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Financial Crises, Credit Ratings, and Bank Failures

Default, Currency Crises, and Sovereign Credit Ratings

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Sovereign credit ratings play an important part in determining countries' access to international capital markets and the terms of that access. In principle, there is no reason to expect that sovereign credit ratings should systematically predict currency crises. In practice, in emerging market economies there is a strong link between currency crises and default. Hence if credit ratings are forward-looking and currency crises in emerging market economies are linked to defaults, it follows that downgrades in credit ratings should systematically precede currency crises. This article presents results suggesting that sovereign credit ratings systematically fail to predict currency crises but do considerably better in predicting defaults. Downgrades in credit ratings usually follow currency crises, possibly suggesting that currency instability increases the risk of default.

Sovereign credit ratings play an important part in determining countries' access to international capital markets and the terms of that access. As more countries are added to the list of rated sovereigns, the information content of ratings becomes even more important.[1] Credit ratings have been shown to have a significant impact on the yield spreads of sovereign bonds.[2] Indeed, sovereign credit ratings are taken as summary measures of the likelihood that a country will default. It is hardly surprising that the countries with the lowest ratings are those that are unable to borrow from international capital markets and are dependent on official loans from multilateral institutions or governments. In a cross-sectional setting, sovereign credit ratings do well in distinguishing across borrowers.

Developed countries take access to international capital markets for granted. At the other end of the spectrum, many low-income countries, mired in debt,

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1. To cite a recent example, Standard and Poor's added Guatemala to the list of rated sovereigns in November 2001.

2. See, for example, Larraín and others (1997), who find evidence that ratings "Granger cause" the yield spreads of sovereign bonds.

have no access to international lending even under relatively favorable states of nature.[3] For emerging market economies, access to international capital markets is precarious and highly variable over time. For these economies sovereign credit ratings are most critical.

In principle, there is no reason to expect that sovereign credit ratings should systematically predict currency or banking crises. After all, developed countries have had their share of currency crises (such as the 1992–93 Exchange Rate Mechanism crisis in France and the United Kingdom), banking crises (such as that in Japan in the 1990s and the savings and loan crisis in the United States in the early 1980s), and simultaneous currency and banking crises (such as the twin crises in the Nordic countries in the early 1990s and in Spain in the late 1970s and early 1980s).[4] These crises did not lead to systematic markdowns in credit ratings.

In practice, however, in emerging market economies there is a strong link between currency crises and default.[5] Without the colossal bailout packages put together by the international community, there is little doubt that the currency crises in Mexico, the Republic of Korea, Thailand, and more recently Turkey would all have produced a sovereign debt default.[6] Hence if credit ratings are forward-looking and currency crises in emerging market economies are linked to defaults, it follows that downgrades should systematically precede currency crises. It is this temporal (rather than cross-sectional) behavior of credit ratings that this article investigates.

Contrary to logic, recent anecdotal evidence suggests that downgrades in credit ratings have not preceded financial crises. Downgrades appear to have followed, not preceded, the crises in Asia in 1997 (table 1). A natural question, then, is whether this failure by the rating agencies to anticipate debt servicing difficulties is systematic. Goldstein and others (2000) examine the links between currency and banking crises and changes in sovereign credit ratings by Institutional Investor and Moody's for 20 countries. They find mixed evidence on the ability of the rating agencies to anticipate financial crises. Neither rating agency predicted banking crises, but there is evidence that the Moody's sovereign ratings have some (very low) predictive power for currency crises.

This article casts a wider net, examining the links among crises, default, and rating changes for 46–62 economies, depending on the rating agency. It also extends the analysis to Standard and Poor's sovereign ratings and different approaches to dating the currency crises.

3. Favorable states of nature include both shocks that are idiosyncratic to a country, such as an increase in its terms of trade, and common shocks, such as a decline in world interest rates.

4. For an analysis of twin crises see Kaminsky and Reinhart (1999).

5. Furthermore, some of the indicators useful in predicting currency crises are also useful in predicting debt crises. See Detragiache and Spilimbergo (2001).

6. Even if the government itself has little outstanding debt, history has shown that, time after time, governments assume private-sector debt during currency crises.

TABLE 1. Performance of Rating Agencies before the Asian Crisis: Long-Term Debt Ratings, 1996–97

Rating agency and country		Jan. 15, 1996		Dec. 2, 1996		June 24, 1997		Dec. 12, 1997	
		Rating	Outlook	Rating	Outlook	Rating	Outlook	Rating	Out
Moody's foreign currency debt									
Indonesia		Baa3		Baa3		Baa3		Baa3	
Korea, Rep. of		A1		A1	Stable			Baa2	Negative
Malaysia		A1		A1		A1		A1	
Mexico		Ba2		Ba2		Ba2		Ba2	
Philippines		Ba2		Ba2		Ba2		Ba2	
Thailand		A2		A2		A2		Baa1	Negative

