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Sovereign Credit Ratings, Emerging Market Risk and Financial Market Volatility

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Introduction

Credit rating agencies were conspicuous among the many who failed to predict Mexico's economic 1994-95 crisis. While the December 20 devaluation of the peso rocked the world financial markets, until December 22 Standard and Poor's had Mexico's sovereign debt only one step below an investment grade rating with a "positive outlook". The Mexican crisis has thus produced the sentiment that rating agencies react to events rather than anticipating them and raised questions about how seriously investors should take sovereign ratings on developing countries.

Our paper aims at broader empirical content for judging whether the two leading rating agencies lead or lag market events with respect to sovereign risk. The evidence will be based on announced as well as implemented ratings of sovereign bonds from the two major rating agencies for up to 49 OECD and non-OECD countries and their impact on yield spreads relative to US treasury bonds and on stock market returns. We go beyond an earlier study (Larrain, Reisen, von Maltzan,1997) by investigating whether credit ratings add to or dampen bond market and emerging stock market volatility.

The next section will present a discussion on the potential of the rating industry to attenuate boom-bust cycles with overborrowing in the international capital markets. Section 2 will describe the country sample, the data and the methodology. Section 3 will present the econometric evidence on the interaction of sovereign yield spreads and changes in country ratings. We take three approaches: first, we perform Granger causality tests based on an unbalanced panel data set with yearly observations for the period 1988-95; second, we perform an event study to examine the daily reaction of sovereign yield spreads on rating change announcements and implemented rating changes between 1987 and 1996. For the third approach — also an event study — we use the historical volatility of sovereign bond yield spreads in order to measure country risk perception. Taking into account the strong sensitivity of stock markets towards news, we run the event study likewise for the historical volatility of stock market returns. Section 4 concludes.

1 Sovereign Emerging-Market Risk and the Rating Industry

The Asian crisis of 1997 and the Mexican crisis of 1994-95 have again demonstrated the vulnerability of emerging-market economies to financial crises associated with the reversal of excessive private capital inflows. The boom-bust cycle with overborrowing

can be explained, *inter alia*, by the negative Harberger externality (Harberger, 1985): Private borrowers do not internalise the rising marginal social cost of their private borrowing that arises from the upward-rising supply of foreign capital. In principle, the credit rating industry could help mitigate such congestion externality in world capital markets.

Governments generally seek credit ratings not only to ease their access to international capital markets, but also because these assessments affect the ratings of other borrowers of the same nationality. Many investors, in particular institutional investors, prefer rated over unrated securities, partly as a result of domestic prudential regulation. And sovereign yields tend to rise as ratings worsen, reflecting the rise in the default risk premium (Cantor and Packer, 1996). The increase in the cost of borrowing, along with the threat of reduced availability of credit, would then provide the incentive for both the public and private sector to abstain from excessive capital inflows. By reducing the negative Harberger externality, early changes in sovereign ratings could help to impose market-based financial discipline. Cantor and Packer (1996) have recently claimed that ”credit ratings appear to have some independent influence on yields over and above their correlation with other publicly available information (p. 34)”. This finding would imply that the ratings lead rather than lag the financial markets, by acquiring advance knowledge or superior information that has subsequently been conveyed to market participants.

Several considerations, however, suggest that there is little room for the credit rating industry to reduce congestion externalities with respect to sovereign emerging-market risk. These considerations originate in the nature of sovereign risk and the information content of sovereign-risk ratings.

First, in the absence of a credible supranational mechanism to sanction sovereign default, unlike in national lending the default risk premium is more determined by the borrower’s willingness to pay than by his ability to pay (Eaton, Gersowitz and Stiglitz, 1986). This does not just result from the existence of informational asymmetries between borrowers and lenders, that can be particularly pronounced in the international context. The incumbent authorities can also not commit themselves or their successors credibly that the foreign capital inflow will be put to productive use or that future returns will be used to repay the foreign liability.

Second, therefore, the nature of information that a rating may convey is different for sovereign risk. While rating agencies may receive inside information from domestic corporate borrowers that can be essentially defined as private (such as acquisition, expansion, new products and debt issuance plans), sovereign-risk ratings are primarily based on publicly-available information (such as debt and foreign-reserve levels or political and fiscal constraints). Consequently, announced or implemented rating changes will rarely be "uncontaminated" with other publicly-available news.

Whether the sovereign credit rating industry leads or lags the financial markets is not just of academic interest. In order to help mitigate boom-bust cycles with overborrowing, the industry — in particular the two leading agencies — would have to lead by acquiring advance knowledge or superior analysis that is subsequently conveyed to market participants. If, by contrast, rating agencies lag market events, they might contribute to amplify boom-bust cycles. During the boom, improving ratings would reinforce euphoric expectations and stimulate excessive capital inflows; during the bust, downgrading might add to panic among investors, driving money out of the country and sovereign yield spreads up.

2 Data, Sample Selection and Methodology

Our analysis presents the econometric evidence on the interaction between ratings (assigned or imminent) and yield spreads on sovereign government bonds, including those of emerging markets. This focus severely limits data availability because most emerging-market government securities have been rated only since the 1990s and are not regularly quoted on the financial markets. In order to use a different measure for country risk perception we construct the historical volatility of sovereign bond yield spreads as well. Taking into account the strong sensitivity of stock markets towards news, we calculate likewise the historical volatility of stock market returns. This approach allows us to increase the number of observations for the event study.

