Country Debt Default Probabilities In Emerging Markets: Were Credit Rating Agencies Wrong?

Angelina Georgievska, BNP Paribas, London, UK,
Ljubica Georgievska, Goldman Sachs, London, UK
Dr Aleksandar Stojanovic, Head of Department of Accounting and Finance, Director of Centre for Governance, Risk and Accountability, University of Greenwich Business School, London, UK
Dr Natasa Todorovic, Senior Lecturer in Investment Management, Cass Business School, London, UK

Credit Rating Agencies' Ratings in Debt Default Models

Sovereign credit ratings and their associated default probabilities have historically been used by leading international banks for determining their capital allocation in a particular country, pricing of sovereign bonds and loans and, most importantly, as an input to their credit risk management models. Such credit ratings and default probabilities are traditionally provided by the leading credit rating agencies (CRAs). According to the Basel Capital Accord – Basel II, banks were allowed to use their internal sovereign ratings and/or CRA's ratings and their associated default rates in determining their required regulatory capital against credit risk. When this is applied to emerging markets, due to the lack of data on sovereigns, the sovereign credit ratings are mainly based on corporate defaults, assuming the latter is a good proxy for the former. However, corporations and governments are fundamentally different borrowers both in terms of their legal status and solvency, making this assumption doubtful. Therefore, in this Chapter that draws upon a recently published article "Sovereign Rescheduling Probabilities in Emerging Markets: A Comparison with Credit Rating Agencies' Ratings"[1], we assess whether country default probabilities derived from the empirical models we specifically designed for sovereigns, are more appropriate measures of sovereign default than CRAs' corporate default rates. Specifically,

in search of the most accurate approach to predicting sovereign debt rescheduling, we compare the real-world probabilities estimated using historical data in our models with the assigned probabilities of three major international rating agencies, namely, Moody's, Standard & Poor's (S&P) and Fitch. Basing our probabilities of sovereign default on models using 124 emerging countries over the period 1981-2002, we show that CRA's underestimate sovereign debt default probabilities which brings into question banks'/investors' reliance on the CRA's credit ratings.

Debt Rescheduling Probability Model

When deriving a model that would be specific for estimation of sovereign default probabilities in emerging markets, one needs to be aware that potentially large a number of economic, political and market factors determine the extent of a country's debt repayment difficulties. Sovereign default may be caused by a country's politically motivated unwillingness to repay their external debt or simply by inability stemming from insolvency and/or illiquidity. Solvency is often measured by the GDP, government revenues or exports and it also depends on the exchange rate regime (an overvaluation of currency can lead to external imbalances and hence to accumulation of debt). Macroeconomic factors such as inflation and money growth affect foreign investors' risk attitude: for instance, an increase in inflation would inversely affect the amount of foreign capital invested in a country. Illiquidity, as another variable contributing to a country's inability to repay its debt, is usually measured by the Short-term debt to Reserves or M2 to Reserves. Moreover, political and institutional factors are very important determinants of probability of default as they affect country's stability and debt repayment policies. Further, financial ratios that have most commonly been identified in literature as significant determinants of probability of sovereign default are: Reserves to Imports (e.g., Aylward and Thorne, 1998); Total External Debt to GDP (e.g., Balkan, 1992, Detragiache and Spilmbergo, 2000 etc.); and Total Debt Service Payment to Exports (e.g., Solberg, 1988 and Rivoli and Brewer, 1997). Finally, it has been documented that a country's past debt repayment record can be used as an excellent indicator of their current likelihood to default. The list of variables that could potentially affect sovereign default presented here is not exhaustive, so for more detailed review of these and other variables see Georgievska et al. (2008). To select the most appropriate variables out of a large pool, which could be used in building an empirical model for estimating probability of sovereign default, we deploy the Principal Component Analysis technique. Our selection method[2] leads us

to adopt variables that can be grouped into four main categories and are expected to have either positive or negative impact on probability of rescheduling as described in Table ZZZ.1:

