



# RISK METRICS FOR DECISION MAKING AND ORSA



## Introduction

The Joint Risk Management Section of the Society of Actuaries (SOA), the Casualty Actuarial Society (CAS) and the Canadian Institute of Actuaries (CIA), in collaboration with the International Network of Actuaries in Risk Management (IN-ARM), are pleased to release our third essay e-book, this time addressing "***Risk Metrics for Decision Making and ORSA.***"

This e-book contains 18 topical essays that express the opinions and thoughts of a number of authors on the subject. An essay is understood herein to essentially represent a short non-fiction form of writing expressing the often subjective opinion of the author. It should be understood that the thoughts and insights shared herein are not necessarily those of the Society of Actuaries, the Casualty Actuarial Society, the Canadian Institute of Actuaries, or corresponding employers of the essayists.

The insurance regulatory framework is evolving around the world. The National Association of Insurance Commissioners' (NAIC's) Own Risk Solvency Assessment (ORSA) initiative in the United States appears to be echoing the Solvency II ORSA in Europe; both intending to comply with the Insurance Core Principles of the International Association of Insurance Supervisors (IAIS). The intent of these essays is to generate discussion and debate surrounding the principles and ideas underpinning the ORSA initiative and the risk metrics used for decision making. Different points of view are presented and have been welcome.

In Owen Stein and Anthony Shapella's essay, "***Undertand ORSA Before Implementing It,***" they emphasize the responsibility of the company and going beyond regulatory compliance, which in turn is advocated by the Sam Gutterman, Brian Paton and Sunil Sen essay, "***More than Regulatory Compliance.***" On the contrary, Stephen D'Arcy's essay "***Clarifying Uncertainty***" advocates for an ORSA template prescribed by the regulator for comparability purposes. It could be argued that this notion is contrary to what is intended in the current draft proposal of the NAIC. Loïc Chenu's essay titles, "***Some Key Questions an ORSA Should Answer,***" attempts to bring both of these bipolar views under consideration in referencing the differences and intentions of the ORSA process, company-specific considerations, and the nature of the ORSA report itself as it relates to appropriate disclosure.

What one can glean from reading these essays may be perhaps that there should not be one way to do an ORSA. What seems to be a common understanding from the essays is that there needs to be:

- An internal risk management process (called either enterprise risk management (ERM) or ORSA) that covers both the observation and assessment of the entire business landscape, from risk identification to risk measurement to risk reporting, and the corresponding actions one can take that influence, prospectively, this landscape, considering risk appetite, business strategy and capital management.
- Multiple communication outputs, tailored to each audience, to share the risk transparency of the company. The multiplicity of audiences prompts the need for proper framing of the resultant communication consistent with the "eyes" of the beholder. This communication could be called, say, the ORSA report or ORSA template.

We hope these essays will provide thought-provoking discussion and commentary in the months and years to come.

## Introduction continued

It is with great pleasure to congratulate the three articles voted the top three essays in our Call. It carries a cash bonus as well as an invitation to speak at the next ERM symposium in 2013.



“Understand ORSA Before Implementing It” – Anthony Shapella/Owen Stein



“Effective Resilience and Interdisciplinary Approaches to Risk” – Rick Gorvett



“Focusing on Own Risk of the ORSA Process” – Max Rudolph

### TRUE OBJECTIVE OF RISK MANAGEMENT

These essays address the philosophies considering the “real” objectives and considerations of risk management. As was learned from our earlier series of essays, most risks that manifest themselves are not directly caused by any exogenous event, but rather from the decisions, biases, and behaviors of people. Although often called the “softer” side of ERM, it mostly makes up the “harder” side of contingent consequences, as learned from the financial crises.

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### STAKEHOLDER MANAGEMENT

Multiple groups have keen interest and insight in the insurance industry, usually resulting in divergent points of view. What the regulatory authorities expect out of an initiative may be quite different from the expectations and/or needs of the other stakeholders (e.g., shareholders, policyholders, employees, management). The primary focus of these two essays reflects the thoughts underlying these potentially divergent expectations.

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### GENERAL OVERVIEW OF WHAT ORSA IS

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## Introduction continued

### MODELS AND MEASURES

The following essays consider the wide range of modeling and quantification aspects underlying a company's ORSA. Issues discussed range from assessing the risk of a particular model being wrong and its corresponding miscommunication minefield to considering what the "true-and-pure" measure of risk ought to be, and whether that can be even agreed on.

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We hope that this e-book generates further thought and discussion. What are your takeaways?

We welcome further commentary, editorials and rebuttals to add to our continuing thought leadership on the topic.

Enjoy!

Best wishes,

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On behalf of the Joint Risk Management Section Council of the Society of Actuaries, Casualty Actuarial Society, Canadian Institute of Actuaries

In collaboration with the International Network of Actuaries in Risk Management.

# How to Make Sure that You Take the Right Road to Enterprise Risk Management

by Dave Ingram

*“If you don’t know where you are going, any road takes you there” – Lewis Carroll*

Many firms have charged ahead to creating an enterprise risk management (ERM) program. Some never get to the end of the development process. Others get to the starting line, but have that unsatisfying, “Is that all there is?” feeling about their ERM. A few firms are highly satisfied with their ERM programs, but it is quite possible that satisfaction is more the result of luck than planning.

Much of this discontent is the direct consequence of a lack of clarity of direction of the ERM process. It is not enough to say that you want to manage risks. Management is the process of directing people and resources to achieve business objectives, so “risk management” cannot itself be an objective. To create a risk management program that you are happy with requires that you have both an objective and a reason or reasons for the risk management program.

A firm like an insurer, whose primary business is risk taking, needs to be clear whether it expects, over the next planning period, to: (a) grow risk faster than its capital—that is, to increase the riskiness of the firm; (b) increase capital faster than its risk, thereby increasing the security of the firm; or (c) grow risk and capital in tandem to maintain security and riskiness.

Many insurance company management groups cannot immediately say whether one or the other of those three mutually exclusive objectives is being pursued by the insurer. If that is the case, then ERM is much too complicated a next step to consider. Management needs to get straight how it sees its firm’s riskiness changing as it goes forward.

Without clarity on that simple statement, management cannot form a risk appetite. And one way of defining ERM is the set of management practices that the company undertakes to keep the company’s risk within its risk appetite while achieving other corporate goals. Risk appetite is the fulcrum on which ERM balances. Without a risk appetite, ERM is like a fancy new car with no tires. It cannot achieve anything meaningful because the definition of achievement is missing.

The management group is not done when it has defined this one aspect of its risk objective. There is more. The additional objectives of risk management that have been adopted by firms for their risk management programs fall into seven categories:

1. Compliance with rating agency and/or regulatory standards.
2. Measuring risk—most often for the purpose of determining the necessary amount of capital required for the risks of the firm.
3. Diversifying risk—assuring that the firm does not have any excessive concentrations of exposure to risks or methodologies that might result in the failure of the firm.
4. Loss controlling—controlling the risk exposures to control the loss potential of the business.
5. Pricing risk—exploiting risk by assuring that the margins for risks accepted are adequate to achieve desired levels of return.
6. Risk-reward steering—informing the planning process to encourage further investment in the business opportunities that produce the best combined return on risk for the entire firm.

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7. Supporting success—using the risk management insights and methods to increase the likelihood that the firm will achieve its objectives and identify new opportunities.

They all sound great. It would be hard to argue that any firm would not want most, or possibly all, of these things to happen.

However, risk management is still just a management exercise. It is being performed by people—human, fallible people. Teams of people, even risk management teams, cannot usually perform well when they are given seven somewhat different objectives to achieve.

So management will need to decide. Which of these possible ERM goals is the most important? Which are also very important, and which must therefore fall into the “nice to have” category for now?

The identification of these ERM objectives might be difficult to achieve right out of the box. But it is possible to practice this objective-setting process by identifying the risk management objectives for each of the key risks of the firm, and it is usually much easier to identify those objectives for individual risks.

In early 2011, eight insurers volunteered to attempt the process of identifying their risk management goals for a standard set of “Key Risks.” These firms were from the United States, Canada, Australia, Peru, Korea, the United Kingdom, Germany and Bermuda. Most of them identified

only one of these goals for each risk. In a couple of cases, they identified two.

For insurance risk, four of the firms said that their risk management goal was to assist in steering their business toward a better return for risk. One firm said that its goal was to control losses from insurance risk. Two had dual goals. One targeted both risk steering and loss controlling, and the other targeted both risk steering and risk pricing.

For investment risk, three firms had a single goal: one each for diversification, loss controlling and risk-reward steering. The other five firms all had two or three goals. Two firms targeted diversification, loss controlling and risk-reward steering all at the same time. For the other two firms, one favored diversification and loss controlling and the other risk-reward steering and loss controlling.

Only five of the firms were able to identify an objective for their operational risk. Two favored risk measurement and three loss controlling.

After identifying those goals, all eight were able to say what their ERM goals were. Three favored risk steering; two favored risk steering along with loss controlling; and another one solely loss controlling. One had three goals for its ERM function: a combination of diversification, loss controlling and risk steering.

Note that, for this exercise, the objectives of compliance and supporting success were not offered as choices and none insisted on adding them.

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With these clear goals and objectives, the risk management teams can develop the risk management capabilities that make sense for their situations. And they will not waste time and money developing capabilities that are not wanted or needed.

The firm with the enterprise-level goal of loss controlling does not need a complicated system of risk evaluation; simple stress-testing capabilities may suffice. The other seven firms did say that they wanted to do risk-reward steering, so they should be interested in developing economic capital models—the tool of choice for that objective. However, experience shows that some firms that go through the exercise and expense of developing the economic capital model find that they do not really want the risk-steering advice. They find that the risk-reward information, when they get it, ends up being their third or fourth or fifth most important consideration. They find that the risk-reward information is just not important enough for them to satisfy the Solvency II use test requirement that they felt the need to keep improving the model.

Only two of the seven firms that indicated a preference for risk steering actually had an economic capital model fully developed and were practicing the risk steering. It might make sense for them to test their management's actual

interest in the goal by preparing risk-reward information based upon a less expensive method than an economic capital model.

External risk factor models, such as the rating agency models, the U.S. risk-based capital (RBC) or the Solvency II standard formula, provide one possible basis for developing trial risk-reward information. Solvency II rules provide a name for an improved process, Undertaking Specific Parameters (USP). Insurers can use the idea of USPs without necessarily following the exact Solvency II directions by simply developing their own best approximation for USPs when they feel that the standard factors are either too high or too low for their firm's actual risks.

With a low-cost estimate of risk, risk managers can quickly determine whether management now has enough interest in the resulting risk and risk/reward information to justify spending the money to improve the model.

And if not, they can go back to the question of their ERM goal and find out what management really wants them to accomplish before developing an ERM system that fits someone else's objectives.

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## Vounó Borealis (Mountain Wind)

by Jason B. Sears

Sitting on my desk is a picture of my two best friends and me on the slopes of Glacier Peak in Washington state. In the background are the snow-capped Cascade Mountains, Seattle and the Puget Sound. Across the sound the Olympic Mountains cut the sky like a saw blade. The mountains in the Great Northwest are the most beautiful mountains I have ever seen. I know, first hand, that they are also deceiving. The relatively low summits mixed with breathtaking beauty attract myriad mountain climbers with varied skill levels. One wouldn't assume that these mountains take lives with disturbing regularity.

One spring several years ago, I attempted to summit White Horse Mountain with some friends. While we were scrambling up a gravelly gully, one of my partners above me accidentally kicked loose a 300-pound boulder. He called out, "Rock!" He paused, then yelled again, "Big rock!" The rock bounced down the gully, and, before I could move, it bounced off my leg. Needless to say, the climb was over; but I miraculously survived with only a massive bruise covering the entire left side of my left leg. I eventually made it down from the mountain alive because of a combination of experience, first-aid training, trustworthy partners and good luck.

Everything we do involves a level of risk. We are constantly performing a mental reckoning of the risk-reward payoff. For most climbers, the danger inherent in mountaineering is understood and accepted because the reward of the experience more than outweighs the risk. Similarly, as businesspeople, and more specifically as actuaries, we get paid for taking risks. Actuaries are the well-trained, skilled and respectful mountaineers of the business world. We understand that if we avoid risks we

won't get paid, so we optimize risk-taking behavior instead of attempting to eliminate it.

As an actuary working in enterprise risk management (ERM), I believe that mountaineering and ERM are analogous. A chartered enterprise risk analyst (CERA) with specialized training in modern risk optimization is like a climber who has been through the rigors of the Mountaineers' training courses like Avalanche Awareness and First Aid. It is for this reason that I wholeheartedly support the National Association of Insurance Commissioners' (NAIC's) current approach to the Own Risk Solvency Assessment (ORSA). I see the ORSA as a checklist of minimum requirements for conducting business to ensure that the participant is fully aware of the inherent risks. At the same time, it allows the participant the degrees of freedom necessary to adapt and innovate. In this way, ORSA is like a mountaineer's checklist: reminding that it is necessary to carry an ice-axe and a rope with harnesses and trained partners on an expedition, even if it is possible that they won't be needed.

However, it is my opinion that the need for vital balance between parsimony and the tendency to be prescriptive is extant for regulators. Minimum requirements for an ORSA are undoubtedly good. There are countless stories of ignorant or overly exuberant people who thought they could summit a peak with pure willpower. The unwitting amateurs are everywhere, from hills to the most technical climbs. Often they either die or need to be rescued, at great expense to the taxpayer and at great risk to the lives of rescue climbers. A great many of these crises could be avoided by requiring a certification of a minimum level of training to be eligible for a rescue.



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Minimum requirements seem natural, but what about the other extreme? If to qualify for rescue a climber needed to adhere to strictly defined routes, movements, seasons, tools, partners, preventive measures, evasive tactics, et cetera, it quickly becomes obvious that the cure is worse than the disease. No two days of mountaineering are ever the same because there are simply too many variables. As a result, mountaineers make mistakes, and many of them. Avoiding all mistakes is impossible. The real skill comes from being able to adapt to a constantly changing situation and the ability to cope with mistakes. When taking risks it is imperative to be free to adapt and innovate. Regulators should keep in mind that being overly prescriptive eliminates the incentive to think. In ERM, it would be a shame to waste all of actuaries' years of rigorous training in a new way of thinking by turning their career into one where they fulfill the job requirements by checking boxes.

On the contrary, the ORSA is an evolutionary step in risk management. It allows the controls to fit the risks. Assuming risk management is the same regardless of the industry is recklessly dogmatic. Ice-climbing is not the same as glacier travel, and health insurance is not property-casualty insurance. This issue has been overlooked for far too long. The ORSA should work for a business, not against it. The success of the ORSA will hinge on whether the ORSA can be used, trusted and supported by senior management. For this to happen, the ORSA needs to be amenable to integration into an existing business model. In addition to being a tool for NAIC, it needs to be useful to the executive suite. The ORSA will be successful if it enables intelligent decisions by all involved parties.

The goal of the ORSA is to provide a tool that the NAIC can use to assure regulators and policyholders that an insurance

company is considering the most important factors in order to ensure long-term stability. The ORSA should outline minimum risk assessment practices and reward best practices.

There is no magic to minimum requirements. They could be as simple as requiring documentation and an actuarial attestation to indicate that the appropriate risk factors have been considered. They should not prescribe any particular course of action. Business, like mountaineering, is never the same from one day to the next, so freedom to adapt and innovate is imperative.

All constituents will be better served by parsimonious minimum requirements coupled with the freedom to evolve. This is the current trajectory of the ORSA. It allows companies to differentiate on risk management talent and be rewarded for competitive advantages. The ORSA minimizes risk, but it still enables intelligent risk-taking and allows mistakes.

Like business, mountaineering is risky. I believe that in mountaineering, as in business, pay is commensurate with the risk assumed. One could eliminate the risk by staying home and watching TV. On White Horse Mountain, after suffering the injury, my team decided to find a safe place to camp for the night before attending to the business of descending the mountain. That night the sky was crystal clear, and there had been a massive solar flare. We witnessed aurora borealis (rarely seen so far south), a spectacular show that went on until the sun rose and painted the entire sky.

In many tragedies, ignorance and irrational optimism are obvious culprits. Regardless of the cause, the hazards of

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mountain climbing are constant and unforgiving. They can be diminished with the addition of trained, skilled and respectful climbing, but never eliminated. In spite of this, I know of no climbers who would wish away the hazards of mountaineering. The same is true for business. Any

wise businessperson knows risk and reward are inextricably intertwined. Conducting business without taking risks is like mountaineering without the boulders: it is not natural, and one certainly won't get paid for it.

