
ANTICIPATING THE UNTHINKABLE: THE ADEQUACY
OF RISK MANAGEMENT IN FINANCE AND
ENVIRONMENTAL STUDIES

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INTRODUCTION

The purpose of this Article is to consider the role of risk management in the current financial crisis. In general, risk management is the practice of assessing and identifying the different kinds of risks facing a person, an institution, or society because of its activities and environment, determining the likelihood of losses and other consequences from those risks, and taking appropriate actions, which include monitoring the risks and reducing the losses and other consequences from them. In financial institutions, financial risk managers, who are part of a risk-management department or group, are generally charged with assessing and measuring the risks facing the financial institution as a result of its activities and the business environment, monitoring the risks for any change, determining whether the institution has the resources to deal with the risks, alerting senior managers and boards of directors about the risk information, and suggesting courses of action for the institution to take to deal with the risks.

My argument is that risk management in systemically important financial institutions failed, which contributed to the recent collapse of the financial system. For a number of reasons that I shall explore below, risk management did not fulfill its purpose, which was to prevent financial institutions from suffering the kinds of losses that they experienced in the crisis. This Article identifies these risk-management failings and offers remedies to them.

At times, environmental risk management, which deals with extreme environmental risks such as global warming,¹ inspires my

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1. Global warming is the steady increase in the ambient temperature that has been occurring since the Industrial Revolution and has accelerated at the end of the last century into our current one. It is due primarily, but in a complex way, to human activities that have increased carbon dioxide in the

discussion of financial risk management. For example, as discussed below, environmental risk management emphasizes the importance of “tail risk[s],”² which constitute a cascade of bad events—a phenomenon that financial risk management did not adequately account for before the crisis. In addition, the failings of financial risk management may provide lessons for environmental risk management. That is, since the financial crisis is upon us, risk management problems that contributed to it can be identified and studied. It might thus be possible to identify aspects of risk management, such as the relationship between risk managers and senior decision makers, that prevented its practitioners from fulfilling their role of seeing an approaching crisis and taking appropriate action (or persuading others to do so) to deal with it. Understanding risk-management failings in a real-world setting may provide guidance to environmental risk management, which faces similar problems in its relationship with political decision makers.

This Article proceeds as follows. Part I briefly identifies the financial crisis. Part II then discusses the practice of risk management in financial institutions and identifies its failings as revealed by the financial crisis. These failings include problems in risk management modeling, questions about the reliability of the models themselves, failures to supplement models with other risk management approaches, governance problems in financial firms regarding risk management, and imperfect regulatory oversight of risk management in these firms. Part III considers the lessons that can be drawn from the financial crisis and identifies improvements to risk management that would avoid a repetition of the crisis. This Part also highlights obstacles to risk management reforms, which include compensation practices in financial institutions and, more generally, human limitations in dealing with complexity. In addition, it provides a course of action for risk management in light of these obstacles.

I. THE FINANCIAL CRISIS AND GOVERNMENT RESPONSES TO IT

We are all now so familiar with the financial crisis that I shall devote only a few words to it. It was triggered by the collapse of the credit markets, which was itself caused by losses in asset-backed securities, initially and chiefly those backed by subprime mortgages

atmosphere, which, among other things, eliminates other protections in the atmosphere against the sun’s warming effect. *See generally* Nicholas Stern, *Richard T. Ely Lecture: The Economics of Climate Change*, 98 AM. ECON. REV., May 2008, at 1; Cass R. Sunstein & David A. Weisbach, *Climate Change and Discounting the Future: A Guide for the Perplexed* 7–8 (Reg-Mkts. Ctr., Working Paper No. 08-19, 2008).

2. Robin L. Lumsdaine, *Correlation, Models, and Risk Management in Challenging Times*, 7 J. FIN. ECONOMETRICS 40, 41 (2009).

(mortgage-backed securities or “MBSs”).³ During a sustained period of low interest rates, credit was extended widely to enable people to purchase or to refinance real estate; in the last two years before the meltdown, there was even an enormous growth in real estate loans to those with low incomes and little savings and thus with little hope of repaying those loans unless real estate prices continued to rise.⁴ The home mortgage loans were pooled and interests in the pools were sold by financial institutions as differing kinds of securities to investors who sought higher returns on debt investments at this period of low interest rates.⁵

Once real estate values began to decline, defaults among subprime borrowers rose.⁶ This caused a broad reevaluation and repricing of the MBSs.⁷ The subprime meltdown and loss of value in the MBS market caused investors to become suspicious about the accurate pricing of other asset-backed securities, which led to sales and thus to falling prices of these securities.⁸ A general loss of liquidity for many of these and other financial assets and a freezing-up of the market for their issuance resulted.⁹ As the value of financial assets declined, financial institutions found their capital position weakened and became concerned about the solvency of their counterparties.¹⁰ They were reluctant to engage in transactions with, and particularly to extend credit to, other firms because they

3. See Carmen M. Reinhart & Kenneth S. Rogoff, *Is the 2007 U.S. Sub-Prime Financial Crisis So Different? An International Historical Comparison* (Nat'l Bureau of Econ. Research, Working Paper No. 13,761, 2008) (comparing the current crisis to other post-World War II financial crises because it has all the characteristics of a serious, but typical, financial crisis: a run-up in asset and equity prices due to capital inflows, slowing economic growth, an increase in public debt, and a large current account deficit). See generally Faten Sabry & Thomas Schopflicher, *The Subprime Meltdown: A Primer*, NERA INSIGHTS, June 21, 2007, available at http://www.nera.com/image/PUB_SubPrimer_1108.pdf.

4. See generally JOINT ECON. COMM., 110TH CONG., THE U.S. HOUSING BUBBLE AND THE GLOBAL FINANCIAL CRISIS: HOUSING AND HOUSING-RELATED FINANCE (2008).

5. *Id.* at 17 (explaining that many subprime buyers made little or no down payments and were unable to afford the mortgage payments, and thus they depended upon an increase in home prices in order to make the purchase economically worthwhile).

6. *Id.*

7. Sabry & Schopflicher, *supra* note 3, at 8.

8. See Ricardo J. Caballero & Arvind Krishnamurthy, *Musical Chairs: A Comment on the Credit Crisis*, FIN. STABILITY REV. (SPECIAL ISSUE ON LIQUIDITY), Feb. 2008, at 9, 10 (F.R.G.).

9. *Id.*

10. See generally TECHNICAL COMM., OF THE INT'L ORG. OF SEC. COMM'NS, FINAL REPORT OF THE TASK FORCE ON THE SUBPRIME CRISIS 16–19 (2008) (explaining that many MBSs and other asset-backed securities were traded privately, primarily among institutions, outside organized markets; when trading stopped, it became difficult for the financial institutions to give an accurate assessment of their own financial position).

were unsure about the exposure of these firms to the MBSs.¹¹ The subprime meltdown thus triggered a serious crisis in the worldwide financial system.

Eventually, numerous large financial conglomerates collapsed, had to be hastily merged with others, or received government support to survive. Bear Stearns had to be merged with J.P. Morgan;¹² the federal government seized the two “quasi” banks, Fannie Mae and Freddie Mac, that funded home mortgages and guaranteed MBSs;¹³ Lehman Brothers filed for bankruptcy, and Barclays Bank acquired many of its operations, while at the same time Merrill Lynch, fearful of its future, agreed to be acquired by Bank of America;¹⁴ and the federal government took over one of the largest U.S. insurance companies, American International Group, Inc., because of its massive liabilities from writing credit default swaps on MBSs.¹⁵ Goldman Sachs and Morgan Stanley became bank (and then financial) holding companies under the direct jurisdiction of the Board of Governors of the Federal Reserve System (“Federal Reserve”) in order to avoid becoming the next casualties in the crisis.¹⁶

Major legislative and regulatory action was taken to deal with the crisis. Congress passed, and the President signed on October 3, 2008, the Emergency Economic Stabilization Act of 2008 (“EESA”).¹⁷ EESA established the Troubled Asset Relief Program (“TARP”), which gives the U.S. Treasury the authority to purchase or guarantee up to \$700 billion in troubled assets held by financial

11. *Id.* at 17.

