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BOOM AND BUST AND SOVEREIGN RATINGS

by

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TABLE OF CONTENTS

RÉSUMÉ

Les années 90 ont été marquées par une succession de cycles d'expansion-contraction de grande ampleur dans les opérations de prêts destinés aux marchés émergents. Cette volatilité a culminé avec la crise monétaire et financière qui a atteint l'Asie en 1997-98. La relation entre les notations de crédit souverain et les écarts de rendement des obligations en dollar sur la période 1989-97 est examinée dans ce document. Sur la base de ces données empiriques, les auteurs visent à évaluer si les trois principales agences de notation — Moody's, Standard & Poor's et Fitch IBCA — amplifient ou atténuent les cycles d'expansion-contraction des opérations de prêt sur les marchés émergents. En premier lieu, la réponse du marché avant et après la diffusion des notations est étudiée sur 30 jours ouvrables. Il en ressort que, en dépit d'une anticipation élevée des annonces, l'impact des hausses pressenties et des notations à la baisse est important, pour une combinaison des cotes des trois agences. En second lieu, un test de causalité de Granger permettant de corriger les corrélations de notations et d'écarts de rendement, montre que les changements des cotations souveraines et ceux des rendements obligataires sont interdépendants. Ces résultats reposent sur des observations bien plus nombreuses que celles qui couvrent les épisodes de crise au Mexique et en Asie, même si ces derniers ont été amplement médiatisés. On peut en déduire que les notations souveraines sont susceptibles de modérer l'euphorie des investisseurs à l'égard des obligations des marchés émergents, mais que les agences de notation n'ont pas su utiliser ce potentiel au cours de la dernière décennie.

SUMMARY

The 1990s have witnessed pronounced boom-bust cycles in emerging-markets lending, culminating in the Asian financial and currency crisis of 1997-98. By examining the links between sovereign credit ratings and dollar bond yield spreads over 1989-97, this paper aims at broad empirical content for judging whether the three leading rating agencies — Moody's, Standard & Poor's and Fitch IBCA — can intensify or attenuate boom-bust cycles in emerging-market lending. First, an event study exploring the market response for 30 trading days before and after rating announcements finds a significant impact of imminent upgrades and implemented downgrades for a combination of ratings by the three leading agencies, despite strong anticipation of rating events. Second, a Granger causality test, by correcting for joint determinants of ratings and yield spreads, finds that changes in sovereign ratings are mutually interdependent with changes in bond yields. These findings are based on many more observations than just the highly publicised crisis episodes in Mexico and Asia. They imply that sovereign ratings have the potential to moderate euphoria among investors on emerging-market bonds, but that the rating agencies have failed to exploit that potential over the past decade.

Key words: Credit rating; Sovereign risk; Currency crisis; Emerging markets. JEL Classification: F3, G2.

PREFACE

Sovereign ratings have become an important, but controversial, backbone of international capital markets. Sovereign ratings on securities issued in emerging markets are fairly recent, a reflection of today's primacy of private flows in financing developing countries. In the wake of the Mexican and Asian currency crises, the correctness, timeliness and impact of sovereign ratings have been intensively debated. The controversy has focused on ratings of emerging-market sovereign debt, as they establish a ceiling for ratings of all other borrowers of the same nationality.

By examining the link between sovereign ratings and bond yield spreads, this paper investigates the power of the rating industry to move financial markets. This is important as the market impact of sovereign ratings is crucial to their power to moderate (through early ratings) or intensify (through late ratings) international lending cycles. The paper finds that joint downgradings by the three leading agencies do, indeed, have a market impact, as do joint potential upgradings. Provided these ratings come early, the rating industry consequently can play a useful role in dampening investors' euphoria as well as facilitating the access of developing countries to international bond markets.

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I. INTRODUCTION

The 1990s have witnessed pronounced boom-bust cycles in emerging-markets lending, culminating in the Asian financial and currency crisis of 1997-98. The sovereign rating industry, much as it did during the Mexican crisis three years earlier, was heavily criticised for failing to predict these currency crises. The rise in private capital flows to the emerging markets prior to these crises, and the diminished importance of concessional finance, have raised the influence of sovereign ratings on the terms at which money can be raised in global financial markets. As sovereign ratings serve as a ceiling for private-sector ratings of any given country, their influence stretches far beyond government securities.

Casual observation suggests that sovereign ratings largely failed to predict the Asian crisis, although Moody's downgraded Korea and Thailand ahead of the crisis, albeit from very favourable levels of assessment. After the crisis erupted, sovereign ratings of Asian borrowers tumbled to "junk status". The downgrading of Asian sovereign ratings reinforced the region's crisis in many ways: commercial banks could no longer issue international letters of credit for local exporters and importers; institutional investors had to offload Asian assets as they were required to maintain portfolios only in investment-grade securities; foreign creditors were entitled to call in loans upon the downgrades. The late warning signals provided by the rating agencies were partly ascribed to the fact that the Asian crisis victims showed sound macroeconomic performance which hid — not only to the agencies — their financial and corporate balance-sheet weaknesses (see, for example, Huhne, 1998).

In principle, sovereign ratings might be able to help attenuate boom-bust cycles in emerging-market lending. During the boom, early rating downgrades would help dampen euphoric expectations and reduce private short-term capital flows which have repeatedly been seen to fuel credit booms and financial vulnerability in the capital-importing countries (see, for example, McKinnon and Pill, 1996). By contrast, if sovereign ratings had no market impact, they would be unable to smooth boom-bust cycles. Worse, if sovereign ratings lag behind, rather than lead financial markets, but have a market impact, improving ratings would reinforce euphoric expectations and stimulate excessive capital inflows during the boom; during the bust, downgrading might add to panic among investors, driving money out of the country and sovereign yield spreads up. If guided by outdated crisis models, sovereign ratings would fail to provide early warning signals ahead of a currency crisis, which again might reinforce herd behaviour by investors.

As far as sovereign ratings are concerned, there are several reasons why a significant market impact will not be easily established. First, sovereign-risk ratings are primarily based on publicly available information (Larraín, Reisen and von Maltzan, 1997), such as levels of foreign debt and exchange reserves or political and fiscal constraints. Consequently, any sovereign-rating announcement will be "contaminated" with other publicly available news. Rating announcements may be largely anticipated by the market. This does not exclude, however, that the interpretation of such news by the rating agencies will be considered as an important signal of creditworthiness. In the absence of a credible supranational mechanism to sanction sovereign default, the default risk premium — unlike in national lending relationships — is determined by the borrower's willingness, rather

than ability, to pay (Eaton, Gersowitz and Stiglitz, 1986). Again, it is not easy for the rating agencies to acquire an information privilege in this area that could be conveyed to the market through ratings.