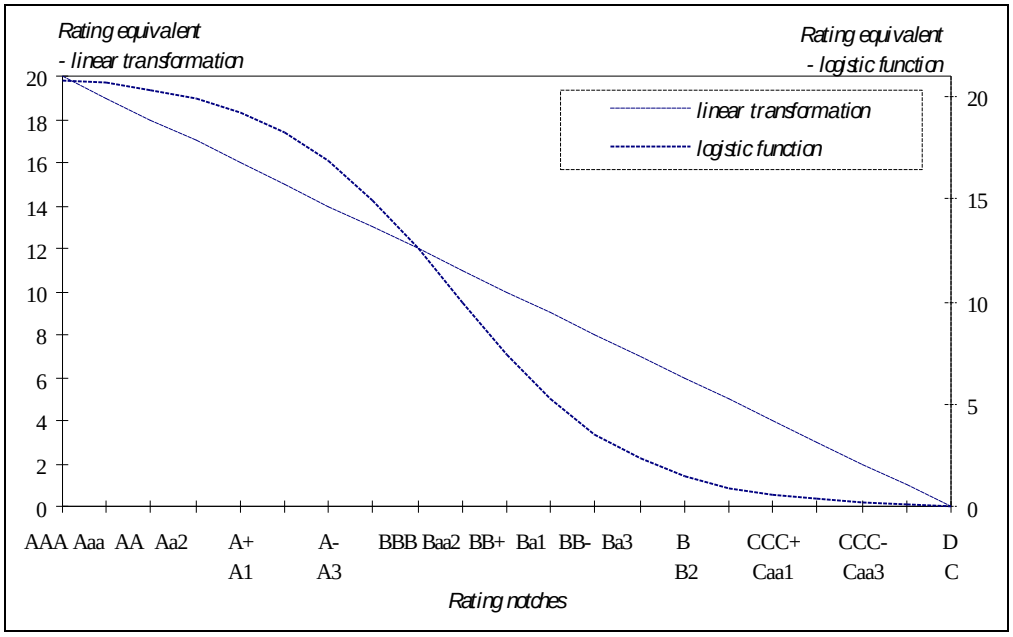
2.1 Data and Sample Selection

The sample consists of the ratings of sovereign foreign-currency debt for the period early 1987 to mid 1996 which have been assigned by Moody's and Standard & Poor's. The rating history has been obtained directly from these two market leaders who cover ca. 80 per cent of sovereign credit ratings. We do not only analyse **implemented** rating

assignments, but also **imminent** rating changes (when Moody's puts a country on **watchlist** and Standard & Poor's assigns a country with a positive or negative **outlook**). The data will be used for an annual Granger causality test on 26 sovereigns from 1988 to 1995 and for a short-term event study on 78 rating announcements from 1987 to 1996.[1]

Although the two agencies use different symbols in assessing credit risk, every Moody's symbol has its counterpart in Standard & Poor's rating scale. This correspondence allows us to transform the rating notches[2] into numbers, either by way of linear or logistic transformation, representing two hypotheses about the sovereign risk implied by varying rating notches. A linear scale of transformation assigns the highest rating notch (Aaa for Moody's, AAA for Standard & Poor's) the number 20 and falls over the residual 19 notches to the lowest level of creditworthiness (C for Moody's, D for Standard & Poor's), equal to zero. The linear scale implies that differences of ratings correspond one to one with differences in perceptions of country risk.[3] The logistic transformation, by contrast, implies the hypothesis that risk perceptions first deteriorate slowly as rating notches decrease, then deteriorate faster in a certain region of rating notches (where ratings fall from investment-grade to speculative-grade) and finally deteriorate slowly again as ratings reach the bottom of the classification (see Fig. 1).

Fig. 1: Numerical Transformation of Sovereign Ratings



The second core data needed for our analysis are fixed-rate dollar bond redemption yield spreads on central government bonds above US treasury bond yields. Excluding currency risk, dollar bond spreads can be assumed to primarily reflect country risk premia on government bonds of the same maturity.

The benchmark are 10-year US treasury bonds. For our sample, more than 70 per cent of the government bonds observed are of 10-year maturity; for the rest (except Brazil where maturity is 20 years), we had to take bonds of shorter maturity. The inclusion of shorter maturities introduces differences in yield spreads which are related to the yield curve; fortunately, the shorter maturities apply only for the period 1992-95 when the US yield curve remained relatively stable. Transaction price data on government bonds, in particular for the emerging markets, are not easily available. The major problem is that the government bonds are not actively traded, being mostly held by long-term institutional investors or by central banks. Among the full data set on government dollar bond yields, obtained from Datastream, Bloomberg, JP Morgan, Merrill Lynch and the Federal Reserve Bank of New York, we filtered out by visual inspection all countries of which government bonds were not regularily priced, leaving us with a sample of 26 countries against a total of ca. 60 countries whose sovereign debt has been rated during part of the observation period. For every rating observation, we selected only one, the most regularly traded, government bond for each country, in order to maintain an equally weighted sample.

Our second measure for country risk perception is historical volatility for relative yield spreads and real stock market returns. We assume that high volatility levels correspond with high risk perception of market participants. The performance of stock markets is measured by IFC Global indexes for total return in US$, published by the International Finance Corporation (IFC). IFCG indexes are intended to represent the performance of the most active stocks in their respective stock markets, and to be the broadest possible indicator of market movements and volatility. We have chosen the end-week notation for 22 developing countries for the period from end-December 1988 until end-March 1997. Stock market indices for industrialised countries were extracted from Datastream, using end-week notation starting from 1988 until end March 1997. We construct historical volatility by using a moving average measure over a window of 30 days for yield spreads and over a window of 8 weeks for stock market returns.

Apart from the three core data on ratings, dollar bond spreads and stock market returns, we use standard macroeconomic variables that determine country risk (see, e.g.,

Edwards, 1984) to correct our long-term analysis for such factors. In order to have a consistent data base that covers the full sample period, we took these variables from the DRI database (see Table A1).

2.2 Methodology

To examine whether the two rating agencies lead or lag financial markets, we will proceed with three different methodologies. First, we perform **Granger causality tests** based on an unbalanced panel data set with yearly averages for ratings and yield spreads during 1988-95.[4] Representing annual average of the yield spread by a vector Y, the average of the numerically transformed annual rating levels assigned by Moody's and Standard & Poor's by a vector X, and exogenous macroeconomic country risk determinants (see below) by a vector W_t, the Granger causality test can be performed by the estimation equations

(1) $Y_{it} = \beta X_{it-1} + \mu W_{it-1} + \alpha_i + U_{it}$

(2) $X_{it} = \gamma Y_{it-1} + \eta W_{it-1} + \lambda_i + V_{it}$

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.

