



Rating the rating agencies: Anticipating currency crises or debt crises?

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Abstract

We revisit the question whether sovereign ratings predict financial crises. In line with previous studies, we find that ratings do not predict currency crises and are instead downgraded *ex-post*. However, the likelihood of currency crisis and the implied probability of sovereign default are not closely linked in emerging markets post-1994. When debt crises are defined as sovereign distress – when spreads are higher than 1000 basis points or 10 percentage points – we find that access to international capital markets is reduced by half. In addition, although sovereign distress events last for typically 5.2 consecutive months, they can persist for longer periods up to nine quarters. Finally, lagged ratings and ratings changes, including negative outlooks and credit watches, are useful in anticipating sovereign distress.

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1. Introduction

Do sovereign ratings predict financial crises? A number of studies have addressed this question in the wake of numerous financial crises that took place since the 1980s in emerging markets. The main finding is that sovereign ratings fail to anticipate

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banking and currency crises and are instead adjusted ex-post ((Goldstein, Kaminsky, and Reinhart (GKR), 2000; IMF, 1999; Radelet and Sachs, 1998; Reinhart, 2002). These studies also discuss a number of reasons why ratings should or should not predict financial crises.

One argument in explaining the poor performance of sovereign ratings in predicting financial crises is that rating agencies may not have timely, accurate, and comprehensive information on the borrower's creditworthiness. For instance, GKR (2000) note the problems in obtaining information on Thailand's commitments in the forward markets, Korea's estimates of net usable reserves, and the size of external foreign currency-denominated debt of Indonesian corporations, as well as measures of non-performing loans in all three of these countries prior to the Asian crisis.

A second line of reasoning is that ratings do not predict crises because of the "moral-hazard play." If rating agencies expect implicit guarantees from the international official sector, then ratings would incorporate the perceived reduction in risk associated with official support. For instance, GKR (2000) argue that expectations of implicit guarantees from the international community seems to have been a factor in Mexico in 1994–1995 and in Russia and Ukraine in 1998.

A third argument is that rating agencies may not have enough incentives to downgrade sovereign ratings before a crisis occurs because they receive fees from the sovereign borrowers they rate and because such downgrades can precipitate a crisis. As a consequence, rating changes are lagging indicators of crises.

The main line of defense given by rating agencies is that ratings are meant to provide an assessment of the *likelihood of default*, not the *likelihood of currency crisis*. For instance Standard & Poor's (S&P) defines an issuer credit rating as a current opinion of an obligor's overall financial capacity (its creditworthiness) to pay its financial obligations. Similarly, Moody's defines a foreign currency issuer ratings as opinions of the ability of entities to honor senior unsecured financial obligations and contracts denominated in foreign currency.

One counterargument to this main line of defense, however, is that currency crises and debt crises may be linked. For instance, a number of studies, including GKR, have found that currency crises are followed by downgrades. Based on this observation, Reinhart (2002) suggests that currency crises do affect the probability of default and that it is critical to assess how well sovereign credit ratings predict both currency crises and default. Using data from 1979 to 1999, Reinhart (2002) finds that ratings fail to anticipate currency crises but do better predicting defaults.

The literature on early-warning systems for financial crises has so far paid little attention to the role of rating agencies in assessing the probability of sovereign default. In fact, the prediction of currency crises is a different exercise from the forecasting of sovereign defaults. In addition, episodes of major turbulence in currency markets in the mid-1990s, rather than defaults, were the main catalyst for this literature. Last but not least, default events especially in the 1990s are much more scarce than currency crisis events.

Studies on currency crises have, nevertheless, found that currency crises and debt crises are closely linked in emerging market economies. For instance, GKR (2000) and IMF (2001) conclude that currency crises in developing countries are not

decoupled from sovereign debt crises. A closer look at previous studies, including Reinhart (2002), shows, however, that most debt crises considered occurred in the 1980s and are related to problems with bank debt.

One central motivation of this paper is to differentiate between currency and external debt crises when assessing rating agencies' ability to predict financial crises. In this regard, we revisit the question whether sovereign ratings are useful in forecasting both types of crises in the 1990s. Another contribution of this paper is its use of information from the bond market to capture episodes of external debt servicing difficulties unlike conventional definitions of debt crises. Indeed, in contrast to the frequent episodes of defaults on bank loans in the 1980s, the 1990s coincide with a period with large but very few sovereign defaults which limits the usefulness of standard definitions of debt crises.

We follow GKR (2000) and estimate a family of probit models to assess the predictive ability of sovereign ratings in anticipating currency crises as well as debt crises occurring from 1994 onward. As in previous studies of sovereign ratings and currency crises, we find that ratings do not predict currency crises but are instead adjusted after the fact. However, unlike previous studies, we do not find that currency crises are closely linked to the risk of debt crises when the 1994–2002 period is considered. Although GKR (2000), IMF (2001), and Reinhart (2002) find that currency crises are linked to debt crises, their results are based on a relatively small sample of actual defaults, which cluster in the 1980s loan crisis. To overcome these limitations, we use implied probabilities of default from dollar-denominated sovereign bond spreads and estimated probabilities of a currency crisis from a standard early-warning system model.

We find that while the two are indeed often associated, the risk of debt crisis (variously measured) is generally distinct from the risk of currency crisis (either measured as actual incidence of crisis or from an early-warning-system model). Indeed, ratings and spreads are not closely related to currency crises, and since both are plausible proxies for default risk, this in turn does not seem closely related to the risk of a currency crisis. The correlation between the probability of a currency and the probability of a sovereign default is 6% and the average risk-neutral implied probability of default during currency crisis is 7.71%, compared with 6.48% for the whole sample and 6.31% for non-crisis periods. Since implied probabilities of default, spreads, as well as ratings all proxy for default itself, our result that defaults are not correlated with currency crises are not surprising in light of the previous studies that find that sovereign ratings and spreads do not predict currency crises.

Since currency crises are somewhat decoupled from the probability of default in the post-1994 era, the determinants of ratings may not be the right set of fundamentals when it comes to predicting currency crises. Ratings could, however, prove useful in anticipating debt crises. One problem with debt crises, however, is that there have been very few sovereign defaults on rated debt in the 1994–2002 period (eight defaults by seven countries according to Moody's (2003)).

