

Behavioral Economics and Its Implications for Enterprise Risk Management

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Abstract

The underlying premise of this paper is that enterprise risk management (ERM), as it continues to evolve as both a process and a collection of risk management techniques, can benefit from several different (but ultimately somewhat related) “megatrends.” The core of this paper concentrates on the impact on ERM of one of those megatrends: the emergence of a behavioral economics perspective, which is beginning to have a large impact on our understanding of the economy and on certain economic and business processes. The evolution and context of behavioral economics are described, and potential implications for the practice of ERM are discussed. The paper culminates with a variety of specific suggestions for ERM practice in response to findings from behavioral economics research, specifically a number of human cognitive dissonances inconsistent with traditional economic theory.

Man is a mystery. It needs to be unraveled, and if you spend your whole life unraveling it, don't say that you've wasted time.

– Fyodor Dostoyevsky

Section 1: Introduction

Enterprise risk management continues to evolve, increasing in importance and sophistication and in the spread of its application and influence. As a framework for identifying, quantifying and managing risks, ERM can be considered both process and a collection of advanced quantitative and qualitative risk management techniques. Because of its growing significance, it is interesting to consider how ERM might respond to, and even benefit from, the evolution of certain changes and developments (which we might call “megatrends”) in the broader world and society.

Among the emerging conceptual megatrends with the capacity to change how we view the world, the following are some with significant potential impact on ERM:

- Economies and organizations viewed as *complex systems*
- Economies considered as *evolutionary processes*
- Human dynamics reflected by *behavioral economics*

The core of this paper involves the third of these trends. We describe the nature and development of behavioral economics as a response to certain unrealistic assumptions in traditional economics, and we consider the potential impact on ERM of this emerging perspective of human behavior and dynamics. The paper culminates with a variety of specific suggestions for ERM practice in response to findings from behavioral economics research, specifically a number of human cognitive dissonances inconsistent with traditional economic theory.

Before proceeding with the discussion of behavioral economics, Section 2 provides some brief words regarding the first two conceptual trends mentioned above: complex systems and evolutionary perspectives. These are discussed because they help provide an overall context for an emerging economic perspective. They are also related to, and can help us understand, the nature and existence of the *cognitive dissonances* being uncovered by recent research in behavioral economics and cognitive neuroscience.

Section 3 offers a brief history of key economic paradigms and concepts, and how behavioral economics emerged as a response to traditional economic assumptions that began to appear as unreasonable. This history and background provides an appreciation for the essence of behavioral economics. Rather than simply jump immediately to a list of implications for ERM, our ability to apply an appropriate thought process and identify possible future areas for the

application of behavioral economics-inspired improvements to ERM techniques, is enhanced by understanding this background: what came before behavioral economics, how it evolved and what are its essential differences with more traditional economics.

Section 4 identifies and defines a number of human cognitive dissonances and discusses their general relevance. In Section 5, a potential impact on risk management of each dissonance is suggested, and one or more implications for ERM practice are proposed.

Section 6 offers a summary and conclusion. The paper ends with references and a list of suggested books available for further reading.

Section 2: Important Emerging Megatrends

Before discussing the emergence of a behavioral economics paradigm, we briefly suggest and summarize two other conceptual trends that have the potential to impact, and possibly benefit, the practice of ERM.

Complex Systems

A **complex adaptive system** (CAS) is a system of individual interacting “agents” that adapt to changing conditions. The characteristics of a CAS include:

- The system is built, and best appreciated and understood, as a **bottom-up**, rather than a top-down, system. The micro-units of the system interact and aggregate to form its macro-structure—and the macro-structure may well have properties and characteristics that are not obvious extensions of the properties at the micro-level.
- The system **self-organizes**, exhibiting **emergence** and nonlinearities—the micro-versus-macro “disconnect” mentioned above.
- The system is **irreducible**.

Some potential examples of such systems include economies, ecologies, consciousness and organizations. While much attention has been paid to complex systems over the last decade or two, this is really not a completely new idea. Historical recognition of a complex systems perspective in economics goes back at least to Adam Smith (1776) and his famous line in *An Inquiry into the Nature and Causes of the Wealth of Nations* alluding to the “invisible hand” and the “disconnect” between intentions and ends:

He intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention.

