

## Current Megatrends: Implications for Enterprise Risk Management



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### Agenda

ERM is significantly impacted by its presence within the following contexts:

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

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- “Man is a mystery. It needs to be unravelled, and if you spend your whole life unravelling it, don't say that you've wasted time.”

- Fyodor Dostoyevsky

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### Enterprise Risk Management

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

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### (1) ERM - Complex Adaptive Systems

- A CAS is a system of individual interacting “agents” which adapt to changing conditions
- Characteristics
  - Bottom-up rather than top-down
  - Self-organized emergence, exhibiting nonlinearities
  - Irreducible
- Some examples
  - Economies, ecologies, consciousness, organizations

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### Complexity and Agent-Based Modeling

“One of the most general shorthand abstractions that if adopted would improve the cognitive toolkit of humanity is to think bottom up, not top down. Almost everything important that happens in both nature and in society happens from the bottom up, not the top down.”

- Michael Shermer, 2011, *Edge*, “What scientific concept would improve everybody’s cognitive toolkit?”  
<http://edge.org/?q=res-detail&aid=&rid=908>

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### Historical Recognition

“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.”

- *An Inquiry into the Nature and Causes of the Wealth of Nations*, Adam Smith, 1776

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### (2) ERM - Evolutionary Processes

- Parallels between economic systems and biological evolutionary theory
  - Complex systems
  - Self-organized agents / individuals
  - Adaptation / natural selection
  - Emergence of “order”
  - Understanding the historical process helps to explain behavior

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### Biology and Economics

- “Why is Economics Not an Evolutionary Science?” Thorstein Veblen, *QJE*, 1898
  - Title says it all
- *Why Most Things Fail: Evolution, Extinction & Economics*, Paul Ormerod, 2005
  - Company and species extinction → similar patterns
- “Structure and Response in the World Trade Network,” He and Deem, arXiv, 2010
  - “... treating the world trade network as an evolving system... globalization... should lead to increasingly large recessions and decreased rate of recovery, in contrast to standard economic understanding.”

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**Why Mention Complex Systems and Evolutionary Theory?**

They are related to, and can help us understand, the nature and existence of the *cognitive dissonances* being uncovered by behavioral economics and cognitive neuroscience

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**(3) ERM as Impacted by Behavioral Economics**

- Traditional economics – *Homo economicus*
  - Based on
    - Rationality
    - Expected utility theory
- Behavioral economics and finance
  - “Irrationalities”
  - Psychology, social anthropology...

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**The World is Changing...**

“... one of the hallmarks of the twenty-first century will likely be more and more unthinkable events, previously unseen contexts, and pressure to react extremely quickly, even when we cannot predict the cascading impact our actions might have.”

- Michel-Kerjan and Slovic (2010), *The Irrational Economist: Making Decisions in a Dangerous World*

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**...And Thus, So Must We**

“The very modes of thought that are highly rational most of the time can get us into big trouble when the nature of the environment surrounding us, or the time horizon on which we make decisions, changes.”

- Michel-Kerjan and Slovic (2010)

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**Economic History**

- Classical economics
  - E.g., Adam Smith
- Neoclassical economics
  - William Stanley Jevons
  - Jeremy Bentham
  - Utility = happiness
    - Pleasure versus pain

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**Economic History (cont.)**

- Neoclassical economics:
  - “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.”
  - Angner and Lowenstein (2007), “Behavioral Economics,” in *Philosophy of Economics* (2012)

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### Economic History (cont.)

- More recent neoclassical economics
  - Sought methodological improvements
  - Preferences
  - Avoid appeals to psychology
  - Human behavior not a factor
  - No room for “irrationality”

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### *Homo Economicus*

- Completely rational
- Maximizes utility (satisfaction or well-being), given opportunities and constraints

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### But Wait...

Adam Smith: “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.”

- Beginning of: Smith (1790), *The Theory of Moral Sentiments*, Sixth Edition

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**Furthermore...**

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

- Ashraf, Camerer, and Loewenstein (2005), “Adam Smith, Behavioral Economist,” *Journal of Philosophical Perspectives* 19(3): 131-145

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**Complex Social Systems**

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

- *Human Action*, Ludwig von Mises, 1949

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**Behavioral Economics**

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

- Camerer, Loewenstein, and Rabin (2004), *Advances in Behavioral Economics*

- Reaction against neoclassical view
- Primarily an outgrowth of cognitive science
- Behavioral decision-making
- Interdisciplinary

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### Behavioral Economics (cont.)