In this paper, we therefore define debt crises as “sovereign distress,” defined as events occurring when the average spreads on the most liquid sovereign bonds are above 1000 basis points (10percentage points). According to Altman (1998),

distressed non-sovereign securities can be defined narrowly as those publicly held and traded debt and equity securities of firms that have defaulted on their debt obligations and/or have filed for protection under Chapter 11 of the US Bankruptcy Code. Under a more comprehensive definition, Altman (1998) considers that distressed securities would include those publicly held debt securities selling at sufficiently discounted prices so as to be yielding, should their issuers not default, a significant premium of a minimum of 10% over comparable US Treasury securities.

We find that for a particular sovereign debtor, periods of distress – defined as events of relatively high cost of capital – correspond to episodes when access to international capital markets is reduced by half. Furthermore, at distressed-spreads levels, sustainability issues become more acute as spreads can remain at distressed levels for protracted intervals of one to nine quarters.

Finally, using a simple probit estimation, we find that lagged ratings and ratings changes help predict sovereign distress. These results suggest that the set of fundamentals that determine credit ratings is relevant when it comes to assessing and anticipating credit events.

The rest of the paper is organized as follows: Section 2 addresses the question whether sovereign ratings predict currency crises while Section 3 studies the behavior of ratings after a currency crisis. Section 4 reviews the limitations of the typical definitions of debt crises while Section 5 studies the relationship between the risk of currency crises and the probability of default. Next, Section 4 suggests the capital market-based concept of debt crisis, that of sovereign distress and studies the ability of ratings to predict distress. Finally, Section 6 concludes with suggestions for future research.

2. Do ratings predict currency crises?

Sovereign credit ratings can be seen as a proxy for macroeconomic fundamentals that affect the probability of sovereign default. In addition, rating agencies claim that they use qualitative factors in forming their opinion of a country's ability and willingness to repay its debt. For instance, S&P's (1998) reports that its ratings are based on a country's income and economic structure, economic growth prospects, fiscal flexibility, and external debt, and liquidity. In addition, a country's form of government, the adaptability of its political institutions, the extent of popular participation, the orderliness of leadership succession, the degree of consensus on economic policy objectives, its integration into global trade and financial system, and its internal and external security risks are also used to determine sovereign ratings. Bhatia (2002) offers an extensive description of both rules-based and discretionary elements in the sovereign ratings process.

A number of studies (Cantor and Packer, 1996; Haque et al., 1996; Juttner and McCarthy, 1998; Monfort and Mulder, 2000) have found a close association between credit ratings and a reduced number of macroeconomic variables. For instance, Cantor and Packer (1996) find that per capita GDP, inflation, the level of external debt, and indicators of default history and of economic development explain ratings well. In a follow-up study, Juttner and McCarthy (1998) found that these factors ade-

quately explain ratings in 1996 and 1997, but that additional variables – notably problematic bank assets as a percent of GDP and the interest rate differential (a proxy for expected exchange rate changes) – appeared to have come into play in 1998.

On the basis of the results that sovereign ratings use all available information on economic fundamentals, GKR (2000) suggest that credit ratings should help predict crises because macroeconomic indicators have some predictive power. They note that a simple univariate model using ratings as the explanatory variable should not be misspecified. In this section, we follow GKR (2000) and use a probit estimation method to answer the questions whether ratings predict currency crises, and if not whether ratings are adjusted in the aftermath of currency crises. We use monthly data for a sample of 13 emerging market countries which experienced currency crises¹ in the 1990–2002 period and had a long-term sovereign rating on their external debt. The countries are Argentina, Brazil, Colombia, Indonesia, Korea, Malaysia, Mexico, Philippines, South Africa, Thailand, Turkey, Uruguay, and Venezuela.

Most studies of ratings, such as Cantor and Packer (1996), convert agencies' letter grades into 20 numerical scores ranging from triple-A to "selective default." Rating agencies, however, typically issue positive/negative outlook reports and subsequently place a sovereign on a review or watch list for upgrade/downgrade prior to the actual downgrade or upgrade actions. For instance, S&P's explains that its CreditWatch indicates the potential direction of a credit rating change, dependent on identifiable events and short-term trends, and is typically resolved within 90 days. Furthermore, S&P's rating outlook indicates the potential direction of a credit rating change within 6 months to 2 years.

Following Bartholdy and Lekka (2002), we choose a finer rating scale that includes both the actual ratings and the rating bias (outlook and review/CreditWatch). Changes in outlook and review/CreditWatch are treated as intermediate steps between two ratings. This enhanced scale is then translated into an index, spanning from 1 to 58 (see Table 1). To capture the value of the information contained by the rating bias in between two values of the letter ratings, we add a value of one to the rating value if there is a positive outlook or a review for possible upgrade or positive CreditWatch. We use ratings changes from S&P's and Moody's to calculate the average of the monthly comprehensive ratings index. We also use a logit-type transformation of ratings to address the possible existence of non-linearities in the ratings scale and transform our ratings index I_t as

$$L_t = \ln \left(\frac{I_t}{59 - I_t} \right).$$

Using a standard definition of currency crisis, we find 30 currency crisis events from 1990 to 2002 for countries with long-term foreign currency debt ratings (see Table 2). In the Early Warning System literature, a crisis is said to have occurred

¹ We do not attempt to explain why some countries never experienced a crisis. Rather, we focus on the time series variation for countries that did experience a crisis. In a sample including non-crisis countries, probit estimations with fixed effects would control for unobserved country factors.

Table 1
Rating scale

Moody's rating	Score assigned	S&P's rating
Aaa	58	AAA
Aa1	55	AA+
Aa2	52	AA
Aa3	49	AA–
A1	46	A+
A2	43	A
A3	40	A–
Baa1	37	BBB+
Baa2	34	BBB
Baa3	31	BBB–
Ba1	28	BB+
Ba2	25	BB
Ba3	22	BB–
B1	19	B+
B2	16	B
B3	137	B–
Caa1	10	CCC+
Caa2	7	CCC
Caa3	4	CCC–
Ca	1	CC
	0	SD
Outlook/Review	Value	Outlook/CreditWatch
Review possible upgrade	+2	CW-positive
Positive	+1	Positive
Stable	0	Stable
Negative	–1	Negative
Review possible downgrade	–2	CW-negative

when an exchange market pressure index (EMPI) – a weighted average of monthly percentage depreciations in the nominal exchange rate and monthly percentage declines in foreign exchange reserves – exceeds its mean by more than three standard deviations. Means and standard deviations are country specific. Weights are calculated so that the variance of the two components of the index are equal. In econometric estimations, the EMPI is used to create a binary variable, a crisis indicator, equal to one if a crisis occurs in the subsequent months, for instance the next 24 months (the signaling window), and equal to zero otherwise.

