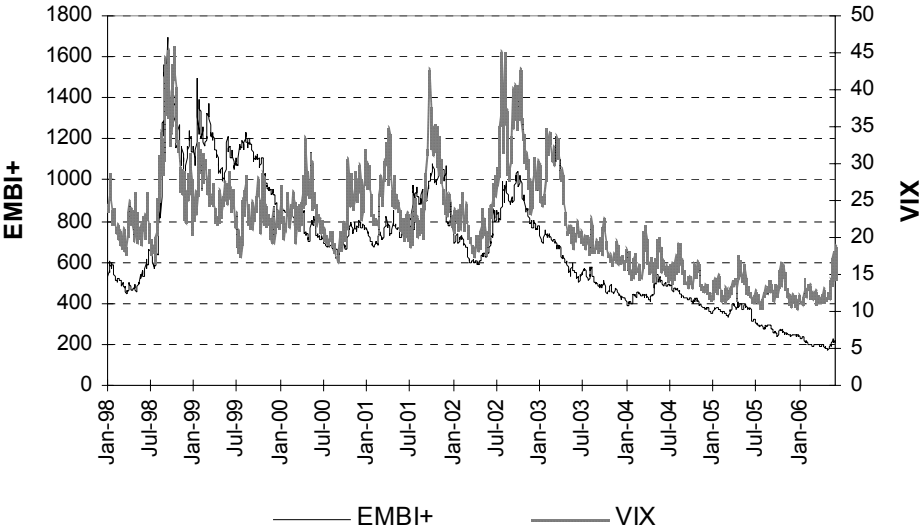
B. EXPLANATORY VARIABLE I: GLOBAL RISK AVERSION

Global liquidity and risk aversion are strongly linked. The US short-term interest rate and the slope of the US yield curve are usual variables employed to represent global liquidity scenarios. The rationale behind this argument is that a low short-term interest rate and a steep yield curve prompts investors to be carry traders,

borrowing at low short-term rates to invest in higher-yielding assets (“*the search for yield*”), thus squeezing the spreads of corporate and sovereign bonds in both developed and emerging markets.

Notwithstanding the interest rate, recent research suggests that the market’s risk premium (investors’ risk perception) also influences the general level of spreads. The VIX Index and the return on US corporate high-yielding bonds are widely accepted proxy variables to represent market risk perception. In this study, we use the VIX as the global risk aversion index. The evolution of the VIX Index vis-à-vis the EMBI+ spreads is presented in Figure 2, showing a strong relationship.

Figure 2 – VIX(%) vs. EMBI+(bp)



Source: JP Morgan and CBOE

C. EXPLANATORY VARIABLE II: FUNDAMENTALS

Several macroeconomic fundamentals have been used in the literature on determinants of sovereign ratings or spreads: per capita income, real GDP growth,

inflation, fiscal balance/GDP, current account balance/GDP, level of development, and history of default, among others.

In this paper we select total government debt/GDP, which represents the total of each government's obligations in relation to its tax basis, as the primary economic fundamental. This choice was motivated by its widespread popularity in the empirical literature⁶, while it also has the advantage of being less sensitive to the effects of liquidity because it is a stock variable calculated at the end of the fiscal year. According to the definition in Moody's (2005), total government debt includes the consolidated budgets of the central, state/regional and local governments, the social security system, and other extra-budgetary funds for non-commercial activities. The concept excludes loans and refinancing of government controlled corporations, except financial transfers in the form of subsidies. Appendix A presents the total government debt/GDP ratios of the emerging markets considered.

D. EXPLANATORY VARIABLE III: GOVERNANCE INDICATORS

We use the following governance variables, introduced by Kaufmann, Kraay and Mastruzzi (2005): a) Government Effectiveness – to measure the competence of the bureaucratic machinery, quality of public services, independence in the face of political pressures, credibility and commitment of the government; b) Regulatory Quality – to measure the incidence of interventionist policies such as over-

⁶ See Codogno, Favero and Missale (2003); and Bernoth, von Hagen and Schuknecht (2004).

regulation, price controls, inadequate bank supervision, bottlenecks to foreign trade or feasibility of doing business; c) Rule of Law – to measure judicial efficiency, reliability and predictability as well as performance and respect for contracts; and d) Control of Corruption – to measure the level of bribery, intimidation, extortion and other forms of official corruption and abuse of power. These indicators, estimated through various methodologies, are based on hundreds of individual variables from different sources that gauge the perception of governance. Appendix B presents the governance indicators of the emerging-market countries considered in this study.

II. VULNERABILITY OF EMERGING ECONOMIES TO GLOBAL RISK AVERSION SHOCKS

In order to isolate the effect of a global risk aversion shock, we estimate the fixed effect panel (1) based on daily data from two distinct periods: a) January 1998 to December 2005, and b) January 2003 to December 2005; the latter encompassing the current liquidity period. This analysis allows us to investigate whether and how sovereigns' vulnerability to external shock have changed over time. The panel model is:

$$SPD_{i,t} = \alpha_i + \beta_i VIX_t + CD_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $SPD_{i,t}$ stands for the spread of country i at time t , VIX_t is the VIX Index, and $CD_{i,t}$ represents a crisis dummy, which takes value 1 for spreads above 2500 basis points and 0 otherwise. In the face of heteroskedasticity and serial autocorrelation

of the residuals, we implement the estimation using OLS with the proper correction for each problem⁷.

Table 2 presents the results. All β_i coefficients are significant (p -value < 0.01) and of the expected sign (the higher the VIX Index, the greater the spread) for every country and both periods, with a high R^2 (94.7% for the first period, and 99.1% for the second).