In other words, as with complex systems in general, the macro-economy emerges nontrivially from its micro-components—the macro-level is not merely the simple aggregation of the micro-level.

Note the “parallel” with ERM. By ERM, we mean a risk management process that:

- Takes a *holistic* financial and operating perspective;
- Recognizes *interdependencies* among corporate, financial and environmental factors; and
- Strives to determine and implement an optimal *strategy* to achieve the primary objective: *maximizing* the *value* of the firm.

These key attributes parallel those of a complex system. Ultimately, research in complex systems should provide insights into the practice and perspective of ERM.

Evolutionary Processes

Viewing economies as evolutionary processes was mentioned as a conceptual trend above because of the parallels between economic systems and biological evolutionary theory. Both areas involve complex systems, self-organization, emergence and adaption (in biology, this largely takes the form of natural selection). Also, as is so true in most areas of inquiry (but too often ignored as a possibly interesting but mostly irrelevant side issue), appreciating how both economies and ecologies evolved over time can help us to understand, explain and ultimately model their current statuses and dynamics.

A number of both old and recent texts have made and advocated this connection between economic theory and biological evolution. Three quick examples:

- A paper titled “Why is Economics Not an Evolutionary Science?” by Thorstein Veblen appeared in the *Quarterly Journal of Economics* in 1898. As the title says, Veblen asked why economics wasn’t making more use of the parallels with evolutionary science.
- A book by Paul Ormerod, in 2005, titled *Why Most Things Fail: Evolution, Extinction & Economics*, discusses a variety of connections in this area, including the observation that both company failures and species extinctions have historically exhibited similar patterns:

The precise mathematical relationship which describes the link between the frequency and size of the extinction of companies, for example, is virtually identical to that which describes the extinction of biological species in the fossil record. Only the timescales differ.

- From *Physical Review Letters* in 2010, in a paper titled “Structure and Response in the World Trade Network,” authors He and Deem describe global trade in biological terms, and find that this bio-perspective ultimately leads to an interesting conclusion:

The theory [treating the world trade network as an evolving system] predicts that globalization ... should lead to increasingly large recessions and decreased rate of recovery, in contrast to standard economic understanding.

As with complex systems research, there may be much that ERM can potentially gain from recognition of the parallels between economics and evolutionary processes.

Section 3: Economics and Behavioral Economics

This paper concentrates on the third of the conceptual megatrends listed in Section 1, behavioral economics, and its potential impact for ERM. We briefly look at the evolution of behavioral economics as a response to perceived unrealistic assumptions in traditional economic theory.

Classical and Neoclassical Economics

Many people think of modern, classical economics as having begun in the late 18th century with Smith and his relatively capitalist, laissez-faire perspective. He was followed, still in the classical tradition, by economists such as David Ricardo and Jean-Baptiste Say. For the most part, classical economics was characterized by free and competitive economic forces and largely focused on national economic growth.

In the mid- to late-1800s, classical economics led to neoclassical economics (although there is some debate as to precisely what the distinction is between these two perspectives). Neoclassical economics is largely what most of us have learned about in school: the determination of prices and equilibria via supply and demand, with rational individuals making decisions by maximizing utility. Economists and philosophers such as William Stanley Jevons and Jeremy Bentham took this perspective, largely equating “utility” with “happiness,” and focusing on decision-making in a pleasure-versus-pain context.

This hedonic perspective in early neoclassical economics is interesting, for a reason stated nicely by Angner and Loewenstein (2006):

Hedonic psychology permits people to act irrationally because, for example, they fail to properly anticipate the pleasure resulting from

certain actions, or because (in the intertemporal context) they fail to properly take future pleasure into account in their deliberations.

This is interesting because, over the decades, neoclassical thought generally diverged from this possibility of people acting “irrationally.” As neoclassical economics evolved, it tended to be characterized by attention to methodological (including mathematical) improvements, but also by an avoidance of appeals to psychology. In general, human behavior was removed as a factor in the economic process, since everyone was assumed to act rationally—there was no room for “irrationality.”