Rating agency and country		Jan. 15, 1996		Dec. 2, 1996		June 24, 1997		Oct. 1997	
		Rating	Outlook	Rating	Outlook	Rating	Outlook	Rating	Out
Standard and Poor's									
Indonesia	Foreign currency debt	BBB	Stable	BBB	Stable	BBB	Stable	BBB	Negative
	Domestic currency debt			A+		A+		A–	Negative
Korea, Rep. of	Foreign currency debt	AA–	Stable	AA–	Stable				
	Domestic currency debt								
Malaysia	Foreign currency debt	A+	Stable	A+	Stable	A+	Positive	A+	Negative
	Domestic currency debt	AA+		AA+		AA+		AA+	Negative
Mexico	Foreign currency debt	BB	Negative	BB		BB			
	Domestic currency debt	BBB+		BBB+	Stable	BBB+	Positive		
Philippines	Foreign currency debt	BB	Positive	BB	Positive	BB+	Positive	BB+	Stable
	Domestic currency debt	BBB+		BBB+		A–		A–	Stable
Thailand	Foreign currency debt	A	Stable	A	Stable	A	Stable	BBB	Negative
	Domestic currency debt			AA		AA		A	Negative

Note: The rating system for Moody's is as follows (from highest to lowest): Aaa, Aa1, Aa2, Aa3, A1, A2, A3, Baa1, Baa2, Baa3, Ba1, Ba2, Ba3. The rating system for Standard and Poor's is as follows (from highest to lowest): AAA, AA+, AA, AA–, A+, A, A–, BBB+, BBB, BBB–, BB+, BB, BB–. Blank cells denote no action or change at that time.

Source: Radelet and Sachs (1998).

I. Crises, Default, and the Aftermath

Calvo and Reinhart (2000) have suggested that one reason emerging market economies may fear devaluations (or large depreciations) is that the devaluations are associated with a loss of access to international credit, which in turn is associated with severe recessions.[7] To examine this issue, the article begins by assessing the temporal links between episodes of sovereign default and currency crises. In response to the recent anecdotal evidence suggesting that downward adjustments in sovereign credit ratings have come after currency crises were well under way, it also reviews the behavior of credit ratings in the aftermath of crises. It also examines the extent to which currency crises lead to a reassessment of the risk of sovereign default and whether distinct patterns emerge for developed and emerging market economies.

Data and Definitions

The analysis covers the sovereign credit ratings issued by Institutional Investor, Moody's Investors Service, and Standard and Poor's. The Institutional Investor sample begins in 1979 and runs through 1999. The panels for the Moody's and Standard and Poor's ratings are unbalanced (that is, they do not have the same number of observations for all economies).

The Institutional Investor ratings run from 0 (least creditworthy) to 100 (most creditworthy). The ratings are reported twice a year and changed frequently. Moody's and Standard and Poor's use multiple letters to rate a sovereign's creditworthiness. For the purposes of the analysis the letter ratings are mapped into 17 categories, with 16 corresponding to the highest rating and 0 to the lowest (for an illustration see table 2).[8] Moody's and Standard and Poor's may change their ratings at any time (though they do so much less often than Institutional Investor), so the samples for these rating agencies include, for each economy, the months in which any rating changes took place.

With 62 economies, the Institutional Investor sample is the largest (table 3). The Standard and Poor's sample is the smallest, with 46 economies, but is nonetheless more than twice the size of the 20-country sample used by Goldstein and others (2000). The sample for the analysis of the links between currency crises and default includes 58 economies and spans the period 1970–99.

Methodological Issues

To assess the interaction among currency crises, default, and sovereign credit ratings, the crises need to be dated. Two indexes of currency crises are constructed, to assess whether the results are sensitive to the definition of crises used. The first index is that used by Kaminsky and Reinhart (1999) for 20 countries now

7. Calvo and Reinhart (2000) present evidence that the recessions following devaluations are deeper in emerging market economies than in developed economies.

8. This approach follows the procedure adopted in Cantor and Packer (1996a, 1996b).

TABLE 2. Scale for Moody's Foreign Currency Debt Rating

Rating	Assigned value
Aaa	16
Aa1	15
Aa2	14
Aa3	13
A1	12
A2	11
A3	10
Baa1	9
Baa2	8
Baa3	7
Ba1	6
Ba2	5
Ba3	4
B1	3
B2	2
B3	1
C	0

Source: Compiled by the author based on data from Moody's.

extended to the larger sample. The second is the definition of crises employed by Frankel and Rose (1996).[9]

Kaminsky and Reinhart's (1999) crisis index, (*KR*), *I*, is a weighted average of the rate of change of the exchange rate, $\Delta e/e$, and the rate of change of reserves, $\Delta R/R$, with weights such that the two components of the index have equal sample volatilities:

$$I = (\Delta e/e) - (\sigma_e/\sigma_R) * (\Delta R/R), \tag{1}$$

where σ_e is the standard deviation of the rate of change of the exchange rate and σ_R is the standard deviation of the rate of change of reserves. Because changes in the exchange rate enter with a positive weight and changes in reserves with a negative weight, readings of this index that are three standard deviations or more above the mean are catalogued as crises.

