WILEY FINANCE

OPERATIONAL RISK TOWARD BASEL III

Best Practices and Issues in Modeling, Management, and Regulation

GREG N. GREGORIOU, Editor

Operational Risk toward Basel III

Best Practices and Issues in Modeling, Management, and Regulation

GREG N. GREGORIOU

WILEY
John Wiley & Sons, Inc.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993, or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic formats. For more information about Wiley products, visit our Web site at www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Operational risk toward Basel III : best practices and issues in modeling, management, and regulation / [edited by] Greg N. Gregoriou.
p. cm. — (Wiley finance series)
ISBN 978-0-470-39014-6 (cloth)
1. Banks and banking, International—Risk management. 2. Bank capital—Mathematical models. 3. Financial risk management—Mathematical models. I. Gregoriou, Greg N., 1956–
HG3881.O58 2009
332.1068′1—dc22

2008038661

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

Operational Risk toward Basel III

Founded in 1807, John Wiley & Sons is the oldest independent publishing company in the United States. With offices in North America, Europe, Australia, and Asia, Wiley is globally committed to developing and marketing print and electronic products and services for our customers' professional and personal knowledge and understanding.

The Wiley Finance series contains books written specifically for finance and investment professionals as well as sophisticated individual investors and their financial advisors. Book topics range from portfolio management to e-commerce, risk management, financial engineering, valuation, and financial instrument analysis, as well as much more.

For a list of available titles, visit our Web site at www.WileyFinance.com.

Foreword

This is an important book, and it is published at just the right time. I have accepted with great pleasure the invitation to write the Foreword for Greg Gregoriou's new volume on operational risk, but I had not anticipated that it would allow me to reflect on the concurrent unfolding of the disastrous September events. As one financial institution after another is failing or is subjected to an emergency sale, we start to comprehend that the basic rules of banking are in the process of being fundamentally redefined. A significant fallout for the real economy is by now more than likely, and the resulting political tremors will have a potentially decisive impact on the November elections. The reported loss figures are staggering and of almost incomprehensive magnitude for the average citizen. The rescue of the German IKB has, for instance, led to accumulated losses of 9 billion euros so far, an amount that is equivalent to an extra burden of approximately 300 euros for every taxpayer. Hundreds of billions of dollars need to be committed as part of the U.S. government's bailout program, translating into a still-unknown cost for the U.S. taxpayer.

While the crisis is clearly of a systemic nature, its ultimate source lies with the notoriously myopic behavior of the banking community and, as some commentators have argued, is the outcome of collective greed. Bankers have increasingly viewed their careers as long call options that, in the worst case, could force them into a lengthy retirement in a lavish country home. The investor community valued the extraordinary returns and forced the banking community into a prisoner's dilemma where playing the transaction game became a dominant strategy for everybody involved. Betting the bank by taking on excessive liquidity risk exposures was ultimately acceptable because the buildup of counterparty risk made a governmental bailout all the more likely. Industry insiders have warned for quite some time that credit volume growth far exceeding economic growth has historically always led to some form of a financial crisis. Without question, it is particularly worrisome that the whole problem did not appear on the radar of regulatory authorities until it was too late.

The subprime crisis and its fallout in financial markets as well as the real economy will trigger far-reaching regulatory reforms and should also lead to a toughening of the penalty structure for bankers in charge of running complex financial market operations. It, however, also requires institutional efforts by banks to reexamine and strengthen their approaches to risk management. Trading and credit risk management systems must obviously be extended to capture liquidity risk exposures. Financial institutions must, however, also reevaluate the way they are dealing with operational risks in order to impose checks and balances on the bankers' irrational ignorance of the aforementioned prisoner's dilemma problem. It will require changes in the governance structures and the development of adequate back-office systems.

