

Vulnerability of Emerging Markets to Global Shocks: *The Role of Debt and Governance on Sovereign Spreads^δ*

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Emerging markets have been enjoying an extremely favorable economic climate generated by high global liquidity over the past three years. In 2006, for example, the excess of 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 Exhibit 1.

Among the mechanisms contributing to this process are: a) the low interest rates in mature markets (the U.S., the U.K., Europe, and Japan), until recently declining due to the burst 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 U.S. relative to the country's economic growth rate.

The overall liquidity, together with the reduction on risk perception 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, reducing the proportion denominated in foreign currency and accumulating reserves.

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

The empirical literature on the determinants of sovereign spreads has recently 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 on international interest rates, when analyzing capital flows to emerging economies, since an increase in mature markets' interest rates would imply higher current and future debt financing costs.

EXHIBIT 1

Evolution of EMBI+ Stripped Spreads (bp)



Source: J.P. Morgan.

Among the contributions identifying the influence of macroeconomic 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 provide 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 to 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 U.S. 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, noting, however, that there is some kind of country specific vulnerability as some countries entered into deep crisis while others escaped unscathed from 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 presented in the *Global Finance Stability Report* [2004] also 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 countries' rating, global risk aversion, and the expectations about U.S. monetary policy are the main drivers of sovereign spreads.

The objective of this study is to determine, based on a panel data model composed by interest rate sovereign spreads of 24 emerging-market countries in the period 1998–2006, the countries that are more vulnerable to a global risk shock. The 24 countries considered in this study make up near 97% of the 2006 EMBIG³ composition, as shown in Exhibit 2. 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 some guidance for policymakers. We try to identify the relative importance of external factors, versus macroeconomic fundamentals, as explanations for the behavior of 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 suggested panel uses the HAC⁴ matrix proposed by Newey and West [1987] for a panel model with heteroskedasticity and auto-

EXHIBIT 2

EMBIG—Market Capitalization

Country	Share (%)	Country	Share (%)
Brazil	19.4	Argentina	1.6
Mexico	17.0	South Africa	1.6
Russia	12.9	Lebanon	1.6
Turkey	7.4	Ecuador	1.5
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	2.7	Ukraine	1.0
China	2.5	El Salvador	0.8
Panama	2.2	Bulgaria	0.5
Chile	1.8	Hungary	0.5
Total			97.8

Source: J.P. Morgan.

correlation, and allows more generality in the autocorrelation level, which is not 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 economies.⁵

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

DETERMINANTS OF THE SPREADS

The next subsections describe the variables used in this study.

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 a J.P. Morgan report [2004], the EMBIG is constructed by weighting the market value of U.S. 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 (U.S. 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 vari-

ables 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 as Panama, Nigeria, and Venezuela.

Explanatory Variable I: Global Risk Aversion

Global liquidity and risk aversion are strongly linked. The U.S. short-term interest rate and the slope of the U.S. yield curve are usual variables employed to represent the global liquidity scenario. The rationale behind this argument is that a low short-term interest rate and a steep yield curve prompt 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 U.S. corporate high-yielding bonds are widely accepted proxy variables to represent market risk perception. In this study, we adopt the VIX as the global risk aversion index. The evolution of the VIX Index vis-à-vis the EMBI+ spreads is presented in Exhibit 3, showing a strong relationship.