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## Too Good to Be True

by Victoria Grossack

### Introduction

The last few decades have witnessed spectacular financial failures and disasters, including the savings and loans crisis that cost the United States \$87.9 billion. We've also had Executive Life, the long-term management crisis, Enron, AIG and the subprime mortgage crisis. The collapse of the markets in 2008 also precipitated the implosion of history's greatest fraud, the Madoff Ponzi scheme, estimated somewhere between \$50 billion and \$65 billion.

After each crisis people asked, "How could these abuses have happened? Why were they not detected sooner?" After all, much of the information was available, and frequently there were many red flags. It is clear that, in addition to those committing fraud knowingly, many others were either fooled or looked the other way. Despite news being too good to be true, they accepted it.

This paper looks at the "too-good-to-be-true" syndrome. First it examines different shadings of "true." Second, it reviews company culture and how it can make it more difficult to seek the absolute truth. Finally, it makes suggestions on how a company can incorporate defenses against the too-good-to-be-true syndrome.

### What Is Meant by True?

Before going into the "too-good-to-be-true" syndrome, it is helpful to look at what it means for something to be true. Of course, in many cases a statement is either completely true or completely false; however, there are other situations where statements can be somewhere in-between. Categorizing them is useful, so here is a description of areas along the gradient.

*Absolutely true.* Sometimes good news is completely genuine. Nevertheless, it is still worth studying because aspects can be copied and used in other sections of business. It is also important to remember that nothing lasts forever, which leads us to the next category.

*Temporarily true.* Something may be true for now but depends on conditions that may not hold true in the future. Examples abound: the underwriting cycle; a competitive edge that can't be maintained; the saturation of a market; the closing of a loophole in the tax code; bubbles in oil, stocks, housing or gold.

The problem with this is that investors, managers and employees become dependent on favorable conditions. The dependency may be partly due to vanity—some CEOs love the adulation awarded to high achievers—and also because management has a liking for large bonuses. But the dependency extends to others as well, such as employees who will lose their jobs when the good times end. So, when a profit source evaporates, some firms do whatever they can to continue achieving good results (or the illusion of good results). Some pursue risky opportunities, while others engage in questionable or even fraudulent, accounting. This, unfortunately, results in far greater disasters than might have occurred otherwise.

*True but dishonest.* Occasionally the money is there—the money exists—but it is coming from a different source. This was true of the Nugan Hand Bank failure, which was a conduit for dirty money. Many assumed it was true of Bernie Madoff. They assumed that his fantastic returns were based on illegal insider information and were happy to accept what

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they thought were ill-gotten gains. Unfortunately for them, Madoff's statements were completely false.

*Questionably true.* In many businesses, especially those that are financial- or insurance-based, some of the numbers, such as derivatives and reserves, are based on complicated calculations. These would be difficult enough to get right in the best of circumstances. Unfortunately, pressure is occasionally put on accountants, actuaries, auditors and many others to select assumptions that lead to a preferred result.

*Simply missing.* If numbers are not supplied, it is a very bad sign. Enron apparently found it too inconvenient to supply balance sheet statements along with its earnings statements.

*Completely false.* In other situations, there is no question about the falsehood of numbers being reported. Madoff made up everything for his Ponzi scheme; Olympus falsified results for years.

If a company's numbers are in the "questionably true" category, the moral hazard of slipping into "completely false" is fairly high. Furthermore, it is all too easy for outsiders to assume that a statement is in the absolutely true category when it might be in one of the others—especially when it is a statement that people want to hear.

### Cultures of Complicity and Complaisance

It goes against human nature to doubt positive information. Messengers bringing bad news get shot; while those arriving with good receive medals. Expressing doubt is more difficult, especially doubting those who have been praised in the past, those who have received salaries and promotions

and other acknowledgements as a reward for their achievements. Madoff was on the boards of many organizations, and even served as the non-executive chairman of the NASDAQ. Doubting his claims meant setting one's opinion not just against him but against all of the people who had praised and rewarded him.

Questioning good news within an organization can be especially difficult. First, people generally want to believe news that benefits them. Good news means bonuses, significant stock options and money for both necessities and perks. Second, casting doubt on good news—especially being the first person to do so—may have consequences for the employee expressing concern or disbelief. It often means making enemies; it may mean losing a client or a job. Third, if the good results are originating in a different department, expressing a lack of confidence in results may be dismissed because of a lack of expertise on the part of the skeptic. All of these lead to complaisance.

Another problem for a skeptical employee is not knowing who is complicit in a situation. The person to whom you are complaining may have ordered the procedure in the first place. Or, assuming that the leadership is innocent, this means pointing out that they are gullible. They may have the choice between playing knaves or fools; neither option is attractive.

Of course, uncovering these issues is a role for auditors—and they stop plenty of questionable activity and uncover a considerable amount of fraud—but auditors can be fooled. They also have a conflict of interest in that they are usually hired by those they audit. This conflict was reduced after the Enron scandal, in which Arthur Andersen failed to put

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a stop to Enron's fraud and ended up being put out of business. There is now a separation between the auditing and the consulting function.

Another check on malfeasance is the regulators: they have the authority, the expertise, and less conflict of interest. Of course, regulators are subject to many of the same human influences; hence the SEC did not take charges about Madoff. Regulators can also be lied to. To quote Shauna Fennes, one troubled bank had three steps for dealing with regulation: Ignore the regulator, placate the regulator, and then lie to the regulator. Furthermore, regulators are often short on resources, lack the expertise, and review information too infrequently to do much but clean up messes after they happen.

Madoff was found out by Harry Markopolos, a rival investor. Sometimes it is easier for someone outside of the organization to discover a problem. They have less information, but they can be more objective in their judgments. Markopolos actually had a reason to want Madoff's results to be false, because his own results were compared unfavorably with them. Unfortunately for Markopolos, when he tried to tell the SEC, he was ignored, even dismissed as jealous and incompetent.

### Dealing with the Too-Good-to-Be-True Syndrome

Those serious about risk management can benefit by developing procedures to prevent dependencies on too-good-to-be-true assumptions in their own companies.

First, being aware of the bias that people have in accepting good news is important. Encouraging a company culture that practices genuine skepticism of good news is essen-

tial. It is important to separate the gold from the glitter: an expensive suit may make someone look good, but con men have made a point of dressing well for hundreds, perhaps thousands, of years. A company could even encourage role-playing sessions in which relevant personnel are trained to express doubt.

Second, identify the most significant contributors to good news in each area of your company and verify that they really are as strong as they say they are. What are the assumptions? Are these things really true?

Third, identify the biggest pieces of good news in your industry. Note that these may apply to your competitors, but also parts of the market on which your firm relies, such as brokers, customers, banks and rating agencies.

Fourth, apply rigorous audit techniques to these significant generators of good news. It is important to be thorough and to get as many different sources for confirmation as possible, especially external sources. If the SEC had done an external review of Madoff's claimed trades, instead of taking the paper he gave them on faith, his fraud would have ended years earlier.

Fifth, investigate external assertions and assumptions that appear too good to be true. Of course, companies may have limited ability to audit external entities. Suppliers and customers may allow access to some of their numbers, but external entities are unlikely to let third parties inspect everything. Competitors are likely to refuse all requests. So what can be done to determine the reliability of information? The answer is: model building.

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Modelers could review each piece of information used to support a statement, determine which are independent, and assign estimates of reliability to them in order to come up with an assessment of the probable truth of a situation. Modelers should do the same in the other direction: estimate how hard it would be to falsify an assertion. Markopolos did this with Madoff's alleged results and determined within a few minutes that they were impossible.

**Conclusion**

A healthy skepticism toward things purported to be true should be an important part of a company's well-functioning ORSA. Too much money has been lost because of risks, bubbles and frauds that should have been foreseen. Although it will never be possible to catch everything, catching more problems and catching them sooner can make a difference.

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## Minimally Destructive Scenarios and Cognitive Bias

by Mary Pat Campbell

In choosing metrics and processes for conducting an Own Risk and Solvency Assessment (ORSA), one needs to be clear at what the purpose of an ORSA is. While it seems regulators are looking for specific measurements to be made for this exercise, ideally ORSA will go beyond compliance theater. For ORSA to be a serious part of running a business, it needs to improve risk decision making, and in a tangible way.

Over the past decade, a multitude of risk metrics have been thrown at people in the insurance industry. Value-at-risk (VaR) has been a popular metric for setting capital, as it can capture tail risks and is relatively easy to explain and understand. However, VaR has many shortcomings that make it easy to game for experienced practitioners, and decision making based on VaR meant that one was blind to the distribution beyond the percentile used. The magnitude of catastrophe, when it occurs, is of great importance to insurers.

Other risk measures fixed this “extremity blindness”; one of the most popular being conditional tail expectation, or Tail-VaR, which takes the expected value beyond the specific percentile. But while TailVaR fixes some of the major shortcomings of VaR, it retains one of the most important ones: How does one make decisions based on this metric?

### The Framing Effect

Consider the state of mind one is in when considering traditional risk measures based on probability distributions. The frame is how likely certain events are, which plays into particular cognitive biases.

If the measure is VaR(99.5), for example, and surplus is well within this mark, the temptation is to figure things are OK—“Oh, the possibility it’s worse is a 1-in-200-year situation ... no problem.”

Probability-based metrics get people focused on the probabilities, and even very numerate people have problems making good decisions based on this sort of information. Even more to the point, a specific probability level gets chosen, or one looks at the VaR or TailVaR level of the capital, and gets fixated on that specific number. But people have very poor “gut feel” for these sorts of things, which is just another term for being able to connect the data to one’s experience and mental model of how the business works.

To help management make better decisions, the focus needs to move off of numbers that are disembodied from anything one can have actual feedback on. I propose changing the frame from the probabilities to the specific scenarios themselves.

### Minimally Destructive Scenarios

So the question becomes not what the likelihood of various scenarios is, but what kind of scenarios the company can actually handle. Ideally, one would explore the least extreme scenarios in the variety of dimensions that would wipe out all free surplus for an insurer within a certain time horizon, which produces a set of what I’m terming “minimally destructive scenarios.”

The concept is not a new one—something similar was termed “reverse stress-testing” by the Financial Services Authority (FSA) in the United Kingdom in Policy Statement 09/20, released in 2009. The definition from the FSA:

## Minimally Destructive Scenarios and Cognitive Bias *by Mary Pat Campbell*

“Reverse stress-tests require firms to explicitly identify and assess scenarios most likely to render its business model unviable ....

... a firm’s business model is described as being unviable at the point when crystallising risks cause the market to lose confidence in the firm. A consequence of this would be that counterparties and other stakeholders would be unwilling to transact with or provide capital to the firm and, where relevant, existing counterparties may seek to terminate their contracts. Such a point could be reached well before a firm’s regulatory capital is exhausted.”

However, note the language refers to likelihood, and the definition of “unviable” is not necessarily well-defined (though you’d know it when you saw it occur in the marketplace). While there is value in attempting to do the exercise as described by the FSA, I believe having something well-defined in terms of boundaries will make the exercise less onerous for companies to complete.

To be sure, finding such minimally destructive scenarios is not trivial, and they are not at all unique. Inverse problems are often like this. Indeed, there is theoretically an infinite number of such sets, but the idea is to simplify the search initially. Pick some key driving variables in the models and find the contours of “destruction” in each of these dimensions singly and in combination. As one gains experience in this exercise, the level of sophistication in describing these “destructive surfaces” in the scenario space can increase. One’s understanding of what “minimal” is may also change in defining the scenarios.

The exercise of reverse stress-testing the models may elicit surprises, such as finding interactions or nonlinearities that one would not have thought through if one were simply

running the model forward in the usual way, in choosing a scenario and assumption set and then looking at the results. Here, one starts with the result and runs the model backwards. If nothing else, those involved in model development and evaluation should gain some insight in the models, and be better able to see the weaknesses and strengths of their particular models.

### Changing the Frame

But, most importantly, these minimally destructive scenarios change the frame. Instead of asking, “What’s the probability we can survive?” the question has now changed to “This is what we won’t survive. Are we comfortable with that?”

Suppose one minimally destructive scenario was the euro collapsing. If this were for an international insurer, management would possibly find that sort of minimally destructive scenario unacceptable. If it were a small, localized European insurer, not surviving a complete collapse of the eurozone might be reasonable as a minimally destructive situation, depending on company strategy.

But let us suppose one seeks out such minimally destructive scenarios, and determines the minimum it would take something so extreme it would be akin to supervolcanoes, the Black Death and an alien invasion to wipe out free surplus. At this point, the likely reaction would not be “perhaps our strategy is too conservative,” but “our models aren’t believable.”

One can explore the impact of different options—e.g., changing pricing, adding or dropping product features, changing investment strategy—by seeing how these minimally destructive scenarios change. This metric isn’t intended to replace other decision-making metrics, such as hurdle rate, but simply change the frame of how one looks at the decision.



**Minimally Destructive Scenarios and Cognitive Bias** by *Mary Pat Campbell*

One can determine how these scenarios change as the business moves forward in time, giving feedback to how well one's models are working.

concrete frame of reference for making decisions. The more tangible the metric, the more likely it will actually be used for decision making.

In none of the cases above is one slapping a probability on these minimally destructive scenarios. To be sure, people may have an opinion on the likelihood of various scenarios occurring, and that will be difficult to get away from in people working in a business ruled by probabilities. However, by making the scenarios themselves the focus, people have a

**Reference**

FSA on Reverse Stress-Testing: [http://www.fsa.gov.uk/pages/About/What/International/stress\\_testing/firm\\_s/reverse\\_stress\\_testing/index.shtml](http://www.fsa.gov.uk/pages/About/What/International/stress_testing/firm_s/reverse_stress_testing/index.shtml)

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## “Effective Resilience” and Interdisciplinary Approaches to Risk

by Rick Gorvett

Enterprise risk management (ERM) is at a critical point in its evolution as a process.

After more than a decade of development, there seems to be little doubt about the appropriateness of a holistic, ERM-type perspective for identifying, quantifying and managing risks. Much of ERM’s evolution thus far has involved the marketing of its framework and potential, and while there continue to be a few holdouts against this approach to risk management, most people and organizations do recognize the inherent logic and sensibility of an ERM process (while sometimes disagreeing about the specifics of its implementation). Overall, certain guiding principles of ERM generally seem clear—for example (among many):

- Risks should be viewed within the context and framework of the entire firm—including its operations, market strategy, human resources, etc.
- ERM is “everyone’s business”—all members of an organization should be familiar with, invested in, and have a role in the process.
- Successful implementation of ERM requires a high-level advocate in the organization.

These, and many other, guiding principles are clearly important and foundational. However, now that the basic ERM idea has been successfully marketed, practitioners and researchers in ERM need to build upon these core concepts. With the ever-expanding interest in such things as stress-testing and economic capital, and the potential introduction of mandated evaluations such as the National Association of Insurance Commissioners’ (NAIC’s) Own Risk and Solvency Assessment (ORSA), additional meat and muscle need to be added to our emerging skeletal risk management structure.

There are still many advances to be made in both the conceptual and technical underpinnings of ERM. Only with the creation and development of those enhancements—many of them of a quantitative nature—will ERM ultimately live up to its full potential.

### An Interdisciplinary Perspective

One suggested enhancement to risk management and ERM is to broaden our framework and reference base—i.e., to recognize the potential of advances in other fields and disciplines to enlighten our understanding and analyses of risks. For example, areas such as behavioral economics and complex systems, while sometimes unfairly considered to be “flavor-of-the-month” pop fields of study, actually have developed important techniques and insights, which may have direct relevance for risk management. Certainly, a better understanding of human cognitive tendencies and methods of decision making, and then incorporating those dynamics into the risk management analytical framework, is a worthwhile and important endeavor, and can help us to better appreciate the nuances of people’s perception of, and reaction to, risks.

### An “Effective Resilience” Factor

Another suggestion is to enhance our toolkit for quantifying risks by, as much as possible, considering risk in a multidisciplinary context. As a particular example, a risk metric, *effective resilience*, is suggested.

“Resilience” is a widely used and applied word, both in everyday language and in various fields of study. The term has been used to represent a technical measure in fields such as ecology, systems engineering, psychology, economics and

“Effective Resilience” ... by Rick Gorvett

materials science. Although the details and specific applications differ, the term has a common core meaning across these different areas: resilience represents the ability of a system (or an organization, or an individual person) to recover or “bounce back” from an adverse situation or event. Resilience is both an intensity- and time-dependent function of a system: initially, the level of adversity suffered by the system depends on the intensity (or magnitude) of the event; generally, the level of recovery of the system increases over time (i.e., the adverse position of the system is gradually diminished due to recovery/risk management efforts). Put another way, the ability to respond to, and recover from, an adverse event and its negative impact—across both intensity and time dimensions—directly affects the organization’s operating level.