Table ZZZ.1: The impact of selected variables on the probability of default/recheduling

Variables	**Impact of the increase in value of the variable on probability of default/recheduling**	
	Positive	**Negative**
Past rescheduling record:		
Lagged Rescheduling	x	
Political Variable:		
ICRG Rating[(a)] (50% political, 25% financial and 25% economic risk)		x
Solvency variables:		
Total Debt/GNP	x	
Arrears/Exports	x	
Exports/GDP		x
Liquidity Variables:		
International Reserves/GDP		x
Macroeconomic variables:		
Current Account Balance/GDP		x
Imports/GDP [(b)]	ambiguous	ambiguous

[(a)] A higher number, obtained as a weighted average of points assigned for political, economic and financial risk of a country, indicates the lower potential risk and vice versa.
[(b)] When the imports in relation to the GDP are higher, the country is more vulnerable to foreign shocks, and more likely to external debt rescheduling (Frenkel, 1983). However, (Odedokun, 1995) argues that the higher this ratio, the more open the economy is, which in effect reduces the probability of default.

The event of debt default/rescheduling is defined as a binary variable:

$$\textbf{Rescheduling}_{it} = \begin{cases} 1 & \text{if country } i \text{ reschedules its external debt in year } t\text{, i.e. if its total amount of debt recheduled is above zero in year } t \\ 0 & \text{if country } i \text{ does not reschedule its external debt in year } t \end{cases}$$

In our sample there were 519 debt defaults/reschedulings[3] in total. Although 22 countries had no defaults in this period, some, for example Gabon, Zambia, Tanzania and Nicaragua faced a dozen or more default/rescheduling events.

Applying the panel logit models, traditionally used in this setting, we estimated the probabilities of sovereign default in emerging market countries in our sample. In search for the most accurate model we considered those which: 1) maximise percent of correct predictions (that the default had occurred) and 2) minimise the 'false negatives', i.e. minimise the error that the actual defaults are classified by the model as non-defaults (known as Type I error). Using the variables

described earlier, we have derived two models that satisfy criterion 1) and 2) respectively and give us empirical estimates of debt rescheduling probabilities in emerging markets. Specifically, Model 1, which included Prior Rescheduling Event (over the past one year), Total debt/GNP, Exports/GDP, Current Account Balance/GDP and International reserves/GDP, gave us 82.68% of correct predictions of actual defaults and 9.13% Type I error. Model 2, which, in addition to Past Rescheduling and Total debt/GDP, included the political variable (ICRG index), Arrears/Exports and Imports/GDP had 82.54% correct predictions and 8.33% Type I error. Overall, our determinants of debt rescheduling suggest that in order to reduce their probability of default/rescheduling and get better access to international capital markets, emerging countries should: maintain a good past debt repayment record; reduce their current account deficit; improve their political stability; increase their exports relative to imports; keep close control of international reserves relative to GDP (which is of particular relevance for countries with underdeveloped banking system); and limit the size of the external debt compared to their resource base (GNP).

Empirical vs. CRAs Probabilities of Emerging Markets Sovereign Debt Recheduling

A direct comparison between empirical one-year default probabilities from our Models 1 and 2 and the one-year sovereign credit ratings from Moody's, Standard and Poor's, and Fitch cannot be done, as the CRAs use letter ratings that range from AAA (for S&P and Fitch, Aaa for Moody's) to C, while our models provide quantitative probability of default. To enable this comparison, we use transformation of letter ratings into their associated one-year cumulative default probabilities (or ranges of default probabilities)[4]. More specifically, to derive one-year cumulative default probabilities, all three CRAs use periods of up to 20 years. For instance, credit rating of B1 corresponds to the average one-year cumulative default rate of 2%, which represents the percentage of historical number of debtors that have defaulted within one year of being assigned rating B1, within a total number of countries and companies with B1 rating over the same one year period. The year selected for comparison is the final year in our sample, 2002, when, at the beginning of the year, 42 countries have been rated by the three CRAs.