A probit estimation corrected for robust covariances² is used to assess the ability of sovereign ratings to predict currency crises. The dependent variable is the currency

² Errors are robust to heteroskedasticity but not to serial correlation. As a result, the coefficient estimates will be consistent but the estimated standard error may be too small. The negative results obtained in Table 3 should, however, be reinforced by the higher serial-correlation-corrected errors.

Table 2
Currency crises dates, 1994–2002

Argentina	January 02
Brazil	November 90
Brazil	January 99
Colombia	August 95
Colombia	September 98
Colombia	August 99
Colombia	July 02
Indonesia	January 98
Indonesia	June 98
Korea	November 97
Korea	December 97
Malaysia	July 97
Malaysia	August 97
Malaysia	December 97
Malaysia	January 98
Mexico	December 94
Philippines	December 97
South Africa	December 01
Thailand	July 97
Thailand	August 97
Thailand	December 97
Thailand	January 98
Turkey	March 94
Turkey	April 94
Turkey	February 01
Uruguay	July 02
Venezuela	May 94
Venezuela	December 95
Venezuela	April 96
Venezuela	February 02

crisis indicator as defined earlier and the independent variable³ is the 3-month change in the comprehensive ratings index. As in [GKR \(2000\)](#), we find that ratings do not predict currency crises in emerging markets (see [Table 3](#)). The coefficient for the 3-month change is statistically significant at the 5% level but the marginal effect is negligible and equal to -0.5% . The estimated coefficients for the 12-month change (or 6-month) has the anticipated negative but are statistically insignificant. Results do not change significantly whether we consider S&P's or Moody's ratings separately. These results are in line with [GKR \(2000\)](#) who, using data for 21 currency crises in 24 emerging market economies, find that the coefficient of Moody's ratings is statistically significant at the 5% level but with a marginal effect of 3% for a 12-month change.

³ Different specifications using the level of ratings and ratings changes for different time periods as well as the simple ratings index (upgrade, downgrade or no change) in addition to the logit-type transformation of the ratings scale have also been estimated. Results for these specifications are only reported when significant.

Table 3

Do ratings predict currency crises? (probit estimation with robust standard errors,^a 1328 observations, 1990–2002)

Independent variable	Coefficient	Standard error	Marginal effects	Probability	Pseudo- R^2
3-month change in the comprehensive ratings index	-0.108	0.048	-0.005	0.025	0.013

^a The dependent variable is a dummy variable which takes a value of 1 if there is a currency crisis in the following 24 months.

3. Do currency crises predict ratings downgrades?

Studies of the behavior of rating agencies around the Asian crisis (see IMF, 1999) find that ratings changes lag currency crises, with downgrades following crisis events rather than preceding them. It has been argued (GKR, 2000) that rating agencies may have an incentive not to downgrade sovereigns prior to financial crises since they receive fees from the borrowers they rate and because downgrades can subject the agencies to charges of having precipitated a crisis. Rating agencies often offer the counterargument that reputational considerations should eliminate such incentives.

Analyzing the behavior of ratings after a currency crisis can prove useful for both market participants and policy makers. While the former focus in the possible effects of rating changes on market variables such as bond prices, the latter are interested in crisis management and the possible pro-cyclicality of sovereign ratings (see IMF, 1999).

To examine this issue, we follow GKR (2000) and use an ordered probit estimation to test whether the presence of a crisis helps predict downgrades. The dependent variable is the 3-month change in the ratings while the explanatory variable is the currency crisis indicator lagged 3 months. The dependent variable assumes the value of minus one, zero, or one depending on whether there was a downgrade, no change, or an upgrade, respectively. Different specifications, including a wider window for ratings downgrade have been estimated without significant changes to the results.

The results of the estimation (see Table 4) suggest that currency crises help predict credit downgrades. The coefficient of the crisis indicator is statistically significant with a marginal predictive contribution of about 5%. This result is in line with GKR (2000) who, using a different sample, also find that a currency crisis increase

Table 4

Do currency crises help predict credit-rating downgrades? (ordered probit with robust standard errors,^{a,b} 1575 observations, 1990–2002)

Independent variable	Coefficient	Standard error	Probability	Pseudo- R^2
Currency crisis dummy	-1.579	0.244	0.000	0.043

^a The dependent variable is 3-month changes in the rating, i.e., a dummy which takes a value of minus one, zero, or one depending on whether there was a downgrade, no change, or an upgrade, respectively. Constant not shown.

^b The explanatory variable is the currency crisis dummy lagged 3 months.

the probability of a downgrade by Moody's by only 5%. In the next section, we take a closer look at the relationship between the probability of a crisis and the probability of sovereign default.

4. How do we measure debt crises?

Although studies of debt crises⁴ are not new, there is no consensus on the definition of such crises. In this section, we review a number of definitions and illustrate some of their limitations. One can broadly separate the definitions of debt crises into two large groups. In the first group, debt crises are often defined as sovereign defaults or as events which coincide with large debt arrears. The limitations of these definitions have led to new types of definitions based, for instance, on bail-out episodes from the international community or using capital market events. One contribution of this paper is to define a debt crisis using information from sovereign bond markets.

4.1. Debt crises as sovereign default

Moody's (2003) defines a sovereign issuer as in default when one or more of the following conditions are met:

- There is a *missed or delayed disbursement of interest and/or principal*, even if the delayed payment is made within the grace period, if any;
- A *distressed exchange* occurs, where
 - the issuer offers bondholders a new security or package of securities that amount to a diminished financial obligations such as new debt instruments with lower coupon or par value or
 - the exchange had the apparent purpose of helping the borrower avoid a “stronger” event of default (such as missed interest or payment).