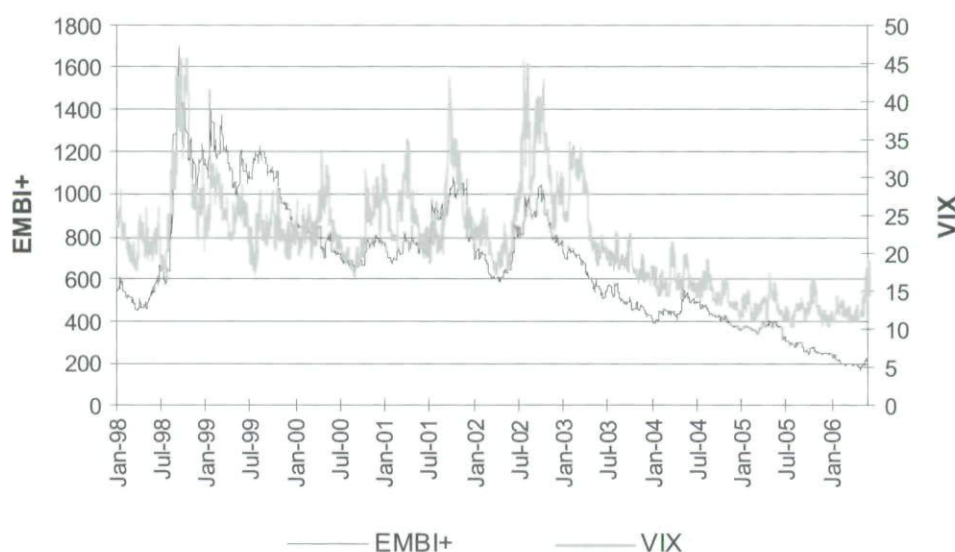
Explanatory Variable II: Fundamentals

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 article, 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 literature,⁶ and 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 [2006], 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 data ratios of the emerging markets considered.

EXHIBIT 3

VIX(%) vs. EMBI+(bp)



Source: J.P. Morgan and CBOE.

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, and credibility and commitment of the government; b) Regulatory Quality—to measure the incidence of interventionist policies such as over-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 a country's governance.

VULNERABILITY OF EMERGING ECONOMIES TO GLOBAL RISK AVERSION SHOCKS

In order to isolate the effect of a global economic shock on the emerging-markets countries, we propose the fixed effect Panel (1), based on daily data from 1998 to 2006 (see Exhibit 4). This analysis allows us to investigate whether and how sovereigns' vulnerability to external shocks has changed over time. Vulnerability, therefore, is formally described as the partial derivative of the spread in relation to the VIX Index at year a , i.e., the $\beta_{i,a}$ coefficient.

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

where $SPD_{i,t}$ refers to the daily spread of country i , 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, the estimation is implemented by using OLS with the proper correction for each problem.⁷

Exhibit 4 presents the $\beta_{i,a}$ coefficients. All estimates show the expected sign (the higher the VIX Index, the greater the spread) for the time period considered. The

overall descendent path illustrates the global improvement of emerging-market countries' vulnerability throughout the analyzed period. The time evolution of the coefficient is in line with some of the severe emerging crises that occurred in the period, such as those in Russia [1998], Argentina [2001], and Brazil [2002].

Exhibit 5 presents the emerging economies ordered by vulnerability, showing the effect of an external shock of one standard deviation on the VIX Index level⁸ over the sovereign spreads from 1998 to 2006.

In 1998, Venezuela, Ecuador, Nigeria, Brazil, Russia, Bulgaria, and Malaysia, were all more vulnerable to an external shock, presenting increases of more than 189 basis points (the overall average) in their spreads in response to an external shock. Nevertheless, the results for 2006 indicate a rebalancing in the ranking along with an impressive reduction of the countries' vulnerability (the overall increase in spreads due to the same global shock was estimated at 38 basis points), mainly due to the favorable liquidity scenario and improvement in fundamentals.

DOES INDEBTEDNESS EXPLAIN THE SPREADS?

The following panel (see Exhibit 6) analyzes the explanatory power of the country indebtedness level on sovereign spreads for the period 1998 to 2006:

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

where $SPD_{i,t}$ represents the daily spread of country i , VIX_t is the VIX Index, $F_{i,a}^D$ stands for the total government debt/GDP of country i in year a , and $CD_{i,t}$ is 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. Also, the vulnerability coefficient β_i in Panel (2) is set as time invariant.

