Spring 1-1-2009

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Recommended Citation
Michael C. Macchiarola, Beware of Risk Everywhere: An Important Lesson from the Current Credit Crisis, 5 HASTINGS BUS L.J. 267 (2009).
Available at: http://repository.uchastings.edu/hastings_business_law_journal/vol5/iss2/2

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BEWARE OF RISK EVERYWHERE:
AN IMPORTANT LESSON FROM
THE CURRENT CREDIT CRISIS

Michael C. Macchiarola*

"I saw the best minds of my generation destroyed by madness."

- Allen Ginsburg in "Howl"

I. INTRODUCTION

As the credit crisis continues to spiral through the world's economies, there has been no shortage of pundits and commentators offering their spin on the problems and proposing solutions. While the entire episode will take some time to sort itself out, its effects are being felt widely and some lessons about its cause can already be gleaned. As a result of this increased attention, a real "teaching moment" has begun to take shape for law school professors training future lawyers in course material dealing with financial issues. This Article attempts to highlight a lesson that should be incorporated into the curricula following recent market events.

The purpose of this Article is to remind attorneys, future attorneys,
law professors, investors, and anyone else that will listen to beware of risk everywhere—especially where you don’t see it. This Article does not mean to suggest that this lesson is by any means the only takeaway from recent market events. Nor does it necessarily represent the most important principle to be learned from this crisis. Instead, this Article is meant to stimulate discussion around a series of issues which, despite their growing importance in both the professional and personal lives of lawyers, still see far too little emphasis on law school campuses. Moreover, it is hoped that this Article will serve to some small way to make these issues more accessible and less threatening to law students and faculty alike. The credit crisis and its lingering effects are not going away anytime soon. As a result, law schools should seriously consider expanding the traditional opportunities available to students to study the policies and products of the capital markets. Moreover, with the regulatory landscape likely to change significantly in the coming years, newly minted attorneys—free from much of the history and preconceived thinking about markets and products and how they should function—will bring a much needed perspective to the market. Understanding this Article’s lesson will serve any young attorney well in navigating the increasingly difficult waters of a legal practice in the coming years.

The Article will begin with a short review of the events that have brought our current extraordinary period of financial turbulence. This section briefly discusses some of the products, policies and conditions that were in place and encouraged during the period that preceded the recent contraction. Rather than pass qualitative judgment, this section of the Article is meant only to provide context and to set the stage for the lesson’s presentation.

Law students in my Corporate Finance course often ask why it is so important that they endure such a heavy dose of financial theory. The following vignette, recently recounted to me by a colleague, is instructive in answering the question:

There was a law student presenting a case in a first-year Contracts class. The student did a fine job stating the holding, rehashing the facts of the case and describing the court’s reasoning. When the professor pressed the student for further detail on the mechanics of a damage calculation, the student replied that the question was a “business issue” and added “I’m just the lawyer.” “And a pretty shitty one you’ll make,” responded the professor.3

2. There is a tension here. A good history student knows that it is probably best to write history after everyone is dead. A good business student, by contrast, knows that if you are not learning from yesterday, you are at a disadvantage today.

3. This teaching moment is attributed to Professor Frank J. Macchiarola, the father of the author, during his time as the Dean of Cardozo Law School. While the lesson is certainly recognizable, the
The moral—in colorful language—is that lawyers must understand their client’s business intimately. While the process of learning can be mind-numbing at times, such an understanding is essential to zealous advocacy. As the disclaimer on my Corporate Finance syllabus warns, “this stuff does not necessarily go down easy.” As a result, law students wishing to become effective advocates for their clients must embrace the notion that practicing law well in this area requires a constant vigilance and an untiring desire to learn, understand and process information. In practice, it is abundantly clear that the finest lawyers work hard to understand the financial theories that underpin today’s products and markets. Hopefully the lesson of this Article will serve as a guidepost as new legal professionals begin their own journey toward steering their clients through the complex issues that will fall out from this crisis in the coming years.

II. OH, WHAT A TANGLED WEB WE’VE WEAVED

“When the capital development of a country becomes a by-product of the activities of a casino, the job (of capitalism) is likely to be ill-done.”

— John Maynard Keynes

At the turn of the twenty-first century, three important developments provided the perfect environment for a dramatic expansion of credit in the United States.4 First, an extraordinarily tranquil period of macroeconomic conditions coupled with a global savings glut5 resulted in historically low long-term interest rates and benign volatility.6 Second, the innovation and

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4. See, e.g. George Melloan, We’re All Keynesians Again, WALL ST. J., Jan. 13, 2009 at A17 (observing that between 2002 and 2007, the funds raised in the United States credit markets nearly doubled).

5. See Ben S. Bernanke, Chairman, Fed. Reserve, Remarks at the Sandridge Lecture, Virginia Association of Economics: The Global Savings Glut and the U.S. Current Account Deficit, (Mar. 10, 2005) (observing “a remarkable reversal in the flows of credit to developing and emerging-market economies, a shift that has transformed those economies from borrowers on international capital markets to large net lenders.”). See also, Andy Mukherjee, Liquidity Glut Stunts Growth, Asia’s Excess Savings Keep the Region’s Debt Markets Shallow, BLOOMBERG, Apr. 9, 2007 (“a liquidity glut is militating against Asia’s capacity to generate an adequate supply of financial assets that will allow it to keep its savings at home.”).

expansion of securitization\(^7\) "produced sophisticated financial assets with relatively high yields and good credit ratings."\(^8\) Third, with both major political parties "intoxicated with the idea of ‘affordable’ housing,"\(^9\) mortgage underwriting standards "had been undermined by virtually every branch of government since the early 1990s."\(^10\)

During the first half of this decade, these low interest rates, large inflows of foreign capital, and increasingly lax mortgage lending standards combined to dramatically inflate the price of houses in the United States.\(^1\) As home prices increased, mortgage lenders saw very little risk in extending credit because the underlying housing collateral continued to increase rapidly in value.\(^2\) The rise in home ownership also served to increase the price of housing in the United States—which the bubble, in turn, attracted a large number of

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7. Securitization is the process of repackaging otherwise illiquid individual loans and converting them into (more liquid) marketable securities. Many have laid a great deal of the blame for the current credit crisis squarely at the feet of securitization techniques. For a rather thorough examination of the process of securitization and a critique of its “dubious legal foundations,” see Kenneth Kettering, *Securitization and its Discontents: The Dynamics of Financial Product Development*, 29 CARDOZO L. REV. 1553 (2008). See, e.g. Anastasia Nesvetailova, *Ponzi Finance and Global Liquidity Meltdown: Lessons from Minsky* (City Univ. London Ctr. of Int’l Politics, Working Paper No. CUTP/002,2008) (“while the process of securitisation has made many assets highly tradable, the ‘bundling together’ of such assets makes the task of evaluation price exposures, the nature of risks involved, as well as the very identity of borrower and lender, virtually impossible.”). *Id.* at 4. *See also* MARTIN NEIL BAILY, ROBERT E. LITAN, & MATTHEW S. JOHNSON, BROOKINGS INST., THE ORIGINS OF THE FINANCIAL CRISIS 8 (2008) (observing that these “new financial innovations thrived in an environment of easy monetary policy by the Federal Reserve and poor regulatory oversight.”).

8. Mizen, *supra* note 6, at 532 (observing that “[n]ew assets were developed based on subprime and other mortgages, which were then sold to investors in the form of repackaged debt securities of increasing sophistication. These received high ratings and were considered safe; they also provided good returns compared with more conventional asset classes.”).


12. Hull, *supra* note 10, at 2 (observing that “[m]ortgage lenders thought they were taking very little risk during the 2000 to 2007 period because the value of the collateral underlying their loans was rising very fast.”).

13. According to the U.S. Census Bureau, the home ownership rate in the United States actually peaked in 2004, hitting 69.2 percent. The rate, which remained in the mid-60s in percentage terms for most of the 1990s, has remained above 67 percent for every quarter since 2000. *See U.S. CENSUS...
speculators looking to quickly buy and resell—or "flip"—homes for a profit.\footnote{14} As with all bubbles, the lessons of history, including lessons about the default rates of poor credit, were largely ignored.\footnote{15} As housing prices stopped rising and the housing bubble started to deflate in 2006, however, mortgage lenders were saddled with larger than expected losses as borrowers ended up in foreclosures in significant numbers.\footnote{16} The correction of this overexpansion and over-availability of credit has resulted in oversized losses by financial institutions throughout the world and has led to an almost unprecedented global tightening of credit.\footnote{17}

Experts have pointed to several factors that combined to cause the problems in the United States' housing sector to spill more broadly into the global credit markets.\footnote{18} The trigger of the crisis can be traced to the loss of confidence in the market for mortgage-backed securities.\footnote{19} Following the

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14. See LIEBOWITZ, \textit{supra} note 10, at 4 (pointing out that "[e]stimates are that one quarter of all home sales were speculative sales of this nature."). See also BAILY ET AL., \textit{supra} note 7, at 7 (commenting that "[l]ike traditional asset price bubbles, expectations of future price increases developed and were a significant factor in inflating home prices.").


16. According to RealtyTrac, total foreclosure filings in the United States in 2007 numbered 2,203,295, representing a 74.99 percent and 148.33 percent increase from 2006 and 2005, respectively. According to the same statistics, 1.033 percent of all United States households were in foreclosure at the end of 2007. See Press Release, RealtyTrac, U.S. Foreclosure Activity Increases 75 Percent in 2007 (Jan. 29, 2008), available at http://www.realtytrac.com/ContentManagement/pressrelease.aspx?ChannelID=9&ItemID=3988&acct=64847. See LIEBOWITZ, \textit{supra} note 10, at 15-17 (asserting that "[t]he immediate cause of the rise in mortgage defaults is fairly obvious—it was the reversal in the remarkable price appreciation of homes that occurred from 1998 until the second quarter of 2006" and "[t]he increase in foreclosures began rising virtually the minute housing prices stopped rising.").

17. See Hull, \textit{supra} note 10, at 2. See also Bill Gross, \textit{So CQish}, PIMCO INVESTMENT OUTLOOK. Nov. 2008, http://www.pimco.com/LeftNav/Featured+Market+Commentary/10/2008/10+Gross+November+2008+So+CQish.htm (noting that "[t]he past era can best be described as a more than half-century build up in credit extension and levered finance."); Roger C. Altman, \textit{supra} note 15, at 4 (noting that "[t]he crisis' underlying cause was the (invariably lethal) combination of very low interest rates and unprecedented levels of liquidity.").


August 2007 collapse of two Bear Stearns hedge funds that were heavily exposed to subprime mortgages, the price of mortgage-backed securities fell, as the market adjusted to reflect the risk of an investment in the asset class.\(^\text{20}\) As a result, activity in the secondary market for mortgage backed securities began to slow dramatically.\(^\text{21}\) With asset prices and market liquidity dropping as mortgage-backed securities plunged into crisis, the funding needs of financial institutions increased.\(^\text{22}\) All of these factors produced a dramatic increase in banking sector demand for liquidity, bringing many credit markets to a virtual halt.\(^\text{23}\) In addition, any efforts toward a solution have been hindered by the fact that the new global financial system was “built on highly interconnected confidence, which, once dissipated, is difficult to resurrect.”\(^\text{24}\)

\(^{1110}\)html.

\(^{20}\) See Roger Lowenstein, *Long-Term Capital Management: It’s a Short-Term Memory*, N.Y. Times, Sept. 6, 2008, at BU1 (noting that “it was Bear that sounded the first shot in the current mortgage crisis” and “[a]s foreclosures kept rising, other institutions suffered losses and the crisis spread”). For a lucid description of the troubles at the Bear Stearns hedge funds and the fallout that followed, see Bryan Burrough, *Bringing Down Bear Stearns*, Vanity Fair, Aug. 2008, at 106.

\(^{21}\) COATS, *supra* note 11, at 5 (also noting that, following the disclosure that the underwriting standards had been misrepresented, originators also “took back” mortgage related products, “creating the need for additional liquidity to fund them.”).

\(^{22}\) This “liquidity spiral” results from the fact that the collateral value of the assets on the balance sheets of borrowers erodes and margins rise or investors are unable to roll over their short-term liabilities. See Markus K. Brunnermeier, *Deciphering the 2007-08 Liquidity and Credit Crunch*, 23 J. Econ. Persps., Winter 2009, at 77. See also Timothy Geitner, President, Fed. Reserve Bank of N.Y., Welcoming Remarks at the Second New York Fed-Princeton University Liquidity Conference, Restoring Market Liquidity in a Credit Crisis (Dec. 13, 2007) (noting that “the sharp deterioration in the value of nonprime mortgage securities and the resulting increase in uncertainty about the value of a much larger amount of financial assets exposed to that risk . . . produced a large unexpected increase in demand for funding from banks at the same time the banks confronted a reduced capacity to raise financing.”); Randall S. Kroszner, Governor, Fed. Reserve Sys., Remarks at the Risk Minds Conference, International Center for Business Information, Geneva, Switzerland, Assessing the Potential for Instability in Financial Markets (Dec. 8, 2008) (observing that “risk managers did not fully contemplate the possibility that many participants would need to unwind their positions at the same time, that such actions might present substantial losses for several key counterparties, and that collateral posted as protection for positions would fall in value at the same time.”).

