



SOCIETY OF ACTUARIES

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# Risk Management

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# Artificial Intelligence and Autonomous Automobiles

By Steve G. Steinberg

**THERE IS A SENSE OF EXCITEMENT THAT INFECTS EVERYONE**, whether Detroit exec or Silicon Valley VC, who is involved with electric cars. It comes from the belief, propagated by an enthralled media, that what they are doing is important—even vital. Electric vehicles, they insist, are revolutionary.

They are delusional.

Whether a car runs on gas, electricity, or steam, it remains a deadly weapon, with victims denominated not just in bodies, but in wasted wages and lost time. No matter what your attitude toward suburban and urban sprawl (personally, I'm a fan) anyone who has tried driving the I405 at rush hour knows that cars need far more than a new motor.

But, fortuitously, the hype over the electrical car is providing covering fire for a true revolution: the *computational* car. It is the increasingly autonomous intelligence of automobiles, far more than a new drive train, that stands to alter fundamentally how we interact with cars, and how they affect our planet.

Already, more than a dozen 2010 car-year models offer intelligent safety features such as lane departure warning and adaptive cruise control. Crucially, they do not just flash a light or sound a buzzer when a problem is detected: they *autonomously* apply the brakes or adjust the steering. The driver is no longer the fail-safe that ensures the machine is running correctly. The driver is a problem to work around. The driver, you might say, is a bug.

Of course, I am far from the first to recognize the importance of this development. Even *Wards*, the automotive trade weekly, recently acknowledged that artificial intelligence is poised to change cars more thoroughly than electric propulsion ever will. And Brad Templeton, a well-known net entrepreneur, has written extensively and persuasively on how today's intelligent safety features will inexorably lead to autonomous vehicles.

Making this technology all the more notable is that it wasn't supposed to happen.

For many years, the conventional wisdom, certainly within the auto industry, was that carmakers would never introduce intelligent safety features so long as there

were plaintiff lawyers. Autonomous technology shifted the liability for accidents from the car's owner to the car's maker, said industry spokespeople, and was tantamount to corporate suicide.



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Three developments changed their minds. First, active safety technologies have become substantially more robust, thanks to improvements in sensor design, and, most importantly, in sensor fusion and planning algorithms. Second, drive-by-wire has rendered the legal debate largely academic—car functions are already mediated by computers, one way or another. Lastly, and probably most importantly, the auto industry experienced an unprecedented, violently destabilizing, massive contraction. Technology that previously seemed like a grave, existential threat now seems like the least of their problems. It turns out that, innovation, like freedom, “is just another word for nothing left to lose.”

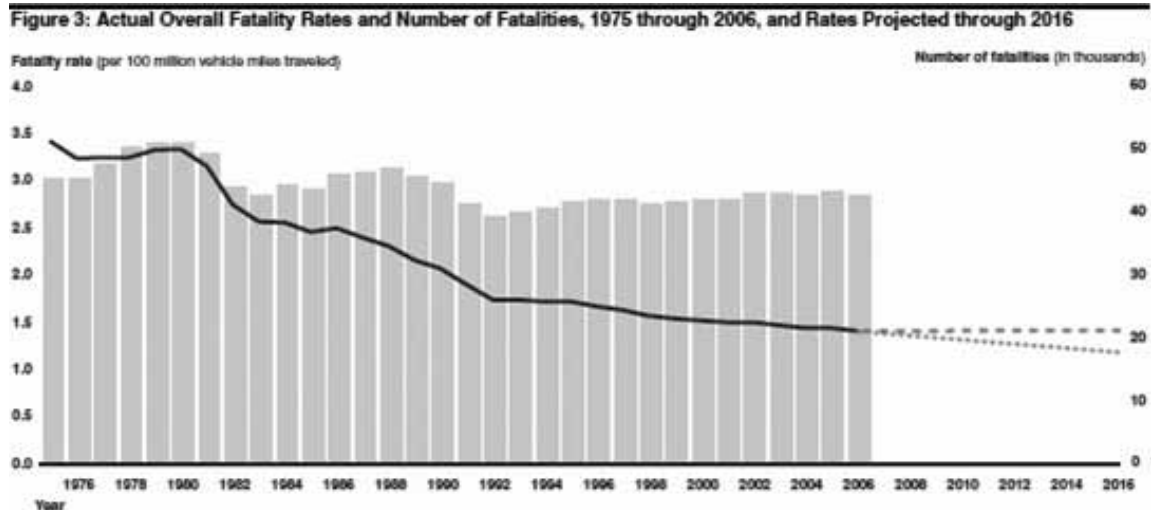
All those developments made autonomous technology possible, even practical. But the impetus to actually *do* something about it came from charts like the one below. The line shows the automotive fatality rate declining steadily for the last 25 years of the 20th century, from 3.5 deaths per 100 million miles traveled in 1975 to just over 1.5 deaths in 2000. Then the line flattens out. For the last 10 years the fatality rate has barely budged.