Similarly, Standard and Poor's (Chambers and Alexeeva, 2003) generally defines default as the failure of an obligor to meet a principal or interest payment on the due date (or within the specified grace period) contained in the original terms of the debt issue. The agency notes that

- For local and foreign currency bonds, notes, and bills, each issuer's debt is considered in default either when *scheduled debt service is not paid* on the due date or when an *exchange offer of new debt contains less favorable terms* than the original issue; and

⁴ See also Peter (2002) for a review of the early literature on debt crises.

- For bank loans, when either scheduled debt service is not paid on the due date or a rescheduling of principal and/or interest is agreed to by creditors at less-favorable terms than the original loan. Such rescheduling agreements covering short- and long-term bank debt are considered defaults even where, for legal, or regulatory reasons, creditors deem forced rollover or principal to be voluntary.⁵

In addition, many rescheduled sovereign bank loans are ultimately extinguished at a discount from their original face value. Typical deals have included exchange offers (such as those linked to the issuance of Brady bonds), debt/equity swaps related to government privatization programs, and/or buybacks for cash. Standard and Poor's considers such transactions as defaults because they contain terms less favorable than the original obligation.

4.2. Debt crises as large arrears

In [Detriagache and Spilimbergo \(2001\)](#) an observation is classified as a default⁶ is if either or both of the following conditions occur:

- There are *arrears of principal or interest* on external obligations towards commercial creditors (banks or bondholders) of more than 5% of total commercial debt outstanding.
- There is a *rescheduling or debt restructuring* agreement with commercial creditors as listed in the World Bank's Global Development Finance.

[Detriagache and Spilimbergo \(2001\)](#) argue that the 5% minimum threshold is to rule out cases in which the share of debt in default is negligible, while the second criterion is to include countries that are not technically in arrears because they reschedule or restructure their obligations before defaulting.

[Peter \(2002\)](#) also uses arrears but his definition of default includes increases in the stock of total arrears rather than just imposing a threshold to the stock of accumulated arrears. His argument is that a country that reduces its stock of arrears relative to total debt should be judged more positively than a country that increases its stock of arrears.

4.3. Limitations of using sovereign defaults in empirical studies

There are a number of limitations when attempting to use the different definitions of debt crises in empirical studies. First, the number and dates of debt crises depend on the definition chosen. Second, there is very limited number of observations in the

⁵ For central bank currency, a default occurs when notes are converted into new currency of less-than-equivalent face value.

⁶ [Hu et al. \(2001\)](#) use data on defaults provided by the UK Export Credit Guarantee Department (ECGD).

1990s. Finally, the definitions ignore episodes of external debt difficulties that do not result in debt crises due to bailouts from the international community.

The history of sovereign ratings for emerging market economies, and hence of sovereign defaults as defined by rating agencies, is very short. Indeed, there were only five non-industrial countries rated in 1990 according to Hu et al. (2001). Second, there is a limited number of sovereign defaults and most of them occurred between 1998 and 2002. According to Moody's definition there have been only seven rated sovereign bond issuers that have defaulted on their foreign-currency denominated bonds since 1985 and all defaults happened between 1998 and 2002. The sovereigns are Pakistan (November 1998), Russia (August 1998), Ukraine (September 1998 and January 2000), Ecuador (August 1999), Peru (September 2000), Argentina⁷ (November 2001), and Moldova (June 2001). Moody's (2003) notes that there are sovereigns that have defaulted on other rated obligations besides bonds during this period. These include Korea (1998-bank deposits), Indonesia (1999, 2001-bank loans), and Uruguay (2002-foreign currency loans and deposits).

The limited number of sovereign defaults can be explained, in part, by bailouts packages put together by the international community. For instance, Reinhart (2002) argues that without such bailouts, there is little doubt that Mexico, Korea, Thailand, and Turkey would have produced a sovereign default. Such bailouts episodes do not result in sovereign defaults as defined by rating agencies.

Similarly, the Detriagache and Spilimbergo (2001) criteria identify 54 debt crises from 1970 to 1998 for a sample of 23 countries. While events tend to cluster in the early 1980s, when most Latin American countries and several African countries defaulted on their syndicated bank debt following the borrowing boom of the 1970s, there are very few crises in the 1990s. Episodes of bailouts are also not captured by the Detriagache and Spilimbergo (2001) definition of debt crises as the Mexican (currency) crisis of 1994–1995 did not result in arrears or rescheduling and their definition identifies four debt crises in the 1994–1998 period.

In order to overcome the problem of bailouts, Manasse et al. (2003), define a debt crisis as events when a sovereign is default as defined by Standard and Poor's, or if it receives a large non-concessional IMF loan defined as access in excess of 100% of quota.

Another illustration of the problems created by the limited number of defaults can be found in the estimated transition matrix compiled by rating agencies. The transition matrix for sovereign rated borrowers (see Table 5) shows the probability of migrating from one rating grade to another, including the default category. The Moody's (2003) average 1-year rating migration rates from 1985–2002 for Caa, Ca, C to default is 0%. In contrast, the probability of default for B-rated sovereigns is 3.9%. One should expect the probability of default of poorer ratings grade to be worse than that of better ratings grades, which is not the case in the Moody's transition matrix. The reason for this anomaly is that very few sovereigns have been

⁷ Argentina declared it would miss payment on foreign debt on November 2001 but missed the actual payment on January 2002.

Table 5

Sovereign ratings transitions^a (average 1-year rating migration rates, 1985–2002)

Rating from	Rating to							
	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default
Aaa	93.9%	6.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Aa	5.1%	92.5%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%
A	0.0%	2.7%	90.3%	6.2%	0.9%	0.0%	0.0%	0.0%
Baa	0.0%	0.0%	4.8%	79.6%	8.3%	0.3%	0.0%	0.0%
Ba	0.0%	0.0%	0.0%	3.7%	85.2%	10.0%	0.0%	0.7%
B	0.0%	0.0%	0.0%	0.0%	2.2%	87.7%	2.2%	4.0%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%

^a Adapted from Moody's (2003).

rated in the Caa, Ca, and C rating categories and only one, Moldova (rated Caa1 in the beginning of 2000), subsequently defaulted in June 2001.

