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"Rules of thumb" for sovereign debt crises ☆

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ABSTRACT

This paper investigates the economic and political conditions that are associated to the occurrence of a sovereign debt crisis. We use a new statistical approach (Classification and Regression Tree) that allows us to derive a collection of "rules of thumb" that help identify the typical characteristics of defaulters. We find that not all crises are equal: they differ depending on whether the government faces insolvency, illiquidity, or various macroeconomic risks. We also characterize the set of fundamentals that can be associated with a relatively "risk-free" zone. This classification is important for discussing appropriate policy options to prevent crises and improve response time and prediction.

1. Introduction

Following the debt crises of the 1980s, sovereign debt defaults have become more frequent. Episodes of outright default include Russia, Ecuador, and Argentina. In other cases, formal default was avoided via a debt restructuring under a coercive threat of default as in Ukraine, Pakistan, and Uruguay. Default was averted through large-scale IMF financial support in cases such as Mexico, Brazil, and Turkey.

While there has been a significant amount of research regarding debt crises in general, and about the policy responses to these defaults, in particular,[1] the macroeconomic and structural weaknesses leading to them are still not properly understood: there is little comparative empirical work on the sovereign debt crises of the last decade. Many policymakers and analysts continue to use simple rules of thumb to judge risks and to assess fiscal sustainability (Mody and Saravia, 2003), as well as the soundness of macroeconomic policies. Too often, these rules are not based on a rigorous quantitative analysis, and may miss some core elements that led to these sovereign debt crises.

Our aim is to provide answers to the following basic questions. What set of economic and political conditions is empirically associated to the likely occurrence of a sovereign debt crisis? Can one derive thresholds for vulnerability indicators that will effectively signal the risk of a sovereign debt crisis? Part of the motivation for the paper stems from so-called surveillance failures, namely cases where international financial institutions, such as the IMF, as well as rating agencies, private sector agents, and academics, were taken "by surprise" and grossly under-estimated the likelihood of a sovereign default.

In the paper, we use a new statistical approach and derive a set of "rules of thumb" that help identify the typical characteristics of defaulters. We find that not all crises are equal: they differ depending on whether the government faced insolvency, illiquidity, or various macroeconomic weaknesses and risks. This classification is crucial for discussing appropriate policy options for preventing crises and responding to them once they occur. For example, it is often argued that solvent but illiquid countries with large amounts of short-term debt may need IMF support to avoid a liquidity run or "roll-off" crisis. Conversely, highly indebted countries may face a debt crisis, unless there is a strong and credible fiscal consolidation. In addition, it is argued that conditionality should set targets indicating that a country's macroeconomic fundamentals are heading towards a relatively "safe" zone. In the paper these concepts of liquidity crisis, insolvency crisis, crisis triggered by weak macro-fundamentals, and relatively "safe zone" are made precise. Unless the diagnosis is correct, it is hard to get the policy cure right.

This empirical analysis is based on a dataset containing annual observations for 47 emerging market economies from 1970 to 2002. A country is defined to be in a state of "debt crisis" if it is classified as being in default by Standard & Poor's, or if it receives a large non-concessional IMF loan (where "large" means in excess of 100% of IMF quota). Standard

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[1] See for example Roubini and Setser (2004) for a systematic analysis of the crises in emerging market economies in the last decade, and on how they were resolved.

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Table 1
Countries and default episodes in the full sample.