The gains in the 1980s and 1990s stemmed primarily from mechanical improvements in car bodies—better vertical rigidity, intentional crumple zones. By the end of the millennium, engineers were butting up against the physical limits of materials, chasing rapidly diminishing returns. Today, any significant decline in the fatality rate will have to come from changes in how cars are driven, or, ideally, *not* driven. And pressure is mounting: the extraordinary growth in texting and its deleterious effects on driver attention means that even holding everything else constant, the fatality rate will rise.

## RISK COMPENSATION

This still begs the critical question: Do intelligent safety features *work*? Do they save lives and limbs? We know

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that changing lanes unintentionally and rear-ending a forward vehicle—the accident types the two most popular intelligent safety features address—account for a very significant percentage of fatalities, although estimates vary substantially. But we have almost no data on the efficacy of the new intelligent safety solutions, and what we do have is contested.

This uncertainty is surprising given that auto accidents are the leading cause of death for teenagers, and one of the top-ten causes for adults. You might think the National Highway Traffic Safety Administration rigorously evaluates new safety features, akin to how the FDA evaluates new drugs and devices.

That is not the case. At best, the NHTSA does some simple, unrealistic *in vitro* style tests. They never perform double blind experiments in the real world. Even the statistics the agency collects about automotive accidents are of dubious usefulness, due to poor sampling design and paucity of detail.

Still, we can thank the NHTSA for a recent report that at least throws the uncertainty about autonomous safety features into stark relief. The NHTSA had volunteers drive a test track in cars with automatic lane departure correction, and then interviewed the drivers for their impressions. Although the report does not describe the undoubted look of horror on the examiner's face while interviewing one female, 20-something subject, it does relay the gist of her comments.

After she praised the ability of the car to self-correct when she drifted from her lane, she noted that she would love to have this feature in her own car. Then, after a night of drinking in the city, she would not have to sleep at a friend's house before returning to her rural home.

This phenomenon, where improved safety spurs on greater risk taking, is known as risk compensation, or "risk homeostasis." Most of us became familiar with the concept from debates over anti-lock brakes (ABS), but its specter has plagued nearly every attempt to improve automotive safety, from seat belts to night vision. Yet almost nothing about risk compensation—its etiology, its prevalence, its significance—is certain.

To prove the phenomenon even exists, one particularly inspired British researcher had volunteers ride bicycles on a closed course, with half the people wearing helmets and proper attire, and the other half clad in their underwear. Graduate students positioned on the sidelines graded the volunteers performance and tallied any unsafe maneuvers. The results showed that the unclothed group practiced much safer driving habits, thereby supporting risk compensation theory—and Britain's reputation for eccentricity.

Many other, more targeted studies from the 1990s also painted automotive safety as a zero-sum game, with any gains in safety vitiated by greater risk taking. Not only did careful, well-designed experiments in Europe show that anti-lock brakes lead to more aggressive driving, but many of the countries that adopted seat-

**“The key empirical development was the overwhelming success of electronic stability control (ESC).”**

belt legislation found that auto fatalities barely budged, while the number of pedestrians injured by cars actually increased.

These studies make for fascinating reading but can be hard to integrate with common sense. Anyone who has driven a vintage car knows they do not feel as safe. Fortunately, over the last ten years the scholarly consensus has shifted—pushed by both empirical and theoretical developments—to a much more nuanced view.

The key empirical development was the overwhelming success of electronic stability control (ESC). Introduced in 1995, the technology works in conjunction with ABS to prevent over- and under-steer. The NHTSA reports that ESC reduces accidents by 35 percent—a number large enough to outweigh the study’s methodological shortcomings, which were legion. This success prompted researchers to reexamine ABS, and with the benefit of hindsight, many now believe that ABS is ineffective for very specific reasons. (Essentially, when the brake pedal automatically ‘pumps’, it disconcerts drivers and they instinctively raise their foot.)

