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Advanced Financial Risk Management:

Tools and Techniques for Integrated Credit Risk, Market Risk, Liquidity Risk and Interest Rate Risk Management

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Part 1: Risk Management: Definitions and Objectives

Chapter 1:
A risk management synthesis:
Market risk, credit risk, liquidity risk and asset and liability management

The field of risk management has undergone an enormous change in the last 40 years and the pace of change is accelerating, thanks in part to the lesson learned in the credit crisis that began in late 2006.

It hasn't always been this way in the risk management field, as Frederick Macauley must have realized nearly 40 years after introducing the concept of duration in 1938. The oldest of the three authors entered the banking industry in the aftermath of what seemed at the time to be a major interest rate crisis in 1974-1975 in the United States. Financial institutions were stunned at the heights to which interests rates could rise, and they began looking for ways to manage the risk. Savings and loan associations, whose primary asset class was 30-year fixed rate mortgages, hurriedly began preparing to offer floating rate mortgages for the first time. In the midst of this panic by management, where did risk managers turn? To a mark to market concept and hedging using Macauley duration which we discuss in Chapters 3-13? Unfortunately for many of the institutions involved, the answer was no.

During this era in the United States, a mark to market approach came naturally to members of the management team who rose through the ranks on the trading floor. In

this era, however, and even today, chief executive officers who passed through the trading floor on their way to the top were rare. Instead, most of the senior management team grew up looking at traditional financial statements and thinking of risk on a net income basis rather than a mark to market basis. This is one of the reasons Citicorp CEO Charles Prince was described in the Introduction as an executive who "didn't know the difference between a CDO and a grocery list."

As a result, the first tool to which management at the time turned was simulation of net income, normally over a time horizon of 1 to 2 years. Given the Wall Street analyst pressures that persist even today, it is not a surprise that net income simulation was the tool of choice. What is surprising, however, is that it was often the only choice and the results of that decision were fatal to a large number of U.S. financial institutions when interest rates rose to 21 percent in the late 1970s and early 1980s. One trillion dollars later, U.S financial institutions regulators had bailed out hundreds of failed financial institutions who disappeared because of the unhedged interest rate risk and the credit risk which.was driven by the high interest rate environment.

From the perspective of 2012, risk management has taken two steps forward and one step backwards. The Federal Reserve's Comprehensive Capital Analysis and Review 2012 ("CCAR 2012") very appropriately focuses on a lengthy list of macro-economic factors that contributed heavily to the credit crisis of 2006-2010. Those macro factors represent the two steps forward. The step backward was the fact that the reporting of the CCAR 2012 results is still heavily oriented toward financial accounting and net income measures instead of mark to market risk measures.

From a perspective in the 1980s, the failure of net income simulation-focused risk management must have been only mildly satisfying to the fans of Frederick Macaulay and his analytical, mark to market approach to risk management. Even in the mid-seventies, when a moderate crisis had just occurred and hints of the crisis to come were getting stronger, resistance to mark to market concepts in risk management were strong and the costs to its advocates were high in career terms. The eldest of the three authors, encouraged by the U.S. Comptroller of the Currency, pushed hard for the adoption of mark to market-based risk management at the sixth largest bank in the United States from 1977 to 1982. The chief financial officer, one of the brightest people in banking at the time, listened carefully but did not buy the concept, his Ph.D. from Stanford University notwithstanding. He was so programmed by accounting concepts by that stage of his career that the mark to market approach to risk management was a foreign language that he would never feel comfortable speaking. The advocate of the mark to market approach to risk management had to change firms.

This type of financial accounting-focused executive is still in the majority today. The departed Charles Prince at Citigroup is a prime example, but the former CEOs at failed firms like Lehman Brothers, Bear Stearns, Northern Rock PLC, Royal Bank of Scotland PLC, Merrill Lynch, Bank of America, Wachovia, and Washington Mutual all suffered from the same fate. The risk that CEOs face from ignoring mark to market risk measurement is much larger and more subtle now than it was during the savings and loan crisis. Trading activities are larger, financial instruments are more complex, and the compensation system at large financial institutions has caused the interests of traders and the interests of management and the shareholders to diverge wildly.