The paper will examine the link between sovereign rating “events” and bond yield spreads. To investigate the size and duration of the market impact, we collect the press releases by the three leading rating agencies — Moody’s, Standard & Poor’s and Fitch IBCA — over the period 1989-97. The objective of our study is to find out whether the leading agencies fulfil a necessary condition to dampen boom-bust cycles: a significant market impact of their rating announcements above and beyond other yield determinants. We will also investigate whether the market impact is temporary, possibly indicating a rating-induced reinforcement of herd behaviour among market participants, or whether the impact of rating “events” can be sustained over several months, possibly indicating that the rating agencies have been able to reveal new information to market participants. Our empirical analysis first features an event study with an observation window spanning 30 trading days both before and after each sovereign rating announcement. Then, we investigate the monthly bivariate Granger causality relationships between sovereign ratings and yield spreads after correcting for other yield determinants. Finally, we interpret the evidence.

II. DO SOVEREIGN RATINGS IMPACT THE MARKET? AN EVENT STUDY

To examine whether the three leading rating agencies do have a market impact, we undertake an event study which explores the link between press releases from the agencies containing rating announcements on sovereign US dollar debt (the rating "event") and movements in sovereign bond yield spreads. The observation period is from 1989, when emerging market ratings started to gain momentum, to 1997.

The rating history has been obtained directly from the three market leaders who cover some 80 per cent of sovereign credit ratings. We not only analyse implemented rating assignments, but also imminent rating changes (when Moody's puts a country on *watchlist*, Standard & Poor's assigns a country with a positive or negative *outlook* and Fitch IBCA announces a positive or negative *ratingwatch* for a country). For the observation period, we collected 152 rating announcements of which 97 events affected the emerging markets: 16 ratings were put on review for possible downgrade and 29 for possible upgrade; 26 of the announcements report actual rating downgrades and 32 actual upgrades, the remainder contained rating confirmations or assignments[1]. As the three agencies use rating notches that correspond with each other, we can make a linear transformation from notches to numbers (20 for the highest rating notch, 1 for the lowest). Earlier runs with "logistic" rather than linear transformations did not modify the results.

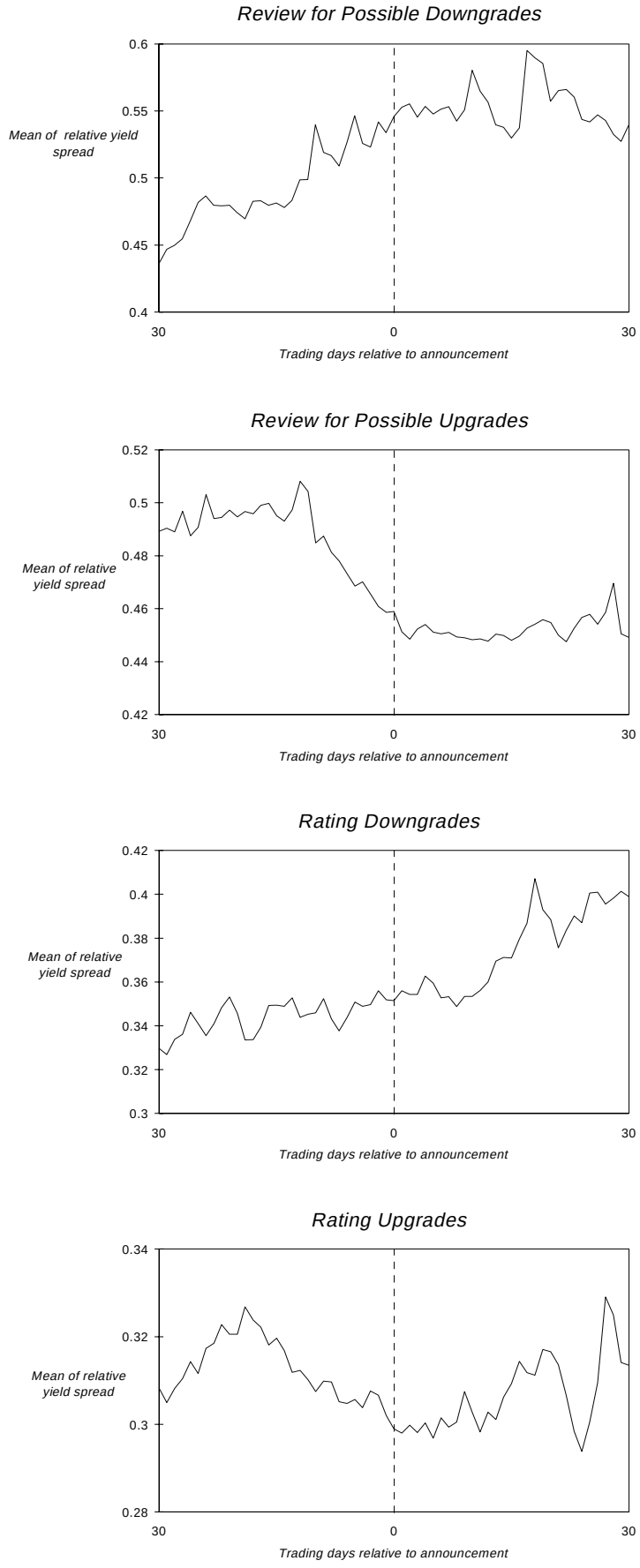
The market impact is measured by movements in relative dollar bond yield spreads[2]; summary statistics are provided in the Annex Table A.1. The "risk-free" benchmark for the computation of spreads is the 10-year US treasury bond. The relative yield spread is calculated as a fraction of the benchmark yield on central government bonds, based on data obtained on fixed-rate dollar bond redemption yields. As most emerging-market government bonds are not actively traded, data availability is severely constrained, confining the sample to those 29 countries whose government bonds are regularly quoted. More than 70 per cent of these bonds are of 10-year maturity; for the rest (except Brazilian bonds which have 20-year maturity), we had to accept shorter maturities. For every rating "event" we select only one, the most regularly traded, government bond for each country in order to maintain an equally weighted sample.

Standard event study methodology (see, for example, Hand, Holthausen and Leftwich, 1992) requires linking rating "events" to "abnormal" returns — the difference between model-generated returns and actual returns. The model-generated return R_{it} depends on the return of the market portfolio R_{mt} (here represented by an index for 10-year US treasury bonds)

$$(1) \qquad R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \ , \text{ with } \mathrm{E}[\varepsilon_{it}] = 0, \ Var[\varepsilon_{it}] = \sigma^2_{\varepsilon_i}$$

The coefficients for model-generated returns have to be calculated for periods free of rating events. Because our relevant time series are much too short to calculate the coefficients within an event-free period, we have to constrain α_i to 0 and β_i to 1, as suggested by Campbell, Lo and MacKinley (1997). This implies that we have to base the event study on the observed dollar bond yield spreads between sovereign government bonds and US treasury bonds.