	Number of crisis	Average length	Years in crisis	Crisis episodes (starred are added by IMF loans)
Algeria	1	6.0	6	1991–1997
Argentina	3	5.0	15	1982–1994, 1995*,1996, 2001, 2002
Bolivia	2	6.5	13	1980–1985, 1986–1994
Brazil	3	5.3	16	1983–1995, 1998*,99*,2000, 2001*,2002*
Chile	1	8.0	8	1983–1991
China	0	…	0	
Colombia	0	…	0	
Costa Rica	1	10.0	10	1981–1991
Cyprus	0	…	0	
Czech Republic[a]	0	…	0	
Dominican Republic	1	22.0	22	1981–
Ecuador	2	8.0	16	1982–1996, 1999–2001
Egypt	1	1.0	1	1984–1985
El Salvador	1	16.0	16	1981–1997
Estonia[a]	0	…	0	
Guatemala	1	1.0	1	1986–1987
Hungary[a]	0	…	0	
India	0	…	0	
Indonesia	2	2.5	5	1997*–2001, 2002
Israel	0	…	0	
Jamaica	3	4.7	14	1978–1980, 1981–1986, 1987–1994
Jordan	1	5.0	5	1989–1994
Kazakhstan[a]	0	…	0	
Korea, Rep. of	2	2.0	4	1980*,81*,82, 1997*,98*,99
Latvia[a]	0	…	0	
Lithuania[a]	0	…	0	
Malaysia	0	…	0	
Mexico	2	5.0	10	1982–1991, 1995*, 96
Morocco	2	3.0	6	1983–1984, 1986–1991
Oman	0	…	0	
Pakistan	1	2.0	2	1998–2000
Panama	1	14.0	14	1983–1997
Paraguay	1	7.0	7	1986–1993
Peru	3	6.3	19	1976–1977, 1978, 1979*–1981, 1983–1998
Philippines	1	10.0	10	1983–1993
Poland[a]	0	…	0	
Romania[a]	0	…	0	
Russia[a]	1	3.0	3	1998–2001
Slovak Republic[a]	0	…	0	
South Africa	4	1.8	7	1976*,77*,78, 1985–1988, 1989–1990, 1993–1994
Thailand	2	1.0	2	1981*,82, 1997*, 98
Trinidad and Tobago	1	2.0	2	1988–1990
Tunisia	1	1.0	1	1991*, 92
Turkey	2	3.5	7	1978, 1979, 1980*, 1981*, 1982, 1983, 2000*, 2001*, 2002
Ukraine[a]	1	3.0	3	1998–2001
Uruguay	3	2.0	6	1983–1986, 1987–1988, 1990–1992
Venezuela	3	3.3	10	1983–1989, 1990–1991, 1995–1998
Total	54	5.5	261	

Sources: IMF, Standard & Poor's, World Bank, and authors' calculations. A star indicates according to IMF loan.
[a] Transition countries are included only from 1995 onwards.

& Poor's rates sovereign issuers in default when a government fails to meet principal or interest payment on an external obligation on due date (including exchange offers, debt equity swaps, and buy back for cash).

We employ the Classification and Regression Tree methodology (CART) for classification and prediction.[2] CART is a computer-intensive data mining technique that selects explanatory variables, their critical values, and their interactions in order to identify "safe" from "crisis-prone" types. The main conclusions of our empirical analysis are as follows.

First, out of 50 candidate variables, 10 predictor variables turn out to be sufficient for classification and prediction: total external debt/GDP ratio; short-term debt reserves ratio; real GDP growth; public external debt/fiscal revenue ratio; CPI inflation; number of years to the next presidential election; U.S. treasury bills rate; external financial requirements (current account balance plus short-term debt as a ratio of foreign reserves); exchange rate overvaluation; and exchange rate volatility.

Second, a relatively "safe" country type is described by a handful of economic prerequisites: low total external debt (below 49.7% of GDP); low short-term debt (below 130% of reserves); low public external debt (below 214% of fiscal revenue); and an exchange rate that is not excessively over-appreciated (overvaluation below 48%).

Third, three major types of risks are identified: (i) solvency (or debt unsustainability); (ii) illiquidity; and (iii) macro-exchange rate risks. The debt unsustainability risk types are characterized by: external debt in excess of 49.7% of GDP, together with monetary or fiscal imbalances, as well as by large external financing needs that signal illiquidity as an element of debt unsustainability. Liquidity risk types are identified by moderate debt levels, but have short-term debt in excess of 130% of reserves coupled with political uncertainty and tight international capital markets. Macro-exchange rate risk types arise from the combination of low growth and relatively fixed exchange rates. Each of these risk types differ in their likelihood of producing a crisis. Finally, our model has excellent predictive capacity in-sample, while the out-of-sample forecast have both less false alarms and less correct predictions than the Early Warning Signal (EWS) literature.

The analysis has one important, albeit simple, implication for sustainability analysis. It shows that *unconditional* thresholds, for example for debt–output ratios, are of little value per se for assessing the probability

[2] The analysis employs the data mining software CART developed by Salford Systems.