



Measuring systemic risk: A risk management approach [☆]

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Abstract

This paper proposes a new method to measure and monitor the risk in a banking system. Standard tools that regulators require banks to use for their internal risk management are applied at the level of the banking system to measure the risk of a regulator's portfolio. Using a sample of international banks from 1988 until 2002, I estimate the dynamics and correlations between bank asset portfolios. To obtain measures for the risk of a regulator's portfolio, I model the individual liabilities that the regulator has to each bank as contingent claims on the bank's assets. The portfolio aspect of the regulator's liability is explicitly considered and the methodology allows a comparison of sub-samples from different countries. Correlations, bank asset volatility, and bank capitalization increase for North American and somewhat for European banks, while Japanese banks face deteriorating capital levels. In the sample period, the North American banking system gains stability while the Japanese banking sector becomes more fragile. The expected future liability of the regulator varies substantially over time and is especially high during the Asian crisis starting in 1997. Further analysis shows that the Japanese banks contribute most to the volatility of the regulator's liability at that time.

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Larger and more profitable banks have lower systemic risk and additional equity capital reduces systemic risk only for banks that are constrained by regulatory capital requirements. © 2004 Elsevier B.V. All rights reserved.

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1. Introduction

“Second only to its macrostability responsibilities is the central bank’s responsibility to use its authority and expertise to forestall financial crises (including systemic disturbances in the banking system) and to manage such crises once they occur.”

Alan Greenspan (1997)

As the integration of financial markets progresses rapidly, regulators and supranational agencies become increasingly worried about systemic risk in the banking sector. The main concern is that the simultaneous failure of several banks would result in a severe economic crisis. The impact of such a banking crisis on the economy can be substantial, as past experiences have shown. Hoggarth et al. (2002), for example, find that output falls by an average of 15–20% of GDP during banking crisis periods. Despite these concerns about system wide problems capital requirements, auditing policies, and deposit insurance premiums do not consider bank interdependencies. Current bank regulation is specified at the individual bank level. The idea behind the current regulatory framework is that there is little risk for the banking system as a whole as long as the default risk of individual banks is low. Even regulators themselves doubt this and try to push bank supervision more towards a system-wide or macroprudential framework.¹ During the last years, bank supervisors also forced banks to implement more advanced risk management systems. When a bank assesses the risk of its investment portfolio, it should not only look at the risk of individual exposures but also account for correlations of the exposures. Banks are also forced to be adequately capitalized to survive a major economic shock. Regulators, in contrast, have not implemented this portfolio perspective at the level of the banking system. They do not see the banks under their jurisdiction as portfolio, consider correlations between them, and the ideas and tools of modern risk management have not found their way into prudential bank supervision. This paper closes this gap and attempts to measure risk at the level of the banking system rather than at the level of individual banks using standard tools of modern risk management similar to those applied by major banks.

Following Merton (1974), I interpret equity as a call option on a bank’s assets. Using a time series of observed equity prices and balance sheet information, I back out the market value of a bank’s asset portfolio and its associated dynamics. Three key input parameters of this asset process are essential to estimate the risk of a bank-

¹ See e.g. Borio (2003).

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