5. Do currency crises and defaults coincide?

Credit rating agencies argue that ratings are meant to provide an assessment of the *likelihood of default* not the *likelihood of currency crisis*. The literature on early warning system of financial crises has, however, focused on the role of rating agencies in assessing the probability of currency crises. If currency and debt crises are closely linked in emerging market economies, then studying the performance of sovereign ratings in predict debt crises may not add much information.

GKR (2000) and IMF (2001) recognize that currency crises and debt crises are distinct events. For instance, IMF (2001) notes that a currency may become overvalued or a peg unsustainable for macroeconomic reasons that are not associated with the ability of the country to service its foreign obligations. It is also conceivable that a country falls into arrears or defaults on its external debt without a change in the exchange rate. This was the case, for example, of Pakistan in 1999, where a suspension of payments was decreed without a sharp depreciation of the exchange rate. This was also the case for Peru in 2000, which had a debt crisis as a result of litigation⁸ procedures from a “vulture fund” but did not experience a currency crisis, thanks in part to large holdings of foreign exchange reserves during the same period.

Both studies, however, conclude that currency crises in developing countries are closely linked to the probability of sovereign default. The evidence used in these studies is mostly based on an analysis of the incidence of debt crises since 1970

⁸ Krueger (2002) reports that “in 1997 Elliott Associates bought \$20m of commercial loans guaranteed by Peru. Rather than accepting the Brady bonds offered when Peru tried to restructure its debt, Elliott demanded full repayment and interest. In June 2000 it obtained a judgment for \$56m and an attachment order against Peruvian assets used for commercial activity in the US. Elliott targeted the interest payments that Peru was due to pay to its Brady bond holders who had agreed to do the restructuring. Rather than be pushed into default on its Brady bonds, Peru settled.”

by [Detragiache and Spilimbergo \(2001\)](#). According to their definition and for a sample of 23 countries, there have been 87 currency crises and 15 debt crises from 1970 to 1998. Of these, 8 took place in the same year as a currency crisis and 3 more within 1 year. However, most of the debt crises cluster in the early 1980s and there are four debt crises post-1994, including El Salvador in 1995 and Indonesia, Korea, and Thailand in 1998. Out of these four cases, three countries, namely Thailand, Indonesia, and Korea experienced both currency and debt crises in about the same year.

[Reinhart \(2002\)](#), using 160 defaults and 135 currency crises in emerging markets from a number of sources ⁹ including [Detragiache and Spilimbergo](#), studies the relationship between default and currency crises. Using the “signals” approach, she finds that the probability of having a currency crisis conditional on having defaulted is about 69% while the probability of defaulting conditional on having had a currency crisis is about 46% for emerging market economies. [Reinhart \(2002\)](#) notes that, although there is no obvious causal pattern, currency crises are more frequent and in about half the cases do not necessarily lead to default.

A closer look at the debt crises data used in all the previous studies reveals that the credit events considered are mostly related to defaults on bank syndicated loans and trade credit obligations in the 1980s. In contrast, the post-1994 period is characterized by major turbulence in the sovereign bond markets but with very few default events. Based on the limited number of coincidental currency and debt crises post-1994, we revisit the question whether currency crises are decoupled from the probability of sovereign default.

In order to overcome the lack of actual defaults, we use risk-neutral implied probabilities of default (IPD) from dollar-denominated sovereign bonds. In theory, the implied probability of default captures only credit risk, in contrast to bond spreads which are affected by several other factors such as liquidity and bond’s specific characteristics, in addition to credit risk. One advantage of using implied probabilities of default rather than the spreads themselves is that the estimation of the IPD clearly separates the loss given default from the probability of default itself (see [Duffie and Singleton, 2003](#)). Furthermore, although implied probabilities of default are equal to yield spreads under certain assumptions (in a one-period framework, with zero recovery value), they fully incorporate recovery values and represent distressed credits better than spreads which are difficult to interpret at high levels.

We obtain risk-neutral implied probabilities of default using a simple intensity-based model ¹⁰ where default is defined as the first arrival time τ of a Poisson process with a constant mean arrival rate, called intensity and denoted λ . The probability of survival for t years is

$$p(t) = e^{-\lambda t}. \quad (1)$$

⁹ Reinhart includes data from [Beim and Calomiris \(2001\)](#) who focus on extended periods where all or part of interest and/or principal payments due were reduced or rescheduled.

¹⁰ See [Duffie and Singleton \(2003\)](#) and [Nencioni and Xu \(2000\)](#).

That is the time to default is exponentially distributed. The expected time to default is $1/\lambda$ and the probability of default over a time period of length Δ , given survival to the beginning of this period, is approximately $\Delta\lambda$, for some small Δ . We assume that the probability remains constant throughout the life of the bond and that the term structure for the risk-free interest rate is constant. Finally, we assume that in case of default, the bondholder receives a recovery value which is a fixed percentage of the bond's principal, in this case 30% of the principal.¹¹ Our results do not change qualitatively if we vary the value of the recovery rate, but higher recovery rates lead to higher implied probabilities of default.

In this simple framework, the implied probability of default (IPD) is such that

$$\text{IPD} = \frac{S(1+r)}{S(1+r) + (1+r-R)}, \quad \text{where } S = \frac{i-r}{i+r}, \quad (2)$$

where i is the yield on a sovereign bond, r is the yield on a US treasury bill with identical characteristics, and R is the recovery value which we have fixed at 30%. Our results do not change qualitatively if we vary the value of the recovery rate, but higher recovery rates lead to higher implied probabilities of default.

We use Chase-JP Morgan's EMBI+ spreads over US Treasury from January 1994 to December 2002 for a sample of 13 emerging market countries which had currency crises in the 1990–2002 period (Argentina, Brazil, Colombia, Indonesia, Korea, Malaysia, Mexico, Philippines, South Africa, Thailand, Turkey, Uruguay, and Venezuela).

We find little evidence that the average probability of default changes during currency crises. The average risk-neutral IPD during currency crisis is 7.71% compared to a value of 6.48% for the whole sample, (and 6.31% for non-crisis periods). Using t -tests, we cannot reject the null that the mean probability of default during currency crises and the overall sample mean are equal.