Table 2: Global Risk Aversion

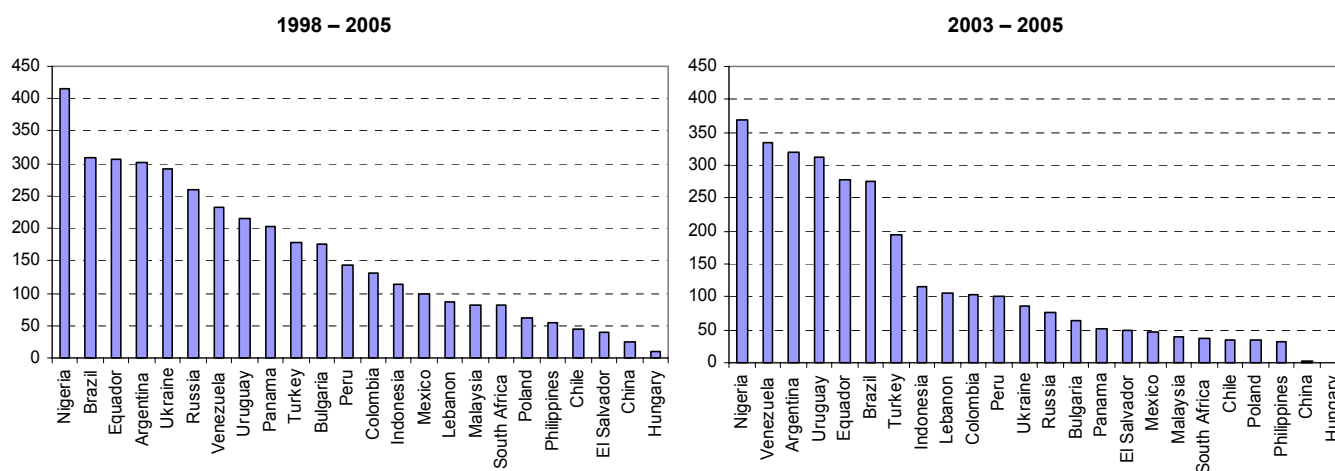
Country i	1998–2005				2003–2005			
	α_i	p -value	β_i	p -value	α_i	p -value	β_i	p -value
Argentina	-224.22	0.00	39.14	0.00	-39.69	0.527	41.66	0.00
Brazil	-119.54	0.00	40.09	0.00	-37.53	0.046	35.82	0.00
Bulgaria	-55.94	0.119	22.73	0.00	5.07	0.529	8.32	0.00
Chile	10.51	0.011	5.76	0.00	11.03	0.00	4.57	0.00
China	33.07	0.00	3.25	0.00	56.85	0.00	0.22	0.00
Colombia	134.19	0.00	16.96	0.00	177.96	0.00	13.56	0.00
El Salvador	187.20	0.00	5.25	0.00	172.30	0.00	6.23	0.00
Ecuador	255.69	0.00	39.83	0.00	263.67	0.00	36.09	0.00
Hungary	38.12	0.00	1.31	0.00	51.48	0.00	-0.87	0.00
Indonesia	88.85	0.00	14.85	0.00	88.85	0.00	14.85	0.00
Lebanon	154.76	0.00	11.31	0.00	157.69	0.00	13.77	0.00
Malaysia	-22.86	0.304	10.57	0.00	28.39	0.00	4.98	0.00
Mexico	47.15	0.009	12.92	0.00	94.50	0.00	6.14	0.00
Nigeria	-173.83	0.00	53.99	0.00	-198.30	0.00	47.85	0.00
Panama	-104.47	0.039	26.19	0.00	199.48	0.00	6.85	0.00
Peru	69.59	0.00	18.48	0.00	116.43	0.00	13.00	0.00
Philippines	303.57	0.00	7.11	0.00	367.24	0.00	4.09	0.00
Poland	-14.10	0.046	7.88	0.00	-4.89	0.063	4.42	0.00
Russia	-155.06	0.007	33.77	0.00	73.92	0.00	9.93	0.00
South Africa	20.46	0.111	10.51	0.00	50.75	0.00	4.94	0.00
Turkey	23.96	0.036	23.21	0.00	-26.67	0.209	25.38	0.00
Ukraine	-94.72	0.123	38.03	0.00	95.10	0.00	11.14	0.00

⁷ We estimated all panels using Stata v8.0 by executing the *ivreg2* routine, which implements the HAC (heteroskedastic and autocorrelation consistent) matrix (as suggested by Newey and West (1987)). As suggested by Wooldridge (2004), we also conducted the serial correlation test.

Uruguay	52.63	0.119	27.84	0.00	-90.28	0.00	40.44	0.00
Venezuela	129.52	0.00	30.25	0.00	-99.87	0.00	43.53	0.00
CD_{AR}	4689.51	0.00	-	-	4496.24	0.00	-	-
CD_{EQ}	2325.81	0.00	-	-	-	-	-	-
CD_{NGR}	754.92	0.00	-	-	-	-	-	-
CD_{PA}	1647.96	0.00	-	-	-	-	-	-
CD_{RU}	3426.53	0.00	-	-	-	-	-	-
CD_{VNZ}	1110.94	0.00	-	-	-	-	-	-
R^2	0.947				R^2	0.991		
Root MSE	257				Root MSE	102		
No.of obs	43199				No.of obs	17672		
Akaike (AIC)	13.092				Akaike (AIC)	10.558		
Schwarz(SC)	13.102				Schwarz(SC)	10.580		
HQ	13.095				HQ	10.565		

Figure 3 illustrates the vulnerability rank of emerging economies by showing the effect on the sovereign spreads given a one standard deviation shock in the VIX Index ⁸.

Figure 3 – Vulnerability to a VIX Shock (in basis point)



In the 1998-2005 period, 58% of the countries show an increase of more than 100 basis points in their spread due to the VIX shock, while only four countries (Chile,

⁸ One standard deviation shock on the 2005 VIX index leads to the global risk perception as of 2003.

El Salvador, China and Hungary) have a variation of at most 50 basis points. For the 2003-2005 period, the results indicate an overall reduction of the countries' vulnerability (mainly due to the excess liquidity scenario and improvement in countries' fundamentals) and a rebalancing in ranking, with Argentina, Venezuela, Uruguay, Turkey and Lebanon increasing their elasticities and Russia, Ukraine and Brazil decreasing theirs (mainly due to the recovery after both the Russian crisis and the Brazilian 2002 election sentiment).

III. DOES INDEBTEDNESS EXPLAIN THE SPREADS?

The following panel analyzes the explanatory power of the countries' indebtedness level on sovereign spreads for the period from 1998 to 2005:

$$SPD_{i,t} = \underbrace{\alpha_{1i} + \alpha_2 F_{i,a}^D}_{\alpha_i} + \beta_i VIX_t + CD_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $SPD_{i,t}$ represents the daily spread of country i at time t , VIX_t is the VIX Index, $F_{i,a}^D$ equals the total government debt/GDP of country i in year a , and $CD_{i,t}$ represents the crisis dummy described in the previous section. The main difference between panels (2) and (1) is that the fixed effect α_i is taken as a function of the fundamentals in the latter instead of being exogenous, therefore making the model more restricted.

The results of this panel⁹ are presented in Table 3 and show a high R^2 (93.40%), even with the adoption of low frequency annual data as economic fundamentals to explain the high-frequency daily spreads. Indebtedness explains the level of sovereign spreads throughout the period analyzed, with an estimated coefficient α_2 of 8.50 and of the expected sign (the higher the indebtedness, the greater the spread). Hence, a reduction of 10% in the debt level would decrease the spreads by 85 basis points. Moreover, all elasticity coefficients are significant and have the expected sign for all the countries.

⁹ In addition to heteroskedasticity, this panel also presents autocorrelation of residuals due to the annual frequency of the indebtedness data. We used the *areg* routine in Stata for the estimation by using OLS with robust standard errors to correct for heteroskedasticity and clusters to correct for autocorrelation of residuals.