12. Kate Kelly, *Lost Opportunities Haunt Final Days of Bear Stearns*, WALL ST. J., May 27, 2008, at A1; Kate Kelly, *Fear, Rumors Touched Off Fatal Run on Bear Stearns*, WALL ST. J., May 28, 2008, at A1; Kate Kelly, *Bear Stearns Nears Collapse Twice in Frenzied Last Days*, WALL ST. J., May 29, 2008, at A1; see also Kate Kelly et al., *Bear's Final Moment: An Apology and No Lack of Ire*, WALL ST. J., May 30, 2008, at C1.

13. James R. Hagerty et al., *U.S. Seizes Mortgage Giants*, WALL ST. J., Sept. 8, 2008, at A1.

14. Carrick Mollenkamp, *Crisis on Wall Street as Lehman Totters, Merrill is Sold, and AIG Seeks to Raise Cash*, WALL ST. J., Sept. 15, 2008, at A1.

15. A credit default swap is a financial instrument in which, in return for a one-time payment or periodic payments, the swap writer or issuer agrees to pay the swap purchaser the value of a debt security if the issuer defaults on repayment of amounts owed on them. Purchasers and sellers of credit default swaps may also buy or sell this insurance-like instrument because they are speculating on the risk of default of the debt issuer. Willem Buiters, *The Magical World of Credit Default Swaps Once Again*, FIN. TIMES MAVERECON, June 14, 2009, available at <http://blogs.ft.com/maverecon/2009/06/the-magical-world-of-credit-default-swaps-once-again/>.

16. See Jon Hilsenrath et al., *Goldman, Morgan Scrap Wall Street Model, Become Banks in Bid to Ride Out Crisis*, WALL ST. J., Sept. 22, 2008, at A1.

17. Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343, 122 Stat. 3765 (2008).

institutions.¹⁸ Under the authority of EESA, the Treasury established the Capital Purchase Program, which allowed it to provide direct capital support to financial institutions.¹⁹ When the Obama administration took over in 2009, it continued the approach of shoring up the capital positions of major financial conglomerates, such as Bank of America. Moreover, the Treasury announced an ambitious plan, the “Financial Stability Plan,” to put financial institutions and the financial system back on a sound footing.²⁰ This Plan included a program of continuing to provide capital to financial institutions (now renamed the “Capital Assistance Program”) and to “stress test” the largest, most systematically important financial institutions to ensure that they had enough resources to weather the crisis (more about this testing later).²¹ The Plan also included the development of a program originally envisioned in the TARP, where private investment funds, jointly owned by private investors and the government and supported by government loans, would purchase the troubled MBSs and other assets from financial institutions (the “Public-Private Investment Program”).²²

II. RISK MANAGEMENT IN FINANCIAL INSTITUTIONS AND ITS FAILINGS

A. *Risk Management*

Over the past twenty years, risk management has become an essential function in financial institutions. A sub-discipline of finance, risk management is intended to help an institution identify and assess the risk of loss associated with its investments and activities, monitor and keep in check these risks, and prepare for and minimize the losses associated with them.²³ Risk management often involves the use of mathematical models to predict the probabilities of losses on investments and activities and the amount of these losses on the basis of the past performance of these investments and activities.²⁴ Thus, risk-management practice often demands quantitative and statistical skills, and therefore those in this area generally have mathematical or scientific backgrounds.²⁵

18. *Id.* §§ 101, 115.

19. Press Release, U.S. Dep’t. of the Treasury, Treasury Announces TARP Capital Purchase Program Description (Oct. 14, 2008), *available at* <http://www.ustreas.gov/press/releases/hp1207.htm>.

20. The continuing initiatives under this Plan are described on the Plan’s website at <http://www.financialstability.gov>. U.S. Dep’t. of the Treasury, Financial Security Fact Sheet 1, <http://www.financialstability.gov/docs/fact-sheet.pdf> (last visited June 15, 2009).

21. *Id.* at 2.

22. *Id.* at 3.

23. *See generally* PETER S. ROSE & SYLVIA C. HUDGINS, *BANK MANAGEMENT & FINANCIAL SERVICES* 30 (7th ed. 2008).

24. *See generally* Anette Mikes, *Risk Management and Calculative Cultures* 11–16 (2008), *available at* <http://ssrn.com/abstract=113866>.

25. Joe Nocera, *Risk Mismanagement: Were the Measures Used to Evaluate*

One important explanation for the growth in the importance of risk management is the regulation of capital. Since financial institutions are highly leveraged (they use other people's money to make money), their owners have always been required to have some of their own funds at risk. This capital provides a cushion for the lenders as well as motivates the owners not to take excessive risks in their investments and activities. Historically, and even today, banks and other financial institutions must have a set amount of capital in relationship to their total assets, which is known as a leverage ratio.²⁶ Over time, however, regulators have also made capital risk based. This means that a financial institution must have capital in proportion to the riskiness of its assets and activities: the riskier an institution is, the more capital it must have, which means that it may use less borrowed funds for its investments. The risk-based capital model is an international agreement promulgated by the Basel Committee on Banking Supervision which is then adopted by participatory countries like the United States.²⁷ The model establishes guidelines for determining the risks of an institution's assets and activities and sets basic capital amounts.

Originally, the Basel guidelines, known as "Basel I," focused only on *credit* risk, which is the risk that a borrower would default on its payment of principal and interest, in an institution's loan portfolio and related off-balance-sheet activities, such as the provision of a standby letter of credit.²⁸ Over time, financial regulators refined the risk-based capital framework to take account of financial institutions' involvement in hedging activities, such as futures, interest rate and currency swaps, and other hedging devices.²⁹ Moreover, as the largest financial institutions began to engage in securities-market activities, which include purchasing securities (chiefly debt) for investment purposes and for trading, capital standards had to take account of *market* risk. This deals with the risk of loss of value of the securities due to such factors as changes in interest rates and securities-market developments.³⁰ This development brought quantitative- and finance-based

Wall Street Trades Flawed?, N.Y. TIMES MAG., Jan. 4, 2009, at 26.

26. See, e.g., 12 C.F.R. § 3.6(b) (2008) (leverage ratio for national banks).

27. ROSE & HUDGINS, *supra* note 23, at 483–84.

28. Under this instrument, a bank agrees, for a fee, to provide contingent credit to a borrower, such as to pay the borrower's obligations if the borrower fails to pay them itself.

29. ROSE & HUDGINS, *supra* note 23, at 487–91.

30. See ANTHONY SAUNDERS & MARCIA MILLON CORNETT, FINANCIAL INSTITUTIONS MANAGEMENT: A RISK MANAGEMENT APPROACH 266 (6th ed. 2008). The most well-known of the methods was the "value-at-risk" ("VaR") methodology, which purports to determine the probability of loss for particular financial assets or groups of assets over a specified period at a high degree of confidence.

practitioners to the forefront of risk management, for finance had produced methods and techniques for modeling the risks of securities in order to establish accurate pricing.³¹ As a refinement to Basel I, regulators allowed financial institutions engaged in market activities to develop and use their own methods of assessing market risk, provided that the methods met certain standards.³²

The risk-based capital standards have been reformulated in a way that gives even more importance to risk management modeling. The largest, most sophisticated institutions are now allowed to use risk models in their assessment of credit risks and in a new risk category of *operational* risk.³³ Under this new approach known as “Basel II,” financial institutions can use mathematically based credit risk models to measure the credit risks in their loan portfolio and related off-balance-sheet activities.³⁴ In addition, it allows a financial institution to use “advanced measurement approaches” for modeling operational risk (on a quantitative basis), which measure the risk of losses from such events as fraud (external and internal), occupational safety, failure to fulfill fiduciary obligations, system breakdowns, problems in transaction processing, terrorism, and natural disasters (also at a 99.9% confidence level measured on the basis of a one-year period).³⁵ Since financial regulators understand that it does not make sense for every financial institution to engage in this kind of risk-management modeling, it provides a “standardized approach” for the enhanced risk assessment, although one more sophisticated than Basel I.³⁶

There are other financial risk-management procedures than the quantitative models. As discussed further below, risk assessment includes stress testing and scenario analysis. Both of these

31. *See generally id.* at 268–83.