This perspective led to the concept of *homo economicus*, a completely rational person who maximizes utility (satisfaction or well-being) given specific opportunities and constraints. It is this conceptual assumption, which underlies what is now “traditional” economics and yet which many feel is unrealistic, that has been the main factor influencing the emergence of behavioral economics.

It is also interesting to note that, although many think Smith also advocated this “completely rational” view of human dynamics, largely because of the reference to self-interest in *The Wealth of Nations*, his views were much broader. Smith had an academic position as a moral philosopher, and a work of his which actually pre-dates (in its original edition) his 1776 *The Wealth of Nations*, was *The Theory of Moral Sentiments*. In that work, he wrote:

How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it except the pleasure of seeing it.

So, Smith recognized this duality in human action and dynamics. In fact, his recognition of this duality was rather prescient, as Ashraf, Camerer and Loewenstein (2005) note:

Adam Smith’s psychological perspective in *The Theory of Moral Sentiments* is remarkably similar to “dual-process” frameworks¹ advanced by psychologists, ... neuroscientists ... and more recently by behavioral economists, based on behavioral data and detailed observations of brain functioning. ...

¹ The dual process refers to viewing brain function as having essentially two dimensions, each with two sides: controlled versus automatic processes and cognitive versus affective processes. See, for example, Loewenstein, Camerer and Prelec (2005).

Behavioral Economics

One must study the laws of human action and social cooperation as the physicist studies the laws of nature.

– Ludwig von Mises (1949)

Behavioral economics increases the explanatory power of economics by providing it with more realistic psychological foundations.

– Camerer, Lowenstein and Rabin (2004)

In particular, behavioral economics emerged in reaction to the notion, held by many neoclassical economists, that social and behavioral science should avoid reference to entities (like cognitive and affective states) that cannot be directly observed.

– Angner and Lowenstein (2006)

In its historical context, then, behavioral economics arose as a reaction against the neoclassical view of *homo economicus*—the completely rational human who makes economic decisions in a perfectly rational way at all times. While over the years economists have largely been willing to admit that such an assumption is technically somewhat unrealistic, the approximation has been viewed as a reasonable working principle for theoretical purposes. This perspective on human behavior led to such mathematical frameworks as expected utility theory.²

However, in the mid-20th century, Herbert Simon developed the concept of “bounded rationality” to reflect human cognitive limitations. He advocated for simpler models that would better reflect true underlying human dynamics. Then, Daniel Kahneman and Amos Tversky looked further at human behavior from a psychological perspective, introducing and implementing a series of illuminating tests and experiments that shed considerable light on human decision-making under risk.

Mathematically, the investigations of Kahneman and Tversky led to prospect theory³ and cumulative prospect theory. More generally, their work led to the identification of a number of “irrationalities” or “cognitive dissonances” inherent in human behavior that often prevent us from making optimal and/or consistent decisions. These cognitive dissonances, a result of

² Expected utility theory, based on the von Neumann-Morgenstern framework, involves decision-making that maximizes expected utility as a function of utility curves and probabilities of outcomes. The assumption is that individuals are rational, but they can be risk-averse, and generally have concave utility functions.

³ Prospect theory is an alternative to expected utility theory for describing actual decision-making under risk, and focuses on the “frame” or reference point context in which decision-making is undertaken. This allows for the empirical observation that we tend to be risk-averse with respect to gains, but risk-seeking with respect to losses.

heuristics, which facilitate our ability to analyze and make judgments, suggest just how far from “perfectly rational” human behavior actually is. A selection of these biases, and some of their potential implications for ERM, are examined in sections 4 and 5.

In summary, then, behavioral economics emerged as a reaction against the traditional economic view of *homo economicus*. The *homo economicus* view resulted in a virtually deterministic approach to human behavior, essentially a Newtonian version of human dynamics. Yet, the idea that economists (and financial economists, actuaries and risk managers) should consider such social sciences as psychology, social anthropology, etc., when reflecting upon or modeling human behavior is not completely new, with mentions through the history of modern economics (for example, the quotations from Smith and von Mises documented above). In its current incarnation, behavioral economics has been primarily an outgrowth of cognitive science, dealing with behavioral decision-making in an interdisciplinary context.

