Anatomy of banking crises in developing and emerging market countries

Rupa Duttagupta*, Paul Cashin

International Monetary Fund, 700 19th Street NW, Washington, DC, USA

ABSTRACT

This paper uses a Binary Classification Tree (BCT) model to analyze banking crises in 50 emerging market and developing countries during 1990–2005. The BCT model identifies three conditions (and the specific threshold of the key indictors) at which the vulnerability to banking crisis increases—(i) very high inflation, (ii) highly dollarized bank deposits combined with nominal depreciation or low bank liquidity, and (iii) low bank profitability—which highlight that foreign currency risk, poor financial soundness, and macroeconomic instability are important drivers of banking crises. The results also emphasize the importance of conditional thresholds in triggering crises, in that banking crises are underlined by a combination of vulnerabilities—or a sequence of (non-linear) conditions—rather than the deterioration of a unique factor.

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1. Introduction

The advent of the 1990s witnessed a wave of banking crises in developing countries. These ranged from bank meltdowns in many transition economies in the early 1990s (triggered by macroeconomic instability), to the East Asian crises in 1997–1999 (spurred in part by over-lending), to the Dominican Republic crisis of 2003 (reflecting weak balance sheets). More recently, the 2008–2009 global financial crisis started in industrial countries but then spread to many developing and emerging market countries, including in Eastern Europe, straining financial systems that were characterized by excessive dollarized liabilities in the context of relative inflexible exchange rate regimes. Historically, banking crises have imposed a tremendous economic burden, including huge fiscal costs of resolution and/or

* Corresponding author. Tel.: +1 202 623 8583; fax: +1 202 589 8583.
E-mail address: rduttagupta@imf.org (R. Duttagupta).

sharp output losses.[1] Consequently, the plethora of banking crises has sustained the drive for a better understanding of the factors that caused them.

The extensive empirical literature on banking crises has generally used two standard econometric tools.[2] The first is the signals approach, which studies and contrasts behaviors of economic indicators for periods both before and after a crisis, and identifies individual variables that best signal an impending crisis based on over- or under-shooting of specific threshold values (see Kaminsky and Reinhart, 1999). The second approach computes the probability of a banking crisis using a limited dependent variable model (see Demirgüç-Kunt and Detragiache, 1998; Eichengreen et al., 1998). Both these tools consider the significance of individual factors in causing banking crises. In contrast, this paper provides a fresh perspective on banking crises, by demonstrating that such crises are most often underpinned by a combination of weaknesses rather than a single compelling factor.

This paper makes an important contribution to the above literature by analyzing banking crises using a binary classification tree (BCT) technique, which to our knowledge has not been used previously to analyze banking crises.[3] The BCT (described in detail below) is particularly useful to unravel the complex interactions between factors—for instance exchange rate depreciation (above a certain threshold), combined with large foreign exchange liabilities (above a certain threshold)—that eventually perpetuate a banking crisis. The BCT model also recognizes that economic indicators may have a non-linear impact on the probability of crisis, in that any increase or decrease of a key indicator need not increase crisis-proneness, unless the value of the indicator crosses a certain threshold, which the model identifies. The latter is very difficult to do in a standard regression analysis—while in principle one can always check the significance of variables at particular thresholds, it is virtually impossible to guess what these thresholds might be. Thus, using a BCT, we are able to identify first, the main indicators underlying a banking crisis; second, establish the threshold limits beyond which these indicators increase vulnerability to such a crisis; and third and most importantly, the combination of conditions between indicator variables underlying crisis-proneness. The focus of the literature, until now, has only been on addressing the first and in a few cases the second of the above questions. We feel that unraveling the complex pattern of relationships between indicator variables in the run up to a banking crisis is the most essential step to understanding such crises, which makes the BCT methodology a more appealing tool for analyzing banking crises compared to standard regression techniques.

The BCT is a non-parametric statistical technique that is able to sift a large set of potential indicators and compare all candidate variables (at all possible threshold values) to identify which variables (and at what threshold values) are best able to split the sample and allocate the observations correctly into the two classes (in this case, crisis versus non-crisis). Thus, starting with the whole sample (parent node), two child nodes are generated at a particular threshold value of a key splitting variable such that the probability of crisis increases unambiguously in one child node and declines in the other, when compared to the probability of the crisis at the parent node. The process continues, in that each child node gets further split into more nodes, and eventually stops according to the criteria used to determine further improvements (see below). At each terminal node, the tree reveals a sequence of conditions among key indicators that can be identified as crisis-prone (and conversely also the conditions that describe a "tranquil" or non-crisis state).

We analyze banking crises in a sample of 50 emerging market and developing countries during 1990–2005. The set of explanatory variables include: indicators of overall macroeconomic environment (growth, inflation, nominal depreciation, and government balance), external vulnerability (official foreign exchange (FX) reserve cover of broad money, export growth, and terms of trade (TOT) growth), monetary conditions (credit growth, real deposit rate, foreign interest rate, existence of explicit deposit insurance, and de facto exchange rate regime), and banking sector health (e.g., extent of liability dollarization in banks, net FX open position, bank liquidity, equity strength, asset quality, and two proxies for bank profitability).

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[1] See Honohan and Klingebiel (2000).
[2] See Gaytán and Johnson (2002) and Demirgüç-Kunt and Detragiache (2005) for comprehensive surveys of the recent empirical literature on banking crises. Some authors have also used qualitative approaches that identify stylized patterns of key bank vulnerability indicators prior to a crisis (e.g., Honohan, 1997).
[3] See Breiman et al. (1984).