# When Bad Things Happen to Good Portfolios

## Rethinking Risk and Diversification

*By Scott Welch, CIMA®*

*"First, we make a guess. Then we compute the consequences of the guess. Then we compare the consequences to [the] experiment. If it disagrees with [the] experiment, it's wrong. In that simple statement is the key to science. It doesn't make a difference how beautiful your guess is. It doesn't make a difference how smart you are, who made the guess, or what his name is. If [the guess] disagrees with experiment, it's wrong."*[1]

When physicist Richard Feynman offered this observation on theory versus empirical reality, he probably wasn't thinking about modern portfolio theory (MPT). The market events of 2008 and early 2009, however, certainly raised questions of whether MPT holds up in practice.

For more than 20 years advisors and investors built portfolios based on a belief that risk could be minimized and successfully managed using appropriate diversification—an intelligent mix of stocks, bonds, cash, and real assets. And, for most of those 20 years, it worked—the markets experienced an unprecedented period of steadily rising equity prices (with a few hiccups), low volatility, low and falling interest rates, easy access to credit, and general economic stability. For the most part, anyone who questioned the "truth" of MPT simply was ignored.

However, the events of 2008 and early 2009—the collapse of the credit markets, the evaporation of liquidity, the skyrocketing increase in volatility, the lock-step correlations between asset classes, and the precipitous decline in global equity prices—dramatically challenged the "truth" of MPT. "This wasn't supposed to happen," seemed to be the stunned collective reaction of the wealth management industry.

Naysayers claimed that MPT had failed, and its adherents claimed that markets are hyperefficient and that what happened in 2008 was exactly what was supposed to happen—that is, excessive risk taking was excessively punished. The only surprise was the speed and severity of the market's reversion to the mean.

The truth, as usual, probably lies somewhere in the middle. This article examines some of the underlying tenets of MPT that don't hold up well in reality—where guess clearly disagrees with experiment—and summarizes the new ways that investors and advisors are thinking about risk, diversification, and intelligent portfolio construction. In many ways it is a "back to the future" storyline as wealth managers realize the danger of blind faith in the theories of investing and rediscover the importance of common sense.

### Not So Thoroughly Modern Portfolio Theory

Let's begin with the investor. Table 1 shows a brief comparison of MPT's "guesses" with investors' actual "experiments," revealing the potential pitfalls of strictly adhering to the theory.

Now let's look at the market. Table 2 shows another quick comparison that highlights the differences between theory and reality.

Because all of the investor and market "realities" described in tables 1 and 2 are, essentially, intuitive and not especially hard to understand, the begged question is, "How did we not see 2008 coming?" Enter Hyman Minsky.

Minsky was a late-20th century economist who was not especially renowned or acclaimed in his own lifetime (he died in 1996). His primary contribution to economic thought was his research and explanation of financial crises, summarized in his working paper, "The Financial Instability Hypothesis."[2] He believed that "[i]nstability is an inherent and inescapable flaw of capitalism." Specifically, Minsky segmented borrowers into three categories:

**Hedge borrowers.** Hedge borrowers' cash flow can cover both interest and principal on any debt incurred.

**Speculative borrowers.** Speculative borrowers' cash flow can cover interest but not principal.

**Ponzi borrowers.** Ponzi borrowers' cash flow cannot cover either interest or principal and they must rely on rising asset prices and increased borrowing to survive (sound familiar?).

Minsky's theory states that in strong economic times the risk of failure is "forgotten," leading to increased borrowing and a slow (but inevitable) "flow" from hedge borrowing through speculative borrowing and finally to Ponzi borrowing, at which point a market bubble has evolved that will soon, just as inevitably, pop. During periods of economic strength and stability, "within horizon" risk is forgotten or ignored and stability is extrapolated into perpetuity. This leads hedge borrowers to morph slowly into speculative borrowers and speculative borrowers

**TABLE 1: MPT THEORY V. REALITY FOR THE INVESTOR**

| MPT Assumption | Investor Reality |
|---|---|
| • Investors behave rationally | • Investors frequently behave irrationally |
| • Investors seek to optimize their "utility function" | • What is a utility function? |
| • Investors have uniform risk tolerances | • Investors' risk tolerances differ widely as a function of objectives and the beginning level of wealth |
| • Investors view risk mathematically, symmetrically, and in a "continuous" manner | • Investors' risk tolerances change asymmetrically over time and frequently jump discontinuously under different market conditions |
| • Expected return and standard deviation (or volatility) are sufficient to determine an investor's "optimal" portfolio | • Investors are objective-based and do not view upside and downside risk in the same way |
| • Investors are primarily concerned with "end of horizon" results | • Investors are very "path dependent" and sensitive to "within horizon" performance |