Figure 1. **103 Rating Events and Sovereign Yield Spreads**
1989-97



Source: Bloomberg, Datastream, DRI, JPMorgan, Merrill Lynch, Moody's, Standard & Poor's.

Figure 1 shows the mean of relative yield spreads during a period of 30 days before and after 103 rating events classified as reviews for possible downgrade, reviews for possible upgrade, rating downgrades or rating upgrades. In general, Figure 1 conveys that a change in the risk assessment by the three leading rating agencies is preceded by a similar change in the market's assessment of sovereign risk. The pattern is particularly clear when countries have been put on review for possible downgrade or upgrade. During the 29 days preceding a review for possible downgrade, relative spreads rise by about 12 percentage points. Likewise, over the 29 trading days before a country is put on positive outlook by one of the three agencies, the relative yield spread falls on average by 4 percentage points. Moreover, once a country's rating has been put on review for a negative or positive outlook, the market trend appears to stabilise.

Implemented negative rating changes seem to exert a sustained impact on bond yield spreads; the rating downgrade is largely unanticipated. After a country's rating has been downgraded, the market appears to vindicate the agencies' assessment over the next 30 trading days with an upward movement in relative yield spreads. By contrast, implemented rating upgrades are anticipated by a drop in bond yield spreads; once the upgrade is announced, we discern a volatile market reaction.

In a test for statistical significance of rating events on market prices, Table 1 presents the results of our event study for several time windows — six 10-day-windows for the 29 trading days before and after the announcement as well as one two-day window (day 0 and day +1) for the date of the announcement. The table displays the change of the mean of the relative yield spreads and the respective t-statistic[3]. Because positive rating announcements should be associated with negative changes in the yield spread, we multiply the changes in the relative spread by -1 for negative rating announcements. We also calculate the percentage of the changes of relative yield spreads with a positive sign. In the sample, 50-60 per cent of the changes have the right sign, meaning that the yield spread in-/decreases with a rating down-/upgrade, respectively. A z-statistic (as applied by Cantor and Packer (1996)) tests whether the indicated percentage of yield spread changes into the right direction is significantly higher than 50 per cent. We find significant percentages in all samples, except for the "Standard & Poor's-full sample" and the "Fitch IBCA-full sample".

Table 1 replicates quite closely Cantor and Packer (1996) to see how dollar bond spreads respond to rating announcements. While their study is only based on observations up to 1994, our analysis fully captures events following Mexico's Tesobono and the East-Asian crisis to end-1997. Moreover, our more recent observation period implies that our country sample represents relatively more emerging-market observations. Our findings question the results obtained by Cantor and Packer for the full sample of rating events: the impact of rating announcements on dollar bond spreads is not significant. However, we do find a significant impact (at the 10 per cent level) on emerging market sovereign bonds when all rating announcements are combined. Within the announcement window (day 0/+1), a rating event on emerging-market sovereign bonds moves the relative yield spread only by 0.6 percentage points. Adding the significant yield spread response during the ten days before and after the rating "event", the combined move of the relative yield spread on emerging-market dollar bonds is 3.5 percentage points around the rating event. While we find a weak significant market response to rating "events" on emerging-market bond markets, the response is not sustained beyond the ten-day window. The fact that 11 to 20 days after the rating "event" yield spreads make a significant move in the "wrong" direction, may be indicative of initial overshooting yield response or of policy actions upon ratings.

Table 1. **Short-term Impact of Rating Announcements, 1989-97**
Mean Change of Relative Yield Spreads

Full Sample		Full Sample			Emerging Markets	
No. of announcements		152			97	
Trading Days	Cumulative Mean Change	t-statistic	% with right sign	Cumulative Mean Change	t-statistic	% with right sign
-30 to –21	0.008	1.03		0.008	0.94	
-20 to –11	-0.006	-0.70		-0.008	-0.88	
-10 to –1	-0.008	-0.90		-0.015	-1.60*	
0 to + 1	-0.003	-0.74	52.6	-0.006	-1.43*	58.8
+2 to +10	-0.005	-0.56	(1.30*)	-0.014	-1.61*	(3.45***)
+11 to +20	0.003	0.37		0.013	1.43*	
+21 to +30	-0.002	-0.21		0.000	-0.01	
Moody's		Full Sample			Emerging Markets	
No. of announcements		47			29	
Trading Days	Cumulative Mean Change	t-statistic	% with right sign	Cumulative Mean Change	t-statistic	% with right sign
-30 to –21	0.019	1.02		0.013	0.68	
-20 to –11	-0.019	-0.92		-0.019	-0.89	
-10 to –1	0.015	0.73		0.012	0.58	
0 to + 1	-0.008	-0.81	55.3	-0.012	-1.27	62.1
+2 to +10	0.020	0.99	(1.46*)	0.020	0.98	(2.60***)
+11 to +20	-0.009	-0.43		0.000	0.02	
+21 to +30	-0.016	-0.78		-0.018	-0.86	
Standard & Poor's		Full Sample			Emerging Markets	
No. of announcements		82			55	
Trading Days	Cumulative Mean Change	t-statistic	% with right sign	Cumulative Mean Change	t-statistic	% with right sign
-30 to –21	0.004	0.37		0.005	0.43	
-20 to -11	0.002	0.14		-0.001	-0.11	
-10 to -1	-0.023	-1.87**		-0.029	-2.37***	
0 to + 1	-0.002	-0.31	50.0	-0.004	-0.66	56.4
+2 to +10	-0.022	-1.90**	(0.00)	-0.034	-2.91***	(1.89**)
+11 to +20	0.009	0.77		0.020	1.60*	
+21 to +30	0.006	0.50		0.010	0.78	
Fitch IBCA		Full Sample			Emerging Markets	
No. of announcements		46			26	
Trading Days	Cumulative Mean Change	t-statistic	% with right sign	Cumulative Mean Change	t-statistic	% with right sign
-30 to -21	0.002	0.11		0.008	0.60	
-20 to -11	-0.008	-0.54		-0.012	-0.80	
-10 to -1	-0.003	-0.23		-0.012	-0.83	
0 to + 1	0.002	0.32	56.5	-0.001	-0.13	61.5
+2 to +10	0.007	0.48	(1.25)	-0.003	-0.24	(1.66*)
+11 to +20	0.007	0.49		0.013	0.84	
+21 to +30	-0.001	-0.05		0.000	-0.03	

*** Significant at the 1 per cent level; ** Significant at the 5 per cent level; * Significant at the 10 per cent level.

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, JP Morgan, Standard & Poor's. Ratings are drawn from the period 01/01/1989 – 31/12/1997. *Rating* – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield].