\(^{23}\) COATS, *supra* note 11, at 5. See also Special Report on Regulatory Reform, Congressional Oversight Panel (Jan. 2009) [hereinafter Congressional Oversight Panel] at 6, observing:

> The first cracks were evident in the subprime mortgage market and in the secondary market for mortgage-related securities. From there, the crisis spread to nearly every corner of the financial sector, both at home and abroad, taking down some of the most venerable names in the investment banking and insurance businesses and crippling others, wreaking havoc in the credit markets, and brutalizing equity markets worldwide.

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The President’s Working Group offered the following assessment of the current situation:

Since mid-2007, financial markets have been in turmoil. Soaring delinquencies on US subprime mortgages were the primary trigger of recent events. However, that initial shock both uncovered and exacerbated other weaknesses in the global financial system. Because financial markets are interconnected, both across asset classes and countries, the impact has been widespread... uncertainty about asset valuations in illiquid markets and about financial institutions’ exposures to asset price changes left investors and markets jittery.25

These problems associated with housing finance reveal broader failings, including inadequate market discipline and poor credit and liquidity risk management by many financial firms.26 This Article hopes to make some small contribution in assisting future decision makers to be better prepared to anticipate and manage these risks, to recognize when markets have moved far upfield from their original theoretical underpinnings and to retain an appropriate level of vigilance with respect to their role in advising these firms in the future. More than anything else, this Article hopes to encourage attorneys and future attorneys to approach all products and policies in the financial world with a healthy skepticism. If it’s too good to be true, it probably is!

III. BEWARE OF RISK EVERYWHERE

Warren Buffett observed that “you only learn who has been swimming naked when the tide goes out.”27 If this is the case, the global financial markets over the past ten years most closely resemble a nudist colony.

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[The financial system] has been badly weakened by an era of irresponsibility, a series of imprudent and dangerous decisions on Wall Street, and an unrelenting quest for profit with too little regard for risk, too little regulatory scrutiny, and too little accountability. The result has been a devastating loss of trust and confidence in our economy, our financial markets, and our government.

Perhaps history's most famous nudist was the emperor in Hans Christian Anderson's classic "The Emperor's New Clothes." In his 1837 tome, Anderson told the story of the emperor of a prosperous city who hires two rogues promising to make him the finest suit from the most beautiful cloth. The emperor, unable to see the (non-existent) clothes, admires their magnificence for fear of appearing stupid or a simpleton. Encouraged by his advisors and mispricing the risk to his reputation, the emperor embarks on a grand parade through the capital buck naked while his sycophantic subjects fawn over his supposed new threads. It is not until a young boy cries out that "the Emperor has no clothes" that the whole charade comes to a crashing end, leaving the emperor exposed—literally!

The market turmoil of the past two years coincides with further erosion of confidence in what financial institutions and other market participants knew—or thought they knew—about the environment in which they were operating. As a result, many banks, hedge funds, financial institutions and individuals are reeling from the effects of having been "exposed" to certain risks that they failed to see, underestimated, mispriced or ignored. Some of the specific risks that market participants face are examined in this section of the Article.

First, the risk-free asset and its selection and application are discussed. This examination reveals that the current crisis should serve as a clarion call, signaling a fundamental shift in the measurement of risk across all asset classes. After suggesting that the financial community abandon the reflexive use of the United States Treasury Bill as the long-held proxy for the risk-free asset (or, at least, examine the implications its continued use), this section of the Article questions whether modern finance's current linear approach to understanding risk is sufficient at all. Next, this section of the Article highlights how financial institutions in this current crisis failed to heed some of the simple lessons of the Long Term Capital Management ("LTCM") failure of the late 1990s. Despite the rather recent example of LTCM, today's financial institutions repeated many of its mistakes—albeit it on a much broader scale. Most notably, in the recent crisis, financial institutions had grown too comfortable with risk, gaining a false sense of complacency from risk management procedures that failed, among other things, to adequately account for the fact that liquidity and correlation change in turbulent markets. Skilled financial engineers and risk managers, ever confident in their ability to understand, measure, model and manage risk, simply missed the mark. Finally, as the example of the auction rate securities market highlights, blindspots can come in super-size.

29. See DAVID SMICK, THE WORLD IS CURVED: HIDDEN DANGERS TO THE GLOBAL ECONOMY 196 (2008) (observing that risk in the market over the last dozen years has been severely underpriced).
Entire markets can grow from a faulty premise that should have been obvious. While this Article only explores a few select examples, there seem to be no limit to the number of instances in the past cycle where market participants operated with either a lack of awareness of or a lack of respect for risk. Investors and their counselors alike—much like Anderson’s emperor—should all benefit from a friendly reminder to *beware of risk everywhere—especially where you don’t see it.*

A. RISK AND THE RISK-FREE RATE

Usually, we associate the concept of “risk” with the probability that something bad will happen. Risk comes with a blind spot too, in that people “tend not to be able to anticipate a future they have never personally experienced.” In finance, however, risk simply measures the amount of uncertainty involved in future outcomes. Risk, for an investor, is measured by the variance of the actual return of the underlying asset from its expected return. A risk-free asset, therefore, offers actual returns that are always equal to its expected return. Though a truly risk-free asset can only exist in theory, most academics and professionals employ short-dated government bonds as a proxy. Consider, for example, an investor with a

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32. Penner, supra note 30, at 624. Cf. Lowenstein, supra note 20, at BU1 (“[r]isk—say, in a card game—can be quantified, but financial markets are subject to uncertainty, which is far less precise.”). See also Philippe Jorion, *Value at Risk: The New Benchmark for Managing Financial Risk* 3 (3d ed. 2007) (characterizing risk as “the volatility of unexpected outcomes, which can represent the value of assets, equity or earnings.”).

33. Penner, supra note 30, at 624. See also Harry M. Markowitz, *Portfolio Selection*, 8 J. Fin. 77, 89 (1952) (observing that the variance of returns is equal to the square of the standard deviation of returns). See also Robert N. Rapp, *Rethinking Risky Investments for that Little Old Lady: A Realistic Role for Modern Portfolio Theory in Assessing Suitability Obligations of Stockbrokers*, 24 Ohio N.U.L. Rev. 189, 243 (1998) (“Economic theory teaches that the real risk of an investment is defined by the uncertainty, or variability, of its expected return or, in other words, the average amount of variation among all the possible returns from the investment.”). See also *Damodaran Valuation*, supra note 30, at 64 (observing that the standard deviation or variance of actual returns around an expected return has become the most widely accepted measure of risk).

34. *Damodaran Valuation*, supra note 30, at 54.

35. See, e.g., Penner, supra note 30, at 629 (“The archetypical risk-free asset is U.S. Treasury bills” and “[these assets are considered essentially risk-free because the risk of default is infinitesimal, although inflation and rising interest rates can affect their returns.”). See also Rapp, supra note 33, at 243-44 (qualifying Treasury securities as risk-free). Cf. Paul Krugman, *The Return of Depression Economics*, 171-72 (2009) (“U.S. government debt is as safe as anything on the planet, not because the United States is the most responsible nation on earth but because a world in which the U.S. government
one-year time horizon purchasing a one-year U.S. Treasury Bill with a 5 percent expected return. As Professor Damodaran observes, “the actual return that this investor would have on this investment will always be 5 percent, which is equal to the expected return.”

There are two basic conditions that must be satisfied in order for an asset’s actual return to equal its expected return absolutely. First, the asset can have no risk of default. In effect, the requirement that the risk-free asset be absent default risk eliminates any security issued by a private firm. While governments are not necessarily better run than private firms, they do have the power to print currency and, therefore, they are able to fulfill their promises—at least in nominal terms. Second, in order for an asset’s return to equal its expected return, there can be no reinvestment risk. The short maturity of the proxy bond is meant to sidestep this problem—minimizing any reinvestment risk by shortening the term of the obligation.

Financial markets are inherently risky and extreme price swings are the norm—not aberrations that can be ignored. An understanding of the risk-free asset, therefore, only tells an investor so much. Because the risk-free rate of return is available to an investor without any default risk or reinvestment risk, it follows that an investor requires additional reward in the form of a higher rate of interest to invest in a risky asset—an asset that includes the risk of default and reinvestment.

36. DAMODARAN VALUATION, supra note 30, at 62.
37. Default occurs when a debtor has not met its legal obligations under the debt contract. A default can occur as a result of a debtor’s failure to make a payment when due or the violation of a loan covenant and may result from the debtor’s unwillingness or inability to pay its debt.
38. DAMODARAN VALUATION, supra note 30, at 154 ("[E]ven the largest and safest firms have some measure of default risk.").
39. Of course, the government of the United States has never defaulted on a governmental debt in its history. The Confederate States of America did default, however, during its war against the Union of the United States during the Civil War. But cf. Alex J. Pollock, Was There Ever a Default on U.S. Treasury Debt?, AMERICAN SPECTATOR, Jan. 21, 2009, http://spectator.org/archives/2009/01/21/was-there-ever-a-default-on-us. See also Zvi Bodie, Alex Kane, & Alan J. Marcus, INVESTMENTS, 138 (4th ed. 1999) ("[A] U.S. Treasury bond that offers a ‘risk-free’ nominal rate of return is not truly a risk-free investment—it does not guarantee the future purchasing power of its cash flow.").
40. Reinvestment risk describes the risk resulting from the fact that earnings (interest or dividends) from an investment may not be able to earn the same rate of return as the original invested funds upon reinvestment. Falling interest rates over the term of a bond, for example, may prevent an investor from reinvesting the coupon payments in an investment that generates the same rate of return as the original bond.
41. See generally BENOIT MANDELBROT & RICHARD L. HUDSON, THE (MIS)BEHAVIOR OF MARKETS 20 (Basic Books, 2004); See also John C. Bogle, Remarks before the Risk Management Association, Black Monday and Black Swans (Oct. 11, 2007) ("Changes in the nature and structure of our financial markets—and the radical shift in its participants—are making shocking and unexpected market aberrations ever more probable."). See also Congressional Oversight Panel supra note 23, at 2 (noting that “[f]inancial markets are inherently volatile and prone to extremes.").
42. See, e.g., Altman, supra note 15, at 4 ("One basic law of finance is that yields on loans are
much reward is required for an investor to absorb a certain amount of risk, however, is the Holy Grail of modern finance.

The use of variance as a measure of risk has at least two basic problems. First, upside and downside variation of returns are treated similarly—meaning that a stock that has risen significantly appears "as risky" as a stock that has fallen by the same amount. Second, the possibility of large payoffs and sizable price jumps might make an investment more or less desirable. Such attributes, however, are beyond the scope of analysis based solely on expected return and variance. These issues notwithstanding, in modern finance, the capital asset pricing model ("CAPM") is the standard for estimating the required rates of return for different assets moving out on the risk continuum from the risk-free asset. CAPM attempts to quantify the higher return that investors demand in exchange for holding a risky asset instead of the risk-free asset. In fact, CAPM provides that, in competitive markets, expected returns will increase linearly with an asset's beta. Therefore, all investments must plot along a

43. See DAMODARAN VALUATION, supra note 30, at 64 (discussing the limitations of variance as a risk measure).

44. See William F. Sharpe, Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, 19 J. FIN. 425 (1964) (observing that an investor "may obtain a higher expected rate of return on his holdings only by incurring additional risk."); John Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, 47 REV. ECON. & STATISTICS 13 (1965). See also Eugene F. Fama & Kenneth R. French, The Capital Asset Pricing Model: Theory and Evidence J. Econ. Persps., Summer 2004 at 25 (observing that CAPM is the centerpiece of MBA investments courses). See also DAMODARAN VALUATION, supra note 30, at 69 (observing that CAPM is the risk-reward model that has "been in use the longest and is still the standard in most real-world analyses"). See also Ronald J. Gilson & Reinier H. Kraakman, The Mechanisms of Market Efficiency, 70 VA. L. REV. 549, 549-50 (1984) (arguing that the Efficient Market Hypothesis is the contextual backdrop for all serious discussion of financial regulation).

45. The original Sharpe and Lintner versions of CAPM contained four assumptions. First, the models assumed that investors seek low volatility and high return on average. Second, similar to many models in finance, these models assume that taxes, illiquidities and transaction costs can be disregarded. Third, the models assume that all investors have access to the same data and make the same conclusions with respect to expected returns, volatilities and correlations of market securities. Finally, the original CAPM models assume that investors only establish long positions in securities and can borrow without limit at the risk-free rate. See Sharpe, supra note 44; Lintner, supra note 44.

46. See RICHARD A. BREALEY, STEWART C. MYERS AND FRANKLIN ALLEN, PRINCIPLES OF CORPORATE FINANCE, 215 (9th Ed., 2008) (noting that the market risk premium, representing the additional return expected for holding the risky asset over and above the return offered by the risk-free asset, has averaged 7.6 percent per year.). See also Rapp, supra note 33, at 241 (observing that "[i]nvestors will sacrifice returns to avoid risk and demand greater returns to accept it.").