The results,⁹ presented in Exhibit 6, show a high R^2 (93.40%), even with the adoption of low frequency annual 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

EXHIBIT 4

Panel 1 Estimates

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Country <i>i</i>	β_{ia}	β_{ia}	β_{ia}	β_{ia}	β_{ia}	β_{ia}	β_{ia}	β_{ia}	β_{ia}
Argentina	26.93	7.54	8.07	16.50	78.50	55.77	-3.10**	34.25	10.21
Brazil	37.92	40.08	32.80	54.33	58.17	35.60	29.37	14.22	5.35
Bulgaria	33.71	8.89	13.56	4.43	1.37	2.58	11.73	1.22	2.28
Chile	N/A	0.16	1.71	2.36	3.26	3.89	3.53	-0.06**	0.45
China	6.40	5.51	0.58	1.33	-0.14**	1.15	1.28	1.57	0.43
Colombia	26.53	1.63**	9.38	4.01	17.57	11.87	14.67	17.54	7.00
El Salvador	N/A	N/A	N/A	N/A	5.69	3.44	1.07**	2.90	5.20
Ecuador	55.55	20.02**	2.43**	10.74	34.27	29.26	12.27	14.09	18.78
Hungary	N/A	0.20**	0.69	-0.63**	0.47	0.28	0.89	-0.56**	1.29
Indonesia	N/A	N/A	N/A	N/A	N/A	N/A	16.66	5.54	3.90
Lebanon	0.18**	1.41	0.56**	4.83	9.15	10.45	6.92	11.46	9.72
Malaysia	32.25	14.20	2.83	1.70	1.29	4.33	5.93	1.28	1.99
Mexico	24.77	17.44	4.72	5.13	6.10	5.64	3.71	6.88	3.37
Nigeria	46.59	42.19	-3.29**	58.17	61.79	45.43	6.61	22.57	8.57
Panama	12.73	1.49**	5.64	4.17	7.41	4.48	6.02	8.43	3.98
Peru	20.42	11.12	13.37	2.58	17.10	11.00	18.39	8.06	4.81
Philippines	24.55	10.07	8.31	6.13	4.51	5.97	0.19**	12.73	7.06
Poland	7.28	0.73**	-0.13**	3.19	2.75	5.68	3.06	-0.5**	1.09
Russia	34.68	159.17	7.96**	8.25	2.42	7.47	7.63	8.74	2.27
South Africa	15.07	17.77	6.63	2.26	1.41	2.92	7.32	3.44	2.35
Turkey	20.93	10.74	13.25	8.79	16.29	18.61	15.26	11.04	6.90
Ukraine	N/A	N/A	37.77	5.21**	0.42**	10.33	7.26	6.83	8.40
Uruguay	N/A	N/A	N/A	42.95	45.92	37.90	31.85	15.24	8.38
Venezuela	59.55	37.34	12.57	7.67	7.50	34.48	33.73	12.67	-0.08**
R^2	0.962	0.975	0.940	0.967	0.988	0.991	0.995	0.990	0.973
Root MSE	199.4	196.8	190.6	156.1	161.2	123.2	75.65	77.57	36
No. of obs	4419	4861	5167	5330	5669	5750	5922	6000	6000
Akaike (AIC)	12.81	11.52	11.32	11.10	11.18	10.16	9.61	9.48	8.50
Schwarz(SC)	12.86	11.57	11.38	11.16	11.24	10.22	9.67	9.53	8.55
HQ	12.83	11.54	11.34	11.12	11.20	10.18	9.63	9.50	8.52

*N/A indicates that the country was not part of the EMBIG Index at that year.

**Parameters not significant at 10% confidence level. All parameters not assigned are significant at 1% confidence level.

of 10% in the debt level would decrease the spreads by 85 basis points. Furthermore, all vulnerability coefficients are significant and have the expected sign for all countries.

DOES GOVERNANCE EXPLAIN THE SPREADS?

In order to discuss the role of the governance indices as determinants of sovereign spreads, we suggest implementing Panel (3) (see Exhibit 7) for each of the governance indicators presented in Kaufmann, Kraay, and

Mastruzzi [2005] individually,¹⁰ considering the period from 1998 to 2006. According to the results, we selected the Regulatory Quality index due to its highest coefficient of fit R^2 (92.40%)¹¹:

$$SPD_{i,t} = \underbrace{\alpha_{1i} + \alpha_{2i} F_{i,t}^G}_{\alpha_i} + \beta_i VIX_t + CD_{i,t} + \varepsilon_{i,t} \quad (3)$$