Table 3: Indebtedness vs. Spreads

Country i	α_{1i}	p -value	β_i	p -value
Argentina	-207.19	0.00	37.95	0.00
Brazil	-318.42	0.00	41.22	0.00
Bulgaria	89.29	0.00	12.87	0.00
Chile	347.14	0.00	3.78	0.00
China	252.14	0.00	3.80	0.00
Colombia	85.92	0.00	18.29	0.00
El Salvador	241.65	0.00	5.93	0.00
Ecuador	308.81	0.00	35.09	0.00
Hungary	-45.01	0.00	1.96	0.00
Indonesia	132.75	0.00	9.05	0.00
Lebanon	-899.17	0.00	20.39	0.00
Malaysia	-22.93	0.00	12.11	0.00
Mexico	248.69	0.00	10.53	0.00
Panama	-343.15	0.00	29.54	0.00
Peru	139.58	0.00	17.45	0.00
Philippines	44.65	0.00	10.38	0.00
Poland	-38.55	0.00	9.79	0.00
Russia	102.03	0.00	25.97	0.00
South Africa	114.76	0.00	8.24	0.00
Turkey	-113.40	0.00	20.52	0.00
Ukraine	146.83	0.00	33.43	0.00
Uruguay	-194.87	0.00	28.76	0.00
Venezuela	138.08	0.00	34.08	0.00
α_2	8.50	0.00		
constant	-400.65	0.00		
CD_{AR}	4057.10	0.00		
CD_{EQ}	2127.75	0.00		
CD_{NGR}	(dropped)			
CD_{PA}	1556.79	0.00		
CD_{RU}	3203.61	0.00		
CD_{VNZ}	1097.20	0.00		
R^2	0.934		Akaike (AIC)	12.966
Root MSE	236.36		Schwarz(SC)	12.972
No. of obs	40951		HQ	12.968

IV. DOES GOVERNANCE EXPLAIN THE SPREADS?

The role of the governance indices as determinants of sovereign spreads is still little discussed in the literature. Panel (3) is implemented for each of the indicators presented in Kaufmann, Kraay and Mastruzzi (2005) individually¹⁰ and for the period from 1998 to 2005. According to the results, we selected the Regulatory Quality index because it had the highest coefficient of fit R^2 (92.40%):

$$SPD_{i,t} = \underbrace{\alpha_{1i} + \alpha_2 F_{i,a}^G}_{\alpha_i} + \beta_i VIX_t + CD_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $SPD_{i,t}$ stands for the daily spread of country i at time t , VIX_t is the VIX Index, $F_{i,a}^G$ equals the governance index of country i in year a , and $CD_{i,t}$ represents the crisis dummy described above.

The results in Table 4 show a significant governance coefficient with the expected sign, i.e., the spreads diminish with an increase in the Regulatory Quality composite index. Thus, efforts to achieve greater transparency in terms of governance have a significant impact on reducing the country risk and the corresponding cost of capital.

¹⁰ This panel also presents heteroskedasticity and autocorrelation of residuals due to the low annual frequency of the governance data. As before, we used the *areg* estimation routine.

Table 4: Governance vs. Spreads

Country i	α_{1i}	p -value	β_i	p -value
Argentina	-253.69	0.00	42.67	0.00
Brazil	-149.29	0.00	41.55	0.00
Bulgaria	51.34	0.00	20.52	0.00
Chile	292.12	0.00	4.75	0.00
China	-80.28	0.00	4.16	0.00
Colombia	105.43	0.00	17.23	0.00
El Salvador	-26.49	0.00	6.57	0.00
Ecuador	241.34	0.00	44.07	0.00
Hungary	247.48	0.00	0.86	0.00
Indonesia	-58.34	0.00	15.18	0.00
Lebanon	49.00	0.00	13.72	0.00
Malaysia	58.91	0.00	9.70	0.00
Mexico	89.86	0.00	14.16	0.00
Nigeria	-483.08	0.00	57.33	0.00
Panama	-108.39	0.00	31.05	0.00
Peru	52.10	0.00	21.16	0.00
Philippines	236.43	0.00	10.07	0.00
Poland	127.32	0.00	6.61	0.00
Russia	-218.52	0.00	27.64	0.00
South Africa	118.97	0.00	7.90	0.00
Turkey	17.91	0.00	24.54	0.00
Ukraine	-178.22	0.00	32.66	0.00
Uruguay	48.66	0.00	30.31	0.00
Venezuela	-188.06	0.00	35.82	0.00
α_2	-223.47	0.00		
constant	43.01	0.00		
DC_{AR}	4444.13	0.00		
DC_{EQ}	2452.78	0.00		
DC_{NGR}	661.40	0.00		
DC_{PA}	1505.78	0.00		
DC_{RU}	3524.87	0.00		
DC_{VNZ}	1154.58	0.00		
R^2	0.924		Akaike (AIC)	14.067
Root MSE	250.49		Schwarz(SC)	14.074
No. of obs	40870		HQ	14.069

V. EXPLAINING THE VULNERABILITY

External shocks produce different effects on each emerging country. In this section we analyze, with a more restricted panel for the period from 1998 to 2005, whether the indebtedness and governance indicators are able to explain not only the level of the spread but also its elasticity to a global risk aversion shock.

We implemented Panel (4) individually for Indebtedness (D) and Governance (G), where elasticity (i.e., vulnerability) is formally described as the partial derivative of the spread in relation to the VIX Index.

$$SPD_{i,t} = \underbrace{\alpha_1 + \alpha_2 F_{i,a}^{D/G}}_{\alpha_i} + \underbrace{(\beta_1 + \beta_2 F_{i,a}^{D/G})}_{\beta_i} VIX_t^* + CD_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $SPD_{i,t}$ represents the daily spread of country i at time t , VIX_t^* is the VIX Index centered around its mean¹¹, $F_{i,a}^{D/G}$ equals the total government debt/GDP or the Regulatory Quality index, and $CD_{i,t}$ represents the crisis dummy previously described.

In this model, both the fixed effect α_i and the VIX coefficient are functions of the debt level and governance indicator. The results are presented in Table 5.

¹¹ Centering the VIX allows interpreting the first term of Eq.(4) as the level of the spread.

