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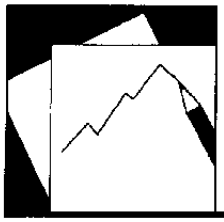

IMF Working Paper

Rating the Rating Agencies: Anticipating Currency Crises or Debt Crises?

Amadou N. R. Sy

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International Capital Markets Department

Rating the Rating Agencies: Anticipating Currency Crises or Debt Crises?

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Abstract

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In contrast to the early-warning system literature, we find that currency and debt crises are not closely linked in emerging markets. We find that after 1994, credit ratings predict debt crises but fail to anticipate currency crises. When debt crises are defined as sovereign distress—when spreads are higher than 1,000 basis points—we find that countries experience reduced capital market access and high interest rates on their external debt for typically more than two quarters. We also find that lagged ratings and ratings changes, including negative outlooks and credit watches, anticipate such debt crises.

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I. 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 banking and currency crises and are instead adjusted ex post (Goldstein, Kaminsky, and Reinhart (GKR) (2000); IMF (1999); Radelet and Sachs (1998); and Reinhart (2002)). These studies also offer an interesting discussion of the 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 nonperforming 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 explicit or implicit guarantees from the official sector, then ratings would incorporate the perceived reduction in risk associated with offical support. For instance, GKR (2000) argue that expectations of implicit and explicit guarantees of financial institutions' liabilities which were reinforced by strong fiscal positions created a moral-hazard play in Asia prior to the 1997–1998 crises. Moral hazard seems also to have been a factor in Mexico in 1994–95 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. IMF (1999) offers a comprehensive discussion of the role of credit rating agencies and the performance of credit-ratings around the Asian crisis.

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 on the basis that currency crises and debt crises are closely linked in emerging market economies. GKR (2000), IMF (2001), and Reinhart (2002) all conclude that currency crises in developing countries are closely linked to the probability of sovereign default. Based on the observation that emerging

market sovereigns are downgraded after currency crises, Reinhart (2002) suggests, however, 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.

A closer look at previous studies, including Reinhart (2002), shows, however, that most debt crises considered occured in the 1980s and are related to problems with bank debt. In this paper, we revisit the question whether sovereign ratings are useful in predicting currency and external debt crises in the turbulent period from 1994 onward, which is characterized by large defaults on foreign currency-denominated bonds, in contrast to the syndicated-loan-market debacle of the 1980s. In this paper, we follow Reinhart (2002) 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 curency crises, we find that ratings do not predict currency crises but are instead adjusted after the fact. However, unlike GKR (2000), IMF (2001), and Reinhart (2002), we do not find that currency crises are closely linked to the probability of sovereign default when the 1994–2002 period is considered.

Using implied probabilities of default from dollar-denominated sovereign and estimated probabilities of a currency crisis from a standard early-warning system model, we find that the correlation between the probability of a currency and the probability of a sovereign default is 6 percent. The average risk-neutral implied probability of default during currency crisis is 7.71 percent, compared with 6.48 percent for the whole sample and 6.31 percent for noncrisis periods.

Since currency crises are 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 1,000 basis points (10 percentage points).

According to Altman (1998), distressed nonsovereign 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 U.S. 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 percent over comparable U.S. Treasury securities.

We find that, for a particular sovereign debtor, distress corresponds to periods when access to international capital markets is drastically reduced and cost of capital is prohibitevely

high. Furthermore, at distressed-spreads levels, sustainability issues become more acute. We also find that distress corresponds to protracted events that can last between three months and nine quarters. 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 II addresses the question whether sovereign ratings predict currency crises while section III studies the behavior of ratings after a currency crisis. Section IV considers the relationship between currency crises and the probability of default. Next, Section V reviews the limitiations of debt crises as defaults on rated bonds. Section VI suggests an alternate concept of debt crisis based on sovereign distress. Finally, Section VII concludes with suggestions for future research.

II. 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 qualititative 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, Kumar, Mark, and Mathieson (1996); Juttner and McCarthy (1998); and 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 adequately 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 crises 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 six months to two 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 nonlinearities 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 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 covariances is used to assess the ability of sovereign ratings to predict currency crises. The dependent variable is the currency crisis indicator as defined earlier and the independent variable is the 3-month change in the comprehensive ratings index. Different specifications using ratings changes for different time periods and 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 reported when significant.

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 percent level but the marginal effect is negligible and equal to -0.5 percent. 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 percent level but with a marginal effect of 3 percent for a 12-month change.

III. 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 that agencies have an incentive not to downgrade sovereigns prior to financial crises since rating agencies 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. Whatever the reasons, analyzing the behavior of ratings after a currency crisis can prove useful for both market participants and policy makers.

