

Risk Management By Michel Crouhy, Dan Galai and Robert Mark

Risk Management represents the consolidation of the entire financial risk management field—policies, methodologies, data, and technological infrastructure. The authors (two bank risk managers and one academic) are respected experts in the field who have broad experience across banking, corporate and academic risk management. Over seventeen chapters, the authors tackle: risk management history, regulation, the structuring of a bank's risk management function, the Bank of International Settlements (BIS) capital requirements (the "Basle Accord"), market risk and Value-at-Risk (VaR) measures, credit ratings, credit risk, hedging, operational risk, capital management, model risk, risk management in nonbank corporations, and the future of risk management. The depth of coverage is extensive, as they aim to be a new industry standard reference. By all accounts, they have succeeded admirably. It is quite a broad spectrum, so this review will focus on four major "sections": History and Regulation, Market Risk, Credit Risk, and Other Risk.

History and Regulation (Chapters 1-4). Chapter 1 presents the evolution of financial risk management from foreign currency futures to credit derivatives, as well as regulatory and academic advances. The authors highlight the impact of the well-known CAPM and Black-Scholes models, both of which originated in academia but went on to have significant impact on markets. Section 1.7 provides an overview of the typology of risk management. Chapter 2 covers the new era of regulation. It explains the policies of the Group of 30 (G-30), the 1988 BIS (Basle) Accord, and 1996 and 2000 amendments. These established the framework for regulatory, risk-based capital requirements. The 2000 amendment introduced the concept of the "three pillars": minimum capital requirements, supervisory review process, and market discipline requirements. Chapter 3 recommends an approach for structuring and managing a risk management function in compliance with the "three pillars." It provides details on risk limits, data collection and infrastructure, audit, and transfer pricing—a means of allocating capital costs.

Chapter 4 should make actuaries interested in enterprise risk management jump for joy. It explores the implications of the Basel Accord's two-tiered approach to capital requirements. Banks are subject to either the "standardized" or "internal model" approach. The authors show that banks subject to standardized may be at a significant competitive disadvantage. To quote from page 137, "Ideally, this competitive disadvantage should encourage banks to invest in more sophisticated methodologies in order to reap the benefits of lower regulatory capital. This 'carrot and stick' approach associated with BIS 98 is one of its most powerful features." One can only imagine future insurance regulators and rating agencies requiring *less* capital for insurers who have an internal risk model.

Market Risk (Chapters 5-6). Chapter 5 lays out the fundamentals of Value-at-Risk or "VaR". VaR is defined as the answer to the question, "How much can I lose on my portfolio over a given period of time?" Actuaries should be familiar with the concept, since it is essentially a selected quantile of the return distribution. The authors lay out the major decision points on VaR calculation, in particular analytic or simulation, parametric

or non-parametric. Table 5.10 summarizes the pros and cons of each variation on these approaches.

Chapter 6 extends VaR for critical items such as Incremental- and Delta-VaR, stress testing, scenario analysis, long time horizons, confidence intervals, and extreme VaR. Those actuaries familiar with the debates over insurance risk measures and capital allocation will see many parallels in the formulas for Delta-VaR. Section 7, “Limitations of VaR as a Risk Measure,” includes discussions of favorite topics like sub-additivity as well.

Credit Risk (Chapters 7-12). Chapter 7 gives broad coverage of credit ratings and the rating agencies, default probabilities, and rating transition. It also documents the decision bases for ratings, both financial and non-financial. Chapter 8 delves further into the credit migration approach to measuring credit risk. It presents several detailed examples of default calculations based on the CreditMetrics™ approach, based on transition matrices—tables of probabilities of entities with a given current rating moving to the various other ratings.

Chapter 9 then covers the famous Merton model of default, and the Moody’s KMV software that implements this approach. Actuaries should really take to the Merton model, as it defines default probability in terms of the distribution of a firm’s equity value. Basically, default is assumed to occur when equity value hits zero. Given a firm’s current equity value, an estimate of its volatility, and an assumed distributional form (typically Log-normal), one can calculate the implied default probability. Chapter 10 presents the famous “actuarial approach” as represented by the CreditRisk+ software product. The so-called actuarial approach is essentially the collective risk model for default losses, where default is the equivalent of claims, and “loss given default” is the equivalent of severity. For the credit risk practitioner, Chapter 11 compares industry-sponsored credit models—CreditMetrics, CreditPortfolioView, Moody’s KMV, and CreditRisk+, and the so-called reduced-form models. The credit risk coverage concludes with Chapter 12 on hedging credit risk. This involves traditional techniques of “credit enhancement,” including such things as collateralization, netting, and letters of credit. It also goes into the tremendous innovations in credit derivatives, such as credit default swaps, total return swaps, credit-linked notes, and spread options. Section 6 gives details of securitization of loans and high-yield bonds via collateralized loan (or debt) obligations—“CLO’s and CDO’s.”

Other Risk (Chapters 13-17). The first of these “other risks” is operational risk. Chapter 13 explains the imperatives for sound operational risk management in banking. Actuaries should take note of the acknowledged dearth of quantification techniques and models for operational risk. It is an area where the “actuarial approach” is very well suited. Following this is Chapter 14 on “Capital Allocation and Performance Measurement,” certainly a topic with which actuaries can relate. Risk-adjusted return on capital, or “RAROC,” is explored in some detail. The banking application of this approach has had a dramatic impact on banking practices, risk assessment, and policy decisions. Here again,

actuaries should feel familiar with the conceptual framework, as (apart from terminology differences) it is akin to insurance.

Chapter 15 introduces “Model Risk,” a risk source unfamiliar to most actuaries—for now. The text explains the many facets of model risk, from mis-specification to calculation error, faulty parameterization and calibration to lack of adequate peer review. For complex—and new—financial products, the valuation models are the backbone of both risk management and financial reporting. Adequate testing of complex models is also increasingly difficult, as any actuary involved in DFA model development can attest.

Chapters 16 and 17 provide high-level overviews of risk management at non-financial companies (a topic better covered in many other sources) and the future of risk management in banking. This last chapter provides a compelling picture of the “fully risk-enabled bank” that has the infrastructure, systems, and processes to capture, process and disseminate risk management information in near-real time.

Overall, Risk Management delivers on its goal: providing solid, in-depth coverage of the essentials of the financial risk management field.