**TABLE 2: MPT THEORY V. REALITY FOR THE MARKET**

| MPT Assumption | Market Reality |
|---|---|
| • Investment returns follow a statistical "normal" (bell curve) distribution | • Many investment returns exhibit skew (are not normal) and/or kurtosis (fat tails or extreme events) |
| • Standard deviation (volatility) and correlation (the strength and directional relationship between asset classes) capture the risk of a portfolio | • Portfolios have many types of risk—liquidity, counterparty, credit, leverage—that are not captured by portfolio statistical characteristics |
| • Market behavior is efficient and can be modeled quantitatively and accurately | • Extreme market behavior happens more frequently than statistically predicted and, when it does occur, it results in complete model failure |
| • Model inputs (expected return, standard deviation, and correlations) are static over time | • Model inputs can and do fluctuate wildly over time |

to morph into Ponzi borrowers, all precariously balanced on a proverbial house of cards held together by easy credit and rising asset values.

In other words, periods of market stability mask underlying high levels of market instability until a "Minsky moment" occurs—a tipping point when the credit bubble pops, the house of cards collapses, and leveraged financial markets crater. It would be hard to find a more elegant or accurate description of the events leading up to and through 2008 and early 2009. Minsky's theory also helps to explain why so many investors did not see—or chose to ignore—the warning signals: They collectively forgot that failure was an option.

## Responses to the Cracks We See in MPT

We can segment the many ways that academics and practitioners are responding to the suddenly visible cracks in MPT into three broad approaches: 1) behavioral responses, 2) quantitative responses, and 3) "rethink the problem" responses.

### Behavioral Responses

**Post-modern portfolio theory.** One interesting challenger to MPT is behavioral finance theory. Simply put, behavioral finance is the study of why seemingly rational investors frequently make seemingly irrational decisions about their money. Behavioral finance has been around in academia since the 1960s, but investment professionals have been trying to integrate it into their practices during only the past decade.

The difficulty with applying behavioral finance theory is that, because it is closely tied to human emotion, conditioning, and biases, it can be very difficult to meaningfully quantify. In other words, behavioral finance can effectively explain why investors acted a certain way in the past, but it's hard to use it to predict what investors will do in the future.

The question then becomes, "Is there a way of bridging the gap between MPT and behavioral finance?" One attempt is post-modern portfolio theory (PMPT).[3]

PMPT begins by asking some fundamental and intuitive questions:

1. Is standard deviation an appropriate measure of risk?
2. Are returns really normal?
3. Do investors actually base their decisions solely on optimizing the risk/return utility?

PMPT then makes the following assumptions about investor behavior and investment performance:

1. Investors like upside risk but do not like downside risk, so use downside risk metrics to determine the "risk" of the portfolio because that more accurately captures the way investors think about their money. These downside metrics attempt to measure such intuitive risk factors as:
   a. How often might the investor lose money?

b. When they lose, how much might they lose?
c. What is the maximum loss in any given time period?
d. When they do lose money, how long might it take to earn that money back?

2. Investors are "objectives-based" with respect to their portfolios. That is, they care more about whether the portfolio will earn enough to meet personal investment objectives (e.g., retire at a certain age, generate enough cash flow to maintain or improve lifestyle, meet philanthropic or wealth-transfer goals) and less about the statistical expected return of the portfolio.
3. PMPT recognizes that the so-called "minimum acceptable return" (MAR) differs among investors, so it doesn't assume a homogenous risk/return trade-off profile across all investors.
4. Actual investment returns are not assumed to be normally distributed around the mean, and various methods are employed (e.g., Monte Carlo simulation) to estimate the actual performance that the investor will realize.

Back in the 1950s, when Harry Markowitz first envisioned what we now call MPT, he recognized that using standard deviation (or variance) was not the "best" way to measure portfolio risk—he preferred a "semi-variance" approach that focused on downside risk (rather than viewing upside and downside risk symmetrically as standard deviation does). Given the speed and computational abilities of computers at that time, however, he opted to use far-easier-to-calculate standard deviation instead. With today's computer power, however, many are reconsidering this decision.

