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How well do aggregate prudential ratios identify banking system problems?

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ABSTRACT

Aggregate prudential ratios have become a mainstay of financial stability analysis. But how reliable are these indicators when it comes to distinguishing between strong and weak banking systems? We address this issue by analyzing the performance of aggregate prudential ratios in systemic banking crises, drawing upon a large cross-country dataset. We caution against sole reliance on these indicators, and advocate supplementing them with other tools and techniques. Nonetheless, our findings offer evidence that some of the ratios can help identify systemic banking problems.

1. Introduction

Reflecting the high costs of banking crises,[2] banking sector stability has received increased attention in policy discussions in the past two decades. The debate acquired a new level of urgency when banking systems around the world experienced major disruptions in 2007–2009.

An important question in those discussions is how to measure strengths and weaknesses of banking systems, so that problems at the systemic level can be properly identified and addressed. The monitoring and analysis of systemic stability often employs aggregate prudential ratios, such as the banking system capital adequacy ratio (CAR), nonperforming loans (NPLs) to total loans, and return on assets in the banking system. Surveys of financial stability reports published by central banks find that virtually all such reports use aggregate prudential ratios in their financial stability assessment (Čihák, 2006; Oosterloo et al., 2007).[3] The use of such ratios, though less ubiquitous, is also common in academic articles on financial stability, including those in the *Journal of Financial Stability*.[4] For example, Sorge and Virolainen (2006) approximate banking sector soundness in Finland by the (aggregate) ratio of loan-loss provisions to total loans, and estimate the relationship between this variable and a set of macroeconomic and other explanatory variables.

Reflecting on the perceived importance of aggregate prudential ratios, substantial efforts have been devoted on national and international levels to define and compile so-called financial soundness indicators (FSIs). These FSIs are a subset of aggregate prudential ratios aiming to measure soundness of banks and their corporate and household counterparts (Sundararajan et al., 2002).[5]

But what do the aggregate prudential indicators actually indicate? In particular, are these FSIs able to identify instabilities

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[2] According to Hoggarth et al. (2002), banking crises have on average been associated with output losses equivalent to 15–20% of annual GDP.

[3] The surveys also indicate wide variation in the usage of the data (with only a minority of the reports providing the data in a comprehensive table) and in the coverage of individual indicators (with capital adequacy ratios being the most frequently used, and indicators of sensitivity to market risk being the least commonly used).

[4] In a full-text ScienceDirect search of academic articles on financial stability published in 2004–2008 (including those from the *Journal of Financial Stability*), 54% of such articles contained at least one reference to aggregate prudential indicators (excluding theoretical articles and other items without empirical content).

[5] Appendix A provides an overview of the FSIs. International Monetary Fund (2004) provides the detailed FSI definitions. Cross-country data from a coordinated compilation exercise by the IMF and national authorities are available at www.imf.org/external/np/sta/fsi/eng/cce/index.htm.

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of banking systems? In this paper, we attempt to answer these questions. Drawing upon a set of aggregate prudential ratios for 100 developed and developing economies, we present the first econometric analysis of the applicability of these ratios for the identification of banking problems. We employ parametric and nonparametric techniques to establish the extent to which a set of aggregate prudential ratios is able to explain the emergence of a banking crisis. Our paper is the first that systematically uses aggregate prudential ratios to examine whether they are beneficial for the identification of banking crises. Also, unlike most of the existing early warning system literature, the models presented here include indicators that capture information about the soundness of the nonfinancial sector.

To preview our results, we find that certain indicators, such as banks' return on equity and corporate leverage, are useful for the detection of banking system vulnerabilities. We also find that the contemporaneous capital adequacy ratio and the contemporaneous ratio of nonperforming loans to total loans provide warning signals for systemic banking problems.

The paper is structured as follows. Section 2 surveys the literature on models of banking crises. Section 3 describes the dataset, and performs an initial analysis. Section 4 presents the methodological approach and the estimation results. Section 5 concludes.

Table 1
Key descriptive statistics of the sample.

