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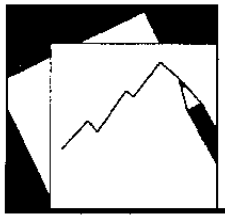

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Using Credit Ratings for Capital Requirements on Lending to Emerging Market Economies: Possible Impact of a New Basel Accord

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Using Credit Ratings for Capital Requirements on Lending to Emerging Market Economies: Possible Impact of a New Basel Accord

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Abstract

The Basel Committee on Banking Supervision has proposed linking capital requirements for bank loans to ratings by commercial credit rating agencies. Estimates for 20 emerging market economies show that sovereign ratings react procyclically to crisis indicators. Ratings deteriorate if the real effective exchange rate depreciates, in contrast with the positive effect on overall debt service capacity depreciations are normally supposed to have. Simulations show that linking capital requirements to ratings would have drastically increased these requirements during the crisis periods after decreasing them in the run up to the crises. Simulations suggest modest efficiency gains of using sovereign credit ratings for capital requirements on emerging market lending.

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Contents Page

I. INTRODUCTION AND SUMMARY

The current system of capital requirements for international lending by banks has generally been faulted for contributing to the crises that swept through emerging market countries during the past five years. Many have charged that the system has contributed to imprudent lending practices and volatility in lending by providing insufficient incentives for banks to discriminate between countries depending on the soundness of their policies and fundamentals.[2]

Under the current system, risk weighting for sovereign loans depends largely on OECD membership. Under the 1988 Capital Accord, bank lending to the sovereigns of OECD countries is not subject to capital requirements.[3] The weaknesses of this approach are illustrated by the fact that two newly minted OECD countries, Mexico and Korea, suffered major crises shortly after their anointment and ensuing reduction in capital requirements. In addition, under current arrangements, short-term lending to banks of emerging market economies is subject to very limited capital requirements. This has been faulted for contributing to an overly short maturity structure of emerging market country debt.

For emerging market economies and the banks lending to these countries, these are important issues. Bank lending to emerging market economies increased to about 1 trillion dollars by mid-1997, and turned out to be the least stable category of funding for these countries in the later half of the 1990s, with massive inflows especially in 1995, 1996, and early 1997, and large outflows from mid-1997 onward.

Table 1: Bank Loans to and Debt Securities Issued by Developing Countries
(In billions of U.S. dollars unless otherwise indicated)

	Dec-93	Dec-94	Dec-95	Dec-96	Dec-97	Dec-98
Bank loans to developing countries 1/	596	653	735	838	931	866
o/w: short-term	317	350	408	465	520	437
Debt securities of developing countries 1/	122	161	184	270	355	414

1/ Source of data: BIS. Includes developing countries and transition economies and Turkey, but excludes Hong Kong and Israel. Securities by nationality of issuer.

In June of 1999 the Basel Committee on Banking Supervision (hereafter the Basel Committee or BBS) launched a proposal for a new capital adequacy framework to replace the

[2]Cf. Inter alia *The Economist*, "On Watch" May 15, 1999, "Capital Idea," April 17, 1999.

[3]The 1988 Accord provided for three weights for capital requirements: 0 percent for OECD government bonds, 20 percent for all claims on OECD banks and short-term claims on non-OECD banks, and 100 percent for claims over one year on banks, corporates and sovereigns of other countries, implying that banks have to set aside capital equal to respectively to 0 percent, 1.6 percent and 8 percent of such loans.

1988 Accord (BBS 1999). [4] The key change affecting emerging market lending in the proposal by the Basel Committee is to use assessments for sovereigns by rating agencies based on long-term foreign currency obligations to determine risk weighting. The proposed weighting for sovereign loans is detailed in the first column of Table 2.[5]

At face value, the proposal to link capital requirements to foreign currency credit ratings is an important step forward as the rating agencies aim to capture some of the systemic repayment risk. Following a rapid growth in ratings in the 1990s, coinciding with the spurt in bond financing shown in Table 1, ratings are now widely conducted: about one hundred countries currently have a sovereign debt rating.

However, there are three main problems with using ratings for capital requirements:

- The relation between sovereign ratings and repayment risks is *not well tested.* Contrary to corporate ratings, the track record of rating agencies is limited in the area of sovereigns as recognized both by the Basel Committee and the rating agencies themselves: for example, three quarters of the ratings of emerging market economies are no more than five years old (see Appendix I Table 10).[6] The IMF staff (1999), in its review of rating agencies, highlights, in addition to the limited track record, the lack of an explicit and probabilistic methodology and limited resources devoted by rating agencies to sovereign ratings.

- Sovereign ratings could be *procyclical*, although the aim of the rating agencies seems to be to see through the business cycles of the countries, i.e., to be cycle neutral and avoid unnecessary and foreseeable changes in ratings (Treacy and Carey 1998, IMF 1999). One could argue that capital requirements should instead be countercyclical: during a normal

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[4]The 1988 Accord is commonly acknowledged to have made a major contribution to international bank regulation and supervision. It has helped to reverse the downward trend in capital adequacy, and contributed to a level playing fields within G-10 countries and elsewhere (De Swaan, 1998).

[5]Sophisticated banks could use their own internal ratings. The Basel Committee also advocates making use of other bodies performing similar assessments, such as export agencies in the G-10 countries, as the committee expresses doubt about the performance of the main rating agencies. Data on export credit agency tariffs that can be seen as a proxy for their ratings are scant.

The other key change is the proposal to increase the capital requirements on short-term interbank loans—the maturity in the definition of short-term loans is reduced from 12 to 6 months, and the requirements are increased for loans to banks in countries with a rating of triple B or less.

[6]Ratings of sovereigns date back to the 1920s, but such ratings were mostly abandoned until the 1970s (Standard and Poor, August 1998).

Table 2: Proposed Risk Weights

Sovereign Rating		Proposed Risk Weight			
Standard and Poor's	Moody's	Sovereign loans	Interbank loans		Corporates
			Option I 1/	Option II 2/ 3/	
AAA to AA-	Aaa to Aa3	0%	20%	20%	20%
A+ to A-	A1 to A3	20%	50%	20%	20%
BBB+ to BBB-	Baa1 to Ba1	50%	100%	50%	50%
BB+ to B-	Ba1 to B3	100%	100%	100%	100%
Below B-	Below B3	150%	150%	150%	150%
Unrated	Unrated	100%	100%	100%	100%
1998 Accord:	OECD	0%	20%	20%	100%
	Non-OECD	100%	100%	20% 4/	100%

1/ Risk weighting based on the weighting of the sovereign of the country in which the bank is incorporated.
2/ Risk weighting based on assessment of individual bank, which is assumed here (in contrast to the presentation in the proposal) to be the highest possible. The risk weight is 50 percent for unrated banks unless capped by the sovereign rating.
3/ For short-term claims the risk weight of the individual bank is one category more favorable. The proposed Accord defines short-term as six months maximum.
4/ Short-term loans. The 1988 Accord defines short-term as one year maximum.

downturn in the business cycle some of the factors for which a capital cushion is needed are materializing and capital should be applied for those purposes.[7]

- For sovereigns the aim of rating agencies appears to be to capture *default risk* rather than the *unexpected loss* i.e. a measure of the potential for higher than usual losses (Moody's 1991, Standard and Poor's 1998).[8]

  - The focus of rating agencies on default risk could limit their usefulness in the Capital Accord. The focus of capital requirements should, in contrast, be on covering the unexpected loss with a high probability (Jackson and Perraudin 1999),[9] i.e., to secure

[7] If the objective of capital requirements is to have a constant small probability of insolvency, capital requirements can be smaller during expected downturns in the business cycle when write-offs are relatively high but are expected to decline.

[8] Expected loss, which is a function of default risk and the recovery rate of defaulted loans is in principle priced into loans. This point is not a critique of rating agencies, but reflects on their usefulness for capital requirements.

[9] Whether capital should also cover some of the expected losses resulting from changes in the outlook since the origination of the loan depends on whether banks provision separately for this element of loss. Jackson

(continued...)

bank soundness and limit the likelihood of insolvency (Greenspan 1998).[10] Thus there appears to be a gap between the target of the Accord (to provision against unexpected loss), and the instrument (ratings), which measures "default risk."[11]

- The focus on default risk rather than loss, is also potentially problematic for use in the Capital Accord because default risk for emerging market economies is more prone to contagion and spill-over than expected loss because countries are susceptible to liquidity crises:[12] an unexpected liquidity crisis in a major borrower could trigger a downgrade of that country. This could trigger expectations of downgrades in other countries, as the risk of default in these countries increases, and increased capital requirements and withdrawal of funds, and contribute to the chance these countries indeed will need to resort to a default as their reserves are depleted. It should be noted that a default that is invoked as a protection for a liquidity run does not necessarily imply an expected loss as the solvency of the country need not be fundamentally effected. In other words during such a period of contagion, as at end 1997, there may be an increased divergence between "unexpected (NPV) loss" and the "probability of default" which makes the use of ratings during such periods a less suitable proxy for capital requirements.

Whereas the latter is an a prior argument against the use of ratings for capital requirements when contagion is a concern, the other potential issues are essentially questions of degree. It requires estimations and simulations to shed light on the extent to which these are indeed major issues. To examine the nature of the ratings and the degree of procyclicality, we estimate and present in Section II a model of ratings for sovereigns of emerging market economies focusing on sovereign ratings for 20 of the larger emerging market economies on a semiannual basis from 1994-99. The sample covers basically all emerging market countries for which a relatively long time series is available and captures about 75 percent of private emerging market lending (see Figure 3 in Appendix II). We focus on the two main rating agencies, Moody's and Standard and Poor's, and also study the ratings published by Institutional Investors, which are compiled relying inter alia on experts of the largest

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and Perraudin 1999 contains a useful overview of relevant research on the relation between ratings and capital requirements.

[10]Apparently, rating agencies concentrate on default risk for sovereigns because they have difficulty capturing expected loss for sovereigns. This may reflect the general problem that defaults of sovereigns are infrequently observed and depend on willingness to pay and not only ability to pay.

[11] For corporations the correlation between the ratings and the default probability varies considerable with the duration (Moody's January 1999): the relative risk of highly rated corporations increases much more rapidly over time than the risk of low rated corporations.

[12]It is important to note here that while corporations can seek protection in Chapter 11 type bankruptcy proceedings from a liquidity squeeze, and banks can usually resort to a domestic lender of last resort, countries have only a generally quite limited resort to liquidity support from the IMF or other central banks.

international banks and might give some insights into how internal ratings of banks might perform. Estimations of ratings behavior point to procyclicality, and a tendency to downgrade following relatively deep crises and depreciations of the real effective exchange rate.

To understand the impact of ratings on capital requirements we simulate and present in Section III the impact that actual ratings changes would have had on capital requirements, assuming that the proposed Accord had been in place from early 1994 on. The simulation suggests that overall capital requirements would have been rather procyclical, with requirements falling ahead of the Asian crisis and steeply increasing during the crises. We contrast this procyclical impact of the proposed system with the positive impact it may have on efficiency through the increased capital requirements for lending to countries that are deemed more risky (in Section IV). The calculations suggest that the impact may only be modest—if indeed positive.

Section V concludes the paper. Appendix I contains a brief presentation of ratings used as well as their methodology.[13] Appendix II discusses data and their sources.

II. Explaining Sovereign Ratings

Experience with estimating rating models

Since agencies have commenced to rate a much larger number of countries, a few empirical studies have been conducted to estimate models that can explain such ratings. Cantor and Packer (1996) claimed some early success in estimating ratings of Moody's and Standard and Poor's (SPM) of 23 industrial and 26 developing countries for September 1995. In sharp contrast to the complexity of the SPM methodologies, they found that credit ratings can be explained up to 90 percent by a small number of economic variables (better ratings were associated with high per capita income, low inflation, a low ratio of foreign currency external debt to exports) and various dummies (the absence of history of defaults on foreign currency debts since 1970, and a high level of economic development as measured by the classification as an industrialized country by the IMF).

Estimating the same relation over time reveals that it is not stable. Using Cantor and Packer's methodology, Juttner and McCarthy (1998) found that the relation used by Cantor and Packer was deteriorating if estimated for subsequent years, especially 1998. They introduced some additional variables, but found that results were still not stable and varied from year to year, leading these authors to the conclusion that rating behavior changes during crises and cannot be predicted. However, their results should not come as a surprise: the rating agencies after all attempt to see through cycles. The short-run relation with fundamentals is thus not the

[13]The 1999 IMF Capital Markets Report contains a detailed overview of rating agencies (IMF 1999).

same as the long-run relations, and the result of static estimations can thus be expected to change from one year to another.

Specification

To capture behavior of the rating agencies that changes over time we will estimate a dynamic relation of the error correction type which is well suited to deduce the difference between short-run and long-run relations. Moreover, we will estimate the relation only for emerging market economies, as rating behavior for industrialized countries may well be quite different (the degree of inertia in ratings, for example appears to be significantly larger for industrialized country ratings).[14]

$$(1) \qquad \text{Rating}_{i,t} = \alpha \text{Rating}_{i,t-1} + \sum_j \beta_j \Delta X_{j,i,t} + \sum_j \gamma_j X_{j,i,t-1} + c + \varepsilon_{i,t}$$

In this equation, i indicates the rating agency whose ratings are estimated, X the set of exogenous variables, Δ first differences and c the constant. For the set of exogenous variables we use the variables used in the papers discussed above, and variables commonly used in models of bond spreads for emerging market economies. Table 3 contains an overview of these variables and their abbreviations, and an overview of the variables used in three other key studies quoted above. The acronyms are used throughout this paper. The models of bond spreads quoted contain a few additional variables to explain creditworthiness (notably the debt service ratio, investment over GDP, and short-term debt over reserves) which we will use here as well.