An example of this is the "Sortino ratio," developed by Frank Sortino. The Sortino ratio is a semi-variance–based risk metric that attempts to measure the downside risk-adjusted return relative to an investor's MAR. Contrast the Sortino ratio with the more frequently used "Sharpe ratio," which measures risk-adjusted return relative to the risk-free rate and uses standard deviation as the measure of risk.[4]

Depending on the inputs, PMPT can result in recommended portfolios that are wildly different than MPT for a given investor. Further, the assumptions of PMPT mean that each investor has his/her own "efficient frontier," based on his/her specific downside risk tolerances and personal objectives-driven MAR. In other words, a portfolio that is efficient from a PMPT perspective may look inefficient through the MPT lens.

Note that PMPT has not been widely tested and is not widely accepted among financial academics. PMPT challenges include the statistical implications of focusing only on downside risk, which may significantly reduce the amount of data included in the calculation (and reduce the statistical significance of the outcome). Also, there is little or no empirical evidence that downside risk metrics generated from historical data are more accurate at forecasting outcomes than traditional MPT metrics.

However, the analysis and research continues, and PMPT will be refined and more widely used as academics and practitioners seek better ways to bridge MPT and behavioral finance.

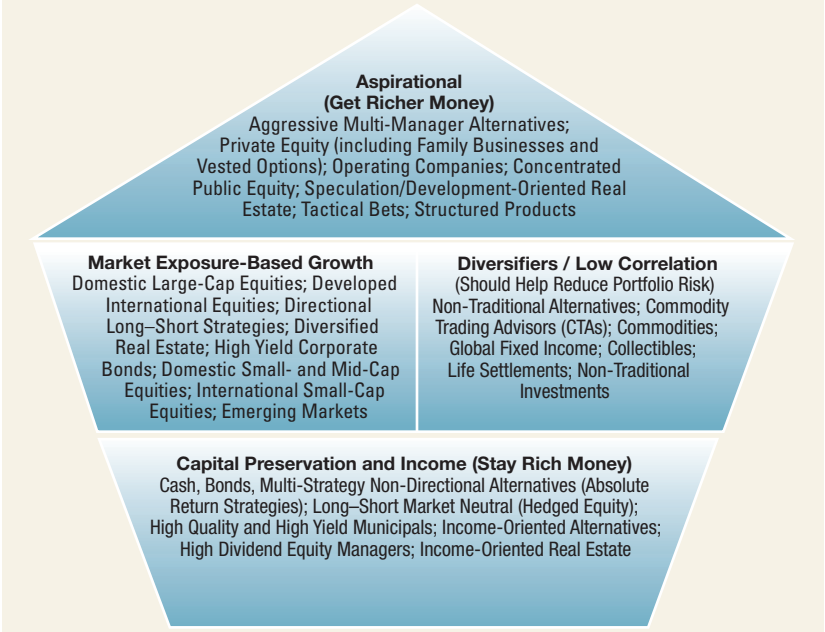
**A purpose-driven investment life.** A less quantitative but still behaviorally oriented revision of MPT is objectives-based portfolio construction.[5] The concept is to build client portfolios that target specific client or portfolio objectives. This contrasts with the usual MPT approach of optimizing the risk/return trade-off of the overall portfolio—a statistical portfolio property that may or may not have any real meaning to the average investor.

Figure 1 illustrates how an overall portfolio might be segmented to meet specific investor objectives, in this case lifestyle maintenance, market participation, and aspirational wealth. Presenting different strategies in the context of the investment objectives may result in better understanding by the investor and improve longer-term investor discipline.

Figure 2 illustrates a slightly different concept by presenting individual investments in the context of their specific purposes within the overall portfolio.