On the one hand, CEOs understand how critical risk management can be. Lehman CEO Dick Fuld was quoted by Larry McDonald and Patrick Robinson (*A Colossal Failure of Common Sense*, page 317) as saying "The key to risk management is never putting yourself in a position where you cannot live to fight another day." On the other hand,

the view held by the staff of management's expertise showed a clear understanding of what management did and didn't understand. McDonald and Robinson note on page 234 of their book, "The World War I British Army was once described by a German general as 'lions led by donkeys.' Mike Gelband's [head of fixed income] opinion of the chain of command in Lehman's little army could scarcely have been more succinctly phrased."

Every once in a while, the donkeys at the top realized that there are both lions and donkeys down below. Business Insider on October 7, 2009 quoted John Thain after he was brought in to rescue Merrill Lynch, "'The bankers and traders dealing in CDOs didn't understand what they were doing,' John Thain said in a recent speech; 'To model correctly one tranche of one CDO took about three hours on one of the fastest computers in the United States. There is no chance that pretty much anybody understood what they were doing with these securities. Creating things that you don't understand is really not a good idea no matter who owns it,' the former Merrill Lynch chief executive said in a speech this month, according to Financial News."

The failures of many financial institutions during the credit crisis could be directly traced to a fundamental lack of understanding of risk in a large financial institution. When important macro-economic factors change (like interest rates, home prices, oil prices, foreign exchange rates, the business cycle), all of the risks that the financial institution faces are affected, even if the financial institution calls these risks by different names and attempts to manage the risks with separate groups of people and separate risk systems that go by the labels "credit risk," "market risk," "asset and liability management," "liquidity risk" and so on.
Comments from executives who were brought in to rescue failing firms show a clear recognition of this problem. Here are a few recent samples:
John Thain, CEO brought in to rescue Merrill Lynch, said, "There were at least two major problems. One was that credit risk management was separate from market risk management, and that doesn't make sense, because they are both permutations of the other. We are combining market and credit risk. Merrill had a risk committee. It just didn't function. So now when we have a weekly meeting, the head of fixed income and equities show up. I show up, and the risk heads show up. It functions and functions across the businesses." Thain was quoted by Susanne Craig and Randall Smith in "Merrill's Risk Manager, New Chief John Thain on What Led to the Losses and Why He's Hiring Goldman Sachs Executives," *Wall Street Journal*, January 18, 2008; Page C1

Bloomberg.com, April 24, 2008, reporting on the Merrill Lynch shareholders meeting, said, **"**Ann Reese, chairwoman of Merrill's audit committee, said the board had had 'numerous discussions' with management about its investments in the months before the credit crisis. The board initially didn't realize that prices of CDOs were linked to the U.S. housing market, she said…'The CDO position did not come to the board's attention until late in the process,' said Reese, a former chief financial officer of ITT Corp. who now is co-executive director of the non-profit Center for Adoption Policy. 'For reasons that we have subsequently explored, there was not a

sense that these triple-A securities should be included in the overall exposure to residential real estate.'"

The UBS AG "Shareholders' Report on UBS's Write-downs" (April 18, 2008, page 19) stated, "Whilst there were a number of credit spread RFL [risk factor limits] limits in place, there was no RFL [risk factor limit] that specifically addressed certain factors relevant to Subprime exposure, such as delinquency rates or residential real estate price developments."

Vikram Pandit, CEO at Citigroup after the departure of Charles Prince, said the following on the PBS Charlie Rose show (reported by Reuters.com on November 25, 2008): "What went wrong is we had tremendous concentration in the sense we put a lot of our money to work against U.S. real estate," Pandit said in an interview on PBS' Charlie Rose show. "We got here by lending money, and putting money to work in the U.S. real estate market, in a size that was probably larger than what we ought to have done on a diversification basis."

Besides management's failure to understand how macro-economic factors drove risk, there were other serious problems. One of the biggest problems was the evolution of compensation packages for traders after the merging of commercial banking and investment banking in the 1990s**.** Mervyn King, Governor of the Bank of England, was quoted on www.reuters.com on May 7, 2008 as saying "Banks have come to realize in the recent crisis that they are paying the price for having designed compensation packages which provide incentives that are not, in the long run, in the interests of the banks themselves, and I would like to think that would change."