Section 4: Cognitive Dissonances and Their Implications for ERM

When describing empirically observed deviations from the *homo economicus* model, we prefer the term “cognitive dissonances” to a term like “irrationalities.” It is difficult to label something irrational unless one is completely certain that all possible parameters and variables have been identified for what is rational. While many are comfortable referring to cognitive dissonances as irrationalities, it is possible that, through advances in neuroscience and brain science, additional factors may well be discovered that at least partially explain certain human behaviors and may thereby make them seem less irrational, or at least more understandable. In fact, a significant benefit can be derived from examining human evolution: Many behaviors seem more understandable in the light of the historical evolutionary process. As mentioned in Loewenstein, Camerer and Prelec (2005):

The brain is the ultimate “black box.” The foundations of economic theory were constructed assuming that details about the functioning of the brain would never be known.

With recent scientific advances, we are now beginning to know. ...

Below is a selection of some behavioral cognitive dissonances. While this list is not complete, it provides a flavor for human behavioral biases.

- ***Anchoring effect***: bias toward an initial or previously observed value
- ***Confirmation bias***: bias toward observations that confirm our preconceptions

- **Endowment effect** or loss aversion effect: we have a deep or even distorted dislike for losing what we already have
- **Framing effect**: the frame of reference affects how risk is perceived
- **Hindsight bias**: reconstructing the past with benefit of hindsight
- **Mental accounting**: we use different mental accounts for different experiences, such as gains and losses
- **Overconfidence**: unjustified comfort or optimism
- **Recency effect** or availability bias: bias toward more recent or available information
- **Representation bias**: we sometimes characterize things based on only a few essential features, ignoring differences in other features and details

How far do the applications and the potential impact of these biases extend? In particular for this paper, do these biases represent essential considerations in the context of performing enterprise risk management and making decisions based upon an ERM process? The underlying theme of this paper is that they do. We offer one example among many.

Because of dissonances such as these (and others), people have difficulty evaluating probabilities. We often anchor on a previous value (which may or may not be valid any longer), or we link a new type of risk conceptually with another type of risk based on one or a few essential features that both have in common (although the details and subtleties of the risks may in fact be quite different). Even more generally, we are simply *bad* at estimating probabilities. Per Lloyd (2011):

People are bad at assessing probabilities. They are bad at it not just because they are bad at addition and multiplication. Rather, people are bad at probability in a deep, intuitive level: they overestimate the probability of rare but shocking events. ... Conversely, they underestimate the probability of common, but quiet and insidious events. ...

... When it comes to understanding probability, people basically suck.

Or, per Lisi (2011):

We humans are terrible at dealing with probability. We are not merely bad at it, but seem hardwired to be incompetent, in spite of the fact that we encounter innumerable circumstances every day which depend on accurate probabilistic calculations for our well-being. ... This blind spot in our collective consciousness—the inability to deal with probability—may seem insignificant, but it

has dire practical consequences. We are afraid of the wrong things, and we are making bad decisions. ...

... We are especially ill-equipped to manage risk when dealing with small likelihoods of major events.

An important area of misunderstanding or misperception of probabilities—perhaps leading to either underappreciation or exaggeration of one’s own prospects—is health and health care. In his 2000 book *The Culture of Fear: Why Americans are Afraid of the Wrong Things*, Barry Glassner states:

Women in their forties believe they have a 1 in 10 chance of dying from breast cancer, a Dartmouth study found. Their real lifetime odds are more like 1 in 250.

In any risk assessment situation, whether personal or corporate, an ineffective or inaccurate evaluation of risk potential can be extremely serious, leading to suboptimal (to say the least, in some cases) operational decisions.

Section 5: Implications for ERM

There is a clear need, then, from several perspectives, for actuaries and risk managers to understand and appreciate behavioral issues and human dynamics. First, when analyzing underlying loss and risk data, it is important to understand the production source of those data—say, the nature and types of entities and consumers involved. A full and adequate interpretation of data may be aided by knowing, for example, whether behaviorally informed marketing efforts (which are becoming more and more common) were utilized in selling a product.