- "... Behavioral economists have spent a great deal of time exploring not just the role of cognition, but also that of affective states, emotions, moods and feelings, in human judgment and decision making."

- Angner and Lowenstein (2007), "Behavioral Economics," in *Philosophy of Economics* (2012)

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### Evolution of Behavioral Economics

- Herbert Simon
  - "Bounded rationality" to reflect human cognitive limitations → simplified models
- Kahneman and Tversky
  - Behavioral decision-making
  - Cognitive biases
    - Resulting from heuristics which facilitate our ability to analyze and make judgments
  - Prospect theory
    - Alternative to expected utility theory for describing actual decision-making under risk

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### Expected Utility Theory

- Von Neumann-Morgenstern
- Goal is to maximize expected utility
  - Function of utilities and probabilities of outcomes
- Individuals are rational
- Can be risk-averse
- Concavity of the utility function

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**Are We Rational Utility Maximizers?**

- “Stop me from eating!”
- “Playing with the house’s money”
- Cautiousness when being “in the hole”
- “Two and a Half Men”
- Romans 7:15

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**Do These Anecdotes Indicate Irrationality?**

- Perhaps “anomalous” or “dissonant” is better than “irrational”
- Perhaps we simply don’t know or fully understand all the explanatory factors involved
- “The foundations of economic theory were constructed assuming that details about the functioning of the brain – the ultimate ‘black box’ – would never be known.”
  - Loewenstein, Camerer, and Prelec (2007), “Neuroeconomics: How Neuroscience Can Inform Economics,” *Rotman Magazine* (Winter): 40-44

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**Dual-Process Brain**

- Controlled vs automatic processes
    - Controlled: computational; deliberate; economic tools
    - Automatic: fast; reflexive; evolutionary
  - Cognitive vs affective processes
    - Cognitive: analytical; conscious
    - Affective: feelings; largely subconscious
- Loewenstein, Camerer, and Prelec (2007), “Neuroeconomics: How Neuroscience Can Inform Economics,” *Rotman Magazine* (Winter): 40-44

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**Dual-Process Brain (cont.)**

| Examples   | Cognitive              | Affective          |
|------------|------------------------|--------------------|
| Controlled | Actuarial calculations | Method acting      |
| Automatic  | Physical skills        | Startled movements |

- Loewenstein, Camerer, and Prelec (2007),  
 "Neuroeconomics: How Neuroscience Can Inform Economics," *Rotman Magazine* (Winter): 40-44

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**Beliefs**

- "Beliefs come first, explanations for beliefs follow... our perceptions are dependent on the beliefs that we hold about it."
- "Patternicity: the tendency to find meaningful patterns in both meaningful and meaningless data."
- "Agenticity: the tendency to infuse patterns with meaning, intention, and agency."

- Shermer (2011), *The Believing Brain*

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**Prospect Theory**

- "Frame" or "reference point"
- Risk-averse with respect to gains, but risk-seeking with respect to losses

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### A Selection of Cognitive Dissonances

- **Anchoring** effect – bias toward initial value
- **Confirmation** bias
- **Endowment** effect / loss aversion
- **Framing** – reference pt. affects perceived risk
- **Hindsight** bias
- **Mental accounting**
- **Overconfidence** / Optimism
- **Recency / availability** – bias toward recent data
- **Representation** – essential features

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### This Stuff Applies to Us, Too

“Despite suggestions to the contrary, actuaries are human.”

- Nigel Taylor (2000), “Making Actuaries Less Human”

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### Anchoring Effect

- Focus on a small subset of available data
- Subset may or may not be highly relevant
- Ignore or undervalue other or new information
- Any changes from anchor point seem particularly significant
- **ERM Implications:**
  - Last-year’s estimate
  - Judgmental probability discussions

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### Anchoring Effect (cont.)

- Experiment:
  - (To One Group) Do you think the percentage of African countries that are in the United Nations is above or below 10?
  - Give a specific estimate of the exact percentage.
  