In order to calculate the correlation of default between the probability of default and the probability of currency crises, we fit an early warning system model as in [Berg and Pattillo \(1999\)](#) to obtain probabilities of currency crises. The correlation between the likelihood of default and currency crises is low and equal to 6% for the whole sample. We also estimate the probability of default as a function of the probability of a currency crisis. The R^2 is 0.004 and the coefficient of the implied probability of default is insignificant at the 5% level. This is not surprising for a univariate regression given the low correlation between the two variables. We also estimate the probability of crisis as a function of the probability of default and find, again not surprisingly, that the coefficient of probability of crisis is not significant at the 5% level. Finally, we run Granger causality tests using different lags and find that the probability of default does not Granger cause the probability of currency crisis and vice versa.

¹¹ The value of 30% of par is chosen based on the results from [Merrick \(2001\)](#) who estimates recovery values for Argentina and Russia during the 1998 Russian crisis.

Our results suggest that while the two are often associated, the risk of debt crisis (variously measured) is generally distinct from the risk of currency crisis, either measured as actual future incidence of crisis or from an early-warning-system model. These results are not surprising and are in line with previous studies such as GKR (2000), which show that bond spreads are not closely related to currency crises. Indeed, given the simple model used in Eq. (2), there is a direct relationship between implied probabilities of default obtained from bonds spreads, and bond spreads themselves.

We next address the question whether sovereign ratings can be used as a proxy for the probability of sovereign default. To answer this question, we use a pooled time series, cross-section data estimation (see Table 6) to regress the comprehensive ratings index on the implied probabilities of default. We find a very close association between the two measures which suggest that sovereign ratings are a proxy for the probability of sovereign default. The R^2 is 53% (65% for the logit-type transformation model) and the ratings coefficient has the right sign and is statistically significant. We find that a one-notch downgrade preceded by a negative outlook and a negative credit watch increases the probability of default by 150 bps.

In short, ratings, implied probabilities of default, and spreads are not closely related to currency crises, and since both are plausible proxies for default risk, the risk of a debt crisis in turn does not seem closely related to the risk of a currency crisis. A key question asked by GKR (2000) is whether the determinants of ratings are the “right” set of fundamentals when it comes to predict financial crises. The results above suggest that there may be variables, other than macroeconomic fundamentals, at play in the relationship between currency crises and the likelihood of sovereign default which should merit further attention.

Sovereign ratings are associated to variables such as per capita income; inflation; GDP growth; foreign exchange, debt-to-exports, external debt default history, and the level of economic development (Cantor and Packer, 1996) in addition to bank assets over GDP and the interest rate differential (Juttner and McCarthy, 1998). In contrast, the EWS literature finds that the probability of a currency crisis is determined by real exchange rate overvaluation, current account, foreign exchange reserves, export growth, and short-term debt to reserves (IMF, 2001). The previous results suggest that these two set of fundamentals have each a role in predicting two distinct types of events: currency crises and debt crises.

Table 6

Are ratings a proxy for the probability of sovereign default?^a (pooled time series, cross-section estimation, 925 observations, 1994–2002)

Independent variable	Coefficient	Standard error	Probability	Pseudo- R^2
3-month change in the comprehensive ratings index	−0.524	0.016	0.000	0.53

^a The independent variable is the risk-neutral implied probability of default (IPD) obtained from sovereign spreads. IPD are obtained using an intensity based model with constant term structure of interest rates and a recovery value of 30% of par value.

Reinhart (2002) suggests that rating agencies focus on a set of fundamentals that are not the most reliable in predicting currency crises. She notes, for instance, that ratings give much weight to debt-to-exports ratios which have tended to be poor predictors of currency crises. In contrast, real exchange rate misalignment – a key leading indicator of currency crisis – has little weight in the determination of ratings.

6. Sovereign distress, capital market access, and ratings

Given the limitations of the different definitions of debt crises reviewed earlier, we suggest a parallel with the distressed debt literature in corporate finance. According to Altman (1998), distressed securities can be defined narrowly as those publicly held and traded debt and equity securities of firms that have defaulted on their debt obligations and/or have filed for protection under Chapter 11 of the US Bankruptcy Code. Under a more comprehensive definition, Altman (1998) considers that distressed securities would include those publicly held debt securities selling at sufficiently discounted prices so as to be yielding, should they not default a significant premium of a minimum of 10% over comparable US Treasuries. Similarly, some market participants consider securities to reach distressed levels when they have lost one-third of their value.

Distress in sovereign bond markets occurs when market participants' assessment of the probability of default is such that they require a significantly higher premium for holding a country's debt. The concept of distress is a market-based concept which can be relevant for public and private creditors. Theoretically, there is a level of interest rates above which debt dynamics for a particular country become unsustainable. Although more work is warranted in this area, we assume that debt sustainability issues become important when spreads reach relatively "high" levels. Similarly, access to international capital markets may be closed or the cost of capital could become prohibitively high when spreads reach a certain level. Finally, it is also reasonable to assume that high levels of sovereign spreads could also affect corporate market access.

In practice, the 1000 bps mark for spreads is often considered as a psychological barrier by market participants.¹² In the sovereign context, we assume that sovereign bonds are distressed securities when the monthly average spreads of the most liquid bonds (as measured by the monthly EMBI+ country spread) is trading 1000 basis points or more above US Treasuries.

The definition of debt crises as distressed debt events is more comprehensive than limiting credit events to defaults and would include cases where a sovereign avoids default because of bilateral or multilateral support. The idea is to have an event that would be relevant in terms of increased credit risk but not necessary default, and

¹² Using extreme value theory and kernel density estimation, Pescatori and Sy (2004) find that the 1000 basis points mark represents a statistically significant threshold.

occurs at a higher frequency than sovereign default events given the scarcity of such credit events.

Under the above definition of sovereign distress, we find 140 distressed debt events (about 14% of observations) compared to 30 currency crises events. There are only 5 months when both a currency crisis and distress occur at the same time. This again suggests that spreads and distressed spreads in particular, are limited in their ability to predict currency crises.

The analysis of distressed events and currency crises can be thought of as a non-linear analysis of spreads and currency crises, and is as such very closely related to the previous section on probabilities of default and currency crises. Indeed, although the level of spreads (converted into probability of default) is not correlated with the probability of the currency crisis, this result may have been obtained because the relationship between the two variables is non-linear, with spreads above some critical threshold indicating a higher risk of currency crisis (and vice versa). Our results indicate, however, that this is not the case and that distressed spreads are not associated with currency crises.