Construction of the index is modified for economies in the sample that have experienced hyperinflation. Although a 100 percent devaluation may be traumatic for a country with low to moderate inflation, a devaluation of that size is common during episodes of hyperinflation. For countries that have had such an episode, a single index would miss sizable devaluations and reserve losses in the periods of moderate inflation, since the high-inflation episode distorts the his-

9. An earlier version of this article included a modified version of Frankel and Rose's index that dates "milder" crises. See Reinhart (2002).

TABLE 3. The Samples

Institutional Investors: biannual observations for 62 economies, 1979–99
Algeria, Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Dominican Republic, Ecuador, Arab Republic of Egypt, El Salvador, Ethiopia, Finland, Ghana, Greece, Hong Kong (China), Hungary, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Republic of Korea, Malaysia, Mali, Mexico, Morocco, Nepal, New Zealand, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, the Philippines, Poland, Portugal, Romania, Saudi Arabia, Singapore, South Africa, Spain, Sri Lanka, Swaziland, Sweden, Tanzania, Thailand, Turkey, United States, Uruguay, Venezuela, and Zimbabwe.
Moody's Investors Service: monthly observations for 48 economies, unbalanced panel, 1979–99
Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Dominican Republic, Ecuador, Arab Republic of Egypt, El Salvador, Finland, Greece, Hong Kong (China), Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Republic of Korea, Malaysia, Mexico, Morocco, New Zealand, Norway, Pakistan, Panama, Paraguay, the Philippines, Poland, Portugal, Romania, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Thailand, Turkey, United States, Uruguay, and Venezuela.
Standard and Poor's: monthly observations for 46 economies, unbalanced panel, 1979–99
Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Dominican Republic, Arab Republic of Egypt, El Salvador, Finland, Greece, Hong Kong (China), Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Republic of Korea, Malaysia, Mexico, Morocco, New Zealand, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, the Philippines, Poland, Portugal, Romania, Singapore, Spain, Sweden, Thailand, Turkey, United States, and Uruguay.
Sample for the interaction between currency crises and defaults: 58 economies, 1970–99, 151 currency crises, 113 defaults
Algeria, Argentina, Bolivia, Brazil, Burkina Faso, Cameroon, the Central African Republic, Chile, Colombia, the Democratic Republic of Congo, Costa Rica, Côte d'Ivoire, Denmark, Dominican Republic, Ecuador, Arab Republic of Egypt, Ethiopia, Finland, Gabon, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, India, Indonesia, Israel, Jamaica, Jordan, Madagascar, Malawi, Mexico, Morocco, Nicaragua, Niger, Nigeria, Norway, Paraguay, Peru, the Philippines, Romania, São Tomé and Principe, Senegal, Sierra Leone, Spain, Sudan, Sweden, Tanzania, Togo, Trinidad and Tobago, Turkey, Uganda, Uruguay, Venezuela, Zambia, and Zimbabwe.

torical mean. To avoid this, the sample economies are sorted into two groups according to whether the inflation rate in the previous six months exceeded 150 percent, and an index is then constructed for each subsample.[10] As earlier studies (see Frankel and Rose 1996) have noted, the dates of crises obtained using this method map well onto the dates obtained when crises are defined exclusively on the basis of events, such as the closing of the exchange markets or a change in the exchange rate regime.

10. Similar results are obtained by using significant departures in inflation from 6- and 12-month moving averages.

The Frankel and Rose (*FR*) definition of a currency crisis is a 25 percent or greater devaluation in a given month that is also at least 10 percent greater than the devaluation in the preceding month (Frankel and Rose 1996).[11]

Episodes of default are dated using Beers and Bhatia (1999), who provide dates of default from 1824 to 1999 (the analysis here focuses on 1970–99); Beim and Calomiris (2001); the World Bank's *Global Development Finance* (various years); and the dates of debt crises provided by Detragiache and Spilimbergo (2001).[12] In some cases these sources pinpoint the exact month in which a default was announced. The sample includes defaults on both foreign currency bank debt and foreign currency bond debt but not on local currency instruments. It includes defaults for both rated and unrated sovereigns.

A Sketch of the Signals Approach

The "signals" approach developed by Kaminsky and Reinhart (1999) is used to compare the performance of the ratings—and of some of the economic indicators on which rating agencies focus—with the performance of some of the other (and better) predictors of financial crises. In a nutshell, the signals approach involves a set of possible outcomes, as presented in the following two-by-two matrix (matrix 1).[13]

Matrix 1. Crisis and Signals

	Crisis occurs in the following 24 months	No crisis occurs in the following 24 months
Signal	A	B
No signal	C	D

A perfect indicator would have entries only in cells A and D.