**FIGURE 1: AN OBJECTIVES-BASED INVESTMENT HIERARCHY**

**FIGURE 2: A PURPOSE-DRIVEN INVESTMENT HIERARCHY**




Note that the statistical properties of MPT are not necessarily discarded when implementing objectives-based portfolio construction. The overall portfolio may still be optimized using traditional MPT inputs and outputs. The presentation of the portfolio, however, is designed to align with how investors actually think about their money (i.e., that the portfolio exists to fund specific investor objectives and individual strategies serve specific purposes within the portfolio).[6]

## Quantitative Responses

Many quantitatively oriented academics and practitioners are less concerned with investor behavior than with improving the robustness of the models used to construct and manage portfolios. These quantitative types look back over the history of the markets and see nonnormal return distributions, extreme or fat-tail events that occur far more frequently than statistically suggested, and highly volatile asset class correlations that converge to +1 during market disruptions, and they believe the answer lies in applying new and better math to the problem.

Some of the more interesting ideas being applied are summarized below:

**Market turbulence portfolio optimization** suggests that markets pass through periods of quiescence and turbulence and that these periods are both persistent and forecastable. If true, then building and managing portfolios to incorporate these different turbulence regimes (rather than assuming static volatility and correlation conditions) results in truer diversification, less tail risk, and more consistent portfolio performance. Mark Kritzman at Windham Capital is a leading proponent of this theory, and he has published extensively on the subject.[7]

**Extreme value theory (EVT)** is the statistical analysis of results that deviate wildly from the norm, that is, the study of market behavior in the fat-tail portion of the return distribution. EVT typically is used to study the risk of low-probability, high-impact events such as floods and mutational evolutionary events. Industry thought leaders such as Blake LeBaron believe that applying EVT to portfolio management leads to better understanding of both the likelihood and outcome of extreme market events and thus drives more-intelligent portfolio construction and risk management.

**Value at Risk (VaR) and Conditional Value at Risk (CVaR)** are related to EVT. VaR is a statistical metric that measures the potential risk of loss within a portfolio over a specified time period.

In May 2009 at the IMCA Spring Professional Development Conference in San Diego, one session explored some of the weaknesses of using VaR to measure portfolio risk. These weaknesses are driven primarily by VaR's assumption of normal return distributions, which dramatically underestimates tail or extreme event risk.

The presenter, William Shadwick, recommended using CVaR instead. CVaR measures "extreme risk" or "the risk beyond VaR."[8] He further recommended using a Laplace distribution rather than a normal distribution when measuring CVaR.

Laplace distribution curves have higher and narrower "peaks" at the mean and fatter tails than normal bell curves, and thus place a higher probability on tail events. The belief is that portfolios can be more robustly constructed and managed by 1) assuming a higher probability of tail events and 2) focusing on what happens if those tail events occur.

**Fractals and chaos theory.** Fractals are geometric shapes that are, regardless of scale, "self-similar"—no matter how macro or micro you look at any given shape, it exhibits the same geometric properties. The mathematical equations describing fractals can be applied to any number of different phenomena. Chaos theory analyzes systems that are highly sensitive to both initial conditions and subsequent small changes to those conditions (resulting in seemingly random evolution of the system).[9] Mathematician Benoit Mandelbrot and quantitative practitioner Edgar Peters are two

leading proponents of applying fractal analysis and chaos theory to investment management. They suggest these mathematical concepts result in pricing and market models that display discontinuity, path dependence, and high levels of randomness—in other words, a much closer approximation to real market behavior.

All these quantitative responses share the following observations and assumptions:

- Standard deviation and correlation analysis are backward looking, unstable over time, and represent an insufficient measure of actual portfolio risk.
- Assuming normal "bell curve" return distributions can be very dangerous.
- Traditional MPT metrics significantly underestimate actual market risk; the empirical evidence indicates that the chance of a market "blow up" is far greater than indicated by normal distribution assumptions.
- Market price movements are neither independent nor continuous, as assumed by MPT assumptions.
- A better understanding and modeling of actual market behavior, especially extreme market movements, leads to more-robust portfolio construction and risk management.

Interestingly, the quantitative responses do not discard outright the underlying tenets of MPT (i.e., the benefits of diversification, the optimization of risk and return, etc.). The same is true for the behavioral responses. The intent of these approaches is to tweak the model to reflect more accurately the empirical reality of the market place.

## Rethink-the-Problem Responses

**Black swan response.** Nassim Nicholas Taleb's now ubiquitous notion of black swan events posits that 1) markets are utterly unpredictable and 2) truly disruptive events are far more likely to occur—and will have a far worse impact—than statistics suggest. Further, once these events take place, they are rationalized in hindsight by the markets, as if they could/should have been anticipated (leading to a false belief that models can be improved to anticipate future black swan events).