The result of the change in compensation systems was simple to describe. Traders increasingly had an incentive to "stuff" their own institution with over-priced assets, like the super senior tranches of collateralized debt obligations, that the traders would otherwise have to sell at a loss. For example, the Financial Crisis Inquiry Commission (Financial Crisis Inquiry Report, February 25, 2011, page 260) explained, "Prince and Robert Rubin, chairman of the Executive Committee of the board, told the FCIC that before September 2007, they had not known that Citigroup's investment banking division had sold some CDOs with liquidity puts [the right to sell the CDO tranches back to Citigroup] and retained the super-senior tranches of others."
Clearly, mark to market risk management is necessary but not sufficient to correctly assess the risk of the institution as a whole. Complete information on the positions of the institution, something Rubin and Prince did not have, is also necessary but not sufficient. The heart of this book is to outline what tools and techniques are both necessary and sufficient to have a complete and accurate understanding of the risk of the firm.

Risk Management: Definitions and Objectives

In the last decade, the definition of what risk management is all about has changed dramatically for reasons we outline in the rest of this chapter. At this point, the best practice definition of risk management can be summarized as follows:

Risk management is the discipline that clearly shows management the risks and returns of every major strategic decision at both the institutional level and the transaction level. Moreover, the risk management discipline shows how to change strategy in order to bring the risk return trade-off into line with the best long and short-term interests of the institution.

This definition knows no boundaries in terms of the nature of the institution. It applies to

- Pension funds
- Insurance companies
- Industrial corporations
- Commercial banks
- Cooperative financial institutions like savings banks
- Securities firms
- National government treasuries
- Foundations and charities

Similarly, the definition knows no political or organizational boundaries like those that have traditionally constrained the discipline of risk management from achieving this integrated approach to risk management. This definition of risk management includes within it the overlapping and inseparable sub-disciplines such as

- Credit risk
- Market risk
- Asset and liability management
- Liquidity risk
- Capital allocation
- Regulatory capital calculations
- Operational risk
- Performance measurement
- Transfer pricing

and many other sub-disciplines. The primary focus of this book is to show how to execute the practice of risk management in a way that is fully integrated and makes no distinction between these sub disciplines. There should be no distinctions between these sub disciplines of risk management because they are simply different views of the same risk. They share the same mathematical roots, the same data needs, the same management reporting needs, and increasingly the same information technology infrastructure, a discussion we turn to in detail in Chapter 40.

Even more important, as the incidents at Citigroup illustrate, this definition of risk management applies to all layers of management and those in positions of responsibility for the institution, including the Board of Directors, the company's auditors, and the institution's regulators, if any. All layers of management share a common obligation and, yes, burden with respect to the practice of risk management. The Basel Committee on Banking Supervision (see www.bis.org for pronouncements of thousands of pages) has recognized this, as have banking regulators all over the world, in their increasingly strict "separation of duties" requirements because of incidents like this:

> Internal auditors at one of the biggest firms on Walls Street, ABC & Co., approached a trader in exotic options and asked how they could come up with an independent estimate of a certain type of volatility. The trader replied "Call Joe at XYZ Brothers at 555-1234." The auditors retired to their offices to dial Joe but before they did the trader had called Joe himself, an old drinking buddy, and told him what answer to give to the auditors' question.[1]

Conflicts of interest become starkly apparent in the execution of best practice risk management. The willingness of traders at Citigroup to provide "liquidity puts" on the CDO tranches they sold reflected their own best interests, not the best interests of the shareholders of Citigroup. All too often over the last 40 years, the only people expert enough to assess the risk of certain complex transactions have had a vested interest in mis-stating the risk, and often the valuation, of the transactions.

This incident confirms the risk that comes from an expertise differential between trading and risk control. Fortunately, the developments in financial technology over the last 40 years have led to a sharp narrowing of the gap in spite of the incident mentioned above. More important, the incident at Citigroup confirms the need for this progress to continue. We can trace the rapid advance in risk management technology to a number of factors.

Advances in Integrated Risk Management and Institutional Barriers to Progress

For most of the last 40 years, there have been sharply defined "silos" that compartmentalized risk management in narrowly defined areas. "Market risk" was focused on a narrowly defined set of instruments accounted for on a market value basis, traded on a trading floor, with prices that were generally observable in the market. "Credit risk" was itself split into two sub-disciplines that were often strangely disconnected:

- the decision about whether or not to originate a particular loan or private placement
- the on-going assessment of portfolio quality on instruments that have already been put on the balance sheet

The first discipline was largely based on internal and external ratings of riskiness, which we discuss in Chapter 18, and traditional financial analysis. The second discipline was conceptually more difficult but lower quality analytics normally prevailed—it consisted mainly of measuring the slowly changing migration of the portfolio from one distribution of ratings in the portfolio to another. Neither discipline led to useful insights on pricing, valuation or hedging of risk.