This matrix permits the definition of several useful concepts employed to evaluate the performance of each indicator. If no information were available on the performance of the indicators, it would still be possible to calculate, for a given sample, the unconditional probability of crisis:

$$P(\mathrm{C}) = (A + C)/(A + B + C + D). \tag{2}$$

11. The modified *FR* index (*MFR*), used in the earlier version of this article (Reinhart 2002), classifies as a crisis a devaluation in a given month that is 20 percent or greater and at least 5 percent greater than the devaluation in the preceding month.

12. Detragiache and Spilimbergo (2001) classify an observation as a debt crisis if either or both of the following conditions occur: there are arrears of principal or interest on external obligations to commercial creditors (banks or bondholders) exceeding 5 percent of total commercial debt outstanding, or there is a rescheduling or debt restructuring agreement with commercial creditors as listed in the World Bank's *Global Development Finance*.

13. For a more detailed description of the signals approach see Kaminsky and others (1998) and Goldstein and others (2000).

If an indicator sends a signal and that indicator has a reliable track record, the probability of a crisis, conditional on a signal, $P(C \mid S)$, can be expected to be greater than the unconditional probability where

$$P(C \mid S) = A/(A + B). \tag{3}$$

Formally,

$$P(C \mid S) - P(C) > 0. \tag{4}$$

The intuition is clear: if the indicator is not "noisy" (prone to sending false alarms), there will be relatively few entries in cell B, and $P(C \mid S) \approx 1$. This is one of the criteria used to rank the indicators. The noise-to-signal ratio can be defined as

$$N/S = [B/(B + D)]/[A/(A + C)]. \tag{5}$$

If an indicator has a track record of relatively few false alarms, this may mean that the indicator issues signals relatively rarely and that there is a danger that it misses crises altogether (that is, that it does not signal before a crisis). Hence the proportion of crises accurately signaled is also calculated for each indicator:

$$PC = C/(A + C). \tag{6}$$

For credit ratings, a downgrade in the 24 months before a crisis would be considered a signal.

Currency Crises and Default: The Links

To analyze the interaction between defaults and currency crises, the two-by-two matrix (matrix 2) can be recast as follows if defaults signal currency crises.

MATRIX 2. Defaults Lead Currency Crisis

	Currency Crisis occurs in the following 24 months	No crisis occurs in the following 24 months
Default	A	B
No default	C	D

If the converse is true, the matrix can be recast in this way (matrix 3):

MATRIX 3. Currency Crises Lead Default

	Default occurs in the following 24 months	No default occurs in the following 24 months
Currency crisis	A	B
No currency crisis	C	D

To simply look at the joint occurrence of default and currency crises, the 24-month window would be extended so that it is two-sided around the default date.

The sample for the analysis of the links between defaults and currency crises includes 113 defaults and 151 currency crises, 135 of them in emerging market economies. The unconditional probability of defaulting is 13.3 percent if developed economies (for which the probability of default is zero) are excluded from the sample (table 4).[14] The unconditional probability of a currency crisis is about 17 percent. This probability changes little when developed economies are excluded from the sample, highlighting the fact that the key difference between developed and emerging market economies is debt problems—although debt problems are tightly linked to currency problems in emerging market economies, as we shall see. The probability of having a currency crisis within 24 months of defaulting (with the crisis either before or after the default) is about 84 percent. Because defaults are somewhat rarer than currency crises, the probability of having a default within 24 months of a currency crisis is lower: about 58 percent for the entire sample and 66 percent for emerging market economies. This second subset is the relevant group, because it accounts for all the episodes of default in the sample. This exercise points to the strong association between debt events and currency crises in emerging market economies.

What temporal pattern do the results reveal? The probability of having a currency crisis conditional on having defaulted is about 69 percent, whereas the probability of defaulting conditional on having had a currency crisis is somewhat lower, at around 46 percent for emerging market economies. What inference is to be drawn from these results? Not so much that there is any obvious causal pattern—although currency crises conditional on having defaulted are more common—but that currency crises are more frequent and in about half the cases (even in emerging market economies) do not necessarily lead to default. Indeed, this stylized fact may help explain why credit ratings do poorly in predicting currency crises, an issue taken up later. Of course, as discussed, there are a few cases in the sample in which a currency crisis would have precipitated a default in the absence of a major intervention by the financial community.

Sovereign Credit Ratings in the Aftermath of Crises

Further evidence that devaluations (or large depreciations) are followed more often than not by debt servicing difficulties can be gleaned from studying the behavior of sovereign credit ratings in the aftermath of such events. Results from analysis of Institutional Investor ratings around currency crises show no significant difference between developed and emerging market economies in the probability of a downgrade (or multiple downgrades) following a currency crisis (table 5). But this is where the similarities between the two groups of economies end. The average rating for emerging market economies at the time of a crisis is 37.6, slightly less than half the average score for developed countries. This suggests, of course, that even in the absence of a crisis access to international lending is far from even for the two groups. Moreover, that vast gap widens further in the aftermath of de-

14. This is the probability of a new default, not the probability of being in a state of default, which is larger. For example, Sierra Leone was in default on its foreign currency bank debt during 1983–84 and 1986–95. This is treated as a single episode of default beginning in 1983, just as in Beim and Calomiris (2001).