Table 5: Determinants of Vulnerability

Indebtedness				Governance			
Variable	Coefficient	<i>p-value</i>		Variable	Coefficient	<i>p-value</i>	
α_1	332.46	0.00		α_1	564.75	0.00	
α_2	2.90	0.00		α_2	-237.67	0.00	
β_1	10.86	0.00		β_1	23.67	0.00	
β_2	0.16	0.00		β_2	-9.11	0.00	
CD_{AR}	4675.27	0.00		CD_{AR}	4527.54	0.00	
CD_{EQ}	2983.95	0.00		CD_{EQ}	4646.00	0.00	
CD_{NGR}	-	-		CD_{NGR}	3269.56	0.00	
CD_{PA}	1705.26	0.00		CD_{PA}	1316.88	0.00	
CD_{RU}	3583.12	0.00		CD_{RU}	1824.34	0.00	
CD_{VNZ}	1857.56	0.00		CD_{VNZ}	3431.38	0.08	
R^2	0.839	Akaike (AIC)	14.178	R^2	0.833	Akaike (AIC)	14.235
N ^o of obs	40951	Schwarz(SC)	14.180	N ^o of obs	43199	Schwarz(SC)	14.237
Root MSE	368	HQ	14.179	Root MSE	371	HQ	14.235

Both coefficients of fit R^2 (~83%) are smaller than those of previous sections as expected, since the model is more restricted than the previous panels. However, all coefficients are significant and have the expected sign, i.e., the higher the debt level and the worse the governance, the higher the country's spread and vulnerability. This leads us to conclude that Indebtedness and Governance play a relevant role in determining both the level of sovereign spreads and their sensitivity to a global external shock, thus able to be part of a strategy for mitigating spillover effects.

VI. NARROWING THE SPREADS: LIQUIDITY OR FUNDAMENTALS?

Current research on the determinants of sovereign spreads tries to identify the effects of liquidity, global risk perception and debt levels on narrowing sovereign

spreads, especially after 2003. In this section we intend to push the debate further via variance decomposition analysis of panel **(2)** described in Section 4, which performed the best according to the information criteria of Akaike, Schwarz and HQ. The observed and predicted sovereign spreads of this model are shown in Appendix C.

The contribution of each explanatory variable (VIX and Indebtedness) to the total variance of the spreads is calculated through the coefficients estimated in panel **(2)**, by dividing each variance related to such variables by the total variance of spreads. The results for the periods from 1998 to 2002 and 2003 to 2005 are presented in Table 6. For the 1998–2002 period, the VIX index explained 25.78% of the total variance of the spreads, while indebtedness only explained 11.96%, primarily due to the annual frequency of the indebtedness data. In contrast, the VIX index explained 56.91% of the variance, while indebtedness explained just 7.10% in the 2003–2005 period.

In the view of these results, our study supports the argument that the VIX index, or more generally, the high liquidity scenario and low global risk perception have been the main drivers of the sovereign spreads after 2003. As for the previous period (1998–2002), indebtedness had a more relevant role compared to the VIX in explaining the spread variance.

Table 6: Spread Variance Decomposition

	1998 – 2002		2003 – 2005	
	VIX	Indebtedness	VIX	Indebtedness
Argentina	1.81%	3.19%	1.95%	1.40%
Brazil	47.58%	2.25%	86.80%	0.74%
Bulgaria	22.43%	20.93%	56.43%	22.31%
Chile	13.71%	2.28%	51.60%	21.90%
China	15.34%	14.66%	59.03%	0.97%
Colombia	32.12%	23.80%	74.28%	1.28%
El Salvador	28.29%	39.25%	53.21%	0.28%
Ecuador	5.15%	1.25%	82.98%	0.72%
Hungary	5.09%	26.92%	5.17%	28.72%
Indonesia	-	-	41.52%	45.22%
Lebanon	14.65%	27.92%	72.76%	2.08%
Malaysia	17.41%	3.11%	78.35%	0.66%
Mexico	37.79%	15.99%	68.47%	7.27%
Panama	78.13%	0.50%	88.82%	1.07%
Peru	41.76%	1.12%	74.59%	3.20%
Philippines	34.35%	16.44%	75.26%	1.30%
Poland	0.17%	0.02%	3.85%	0.04%
Russia	64.28%	21.96%	90.01%	6.71%
South Africa	6.52%	2.22%	27.64%	2.09%
Turkey	3.95%	10.15%	38.19%	3.20%
Ukraine	38.61%	3.75%	81.22%	1.22%
Uruguay	24.80%	23.83%	60.63%	10.97%
Venezuela	33.22%	1.59%	36.22%	0.00%
Mean	25.78%	11.96%	56.91%	7.10%

VII. CONCLUSIONS AND RECOMMENDATIONS

High international liquidity and low investor risk perception have generated an extremely favorable situation for emerging markets in the past three years. This fact, together with the improved fundamentals of these countries, pushed down the sovereign spreads to their lowest historical level in 2006, breaking the 200-basis-point barrier.

This favorable scenario should be considered with some caution, since small changes in global liquidity or risk perception can have a substantial impact on

sovereign spreads, particularly of emerging economies with fiscal problems and low levels of governance. Therefore, the sustainability of these spreads in the face of external shocks is a crucial issue for policymakers in emerging countries.

The present work has analyzed the determinants of sovereign spreads of 24 emerging countries from 1998 to 2005, estimating the vulnerability of these countries to a global risk aversion shock with the help of several panel models.

Nigeria, Venezuela, Argentina, Uruguay, Ecuador, Brazil, Turkey, Indonesia, Lebanon, Colombia and Peru are currently the most vulnerable, presenting increases of over 100 basis points in their spreads as a response to a global risk aversion shock that causes the VIX index to rise to its level of 2003.

Macroeconomic fundamentals, particularly *Total Government Debt as a proportion of GDP*, and governance indices, such as *Regulatory Quality*, significantly explain both the level of spreads and the sensitiveness to global risk aversion shocks for all emerging economies in the sample, a non-trivial result given the low annual frequency of these explanatory variables against the daily frequency of the sovereign spreads.

The study also suggests that the favorable external scenario generated by the current low international risk aversion is the main driver of the substantial reduction of the spreads paid by emerging countries after 2003. However, the results also evidence that the emerging markets' responses to adverse external shocks are country specific that can be mitigated by improving debt and governance indicators.

REFERENCES

1. Arora, V.; Cerisola, M. (2001). "How Does US Monetary Policy Influence Sovereign Spreads in Emerging Markets?". IMF Staff Papers 48 (3).
2. Barr, D. G.; Pesaran, B. (1997). "An Assessment of the Relative Importance of Real Interest Rates, Inflation, and Term Premium in Determining the Prices of Real and Nominal U.K. Bonds". Review of Economics and Statistics 79, 362–366.
3. Bernoth, K.; von Hagen, J.; Schuknecht, L. (2004). "Sovereign Risk Premia in the European Government Bond Market". European Central Bank working paper n. 369.
4. Calvo, G. A. (2003). "Explaining Sudden Stops, Growth Collapse and BOP Crises: The Case of Distortionary Output Taxes". IMF Staff Papers 50, 1–20.
5. Calvo, G. A.; Leiderman, L.; Reinhart, C.M. (1993). "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors". IMF Staff Papers 40 (1), 108–51.
6. Chicago Board Option Exchange (2003). VIX – CBOE Volatility Index.
7. Codogno, L.; Favero, C.; Missale, A. (2003). "Yield Spreads on EMU Government Bonds". Economic Policy (October 2003), 504–532.
8. Dooley, M. P.; Fernandez-Arias, E.; Kletzer, K. M. (1996). "Is the Debt-crisis History? Recent Private Capital Inflows to Developing Countries". World Bank Economic Review 10 (1), 27–50.
9. Eichengreen, B.; Mody, A. (1998). "What Explains Changing Spreads on Emerging-Market Debt: Fundamentals or Market Sentiment?". NBER working Paper n. 6408.