32. *See id.* at 288–90. The models were required to use a 99% confidence level with respect to a probability of loss over a ten-day period. For the market risk measurement rules for U.S. bank holding companies that were promulgated by the Federal Reserve Board, see 12 C.F.R. § 225 app. D (2009).

33. The Federal Reserve and the other banking regulators have adopted guidelines as to credit and operational risk modeling based on Basel II. In the United States, Basel II began on a three-year transitional basis in 2009 (it thus generally postdates the financial crisis), with financial institutions computing their capital in accordance with both old and new standards in a “test” year. *See Risk-Based Capital Standards: Advanced Capital Adequacy Framework—Basel II*, 72 Fed. Reg. 69,288 (Dec. 7, 2007).

34. *Id.* at 69,292–93 (demanding that risk measurement be made at a higher confidence level than had previously been required of VaR, that is, at a one-year measurement level and a 99.9% confidence level).

35. *Id.* at 69,293–94. The operational risk analysis must rely on internal data, external data, scenario analysis, and assessments of business environment and internal controls, with scenario analysis here being expert judgment and assessment of the “likelihood and loss impact of plausible high-severity operational losses” in economic-downturn conditions. *Id.* at 69,316–17.

36. *See Risk-Based Capital Guidelines; Capital Adequacy Guidelines; Standardized Framework*, 73 Fed. Reg. 43,982 (July 29, 2008).

approaches assess a firm's potential losses by assuming the existence of very adverse situations or "scenarios," and then by evaluating how the firm would be affected under the situation and whether it would be adequately prepared and have adequate capital to deal with it.³⁷ While mathematical modeling is involved in these kinds of analyses, they also require a broad historical and imaginative perspective in order to envisage possible adverse events and scenarios. To function well, stress testing and scenario analysis demand experienced persons who, like a devil's advocate, understand the assumptions and results of the quantitative analysis of risk and then test them in new directions. Indeed, there may even be a conflict between two "cultures" of risk management in financial institutions, one composed of those with confidence in quantitative risk methods and their results and another consisting of those who regard them with skepticism and want them supplemented with risk management based on history and experience.³⁸

It should be emphasized here that the risk-management practices of financial institutions are under the supervision of financial regulators. For example, the Federal Reserve explicitly rates bank holding companies on their risk-management practices.³⁹ Financial regulators are assumed to approve the adequacy of the quantitative and qualitative risk models used by the institutions under their jurisdiction.⁴⁰ Indeed, Basel II specifically requires regulators to supervise institutions' risk management and risk

37. For a discussion of basic principles on stress testing, see BASEL COMM. ON BANKING SUPERVISION, PRINCIPLES FOR SOUND STRESS TESTING PRACTICES AND SUPERVISION 9–11 (2009) [hereinafter PRINCIPLES FOR SOUND STRESS TESTING]. Scenario analysis may be distinguished from stress testing insofar as, under the former, executives in a financial institution may "act out" their probable conduct and try to anticipate the conduct of others in a stressed environment.

38. See Anette Mikes, *Risk Management at Crunch Time: Are Chief Risk Officers Compliance Champions or Business Partners?* 7 (May 30, 2008) (unpublished manuscript), available at <http://ssrn.com/abstract=1138615> (describing the two risk-management cultures as "calculative" and "judgmental"). She associates scenario analysis with "Holistic Risk Management," which is more judgment and intuitive oriented, as opposed to Risk Silo Management, which depends upon VaR. *Id.* at 15–16; see also Anette Mikes, *Counting Risk and Making Risk Count: The Organizational Significance of Risk Management* 22 (Aug. 9, 2008) (unpublished manuscript), available at <http://ssrn.com/abstract=1214063>.

39. DIV. OF BANKING SUPERVISION & REGULATION, FED. RESERVE BD., BANK HOLDING COMPANY SUPERVISION MANUAL supp. 28 § 4070 (2005) (discussing the Bank Holding Company Rating System that includes a rating on an "R" component, which represents risk management). Many of the largest bank holding companies are "financial" holding companies, which allows them to engage in a broad range of financial activities. See generally 12 U.S.C. § 1843(k) (2006). The Board is explicitly mandated to inspect the institutions as to their risks and their risk-management systems. *Id.* § 1844(c)(2)(A).

40. See, e.g., OFFICE OF THE COMPTROLLER OF THE CURRENCY, RISK MODELING: MODEL VALIDATION, OCC Bulletin 2000-16 (May 30, 2000).

models used in their capital determinations.⁴¹

Accordingly, sophisticated risk assessment and management receive the blessing of the law and have thus become an essential function in a financial firm. In addition, it should be remembered that risk managers *manage* the identified risks: not only do they use their models to predict losses, but they also suggest strategies for addressing and reducing them. Therefore, risk management could give a firm a competitive advantage over similarly situated institutions and could become a profit center for the firm. It allows a firm to determine with precision the risks of its assets and activities and to have strategies for dealing with the risks. Accordingly, if risk management helps reduce an institution's overall risk, the firm's capital can be used to support more activities and thus to generate more profits for that capital. Another way of saying this is that the firm can use greater leverage than its competitors, which would boost the return on the firm's capital. The value of risk management, of course, depends upon the accuracy of its risk assessment. Yet this accuracy, as well as other attributes of risk management, is called into question by the current crisis.

B. *The Failings of Risk Management*

The current financial crisis is as much a crisis of risk management as the corporate scandals of the early part of this century were a crisis of financial accounting. In that earlier event, financial accountants, particularly in accounting firms, were too ready to go along with executives who engineered and profited from transactions that complied with the form of accounting rules but not with their substance. The accountants were swayed by executives who retained them for lucrative consulting services that they provided in addition to their auditing.⁴² As a result of the corporate scandals, Congress passed the Sarbanes-Oxley Act of 2002, which greatly enhanced the regulation of accounting firms that audited public companies and transformed the relationship of outside accountants with publicly traded firms by making them directly responsible to the board audit committee, not to a firm's executives.⁴³

41. ROSE & HUDGINS, *supra* note 23, at 493. This is the second "pillar" of Basel II, the first being the new capital-adequacy framework, which uses the advanced modeling. The third "pillar" is increased market review of a bank's capital adequacy. Both the first and third pillar rely upon the "external" risk assessors, which are the credit rating agencies that use risk models similar to those used internally in the financial institutions. A discussion of these agencies is beyond the scope of this Article.

42. For a general discussion of the earlier scandal, see JOHN C. COFFEE, JR., *GATEKEEPERS: THE PROFESSIONS AND CORPORATE GOVERNANCE* 108–91 (2006).

43. For a discussion of how outside accounting firms are directly responsible to the board audit committee, see JAMES A. FANTO, *DIRECTORS' AND OFFICERS' LIABILITY* § 3:3.2 (2d ed. 2005).

There has been, so far, a similar focus upon risk management and risk-management professionals in this crisis, although any legal reforms involving risk management have yet to be formulated because the financial crisis is ongoing.⁴⁴ Risk management in financial firms is receiving part of the blame for the crisis.⁴⁵ It is not entirely clear how risk management failed in financial firms because complete information about the institutions involved in the crisis has yet fully to emerge. However, preliminary evidence exists for the following criticisms of risk management, focusing upon technical problems in the risk-assessment and risk-management models. One complaint is that risk models sometimes used limited or even inappropriate data.⁴⁶ That is, since the models rely upon historical data to predict the probability and amount of future losses, the predictions can be unreliable if the data used was from the performance of securities or other assets in the period before the crisis, which was one of low volatility. In other words, the data was not sufficiently historical or representative.⁴⁷

A related criticism is that risk models were used to estimate the loss probabilities on securities for which there was limited historical data in the first place.⁴⁸ The point here is that many of the asset-backed securities, such as the collateralized debt obligations

44. It should also be noted that there are relationships between accounting and risk management, since internal control procedures, which are the province of internal auditing and under the supervision of the audit committee, also involve ensuring that risk-management guidelines are followed throughout an organization. See, e.g., COMMITTEE OF SPONSORING ORGANIZATIONS OF THE TREADWAY COMMISSION, ENTERPRISE RISK MANAGEMENT—INTEGRATED FRAMEWORK: EXECUTIVE SUMMARY 6 (2004).