Second, and more directly relevant for ERM, it is important to avoid or account for cognitive biases when discussing and estimating risks and their parameters. One can easily imagine a firm’s risk committee, sitting around a conference room table, sequentially trying to quantify risk probabilities; the potential for “anchoring” probabilities from consideration of one type of risk to the next, or from one participant’s numerical predisposition regarding a certain type of risk, for example, is evident. In addition, the manner in which risk discussions are presented and framed has the potential to be highly influential in risk quantification.

We now discuss, in a risk and ERM context, each of the nine cognitive biases mentioned and defined in Section 4.

Anchoring Effect

The problem with “anchoring,” or focusing on a small subset of available data, is that the anchoring value or the data subset may not be fully relevant, or especially representative, of the overall data and environment. Anchoring can lead to ignoring or undervaluing other, or new, information, and any changes from the anchor point can be difficult to achieve—and, when they are achieved, they can seem particularly significant because of the difficulty and rarity of diverging from the anchor point.

The tendency to anchor can emerge in a number of contexts, including with respect to information unrelated to the risk analysis at issue, and with respect to different ways of asking or expressing a question. With respect to the latter, Tversky and Kahneman (1974) mention an interesting and troubling experiment: Two separate groups were asked an almost identical question, with just one number in the question different between the two. Each member of the first group was asked whether they thought that the percentage of African countries in the United Nations is above or below 10. Each member of the second group was asked whether they thought that the percentage of African countries in the United Nations is above or below 65. Each member in both groups was also asked, after being asked the above question, to provide a specific estimate of the exact percentage. Overall, the percentages provided by the second group were significantly higher than those provided by the first group. The inclusion of a different “anchor” in the two questions was sufficient to bias the results between the two groups.

Other studies regarding numerical estimates have verified the anchoring effect with respect to “irrelevant” anchors. For example, thinking of part of an irrelevant number sequence—say, one’s phone number or social security number—can systematically bias subsequent numerical estimates in the direction of the irrelevant number.

ERM Implications: There are many potential actuarial and ERM implications of the anchoring bias. Two examples:

- ***“Last year’s estimate”:*** Whether in a formal context such as the complement of credibility, or in a more informal way, actuaries often anchor their analyses to a previous result or to a broad-based indication, and only deviate from that earlier or broader result in the event of compelling and statistically significant evidence. This can certainly be a reasonable approach—but one should be prepared to adequately answer the question “what makes that earlier or broader value particularly viable,” or at least more viable than the newer or more specific data would indicate.
- ***Discussions of judgmental probability:*** As much as possible, risk analysts will want to estimate probabilities of risks without any “analytical baggage” carrying over from prior activities. This does not mean there are not sometimes links or relationships between

risks, the recognition of which can be beneficial to the analytical process. But irrelevant data or analytical indications should be cleansed.

Confirmation Bias

The existence of preconceptions or prior hypotheses in our minds can lead to selective observation, interpretation and memory. More specifically, we sometimes are more likely to notice or recall examples and anecdotes that confirm our preconceptions. In a world with ever more and faster information, this can mean that supporting evidence for many different preconceptions associated with a particular issue can often be readily found.

ERM Implication: We need multiple internal and external perspectives in order to perceive and analyze risks as objectively as possible.

Endowment Effect

When we already own, or are endowed with, things, we have a tendency to value them more highly than things we do not have. We emphasize loss aversion relative to those endowed items—the idea of losing something we *have* is more distasteful than not obtaining something we do not have. While this effect has clear applicability in a consumer/commodity ownership context, it is also relevant for ERM.

ERM Implication: We need to achieve methodological consistency across the analysis of all risks. Firms typically have niches or market segments they target with their goods or services. A corporate culture or attitude of “ownership” can evolve with respect to a particular product, line of business, consumer niche, etc.—or even with a particular type of risk on which the organization may feel it has a good handle. A risk-analytic framework and procedure that is methodical and consistent across all business areas and types of risks is essential for adequate risk evaluation and coverage. Following documented processes—probably including formalized worksheets such as enumerated steps and checklists—is an important aspect of ERM.

Framing Effect

A significant result of the work done by Kahneman and Tversky is the empirical demonstration that the framework or format of the description of alternatives can affect the choice of a person in a decision-making situation. This is because we perceive and value gains and losses differently.