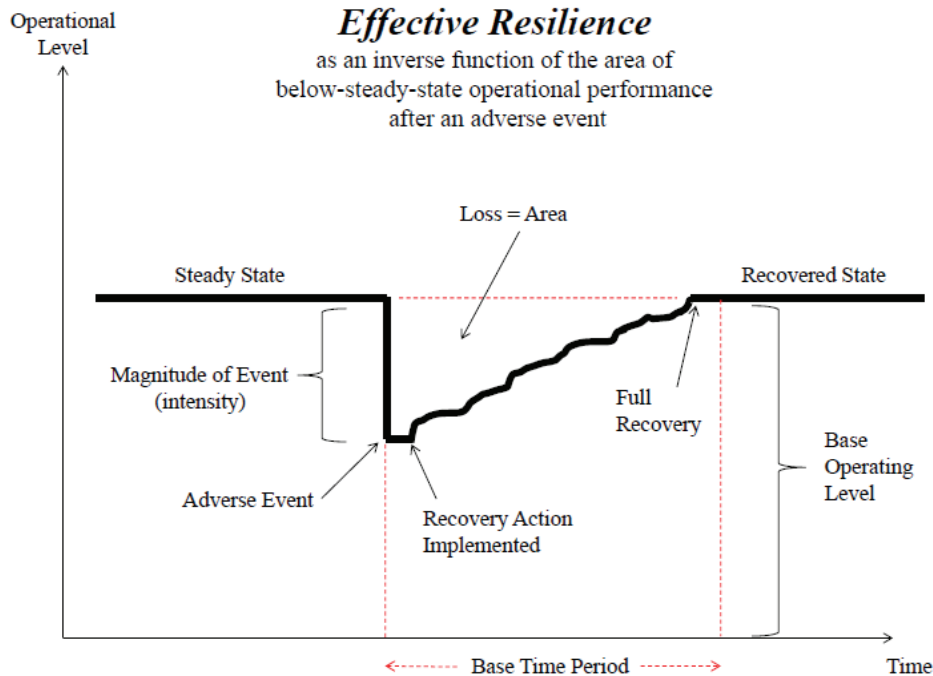
An *effective resilience factor*, then, is a risk metric that reflects an organization’s exposure and response to an adverse event, and measures the ability of the organization to

mitigate the reduction in its operating level. A generalized example is found in the accompanying exhibit.

For a given *Base Time Period* and *Base Operating Level* (the product of which is the **Base Area**, which reflects normal or steady state operations in the absence of an adverse event), a smaller *Loss Area* (the area of reduced operating level, below the steady-state level and above the organization’s recovery path) in the exhibit would represent greater organizational resilience. Thus, for a given adverse event and a given risk management recovery action, the *Effective Resilience Factor* (ERF) of a firm can be determined as

$$ERF = \frac{Base\ Area - Loss\ Area}{Base\ Area} = 1 - \left( \frac{Loss\ Area}{Base\ Area} \right)$$

Defined in this way, the *ERF* takes on a value between 0 and 1, with a value closer to 1 indicating greater organizational resilience (based on the assumed risk management/disaster recovery strategy).



“Effective Resilience” ... by Rick Gorvett

The modeling of the recovery path (the gradual increase in operational level from its lowest point at or immediately after the time of the adverse event, to full recovery) would be inherently multi-disciplinary. The path would necessarily be a function of broader economic, financial and labor market factors, and (for evaluating an insurance company) insurance market conditions in light of the adverse event (which may or may not be systemic). Such modeling would require assumptions regarding, for example, consumer behavior, supply-demand shifts and interactions, and the nature and extent of interrelationships within this very complex system. A risk management strategy effectiveness metric like *ERF*, which makes explicit and transparent assumptions about these parameters and interactions, and accounts for macroeconomic and other effects consistent and concurrent with an adverse event, would be very attractive.

The exhibit shows a simple cross-section of one adverse event. To reflect a portfolio of risks to which the organization is exposed, a three-dimensional surface chart could be produced. The horizontal *x* and *y* axes would be the different intensities of adverse events, and the times to recovery, respectively. The vertical *z* axis would reflect the loss level associated with a given event intensity at a given time after the event (during the recovery process). The effective resilience metric could then be calculated as the double-integral, or the area under the surface. For a given list of adverse events and intensities, a firm could test and compare different risk management strategies, by observing the resulting effects on the resilience factor of changing strategies.

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In summary, some of the attractive characteristics of an *effective resilience* measure are that it:

- Summarizes in one number, with a value between 0 (low resilience) and 1 (high resilience), the effectiveness of a risk management plan.
- Reflects the adequacy and effectiveness of disaster planning and recovery strategies, rather than just quantifying adverse scenarios. It thus is consistent with the ORSA desire to promote and encourage good risk management, looked at from a broad and holistic perspective.
- Can be used to compare the relative resilience of different organizations to a common hypothetical adverse scenario.
- Can be used to compare, for an individual organization, the relative effectiveness of different operational and recovery strategies in response to a hypothetical adverse scenario.

By informing our risk management evaluations and decisions with interdisciplinary concepts and techniques, and recognizing the potential impact of risks on all scales—company, market and economy—of the operating environment, we will create a more effective and robust ERM process.

## Clarifying Uncertainty

by Stephen P. D'Arcy

Actuaries need to play a vital role throughout the entire Own Risk Solvency Assessment (ORSA) process. Actuarial involvement should begin when the firm starts to make decisions about what tools to develop to assess its solvency appropriately, continue through the model building and testing stage, and culminate with the interpretation of the output from this process. During the initial and interim steps, actuaries will be working with accounting, finance, management information systems, underwriting and other areas to develop and test assessment tools. However, actuaries should assume full responsibility for interpreting the output, as this will require clarifying uncertainty, an area in which the actuarial profession is uniquely qualified. The ORSA approach will succeed only if its stakeholders—board members, employees, investors, policyholders, regulators and the public—understand the risks the firm is taking.

Standardization of reporting is an important factor in the success of ORSA. If firms are free to report the data in whatever manner they choose, a bewildering array of reports will be produced; and comparisons among firms, or even for one firm over time, will be impossible. Accountability is another key element. The person certifying the reports needs to be accountable for the validity of the information. This presents a significant challenge, as the relevant information is not a single verifiable value. Measuring uncertainty is very different from measuring such items as premiums, assets or other values that can be confirmed by totaling individual components. When dealing with uncertainty, there must be professional standards that define the obligations of the person certifying any reports, and these standards should reflect the complexity of the process.

Given the importance of the ORSA reports, the need for verification of the results, and the challenges that go into evaluating the validity of the reported values, what, then, should the required reports include? The following pro-

spective information should be publicly reported annually for any firm under ORSA:

1. Projected 25<sup>th</sup> percentile, median and 75<sup>th</sup> percentile values of net income for the firm over the next year.
2. Probability of the firm incurring a loss (negative net income) over the next year.
3. Probability of the firm's surplus falling below regulatory minimum values based on risk-based capital or other established standard within the next year (financial impairment).
4. Probability of the firm's surplus falling to zero over the next year (insolvency).
5. Firm's ending surplus based on the 1/1000 outcome (0.1 percent) over the next year.
6. Narrative report explaining the results of the ORSA process, the above listed measures, and any relevant situations that are not included in the model (e.g., the breakup of the euro).
7. Name and professional qualifications of the person certifying these values.

In addition, in order to readily assess the validity of the reporting process, a retrospective evaluation needs to be included in the ORSA report. Each firm should report the net income for the current year in terms of the percentile value of actual results compared to projected results using the process that was in place for the preceding year. For example, if the actual results were exactly the median value projected in the ORSA report the prior year, then this value would be 50 percent. If the results were below the median value and only 10 percent of the prior year's projected results indicated a lower net income, this value would be 10 percent. In addition, the name of the person certifying the prior year's re-

### Clarifying Uncertainty *by Stephen P. D'Arcy*

port should be included. This information should be repeated in subsequent years' reports until a history of 10 years is included. When this decade of data is available, it will be relatively easy for stakeholders to assess the validity of the firm's ORSA reporting process. The retrospective percentile values should be distributed around 50 percent, with only occasional large deviations from the median.

When this retrospective report is available, stakeholders will be able to assess the past performance of an individual based on all the firms for which that person has certified the ORSA reports. They can then use this information to determine the confidence they place in current reports from that individual. For example, if one individual has a consistent pattern of low retrospective percentile values, then regulators may focus attention on firms for which that person has certified reports. This would provide an early warning signal for regulators that would allow them to allocate resources efficiently. Conversely, investors may place a market premium on a firm that relies on an individual with a record of retrospective percentile values around or above 50 percent to certify its ORSA reports. In addition, the professional association of the person certifying the reports will be able to review that individual's performance to determine if an investigation is warranted that could lead to counseling or discipline.

When ORSA is initially introduced, there will be no historical reports to use as a validity gauge. A firm might apply the current model to the prior year's data to generate the distribution needed to determine the retrospective percentile for the last year. This could be a useful approach to provide some assurance that the current process is reasonable, but this approach should not be used for the retrospective percentiles. The retrospective reports need to be based on the approach actually used each year to project the next year's results. The approach used to generate these values each

year will change as firms improve the process and modify input parameters. However, those certifying the results need to produce the retrospective percentile based on the projections actually made each year in order for the process to be accountable.

In addition to the single year reports suggested here, firms may choose to project results for additional years. This information, which may be useful, should not be used as the basis for the standard prospective and retrospective reports. For one, the uncertainty involved in modeling future results increases dramatically the more distant the time frame projected. Second, the further in the future that is projected, the longer it takes to assess the results. Therefore, the standard reports should focus on a single year.

One drawback of the single year projection is the timing involved in generating the reports, having regulators review them and then, if needed, acting on them in time to have a useful effect. If the following time frame is used, this should minimize this problem:

1. Firms should be able to produce the projections for the following year no later than Dec. 1 of the preceding year, giving the individuals providing the certifications at least three months to review and request modifications, if needed.
2. Firms should have the actual net income for the preceding year by Feb. 15 of the current year. This value simply needs to be measured against the projected results produced one year earlier to generate the retrospective percentile.
3. Final reports would be submitted by March 1 of the current year, which is the current National Association of Insurance Commissioners (NAIC) filing requirement for annual financial statements.

### Clarifying Uncertainty *by Stephen P. D'Arcy*

4. If it would take too long to review the financial data submitted by all firms to determine which situations merit immediate attention, there could be a requirement that firms provide a special report to their home regulator if certain conditions are met, such as the probability of financial impairment exceeding 20 percent or the probability of insolvency exceeding 5 percent. These reports could also be due on March 1.

The actuary's key role in the ORSA process should be to quantify the uncertainty surrounding the future financial

results of the firm. Actuaries have the skills needed to perform such a task. By providing relevant standardized reports that clarify the uncertainty in terms easily understood by all stakeholders, the actuary will provide an essential element in the ORSA process. Holding the individual performing the certification accountable to the professional standards underlying this role will create both an incentive to perform this task in line with these standards and a lever to withstand pressure from others to relax these standards for short-term gain. The result will be to enhance the financial security of the insurance industry at a time when all financial institutions are facing stakeholders skeptical about their financial condition.

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## Is ORSA a Good Move for All the Stakeholders?

by Yayuan Ren and Jianwei Xie

The U.S. insurance industry has been doing just fine for so many years without the novel Own Risk and Solvency Assessment (ORSA), which was recently proposed in early 2011. Do we really need ORSA at this point, right after our current self-sufficient system successfully survived the “perfect storm,” the so-called once-in-a-hundred-years recession? Or can we employ ORSA as an alternative for not completely following the Europeans’ steps on the fancy Solvency II scheme? The answers to these questions rely on whether ORSA is beneficial to the stakeholders of the U.S. insurance industry. If so, ORSA would be a good move. After giving it some thought, we believe that the answer would be a “yes,” and the United States would benefit from employing ORSA.

### The Insurers

As a great addition to our current insurance regulatory environment, ORSA encourages insurers to improve their risk management, both strategically and technically. Every insurer needs to set up its own risk management procedure to identify, assess, measure, monitor, control and mitigate their risks. Instead of just focusing on satisfying the imperfect regulatory formulae like risk-based capital (RBC), insurers are finally required to do something more creative and to undertake serious effort to develop their own risk management systems. For insurers, ORSA will not be another standardized form or data call to report, but a customized framework and risk management model to serve their own business strategies and risk appetites.

Why is ORSA better? It promotes insurers to think and act more proactively on their own risk management policies, quantitative measurement of risk exposure in both normal

and stress environments, implementation of economic capital models and solvency assessment tools. Through carefully completing the three proposed sections for ORSA, the insurers get the opportunity to re-examine and improve their enterprise risk management (ERM) procedures with regular frequency. In return, the improved ERM system will surely help the insurers’ business. For instance, with improved risk profiles, it will be easier for insurers to raise capital with lower costs and to conduct the lines of business with the desired risk characteristics that fit their risk appetites.

ERM has been a hot topic in the insurance industry for years, but not all the insurers have set up their own comprehensive ERM frameworks. The implementation of ORSA will definitely draw enough attention of insurance companies’ executives to improve the risk management work and therefore promote the U.S. insurers’ competitive advantage as a whole.

### The Regulators

Who wants to be those kinds of parents who have to take care of their children all the time, or forever? We want our children to be able to do independent rationalization and make reasonable judgments without too much of our intervention, as long as we believe they are ready to be on their own.

ORSA is a great way for regulators to evaluate the readiness of insurers to manage the solvency risk themselves. It is like the parents reading the children’s journal to get a comprehensive understanding of the youngsters’ thoughts. In my point of view, it does not really matter whether they are ready or not; at least the regulator has something to



Is ORSA a Good Move ... *by Yayuan Ren and Jianwei Xie*

count on and knows the insurers are trying hard to improve their risk management. In return, the regulators will benefit from the fellow insurers' improved risk management. Isn't it wonderful if your children always proactively think about becoming a disciplined person? For the parents, it means less work on disciplining and more time for other instructive activities. For regulators, thanks to ORSA, they can spend more resources to work on other meaningful projects, such as RBC formulae modifications, regulation on evolving products and evolving market, etc.

### The Policyholders

As policyholders, we are happy to see that the U.S. insurance regulators are not completely embracing the uncertain Solvency II regime. In fact, we are glad that we are not abandoning the RBC formulae, which have been acting as a safeguard to protect policyholders from insurers' solvency risk. Although RBC is not perfect, it has proven to be working pretty well especially during the recent economic collapse.

Combined with ORSA, policyholders will be in better hands in terms of the claim payments guarantee in the events of losses. Through ORSA, insurers can realize and allocate assets for the risks not recognized through the RBC formulae, promoting the insurers' solvency. Moreover, ORSA can potentially improve insurers' asset/liability allocations and efficiencies; in return, policyholders can expect better insurance prices as well. For instance, after recognizing the correlations among products through implementing economical capital models, insurers can potentially lower the existing overall loss cost assumption based on the risk diversification effect among the retained risks, leading to lower overall premium charges. As policyholders, we will

be more than happy to embrace anything that can lower our premiums and still ensure the claim payments. The policyholders really do not care if you call it ORSA or NASA, Solvency II or Solvency III.

### The Investors

There are two big categories of insurance industry investors: debt-holders and shareholders. Debt-holders will easily embrace ORSA since the default risk can be somehow reduced through implementing ORSA. Insurer default risk can be reduced through a sound economical capital model and internal solvency assessment, both preventing insurers from taking excessive risk. When insurers' insolvency risk becomes lower, the debt-holders' benefits are clearly better protected.

Similar to debt-holders, shareholders can also benefit from the managed solvency risk. They will be more confident that their share value is not going to become zero.

Through ORSA, potential investors will be able to learn more about insurers' risk appetite and risk profiles. Such information cannot be obtained from insurers' 10-K or other financial statements. As a result, ORSA provides greater information transparency for investors, especially non-institutional investors, to better understand the investment risk they are about to take. For instance, if ORSA indicates that an insurer chooses 99.5 percent confidential interval for reserving risk, investors can reasonably expect a relatively stable but humble rate of investment return; on the other hand, if the ORSA indicates that the insurer is a risk taker, the investors' return can be relatively big but volatile. ORSA will be a great tool for investors to evaluate the risk and value of insurers and to set up their investment portfolios with desired diversification level.

Is ORSA a Good Move ... *by Yayuan Ren and Jianwei Xie*

### The Rating Agencies

With the greater transparency that ORSA will bring in, rating agencies will be able to gather more information with regard to insurers' corporate governance and ERM effectiveness. With the improved information, rating agencies can make sounder decision on the ratings for insurance companies. In addition, with the new information added by ORSA, rating agencies can develop comprehensive rating engines to better present the insurance companies' performance.