45. See, e.g., *The Financial Crisis and the Role of Federal Regulators Hearing Before the H. Comm. on Oversight and Gov't Reform*, 110th Cong. 3–4 (2008) (testimony of Alan Greenspan, former Chairman, Bd. of Governors of the Fed. Reserve Sys.); Ben S. Bernanke, Chairman, Bd. of Governors of the Fed. Reserve Sys., Speech at the Council on Foreign Relations: Financial Reform to Address Systemic Risk (Mar. 10, 2009).

46. SENIOR SUPERVISORS GROUP, OBSERVATIONS ON RISK MANAGEMENT PRACTICES DURING THE RECENT MARKET TURBULENCE 16–17 (2008).

47. *Id.*; see also *Financial Regulation: Review of Regulators' Oversight of Risk Management Systems at a Limited Number of Large, Complex Financial Institutions Hearing Before Subcomm. on Sec., Ins., and Inv., Sen. Comm. on Banking, Hous., and Urban Affairs*, 111th Cong. 20–22, 24 (2009) [hereinafter *Financial Regulation*] (testimony of Orice M. Williams, Dir., Fin. Markets and Cmty. Inv., U.S. Gov't Accountability Office); Uday Rajan et al., *The Failure of Models That Predict Failure: Distance, Incentives and Defaults* 28–29 (Stephen M. Ross Sch. of Bus. at the Univ. of Mich., Research Paper No. 1122, 2008) (arguing that risk models of credit agencies used information on loan defaults for periods when banks held onto the loans and thus used “soft” information about borrowers in making them). This data proved unreliable as banks began to securitize loans, for they had less incentive to rely upon the soft information (since they were no longer holding the loans), but credit rating agencies and investors continued to rely upon outdated model results. *Id.*

48. SENIOR SUPERVISORS GROUP, *supra* note 46, at 16–17.

(“CDOs”) and CDOs that had, as pools, other CDOs (this structure was known as CDO²) that proliferated in the years before the meltdown were relatively recent financial innovations.⁴⁹ Moreover, these securities were often divided into classes or “tranches” with different rights.⁵⁰ It has been reported that, in evaluating risks and loss probabilities as to these securities, risk managers sometimes used data from securities that were different from the evaluated financial instruments (e.g., data about corporate debt used for determining the risks of asset-backed debt).⁵¹ As a result, the risk-assessment models seriously underestimated the risks of loss associated with these securities. This model error, as well as the one involving use of recent data, led financial firms to underestimate their total risk exposure. Another criticism of the risk models is that the complexity of many of the asset-backed securities undermined the proper functioning of the risk models; that is, the inputs were so numerous that the models did not have the computational capacity to predict adequately the risks associated with these securities.⁵²

Other criticisms about risk-management failings in the crisis are even more serious than the above because they question the reliability of the risk models. One such complaint is that the models systematically understate the probability of bad outcomes since they assume a symmetric distribution of gains and losses, when in fact the distribution may be asymmetric.⁵³ If that assumption is incorrect, losses, including serious losses, may occur with greater probability, which is known as the “fat tails” issue.⁵⁴ Yet a related criticism is that the models do not take into account “tail

49. *Id.*

50. It has been argued that credit-rating agencies, and investors, were confused by the complexity of the asset-backed securities, which often included not just loans, but asset-backed securities based on the loans or based on other asset-backed securities or related derivatives; the complexity was used to suggest that the movement away from the basic pool of loans made the asset-backed securities further out on the chain less risky. See Patrick Honohan, *Risk Management and the Costs of the Banking Crisis*, NAT'L. INST. ECON. REV., Oct. 2008, at 15, 16, 21.

51. SENIOR SUPERVISORS GROUP, *supra* note 46, at 15.

52. *Id.* at 13.

53. *Id.* at 15.

54. See, e.g., Barry Eichengreen, *Ten Questions About the Subprime Crisis*, FIN. STABILITY REV. (SPECIAL ISSUE ON LIQUIDITY), Feb. 2008, at 19, 21–22 (2008) (F.R.G); see also Susan Pulliam, et al., *Merrill Upped Ante as Boom in Mortgage Bonds Fizzled*, WALL ST. J., Apr. 16, 2008, at A1 (describing how Merrill ignored risk-management practices to acquire a long position in mortgage-backed securities and its efforts to reduce that position). For example, one could contend that the risk-management models of the financial institutions did not accurately assess the risks of the MBSs and related securities and particularly suffered from a fundamental underestimation of the risks that an unlikely, but disastrous, event might occur and that a liquidity crisis would be widespread and affect all assets equally.

dependence,” which is the risk that a loss in one domain will lead to losses in others; therefore, losses at the tail of the probability distribution can be extreme because they produce a cascade of other losses that then magnify the losses in the original domain that triggered the cascade.⁵⁵ An example of tail dependence in the current crisis was that concerns about defaults in subprime MBSs caused losses of liquidity in other financial assets and then threatened the solvency of financial institutions that depended upon this liquidity.⁵⁶ Risk models do not reflect this phenomenon since they focus on probability distributions for financial assets in isolation from other events. These are significant criticisms, for if financial institutions underestimate loss probability, they will not have adequate capital in extreme circumstances.

There are even harsher criticisms of risk modeling. Nassim Taleb forcefully argues that the models make useless predictions because they do not foretell the harmful and catastrophic events that truly matter and that occur in a random way that cannot be modeled.⁵⁷ In his view, the catastrophic events are always new and unimaginable; they are the “black swans.”⁵⁸ Moreover, he believes that risk management actually enhances risk because it leads risk modelers and their followers to believe that risk is “managed” (an impossible task), which encourages them to engage in even riskier conduct, which in turn changes the situation that had been modeled in the first place.⁵⁹ A similar criticism has been articulated by Emanuel Derman, the former head of quantitative risk strategies at Goldman Sachs and a professor in the Industrial Engineering and Operations Research Department at Columbia.⁶⁰ He cautions that, unlike models in the “hard” sciences, financial models reveal only guesses at causal relationships between data and future outcomes.⁶¹ In his view, the predictive power of the models is undermined by

55. The environmental literature on risk management underscores this phenomenon. See Carolyn Kousky & Roger M. Cooke, *Climate Change and Risk Management: Challenges for Insurance, Adaptation, and Loss Estimation* 2–3 (Resources for the Future, Discussion Paper No. 09-03, Feb. 2009); see also PRINCIPLES FOR SOUND STRESS TESTING, *supra* note 37, at 9–10.

56. See PRINCIPLES FOR SOUND STRESS TESTING, *supra* note 37, at 1–2.

57. NASSIM NICHOLAS TALEB, *THE BLACK SWAN: THE IMPACT OF THE HIGHLY IMPROBABLE* 274–85 (2007).

58. *Id.* at 281–82. For a journalistic account of Taleb’s views on risk management and his fame in light of his predictions of model failure, see Nocera, *supra* note 25, at 27–31.

59. TALEB, *supra* note 57, at 288–89; see also Francesco Cannata & Mario Quagliariello, *The Role of Basel II in the Subprime Financial Crisis: Guilty or Not Guilty?* 11–13 (Carefin, Working Paper No. 3/09, 2009).

60. Industrial Engineering & Operations Research, Columbia University, Emanuel Derman, <http://www.ieor.columbia.edu/fac-bios/derman/faculty.html> (last visited June 20, 2009).

61. Emanuel Derman, *Models*, FIN. ANALYSTS J. Jan./Feb. 2009, at 28, 32–33.

basic uncertainty about whether the modeled relationships even exist and by the unpredictability of human behavior.⁶² Accordingly, he believes that while the models can be useful, they must be constantly checked and revised and ultimately be regarded with skepticism even by their creators.⁶³

Aside from model problems, it could also be argued that risk managers and financial firms failed to supplement quantitative risk analysis with adequate stress testing or scenario analysis. As already noted, under these approaches risk managers run simulations of how a firm would respond to seriously adverse events, such as the failure of an important counterparty, a significant rise in interest rates, a shock in the currency markets, or sustained illiquidity of numerous assets. It appears that in some financial firms no such testing or analysis occurred, or, if it did, relatively benign adverse events were used for the tests.⁶⁴ For example, although respected economists had warned about the possibility that the U.S. housing market was in a bubble,⁶⁵ many firms did not run a stress test based upon a serious decline in this market.⁶⁶ Risk managers and others failed to take a sufficiently historical or imaginative perspective in the stress test or scenario analysis, which might have led them to use scenarios, such as a meltdown in financial markets, that had previously occurred.⁶⁷ It could be that quantitative risk modeling pushed to the side these more qualitative forms of risk assessment. Indeed, there is evidence that firms performing better in the crisis did not rely unthinkingly upon results from quantitative models but evaluated them critically and in conjunction with other information.⁶⁸

62. *Id.*

63. *Id.*; see also EMANUEL DERMAN, QUANTITATIVE STRATEGIES RESEARCH NOTES: MODEL RISK 6–7 (1996).