TABLE 4. The Twin D's: Devaluation and Default, 1970–99
(percent)

Probability	All sample economies	Emerging market economies only
Unconditional probability of a default occurring in the next 24 months	12.0[a]	13.3
Unconditional probability of a currency crisis occurring in the next 24 months	17.3	16.9
Probability of a currency crisis occurring within 24 months before or after a default	84.0[b]	84.0[b]
Probability of a default occurring within 24 months before or after a currency crisis	57.5	65.7
Probability of a currency crisis occurring within 24 months of having defaulted	69.3	69.3
Probability of a default occurring within 24 months of having had a currency crisis	39.4	46.0

[a]The probability of default for the developed economies in the sample is 0.

[b]The probabilities for the entire sample and the subset of emerging market economies are the same because although developed economies had currency crises, none defaulted within the sample period.

Source: Author's calculations.

valuations associated with currency crises. In the 12 months following a currency crisis, the sovereign rating index for emerging market economies falls by 10.8 percent on average, a downgrade about five times that for developed economies. The difference between the postcrisis downgrades for emerging market and developed economies is significant at standard confidence levels.

A comparable exercise performed for the Moody's ratings shows an even greater gulf between emerging market and developed economies. Like the Institutional Investor ratings, the Moody's ratings at the outset of a currency crisis are significantly lower for emerging market economies—on average, about a third that for developed economies (table 6). Again, the downgrade for emerging market economies (about 9 percent) is far greater than that for developed economies (less than 1 percent). But the probability of a downgrade—and the probability of multiple downgrades—in the 12 months following a crisis are significantly higher for emerging market economies in the case of Moody's sovereign ratings. Consistent with the findings on the interaction between defaults and currency crises, the behavior of sovereign credit ratings in the aftermath of currency crises suggests that such crises increase the probability of default—but not necessarily that currency crises equal default.

A useful analysis complementing the preceding one examines whether knowing that there was a currency crisis indeed helps predict downgrades in sovereign credit ratings for emerging market and developed economies. For the Institutional Investor sample, for which there is a continuous time series, the six-month change in the credit rating index is regressed on a dummy variable that takes the value of one when there was a crisis six months earlier, and zero otherwise. The

Table 5. Probability and Size of Downgrades in Institutional Investor Sovereign Credit Ratings around Currency Crises, 1979–99

	Probability (percent)		
	Of downgrade in the 6 months following the crisis	Of downgrade in the 12 months following the crisis	Of more than one downgrade in the 12 months following the crisis
Emerging market economies	39.0	79.3	31.7
Developed economies	38.4	73.1	30.8
Difference	0.6	6.2	0.9
	Index level		
	At time of crisis	In the next 6 months	12 months later
Emerging market economies	37.6	36.0	33.5
Developed economies	76.0	74.9	74.5
Difference	–38.4**	–38.9**	–41.0**
	Size of downgrade (percentage change)		
	In the 6 months following the crisis	In the next 6 months	In the 12 months following the crisis
Emerging market economies	4.3	6.9	10.9
Developed economies	1.4	0.5	1.9
Difference	2.8*	6.4**	8.9**

*Significant at the 10 percent level.
**Significant at the 5 percent level.
Source: Calvo and Reinhart (2000); author's calculations.

TABLE 6. Probability and Size of Downgrades in Moody's Sovereign Credit Ratings around Currency Crises, 1979–99

	Probability (percent)		
	Of downgrade in the 6 months following the crisis	Of downgrade in the 12 months following the crisis	Of more than one downgrade in the 12 months following the crisis
Emerging market economies	20.0	26.7	6.7
Developed economies	10.0	10.0	0.0
Difference	10.0**	16.7**	6.7*
	Index level		
	At time of crisis	In the next 6 months	12 months later
Emerging market economies	4.9	4.5	4.3
Developed economies	15.0	14.9	14.9
Difference	–10.1**	–10.4**	–10.6**
	Size of downgrade (percentage change)		
	In the 6 months following the crisis	In the next 6 months	In the 12 months following the crisis
Emerging market economies	8.2	4.4	12.2
Developed economies	0.7	0.0	0.7
Difference	7.5**	4.4**	11.5**

*Significant at the 10 percent level.
**Significant at the 5 percent level.
Source: Calvo and Reinhart 2000; author's calculations.

method of estimation is generalized least squares, correcting for both generalized forms of heteroscedasticity and serial correlation in the residuals. For the Moody's sample the dependent variable is the three-month change in the rating, and the explanatory variable is the dummy variable for currency crises three months earlier. This specification makes it possible to determine more precisely whether downgrades follow rapidly after crises occur. The dependent variable assumes the value –1 (if there was a downgrade), 0 (no change), or 1 (an upgrade). The parameters of interest are estimated using an ordered probit technique that permits correction for heteroscedastic disturbances.