If ratings would Granger cause dollar bond speads, the estimation should find a feedback from X_{it-1} on Y_{it} (with β ? 0). Simultaneously, Granger causality requires that dollar bond spreads should not influence ratings ($\gamma = 0$). Granger causality would imply that the history of ratings matters for the evolution of yield spreads, but not vice versa. Were the rating agencies to lead (inform) the market, omitting X_{t-1} in the estimation equation (1) would alter the joint distribution of the vector W_{t-1}, while omitting Y_{t-1} in equation (2) would not alter the joint distribution of W.

The vector W represents the determinants of default cited in the literature on sovereign credit risk (e.g., Edwards, 1984). These variables are also repeatedly cited in rating agency reports as determinants of sovereign ratings (Cantor and Packer, 1996), with the hypothesized impact on ratings in parentheses:

- total foreign debt as a percentage of exports (-)
- central government spending as a percentage of GDP (-)

- annual rate of consumer price inflation (-)
- current account deficit as a percentage of GDP (-)
- real rate of annual GDP growth (+)
- savings as a percentage of GDP (+)
- default history, represented by a dummy, if the country has defaulted on its foreign-currency liabilities since 1970 (-).

Since a considerable amount of capital flows to the emerging markets is determined by global cyclical factors (Calvo, Leiderman and Reinhart, 1996), our vector W includes also the 10-year US treasury bond yield. We hypothesize that a rise in the US treasury bond yield will tend to raise yield spreads, since it will cause a return of foreign capital to the industrial countries.

Second, we undertake an **event study** to investigate the short-run impact of press releases where the two leading agencies announce imminent or implemented rating changes on sovereign bonds. The event-study method analyses the yield spread response of sovereign dollar bonds in an observation window spanning from 40 trading days before the press release (day 0) to 40 trading days after. Usually (e.g., Hand, Holthausen, and Leftwich, 1992) the method would focus on 'abnormal' excess returns after correcting yield spreads in a market model that relates the country-specific yield to the respective benchmark (in our case, JP Morgan's global government bond index or JP Morgan's emerging markets bond index plus). Alternatively, the event study can use **relative** yield spreads (the yield spread as a fraction of the benchmark yield) to study the response to rating announcements. In both cases, the response of yield spreads is subsequently subject to test-statistic which follows a t distribution. The null hypothesis for the sovereign bond market is that rating announcements will not lead to significant changes in yield spreads, since these announcements are "contaminated" with other publicly available news.

Emerging market assets, both bonds and stocks, generally display a high risk premium, reflecting the higher volatility in their underlying returns. In order to assess the impact of rating events on the volatility of financial market returns, a **second event study** will test the null hypothesis that sovereign bond and stock market volatility will not change significantly in the wake of imminent or implemented rating changes. We measure **historical volatility** using the standard deviation of price changes for defined time intervals:

$$S(X)_t = \sqrt{\frac{1}{(k-1)}\sum_{i=1}^{k}(X_{t-i+1} - \overline{X}_t)^2},$$

(3) with $\overline{X}_t = \frac{1}{k}\sum_{i=1}^{k} X_{t-i+1}$

and $k \begin{cases} = 30 \text{ days for yield spreads} \\ = 8 \text{ weeks for stock market returns} \end{cases}$

where X is either the sovereign bond yield spread or the stock market return. Historical volatility is thus an average over a window of 30 days for yield spreads and over a window of 8 weeks for stock market returns where each window moves over the whole observation period.

3 Results

3.1 Granger-Causality

We perform the Granger Causality test for the period 1989-95 by estimating equations (1) and (2) in an unbalanced panel of 114 observations for 26 countries, of which 10 are classified as emerging-market economies by the International Finance Corporation. The structure of Granger Causality tests would require the application of a dynamic model, which can be estimated efficiently by using a General Methods of Moments (GMM)(see, e.g. Ahn and Schmidt, 1995).[5] Since the GMM estimator would require a high number of instrument variables which would entail an important loss of degree of freedom for our estimates, we are forced to use the less efficient Maximum Likelihood (ML) estimator in a panel model of fixed effects.[6] We make the usual assumptions of a fixed-effect model in a one-way error component regression (Baltagi, 1995). We obtain heteroskedasticity-robust standard errors by using the White estimator. We first estimate equations (1) and (2) by using four lags for each variable and subsequently reduce the number of explanatory variables by using the Schwartz Bayesian criterion.

Table 1 presents the statistics of the Granger Causality test, using the logistic transformation of ratings into numbers which produced slightly more significant estimates than the linearily transformed ratings. The underlying estimation equations are (1) and (2)(see Appendix). While the adjusted R^2 in Table 1 points to a high explanatory

power of the model underlying equations (1) and especially (2) and while the t-statistics of the underlying parameters are generally significant, we cannot exclude multicollinearity problems in our vector W variables.[7] The results show a two-way causality between ratings and yield spreads and reject Granger Causality of both ratings and yield spreads. While the estimation equation (1) leads to reject the hypothesis $\beta = 0$, equation (2) rejects the hypothesis $\gamma = 0$. This result means that ratings cause yield spreads and vice versa, with the implication that the financial markets and the two leading rating agencies broadly share the same model in assessing sovereign risk and that their risk assessments interact.