Moreover, ORSA would also benefit other stakeholders including employees in the insurance industry and the public. Employees will enjoy their more secure jobs when their employers improve their corporate governance through ORSA. For the public, the implementation of ORSA will help build the confidence on the insurance industry becoming less vulnerable to economic volatilities. With better ERM practice carried out by the entire U.S. insurance industry, taxpayers' money will be far less likely to be exposed to the insurance industry bailout bills.

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## More than Regulatory Compliance

by Sam Gutterman, Brian Paton and Sunil Sen

### Introduction

The fundamental building block for an Own Risk and Solvency Assessment (ORSA) is the internal risk management process and framework. As a result, insurance companies' risk management processes have been receiving more attention by both external and internal sources, including;

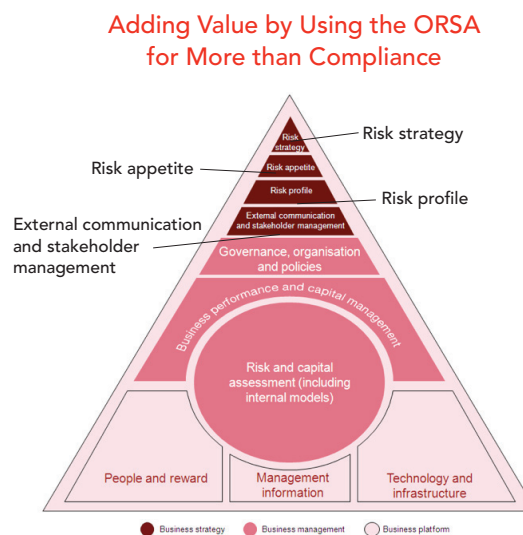
- Rating agencies, due to the potential impact of a risk management process on company ratings;
- Regulatory—for example, Solvency II, Office of the Superintendent of Financial Institutions (OSFI) “vision,” and now the National Association of Insurance Commissioners' (NAIC's) ORSA; and
- Internal management—for example, as a lesson learned from the global financial crisis.

The ORSA report should not only satisfy a compliance requirement, but at the same time should serve as an opportunity to document the internal risk management processes and quantitative assessments a company currently utilizes. Producing the document may also enhance internal transparency and identify shortcomings in the existing risk management framework. It will also provide more internal visibility of its underlying contents.

The NAIC's ORSA guidance manual will require companies (that meet certain criteria, including a minimum size) to include required qualitative and quantitative information on how risks are identified, measured and managed.

If the ORSA is regarded only as a regulatory compliance hurdle with the document produced to meet the minimum requirements, then it is highly likely that the full value of the ORSA will not be obtained. To derive optimal value the ORSA should be regarded as a process rather than just a

document. As a result, risk management can be better considered as part of business planning. This can create a cohesive direction for the company and avoid an approach based on independent processes and siloed activities. It can then be leveraged to bridge existing gaps in risk management processes, and introduce risk and business reporting feedback loops to further enhance shareholder value. As such, the results and findings of such a process would become integral metrics used by a company's board for monitoring performance, decision making and strategic planning.



Regarding the ORSA as a process with regular metric reporting and feedback loops requires its integration with existing business and strategic planning processes. If integration is not achieved, it will be difficult to determine whether risk appetite, limits and thresholds are consistent with business and strategic plans for the company. This can result in the potential for competing organizational goals. Without alignment, risk management actions to stay within appetite levels may adversely affect a company's ability to meet its business plans, or vice versa. Decisions to meet plan objectives could cause breaches in risk limits; such a breach represents an operational red light, while getting close rep-

More than Regulatory Compliance *by Sam Gutterman, Brian Paton and Sunil Sen*

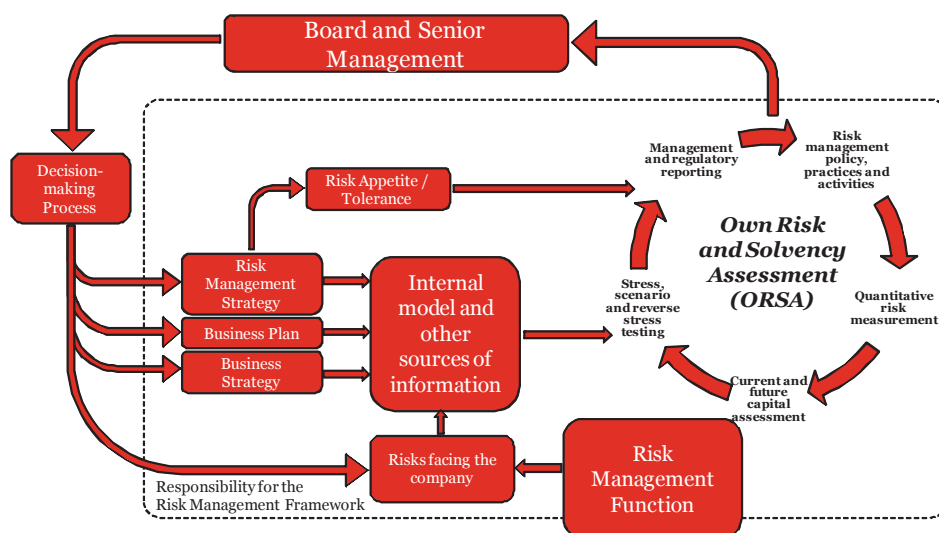
resents a yellow. Linking the ORSA to the overall business planning process and determining appetite, threshold and risk limits that meet risk and business objectives is a first step in the process to being able to use it to enhance shareholder value and gain competitive advantage. In doing so, emphasis should be placed on the interaction between the wide-ranging aspects of business strategies (including pricing/product design, distribution and investment strategies, operational/cost control strategies and IT strategies). Business issues today are far too complex to continue with a silo approach, particularly when considering strategic direction.

Creating an appropriate feedback loop is also important. For example, the current year's ORSA process should include an assessment of the effectiveness of last year's risk management mitigation techniques and lessons learned from the prior process. It should include an action/mitigation plan, including risk tolerance/budgets in key risk areas specific to the company, aligned with risk appetite and with regular high-level checkpoints. The integration with business planning means that the management of risks becomes an integral part of how business objectives are met rather than a competing requirement.

In addition, the monitoring process needs to be embedded

in a dynamic basis into everyday decision making. In attempting to do this, it is helpful to think of the different types of risk that need to be considered. The ORSA will require companies to consider all relevant and material risks, and therefore will include risks of an operational and strategic nature, as well as the more commonly addressed underwriting and investment risks. Risks can therefore be broken down into those that may arise in the relatively immediate term (for example, hedging risks or fraud), those that arise over a business planning horizon (for example, concentration, policyholder action and regulatory risks) and those that have an even longer nature (for example, distribution channel risks and risks due to consolidation of operations).

Considering the different types and expected horizon of risks is essential to construct and manage both retrospective and forward-looking early warning metrics and indicators. As a result, metrics for key short-term operational and asset-liability management (ALM) risks may need to be produced and managed on a daily basis, with corresponding monitoring and potential escalation to the risk management governance process as appropriate. For example, investment decisions should be monitored frequently with input from risk management and corporate strategy departments to ensure these risks remain within appetite. During the fi-



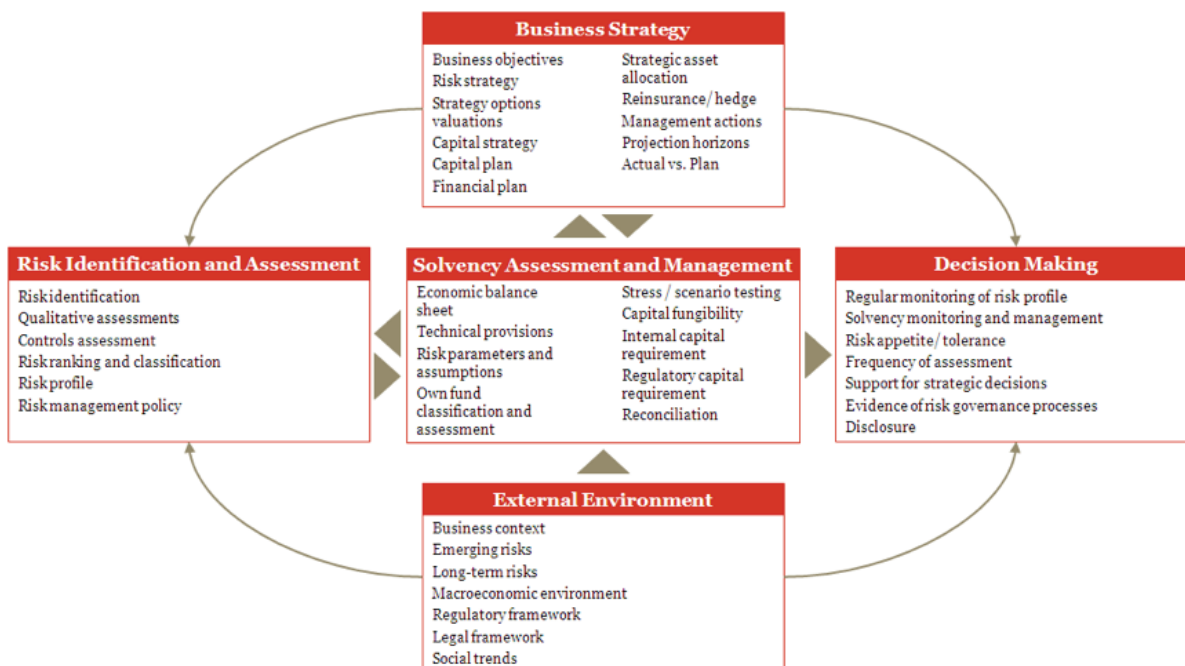
**More than Regulatory Compliance** *by Sam Gutterman, Brian Paton and Sunil Sen*

financial crisis of 2008 and in the current euro crisis, corporate and sovereign bond credit spreads can and do fluctuate widely on a daily basis.

Furthermore, these risks may not be diversified. It is essential that metrics are available at the required frequency so that during such times investment strategy can be adapted to mitigate losses and take advantage of current opportunities. Key metrics used could include credit spreads, key rate durations, option-adjusted spreads and mark-to-model values for illiquid securities.

Similarly for longer-term and strategic risks, the frequency of monitoring would be adapted to the features of the risk. The timing of monitoring and reporting would be designed to react to the timing at which further credible information becomes available and early warning indicators flash. In contrast, current planning processes typically focus primarily on regulatory capital, revenue, operating earnings and current year-to-date expenses that are reported on a

monthly or quarterly basis independent of timing of emergence of risk. Although in many cases they incorporate a SWOT (strengths, weaknesses, opportunities and threats) identification process, the follow-through on this analysis tends to be limited and short-term in nature, both in shoring up weaknesses and taking advantage of strengths and opportunities. This may not adequately address risks that arise across the planning horizon, especially tail risk (excessive exposure of any kind). These must be identified and quantified, even on a simple green-/yellow-/red-signal basis indicating the likelihood of such risks and their possible adverse effect. The effectiveness of mitigation strategies and tactics that are designed to address them should also be quantified. Controlling tail risks that may emerge quickly (for example, as evidenced through a surge in sales in what turns out to be an underpriced product, or through excessive concentrations in multiple international subsidiaries) requires metrics that respond to an insurer’s position during a financial, natural disaster or pandemic crisis.



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The growing trend is toward the use of “risk dashboards” or risk reporting processes that can quickly allow management to become aware of and respond to changes in key metrics impacting the business. In addition, a controlled alignment of management performance and remuneration is needed, through quantitative measures such as economic value added or risk-adjusted return on capital (RAROC). This may enhance the embedding of risk management into corporate planning and sales projections, and, coupled with risk dashboards, focus business decisions to contribute to an increase in long-term economic value.

Risk management is often thought of as only a defensive mechanism. However the ORSA process can also be used to identify opportunities to take on further risks to increase shareholder value and create competitive advantage. The process should also produce metrics that allow identification of possible rewards that merit taking on additional risk, particularly where a company believes it may have a strategic

or financial competitive edge, such as market experience or a strongly capitalized position.

**In Conclusion**

To add value to a company, the ORSA should be viewed as being more than a compliance requirement. Rather, it should be considered an integral element of a company’s governance, part of its holistic business, risk and strategic planning process used by both management and the board on a regular feedback loop basis. The ORSA process, borrowing enterprise risk management (ERM) techniques, should be used to identify, control and mitigate short- and long-term risks. Carefully constructed metrics can facilitate the process. Furthermore, the value of the ORSA process can be used to exploit opportunities to add value and increase shareholder and policyholder value. Risk can represent an opportunity; the ability of insurers to leverage their knowledge and risk management capabilities can allow them to find and maintain a competitive edge.

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## Focusing on Own Risk of the ORSA Process

by Max J. Rudolph

Effective risk management is not driven by a regulatory process. In the long run the corporate culture and CEO incentive plans have much more to do with successfully traversing a long time horizon than any models. Risks tend to accumulate, especially during stable periods when many so-called experts claim it is “different this time.” It never is.

So how can an insurer required to comply with an Own Risk Solvency Assessment (ORSA) regulation leverage this information and use it internally to improve the likelihood of solvency and gain a competitive advantage?

### Risk Concentrations

Becoming aware of risk concentrations is the most important concept to understand when managing risk. Risk-focused decision making is likely the largest concentration issue at many companies, where one individual uses dictatorial power to push through an agenda. Risk comes in many forms.

Many seeking to implement ORSA have well-intentioned agendas. They are trying to do the right thing. But that, unfortunately, is not enough. Insolvencies will not be reduced through legislation. Who among the risk community feels safer now that Risk Focused Examinations are a requirement? ORSA is the start of a useful process, not the final effort. Think back to the origins of cash-flow testing requirements. The seven scenarios tested were not that useful by themselves. Once the initial models were built, a new paradigm had formed.

Modeling economic capital, for example, provides useful information during normal times but tends to be procyclical and virtually useless when the economy implodes. The missing analysis concerns the gross exposures to con-

centrated risk. Modeling net exposures works fine when counterparties are functioning, but insurers will not enjoy the surprise when a reinsurer or other financial counterparty becomes insolvent and exposes the tangled web of financial intermediaries. That is when the concentrated exposures to geographic location or risk become apparent.

### Helping ORSA Drive Value

So if ORSA will not meet internal needs, how can you drive the process so it adds value and allows better decisions to be made? While you must realize that models will not solve your problems, they can be very useful in helping to understand the risks that have been accepted. The risk manager must avoid using models as a black box that generates a single number. Models cannot optimize a block of business, but they can provide information about how a new block will integrate with an existing one if you understand their assumptions and value drivers. Optimization routines are generally based on the benefits of diversification, using correlation matrices to combine multiple risks. Correlations are based on recent historical data, and do not go back far enough to include previous hard times. Think of the different decisions that would have been made if housing market data had included information from the Great Depression of the 1930s, or if payout annuity pricing factored in the 1918 influenza pandemic. When we model future interest rates, no one considers data from the Weimar Republic’s hyperinflationary period. Why not? Hyperinflation does not seem all that remote right now.

Data is never complete, and correlations constantly change. Many of the metrics required by the Basel Accords did not include data going back 10 years, so banks made decisions assuming risk interactions would remain consistent with those from a period of relative peace and

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prosperity. The time horizon tested under ORSA has long been a bone of contention. In reality, it doesn't matter. No matter what time horizon you choose, the data will underestimate the likelihood of default (kudos to Nassim Taleb for making so much money from this revelation). Data collected in recent periods ignores future risks we have not considered, as well as the inevitable but ignored asteroid, super volcano and war. To argue about the probability of insolvency in the next year is preposterous. Defaults cluster, and if you go far enough into the tail, all firms are subject to creative destruction. To say that every firm should be capitalized so only one out of 200 will fail in any year (99.5 percent) is ridiculous and should satisfy no one.

Realistic stress-testing is the best way to test for solvency risk. Unfortunately, most CEOs prefer to be wrong with the herd rather than alone when managing risks. No one was ever fired for not seeing the approaching "perfect storm." Regulatory-driven stress tests tend also to be impacted by politicians. The initial European bank stress tests had no component for a sovereign debt crisis, even though one was already under way. They did not want to "scare the markets." Does anyone test their CEO's strategic plan for ineptitude? I didn't think so.

Understanding gross exposures, where your counterparties (e.g., reinsurers or swap counterparties) go under, or when a 10-day rainstorm hits California, should be the norm. An insurer should know before the fact what their exposure is to a strong storm or earthquake hitting San Francisco, Tulsa or Charlotte. Building and maintaining this database may be the most useful thing a risk team can accomplish, because it helps the firm better understand its risk profile and prioritize its decision making.

