

# RISK: THE FINAL FRONTIER



# Human nature is at the heart of investing, but when it comes to psychological factors, modern risk management has a blind spot

BY ROGER MITCHELL

“Everyone is a moon, and has a dark side which he never shows to anybody,” wrote Mark Twain in *Following the Equator*.

Luka Celati, chief investment officer of Abraxas Capital Management in London, might put it a little differently. Author of the book *The Dark Side of Risk Management*, Celati believes that every investor is a moon, with a dark side that modern risk management has failed to discover.

“By definition, the word ‘management’ has a human element at its core,” says Celati, “and that’s what the risk industry — in its perennial bid to provide ever greater amounts of information — often forgets until the next accident happens. Unfortunately, nobody seems to learn the lesson.”

The words “lunacy” and “lunatic” are derived from “luna,” the Latin word for moon. While modern medicine no longer attributes mental illness to the influence of the moon, over the past few decades, cognitive psychologists have discovered a different sort of lunacy. The surface of the mind is cratered with irrationality, bias, and faulty heuristics. It is an alien landscape. We hardly know ourselves.

When applied to markets, many of these findings may have profound implications for a body of investment theory that assumes investors behave rationally. Beyond the theoretical debate, some observers inferred that a manager might improve performance by either exploiting the cognitive errors of others or eliminating his or her own. Some firms, like Fuller & Thaler Asset Management in San Mateo, Calif., now specialize in applying behavioral insights to asset management.

The implications for risk management in particular may be just as profound, yet this area has received little attention. “One of the most important insights from behavioral research is that we need to distinguish between ‘normative’ theories that tell us how rational agents ‘should’ behave and ‘descriptive’ theories that tell us what real people do,” says Richard Thaler, principal at Fuller & Thaler and professor of behavioral science and economics at the Graduate School of Business of the University of Chicago. “Our normative theories of risk, such as expected utility theory and modern portfolio theory, are fine as normative theories, but a host of other factors need to be included.”

## A WOUNDED SNAKE

On 18 June 1178, about an hour after sunset, five monks at Canterbury Cathedral were looking at the new crescent moon. Suddenly, the upper horn of the moon “split in two. From the midpoint of this division a flaming torch sprang up, spewing out ... fire, hot coals and sparks. ... The body of the moon, which was below, writhed ... throbbled like a wounded snake.”

Until recently, modern astronomers believed that the monks had seen an asteroid strike the moon. In 2001, a researcher disputed this notion and concluded that they happened to be standing almost directly in the path of an oncoming meteor. From their angle, the “flaming torch” just happened to appear in front of the moon.

In either case, the monks were probably amazed and frightened. They had no way of knowing what they were seeing. Over the centuries, a few philosophers had speculated that the moon was a sphere, but this was only conjecture. Even the shape of the earth was a matter of some debate. The standard celestial model was the Ptolemaic system, which placed the earth at the center of the universe, and most authorities believed the moon was perfectly smooth. The spectacle of “shooting stars” was well known. But the phenomenon of rocks from outer space falling to earth and burning in the upper atmosphere was unheard of. More than 400 years would pass before Copernicus put the sun, not the earth, at the center of the solar system and Galileo pointed his telescope at the moon and was astonished to see white peaks jutting out of what were evidently valleys.

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in the financial firmament make markets and portfolios writhe and throb like a wounded snake, part of the reason may be that the standard approach to risk management places financial dynamics at the center of its analytical system (to the exclusion of human psychology) and implicitly assumes that decision making is perfectly smooth. Accidents and disasters are regarded as extraordinary events, either statistical aberrations or portents of paradigm change. And if corruption appears to be involved, we can just change the regulations.

The laws of human nature, however, are not so easily amended. “Mainstream risk management literature has broadly neglected human weaknesses in decision making in studying risk issues,” says Celati. “Far too often, the explanation stops at the inadequacy of a given risk model or a particular organizational arrangement in dealing with a particular situation. Notwithstanding their consequences, these are almost always effects of deeper behavioral problems. When you look back at risk disasters over the last 20 years, both in finance and outside, they all have human error at their root.”

### **SATISFACTION GUARANTEED**

**W**hen it comes to behavioral bias, professional investors are peculiar in some ways, according to Hersh Shefrin, professor of finance at Santa Clara University’s Leavey School of Business and author of “The Role of Behavioral Finance in Risk Management” (a chapter in the forthcoming book *Risk Management: A Modern Perspective*, edited by Michael Ong). For example, whereas most people are

prone to hot-hand fallacy (undue confidence that a recent trend will continue), professional investors are prone to gambler’s fallacy (undue confidence that a trend will revert to the mean). It seems that specialized training can alter people’s tendencies.