Table 1: Granger Causality Test Statistics
— from panel regressions —

Equation	(1)	(2)
Dependent Variable	yield spread	rating
Period	1988-95	1988-95
F-statistic	11.13***	9.04***
	F(2,97)	F(1,93)
P-value	0.000	0.000
adjusted R^2	0.920	0.966
SER	0.565	0.311
Observations	114	114

*** Significant at the 1 per cent level. The F-statistic tests whether the coefficient of the rating variable in eq. (1) and of the yield spread variable in eq. (2) differs significantly from zero when comparing the unrestricted with the restricted equation where the rating, resp. the yield spread variable has been excluded.

3.2 Event Study

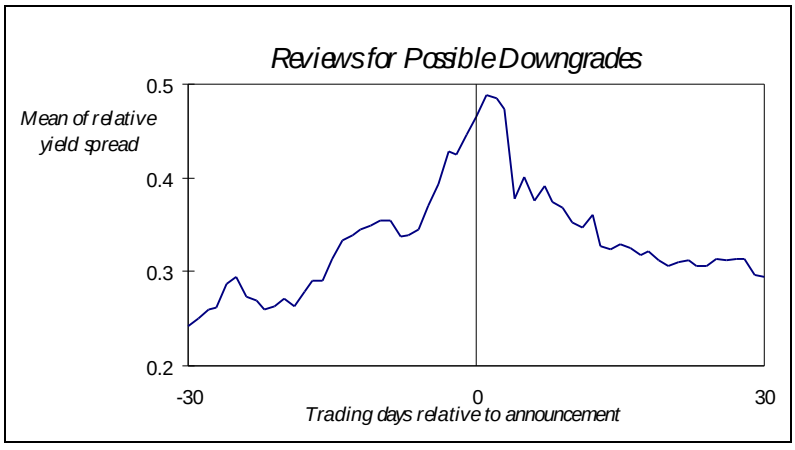
We next investigate how dollar bond spreads respond to Moody's and Standard & Poor's announcements of changes in their sovereign assessments. Our analysis is based on 78 rating events between 1987 and 1996 [8], of which 42 events affected the emerging markets. 8 ratings were put on review for possible downgrade and 14 for possible upgrade; 25 of the announcements report actual rating downgrades and 27 actual upgrades. Figure 2 visualises the average movements of relative yield spreads — yield

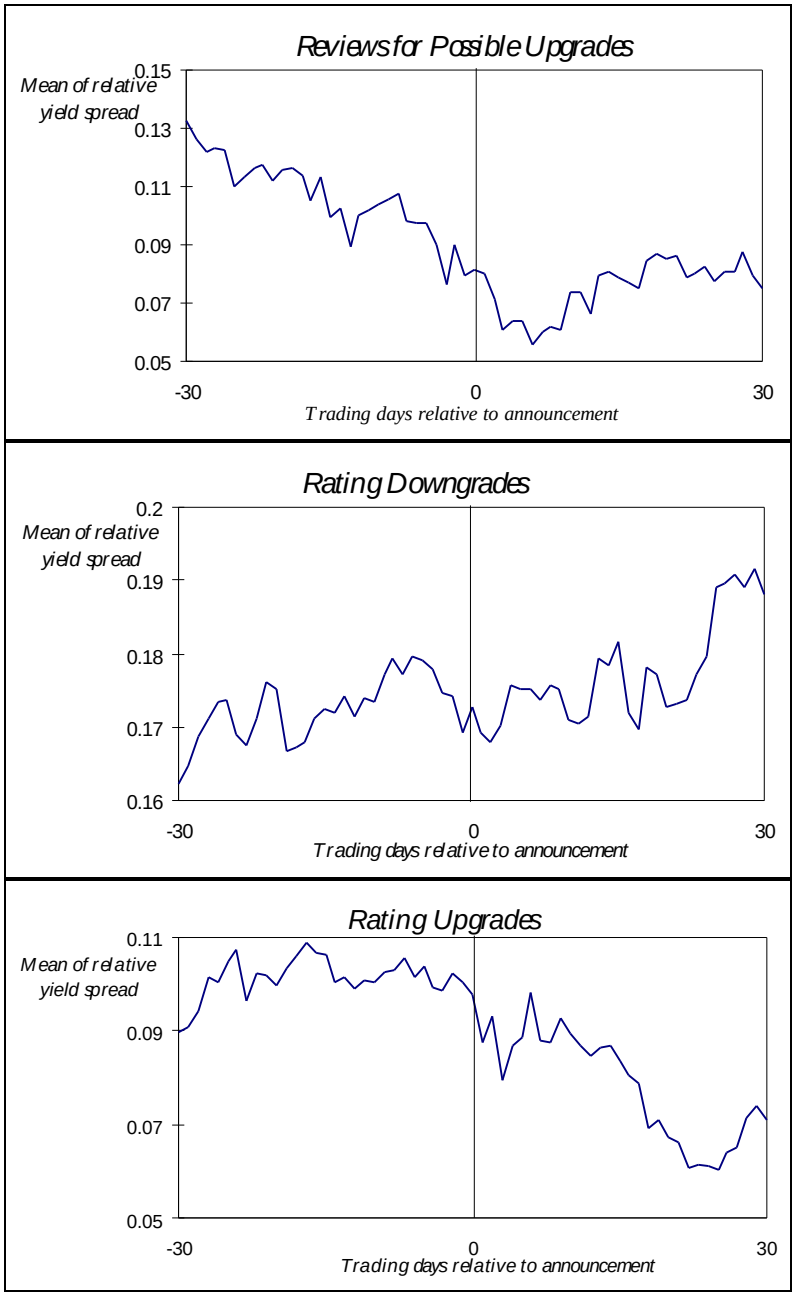
spreads divided by the appropriate US treasury rate — around the day 0 of the 78 rating announcements.

In general, Figure 2 shows clearly that a change in the risk assessment by the two 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 25 percentage points — a result which is heavily influenced by Mexico's tesobono crisis and the Tequila effect on Argentina. Likewise, the 29 trading days before a country is put on positive outlook by one of the two agencies, the relative yield spread falls on average by eight percentage points. Moreover, once a country's rating has been put on review for a negative or positive outlook, the market trend appears to reverse. This pattern clearly recalls the common bourse wisdom to buy on the rumour and to sell on the fact.