To explore the announcement effect of rating events in more detail, Table 2 reports the median changes of relative yield spreads for four rating announcement categories: downgrade outlook/watchlist change announcements, upgrade outlook/watchlist change announcements, assigned rating downgrades, and assigned rating upgrades. The statistical significance of our results suffers obviously from that disaggregation; however, the distinction into different announcement categories allows us to originate the source of significant announcement effects that were reported above in Table 1.

Table 2. **Short-term Impact of Various Rating Categories, 1989-97**
Mean Change of Relative Yield Spreads

	Review for Possible Downgrade				Review for Possible Upgrade			
	Full Sample		Emerging Markets		Full Sample		Emerging Markets	
No. of announcements	16		8		29		22	
Trading Days	Cumulative Mean Change	t-statistic	Cumulative Mean Change	t-statistic	Cumulative Mean Change	t-statistic	Cumulative Mean Change	t-statistic
-30 to -21	0.041	0.90	0.069	1.52*	0.025	2.30**	0.029	2.64***
-20 to -11	0.018	0.35	0.037	0.73	0.007	0.59	-0.005	-0.45
-10 to -1	0.033	0.65	0.069	1.36	-0.046	-3.77***	-0.057	-4.75***
0 to + 1	0.018	0.79	0.030	1.33	-0.007	-1.37*	-0.010	-1.91**
+2 to +10	0.026	0.54	0.036	0.74	-0.003	-0.26	-0.011	-0.92
+11 to +20	-0.091	-1.80**	-0.227	-4.48***	0.007	0.54	0.007	0.56
+21 to +30	-0.014	-0.27	-0.039	-0.76	-0.006	-0.47	-0.009	-0.71

	RATING: Downgrade				RATING: Upgrade			
	Full Sample		Emerging Markets		Full Sample		Emerging Markets	
No. of announcements	26		8		32		26	
Trading Days	Cumulative Mean Change	t-statistic	Cumulative Mean Change	t-statistic	Cumulative Mean Change	t-statistic	Cumulative Mean Change	t-statistic
-30 to -21	0.023	2.09**	0.069	6.41***	0.012	0.68	0.013	0.73
-20 to -11	0.006	0.47	-0.015	-1.22	-0.010	-0.52	-0.014	-0.71
-10 to -1	0.007	0.54	0.020	1.63*	-0.008	-0.41	-0.013	-0.62
0 to + 1	0.004	0.77	0.012	2.13**	-0.004	-0.44	-0.007	-0.83
+2 to +10	-0.003	-0.23	0.040	3.49***	0.005	0.25	0.005	0.26
+11 to +20	0.035	2.91***	0.055	4.53***	0.014	0.69	0.017	0.87
+21 to +30	-0.005	-0.41	-0.022	-1.83*	-0.023	-1.13	-0.024	-1.21

*** Significant at the 1 per cent level; ** Significant at the 5 per cent level; * Significant at the 10 per cent level.

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, JP Morgan, Standard & Poor's. Ratings are drawn from the period 01/01/1989 – 31/12/1997. *Rating* – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield].

Table 2 reports a significant market response to rating “events” with the expected sign in two of the four panels, namely for imminent upgrades and actual downgrades. When emerging countries are put on positive outlook, the market anticipates the move during the ten trading days before the announcement significantly, as yield spreads shrink by 5.7 percentage points. The interest convergence is further significantly reinforced during the announcement window (day 0 and next). Note, however, that the market response is not sustained thereafter. Adding OECD countries to the sample (full sample) weakens the size of the market response, but does not impair the significance of the results.

Implemented downgrades of emerging-market bonds are shown to produce a strongly significant market reaction; note, however, that our results here are based on just eight cases. During 30 trading days, from 10 days before the press release issued by the rating agency until 20 days thereafter, relative yield spreads widen significantly by an accumulated 12.7 percentage points. However, the yield increase is partly reversed after 21 trading days upon the rating announcement.

With all warranted caution, three results emerge from the event study which deserve to be emphasised:

— While generally rating “events” from each of the three leading rating agencies do not produce a statistically significant response in sovereign yield spreads, the aggregated rating announcements of the three agencies can produce significant effects on yield spreads in the expected direction, notably on emerging-market bonds.

— Implemented rating downgrades widen yield spreads on emerging-market bonds. While the rise in yield spreads precedes the downgrades, it is sustained for another 20 trading days after the rating “event”.

— Imminent rating upgrades of emerging-market bonds are preceded by significant yield convergence. Subsequent to the rating “event”, however, there is no significant market response.

The interpretation of these findings is complicated by several considerations. First, to the extent that the rating “event” is anticipated by the market, the subsequent response in yield spreads will understate the effect which can be attributed to ratings. Second, both rating “events” and yield spreads may be jointly determined by exogenous shocks; this calls for analysis which corrects yield determinants for fundamental factors.

III. SOVEREIGN RATINGS AND YIELD SPREADS: A GRANGER CAUSALITY TEST

We employ a Granger causality test in order to establish the extent to which sovereign ratings lead or cause changes in yield spreads beyond and above other observable yield determinants. The test is based on a monthly balanced panel data set with end-of-month data for ratings and yields over the period January 1988 to December 1987. Considering three-monthly lags for both the rating-event and the yield spread variables, this yields 448 observations of which 245 concern emerging-market debt[4]. The summary statistics for the Granger test are reported in the Annex Table A.2. We analyse Granger causality on samples that represent each rating agency and their average rating: the first sample represents the rating announcements published by Standard & Poor's, a second one represents Moody's ratings, a third one represents an average of all three agencies' ratings[5]. The Granger causality test can be performed by the estimation equations:

$$(2) \quad Y_{it} = bX_{it-1} + mW_{it-1} + a_i + U_{it}$$

$$(3) \quad X_{it} = gY_{it-1} + hW_{it-1} + l_i + V_{it}$$

where subscripts i and t denote countries and years respectively, where α and λ are country-specific intercepts (fixed effects), and U and V residuals. Relative government bond yield spreads are represented by vector Y, the numerically transformed rating levels assigned by Moody's, Standard & Poor's or the average level of the ratings announced by the three agencies by a vector X, and exogenous macroeconomic country risk determinants (see below) by a vector W_t, which also includes the lagged endogenous variables.

Ideally, the vector W should represent the determinants of default cited in the literature on sovereign credit risk (for example, Edwards, 1984). The default variables repeatedly cited in rating agency reports as determinants of sovereign ratings (Cantor and Packer, 1996) are GDP per capita, real annual GDP growth, annual change of consumer prices, current account/GDP, government balance/GDP, investment ratio, broad money/ reserves, annual credit growth, short-term debt/reserves and terms-of-trade. However, most of these data are available only on an annual basis. In order to determine whether ratings lead or lag behind yield spreads, we need at least a monthly periodicity in the Granger test. Otherwise, neither temporary effects of rating changes could be detected nor could multiple rating changes in any given year be represented appropriately[6]. We hence choose to represent vector W by the following monthly variables: stock market return; foreign exchange reserves; real exchange rate; terms of trade, industrial production.