The "asset and liability management" risk silo in major banks and insurance companies was normally confined to very short term forecasts for financial accounting based net income. Best practice consisted of using a small number of scenarios for testing net income sensitivity to specific changes in the shape and level of yield curves. In commercial banks, at least both sides of the balance sheet were included in this exercise. In life insurance and pension funds, the analysis of income and cash flow were generally restricted to the investment portfolio—the asset side of the institution

[1] We wish to thank our colleague Tatsuo Kishi for this story about his former employer, a well-known investment banking firm.

only. The actuaries ruled the liability side and were not part of the income simulation process until the last moment, when the asset side analysis and liability side analysis were pasted together. A classic sign of this bifurcation of risk is the concept of the "replicating portfolio," the asset strategy that best matches the total cash flows on the liability side in N scenarios. This concept is used in insurance and nowhere else because of the huge political Chinese wall between the actuaries and everyone else in the insurance business. If that wall came down, there are many more accurate and efficient ways to set risk strategy than the replicating portfolio concept.

"Performance measurement" was another silo with substantial differences among types of institutions, even though their balance sheets were nearly identical in composition. To a pension plan, "performance measurement" applied only to the asset side of the organization and it referred solely to whether the investment portfolio, sector by sector, outperformed a specific benchmark index. To a commercial bank, performance measurement meant "funds transfer pricing," the assignment of financial accounting profits to each asset and liability on the balance sheet of the bank and the subsequent compilation of financial accounting profits for each business unit. This process was further complicated by "capital allocation" that assigned capital even to business units even if they had no liabilities and could have used the same performance measurement approach as a pension plan. At an investment bank or on the trading floor of a commercial bank, "performance measurement" was simply a raw calculation of profit or loss with little or no adjustment for risk or performance versus a naïve benchmark.

In Chapters 36-41, we explore these institutional differences in great detail and reconcile the differences in implications and management actions. These differences across institutions and industry segments are large, even though the financial institutions and major corporate treasury operations we are discussing are very similar to each other.

A number of key breakthroughs in financial theory, financial instruments and computer science have proven that the silo approach to risk management is no longer tenable. Furthermore, these developments have shown that the differences in risk management approaches by institutional type are unnecessary and often counterproductive.

The key events in this realization are easy to summarize:

Black-Scholes options model

The introduction of the options pricing model by Fisher Black and Myron Scholes [1973] showed how to value a financial security that until that point had been considered impossible to value if there was not an observable market price. Just as important, Black and Scholes and associates like Robert Merton showed explicitly how to incorporate riskiness into security valuation. This innovation provided the very foundation for modern risk management. Recently, some pundits have blamed the late Fischer Black and Myron Scholes for the credit crisis which began in 2006. For an example of this genre, see Ian Stewart's "The mathematical equation that caused the banks to crash," (The Observer, February 11, 2012). Given that Fischer Black, one of the giants of finance, passed away in August 1995, Stewart's thesis is the financial equivalent

of blaming Henry Ford (who died in 1947) for 21st century automobile crashes.

Term Structure Models and the Heath, Jarrow and Morton Approach

In the middle of the 1970s, Robert Merton [1973] and Oldrich Vasicek [1977] introduced models of the yield curve that were consistent with the "no arbitrage" foundations of Black and Scholes and based on the assumption that the short term rate of interest varies randomly and drives the rest of the yield curve. Following an explosion of related term structure model development in the late 1980s and early 1990s, some of it by Fischer Black, Heath, Jarrow and Morton {"HJM"] published an imposing synthesis in three papers from 1990 to 1992. The HJM approach was a general solution that described what kind of random yield curve movements were consistent with no arbitrage for any given specification for the volatility of interest rates. The HJM approach and its special cases are a special emphasis of Chapters 6 to 14 of this book.

Interest Rate Risk Crisis and the Credit Crisis

The interest rate spikes of the late 1970s and early 1980s created a strong need to put the new risk management technologies to work as soon as possible. The collapse of the Japanese bubble and the U.S. and Euro credit crisis of 2006-2010 made it quite clear that legacy approaches to risk management and the silo organization of the risk management effort did not prevent the failures of financial firms.