64. See PRINCIPLES FOR SOUND STRESS TESTING, *supra* note 37, at 8–9 (finding that stress testing was generally done as a mechanical exercise in a business segment, with little qualitative input from senior management and little aggregation of testing firmwide; did not include all risks; relied upon benign situations and failed to anticipate a crescendo of self-reinforcing effects; and, at the direction of senior management and the board at many banks, refused to contemplate extreme scenarios in stress testing); *Financial Regulation*, *supra* note 47, at 23.

65. Jonathan R. Laing, *The Bubble's New Home*, BARRON'S, June 20, 2005, at 24.

66. Gunter Löffler, *Caught in the Housing Crash: Model Failure or Management Failure* 11–12 (Univ. of Ulm, Working Paper, 2008) available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1326427. Löffler performs a stress analysis that risk-management departments should have performed in 2005. This analysis produces a scenario of a housing decline worse than the one experienced in 2008. Thus, he concludes that either risk managers failed to do their jobs or that business managers failed to heed risk managers. *Id.*

67. *Id.* at 5–7.

68. Nocera, *supra* note 25, at 50; Dennis Overbye, *They Tried to Outsmart Wall Street*, N.Y. TIMES, Mar. 10, 2009, at D1.

The failure to engage in adequate stress testing and scenario analysis points to a corporate-governance failing in risk management in financial firms. Despite the significance of risk assessment in capital determinations and in financial firm management in general, risk-management results and even the risk-management function were not given enough attention by senior executives and boards of many firms.⁶⁹ Most large financial firms have elaborate risk-management groups and risk professionals for each business division, as well as a chief risk officer.⁷⁰ However, it is not clear that senior executives always demanded and analyzed group-wide risk assessments, treated these results skeptically and required adequate stress testing, and simply devoted the necessary attention to risk management.⁷¹

Moreover, it is questionable whether boards of financial firms adequately fulfilled their supervisory duties over risk management. Under general practice, risk management may fall under the jurisdiction of the audit committee since it supervises a firm's internal controls, and risk monitoring (i.e., ensuring that a firm stays within designated risks) would be part of these controls.⁷² However, this committee may be overworked in light of the requirements imposed upon it by Sarbanes-Oxley.⁷³ Financial firms often had a separate risk committee, which would approve of a firm's risk profile.⁷⁴ Yet it is doubtful whether these committees were adequately critical and skeptical in dealing with the results generated by the risk management professionals. That is, risk managers may have emphasized the comprehensiveness and predictive power of the quantitative models, and the risk committee members were content to rely upon the "experts" and not to feel obligated to understand the complexities and limitations of these models.⁷⁵ Moreover, it is likely that board risk committees did not have outside risk-management experts provide an independent judgment of the adequacy of a firm's risk-management practices, for this outside review of risk management is not mandated by law. In other words, a risk committee might need an outside consultant in the same way that an audit committee relies upon an outside

69. *Financial Regulation*, *supra* note 47, at 18.

70. *See, e.g.*, JP Morgan Chase & Co., Annual Report (Form 10-K), at 69–70 (Feb. 29, 2008) (discussing the group's risk-management function).

71. SENIOR SUPERVISORS GROUP, *supra* note 46, at 3, 7–9.

72. FANTO, *supra* note 43, § 3:29 to 3:30.

73. *Id.* § 3:14 to 3:49.

74. Matteo Tonello, *The Role of the Board in Turbulent Times: Overseeing Risk Management and Executive Compensation*, at 4 (The Conference Bd., Executive Action Series No. 292, Dec. 2008).

75. *See* CHARLES R. MORRIS, *THE TWO TRILLION DOLLAR MELTDOWN: EASY MONEY, HIGH ROLLERS, AND THE GREAT CREDIT CRASH* 58 (2008) ("The re-engineering greatly improved market efficiencies and reduced funding costs but also created the illusion that the underlying risks were well understood and under control.").

accounting firm as to a firm's financial statements and internal controls.⁷⁶ Furthermore, boards may have felt no need to question risk-management results because the firms were extremely profitable and outside parties with expertise in risk assessment, the credit-rating agencies, agreed with the firms' own risk assessments.⁷⁷

Finally, financial regulators must shoulder blame for the risk management failures. As discussed earlier, financial regulators examine and rate financial firms on risk management, including the adequacies of the risk-management models.⁷⁸ Indeed, they evaluate risk management with respect to other examination topics. For example, the financial condition of a firm is examined from the perspective of its risk profile.⁷⁹ Therefore, regulators are expected to have expertise in risk management in order to judge the adequacy of the firms' risk-management efforts, even if they do not impose specific risk management methods or models upon firms. Moreover, the Federal Reserve even claims that its own supervision is risk based, as it purports to focus on financial institutions and activities that pose the greatest risk to the financial system.⁸⁰

It does not appear that the federal financial regulators fulfilled their function. It has been reported that they did not question critically the data used in the quantitative risk assessments, the adequacy of the models, the seriousness of the scenarios that firms used to stress test the firm's operations and assets, or the role of risk management in the firm's governance.⁸¹ Moreover, when they did report flaws in the risk management to senior decision makers of a given firm, they did not insist that firms quickly remedy the problem or take more serious enforcement action against a firm.⁸² Rather, they were content with assertions by firm management that any problems would eventually be fixed or were not serious in light of the overall profitability and adequate capital position of the institution.⁸³ Indeed, regulators, like firm risk managers, executives, and board members, did not themselves envision seriously adverse scenarios and demand that a firm be prepared for them.⁸⁴

76. *Id.* at 54–55.

77. See Amar Bhidé, *In Praise of More Primitive Finance*, ECONOMIST'S VOICE, Feb. 2009, at 2–4, available at <http://www.bepress.com/ev/vol6/iss3/art8>.

78. OFFICE OF THE COMPTROLLER OF THE CURRENCY, *supra* note 40, at 1–2.

79. DIV. OF BANKING SUPERVISION & REGULATION *supra* note 39, §§ 4070.0.4.3.1–4070.0.4.4.

80. See Federal Reserve Board, Supervisory Letter SR 08-9/CA 08-12 (Oct. 16, 2008), <http://www.federalreserve.gov/boarddocs/srletters/2008/sr0809.htm>.

81. *Financial Regulation*, *supra* note 47, at 18–25.

82. *Id.* at 19–20.

83. *Id.* at 24.

84. *Id.*; see also Eric S. Rosengren, President & Chief Executive Officer, Fed. Reserve Bank of Boston, Remarks at the ICBI RiskMinds 2008 Conference: The Global Risk Regulation Summit: “Some Principles to Consider in Future

III. LESSONS FROM RISK-MANAGEMENT FAILURE, OBSTACLES TO REFORM, AND COURSE OF ACTION

This Part briefly discusses the initial lessons from the risk-management failure in financial institutions. It also identifies several obstacles to any reform of risk management and proposes a preliminary course of action for risk management in light of these obstacles.

A. *Lessons*

From one point of view, the lessons from the risk-management failure are straightforward. The shortcomings of the quantitative models could be fixed. They should use more historical data and representative data so that their predictions of risk of losses are at least more accurate on their own terms. Moreover, to the extent that models (and computing power) allow, they should be modified to include more variables, such as generalized illiquidity, contagion of defaults, and asset-price covariance. Indeed, the Basel Committee on Banking Supervision is already directing many technical changes to banks' risk models to deal with model shortcomings.⁸⁵

There is also an obvious need to enhance stress testing and scenario analysis and thus to involve more experienced-based judgment in risk management. In other words, one lesson learned is that qualitative risk management must supplement the quantitative modeling; there cannot be an uncritical reliance upon mathematical models predicting risk of loss. As financial economist René Stulz forcefully argues, those other than mathematicians, for example economists and historians, must be involved in risk analysis.⁸⁶ In discussing the failure of financial institutions to engage in adequate stress testing and scenario analysis, the Basel Committee on

Regulatory Reform" (Dec. 8, 2008) (observing, in comments upon the financial crisis, that federal regulators did not anticipate an event where liquidity across the board would be so significantly disrupted), *available at* <http://www.bos.frb.org/news/speeches/rosengren/2008/120808.pdf>.