Theoretical developments have had an even more profound effect on how we think about risk compensation. These developments reflect an ongoing revolution in statistical practice—enabled by Moore’s law as well as Bayes law—that allows us to peek into the black box of causation. Thanks to books like *Freakanomics* and Jared Diamond’s new anthology, the reverberations of this revolution have started to enter the public consciousness, but the full sweep of its implications remains vastly under-appreciated.

It is, admittedly, both technically and philosophically complex. But at the most concrete level, the use of MCMC (Markov Chain Monte Carlo) type methods to iteratively ‘solve’ Bayesian networks, allows us—in certain cases—to make strong claims about causes from naturally observed data rather than from carefully randomized experiments.

This may be easier to explain with an example.

Traditionally, to determine the efficacy of seatbelts in preventing fatalities, we would randomly assign people to two classes and then ensure that the control class never wore their seatbelt, while people in the other

class always buckled up. We could not simply look at people who *already* wear seatbelts and those who do not, because the people who naturally wear seatbelts are more likely to be naturally cautious drivers. We couldn’t even do the study longitudinally—by, say, looking at a country before and after seat-belt legislation—because confounding factors like a steadily aging population, or the growth in texting would distort our conclusions.

But these rules of statistical best practice are being overturned. There are now at least half-dozen studies that use sophisticated causal inference to tease apart the root causes and consequences of automotive safety. What they have found is satisfying in its lack of surprise. Concisely, risk compensation exists, but not universally—it is personality dependent. “Sensation seeking” is one blunt-edged, but not totally wrong, way to characterize the people who do exhibit risk compensation.

Nonetheless, the insight that intelligent safety features will only help a subset of the population can seem deflating. The big stories in technology are always the ones that surpass expectations.

I will argue that for at least one industry—the auto insurance—autonomous safety features *will* lead to better than expected performance. The argument, detailed below, is circuitous, but stems from the realization that the mathematical risk models auto insurance companies rely on have never described reality very well. The coming innovations in automotive safety will actually push reality in the direction of the model, making the business significantly more profitable.

## INSURANCE: NOT AS BORING AS YOU THINK

But ... *In-sur-ance*. It does not whisper alluringly, like diamonds, or sigh seductively, like oil. It creaks; it pops. Insurance is not usually associated with fast-growing companies, charismatic CEOs, or technological discontinuities. The very nature of insurance seems most amenable to gradual, incremental progress. It’s safer.

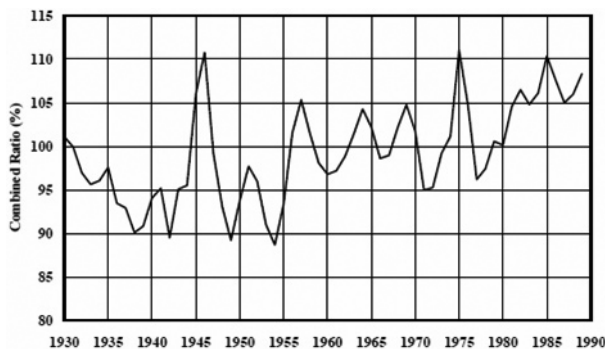
But don’t mistake characteristics of the recent past for inalienable traits. Study the history of insurance—as

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the industry's fastidious, compulsive record-keeping uniquely allows—and you notice that the most lucrative periods always come in the wake of big socio-technical changes. Changes that eliminate risk faster than prices can fall.

One of these changes can be seen in the example of fire insurance from 1907 to 1927. The massive destruction caused by the 1906 San Francisco earthquake and fire sets off a nation-wide overhaul of building safety codes, decisively reducing the frequency and potency of commercial fires. Or, perhaps more analogous to automotive safety: Marine insurance, late 1880s. Wood-and-sail ships are forcefully retired by faster and safer steel-and-steam vessels. England dominates in the construction and operation of these new steel ships, fostering a powerful local marine insurance industry and relegating American insurers to table scraps. Lloyds becomes *Lloyds*.

This same innovation-driven dynamic also occurs on the smaller, micro-scale as well, producing the cyclic pattern so characteristic of insurance industries. These cycles are often explained with vague suppositions to supply and demand, but those are rarely the real drivers—regulatory hurdles (for supply) and regulatory requirements (on demand) leech their force. Instead, small, predictable social and technical changes are constantly reducing risk, and thus cost. The regulatory rate setting process inserts a lag between a risk reduction and the associated drop in price, and *voilà: cycle!*



The chart below shows the historical combined ratio for auto insurance since 1930. (Remember, the combined ratio is incurred losses plus expenses divided by earned premiums. The further the ratio is below 100, the more profitable the underwriting.)