EXHIBIT 5 **Vulnerability to a VIX Shock (bp)**

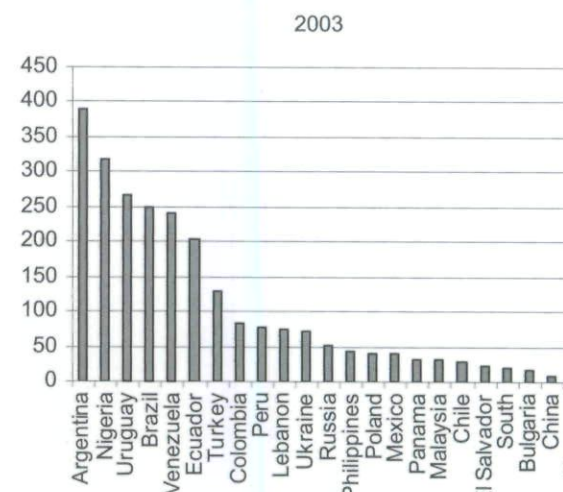
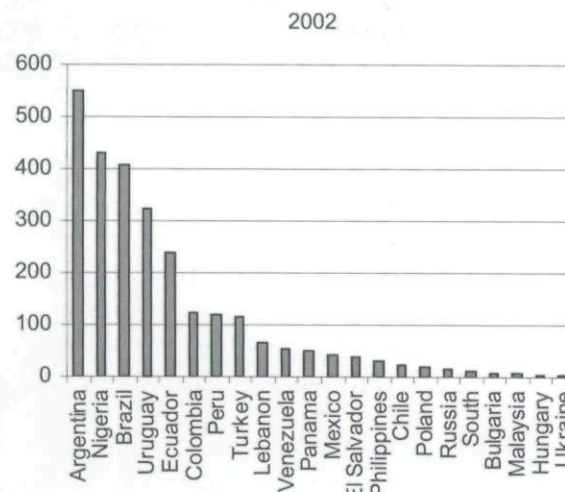
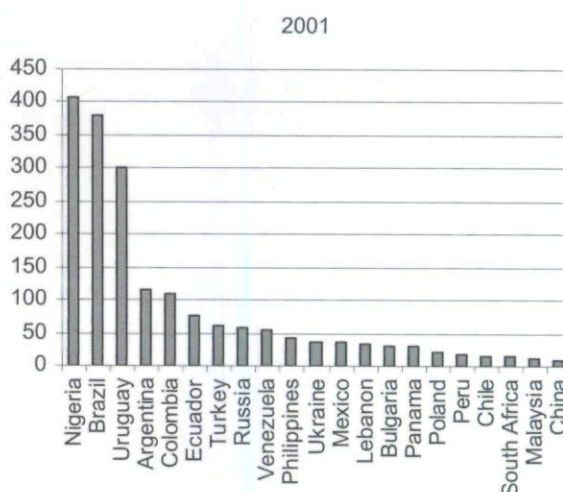
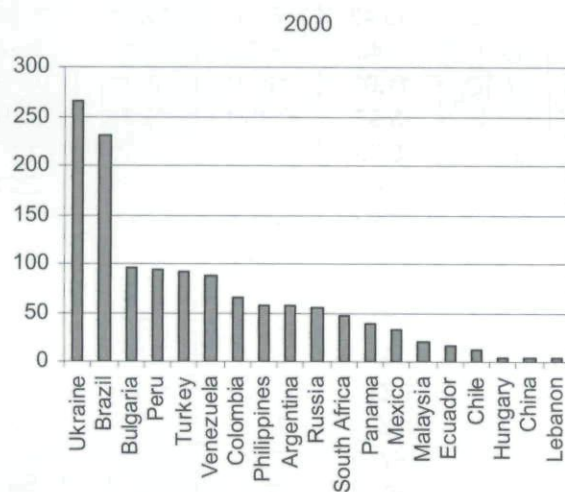
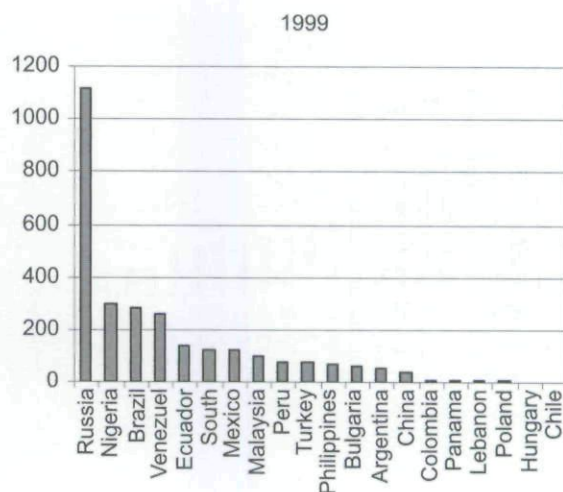
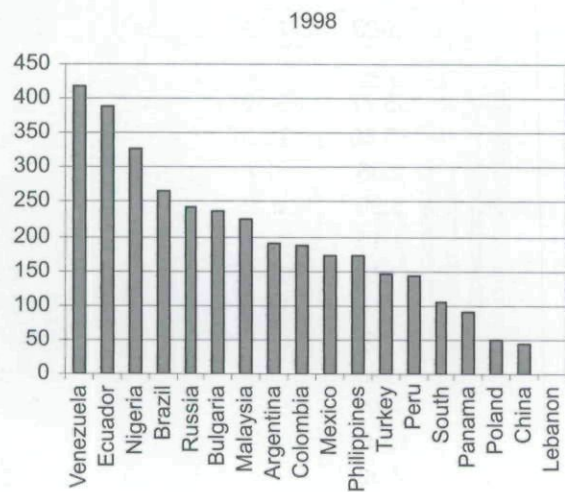
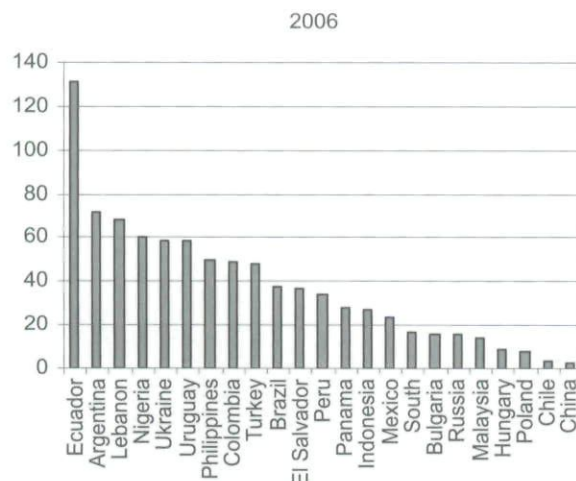