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 three-month change in the ratings while the explanatory variable is the currency crisis indicator lagged three 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.

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 percent. This result is in line with GKR (2000) who, using a different sample, also find that a currency crisis increase the probability of a downgrade by Moody's by only 5 percent. In the next section, we take a closer look at the relationship between the probability of a crisis and the probability of sovereign default.

IV. Are Currency Crises Decoupled from the Probability of Sovereign Default?

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 so far paid little attention to the role of rating agencies in assessing the probability of sovereign default on the basis that currency crises and debt crises are closely linked in emerging market economies. For instance, GKR (2000) and IMF (2001) recognize that

currency crises and debt crises are distinct events. 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.

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 by Detragiache and Spilimbergo (2001). In their study, Detriagache and Spilimbergo (2001) define debt crises as situations in which a country has run up arrears of 5 percent to commercial creditors (banks or bondholders) or higher or has had a general rescheduling of debt service terms. According to this 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 one year. However, most of the debt crises cluster in the early 1980s. Similarly, Hu, Kiesel, and Perraudin (2001) use data on defaults provided by the UK Export Credit Guarantee Department (ECGD).

Reinhart (2002), using 160 defaults and 135 currency crises in emerging markets from a number of sources including Detrigache and Spilimbergo, studies the relationship bertween default and curency crises. Using the "signals" approach, she finds that the probability of having a currency crisis conditional on having defaulted is about 61 percent while the probability of defaulting conditional on having had a currency crisis is about 46 percent.

A closer look at the debt crises data used in all the previous studies reveals that the credit events they consider 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. There are only four debt crises according to the definition of Detragiache and Spilimbergo (2001) post-1994, including El Salvador in 1995 and Indonesia, Korea, and Thailand in 1998. In this sample, only Thailand and Indonesia experienced both currency and debt crises in the same year. Moreover, the Detragiache and Spilimbergo (2001) definition of debt crisis ignores the 1994–1995 Mexican episode. Similarly, Reinhart (2002) uses data from 1979 to 1999 only which omit a number of bond defaults in 1998 and later.

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. To answer this question, we use risk-neutral implied probabilities of default (IPD) from dollar-denominated sovereign bonds. 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. Estimation of the implied probability of default has also the advantage of clearly separating the loss given default from the probability of default unlike bond spreads (see Duffie and Singleton (2003)).

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 obtain risk-neutral implied probabilities of default using a simple intensity-based model[2] 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

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

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 percent of the principal[3]. 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 find little evidence that the average probability of default changes during currency crises. The average risk-neutral IPD during currency crisis is 7.71 percent compared to a value of 6.48 percent for the whole sample, (and 6.31 percent 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 percent 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 percent 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 percent 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.

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[2] see Duffie and Singleton (2003).

[3] The value of 30 percent of par is chosen based on the results from Merrick (1999) who estimates recovery values for Argentina and Russia during the 1998 Russian crisis. Chan-Lau (2003) also estimate recovery values using credit default swaps data.

These results suggest that, unlike the pre-1994 period, currency crises are decoupled from the probability of sovereign default in the 1994–2002 period. This suggests that defaults on bonds seem to have different dynamics than defaults on bank debt.

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 5) 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 percent (65 percent 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.

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.

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.

V. Debt Crises as Defaults on Rated Bonds or Payment Defaults

The previous analysis finds that there is little association between probabilities of default and currency crisis for the period 1994–2002. This suggests that assessing the ability of ratings to predict default events rather than currency crises is a relevant exercise. There is however no consensus on the definition of a sovereign debt crisis. The Detragiache and Spilimbergo (2001) and ECGD definitions lead to a limited number of debt crises in the 1994–2002 period. In the following section, we present Moody's definition of default and show the limitations of defining debt crises as defaults.

Moody's (2003) defines a sovereign issuer as in default when one or more of the following conditions are met: (1) 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; (2) a distressed exchange occurs, where (2.1.) 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 (2.2.) the exchange had the apparent purpose of helping the borrower avoid a "stronger" event of default (such as missed interest or payment).

There are two major problems when attempting to use sovereign defaults as debt crises in empirical studies. First, the history of sovereign ratings for emerging market economies is very short. Indeed, there were only 5 non-industrial countries rated in 1990 according to Hu, Kiesel, and Perraudin (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), Argentina[4] (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).

An 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 6) 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 zero percent. In contrast, the probability of default for B-rated sovereigns is 3.9 percent. 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 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.