But professional investors are all too typical in such traits as excessive optimism (setting the mean too high on average) and overconfidence (misjudging the standard deviation and not fully capturing the tails of a distribution). As a result, they set confidence intervals that are much too narrow. The sad fate of Long-Term Capital Management is a compelling example. LTCM pegged its maximum risk of a single-day loss at \$35 million. On 21 August 1998, it lost \$553 million. “They were shocked,” Shefrin says, “when their worst day turned about to be 16 times as bad as they had imagined it could be.”

“One of the important lessons from the psychology of decision making is that when things go wrong, the cause is one that had not been anticipated,” says Thaler. In the case of LTCM, he explains, “managers failed to realize that their various bets, which seemed to be quite different from one another, were actually quite highly correlated simply because a convergence strategy that appealed to their portfolio managers also appealed to other hedge fund managers, and they all faced a liquidity crisis at the same time. The main lesson here is: expect the unexpected.”

Part of the problem is that people think they know more than it is even possible to know. Take the problem of determining causality. Even for relatively simple cases in which an outcome is

already known (e.g., if I had avoided that disastrous investment, how much better off would my portfolio be?), we often must imagine, rather than “know,” causality. One might expect a careful analysis to determine the actual cause. “It seems, however, that our beliefs about the universe of the actual ... are affected by our considerations of the merely possible — created by the ‘what ifs’ and ‘if onlys’ of counterfactual thinking,” concluded psychologists Barbara Spellman and David Mandel in a paper titled “When Possibility Informs Reality” (*Current Directions in Psychological Science* [August 1999]).

Counterfactual thinking means generating alternatives and imagining how outcomes change under different scenarios. The strategy is essential. Reality is too complex, the variables virtually infinite. To assign causality, we have to take a counterfactual subset of all possible outcomes. Thus, our ideas about causality may be constrained by our ideas about possibility. Not that there’s anything necessarily wrong with that. “Are small subsets bad?” says Spellman. “Well, no, not if you have the ‘right’ small subset.”

But if you have the wrong subset or fail to recognize that you are choosing a subset conditioned by the limits of your imagination, things could get ugly.

As it turns out, an economic rationale for counterfactual thinking already exists. Decades ago, economist Herbert Simon postulated two types of decision makers: maximizers, who asymptotically seek the perfect solution (even while aware that perfection is unattainable), and satisficers, who seek



the good-enough solution. For investment purposes, the concept languished as an interesting but mostly impractical curiosity until Andrew Lo at MIT attempted to “operationalize” it in his Adaptive Markets Hypothesis. [Ed. note: for a fuller discussion of AMH, see “All Systems No” in our July-August 2005 issue]. In the AMH framework, because the risk–reward relation is assumed to vary over time, models must evolve continually. Cognitive mis- cues are not regarded as inherently irrational. Instead, the emphasis is on adaptation. All heuristics are assumed to be unstable. Decision-making algorithms that are well suited to a given environment may become maladaptive if circumstances change.

Under such conditions, crafting, much less implementing, a quasi-perfect strategy becomes an extreme challenge. A strategy driven by good-enough approximation will prove more flexible. It also will be less likely to depend on confidence intervals that require delusional levels of precision. In effect, satisficing implies extensive use of counterfactual reasoning (that is, trying to select a good-enough subset without perfectly understanding causality).

“The unfortunate fact of life is that risk is probably too complex to entirely grasp,” says Shefrin. “So we wind up having to rely on heuristics. Sometimes those heuristics look like they’re fully rational, but they’re basically small optimizing programs where we’re trying to do a better job of using a rule of thumb.”

## BEYOND PARADOX

Consider a baseball scenario. Player A has a higher batting average

than Player B for the first half of the season and again for the second half of the season. Who has a higher average for the overall season? Most people (93 percent in one study) pick Player A. Now look at the following table:

Player	First Half	Second Half	Overall Season
A	4 for 10 (.400)	25 for 100 (.250)	29 for 110 (.264)
B	30 for 100 (.300)	2 for 10 (.200)	32 for 110 (.291)

This is an example of Simpson’s paradox. The paradox comes from not knowing whether to look at the parts or the whole when making judgments. In more complex scenarios, the challenge of keeping track of frequencies while also tracking covariance among possible causes and effects (or even among causes themselves) becomes extremely difficult, if not impossible.