85. For example, banks must add an "incremental risk charge" to their capital with respect to their trading activities in addition to risk charges determined by VaR models to reflect credit risk in the traded assets. BASEL COMMITTEE ON BANKING SUPERVISION, CONSULTATIVE DOCUMENT: GUIDELINES FOR COMPUTING CAPITAL FOR INCREMENTAL RISK IN THE TRADING BOOK 6–7 (2009) (observing that internal models must realistically and conservatively assess factors such as liquidity, clustering of defaults, credit events among borrowers, concentrations, etc. in coming up with the charge).

86. René M. Stulz, *Risk Management Failures: What Are They and When Do They Happen?* 18–19, 22 (Dice Center, Working Paper No. 2008-18, 2008) (emphasizing the importance of an institution's culture in risk management and the fact that the culture has built within it a risk-management approach that does not rely just on statistical models, but also on catastrophe scenarios, which appear more frequently than one thinks and which produce illiquidity, predatory behavior by multiple parties, and an overall collapse of pricing).

Banking Supervision prescribes ways of enhancing this testing and analysis, for example, by using more extreme and imaginative scenarios, doing the stress test from a firm-wide perspective, and involving senior executives, boards, and experts directly in the scenario analysis.⁸⁷ It also recommends a reverse stress test, whereby a financial firm is assumed to be insolvent and the purpose of the exercise is to imagine ways in which this adverse scenario could come about (and then to prepare for it).⁸⁸

From a bank-capital perspective, the crisis arguably came too soon because Basel II, which enhances risk modeling and stress testing, had not been implemented in U.S. banks and bank holding companies, as it is scheduled to be phased in over the next three years.⁸⁹ As noted earlier, the new capital standards enhance goals for risk modeling, that is, loss predicted at a higher confidence level at longer periods, and extend the modeling to credit and operational risks.⁹⁰ Basel II mandates testing of the appropriateness of the risk-management procedures and systems, which would include “(i) evaluating the conceptual soundness of the . . . systems; (ii) ongoing monitoring [of the systems with] process verification and . . . benchmarking” (i.e., to check their results against results used by other systems), “and (iii) outcomes analysis” (i.e., to see whether the models adequately forecast risk; this is known as “backtesting”).⁹¹ Moreover, Basel II calls for stress testing of the outputs of the internal models with scenarios that are “plausible” and severe.⁹² It also requires that the board and senior management oversee risk-management procedures and systems.⁹³ The implementation of the Basel II in the United States significantly enhances risk management and may address some of its failings that led to the current crisis.⁹⁴

Another lesson from the risk-management failures is a corporate-governance one: there must be a greater involvement of the board and senior executives of a financial firm in risk

87. PRINCIPLES FOR SOUND STRESS TESTING, *supra* note 37, at 13–14, 17.

88. *Id.* at 18–19. The Committee also recommends that a financial institution have a plan for dealing with emergencies and a minimum amount of liquid assets always available to deal with the adverse scenarios. BASEL COMMITTEE ON BANKING SUPERVISION, PRINCIPLES FOR SOUND LIQUIDITY RISK MANAGEMENT AND SUPERVISION 4 (2008) [hereinafter PRINCIPLES FOR SOUND LIQUIDITY RISK MANAGEMENT AND SUPERVISION]. In this paper, the Committee recommends that the institution conduct stress testing related to liquidity. *Id.* at 24–27.

89. See 72 Fed. Reg. 69,302 (Dec. 7, 2007).

90. *Id.* at 69,314; see also *id.* at 69,312 (mandating that credit risk models use at least five years of data to predict default and economic loss from default).

91. *Id.* at 69,319.

92. *Id.* at 69,320–21.

93. *Id.* at 69,319.

94. This point is also made by Cannata & Quagliariello, *supra* note 59, at 13–14.

management.⁹⁵ These senior decision makers should supply the judgment, criticism, and perspective that supplement quantitative and even qualitative risk management. However, they cannot provide their insights and supervision unless they are educated about the risk-management models, procedures, and the foundational assumptions in them. A positive development of the crisis is that risk management has become an explicit focus of corporate-governance practitioners and best practices are emerging as to what is called “enterprise risk management.”⁹⁶ A board should understand the basics of the risk models used by a firm, have a separate risk committee (even an executive risk committee composed of both executives and board members), have in place crisis procedures for dealing with risk, and ensure that executive compensation is keyed to the risk taking of the institution.⁹⁷ The board might want also to consider whether it needs to do a risk-management audit undertaken by outside experts in the field in order to evaluate the firm’s risk procedures. However, the most important role for the board is to act as a devil’s advocate on risk issues, for example, by questioning assumptions of the risk managers and imagining adverse scenarios.

Financial regulators have to improve their supervision of risk management as well. They do not need more regulatory power on this issue, for they have now the authority to oversee firms’ risk models and demand improvements in them.⁹⁸ They must simply exercise their authority, particularly when good times reappear. For example, they must demand that firms remedy their risk management immediately when they find defects in it, and they must penalize firms for repeated bad model outcomes, such as by restricting a firm’s activities.⁹⁹ Indeed, it is ironic that it took this cataclysmic financial crisis for financial regulators to engage in a program of “stress testing” major bank groups so that, in the words of Treasury Secretary Timothy Geithner, there is a “more consistent, realistic, and forward-looking assessment about the risks on [their] balance sheets.”¹⁰⁰ Certainly, this stress testing is extraordinary

95. See GROUP OF THIRTY, FINANCIAL REFORM: A FRAMEWORK FOR FINANCIAL STABILITY 41 (2009).

96. *Id.*

97. See Tonello, *supra* note 74, at 3–4; see also PRINCIPLES FOR SOUND LIQUIDITY RISK MANAGEMENT AND SUPERVISION, *supra* note 88, at 33 (for the role of the board in insisting upon adequately bad scenarios for stress testing); SENIOR SUPERVISORS GROUP, *supra* note 46, at 6–10.

98. *Financial Regulation*, *supra* note 47, at 3–4.

99. See PRINCIPLES FOR SOUND STRESS TESTING, *supra* note 37, at 21–22 (urging regulators to monitor banks’ stress testing, particularly its forward-looking nature and involvement of senior management). They must therefore avoid going along with management’s assurance that the problems are not severe and can be fixed in due course. See *Financial Regulation*, *supra* note 47, at 19.

100. Press Release, U.S. Dep’t of Treasury, Secretary Geithner Introduces

since it is designed to increase market confidence that large financial institutions will be able to weather the current severe economic scenario. However, it also shows the proper relationship between financial regulators and financial institutions on risk management. The institutions are conducting the tests with their models, although under assumptions provided by regulators and with these regulators overseeing and criticizing the operation and output of the models and supplementing model results with their own judgments.¹⁰¹

B. *Obstacles and Course of Action*

As encouraging as are the potential reforms to risk management discussed above, there remain serious obstacles to these reforms coming to pass in financial firms. These obstacles are compensation in the financial firms and human limitations in dealing with the complexities of risk analysis in the financial-institution setting.

1. *Compensation*

Risk management demands a long-term perspective. Its goal is to ensure that a financial institution is prepared for, and thus can survive in the face of, the probable losses that it might experience. However, risk management is performed by professionals and supervised by executives and directors whose interests are different from those of the institution and are generally more short-term in nature. Compensation is supposed to align the interests of these individuals with those of the institution.¹⁰² The problem is that compensation in financial institutions, as the financial crisis has starkly revealed, is based too much on the short term and is generally insensitive to the risks facing an institution. Employees, executives, and directors of financial firms are generally

Financial Stability Plan 2 (Feb. 10, 2009), <http://www.treas.gov/press/releases/tg18.htm>. This stress test is designed to see whether a financial institution has enough capital to survive a severe economic decline and focuses on banks with greater than \$100 billion of assets, which are two-thirds of holding-company assets today (nineteen institutions). U.S. Dep't. of the Treasury, Financial Security Fact Sheet 1, <http://www.financialstability.gov/docs/fact-sheet.pdf> (last visited June 20, 2009). The point of the tests is to estimate losses in the credit and market books over a two-year time horizon (2009–2010) and to evaluate a firm's resources to deal with them.