We are still in the early stages of developing a sound understanding of operational risk management. Hence, there is still considerable scope for academics to make valuable contributions with their ongoing research. Greg Gregoriou's new book helps to fill this knowledge gap and does so in a very timely fashion. It provides a comprehensive coverage of this exciting field, ranging from quantitative and qualitative risk measurement approaches to risk mitigation and regulatory implications. The edited volume includes American as well as European viewpoints and brings together academics as well as practitioners. The 23 chapters in total cover a lot of ground and give readers an in-depth overview of the current state of the art in operational risk management. While the contributors could not fully predict recent events, their contributions are nevertheless strongly influenced by the financial market woes of the past 14 months. This volume will therefore shape the discussion on how to better shield financial institutions against operational breakdown in future years.

—ULRICH HOMMEL, PH.D.
Professor of Corporate Finance and Director of the Strategic Finance Institute (SFI), European Business School (EBS), International University, Oestrich-Winkel, Germany
September 2008

About the Editor

A native of Montreal, Dr. Gregoriou obtained his joint PhD at the University of Quebec at Montreal in Finance, which merges the resources of Montreal's four major universities (McGill University, Concordia University, and HEC-Montreal). He has written over 50 articles on hedge funds and managed futures in various peer-reviewed publications. His articles have appeared in the *Journal of Portfolio Management*, *Journal of Futures Markets*, *European Journal of Operational Research*, *Annals of Operations Research*, and others. In addition to a multitude of publications with a variety of publishers, Gregoriou is author of the Wiley books *Stock Market Liquidity*; *International Corporate Governance After Sarbanes-Oxley*; *Commodity Trading Advisors*; *Hedge Funds: Insights in Performance Measurement, Risk Analysis, and Portfolio Allocation*; and *Evaluating Hedge Fund and CTA Performance*.

Professor Gregoriou is hedge fund editor and editorial board member for the *Journal of Derivatives and Hedge Funds*, as well as editorial board member for the *Journal of Wealth Management*, the *Journal of Risk Management in Financial Institutions*, and the *Brazilian Business Review*. Professor Gregoriou's interests focus on hedge funds and managed futures.

Acknowledgments

I would like to thank Jennifer MacDonald, Bill Falloon, and Laura Walsh at John Wiley & Sons for their immense help. I am also deeply indebted to Dr. Georges Hübner, Deloitte Professor of Financial Management in the Department of Accounting, Finance and Law, HEC Management School–University of Liège, for his comments and valuable suggestions, and also thank Jean-Philippe Peters, manager at Deloitte Luxembourg S.A. Finally, I thank the handful of anonymous referees who assisted in the selection and review process of the chapters in this text. Neither the editor nor the publisher is responsible for the accuracy of each individual chapter.

GREG N. GREGORIOU

About the Contributors

Marco Bee is Assistant Professor in Economic Statistics at the University of Trento (Italy). After spending one year as a visiting scholar at the Department of Mathematics of the Indiana University and receiving a PhD in Mathematical Statistics from the University of Trento in 1998 he has held positions at the Risk Management department of Banca Intesa in Milan from 1999 to 2005. His current research interests focus on quantitative risk management and computational statistics.

Keith H. Black serves as an associate at Ennis Knupp + Associates. He is a member of the firm's opportunistic strategies group, which advises foundations, endowments, and pension funds on their asset allocation and manager selection strategies in the alternative investment space. His prior professional experience includes commodities derivatives trading at First Chicago Capital Markets, stock options research and CBOE market-making for Hull Trading Company, and building stock selection models for mutual funds and hedge funds for Chicago Investment Analytics. He has also served as a research consultant to an equity brokerage firm and a hedge fund marketing firm. Mr. Black contributes regularly to *The CFA Digest*, and has published in *the Journal of Global Financial Markets, the Journal of Trading, the Journal of Financial Compliance and Regulation,* and *Derivatives Use Trading and Regulation.* He is the author of *Managing a Hedge Fund,* which was named to the list of the top 10 books of 2005 by the *Financial Engineering News.* He has been quoted over 50 times on hedge fund and equity market topics in the print and broadcast media, including the *Financial Times, Chicago Tribune, CFA Magazine, Pensions and Investments*, NPR, Fox, and NBC. Mr. Black previously served as an assistant professor at the Illinois Institute of Technology, where he taught a variety of courses in portfolio management and alternative investments, including equity valuation, hedge funds, and enterprise formation and finance. Mr. Black earned a BA from Whittier College in Economics and Mathematics/Computer Science as well as an MBA in Finance and Operations Research from Carnegie Mellon University. He has earned the Chartered Financial Analyst (CFA) and the Chartered Alternative Investment Analyst (CAIA) designations. He serves as a member of the CFA Institute's Retained Speakers Bureau, where he is regularly invited to present to CFA Society members worldwide on topics related to alternative investments.