Taleb's ideas don't really open themselves up to modeling or mathematical treatment, because by definition the disruptive events are unpredictable and likely to have a larger impact than anticipated. The practical implication for portfolio management, if Taleb is correct, is that "catastrophe insurance" or, conversely, "opportunity exploiters" (which may take the form of various financial products) should be standard components of any portfolio asset allocation.

> "Lo's hypothesis makes for fascinating reading, and a growing amount of research is examining financial markets as a complex adaptive system ..."

**Unified field theory response.** Still other academics and practitioners are exploring completely different ways to think about the problem. Andrew Lo, for example, suggests an adaptive market hypothesis that attempts to integrate MPT, behavioral finance, and evolutionary neurobiology.[10] Lo's hypothesis makes for fascinating reading, and a growing amount of research is examining financial markets as a complex adaptive system (i.e., a system of myriad interconnected networks of relationships that "learn" and evolve accordingly over time). To date, however, no practical applications exist.

**Risk factor response.** More interesting, at least in terms of practical application, is the concept of "deconstructing" asset classes into their underlying risk factors and then building portfolios diversified across these risk factors, rather than across asset classes, as illustrated in figure 3.

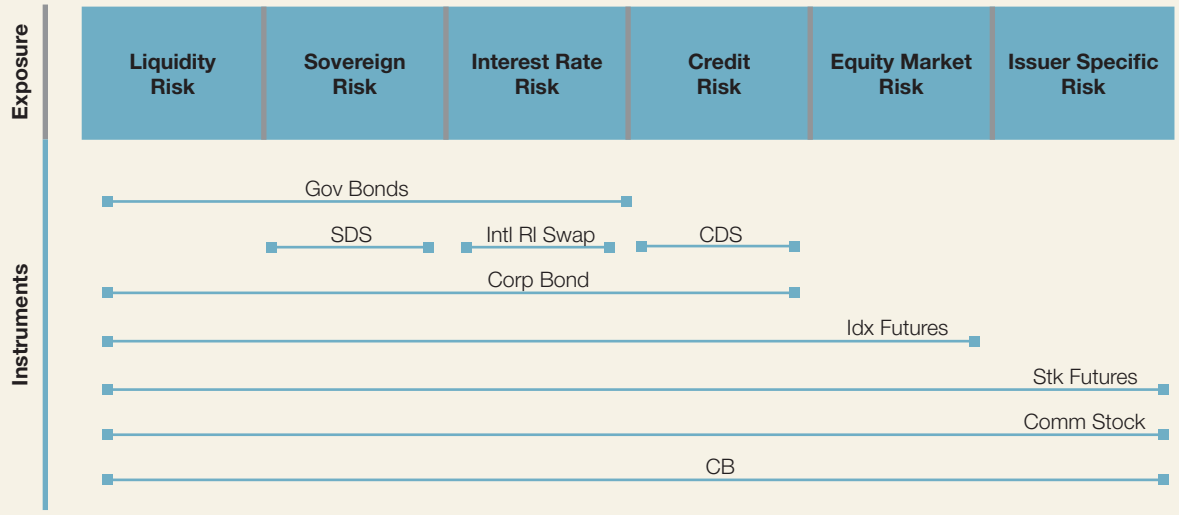
If traditional asset classes are thought of simply as convenient bundles of underlying risk factors, this approach makes intuitive sense. It also may explain why traditional diversification fails during times of market disruption—asset classes that we believe have low correlation to one another really are exposed to similar sets of risk factors (equity markets, interest rates, etc.), and therefore react in similar ways to dramatic changes in those risk factors. Under this scenario, diversifying across risk factors should deliver better "true diversification" and more-robust portfolio protection against extreme market movements.

Several large institutional investors already are applying a logical extension of this concept.[11] Recognizing that traditional asset class diversification left many portfolios exposed to common underlying risk factors, these investors are broadening their asset class definitions (equities, bonds, real assets, etc.) and rethinking diversification along risk factor (and return driver) lines. The issue remains, of course, of correctly identifying these risk factors and how they may positively or negatively impact portfolio performance.