101. On the methodology of the stress test, see BD. OF GOVERNORS OF THE FED. RESERVE SYS., THE SUPERVISORY CAPITAL ASSESSMENT PROGRAM: DESIGN AND IMPLEMENTATION 2–4 (2009) [hereinafter DESIGN AND IMPLEMENTATION]. On its results, see BD. OF GOVERNORS OF THE FED. RESERVE SYS., THE SUPERVISORY CAPITAL ASSESSMENT PROGRAM: OVERVIEW OF RESULTS (2009) [hereinafter OVERVIEW OF RESULTS].

102. On the theory of compensation in the firm, see generally LUCIEN BEBCHUK & JESSE FRIED, PAY WITHOUT PERFORMANCE: THE UNFULFILLED PROMISE OF EXECUTIVE COMPENSATION 15–22 (2004).

compensated on a yearly basis from revenues generated by fees for the completion of transactions and profits from trading strategies.¹⁰³ They receive their compensation primarily in the form of yearly bonuses that can be enormous in some cases.¹⁰⁴ They are thus not penalized monetarily if, several years later, a transaction or trading strategy that generated the fees produces a significant, or even disastrous, loss for the firm, as occurred in the case of the structuring of and investments in asset-backed securities. Moreover, the short-term nature of the compensation encourages those working in a financial firm to focus on the short term, not to be concerned with losses that may occur either after they have left the firm or after they have amassed enough private wealth to be indifferent to the fate of the institution. They are thus opposed, by their situation, to risk management with its long-term focus.

Current compensation systems in financial institutions are therefore an obstacle to risk-management reform. They must be transformed in order to align better the compensation of financial-institution employees, executives, and board members with the risks of an institution. How this could be accomplished is beyond the scope of this Article and is likely to be difficult, especially since it must upset the status quo.¹⁰⁵ At the very least, it must answer the following questions in its implementation: Should an employee be responsible for losses associated with both expected and unexpected risks? For how long is he or she responsible for these losses, and how will the compensation system enforce this responsibility? Which proportion of his or her compensation should be made risk-based?

There are preliminary reform efforts in this area. The most publicized and controversial aspect of recent legislative and regulatory efforts to support financial institutions has been putting compensation restrictions on executives in institutions receiving government aid.¹⁰⁶ These efforts are also pushing institutions to

103. See INST. OF INT'L. FINANCE, FINAL REPORT OF THE IIF COMMITTEE ON MARKET BEST PRACTICES: PRINCIPLES OF CONDUCT AND BEST PRACTICE RECOMMENDATIONS 58–62 (2008) [hereinafter FINAL REPORT OF THE IIF COMMITTEE ON MARKET BEST PRACTICES]; SENIOR SUPERVISORS GROUP, *supra* note 46, at 7.

104. FINAL REPORT OF THE IIF COMMITTEE ON MARKET BEST PRACTICES, *supra* note 103, at 58.

105. A good example of the difficulty of changing the status quo is the fact that even financial institutions that received massive support from the government to keep them solvent have attempted to continue the pay practices that led them into difficulty. See, e.g., Liam Plevin et al, *The AIG Controversy: The Logic Behind the Payouts: A Primer*, WALL ST. J., Mar. 18, 2009, at A2 (discussing background information relating to the payment of controversial bonuses to AIG executives).

106. See generally James Fanto, *No More of "Anything Goes": Executive Compensation Restrictions Under the American Recovery and Reinvestment Act*, 2009 EMERGING ISSUES LEXIS 3423, <http://law.lexisnexis.com/practiceareas/>

connect compensation to risk management.¹⁰⁷ For example, the Treasury requires that the board compensation committee of a firm receiving government aid must meet annually with risk managers to look at the relationship between compensation incentives and risk-management policies.¹⁰⁸ Similarly, financial regulators have articulated risk-based compensation as a long-term reform once the crisis is stabilized.¹⁰⁹ Moreover, international financial forums have articulated the need for reform to link compensation in financial institutions to risk taking.¹¹⁰ Indeed, an international solution may be called for in compensation, as in the environmental area. Since individual carbon production can collectively have long-lasting effects on global warming, the issue must be addressed on a worldwide basis, so that several parties or countries are not undermining others' efforts to deal with the problem.¹¹¹ A similar global solution may be needed so that, as a result of short-term compensation systems, financial institutions of several countries are not causing a global financial meltdown.

2. *Human Limitations*

A second obstacle to improved risk management concerns human limitations. First, the current large financial groups may have so many activities and operations that their risks are too complex to model and control. One has only to look at an organization chart for one of these groups to consider the difficulties

emerging-issues (last visited Mar. 9, 2009).

107. *Id.*

108. *Id.*; see also Emergency Economic Stabilization Act of 2008, 12 U.S.C. § 5221 (as amended by American Recovery and Reinvestment Act of 2009, Pub. L. 111-005, § 7001, 123 Stat. 115 (2009)) (imposing executive compensation restrictions on firms receiving government support); TARP Standards for Compensation and Corporate Governance, 74 Fed. Reg. 28,394, 28,398–99 (June 15, 2009) (setting executive compensation standards); U.S. GOV'T ACCOUNTABILITY OFFICE, TROUBLED ASSET RELIEF PROGRAM: ADDITIONAL ACTIONS NEEDED TO BETTER ENSURE INTEGRITY, ACCOUNTABILITY, AND TRANSPARENCY 26–27 (2008).

109. Press Release, U.S. Dep't of Treasury, Treasury Announces New Restrictions on Executive Compensation (Feb. 4, 2009), available at <http://www.treasury.gov/press/releases/tg15.htm>; see also Deborah Solomon & Damien Paletta, *U.S. Eyes Bank Pay Overhaul*, WALL ST. J., May 13, 2009, at A1 (discussing the Obama administration's plans for the reform of compensation practices in financial institutions); Press Release, U.S. Dep't of Treasury, Statement by Treasury Secretary Timothy Geithner on Compensation (June 10, 2009), available at <http://www.financialstability.gov/latest/pressreleases.html>.

110. See, e.g., INST. OF INT'L FIN., COMPENSATION IN FINANCIAL SERVICES: INDUSTRY PROGRESS AND THE AGENDA FOR CHANGE 21–22 (Mar. 2009); see also Lloyd C. Blankfein, Chairman and CEO, The Goldman Sachs, Group, Inc., Remarks at the Council of Institutional Investors Spring Meeting 5 (Apr. 7, 2009), <http://www2.goldmansachs.com/ideas/public-policy/speech.pdf> (last visited Aug. 27, 2009).

111. Stern, *supra* note 1, at 26–33.

for risk modeling and scenario analysis.¹¹² Given the complexity of these institutions and their interconnectedness in the financial system, which produces added complexities, it may be inevitable that some risks will grow undetected and result in a serious threat to the financial system, as has been the case in the current crisis.¹¹³ If, as has happened, financial institutions continue to expand their activities, the financial system may be prone to repeated catastrophes.¹¹⁴ Simply put, no risk manager, executive, board of directors, or regulator can understand all the risks of a financial group.

This complexity perspective suggests that quantitative risk management, even if enhanced by stress testing and other qualitative approaches, can be dangerous because it gives those in financial institutions and financial regulators the illusion that they have identified and controlled risks. Although they do not know the exact amount of the losses, they believe that they know the causes of them: these are the “known unknowns.”¹¹⁵ However, if financial-market complexities produce new situations of risk that may have little to do with model outcomes, risk assessment and measurement may aggravate the situations because they change the conduct of parties who believe that they have already prepared for the worst.¹¹⁶

112. See, e.g., GROUP OF THIRTY, *supra* note 95, at 40 (noting that if there is no adequate risk management, a firm should reduce its size and complexity); *id.* at 26–27 (pointing out that the largest financial institutions in the United States are becoming even larger, posing greater systemic risk to the financial system and creating complexity: “[i]s it really possible, with all the complexities, risks, and potential conflicts, that even the most dedicated board of directors and top management can understand and maintain control over such a diverse and complex mix of activities?”).