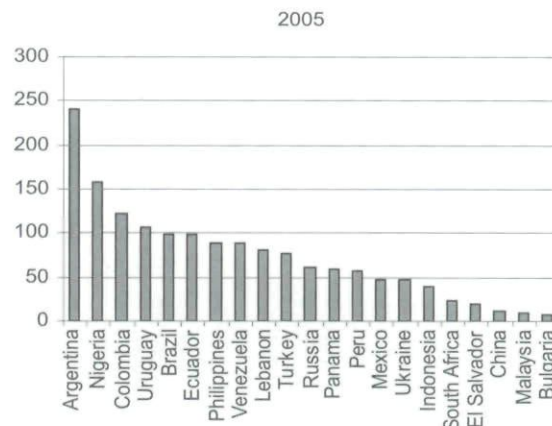
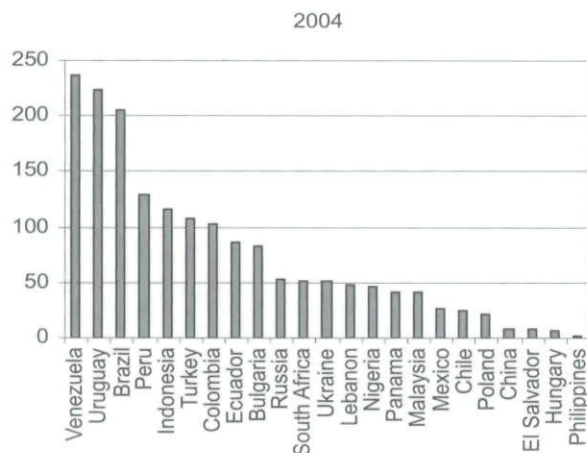


EXHIBIT 5 (Continued)



where $SPD_{i,t}$ refers to the daily spread of country i , VIX_t is the VIX Index, $F_{i,a}^G$ represents the governance indicator of country i in year a , and $CD_{i,t}$ is the crisis dummy described above.