Results for the static specification

In view of the large number of variables and to be able to compare our results to those found by others, we first estimate a static version of equation (1) (i.e., with α and β zero) in line with Cantor and Packer and Juttner and McCarthy. The results are presented in Table 14 (at the end of the paper).[15] Only 8 out of 15 variables (not counting multiple lags) are significant and have the expected sign. The results for the various ratings are remarkably similar, and

[14]The need to test a dynamic specification is also evident from the results of Ul Haque, Kumar, Mark, and Mathieson (1997) who studied, in the absence of ample data on the more widely used and frequently updated ratings of SPM, ratings provided by Euromoney, Institutional Investor, and the Economic Intelligence Unit for 60 developing economies from 1980 to 1993. Their study shows that these ratings display a high degree of inertia and implied long-run elasticities that are much higher than short-run elasticities.

[15]As a selection procedure we commenced with the full set of X variables but with one each of variables with multiple lags. Debt over exports is consistently more significant than debt over GDP. The variables defined over longer periods, mostly three or four years, to indicate averaging out of trends, were not as significant as the trends for shorter periods or insignificant as such.

Table 3: Name and Definition of Variables Used

Variables	Name and definition	Set of Z variables	Expected sign	Cantor and Packer	Juttner and McCarthy	Ul and others Haque	Eichengreen and Mody
Dependent variable	Ratings: Institutional Investors, Moody's and Standard and Poor's 1/						
Period considered	From the first semester of 1995 to the first semester of 1999.						
Countries considered	20 emerging market countries						
Independent variables 2/							
Debt variables							
Debt	DEBTGDP: total external debt over GDP	Z	+			UH	EM
	DEBTX: total debt over exports	Z	+	CP	JMc		
Debt service	DSX: debt service over exports	Z	+				EM
Debt rescheduling	RSCH: dummy is 1 if rescheduling takes place between 1970 and 1993	Z	+	CP	JMc		EM
Other external indicators 2/							
Reserves	STDR: short-term debt over reserves (including gold at market prices)	Z	+				EM
	RESM: reserves over imports	Z	-			UH	
Current account balance	CAGDP: current account over GDP (- is deficit)	Z	-			UH	
	CAGDP3: current account over GDP (- is deficit) in the preceding 36 months	Z		CP	JMc		
Real effective exchange rate	REER: REER appreciation in the 12 preceding months	Z	+		JMc	UH	
	REER4: REER appreciation in the 48 preceding months	Z					
Exports	XGR: export growth	Z	+			UH	
Short term debt share	STDTD: short term debt as a share of total debt		+				EM
Terms of trade	TOT: price of exports over price of imports	Z	-			UH	
Domestic indicators 2/							
Inflation	INF: CPI growth rate over preceding 12 months	Z	+			UH	
	INF3: CPI growth over preceding 36 months	Z		CP	JMc		
Credit	LB: "lending boom," growth rate of the variable (domestic credit – claims on central government) over the twelve previous months	Z	+				EM..
	LB4: "lending boom" over the 48 previous months	Z			JMc		
Growth rate	GRGDP: growth rate of GDP	Z	-			UH	EM
	GRGDP3: growth rate of GDP, three year average	Z		CP	JMc		
Fiscal balance	FBGDP: general government balance over GDP (- is deficit)	Z	-				
	FBGDP3: general government balance over GDP, three year average	Z		CP	JMc		
Saving and investment	IGDP: investment over GDP	Z	-				
	SGDP: saving over GDP	Z	-				
Per capita income	PCI: log of nominal GDP per capita	Z	-	CP	JMc		
Other variables 2/							
Treasury bill	TBILL: average 3 months US Treasury Bill rate at the end of the year	Z	+			UH	
Dummies	ASIA: dummy for Asian countries						
	LAC: dummy for Latin American countries						
Spread	SPRD: spread over T-Bonds of various emerging Eurobonds in end of January or end of July				JMc		

1/ Rating as of end of January and July for Moody's and S& P's (using a linearized form, AAA is 0 and C is 20), and March and Sept. for Institutional Investor. We also take account of 'outlook' and 'watch' cf. Appendix II.

2/ Unless otherwise indicated stock variables are for end of period and flow variables are measured over 12 months ending at the measurement date. Thus XGR is export growth over the 12 preceding months, IGDP is Investment over the preceding 12 months over GDP over the preceding 12 months.

correspond to the variables that are the core focus of the methodologies of Moody's and Standard and Poor's.

All of the variables put forward by Cantor and Packer except for per capita income are significant: debt over exports (DEBTX), the rescheduling history (RSCH), the fiscal balance (FBGDP), output growth (GRGDP), and inflation (log(INF)) feature in the core equation. In addition, CAGDP is very significant but its sign is not as expected as a higher deficit is associated with a better rating (a result we will discuss later). Several variables that are used by Ul Haque et all (the terms of trade, TOT, and export growth rate, XGR) and by Edwards (1984) (investment over GDP, IGDP) contribute to the ratings. The values of the R-squared, at about 0.8, are somewhat smaller than the values found by Cantor and Packer and Juttner and McCarthy. Most important though is the fact that the estimation results suffer from severe autocorrelation as evidenced by the DW coefficient—this coefficient is not reported by Cantor and Packer or Juttner and McCarthy.

The results for subperiods presented in Table 15 point out that the relation is indeed not stable. Estimation results are presented for three subperiods of equal length: the first period commences with the Mexico crisis and lasts until the recovery sets in at end-1995; the second period covers 1996 and the first half of 1997, a period of relative calm; while the last period covers the second half of 1997 and 1998 a period of general turbulence in most emerging markets, ranging from Thailand to Russia and Brazil. Only 5 of 8 variables show stable parameter estimates: debt over exports, rescheduling, the fiscal balance, output growth, and inflation (DEBTX, RSCH, FBGDP, GRGDP and log(INF)), all of which turn out to be the among the set of Cantor and Packer variables. The variables whose coefficient is least stable is export growth. Noteworthy is also that the estimates of Institutional Investor display the greatest stability, while the explanatory power of the ratings in the last period breaks down quite dramatically for both Moody's and Standard and Poor's with the R-squared dropping from 0.9 to 0.5, a result that is far starker than that of Juttner and McCarthy. This compares to a more limited drop in the R-squared from 0.9 to 0.7 for Institutional Investor.

Results for the dynamic specification

If credit rating agencies see through cycles, as the objective apparently is, ratings would be constant and react only to unexpected innovations in variables,[16]

$$(2) \qquad E[\text{Rating}_{i,t}, I_{t-1}] = \text{Rating}_{i,t-1} \qquad \text{Rating}_{i,t} = \text{Rating}_{i,t-1} + \eta_{i,t}$$

[16]This also assumes that rating agencies see through trends. In our interpretation we focus on seeing through cycles as the period over which we estimate is relatively short (4 ½ years) and cyclical fluctuations in variables such as GDP growth, the fiscal balance and the current account dominate by far any trend. In addition it can be argued that rating agencies also aim to see through short-term trends as their objective is to provide stable ratings.

i.e., predicated on information available at the time of the rating (I_{t-1}) the rating would follow a random walk. In equation (1) we thus expect α to be one, and all γ's to be zero. For α different from one, equation (1) can be solved for a long-term solution and short-term parameters can be determined as the γ's and the long-term parameters as $\gamma(1-\alpha)$, where $\alpha<1$ to ensure stable convergence.

The estimation of a dynamic error correction specification yields a number of interesting results, presented in Table 16: α is indeed close to one (just significantly different from one, especially for Moody's, and less so for Standard and Poor's) indicating that this condition for a random walk is almost fulfilled and ratings display a very high degree of inertia.[17] However, not all γ's are insignificant (i.e., they are different from zero).[18] Especially lagged export growth and, to some extent, lagged debt over exports appear to contribute to current ratings, suggesting that rating agencies do not quite see through crises. All core variables that explained the level of the rating in the static specification are significant in the dynamic specification, except for the rescheduling dummy, and terms of trade. Note that the DW coefficient recovers to more normal levels and that the R-squared is high, especially so for the ratings by the Institutional Investor.

The response to external crises indicators

An important question is how rating agencies respond to crises: do they downgrade when strong market pressures are observed during crises, do they respond to expected factors such as lagged crisis indicators, or only to innovations as in equation (2)? When a standard crisis index of the Sachs, Tornell, and Velasco type[19] is included in the estimation, the index is highly significant, both the innovations and the lagged term (Table 17). The latter suggests that rating agencies do not quite see through a crisis. Moreover, the rating agencies react stronger when the crisis is deeper and exceeds a minimum threshold. This can be illustrated by estimating the impact of the crisis index split in two components: the first component (CRISHIGH) consists of the crisis index for those observations that exceed the mean plus standard deviation, and zero for the other observations; the other, complementary, component (CRISLOW) takes the value zero for those countries whose crisis index exceeds the mean plus the standard deviation, and the value of the crisis index for other observations.

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[17]In principle we could also have estimated lagged innovations, which is consistent with equation (2). Since these are random we could omit these without significantly effecting the estimation results so as to limit the number of independent variables.

[18]Estimations for the period up to and including the first half of 1997 show for both Moody's and Standard and Poor's a coefficient that is not significantly different from one. These agencies made few changes in their ratings over this period. This changed clearly with the onset and spread of the Asian crisis.

[19]Following Sachs, Tornell, and Velasco (1996) we use a crisis index, CRIS, that is a weighted average of the change in real effective exchange rate and the change in reserves in the five *preceding* months. The weights of the variables are the inverse of the variance for the preceding ten years, implying that a heavily fluctuating variable is weighted less (e.g., reserve changes under a fixed exchange rate regime).

CRISHIGH is highly significant while CRISLOW is not or far less significant and has a lower coefficient. This indicates that if the crisis index is high, ratings are likely to go down subsequently, but if reserves are built up or the rate appreciates (which generally occurs more gradually) and the crisis index turns modestly positive, no or little of such an effect occurs. Thus given that crisis indices tend to be asymmetric, the response by rating agencies to downturns and upturns is also asymmetric.[20]

An illustrative estimation result of an equation including the crisisindex is the following equation for the rating by Moody's in which all variable insignificant at the 5 percent level have been eliminated:

$$M = 1.6 + 0.95*M(-1) - .94*XGR(-1) - 7.8*\Delta IGDP + .034*\Delta CRISHIGH + .039*CRISHIGH(-1)$$
$$(3.4)\ (51.6)\qquad (-2.6)\qquad (-2.9)\qquad (9.8)\qquad (6.9)$$

T-statistics between brackets (all variables are significant at the 99 percent level or higher)
Adjusted R-squared 0.95
Durbin Watson statistic 2.17

The rating agencies themselves emphasize that the behavior of countries during crisis reveals information about reaction functions of the authorities that were hitherto unknown.[21] Thus during the Thailand crisis information on the large open derivative position was revealed, while it became clear in the case of Korea that reserves were invested with domestic banks. It is in general quite likely that strong pressures on a country will reveal negative information, whether it is about the state of the banking system or otherwise. The chances are the higher, the weaker the information infrastructure of a country. This suggests that ratings are indeed likely to be procyclical. The intrinsic problem is of course that during a crisis the full impact of the new information is not to be gauged. For example, the crises themselves may make the government doubly aware to avoid them in the future, e.g., Germany's strong anti-inflation policy is in part a response to the experience with hyperinflation. Korea's reserves have been built up since the crisis to levels that are much higher than before.