113. Luisa Fernandez et al., *On Democratizing Financial Turmoil: A Minskian Analysis of the Subprime Crisis* 24 (Levy Econ. Inst. of Bard Coll., Working Paper No. 548, 2008) (contending that the crisis is an example of the inherent instability of the financial system which occurred because the system offered funds to the poor in massive amounts and then spread the risk of failure throughout the financial system through Wall Street efforts).

114. See RICHARD BOOKSTABER, *A DEMON OF OUR OWN DESIGN: MARKETS, HEDGE FUNDS, AND THE PERILS OF FINANCIAL INNOVATION* 255–60 (2007).

115. See GEORGE COOPER, *THE ORIGIN OF FINANCIAL CRISES: CENTRAL BANKS, CREDIT BUBBLES AND THE EFFICIENT MARKET FALLACY* 144 (2008) (explaining that this is the situation where the probability distributions for assets are stable).

116. *Id.* at 147–48 (pointing out how past data (which deals with one economic cycle) may be totally unrepresentative of another cycle, and, more importantly, may not at all be predictive of what occurs in extreme circumstances, and that risk management in these circumstances gives market participants a false sense of security and adds to the instability of the system because when one is in a “unknown known” situation one acts as if one is in a “known unknown” scenario); see also Bhidé, *supra* note 77, at 3–4 (contending that, fooled by the spurious predictability of models of rational markets, banks have been encouraged to engage in all kinds of risky activities and are becoming too complex to manage).

In other words, rather than being in the predicted and predictable state of affairs, financial institutions are presented with “unknown knowns” as a result of complexities. This is Taleb’s “black swan” moment, which risk management both aggravated and could not predict.¹¹⁷

A second human limitations argument (which has implications in the environmental area) is the human inability to acknowledge and thus to take action on the basis of truly adverse scenarios. Even if risk management were able to predict losses in complex financial institutions, the questions would be whether we would test the systems with sufficiently negative scenarios and whether we would take the required action to prepare for these negative outcomes, particularly when they are in the future and the present financial situation is good. There is an extensive psychological literature suggesting that human beings can be excessively optimistic, refuse to acknowledge properly the risk of loss, and focus too much on present or visible issues (even if statistically insignificant).¹¹⁸ From a social psychological perspective, moreover, our participation in groups and organizations may reinforce these tendencies because group members may be reluctant to express views at odds with the group’s dominant perspective.¹¹⁹ In other words, although in the middle of the financial crisis, as now, we are alert to risks of loss, memories of the crisis will fade in good times and concerns about catastrophic risks will be less vivid.¹²⁰

A good example of the unwillingness to imagine and to act upon extremely adverse scenarios is the stress testing that financial regulators conducted on the major financial institutions.¹²¹ The regulators required the institutions to run tests under a “baseline” and “more adverse” scenario.¹²² However, the latter scenario only assumed for the worst scenario over the next two years -3.3% real GDP growth, 10.3% unemployment, and an approximately 22% decline in home prices.¹²³ In short, even in the middle of one of the worst financial catastrophes in decades, financial regulators could not even assume an extremely adverse scenario for planning purposes. It is no surprise, therefore, that it is so difficult to convince people, and political leaders, that a human catastrophe awaits them some fifty years in the future as a result of global warming.

117. See COOPER, *supra* note 115, at 147–48.

118. See generally BEHAVIORAL LAW & ECONOMICS (Cass R. Sunstein ed., 2000).

119. See S. ALEXANDER HASLAM, PSYCHOLOGY IN ORGANIZATIONS: THE SOCIAL IDENTITY APPROACH 99–106 (2d ed. 2004).

120. See CASS R. SUNSTEIN, LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE 155 (2005).

121. See DESIGN AND IMPLEMENTATION, *supra* note 101, at 1–2.

122. *Id.*

123. *Id.* at 6.

3. *Recommended Course of Action*

What is the proper course of action for risk management in financial institutions given these obstacles? Certainly, all of the reforms discussed earlier—improvements in risk-management models, enhancements to stress testing, making risk management a part of corporate governance, and more attention of financial regulators to risk management—should occur and efforts should be made to make compensation in financial firms more risk-based. Yet given the complexities of financial institutions and the financial systems that generate novel risk situations, risk management should be made “coarser” or simpler. This means that it should be close to the financial activities that it evaluates and provide straightforward, forward-looking guidance.¹²⁴ In the words of psychologist Gerd Gigerenzer, it should be made “fast and frugal” so that risk managers can respond to new situations of risk; having detailed plans for every scenario that has been experienced may prevent risk managers from actually seeing a new risk challenge.¹²⁵ This would argue against excessive reliance upon quantitative modeling with its complexities, however much the modeling is improved, and more in favor of a qualitative approach to risk management that involves personal judgment and assessment.

It may well be that qualitative risk management must also be accompanied by other action in order to improve risk management. Finance must be more limited or at least not use all its inventions until they have been tested extensively.¹²⁶ In this vein, several prominent scholars of finance and economics have called for a simpler finance.¹²⁷ This does not necessarily mean a return to an earlier regulatory situation where financial activities were separated into different institutions that could not be affiliated, although certainly the value of the financial conglomerate must be reconsidered in light of its contribution to the crisis. Rather, it may argue for creating at least one banking system that alone receives government support, that engages in only basic finance, such as receiving deposits and making commercial loans (and conducting limited hedging), and that is insulated from more complex financial activities.¹²⁸

Finally, a course of action for large, complex financial institutions could be borrowed from the environmental arena. Environmental risk management argues that redundancies be built

124. BOOKSTABER, *supra* note 114, at 235–37.

125. GERD GIGERENZER, *GUT FEELINGS: THE INTELLIGENCE OF THE UNCONSCIOUS* 20–39 (2007).

126. BOOKSTABER, *supra* note 114, at 259–60; DERMAN, *supra* note 63, at 9–10.

127. *See, e.g.*, Paul Krugman, *Making Banking Boring*, N.Y. TIMES, Apr. 10, 2009, at A23.

128. Bhidé, *supra* note 77, at 6.

into risk-management systems to address tail risks and the uncertainty of outcomes.¹²⁹ Using this approach in finance would mean that financial institutions could not engage in new market activities or sell new financial products without redundant regulation, such as an adequate capital charge, a developed market infrastructure, and a regulatory framework that has been used in the past.¹³⁰ This approach would argue that uncertainty, which is the “unknowability” of risk, requires an extremely conservative and skeptical approach in the face of risk and an acceptance that risk never disappears nor is completely managed. Accordingly, in risk management of financial institutions, we should always err on the side of demanding redundancies, even if their cost is significant.

CONCLUSION

This Article argued that the current financial crisis demonstrates a failure of risk management. In doing so, it explained risk management in financial institutions, analyzed its failings, considered risk-management lessons learned from the crisis, and proposed reforms to it. Yet it cautioned that there are significant obstacles to the reforms, particularly the short-term nature of compensation in financial institutions and the complexity of financial activities that pose challenges to risk management. It attempted to propose a course of action to guide risk management in financial institutions going forward. The basic lesson here is borrowed from risk management in environmental analysis, which argues for building in safeguards and redundancies in anticipation of unexpected losses in crises.

The risk-management failure in financial institutions leaves one concerned about the adequacy of preparations to deal with environmental crises, like global warming. In the financial crisis, there was an excessive dependence upon imperfect quantitative risk models, a reluctance to imagine adverse scenarios in stress testing, a failure of senior decision makers to pay attention to risk management, often because of a focus on short-term results, and regulatory passivity when dealing with risk management problems at a time when the financial industry was profitable and looked safe. All of these failings contributed to a worldwide financial crisis and economic hardship. Similar failure in environmental risk management, however, may well have a more catastrophic outcome.

129. See Kousky & Cooke, *supra* note 55, at 5–6.

130. Credit default swaps are a good example of the risks posed by new products without a developed infrastructure.