Current best practice says that risks should be aligned with the firm's risk appetite, but companies discovered in 2008 that their risk appetite is not stable. In the good times, boards become much more likely to approve the risky new opportunity. Models thrive during these periods, purporting to optimize results. But they are using data from the tail, from the portion of the distribution where extreme positive results occur. Qualitative assessment and contrarian thought can provide a competitive advantage. "This time it's different!" becomes the mantra in the press. But it's not different, and when instability returns, risk appetite goes down. Warren Buffett has said, "Be greedy when others are fearful, and fearful when others are greedy." CEOs and risk managers would do well to hang this on the wall of their office.

It's not what the regulators ask for that is important; it's how you leverage it to add value that makes enterprise risk management (ERM) worthwhile. It will pay for itself many times over if firms understand the benefits they receive.

### Building a Competitive Advantage

Risk management is no different than other business disciplines. Early adopters can enjoy an advantage, but eventually the practice becomes common and leads to concentration risk. If everyone has the same risk mitigation strategy, thinking they are the only ones employing it, then it eventually won't work. At some point there will be no one to take the other side of the bet. We have seen this in the past when hedge funds were forced to exit an asset class and found that many were following the same strategies and using the same asset classes. What seemed safe quickly morphed into heavy losses and fund closure.



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Those who choose the path of least resistance—maintaining harmony and not making waves—will, in the long run, destroy value. A healthy dialogue that encourages alternative views will bring out the best in a team, and it should not always be the same person. The key is to get these viewpoints into the mix early enough so they can be used to make better decisions.

#### Splitting the Job

ERM can turn into a bureaucracy if you are not careful. Better decisions will be made if strong employees rotate through the risk manager position and then return to line management. This will only work if the corporate culture embraces risk in a way that is driven top-down and practiced bottom-up. The ERM team will own the process, not the risks. It will communicate consistent practices and coordinate communi-

cation of risk concepts. The best location for this team will depend on the specific firm, but could include audit, finance or actuarial. Residing here will be the master list of risks and the projects to better manage them. The focus here will be on risk mitigation and managing the ERM process. The risk manager should not receive a bonus based on financial results. Incentives should be aligned with maximizing long-term value. The strategic planning area is where the chief risk and return officer will reside. This person will look at opportunities as well as mitigation efforts. The chief risk and return officer needs to be a trusted confidante of the CEO and respected by the board, knowledgeable enough to ask modelers tough questions and understand the answers. Someone who understands emerging risks and interactions between risks, has an eye for unintended consequences, and is willing to share ideas and concerns would be ideal for such a position. It sounds just like many actuaries I know.

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## Understand ORSA Before Implementing It

by Anthony Shapella and Owen Stein

The National Association of Insurance Commissioners (NAIC) is moving forward to implement a new regulatory requirement that requires U.S. insurers to perform an Own Risk and Solvency Assessment (ORSA). Before developing a response to the ORSA requirement, insurers will want to understand its genesis and the underlying rationale for it, as well as its implications. This article provides an overview of the evolution and rationale for ORSA, as well as practical implications for insurers as they begin to design an ORSA process.

### The Evolution of ORSA

The new ORSA requirement is one component of the NAIC's initiative to bring the U.S. regulatory regime into alignment with the Insurance Core Principles (ICPs). The ICPs are developed by the International Association of Insurance Supervisors (IAIS) and outline "the requirements for an effective insurance supervisory system." Almost 200 countries, including the United States, have joined the IAIS and all have agreed to be bound by the ICPs. The International Monetary Fund and World Bank regularly review these countries—through a Financial Sector Assessment Program (FSAP)—to ensure that local insurance regulation meets the ICP principles.

To date, the U.S. insurance market has not fully appreciated the extent to which insurance regulation is being "globalized" through the IAIS, around the ICPs. The ICPs are international mandates and, as the largest insurance market in the world, the United States faces tremendous political pressure to adhere to them. Given its prominence, the United States has started to direct its political influence toward the evolution of the ICPs through active participa-

tion in the IAIS. This activity will continue with the new Federal Insurance Office, which will work with the NAIC to effectively influence ongoing regulatory developments at the IAIS.

The U.S. ORSA is a byproduct of the ICPs. ORSA requirements established in the United States, and abroad, must meet the minimum standards set out in ICP 16—Enterprise Risk Management for Solvency Purposes. ICP 16 requires the supervisor to establish enterprise risk management standards that require insurers to identify, assess and address all relevant and material risks. Specifically, ICP 16.11 states that, in an effective insurance supervisory system:

The supervisor requires the insurer to perform its own risk and solvency assessment (ORSA) regularly to assess the adequacy of its risk management and current, and likely future, solvency position.

The United States is not alone in implementing new ORSA requirements. For example, similar requirements are being established in Canada, Bermuda, Japan and Australia, as well as all of Europe. Others in Asia and Latin America will likely follow suit. In general, these regulators expect "reciprocity," such that an ORSA prepared for one jurisdiction will satisfy the requirement in others.

ICP 16 is about 30 pages in length, and insurers embarking on ORSA implementation would be well-served to review the entire document to understand the underlying drivers behind the new NAIC requirement. While the U.S. ORSA requirement has some unique features, it will meet these

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basic requirements. That said, a few points are worthy of further discussion.

### ORSA—It's a Process

In assessing the implications of ORSA, one must differentiate between (a) the ORSA process itself, and (b) the ORSA regulatory requirement.

#### The ORSA Process

The ORSA process is an internal activity of the company, which consists of—what most would consider—good enterprise risk management. In essence, it is an internal assessment of the risks associated with an insurer's business plan, and the sufficiency of capital resources to support those risks. It includes ongoing processes to support:

- Risk identification and prioritization
- Risk measurement
- Articulation of risk appetite and tolerances
- Implementation of risk limits and controls
- Development of risk mitigation strategies
- Capital adequacy assessment
- Governance and risk reporting.

ORSA's defining element is the linkage it creates between risk management, capital management and strategic planning. Within the ORSA, the company is expected to self-assess its current and future capital adequacy in light of its two- to five-year business plan.

#### The ORSA Requirement

Beyond establishing an ORSA process, insurers will need to prepare materials to evidence the efficacy of the process to external parties. The NAIC's *ORSA Guidance Manual* indicates that those insurers required to conduct an ORSA will also be required to provide a high-level summary report annually to the domiciliary regulator, if requested. The three sections of the ORSA Report will (1) describe the company's enterprise risk management program; (2) summarize the company's risk assessment for each material risk; and (3) describe how the company aggregates individual risk assessments to determine the level of financial resources it needs for its current business, and for its planned business over its planning horizon.

In addition to the ORSA Report, companies will be required to assemble and maintain documentation of all aspects of their ORSA process, which may be used for more in-depth on-site reviews. ORSA materials will eventually be integrated into regulatory examinations, helping state insurance departments determine the scope, depth and timing of each insurer's exam and informing the state regulator's new risk-focused examination approach.

### ORSA—Practical Considerations

At its core, the original purpose of the ORSA was to foster internal risk management within each insurer, enhance management awareness of the interrelationships between risks, and increase understanding of the relationship between overall risk exposure and the capital needed to support it. A predicate belief is that better internal risk management at all insurers is in the public interest because it will reduce insolvencies and enhance capital efficiency across

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the global insurance industry. The original proposers articulated a number of principles for the ORSA. For example, an ORSA should:

- Be the responsibility of the company
- Incorporate a forward-looking assessment of all material risks
- Be embedded into the decision-making processes of the business.

While some companies may choose to treat the ORSA as an entirely new regulatory reporting requirement, that is not the intent, and insurers will be missing an opportunity if they approach it in this manner. Instead, companies should recognize that the ORSA encompasses most of what is considered good risk management practice (see figure below), and that the ORSA requirement should therefore serve as a catalyst for implementing risk management internally.



Of course, to genuinely foster risk management, insurers must be allowed to develop and conduct their ORSAs in a manner that is consistent with the scope and scale of their business, internal culture and management structure, and chosen approach to enterprise risk management. The NAIC's *ORSA Guidance Manual* explicitly recognizes that each insurer's ORSA process will be unique, and currently provides insurers relative latitude in the design of the internal ORSA process. Thus, insurers have the opportunity to leverage much of their existing enterprise risk management capabilities to develop an ORSA process that is maximally useful to the management of the business. In addition, it affords companies the ability to evolve their ORSA over time, in light of successes and failures. The insurance industry, and particularly the North American CRO Council, has worked hard over the last few months to limit the introduction of prescriptive requirements into the conduct of an ORSA. From a policy standpoint, the introduction of ORSA will not be of benefit to the public if it evolves into a highly prescribed regulatory compliance exercise, and the industry will need to continue to resist efforts to add prescriptions that will make it so.

Embedding the ORSA process into business planning is fundamentally important. An effective ORSA will be more about process than results. Unlike risk-based capital, where every company has an "RBC ratio," there will be no "ORSA score" at the culmination of the ORSA exercise. Instead, ORSA effectiveness should be gauged by the extent to which it is integrated into decision making and planning, both at the strategic and the day-to-day level. Effectiveness of processes, such as monitoring for adherence to risk limits—consistent with the adopted risk appetite—are key to the implementation of ORSA. Ultimately, the litmus test for ORSA will be how management responds to

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the next financial crisis or threat. To this end, the NAIC has placed great emphasis on fostering an interactive dialogue between financial examiners and executive management on the process itself—not just the numeric output.

To further this point, an effective ORSA will be more qualitative than quantitative. While it will be natural for actuaries to think of the ORSA as essentially just another application for their financial models, that is also not the intent. In fact, the NAIC's *ORSA Guidance Manual* does not even require the insurer to employ an economic capital model. Stress-testing of the financial balance sheet against regulatory and rating agency capital requirements could be sufficient, if that is how the company chooses to internally manage risk. In essence, the ORSA needs to balance and integrate the quantitative risk analysis with qualitative risk management processes.

It should also be noted that an important aspect of ORSA is that it is to be conducted on a group-wide basis. This makes eminent sense, as that is how the business is ultimately managed. Larger companies may choose to conduct ORSAs within major business segments, and then aggregate up from there. Given that the goal is to integrate the ORSA into decision making, decisions about how to organize the ORSA will vary from company to company, depending on how they choose to organize themselves for other purposes. Some have suggested that ORSA Reports be prepared for each legal entity, as well as the group as a whole. This makes little sense. While there is sometimes coincidence between business segments and legal entities, this is more often not the case.

Finally, ORSAs will eventually serve as a source of information for the regulators about the insurer's risk management program and capabilities, as well the risks it faces and its internal capital resources. While this certainly has the potential to enhance supervision, particularly if it is used to focus regulatory examinations on key risk issues, it will require the development of stronger risk management capabilities within the supervisory community before such information can be effectively utilized. Supervisory staff will need to be able to differentiate between strong and weak risk management practices, requiring skills that are typically not present in many state insurance departments. In addition the information will not be uniform across companies (by design), which is countercultural to most regulatory environments. As the ORSA requirement is implemented, we should expect natural pressure from supervisors to try to establish additional standard reporting requirements to facilitate "benchmark" comparisons across companies, and standard reporting formats to facilitate checklist reviews. The insurance industry will need to resist these pressures, to the extent that they are counterproductive to the intended purposes of the ORSA.

In sum, ORSA is an insurer's internal process of self-assessing its material risks and evaluating the capital to support them. The design of an ORSA process should consider the insurer's existing enterprise risk management framework and focus on balancing quantitative and qualitative elements. Ultimately, the test of a successful ORSA lies in its ability to improve the insurer's risk and capital management processes and influence strategic decisions. Finally, the ability to communicate the process to regulators will be fundamentally important given the unique nature of the ORSA information.

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## Some Key Questions an ORSA Should Answer

by Loïc Chenu

### Introduction

Risk management functions in insurance companies have soared in recent years, and even more so due to the late 2008 financial crisis. With this as background, U.S. and EU regulators—the National Association of Insurance Commissioners (NAIC) and the European Insurance and Occupational Pensions Authority (EIOPA)—are putting in place an Own Risk and Solvency Assessment (ORSA) process, of which the goal is to provide the regulatory framework for risk management.

In this paper, we will first define our understanding of an ORSA process by articulating both the quantitative and qualitative elements at stake. We will then go over the main questions the ORSA should answer, in our opinion.

### What Is ORSA?

We suggest the definition of ORSA as a process through which the insurance body checks the current and future alignment between its risk management policy and its solvency level.

This definition highlights two aspects of ORSA. The first is qualitative and leads to the implementation of a risk management policy that is both:

- Prevention, addressing the question: How to prevent an adverse event to occur? and
- Remediation, offering action plans to implement in case of adverse event occurrence.

The preventive approach, placed upstream, is almost exclusively owned by the internal audit. The remediation approach, downstream, is naturally owned by the decision makers that can shift the risk exposure.

The quantitative aspect of ORSA includes the solvency level. In our opinion, it should not be limited to a regulatory ratio; but should be understood at the company's solvency as seen by itself, taking into account its strategic development plan. In that sense and as ORSA should be applicable to companies regardless of their size and activity that could vary widely from one to the other, it would be preferable to have the ORSA regulation to focus less on the implementation and more on the objectives. These objectives should address the following questions:

### What Are the Risks Facing the Company?

The risk map should be the first step in any ORSA process. It should identify the events, should they occur, that would be adverse to the company's interest in order to allocate correct solvency capital down the road. In order to have this risk map efficient, the major risks should be identified and could benefit from an individual capital allocation and non-major risks that could have capital allocated jointly.

### What Is the Impact of Each Risk on Company's Surplus?

The impact estimate of a risk on company's surplus should be owned by the actuarial function. It should compute this prospective calculation based on a central scenario. Practically, we think this scenario to be the strategic plan's balance sheet and income statements not under stress. Each major risk identified shall be associated with an event (increase/decrease of interest rates, a CAT event ...) applied to the central scenario. The resulting variation of surplus is the impact estimate, according to the severity level, and allows allocating solvency capital accordingly. Please note that not all risks are quantifiable, and expert judgment's type of measure could be used.

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### Who Is Responsible for Each Risk Monitoring?

The answer to this question could be illustrated by an organizational chart showing responsibility scope of each decision-making structure for each risk, showing hierarchical links between these structures. This should allow companies to check the absence of conflict of interests between stakeholders.

### How Are Risks Monitored?

We suggest that enterprise governance includes implementing key primary indicators (KPIs)—both quantitative and qualitative—assigned to each identified risk, monitored on an ongoing basis to a “risk management” function for monitoring. This function could design a threshold to each indicator above which a decision regarding the risk exposure needs to happen. More than one threshold would be useful to monitor the magnitude of the underlying risk. Two thresholds could be in place: one triggering the agenda of the next scheduled risk committee; the other one triggering an ad-hoc risk committee, including senior management.

Due to their strategic nature, we believe the risk indicators should be simple in order to be both reliable and understood by decision makers, but also by the front line performing the implementation. In that respect, the economic capital models may not be suited for the tasks, especially if they are stochastic in nature.

### What To Do After a Risk Occurrence?

We believe an action plan should be articulated for all identified risks, upon occurrence and above the predefined materiality threshold. For each, various actions can be thought based on the magnitude of the risk (policy cancellation, asset allocation...). As possible, the cost benefit of each action plan should be measured in order to inform senior management in its decision. The action plan should include reinsurance purchase in case of underwriting risk event, with prior cost estimate in line with the surplus relief provided.

### Who Is the ORSA Audience?

As long as the ORSA implementation is not constrained by a voluminous regulatory framework, the process should be first and foremost directed to the company itself; this line of thinking is being shared by the European regulator. Thus, the use of ORSA information by other stakeholders (rating agencies, debt holders ...) begs the question of trust in the relationship, which is different from accounting information based on neutral standardized framework for all. To that extent, the building of standardized ORSA indicators, audited through a certified third party, could be an adequate response for financial communication purposes.

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# Effective Risk-Based Decision Making: ORSA and Beyond

by Guillaume Briere-Giroux and Mark Scanlon

## Introduction

November 2011 saw the finalization of the *NAIC Own Risk and Solvency Assessment (ORSA) Guidance Manual* that outlines a new requirement for U.S. insurers to conduct an ORSA and report findings on a regular basis. ORSA is a process in which insurers assess their risk and capital management framework given current and future risks in light of their business strategy. While there are important qualitative aspects to an ORSA, the ability to quantify risk and capital today, as well as projected into the future, is vital to a successful ORSA process.