Striking findings emerged from the comparison of empirical vs. CRAs probabilities of default: 95.59% of the countries rated by Moody's, 85.71% of those rated by S&P and 96.3% of Fitch rated countries had lower one-year cumulative default probabilities than equivalents generated

by our Model 1 (corresponding numbers of comparison with Model 2 are 97.3%, 88.57 and 92.59%). Table ZZ.2 sets out the default/rescheduling probabilities derived from our models along with CRAs' one-year cumulative default probabilities, focusing at the sample of nine countries that have actually rescheduled/defaulted in 2002.

Table ZZ.2: Model 1 and Model 2 One-Year Default/Reschediling Probabilities vs. CRAs' One-Year Default Rate in 2002: sample of countries that has actually defaulted/recheduled

Country That Has Defaulted In 2002	Model 1 Default Probabilities	Model 2 Default Probabilities	Moody's associated Default Probability	S&P's associated Default Probability	Fitch's associated Default Probability	Moody's Rating	S&P Rating	Fitch Rating
Bolivia	12.90%	14.09%	2.00%	2.63 - 3.33%	---	B1	B+	---
Honduras	46.33%	58.62%	6.81%	---	---	B2	---	---
Indonesia	66.63%	76.43%	6.86%	100.00%	1.68 - 21.97%	B3	CCC	B-
Jordan	36.29%	48.18%	1.58%	2.63 - 3.33%	---	Ba3	BB-	
Mexico	7.83%	6.89%	1.78%	0.00 - 2.63%	0.27 – 1.55%	Baa3	BB+	BB+
Moldova	8.65%	9.12%	13.95%	---	21.97%	Caa1	---	CC
Nicaragua	76.25%	85.31%	6.81%	---	---	B2	---	---
Pakistan	65.88%	70.98%	13.95%	3.33 - 100%	---	Caa1	B-	---
Russian Federation	61.73%	55.17%	1.58%	2.63 - 3.33%	1.55 – 1.68%	Ba3	B+	B+

Note: --- Indicates that the data is not available (countries are not rated)

For majority of the selected countries, the one-year cumulative default rates implied from their CRAs ratings at the beginning of 2002 are very low, mostly being well below 10%, giving no signal of potential default (the exception is Indonesia, for which the S&P correctly assigns 100% probability of default). Conversely, most of the default probabilities generated by our empirical models were above 50% (particularly when Model 2 is taken into consideration), indicating that rescheduling is likely to occur. For instance, in the case of Nicaragua, Model 1 and Model 2 give very high default probabilities of 76.25% and 85.31% respectively, while Moody's assigns it a B2 rating and associated cumulative default probability of only 6.81%. This and further analysis in Georgievska et al. (2008), leads us to conclude that CRAs did not effectively predict 2002 defaults/reschedulings. That is not to say that empirical models are always correct. If some empirical models (and CRAs) use past rescheduling/default event as one of the determinants of probability of default, then, a country that has defaulted in the recent past (upto one year ago) may be classified by empirical models (and some CRAs) as 'likely to default' in the next period. However, in reality, one default *does not have to* follow another. The example of Argentina (which defaulted in 2001, but not in 2002 despite the predictions of default from our empirical models and all CRAs but Fitch) bares this out.

One of the reasons why CRAs' default rates are underestimating emerging countries sovereign defaults over one-year horizon lies in the fact that CRAs sovereign ratings are mainly based on historical corporate default rates (the exception are Fitch's ratings, which specifically follow sovereign defaults). Given that characteristics of borrowers in each case are very different (government vs. corporation), corporate bonds credit ratings and their associated default probabilities generally do not appear to be good proxies for sovereign default probabilities.