Figure 1 illustrate some of these results. This figure displays the evolution of ratings over time for 6 countries most effected by crises in the sample, and the evolution of the crisis index and bond spreads. The graphs illustrate first that the rating behavior changed since

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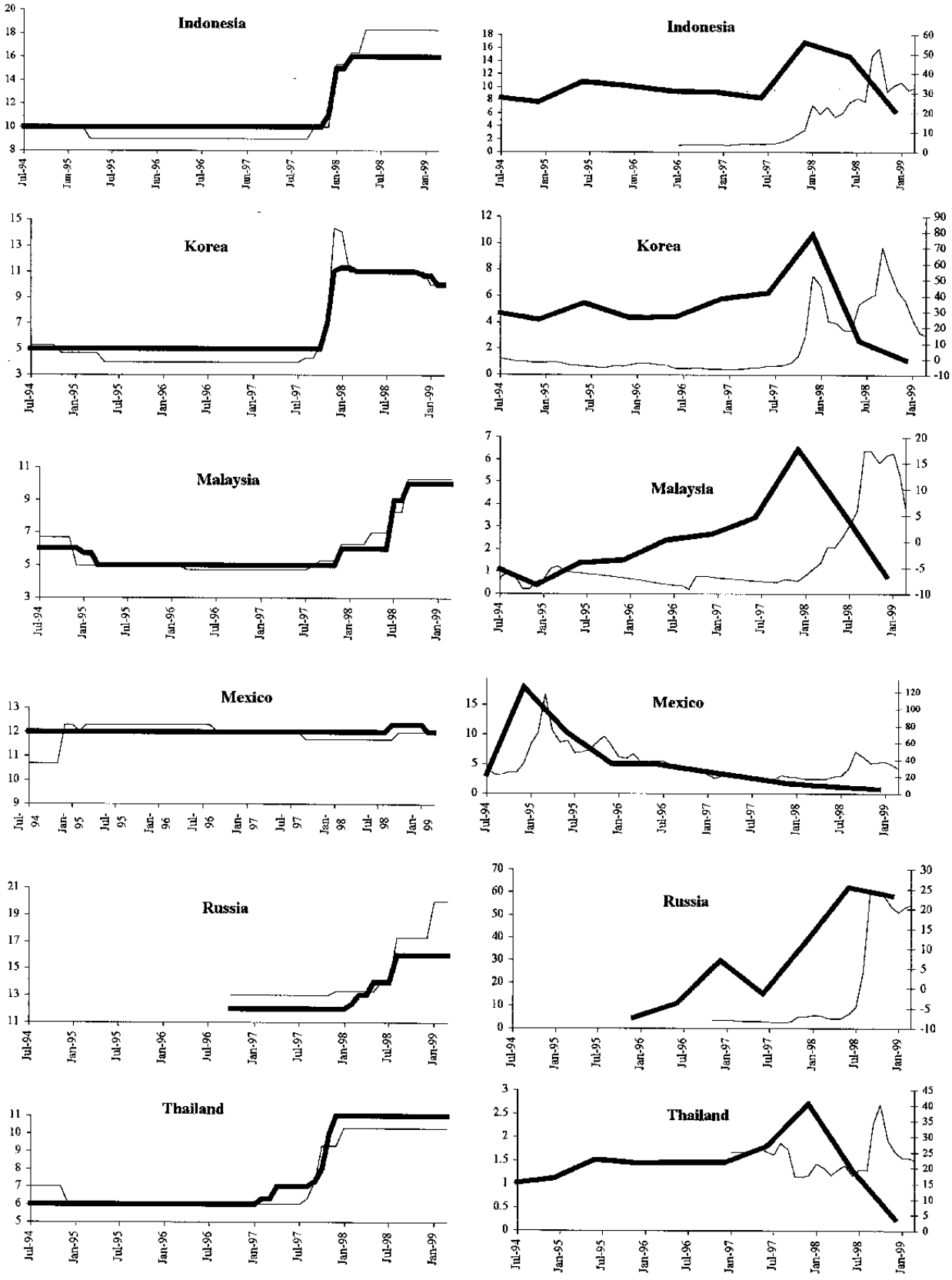
[20] The approach taken here differs from that in a recent article by Ferri, Liu and Stiglitz (1999), which characterizes large residuals as a sign of discretionary ratings and procyclicality. This paper uses exogenous variables such as crisis indicators to explain more systematically rating behavior during crises, i.e. it identifies procyclicality and crisis proximity though specific variables rather than residuals. The results also differ because their sample includes several industrial countries and covers a longer period resulting in a low R^2.

[21] Presentations by Moody's and Standard and Poor's at a World Bank Conference on Debt Management November 1-3, 1999. Without Korea, the lagged coefficient on ratings by Moody's and Standard and Poor's indeed becomes insignificantly different from one. The change is, however, still predictable depending primarily on the crisis index (notably when high) but also on the experience with export growth (see Table B5).

Figure 1: A Comparison of Ratings, Spreads and Crisis Index

Moody's (bold) and Standard and Poor's ratings

Fitted crisis index (bold, right axis) 1/ and spread in 100's of bp



Mexico, second the empirical result that the crisis index leads the change in the ratings, and third that the ratings respond asymmetrically to the crisisindex. For example, in Indonesia and Russia, the index increases before the countries are downgraded, and in the Asian countries the crisis index comes down rapidly in the aftermath of the crisis as the real exchange rate recovers and the external prospects of the countries again improve. The ratings, in contrast, not only increase later, but they stay higher (i.e., the downgrades occur during or after the crisis and persist following the crisis).[22]

Differences in behavior during and out of crises

To better understand the impact of the crisis index, we estimated the impact of the core indicators that explain the crisis indices using the three of the key indicators that were found to explain crises and their depth reasonably well: short-term debt over reserves (STDR), current account balance (CAGDP), and real effective exchange rate appreciation (REER) (Borensztein et al. 1999, and Bussiere and Mulder 1999). Higher short-term debt ratios, higher current deficits and an appreciated real effective exchange rate all contribute to an increased risk of crisis and/or a deeper crisis. Of these three crisis indicators the real effective exchange rate is the most significant in explaining the rating behavior. However, this variable does not have the expected positive sign but a negative one, i.e., a depreciating real effective exchange rate is apparently likely to lead to a downgrade instead of being regarded as a sign of improving competitiveness as in the early warning models, whereas an appreciated exchange rate is one of the indicators commonly used to suggest an increased chance of a crisis and vice versa. The results presented in Table 17 also show that if the current account is larger a country is likely to have a higher grade, which also is a counter intuitive result. The ratio of short-term debt over reserves has the expected effect.

To examine whether the rating behavior differs during crisis periods from the period before and after the crisis we define a crisis dummy, CRISD1, that takes the value one in the two years (four observations) after the crisis index exceeds its mean by one standard deviation in a given month.[23] The results, presented in Table 19, show that the response to a change of the real effective exchange is especially strong during the crisis periods, and not significant out of crisis periods. On the other hand, the response to the current account deficit is primarily significant out of crisis for the rating agencies (for Institutional Investor it is significant both in and out of the crisis). This suggests that the impact of the current deficit primarily reflects unobserved cross-country factors.

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[22]This does not mean that crisis indicators can be used as a substitute for rating creditworthiness. The mean of the crisis index is about zero for each country over the long run as appreciations offset depreciations and reserve gains offset reserve losses. The variance of the crisis index could however be used to proxy a country's external vulnerability.

[23]Thus the length of the crisis period is taken to be two years. We tested various hypotheses for the length of the post crisis effect, ranging from two to four semesters, and also allowed for a gradual decline. Results were broadly similar to the one presented.

The estimation results also suggest that the two main rating agencies (Moody's and Standard and Poor's) pay attention to the level of liquidity during the crisis. This could indicate that the agencies have indeed commenced to use this variable since the Asian crisis—most crises occurred during that period and rating agencies highlighted the importance if not oversight of this factor (FitchIBCA 1998).

Comparing the behavior of SPM versus Institutional Investor we see broadly the same behavior. The rankings by the Institutional Investor experts are, if anything, more stable and predictable than those of the rating agencies. They suffer from the same drawbacks as the rating agencies, thus reacting with lags to a high crisis index and in a non-symmetric way.

III. Simulating Capital Requirements Under The Proposed Accord

These estimation results for rating agencies cast doubt on the usefulness of ratings during crisis periods. The empirical evidence suggests that the ratings do not quite see through crises (they react with a lag to crises), and respond negatively to what usually are equilibrating trends in the real effective exchange rate, and thus could be destabilizing.[24]

The empirical results were obtained using unweighted ratings of 20 countries. However, the size of countries differs and thus the impact of changing ratings on overall capital requirements varies by country. Moreover, the proposed capital requirements would increase only if the ratings change from one risk bucket to another, which may exacerbate or limit the effect of rating changes. Therefore, it is also useful to simulate the impact of the proposed Accord on capital requirements using actual historical data for ratings and lending.

Unfortunately, we can only conduct meaningful simulations for a limited number of years, given the recent nature of the ratings on most countries. These limited simulations, however, suggest that capital as a percent of loans required for emerging market borrowing would have varied significantly if the proposed Accord had been applied (Table 4a), and more so than under the existing Accord. If the proposed Accord had been applied during the past six years, these simulations suggest that the capital requirement would have fallen from about 6.1 percent in early 1994 to a low of 5.1 percent of loans before the onset of the Asian crisis, and would have sharply increased by about 40 percent in the second half of 1997 and reached about 7.2 percent by January 1998.[25] This would have required an increase in capital of some $6 billion for medium- and long-term loans and $9 billion for short-term loans, during these years of turmoil, for banks to continue the same level of lending to the countries in our

[24] Their use for determining capital requirements could also be destabilizing on a priori grounds in view of the focus of sovereign ratings on defaults and the susceptibility of defaults to contagion, as discussed in the introduction.

[25] Using Standard and Poor's ratings leads to broadly similar results.

sample if requirements were binding. Two-thirds of the increase would be on account of Indonesia, Korea, and Thailand, but significant increases would also have been required for lending to Argentina, Brazil, the Philippines, and Russia (Table 4b). Alternatively, a loan contraction on the order of $180 billion would have been required if banks had not expanded their capital base and the requirements had been binding.[26]

This contrasts with requirements under the current Accord, which appear to have been broadly constant (row 6) over the period as a whole. In the run up to the Asian crisis the requirements would actually have declined somewhat—reflecting the accession to the OECD of several large countries—but less sharply than under the proposed Accord, and they would since have increased modestly—mainly reflecting the shift away from short-term lending.

Table 4a: Capital Required for Emerging Market Lending under Proposed Accord
(In millions of U.S. dollars unless otherwise indicated)

	Jan-94	Jan-95	Jan-96	Jan-97	Jan-98	Jan-99
Capital requirements on total loans						
(1) Proposed Basel Accord 1/	25,194	26,106	27,997	32,054	49,300	45,360
(2) In percent of claims	6.1	5.7	5.3	5.1	7.2	7.3
Potential impact on lending						
(3) Constant capital loan amount	527,091	563,611	606,041	624,828	447,788	437,818
(4) Implied loan contraction					177,040	9,970
Memorandum items						
(5) Weighted average spreads (in percent) 2/				2.2	3.6	11.7
(6) Current Basel Accord (in percent of loans) 3/	6.6	6.1	6.2	5.8	6.1	6.3

1/ Based on Moody's ratings and BIS consolidated statistics for the sample countries. These data are on loans in non-local currencies. Ratings unavailable for earlier years were extrapolated backward based on the earliest rating. Assumes sovereign ratings are binding (i.e., bank and corporate ratings are assumed as high as sovereign ratings). Calculations assume that all 18 BIS reporters would apply the Accord—over 90 percent of claims are claims of G-10 banks.
2/ End-1998 weight.
3/ Assumes that proportional share of interbank loans are short term. If all interbank loans are short term the requirement for 1999 would be 5.6 percent.

[26] Such procyclical capital requirements are by themselves no reason to significantly contract lending as capital may exceed required capital by a wide margin. The actual contraction in lending to emerging market economies observed during 1998 may have been determined on the basis of other considerations than capital requirements. A small increase in required capital will have a limited immediate impact on the overall lending decisions of well capitalized banks. However, for less well capitalized banks procyclical requirements may well impact their overall lending. Moreover, to the extent that the risk of further downgrades increases with the actual down grades, this provides an incentive for these banks to target a reduction in lending to these countries. In addition, it should be noted that the increases in regulatory capital would occur at a time when actual losses increase, which reduces profits and also limits the scope for capital increases.

These results are approximations because insufficient data are available on the actual ratings of interbank and company loans. Thus, as spelled out in Table 4a, ratings are assumed to be the highest possible (i.e., sovereign ratings were binding). Note that the sample covers about 75 percent of bank exposure to emerging and developing countries. Other assumptions are detailed in Table 4a. Simulation over a longer period is hampered by the lack of ratings for important countries.

Table 4b. Weighted Capital Requirement According to BBS Proposal
(In millions of US dollars)

	Dec-92	Dec-93	Dec-94	Dec-95	Dec-96	Dec-97	Dec-98
Argentina	2421	2466	2847	3068	3586	4834	4921
Brazil	4113	4340	4035	4595	5436	6109	5865
Chile	388	403	496	545	606	847	887
Colombia	554	599	803	438	671	739	683
Colombia 2/	554	599	803	875	1342	1478	1366
Hungary	709	609	712	728	468	449	645
Hungary 2/	709	609	712	728	936	897	1290
India	888	905	598	620	676	779	1544
India 2/	888	905	1197	1241	1352	1559	1544
Indonesia	1137	1219	1399	1781	2221	4671	3586
Indonesia 2/	1137	1219	1399	1781	2221	2335	1793
Jordan	123	110	94	91	77	84	71
Korea	620	665	906	1240	1599	7536	5223
Korea 2/	620	665	906	1240	1599	1507	1045
Malaysia	136	208	216	268	356	441	833
Mexico	4310	4629	5170	4584	4809	4943	5197
Pakistan	177	193	273	402	464	475	603
Pakistan 2/	177	193	273	402	464	475	402
Peru	205	207	245	448	637	792	846
Philippines	550	467	546	666	1063	1579	1293
Poland	495	453	280	271	303	380	580
Russia	3843	3843	3843	4160	4585	5773	4688
South Africa	531	482	549	640	679	840	778
Thailand	367	475	702	1005	1122	4708	3260
Thailand 2/	367	475	702	1005	1122	942	652
Turkey	618	1578	1296	1490	1810	2340	2854
Turkey 2/	618	789	648	745	905	1170	1427
Venezuela	1456	1341	1095	956	887	979	1003
Total capital	23640	25194	26106	27997	32054	49300	45360

1/ Using Moody's ratings. Footnote 1 of Table 4a applies.

2/ Assuming an unchanged rating as of December 1992. The changed requirements are the result of changes in ratings that put the country in another risk bucket. Countries with no additional line remained in the same risk bucket.