47. Beta represents a measure of an individual security's sensitivity to market movements. Statistically, the beta of stock $i$ is defined as $\beta_i = \sigma_{im}/\sigma_m^2$ where $\sigma_{im}$ is the covariance between stock $i$'s return and the market return and $\sigma_m^2$ is the variance of the market return. See BREALEY et al. supra note 46, at 193. See also Rapp, supra note 33, at 245 (observing that "[u]nder CAPM, the required rate of return on an investment is a linear function of the security's beta, its systemic risk."). See also Fama & French, supra note 44, at 5 (observing that beta measures the sensitivity of an asset's return to variation
sloping line, known as the security market line. The model states:

\[ E(R_i) = R_f + \beta_i (E(R_m) - R_f) \]

where:

- \( E(R_i) \) is the expected return of the capital asset;
- \( R_f \) is the risk-free rate of interest;
- \( \beta_i \) is the beta of the asset; \(^{48}\)
- \( E(R_m) \) is the expected return of the market; and
- \( (E(R_m) - R_f) \) is the market premium (or risk premium) representing the expected market rate of return minus the risk-free rate of return.

A few observations about the CAPM formula are warranted. The fact that a risk-free asset can only exist in theory remains undisputed. In light of recent market events, however, the reflexive use of the T-Bill as a proxy for the risk-free asset begs caution. Moreover, if the use of the T-Bill as a proxy for the risk-free asset becomes strained, the effects of the error in the \( R_f \) input of the CAPM formula will be felt across the entire risk spectrum—from risk-free to the most risky assets. The implications of such an error could be profound.

Perhaps the greatest evidence that U.S. Treasury bonds are not free from default risk is the fact that credit default swaps are now readily available with the United States government as the reference entity. \(^{49}\) In

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An asset's beta combines the volatility of the asset's returns and the correlation of those returns with other assets into a single measure. The first factor in beta is the width of the average swing in the asset's value relative to the average swing in the portfolio's value. This can be measured by the standard deviation of the asset's returns divided by the standard deviation of the portfolio's returns. The second factor in beta is the correlation between the asset's moves and the portfolio's moves. A correlation of -1 implies the asset's returns always move up when the portfolio's returns move up. A correlation of 1 implies the asset's returns always move down when the portfolio's return moves up. A correlation of 0 implies the asset and the portfolio move independent of each other.

49. See John Hull & Alan White, Valuing Credit Default Swaps I: No Counterparty Default Risk 1. Derivatives, Fall 2009, at 29, 29, offering the following description of credit default swaps:

A credit default swap (CDS) is a contract that provides insurance against the risk of a default by particular company. The company is known as the reference entity and a default by the company is known as a credit event. The buyer of the insurance obtains the right to sell a particular bond issued by the company for its par value when a credit event occurs. The bond is known as the reference obligation and the total par value of the bond that can be sold is known as the swap's notional principal.

The buyer of the CDS makes periodic payments to the seller until the end of the life of the CDS or until a credit event occurs. A credit event usually requires a final accrual payment by the buyer. The swap is then settled by either physical delivery or in cash. If the terms of the swap require physical delivery, the swap buyer delivers the bonds to the seller in exchange for their par value. When there is cash settlement, the calculation agent polls dealers to determine the mid-market price, Q,
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fact, in recent months, the price of credit default swap protection on assets issued by the United States government has increased dramatically.50 Were these obligations truly "risk free," there would be no need for any investor to seek credit default swap protection. Moreover, absent such risk, a credit default swap with a United States reference obligation would have little cost due to the certainty that the protection buyer would never be able to collect because a credit event would absolutely not happen. Instead, the rising price of the protection suggests that the possibility of default, while still quite remote, might be increasing in likelihood.51

of the reference obligation some specified number of days after the credit event. The cash settlement is then (100-Q) percent of the notional principal.

Id.

50. See Karen Brettell, U.S. Treasuries' Debt Protection Costs Jump to Record, REUTERS, July 11, 2008 (observing "[t]he cost to insure Treasury debt with credit default swaps jumped to 16.5 basis points, or $16,500 per year for five years to insure $10 million in debt, from 8 basis points on Thursday"). See also Abigail Moses, U.S. Treasury Credit-Default Swaps Increase to Record, CMA Says, BLOOMBERG, July 15, 2008 (noting that "[t]he cost of protecting against losses on Treasuries soared to a record on concern that the U.S. government faces higher liabilities with its support for Fannie Mae and Freddie Mac.").

51. See Laurence J. Kotlikoff, The Emperor's Dangerous Clothes, ECONOMIST'S VOICE, Apr. 2008, at 2 (noting that "[u]nless we change our path, the nation will default on its creditors" and "[a]nyone who thinks the U.S. is immune from fiscal meltdown and high inflation, if not, hyperinflation, should think again"). See also Nick Szabo, So Much for the "Risk-Free Investment", UNENUMERATED, July 17, 2008, http://unenumerated.blogspot.com/2008/07/so-much-for-risk-free-investment.html (observing "that the risk of overt default has now substantially increased means that investors are are [sic] recognizing that the unprecedented revenue-generating combination created in 1913 - IRS... and the Federal Reserve... is not indestructible."). See also James West, U.S. Debt Default, Dollar Collapse Altogether Likely, SEEKING ALPHA, Feb. 3, 2009, http://seekingalpha.com/article/118103-u-s-debt-default-dollar-collapse-altogether-likely (last visited Feb. 13, 2009) (asserting that the prospect of a U.S. default on its debt is "not just likely" but "inevitable, and imminent"). Such worries are not necessarily a new phenomenon. See also The Junkification of American T-bonds, THE ECONOMIST, May 27, 1989 at 77 (observing that investors "may become worried about the Treasury's willingness and ability to honour its commitments" following the "blank cheques drawn on the taxpayer" by the Resolution Trust Company). Michael Kinsley, The Upside-Down Economics of Consumption, REAL CLEAR POLITICS, Feb. 20, 2009, http://www.realclearmarkets.com/articles/2009/02/the_upsidedown_economics_of_co.html (noting that "[s]o far...there have been only the faintest whispers about the possibility of an actual default by the U.S. government. Somewhat louder whispers can be heard, though, about the gradual default known as inflation."). See also William Pesek, China Risks the Madoff Treatment for Treasuries, BLOOMBERG, Jan. 9, 2009, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aHOuXtmCv61Y (commenting that "[t]he reason credit-rating companies aren't swarming around and threatening to downgrade the U.S. is trust... That doesn't mean critics who say the [U.S. Treasury] market has become the world's biggest pyramid scheme are wrong."). Ajay Kamalakaran, China to Stick with U.S. Bonds, REUTERS, Feb. 12, 2009, http://www.reuters.com/article/rbssFinancialServicesAndRealEstateNews/idUSBNG44022420090212 (noting that China will continue to buy U.S. Treasury bonds even though it believes that the dollar will depreciate); Floyd Norris, Foreign Investors Wary of Long-Term U.S. Securities, N.Y. TIMES, Feb. 21, 2009, at B3 (observing that foreign investors have flown to short-term U.S. Treasury Bills, but were net sellers of longer term American securities in every month from July through December of 2008). See also, Keith Bradsher, China Cuts Bond Buys from U.S. and Others, N.Y. TIMES, Apr. 13, 2009, at B1 (noting that China's foreign reserves grew in the first quarter of 2009 at the slowest pace in nearly eight years as China's leaders are growing increasingly nervous "about their country's huge exposure to America's financial well-being"); Roger Lowenstein, No Safety in Numbers,
As CAPM provides, if the risk-free proxy is not truly risk-free, its expected return must be calculated as any other risky asset—based on the product of (i) the difference of the spread of the market’s expected return over the true risk-free rate multiplied by (ii) its beta. Also, if the risk-free proxy is not truly free from risk, the data of the risk-free proxy cannot be used as an accurate input into the various pricing formulae that require a risk-free rate as an input. If, therefore, the current risk profile for the obligations of the United States is anything but a temporary anomaly, the effects of this increased riskiness could be profound across all asset classes. Many different corners of modern financial theory rely on a risk-free input in calculating the value of an asset.\(^5\)

Beyond the mechanical and practical implications of a risky T-Bill on CAPM, there remains the question of whether the CAPM approach is effective at all—or whether, instead, modern finance has been mis-measuring risk for quite some time.\(^5^3\) The heart of the argument against CAPM attacks two assumptions that underlie the model, with critics charging that CAPM simply cannot be supported after any careful analysis of market data. To understand the critique, however, a “random walk” through the history of the Capital Asset Pricing Model and its ancestry is required.

**B. THE DEVELOPMENT OF MODERN FINANCIAL THEORY**

In 1900, a French mathematician named Louis Bachelier started a revolution with a little-known dissertation applying the field of probability to the market for French government bonds.\(^5^4\) Bachelier’s work, often called the “random walk,” postulates that prices will go up and down with equal probability, as a fair coin will fall on heads or tails.\(^5^5\) These theories

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N.Y. TIMES MAG., Mar. 22, 2009, at 11 (offering that U.S. Treasuries, although widely regarded as "riskless", bear more risk than many appreciate, and promising that the promised rates of return may “turn out to be worth less over time” because of the effects of inflation). Cf. Pollock, supra note 39 (observing that the decision in 1933 by the United States government—supported by a resolution of Congress and upheld by the Supreme Court—not to honor the “unambiguous obligation to pay in gold” amounted to a depreciation of the currency and an intentional repudiation of its obligations).

52. The Black-Scholes Option Pricing Model, generally accepted as the preferred method for pricing options today, for example, requires a risk-free interest rate input and relies on the notion that it is possible to borrow and lend at a constant risk-free interest rate.

53. See MANDELBROT & HUDSON, supra note 41, at 24 (asserting that, indeed, “[w]e have been mis-measuring risk.”).


55. See MANDELBROT & HUDSON, supra note 41, at 9. See also Burton G. Malkiel, The Efficient Market Hypothesis and Its Critics, J. Econ. Persps., Winter 2003, at 59 (noting that the “logic of the random walk idea is that if the flow of information is unimpeded and information is immediately reflected in stock prices, then tomorrow’s price change will reflect only tomorrow’s news and will be
were honed over time as it was observed, for example, that the variation in prices is measurable. The empirical rule provided mathematicians with a yardstick to measure a rough estimate of probability given a particular standard deviation.\textsuperscript{56} As Bachelier’s price movements were examined, it was observed that they had certain properties. Specifically, few changes were very large and, if plotted on graph paper, the histogram formed a bell curve, with most of the small changes in price movement clustered around the center and rarer big changes at the edges (or tails) of the bell.\textsuperscript{57}

Following up on the work of Bachelier, Eugene Fama offered the Efficient Market Hypothesis ("EMH"),\textsuperscript{58} which posits that an ideal market is informationally efficient, with all relevant information already priced into a security today.\textsuperscript{59} Therefore, the theory prescribes that each price change is independent from the last and, at any time, the actual price of a security will be a good estimate of its intrinsic value.\textsuperscript{60} Far from a proof of market irrationality, randomly evolving stock prices are the necessary consequence of intelligent investors competing to discover relevant information on which to buy or sell stocks before their peers become aware of the information.\textsuperscript{61} Chartists and technical analysts disagree with the random walk model and create elaborate charts of the past price movements of securities in an effort to predict future price movements. To Fama, the independence assumption means that such chartist theories and theories of fundamental analysis "are really the province of the market independent of the price changes today.").

\textsuperscript{56} A standard deviation is a simple mathematical yardstick for measuring the scatter of data. The standard deviation is a statistical measure of the dispersion around the mean. In a normal distribution, approximately 68 percent of the observations would fall within a single standard deviation of the mean and 95 percent of the observations would fall within two standard deviations of the mean. The variance, discussed at note 72, \textit{infra}, is the standard deviation squared. \textit{See generally, PETER L. BERNSTEIN, AGAINST THE GODS: THE REMARKABLE STORY OF RISK} 127-28 (1996) (describing the history of the standard deviation measure).

\textsuperscript{57} \textit{See MANDELBROT & HUDSON, supra note 41, at 10.}

\textsuperscript{58} Eugene F. Fama, \textit{Efficient Capital Markets: A Review of Theory and Empirical Work}, 25 J. Fin. 383 [hereinafter Fama I]. Professor Paul Samuelson's work preceded Professor Fama’s. \textit{See Paul A. Samuelson, Proof That Properly Anticipated Prices Fluctuate Randomly, INDUS. MGMT. REV., Spring 1965, at 41.} In addition, Maurice Kendall is frequently credited with bringing the random walk ideas to the attention of the community of economist in the 1950s.

\textsuperscript{59} \textit{See Fama I, supra note 58, at 383} (asserting that a “market in which prices always 'fully reflect' available information is called 'efficient.'”), Eugene F. Fama, \textit{Random Walks in Stock Market Prices, FIN. ANALYSTS J., Jan./Feb. 1995, reprinted from Sept./Oct. 1965, at 76} [hereinafter Fama II] (positing that "[a]\n\n\textsuperscript{57}A market where successive price changes in individual securities are independent is, by definition, a random walk market.").

\textsuperscript{60} Fama II, \textit{supra} note 59, at 76 (observing that "[a] market where successive price changes in individual securities are independent is, by definition, a random walk market.").

\textsuperscript{61} Zvi Bodie, et al., \textit{supra}, note 39, at 329. \textit{See also BREALEY, ET AL., supra note 46, at 358} (observing that "[i]f past price changes could be used to predict future price changes, investors could make easy profits.").
Moreover, EMH provides that such theories "are completely without value" as "there is no problem in timing purchases and sales" of a security. Instead, Fama insists that an investor should be as comfortable buying a stock at anytime versus another since it remains correctly priced by the efficient market.