For context, today's auto insurance companies have combination ratios right at, or slightly above, 100 and

depend on ancillary services and investment income for profitability<sup>5</sup>.

You can easily make out the cycle starting just after 1945 and repeating every six or seven years. The initial peak was, of course, the end of WW II—gasoline was no longer rationed, servicemen returned, inflation soared—but the cycle was the result of the McCarran-Ferguson act, which resulted in most states regulating auto insurance rates, and passed in 1945.

I have shown that there are good reasons, both historical precedent and structural mechanisms, why significant risk reductions lead to increased profitability. What's left is to show that autonomous safety technologies will reduce the risk covered by insurers *more than is expected* ... even in the face of "risk compensation."

## ACCIDENT THEORY

To do this, you first need to understand how auto insurance companies think about accidents.

Anyone who has had a car accident knows there are two perspectives. Other people's perspective, also known as the negligence theory, which says accidents are the result of momentary carelessness. Or *coincidence theory*, which says that if you drive enough miles, something bad is bound to occur.

Both, of course, have some element of truth. Your grandmother is truly a hazard, despite only driving to church on Sundays. And Mario Andretti would have accidents too, if he commuted three hours to work. The question is which factor dominates,

The data unequivocally says the latter. Accidents are most correlated to the number of miles driven. To put it in actuarial terms, miles driven is an exposure variable, and is multiplicative, while negligence is a class variable, and additive.

Nonetheless, for historical, political, and idiosyncratic reasons, insurance premiums have always been firmly rooted in negligence theory. It is this tension—between how insurance companies think about accidents, and how accidents actually are—that leads to logical inconsistencies and inefficient pricing.

For example, insurance companies almost never consider “no-fault” accidents when evaluating your driving record. (In fact, doing so is prohibited in some states.) However, no-fault accidents are an extremely good predictor of future *fault* accidents. The correlation would be bizarre if accidents were truly the result of negligence, but makes perfect sense if accidents are largely stochastic.

A far more pernicious inefficiency stems from the empirical correlation between low credit scores and auto accidents. Insurance analysts, viewing the world through negligence theory blinders, explain the higher number of accidents by characterizing people with bad credit as impulsive, reckless, and frankly not that sharp. This explanation, in only marginally more polite terms, is frequently trotted out as fact in the popular press.

It is fallacious.

The real explanation is more subtle. Because insurance acts as a *per-car* tax, people naturally try to reduce the number of cars they have assessed. In practice, this means letting the insurance on their second vehicle lapse, and using their primary car exclusively. Both actions increase the average miles driven per poor-credit person car and, therefore, the number of accidents per-PCPC. The unfortunate end game is that people with less money are stuck with disproportionately high insurance premiums

The solution, say some policy experts, is to price insurance on a per-mile, rather than per-car, basis. People with poor credit would be disincented to drive, and would thus have fewer accidents and lower premiums.

Coincidentally enough, in the last two years, nearly every auto insurance company has announced just such a “pay-per-mile” plan with an excess of fanfare. Even insurance companies like to be on trend, and this press release stampede was all about a shiny new piece of technology: the secure GPS system, used to track miles driven.

Try to actually sign up for one of these per-mile plans, however, and you will face a seemingly infinite number of obstacles. Most insurers killed the plans before the press releases went cold because they would have been a drag on profits. It is easy to see why: all the customers who drive very little would sign-up for the GPS programs, leaving just the long haul drivers in the pool.

The cross subsidies and mixing of means that lies at the heart of any insurance program would be eliminated.

Autonomous safety features offer a much more sustainable model for insurance companies. The computational car will allow the majority of drivers—the non-risk takers—to reduce their chance of accident asymptotically, to the point where miles driven is no longer the determining factor. Then, insurer’s models, which price as if your personality rather than miles driven controls your accident rate, will accord with reality.

## ECONOMIC PERFORMATIVITY

This counter-intuitive phenomenon—the real world remade in the form of the model, rather than the model adjusted to reflect reality - is currently a hot topic among economists, under the rubric of ‘performativity’. It turns out to be a surprisingly ubiquitous process, underlying many economic developments. The canonical example is the Black-Scholes equation, first published in 1973. Before then, option prices on the Chicago Board of Trade varied markedly from what Black-Scholes predicted. Within a few months of the equation’s publication, however, options were trading in-line with theory.