Advent of the Personal Computer

The advent of the personal computer and popular spreadsheet software democratized risk management analysis, bringing to the working level the potential to go far beyond the insights that could be gained by large, old-fashioned mainframe systems then dominating the financial services industry. High quality risk management analysis could be explored and proven much more quickly and economically. Once these "proof of concept" explorations were accepted by management, enterprise-wide risk management had the political support necessary to commit major resources to a larger, state of the art system.

Expansion of the Interest Rate Derivatives Market

The interest rate derivatives market had a chicken and egg relationship with the exploding market in interest rate swaps, caps and floors in the middle and late 1980s. New financial analytics for valuing these instruments made popular acceptance of these risk management tools very rapid. A recent lawsuit by Charles Schwab (filed August 23, 2011) accuses a large number of prominent financial institutions of manipulating the London interbank offered rate that has been the basis for the floating ride side of interest rate swaps since the 1980s. While the outcome of the legal process is not known as of this writing, improvements in the integrity of the interest rate derivatives market are already underway.

Computer Storage Capacity and Multi-threading

Rapid declines in the cost of computer storage capability meant that transaction level risk management could become a reality in two senses. First, multiple "instances" of the same data could be used by many analysts, who no longer were blocked from access to the (formerly) single mainframe source of the data. Second, processing speed and the level of precision took a great leap forward with the development of multi-chip processors and the ability to "multi-thread," spreading calculations and input-output over multiple computer chips working simultaneously.

Monte Carlo Simulation and 64-bit Operating Systems

Another important development in the mid-1980s was the rapidly adoption of Monte Carlo simulation as a risk management tool, further accelerating the analysis of risk and return by major financial institutions. Faster computer chips were an essential component in making this step forward possible. The biggest boost in the popularity and power of Monte Carlo simulation came after 2000, however, with the development of the 64 bit operating system. This allowed a vastly greater amount of computer memory to be used in the course of processing, eliminating the need to store intermediate calculations on disk for later use. The impact of this development cannot be overstated.

Development of Quantitative Credit Models and the Introduction of Credit Derivatives

The next major development that resulted in an acceleration of progress in risk management was the introduction of quantitative models of credit risk and the proliferation of credit derivatives like credit default swaps, first to default swaps, and collateralized debt obligations. Researchers like Robert Jarrow (1999, 2001), Jarrow and Turnbull (1995), and Duffie and Singleton (1999) constructed elegant models of credit risk on a random interest rate framework, completing the analytical integration of credit risk and interest rate risk. Tyler Shumway (1998, 2008), Jarrow and Chava (2004), and Campbell, Hilscher and Szilagyi (2008, 2011) used logistic regression on historical data bases to implement the mathematical credit models.

Measuring the Trade-offs between Risk and Return

The implications of these developments for integrated risk management and a more sophisticated trade-off between risk and return were huge. For the first time, risk could be measured instead of just debated. In addition, alternative strategies could be assessed and both risk and return could be estimated using transaction-level detail for the entire institution and any sub portfolio within the institution. Just as important, these developments dashed any rationale for the "silo" management of risk except that of sheer corporate politics. Market risk, credit risk, liquidity risk and asset and liability management all use the same mathematics. They use the same data. They are caused by the same macro-economic factors. And they impact their institutions in the same way. Any argument that they are separate and distinct from an analytical point of view is a hard one to justify from the perspective of the twenty-first century.

The authors hope that this volume will help convince any doubters by the time the last chapter is read.

When Bad Things Happen to Good People

In Chapter 2, we talk about the nature of risk and return measurement in great detail and discuss the organizational structure consistent with best practice in risk management. Before entering into that discussion, talking generally about risks taken that turn out badly provides some practical insights into the kinds of analytics we need to bring to bear to assess the likelihood, magnitude, and timing of specific risks.

These three factors are linked closely. The likelihood of a risk occurring depends on the time interval over which we measure the probability of occurrence. A given risk (like the March 11, 2011 earthquake in Sendai) can have different magnitudes, and the probability of an event of size X is not the same as the probability of an event of size Y. Finally, timing is everything. An earthquake tomorrow has a greater present value cost than an earthquake in the year 2525.