For actual rating changes, Figure 2 displays a somewhate different observation. Only shortly ahead of the agency announcement can a market movement clearly be discerned, when a downgrade (upgrade) is preceded by a modest rise (drop) in yield spreads. After the rating has been changed, the market appears to vindicate the agencies' assessment over the next 30 trading days with a respective movement in relative yield spreads.

Fig. 2: 78 Rating Events and Sovereign Yield Spreads, 1990-96





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

To capture the immediate effects of rating announcements, Table 2 presents the results of our event study for several time windows — three windows each for the 29 trading days before and after the announcement as well as a two-day window (day 0 and day 1) for the date of the announcement. Ideally, the event study should investigate 'abnormal' excess returns after correcting dollar bond spreads in a market model that relates the country-specific yield to an appropriate benchmark. This procedure would require that the signs of the 'abnormal' excess returns are homogenous with the direction of each

announced change in the agencies' rating. Since this requirement did not hold for our sample[9], Table 2 displays the change of the mean of the relative yield spreads and the respective t-statistic.[10]

Table 2: Short-term impact of the full sample of rating announcements
- mean change of relative yield spreads -

Full sample

	full sample			*emerging markets*		
No. of announcements	*78*			*42*		
Trading Days	*Cumultative Mean Change*	*t-statistic*	*% with right sign*	*Cumultative Mean Change*	*t-statistic*	*% with right sign*
-30 to -21	0.002	0.17		0.003	0.27	
-20 to -11	0.009	0.75		0.017	1.43*	
-10 to -1	0.012	1.06		0.026	2.18**	
0 to + 1	0.007	1.27	55.1	0.016	2.95***	64.3
+2 to +10	-0.010	-0.98	1.81	-0.017	-1.62*	3.70
+11 to +20	0.000	-0.01		-0.004	-0.35	
+21 to +30	-0.007	-0.59		-0.018	-1.55*	

Moody's

	full sample			*emerging markets*		
No. of announcements	*40*			*20*		
Trading Days	*Cumultative Mean Change*	*t-statistic*	*% with right sign*	*Cumultative Mean Change*	*t-statistic*	*% with right sign*
-30 to -21	-0.007	-0.53		-0.021	-1.67*	
-20 to -11	0.005	0.43		0.014	1.12	
-10 to -1	0.000	-0.04		0.006	0.50	
0 to + 1	0.006	1.08	55.0	0.017	3.01***	70.0
+2 to +10	-0.005	-0.46	1.26	-0.005	-0.45	3.58
+11 to +20	0.003	0.26		0.001	0.05	
+21 to +30	0.004	0.29		-0.003	-0.23	

Standard & Poor's

	full sample			*emerging markets*		
No. of announcements	*41*			*23*		
Trading Days	*Cumultative Mean Change*	*t-statistic*	*% with right sign*	*Cumultative Mean Change*	*t-statistic*	*% with right sign*
-30 to -21	0.010	0.65		0.027	1.64*	
-20 to -11	0.011	0.71		0.019	1.15	
-10 to -1	0.024	1.48*		0.041	2.53***	
0 to + 1	0.007	0.95	56.1	0.013	1.84**	56.5
+2 to +10	-0.015	-1.04	1.56	-0.029	-1.98**	1.25
+11 to +20	-0.002	-0.14		-0.005	-0.32	
+21 to +30	-0.018	-1.11		-0.034	-2.11**	

Table 2 replicates quite closely Cantor and Packer (1996) to see whether dollar bond spreads respond to rating announcements. Note, however, that our analysis fully captures events following Mexico's Tesobono crisis up to 1996, unlike Cantor and Packer whose tests are based on observations up to 1994 only. 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 which applies to all OECD and non-OECD countries: the impact of rating announcements on dollar bond spreads is not significant, in contrast to the findings by Cantor and Packer.[11] However, we do find a highly significant (at the 1 per cent level) impact of rating announcements on emerging market sovereign bonds. Within the announcement window (day 0-1), a rating event on emerging-market sovereign bonds moves the relative yield spread by 1.6 percentage points. The change in the yield spread during the rating announcement is larger than the change in the preceding 29 trading days; but it is subsequently reversed, indicating a degree of market overshooting.

Roughly 55 per cent of the full sample and 64 per cent of the emerging-market sample of rating events are associated with the expected change in the yield spread.[12] Moody's rating events seem to exert a more important effect on emerging market bond yields than rating events triggered by Standard & Poor's: the coefficient of the impact of rating events on yield spreads is slightly higher as is the percentage of observations where rating events coincide with the expected sign in yield spread changes.

To explore the announcement effect of rating events in more detail, Table 3 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 we reported in Table 2.

Table 3: Short-term impact of various rating announcements categories
- mean change of relative yield spreads -

	OUTLOOK / CREDITWATCH: downgrade				*OUTLOOK / CREDITWATCH: upgrade*			
	full sample		*emerging markets*		*full sample*		*emerging markets*	
No. of announcements		*8*		*3*		*14*		*11*
Trading Days	*Cumultative Mean Change*	*t-statistic*	*Cumultative Mean Change*	*t-statistic*	*Cumultative Mean Change*	*t-statistic*	*Cumultative Mean Change*	*t-statistic*
-30 to -21	0.019	0.36	0.026	0.50	-0.015	-0.68	-0.016	-0.75
-20 to -11	0.087	1.66*	0.228	4.36**	-0.010	-0.47	-0.011	-0.50
-10 to -1	0.096	1.85*	0.275	5.26***	-0.023	-1.04	-0.026	-1.21
0 to + 1	0.042	1.78*	0.113	4.86**	0.001	0.06	-0.003	-0.34
+2 to +10	-0.135	-2.88**	-0.351	-7.52***	-0.006	-0.30	-0.005	-0.24
+11 to +20	-0.046	-0.89	-0.137	-2.63**	0.011	0.52	0.012	0.56
+21 to +30	-0.011	-0.21	-0.052	-1.00	-0.010	-0.48	-0.010	-0.45