Today, there are three forms in which the efficient market hypothesis is commonly stated—weak form efficiency, semi-strong form efficiency, and strong form efficiency. These three levels are distinguished by the degree of information reflected in the relevant security prices. In the weak form of efficiency, prices reflect the information contained in the record of past prices. Markets that display efficiency in the weak sense, therefore, do not allow for consistently superior profits by studying past returns. Instead, stocks follow a random walk. The weak form of the hypothesis has the most empirical support of the three forms. The semi-strong form of efficiency provides that markets incorporate the record of past prices and all other published information about a security. In such a market, stock prices will adjust immediately upon the publication of additional information, thereby eliminating any excess profit that can be garnered from the possession of such information. Finally, in a market that displays characteristics of strong efficiency, prices reflect all information, 

62. Fama II, supra note 59, at 75-76. See also Malkiel, supra note 55, at 59 (observing that, under the principles of EMH, technical or fundamental analysis should not allow an investor to achieve greater returns than a randomly generated portfolio).

63. Fama II, supra note 59, at 75.

64. Id. at 76-77 (asserting that a "simple policy of buying and holding the security will be as good as any more complicated mechanical procedure for timing purchases and sales.").

65. The EMH is not without its critics. In fact, as Professor Malkiel notes, "by the start of the twenty-first century, the intellectual dominance of the efficient market hypothesis had become far less universal." See Malkiel, supra note 55, at 60. Many economists began to explore the notion that stock prices were, at least, partially predictable. Attacks on the pure EMH rationale have come from many corners as academics have attempted to prove that pricing irregularities or patterns can appear and persist for periods of time. Experts have attempted to prove, among others, (i) seasonal and day of the week patterns, (ii) short-term momentum and "stickiness" of prices, (iii) patterns based on dividend ratios, (iv) tendencies based on company size and (v) value versus growth anomalies. In the end, any of these patterns that have been discovered might persist for some period of time but should fade away without offering investors an opportunity for an outsized return. As Professor Malkiel points out, "[i]f any $100 bills are lying around the stock exchanges of the world, they will not be there for long." Malkiel, supra note 55, at 80.


67. In Basic Inc. v Levinson, 485 U.S. 224, (1988), the United States Supreme Court accepted the semi-strong form of the efficient market hypothesis. In adopting the fraud-on-the-market theory in support of a violation of Rule 10b-5 of the Securities and Exchange Act of 1934, the Court observed that "an investor who buys or sells stock at a price set by the market does so in reliance on the integrity of that price." Id. at 247. See also Barbara Black, Fraud on the Market: A Criticism of Dispensing with Reliance Requirements in Certain Open Market Transactions, 62 N.C. L. REV. 435 (1984) (analyzing the fraud on the market theory); Ian Ayres, Back to Basics: Regulating How Corporations Speak to the Market, 77 VA. L. REV. 945 (1991) (examining the Court's analysis in the Basic Inc. case).
public and private.\footnote{68}{The strong form of market efficiency has been contradicted by the fact that insiders can earn extraordinary trading profits. See Nejat H. Seyhun, Insiders' Profits, Costs of Trading, and Market Efficiency, 16 J. FIN. ECON. 189 (1986).}

Around the same time that the random walk model was being developed, Modern Portfolio Theory ("MPT") was emerging from the mind of Harry Markowitz.\footnote{69}{Harry Markowitz, Portfolio Selection, J. FIN. 77 (1952) [hereinafter Markowitz I]. See also Lawrence A. Cunningham, From Random Walk to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Market Hypothesis, 62 GEO. WASH. L. REV. 546, 567 (1994) (summarizing Markowitz's contributions in historical context).}

Built on the old adage "don't put all your eggs in one basket," MPT expands the risk-reward tradeoff so prevalent in modern financial thought. Namely, the theory provides that all investments are reducible to the elements of risk and return. Investors, in turn, are risk averse actors willing to sacrifice returns to avoid risk and demanding greater returns to assume risk.\footnote{70}{MPT establishes that investors will best address their risk aversion by investing in a portfolio of investments that offers the greatest expected return for a given level of risk. In short, the risk associated with spreading your money over multiple stocks is less than investing in a single company's stock.}

Under MPT, the expected return of a portfolio, the proxy for reward, is simply the weighted arithmetic average of the returns of each of its assets. Risk, in turn, is represented by the variance of the possible returns around the expected return.\footnote{72}{Variance measures the dispersion of the returns and is represented mathematically by the sum of the expected squared deviations from the expected return.}

MPT's breakthrough is that, with respect to a portfolio's risk, no such rule (adding the risks of the individual components of the portfolio) can be followed.\footnote{73}{The portfolio variance of a two-stock portfolio, for instance, is established according to the following formula:
\[\sigma_p^2 = \sigma_1^2 x_1^2 + \sigma_2^2 x_2^2 + 2x_1x_2 \rho_{12} \sigma_1 \sigma_2\]
where:
- \(x_1\) and \(x_2\) represent the proportion of the portfolio represented in stocks 1 and 2, respectively;
- \(\sigma_1^2\) and \(\sigma_2^2\) represent the variances of those stock's returns;
- \(\rho_{12}\) represents the covariance between stocks 1 and 2; and
- \(\rho_{12}\) represents the correlation of stocks 1 and 2.
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In fact, because variations in returns on individual investments may reduce the variance of returns on the entire portfolio, portfolio risk is primarily a function of the degree of variance of individual investments compared to the portfolio as a whole.\footnote{74}{Covariance is a measurement of the co-movements between two variables. See Markowitz I, supra note 69, at 79.}

As a result, investors benefit from holding a diversified portfolio instead of individual securities. MPT also contends that, with respect to any security, two
elements of risk can be distinguished: systemic and idiosyncratic. Systemic risk arises from the tendency of a security to vary in lockstep with the overall market in which it is traded. Systemic risks, therefore, cannot be diversified away. Examples of these risks include interest rates, recessions and wars. Idiosyncratic or specific risk, on the other hand, arises from the particular peculiarities of the individual stock being investigated. These risks represent the portion of an asset’s return that is not correlated with general market moves. As such, this risk is specific to individual assets and can be diversified away as the number of assets in the portfolio is increased.

Armed with the Random Walk, the Efficient Market Hypothesis and Modern Portfolio Theory, economists “developed a very elaborate toolkit for analyzing markets, measuring the ‘variance’ and ‘betas’ of different securities and classifying investment portfolios by the probability of risk.” 75 Despite the confidence of economists, however, the track record of modern finance is littered with failures. Rather than proceeding cautiously in light of Fama’s own warning that, in an uncertain world, “no amount of empirical testing is sufficient to establish the validity of a hypothesis beyond any shadow of doubt,” 76 Wall Street risk managers embraced risk with an arrogance and a hubris that would ensure that, sooner or later, they would be hoisted by their own petard. As the market turmoil embodied in the Russian Debt Crisis, the Asian Crisis, the collapse of the Mexican Peso and the bursting of the Internet Bubble all show, these theories, although neat and elegant, continue to underestimate the frequency and magnitude of rare events. Finally, the recent Credit Crisis and its magnitude are far beyond what any of these models might have predicted. Today, we are left to make no conclusion other than that the theory is flawed! 77

The flaw, it seems, is in the heavy reliance on two assumptions to support today’s basic approach—that price changes are statistically independent and they are normally distributed. First, financial price movements do seem to have a memory. In fact, “different kinds of price

75. See MANDELBROT & HUDSON, supra note 41, at 11.
76. Fama II, supra note 59, at 78. See also BERNSTEIN, supra note 56, at 202 (warning that “[w]e cannot even be 100 percent certain that the sun will rise tomorrow morning: the ancients who predicted that event were themselves working with a limited sample of the history of the universe.”).
77. Today’s smartest investors understand this risk. See e.g. MOHAMED EL-ERIAN, WHEN MARKETS COLLIDE: INVESTMENT STRATEGIES FOR THE AGE OF GLOBAL ECONOMIC CHANGE 279 (2008) (describing the need for “tail insurance” to protect against events where the probability is small, but the consequences are huge). El-Erian also describes “Pascal’s Wager,” an argument set out by the French mathematician and physicist, who reflected on the relative costs and benefits of believing in God, in the face of a lack of proof as to whether he exists. As El-Erian describes Pascal’s thinking, “because of the consequences of potentially being wrong, the expected value (probability times consequences) of believing in God always exceeded that of not believing.” See El-Erian at 279-80.
78. See, e.g., George Soros, The Game Changer, FIN. TIMES, Jan. 28, 2009, at 8 (calling for a prompt a rejection of the efficient market hypothesis and a thorough reconsideration of the regulatory regime).
series exhibit different degrees of memory. See also ROGER LOWENSTEIN, WHEN GENIUS FAILED: THE RISE AND FALL OF LONG-TERM CAPITAL MANAGEMENT 72 (2000) [hereinafter LOWENSTEIN] (observing "markets have memories. Sometimes a trend will continue because traders expect (or fear) that it will.").

80. Benoit Mandelbrot & Nassim Nicholas Taleb, How the Finance Gurus Get Risk All Wrong, FORTUNE, July 11, 2005, at 99. See also NASSIM NICHOLAS TALEB, THE BLACK SWAN 269 (2006) (commenting that "selecting the Gaussian while invoking some general law appears to be convenient."). See also LOWENSTEIN, supra note 79, at 72 (quoting Eugene Fama as noting that "[l]ife always has a fat tail."). See also Bogle, supra note 41 (pointing out that "the application of the laws of probability to our financial markets is badly misguided."). See also THE CLIFTON GROUP, SHORTFALLS OF TRADITIONAL FINANCIAL RISK MODELS, 1 (2008):

The traditional financial risk model is a normally distributed bell curve. Bell curves are useful for modeling many statistical trends of large, random populations; however, we believe their application has been mistakenly extrapolated into the world's financial realm. Normal distributions are founded on certain assumptions: events occur independently, extremes are very rare and outliers have minimal effect on expected outcomes. All these assumptions—the assumptions in which the distribution's effectiveness is founded on—are violated when applied to financial markets.

81. See MANDELBROT & HUDSON, supra note 41, at 12. No less than Eugene Fama himself sounded this warning, offering: "If the population of price changes is strictly normal, on the average for any stock . . . an observation more than five standard deviations from the mean should be observed about once every 7,000 years. In fact, such observations seem to occur every three to four years." See Eugene F. Fama, The Behavior of Stock-Market Prices, 39 J. BUS. 34 (1965).

82. Mandelbrot & Taleb, supra, note 80, at 99 (pointing to the collapse of Enron's stock price or the spectacular rise of Cisco's stock price throughout the 1990s as two examples). See also LOWENSTEIN, supra note 79, at 72 (observing that economists theorized that even if the life of the Universe were repeated one billion times, the returns of Black Monday would have remained "unlikely"). See also Richard Hoppe, It's Time We Buried Value-at-Risk, RISK PROFESSIONAL, 14 July/Aug. 1999 (noting that the October 19, 1987, crash was a 28 sigma close-to-close event and observing that "something is rotten in the foundation of the statistical edifice that produced the probability estimates."). See also MANDELBROT & HUDSON, supra note 41, at 13, observing:

From 1916 to 2003, the daily index movements of the Dow Jones Industrial Average do not spread out on graph paper like a simple bell curve. The far edges flare too high: too many big changes. Theory suggests that over that time there should be fifty-eight days when the Dow moved more than 3.4 percent; in fact, there were 1,001. Theory predicts six days of index swings beyond 4.5 percent; in fact, there were 366. And index swings of more than 7 percent should come once every 300,000 years; in fact, the twentieth century saw forty-eight such days. Truly, a calamitous era that insists on flaunting all predictions. Or, perhaps, our assumptions are wrong.

Id. See also Anatole Kaletsky, Now is the Time for a Revolution in Economic Thought, TIMES (London), Feb. 9, 2009, at 37 (observing that Mandelbrot's approach "appear[s] to work far better in modeling extreme movements in financial markets than the conventional methods based on statistically
Criticism of the modern financial theories is nothing new. For a long time, however, these critiques have been largely ignored by a financial services apparatus heavily invested in the EMH and its progeny. One of the most thoughtful criticisms from the legal community was Professor Cunningham’s *From Random Walk to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Markets Hypothesis*. In his 1994 article, Professor Cunningham laments the linear methodology and thought of the EMH which, he argues, have been rendered obsolete by chaos models applying non-linear techniques to understanding the financial markets. Some fifteen years after Professor Cunningham’s work, his advice to lawyers to “feel obligated to confront sooner rather than later” the methodological shift in financial economic theory away from the linear thinking of the Efficient Market Hypothesis seems more important than ever. Having failed to heed his advice the first time, and instead doubling-down on the troubling modern financial theories born of the EMH, market participants find themselves picking up the pieces of a financial house of cards. In particular, his warning against excessive reliance on the linearity that comes with capital market theory warrants closer examination.