Klaus Böcker is Senior Risk Controller at UniCredit Group. In this capacity, one of his primary responsibilities is overseeing all quantitative aspects of UniCredit Group's economic capital model. He studied theoretical physics at the Munich University of Technology. His main research interest is quantitative finance with special focus on risk integration and operational risk. Mr. Böcker published several papers in *Risk Magazine* and the *Journal of Risk*, and together with his coauthor, Claudia Klüppelberg, he recently received the 2007 New Frontiers in Risk Management Award of the PRMIA Institute for their research paper entitled "Multivariate Models for Operational Risk."

Silke N. Brandts is currently head of innovation and consulting management for transaction banking at DZ BANK in Frankfurt, Germany. Previously she was Project Manager at Bain & Company, Germany, in the financial service practice. She obtained her doctorate at the graduate program Finance and Monetary Economics at the Johann Wolfgang Goethe-Universität Frankfurt, Germany, after having pursued her Master's degree in Economics at the Universities of Bonn, Germany, and University of California, Berkeley.

Nicole Branger is currently Professor for Derivatives and Financial Engineering at the Westfälische Wilhelms-Universität Münster. Previously she held positions as Associate Professor at the University of Southern Denmark, Odense, as Visiting Professor of Management at the Owen Graduate School of Management, Vanderbilt University, United States, and as Assistant Professor at the Johann Wolfgang Goethe-Universität Frankfurt, Germany. She obtained her doctorate as well as her Master's in Industrial Engineering and Management at the University of Karlsruhe, Germany.

Tyrone M. Carlin is Professor and Dean of Law at Macquarie University and holds concurrent posting as Professor of Management at Macquarie Graduate School of Management. His research is concentrated in the areas of corporate governance and corporate financial reporting. He has published more than 100 articles in his fields of interest and is coeditor of the *Journal of Law & Financial Management* and the *Journal of Applied Research in Accounting and Finance*.

Simona Cosma is Researcher of Financial Institutions and Lecturer in Financial Institutions Management at the University of Salento (Italy). She holds a PhD in Banking and Finance from the University of Rome "Tor Vergata." Her research interests and publications include risk management and bank organization and marketing. She has been also coordinator and lecturer in professional training courses for banks, and she also acted as a consultant for the Italian Bankers' Association.

Carolyn Vernita Currie is a member of the Association of Certified Practising Accountants, the Chartered Secretaries Association, and a fellow of Finsia, a merger of the Australian Institute of Banking and Finance and the Securities Institute. She has almost four decades of experience in the public and private sector, as a merchant banker, regulator, internal auditor, and financial trainer. For the last 15 years she has been a Senior Lecturer in Financial Services at the University of Technology Sydney (UTS) as well as Managing Director of her own consulting company and several private investment companies.

Magali Dubosson is Dean of the Economics and Management Department of the Geneva School of Business Administration (HEG-Genève). She is a marketing professor at HEG Genève and also lecturer at EPFL, Essec Management Education Paris and at Ecole des Ponts et Chaussées Paris (AFT-IFTIM). She got her Master's degree in International Management and her PhD at HEC, University of Lausanne. Her main research interests are the pricing of services, customer service, and business models.

Giuseppe Espa is Professor in Economic Statistics at the University of Trento (Italy). In 1995 he received a PhD in Statistics from the University of Rome "La Sapienza." From 1994 to 2001 he was assistant professor and from 2001 to 2006 associate professor in economic statistics. He has been working with the Italian National Statistical Office (Istat), the Italian National Research Council (CNR), and the College of Europe. His main research interests concern spatial econometrics and applied statistics.

John Evans holds a PhD from the University of Illinois. He is currently a Professor and Pro Vice Chancellor of Curtin University in Miri, Sarawak. He is a well-experienced academic with a corporate finance background, and he is well published in internationally refereed journals in financial economics and corporate finance.