VI. Debt Crises as Sovereign Distress

Given the limited number of sovereign defaults, even under a very broad definition such as Moody's, 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

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

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 U.S. 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 percent over comparable U.S. 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 1,000 bps mark for spreads is often considered as a psychological barrier by market participants. 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 1,000 basis points or more above U.S. Treasuries. We then define debt crises as sovereign bonds distress events. We later consider an alternative definition of debt crises in which a crisis occurs when spreads for a particular country are above the ninetieth percentile of their historical distribution.

Note that 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 occurs at a higher freqency 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 percent 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. When we define a indicator of distress as a binary variable equal to one if there is one month or more in which spreads are higher than 1,000 bps in the subsequent 24 months, we obtain 475 distressed events and only 11 joint events of currency crisis and distress. This again suggests that spreads and distressed spreads in particular, are limited in their ability to predict currency crises. These results are in sharp contrast to IMF (2001), where annual data since 1970 on country arrears of 5 percent higher or general rescheduling of debt service terms were used to find that 50 percent of debt crises (8 out of 15 in total) occurred in the same year as a currency crisis and 3 more within a year.

A. 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 the negative correlation between gross issuance and sovereign spreads is 4 time higher when spreads reach distressed levels compared to the whole sample (-0.23 vs. -0.06). A test of equality of correlations[5] rejects the null that the two correlations are equal at the 10 percent confidence level. Furthermore, the average monthly issuance volume is USD1,560 million as compared to USD32 million when spreads reach distressed levels. These results indicate that distressed levels for spreads are associated with reduced access to the 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 average *monthly* sovereign spreads never reached or exceeded the 1,000 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 750–984 bps range, which suggests that daily spreads may have briefly exceeded the 1,000 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 1,000 bps mark. Furthermore, in addition to Uruguay, it is only in these three countries that spreads remained consistently at distressed levels for more than 6 months.

The data suggest that defining a credit event for sovereign debt as events when spreads are at distressed levels implies a bias towards those events when spreads typically remain at distressed levels for more than two quarters. 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.

B. 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 the question whether credit ratings predict sovereign distress. We use a probit estimation with comprehensive ratings in *level* as the explanatory variable and a distress indicator as the independent variable. The

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[5] The difference between the Fisher Z-transforms of the two correlation coefficients approximately follows a Standard Normal distribution (see Papoulis, 1990).

distress indicator is a binary variable which takes a value of one if spreads reach or exceed 1,000 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 21 percent. The coefficient of the ratings variable has the right negative sign and is statistically significant at the 1 percent 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 (see Sy (2002)).

We also consider *lagged ratings in levels* and *lagged ratings changes* as explanatory variables (see 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. The R^2 of the probit estimation is 28 percent, coefficients of ratings and lagged ratings changes are each statistically significant at the 1 percent, 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 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 percent.

Finally, we focus on debt crises, defined as those events when monthly sovereign spreads are above the ninetieth percentile of a particular country's sovereign spreads. Under this definition, we find 93 debt crises, and 3 joint events of debt and currency crises. Using a cuttof level from the distribution of spreads for each sovereign in order to define debt crises has the advantage of avoiding absolute cutoff levels such as the 1,000 bps distress mark. However, under this definition all countries experience debt crises. One potential problem with using ratings to anticipate debt crises defined as above is that each ratings grade correspond to a certain probability of default and that the highest grade sovereigns should presumably experience no debt crises. For instance, the distribution of spreads for a AAA/Aaa rated sovereign can result in a low standard deviation and it is not clear how its rating can help explain the likelihood of sovereign spreads falling in the tail of the distribution.

We use a probit estimation to assess the predictive ability of ratings to anticipate events when spreads are above the ninetieth percentile of the distribution of spreads for each country. We use lagged ratings levels and lagged ratings changes as explanatory variables and a debt

crisis dummy, which takes a value of one when spreads are above the 90th percentile for a particular country in the following 12 months. We find[6] that only the coefficients of the lagged ratings changes variables are significant. The coefficient of the lagged ratings in level is not significant.

This result suggests that sovereign ratings are limited in anticipating debt crises defined as above. Presumably, the probability of default and the probability of an extreme event are linked. However, the nature of this relationship for bonds spreads seems not to be well captured by the level of credit ratings, especially for high grade ratings.