ERM Implications:

(1) Care must be used in how questions, or requests for judgmental information and estimates, are asked and considered.

(2) Care must be taken in communicating results and information to parties involved in and affected by enterprise risk management. To the extent that ERM should be an embedded, organizationwide process that is “everyone’s business,” it’s important for ERM practitioners to take care, in their communications, not to bias others’ observations or identifications of risks.

Hindsight Bias

Everyone does it to at least some extent: We reconstruct the past, in hindsight, and thereby assign a greater probability to an event (that actually occurred) *afterward* than was estimated beforehand. This is often manifested by a comment such as “I told you so” or “I knew it.” This can have huge implications for any analytical setting, including ERM. It can lead to an unrealistic evaluation of, and comfort with, past analytical efforts, resulting in overconfidence and methodological problems for prospective analyses.

ERM Implication: Risks should be identified and explored as early as possible. Strong and clear documentation of the ERM process and of findings and analyses, including an ongoing follow-up procedure regarding risk statuses, can help to keep everyone historically “honest.”

Mental Accounting

The idea that it’s the *experience* that counts, and that we categorize and evaluate different experiences in different mental accounts, is attributed to Richard Thaler. In this perspective, people value good and bad experiences differently: We tend to be risk-averse relative to gains and risk-seeking relative to losses. Furthermore, for example, many small good experiences can outweigh one big good experience.

With respect to ERM, this leads to the question of what kinds of risks and rewards a firm or individual should concentrate on. Do small successes in several different market niches outweigh a large success in a single niche? Is it warranted to concentrate on one potentially significant risk exposure, to the exclusion or detriment of a series of small risk exposures?

ERM Implication: We need to develop appropriate risk and return metrics. The question of what is “appropriate” is, of course, a difficult one. But, at the least, we should be able to say that the identification of a firm’s goals and objectives is a critical starting point in considering this. Then, individual or collective risks or experiences can be evaluated within that context.

Overconfidence Effect

It is no secret that, in many ways, people tend to overestimate their status or performance. This phenomenon is particularly striking when opinions of oneself are observed across an entire group—how can *everyone* be above average? When it comes to analytical situations, this overconfidence is characterized by having greater certainty (e.g., about a probability value, an analytical technique, etc.) than is objectively justified. From an ERM perspective, this false level of comfort and security can lead to risk analysts using and examining fewer data than is appropriate or available. It can also lead to laziness and indifference regarding technical and methodological improvements.

ERM Implications:

(1) Analytical models need to be tested thoroughly and frequently. As appropriate, testing might include back-testing, forward-testing in light of new, emerging data, etc.

(2) Peer review needs to be a significant and ongoing part of the ERM process.

Recency Effect

Often, we overemphasize the prevalence or impact of recent events (or those that are more “available” to us for observation), and endow them with greater visibility and gravitas. This is particularly common, for example, in fields like entertainment and sports. Asking who were the 10 greatest quarterbacks of all time is a fun exercise, but the suggestions are likely to be biased toward more recent players because they are more likely to have been seen and their performances are more at the forefront of our minds and experiences.

An example of an experiment testing the availability heuristic—based on Kahneman and Tversky (1983)—is the following:

Estimate how many words in the English language have each of the following seven-letter structures:

- (1) _ _ _ _ i n g
- (2) _ _ _ _ _ n _

It is much easier to think of (i.e., examples are more readily available to our minds) type (1) words (the ---ing words) than words that happen to have an “n” as their sixth letter. Thus, we tend to think that words of type (1) are more prevalent. However, type (1) is a subset of type (2)—any type (1) words are also type (2) words. Thus, more words fall into type (1) than type (2).

In an analytical context, the recency/availability effect can result in overreaction to more recent or available information, with a consequent possible misperception of risk event probability.

ERM Implication: We must use appropriate statistical tools and procedures. The ideal tool is one that neither overreacts nor underreacts to recent data—it acknowledges that more recent information may indeed be more relevant because of changing exposures or conditions over time, but it weights older versus newer data in a manner consistent with the situation. Of course, this is easier said than done—but it certainly gives importance to actuarial research and advancement in Bayesian and credibility-based techniques.