Dean Fantazzini is a Lecturer in econometrics and finance at the Moscow School of Economics—Moscow State University. He graduated with honors from the Department of Economics at the University of Bologna (Italy) in 1999. He obtained a Master's in Financial and Insurance Investments at the Department of Statistics—University of Bologna (Italy) in 2000 and a PhD in Economics in 2006 at the Department of Economics and Quantitative Methods, University of Pavia (Italy). Before joining the Moscow School of Economics, he was a research fellow at the Chair for Economics and

Econometrics, University of Konstanz (Germany) and at the Department of Statistics and Applied Economics, University of Pavia (Italy). He is a specialist in time series analysis, financial econometrics, multivariate dependence in finance, and economics with more than 20 publications.

Nigel Finch is a lecturer in Management at the Macquarie Graduate School of Management, specializing in the areas of managerial accounting and financial management. His research interests are in the areas of accounting and management decision making, finance and investment management, and financial services management. Prior to joining Macquarie Graduate School of Management, Mr. Finch worked as a financial controller for both public and private companies operating in the manufacturing, entertainment, media, and financial services industries. Subsequently he worked as an investment manager specializing in Australian growth stocks for institutional investment funds.

Guy Ford is Associate Professor of Management at Macquarie Graduate School of Management, where he teaches in the areas of financial management, corporate acquisitions, corporate reconstructions, and financial institutions management. Formerly of the Treasury Risk Management Division of the Commonwealth Bank of Australia, he has published refereed research papers in a range of Australian and international journals and is the coauthor of two books, *Financial Markets & Institutions in Australia* and *Readings in Financial Institutions Management.* He is a founding coeditor of the *Journal of Law and Financial Management.*

Emmanuel Fragnière, CIA (Certified Internal Auditor), is a professor of service management at the Haute Ecole de Gestion of Geneva, Switzerland. He is also a lecturer at the Management School of the University of Bath, UK. He specializes in energy, environmental, and financial risk. He has published several papers in academic journals such as *Annals of Operations Research, Environmental Modeling and Assessment, Interfaces,* and *Management Science.*

Giampaolo Gabbi is Professor of Financial Markets and Risk Management at the University of Siena, Italy, and Professor SDA Bocconi Milan, where he coordinates several executive courses on financial forecasting and risk management. He coordinates the McS in Finance at the University of Siena and is also head of the Master's in Economics at the same university. Professor Gabbi holds a PhD in Banking and Corporate Management. He has published many books and articles in refereed journals, including *Managerial Finance*, the *European Journal of Finance*, and the *Journal of Economic Dynamics and Control.*

Andrea Giacomelli is Professor of Contract in Risk Management at the Ca' Foscari University of Venice, is collaborating with GRETA Consulting (a division of Ca' Foscari FR s.r.l.), and is a partner in Financial Innovations, an Italian consulting firm specialized in risk management. He holds a degree from the Ca' Foscari University of Venice (Laurea in Economics). His research interests are in risk measurement and management, pricing of assets subjected to credit risk, credit scoring models, back-testing of rating systems, statistical analysis of subjective information, Bayesian networks, and econometrics. His main advisory experiences concern the development of credit rating systems and the development of approaches for the subjective analysis of risks. He teaches risk management in the International Master's in Economics and Finance program and Market and Credit Risk in the undergraduate program, and he is one of the local organizers of the CREDIT conference in Venice.

Werner Gleissner is currently the CEO of FutureValue Group AG and a Managing Director of RMCE RiskCon GmbH. The author of more than 100 articles and more than a dozen books, his current research and development activities and projects focus on risk management, rating, strategy development, the development of methods for aggregating risks, value-based management valuation, decision making under uncertainty, and imperfect capital markets. Dr. Werner lectures at various universities in the field of rating, risk management, value-based management, and entrepreneurship. Dr. Werner is also the editor of the well-known loose-leaf series on corporate risk management ("Risikomanagement im Unternehmen"). He holds a degree as a commercial engineer equivalent to a Master's in Business Engineering and a PhD in Economics and Econometrics, both from the University of Karlsruhe, Germany.