The results of the estimation show that for emerging market economies, currency crises help predict downgrades regardless of which rating index is used (table 7). For developed economies, however, there is no conclusive evidence that ratings respond to currency crises in a systematic and significant way, at least after 1970. This finding is perfectly consistent with the probability assessment showing no links between currency crises and default. For emerging market economies the coefficients are significant at standard confidence levels, but the marginal predictive contribution of currency crises to predicting default remains small. For example, a currency crisis increases the likelihood of a downgrade in the Moody's ratings by 5 percent. The results from this exercise reinforce the view that large devaluations or depreciations in emerging market economies increase the likelihood of default, as evidenced by the downgrades in sovereign ratings. That the predictive ability of currency crises is so low suggests that other economic fundamentals are important in explaining changes in sovereign credit ratings (see Cantor and Packer 1996a, 1996b).

The results are also consistent with the conclusions of Larraín and others (1997), who find evidence of two-way causality between sovereign ratings and

Table 7. Sovereign Credit Ratings following Currency Crises in Developed and Emerging Market Economies

	Developed economies	Emerging market economies
Institutional investor[a]		
Coefficient	–0.007	–0.08**
Standard error	0.023	0.011
R^2	0.01	0.07
Moody's[b]		
Coefficient	–0.08	–0.31**
Standard error	0.76	0.11
Pseudo-R^2	0.000	0.060

*Significant at the 10 percent level.

**Significant at the 5 percent level.

Note: Independent variable is a dummy variable for currency crises.

a. Estimation method is ordinary least squares with robust standard errors. Dependent variable is the 6-month change in the sovereign credit rating.

b. Estimation method is ordered probit. Dependent variable is the 3-month change in the sovereign credit rating.

Source: Author's calculations.

market spreads. Hence, not only do international capital markets react to changes in the ratings, but the ratings systematically react (with a lag) to market conditions, as reflected in the yield spreads of sovereign bonds.

II. Sovereign Credit Ratings before Crises

The analysis has shown that there is a strong connection between currency crises and default in emerging market economies—about 84 percent of defaults in these economies are associated with a currency crisis in the months before or after the default. It has also shown that slightly more than half the currency crises in emerging market economies are not linked with a subsequent default. Nonetheless, it is evident from the preceding exercise that currency crises do affect the probability of default, as sovereign credit ratings for emerging market economies are systematically downgraded after currency crises. Hence, although it is critical to assess how well the ratings predict default, it is also useful to assess how well changes in sovereign credit ratings predict crises, given the close connection between the two in emerging market economies.

Probit estimation is used to assess the predictive ability of ratings, with the Institutional Investor, Moody's, and Standard and Poor's ratings as regressors for currency crises and defaults. The dependent variable is a dummy variable for currency crises; the independent variable is the 12-month change in the credit rating lagged 1 year. A comparable exercise is performed for episodes of default. Alternative specifications, such as the 6-month change in the credit rating lagged 6, 18, and 24 months, are also considered.[15] The method of estimation corrects for serial correlation and for heteroscedasticity in the residuals.

The basic premise underpinning the simple postulated model is as follows. If the credit rating agencies use all available information on the economic "fundamentals" to form their rating decisions, then credit ratings should help predict defaults and may (or may not) predict currency crises—if the macroeconomic indicators on which the ratings are based have some predictive power. Moreover, the simple model should not be misspecified—that is, other indicators should not be statistically significant, because that information would presumably already be reflected in the ratings. Hence the state of the macroeconomic fundamentals would be captured in a single indicator: the ratings.

Recent studies that have examined the determinants of credit ratings provide support for the basic premise that ratings are significantly linked with certain economic fundamentals (see Cantor and Packer 1996a, Lee 1993). For example, Cantor and Packer (1996a) find that per capita GDP, inflation, external debt, and indicators of default history and economic development are all significant determinants of sovereign ratings.

15. The alternative time horizons, ranging from 6-month changes to 18- and 24-month changes at a variety of lag lengths, produce very similar results. A subset of these results are reported in Reinhart (2002), the rest are available from the author.

In the results of the probit estimation for Institutional Investor ratings, the coefficients of the credit ratings have the expected negative sign for any of the two definitions of currency crises—that is, an upgrade reduces the probability of a crisis (table 8). But for the two definitions of currency crises the coefficient is significant at the 10 percent level. Moreover, as in Reinhart (2002), this result is not robust to other specifications. For example, if the six-month change in the credit rating six months before the crisis is used as a regressor, none of the coefficients are statistically significant. For defaults, the coefficients of the Institutional Investor ratings are significant—but only at the 10 percent confidence level.

For the Moody's sample the coefficients on the ratings variable are statistically insignificant for both the definitions of currency crises, and for the *FR* definition the coefficient has the wrong sign (table 9). Hence for this larger, 48-country sample the Goldstein, Kaminsky, and Reinhart (2000) results do not hold.[16] Interestingly, for defaults, the Institutional Investor ratings are significant at the 5 percent confidence level. If the potential cases of default in the 1990s (the countries that received massive bailout packages, without which default would have been certain) are included, however, ratings are significant only at the 10 percent level and are very sensitive to the lag structure used.