Implications

It is well known that leading banks and international investors rely on sovereign default probabilities to estimate credit risk exposure in one country, price sovereign bonds and loans and decide upon country capital allocation. However, using CRAs default probabilities for this purpose may have serious implications for both banks and countries in question, as their problems may outweigh the benefits. For instance, CRAs continuous underestimation of sovereign default risk for emerging countries will cause underestimation of credit risk for banks, under-pricing of sovereign bonds and

loans and increasing capital allocation to emerging countries with underestimated probabilities of default. Therefore, if an actual default of a sovereign occurs, it is likely that CRAs will downgrade the country rating very quickly. Then, the banks may experience difficulties in reducing the amount of capital allocation in these (now riskier) countries. Nevertheless, the capital outflows will be imminent under such circumstances. Once the considerable amount of foreign capital is withdrawn from a downgraded country, its fundamentals are likely to deteriorate further, leading subsequently to the new downgrades by CRAs and deepening of the crisis.

Finally, although this article favours the use sovereign debt default probabilities from empirical models and historical data over those provided by the CRAs, it is important to draw the attention of the reader to the cost of applying each method, which varies with the size of investors. Large financial institutions already have the analytical set-up needed for obtaining and processing the data required for the empirical models, so, in that case, the information cost of generating their own sovereign default probabilities is marginal. For individual investors, who by and large do not have adequate analytical frameworks in place, the cost advantage lies with the existing (readily available) CRAs default probabilities, but - as this article suggests – these should be used with caution.

REFERENCES

Aylward, L., Thorne, R., 1998, "An Econometric Analysis of Countries' repayment Performance to the International Monetary Fund", IMF Working Paper No WP/98/32, March, International Monetary Fund

Balkan, M.E., 1992, "Political Instability, Country Risk and Probability of Default", *Applied Economics*, Vol. 24, pp. 999-1008

Berg, A., Sachs, J.D., 1988, "The Debt Crisis: Structural Explanations of Country Performance", *Journal of Development Economics*, Vol.29, pp. 271-306

Citron, J., Nickelsburg, G., 1987, "Country Risk and Political Instability", *Journal of Development Economics*, Vol.25, pp.385-392

Dell'Arricia, G., Schnabel, I., and Zattlemeyer, J., 2002, "Moral Hazard and International Crisis Lending: A Test", IMF Working Paper 012/181, International Monetary Fund, Washington

Detragiache, E., Spilmbergo, A., 2000, "Crises and Liquidity: Evidence and Interpretation", Unpublished Manuscript, Washington, International Monetary Fund

Duffie, D. and Singleton, K. J., 2003, *Credit Risk: Pricing, Measurement and Management*, Princeton NJ: Princeton University Press

Eaton, J. and Fernandez, R, 1995, "Sovereign Debt", NBER Working Paper No.5131

Frenkel, J., 1983, "International Liquidity and Monetary Control", NBER Working Paper No.1118, May

Fitch Ratings, 2002, "Fitch Corporate Finance 2002 Rating Migration and Default Study", Corporate Finance, New York, Fitch Ratings

Georgievska, A., Georgievska, L., Stojanovic, A., and Todorovic, N., 2008, "Sovereign rescheduling probabilities in emerging markets: a comparison with credit rating agencies' ratings", *Journal of Applied Statistics*, Vol.35, No.9, pp. 1031-1051

Goldstein, M., Reainhart, C.M., and Kaminsky, G.L., 2000, "Assessing Financial Vulnerability: An Early Warning System for Emerging Markets". *Institute for International Economics.* Washington D.C.