  - (To Another Group) Do you think the percentage of African countries that are in the United Nations is above or below 65?
  - Give a specific estimate of the exact percentage.
- Based on Tversky and Kahneman (1974)

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### Confirmation Bias

- We have preconceptions or prior hypotheses
- Selective memory
- Selective interpretation
- Consistent with preconceptions
  
- ERM Implications: need multiple internal and external perspectives

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### Endowment Effect

- We value things more highly when we *own* them, or are *endowed* with them
- We emphasize loss aversion relative to those endowed items
  
- ERM Implications: Need methodological consistency of analysis across risks

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### Framing Effect

- Framework or format of description of alternatives can affect choice
- Gains and losses are perceived and valued differently
- **ERM Implications:**
  - How results are communicated
  - How questions are asked and considered

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### Hindsight Bias

- Reconstruct the past
- Assign greater probability to an event afterward than before
- “I knew it” / “I told you so”
- **ERM Implications:**
  - Unrealistic evaluation of past analytical efforts can lead to overconfidence and methodological problems
  - Identify and explore risks early

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### Mental Accounting

- The *experience* counts
- People value good and bad experiences differently
  - Risk-averse relative to gains
  - Risk-seeking relative to losses
- Many small good experiences outweigh one big good experience
- **ERM Implications:**
  - Kinds of risks and rewards to concentrate on?
  - Need appropriate risk and return metrics

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### Overconfidence Effect

- Greater certainty than is justified
- Can lead to using and analyzing less data than is appropriate or available
- How can *everyone* be above-average?
- **ERM Implications: need to back-test models, and use significant peer-review**

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### Recency Effect

- Recent / available events have greater visibility and gravitas
  - Bayesian? Complement of credibility?
- Recent events can thus be overemphasized
- Can result in over-reaction
- Possible misperception of probability
- **ERM Implications: use appropriate statistical tools**

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### Recency Effect (cont.)

- Experiment on availability heuristic:
  - Estimate how many words have each of the following structures:

- (i) \_ \_ \_ \_ i n g
- (ii) \_ \_ \_ \_ \_ n \_

– Based on Kahneman and Tversky (1983)

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**Representation Bias**

- View an event or situation based on how much it resembles or represents other events or situations
- Categorization
- Based on essential features
  
- **ERM Implications: Engage multiple people with diverse backgrounds to opine**

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**Representation Bias (cont.)**

- Experiment:
  - Linda is 31 years old, single, outspoken,...
  
  - Rank the following in order of probability:
    - ...
    - Linda is active in the feminist movement
    - Linda is a bank teller
    - Linda is a bank teller and active in the feminist movement
  
  - Based on Kahneman and Tversky (1983)

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**Evaluating Probabilities**

- “Experts Strive to Put Diseases in Proper Perspective,” by Gina Kolata, *New York Times*, 7/2/02
  - “Such statements, they say, may lead people to exaggerate their chances of getting and dying from a fearsome disease.”
- *The Culture of Fear: Why Americans are Afraid of the Wrong Things*, Barry Glassner, 2000, Basic Books
  - “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.”

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**Emotions: Can't Live With 'em,  
Can't Live Without 'em**

- “People have a hard time imagining how they’ll feel – and how they’ll act – in the future.”
- “Understanding emotions doesn’t lead to easy solutions.”
- “It’s dangerous to make long-term decisions based on short-term emotions.”

- Futrelle (2011), “Your Emotions Can Cost You Money,” *Money*, 40(8-September): 102-106. Interview with George Loewenstein

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**Emotions: Can't Live With 'em,  
Can't Live Without 'em (cont.)**

- “An empathy gap – we don’t fully empathize with our future selves.”
- “... the illusion of courage: People think they will be more willing to take risks in the future than they really will be. They underestimate the fear they will experience...”

- Futrelle (2011), “Your Emotions Can Cost You Money,” *Money*, 40(8-September): 102-106. Interview with George Loewenstein

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**Emotions: Can't Live With 'em,  
Can't Live Without 'em (cont.)**

- “A far more effective strategy is for investors to set short-term goals designed to accomplish long-term goals.”
- “I’ve come to the view that behavioral economics solutions are often being used as a substitute for more fundamental efforts.”

- Futrelle (2011), “Your Emotions Can Cost You Money,” *Money*, 40(8-September): 102-106. Interview with George Loewenstein

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**Impact on ERM**

- Need for actuarial knowledge of behavioral issues and human dynamics
- Understand the potential impact on underlying risk data
  - E.g., behaviorally-informed marketing efforts
- Avoid cognitive biases when estimating risk parameters
  - E.g., anchoring when considering probabilities

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**We Could Go Even *Further*...**

“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.”

- Sedlacek (2011), *Economics of Good and Evil: The Quest for Economic Meaning from Gilgamesh to Wall Street*

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**Suggested Books**

- *The Believing Brain* – Michael Shermer (2011)
- *The Mind of the Market* – Michael Shermer (2009)
- *Animal Spirits* – George Akerlof and Robert Shiller (2010)
- *Predictably Irrational* – Dan Ariely (2008)
- *Nudge* – Richard Thaler and Cass Sunstein (2009)

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