	RATING: downgrade				*RATING: upgrade*			
	full sample		*emerging markets*		*full sample*		*emerging markets*	
No. of announcements		*25*		*6*		*27*		*20*
Trading Days	*Cumultative Mean Change*	*t-statistic*	*Cumultative Mean Change*	*t-statistic*	*Cumultative Mean Change*	*t-statistic*	*Cumultative Mean Change*	*t-statistic*
-30 to -21	0.019	1.86**	0.035	3.40***	0.010	0.43	0.008	0.37
-20 to -11	-0.002	-0.23	-0.016	-1.55*	-0.001	-0.02	0.002	0.09
-10 to -1	-0.005	-0.45	-0.015	-1.45*	-0.004	-0.17	-0.009	-0.40
0 to + 1	0.000	0.00	0.005	1.04	-0.009	-0.91	-0.014	-1.37*
+2 to +10	0.002	0.18	0.008	0.89	0.000	-0.01	-0.001	-0.04
+11 to +20	0.002	0.18	0.014	1.37	-0.023	-1.04	-0.021	-0.96
+21 to +30	0.008	0.76	0.021	2.09**	0.035	1.57*	0.050	2.23**

* Significant at the 10 percent level.; ** Significant at the 5 percent level. ;*** Significant at the 1 percent level.
Source: Bloomberg, Datastream, JP Morgan, Merrill Lynch, Moody's, Standard & Poor's; own calculations.

Table 3 reports a significant change of the yield spread in the expected direction during the announcement period (day 0-1) only when a country is put on review for a **possible downgrade**. For emerging-market securities, the negative announcement has a strong and significant effect on relative yield spreads, which rise by 11.3 percentage points. There is also a strong market anticipation in the 19 trading days before that rating event as spreads rise by 2 percentage points on a daily basis. Also significantly, part of the rise in relative yield spreads is reversed in the month following the announcement that an

emerging-country rating has been put on review with a negative outlook (the reversal may indicate economic policy reactions by the authorities concerned). Even when including the weak significance for rating upgrades in emerging markets, our results contrast with Cantor and Packer who find significant results only for positive announcements. However, we are in line with most other studies using US stock market data finding a significant price response to downgrades but not to upgrades (Goh and Ederington, 1993).

Finally, it is noteworthy that Table 3 reports a slow but rising market response when rating downgrades are actually implemented. The rise in the dollar bond spread in response to a downgrade on emerging-market sovereign bonds becomes significant only 20 trading days after the rating event. The slow response may reflect the reorientation of portfolios by institutional investors which are often guided by prudential regulation that discourages the holding of low-rated securities.

The results of the above event study on the size of yield spreads are reinforced when we examine the impact of rating events on financial market volatility. We divide the **volatility event study** in two parts. First, we analyse changes in volatility of sovereign bond yield spreads with respect to rating announcements which leaves us with 67 rating events between 1987 and 1996.[13] Second, we analyse the volatility of stock market returns. Using this variable we could increase the number of observed rating events up to 210, as we include more countries and use a longer time period, end-December 1988 to end-March 1997. Additionally, we use those rating events for which only the exact month of pronouncement was available.[14] We measure the impact of rating events on the volatility of bond yield spreads on a daily basis and of stock market returns on a weekly basis. This important difference has to be kept in mind when interpreting the results. Figure 3 visualises now the average historical volatility of relative yield spreads around day 0 for the 67 announcements and the average historical volatility for real stock market returns around week 0 for 210 announcements.

All eight panels in Figure 3 clearly are in line with the results obtained earlier for the size of yield spreads. We observe a significant change in the level of volatility for both, relative bond yield spreads and real stock market returns, after the rating event. In other words, the risk perception of financial markets, measured by volatility, shifts with a change in the risk assessment by the leading two rating agencies. Moreover, volatility increases with rating downgrades and decreases with rating upgrades. The size of the shift is even bigger, when reviews of ratings are taken into account. While implemented rating changes raise volatility by 10 percent for both bonds and stocks, announced rating reviews lead to changes of up to 40 percent in the level of stock market volatility. As these findings were based on 210 rating events over the period between end-December 1988 and end-March 1997 and cover 22 emerging markets and 27 industrialised countries, they can be interpreted with a higher degree of confidence than our earlier study on the impact of ratings on yield spreads.

We also find that rating upgrades and reviews for rating upgrades are usually preceded by declining volatility levels for relative yield spreads. For positive reviews, the trend towards lower volatility continues. However, once the news on implemented upgrades are out, volatility tends to rise again. In general, real stock market return volatility remains on a higher level, and only after the rating event it starts to drop. These two different patterns might strengthen the argument that sovereign bond markets anticipate rating announcements, while stock market participants are mainly concerned about domestic news and therefore capture news about sovereign risk changes via rating agencies' announcements. We venture the hypothesis that foreign investors are relatively more important than local investors in determining government bond yields than stock market returns.

In Table 4 and Table 5 we present the statistical analysis of rating announcement effects on changes in volatility for relative yield spreads and respectively real stock market returns. For the test procedure we assume that the **volatility before the rating event** mirrors "normal" volatility.[15] Both tables show test statistics of cumulative average volatility that are tested to be equal to the volatility before the rating event. We find a significant change in volatility levels for yield spreads and for stock market returns on the event day, respectively the event week. This indicates that volatility differs before and after the rating event. Rating announcements thus have a significant impact on volatility levels.