10. Ferrucci, G. (2003). "Empirical Determinants of Emerging Market Economies' Sovereign Bond Spreads". Bank of England working paper n. 205.
11. Global Financial Stability Report. International Monetary Fund. April 2004.
12. J.P. Morgan (2004). EMBI Global and EMBI Global Diversified. Rules and Methodology. J.P. Morgan Securities Inc. Emerging Markets Research.
13. Kamin, S.; Von Kleist, K. (1999). "The Evolution and Determinants of Emerging Market Credit Spreads in the 1990s". BIS working papers n. 68.
14. Kashiwase, K.; Kodres, L. (2005). "Emerging Market Spread Compression: Is it Real or is it Liquidity?". Forthcoming IMF Staff Paper.
15. Kaufmann, D.; Kraay, A.; Mastruzzi, M. (2005). "Governance Matters IV: Updated Governance Indicators 1996–2004". The World Bank.
16. Litterman, R.; Scheinkman, J. (1991). "Common Factors Affecting Bond Returns". Journal of Fixed Income 1, 54–61.
17. McGuire, P.; Schrijvers, M. (2003). "Common Factors in Emerging Spreads". BIS Quarterly Review. December.
18. Min, Hong G. (1998). "Determinants of Emerging Market Bond Spreads: Do Economic Fundamentals Matter?". Policy Research Paper n. 1899. World Bank.
19. Moody's (2005). Moody's Statistical Handbook. November.
20. Newey, W.; West, K. (1987). "A Simple, Positive Semi-Definite, Heteroscedastic and Autocorrelation Consistent Covariance Matrix". Econometric 55, 703–708.
21. Reinhart, C. (2002). "Default, Currency Crises and Sovereign Credit Ratings". NBER working paper n. W8738.

22. Wooldridge, J. (2004). "Cluster-sample Methods in Applied Econometrics".
Michigan State University working paper.

APPENDIX A: TOTAL GOVERNMENT DEBT/GDP (%)

Country	1998	1999	2000	2001	2002	2003	2004	2005
Argentina	37.6	43	45	53.7	134.6	138	124.9	76.9
Brazil	54.8	59	64.6	70.6	71.4	76.9	71.9	70
Bulgaria	77.1	77.1	71.3	66.1	53	45.6	38.7	29.8
Chile	12.5	13.8	13.7	15	15.7	13.1	10.9	8.3
China	14.2	17.6	19.1	20.3	22.1	22.3	21.5	21.6
Colombia	27.6	38.2	46.4	52.8	60.2	58.4	55.3	54
Ecuador	56.3	84.9	73.2	57.5	51.5	48.2	44	42.2
El Salvador	23.4	25.5	26.7	32.5	37.1	39.3	39.2	40
Hungary	61.9	54.4	55.4	52.2	55.3	57.4	51.4	59.8
Indonesia	60.5	88.6	100.3	90.9	80.3	66.5	54	49.4
Lebanon	100.8	119.9	134	149.7	156.9	166.6	166.4	172.5
Malaysia	37.6	37.3	36.7	43.6	45.6	47.8	48.2	46.1
Mexico	40.8	35.9	28.9	28.3	29.2	29.2	25	22.8
Nigeria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Panama	N/A	67.9	66.5	71.1	69.4	67.3	72.6	67.9
Peru	38.2	44.1	42.2	42.5	43.4	44	42.4	37.1
Philippines	56.1	59.6	64.6	65.7	71.1	78	77.4	75.4
Poland	43.5	42.7	39.3	39.7	45.1	50.2	48.8	48.4
Russia	55.7	72.5	59.8	47.6	40.4	29.6	22.4	15.9
South Africa	48.7	48.1	44.4	45.3	39	39.9	37.7	35.5
Turkey	42.5	55.3	51.5	103.1	90.4	80.2	74.3	68.7
Ukraine	28	48.7	45.3	36.7	34.3	29.1	24.9	21.2
Uruguay	N/A	25.6	30.6	37.8	77.1	90.8	81.3	66.9
Venezuela	27.6	27.3	25.8	28.9	40.6	44.4	44.7	44.7

APPENDIX B: GOVERNANCE INDICES

Country	Regulatory Quality					
	1998	2000	2002	2003	2004	2005
Argentina	0.77	0.43	-0.84	-0.65	-0.74	-0.64
Brazil	0.23	0.30	0.20	0.28	0.08	0.08
Bulgaria	0.39	0.15	0.59	0.58	0.64	0.63
Chile	1.10	1.19	1.46	1.52	1.48	1.40
China	-0.11	-0.03	-0.46	-0.35	-0.38	-0.28
Colombia	0.43	-0.02	-0.10	0.00	-0.03	0.05
El Salvador	0.12	-0.32	-0.61	-0.54	-0.58	-0.83
Ecuador	1.31	1.07	0.05	0.06	0.24	0.12
Hungary	1.04	1.00	1.17	1.10	1.15	1.11
Indonesia	0.04	-0.41	-0.71	-0.69	-0.44	-0.45
Lebanon	0.45	0.21	-0.52	-0.28	-0.30	-0.28
Malaysia	0.49	0.28	0.53	0.59	0.57	0.50
Mexico	0.68	0.56	0.42	0.43	0.46	0.33
Nigeria	-0.56	-0.45	-1.22	-1.24	-1.28	-1.01
Panama	1.12	0.92	0.45	0.32	0.32	0.25
Peru	0.78	0.50	0.17	0.21	0.14	0.10
Philippines	0.61	0.28	0.02	0.06	-0.20	-0.02
Poland	0.75	0.64	0.62	0.54	0.77	0.82
Russia	-0.39	-1.64	-0.38	-0.34	-0.23	-0.29
South Africa	0.36	-0.03	0.50	0.56	0.55	0.59
Turkey	0.75	0.31	0.02	0.06	0.07	0.18
Ukraine	-0.88	-1.28	-0.66	-0.62	-0.48	-0.26
Uruguay	0.92	0.93	0.45	0.34	0.31	0.26
Venezuela	0.08	-0.65	-0.57	-1.16	-1.11	-1.15