In other words, Black-Scholes became an accurate model of option pricing ... because people began using it to price options. But it was also self-fulfilling in a deeper sense. Just as models in physics rely on simplifying assumptions—frictionless inclines, no wind resistance—Black-Scholes assumes zero transaction costs, unlimited borrowing at the riskless interest rate, and unconstrained short-selling. These were all wildly unrealistic in the pre-E\*TRADE world of 1973. However, as regulators adopted Black-Scholes to govern everything from bank risk to executive compensation, the model’s assumptions rode along like stowaways, becoming deeply embedded in economic policy. The world was remade in the model’s image.

Performativity is a powerful prism to view events through, but like previous big ideas—Kuhnian paradigms, Shannon information theory—it is in danger of being over-used to the point of meaninglessness. ■

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# The ERM Rainbow

By Alice Underwood and David Ingram

## WHAT IF THERE WAS A LAW THAT EVERYONE MUST HAVE THE SAME FAVORITE COLOR?

It would be so much more efficient! We would only need one color of paint for cars, for houses, even for furniture and toys. Clothing stores would take up much less space. Society could save huge amounts of wasted money and put it to more productive purposes. The single-color system would make the world a more peaceful place: fewer arguments between parents and children about what to wear in the morning, between couples over how to decorate the living room ... everyone's stress level would be reduced with a best color pre-determined for all of us.

Something along these lines was once tried. Henry Ford famously declared, "Any customer can have a car painted any color that he wants so long as it is black." This strategy simplified production—and black paint dried faster than other colors, reducing time on Ford's assembly lines. The monochrome approach was wholly aligned with Ford's focus on efficiency. But the situation didn't last. People wanted cars in different colors and eventually Ford had to start providing them.

Even if somehow a law were passed decreeing a universal favorite color, it wouldn't change people's individual preferences. Those whose true favorite color was something else might go along; *pretending* to change their preference to avoid penalties, but most would seek out their real favorite whenever the color police weren't looking.

Lately, risk management authorities have been trying to tell firms how they should think about and manage risk. People who have labored in risk management through the boom period before the crisis—a period when risk managers were largely

ignored—are very happy that those authorities may finally be empowered to force firms to get with the program. But, such decrees are not working and will not work, because individuals and companies have risk perspectives that cannot be changed by fiat—any more than mandating a favorite color for everyone would change anyone's *real* favorite color.

Corporations and the human beings who run them have their own views of risk and risk management. These perspectives have formed over time, in response to personal experiences and the changing business environment, influenced by watching various strategies succeed or fail. Studies show that risk perspectives fall into four broad groups with almost wholly incompatible views—and only one of those four perspectives is totally compatible with the current paradigm of enterprise risk management (ERM). If proponents of ERM do not offer approaches that make sense for each of the four risk perspectives, ERM could become as obsolete as the Model T.

## FOUR DIFFERENT PERSPECTIVES ON RISK

The four basic risk perspectives were first discovered in the context of research that was not originally seeking to study risk attitudes. But clear patterns emerged in the data and have proved quite resilient over time. Most people tend to identify with one of the following perspectives:

- **Profit Maximization.** This perspective does not consider risk very important—*profits* are important. Businesses managed according to this perspective will accept large risks, so long as they are well compensated. Managers who hold this perspective believe that risk is mean reverting—gains will always follow losses—and the best companies will have larger gains and smaller losses over time.
- **Conservation.** According to this perspective, increasing profit is not as important as avoiding loss. Holders of this view often feel that the world is filled with many, many dangerous risks that they must be very careful to avoid.
- **Risk Reward.** Careful balancing of risks and rewards is the heart of this perspective. Firms that hold this view employ experts to help them find risks offering the best rewards, while at the same time



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managing these risks to keep the firm safe. They believe that they can balance the concerns of the first two groups, plotting a very careful course between them.

- **Pragmatism.** This perspective is not based on a specific theory of risk. Pragmatists do not believe that the future is very predictable—so, to the greatest extent possible, they avoid commitments and keep their options open. They do not think that strategic planning is especially valuable, but rather seek freedom to react to changing conditions.