In this essay, we focus on the “Prospective Solvency Assessment” aspect of the NAIC’s ORSA. This places a spotlight on an insurer’s strategic decision making from a risk and capital management perspective. It requires those in senior management to describe actions they would take to address possible adverse changes in their risk and solvency position, i.e., what they would do to reduce risk, increase capital, and/or adjust the business strategy. As described in the NAIC’s guidance, this process should:

- Forecast risk capital (which may differ from regulatory capital) in a robust manner
- Be closely tied to the insurer’s business planning, over a multiyear time horizon
- Be aligned with the insurer’s stated risk appetite
- Consider normal and stressed environments
- Consider impacts from relevant internal and external drivers.

While the NAIC’s ORSA introduces this as a formal requirement, it is arguably an exercise companies should already be doing as part of a sound enterprise risk and capital man-

agement framework. Further, we contend that by applying a slightly broader scope than the specific requirements of the NAIC’s ORSA, insurers can develop this into a valuable process to support risk-based decision making.

To be effective in supporting risk-based decisions, not only must the risk metrics provide senior management with information that is relevant, reliable and actionable, but the systems and processes in place need to be able to provide this information on a timely basis. In this essay, we initially consider how to determine which metrics to include in such a process and then discuss some important business requirements and practical challenges for implementing a calculation approach to support it.

## Which Metrics Drive Decision Making?

Technology and competition have contributed to the rise of complex products, such as variable/ indexed annuities with living benefits and universal life with secondary guarantee found in the life insurance sector. As part of the ongoing management of their business, insurers require a variety of metrics to be calculated on a regular basis for different purposes. Identifying which metrics to use and understanding how they relate to each other to drive decision making can be challenging. For example:

- What seems to be adequate with one metric (e.g., economic) is often inadequate with another (e.g., statutory results, management reporting and liquidity management).
- What seems a reasonable strategy in the short term may lead to suboptimal outcomes in the long term.

From an enterprise risk management (ERM) perspective, the metrics used should reflect the way senior management (and



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the board) thinks about risk. When they think about the company’s strategic objectives and potential risks to achieving those objectives, what are the metrics that they really care about? For companies with an enterprise risk policy and formalized risk appetite and tolerance statements in place, the board and senior management’s views will be explicitly stated; so identifying which metrics are important—and how they combine to drive decisions—should be a lot clearer.

Insurers’ risk appetite and tolerance statements typically reference a combination of balance sheet and earnings metrics. This reflects the sometimes conflicting requirement to achieve objectives related to enhancing long-term value and capital strength while avoiding short-term earnings surprises (or, similarly, the need to meet certain short-term earnings objectives, subject to protecting some minimum level of capital strength). Figure 1 presents a summary of metrics included in U.S. insurers’ risk appetite statements (results from Towers Watson’s 2010 Global ERM Insurance Survey). Looking across the industry, no single measure stands out, with economic, regulatory, rating agency and GAAP measures being noted as important. In general, we would expect larger, more

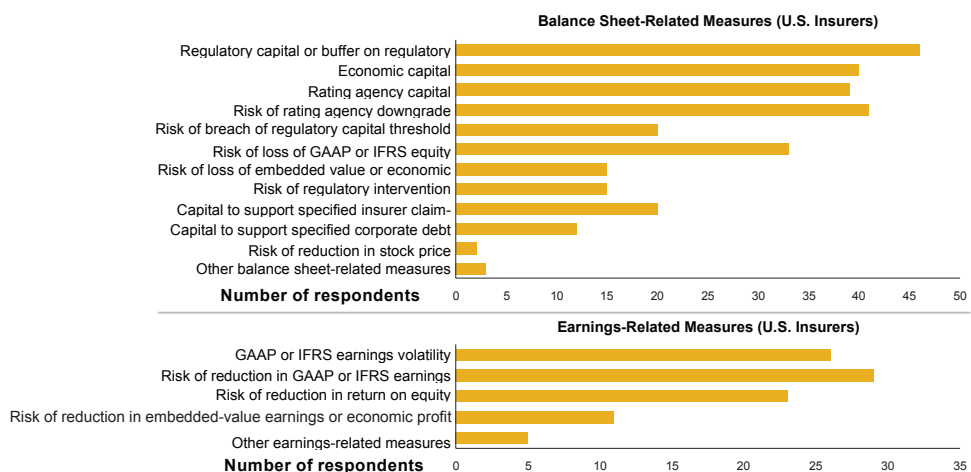
complex and diverse companies to require more metrics than smaller companies with relatively simple products.

We note that while a lot of focus has been placed in recent years on economic capital (EC) as an emerging best practice metric to evaluate risk and guide management decisions; by itself it is usually insufficient to drive effective decision making. As the survey results indicate, other metrics are also relevant to insurers—for example, despite some recognized shortcomings from a risk measurement perspective, statutory risk-based capital remains an important metric and driver of decisions for U.S. insurers. Another challenge with EC for many insurers is that they currently focus on EC at a specific valuation date so their analysis is limited to a risk snapshot at a point in time. Consequently, their analysis does not provide insights into how the capital and profits will be impacted over time and under different strategies, measurement bases and environments.

How Can You Actually Do It?

Now that we have established a need to look at different metrics across multiple time horizons, we turn our attention

FIGURE 1: RISK METRICS USED BY U.S. INSURERS IN RISK APPETITE AND TOLERANCE STATEMENTS



Source: Towers Watson’s 2010 Global ERM Insurance Survey  
 Q.14 Which of the following measures of risk are used in your risk appetite/tolerance statement? (79 respondents)

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to what this process might look like in practice. Considering that it is often a significant undertaking for insurers to calculate capital on a single measurement basis at a single valuation date, insurers will likely need to rely on various simplifications and approximations in implementing this expanded process. In so doing, insurers need to strike the right balance between having an approach that is sufficiently complex to provide reliably accurate and granular information, but simple enough that results can be produced quickly and clearly enough that they can be used by senior management.

We believe that management should define a variety of “what if” scenarios, against which it can evaluate the impact on the identified metrics over the business planning horizon. The business strategy should form the “base case” projection, with others defined as variations around that owing to changes in internal and/or external factors. The individual scenarios should reflect plausible combinations of key drivers, such as equity markets, interest rates, implied volatilities, credit spreads and defaults. Ideally, insurers should look at scenarios involving multiple risks moving together, as well as some which focus on a specific risk only. Specifying scenarios with differing degrees of severity can provide useful insights (e.g., “moderate” vs “extreme”). Similarly, insurers may want to assess various “good” scenarios, identify possible “killer” scenarios, or scenarios reproducing past financial crises. In addition to the business strategy, the insurer’s risk appetite and tolerance statements should be used to help specify scenarios that will provide meaningful information to management. Those in senior management should be actively involved in specifying or reviewing the scenarios to ensure their views are reflected and that the process is seen as valuable to them.

While there is inherent subjectivity in deciding which scenarios to examine, the iterative thought process involved in

scenario selection reinforces understanding of risk exposures and provides further insights into the short-term and long-term effectiveness of risk mitigation strategies. That is, the loss in absolute accuracy from using a more limited number of scenarios is compensated by the information gained from:

- Investigating the emergence of results within scenarios, short-term volatility vs. long-term volatility
- Testing the performance of alternative strategies on a projected basis (e.g., sales, investment strategy)
- Ability to observe results using a variety of measurement bases along each path.

Focusing on the multiyear projections and how they can best serve to enhance risk-based decisions, we believe that they should include or reflect a number of key capabilities:

- Reflect credible future economic environments that reflect dependencies between the relevant economic variables, such as interest rates, equity markets, credit spreads, defaults and implied volatilities.
- Reflect the impact of new business, with the level and mix of new business varying to reflect the specific environment being projected and policyholder behaviors and assumptions projected consistently with the projected economic environment.
- Accurately represent management strategies like hedging, asset liability management, credited rate setting, premium setting, reinsurance and new business strategy (per above) while enabling alternative strategies to be tested.
- Allow the expected basis to be dynamically re-evaluated over time as the actual experience under a particular scenario emerges.
- Include a refresh of balance sheets and income state-

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ments under all the relevant bases (e.g., economic, statutory and management reporting, such as U.S. GAAP) over the time horizon consistent with the business strategy.

- Aggregate results in a logical manner and allow multiple views of the granular contributors of the results (e.g., by risks, by line of business).
- Enable adequate consolidation of results and interactions between different segments of the enterprise, including tax, capital flows and their associated constraints.
- Enable the modeler with drill-down capabilities and detailed reports that provide ability to efficiently understand/validate results.
- Produce results quickly enough so that the information is “fresh” and can be reported to senior management (and other stakeholders as appropriate) in a way that is clearly understood and allows them to act upon it.

While the above may seem ambitious, by leveraging and

refining existing modeling methodologies and systems, we believe it is an achievable goal. Indeed, a number of companies have already developed the type of detailed, multi-year, multi-metric calculations described above; although, in some cases, targeted more specifically at a line of business or product line rather than the entire enterprise. As the demands for richer risk-based information increase, we expect to find more companies adopting similar approaches and applying them to their strategic business planning and a broader set of risk measurement needs—such as an ORSA.

On a final note, it is important to remember that ultimately decisions need to be made by people, not models; so, while we don’t want to downplay the significance of the modeling required to support the process, we want to highlight that the real value for those in senior management will come from them actively participating throughout the process.

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## Arbitrage-Free Perspective on Economic Capital Calibration

by David Wang

A stockbroker comes into the office in the morning, logs on to his computer, and sees two different price quotes for the same stock. Naturally, he puts in buy orders on the lower quote and sell orders on the higher quote. He can make money out of it until the stock is listed with just a single price quote.

This is a simple example of arbitrage opportunity. In reality, arbitrage opportunities rarely exist, and, when they do, market participants (especially hedge funds) jump on them fast and they disappear quickly. Therefore, “arbitrage-free” is an important assumption in finance. At any time, a given asset should only have a single price. That assumption further leads to risk-neutral valuation techniques. Because there can be only one price on the asset, market participants with different risk tolerance levels will have to reach the same price. Removing risk premium and assuming risk-neutral thus provides a consistent pricing framework for all investors.

Insurance products are, of course, nontradable, and thus do not have an observable market price. However, market-consistent reporting, such as market-consistent embedded value (MCEV), Solvency II or International Financial Reporting Standards (IFRS), attempts to put a price to insurance products using market-consistent principles.

A company typically determines the market-consistent value of its products using the risk-neutral valuation techniques, particularly if those products include embedded guarantees. There can sometimes be debate on how risk-neutral parameters can be calibrated, particularly for long-term liabilities. For the purposes of this essay, we are going to ignore such debate and instead assume that a final price has been agreed on, at least internally by the company, as a fair market price for the products.

Let us further assume that this price is determined in accordance with CFO Forum MCEV principles.\* If we simplify the MCEV calculations, then the price can be determined as follows:

Formula 1:

$$\begin{aligned} \text{Price} &= \text{Risk-Neutral Net Cash Flows (RNNCF)} \\ &\quad - \text{Cost of Non-Hedgeable Risks (CNHR)} \\ &\quad - \text{Frictional Cost (FC)} \end{aligned}$$

RNNCF calculates the average of the present values of net cash flows related to the insurance products across risk-neutral scenarios. Because risk-neutral valuation is used, it essentially captures all the market risks that can be hedged.

Risk-neutral valuation assumes investment returns that are the same as the discount rates. Thus, the emergence of earnings and the timing of regulatory reserves and capital have no impact on the results. In other words, the increase in reserve and capital is offset by the interest earned on reserve and capital. The only cost of capital captured in the calculation is the cost of non-hedgeable risk capital through CNHR and the taxation/investment expense through FC.

Now let us pause here and think about the “arbitrage-free” assumption at the beginning. At any time, there can be only one price on any asset. If the company considers the price calculated above as the fair price for its products, then it must hold true that the same price has to be arrived at if the company uses a real-world pricing approach instead of a risk-neutral approach.

This gives us a very good basis to calibrate the appropriate economic capital.

\* Please refer to [http://www.cfoforum.nl/embedded\\_value.html](http://www.cfoforum.nl/embedded_value.html) for details.

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In real-world pricing, the company would replace all economic scenarios and assumptions with those reflecting realistic probabilities. Risk premiums are allowed to be assumed in the projection. And if the present values are discounted at the earned rate, the impact of reserve and capital is neutral, just as it is in risk-neutral pricing.

Let us denote real-world net cash flows (RWNCF) to be the average of the present values of net cash flows related to the insurance products across real-world scenarios. Because risk premiums are explicitly allowed in the scenarios, RWNCF benefits from the higher expected return without proper allowance for the higher market risk. Therefore, to reach the same price, RWNCF has to be reduced by a cost of capital that includes both CNHR and the cost of hedgeable market risks, or the cost of the entire economic capital.

Formula 2:

$$\begin{aligned} \text{Price} &= \text{Real-World Net Cash Flows (RWNCF)} \\ &\quad - \text{Cost of Total Economic Capital (CTEC)} \\ &\quad - \text{Real-World Frictional Cost (RWFC)} \end{aligned}$$

If we combine Formula 1 and Formula 2, we get

Equation 1:

$$\text{Price} = \text{RWNCF} - \text{CNHR} - \text{FC} = \text{RWNCF} - \text{CTEC} - \text{RWFC}$$

This equation provides a very useful guideline for the company in its economic capital calibration. In particular, it helps the company define the economic capital tail event that corresponds to the degree of risk the company takes on. For example, the European Solvency II sets the tail event to be 1

over 200, and the U.S. C3 Phase II sets the tail event to be a conditional tail event of 90 (CTE90). But in reality, companies vary significantly in all respects, including product mix, investment strategy and experience monitoring, and therefore the degree of risk each company is exposed to should vary significantly too. Having the same tail event is certainly recommended for regulatory capital such as Solvency II and C3 Phase II, but each company should still determine an economic capital that really matches its own risk.

Equation 1 suggests that the appropriate economic capital tail event should be set such that the equation will hold. In other words, real-world pricing will not overstate the price of the products as long as the economic capital considered matches all the risks that the products expose the company to.

One often-debated issue in economic capital calculation is whether it should be a runoff approach as with the C3 Phase II or a one-year shock approach as with Solvency II. Equation 1 suggests that it probably does not matter because there can only be one price and therefore results from different economic capital models should be the same. Thus the selection of the economic capital calculation approach becomes more a modeling decision.

Another debate in actuarial work is whether pricing should be done on a risk-neutral basis or a real-world basis. Equation 1 suggests that both should provide the same answer as long as the correctly calibrated economic capital is recognized in real-world pricing. Typically in the United States, however, real-world pricing only recognizes the regulatory capital. Companies need to realize that the resultant price may not fully reflect all the risks companies are exposed to.

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The application of Equation 1 can range from one product, to a product line, to the entire corporation. The corporate-level application is probably more meaningful because it allows for diversifications across different products, and the market capitalization of the company can be directly used as the price instead of having to perform a risk-neutral valuation and a real-world valuation.

In summary, Equation 1 suggests a clean and conclusive way to calibrate the economic capital. However, a lot of the

details still need to be studied when we apply Equation 1 in the real world. One of the biggest challenges is perhaps how a company can arrive at the market-consistent price for a long-term product with complicated guarantees. We will not discuss it in this essay, but will continue our research and discussions in a separate paper.

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## How an Insurance Company Can Better Measure and Understand Its “Own Risks”

by *Russell Sears*

Fundamental to preventing a model of risk from expanding the risk instead of managing the risk is that the “error” terms in the model are preventing them from being highly auto-correlated. If the risk model’s “error” is internally believed to be less correlated than it actually is, then there will be a disconnection between management and the true risk. A company’s “own risks” can grow by repeating the same mistakes over and over by assuming a standard model of risk is the actual risk that particular company is taking.

Often the market will recognize the opportunity from the mispriced risk before management discovers the error. Internally there will appear to be a risk arbitrage. Sales and future expected profit growth may internally be recognized as good management, while externally business and sales are being driven by mispriced risks and created incentives to offload those aggregated correlated risks.

However, the insurance industry exists to aggregate risks and reduces risks and variability by the law of large numbers. Further, its long-term objectives differ from many shorter-term market participants. Therefore insurance companies can absorb and accept short-term risk that many market participants are not willing to take. Finally, the insurance company internally does have expertise and specialization within specific markets and certain risks. Specialization can increase competitiveness and ability to manage risk.

Therefore, metrics to accurately assess a company’s “own risks” will entail recognition of its true competitive advantage and risk management abilities while they also will give early warnings to highly correlated risks not necessarily contained in a simple risk model.

This suggests that rather than a pure risk model metric of a company’s “own risk,” a company’s “own risk” is better measured by actual-to-modeled risk expectation and direct recognition of extraordinary risks pools. Industry-wide models can be used by the industry to compare risks between companies, but good management will be aware of these models’ blind spots. A company’s “own risk” occurs from the difference in managing the model’s blind spots and managing by the models.