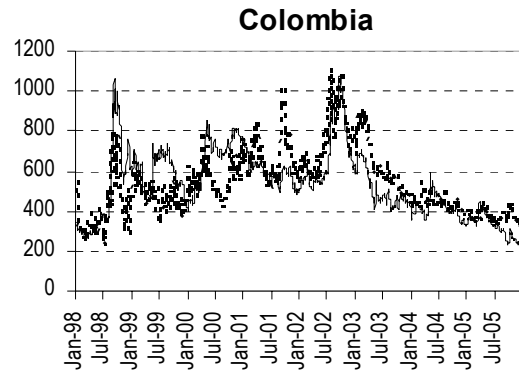
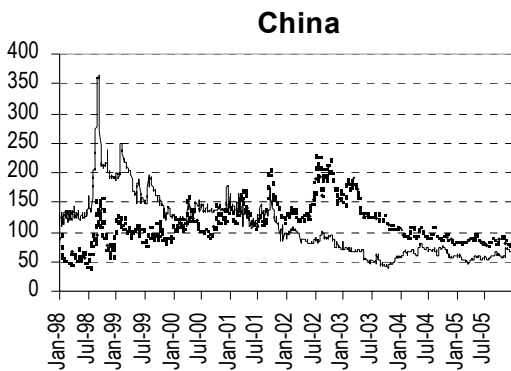
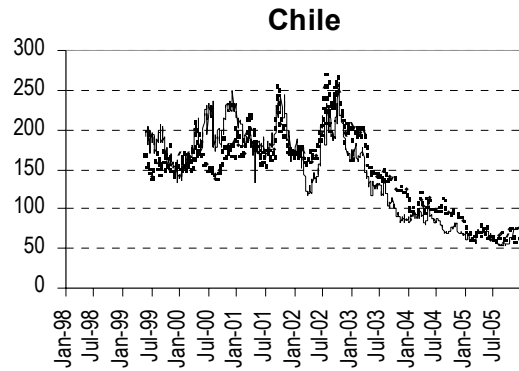
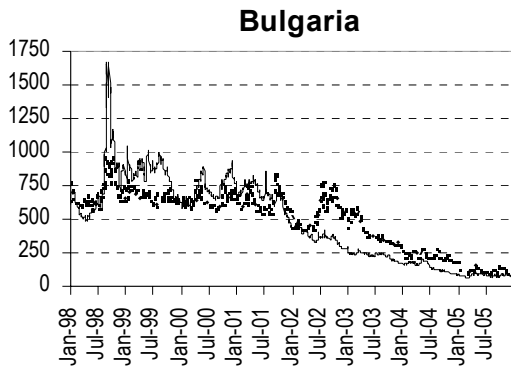
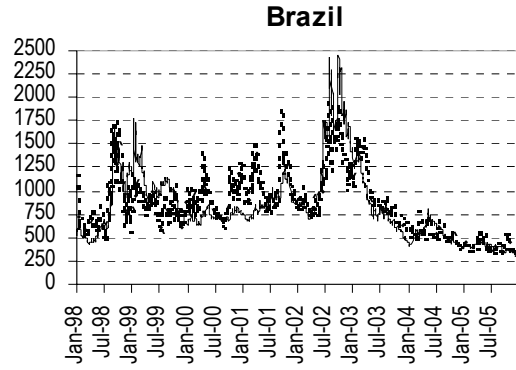
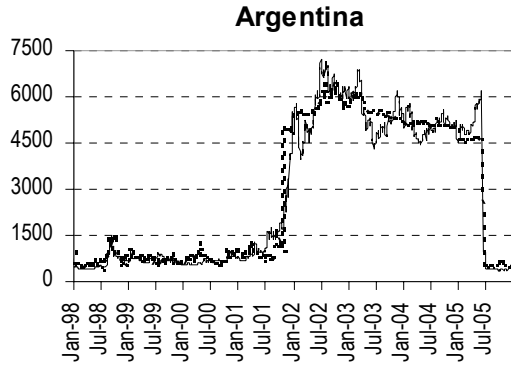
Government Effectiveness						
Country	1998	2000	2002	2003	2004	2005
Argentina	0.34	0.36	-0.4	-0.37	-0.24	-0.27
Brazil	-0.08	-0.13	-0.11	0.06	0.08	-0.09
Bulgaria	-1.03	-0.12	0	-0.07	0	0.23
Chile	1.31	1.31	1.25	1.23	1.3	1.26
China	0.06	0.25	0.14	0.08	0.05	-0.11
Colombia	-0.04	-0.22	-0.39	-0.19	-0.13	-0.09
El Salvador	-0.84	-1.04	-0.9	-0.82	-0.83	-1.01
Ecuador	-0.01	-0.11	-0.48	-0.41	-0.25	-0.3
Hungary	0.76	0.83	0.8	0.75	0.7	0.79
Indonesia	-0.57	-0.39	-0.55	-0.58	-0.42	-0.47
Lebanon	-0.03	-0.23	-0.4	-0.24	-0.32	-0.3
Malaysia	0.73	0.71	0.95	0.85	0.95	1.01
Mexico	0.16	0.28	0.25	0.12	0.07	-0.01
Nigeria	-1.42	-1	-1.02	-0.87	-0.95	-0.92
Panama	-0.04	-0.03	-0.1	-0.13	-0.03	0.11
Peru	0.19	-0.4	-0.38	-0.48	-0.47	-0.6
Philippines	0.13	0.12	-0.06	-0.16	-0.17	-0.07
Poland	0.84	0.52	0.64	0.65	0.6	0.58
Russia	-0.62	-0.7	-0.47	-0.34	-0.37	-0.45
South Africa	0.12	0.4	0.63	0.64	0.74	0.84
Turkey	-0.38	0.11	-0.05	0.09	0.07	0.27
Ukraine	-0.88	-1.28	-0.66	-0.62	-0.48	-0.26
Uruguay	0.92	0.93	0.45	0.34	0.31	0.26
Venezuela	0.08	-0.65	-0.57	-1.16	-1.11	-1.15