6.1. Sovereign distress and international capital markets access

We use Capital Data Bondware gross issuance data in dollar-denominated bond markets (see Table 7) to have a sense of market access when spreads reach distressed levels. We find that, on average, issuance volume in distressed periods is about half that in non-distressed periods. The average monthly issuance volume is USD207 million when spreads reach or exceed distressed levels as compared to USD396 million in non-distressed periods. Furthermore, 68% of the distressed months correspond to periods where there is no issuance at all while 48% of the non-distressed months correspond to months without any bond issuance. These results suggest that distressed levels for spreads are associated with reduced access to the dollar-denominated sovereign bond market.

A closer look at the sample (see Table 8) shows that a number of countries did not experience distressed spreads events, that is their average monthly sovereign spreads never reached or exceeded the 1000 bps mark. These countries are Korea, Malaysia, the Philippines, South Africa, and Thailand. During the Asian crisis, monthly spreads for the Asian countries reached maximum monthly average levels in the

Table 7
Gross issuance volume and secondary market bond spreads, 1994–2002

	Volume (USD mill.)		Spreads (bps.)	
	Non-distress	Distress	Non-distress	Distress
Mean	396	207	449	1808
Std. Dev.	671	457	259	1348
Min	0	0	52	1001
Max	6274	2635	999	6851
% Months without insurance	48%	68%		

Sources: Capital Data and author's calculations.

Table 8
Number of consecutive distressed months and average spreads

	Over- all	1 month	2 months	3 months	4 months	5 months	7 months	8 months	11 months	>12 months ^a
Argentina	34 1397	2 1034	–	1 1261	–	–	–	–	1 1240	1 4685
Brazil	35 894	–	2 1084	–	2 1084	–	1 1241	2 1418	–	–
Colombia	1 1000	1 1000	–	–	–	–	–	–	–	–
Indonesia	3 530	1 1069	1 1386	–	–	–	–	–	–	–
Mexico	8 533	–	–	1 1149	–	1 1322	–	–	–	–
Turkey	3 707	3 1042	–	–	–	–	–	–	–	–
Uruguay	8 397	–	–	–	–	–	–	1 2122	–	–
Venezuela	49 1053	1 1037	1 1067	–	1 1101.3	–	1 1121	1 1482	–	1 1616

Sources: Capital Data; and author's calculations.

^a 18 months for Argentina and 27 months for Venezuela.

750–984 bps range, which suggests that daily spreads may have briefly exceeded the 1000 bps mark.

In contrast, the remaining countries in the sample (Argentina, Brazil, Colombia, Indonesia, Mexico, Turkey, Uruguay, and Venezuela) experienced a number of distressed debt events. Three countries, Argentina, Brazil, and Venezuela have experienced the most number of distressed debt events, with respectively 34, 35, and 49 months in which spreads were above the 1000 bps mark. Furthermore, a number of countries have remained in distress during consecutive months for long periods.

Using the monthly data in Table 8, we find that the average number of consecutive months in distress is equal to 5.2 months. In Argentina, Brazil, and Venezuela, in addition to Uruguay, spreads reached and stayed at distressed levels for more than 6 consecutive months. Argentina and Venezuela have at times experienced 18 and 27 consecutive months at distressed levels. These long duration events also correspond to high intensity events, when spreads increase the most. In contrast, events where distress spreads levels were not or only briefly reached – as in the Asian crisis – correspond to short duration and low intensity events. These observations could be relevant in separating liquidity crises from solvency crises or in assessing the relative costs of different types of crises.

6.2. Do sovereign ratings predict distress?

Using default data from a variety of sources, including [Detragiache and Spilimbergo \(2001\)](#) and a probit estimation, [Reinhart \(2002\)](#) finds that 12-month down/upgrades do better predicting defaults than currency crises. In this section, we address

Table 9

Do sovereign ratings predict distress?^a (probit estimation with robust standard errors, 967 observations, 1994–2002)

Independent variable	Coefficient	Standard error	Marginal effects	Probability	Pseudo- R^2
Ratings(-3)	-0.111	0.009	-0.019	0.000*	0.219
Ratings(-3)	-0.127	0.009	-0.027	0.000*	
Δ ratings(-1)	-0.204	0.068	-0.043	0.000*	
Δ ratings(-2)	-0.178	0.050	-0.037	0.000*	
Δ ratings(-3)	-0.18	0.040	-0.038	0.000*	0.280

* A Wald-test rejects the null of all coefficients being equal to zero.

^a The dependent variable is a dummy which takes a value of one if spreads are above 1000 bps in the following 12 months. Ratings refer to the comprehensive rating index. Δ ratings refer to changes in ratings. The constant variable is not shown.

the question whether credit ratings predict sovereign distress. We use a probit estimation¹³ with comprehensive ratings in *level* as the explanatory variable and a distress indicator as the independent variable. The distress indicator is a binary variable which takes a value of one if spreads reach or exceed 1000 bps in a pre-specified signaling window.

We find that ratings have some predictive ability when it comes to anticipating sovereign distress, and that countries with lower credit ratings are more likely to fall in distress. Using a 12-month signaling window and 3-month lagged ratings, we find a R^2 of 22% (Table 9). The coefficient of the ratings variable has the right negative sign and is statistically significant at the 1% level. Alternate specifications using the ratings index with a 24-month window or without the information on negative review/CreditWatch and outlook or a logit-type transformation do not change significantly the estimation results.

The result that credit ratings are associated with the riskiness of sovereign bonds and that countries with the poorest ratings are the most likely to have distressed spreads levels is not surprising since economic fundamentals, as proxied by credit ratings, explain well implied probabilities of default and sovereign spreads.

We also consider *lagged ratings in levels* and *lagged ratings changes* as explanatory variables (Table 9). We focus on a one-year signaling window in order to compare our result with the ratings transition matrix compiled by Moody's (2003). Different signaling windows from one to 24 months do not significantly change the results and adding lagged spreads do not improve the results. The R^2 of the probit estimation is 28%, coefficients of ratings and lagged ratings changes are each statistically significant at the 1%, and have the right sign. Compared to the univariate regression with the 3-month lagged ratings, the coefficient and the standard deviation of the lagged ratings variable is not affected when we add lagged ratings changes. A Wald test

¹³ Again, errors are robust to heteroskedasticity but not to serial correlation. However, the negative results obtained should be reinforced by the higher serial-correlation-corrected errors.