Actuaries have a long history of using experience studies to prevent repetition of the same mistakes in underwriting or pricing risk. Insurance agents seem to be able to find when risks are mispriced. Actuaries have watched for this. Likewise, anywhere models have been used to mitigate risk, experience studies can help. For example, in asset-liability management models, such as cash flow testing, actual cash flows to modeled can be broken down by actual asset cash received versus model and asset prepayment speeds, to realized versus cash surrenders, to experience and dynamic lapses versus actual lapses. Simply looking at monthly cash invested versus new money investment rates generally will show significant opportunity cost losses during periods of interest rate volatility. Often more cash will be available to invest in periods when new money rates are moving lower, and lower cash when rates are moving higher. There is often a considerable difference between what models imply would happen and what actually is experienced. Understanding where this is coming from can help prevent this gap from growing.

Further close measuring of surrenders, lapses and regression studies to the market environment can be an early warning sign to runs-on-the-bank potential, while measur-

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ing expected-to-actual performance or embedded options (both on a cost and payoff basis) can show when second-order hedging risk has built up beyond a company's risk tolerance before a fat tail event happens.

Risk models can increase risk by enabling correlated risks to be concentrated and pooled. This creates a market for that risk that never existed before. Expanding the market to speculation will essential change that market. Over-allocation of risk that never existed before can have a profound impact on the risk auto-correlation (bubbles and panics will occur). Executive Life and AIG Financial Products Division suggest that any measure of a company's "own risks"

should consider the risks that their revolutionary products may deeply impact the market for those risks. Likewise, for smaller companies, high growth in areas of inexperience should be a measure of its "own risk." Because of the need for global understanding of the market risk and the internal nature of these potential blind spots, the insurance industry regulators and rating agencies should share responsibility for the recognition of these risk areas as they develop.

The ideas expressed here are solely those of Russell Sears and not necessarily those of his employer, American Fidelity Assurance Company.

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## The Actuary's Use of Catastrophe Models in ORSA

by Anders Ericson and Kay Cleary

### Introduction

With the regulatory trend towards Own Risk Solvency Assessment (ORSA), companies will have to assess and disclose their own view of risk. For some companies, this will mean establishing more rigorous risk assessment processes.

An insurance company is a risk-bearing entity that, by definition, faces an uncertain financial future and therefore needs to hold capital. A solvency standard transforms and links a risk assessment into a capital requirement. The strength of a firm is a function of both the solvency standard and the quality of the risk assessment to which it is applied. In other words, both the quality of the risk assessment and the solvency standard need to be considered in order to fully understand the strength of a company.

The area of total risk assessment and capital management in insurance can be characterized as an emerging functional area, involving a number of different professions. Actuaries' skills in using limited data and professional judgment position them well to help advance this developing field and become leaders among risk practitioners.

Since catastrophe risk is often a material portion of total risk, an ORSA requirement implies companies need to understand and own the assessment of their catastrophe risk. As the use of catastrophe models has become routine for most companies with material catastrophe loss exposure, an ORSA requirement would require understanding and forming a comprehensive view on model strengths and weaknesses and how they affect the company's catastrophe risk assessment. This goes beyond the current level of catastrophe model expertise of many actuaries.

ORSA regulation requires insurance entities to conduct their own risk assessments. This is a departure from the traditional, more formulaic, approaches commonly required. An ORSA requirement for risk-bearing entities to quantify and disclose their explicit opinion on the risks they underwrite may be necessary to foster a better understanding of risk and help mitigate excessive systemic risk. However, ORSA is not sufficient on its own to prevent systemic risk. There is clearly a risk that firms will adopt approaches similar enough to result in a regulatory system not materially different from the current formulaic approaches. Should this happen, the resulting system would only reflect a change from one systemic model to another. As systemic risk stems from systemic behavior, regulators must be ready to accept a wide range of "models" and company-specific views on risk. Additionally, firms must be ready to hold their own view and, when justified, depart from the norm. Otherwise, an ORSA regulation is unlikely to be truly effective.

In this short essay, we will explore some of the uncertainties related to catastrophe models and how the actuary is well suited to help understand these in the context of an ORSA exercise. Although our discussion is focused on catastrophe models and ORSA, the concepts extend to all actuarial risk models and modeling exercises. Actuaries should understand the model and parameter risks encompassing each risk variable modeled and put all these in context of the overall risk assessment.

### Uncertainty in Catastrophe Models

While catastrophe models are based on science and data, judgment also plays a major role in model development. Most actuaries are not and never will become experts in the physical sciences used to develop these models; nor do they need to. For the physical science components of these models, actuaries appropriately will continue to rely on

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experts in the applicable fields. However, identifying and evaluating uncertainty due to the assumptions, judgments, algorithms, and parameter selection within a catastrophe model is well within the actuary's skill set. The actuary is a good candidate to understand catastrophe model details well enough to be able to determine where additional what-if analyses and stress testing may be appropriate. This kind of evaluation should play a key role in creating and communicating an effective ORSA. As catastrophe modeling software becomes more flexible, such sensitivity and stress testing will become more tractable and should augment current capabilities in overall catastrophe risk assessment.

A typical catastrophe model consists of four sub-models: stochastic event model, hazard model, vulnerability model, and financial model. Each of these sub-models has its own input and output, and analyses proceed through the sub-models in the order listed. A stochastic event set is generated by simulating frequency and location of event occurrences and their physical characteristics. Simulation is used to achieve a full range of potential events. In the hazard component, the damage-causing characteristic (such as peak-gust wind speed for hurricanes) is determined for each stochastic event and exposed geographic area. The vulnerability model uses the hazard model's output to determine each location's damages based on its exposure characteristics (e.g. construction,) and the financial model determines resulting financial losses based on damages and financial contract terms. Each component, as well as the model in its entirety, is subject to process variability, model error (or uncertainty) and parameter error (or uncertainty). Many models produce metrics such as "secondary uncertainty," which cover part of the model's parameter uncertainty. Although secondary uncertainty augments the modeled process variability, many sources of uncertainty are still not fully accounted for. Statistics such as average annual loss (AAL), return period loss (commonly known as PML), and tail conditional

expectation (TCE) give valuable information but need to be understood as estimates with associated uncertainty.

### Aleatory Variability and Epistemic Uncertainty

Rather than process variability, model uncertainty and parameter uncertainty, seismologists talk about aleatory variability and epistemic uncertainty when discussing total uncertainty associated with earthquake outcomes. This terminology is also useful while discussing total uncertainty associated with catastrophe model output. Aleatory variability is defined as the inherent randomness in a process and epistemic uncertainty is defined as the scientific uncertainty in the model of the process. The process of rolling a die represents aleatory variability since the outcome is always a random number (between one and six). If we do not know the number of sides of the die and the probability of each side, then our option is to build a model based on process observations and informed judgment. This introduces epistemic uncertainty. If, for example, the observations were {2, 2, 3, and 4}, then one might assume that the die has 5 sides with probabilities {Pr(1)= 1/10, Pr(2)= 2/5, Pr(3)= 1/5, Pr(4)= 1/5, Pr(5)= 1/10}. Here the epistemic uncertainty stems from the choice of model (a five-sided die) and its parameters (the probabilities). Even if the correct model is chosen, perhaps based on a *priori* knowledge of the type of die, there would still be epistemic uncertainty resulting from the lack of data with which to estimate the required parameters (the probability of each side). Parameter uncertainty typically represents a portion of the total epistemic uncertainty and makes sense only within the context of the chosen model. In other words, a different choice of model results in a different amount of parameter uncertainty. In theory, the amount of epistemic uncertainty goes to zero as the amount of available data goes to infinity. This means that, with enough data, it would be possible to choose the right model and determine its parameters correctly. More data does not, however, reduce the amount of aleatory variability.

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In some cases it may be difficult to distinguish aleatory variability from epistemic uncertainty. In the case of earthquake occurrence, one may hypothesize that it is a predictable physical process that only requires more scientific knowledge to be modeled precisely. However, scientists generally use stochastic models to supplement physical scientific models where science has not yet evolved enough to explain all observed variability. In this context, these stochastic models represent the aleatory variability of the process. For this reason, scientists regard, for example, the occurrence of earthquakes to have inherent randomness or aleatory variability.

As the total amount of risk is comprised of the total of aleatory variability and epistemic uncertainty, it is important for the actuary to be comfortable that the overall risk assessment accounts for enough epistemic uncertainty to be robust with respect to its intended use. A robust assessment should be stable with respect to the uncertain aspects of a model. The total risk also depends on the distribution of exposure and its data quality.

Although aleatory and epistemic may be new terms to actuaries, the concepts, measurement and evaluation of these types of risk are familiar ground, and the skills needed to

review and assess them are well within the profession's domain. Viewing risk this way may be helpful to the actuary in designing analyses to develop a more complete understanding of the total risk. Such analyses could include, for example, stress-testing of model assumptions and scenario-testing exposure data to establish uncertainty ranges.

### Conclusion

The challenges of the emerging area of total risk assessment represent an opportunity for actuaries to apply their unique qualifications. The company actuary is in a unique position to evaluate the company-specific exposure characteristics to determine which model and parameter assumptions may need to be evaluated in more depth and/or stress-tested in order to feel comfortable with the overall risk assessment. By using their skills in interpreting catastrophe model output and gaining a deeper understanding of the uncertainties inherent in the models, they will be well-positioned to advance this critical component of the overall insurance company risk assessment. As actuaries' catastrophe model expertise improves, and catastrophe modeling software advances technologically, the feasibility of such evaluation and testing should make them commonplace and help in the ORSA exercise.

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## Company Management's Reaction Capacity and Management Actions: Need and Difficulty to Take These into Account in ORSA

by *Stephane Loisel*

Translation by *David Schraub and Pierre Laurin*

One goal of Own Risk Solvency Assessment (ORSA) is to estimate the present and future solvency of an insurance company. ORSA should be framed within a prospective and multi-period process with a projection period length comprised of between three and 20 years, depending on the company's business, but most often between five and 20 years. Hence, this allows ORSA to be the link between the enterprise risk management (ERM) framework and the one-year horizon solvency framework. Indeed, one-year security/solvency usually goes against profitability. On a 10-year horizon, a solvency requirement partially depends upon minimum financial performance of the company: good performance, while mainly benefiting shareholders, helps build safety nets that should benefit policyholders but can also be used as risk-absorbing mechanisms in unfavorable events. Conversely, a less profitable company could stay for several years in a riskier zone where it could be challenged by unanticipated events. The multi-period aspect allows reconciling profitability and value creation with solvency and stability. Further, ORSA should allow the demonstration of the advantages of some products whose profitability emerges over time, and which are often unfavorably treated by capital allocation and standard performance measurement approaches. ORSA should reflect the positive impact of a tailored ERM process and should take part in the risk appetite and risk limit discussion.

Reinsurance strategies are defined at the beginning of each year for a one-year period, except potential non-automatic reinstatements. The management actions related to the investment side—the strategic asset allocation, asset-liability management (ALM) and the hedging of some financial risks—are usually projected through the entire duration of the portfolio under the current strategies.

One should already theoretically take leadership team decisions into account within internal models, but it is essential to include them in the multi-period ORSA context: stopping a non-profitable, underfunded or risky business; limiting the scope of a line of business; or increasing its risk management allocation will have a much more significant impact on a five- to 10-year horizon.

The forecasted level of solvency and the quality of the risk management process will therefore rely in part on a solid knowledge of risks and products, but also on the ability of the leadership team to react quickly enough in adverse situations, while handling the risk of false positive alarm signals.

This quick intervention ability raises some statistical issues related to early warning signals of trend shift. These were studied by the Russian school of probability theory in the Cold War era: How to point out a signal shift on a radar screen, which corresponds to a nuclear strike, early enough to allow response while limiting the risk of a false positive that could trigger a nuclear war due to a too-long Brownian excursion. El Karoui et al. (2012) show that a longevity trend shift usually requires 10 years of data to be detected statistically. This shows the practical limitation of yearly cycle review for these kinds of risks.

Fast turnaround requires both a well-established risk monitoring process within the company, as well as expertise and experience of the management team. ORSA should evaluate qualitatively these processes, as well as the ability of senior management to make knowledgeable strategic decisions: exiting a market quickly

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enough in case of profitability drop and timely selling the right quantity of an asset after a significant natural disaster rely both on the expertise of the leadership team and its advisors, and also on the tool timely quantifying the loss.

One should not model management behavior but rather evaluate its ability for prompt reaction and its potential mitigation impact on losses under specific scenarios.

To that purpose, bunkering exercises (see Cousin et al. 2012) allow requesting leaders to react under various scenarios and analyze their reactions. Neurologist Klaus Wunderlich and co-authors (Wunderlich et al. 2011) demonstrated the causation and correlation between risks are best assimilated through experience and unconscious process rather than analytical process. These types of techniques could be more fruitful than advanced technical education on internal models. According to Kahneman et al. (1982), most individuals generally understand the directional impact of new information but underestimate its magnitude when analyzing a probabilistic puzzle. Through tailored management games, leaders should be allowed to build their own frame of reference within the new solvency framework (see Loisel and Védani 2012). For example, a manager generally knows that the Solvency II standard formula tends to penalize nonproportional reinsurance strategies, but he will need reference points in order to evaluate the magnitude.

It is generally difficult or inefficient to justify a shift in the whole pricing process to take into account an unknown or unobserved threat, even if it is likely to occur. Similarly, fair value dogma hardly allows any shift from market value even when it lacks credibility. This implies potential lag in reaction time that should not be underestimated.

Should ORSA and an internal model or standard formula (RBC, Solvency II, or other) have the same approach on the first projection period? It may be useful to perform nested multi-period simulation while looking for risks that could create adverse scenarios and mitigation actions. However, computing times may be prohibitive, and one should be careful about this anchoring bias. A less granular and less constrained but more creative approach through identification of risk sources and management actions sounds more relevant to me. Expert judgment should have a place of choice. One should not hide behind models calibrated on historical data for some risks, like massive surrenders, but answer questions like: Do I address policyholder expectations in this context? What type of other products could they turn to? ORSA should include a balance of qualitative and quantitative sections; the deep knowledge of the business, the underwriting process, the adverse selection bias and the market driver should prevail over overengineered models. An interesting exercise is to request leaders and risk managers to identify the 10 main risks the company faces in the next five years. This allows the emergence of various viewpoints from various groups (see works from David Ingram on group sociology).

ORSA should include some thoughts on procyclical risks for the company and the industry. If counter-cyclical mechanisms are included by some regulators for a few financial risks, other activities could be threatened by a double whammy effect: for example, a natural disaster may be followed by an increase in the 1-in-200-year-event level.

ORSA content should depend on the specific audience and who would have access to the information: Many details on strategy should remain private information

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regardless of potential merger and acquisition (M&A) risks being quite important. This limits the prospective nature of ORSA that requires updates after each significant strategic shift.

ORSA suffers from moral hazard as does every other risk reporting framework: One sometimes fears that reporting tax, regulatory or legal risk could be misinterpreted as admission of guilt. How to evaluate the risk of failing the internal model validation and how to communicate to the supervisor the lobbying capacity of a firm or of a group to influence public institutions and avoid or mitigate adverse regulation shift? Just mentioning a risk might sometimes lead to its occurrence....

A metaphoric example for conclusion: Instead of building an extremely complex model through space and time to predict storm formation over a decade for several air traffic lanes, ORSA should rather identify the characteristics of potential downside environments and the ability for pilots to maneuver around or through these, limiting negative impact thanks to experience and training and thanks to dashboards and early warning systems available. Actuaries have a role to play by teaming with other professions to build realistic flight simulators that allow educating the managers to fly new planes and to anticipate potential conflict inside the cockpit or with passengers in a crisis situation, but also to take into account both the reaction time of those pilots and the efficiency

of their operational support system in the completion of new safety air traffic regulations.

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## Risk Metrics for Decision Making and ORSA

by Stephen J. Strommen

Events surrounding the 2008 financial crisis have revealed glaring weaknesses in the way financial risk and solvency are measured and assessed. While there has been a great deal of progress over the last few decades in theoretical approaches to valuation of risk, these advances have been sometimes misunderstood and often misapplied in the financial world, not just by business but also by regulators and accounting standard-setters. The multiplicity of technical approaches leads to confusion. With that in mind, I present ideas in two areas in an attempt to clarify thinking about these issues. The first area is accounting measurement, and the second is solvency assessment.