Each of the different perspectives leads to a strategy for dealing with risk. Firms led by Profit Maximizers seek out risk, believing that no risk is inherently unacceptable—every risk presents an opportunity, and the trick is to negotiate appropriate compensation. Conservation-oriented firms shun risk of all sorts. Risk reward firms carefully manage and calibrate both the amount and type of risk. Pragmatist firms seek diversification but otherwise have no overarching strategy—they operate tactically, reacting to each new development.

## RESISTANCE TO THE CURRENT ERM PARADIGM IS INEVITABLE

The ERM paradigm currently touted as the solution to all risk problems comes straight out of the risk reward (RR) playbook. ERM helps firms with a RR orientation to do a better job at what they were trying to do anyway.

But, given the four fundamental risk perspectives (and various hybrids thereof), it's hardly surprising that adoption of ERM has been less than universal and often less than enthusiastic. No matter how reasonable ERM sounds to its RR-oriented proponents, it does not align as well with other risk perspectives. In many cases, managers are only pretending that ERM is their new favorite color.

Profit maximization (PM) firms see ERM as an unnecessary restriction. Why should a limited risk appetite be enforced, when any risk can be accepted for the proper price? That means turning away potential profit! If a PM firm bows to outside demands for ERM—such as those imposed by a rating agency or regulator—this may be largely a charade, a sop to the unrealistic pessimists and worrywarts.

For conservation (CO) firms, ERM is a dangerous strategy because it encourages taking more risk. Establishing a risk appetite would only give permission to the cowboys in the ranks to expand risks to fill that risk budget. While such a firm may—with trepidation—adopt an ERM program, CO managers remain convinced that risk assessments can never be comprehensive enough; risk quantification cannot be trusted because the result is always too low.

Pragmatic (PR) firms do not trust risk assessments either. But they are not sure whether the existing assessments are too optimistic or too pessimistic. Adherents of the PR perspective think that ERM takes too constant a view of an ever-changing world. In their minds, ERM means letting a model run the company. And a fixed set of rules and metrics hamper their ability to react to changing circumstances.

In a world of multiple risk perspectives, an RR-only approach to ERM is as self-limiting as an auto manufacturer that offers “any color you want, as long as it's black.”

## ERM NEEDS A BIGGER TENT

The truth is, risk management in one form or another has been practiced since the dawn of time—by adherents of *all* of the four basic risk perspectives. And it would be difficult to argue that adding an enterprise-wide view to any risk management strategy is not beneficial. A broader and more flexible definition of ERM would bring more managers and more firms “into the tent,” enabling the benefits of an enterprise-wide view of risk to be realized more broadly.

A review of the literature suggests that there are four different strategies that fall under the general heading of risk management:

- **Loss controlling.** This is the most traditional form of risk management; it seeks to identify and mitigate the firm's most significant risks. Commonly practiced by non-financial firms, loss controlling also applies to financial risk; examples include the careful underwriting of loans or insurance policies, as well as the

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practice of claims management. Risk management of this sort is not new—but the inclusion of an aggregate, firm-wide view of risk is a relatively new development that could be termed loss-controlling ERM. This type of ERM is favored by CO firms.

- **Risk trading.** A newer form of risk management, this approach arose from bank trading desks and the insurance industry. Risk trading focuses on getting the price of risk correct—which leads to sometimes complicated models of risk, reward, and economic capital. While a risk trading strategy can be applied on a transaction-by-transaction or other “siloe” basis, establishment of a consistent risk valuation on a firm-wide level is risk trading ERM. This type of ERM is favored by PM firms.
- **Risk steering.** Under this strategy, the ideas of risk trading are applied at a macro level to the major strategic decisions of the firm. Here, rather than focusing on the proper price of risk, the question becomes one of how much risk the firm *should* take—and how to steer the firm in that ideal direction. By its very nature, this is an enterprise-wide approach. Perhaps this is why some seem to think that only risk steering ERM is “real” ERM. Risk steering ERM is highly favored by academics and consultants; RR firms find it appealing, but firms that hold any of the other three strategies do not.
- **Diversification.** Spreading risk exposures among a variety of different classes of risks, and avoiding large risk concentrations, is another traditional form of risk management. Formal diversification programs will have targets for the spread of risk with maximums and minimums for various classes of risks. The newer ERM discipline adds the idea of interdependencies across classes, providing better quantification of the benefits of risk spreading. Pragmatists tend to favor diversification because it maximizes their tactical flexibility, but they avoid reliance on any particular risk mitigation process and often mistrust quantitative measurement of diversification benefits.