The structure of Granger causality tests in the context of a fixed effect model requires the application of a dynamic model, which can be estimated efficiently by using a General Methods of Moments (GMM) technique (see Arellano and Bond (1991))[7,8]. First estimations of the level equations (2) and (3) yielded incoherent results as results due to the autocorrelation that fixed effects create in dynamic models. We therefore differentiated the equations and applied the $Y_{i,t-2}$ as instruments (see Arellano and Bond, 1991). This transforms equations (2) and (3) into

$$(4) \quad \Delta Y_{it} = \beta \Delta X_{it-1} + \eta \Delta W_{it-1} + U_{it}$$

$$(5) \quad \Delta X_{it} = \gamma \Delta Y_{it-1} + \eta \Delta W_{it-1} + V_{it}$$

Table 3. **Granger Causality Test: Difference Equation**
Coefficients for Monthly Sample, Balanced Panel, GMM Estimator

	Dependent variable					
	Δ Yield spreads		Δ Yield spreads		Δ Yield spreads	
Hypothesis: rating = 0 in (4)						
Wald-statistic (p-value)	8.31***	(0.00)	1.49	(0.22)	11.26***	(0.00)
Number of observations	448		448		448	
Sum of squared residuals	27.54		20.25		15.21	
Standard error of regression	0.248		0.213		0.184	
Variance of residuals	0.061		0.045		0.034	
Durbin-Watson	1.88		1.85		1.98	
Adjusted R^2	0.619		0.699		0.090	.
Variable	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat
Δ rating (-1)	0.19***	4.52	-0.05	-0.69	0.20***	3.39
Δ rating (-2)	-0.08***	-2.61	0.05	1.06	-0.09***	-2.62
Δ rating (-3)	-0.003	-0.20	0.02**	1.97	-0.04**	-2.17
Δ rating dummy (-1)	-0.12***	-3.72	0.08*	1.45	-0.09***	-3.53
Δ government bond yield spread (-1)	0.24***	2.42	-0.07	-0.91	0.18**	2.19
Δ government bond yield spread (-2)	-0.001	-0.03	-0.02	-0.52	-0.01	-0.10
Δ government bond yield spread (-3)	0.06	1.05	0.06	1.08	0.07*	1.54
Δ stock market return (-1)	-0.02	-0.21	-0.15**	-2.12	-0.01	-0.11
Δ reserves (-1)	0.00	0.82	0.00	-0.24	0.00	-0.76
Δ real exchange rate (-1)	0.00001*	1.62	-0.000004	-1.13	-0.000003	-0.61
Δ terms of trade (-1)	0.02	1.02	-0.05	-1.27	0.005	0.22
Δ industrial production index (-1)	0.0006	0.65	-0.0006	-0.96	0.0004	0.47

	Dependent variable					
	Δ Standard & Poor's rating		Δ Moody's rating		Δ Rating average of all three agencies	
Hypothesis: yield spread = 0 in (5)						
Wald-statistic (p-value)	1.06	(0.30)	6.87***	(0.009)	2.73*	(0.099)
Number of observations	448		448		448	
Sum of squared residuals	5.93		5.00		5.79	
Standard error of regression	0.115		0.106		0.114	
Variance of residuals	0.013		0.011		0.0129	
Durbin-Watson	2.50		2.19		2.50	
Adjusted R^2	0.999		0.999		0.967	
Variable	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.
Δ government bond yield spread (-1)	0.03	0.43	-0.10***	-2.44	-0.10***	-2.44
Δ government bond yield spread (-2)	0.02	0.80	-0.04**	-1.93	-0.04**	-1.93
Δ government bond yield spread (-3)	-0.01	-0.50	-0.02	-0.90	-0.02	-0.90
Δ rating (-1)	-0.12***	-3.27	0.05	1.02	0.05	1.02
Δ rating (-2)	0.13***	4.02	-0.10**	-2.25	-0.10**	-2.25
Δ rating (-3)	0.03**	1.99	0.001	0.37	0.001	0.37
Δ rating dummy (-1)	0.16***	4.58	-0.10**	-1.99	-0.10**	-1.99
Δ stock market return (-1)	0.17***	3.31	-0.16***	-3.64	-0.16***	-3.64
Δ reserves (-1)	0.00*	1.57	0.00**	1.84	0.00**	1.84
Δ real exchange rate (-1)	-0.00005**	-2.06	0.000002	0.31	0.000002	0.31
Δ terms of trade (-1)	0.07***	2.54	-0.05***	-2.71	-0.05***	-2.71
Δ industrial production index (-1)	0.0008	1.23	0.0003	0.51	0.0003	0.51

Note: Estimated by GMM estimator in simultaneous equation system, with instruments for endogeneous variables and up to three lags for the rating and yield spread variable. We applied the Wald-test in order to test for zero-coefficients in the equation system. *** Significant at the 1 per cent level; ** Significant at the 5 per cent level; * Significant at the 10 per cent level.

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, IMF, JP Morgan, Standard & Poor's. *Rating* — [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* — [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* — [yield spread as a fraction of the benchmark yield]; *Stock market return* — [annual stock market return = continuously compound return = $\log\{P_i/P_{t-52}\}$, using weekly stock market return indices from IFC, Datastream and Dresdner Bank]; *Reserves* — [Foreign exchange reserves, IFS line 11, divided by exchange rate, in U.S. dollar]; *Real exchange rate* — [Exchange rates from IFS line rf]; *Terms of trade* – [Exports, IFS line 70.D, divided by imports, IFS line 71.D]; *Industrial production index* — [industrial production index, IFS line 66AA.ZF, 66..CZF, 66..ZF, 66EY..ZF, 66EYCZF, 66..IZF, 66..XZF]

In theory, if ratings would "Granger cause" dollar bond yields, the estimation should find a feedback from X_{it-1} on Y_{it} (with $\beta \neq 0$). Simultaneously, unidirectional Granger causality requires that lagged dollar bond yields should not influence ratings ($\gamma = 0$) and causality would imply that the history of ratings matters for the evolution of yields, but not vice versa. Were the rating agencies to lead (inform) the market, omitting X_{t-1} in the estimation equation (2) would alter the joint distribution of the vector W_{t-1}, while omitting Y_{t-1} in equation (3) would not alter the joint distribution of W. In practice, however, as it is not possible to put all variables of country risk determinants into the regression and as unforecastable shocks may simultaneously impact on yield spreads and ratings, even identifying a two-way causality between ratings and spreads might be consistent with rating agencies revealing information to the market.