As Professor Cunningham observes, linearity means proportionality. In effect, a change in one variable, in modern financial theory, produces a proportionate change in another variable. In CAPM, for example, the expected risk premium varies in direct proportion to beta. It must be the case, however, that certain changes result in outsized consequences. As Professor Cunningham tells it, “the one-ounce straw that breaks the one-ton camel’s back is non-linear because the cause is utterly disproportionate to the effect.” Capital markets are no different, as an incremental bit of information finally results in plummeting prices that are more a response to the cumulative effect of many other bits of information than a response to that single last bit. In our most recent economic cycle, for instance, the

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83. See also SMICK, supra note 29, at 196 (observing that risk in the market over the last dozen years “has been severely underpriced,” and offering that “[u]nderpriced risk eventually leads to periods of stiff and bitter market corrections.”).
84. Cunningham, supra note 69, at 550
85. See Kaletsky, supra note 82 (arguing that “it is time for a revolution in economic thought” that includes more than the current discredited models).
86. See discussion supra Part II.
87. Cunningham, supra note 69, at 571.
88. Id.
89. BREALEY, ET AL., supra note 46, at 214.
90. Cunningham, supra note 69, at 572.
August 2007 collapse of two Bear Stearns hedge funds exposed to the subprime mortgage market seems like a rather miniscule piece of news in relation to the effects that followed.\footnote{See discussion supra pp. 272-74.} A modern risk management platform beholden to this linearity and proportionality constraint will necessarily fail to adequately explain risk.\footnote{See, e.g., Felix Salmon, Recipe for Disaster: The Formula That Killed Wall Street, WIRED MAG., Feb. 23, 2009, http://www.wired.com/techbiz/it/magazine/17-03/wp_quant (arguing that another linear formula, the Gaussian Copula, on which much of the recent mortgage debacle was based, was flawed because it “made no allowance for unpredictability” and “assumed that correlation was a constant rather than something mercurial.”).} While many have offered newer, fresher approaches to measuring risk, the important lesson for the prudent risk manager today is that the problem is not understood simply.\footnote{Cunningham, supra note 69, at 608.} As market participants navigate the choppy seas that risk brings, linear thought, policy and practice and all of its creations are not a reliable lighthouse.\footnote{Cf. LOWENSTEIN, supra note 79, at 76 (quoting a currency trader as referring to Value at Risk models as a “lighthouse for the soon-to-be-shipwrecked.”).} Beyond a rethinking of the proxy that is used as a “risk-free” input in most financial models and a reexamination of the effectiveness of those models, the current crisis highlights the fact that risk in a financial market cannot be understood with mathematical precision. Following the spectacular blowup of LTCM a decade ago, Wall Street professed to understand that trying to quantify risk absolutely is a fool’s game.\footnote{See Lowenstein, supra note 20, at BUI (“In the wake of Long-Term Capital’s failure, Wall Street professed to have learned that even models designed by ‘geniuses’ were subject to error and to the uncertainties that inevitably afflict human forecasts.”). See also MANDELBROT & HUDSON, supra note 41, at 21 (observing that “[p]atterns are the fool’s gold of financial markets.”); Danielson, infra note 144.} Yet, in the years following LTCM, Wall Street only increased its infatuation with financial modeling.\footnote{See Benoit Mandelbrot & Nassim Nicholas Taleb, How the Finance Gurus Get Risk All Wrong, FORTUNE, July 11, 2005, at 100 (complaining that “[d]espite increasing empirical evidence that concentration and jumps better characterize market reality, the reliance on the random walk, the bell-shaped curve, and their spawn of alphas and betas is accelerating, widening a tragic gap between reality and the standard tools of financial measurement.”).} Among other things, the Credit Crisis illustrates the failure of market players to learn the lessons of LTCM. In fact, recent events once again uncovered a fundamental misunderstanding by many market players of their own liquidity risks, the limitations of linearity and the risk that models would come under increasing stress as markets became turbulent and correlations of assets tended to increase (toward one).\footnote{See, e.g. Paul De Grauwe, The Hard Task of Pricing Liquidity Risk, RGE MONITOR, Dec. 17, 2007 (asserting that “[d]uring the last five years prior to August 2007, the market systematically underestimated liquidity risk and therefore systematically put the liquidity risk premium too low.”).} A brief description of each of these misunderstandings—in the LTCM context and today—and the ramifications follows.
C. THE FALL OF LONG-TERM CAPITAL MANAGEMENT

Long-Term Capital Management was founded in 1994 by John Meriwether, a celebrated bond trader who had left Salomon Brothers after a highly publicized bond scandal in 1991. Meriwether assembled a “dream team” of traders and academics in an attempt to create a fund that would profit from the combination of the academics’ quantitative models and the traders’ market judgment and execution capabilities. Sophisticated investors, including many large investment banks, enamored by the track record that Meriwether and his bunch had compiled in their time at Salomon Brothers, invested $1.25 billion at inception. The firm was charging annual fees of 2 percent of capital under management plus 25 percent of profits, well beyond the 1 percent and 20 percent that were the standard in the hedge fund industry. For three years, Meriwether and his band made breathtaking profits, seducing all of Wall Street.

In 1997, for example, LTCM made a profit of $2.1 billion—besting firms like McDonald’s, Nike, Disney, American Express, and Merrill Lynch.

98. In April 1991, Salomon’s head of the government bond desk, Paul Mozer submitted a false bid in excess of the firm’s limits in a Treasury Department auction in an attempt to “corner” the market. Mozer made Meriwether aware of his transgression and it was subsequently reported up the chain at Salomon. After the Federal Reserve Bank learned that it had not been adequately informed of the incident, the Chief Executive Officer John Gutfreund and the President Thomas W. Strauss were forced to resign and Warren Buffett took over as Chairman. Meriwether was fined $50,000 by the SEC and resigned from the firm shortly thereafter. See generally, Leah Nathans Spiro, Dream Team, BUSINESS WEEK, Aug. 29, 1994, at 50 (summarizing the incident and its ramifications).

99. Among others, the LTCM team included Meriwether, former vice-chairman of the Federal Reserve David Mullins and the Nobel Prize winners Myron Scholes and Robert Merton. Eighty investors, including Merrill Lynch CEO David Komansky and Bear Stearns President James Cayne, invested a minimum of $10 million apiece to fund the venture.

100. The Salomon culture and Meriwether’s bond-arbitrage group were described in vivid detail in Michael Lewis’ best-selling Wall Street classic LIAR’S POKER (Penguin Books, 1990).

101. See e.g., Carol Loomis, A House Built on Sand: John Meriwether’s One Mighty Long-Term Capital Has All But Crumbled. So Why Did Warren Buffett Offer to Buy It?, FORTUNE, Oct. 26, 1998, at 110 (characterizing the LTCM fee as “unusually steep”). David Ingram, Book Links, CONTINGENCIES, Jan./Feb. 2001, at 48 (noting that the fee structure was in contrast to the 1 percent and 20 percent that had been the standard for 20 years).

102. See Amy Feldman, Investment Titans Fall, N.Y. DAILY NEWS, September 28, 1998, at 2 (describing the investors in LTCM as “a who’s who list of high finance.”). Based on returns derived from the Wall Street Journal, for example, Philippe Jorion reports after-fees returns in excess of 40 percent for both 1995 and 1996. See JORION, supra note 32, at n.10. See also, Walter H. Weiner, Recent Market Events and the Foundation for Global Market Crises: The Experience of Republic National Bank, 4 FORDHAM FIN. SEC. TAX L. F. 17, 20 (reporting LTCM earnings on capital of 20 percent, 43 percent, 41 percent and 17 percent for each of 1994, 1995, 1996 and 1997, respectively). See also Loomis, supra note 101 (reporting similar profit results).

LTCM was primarily engaged in a strategy known as “market-neutral arbitrage.” Specifically, LTCM was heavily involved in fixed income convergence trading—purchasing bonds that it considered undervalued and selling bonds that it considered overvalued. Compare, for instance, an on-the-run 30-year U.S. Treasury bond yielding 4 percent and an off-the-run 30-year U.S. Treasury bond yielding 4.02 percent. Because the off-the-run security is usually less frequently traded, it typically trades at a slightly less expensive price and, therefore, offers a slightly higher yield. The two bonds, however, must converge to the same value (except for a de minimis time value of money effect) barring a market disruption. An aggressive trader might go short the on-the-run version of the bond and long the off-the-run series in anticipation of the credit spread between the two bonds narrowing. Because these traders bet on miniscule movements in bond spreads, they had “to put a lot of money on a position to make any substantial profits.” LTCM traders, however, were comfortable doing this—largely with borrowed money—because they believed that their quantitative models were superior to anything that the world had ever seen. In the words of one of the LTCM traders, “these models enable us to pursue a large position without a severe concern that our strategies are very exposed to interest rates or yield-curve changes.” One LTCM principal described these activities as “earning a tiny spread on each of thousands of trades, as if it were vacuuming up nickels that others couldn’t see.” Critics, by contrast, have likened the strategy to “picking up nickels in front

104. See UNITED STATES GENERAL ACCOUNTING OFFICE, LONG-TERM CAPITAL MANAGEMENT: REGULATORS NEED TO FOCUS GREATER ATTENTION ON SYSTEMIC RISK 40 (1999).

105. See Hedge Fund Operations: Hearing Before the H. Comm. on Banking & Financial Servs., 105th Cong. (1998) [hereinafter Hedge Fund Operations] (statement of William McDonough, President, Federal Reserve Bank of New York) (describing the strategy of LTCM as using “complex mathematical formulas to identify temporary price discrepancies between different interest rates.”); see also Spiro, supra note 98 (commenting that LTCM “pioneered the art of computer-assisted bond trading” and describing the LTCM strategy as using “computer-generated models to predict tiny but enormously lucrative discrepancies in bond prices.”).

106. An “on-the-run” series of bonds includes the most recently issued bond with a particular maturity. The “off-the-run” series, by contrast, is the former on-the-run series, becoming “off-the-run” once a newer series of the same maturity is issued. Because on-the-run bonds are typically the most liquid, they tend to yield less than their off-the-run counterparts.

107. See generally LOWENSTEIN, supra note 79, at 43-44 (describing the phenomenon of the spreads between on-the-run and off-the-run Treasuries and LTCM’s resulting trading strategy).

108. Spiro, supra note 98. See also Lee Berton, Collapse of LTCM a ‘Must Read’for Profession, 15 ACCT. TODAY, April 2, 2001, at 9, 10 (commenting that LTCM required “huge amounts of money to make a very small profit.”).

109. This quotation is attributed to Lawrence E. Hilibrand, a LTCM trader. See Spiro, supra note 98. But cf. NASSIM NICOLAS TALEB, THE BLACK SWAN 281 (2006) (commenting that “[t]he ideas of portfolio theory inspired the risk management of possible outcomes—thanks to sophisticated ‘calculations.’ They managed to enlarge the ludicrous fallacy to industrial proportions.”).

While this type of hubris made LTCM ripe for a fall, it was the extraordinary events of August 1998 in the global markets that tripped them. That month, the Russian government defaulted on its bonds, triggering a market meltdown. Following the announcement by the Russian government of a debt moratorium, investors began a "flight to quality," seeking superior credit quality and higher liquidity. As a result, LTCM, one of the biggest traders in these bonds, was left with no buyers. To make matters worse, despite the LTCM models that suggested independent price changes across their portfolio of assets, credit spreads widened in almost all of the markets around the world, resulting in major losses for LTCM and other similarly positioned market participants. The portfolio diversification principles at the heart of Modern Portfolio Theory were the foundation for LTCM's models. The theory, well known to the academic giants at LTCM, suggests that diversification reduces the variability of a portfolio such that the benefit from risk diversification makes it worthwhile for investors to allocate funds to assets which—at first sight—offer inferior expected returns. Yet, as LTCM can attest, the benefits of such an allocation, erode at precisely the time that the diversification benefits are needed most, during turbulent market conditions.

112. Hedge Fund Operations, supra note 105.
114. See UNITED STATES GENERAL ACCOUNTING OFFICE, LONG-TERM CAPITAL MANAGEMENT: REGULATORS NEED TO FOCUS GREATER ATTENTION ON SYSTEMIC RISK, 41 (1999): The market had been volatile for several months, but the announcement by the Russian government that it was rescheduling payments on some of its debt obligations and imposing a moratorium on payments by Russian banks on certain obligations sent global markets into a tailspin. The result of the Russian default was a dramatic increase in credit spreads and decrease in liquidity. Investors responded with a "flight to quality" and liquidity.
115. See Weiner, supra note 102, at 21 (noting that LTCM's "downward spiral became a whirlwind" as it reported a 45 percent loss in the month of August 1998).
116. See PRESIDENT'S WORKING GROUP ON FINANCIAL MARKETS, HEDGE FUNDS, LEVERAGE, AND the Lessons of Long-Term Capital Management14 (1999) (noting that "LTCM then faced severe market liquidity problems when its investments began losing value and the fund attempted to unwind some of its positions.").
118. See Larry Swedroe, Anatomy of a Crisis: Lessons Learned From Credit Crunch, INDEX UNIVERSE, Oct. 19, 2008, http://www.indexuniverse.com/sections/features/4666-anatomy-of-a-crisis-lessons-learned.html (noting of investment banks, that "they forgot that even if assets have low correlation, risky assets have a nasty tendency to have their correlations turn high at the wrong time."). See also Hull, supra note 10, at 11 ("One of the lessons from past financial crises is that correlations
The events of the summer of 1998, as described by the Bank of International Settlements, sound eerily similar to the events that followed a decade later, almost to the day.