Table 4: Short-term impact of various rating announcements categories
- average volatility of relative yield spreads -

	OUTLOOK / CREDITWATCH: downgrade				*OUTLOOK / CREDITWATCH: upgrade*			
	full sample		*emerging markets*		*full sample*		*emerging markets*	
No. of announcements		*1*		*0*		*8*		*7*
Trading Days	*Cumultative Average Volatility*	*t-statistic*	*Cumultative Average Volatility*	*t-statistic*	*Cumultative Average Volatility*	*t-statistic*	*Cumultative Average Volatility*	*t-statistic*
-30 to -21	0.10	-0.74			0.42	12.0 ***	0.46	16.2 ***
-20 to -11	0.12	-0.14			0.37	-1.01	0.40	-0.16
-10 to -1	0.16	0.88			0.33	-11.0 ***	0.33	-16.0 ***
0 to + 1	0.03	1.08			0.07	16.9 ***	0.07	16.7 ***
+2 to +10	0.12	0.25			0.32	-4.4 ***	0.33	-5.8 ***
+11 to +20	0.19	1.97			0.31	-13.6 ***	0.34	-14.9 ***
+21 to +30	0.33	5.79 *			0.24	-30.8 ***	0.25	-34.5 ***
	RATING: downgrade				*RATING: upgrade*			
	full sample		*emerging markets*		*full sample*		*emerging markets*	
No. of announcements		*24*		*5*		*26*		*20*
Trading Days	*Cumultative Average Volatility*	*t-statistic*	*Cumultative Average Volatility*	*t-statistic*	*Cumultative Average Volatility*	*t-statistic*	*Cumultative Average Volatility*	*t-statistic*
-30 to -21	0.27	-3.96 ***	0.72	-2.49 **	0.34	25.0 ***	0.40	21.9 ***
-20 to -11	0.31	2.89 ***	0.86	1.90 *	0.27	-2.39 **	0.31	-1.88 *
-10 to -1	0.30	1.06	0.82	0.59	0.22	-22.6 ***	0.24	-20.0 ***
0 to + 1	0.06	10.2 ***	0.15	5.17 ***	0.04	11.7 ***	0.04	7.2 ***
+2 to +10	0.28	2.21 **	0.70	-0.49	0.20	-21.1 ***	0.22	-17.8 ***
+11 to +20	0.33	6.1 ***	0.80	0.05	0.26	-8.2 ***	0.29	-6.2 ***
+21 to +30	0.35	9.5 ***	0.91	3.58 ***	0.27	-3.8 ***	0.30	-4.2 ***

* Significant at the 10 percent level.; ** Significant at the 5 percent level. ;*** Significant at the 1 percent level.
Source: Bloomberg, Datastream, JP Morgan, Merrill Lynch, Moody's, Standard & Poor's; own calculations.

However, we also find significant test statistics before the rating event. This can be interpreted in two ways, either our estimator for the "normal" volatility is an inefficient estimator which would put in question the results in Table 4 and Table 5. Another reason could be that markets already anticipate the rating event, without being fully sure. Abnormal volatility should eventually disappear once the rating event has taken place. In Figure 3 we observe that volatility levels evolve inversely with the direction of the

Table 5: Short-term impact of various rating announcements categories
- average volatility of real stock market returns -

	OUTLOOK / CREDITWATCH: downgrade				*OUTLOOK / CREDITWATCH: upgrade*			
	full sample		*emerging markets*		*full sample*		*emerging markets*	
No. of announcements	*21*		*9*		*41*		*25*	
Trading Weeks	*Cumulative Average Volatility*	*t-statistic*	*Cumulative Average Volatility*	*t-statistic*	*Cumulative Average Volatility*	*t-statistic*	*Cumulative Average Volatility*	*t-statistic*
-30 to -21	18.42	-0.35	19.90	0.22	17.95	2.2 ***	21.22	16.6 ***
-20 to -11	18.92	0.33	18.14	-2.15 **	16.60	-6.0 ***	18.63	0.77
-10 to -1	18.68	0.01	21.16	1.93 **	18.19	3.8 ***	20.67	13.2 ***
0 to + 1	4.66	8.5 ***	6.00	12.2 ***	3.42	22.7 ***	3.75	25.8 ***
+2 to +10	24.03	10.3 ***	30.17	17.7 ***	14.12	-10.9 ***	15.52	-7.3 ***
+11 to +20	20.63	2.66 ***	23.36	4.9 ***	15.25	-14.2 ***	16.25	-13.7 ***
+21 to +30	18.97	0.41	21.13	1.89 **	15.34	-13.6 ***	16.82	-10.2 ***
	RATING: downgrade				*RATING: upgrade*			
	full sample		*emerging markets*		*full sample*		*emerging markets*	
No. of announcements	*33*		*15*		*46*		*29*	
Trading Weeks	*Cumulative Average Volatility*	*t-statistic*	*Cumulative Average Volatility*	*t-statistic*	*Cumulative Average Volatility*	*t-statistic*	*Cumulative Average Volatility*	*t-statistic*
-30 to -21	21.40	-8.6 ***	23.22	-17.3 ***	16.46	0.94	19.06	1.20
-20 to -11	22.52	-5.1 ***	28.46	-1.1	16.48	1.02	19.23	1.78 **
-10 to -1	28.59	13.7 ***	34.77	18.4 ***	15.60	-1.97 **	17.82	-2.98 ***
0 to + 1	5.78	23.2 ***	7.22	30.0 ***	2.94	9.9 ***	3.36	11.3 ***
+2 to +10	28.18	20.9 ***	35.16	30.1 ***	13.23	-4.7 ***	14.75	-7.4 ***
+11 to +20	26.49	7.2 ***	30.83	6.2 ***	14.56	-5.5 ***	16.84	-6.3 ***
+21 to +30	21.81	-7.3 ***	25.58	-10.0 ***	13.94	-7.5 ***	16.00	-9.1 ***

* Significant at the 10 percent level.; ** Significant at the 5 percent level. ;*** Significant at the 1 percent level.
Source: Bloomberg, Datastream, JP Morgan, IFC, Merrill Lynch, Moody's, Standard & Poor's; own calculations.

rating announcement over time already before the event. Financial markets display higher volatility levels before a rating event; the volatility is subsequently reinforced by the rating event itself. However, the market behaviour — viewed from the statistical point of view — seems not to be perfectly consistent. In Table 5 the strong market anticipation disappears for rating upgrades and negative creditwatch/outlook when the volatility of stock markets is examined.