Table 10

Transition to distress vector^{a,b} forecasted 1-year probability of distress by rating grade (in sample)

Ratings	Probability of distress (%)
CC/Ca	98.5
CCC-/Caa3	96.3
CCC/Caa2	92.0
CCC+/Caa1	84.6
B-/B3	73.9
B/B2	60.2
B+/B1	45.0
BB-/Baa3	30.6
BB/Baa2	18.7
BB+/Baa1	10.2
BBB-/Baa3	4.9
BBB/Baa2	2.1
BBB+/Baa1	0.8

^a Assuming median values for lagged ratings changes.

^b Investment grade ratings in shaded area.

shows that coefficients are all significant taken together. We find that the marginal effect of negative bias, that is a negative outlook and a subsequent credit watch, increases the probability of distress in the following year by about 12%.

6.3. “Transition-to-distress” vector

Rating agencies compile ratings transition matrices¹⁴ that give the likelihood of migrating from one ratings grade to another (including default) in a future period, say, 1 year. Similarly, we compile a “transition-to-distress” vector, which shows the (in-sample) forecasted 1-year probability of distress for different ratings grade (see Table 10 and Fig. 1). We evaluate the one-year probability of distress for different values of the previous 3-month ratings level and median values for lagged ratings changes. We find, not surprisingly, that better ratings correspond to lower probabilities of distress. The probability of distress for investment grade sovereigns (BBB-/Baa3 or better) is much lower than the equivalent measure for speculative grade sovereigns. For instance, a BBB-/Baa3 rating correspond to a value of 4.9%, half the probability of distress of BB+/Baa1 rated sovereigns. We also find that B+/B1 and B/B2 ratings correspond to one year probabilities of distress of 45 and 61% respectively. Ratings lower than B-/B3 have probabilities of distress of 85% or more. The “transition-to-distress” vector can be of use to both policy makers and market participants in anticipating credit events.

¹⁴ Hu et al. (2001) combine information from sovereign defaults to derive estimates of sovereign transition matrices. They use data on defaults from the UK Export Credit Guarantee Department (ECGD).

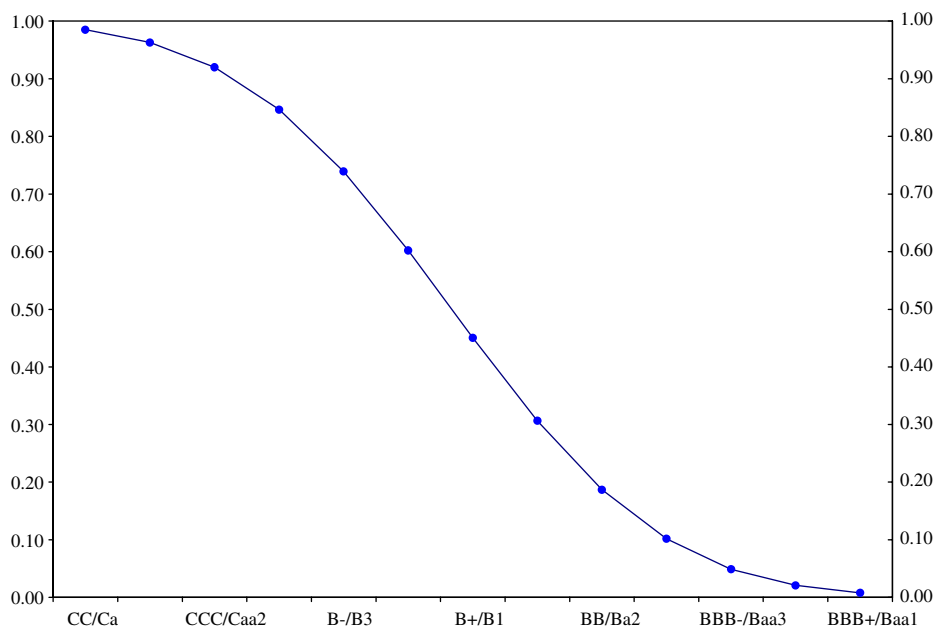


Fig. 1. Probability of distress, by rating grade (assuming median values for lagged ratings changes).

7. Conclusion

This paper revisits the question whether sovereign credit ratings fail to anticipate financial crises. We find, in line with the literature on early-warning-systems that ratings fail to predict currency crises but are instead downgraded following such crises. We argue, however, that debt crises and the relationship between debt crises and currency crises deserve a closer look since ratings proxy for the likelihood of sovereign default.

Given the scarcity of sovereign default data, especially in the 1990s in contrast to the numerous defaults on bank loans in the 1980s, we use information from the sovereign bond market to show that debt crises and currency crises are not closely related to in the period from 1994 to 2002. We find that from 1994 onward, the probability of a currency crisis and the risk-neutral implied probability of default from bond spreads exhibit a correlation of 6%. This result suggests that further studies of the macroeconomic fundamentals that determine the probabilities of currency and debt crises could be helpful to both market participants and policymakers. Using probit estimations, we find that although ratings do not anticipate currency crises well, they do have some ability to predict debt crises, defined as distressed debt events.

Given the limited number of sovereign defaults from 1994 onward and the short history of sovereign ratings in emerging markets, we propose to define debt crises as distressed debt events – that is, events where sovereign bond spreads exceed 1000

basis points. Using this definition, which coincides with periods of drastically reduced market access, we find that lagged ratings and ratings changes, including negative credit watches and outlooks, help predict the likelihood of distress in the next year.

A closer look at distressed debt events show that sovereign distress seems to be more associated with long duration and high-intensity events, since most countries with distressed spreads typically experience high level of interest rates on their external debt for more than two quarters. This result suggests that the concept of sovereign distress could be useful for studies on the distinction between liquidity and solvency crises or for studies of the cost of financial crises. One limitation of measures based on emerging market bond spreads is that the data start only in the early 1990s. It is possible, however, to combine different measures of debt crises to obtain longer series, and since earlier data refer more to bank loan debt rather than bonded debt, combining bank-based and bond market-based proxies of external debt vulnerabilities may prove useful.

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