The results in Exhibit 7 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 country risk and the corresponding cost of capital.

EXPLAINING THE VULNERABILITY

External shocks produce different effects on each of the emerging countries. In this section, we analyze, with a more restricted panel for the period 1998 to 2006, whether the indebtedness and governance indicators can

explain not only the level of the spread but also its elasticity to a global economic shock.

We implemented Panel (4) individually for Indebtedness (D) and Governance (G), where $SPD_{i,t}$ stands for the daily spread of country i , VIX_t is the VIX Index centered around its mean,¹² $F_{i,a}^{D/G}$ represents the total government debt/GDP or the regulatory quality index, and $CD_{i,t}$ is the crisis dummy previously described.

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

In Equation (4), both the fixed effect α_i and the vulnerability coefficient β_i are functions of the country

EXHIBIT 6

Panel 2 Estimates

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

EXHIBIT 7

Panel 3 Estimates

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

indebtedness and governance. The results are presented in Exhibit 8.

As expected, since the model is more restricted than the previous panels, both coefficients of fit R^2 (~83%) are smaller than those of previous sections. However, all coefficients are significant and have the expected sign, i.e., the higher the debt level and the worse the country governance, the higher the sovereign's spread and vulnerability to external shocks. 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.

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, the analysis is extended by implementing the variance decomposition technique in Panel (2), which performed the best according to the information criteria of Akaike, Schwarz, and HQ considering the restricted models.

The contribution of each explanatory variable (VIX and Indebtedness) to the total variance of the spreads is calculated 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 2006 are presented in Exhibit 9. 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, for the 2003–2006 period, the VIX index explained 56.91% of the variance, while indebtedness explained just 7.10%.

In view of these results, our study supports the argument that the VIX index or, more generally, the overall liquidity scenario and the low global risk perception that it creates have been the main drivers of 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.

CONCLUSIONS AND RECOMMENDATIONS

High international liquidity and investor low risk perception have generated an extremely favorable situation for emerging markets after 2003. These facts, along with the improved fundamentals of these countries, pushed down 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 may have a substantial impact on sovereign spreads, particularly in emerging economies with

EXHIBIT 8

Panel 4 Estimates

Indebtedness		
Variable	Coefficient	p-value
α_1	332.46	0.00
α_2	2.90	0.00
β_1	10.86	0.00
β_2	0.16	0.00
CD_{AR}	4675.27	0.00
CD_{EQ}	2983.95	0.00
CD_{NGR}	-	-
CD_{PA}	1705.26	0.00
CD_{RU}	3583.12	0.00
CD_{VNZ}	1857.56	0.00
R^2	0.839	Akaike (AIC) 14.178
No. of Obs.	40951	Schwarz(SC) 14.180
Root MSE	368	HQ 14.179

Governance		
Variable	Coefficient	p-value
α_1	564.75	0.00
α_2	-237.67	0.00
β_1	23.67	0.00
β_2	-9.11	0.00
CD_{AR}	4527.54	0.00
CD_{EQ}	4646.00	0.00
CD_{NGR}	3269.56	0.00
CD_{PA}	1316.88	0.00
CD_{RU}	1824.34	0.00
CD_{VNZ}	3431.38	0.08
R^2	0.833	Akaike (AIC) 14.235
No. of Obs.	43199	Schwarz(SC) 14.237
Root MSE	371	HQ 14.235

EXHIBIT 9

Spread Variance Decomposition

	1998–2002		2003–2006	
	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%

fiscal problems and low levels of governance. Therefore, the sustainability of these spreads at low levels 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 2006, estimating the vulnerability of these countries to a global economic shock with the help of several panel data models.