Financial markets around the globe experienced extraordinary strains, raising apprehensions among market participants and policy makers of an imminent implosion of the financial system. As investors appeared to shy away from practically all types of risk, liquidity dried up in financial markets in both industrial and emerging economies, and many borrowers were unable to raise financing even at punitive rates. Prices for all asset classes except the major industrial country government bonds declined and issuance of new securities ground to a halt.119

By the end of September 1998, LTCM was teetering on the brink of default. Fearful that the failure of LTCM might result in possible dire consequences for the world's financial markets, the Federal Reserve orchestrated a $3.6 billion infusion from a consortium of 14 leading U.S. investment and commercial banks—all creditors who feared the effects of the bankruptcy of a fund that owed $100 billion and what it would do to their own finances.120 In exchange the participants received 90 percent of LTCM's equity—a piece that registered a handsome return over the months following the bailout.121

With such a memory only a decade old, it is difficult to understand how so many market participants could have failed to see the liquidity and correlation risks in the current cycle. I guess there is almost no limit to the ability to ignore the lessons of the past.122

D. VALUE AT RISK

increase in stressed market conditions. Using standard value at risk techniques to estimate correlations from past data and assuming that those correlations will apply in stressed markets is not appropriate.”). See also Peter Coy, Suzanne Woolley, Leah Nathans Spiro & William Glasgall, Failed Wizards of Wall Street, BUS. WK., Sept. 21, 1998, at 114, 118 (commenting that “liquidity dried up across markets. It was a worldwide phenomenon, so the geographic diversification employed by so many quant firms did them not a whit of good.”).


121. See Michael Siconolfi, SEC Probes Hedge Fund’s Disclosure, WALL ST. J., Dec. 8, 1998, at C1 (reporting that LTCM had a $400-million profit since the bailout).

122. See John Bogle, Six Lessons for Investors, WALL ST. J., Jan. 8, 2009, at A15. After making this observation about investors, Mr. Bogle, the founder of the Vanguard Group of Mutual Funds, goes on to quote the Roman orator Cato:

[T]here must be a vast fund of stupidity in human nature, or else men would not be caught as they are, a thousand times over, by the same snares... while they yet remember their past misfortunes, they go on to court and encourage the causes to what they were owing, and which will again produce them.

Id.
One of the most celebrated creations of the modern financial society (and a product of the normal distribution and a linear framework) has been the Value at Risk (''VaR'') approach to risk management. VaR’s great appeal, and its biggest selling point to those that are not quantitative analysts, is that it expresses risk as a single number, a dollar figure, no less.\footnote{Joe Nocera, Risk Mismanagement, N.Y. TIMES MAG., Jan. 4, 2009, at 26. See also Barr Schachter, An Irreverent Guide to Value at Risk, FIN. ENGINEERING NEWS, Aug. 1997 (observing that "VaR was developed to provide a single number which could encapsulate information about the risk in a portfolio, could be calculated rapidly (by 4:15) and could communicate that information to nontechnical senior managers."). Cf. ASWATH DAMODARAN, STRATEGIC RISK TAKING: A FRAMEWORK FOR RISK MANAGEMENT 221 (2007) [hereinafter DAMODARAN RISK] (observing that although "many analysts like VaR because of its simplicity and intuitive appeal, relative to other risk measures, its simplicity emanates from its narrow definition of risk.").}

As a short examination of VaR’s approach reveals, however, it must be interpreted with a healthy skepticism; for it is as limited as the modern approach to understanding risk from which it was born.\footnote{See DAMODARAN RISK, supra note 123, at 221 (observing that "the true VaR can be much greater than the computed VaR if we consider political risk, liquidity risk and regulatory risks that are not built into the VaR."). See also TALEB, supra note 109, at 244-45 (describing the greatest limitation of all models based on the normal distribution: [I]f you are dealing with aggregates, where magnitudes do matter, such as income, your wealth, return on a portfolio or book sales, then you will have a problem and get the wrong distribution if you use the Gaussian, as it does not belong there. One single number can disrupt all of your averages; one single loss can eradicate a century of profits. You can no longer say "this is an exception."}

In its most general form, VaR measures the potential loss in value of a risky asset or portfolio over a specified period of time for a given confidence interval.\footnote{In statistics, a confidence interval is used to indicate the reliability of an estimate. A confidence level, by contrast, determines how likely the interval is to contain the parameter. Increasing the desired confidence level has the effect of widening the confidence interval. A confidence interval can be used to describe the reliability of the results of a particular survey. In a pre-election poll, for example, the result might be that 44 percent of respondents intend to vote for a particular candidate. A 95 percent confidence interval for the proportion in the whole population sharing that intention at the time of the poll might be 41 percent to 47 percent. All other things being equal, a survey result with a small confidence interval is more reliable than a result with a large confidence interval.}

For example, if the VaR of a portfolio is $25 million for a ten-trading-day, 99 percent confidence interval, the VaR model establishes that there is a 1 percent chance that the portfolio’s value will drop by at least $25 million over any given ten-trading-day period. While Value at Risk can be used to measure any firm’s risk exposure, it is most often used by hedge funds and commercial and investment banks to capture the potential loss in value of a trading portfolio from adverse market movements over the prescribed period.\footnote{DAMODARAN RISK, supra note 123, at 201-02 (observing that, by comparing this measurement to the available capital and cash reserves of the firm, the firm hopes to ensure that potential losses can be absorbed without endangering the firm’s very existence).}
measurement to the available capital and cash reserves, the firm hopes to ensure that potential losses can be absorbed without putting the very existence of the firm at risk. Even if VaR is correctly measured, however, it can never fully answer that concern, for it does not even attempt to measure the magnitude of the loss in the catastrophic range where the confidence interval is breached.\textsuperscript{127} As one observer described it:

The fact that you are not likely to lose more than a certain amount 99 percent of the time tells you absolutely nothing about what could happen the other 1 percent of the time. You could lose $51 million instead of $50 million – no big deal. That happens two or three times a year and no one blinks an eye. You could also lose billions and go out of business. VaR has no way of measuring which it will be.\textsuperscript{128}

The first regulatory measures to evoke the VaR methodology were initiated in 1980, when the SEC tied the capital requirements of financial services firms to the losses that would be incurred with a 95 percent confidence over a thirty-day interval, with historical returns used to compute the potential losses.\textsuperscript{129} At the time, the Commission did not refer to this measure as VaR, but “it was clear the SEC was requiring financial service firms to embark on the process of estimating one-month 95 percent VaRs and hold enough capital to cover the potential losses.”\textsuperscript{130} Following a short period where individual institutions embarked on the development of different measures of potential losses, and following a series of high-profile losses associated with the use of derivatives and leverage, the financial world took a significant step toward a more widely accepted and comprehensive risk measure when J.P. Morgan provided public access to its own approach in 1995.\textsuperscript{131}

Over time, the financial services industry has accepted three basic approaches to computing Value at Risk: the Variance-Covariance Model,\textsuperscript{132}
the Historical Simulation Model and the Monte Carlo Simulation Model. Each of the three approaches to VaR has advantages, but comes "with baggage." The variance-covariance approach, for example, requires strong assumptions about the return distributions of the assets in the model. The historical simulation model, on the other hand, assumes that the data of the past is an accurate sample of the risks going forward. Finally, the Monte Carlo simulation, while certainly more robust than the historical model, remains more difficult from a computational standpoint.

While VaR has become a favorite tool of risk managers over the past specified value during a particular period of time. This approach to VaR involves a multi-step process to (i) understand and restate assets as simpler and more standardized underlying instruments, (ii) determine the variance and covariance of each of the underlying instruments in the appropriate weighting and (iii) calculate the Value at Risk for the portfolio using the weights, variances and covariances from the earlier steps. While this approach generally has the advantage of simplicity, a modeler often runs into difficulties in determining the probability distributions. See generally DAMODARAN RISK, supra note 123, at 204-10 (observing that, despite recent improvements, the weakness of the approach is found in the estimation process where the model can suffer from incorrect assumptions, input errors and the fact that values and their relationships change over time).

133. The Historical Simulation approach estimates the VaR of a portfolio by creating a hypothetical time series of returns for the portfolio based upon the historical attributes of the underlying positions. While this approach makes no distributional assumptions it suffers from over-reliance on the notion that history will repeat itself. See JORION, supra note 32, at 262-65 (describing the advantages and drawbacks of the Historical Simulation approach). See also DAMODARAN RISK, supra note 123, at 210-14 (also observing that the historical version of VaR suffers from the fact that trends in the data are ignored because each data point is weighed equally and the model is not particularly good at dealing with new risks that are introduced to assets).

134. The Monte Carlo model of VaR identifies market risks and converts individual assets into positions in standardized instruments in a manner similar to the Variance-Covariance approach. The modeler then specifies (i) probability distributions for each of the market risk factors and (ii) their co-movements before running a simulation. While the Monte Carlo approach represents a certain freedom from the binds of the linear approach, as Professor Damodaran observes, it suffers from the fact that it is only "as good as the probability distribution for the inputs that is fed into it." See DAMODARAN RISK, supra note 123, at 214-17. For an in-depth discussion of the Monte Carlo VaR approach, see JORION, supra note 32, at 307-29.

135. DAMODARAN RISK, supra note 123, at 211.

136. Perhaps the greatest critique of this approach is found in former Federal Reserve Chairman Alan Greenspan's mea culpa before Congress in 2008:

The whole intellectual edifice, however, collapsed in the summer of last year because the data inputted into the risk management models generally covered only the past two decades, a period of euphoria. Had instead the models been fitted more appropriately to historic periods of stress, capital requirements would have been much higher and the financial world would be in far better shape today, in my judgment.

See The Financial Crisis and the Role of Federal Regulators: Hearing Before the H. Comm. on Oversight and Government Reform, 110th Cong. (2008) (statement of Alan Greenspan). See also Nocera, supra note 123, at 29 (observing that "people tend not to be able to anticipate a future they have never personally experienced.").

137. See generally, JORION, supra note 32, at 266-67 (calling Monte Carlo analysis the "most powerful method" to compute VaR while conceding that it requires computational time and expense and is limited by the fact that the inputs "could be wrong"). See also, DAMODARAN RISK, supra note 123, at 19 et seq. (describing some of the limitations of each of the approaches to VaR).
decade, there is reason to be skeptical of both its accuracy as a risk management tool and its use in decision making. As markets become less predictable and previously observed correlations break down, so too do the models. First, the quantitative inputs called for by the VaR model—length of investment horizon and confidence interval—are arbitrary choices. As such, VaR itself is not an objective or scientific measure of the exposure to market risk, but instead a subjective game-type measure. The most basic Variance-Covariance VaR approach to risk is deeply rooted in variance-based linear statistics and probability theory, whose application to market risk estimation is founded on the assumption that markets are Gaussian random walks—that returns in the market follow the normal distribution. The problems and limitations with such an approach should already be clear. As a creation of this linear orthodoxy, the VaR methodology devotes insufficient attention to the truly extreme financial events. While the historical distribution approach allows for a model beyond the normal distribution parameters, it is burdened by the troubling assumption that the returns in the future will be well represented by those gathered from the past. Finally, the Monte Carlo simulation avoids some of the problems of the other two approaches, by relies in large measure, on the portfolio attributes provided by the modeler. Simply put, the model is of little use if those assumptions turn out to be incorrect.

The observations of one critic of the VaR approach are prescient for all market participants and have application more broadly for all attempting to manage risk. The critic suggests an approach that:

138. DAMODARAN RISK, supra note 123, at 218.
141. See Richard Hoppe, It’s Time We Buried Value-at-Risk, RISK PROFESSIONAL, July/Aug. 1999, at 14 (observing that the actual behavior of financial markets does not correspond to the assumptions underlying the mathematical theory).
142. Los, supra note 140, at 19. For one of the most damning rebukes of VaR, see also Jorion, supra note 32, at 552.
143. While I concede that those who fail to learn from the past are bound to repeat it, I always warn my students that those who learn only from the past lack imagination. This warning holds true for all models based on historical data. See Hoppe supra note 141, at 15 (criticizing the assumptions of VaR that mean, variance, skew and kurtosis are taken to be stable through time as meaning that “one must believe that market participants are incapable of learning from experience and have no expectations about tomorrow to change in the light of yesterday’s events.”). See also, JORION, supra note 32, at 134 (conceding that even the “most powerful statistical techniques cannot make short histories reveal once-in-a-lifetime events.”).