The relevance for risk management is not hard to see. It would not be stretching things too much to say that risk management is little more than Simpson’s paradox writ large. The essential problem is relating parts (the assets/instruments) to a whole (the portfolio). Covariance among the parts is, of course, critical, and sorting out causes and effects at the asset and portfolio levels is tricky. Add value-at-risk (VAR) measures, Monte Carlo analysis, and other sophisticated methods and the task becomes entangled in complexity.

This might sound like a familiar set up: one more invincible cognitive defect. Not necessarily.

Over the past 30 years, an investor in the cognition market might have been tempted to sell the human mind short. In study after study, the rationali-

ty index declined as various units failed to meet analyst expectations. Human reason, formerly thought to be a trusty blue-chip enterprise, was found to have major flaws in its accounting. Then something changed. During the most recent decade, the market began to recover.

As associate professor of psychology and head of the Reasoning and Memory Lab at the University of Virginia, Barbara Spellman is one of the researchers who has found that in addition to our biases, we humans also possess keen instincts for problem solving. In the 1970s and 1980s, she explains, “some folks just took great glee in pointing out the flaws without looking at conditions, limiting circumstances, and overarching theories of what human reasoners were doing.” Although the word “heuristic” has acquired an almost pejorative connotation, Spellman points out that “heuristics often give us the right answer and are, therefore, not necessarily counterproductive.” Still, there is a caveat: “As with the visual system, something that works well most of the time can be tricked by illusions, which twist the expected into something our usually well-behaved system misinterprets.

The baseball example comes from an actual study conducted by Spellman and her co-authors (Christy Price of the University of Texas and Jessica Logan of Washington University, “How Two Causes Are Different from One,” *Memory & Cognition* [2001]). When presented with the simplest version of the problem, subjects generally fail. When people are given the relevant data, the authors found, they can see

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through the paradox and “resolve it in a mathematically sophisticated way that involves using conditional contingencies.” In another study involving jurors’ use of counterfactual and causal reasoning, Spellman and coauthor Alexandra Kincannon reported that far from being irrational, people intuitively use counterfactual reasoning in a systematic way (“The Relation between Counterfactual [‘But For’] and Causal Reasoning,” *Law and Contemporary Problems* [August 2001]). “When considering causal judgments for the kinds of simple scenarios used in these ‘single case ‘legal’ approach’ studies,” they concluded, “we have great respect for uninstructed lay responses.”

The point is that while people may be booby-trapped with irrational biases, they also come well armed with powerful intuitions. And Luca Celati, for one, thinks managers need to make better use of their analytical ability — by applying it to themselves. “There are ways to categorize personalities of risk takers and risk decision-makers at various levels in an organization,” he says. Although skeptical about “the feasibility of a top-to-bottom solution,” he believes real progress is possible. “Many organizations would be shocked to learn how undiversified, in terms of basic personality risk factors, they are at both desk and top management level,” he points out. “This is hardly surprising, since it is basic human nature for bosses to hire people who think like them! So understanding risk-capital diversification by personality type would probably be a reasonable start.”

## SAFETY OF FLIGHT

Is it possible to de-bias people? “Ahh, here’s where I get a little sad,” says Spellman. “De-biasing doesn’t work all that well for most people most of the time. We like our reasoning processes. We often see biases in others but not ourselves. Training can help a little but not a lot.”

“I’m quite happy to satisfice,” says Shefrin. “I don’t think we’ll ever eliminate all vulnerability to bias, but there are things we can do to be a lot better than we might otherwise be.” Although convinced that behavioral biases are “hardwired” in our “neural circuits,” he notes that “as behavioral finance gains momentum across the entire landscape of finance, it has finally reached and is beginning to influence the approach risk managers take.” With greater awareness, improvement is possible.


Celati’s idea about diversification by personality type suggests a way forward. If investment managers need to reconsider their notions of risk and its implications, a good place to start might be the decision-making dynamics of individuals and groups. Modern portfolio theory is an excellent set of tools, but tools are only as good as the people and teams who use them. The National Aeronautics and Space Administration (NASA) has a marvelous array of tools, conceptual as well as mechanical, that it uses to operate and maintain its fleet of space shuttles. It also has two fewer space shuttles than it ought to have.