C. "Transition-to-Distress" Vector

Rating agencies compile ratings transition matrices[7] that give the likelihood of migrating from one ratings grade to another (including default) in a future period, say, one year. Similarly, we compile a "transition-to-distress" vector, which shows the (in-sample) forecasted one-year probability of distress for different ratings grade (see Table 10 and Figure 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 percent, half the probability of distress of BB+/Ba1 rated sovereigns. We also find that B+/B1 and B/B2 ratings correspond to one year probabilities of distress of 45 and 61 percent respectively. Ratings lower than B-/B3 have probabilities of distress of 85 percent or more. The "transition-to-distress" vector can be of use to both policy makers and market participants in anticipating credit events.

VII. Conclusion

This paper revisits the conclusion in the early-warning-system (EWS) literature that sovereign credit ratings fail to anticipate financial crises and that currency crises are not decoupled from debt crises in emerging markets. In fact, the EWS literature has paid little attention to debt crises on the basis that most defaults on bank loans in the 1980s occurred at the same time as currency crises.

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[6] Results are available from the author upon request.

[7] Hu, Kiesel, and Perraudin (2001) combine information from sovereign defaults to derive estimates of sovereign transition matrices. They use data on defaults from the U.K. Export Credit Guarantee Department (ECGD).

In contrast to the EWS literature, we use data from 1994 to 2002 and show that debt crises and currency crises are two distinct types of events in this period, which is characterized by major turbulence in the bond markets rather than the loan markets. 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 percent. 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.

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 1,000 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.

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	13	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

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

Table 3. Do Ratings Predict Currency Crises?
(Probit estimation with robust standard errors[1]
1,328 observations, 1990–2002)

Independent Variable	Coefficient	Std. Error	Marginal Effects	Prob.	Pseudo- R^2
3-month change in the comprehensive ratings index	-0.108	0.048	-0.005	0.025	0.013

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

Table 4. Do Currency Crises Help Predict Credit-Rating Downgrades?
(Ordered probit with robust standard errors[1]
1,575 observations, 1990–2002)

Independent Variable	Coefficient	Std. Error	Prob.	Pseudo-R^2
Currency crisis dummy	-1.579	0.244	0.000	0.043

1/ The dependent variable is three-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.
2/ The explanatory variable is the currency crisis dummy lagged three monhts.

Table 5. Are Ratings a Proxy for the Probability of Sovereign Default?[1]
(Pooled time series, cross-section estimation
925 observations, 1994–2002)

Independent Variable	Coefficient	Std. Error	Prob.	Pseudo-R^2
3-month change in the comprehensive ratings index	-0.524	0.016	0.000	0.53

1/ 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 percent of par value.

Table 6. Sovereign Ratings Transitions[1]
(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%	92.8%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%
A	0.0%	2.7%	90.4%	6.2%	0.9%	0.0%	0.0%	0.0%
Baa	0.0%	0.0%	4.8%	87.6%	8.3%	0.3%	0.0%	0.0%
Ba	0.0%	0.0%	0.0%	3.7%	83.2%	10.0%	0.0%	3.1%
B	0.0%	0.0%	0.0%	0.0%	2.2%	87.7%	2.2%	7.9%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%

1/ Adapted from Moody's (2003).

Table 7. Gross Isssuance Volume and Secondary Market Bond Spreads, 1994–2002

	Volume (USD mill.)		Spreads (bps.)	
	Overall	distress	overall	Distress
Mean	348	207	638	1808
Std. Dev.	607	457	728	1348
Min	0	0	52	1001
Max	6274	2635	6851	6851
Total	488,237	28,925		
Average monthly issuance	1560	32		
Number of observations	1404	104	1404	104
Correl. (volume, spreads)*	-0.06	-0.23		

Sources: Capital Data; and author's calculations.
* The difference between the two correlation coefficients is statistically significant at the 10 percent level.

Table 8. Number of Consecutive Distressed Months and Average Spreads										
	Overall	1 month	2 months	3 months	4 months	5 months	7 months	8 months	11 months	>12 * months
Argentina	34	2	-	1	-	-	-	-	1	1
	1397	*1034*		*1261*					*1240*	*4685*
Brazil	35	-	2	-	2	-	1	2	-	-
	894		*1084*		*1084*		*1241*	*1418*		
Colombia	1	1	-	-	-	-	-	-	-	-
	1,000	*1,000*								
Indonesia	3	1	1	-	-	-	-	-	-	-
	530	*1069*	*1386*							
Mexico	8	-	-	1	-	1	-	-	-	-
	533			*1149*		*1322*				
Turkey	3	3	-	-	-	-	-	-	-	-
	707	*1042*								
Uruguay	8	-	-	-	-	-	-	1	-	-
	397							*2122*		
Venezuela	49	1	1	-	1	-	1	1	-	1
	1053	*1037*	*1067*		*1101.3*		*1121*	*1482*		*1616*

Sources: Capital Data; and author's calculations
* 18 months for Argentina and 27 months for Venezuela.

