Chapter 9
Measuring and Charging for Banks’ Systemic Interconnectedness

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ABSTRACT
Generalized calls for more and higher quality capital for systemic institutions were the first natural reaction to the recent global financial crisis. Although the introduction of systemic risk-based capital surcharges is a proposal that has gained acceptance, its design still faces important challenges—including how to measure systemic risk, avoid the surcharges’ procyclicality, and cross-border coordination. This chapter contributes to the debate on the merits and operationalization of systemic risk-based capital surcharges by presenting two methodologies for computing surcharges based on an institution's contribution to systemic risk. The chapter also illustrates ways to lessen their procyclicality. The authors conclude discussing practical cross-border, data, and communication issues for an effective implementation of systemic capital surcharges.

INTRODUCTION AND LITERATURE REVIEW
Generalized calls for more and higher quality capital were the first natural reaction to the crisis, and in time, these calls have been shaped into more concrete proposals. Although the introduction of systemic risk-based capital surcharges is a proposal that has gained acceptance, their specific design is still under development and several challenges for their effective operationalization remain a concern (cf. Bank of England, 2009; Espinosa-Vega, Solé, & Kahn, 2010, for two early examples of how to operationalize this concept).

Because systemic risk externalities spread through the complex web of contract relationships across financial institutions, we require a practical way to estimate institutions’ intercon-
nectedness and their corresponding contribution to systemic risk\(^1\). In addition, systemic risk-based capital surcharges, like most capital charges, have the potential of being procyclical, as they will increase in economic downturns (when systemic risk is likely to be higher) and decrease during booms (when systemic risk is likely to subside).

In July 2011, the Basel Committee on Banking Supervision (BCBS) issued an indicators-based methodology to determine capital surcharges for globally systemic banks. The Committee’s proposed approach is an attempt to capture defining characteristics of systemically important institutions (i.e., size, inter-connectedness, and substitutability, as discussed in FSB-IMF-BIS, 2009) while keeping modeling complexity to a minimum. Notwithstanding, this worthy effort could be complemented with recent research on systemic risk measurement (e.g., financial network modeling, CoVaR, and marginal expected shortfall among others) rapidly becoming mainstream in financial stability analysis. For example, the BCBS approach focuses on the aggregate inter-bank exposures and not on their detailed distribution. Therefore, the BCBS methodology is unable to assess the relative systemic contribution of specific interbank links and, thus, unable to design surcharges according to an institution’s marginal contribution to systemic risk.

This chapter contributes to the debate on the merits and feasibility of systemic risk-based capital surcharges by presenting two approaches of a network methodology. Admittedly, some of the data and modeling requirements of our methodology may limit its straightforward inclusion into the day-to-day prudential regulatory repertoire—at least in its initial stages. An additional concern voiced by many is the procyclicality imbedded in capital requirements and their pernicious effects in the real economy. With this consideration in mind, the chapter also illustrates a way to smooth the new capital surcharges through time hence lessening their potential degree of procyclical-

1. Tracking financial institutions’ portfolios through the credit cycle.
2. Estimating each institution’s spillover effects following a stress event, at each point in the cycle—based on network analysis.
3. Computing capital surcharges as a function of an institution’s systemic risk profile according to two alternative approaches: a ‘Standardized’ Approach (SA) and a more refined approach that borrows from the risk management literature and that is dubbed a ‘Risk-Budgeting’ Approach (RBA).
4. A smoothing technique is applied to the RBA to lessen its procyclical profile.

To demonstrate these ideas and their insight, every step of the proposed methodology is illustrated by means of simulations.

There have been other approaches to measure systemic risk contributions. For example, Tarashev \textit{et al.} (2009, 2010) and Drehmann and Tarashev (2010) apply a well-known measure in cooperative game theory, the Shapley value, to estimate banks contribution to systemic risk. These papers conclude that alternative interbank linkages structures will give rise to different levels of systemic risk. These papers also suggest the need to take into account the interbank network structure to properly assess the systemic importance of different financial institutions. These papers, however, stop short of deriving capital surcharges based on marginal systemic risk. Gauthier \textit{et al.} (2010, 2011) compare different techniques for assigning systemic risk-based capital requirements under different network structures. They conclude that proxies of systemic importance based only on size, abstracting form the specific structure of the banking network, could be misleading. In Gauthier \textit{et al.} (2010), they exploit Canadian banking system data to show that the implementation of systemic...