The results for the Standard and Poor's sample are in line with those for the Moody's sample (table 10). Regardless of the definition of crises or specification of lag structure used, none of the coefficients on the changes in credit rating is statistically significant at standard confidence levels. Moreover, the coefficients often have the wrong sign for the dates of crises, though they are much better for the dates of default.[17]

These results appear to be at odds with those of Larraín and others (1997), who find evidence that ratings "cause" interest rate spreads. The interpretation here, however, is that although ratings may systematically lead yield spreads (Larraín and colleagues present evidence of two-way causality), yield spreads are poor predictors of crises but better predictors of default. The reason is that, as shown, not all currency crises lead to default. Hence the inability of ratings to predict currency crises is not inconsistent with their ability to influence spreads.

Sovereign Credit Ratings and Macroeconomic Indicators of Crises

A comparison of the performance of credit ratings and of some of the economic indicators on which rating agencies focus with the performance of some of the better predictors of financial crises produces results underscoring the preceding ones. Performance is assessed on the basis of the basic descriptive statistics used

16. For the Moody's sovereign ratings Goldstein and others (2000) find a statistically significant coefficient for their 20-country sample. Even so, the marginal contribution of the ratings variable was very small.

17. As for the Moody's sample, the results for the Standard and Poor's sample are sensitive to the inclusion of potential cases of default and to the lag structure used (that is, the predictive performance was much worse with longer lead times for the ratings).

TABLE 8. Do Changes in Sovereign Credit Ratings Predict Currency Crises or Default? Institutional Investor Ratings
(2,195 biannual observations)

	Coefficient	Standard error	Significance level	Pseudo R^2
Currency crises				
Kaminsky and Reinhart definition	–0.435	0.540	0.072	0.005
Frankel and Rose definition	–0.288	0.015	0.059	0.007
Defaults	–0.214	0.015	0.063	0.011
Defaults and potential defaults	–0.161	0.021	0.141	0.008

Note: Estimation method is probit with robust standard errors. Dependent variable is a dummy variable for currency crises. Independent variable is the 12-month change in the sovereign credit rating one year earlier.

Source: Author's calculations.

in the signals approach to gauge an indicator's ability to predict crises: the noise-to-signal ratio, the percentage of crises accurately called, and the marginal predictive power (the difference between the conditional and unconditional probabilities). The basic story that emerges is that the Institutional Investor credit ratings perform much worse in predicting both currency and banking crises than do the better indicators of economic fundamentals (table 11). For the credit ratings the noise-to-signal ratio is higher than one for both types of crises, suggesting a similar incidence of good signals and false alarms. Hence, not surprisingly, the marginal contribution to predicting a crisis is small relative to that of the top indicators; for banking crises the marginal contribution is nil. Moreover, the credit ratings call a much smaller percentage of crises than do the top indicators. Indeed, the Institutional Investor ratings compare unfavorably with even the worst indicators (see Goldstein and others 2000 for details). The results for the Institutional Investor ratings for the larger sample considered here are even worse than those shown in Goldstein and others (2000).

TABLE 9. Do Changes in Sovereign Credit Ratings Predict Currency Crises or Default? Moody's Ratings
(4,774 monthly observations)

	Coefficient	Standard error	Significance level	Pseudo R^2
Currency crises				
Kaminsky and Reinhart definition	–0.217	0.761	0.412	0.001
Frankel and Rose definition	0.014	1.582	0.975	0.000
Defaults	–0.197	0.102	0.048	0.010
Defaults and potential defaults	–0.204	0.180	0.099	0.007

Note: Estimation method is probit with robust standard errors. Dependent variable is a dummy variable for currency crises. Independent variable is the 12-month change in the sovereign credit rating 1 year earlier.

Source: Author's calculations.

TABLE 10. Do Changes in Sovereign Credit Ratings Predict Currency Crises or Defaults in Emerging Market Economies? Standard and Poor's Ratings (3,742 monthly observations)

	Coefficient	Standard error	Significance level	Pseudo R^2
Currency crises				
Kaminsky and Reinhart definition	–0.080	0.091	0.772	0.001
Frankel and Rose definition	–0.014	0.076	0.721	0.001
Defaults	–0.120	0.076	0.054	0.011
Defaults and potential defaults	–0.356	0.170	0.117	0.007

Note: Estimation method is probit with robust standard errors. Dependent variable is a dummy variable for currency crises. Independent variable is the 12-month change in the sovereign credit rating 1 year earlier.

Source: Author's calculations.

Why Don't Sovereign Credit Ratings Do Better in Predicting Financial Distress?