Volatility levels increase when we restrict the analysis to emerging markets.

Furthermore, if rating events are divided into investment grades and non-investment grades as in Figure 4, non-investment grades exhibit higher general volatility levels for both yield spreads and stock market returns. This latter point confirms awareness of market participants about increased risk levels for non-investment grades. Generally, the findings of the volatility study show a strong market reaction to rating announcements. Positive announcements tend to reduce volatility levels in both markets, bond and stock, while the contrary holds for negative rating announcements. It has been shown, however, that rating events never fully come out of the blue, but are anticipated by financial markets to a certain degree, but not to a full extent.

4 Conclusion

This study has investigated to which extent rating events influence sovereign bond yield spreads and overall financial market volatility. While rating agencies are part and parcel of today's financial markets, the study succeeds in tracing some independent effect that ratings exert on financial market prices.

First, our Granger causality test cautions against overestimating the independent long-run impact that sovereign credit ratings exert on the financial-market assessment of sovereign risk, however. The financial market and the two leading rating agencies appear broadly to share the same model in that assessment. As indicated by the explanatory power of the equations that underlie the causality test, dollar bond spreads and a set of default determinants seem to explain somewhat better the level of credit ratings than vice versa. The mutual interaction between sovereign yield spreads and ratings may be characterised by the nature of sovereign risk (requiring assessments on present and future willingness rather than only ability to pay), the information content of sovereign risk ratings ('contaminating' rating changes with other publicly-available news) and the industrial organisation of the rating industry (introducing an upward bias in sovereign ratings).

Second, contrary to our expectations, our event studies find a highly significant announcement effect — obviously muted by strong market anticipation — when emerging-market sovereign bonds are put on review with negative outlook. The result may surprise, beyond the above considerations, because the rating of these bonds is fairly new to the industry; this lack of experience is reflected by a high degree of split ratings. Negative rating announcements seem also to be effective in the aftermath of rating deteriorations (possibly not fully captured by the length of our observation window), as investors are incited to reorient their portfolios. Positive rating events, by contrast, do not seem to have a significant announcement effect on dollar bond spreads. However, significant effects were found on changes in volatility levels of yield spreads and stock market returns.

Third, these findings imply that the sovereign rating industry has the potential to help dampen excessive private capital inflows into the emerging markets with negative rating announcements. Positive announcements, by contrast, do not seem to exert a significant impact on sovereign risk assessments and thus are unlikely to add to the Harberger externality, even though they tend to reduce volatility in both bond and stock markets.

For two reasons, even this conclusion must be cautioned however. The econometric analysis of rating decisions seems sensitive to the sample period chosen and the proxy variable for sovereign country risk. And even if rating agencies have the potential to dampen excessive inflows, our analysis does not provide information whether the agencies would provide negative rating announcements in time.

Notes

1. The sample countries of section 3 include Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Czech Republic, Denmark, Finland, Germany, Hungary, Indonesia, Ireland, Italy, Korea, Malaysia, Mexico, New Zealand, Norway, Philippines, Poland, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, UK, USA, and Venezuela. In section 4 — using the stock market index — we were able to add the following countries to the sample: China, Egypt, France, Greece, India, Japan, Jordan, Netherlands, Pakistan, Russian Federation, Singapore, Slovakia and Taiwan.

2. A rating notch is the one-level difference on a rating scale.

3. An alternative transformation form could be a kinked function with a ”structural break” when the sovereign bond passes non-investment grade to investment grade.

4. Unfortunately, monthly data for variables such as government spending are not available for all countries.

5. The estimation of this model leaves us with two alternatives. One is to use an ANOVA based General Least Square (GLS) estimator for an unbalanced panel. The 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. Secondly, we can 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 Ahn and Schmidt (1995). As both methods cannot be used simultaneously, we decided to use the method for dynamic models, the GMM estimator.

6. This results from F and Hausmann tests which tested for alternative model specification simple OLS, the Var model (variation of slopes and intercepts across the country units), and the Between model.

7. Further research will work with the Principal Component Model in order to reduce the number of regressors and multicollinearity. This would allow to use a GMM estimator for a simultaneous equation model with endogenous variables.

8. Between 1987 and 1996, we observe 126 precisely dated rating events by the two leading rating agencies, of which 48 cannot be used for our analysis for lack of regular trading of the underlying sovereign bond.

9. We constructed market models that regressed country-specific yields on the JP Morgan Global Government Bond Index (for OECD countries) and on the JP Morgan Emerging Market Bond Index Plus to calculate ‘normal’ returns. Although our market models yielded very high R^2, the signs of the ‘abnormal’

excess returns (actual yields minus ‘normal’ yields) were not in line with the direction of rating changes.

10. Using daily changes of the mean of the relative yield spreads and their standard deviation over the 60 days period surrounding the announcement, we constructed a test statistic which is t-distributed, following Holthausen and Leftwich (1986).

11. Because positive rating announcements should be associated with negative changes in spread, we multiply the changes in the relative spread by -1 when rating announcements are positive.

12. The number in parenthesis is a test-statistic which is based on a binomial distribution with p equal to 0.5.

13. The number of rating events decreases by 11 events compared to the first event study. This is because calculating historical volatility requires a minimum of 30 days ahead in order to calculate the moving average variance.

14. In order to use these rating events we constructed the average volatility of the real stock market return of the event month and declared this monthly average as the average volatility of week 0. This construction was impossible for relative yield spreads as the variable was expressed on daily basis.

15. ”Normal” volatility for yield spreads and stock market returns is calculated from the 30 days, respectively from the 30 weeks, preceding the rating event.

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