We believe that limiting the field of ERM to risk steering ERM alone would be a serious error. Such a restrictive definition of ERM would alienate firms and practitioners holding any of the other three risk perspectives. Moreover, such a limited view is inherently

incomplete, for reasons that the pragmatists know all too well.

*Simply put, the world does not stand still.*

## CHANGING RISK ENVIRONMENTS

Why do different people prefer different colors? That’s a difficult question, influenced no doubt by personality, individual differences in color perception, and early experiences and associations. The existence of the four different risk perspectives may be easier to explain—and clearly a key factor is that, over time, the risk environment changes.

A simplistic model of changes in the risk environment might posit that either things are “normal” or they are “broken.” But people do not necessarily agree about what is “normal.” An observer viewing the world through the lens of conservation might say that extreme hazard and danger are the “normal” state of affairs—while a profit maximizer, finding this view timid and overly pessimistic, might argue that profitability is “normal” and hazardous conditions prevail only when the market is “broken.”

Expanding the model to allow more than two states allows for the possibility that both the conservation view and the profit maximization view can make sense. Consider a model with four risk regimes:

- **Boom times.** Risk is low and profits are going up.
- **Recession.** Risk is high and profits are going down.
- **Uncertain.** Risk is very unpredictable; profits might go up or down.
- **Moderate.** Both risk and profit fall within a predictable range.

Such a model seems to be a reasonable description of economic cycles—whether in the banking world, the insurance sector, or the broader economy. As the cycle moves through these four different states, external conditions match the worldview of each of the four different risk perspectives. Each perspective has been right part of the time—and will be again, at some point in the future. But none of the risk perspectives is perfectly adapted to external conditions all of the time.

**“In any given risk environment, companies holding a risk perspective and following an ERM program aligned with external circumstances will fare best.”**

RR purists may object that their view takes into account the full range of the cycle. But, economic cycles are not sine curves; the period and amplitude are irregular, unexpected “black swan” events do occur, and there are always “unknown unknowns.” Model risk can never be eliminated, and restricting ERM to a RR-only view obscures this important fact.

A risk-steering ERM program works especially well in the moderate risk environment when risks are fairly predictable. But in a boom times environment, firms following such a program will unduly restrict their business—not as much as conservation firms, but certainly more than profit maximizing firms—and more aggressive competitors will be much more successful. In the recession environment, a risk steering ERM program again advocates a middle path; this may mean the firm sustains too much damage to be positioned to take full advantage of the market when it turns. When times are uncertain, a firm following a risk steering ERM program will be frustrated by frequent surprises and a world that does not quite fit the model. Competitors not tied to a particular view of risk will fare better, making decisions in the moment with maximum flexibility.

Why do corporations adhere to a particular risk perspective? The firm may have been formed during an environment aligned with their perspective. Alternatively, the company may have suffered traumatic damage during a period of dissonance between an old perspective and the risk environment and then made a shift, perhaps under the direction of new leadership. The firm may have been wildly successful at some point in the past, and now cling stubbornly to the strategy that worked for them then. Corporate culture tends to be self-perpetuating: individuals are drawn to employers with a perspective that makes sense to them—and those in a position to make hiring decisions typically prefer to hire staff whose views mesh with their own.

In any given risk environment, companies holding a risk perspective and following an ERM program aligned with external circumstances will fare best:

Risk Environment	Boom	Recession	Uncertain	Moderate
Risk Attitude	Profit Maximizer	Conservator	Pragmatist	Risk Reward Manager
Risk Management Strategy	Risk Trading	Loss Controlling	Diversification	Risk Steering

Yet in each risk regime, there are companies following strategies that are not well aligned with the environment. Some of these firms muddle along with indifferent results and survive until their preferred environment comes back. Others sustain enough damage that they do not survive; some change their risk perspective and ERM program to take advantage of the new environment. Meanwhile, new firms enter the market with risk perspectives and ERM programs that are aligned with the current environment.

Since many of the poorly aligned firms shrink, die out, or change perspective—and since new firms tend to be well-aligned with the current risk regime—the market as a whole adjusts to greater alignment with the risk environment via a process of “natural selection.”

## RATIONAL ADAPTABILITY

In order to thrive under *all* future risk regimes, a firm ideally would follow a strategy of rational adaptability. This involves three key steps:

- Discernment of changes in risk regime.
- Willingness to shift risk perspective
- Ability to modify ERM program

The difference between rational adaptability and the process of “natural selection” described above is conscious recognition of the validity of differing risk perspectives and proactive implementation of changes in strategy.