Variable	Mean	Standard deviation	Min	Max
Core set				
Regulatory capital to risk-weighted assets	15.02	6.13	−5.0	65.7
Nonperforming loans to total gross loans	8.34	7.84	0.3	37.9
Nonperforming loans net of provisions to capital	35.43	53.37	−15.3	422.6
Return on equity	15.57	13.72	−78.6	114.8
Encouraged set				
Capital to assets	8.87	4.47	2.0	49.7
Total debt to equity	74.85	47.03	0.4	416.2
Return on equity	9.35	9.52	−18.7	54.1

2. Models of banking crises: literature survey

A substantial body of literature exists on models of banking crises. However, its findings are far from conclusive, highlighting a need for further research. Also, the literature has so far made little use of aggregate prudential ratios such as the FSIs. The following is a brief overview of the models (for details, see Breuer, 2004 or Davis and Karim, 2008).[6]

The so-called first-generation models (e.g., Miskhin, 1978) draw upon the experience of the Great Depression in the United States. They hypothesize that a dire macroeconomic setting adversely affects banks' borrowers and subsequently impacts upon the banks themselves, setting off bank runs that ultimately lead to the closure of financial institutions. Calomiris and Mason (1997), using data from the 1932 Chicago bank panic, analyze contagion effects on other institutions that arise from deposit withdrawals. However, they do not find that such contagion effects lead to insolvency.

Second-generation models focus on depositor behavior and view banking crises as self-fulfilling prophecies or "sunspot" events. Diamond and Dybvig (1983) contend that banking crises are unrelated to the business cycle. Rather, sudden shifts in depositors' expectations can trigger a crisis. By contrast, Gorton (1988) rejects the randomness of bank runs. Using long-term U.S. data, he finds a systematic association between bank runs and recessions that cause depositors to change their perception of risk.

Third-generation models underscore the role of boom and bust cycles in the economy. Gavin and Hausmann (1996) is an example of this type of model. Their findings were corroborated by others, such as Hardy and Pazarbaşioğlu (1998), Demirgüç-Kunt and Detragiache (1998), the European Central Bank (2005), and Wong et al. (forthcoming). Contrary to the second-generation models, banking problems are modeled as arising on the asset side of the institutions. During economic upswings, banks engage in excessive lending against collateral such as real estate and equities that appreciate in value, facilitating a lending boom. A bust results in collapsing asset prices, leading financial institutions to scale back their lending. Ultimately, this translates into an economic slowdown that increases borrower default rates. Third-generation models use predetermined (lagged) macro variables as leading indicators.

Fourth-generation models extend the earlier literature by identifying the features of the institutional environment that set the stage for the build-up of macroeconomic imbalances, which subsequently give rise to banking problems. These models accentuate the roles of bureaucracy, protection of shareholder and creditor rights, rule of law and contract enforcement, sophistication of supervisory and regulatory frameworks, incentive schemes created by deposit insurance, and of the socioeconomic environment (see, e.g., Demirgüç-Kunt and Detragiache, 1998; Hutchinson and McDill, 1999; Eichengreen and Arteta, 2000; Hutchinson, 2002; Buch and DeLong, 2008). Evidence for the impact of the institutional setting on the probability of observing systemic events in banking systems is, however, mixed. While the generous design of deposit insurance schemes tends to destabilize banking systems, in particular if the political setting is insufficiently developed (Demirgüç-Kunt and Detragiache, 2005), Barth et al. (2004), drawing upon a World Bank database for bank regulation and supervision, fall short of providing statistically significant evidence for the hypothesis that a strong regulatory environment bolsters financial soundness. More recent research by Das et al. (2004) finds some evidence that countries with a higher quality of financial sector policies are better able to contain the effects of macroeconomic pressures on the overall level of stress in the financial system.

A rapidly growing body of literature has focused on market-based indicators, such as the distance to default or the subordinated debt spread, as early warning indicators for banking problems on the micro level (e.g., Gropp et al., 2004). An advantage of this approach is that it builds upon forward looking information, contained in market prices. Its key disadvantage is its reliance on market prices derived from liquid markets. This limits its applicability to banking systems for which such information cannot be obtained.

Overall, no clear agreement has yet been reached in the literature on models and indicators for systemic banking problems. One of the remaining issues to be addressed relates to the development of a commonly agreed set of indicators for the build-up of banking system vulnerabilities.

[6] Most of the papers reviewed in this section belong to the early warning systems literature, which focuses on crisis prediction. However, some of the papers, such as Barth et al. (2004), are intended to test hypotheses about the correlates of financial crises, and provide an ex-post assessment.