Financial crises are generally difficult to predict—witness the poor performance of international interest rate spreads and currency forecasts.[18] Moreover, though the overwhelming majority of defaults in the sample are associated with currency crises, the converse is not true. The results presented here offer a tentative (though partial) answer to the question of why sovereign credit ratings don't do better in predicting financial distress: rating agencies appear to have focused on a set of fundamentals that are not the most reliable in predicting currency crises. For example, they have given much weight to the debt-to-export ratio, yet this indicator has tended to be a poor predictor of financial stress (see table 11). As in Reinhart (2002), rating agencies have attached little weight to indicators of liquidity, currency misalignments, and asset price behavior, which are more reliable leading indicators of the kind of financial stress that can lead to both currency crises and default.

Detragiache and Spilimbergo (2001) present evidence that liquidity indicators, such as short-term debt and debt repayments due, perform particularly well in explaining subsequent debt servicing difficulties. Openness and measures of currency overvaluation score high marks in their study.

III. Results and Implications

This article has addressed several questions. What is the interaction between currency crises and defaults? The overwhelming majority of the defaults (84 percent) in emerging market economies in the sample are associated with currency crises. But the converse is not true—only slightly less than half the currency crises

18. See Kaminsky and others (1998) on the performance of interest rate spreads, and Goldfajn and Valdés (1998) on the performance of currency forecasts.

TABLE 11. Performance of Institutional Investor Sovereign Credit Ratings and Economic Fundamentals in Predicting Crises

Type of crisis and indicator	Noise-to-signal ratio	Percentage of crises accurately called	Difference between conditional and unconditional probability (percent)
Currency crises			
Institutional Investor sovereign rating	1.07	29	5.2
Average of the top 5 monthly indicators	0.45	70	19.1
Average of the top 3 annual indicators	0.49	36	15.4
Debt-to-export ratio	0.91	53	6.1
Banking crises			
Institutional Investor sovereign rating	1.62	22	0.9
Average of the top 5 monthly indicators	0.50	72	9.1
Average of the top 3 annual indicators	0.41	44	16.3
Debt-to-export ratio	1.04	56	0.9

Note: The top 5 monthly indicators for currency crises are: the real exchange rate, banking crises, stock returns, exports, and M2/reserves. As for currency crises, for banking crises the top 5 monthly indicators include the real exchange rate, stock returns, and exports, but output and the M2 multipliers completes the list. As for the annual indicators, the current account balance and a percent of investment and the overall budget deficit as a percent of GDP make the top 3 for both currency and banking crises. For currency crises the current account as a percent of GDP completes the top 3, whereas for banking crises short-term capital inflows as a percent of GDP rates highly.

Source: Author's calculations; Goldstein and others (2000).

in such economies are linked to default. For developed economies there is no evidence of any connection between currency crashes and default.

How do credit ratings behave following a currency crisis? Are there important differences between developed and emerging market economies in the behavior of ratings? There is evidence that sovereign credit ratings tend to be reactive, particularly those for emerging market economies. Both the probability and the size of a downgrade are significantly greater for emerging market economies. Taken together, these findings point to a procyclicality in the ratings. Perhaps a more instructive interpretation, however, is that currency crises in emerging market economies increase the likelihood of a default. The economic intuition is straightforward. Much of the debt of emerging market economies is denominated in dollars, so devaluations can have significant balance sheet effects. Moreover, most of the empirical evidence suggests that devaluations are contractionary. Calvo and Reinhart (2000), for example, ask how the differences between developed and emerging economies in access to international capital markets influence the outcomes of a currency crisis, particularly with respect to output. They present evidence that in emerging market economies devaluations (or large depreciations) are contractionary, with the adjustments in the current and capital accounts far more acute and abrupt. Hence currency crises often become credit crises as sovereign credit ratings collapse following the currency collapse, and the economy loses access to international credit.

Do sovereign credit ratings systematically help predict currency crises and default? The results of the empirical tests presented here suggest that sovereign credit ratings systematically fail to predict currency crises but do considerably better in predicting defaults. Even so, ratings would not have predicted the nearly certain defaults that would have occurred in several recent crises had the international community not provided large-scale bailouts. These results appear to be robust across different definitions of crises, model specifications, and approaches.

Finally, why are sovereign ratings such poor predictors of currency crises? Financial crises are generally difficult to predict; international interest rate spreads and currency forecasts also perform poorly in predicting such crises. Yet ratings do better in predicting defaults than they do in predicting currency crises, although these results are less robust across different model specifications. Nonetheless, the results presented here suggest that rating agencies would do well to incorporate many indicators of vulnerability that have received high marks from the literature on the antecedents of currency crises. For example, rating agencies have given much weight to debt-to-export ratios, which have proved to be poor predictors of financial stress, but they have given little to indicators of liquidity, currency misalignments, and asset price behavior. Many of these indicators have been shown to be useful in predicting not only currency crises but also debt crises (Detragiache and Spilimbergo 2001). As noted, much can be learned about the antecedents and incidence of default from the literature on currency crises. This should not come as a surprise because after all, about one half of the currency crises are not associated with default, but an equal share of currency crises are linked in one way or another to a sovereign default incident.

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