Table 3 presents the statistics of the Granger causality test for equations (4) and (5)[9]. The adjusted R^2 in Table 3 points to a good explanatory power of the model underlying the equations; the t-statistics of the underlying parameters are generally significant. In general, the model determines the rating changes well, while yield spread changes seem to be partly explained by variables outside the model (bond emission volume, etc.). However, the results lack coherence. We do find a strongly significant unidirectional impact of changing Standard & Poor's ratings on yield spread changes (even after allowing for own imminent rating changes and for rating events by other agencies, denoted by the dummy (0.1) variable "rating dummy"). Note, though, that the first lag of the explanatory S&P rating variable does not carry the expected sign in the coefficient; this may result from initial spread overshooting or from policy responses upon the rating event. In contrast to the S&P results, ratings by Moody's are significantly Granger caused by the lagged bond yield spread changes. For the sample comprising the rating average of all three agencies (including IBCA Fitch ratings), the results show a two-way causality between ratings and yields; while the estimation equation (4) leads to reject the hypothesis $\beta=0$, equation (5) rejects the hypothesis $\gamma=0$. There is a notable persistence of a significant impact of ratings by the three agencies on yield spreads, but again the first lagged rating variable does not show the expected sign; moreover, the adjusted R^2 for equation (4) is very low. A consistent two-way causality emerges between the rating dummy (imminent rating changes and implemented changes by other agencies during the observation period) and yield spread moves.

The fact that the results are very different when the individual rating agencies are used versus pooling the three agencies in the regression, as well as the low R^2 for the pooled sample, seem to originate in the balanced panel method[10]. In order to avoid a specific country bias in the estimates, we had to pool samples with an equal number of observations per country, while trying to maximise the number of countries as well as the number of observations per country. This introduces various subperiods into the estimates, where market reactions may differ significantly, hence weakening the robustness of our test. Nevertheless, a two-way Granger causality between rating changes and movements in yield spreads emerges from our estimates, indicating that the sovereign ratings are an integral part of the market, both deriving information from spread movements and from fundamental yield determinants while also influencing spreads beyond those fundamentals.

IV. INTERPRETATION

The event study examining the link between sovereign ratings and bond yield spreads has detected a significant impact of imminent upgrades and actual downgrades on spreads for a combination of ratings by the three leading agencies: Moody's, Standard & Poor's and Fitch IBCA. They jointly have the potential, therefore, to intensify or to moderate boom-bust cycles, notably in lending to emerging markets. As we detect a sustained impact of joint downgrades on yield spreads, it follows that early rating signals have the potential to moderate euphoria among investors. This requires the absence of split ratings, moreover.

For sovereign ratings to dampen boom-bust cycles effectively, they have to lead, not to lag behind, yield spreads by revealing new information to the market. Even if ratings affect spreads, they will help stabilise lending cycles only if they are more than just a reaction to changes in spreads. However, both changes in ratings and spreads can change in response to exogenous shocks. Moreover, changes in spreads may lead changes in ratings if the latter are largely anticipated by the market; this will lead to understatement of the independent market impact of ratings. Nevertheless, it will be crucial for the agencies to use up-to-date models of sovereign credit crises and currency crises to stabilise international lending cycles with early warnings.

Our Granger test, by correcting for joint determinants of bond yields and sovereign ratings, suggests that sovereign ratings by the three leading agencies do not independently lead the market, but that they are interdependent with bond yield spreads once ratings and spreads are corrected for "fundamental" determinants. While the results suggest that rating announcements are considered as a significant signal of creditworthiness, their impact may be due to prudential regulation and internal guidelines of institutional investors which debar them from holding securities below certain rating categories. The two-way causality between ratings and spreads observed over the past decade may also suggest that the criticism advanced against the agencies in the wake of the Mexican and the Asian currency crises still holds truth when it is based on more observations than just those surrounding these prominent crisis episodes. While our event study suggests that rating agencies do seem to have the potential to moderate booms that precede currency crises, the Granger tests may justify the concern that this potential has not yet been productively exploited by the agencies through independently leading the markets with timely rating changes.

NOTES

1. The 29 sample countries here include Argentina, Brazil, Bulgaria, Canada, China, Chile, Colombia, Czech Republic, Denmark, Ecuador, Finland, Indonesia, Ireland, Italy, Korea, Malaysia, Mexico, New Zealand, Panama, Peru, Philippines, Poland, Russia, South Africa, Spain, Sweden, Thailand, Turkey and Venezuela.

2. The yield spread, by excluding currency risk, is taken to indicate default probability, just as ratings do. In the sovereign-risk context, default risk is either defined as pure non-payment or a refusal to convert local currency into dollars, hence imposing a significant cost on the lender (see Domowitz, Glen and Madhavan, 1998).

3. Using daily changes of the mean of the relative yield spreads and their standard deviation over the 60-day period surrounding the announcement, we constructed a test statistic that is t-distributed, following Holthausen and Leftwich (1986). We also tested several assumptions on which the event study is built (see also Table A.1): *i)* tests applying the autocorrelation function (AC) and the partial autocorrelation function (PAC) have shown that the time series are not autocorrelated; *ii)* ADF tests could reject the hypothesis that our time series are integrated of the order of one or higher; and *iii)* the Jarque-Bera test rejected the hypothesis that the time series follows a normal distribution for 10 out of 16 cases. The 6 cases that could not be rejected are: “Standard & Poor’s-full sample and emerging markets”, “Rating upgrade-full sample and emerging markets” and “Review for possible upgrade-full sample and emerging markets”. The latter result implies that only the latter six samples can be correctly interpreted, while the results of the rejected cases should be read only with caution.

4. The 14 sample countries (of which 7 emerging markets) are Argentina, Brazil, Canada, Denmark, Finland, Ireland, Italy, Malaysia, Mexico, New Zealand, Philippines, Spain, Turkey and Venezuela. Originally the sample consisted of 962 observations. By excluding all those observations where countries have not been rated by any of the three rating agencies or where variables had missing values, the number of observations for the balanced panel is reduced to a maximum of 448. We only include time series that had no missing value within the series. We could not establish a balanced panel where the time periods of each country started and ended on the same date, because yield spread and rating data are not available for all countries over the whole period. In order to establish a balanced panel with the same number of observations, but differing time periods, we have chosen those time periods for each country that included the highest number of rating changes.

5. We could not perform a Granger test on IBCA Fitch ratings for lack of a sufficient number of observations.

6. In an earlier Granger test based on annual data which used the above-mentioned default variables to represent vector W, we found that over the long run yield spreads are exclusively determined by observable country characteristics rather than by ratings (Larraín, Reisen and von Maltzan, 1997).