Representation Bias

It's common for actuaries to use a classification approach when evaluating risks. For example, the premium for a personal auto policy will likely depend upon a number of driver attributes—e.g., gender, age, marital status, etc. (to the extent they are allowed under public policy). However, even with a large number of classes in a rating system, we know that a particular risk, even with all the attributes properly identified, may not be completely consistent with the loss potential of other risks in the “cell” in which it is placed.

This heterogeneity can be a large problem when a risk is categorized according to only a select few features. One cognitive dissonance people often exhibit is to view an event or situation based on how much it resembles or represents other events or situations with respect to a small number of features. If those features, which might be significant on the surface, are not significant statistically in their relationship to prospective losses, a misperception of risk potential can result.

Again, an experiment mentioned in Kahneman and Tversky (1983) is frequently invoked as evidence for the representation bias. A test participant is provided with information about a hypothetical person named Linda—e.g., “Linda is 31 years old, single, outspoken. ...” The participant is then asked to rank a list of Linda's possible attributes in order of their probability, including:

- Linda is active in the feminist movement.
- Linda is a bank teller.
- Linda is a bank teller and active in the feminist movement.

Participants in this experiment had a tendency to focus on certain attributes mentioned about Linda that made her seem more likely to be a feminist than a bank teller. These attributes were influential with participants, to the extent that “Linda is a bank teller and active in the feminist movement” was often given a higher probability than “Linda is a bank teller.” But, of course, the former is a subset of the latter, and thus must have a lower probability. The focus on the

perceived feminist attributes often overrode participants' sense of perspective with respect to probability.

ERM Implication: Engage multiple people with diverse backgrounds to opine on risk potential and characteristics.

Section 6: Conclusion

In this paper, a brief background and description of behavioral economics has been presented, and implications for the theory and practice of ERM have been suggested. We believe that any activity involving the identification, quantification and/or management of risk can benefit from an understanding and awareness of real-world human dynamics and cognitive tendencies.

While this paper examines behavioral economics as a fairly significant adjustment in the cognitive framework relative to traditional economics assumptions, it's worth noting that we could go even *further*. According to Sedlacek (2011), an even larger interdisciplinary net should be cast when trying to understand human economic systems:

There is at least as much economic wisdom to be learned from our own philosophers, myths, religions, and poets as from exact and strict mathematical models of economic behavior.

We agree that a move toward greater interdisciplinarity and broader sharing of insights between disciplines can only enhance actuarial and ERM efforts.

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Suggested Books

Here are several recent books, meant mostly for a general or popular audience, that explore various aspects of human behavior and its relationship to economics and finance.

- *Thinking, Fast and Slow*, by Daniel Kahneman, New York: Farrar, Straus and Giroux, 2011
- *Predictably Irrational: The Hidden Forces that Shape our Decisions*, by Dan Ariely, New York: Harper, 2008
- *Nudge: Improving Decisions about Health, Wealth, and Happiness* by Richard Thaler and Cass Sunstein, New Haven: Yale University Press, 2008
- *The Believing Brain: From Ghosts and Gods to Politics and Conspiracies—How we Construct Beliefs and Reinforce Them as Truths*, by Michael Shermer, New York: Times Books, 2011
- *The Mind of the Market: Compassionate Apes, Competitive Humans, and Other Tales from Evolutionary Economics*, by Michael Shermer, New York: Times Books, 2008
- *Animal Spirits: How Human Psychology Drives the Economy, and Why it Matters for Global Capitalism*, by George Akerlof and Robert Shiller, Woodstock: Princeton University Press, 2009

- *The Irrational Economist: Making Decisions in a Dangerous World*, by Erwann Michel-Kerjan and Paul Slovic, New York: Harper Perennial, 2010
- *I'll Have What She's Having: Mapping Social Behavior*, by R. Alexander Bentley, Mark Earks and Michael O'Brien, Cambridge, Mass.: MIT Press, 2011
- *Economics of Good and Evil: The Quest for Economic Meaning from Gilgamesh to Wall Street*, by Tomas Sedlacek, New York: Oxford University Press, 2011