Individuals often find it difficult to change their risk perspective. Therefore, a company that wishes to adopt

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rational adaptability must ensure that its key decision-makers represent a diversity of risk perspectives. Furthermore, the corporate culture and the managers themselves must value each of the risk perspectives for its contributions to the firm's continued success.

An insurance company is best served by drawing on the respective expertise of underwriters, actuaries, accountants, contract attorneys, and claims experts—and members of one discipline should not feel slighted when the expertise of another discipline is called upon. Similarly, any firm that wishes to optimize its success under each of the various risk regimes should have profit maximizers, conservators, risk reward managers, and pragmatists among its senior management; and those who hold any one of these risk perspectives should acknowledge that there are times when another perspective should take the lead. The CEO must exercise judgment and restraint, shifting among strategies as needed and shifting responsibilities among the management team as required.

Rational adaptability recognizes that during boom times, risk really does present significant opportunities—and it is appropriate to empower the profit maximizers, focusing ERM efforts on risk trading to ensure that risks are correctly priced using a consistent firm-wide metric. When the environment is moderate, the firm employing rational adaptability will give additional authority to its risk reward managers, examining the results of their modeling and using these to reevaluate long-term strategies. And in times of recession, a firm following rational adaptability shifts its focus to conservation: tightening underwriting standards and placing special emphasis on firm-wide risk identification and risk control. Resisting the pull of his or her own personal risk perspective, the CEO must be willing to listen—and act—when others in the firm warn that the company's risk management strategy is getting a little too monochromatic.

## HARMONY

Although rational adaptability may well be an ideal solution, it requires the accomplishment of two very difficult tasks at the same time. The firm must recognize the change in risk environment at the earliest possible time, and be willing to change risk attitude and risk strategy quickly. Achievement of either of those tasks is not easy or common.

An alternative is to seek to find harmony from the discordant voices within the firm that represent the four risk attitudes. And all four voices will exist within most firms. To achieve harmony, the risk committees must provide seats not just for the managers in the firm who believe fervently in the risk models and the risk steering programs that are based upon those models, but also for those who distrust such models. Most risk committees are populated by managers and maximizers. An unsteady coalition between those two perspectives forms the core of most businesses, and experienced business people can often tell stories of classic battles between the two points of view.

Conservators and pragmatists are usually present as well, but their views are not always welcomed in discussions about major corporate decisions. They may have learned to keep their ideas to themselves. However, they should also be represented in the risk management process because their views of risk will sometimes be more appropriate to the risk environment than the views of the maximizers and managers. The trick to creating harmony from these various points of view is to get all members of the risk committee to acknowledge that each of the four perspectives offers value to the organization, and to encourage each of the four to speak out.

Every harmonious firm will create its own unique compromises among the four views. Different firms will choose different times and ways to honor the inherent caution of the conservators, to heed the pragmatists' call for diversification, to follow the models of the risk reward managers, or to give the profit maximizers greater scope to grow. The resulting strategy will never seem perfectly "right" to any of the four groups. But as the environment shifts among moderate, boom, recession and uncertain regimes, the harmonious firm will be able to show reasonable success in each environment and avoid unreasonable failure.

## CONCLUSION

In the open market for goods and services, the firms that are best able to adapt to the market's changing demands will enjoy the greatest success. No firm can be all things to all customers, all of the time; but a firm that too severely limits its offering, focusing on too

narrow a market segment, may wind up making itself irrelevant. Philosophies of risk management face much the same situation.

A recent study by Kay, Goldspink, and Dyson sought to explore attitudes towards ERM by assessing the predominant risk perspective exhibited by various professional groups. Their results show that “[k]ey aspects of the Hyper-Rational approach favoured by the actuaries were often seen as irrelevant to, or explicitly rejected by, the Operational and Strategic sub-groups.” While resistance to ERM is sometimes blamed on poor communication, this study suggests that “any communication issues are symptomatic of the broader paradigm issues described above, not the cause ... the issue is that stakeholders don’t believe the validity of the message.”

In order to gain traction across the full spectrum of human risk perspectives, the discipline of ERM must include approaches that fit the profit maximizing, conservation, and pragmatic risk perspectives as well as the risk reward perspective. And, in order to remain relevant and help firms flourish in all risk environments, ERM must embrace a Harmonious approach, drawing from the entire palette of strategies to suit the changing environment. ■

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