7. This results from F and Hausmann tests which tested for an alternative model specification: simple OLS; the VAR model (variation of slopes and intercepts across the country units); and the Between model.

8. The estimation of this model leaves us with two choices. One is to use an ANOVA based General Least Square (GLS) estimator for an unbalanced panel. This GLS estimator uses the true variance covariance matrix. It is possible to obtain an unbiased, but not optimal estimator for the matrix with the ANOVA method. The other is to use instrumental variables to capture the dynamic of a balanced model. In the latter case we would be using a General Methods of Moments (GMM) estimator which is an efficient instrument variable estimator as shown in Arellano and Bond (1991).

9. Applying the GMM estimator on the sample representing Fitch IBCA’s ratings was not possible due to an insufficient number of observations.

10. Upon rechecking the data series, neither a data entry error nor specific outlier ratings could be detected.

ANNEX

Table A.1. **Event Study, Daily Data Set**
Mean Change of Relative Yield Spread: Tests for Normality and Integration,
60 observations, 1988-97

Variable	Augmented Dickey Fuller Test (2)	Skewness[1)] H_0: θ_1=0	Kurtosis[1)] H_0: θ_2=3	Jarque-Bera test statistic	P-Value
Full sample, full sample	-3.84***	2.1	15.8	532.8***	0.00
Full sample, emerging markets	-4.19***	1.1	9.8	150.8***	0.00
Moody's, full sample	-4.65***	3.3	23.1	1310.4***	0.00
Moody's, emerging markets	-4.6***	2.4	15.6	528.4***	0.00
S&P, full sample	-3.71***	-0.1	2.8	0.14	0.93
S&P, emerging markets	-4.28***	-0.4	3.0	1.43	0.49
Fitch IBCA, full sample	-3.09***	-0.6	4.3	9.83**	0.01
Fitch IBCA, emerging markets	-4.04***	-0.3	4.6	8.69**	0.01
Rating downgrade, full sample	-3.49**	-0.3	5.6	21.0***	0.00
Rating downgrade, emerging markets	-3.40**	1.1	6.6	53.8***	0.00
Rating upgrade, full sample	-3.82***	0.3	2.6	1.34	0.51
Rating upgrade, emerging markets	-4.17***	0.5	3.0	2.55	0.28
Review for possible downgrade, full sample	-3.98***	0.6	5.7	25.5***	0.00
Review for possible. downgrade, emerging markets	-3.68***	0.8	6.2	37.4***	0.00
Review for possible upgrade, full sample	-3.78***	-0.1	2.2	1.98	0.37
Review for possible upgrade, emerging markets	-4.12***	-0.1	2.7	0.38	0.83

*** Significant at the 1 per cent level; ** Significant at the 5 per cent level; * Significant at the 10 per cent level.

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, JP Morgan, Standard & Poor's. Ratings are drawn from the period 01/01/1989 – 31/12/1997.

Rating – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield]

1) The two coefficients are defined as follows:

$$\theta_1 = \frac{\mathrm{E}\left[(\chi-\mu)^3\right]}{(Var[x])^{3/2}} \quad \text{and} \quad \theta_2 = \frac{\mathrm{E}\left[(\chi-\mu)^4\right]}{(Var[x])^2}$$

The parameters are based on the third and fourth central moment of the distribution. The skewness coefficient, θ_1, is a measure of the asymmetry of a distribution. Normal distribution has a skewness coefficient of $\theta_1=0$. The kurtosis coefficient, θ_2, is a measure of the thickness of the tails of the distribution. The normal distribution has a kurtosis coefficient of $\theta_2=0$.

Table A.2. **Granger Causality Test, Balanced Monthly Panel, 1989-97**

Summary Statistics for the Sample of Standard & Poor's (504 observations)

	Median	Mean	Std Dev	Minimum	Maximum	Variance	Skewness	Kurtosis
Standard & Poor's	16.00	13.74	4.77	6.00	20.00	22.74	-0.30	-1.65
Relative yield spread	0.32	0.39	0.40	-0.26	1.91	0.16	0.65	-0.19
Stock market return	0.04	0.02	0.13	-0.45	0.52	0.02	-0.25	1.13
Reserves	1.17E+12	2.01E+12	1.89E+12	3.07E+11	7.20E+12	3.57E+24	1.38	0.40
Real exchange rate	4.47	1545.00	6114.33	0.60	42306.43	3.74E+07	5.05	26.08
Terms of trade	1.02	1.01	0.34	0.37	2.98	0.11	1.33	4.42
Industrial production	113.33	121.59	30.49	87.74	244.65	929.49	2.08	4.30

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, IMF, JP Morgan, Standard & Poor's.
Rating – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield]; *Stock market return* – [annual stock market return = continuously compound return = $\log\{P_t/P_{t-52}\}$, using weekly stock market return indices from IFC, Datastream and Dresdner Bank]; *Reserves* – [Foreign exchange reserves, IFS line 11, divided by exchange rate, in U.S. dollar]; *Real exchange rate* – [Exchange rates from IFS line rf]; *Terms of trade* – [Exports, IFS line 70.D, divided by imports, IFS line 71.D]; *Industrial production index* – [industrial production index, IFS line 66AA.ZF, 66..CZF, 66..ZF, 66EY..ZF, 66EYCZF, 66..IZF, 66..XZF]

Summary Statistics for the Sample of Moody's (504 observations)

	Median	Mean	Std Dev	Minimum	Maximum	Variance	Skewness	Kurtosis
Moody's rating	16.00	13.92	4.80	7.00	20.00	23.06	-0.26	-1.67
Relative yield spread	0.32	0.37	0.39	-0.26	1.91	0.16	0.48	-0.38
Stock market return	0.02	0.01	0.14	-0.45	0.52	0.02	-0.28	1.19
Reserves	1.24E+12	2.17E+12	2.10E+12	3.07E+11	9.56E+12	4.39E+24	1.54	1.35
Real exchange rate	4.51	1527.83	6116.04	0.60	42306.43	3.74E+07	5.05	26.10
Terms of trade	1.00	0.98	0.25	0.37	2.10	0.06	0.28	0.59
Industrial production	112.40	123.62	34.11	87.72	280.67	1163.73	1.81	3.02

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, IMF, JP Morgan, Moody's.
Rating – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield]; *Stock market return* – [annual stock market return = continuously compound return = $\log\{P_t/P_{t-52}\}$, using weekly stock market return indices from IFC, Datastream and Dresdner Bank]; *Reserves* – [Foreign exchange reserves, IFS line 11, divided by exchange rate, in U.S. dollar]; *Real exchange rate* – [Exchange rates from IFS line rf]; *Terms of trade* – [Exports, IFS line 70.D, divided by imports, IFS line 71.D]; *Industrial production index* – [industrial production index, IFS line 66AA.ZF, 66..CZF, 66..ZF, 66EY..ZF, 66EYCZF, 66..IZF, 66..XZF]