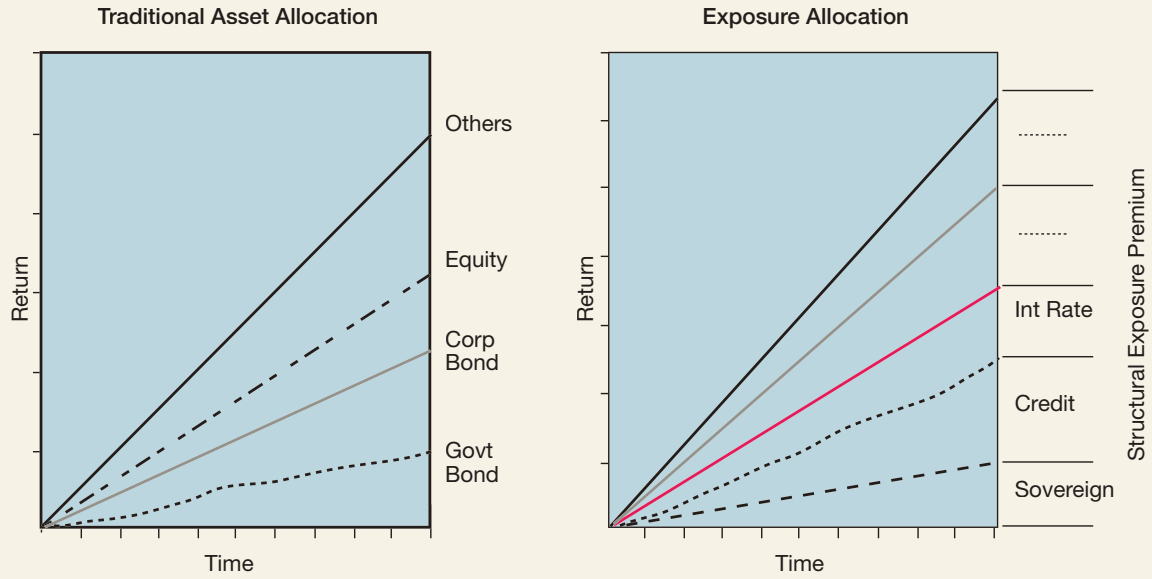
**Qualitative overlay response.** Another practical response to the events of 2008 is simply to recognize that traditional MPT statistics (expected return, volatility, and correlations) represent necessary but insufficient measures of the true risk of an investment portfolio.

Additional steps to measure or address the true risk of a given portfolio might include:

**FIGURE 3: A PORTFOLIO OF DIVERSIFIED RISK FACTORS**




**MAP OF INSTRUMENTS TO EXPOSURES**




**FROM ASSET ALLOCATION TO EXPOSURE ALLOCATION**

Source: Gupta and Straatman (2005)[12]

- Time Diversification
  - » Bucketing portfolios with different target maturity dates and different investment policies
  - » < 2 years (cash, tactical, principal protection, etc.)
  - » 2–10 years (strategic asset allocation)
  - » > 10 years (illiquid holdings)
- Developing metrics for measuring and illustrating the following:
  - » Portfolio liquidity (e.g., weighted average time to liquidate)
  - » Portfolio/strategy leverage (both actual and implied through optionality)
  - » Credit exposure (on both the asset and liability side)
  - » Behavior of investment strategies under nonnormal (extreme) market conditions (i.e., explanation of blow-up risk)
- Re-evaluate nomenclature and benchmarks
  - » The "strategy formerly known as 'absolute return'"
  - » Should benchmarks be objectives-based rather than market index-based?
- Remember Pascal's Wager
  - » Do not assume the probability of being wrong is the same as the consequence of being wrong

- Adopting a very simple "explanation" rule of thumb
  - » If you can't explain an investment strategy to your client, don't use it.
  - » If your client cannot explain an investment strategy back to you, do not allow that client to invest.

## Concluding Thoughts

The empirical disconnect between MPT's assumptions and market reality makes it inaccurate to state, "MPT failed in 2008." Rather, because of Minsky-like stability over the past 20 years, many market practitioners inappropriately or sloppily applied MPT.

Nevertheless, we learned—or relearned—some valuable lessons from 2008:

- Uncertainty is not the same as risk.
- Portfolios are riskier than traditional MPT metrics indicate.
- Most portfolios are riskier than investors can tolerate when bad things happen.
- Known risk is not the menace.
- The MPT baby shouldn't go out with the 2008 market collapse bathwater.
- We don't need theoretical breakthroughs to improve portfolios and risk-management capabilities.