Table 9. Do Sovereign Ratings Predict Distress?
(Probit estimation with robust standard errors
967 observations, 1994–2002))

Independent Variable	Coefficient	Standard Error	Marginal Effects	Probability	Pseudo-R^2
Ratings(-3)	-0.127	0.009	-0.027	0.000**	0.280
Δratings(-1)	-0.204	0.068	-0.043	0.000**	
Δratings(-2)	-0.178	0.050	-0.037	0.000**	
Δratings(-3)	-0.18	0.040	-0.038	0.000**	

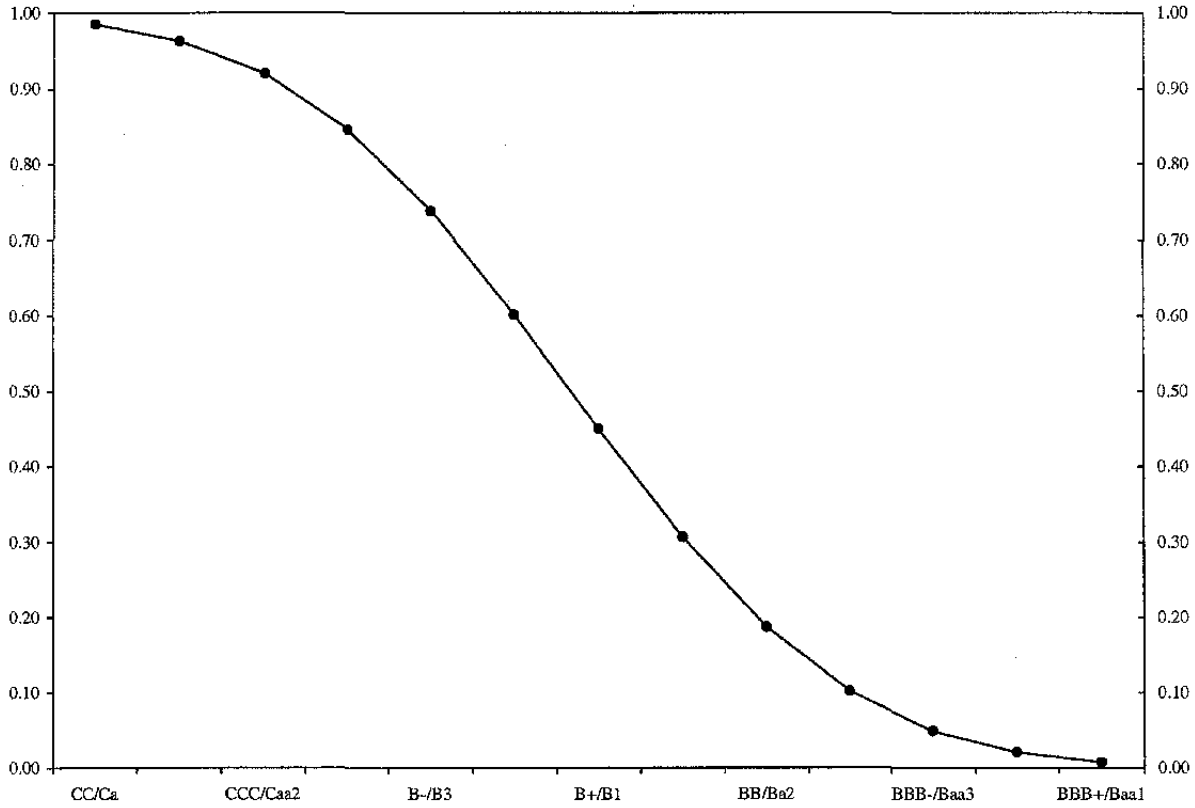
1/ The dependent variable is a dummy which takes a value of one if spreads are above 1,000 bps in the following 12 months. Ratings refer to the comprehensive rating index. The constant variable is not shown.
**A Wald-test rejects the null of all coefficients being equal to zero.

Table 10. Transition to Distress Vector 1/ 2/
Forecasted One-Year Probability of Distress
by Rating Grade (in sample)

Ratings	Probability of Distress (Percent)
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-/Ba3	30.6
BB/Ba2	18.7
BB+/Ba1	10.2
BBB-/Baa3	7.9
BBB/Baa2	4.1
BBB+/Baa1	2.8

1/ Assuming median values for lagged ratings changes.
2/ Investment grade ratings in shaded area.

Figure 1. Probability of Distress, by Rating Grade 1/



1/ Assuming median values for lagged ratings changes.

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