Summary Statistics for the Sample of Fitch IBCA (88 observations)

	Median	Mean	Std Dev	Minimum	Maximum	Variance	Skewness	Kurtosis
Fitch IBCA's rating	10.00	12.47	4.90	6.00	19.00	24.00	0.26	-1.63
Relative yield spread	0.37	0.44	0.30	0.03	1.12	0.09	0.54	-0.90
Stock market return	0.03	0.02	0.13	-0.36	0.41	0.02	-0.70	1.58
Reserves	1.48E+12	2.36E+12	2.10E+12	3.19E+11	6.58E+12	4.41E+24	1.04	-0.51
Real exchange rate	6.03	2616.62	7943.99	0.61	33663.24	6.31E+07	3.21	9.03
Terms of trade	0.98	0.98	0.20	0.61	1.41	0.04	0.25	-0.97
Industrial production	113.37	119.94	21.96	98.13	186.32	482.13	1.52	1.36

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, IMF, JP Morgan, Fitch IBCA.
Rating – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield]; *Stock market return* – [annual stock market return = continuously compound return = $\log\{P_t/P_{t-52}\}$, using weekly stock market return indices from IFC, Datastream and Dresdner Bank]; *Reserves* – [Foreign exchange reserves, IFS line 11, divided by exchange rate, in U.S. dollar]; *Real exchange rate* – [Exchange rates from IFS line rf]; *Terms of trade* – [Exports, IFS line 70.D, divided by imports, IFS line 71.D]; *Industrial production index* – [industrial production index, IFS line 66AA.ZF, 66..CZF, 66..ZF, 66EY..ZF, 66EYCZF, 66..IZF, 66..XZF]

Summary Statistics for the Sample of the Average Rating (504 observations)

	Median	Mean	Std Dev	Minimum	Maximum	Variance	Skewness	Kurtosis
Average rating	16.50	13.70	4.90	6.67	20.00	24.04	-0.24	-1.76
Relative yield spread	0.32	0.39	0.41	-0.26	1.91	0.17	0.54	-0.40
Stock market return	0.05	0.03	0.13	-0.45	0.52	0.02	-0.18	1.30
Reserves	1.21E+12	2.13E+12	2.00E+12	3.07E+11	8.89E+12	3.98E+24	1.53	1.34
Real exchange rate	4.47	2399.15	9240.49	0.60	64218.13	8.54E+07	4.42	19.43
Terms of trade	1.01	1.02	0.38	0.37	3.12	0.14	1.92	6.93
Industrial production	114.29	124.06	32.23	87.74	244.65	1038.89	1.68	2.54

Source: Own calculation. Bloomberg, Datastream, Dresdner Bank, IMF, JP Morgan, Fitch IBCA, Moody's, Standard & Poor's.
Rating – [numerical linear transformation, using the start-of-year rating level; lowest possible rating level = 1, highest possible rating level = 20 = AAA]; *Yield spreads* – [Calculated as the difference between the fixed-rate dollar bond redemption yield on central government bonds and US treasury bond yields; both from Bloomberg, Datastream, Dresdner Bank, JP Morgan]; *Relative yield spreads* – [yield spread as a fraction of the benchmark yield]; *Stock market return* – [annual stock market return = continuously compound return = $\log\{P_t/P_{t-52}\}$, using weekly stock market return indices from IFC, Datastream and Dresdner Bank]; *Reserves* – [Foreign exchange reserves, IFS line 11, divided by exchange rate, in U.S. dollar]; *Real exchange rate* – [Exchange rates from IFS line rf]; *Terms of trade* – [Exports, IFS line 70.D, divided by imports, IFS line 71.D]; *Industrial production index* – [industrial production index, IFS line 66AA.ZF, 66..CZF, 66..ZF, 66EY..ZF, 66EYCZF, 66..IZF, 66..XZF]

— period: 88:01-97:12

— 14 sample countries (of which 7 emerging markets): Argentina, Brazil, Canada, Denmark, Finland, Ireland, Italy, Malaysia, Mexico, New Zealand, Philippines, Spain, Turkey, Venezuela.

— Simultaneous equation system, 3SLS-estimator, instruments for endogenous variable: *a)* in level with dummies for fixed effects; *b)* in differences

— Simultaneous equation system, GMM-estimator, with instruments for endogenous variable: *a)* in differences

— Number of rating changes: 76

BIBLIOGRAPHY

ARELLANO, M. and S. BOND (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, 58, p. 277-297.

BALTAGI, B. (1995), *Econometrics Analysis of Panel Data*, John Wiley & Sons.

CAMPBELL J.Y., A.W. LO and A.C. MACKINLAY (1997), *The Econometrics of Financial Markets*, Princeton University Press, Princeton, NJ.

CANTOR, R. and F. PACKER (1996), "Determinants and Impact of Sovereign Credit Ratings", Federal Reserve Bank of New York, *Economic Policy Review* 2.2, 37-53.

DOMOWITZ, I., J. GLEN and A. MADHAVAN (1998), "Country and Currency Risk Premia in an Emerging Market", *Journal of Financial and Quantitative Analysis*, Vol. 33, No. 2, June, p. 189-216.

EATON, J., GERSOWITZ and J. STIGLITZ (1986), "The Pure Theory of Country Risk", *European Economic Review*.

EDWARDS, S. (1984), "LDC Foreign Borrowing and Default Risk: an Empirical Investigation", 1976-80, *American Economic Review* 74.4, 726-34.

GRANGER, C.W.J. (1969), "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods", *Econometrica* 37, 424-438.

HAND, J., HOLTHAUSEN, R. and R. LEFTWICH (1992), "The Effect of Bond Rating Agency Announcements on Bond and Stock Prices", *The Journal of Finance* 157.2, 733-752.

HOLTHAUSEN, R. and R. LEFTWICH (1986), "The Effect of Bond Rating Changes on Common Stock Prices", *Journal of Financial Economics* 17, 57-89.

HUHNE, C. (1998), "How the Rating Agencies Blew it on Korea", *The International Economy*, May/June, 46-48.

LARRAÍN, G., H. REISEN and J. VON MALTZAN (1997), "Emerging Market Risk and Sovereign Credit Rating", OECD Development Centre, *Technical Papers*, No. 124, Paris.

MCKINNON, R. and H. PILL (1996), "Credible Liberalisations and International Capital Flows: The Overborrowing Syndrome", *in* T. ITO and A. KRUEGER (eds.), *Financial Regulation and Integration in East Asia*, University of Chicago Press, Chicago.