Based on the estimations presented in the previous section, a fairly simple solution could at least in theory be employed to overcome these problems with ratings during crisis periods if the ratings follow a pure cycle. It could be stipulated that capital requirements should depend on the best rating during the past two-three years. This would limit the effect of downgrades that do not quite see through the crises. However, the simulation of the impact of ratings on total capital requirements under the proposed Accord shows that the changes in capital requirements can be very high (and could for example, not be met by eliminating all the short-term loans to crisis countries). The anticipation effect of increased capital requirements that would take effect two years later could therefore still result in immediate cutbacks in lending or capital increases.

IV. Prudential Efficiency: the Impact of Relative Rankings

While ratings may not be the most suitable proxy for how overall capital requirements for lending to emerging markets should evolve over time, their use could offer improved guidance by better differentiating the capital requirements for lending to individual countries at any given moment in time. This section aims to shed light on whether these gains are positive and significant.

The relation between capital requirements and volatility of risks

As discussed in the introduction, regulators in essence have set capital requirements to reduce the chance that banks become or are insolvent (Greenspan 1998), thereby reducing the likelihood of a resort to their central banks as lenders of last resort for liquidity support and the moral hazard impact of the limited liability statutes under which banks generally operate (Miller and Zhang 1999). Without capital requirements banks would have strong incentives to free ride on these protections and operate with very little capital.

To reduce the likelihood of insolvency, regulators should in principle focus on "unexpected" losses rather than expected losses. Expected losses should be offset by spreads for new loans or reflected through the marking to market of current loans.[27] Thus, capital requirements should focus on the volatility of the expected loss rather than the average expected loss (Freixas, and Rochet 1997); i.e., they should focus on the shape of the probability density function (PDF) of losses, and decide how large the tail is they are willing to tolerate—just as in the VaR approach for individual banks' trading portfolios. The problem in practice is the difficulty in estimating the PDF, and proxies will need to be used to for the riskiness of a bank's operations (see Mingo and Jones 1998 for an extensive discussion of the issues involved).

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[27]If banks do not mark-to-market—few banks mark-to-market their bank book—then capital requirements should also take account of the "imbedded" losses; i.e., those already on the books. These losses can be estimated to be a direct function of the remaining duration of the loan and the interest changes over the period expired since the loan was issued, and can be proxied by the actual *change* in classification in loans since issuance. Without prior information on the change in the classification of loans or interest rates this can be proxied by the volatility of spreads, and a measure of duration.

The role of ratings in determining capital requirements across countries

While many data are available on emerging market economies, publicly available data on bank lending to these countries fall short of what is needed to evaluate a required capital buffer. The limited availability of data on actual defaults and losses for sovereigns prevents a meaningful calculation of the volatility of expected losses—for example, no issue rated by Moody's or Standard and Poor's has yet defaulted and no public database is available on defaults and losses on other loans to emerging markets.

Rating agencies suggest that the distribution of transition probabilities of the ratings for sovereigns is a useful source of information (Standard and Poor's 1999). The reported transition probabilities are indeed interesting and suggests that the lower the rating the less stable the ratings are. However, these data, summarized in Table 5, underscore that the relation is not well established (it is not close to a smooth continuous distribution), reflecting a very limited history of ratings and possibly problems with procyclicality of ratings that were discussed in Section II. Moreover, the transition probabilities are a function of the rating process itself and not necessarily indicative of the distribution of expected losses.

Table 5: Sovereign Foreign Currency Average One-Year Transition Rates (1975-1998)

Initial rating	AAA	AA	A	BBB	BB	B	CCC	SD
AAA	97.3	2.7	0.0	0.0	0.0	0.0	0.0	0.0
AA	0.8	96.9	0.8	0.0	0.8	0.8	0.0	0.0
A	0.0	4.6	92.3	3.1	0.0	0.0	0.0	0.0
BBB	0.0	0.0	5.1	88.1	5.1	1.7	0.0	0.0
BB	0.0	0.0	0.0	6.0	85.1	6.0	0.0	3.0
B	0.0	0.0	0.0	0.0	20.0	75.0	0.0	5.0
CCC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Standard and Poor's (1999)

Therefore, we propose to exploit here the general availability of data on interest rates of sovereign emerging market borrowers—most countries have issued sovereign bonds or sovereign-backed bonds—and to use the theoretical relation between spreads and expected loss to obtain a direct estimate of the assessment of expected losses by the markets. Thus, we use Cline and Barnes' (1997) formulae to calculate the implied *level* of expected losses from the interest spreads, assuming risk-neutral preferences of market participants and that U.S. bonds are risk free. We approximate the relative chance of unexpected losses arising from lending to individual countries by the standard deviation of spreads—for smaller spreads the expected loss is approximately linear in spreads under risk neutrality.

The result of making this assumption of risk neutrality, a strong assumption indeed, is that the expected losses and volatility's are biased upwards compared with the likely risk-averse

preferences of investors. Nevertheless, these calculations may provide us with a rank order and some indication of the distances between ranked countries.

In Table 6 we present the results of our calculations. Rankings based on the ratings are presented in the left-hand side of the table, rankings based on the historic volatility of spreads are presented in the right hand side. The bold lines in the left-hand side of the Table correspond to the risk buckets under the proposed Basel Accord. The bold lines in the right hand side are indicative of possible risk buckets based on the volatility of spreads. They are based on decimal ranges (e.g., 0.1-1) which are linear in logarithmic terms. The two rankings are broadly correlated, but not quite. Ranking in terms of variance suggests for example a lower ranking for Colombia, Jordan, Korea, and Malaysia, and higher rankings for India, Indonesia, Peru, and South Africa, than a ranking based on credit ratings.

Table 6: Rankings by Rating, and Variance of Spread

	Proposed BBS risk weight	Rating (Jan 99)1/		Volatility spread 2/	Proposed BBS risk Weight
Chile	20	7	Poland *	0.06	50
Hungary *	50	9	Hungary *	0.08	50
Colombia	50	10	**Chile**	0.10	20
Korea *	50	10	**Thailand**	0.12	50
Malaysia	50	10	**South Africa**	1.2	100
Poland *	50	10	**India**	2	100
Thailand	50	10	**Peru**	2	100
Philippines	100	11	**Mexico ***	2	100
South Africa	100	11	Turkey *	3	100
Argentina	100	12	Colombia	3	50
India	100	12	**Argentina**	3	100
Mexico *	100	12	Philippines	5	100
Peru	100	12	Malaysia	5	50
Jordan	100	13	Korea *	7	50
Brazil	100	14	Brazil	9	100
Venezuela	100	14	Indonesia	19	150
Turkey *	100	15	Jordan	23	100
Russia	150	17	**Venezuela**	30	100
Indonesia	150	18	**Pakistan**	100	150
Pakistan	150	18	**Russia**	527	150

1/ Standard and Poor's
2/ Standard deviation, January 1997-April 1999
* Current OECD members that have 0 % risk weight for sovereign loans.
Countries that fall in the same categories in the two columns are bolded.

To provide some measure of the impact on reallocating capital across countries, we calculate the *absolute* difference in the capital allocated under the old Accord, the proposed Accord and various alternatives, such as the volatility (standard deviation) of the spreads (STDV) and the risk buckets shown in Table 6.[28] The results suggest that the proposed Accord implies somewhat lower absolute differences with the volatility-based measure than the old Accord but the improvement (using this measure) is modest (19.8 versus 25.2 percent) if current ratings are used and historic spreads. It is also of interest to ask if the proposed Accord, if applied in January 1997, would have resulted in a better allocation of capital, using the actual volatility in spreads over the ensuing period as a standard. As the second column in Table 7 shows, the old Accord would have fared better than the proposed Accord (the absolute difference in capital allocated is 25.2 of capital rather than 40.6 percent). These calculations neglect the allocative improvements arising from differentiating between banks and companies in emerging market economies other than the differentiation implied by a different sovereign ceiling.

This simple crosscheck thus suggests that some allocative improvements may result from the proposed Accord, but that these could be modest—if indeed positive.

Table 7. Absolute Difference in Capital Requirements as Percent of Loans

	Using Jan-99 ratings	Using Jan-97 ratings
Between:		
Old and proposed Basel Accord	29.3	
Old Basel Accord and Log of STDV	25.2	25.2
Old Basel Accord and STDV-based Risk buckets	30.5	
Old Basel Accord and Log of rating	18.8	
Proposed Basel Accord and Log of STDV	19.8	40.6
Proposed Basel Accord and STDV-based Risk buckets	17.1	
Proposed Basel Accord and Log of rating	24.9	
Log of STDV and STDV-based risk buckets	11.4	
Log of STDV and Log of rating	15.1	

1/ This is the absolute difference using December 1998 claims as weights. STDV is the Standard deviation of spreads based on spreads over the period January 1997-April 1999 used in Table 6. Risk buckets based on STDV are the buckets in Table 6.

[28] Assuming constant overall capital requirements.

In Table 8 we present the impact on the capital requirements for the various countries. The largest difference from using a spread-based measure would be in Korea. In part this may reflect data problems (no government bond was issued during the earlier period) and in part the fact that Korea's spread returned quickly to a low level. A more detailed model, which inter alia uses forecasts of volatilities, rather than actual volatilities, should be able to generate superior results.

Table 8. Distribution of Capital Requirements

	Old Basel Accord	Proposed Basel Accord	Log of STDV	STDV based risk buckets
Chile	4.3	0.8	2.0	0.7
Hungary *	1.5	1.4	1.4	0.5
Colombia	3.3	1.5	2.7	2.8
Korea *	6.6	5.7	11.2	10.6
Malaysia	3.9	1.8	3.4	3.4
Poland *	1.7	1.3	1.1	0.5
Thailand	7.6	3.6	3.8	3.3
Philippines	2.8	2.8	2.6	2.6
South Africa	3.1	3.4	2.6	3.1
Argentina	11.8	10.8	9.6	10.0
India	3.7	3.4	2.8	3.1
Mexico *	7.6	11.4	9.6	10.5
Peru	1.9	1.9	1.6	1.7
Jordan	0.2	0.2	0.2	0.2
Brazil	13.2	12.9	12.9	11.9
Venezuela	2.5	2.2	2.5	3.0
Turkey *	4.3	6.3	5.5	5.8
Russia	10.4	15.5	14.9	14.2
Indonesia	8.8	11.8	8.5	10.9
Pakistan	1.0	1.3	1.1	1.2
Total	100	100	100	100

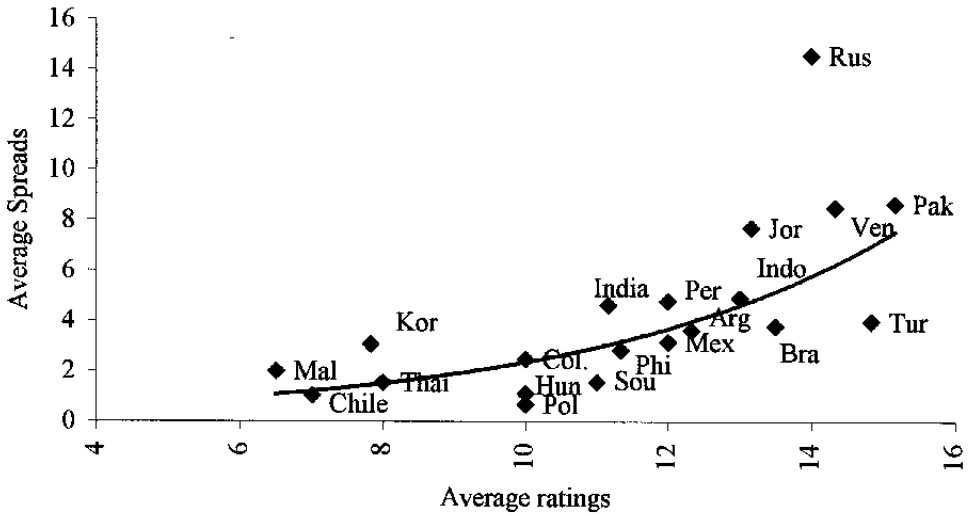
* Current OECD members.

The differentiation in capital requirements by rating category

Some further insight into the consistency of capital requirements across rating categories can be obtained by exploiting the average relation between spreads and ratings—while the

relation between the variance of the rates and the ratings is limited the relation with the average level of spreads at any given point in time is significant (see Figure 2[29]).

Figure 2: Sovereign Bond Spread and S&P's Credit Rating
(Average July 1996 to Jan. 1999)



----------|----**20%**---|------|---**50%**----|------|----------**100%**----------|----|---**150%**

In Table 9 we present calculations based on the expected losses associated with rating categories assuming the loglinear relation between spreads and ratings holds. These calculations suggest the capital requirements may be less than optimal for the top and bottom rating categories.

- The expected loss probabilities (column 4) increase more or less logarithmically with each grade, roughly doubling from one grade to the next lower grade. For the middle rating categories, the Basel risk weights (column 1) also roughly double. However, this is not the case for either the top or the bottom categories, i.e., one would have expected a risk weight of 10 percent for AA rated countries and 200 percent for single B rated countries. One reason for not stepping up the risk weight for single B rated countries is if such ratings require loss provisions.

[29]Note that the 20 percent risk bucket runs from rating 5-7, the 50 percent bucket from 8 to 10, the 100 percent bucket to 16, and the 150 percent bucket covers the rest. The estimation results presented in Table 21 show that the relation between spreads and ratings deteriorates somewhat if the risk buckets are used instead of the detailed ratings.

- The proposed capital requirements (column 2) are quite similar to the implied loss of a one category downgrade (column 5), especially for the middle range of ratings (A, BBB, and BB). But the expected loss implied by a one-category downgrade exceeds the capital requirement at the top (AAA, and AA rated countries) and the bottom end of the ratings (especially single B rated countries).