Duc Pham-Hi, PhD, is Professor of Computational Finance at ECE Graduate School of Engineering in Paris, France, and Partner at R2M-Analytics. Formerly Senior Attaché at French Commission Bancaire, member of the European Union's CEBS Op Risk working group, and Basel Accord Implementation Group on Op risk (AIGOR), he was previously proprietary trader at Natexis Banque, then director at PriceWaterhouseCoopers.

Georges Hübner, PhD, INSEAD, is the Deloitte Professor of Financial Management and cochair of the Finance Department at HEC Management School of the University of Liège. He is Associate Professor of Finance at Maastricht University and Academic Expert at the Luxembourg School of Finance, University of Luxembourg. He is also the founder and CEO of Gambit Financial Solutions, a financial software spin-off company of the University of Liège. Dr. Hübner has taught at the executive and postgraduate levels in several countries in Europe, North America, Africa, and Asia. He regularly provides executive training seminars for the preparation of the GARP (Global Association of Risk Professionals) and CAIA (Chartered Alternative Investment Analyst) certifications. His research articles have been published in leading scientific journals, including *Journal of Banking and Finance, Journal of Empirical Finance, Review of Finance, Financial Management,* and *Journal of Portfolio Management.* Dr. Hübner was the recipient of the prestigious 2002 Iddo Sarnat Award for the best paper published in the *Journal of Banking and Finance* in 2001. He is also corecipient of the Operational Risk & Compliance Achievement Award 2006 in the best academic paper category.

Andreas A. Jobst is a midcareer economist at the Monetary and Capital Markets Department (MCM) of the International Monetary Fund (IMF) in Washington, DC. His research focuses on structured finance, risk management, sovereign debt management, financial regulation, and time series econometrics. He previously worked at the Division for Insurance and Research at the Federal Deposit Insurance Corporation (FDIC), the Deutsche Bundesbank, the Center for Financial Studies (CFS) in Frankfurt/Main, the European Central Bank (ECB), the Bank of England, the Comisión Económica para América Latina y el Caribe (CEPAL) of the United Nations, the European Securitization Group of Deutsche Bank, and the Boston Consulting Group (BCG). Mr. Jobst holds a PhD in Finance from the London School of Economics (LSE). He was also educated in Oxford, Cambridge, Leicester, and Maryland. Dr. Jobst is a regular speaker at professional and academic conferences on risk management and structured finance. His most recent research was published in *Derivatives Use, Trading & Regulation, Journal of Derivatives and Hedge Funds, Managerial Finance, International Journal of Emerging Markets, Journal of Banking Regulation, Journal of Structured Finance, International Journal of Banking Law and Regulation, Journal of Operational Risk, Journal of Financial Regulation and Compliance, The Securitization Conduit, Operational Risk & Compliance*, and *Euromoney*. He has also been one of the authors of the *Global Financial Stability Report* published by the Monetary and Capital Markets Department of the International Monetary Fund (2005–2007).

Meredith A. Jones is Director of Market Research at Strategic Financial Solutions, LLC, a software company founded in 1996 whose mission is to provide solutions relating to the technological needs of the financial industry. She is responsible for researching, speaking, and writing about alternative and traditional investments as well as developing and implementing marketing initiatives and strategic partnerships for SFS. She has written articles for a number of financial publications, including the *Journal of the Alternative*

Investment Management Association, Alternative Investment Quarterly, the Investment Management Consultants Association's *Monitor*, and the Managed Funds Association *Reporter*. Her research has appeared in the *Wall Street Journal, Bloomberg Wealth Manager, Hedge Fund Alert, Infovest 21*, and other publications. Prior to joining SFS, Ms. Jones was Vice President and Director of Research for Van Hedge Fund Advisors International, Inc., a global hedge fund consultant with $500 million under management. There she led a staff of 10 research analysts in manager selection, evaluation, and ongoing monitoring. Ms. Jones conducted quantitative and qualitative due diligence, on-site visits and portfolio construction, as well as a number of other research functions.