In 1987, the shuttle Challenger and its crew of seven were destroyed in an explosion during launch. A presidential commission discovered a severely dys-

functional management culture. In a damning appendix to the commission’s report, physicist Richard Feynman explained that the shuttles flew “in a relatively unsafe condition, with a chance of failure of the order of a percent (it is difficult to be more accurate). Official management, on the other hand, claims to believe the probability of failure is a thousand times less. One reason for this may be an attempt to assure the government of NASA perfection and success in order to ensure the supply of funds. The other may be that they sincerely believed it to be true, demonstrating an almost incredible lack of communication between themselves and their working engineers.”

Sixteen years and 56 shuttle flights later, the shuttle Columbia and its crew of seven disintegrated on reentry. A subsequent investigation documented many of the same organizational problems that doomed Challenger. As Shefrin points out, in both cases, program managers fell into a form of confirmation bias and failed to “disconfirm” their beliefs about “safety of flight” issues. The greatest threat to the shuttle program was not mechanical or technical. It was basic human behavior. The upshot: grafting new information onto deeply rooted structures and processes is not likely to generate healthy new top growth.

While Spellman is pessimistic about debiasing the decision making of individuals, improving the context in which the decisions get made is another story. “It seems to me that if you can’t change people, you might want to change institutions,” she says. “Maybe we can present information in ways



that ‘work’ better with the way people usually think.”

It begins with understanding the nature of the problem. For example, according to Shefrin, even the way risk is measured — whether as return standard deviation, value at risk, or downside risk (e.g., the Sortino ratio) — “gives rise to behavioral issues associated with the quality of judgments that get made.” More generally, intellectual tasks differ from judgmental tasks, and each type of task predisposes people to different types of errors. Whether decisions are made by an individual or a group further alters the risk of error.

“Unless the group puts in place a set of effective processes which are intentionally crafted to mitigate vulnerability to behavioral bias,” says Shefrin, “the group is likely to amplify individual errors rather than to mitigate them.” He recommends that risk managers begin by differentiating tasks and processes on the basis of whether they are intellectual versus judgmental and individual versus group oriented. “It’s the same philosophy as Alcoholics Anonymous,” he says, “People need to face up to what their weaknesses are, and you need structured steps to take, what to do and what not to do, and you need support within groups so that people help each other when they’re likely to slip into a particular behavioral pit.”

Training and education also need to change, according to Shefrin. Often, individuals are trained to perform intellectual tasks in a relatively dispassionate context. In practice, however, most investment activity consists of groups performing judgmental tasks in an emotional context. If people are made

aware of how circumstances and emotions affect their decision making, they will have a better chance of managing their biases.

## IMPLEMENTATION

**A**t some firms, behavioral awareness is already reflected in their attitude toward risk. For example, Fuller & Thaler begins by thinking about risk at two different levels: firm risk and portfolio risk. At the firm level, the goal is to hedge against overconfidence by developing a portfolio of products that include a variety of strategies and markets. “From the first days of our firm,” says Thaler, “Russ Fuller consciously developed our strategies in an attempt to assure our stakeholders, both clients and employees, that periods of underperformance in one product or strategy (and since we try not to be overconfident, we know such periods will occur) will not threaten the existence of the firm.”

At the portfolio level, Thaler continues, “John Kling, our head of research, has developed some in-house methods of controlling risk that I happen to think are quite clever, but I also realize I may be biased on this subject. Nevertheless, John has developed optimization routines, which are unique in the industry, to optimize return while controlling for unanticipated risk factors. And, at least so far, these optimization routines seem to work better than many of the industry standards.”

Abraxas even extends the management of behavioral risk to its clients. “We have ways to help investors see why our fund may not be suitable for them based on their personality charac-

teristics,” says Celati. “That process is what I would consider true marketing and investor education, way beyond the industry’s customary sales spiel.” And within the firm itself, Celati continues, “we have developed tools to help risk takers understand how to align their personality and chosen trading style.”

Broad change may be slow in coming. While Celati sees a few examples of behavioral risk management among hedge funds, other sectors could face obstacles. “Banks have some understanding of the theory,” he says, “but by the time they realize they need to pay more attention, their trading and risk operations have grown so much that it becomes almost prohibitive to change their focus and emphasis.”

Crashing and burning is also prohibitive. Whatever one’s views on human nature, it is the primary mover, not just a curious complication, of everything from global capital markets to petty office politics. The lesson is not to abandon the quest for robust risk models but to understand the limits of attainable precision. And those limits are defined by the character of human reason. Failing to recognize that behavioral dynamics are central to risk management would be like trying to solve a complex equation while leaving out a critical variable. As Richard Feynman noted in his appendix to the Challenger investigation, “For a successful technology, reality must take precedence ... for nature cannot be fooled.”

Neither can risk. **▀**

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