Table 9: Expected Loss Implied by Ratings, Impact of Downgrade

S&P rating	BBS risk weight	Capital requirement (percent)	Spread (100bp) 1/	Expected loss implied by spread 2/	Expected loss of 1 category downgrade	Moody's volatility of corp. default over 1 year	Moody's volatility of corp. default over 10 years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AAA	0	0	0.2	0.6	0.4	0.0	1.9
AA	0	0	0.3	1.0	1.2	0.2	4.2
A	20	1.6	0.6	2.2	2.5	0.2	6.8
BBB	50	4	1.4	4.6	5.2	0.5	10.2
BB	100	8	3.1	9.6	10.1	1.7	13.2
B	100	8	6.7	18.7	18.1	4.6	15.9
CCC	150	12	14.5	33.5	18.5		
C	150	12	24.4	45.8			

1/ Spread associated with the rating, based on estimated loglinear relation (Table 20).
2/ Probability of loss implied by spread assuming average 4-year maturity and a U.S. Treasury Bond coupon of 6 percent.
3/ Expected loss and gains based on spread based approximations of the losses and gains.

The duration of lending

The proposed Basel Accord would also leave incentives open for regulatory arbitrage because commercial ratings do not differentiate according to the maturity of loans. For corporations, the correlation between corporate ratings and the volatility of default changes rather drastically with the length of the time horizon considered: the overall volatility increases with time, but the volatility of the higher-rated corporations increases much more rapidly than the volatility of the lower-rated companies over longer-time horizons than short-time horizons (Table 9, column (6) and (7)). This suggests that the duration of loans should play a significant role in determining the risk buckets in which a loan is classified. For sovereign ratings, this may be less of a drawback than for corporate ratings, as sovereign ratings are more stable than corporate ratings (Standard and Poor's 1999)—the wealth of nations apparently rises and falls more gradually than that of corporations.

V. CONCLUSIONS

The Basel Committee has proposed to use credit ratings as a basis for setting capital requirements for bank lending. However, ratings for sovereigns in emerging market economies are not well tested, as few countries used to be rated. This paper makes use of the increasing number of ratings since the mid-nineties to estimate a model of the ratings as background for a discussion of the impact of using ratings on capital requirements for lending to emerging market economies.

Simple, static estimations of ratings (of the type found in the limited literature on sovereign ratings), show that the level of the ratings in emerging market economies can be well explained by a set of eight variables, with an emphasis on the debt to export ratio, the rescheduling history, the rate of export and output growth, the inflation history, and the share of investment in GDP. However, the relation is not stable; it deteriorates with the onset of the Asian crisis and parameter estimates fluctuate widely with the period chosen. Moreover, estimations of the static relation display quite severe autocorrelation. While earlier work does not point out this problem, it is not unexpected as rating agencies aim for stable ratings, suggesting that they do not react to small changes in observed variables or to expected changes. In effect it can be argued that changes ratings should only respond to innovations in information.

Estimations of a dynamic error correction specification indeed show a very high degree of inertia in the ratings. The ratings almost follow a random walk in which the change only responds to innovations (especially in the share of investment in GDP and inflation), but not quite: some lagged variables (notably export growth) are significant and the coefficient on the lagged dependent variables not quite one. This suggests that rating agencies not only react to news and do not completely see through predictable business cycles and trends.[30]

In addition to structural variables, ratings can be explained by crisis indicators. Estimations suggest that rating agency behavior is asymmetric, and yields "proof of the pudding is in the eating" results: countries are downgraded following major crises, possibly because they do not perform as expected. The ratings in particular display a strong negative correlation with declining (not with increasing) real effective exchange rates over the preceding 6 months during the crisis period. This contrasts sharply with early warning models of external crises, which treat real appreciation as a sign of danger and a real depreciation as a sign that countries are on the road to external recovery.

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[30] This conclusion is similar to that reached in a recent article by Ferri, Liu and Stiglitz (1999). They reach their conclusion of procyclical ratings based on unexplained residuals, which for key Asian countries were positive before and negative after the onset of the crisis. Their sample includes industrialized countries, and the estimations are static. Our conclusions are based on parameter estimates.

Backward looking simulations suggest that the use of ratings for capital requirements as under the proposed Basel Accord would result in significantly sharper fluctuations in required capital than under the current Accord. Calculations for the capital requirements over the 1994-99 period imply that banks capital requirements would have increased by about $15 billion (a sizable 40 percent of the capital requirements for emerging market lending) at a time they were making losses on their exposure. Our calculations suggest that the capital requirements for emerging market lending increased by about 5-10 percent under the current Accord for the same amount of lending mainly due to a relative shift toward longer loans as short-term loans were reigned in. In the run up to the Asia crisis capital requirements would also have declined more sharply than under the current Accord. Thus in terms of procyclicality the current Accord would have performed significantly better.[31]

It is also important to realize that rating agencies apparently focus on the probability of default rather than expected loss in their sovereign rating methodology. This focus on defaults is an *a priori* reason for questioning the use of such ratings for capital requirements as defaults are particularly contagion sensitive. A liquidity-related crisis could trigger a default in one country, leading to downgrades and capital withdrawals from other emerging economies, in turn fuelling further defaults, in the absence of a perfect international lender of last resort. It is important to realize that such a wave of liquidity related crises may only temporarily effect the repayment of obligations, a situation that in domestic markets would be resolved by the intervention of a lender of last resort. While the Capital Accord could be suspended during such a period it nevertheless would add to uncertainty unless it is a priori clear when the Accord will be suspended.

The use of ratings for capital requirements could bring about efficiency gains by providing incentives to allocate capital toward countries that are less subject to risks. Whether and to which extent this is the case is primarily an empirical question. Whether ratings will lead to an improvement can not be determined on a priori grounds as ratings are theoretically not an optimal solution for setting relative capital requirements. This is because ratings focus on the *level of default risk*, while a more ideal standard for determining capital requirements would focus on *unexpected losses*. There is a gap first because of the difference between default risk and expected loss (the recovery rate), and second because ratings focus on the level of expected loss (which is supposed to be offset by spreads and provisioning)[32] rather than unexpected loss (which is not offset by spreads but requires a capital cushion).

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[31] The short history of most ratings prevents a simulation over a longer period to examine whether this was an unusually turbulent period. Of course a more complete study would need to look at the impact of all rating changes over the business cycle in industrialized countries, and examine to which extent banks diversify their exposure, and to which extent, crisis in emerging market countries coincide with downturns in industrialized countries.

[32] This assumes that loans are booked at fair value. Jackson and Perraudin (1999) report that a debate is ongoing on whether banks should use fair value accounting.

A comparison of the capital requirements across countries implied by the ratings and a proxy for unexpected loss (the volatility of spreads on traded bonds as measured by their standard deviation) suggests that the efficiency gains could be modest for emerging market lending. The calculations in the paper show that the ratings are not a terribly good proxy for the volatility of spreads. Using ratings rather than a very simplified structure, as for example embedded in the current Basel Accord, may not yield very large efficiency gains—if indeed the gains are positive.

The proposal for a new Basel Accord also suggests allowing sophisticated banks to use internal ratings as a basis for setting capital charges. Nearly all banks employ such ratings systems and use them as a means to aid the loan allocation and pricing process. Like rating agencies, banks use sovereign ratings as a cap on the ratings to banks and firms in these countries. The rating systems employed by banks are far from uniform[33] and very limited information is available on the sovereign ratings by banks.[34] To nevertheless study the potential impact of internal ratings of sovereigns we used the ratings by industry experts, as reflected in the rankings published by Institutional Investor, as a proxy. Estimations of these rankings yield broadly comparable results to those of the rating agencies. This raises similar concerns about procyclicality similar to those stemming from the use of ratings by rating agencies.

The question is thus what solution for capital requirement would suffer less from the observed procyclicality and contagion sensitivity of ratings, while providing incentives for a more efficient allocation of capital. There are various in essence market based and backward looking solutions available to promote a more efficient allocation of capital. Models of ratings as the one used here or by Ferri, Lui and Stiglitz (1999) can be used to determine shadow ratings that are less crisis sensitive. Data on spreads on bonds and loans at issue and when traded, can in combination with data on volumes, be used to create market based measures of volatility and unexpected loss.

The issue of institutional solutions that could be adopted to provide sovereign and transfer risk ratings that promote efficient allocation of capital and setting of capital requirements, while not suffering from excessive procyclicality or contagion sensitivity, is beyond the scope of this paper. Nevertheless, other research may productively approach several options such as: creation of incentives for rating agencies to provide supplementary sovereign or transfer risk ratings that focus on an objective that is more appropriate for capital requirements; establishment by banking supervisors of a small country credit bureau that does the same while tapping into information available at IFI's and export credit agencies;

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[33] See the recent overview of internal ratings systems by the Basel Committee (January 2000).

[34] It is not yet clear how such non-uniform systems (with different numbers of ratings, different objectives and methodology) could be used to determine capital requirements that are comparable across banks and countries. Also note that a system that allows large or specialized banks effectively lower capital requirements could result through regulatory arbitrage in a higher concentration of lending to emerging market economies.

pooling of information and resources by banks through their trade organizations, to establish ratings. In any case it would appropriate to pay due consideration to economies of scale (there are significant information and resource costs involved in sovereign and transfer risk analysis), to focus on the right objectives (cycle neutrality and unexpected loss), to anchor analysis in market based estimations of risk, and finally to ensure consistency with loss provisioning.

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Rating Emerging Economies

The rating of emerging markets has developed only recently with the increase in bond issues by developing economies. While some Latin American and Central European economies were rated already in the 20s, a number of these defaulted during the 1930s' depression, and in the run-up to the Second World War sovereign ratings for nearly all countries were abandoned. Foreign currency ratings essentially resumed in 1974 (S&P's 1999), but the numbers of emerging market economies rated increased only slowly at first. By 1993 just twelve emerging economies where rated by Moody's. The number of countries rated accelerated rapidly in the mid nineties as many countries (in particular transition and countries and countries in the Middle East) sought access to international bond markets.

Table 10: Characteristics of Ratings of Emerging Market Economies (using Moody's ratings)

	1993	1994	1995	1996	1997	1998	1999
Number of EM ratings	12	17	24	35	49	60	64
Asia	6	7	10	10	10	11	11
Latin America	4	6	7	7	9	13	14
Middle East	1	1	1	9	10	11	11
Transition Economies	1	2	2	4	12	15	16
Others	0	1	4	5	8	10	12
Average rating 1/	9.8	10.2	9.9	9.7	10.0	10.3	10.9
Median rating 1/	10.5	11	10.5	10	10	10	11

1/ As of end-January, using a linearized transformation of ratings (AAA is 1 and CCC is 18)

Definition of credit ratings

The sovereign ratings assigned by rating agencies are meant to capture the likelihood of default; i.e., that debt is not repaid according to the original terms.[35] Standard and Poor's (April 1997) definition of rating states that the sovereign credit ratings "are an assessment of each government's capacity and willingness to repay debt according to its terms." Moody's sovereign rating is "a measure of the ability and willingness of the country's central bank to make available foreign currency to service debt, including that of the central government itself" and notes that the objective of sovereign risk assessment is to answer the question: "what is the likelihood of an international default" (Moody's 1995). This contrasts with, e.g., the corporate rating of Moody's which aims to capture recovery following default as well.

Among the indicators taken into account for the appraisal of creditworthiness, SPM include: political risks, income and economic structure, economic growth prospects, fiscal flexibility, public debt burden, price stability, balance of payments flexibility and external debt and liquidity (for a detailed list see S&P's December 1998 and Moody's 1995). Recently rating agencies have attached more importance to the strength of the financial infrastructure, after critics following the Asian crisis. For example, since 1998, Standard and Poor's has also been publishing additional or complementary information on financial systems, such as the share of "gross problematic assets" (potential level of non-performing loans or other problematic assets in the financial system in a reasonable worst-case economic recession or slowdown) and the ratio of "contingent liabilities" over GDP (the additional cost imposed on the government in case of a bail out of some of those assets) and which are designed to identify credit driven boom and bust cycles.

Institutional Investor country credit ratings were first compiled in 1979, and are published semiannually from the staff of about the 100 largest international commercial banks, money management firms and economists. In 1999, 136 countries were rated by Institutional Investors on a scale from 0 to 100, 100 representing the least chance of default. The responses of over 100 or so persons are then weighted by giving greater weight to responses from institutions with greater worldwide exposure and more sophisticated country analysis systems. Criteria used by individuals are not specified and depend on the respondents.

A difficulty with ratings is that they are measuring an unknown variable: no country has ever defaulted on foreign currency rated bonds. But there has been a number of defaults on non-rated instruments: only recently Russia defaulted in 1998 on local currency debt (ex-Soviet debt), and Indonesia defaulted in March 1999 on an unrated syndicated loan. According to Standard and Poor's (August 1998), 37 sovereign issuers defaulted in 1997 on non-rated instruments (35 on foreign currency debt and/or 3 on local currency debt and/or 3 on foreign currency bonds) of which 5 were rated for other instruments.

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[35]If interpreted literally this does not allow for a voluntary negotiated revision of repayment terms.

Table 11 contains summary statistics for the ratings (and spreads) used (see also data appendix for explanations).