Hajivassiliou, V., 1987, "The External Debt Repayment Problems of LDC's: And Econometric Model Based on Panel Data", *Journal of Econometrics*, Vol. 36, pp.205-230

Hajivassiliou, V., 1989, "Do the Secondary Markets Believe in Life After Debt?", World Bank Policy Planning and Research Working Paper No. 252, Washington, The World Bank

Hajivassiliou, V., 1994, "A Simulation Estimation Analysis of the External Debt Crises of Developing Countries", *Journal of Applied Econometrics*, Vol. 9, pp. 109-113

Haque, N.U., Nelson M., and Mathieson, D.J., 1998, "The Relative Importance of Political and Economic Variables in Creditworthiness Ratings", IMF Working Paper No. 46, Washington D.C., International Monetary Fund

Hemming, R., Chalk, N., 2000, "Assessing Fiscal Sustainability in Theory and Practice", IMF Working paper 00/81, International Monetary Fund, Washington

Hemming, R., Petrie M., 2002, "A Framework for Assessing Fiscal Vulnerability", IMF Working Paper 00/52, International Monetary Fund, Washington

Hull, J., Predescu, M. and White, A., 2005, "Bond Prices, Default Probabilities and Risk Premiums", *Journal of Credit Risk*, Vol. 1, pp. 53-60.

Hutchison, M.M., Neuberger, I., 2001, "Output Costs of Currency and Balance of Payments Crises in Emerging Markets", *Unpublished Manuscript*. Santa Cruz: University of California, Santa Cruz, September

International Monetary Fund, 2000, "Emerging Market Financing – Quarterly Report on Developments and Prospects ", Third Quarter 2000. Washington D.C., International Monetary Fund

Lee, S.H., 1991, "Ability and Willingness to Service Debt as Explanation for Commercial and Official Rescheduling Cases", *Journal of Banking and Finance*, Vol. 15, pp.5-27

McFadden, D., Eckaus, R., Feder, G., Hajivassiliou, V., and O'Connell, S., 1985, "Is There Life After Debt? An Econometric Analysis of the Creditworthiness of Developing Countries", in *International Debt and the Developing Countries*, edited by John Cuddington and Gordon Smith. Washington. The World Bank

Moody's Investros Service, 2003, "Default & Recovery Rates of Corporate Bond Issuers: A Statistical Review of Moody's Ratings Performance, 1920-2002", Special Comment, February ,New York, Moody's Investor Service

Reinhart, C.M., 2002, "Default, Currency Crises and Sovereign Credit Ratings", The World Bank Economic Review, Vol. 16, No.2, pp.151-170.

Rivoli, P., and Brewer L.T., 1997, "Political Instability and Country Risk", *Global Finance Journal*, Vol.8, pp.309-321

Rojas-Suares, L., 2001, *Rating Banks in Emerging Markets*, Institute for International Economics, Washington DC

Roubini, N., 2001, " Debt Sustainability: How to Assess Whether a County is Insolvent", Unpublished paper, New York University, accessed from: http:/pages.stern.nyu.edu/~roubini/debt.pdf

Standard and Poor's, 2002, "Sovereign Ratings 2001:The Best of Times, The Worst of Times", Sovereigns, April ,New York, Standard and Poor's

Solberg, R.L., 1988, *Sovereign Rescheduling: Risk and Portfolio Management*, London: Unwin Hyman Ltd.

Schwarts, E.S. and Zurita, S, 1992, "Sovereign Debt: Optimal Contract, Under-Investment and Forgiveness", Journal of Finance, Vol 47, pp.981-1004

ENDNOTES:

[1] For more details please refer to Georgievska et. al. (2008)
[2] The following were the selection criteria: (a) the variables are individually and jointly significant in the econometric model; (b) the coefficients on the variables included in the model show their expected sign; and (c) the variables included optimize the fit of the model.
[3] Data obtained from the World Bank *Global Development Finance*
[4] Data obtained from: Moody's Investors Service, 2003, "Default & Recovery Rates of Corporate Bond Issuers: A Statistical Review of Moody's Ratings Performance, 1920-2002", Special Comment, February (New York, Moody's Investor Service); Standard and Poor's , 2002, "Sovereign Ratings 2001:The Best of Times, The Worst of Times", Sovereigns, April (New York, Standard and Poor's); Fitch Ratings, 2002, "Fitch Corporate Finance 2002 Rating Migration and Default Study", Corporate Finance, (New York, Fitch Ratings)