Id. (quoting from a Derivatives Strategy interview of Nassim Taleb).
openly admit[s] that the problem as stated cannot be adequately addressed with existing techniques instead of burying the knowledge in a blizzard of technical obfuscation. The hardest thing for me to learn in 20 years as a professor was to say 'I don't know' when I didn't know. But that turns out to be the most truthful thing one can say in many situations. I believe this is one such situation.\textsuperscript{144}

The broad acceptance of VaR as a risk tool might represent an example of the toughest problem of all for market participants attempting to vigilantly manage their risk. In the recent crisis, the false sense of security provided by the VaR methodology might have served as a Trojan horse, inviting more and more risk into the financial institutions that it served.\textsuperscript{145} While these firms took great care to closely monitor the results provided by the risk tools, they failed to adequately question the very underpinnings of those widely accepted measures. Proponents of VaR like to argue that, despite its shortcomings, it is better than what risk managers had before. This is a troubling point of view—one soundly rejected by one of VaR's loudest critics:

That's completely wrong. It's not better than what you had because you are relying on something with false confidence and running larger positions than you would have otherwise. You're worse off relying on misleading information than not having any information at all. If you give a pilot an altimeter that is sometimes defective, he will crash the plane. Give him nothing, and he will look out the window. Technology is only safe if it is flawless.\textsuperscript{146}

Even the most advanced VaR models suffer from the familiar limitations of the linear approach, all are ill-equipped to anticipate the outsized effects of that final one ounce straw on the camel's back.\textsuperscript{147} As the next section of this Article explains, that risk often rears its head when the state of mind of market participants changes and liquidity suffers. Relying on VaR or not, all managers in the current crisis would have done well to have remembered our mantra: to beware of risk everywhere—especially

\begin{itemize}
\item \textsuperscript{144} Hoppe, \textit{supra} note 141, at 16. \textit{See also} Jon Danielson, \textit{The Great Risk Myth}, BUS. SPECTATOR, Jan. 8, 2009, \url{http://www.businessspectator.com.au/bs.nsf/Article/Risky-behaviour-Spd20090107N32VA?OpenDocument&src=srch} ("[t]here is a widely held belief that financial risk is easily measured—that we can stick some sort of riskometer deep into the bowels of the financial system and get an accurate measurement of the risk of complex financial instruments. Misguided belief that this riskometer exists played a key role in getting the financial system into the mess it is in.").
\item \textsuperscript{145} See Robert Langreth, \textit{The Oracle of Doom}, FORBES, Feb. 2, 2009, at 20, 20 (arguing that "[f]aulty risk-control models from overconfident economists offered the illusion that we had everything under control and that banks were profitable when they really weren't...").
\item \textsuperscript{146} JORION, \textit{supra} note 32, at 552 (quoting from a Derivatives Strategy interview of Nassim Taleb). \textit{Cf.} Philippe Jorion, \textit{In Defense of VAR}, DERIVATIVES STRATEGY, Apr. 1997, \url{http://www.derivativesstrategy.com/magazine/archive/1997/0497tea2.asp} (positing that "a wobbly speedometer is better than nothing.").
\item \textsuperscript{147} \textit{See discussion, supra} note 83.
\end{itemize}
where you don’t see it.

E. LIQUIDITY RISKS

Liquidity is generally defined as the ability of a financial firm to meet its debt obligations without incurring unacceptably large losses.\(^{148}\) Liquidity risk, therefore, is the risk to earnings or capital from an institution’s inability to meet its obligations when they come due without accepting such a loss.\(^{149}\) Liquidity risk comes in two basic varieties.\(^{150}\) Funding liquidity risk is the risk of a firm’s inability to fund the positions that it holds or to meet, when due, the cash and collateral demands of transaction counterparties, other credit providers and investors without materially affecting daily operations or overall financial condition.\(^{151}\) Market liquidity risk refers to the firm’s inability to liquidate positions in various asset markets.\(^{152}\) Ultimately, a problem with a firm’s market

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149. Lopez, supra note 148, at 1.

150. See JORION, supra note 32, at 23 (describing, generally, the two forms which he characterizes as “funding liquidity risk” and asset liquidity risk”).

151. Lopez, supra note 148, at 1. See also, JORION, supra note 32, at 23 (discussing funding liquidity risk). See also, Timothy Geithner, President & CEO, Fed. Reserve Bank of N.Y., Keynote Address at the 8th Annual Risk Convention and Exhibition, Global Association of Risk Professionals: Liquidity and Financial Markets (Feb. 28, 2007) (describing funding liquidity as “the availability of credit or the ease with which institutions can borrow or take on leverage.”). In my experience, students often confuse the notions of liquidity and solvency. One of the most colorful explanations of the difference is offered below:

A liquidity crisis is when you write a check for more than the amount in your checking account. You suddenly realize that you need to sell a big securities position to cover it, but selling everything at once might only get you “fire sale” prices. In this case, you need a loan for a few weeks to give you time to work out of your securities position. Without the short-term “liquidity,” the check might bounce even though you really do have the assets to pay it off. In contrast, a solvency crisis is when the only asset you have to cover that check is an IOU from your Uncle Ernie, who keeps promising “I’ll pay you every dime as soon as I win it back on the ponies.”


152. See JORION, supra note 32, at 23 (discussing asset liquidity risk). See also Nathan Bryce, Hedge Funds, Liquidity and Prime Brokers, 13 FORDHAM J. CORP. & FIN. L. 475, 479 (observing that market liquidity is a measure of the degree of difficulty in exiting a given trading position without affecting the security’s market price).
liquidity will impact its ability to manage and hedge market risks and to satisfy any shortfall on the funding side.\textsuperscript{153}

Investors must take care to remember that liquidity varies over time and across markets.\textsuperscript{154} The traditional cautious view of liquidity was trumpeted by the economist Keynes more than seventy years ago:

Of the maxims of orthodox finance none, surely, is more anti-social than the fetish of liquidity, the doctrine that it is a positive virtue on the part of investment institutions to concentrate their holdings of "liquid" securities. It forgets that there is no such thing as liquidity of investment for the community as a whole.\textsuperscript{155}

Keynes was weary of too much liquidity. To Keynes, the seamless ability to buy and sell in the capital markets could result in investors becoming fixated on the short-term—a destabilizing effect on markets. This notion that liquidity begets instability has a long tradition in economics.\textsuperscript{156}

Liquidity risk arises whenever an institution borrows short and lends long.\textsuperscript{157} In entering into such a position, a firm is becoming less liquid and, in turn, its counterparty gains increased liquidity. In effect, borrowing short means that the firm will require frequent votes of confidence from its

\textsuperscript{153} Andre Scheerer, Credit Derivatives: An Overview of Regulatory Initiatives in the U.S. and Europe, FORDHAM J. CORP. & FIN. L. 149, 167-68. See also, Geithner, supra note 151 (describing market liquidity as "the ease with which market participants can transact, or the ability of markets to absorb large purchases or sales without much effect on prices.").

\textsuperscript{154} In fact, investors and their advisors would be wise to heed Professor Nesvetailova's warning that"[a]s sets that are easy to sell when economic agents share a sense of optimism about their profitability, liquidity and safety, often turn out to be unwanted and expensive bundles of 'illiquid' debt when the sense of optimism evaporates. Hence 'liquidity' can evaporate literally overnight." See Nesvetailova, supra note 148, at 10.


\textsuperscript{156} See O'Hara, supra note 148, at 2-3 (tracing the history of "The Dark Side" of liquidity from Keynes through Tobin, Summers and John Coffee). Most recently, Larry Summers echoed the Keynesian view: "It does not follow that once an adequate level of liquidity has been attained, as must have been the case in the stock market years ago, further increases in liquidity are stabilizing. Indeed, ... excessive liquidity actually encourages destabilizing speculation." See Lawrence H. Summers & V.P. Summers, When Financial Markets Work Too Well: A Cautious Case for a Securities Transaction Tax, 3 J. FIN. SERVICES RES. 261, (1989).

\textsuperscript{157} When the yield curve is upward-sloping, longer-maturity Treasuries pay higher rates than those with shorter maturities. This is a typical property of interest rates and it is the main reason that financial institutions are able to earn profits. Banks, for instance, hold assets (loans and securities) that tend to have long maturities on average. Mortgages, for example, often have maturities of thirty years. On the other hand, most bank liabilities are deposits with short maturities. As a result, the interest rates that banks earn on their assets are typically a few percentage points above those that they owe on their liabilities. The ability to take advantage of the yield curve's upward slope—to "borrow short and lend long"—does not come without risks. Unanticipated changes in interest rates represent a potential danger to both profitability and solvency that must be managed. See also Spiro, supra note 98 (noting that "Long Term Capital is a hedge fund: it buys long and sells short using money raised from institutions and well-heeled private investors.").
lenders. The risk of this position arises from the fact that the assets (loan) will generally have a longer maturity than the liabilities (deposits) for the lender. As a result, any "run on the bank" in which many depositors simultaneously show up to withdraw funds can easily lead to default as the institution struggles to gather enough funds to satisfy all of the withdrawals in a prompt manner. Likewise, a decrease in the market value of a firm’s investments or trading positions might require the firm to post additional collateral for the benefit of a counterparty, causing a similar dilemma for the firm. This market psychology was at the heart of Keynes’ cautious view of liquidity and serves as the basis for Paul McCulley’s warning that “liquidity is not a pool of money, but rather a state of mind.”

In recent years, this state of mind has been spread more broadly than has traditionally been the case. Largely as a result of financial innovation and deregulation, liquidity providers encompass a greater diversity of institutions—dubbed the “shadow banking system” by Mr. McCulley.

158. See Lopez, supra note 148, at 1 (observing that “[f]inancial firms are especially sensitive to funding liquidity risk since debt maturity transformation (for example, funding longer-term loans or asset purchases with shorter-term deposits or debt obligations) is one of their key business areas.”).

159. See Congressional Oversight Panel, supra note 23, at 10 (observing that, in addition to traditional bank runs, other types of creditors can weaken or destroy a financial institution and adding that “for example, short-term lenders can refuse to roll over existing loans . . . and market actors may refuse to continue to deal with it.”).

160. See Randall S. Kroszner, Governor, Fed. Reserve System, Remarks at the Risk Minds Conference, International Center for Business Information, Geneva, Switzerland: Assessing the Potential for Instability in Financial Markets (Dec. 8, 2008) (observing that, in the recent credit crisis, “[t]here was not sufficient understanding of the correlation between declines in collateral value and the likelihood that collateral would need to be called upon.”).

161. See Paul McCulley, A Reverse Minsky Journey, PIMCO INVESTMENT OUTLOOK, Oct. 2007, http://www.pimco.com/LeftNav/Featured+Market+Commentary/FF/2007/GCBF+October+2007.htm arguing that liquidity is a function of “[t]he willingness of investors to underwrite risk and uncertainty with borrowed money and the willingness of savers to lend money to investors who want to underwrite risk and uncertainty with borrowed money.”). See also, Geithner, supra note 151 (observing that “liquidity is like confidence. And, like confidence, liquidity plays a critical role both in establishing the conditions than [sic] can lead to a financial shock, and in determining whether that shock becomes acute, threatening broader damage to the functioning of financial and credit markets.”). In the early stages of the current crisis, Citigroup’s then-CEO ruffled some feathers when he compared the liquidity in the market to a game of musical chairs: “When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you’ve got to get up and dance. We’re still dancing.” See Michiyo Nakamoto & David Wighton, Bullish Citigroup Is 'Still Dancing' to the Beat of the Buy-out Boom, FIN. TIMES, July 10, 2007, at l. For my money, Mr. Prince’s statement shows great insight and highlights a serious dilemma of the past cycle. Market participants could not resist the elixir of short term profits even when they might have understood that their actions could eventually amount to collecting nickels in front of a steamroller.

162. For a far more eloquent and colorful description, see Bill Gross, The Shadow Knows, PIMCO INVESTMENT OUTLOOK, Dec. 2007, http://www.pimco.com/LeftNav/Featured+Market+Commentary/IO/2007/IO+December.htm (commenting: “it is certainly true that this shadow system with its derivatives circling the globe has democratized credit. And as the benefits of cheaper financing became available to the many, as opposed to the few, placating and calming waves of higher productivity and widespread diversification led to accelerating economic growth, incomes, and corporate profits. Yet, as is humanity’s wont, we overdid a good thing and the subprime skim milk has soured.”).
Some have trumpeted the benefits of this ongoing trend toward “disintermediation”—enabling companies to access the ultimate sources of funds, the capital markets, without going through banks or financial intermediaries.163 The fact that large pools of liquidity have been outside the confines of the traditional banking sector, however, has frustrated the efforts of federal regulators to recognize and respond to liquidity episodes.164 In fact, this simple structural phenomenon creates profound complications for today’s regulators in attempting to manage a “run on the bank.” While the traditional bank has access to the Federal Reserve as the lender of last resort and the bank’s depositors sleep comfortably under the blanket of the FDIC insurance guaranteeing the return of their capital, today’s pools of shadow banking liquidity share no such protections. Absent an explicit transmission mechanism for government support, the pressure to withdraw intensifies as individual depositors redeem now and ask questions later.165

F. THE FALL OF BEAR STEARNS

In the current cycle, there might be no greater example of the stampeding effects of a changing state of mind than the case of the fall of Bear Stearns. On March 12, 2008, Bear Stearns & Co. President and Chief Executive Officer Alan Schwartz found himself on CNBC assuring the investing public that Bear Stearns was not aware of any imminent threat to its liquidity.166 The very next day, Bear Stearns sought emergency funding

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Congressional Oversight Panel, supra note 23, at 2 (observing that “deregulation and the growth of unregulated, parallel shadow markets were accompanied by the nearly unrestricted marketing of increasingly complex consumer financial products that multiplied risk at every stratum of the economy, from the family level to the global level.”).