Table 11 : Summary Statistics for the Sample

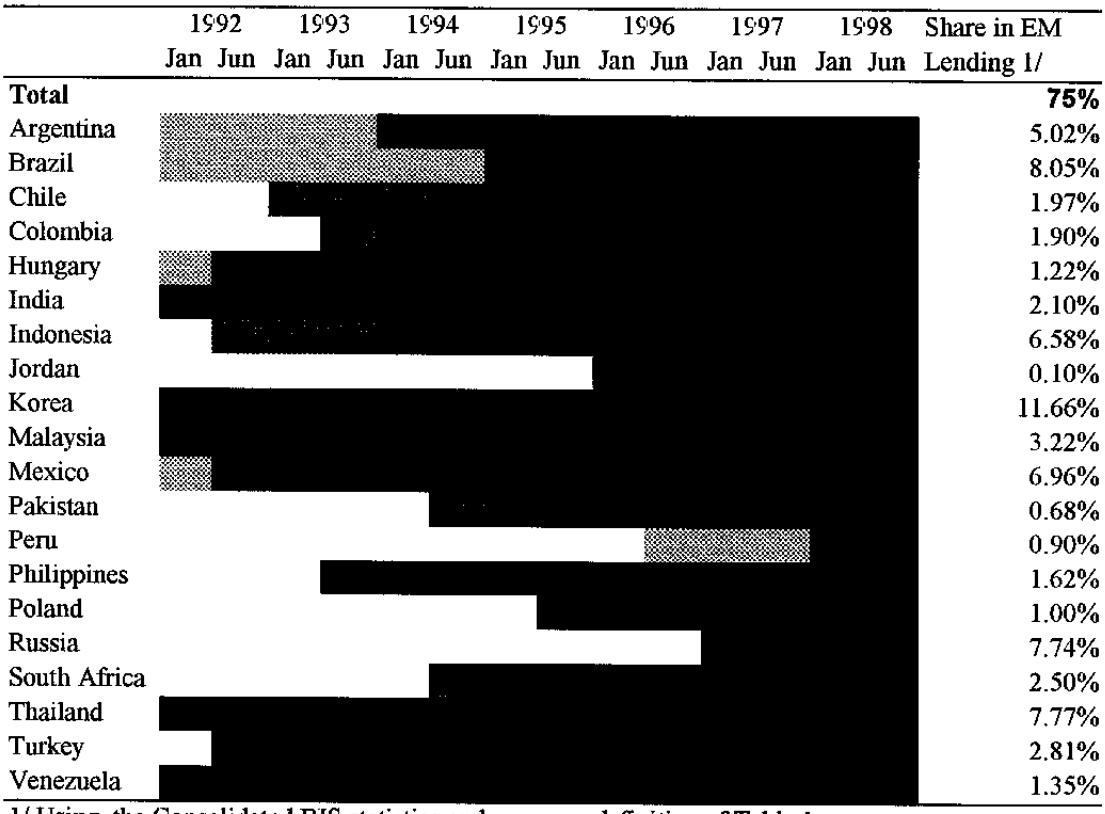
Moody's	Jan-95	Jul-95	Jan-96	Jul-96	Jan-97	Jul-97	Jan-98	Jul-98	Jan-99	Full sample
Observations	16	17	18	19	20	20	20	20	20	170
Mean value of rating	10.53	10.38	10.50	10.74	10.80	10.87	11.63	12.00	12.30	11.08
Standard deviation	2.91	2.91	2.92	3.02	3.03	2.97	2.38	2.29	2.56	2.78
Number of upgrades	2	3	1	0	1	1	1	3	0	12
Mean value	-1.5	-0.9	-0.7	0	-1	-0.7	-1	-1.1	0	-1.03
Number of positive watch	1	1	0	0	1	0	1	0	1	5
Number of downgrades	0	1	0	0	1	2	4	6	5	19
Mean value	0	1	0	0	1	0.85	4.08	1.78	1.2	1.93
Number of negative watch	0	1	1	0	1	1	1	0	1	6
Standard and Poor's	Jan-95	Jul-95	Jan-96	Jul-96	Jan-97	Jul-97	Jan-98	Jul-98	Jan-99	Full sample
Observations	16	17	18	18	19	19	20	20	20	167
Mean value of rating	10.69	10.53	10.67	10.67	10.74	10.53	11.65	11.95	12.25	11.07
Standard deviation	3.20	3.22	3.22	3.33	3.30	3.13	2.41	2.72	2.99	3.06
Number of upgrades	3	5	1	1	2	4	0	1	2	19
Mean value	-1.1	-0.88	-0.7	-1.7	-0.85	-0.85	0	-3	-1	-1.06
Number of positive outlook	3	1	2	1	2	1	2	0	1	13
Number of downgrades	1	0	0	1	1	0	4	4	5	16
Mean value	1.60	0	0	0.40	0.70	0	5.55	2.18	1.60	2.60
Number of negative outlook	0	2	1	1	0	0	5	2	3	14
Institutional Investors	Mar-95	Sep-95	Mar-96	Sep-96	Mar-97	Sep-97	Mar-98	Sep-98	Mar-99	Full sample
Observations	20	20	20	20	20	20	20	20	20	180
Mean value of rating	42.68	43.18	43.43	44.44	45.18	45.90	45.44	43.43	42.06	43.97
Standard deviation	14.23	14.18	13.91	13.43	12.80	12.07	10.70	9.75	11.22	
Sovereign bond spread	Jan-95	Jul-95	Jan-96	Jul-96	Jan-97	Jul-97	Jan-98	Jul-98	Jan-99	Full sample
Observations	10	10	12	14	20	20	20	20	20	146
Mean	4.30	4.71	3.94	2.70	2.33	1.98	3.62	4.56	9.03	4.13
Standard deviation	3.59	3.69	3.48	3.18	1.60	1.31	2.04	3.26	11.45	3.73
Mean	4.30	4.71	4.26	3.27	2.11	1.89	3.61	4.74	7.45	4.04
Std 1/	3.59	3.69	3.75	3.65	1.56	1.43	2.02	3.53	7.21	

1/ On a balanced sample

Data Appendix

The sample used in this paper consists of twenty countries and is in essence that of Sachs, Tornell and Velasco (1996) which is geographically balanced sample. The sample includes all developing countries and emerging market economies which had a share in emerging market lending of over 1 percent as of June 1997 with the exception of China and Taiwan Province of China.[36] The history of ratings of SPM is detailed in Figure 3. Institutional Investors ratings of all our countries are available since 1979.

Figure 3: Rating Availability



1/ Using the Consolidated BIS statistics and coverage definition of Table 1.

[36] China was excluded from the STV sample and Taiwan Province of China is excluded here because its data are not included in the IMF's IFS. Only a few other developing and emerging market economies were rated before January 1996 (e.g. Moody's rated only China, Taiwan Province of China, Trinidad and Tobago, and Uruguay for earlier years). STV also included Zimbabwe, but this country is not rated by Moody's or S&P.

Ratings by SPM could be constructed on a daily basis but Institutional Investors ratings are published only twice a year, in March and in September. Given that some of the data of interest are also only published semiannually (notably BIS statistics on the maturity of external debt) and other data are available only on an annual basis for some emerging economies, the paper concentrates on semi-annual data from the second semester of 1994 till the second semester of 1998. This yields 170 observations for Moody's, 167 for Standard and Poor's and 180 for Institutional Investors. To take into account lags in the release of the data, we use for the rating agencies the rating as of the last day of January or of July (our SPM ratings variables thus cover January 1995 to January 1999 and for Institutional Investors March 1995 to March 1999). For exogenous variables (except for spreads for which data are almost instantaneously available, see below) we use end-of-year and mid-year observations so as to allow for some observation lag. The data are pooled for the purpose of regression, and were estimated using Eviews' OLS panel estimation.

Like most analysts who transform bond ratings into data for regression analysis, we assign numerical value to ratings as follows: a bond rated Aaa or AAA = 1, Aa or AA+ = 2.and so on through C or Ca = 20. Investment grades thus go from 1 to 7, speculative grades from 8 to 16 and 'default grades' from 17 to 20. A higher rating in our linear transformation denotes a higher probability of default or a higher risk of timely repayment. It should be noted that the relation between the ratings and the probability of default is not linear: there is no information on the probability of default for rated sovereign bonds, given the very recent use of ratings for sovereigns and the limited number of defaults or delayed repayments, but the ratings for corporates of both industrialized and developing countries suggest the relation is logarithmic. The "ratings" of Institutional Investor do not require a transformation as they already constitute probabilities. However, we have premultiplied them with –1 so that the signs of regressions are comparable with SPM.

Moody's also publishes in addition to their ratings a "watch" and Standard and Poor's a ratings "outlook" aimed at indicating the agencies' perspectives that might prompt a rating review over the next 6 to 24 months. We incorporate the information given by these watches and outlooks, which could be negative, stable or positive, by reducing the value of our linear

Table 12: Mappings of Ratings to Risks

S&P's	Moody's	Interpretation	Linear mapping
Investment grade:			
AAA	Aaa	Highest quality	1
AA+	Aa1	High quality	2
AA	Aa2		3
AA-	Aa3		4
A+	A1	Strong payment	5
A	A2	Capacity	6
A-	A3		7
BBB+	Baa1	Adequate payment	8
BBB	Baa2	Capacity	9
BBB-	Baa3		10
Speculative grade:			
BB+	Ba1	Likely to fulfill	11
BB	Ba2	Obligations	12
BB-	Ba3	Ongoing uncertainty	13
B+	B1	High risk obligations	14
B	B2		15
B-	B3		16
Default grade:			
CCC+	Caa	Current vulnerability	17
CCC		to default or in default	18
CCC-			19
C	Ca	In bankruptcy or default	20
D	D		21

rating by 0.3 when the watch or outlook is positive (implying an improving situation) and add 0.3 when the credit watch or outlook is negative (implying deteriorating fundamentals). Over the period under study about 40 percent of Standard and Poor's positive outlooks and 90 percent of Moody's positive watchers were confirmed for our sample. In contrast 67 percent of the negative outlooks by Standard and Poor's were confirmed and 70 percent of Moody's negative watchers. It should be noted that the two rating agencies do not use watch and outlook in the same way: Standard and Poor's assigns an outlook to its ratings than much more often Moody's, and the period for which an 'outlook' is given is much longer compared to Moody's 'watch', which forecasts an imminent change or confirmation of ratings (usually in the next three to four months).

The construction of a reliable and comparable set of data on spreads is not easy, given the low liquidity of some of the bonds and the wide difference of characteristics of the bonds. Where available we use Eurobonds, maturing between 2001 and 2003 and use information on Brady bonds to capture the month-to-month market movements in case of missing data. When no sovereign bonds were available for a long enough period, we proxied the spread by

a relatively risk free corporate bond, issued for example by a public sector company or a local development bank. The data are from Bloomberg for the emerging market bond yields; we checked the data for consistency using regular market publications by Merrill Lynch (Emerging Market Daily) and JPMorgan (Emerging Market Analytics). Further details on the spreads are given in Table 13. As for ratings, we took the value of the spread in January and July, but chose to use a monthly average rather than a single observation at the end of the period, given the high volatility of spreads and also sometimes the lack of data for the entire month.

Table 13: Bonds Used

	Bond used	Maturity
Argentina	Rep. of Argentina	12/1/03
Brazil	Rep. Of Brazil	11/1/01
Chile	Compañía teléfono Chile	7/1/07
Colombia	Republic of Colombia	2/1/03
Hungary	National Bank of Hungary	4/1/03
India	ICICI	4/1/00
Indonesia	Rep. Of Indonesia	8/1/06
Jordan	Kingdom of Jordan, Brady bond	12/1/23
Korea	Korea Development Bank	5/1/00
Malaysia	Malaysia	9/1/00
Mexico	United Mexican States	9/1/02
Pakistan	Republic of Pakistan	2/1/02
Peru	Republic of Peru, Brady bond	3/1/17
Philippines	National Power Corp.	11/1/00
Poland	Poland	7/1/00
Russia	Ministry of Finance	11/1/01
South Africa	Rep. Of South Africa	12/1/99
Thailand	Kingdom of Thailand	3/1/02
Turkey	Rep. Of Turkey	5/1/02
Venezuela	Rep. Of Venezuela	12/1/03
Average		3/27/04
Average (excl. Jordan and Peru)		6/2/02

All other independent variables were extracted from IFS and eventually complemented by data from WEO, if the data were not available in IFS, especially for 1998, save for data on external debt to banks, which were extracted from the web site of the Bank of International Settlements. For those semiannual data for which no observations were available we extrapolated the growth rate of the previous year for six months.