In the world of insurance accounting, there is much debate over the way risk should be reflected in the financial statements. Discussion focuses on the way risk should be reflected in liabilities (reserves) and in capital requirements. Quite often a probability-of-adequacy concept is used, with the idea that reserves should be set to be adequate at one probability level, with reserves plus capital being adequate at a higher probability level. This approach ignores the fact that reserves and capital serve different purposes, and the risk metric used for each needs to be tailored to its purpose.

In an accounting context, the function of liabilities (reserves) is to defer income in situations when revenue is collected before, sometimes long before, the related service is rendered or obligation is paid. In the case of long-term contracts that involve risk, such as insurance contracts, liabilities represent the present value of the future service or obligation, including some kind of provision for its inherent risk. The question is how to determine the provision for risk.

I propose using the accounting paradigm of matching revenue and expense. In situations where revenue is collected

long before the related expense is incurred, a liability is set up for the expense. In the case of long-term contracts that involve risk, if we could measure the expense of carrying the risk, we could apply the paradigm of matching revenue and expense very directly.

Fortunately, there is a simple concept that can be applied to measure the expense of carrying risk. Businesses that write long-term contracts involving risk must hold capital sufficient to ensure their ongoing solvency. There is a cost to acquiring and holding capital, because providers of risk capital require an elevated return as compensation for bearing risk. The cost of capital is therefore a cost of bearing the risk. The present value of the cost of capital is, I suggest, the appropriate risk metric that should be used for valuation of liabilities because it is consistent with the paradigm of matching revenue with expense for long-term contracts.

The cost-of-capital approach is one of three approaches enumerated by the International Accounting Standards Board (IASB) for valuation of insurance contracts. The other two approaches are variations on a probability-level concept. However there seems to be little recognition that the cost-of-capital approach and the probability-level approach produce fundamentally different results. The cost-of-capital approach leads to a larger provision for risk on longer-term contracts than on short-term contracts with the same degree of risk (that is, the same size of potential gain or loss). The probability-level approach leads to a provision for risk that does not depend on the length of the contract, but only on the range of possible results. In order to equate the results of the probability-level metric with those on the cost-of-capital metric, one would need to use a lower probability level for short-term contracts than longer-term contracts. If one fails

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to do so, the size of the risk adjustments produced by these two different metrics can differ by as much as a factor of five.

Let us accept the cost of capital as the risk metric for use in reserves, and turn to the question of the risk metric for capital.

Companies should hold sufficient total assets (reserves plus capital) so that there is a very high probability that they will be able to fulfill all their obligations, even those of uncertain timing or amount such as insurance. Therefore, a probability-level metric is fully consistent with the purpose behind capital requirements (given that reserves have already been defined). The matching of revenue and expense does not enter into discussion of required capital; the question is directly one of the likelihood that all obligations can be met.

It therefore makes sense to use a probability-level approach as the risk metric when determining minimum capital requirements, and to use the cost-of-capital approach as the risk metric when calculating reserves. The need for these two different risk metrics for these two different purposes is fundamental to clarifying the discussion in the area of accounting measurement.

Solvency assessment depends, of course, on how solvency is to be measured. We assume here that solvency is defined by the financial statement. A company is solvent if it has assets that exceed liabilities, or, in many regulated industries, if it has capital that exceeds regulatory minimums. With that in mind, a solvency assessment is an assessment as to whether a business can remain solvent over some period of time even if adverse events take place.

This is where a fascination with modern mathematical and computer models has led many astray. A calculation of “economic capital” using a computerized stochastic simulation model is often confused with a solvency assessment. It is sometimes thought that if currently reported capital is greater than “economic capital” determined in this fashion, that solvency must be assured, perhaps with 99.9 percent probability. This kind of measurement has its place as a tool, but is decidedly lacking as a means of solvency assessment for several reasons.

- A stochastic model uses probability distributions that are based on historical experience, but quite often the historical experience is far too small to derive the tails of the distribution with any confidence. The tails of the distribution of future results arising from use of that historical distribution should not be given more confidence than the size of the historical sample suggests. It is hard to see how one can get 99.9 percent confidence for a one-year model when one doesn’t have 1,000 years of experience to draw from.
- Because of the complexity of many economic capital models, their results are sometimes viewed as sacrosanct by board members who do not have the technical background to question them in detail. After all, many of the techniques being applied are based on concepts that earned Nobel prizes. They must be scientifically accurate, right?
- No stochastic model can accurately predict the changes in behavior that might occur in the future if one or two extreme events occur at the same time. Future behavior has a way of changing in unpredictable ways, and that can significantly affect the financial future of any human enterprise.



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- “Economic capital” is often defined as the size of loss that could be experienced if an adverse event occurred. But if a business actually held that amount of capital and then experienced that size loss, it would be left without any capital, thereby essentially being insolvent.
- The figure calculated for “economic capital” is often very sensitive to starting conditions, and can often increase significantly as conditions get more adverse. So “economic capital” is a moving target that can be very difficult to manage to.

To be thorough, a solvency assessment should include plans for any action that would be needed to maintain solvency in specific foreseeable scenarios. With that in mind, and with an understanding of the shortcomings of stochastic models, it seems reasonable to suggest that solvency assessment be based on a careful review of not only the current business plan but also several very specific stressful scenarios. The actions that would be taken in each scenario to maintain solvency and company vitality should be carefully planned. Only then should a simulation model be used to help illustrate the outcome.

This stress-testing approach to solvency assessment has the advantage of being grounded in reality rather than in stochastic models. Every board member can understand and provide input regarding the scenarios and the management actions that would be taken if they occurred. This kind of engagement of board members is vital to the effectiveness of any solvency assessment.

In summary, before one can undertake an ORSA, one must have a financial reporting framework in place using appropriate risk metrics for reserves and capital. The cost of capital is the appropriate risk metric for use in reserves, while the probability level is an appropriate concept regarding capital. However, when one actually undertakes an ORSA, one can better engage management by getting away from the probability-level concept and focusing rather on specific stress tests. In that way, management can be engaged using what they know, rather than being snowed by elaborate and intimidating stochastic financial models.

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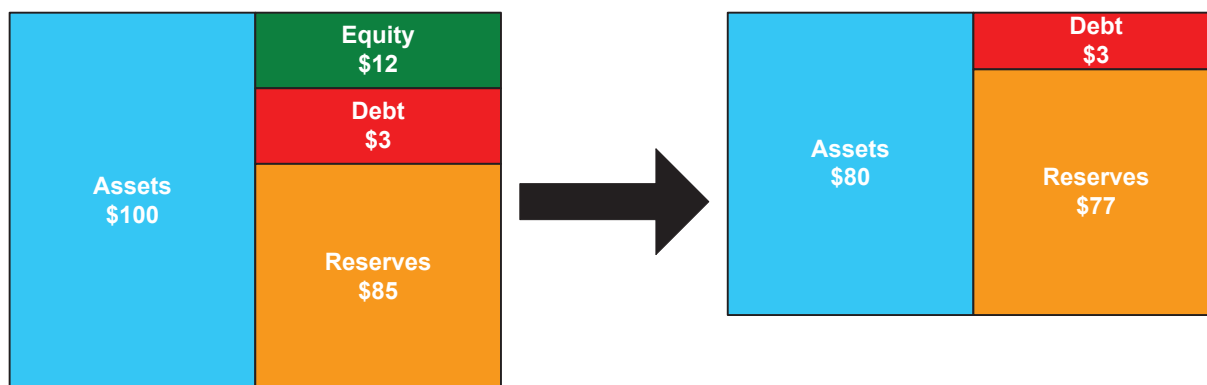
## Economic Capital, Countercyclicity and a “Plausible” ORSA

by Evren Cubukgil and Wilson Ling

The Own Risk and Solvency Assessment (ORSA) is a process to dynamically manage the capitalization of an insurer, and thus the protection provided to its stakeholders from insolvency and default. In order to successfully implement this process, an insurer needs a risk appetite that sets separate levels of acceptable protection for its policyholders and debt holders; by so doing, determining the amount of capital to hold beyond its reserves and what proportion of that capital to fund with debt. Strictly relying on regulatory capital as a measure to calibrate risk appetite is insufficient for this process; an internal or economic capital model is required to assess the full distribution of net asset values. Levels of available and required capital do not remain constant as asset and liability values fluctuate throughout the business cycle. It is important that an insurer manages its solvency level, defined by the ratio of available capital to required capital, with countercyclicity: allowing the solvency level to fluctuate with the business cycle. This is facilitated through scenario stress-testing, which is part of the ORSA process. Evaluating forward-looking stress scenarios should be aimed at modeling plausible future deterioration in economic conditions through the business cycle and managing a capital or solvency buffer above a minimum level—defined as part of a well-articulated risk appetite.

Under ORSA, as envisioned under Solvency II, an insurer’s required capital can be measured in terms of regulatory capital<sup>1</sup> or by an internal model (economic capital), and represents a change in net asset value corresponding to a specified confidence level; i.e., a 1-in-200-year event or 99.5<sup>th</sup> percentile of the one-year distribution of net asset value. Suppose an insurer has no debt and holds assets equal to reserves (liabilities) in addition to available capital corresponding to its required capital at the 99.5<sup>th</sup> confidence level. This insurer could conceptually experience a 1-in-200 year shock to its net asset value and have enough assets left over to pay off its policyholder liabilities—marginally avoiding insolvency. Available capital represents the value of the insurer’s equity and acts as a buffer over reserves which can be drawn down in times of stress. The capital structure of an insurer is not always funded entirely by shareholder equity and can include debt. In such cases, liabilities of policyholders are protected by the value of equity prior to debt default, and by the value of bondholder claims after default.

In the following example, an insurer holds \$100 of assets, against \$85 of liabilities and \$3 of debt. A 1-in-200-year scenario decreases assets by \$20 and decreases liabilities by \$8; thus the required capital of the insurer is \$12, against which it holds \$100 (assets) - \$3 (debt) - \$85 (reserves) = \$12 of available capital in the form of common equity.



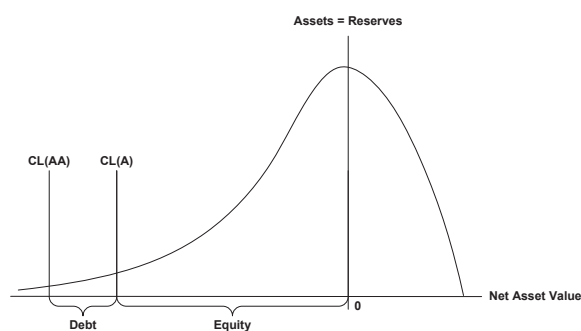
<sup>1</sup> For example, the Solvency Capital Requirement (SCR) under Solvency II.

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As part of the ORSA process, an insurer must manage the risk to which it exposes both its policyholders and debt holders. Relying solely on regulatory capital will often be insufficient for managing exposure of either stakeholder individually—let alone both simultaneously. Regulatory capital requirements, such as the SCR under Solvency II, are calibrated to provide an approximation to the 99.5<sup>th</sup> percentile of an insurer's net asset value distribution over a one-year horizon. Unless an insurer is satisfied to manage against insolvency at the 99.5<sup>th</sup> confidence level—equivalent to a BBB financial strength rating—it must hold available capital beyond the SCR requirement. The question to answer is, “How much additional capital to hold?” With only the level of required capital provided by the SCR, an insurer only has one percentile in the distribution of its net asset value: 99.5<sup>th</sup>. In order to prevent default at the 99.95<sup>th</sup> percentile, it may have to hold 120 percent, 130 percent or 150 percent of the SCR. An insurer will have to model multiple—if not all—percentiles of its net asset value distribution to be able to determine the amount of capital required to protect against a default at specific confidence levels. An internally developed economic capital framework would be required to model the entire distribution of net asset values over a one-year period.

In order to simultaneously manage both its probability of default and the capital buffer above reserves, an insurer should model the entire distribution of its net asset value to know the separate probabilities of having sufficient assets to pay its debt holders and to cover liabilities to its policyholders. The following figure illustrates the

distribution of net asset value of an insurer over a one-year period. The figure illustrates the amount of debt and equity the insurer would have to hold to ensure that (i) at a confidence level associated with an A debt rating, the insurer will have sufficient assets to not default and pay its debt holders; and (ii) at a confidence level associated with a AA rating, it will have sufficient assets to pay its liability holders but not its debt holders.<sup>2</sup>



With an economic capital model, an insurer may determine the probability that the value of its net assets falls beyond equity coverage (default), and the probability its net asset value falls beyond debt coverage and it cannot pay its policyholder liabilities (insolvency). However, the distribution of net assets fluctuates throughout the business cycle and due to non-economic contingencies. If an insurer holds a set pool of assets as available capital, the buffer or protection against default and insolvency provided to stakeholders will fluctuate.<sup>3</sup> Attempting to hold constant the level of protection<sup>4</sup> provided to stakeholders throughout the business cycle creates procyclicality in available capital, which would be required to increase with required capital in the trough of the business cycle and decrease in the peak. Procyclicality

<sup>2</sup> This is the distinction between an issue rating—representing the probability of default for a single instrument issued by a financial institution and an issuer, or financial strength rating—the overall probability that a financial institution will default and not be able to pay all of its liabilities.

<sup>3</sup> It is important to note that the value of available capital will also fluctuate throughout the business cycle, depending on its asset constitution.

<sup>4</sup> Hold constant the probabilities of default and insolvency.

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in capital requirements is not desirable, as it requires an insurer to constantly de-risk or issue equity in a down market—when raising capital is at a premium—while buying back assets and equity during economic booms, when assets are at a premium. Ideally an insurer should aim to achieve countercyclicality in its capital buffer and solvency: building it up during good times and allowing it to be run down in times of stress. This should be an overarching principle in the setting of risk appetite and of scenario stress-testing under the ORSA process.

As part of the ORSA process, an insurer should begin by defining a risk appetite that sets a minimum acceptable level of protection to debt holders from default and to policyholders from insolvency, under times of stress or poor economic conditions. Using the figure above as an example, this could be an AA rating for policies issued and an A rating for debt issued. Holding an additional capital buffer in the form of common equity will increase the financial rating provided to debt holders and policyholders.<sup>5</sup> The ORSA process should seek to manage the capital or solvency buffer above this minimum tolerance. The buffer should be built up under positive economic conditions and allowed to run down toward the minimum tolerance under times of stress. A key purpose of stress- and scenario-testing under the ORSA process should be to manage fluctuations in the solvency buffer through the economic cycle, and ensure that stakeholders are protected by the minimum acceptable level of solvency under stress. Modeling the entire distribution of net asset value with an economic capital framework

will allow the insurer to choose the appropriate confidence level for its capital buffer and monitor changes to that confidence level and the associated probabilities of default faced by debt holders and policyholders through the business cycle.

Within the ORSA process, scenario stress-testing is a vital tool in managing an insurer's capital or solvency buffer as it fluctuates throughout the business cycle. To this end, the scenario stress-testing framework needs to consider plausible stress scenarios, as opposed to focusing on extreme and remote “end of the world” type scenarios.<sup>6</sup> An insurer needs to have a view of plausible stress events that may initiate the next contraction of the business cycle, and the resultant impact on its capital buffer. Under positive economic conditions, the results of scenario stress-testing can be used to evaluate the sufficiency of capital buffers—above the minimum. Similarly, at the bottom of the business cycle it is important to evaluate the impact of further deterioration in economic conditions on capital buffers; this will allow an insurer to determine how far it is from its minimum acceptable level of protection provided to policyholders and debt holders. Assessing the impact of a severe scenario associated with less than a 1-in-200 year probability is not informative for managing capital or solvency buffers through contractions and expansions of an eight- to 10-year business cycle. It would simply not be feasible or competitive for an insurer to hold a solvency buffer to maintain an A or even a BBB rating against default following a 1-in-200-year stress scenario.<sup>7</sup>

<sup>5</sup> However, it should be noted that an economic capital model would be required to determine the decrease in probability of default and insolvency afforded by a given buffer.

<sup>6</sup> That is not to say that such reverse stress scenarios do not belong in the ORSA process—it is valuable for an insurer to be aware of magnitudes of shocks required to render it insolvent, and assess the likelihood of such shocks.

<sup>7</sup> Such a buffer may imply holding capital to the 99.9975<sup>th</sup> percentile of the distribution of net asset value, or a 0.25 basis point probability of default, which is beyond an AAA rating.

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There are three key ingredients to successfully implement an ORSA process: an economic capital framework that can separately model the probability of default and insolvency faced by debt holders and policyholders; a robust risk appetite that sets out the minimum acceptable level of protection provided to debt holders and policyholders; and a scenario stress-testing framework that aims to predict fluctuations in the business cycle and manage the capital buffer above the minimum tolerance levels. These three components of the ORSA process should be combined to manage the solvency of an

insurer with the aim of maintaining a countercyclical capital buffer.

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