Rethinking the problem highlights the intuitive, nonquantitative steps we can take to better manage real risk:

- Use broader strategy definitions to build diversified portfolios, e.g., equities, fixed income, real assets, volatility, momentum.
- Build portfolios based on personal liquidity constraints, not pre-specified time horizons.
- Take less known risk in order to offset unknown risk.

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## Endnotes

1 Richard Feynman, physicist and Nobel Prize winner (1965), quoted by David Nawrocki in A Brief History of Downside Risk Measures, *Journal of Investing* (fall 1999): 9–25, available at http://www56.homepage.villanova.edu/david.nawrocki/Brief%20History%20of%20Downside%20Risk%20-%20Nawrocki.pdf.

2 See Hyman Minsky, The Financial Instability Hypothesis, working paper #74, *The Handbook of Radical Political Economy,* edited by Philip Arestis and Malcolm Sawyer (Alershot, UK: Edward Elgar Publishing, 1993), available at http://www.levy.org/pubs/wp74.pdf.

3 See, for example, Greg Kasten and Pete Swisher, Post-Modern Portfolio Theory, *Journal of Financial Planning* (September 2005), available at http://www.fpanet.org/journal/articles/2005_Issues/jfp0905-art7.cfm.

4 Frank Sortino recently launched a blog where he encourages open-forum dialogue and analysis about PMPT, see http://pmpt.wordpress.com.

5 A quantitative variation on this theme is applying to individual investors the institutional investing concept of liability driven investing (LDI). With institutional LDI, the future liabilities of the investor (pension fund, endowment, defined benefit plan, etc.) are forecast and a portfolio is built that attempts to minimize the risk that the portfolio will not be able to meet its future funding obligations. Any surplus portfolio assets not required to meet future liabilities then can be invested more aggressively to grow the overall portfolio value. This concept now is being applied to individual investor portfolios: future obligations or liabilities (retirement funding, education expenses, weddings, or other target-date events) then are forecasted and portfolios then are constructed to fund those liabilities, with any excess portfolio assets invested more aggressively for dynastic wealth or end-of-life charitable purposes.

6 Others, especially Ashvin Chhabra and Jean Brunel, recommend optimizing each subportfolio and then rolling up the subportfolios into an optimized overall portfolio. I suggest that the primary value of this exercise is illustrative (i.e., to present the recommended portfolio in investor-centric ways), so optimizing at the overall portfolio level is sufficient.

7 See, for example, George Chow, Eric Jacquier, Mark Kritzman, and Kenneth Lowry, Optimal Portfolios in Good Times and Bad, *Financial Analysts Journal* (May/June 1999): 65–73, available at http://www.windhamcapital.com/eerm/documents/optimal_portfolios_in_good_times_and_bad.pdf.

8 For a more detailed analysis of this topic, see Ana Cascon and William Shadwick, A New Approach to Tail Risk, *Journal of Investment Consulting* 10, no. 1 (summer 2009): 33–48.

9 The apocryphal example is the butterfly effect, which suggests that a butterfly flapping its wings in one part of the world leads to a series of events resulting in hurricanes in another part of the world.

10 See Andrew Lo, The Adaptive Market Hypothesis, *Journal of Portfolio Management* (June 2004): 15–29, available at http://web.mit.edu/alo/www/.

11 See, for example: Whitney Kvasager, New Model Portfolio Lifts Indiana Foundation, *FundFire* (December 1, 2008), available at http://fundfire.com/articles/20081201/model_portfolio_lifts_indiana_foundation; Whitney Kvasager, Experts Urge Broad Asset Silos for Pensions, *FundFire (*June 5, 2009), available at http://fundfire.com/articles/20090605/experts_urge_broad_asset_silos_pensions; Christine Williamson, Macro Factors Take Central Role in Asset Allocation following the Market Turmoil, *Pensions&Investments* (August 10, 2009), available at http://www.pionline.com/apps/pbcs.dll/article?AID=/20090810/PRINTSUB/308109971&crit=christine%20williamson.

12 See Pranay Gupta and Jan Straatman, Skill-Based Investment Management (June 7, 2005). Available at SSRN: http://ssrn.com/abstract=737103.

See page 49 for a link to the online CE quiz.