Table 14: Results for Estimation of the Level of Ratings 1/

	Expected sign	All variables			Set of variables with exp. sign			Set of 8 significant variables 2/			2/
		Moody's	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.	Ins. Inv.
DEBTX	+	1.27	1.10	6.24	1.09	0.94	4.48	1.12	0.93	4.34	4.30
		9.49	6.57	11.84	7.81	6.65	9.60	11.94	7.53	11.54	11.23
RSCH	+	1.35	1.28	3.25	1.37	1.24	5.45	1.37	1.32	5.99	5.82
		4.81	3.89	2.65	4.46	3.70	4.49	5.61	4.48	5.74	5.55
TOT	-	-2.34	-3.26	-24.24	-1.60	-1.56	-27.43	-1.50	-1.99	-30.29	-25.59
		-2.01	-2.40	-4.88	-1.52	-1.10	-5.15	-1.55	-1.70	-7.37	-6.00
XGR	-	-1.14	-1.33	-2.39	-1.97	-1.97	-3.34	-1.97	-1.96	-3.39	-3.64
		-1.83	-1.83	-0.89	-3.16	-2.60	-1.24	-3.17	-2.61	-1.27	-1.39
FBGDP	-	-4.11	-13.22	-20.92	-5.15	-13.65	-30.56	-5.72	-14.31	-34.27	-30.38
		-1.27	-3.43	-1.48	-1.41	-3.07	-1.94	-1.69	-3.41	-2.34	-2.08
GRGDP	-	-2.68	-1.29	-18.98	-8.88	-10.96	-39.92	-8.78	-10.97	-37.57	-39.09
		-1.17	-0.47	-2.03	-3.84	-3.89	-4.15	-3.82	-3.92	-4.06	-4.31
IGDP	-	-4.61	-4.58	-28.71	-7.58	-7.92	-29.57	-7.92	-7.35	-28.18	-35.06
		-2.29	-1.95	-3.31	-3.61	-3.28	-3.55	-4.35	-3.34	-3.68	-4.68
log(INF)	+	0.26	0.48	1.46	0.36	0.64	1.53	0.37	0.65	1.49	1.46
		2.79	4.30	3.73	3.64	5.56	3.72	4.07	5.89	3.83	3.75
RESM	-	-0.21	-0.14	-1.56	-0.06	-0.03	-0.41				
		-1.73	-1.01	-3.03	-0.55	-0.27	-0.83				
PCI	-	0.04	0.03	-0.02		-0.04	-0.15				-0.52
		0.57	0.36	-0.08		-0.44	-0.46				-2.45
DSX	+	1.59	1.24	-6.11	0.64						
		2.20	1.39	-2.08	0.82						
REER4	+	0.01	0.00	0.07			0.02				
		2.34	0.57	2.72			0.82				
REER	+	-1.75	-1.45	-0.33							
		-2.18	-1.55	-0.10							
STDR	+	0.08	0.13	0.65							
		0.48	0.70	0.96							
CAGDP	-	18.84	25.17	76.42							
		6.37	7.14	5.90							
TBILL	+	-0.22	-0.15	-0.25							
		-1.67	-0.95	-0.45							
C		14.38	15.77	-19.84	14.06	15.45	-15.11	14.07	15.50	-14.01	-15.05
		11.15	9.88	-3.65	11.45	10.26	-2.69	11.81	10.75	-2.73	-2.99
Adjusted R-squared		0.82	0.79	0.81	0.76	0.71	0.75	0.77	0.71	0.76	0.83
Durbin-Watson		0.66	0.59	0.51	0.59	0.50	0.44	0.58	0.51	0.44	0.44

1/ T-statistics below coefficients. Estimation obtained using Eviews' OLS on panel data.
2/ This includes all variables that are significant at the 20% level for SPM. Most variables are significant at the 1 percent level.
3/ This includes all variables that are significant at the 20% level for Instituional Investor. Most variables are significant at the 1 percent level.

Table 15: Stability of Estimation for the Level of the Ratings

	Expected sign	Moody's				Standard and Poor's				Institutional Investors			
		1994:2 1998:2	1994:2 1995:2	1996:1 1997:1	1997:2 1998:2	1994:2 1998:2	1994:2 1995:2	1996:1 1997:1	1997:2 1998:2	1994:2 1998:2	1994:2 1995:2	1996:1 1997:1	1997:2 1998:2
DEBTX	+	1.13	1.28	1.25	1.08	0.96	0.91	1.27	0.93	4.55	4.30	4.18	4.47
		11.58	10.87	11.83	5.32	7.32	6.37	5.79	3.73	12.20	7.92	5.59	6.00
RSCH	+	1.36	1.65	1.40	1.06	1.34	2.12	1.05	1.34	6.29	11.48	5.07	4.45
		5.36	4.85	5.06	2.04	4.24	5.13	2.42	2.11	6.02	6.59	2.63	2.33
TOT	-	-2.01	-3.35	-0.17	-3.27	-2.52	-4.66	-0.30	-4.04	-29.07	-41.25	-25.39	-23.15
		-2.00	-2.81	-0.13	-1.67	-2.03	-3.21	-0.16	-1.70	-7.12	-6.54	-3.00	-3.24
XGR	-	-2.17	-2.48	3.05	-1.30	-2.21	-2.74	4.49	-1.94	-3.80	-9.99	7.72	-7.71
		-3.37	-2.45	2.98	-0.78	-2.76	-2.22	2.73	-0.96	-1.43	-1.82	1.07	-1.27
FBGDP	-	-5.14	-2.28	-9.47	-6.82	-13.17	-22.58	-14.83	-12.44	-33.05	-83.83	-41.73	-20.86
		-1.45	-0.45	-2.62	-0.83	-2.93	-3.66	-2.42	-1.24	-2.24	-3.05	-1.64	-0.69
GRGDP	-	-9.63	-6.61	-4.68	-7.85	-11.71	-7.13	-7.50	-9.86	-39.36	-11.59	-42.06	-40.18
		-4.05	-2.24	-1.74	-1.51	-3.95	-1.98	-1.76	-1.56	-4.28	-0.74	-2.21	-2.12
IGDP	-	-7.75	-7.62	-9.29	1.02	-7.53	-5.53	-8.81	3.10	-33.04	-11.98	-39.00	-29.53
		-4.15	-3.14	-4.88	0.23	-3.24	-1.87	-2.90	0.56	-4.37	-1.02	-2.90	-1.79
log(INF)	+	0.36	0.33	0.24	0.55	0.65	0.52	0.62	0.81	1.66	1.57	1.33	1.97
		3.82	2.90	2.35	2.52	5.61	3.78	3.73	3.04	4.27	2.43	1.85	2.47
C		14.80	15.51	6.47	14.30	16.34	17.30	6.02	15.97	-14.22	-5.09	-28.35	-14.54
		12.05	8.42	3.69	6.39	10.71	7.71	2.15	5.84	-2.79	-0.49	-2.36	-1.77
Adjusted R-squared		0.77	0.93	0.92	0.53	0.72	0.91	0.82	0.47	0.79	0.89	0.77	0.67
Durbin-Watson		0.68	0.83	0.51	0.49	0.72	0.70	0.34	0.45	0.45	0.43	0.36	0.64

Table 16: Error Correction Specification with Core Variables

	All variables			Set of significant variables					Balanced sample 1/			With LDV = 1		
	Moody's	S&P's	Ins. Inv.	Moody's	Moody's	S&P's	Ins. Inv.	Ins. Inv.	Moody's	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.
Lagged dependant variable (LDV)	0.88 14.87	0.79 12.91	0.91 32.39	0.93 38.11	0.90 20.80	0.84 16.91	0.90 44.98	0.90 44.65	0.89 19.29	0.82 15.33	0.91 37.05	1.00	1.00	1.00
DEBTX-DEBTX(-1)	-0.02 -0.06	0.03 0.07	0.52 0.73											
DEBTX(-1)	0.09 0.95	0.24 2.12	0.47 2.56		0.07 0.79	0.24 2.27	0.41 2.62	0.45 2.82	0.13 1.34	0.30 2.57	0.49 2.45	-0.09 -1.69	-0.01 -0.16	-0.16 -1.41
RSCH	0.22 1.23	0.36 1.53	-0.11 -0.27											
TOT-TOT(-1)	0.78 0.56	0.88 0.46	2.08 0.68											
TOT(-1)	-0.54 -0.79	-0.73 -0.79	-0.58 -0.33											
XGR-XGR(-1)	-0.81 -1.53	-1.20 -1.64	-3.33 -2.75	-0.62 -1.33	-0.72 -1.48	-1.15 -1.73	-3.58 -3.25	-3.59 -3.28	-0.92 -1.72	-1.29 -1.75	-4.20 -3.45	-0.46 -0.96	-0.65 -0.98	-2.75 -2.38
XGR(-1)	-1.71 -2.89	-1.88 -2.30	-4.89 -3.72	-1.51 -3.15	-1.61 -3.23	-1.84 -2.73	-5.39 -4.84	-5.09 -4.56	-1.82 -3.33	-1.91 -2.52	-5.91 -4.74	-1.31 -2.71	-1.26 -1.87	-4.45 -3.82
FBGDP-FBGDP(-1)	-6.73 -1.41	-9.76 -1.46	-18.41 -1.90	-4.75 -1.13	-5.13 -1.20	-7.29 -1.22	-22.86 -2.69	-18.01 -2.05	-3.94 -0.85	-6.22 -0.94	-11.16 -1.05	-3.62 -0.85	-5.69 -0.93	-19.77 -2.20
FBGDP(-1)	-0.84 -0.37	-2.51 -0.77	-1.85 -0.35											
GRGDP-GRGDP(-1)	-0.10 -0.05	-0.69 -0.24	-9.27 -2.11					-8.15 -1.92						
GRGDP(-1)	-2.34 -1.06	-4.71 -1.57	-16.80 -3.84	-1.87 -1.16	-2.25 -1.33	-4.44 -1.91	-11.80 -3.23	-15.87 -3.78	-1.96 -1.09	-4.31 -1.71	-10.82 -2.55	-0.65 -0.42	-1.00 -0.47	-2.64 -0.80
IGDP-IGDP(-1)	-9.40 -2.17	-12.44 -2.09	-23.24 -2.54	-9.64 -2.85	-9.63 -2.84	-12.63 -2.68	-35.60 -4.60	-28.52 -3.35	-9.85 -2.70	-12.66 -2.49	-40.98 -4.89	-9.79 -2.85	-13.22 -2.72	-37.70 -4.60
IGDP(-1)	0.52 0.39	0.25 0.14	4.17 1.47											
log(INF)-log(INF(-1))	0.33 2.73	0.54 3.34	1.77 6.59	0.31 2.96	0.33 2.99	0.55 3.57	1.70 6.55	1.76 6.79	0.34 2.70	0.53 2.97	1.60 5.46	0.28 2.54	0.42 2.73	1.52 5.58
log(INF(-1))	0.03 0.44	0.13 1.34	0.34 2.38		0.03 0.50	0.13 1.41	0.37 2.75	0.35 2.52	0.03 0.54	0.14 1.46	0.34 2.31	-0.03 -0.49	-0.04 -0.54	0.06 0.50
C	3.58 2.96	4.84 3.11	1.32 0.63	2.63 4.05	2.97 3.75	3.88 3.63	2.02 1.34	1.48 0.97	3.21 3.82	4.05 3.44	2.51 1.41	1.78 3.03	1.50 1.83	5.58 3.99
Adjusted R-squared	0.92	0.87	0.98	0.92	0.92	0.87	0.98	0.98	0.92	0.87	0.97			
Durbin-Watson	2.07	2.16	1.72	2.14	2.11	2.22	1.65	1.69	2.09	2.20	1.80	2.22	2.39	1.55

1/ This is the sample of 16 countries (ie excluding Jordan, Peru, Poland and Russia) for which observations are available throughout the estimation period.

Table 17: Error Correction Specification with Core Variables and Crisis Related Variables

	Core Variables			Crisis index			Crisis index (asymmetric) 1/			Crisis related variables		
	Moody'	S&P's	Ins. Inv.	Moody'	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.	Moody'	S&P's	Ins. Inv.
Lagged rating	0.90	0.84	0.90	0.94	0.92	0.94	0.93	0.90	0.94	0.89	0.84	0.90
	20.80	16.91	44.98	25.06	22.89	49.45	25.49	22.24	55.60	20.14	16.80	49.32
DEBTX(-1)	0.07	0.24	0.41	0.01	0.10	0.25	0.05	0.15	0.23	0.12	0.26	0.53
	0.79	2.27	2.62	0.14	1.23	1.72	0.63	1.70	1.79	1.34	2.47	3.48
XGR-XGR(-1)	-0.72	-1.15	-3.58	-0.33	-0.42	-2.35	-0.33	-0.43	-2.14	-0.71	-1.09	-3.93
	-1.48	-1.73	-3.25	-0.79	-0.78	-2.42	-0.83	-0.83	-2.37	-1.58	-1.89	-4.19
XGR(-1)	-1.61	-1.84	-5.39	-0.95	-0.63	-3.12	-0.98	-0.68	-3.03	-1.24	-1.24	-4.91
	-3.23	-2.73	-4.84	-2.18	-1.13	-3.00	-2.36	-1.26	-3.21	-2.71	-2.12	-5.07
FBGDP-FBGDP(-1)	-5.13	-7.29	-22.86	-3.42	-5.71	-18.40	-1.04	-3.47	-15.90	-6.06	-7.89	-12.71
	-1.20	-1.22	-2.69	-0.94	-1.21	-2.12	-0.29	-0.74	-2.29	-1.55	-1.55	-1.62
GRGDP(-1)	-2.25	-4.44	-11.80	-2.15	-3.39	-8.52	-1.53	-2.92	-9.29	-2.52	-4.36	-10.94
	-1.33	-1.91	-3.23	-1.49	-1.83	-2.57	-1.10	-1.61	-3.14	-1.61	-2.16	-3.44
IGDP-IGDP(-1)	-9.63	-12.63	-35.60	-10.22	-13.27	-35.58	-8.40	-11.41	-31.33	-8.25	-10.82	-19.98
	-2.84	-2.68	-4.60	-3.52	-3.55	-5.21	-2.96	-3.04	-4.97	-2.32	-2.30	-2.67
log(INF)-log(INF(-1))	0.33	0.55	1.70	-0.02	-0.06	0.80	-0.02	-0.05	0.72	0.19	0.30	0.90
	2.99	3.57	6.55	-0.16	-0.43	3.08	-0.18	-0.39	3.00	1.74	2.09	3.71
log(INF(-1))	0.03	0.13	0.37	-0.07	-0.08	-0.11	-0.03	-0.02	-0.04	0.07	0.19	0.43
	0.50	1.41	2.75	-1.37	-1.02	-0.79	-0.56	-0.30	-0.31	1.31	2.34	3.59
CRIS-CRIS(-1)				0.03	0.04	0.03						
				7.65	9.49	3.62						
CRIS(-1)				0.03	0.05	0.10						
				5.92	7.32	7.69						
CRISHIGH-CRISHIGH(-1)							0.03	0.05	0.05			
							8.89	9.84	5.15			
CRISHIGH (-1)							0.04	0.06	0.14			
							6.26	6.80	9.34			
CRISLOW-CRISLOW(-1)							0.00	0.02	0.00			
							0.66	2.47	0.14			
CRISLOW(-1)							0.01	0.03	0.04			
							1.64	3.02	2.50			
CAGDP-CAGDP(-1)										6.42	5.28	18.66
										2.10	1.34	2.81
CAGDP(-1)										2.86	4.97	8.85
										1.41	1.83	2.08
STDR-STDR(-1)										0.24	0.61	-0.52
										1.81	3.57	-1.78
STDR(-1)										0.14	0.19	0.33
										1.62	1.69	1.75
REER-REER(-1)										-2.24	-3.93	-6.40
										-4.01	-5.49	-5.28
REER(-1)										-0.23	-1.88	-5.75
										-0.32	-2.03	-3.61
C	2.97	3.88	2.02	1.66	1.24	0.17	1.79	1.45	0.09	2.62	3.18	0.97
	3.75	3.63	1.34	2.37	1.38	0.13	2.65	1.64	0.07	3.56	3.32	0.68
Adjusted R-squared	0.92	0.88	0.98	0.94	0.92	0.98	0.95	0.93	0.98	0.93	0.91	0.98
Durbin-Watson	2.11	2.22	1.65	2.11	2.20	1.47	2.11	2.22	1.56	2.25	2.39	1.46