Claudia Klüppelberg holds the Chair of Mathematical Statistics at the Center for Mathematical Sciences of the Munich University of Technology. She has held positions at the University of Mannheim and in the Insurance Mathematics group of the Department Mathematik at ETH Zurich. Her research interests combine applied probability and statistics with special application to finance and insurance risk processes. She is an Elected Fellow of the Institute of Mathematical Statistics, a member of the Editorial Board of the Springer Finance book series, and associate editor of several scientific journals. Besides numerous publications in scientific journals, Dr. Klüppelberg coauthored the book *Modelling Extremal Events for Insurance and Finance* (Springer 1997) with P. Embrechts and T. Mikosch.

K. Ahmet Köse is Associate Professor in the Business Administration School of Istanbul University in Istanbul, Turkey. He received his PhD and Master's degree in Finance from Istanbul University and was at the University of Illinois as a visiting scholar. His main interests are corporate finance and capital markets. His papers have been published in the *Journal of Business Administration, International Journal of Business Management and Economics*, and other journals. He served as the editor of *Journal of Business* in the B-School at Istanbul University and was vice-director of the Social Sciences Institute. He is a member of the Society of Certified Public Accountants of Istanbul. He is also a part-time adviser of a leading company in the Turkish Logistics industry.

Kimberly D. Krawiec is a Professor of Law at the University of North Carolina and has taught at many other law schools, including Harvard, Virginia, and Northwestern. She teaches courses in securities, corporate, and derivatives law. Professor Krawiec's research interests span a variety of fields, including the empirical analysis of contract disputes; the choice of organizational form by professional service firms, including law firms; banned commercial exchanges; corporate compliance systems; insider trading; derivatives hedging practices; and "rogue" trading. Prior to joining academia, she was a member of the Commodity & Derivatives Group at the New York office of Sullivan & Cromwell. Professor Krawiec has served as a commentator for the Central European and Eurasian Law Initiative (CEELI) of the American Bar Association and on the faculty of the National Association of Securities Dealers Institute for Professional Development at the Wharton School of Business. Representative recent publications include: "Common-law Disclosure Duties and the Sin of Omission: Testing the Meta-theories" (with K. Zeiler), 91 VA. L. REV. 1795 (2005); "Organizational Misconduct: Beyond the Principal-Agent Model," 32 FL. ST. L. REV. 571 (2005); "The Economics of Limited Liability: An Empirical Study of New York Law Firms" (with S. Baker), 2005 U. ILL. L. REV. 107 (2005); "Cosmetic Compliance and the Failure of Negotiated Governance," 81 WASH. U. L. Q. 487 (2003); and "Accounting for Greed: Unraveling the Rogue Trader Mystery," 72 OR. L. REV. 301 (2000).

Wilhelm K. Kross is currently Senior Vice President at Marsh GmbH, Germany, with previous working experience in Africa and North America. He holds a postgraduate degree in engineering from RWTH Aachen, Germany, an executive MBA from Athabasca University, Canada, and a PhD in Finance from the European Business School (EBS) International University, Germany. He is a recognized expert in the fields of project and risk management and is the author of numerous publications, including *Organized Opportunities: Risk Management in Financial Services Operations* (Wiley, 2006).

María Dolores Martínez Miranda is Associate Professor at the Faculty of Sciences in the University of Granada (Spain). She received her PhD in Mathematics from the University of Granada in 2000. Her current research interests include nonparametric density and regression estimation, mixed-effects model, and survey sampling.

Jens Perch Nielsen is Professor of Actuarial Statistics at Cass Business School, London, and CEO of the Danish-based knowledge company Festina Lente. He holds a degree in actuarial science from Copenhagen and in statistics from UC-Berkeley. He is former research director of Royal@SunAlliance with responsibilities in life as well as in non-life insurance. He is coauthor of about 50 scientific papers in journals of actuarial science, econometrics, and statistics.

Loriana Pelizzon is Associate Professor of Economics at the Ca' Foscari University of Venice. She graduated from the London Business School with a PhD in Finance. She also holds a degree from the University of Venice (Laurea in Business Administration). She was Assistant Professor in