Rule of Law						
Country	1998	2000	2002	2003	2004	2005
Argentina	0.06	0.07	-0.87	-0.57	-0.72	-0.56
Brazil	-0.17	-0.21	-0.37	-0.28	-0.34	-0.41
Bulgaria	-0.31	-0.22	-0.07	-0.06	-0.08	-0.19
Chile	1.18	1.23	1.18	1.17	1.21	1.20
China	-0.35	-0.42	-0.28	-0.41	-0.41	-0.47
Colombia	-0.72	-0.73	-0.86	-0.83	-0.74	-0.71
El Salvador	-0.73	-0.74	-0.69	-0.64	-0.70	-0.84
Ecuador	-0.43	-0.59	-0.50	-0.43	-0.40	-0.37
Hungary	0.73	0.77	0.79	0.78	0.75	0.70
Indonesia	-1.06	-1.03	-0.97	-0.89	-0.82	-0.87
Lebanon	0.05	-0.22	-0.33	-0.35	-0.32	-0.36
Malaysia	0.57	0.39	0.48	0.48	0.55	0.58
Mexico	-0.48	-0.45	-0.38	-0.32	-0.38	-0.48
Nigeria	-1.34	-1.10	-1.46	-1.55	-1.50	-1.38
Panama	-0.15	-0.14	-0.10	-0.09	-0.08	-0.11
Peru	-0.63	-0.60	-0.56	-0.55	-0.65	-0.77
Philippines	-0.10	-0.55	-0.59	-0.65	-0.67	-0.52
Poland	0.49	0.54	0.51	0.51	0.41	0.32
Russia	-0.90	-0.99	-0.90	-0.86	-0.81	-0.84
South Africa	0.21	0.15	0.04	0.07	0.19	0.19
Turkey	-0.01	-0.07	-0.15	0.02	0.02	0.07
Ukraine	-0.88	-0.80	-0.87	-0.84	-0.83	-0.60
Uruguay	0.44	0.46	0.49	0.50	0.40	0.43
Venezuela	-0.75	-0.93	-1.14	-1.16	-1.12	-1.22

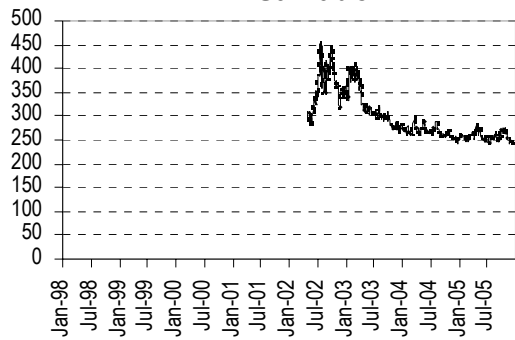
Control of Corruption						
Country	1998	2000	2002	2003	2004	2005
Argentina	-0.29	-0.4	-0.81	-0.46	-0.5	-0.44
Brazil	0.03	-0.01	-0.1	0.03	-0.05	-0.28
Bulgaria	-0.56	-0.2	-0.19	-0.09	-0.03	-0.05
Chile	1.13	1.5	1.51	1.23	1.39	1.34
China	-0.2	-0.38	-0.4	-0.51	-0.59	-0.69
Colombia	-0.67	-0.51	-0.55	-0.46	-0.28	-0.22
El Salvador	-0.81	-1.05	-1.04	-0.82	-0.79	-0.81
Ecuador	-0.34	-0.24	-0.53	-0.34	-0.32	-0.39
Hungary	0.63	0.71	0.56	0.63	0.63	0.63
Indonesia	-1.03	-1.05	-1.19	-1.01	-0.96	-0.86
Lebanon	-0.39	-0.57	-0.4	-0.5	-0.51	-0.39
Malaysia	0.67	0.21	0.33	0.36	0.29	0.27
Mexico	-0.46	-0.49	-0.25	-0.16	-0.28	-0.41
Nigeria	-1.13	-1.16	-1.36	-1.27	-1.3	-1.22
Panama	-0.34	-0.4	-0.27	-0.22	-0.15	-0.27
Peru	-0.24	-0.16	-0.27	-0.3	-0.38	-0.49
Philippines	-0.34	-0.53	-0.55	-0.46	-0.58	-0.58
Poland	0.43	0.48	0.37	0.39	0.15	0.19
Russia	-0.76	-1.04	-0.96	-0.82	-0.81	-0.74
South Africa	0.49	0.49	0.34	0.33	0.41	0.54
Turkey	-0.07	-0.36	-0.45	-0.27	-0.25	0.08
Ukraine	-0.97	-1.03	-1.01	-0.94	-0.96	-0.63
Uruguay	0.36	0.72	0.79	0.71	0.63	0.78
Venezuela	-0.84	-0.71	-0.97	-1.09	-1	-1

APPENDIX C: OBSERVED VS. FORECAST SPREADS (IN BASIS POINTS)

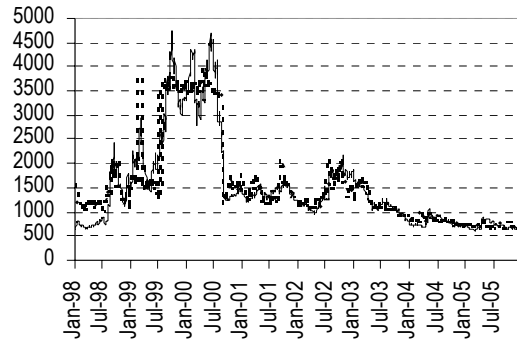
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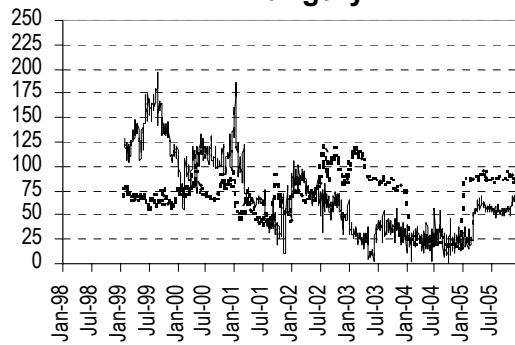
El Salvador



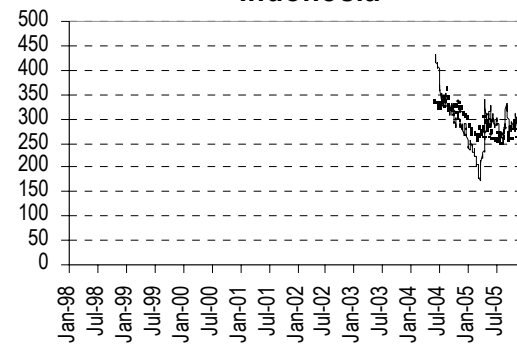
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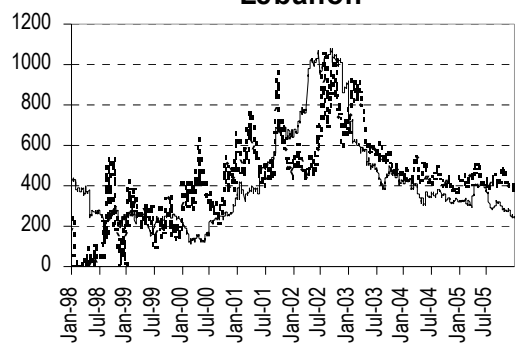
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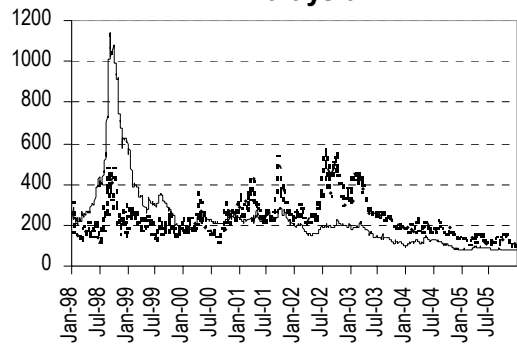
Indonesia