Table 18: Error Correction Specification with Core Variables and Asymmetric Crisis Index, Robustness Check

	Crisis index			Without Mexico			Without Russia			Without Korea		
	Moody's	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.	Moody's	S&P's	Ins. Inv.
Lagged rating	0.93	0.90	0.94	0.91	0.90	0.94	0.95	0.93	0.94	0.95	0.97	0.94
	25.49	22.24	55.60	22.59	20.46	53.74	28.67	24.38	48.80	27.76	32.10	53.73
DEBTX(-1)	0.05	0.15	0.23	0.07	0.16	0.24	0.02	0.12	0.25	0.01	0.05	0.25
	0.63	1.70	1.79	0.89	1.77	1.82	0.29	1.44	1.73	0.12	0.82	1.92
XGR-XGR(-1)	-0.33	-0.43	-2.14	-0.38	-0.49	-2.33	-0.35	-0.49	-2.16	-0.29	-0.24	-2.04
	-0.83	-0.83	-2.37	-0.90	-0.91	-2.55	-0.98	-1.02	-2.38	-0.81	-0.64	-2.24
XGR(-1)	-0.98	-0.68	-3.03	-1.03	-0.73	-3.17	-1.08	-0.81	-3.26	-1.02	-0.59	-2.89
	-2.36	-1.26	-3.21	-2.32	-1.27	-3.30	-2.89	-1.63	-3.35	-2.67	-1.53	-3.01
FBGDP-FBGDP(-1)	-1.04	-3.47	-15.90	-1.01	-2.91	-15.06	-0.38	-2.34	-14.93	-2.25	-6.09	-16.59
	-0.29	-0.74	-2.29	-0.28	-0.60	-2.16	-0.12	-0.54	-1.81	-0.68	-1.79	-2.34
GRGDP(-1)	-1.53	-2.92	-9.29	-1.75	-3.08	-9.74	-0.98	-2.20	-8.77	-1.14	-1.57	-9.22
	-1.10	-1.61	-3.14	-1.10	-1.48	-3.02	-0.78	-1.31	-2.84	-0.90	-1.21	-3.12
IGDP-IGDP(-1)	-8.40	-11.41	-31.33	-8.83	-12.18	-31.76	-6.60	-9.73	-32.72	-7.61	-9.52	-31.84
	-2.96	-3.04	-4.97	-2.93	-3.06	-4.86	-2.60	-2.81	-5.07	-2.97	-3.59	-5.02
log(INF)-log(INF(-1))	-0.02	-0.05	0.72	-0.02	-0.05	0.57	0.11	0.08	0.64	0.01	-0.08	0.76
	-0.18	-0.39	3.00	-0.17	-0.37	2.31	1.19	0.59	2.59	0.08	-0.76	3.17
log(INF(-1))	-0.03	-0.02	-0.04	-0.02	-0.01	-0.04	0.00	-0.02	-0.06	-0.03	-0.07	-0.03
	-0.56	-0.30	-0.31	-0.45	-0.09	-0.35	-0.05	-0.25	-0.48	-0.71	-1.21	-0.20
CRISHIGH-CRISHIGH(-1)	0.03	0.05	0.05	0.03	0.05	0.05	0.05	0.07	0.03	0.03	0.04	0.04
	8.89	9.84	5.15	8.63	9.62	5.36	11.60	12.01	2.80	7.23	10.01	4.72
CRISHIGH(-1)	0.04	0.06	0.14	0.04	0.06	0.15	0.05	0.08	0.13	0.03	0.06	0.13
	6.26	6.80	9.34	6.10	6.64	9.51	8.90	9.08	7.67	5.33	8.48	7.77
CRISLOW-CRISLOW(-1)	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.01
	0.66	2.47	0.14	0.49	2.01	0.14	0.41	2.48	-0.16	0.38	2.02	0.90
CRISLOW(-1)	0.01	0.03	0.04	0.01	0.03	0.04	0.01	0.03	0.04	0.01	0.02	0.05
	1.64	3.02	2.50	1.39	2.53	2.25	0.92	2.93	2.09	1.18	2.73	2.98
C	1.79	1.45	0.09	1.91	1.58	0.09	1.68	1.29	0.01	1.61	0.71	0.05
	2.65	1.64	0.07	2.64	1.68	0.07	2.79	1.59	0.01	2.59	1.11	0.04
Adjusted R-squared	0.95	0.93	0.98	0.95	0.93	0.98	0.96	0.94	0.98	0.95	0.96	0.98
Durbin-Watson	2.11	2.22	1.56	2.11	2.25	1.49	2.07	2.36	1.52	2.01	1.80	1.57

1/ Indonesia, Korea, Malaysia, Philippines, Thailand

Table 19: Error Correction Specification with Crisis Variables, During and Out of Crises

	Benchmark			REER			CAGDP		
	Moody's	S&P's	Ins. (-)	Moody's	S&P's	Ins. (-)	Moody's	S&P's	Ins. (-)
Lagged dependant variable	0.90	0.84	0.90	0.90	0.85	0.92	0.91	0.83	0.90
	20.80	16.91	44.98	22.81	19.39	54.16	19.28	14.89	45.45
DEBTX(-1)	0.07	0.24	0.41	0.08	0.22	0.32	0.07	0.26	0.47
	0.79	2.27	2.62	0.98	2.37	2.39	0.72	2.23	2.87
XGR-XGR(-1)	-0.72	-1.15	-3.58	-0.45	-0.82	-3.11	-0.89	-1.61	-4.15
	-1.48	-1.73	-3.25	-1.01	-1.41	-3.29	-1.77	-2.39	-3.87
XGR(-1)	-1.61	-1.84	-5.39	-1.30	-1.42	-4.51	-1.69	-2.20	-5.44
	-3.23	-2.73	-4.84	-2.84	-2.37	-4.56	-3.35	-3.26	-5.06
FBGDP-FBGDP(-1)	-5.13	-7.29	-22.86	-7.10	-8.70	-14.72	-4.58	-5.27	-16.55
	-1.20	-1.22	-2.69	-1.85	-1.70	-1.90	-1.05	-0.89	-2.01
GRGDP(-1)	-2.25	-4.44	-11.80	-3.43	-6.19	-13.33	-2.14	-4.11	-10.93
	-1.33	-1.91	-3.23	-2.28	-3.09	-4.32	-1.23	-1.76	-3.11
IGDP-IGDP(-1)	-9.63	-12.63	-35.60	-9.76	-12.12	-24.64	-6.23	-4.10	-18.10
	-2.84	-2.68	-4.60	-2.99	-2.77	-3.56	-1.48	-0.71	-2.01
log(INF)-log(INF(-1))	0.33	0.55	1.70	0.07	0.11	0.58	0.29	0.53	1.50
	2.99	3.57	6.55	0.59	0.77	2.31	2.52	3.38	5.89
log(INF(-1))	0.03	0.13	0.37	0.07	0.16	0.44	0.01	0.10	0.34
	0.50	1.41	2.75	1.29	2.07	3.81	0.22	1.08	2.52
<u>During crisis</u>									
Var. *CRISD1-Var. (-1)*CRISD1(-1)				-3.97	-6.08	-10.73	2.47	-0.95	31.87
				-6.47	-7.50	-8.14	0.76	-0.22	4.40
Var. (-1)*CRISD1(-1)				-2.21	-3.67	-13.63	-1.70	-0.74	8.22
				-2.74	-3.45	-8.16	-0.52	-0.17	1.16
<u>Out of crisis</u>									
Var. *(1-CRISD1)-Var. (-1)*(1-CRISD1(-1)				-0.23	-1.07	-1.47	6.53	13.99	30.49
				-0.29	-1.03	-0.85	1.71	2.71	3.57
Var. (-1)*(1-CRISD1(-1))				0.37	-0.75	-2.93	1.10	3.66	4.93
				0.42	-0.64	-1.51	0.42	0.99	0.89
C	2.97	3.88	2.02	2.71	3.42	2.22	3.00	4.29	1.79
	3.75	3.63	1.34	3.80	3.66	1.70	3.70	3.94	1.20
Adjusted R-squared	0.92	0.87	0.98	0.94	0.91	0.98	0.92	0.88	0.98
Durbin-Watson	2.11	2.22	1.65	2.38	2.53	1.50	2.12	2.22	1.62

Table 20: The Relation Between Different Mappings of the Rating Variables and Spread 1/

	Moody's				Standard and Poor's			
	Basic rating	With outlook	Log of probability	BBS mapping	Basic rating	With outlook	Log of probability	BBS mapping
Dependent variable: log (spread)								
Rating	0.26	0.26	0.50	0.02	0.25	0.25	0.53	0.02
	11.95	12.02	11.51	10.73	12.86	13.40	13.28	12.15
C	-2.00	-2.01	0.32	-0.82	-1.84	-1.84	0.39	-0.68
	-7.88	-7.94	3.91	-4.65	-8.22	-8.55	5.65	-4.65
Adj. R-squared	0.56	0.56	0.54	0.51	0.60	0.62	0.61	0.57
Durbin-Watson	0.59	0.58	0.64	0.67	0.58	0.59	0.66	0.59

1/ Sub period : July 1996 to Jan. 1999 only

Table 21: Explanatory Power of the Core Variables with Different Mappings of Ratings 1/

	Moody's				Standard and Poor's			
	Basic rating	With outlook	Log of probability	BBS mapping	Basic rating	With outlook	Log of probability	BBS mapping
DEBTX	1.13	1.13	11.33	0.61	0.94	0.96	7.59	0.40
	11.62	11.58	7.67	10.70	7.26	7.32	4.28	6.02
RSCH	1.35	1.36	12.90	0.73	1.39	1.34	17.54	0.71
	5.31	5.36	3.34	4.93	4.47	4.24	4.10	4.44
TOT	-2.03	-2.01	-51.04	-1.37	-2.33	-2.52	-43.76	-1.35
	-2.02	-2.00	-3.35	-2.33	-1.90	-2.03	-2.59	-2.14
XGR	-2.10	-2.17	-10.25	-0.94	-2.00	-2.21	-15.09	-0.92
	-3.26	-3.37	-1.05	-2.49	-2.53	-2.76	-1.39	-2.26
FBGDP	-4.90	-5.14	33.79	-2.20	-13.35	-13.17	-227.61	-8.46
	-1.38	-1.45	0.63	-1.06	-3.01	-2.93	-3.72	-3.71
GRGDP	-9.70	-9.63	-122.65	-5.26	-10.34	-11.71	-82.69	-4.27
	-4.08	-4.05	-3.40	-3.78	-3.54	-3.95	-2.05	-2.84
IGDP	-7.74	-7.75	-79.17	-2.16	-7.64	-7.53	-99.82	-3.06
	-4.14	-4.15	-2.79	-1.98	-3.33	-3.24	-3.16	-2.60
log(INF)	0.35	0.36	3.30	0.16	0.64	0.65	2.16	0.24
	3.77	3.82	2.32	2.91	5.60	5.61	1.36	4.14
C	14.74	14.80	134.43	2.64	15.88	16.34	135.16	3.17
	11.98	12.05	7.20	3.67	10.55	10.71	6.52	4.09
Adjusted R-squared	0.77	0.77	0.56	0.70	0.72	0.72	0.60	0.67
Durbin-Watson	0.68	0.68	0.59	0.52	0.71	0.72	0.54	0.60

1/ Full sample. Log of probability refers to the corporate default probability. The BBS mapping to the proposed mapping by t