All of these points are obvious, and yet much of risk management has been slow to progress from simple one period models that assume many different risks that are homogeneous in nature. For example, a common calculation in the collateralized debt obligation market is to assume there is only one period (of perhaps five years in length), that all reference names have constant default probabilities, and that all pairs of reference names have the same pairwise correlation in their default probability. This simplistic analysis serious understates the risk of buying a CDO tranche and it is one of the primary reasons for the massive losses in the collateralized debt obligation market. We discuss this in detail in Chapter 20.

We can understand why the likelihood, magnitude and timing of risks have to be analyzed in a more sophisticated manner by talking about how a specific type of institution can fail and what actions would have had to be taken to save the institution.

U.S. Savings and Loan Crisis

The U.S. savings and loan crisis of the 1980s was predominantly due to interest rate risk, with a little interest-rate-induced credit risk thrown in for spice. The savings and loans owned huge portfolios of home mortgage loans with fixed rates for 30 years. Most of the coupons on these loans were in the 8-10% range, although older loans bore much lower coupons. Passbook savings accounts were federally insured and yielded less than half of the mortgage coupons at the beginning of the crisis. Interest rates on the accounts were capped by U.S. federal regulation Q. As short term rates began to rise, the savings and loans were reasonably complacent. They funded a fairly modest portion of their balance sheets with certificates of deposit.

As rates began to rise, two things became increasingly clear to the public, if not to management of the savings and loan associations. The first obvious point was that the value of the mortgages was declining rapidly. The second obvious point was that the savings and loans had very limited ability to hedge the interest rate risk exposure they had so that things were sure to get worse as interest rates rose. And finally, the public

began to realize that the value of the assets of the savings and loans was less than the value of the savings and loans' obligations to depositors.

What happened next? Even with U.S. government deposit insurance in place, depositors voted with their feet. Interest rates on certificates of deposit of the savings and loan associations, even with U.S. deposit insurance, rose to a very substantial premium over U.S. Treasury bills which, in theory, were the same risk. Regular savings depositors withdrew their deposits in droves and savings and loans were unable to fund their cash needs in the certificate of deposit market. The greater fool theory ("even though my net worth is negative on a mark to market basis someone will be dumb enough to buy my certificates of deposit") failed as a funding strategy.

Long Term Capital Management

The collapse of Long Term Capital Management, the prominent hedge fund, in the late 1990s was a similar story. The fund took very large positions arbitraging credit spreads using a very high degree of leverage. Credit spreads moved against LTCM in a significant way. As a private institution, it was very difficult for market participants to know what capital remained and so they did the prudent thing—they declined to continue providing funding against LTCM positions, forcing LTCM to dump their very large positions at very disadvantageous terms. The LTCM partners were too smart to rely on the greater fool theory and sought help to liquidate the firm in a smooth way, but they weren't smart enough to have correctly assessed the likelihood, magnitude and timing of the risk inherent in their portfolio.

The 2006-2011 Credit Crisis

In the introduction, we listed a long chronology of the massive losses that rippled through major financial institutions because of a series if miscues. A fall in home prices caused a sharp increase in mortgage defaults, which in turn led to massive losses in collateralized debt obligations with mortgage-backed securities as underlying reference collateral. The economics of these losses was combined with fraud in the mortgage origination and securitization process and a lack of transparency that hid the true state of affairs from both management (see the quotes above) and shareholders.

Once investors realized that CDO tranches were worth much less than the values that major firms claimed in their financial statements, short term funding for major financial institutions with the biggest holdings disappeared quickly. A partial list of corporate victims is given in the introduction. We discuss the funding shortfalls, institution by institution, in Chapter 37.

The result of the credit crisis was the second $1 trillion bailout of U.S. financial institutions in the last 25 years, with losses of similar magnitude throughout Europe.

A Thousand Cuts

These three case studies show how the magnitude of risk, likelihood of risk and timing of risk are intimately linked. They also show that the greater fool theory rarely works for long once the dice have rolled and come up "snake eyes."

That being said, risk gone bad can still destroy value without leading to the demise of the institution. The experience of both Bank of America and Citigroup during the credit crisis shows how a risk going wrong can destroy value and yet leave the institution able to go forward, wounded but still alive, thanks to generous government bail-out

funding.

That is why our definition of risk management earlier in this chapter is so important—institutions will sometimes lose their bets but if management has been careful about analyzing the trade-offs between risk and return, the magnitude of the losses will be small enough to allow the institution to recover and move on. If management has not been careful, death from a thousand cuts can still come about.

With this in mind, we now turn to the nature of the risk-return trade-off.


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