Our results suggest that in 1998, Venezuela, Ecuador, Nigeria, Brazil, Russia, Bulgaria, and Malaysia, were the most vulnerable emerging market countries, presenting increases of more than 189 basis points (the average for that year) in their spreads in response to a global risk shock that caused the VIX index to increase by one standard deviation. Nevertheless, the results for 2006 indicate changes in the vulnerability ranking, along with an impres-

sive reduction of the countries' vulnerability (the overall increase in spreads due to the same global shock was estimated as 38 basis points).

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 its sensitiveness to external shocks for all emerging economies in the sample.

The study also suggests that the favorable external scenario generated by the current overall liquidity is the main driver of the substantial reduction of sovereign spreads after 2003. However, the results point out that the emerging markets' vulnerability to external shocks is country specific, and that government debt and governance indicators are natural choices for improving a policymaker's strategy on mitigating spillover effect.

APPENDIX A

Total Government Debt/GDP (%)

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
Argentina	37.6	43	45	53.7	134.6	138	124.9	76.9	60.4
Brazil	54.8	59	64.6	70.6	71.4	76.9	71.9	70	72.7
Bulgaria	77.1	77.1	71.3	66.1	53	45.6	38.7	29.8	24.2
Chile	12.5	13.8	13.7	15	15.7	13.1	10.9	8.3	5.4
China	14.2	17.6	19.1	20.3	22.1	22.3	21.5	21.6	17.9
Colombia	27.6	38.2	46.4	52.8	60.2	58.4	55.3	54	52
Ecuador	56.3	84.9	73.2	57.5	51.5	48.2	44	42.2	41.5
El Salvador	23.4	25.5	26.7	32.5	37.1	39.3	39.2	40	31.6
Hungary	61.9	54.4	55.4	52.2	55.3	57.4	51.4	59.8	67.6
Indonesia	60.5	88.6	100.3	90.9	80.3	66.5	54	49.4	41.8
Lebanon	100.8	119.9	134	149.7	156.9	166.6	166.4	172.5	178.1
Malaysia	37.6	37.3	36.7	43.6	45.6	47.8	48.2	46.1	44.9
Mexico	40.8	35.9	28.9	28.3	29.2	29.2	25	22.8	21.4
Nigeria	N/A	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	62.7
Peru	38.2	44.1	42.2	42.5	43.4	44	42.4	37.1	33
Philippines	56.1	59.6	64.6	65.7	71.1	78	77.4	75.4	70.1
Poland	43.5	42.7	39.3	39.7	45.1	50.2	48.8	48.4	42.4
Russia	55.7	72.5	59.8	47.6	40.4	29.6	22.4	15.9	10.9
South Africa	48.7	48.1	44.4	45.3	39	39.9	37.7	35.5	32.4
Turkey	42.5	55.3	51.5	103.1	90.4	80.2	74.3	68.7	64.9
Ukraine	28	48.7	45.3	36.7	34.3	29.1	24.9	21.2	19.6
Uruguay	N/A	25.6	30.6	37.8	77.1	90.8	81.3	66.9	61.9
Venezuela	27.6	27.3	25.8	28.9	40.6	44.4	44.7	44.7	28.5

APPENDIX B

Governance Indicator

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

ENDNOTES

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

²The VIX Index, sometimes called the "investor fear gauge," was first introduced in 1993 by the Chicago Board Options 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.

³J.P. Morgan Emerging Markets Bond Index Global.

⁴HAC stands for heteroskedastic and autocorrelation consistent.

⁵See Reinhart [2002].

⁶See Codogno, Favero, and Missale [2003]; and Bernoth, von Hagen, and Schuknecht [2004].

⁷We 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.

⁸One standard deviation shock on the 2006 VIX index leads to the global risk perception as of 2003.

⁹In addition to heteroskedasticity, this panel also presents autocorrelation of residuals due to the annual frequency of the indebtedness data. The *areg* routine in Stata is executed, which uses OLS with robust standard errors to correct for heteroskedasticity and clusters to correct for autocorrelation of residuals.

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

¹¹Appendix B presents the governance indicator data relative to regulatory quality.

¹²Centering the VIX allows interpreting the first term of Equation (4) as the level of the spread.

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