163. See Steven L. Schwarcz, Systemic Risk, 97 GEO. L. J. 193, 200 (2008) (asserting that such disintermediation will make a chain of bank failures less critical than in the past).

164. See Martin Fedstein, Full Statement for the House Democratic Steering and Policy Committee: The Economic Stimulus and Sustained Economic Growth, (Jan. 7, 2009) (observing that “[b]ecause of the dysfunctional credit markets and the collapse of housing demand, monetary policy has had no traction in its attempt to lift the economy.”). For a reasonably straightforward description of the “shadow banking system” that developed in the United States in recent years, see KRUGMAN, supra note 35, at 158 et seq.

165. Timothy Geithner, the President of the New York Federal Reserve Bank articulated the risks of the shadow banking system in a recent speech:

The scale of the long-term risky and relatively illiquid assets financed by very short-term liabilities made many of the vehicles and institutions in this parallel financial system vulnerable to a classic type of run, but without the protections such as deposit insurance that the banking system has in place to reduce such risks.


from the Federal Reserve. Less than one month later, Mr. Schwartz offered the following testimony to the United States Senate Banking Committee following the collapse of his company.

Due to the stressed condition of the credit market as a whole and the unprecedented speed at which rumors and speculation travel and echo through the modern financial media environment, the rumors and speculation became a self-fulfilling prophecy. Because of the rumors and conjecture, customers, counterparties and lenders began exercising caution in their dealings with us—and during the latter part of the week outright refused to do business with Bear Stearns. Even if these counterparties and institutional investors believed—as we did—that we were stable, it appears that these parties were faced with the dilemma that if the rumors proved true, they could be in the difficult position of having to explain to their clients and others why they continued to do business with Bear Stearns... There was, simply put, a run on the bank.

Even after his firm was subsumed by the storm of a classic liquidity squeeze, Mr. Schwartz showed his basic misunderstanding of liquidity risk when he added, "I want to emphasize that the impetus for the run on Bear Stearns was in the first instance the result of a lack of confidence, not a lack of capital or liquidity." Are not the two the same?

Mr. Schwartz was the classic product of the linear environment. He reported that we had $17 billion of cash sitting at the bank's parent company as a liquidity cushion. As the year has gone on, that liquidity cushion has been virtually unchanged."). That same day, Schwartz is also quoted as saying "[o]ur liquidity and balance sheet are strong... [w]e don't see any pressure on our liquidity, let alone a liquidity crisis." See Why Wall Street Could Go To Jail, FORTUNE, http://money.cnn.com/gallery/2008/fortune/0812/gallery.parloff_quotes.fortune/4.html (last visited Jan. 6, 2009).

167. See BAMBER & SPENCER, infra note 168, at 119-28 (describing the events of March 14, 2008, and the reaction within Bear Stearns).

168. Turmoil in U.S. Credit Markets: Examining the Recent Actions of Federal Financial Regulators: Hearing Before the S. Comm. on Banking, Housing, & Urban Affairs, 110th Cong. (2008) [hereinafter Turmoil in the U.S. Credit Markets] (statement of Alan Schwartz, President and C.E.O of The Bear Stearns Companies, Inc). See also BILL BAMBER & ANDREW SPENCER, BEAR TRAP: THE FALL OF BEAR STEARNS AND THE PANIC OF 2008 at 63 (2008) ( observing that "[t]he rumors, because of the very fact that they had been uttered, became truths."). Cf. KRUGMAN, supra note 35, at 154, describing, more generally, the cycle of a bank run:

Every once in a while, however, things would go spectacularly wrong. There would be a rumor—maybe true, maybe false—that a bank's investments had gone bad, that it no longer had enough assets to repay its depositors. The rumor would cause a rush by depositors to get their money out before it is all gone—what we call a 'run on the bank.' And often such a run would break the bank even if the original rumor was false... Since runs based even on false rumors could break healthy institutions, bank runs became self-fulfilling prophecies: a bank might collapse, not because there was a rumor about its investments having gone bad, but simply because there was a rumor that it was about to suffer a run.

169. Turmoil in the U.S. Credit Markets, supra note 168.
grew up in an investment bank in the modern financial era, where the
development of modern financial theories led many to believe that risks
could be understood absolutely. He earned his stripes in an environment
where risk taking was rewarded handsomely. Sure, Bear had had some
bumps in the road earlier in the year, but in the minds of many, it had
survived those episodes and would live to fight another day. Mr.
Schwartz, when he made his statements to the television audience, was no
doubt quite familiar with what his firm’s VaR models suggested for Bear’s
potential loss—with a 99 percent confidence interval, no less. What Mr.
Schwartz did not know, was never trained or encouraged to ask and
probably had not even entertained, was that the entire basis for his firm’s
model (and the large majority of all models in today’s financial system)
was flawed and therefore doomed to failure—not because of any
mathematical error, but because risk in a financial market cannot be known
with mathematical precision and trying to quantify it absolutely is a fool’s
game. As a changing state of mind beset the market that Spring, Bear
Steams asked for a vote of confidence from its lenders as it had done very
night for years. On that one night in March, the unthinkable happened—
the lenders voted “no confidence” and Bear Stearns became the financial
markets’ latest victim—picking up nickels in front of a steamroller.

Certainly, Mr. Schwartz was not alone in his misunderstanding. The
gathering forces of the liquidity squeeze also remained fairly invisible to
the regulators throughout Bear’s demise. In fact, earlier in the very week
of Bear’s failure, SEC Chairman Christopher Cox—armed with the results
of some very similar calculations, no doubt—ensured investors that his
regulatory agency was comfortable with the capital cushions at the nation’s
five largest investment banks (including Bear Stearns).
After the demise of Bear, the attention of the financial community quickly turned to the fates of Lehman Brothers and Merrill Lynch. In fact, by the time the liquidity episode had run its course and the curtain came down on 2008, all five of the investment banks cited by Mr. Cox were gone—a sobering lesson in liquidity risk indeed.

G. AUCtion Rate SECurities

Auction rate securities ("ARS") offer another example of a recent liquidity episode. Until recently, the market for auction rate securities was a thriving, little-known comer of the United States capital markets. Auction rate securities are long-term securities—either debt that matures in 30 or 40 years or perpetual preferred stock—with interest rates that vary periodically based on an auction process. ARS are often marketed and sold by a single dealer with the only resale market being through a successful auction. During the second week of February 2008, the auctions at which these interest rates are established experienced a wave of failures, causing the Wall Street Journal to declare the market "virtually collapsed." The failures resulted in the filing of numerous lawsuits by

at A1 (noting that SEC staffers "appeared comfortable" with Bear Stearns' position in the days and weeks leading up to its collapse).


176. And a stunning rebuke of the Security and Exchange Commission's own understanding of liquidity risk!


178. Id. The rates paid on ARS are determined by market participants through auctions that are typically held at 7, 28, 35 and 49 day intervals, with some securities resetting through daily auctions. See LEE, infra note 179, at 5. See John J. McConnell & Alessio Saretto, Auction Failures and the Market for Auction Rate Securities 5, (Working Paper, 2008). See also D'Silva, et al., supra note 177, at 1 (observing that interest rate resets are typically "at intervals of one, four, five or seven weeks, although other reset intervals are possible.").


investors claiming that the nature and the risks of these securities were misrepresented. Various investigations by the SEC and several state attorneys general were announced, promising to examine the activities of several major underwriters of ARS securities.\textsuperscript{181}

Auction rate securities were first offered in the United States in the early 1980s as an alternative for entities looking to raise long-term funding.\textsuperscript{182} The auction rate market developed and expanded throughout the 1990s and into the early part of this decade.\textsuperscript{183} By the end of 2005, there were over $250 billion of these securities outstanding,\textsuperscript{184} with the market exceeding $330 billion by 2008.\textsuperscript{185} ARS seemed to offer the best of both worlds. It was hoped that the product could provide the various issuers with a cheaper funding source than the traditional long-term bond. ARS were designed to behave like a long-term bond for the issuer but resemble a short-term security, such as commercial paper, for the investor.\textsuperscript{186} When the auctions functioned as they were designed, the best of both worlds was, indeed, achieved, as the ARS offered a degree of liquidity comparable to very short-term assets for the investor and cost less than more traditional long-term funding for the issuer.\textsuperscript{187}
The interest rate on ARS is set through a Dutch Auction process where existing ARS holders wishing to sell supply securities to the auction. Potential purchasers (including existing holders wishing to reinvest) bid for securities by specifying both the quantity of securities that they wish to buy and the minimum interest rate that they will accept. In the typical auction, each bid and order size is ranked from lowest to highest based on the minimum bid rate. The entire supply of securities is then allocated to those bidders who specified a minimum acceptable interest rate at or below the lowest rate that clears the market (the “clearing rate”). Successful bidders all receive the clearing rate, regardless of the specific rate of their bid. Until the recent troubles, a successful auction was thought to provide a high degree of liquidity for investors, since the investors could choose to redeem their ARS holdings at par at the next scheduled auction. As such, investors viewed these instruments mainly as a vehicle to park short-term cash in exchange for a return a little better than that offered by a traditional money market. In fact, one of the key drivers of the market’s growth was the investors’ belief that these instruments represented the equivalent of a money market fund, prompting one famous analyst to quip:

[for a while they did what they were designed to do—allowing towns and cities to borrow money at slightly lower rates and ‘cash’ investors to earn slightly higher ones—and this led Wall Street to declare them safe. Alas, these days many auction rate securities can’t be sold for love or money, which has left firms... stuck with mountains of unsaleable paper.]
A failed auction can occur due to a lack of demand which, in turn, leads to no receipt of a clearing bid. Following a failed auction, then-existing holders of ARS will hold their positions at the maximum or "penalty" rate provided in the security's offering document until sufficient bids are entered to establish a clearing bid at the next auction. Following the February 2008 failures, ARS holders were left holding indefinitely securities that they only intended to hold for the shortest of maturities—a great price to pay for a small return above that offered by the money market.

Summing up the failed experiment in the design and implementation of the auction rate security market, the experts at the Federal Reserve (eventually) got it quite right and offered a warning of liquidity risks with broader application:

Auction rate securities represented an ingenious attempt to square a particular financial circle: to create a funding instrument that appears long term from the borrower's perspective but short term from the lender's perspective. We now see what should have been obvious before: Such an arrangement is impossible. If a funding instrument is long term for one party, it also must be long term for the counterparty; any appearance to the contrary must be an illusion. The collapse of the ARS market is but one example of how the recent liquidity crisis in our financial markets has adversely affected all arrangements that funded long-term investments with short-duration liabilities. Because such arrangements are inherently unstable, their failure can cause great discomfort for borrowers or lenders or both.

The shame of the liquidity episode that beset the auction rate securities market is that it took a failed market and all of the related costs before market participants and regulators learned what the Federal Reserve now admits "should have been obvious."

A burned auction rate securities investor who seems to have gotten religion, albeit a little too late, delivers our lesson once again:

[s]o the credit crisis has struck again, this time in what I thought was the safest corner of my portfolio. Is any fixed-income security short of U.S. Treasurys and the biggest, most liquid money-market fund safe at this point? I'd like to think so, but this experience has left me shaken. I don't want to contribute to the irrational panic that seems to have swept the debt markets. But if you own any securities that depend on

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194. While not required to, underwriters may provide a clearing bid to ensure the success of an auction and provide liquidity to investors wishing to sell.
196. Id.
investor confidence or raise any liquidity issues, beware of the risks. 197

If the recent credit crisis has had the effect of calling the building block at the epicenter of modern finance into question, it certainly follows that investors in every asset class emanating out on the risk continuum—from the so-called risk-free to the riskiest asset—would be wise to reevaluate the risk of their individual investments.

IV. CONCLUSION

Despite the lessons of the LTCM failure and the intense focus on liquidity risk and correlation breakdown that followed, many financial institutions repeated the same mistakes in the current credit crisis. Bear Stearns was one of many firms that relied on the linear groupthink that has come to dominate the financial markets. In fact, as the auction rate securities market highlights, products and entire markets were designed in recent years without any healthy respect for the potential for a liquidity episode and an understanding that the one ounce straw that ultimately breaks the camel’s back has more than a linear effect. Without the LTCM experience, these failures might have qualified as failures of imagination. With LTCM as a backdrop, however, these failures are inexcusable and can only be characterized as failures of rigor. Armed with the roadmap for how liquidity risk and correlation breakdown could turn pernicious and the ability to understand, model and insulate against the effects of these risks, these financial institutions chose to march further into the darkness without so much as a flashlight. Actors in the market had ample opportunity to cry out like the young boy in Anderson’s story—that the emperor had no clothes! Time and again they passed on that opportunity—decisions that each institution will likely regret for a long time.

Participants and their advisors in today’s markets have a taller order than ever. Aside from the necessity of a substantial base knowledge in the principles of finance, successful participants must possess a rigor, discipline and humility to manage complex risks in an ever-shifting regulatory environment. The most successful players will remain ever vigilant, with a maturity to probe issues beyond the surface. A healthy skepticism of the accepted theories that underpin markets and products and the humility to understand and question the limitations of the tools employed to measure risks will aid in navigating the complex set of risks in today’s markets. Let there be no doubt, however, that a client will be well served by an attorney that has taken the lesson of this Article to heart.

197. Stewart, supra note 180.