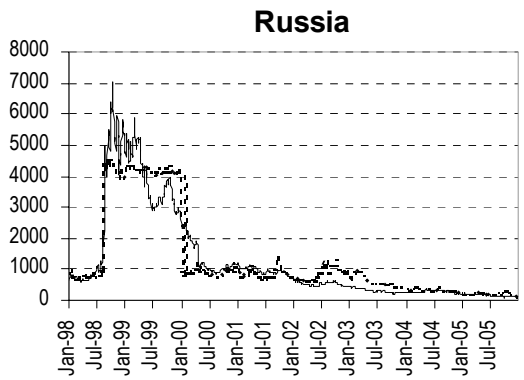
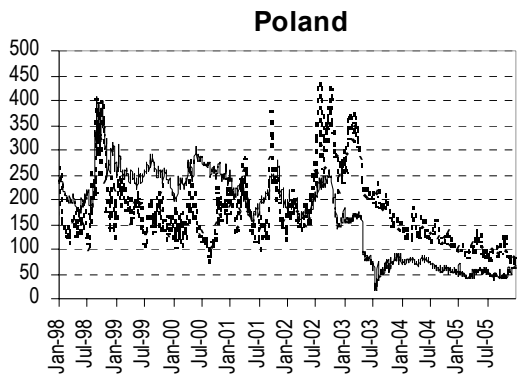
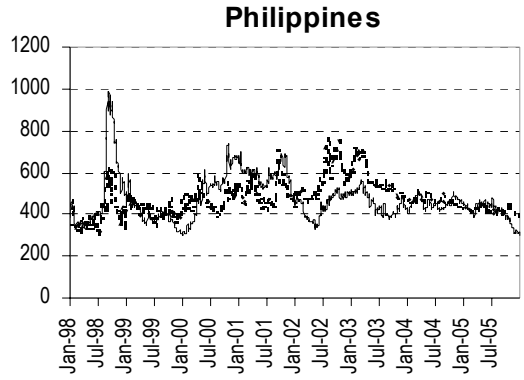
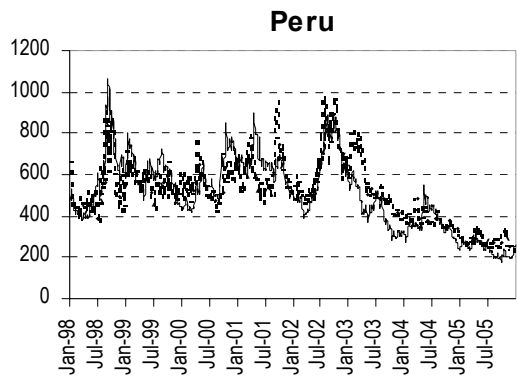
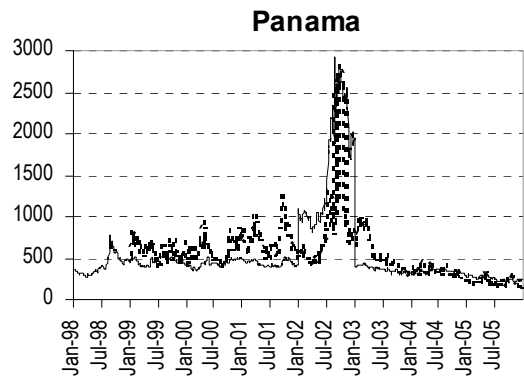
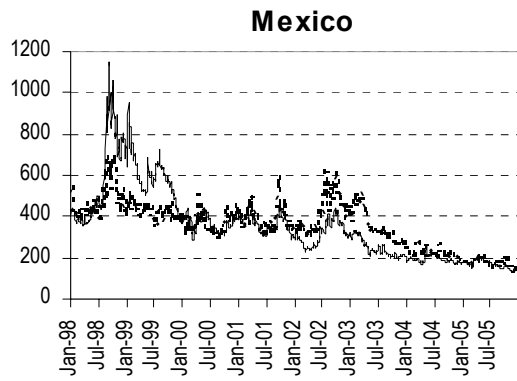


Lebanon

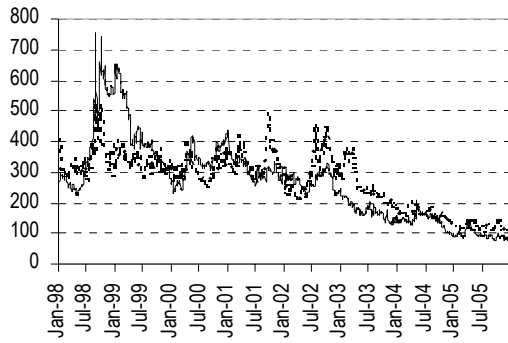


Malaysia

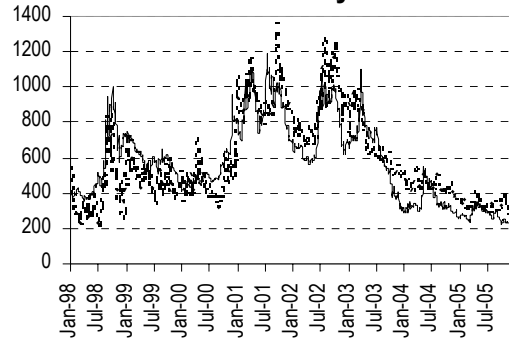




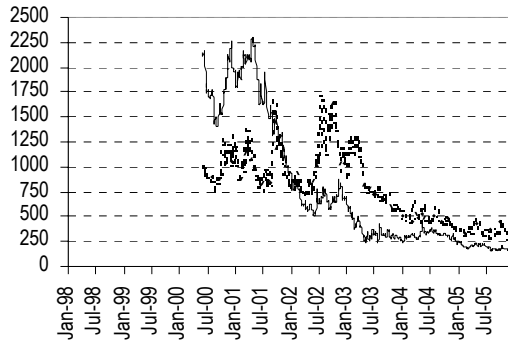
South Africa



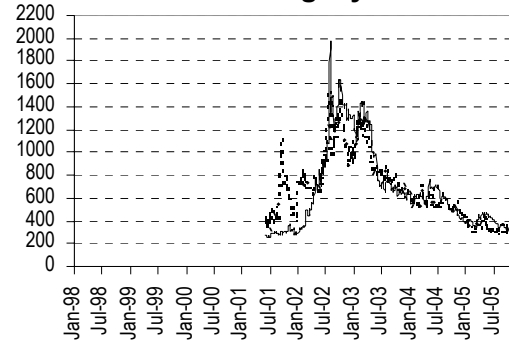
Turkey



Ukraine



Uruguay



Venezuela

